U.S. Fish & Wildlife Service

Supawna Meadows National Wildlife Refuge

Draft Comprehensive Conservation Plan and the Environmental Assessment

September 2010

Front cover:

Supawna Meadows South of Davis Tract
Brian Marsh/USWFS

Northern Harrier
©Mike Dazenbaker

Diamondback Terrapin
Ryan Hagerty/USFWS

Great Blue Heron
Lee Carney

Back cover:

Supawna Meadows South of Davis Tract
Brian Marsh/USWFS

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* 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 150-million acre National Wildlife Refuge System comprised of more than 550 national wildlife refuges and thousands of waterfowl production areas. It 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 Federal Assistance Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

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

U.S. Fish & Wildlife Service

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Refuge Vision Statement

Supawna Meadows National Wildlife Refuge will continue to provide essential tidal marsh habitat to feed and shelter migrating waterfowl and to feed nearby colonial-nesting wading birds, thereby maintaining its significant role as part of the Delaware Bayshore system of wetlands and upland buffers that is one of the most important migratory bird habitats in the nation.

The refuge will continue to serve as an oasis of native biotic communities within sight of the burgeoning industrial, transportation, and residential developments of the lower Delaware River Basin and South Jersey by providing an array of wetland and upland habitats that support a diverse community of breeding and migrating birds, native mammals, and other species.

Refuge visitors will be able to hunt and fish, observe and photograph wildlife, and learn of the ecological importance and diversity of wildlife at Supawna Meadows National Wildlife Refuge. They will understand the refuge as part of a larger network of protected lands within the National Wildlife Refuge System, set aside specifically for wildlife.

Supawna Meadows National Wildlife Refuge

Draft Comprehensive Conservation Plan and the Environmental Assessment
September 2010

Summary

Type of Action:	Administrative – Development of a Comprehensive Conservation Plan
Lead Agency:	U.S. Department of the Interior, Fish and Wildlife Service
Location:	Supawna Meadows National Wildlife Refuge Salem County, NJ
Administrative Headquarters:	Cape May National Wildlife Refuge Cape May Courthouse, NJ
Responsible Official:	Marvin Moriarty, Regional Director, Region 5, Northeast
For Further Information:	Lia McLaughlin, Natural Resource Planner Northeast Regional Office 300 Westgate Center Drive Hadley, MA 01035 (413) 253-8575 northeastplanning@fws.gov

This Draft Comprehensive Conservation Plan (CCP) and the Environmental Assessment (EA) analyzes three alternatives for managing the 3,016 acre Supawna Meadows National Wildlife Refuge (NWR) over the next 15 years. This document also contains seven appendixes that provide additional information supporting our analysis. Following is a brief overview of each alternative:

Alternative A: This alternative is referred to as our "No Action" or "Current Management" alternative, as required by the National Environmental Policy Act (NEPA). Under this alternative, no major changes to our biological, public use or administrative management practices would occur.

Alternative B: This is the Service's preferred alternative. It represents the objectives and strategies recommended by the planning team for best achieving the refuge's purposes, vision and goals and responding to public issues. Under this alternative, we focus refuge management on restoring refuge tidal habitats to support Federal trust resources and species of conservation concern in the area. Our Visitor Services program would be enhanced to provide more opportunities for wildlife observation, photography, hunting, fishing, environmental education, and interpretation.

Alternative C: Under this alternative, we would close Supawna Meadows NWR to all public uses and cease all habitat management activities. Cape May NWR staff would conduct semi-annual site visits.

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Chapter 1

USFWS

Impoundment at Supawna Meadows NWR

The Purpose of and Need for Action

- Introduction
- The Purpose of and Need for the Proposed Action
- The Service and the Refuge System Policies and Mandates Guiding our Planning
- Conservation Plans and Initiatives Guiding the Project
- Refuge Establishment Purposes and its Land Acquisition History
- Refuge Administration
- Refuge Operational Plans ("Step-down" Plans)
- Refuge Vision Statement and Goals
- The Comprehensive Conservation Planning Process
- Issues
- Issues Outside the Scope of this Analysis or Not Completely Within the Jurisdiction of the Service

Introduction

This Draft Comprehensive Conservation Plan (CCP) and the Environmental Assessment (EA) for the Supawna Meadows National Wildlife Refuge (Supawna Meadows NWR; refuge) combines two documents required by Federal laws: a CCP, required by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105–57; Refuge Improvement Act); and an EA, required by the National Environmental Policy Act of 1969 (NEPA), as amended (Public Law 91-190). This document also conforms to U.S. Fish and Wildlife Service (Service, we, our) policy and legal mandates (see "The Service, its Policies and Legal Mandates," below).

Our regional director's final decision, based on this combined document, will produce a CCP to guide management decisions and actions on the refuge during the next 15 years. We will also use it as a tool to help the public, natural resource agencies of New Jersey and Delaware, and our other conservation partners understand and support refuge management priorities.

Chapter 1, "The Purpose and Need for Action," sets the stage for chapters 2 through 4.

The chapter:

- describes the purpose and need for a CCP/EA for the refuge;
- identifies national and regional mandates and plans that influenced this document;
- highlights establishing purposes and land acquisition history of the refuge;
- presents our vision and goals for the refuge;
- explains the planning process we followed in developing this document; and,
- describes the key issues, concerns, and opportunities it addresses.

Chapter 2, "Description of the Affected Environment," describes the physical, biological, and human environment.

Chapter 3, "Alternatives Considered, Including the Service-Preferred Alternative," describes varying management strategies for meeting refuge goals and objectives and responding to key issues of conservation and public use.

Chapter 4, "Environmental Consequences," evaluates the environmental consequences of implementing each of the proposed management alternatives.

Chapter 5, "Consultation and Coordination with Others," summarizes how we involved the public and our conservation partners in the planning process.

Chapter 6, "List of Preparers," credits Service and non-Service contributors.

Appendixes provide additional documentation and reference information we used in compiling this document.

The Purpose of and Need for Action

Our goal is to develop a CCP for the Supawna Meadows NWR that best achieves the refuge's establishing purposes, vision and goals; contributes to the mission of the National Wildlife Refuge System (Refuge System); adheres to relevant Service policies and mandates; addresses key public and conservation issues; and uses sound principles of fish and wildlife science.

NEPA regulations require us to evaluate a reasonable range of alternatives that includes a preferred alternative, the no action alternative, and, if deemed appropriate, one or more other reasonable alternatives. Alternative A (current management) satisfies the NEPA requirement of a "No Action" alternative, which we define as "continuing current management." It describes our existing management priorities and activities, and serves as a baseline for comparing and contrasting Alternatives B and C. The Service's preferred alternative is presented in alternative B. One other reasonable alternative is presented in alternative C. This draft CCP/EA describes the foreseeable impacts of all three alternatives on the socioeconomic, physical, cultural, and biological environments in the project area. We designed each alternative with the potential to be fully developed into a final CCP.

Our purpose in developing a CCP for Supawna Meadows NWR is to establish management direction that best meets the following goals:

Goal 1: Protect, enhance and restore biological integrity, diversity, and environmental health of tidally influenced habitats to support native wildlife and plant communities including species of conservation concern.

Goal 2: Protect, enhance, and restore biological integrity, diversity and environmental health of upland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.

Goal 3: Protect, enhance and restore biological integrity, diversity, and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on breeding, migrating and overwintering birds and other species of conservation concern.

Goal 4: Provide opportunities for compatible, high-quality, wildlife-dependent public uses.

Goal 5: Protect cultural resources on the refuge.

Goal 6: Enhance refuge management through partnerships, friends, volunteers, and community outreach.

Developing a CCP is vital for the future management of every national wildlife refuge. A CCP provides strategic management direction for the next 15 years by:

- providing a clear statement of desired future conditions for habitat, wildlife, visitor services, staffing, and facilities;
- providing State agencies, refuge neighbors, visitors, and partners with a clear
- understanding of the reasons for management actions;
- ensuring refuge management reflects the policies and goals of the Refuge System and legal mandates;
- ensuring the compatibility of current and future public use;
- providing long-term continuity and direction for refuge management; and,
- providing direction for staffing, operations, maintenance, and annual budget requests.

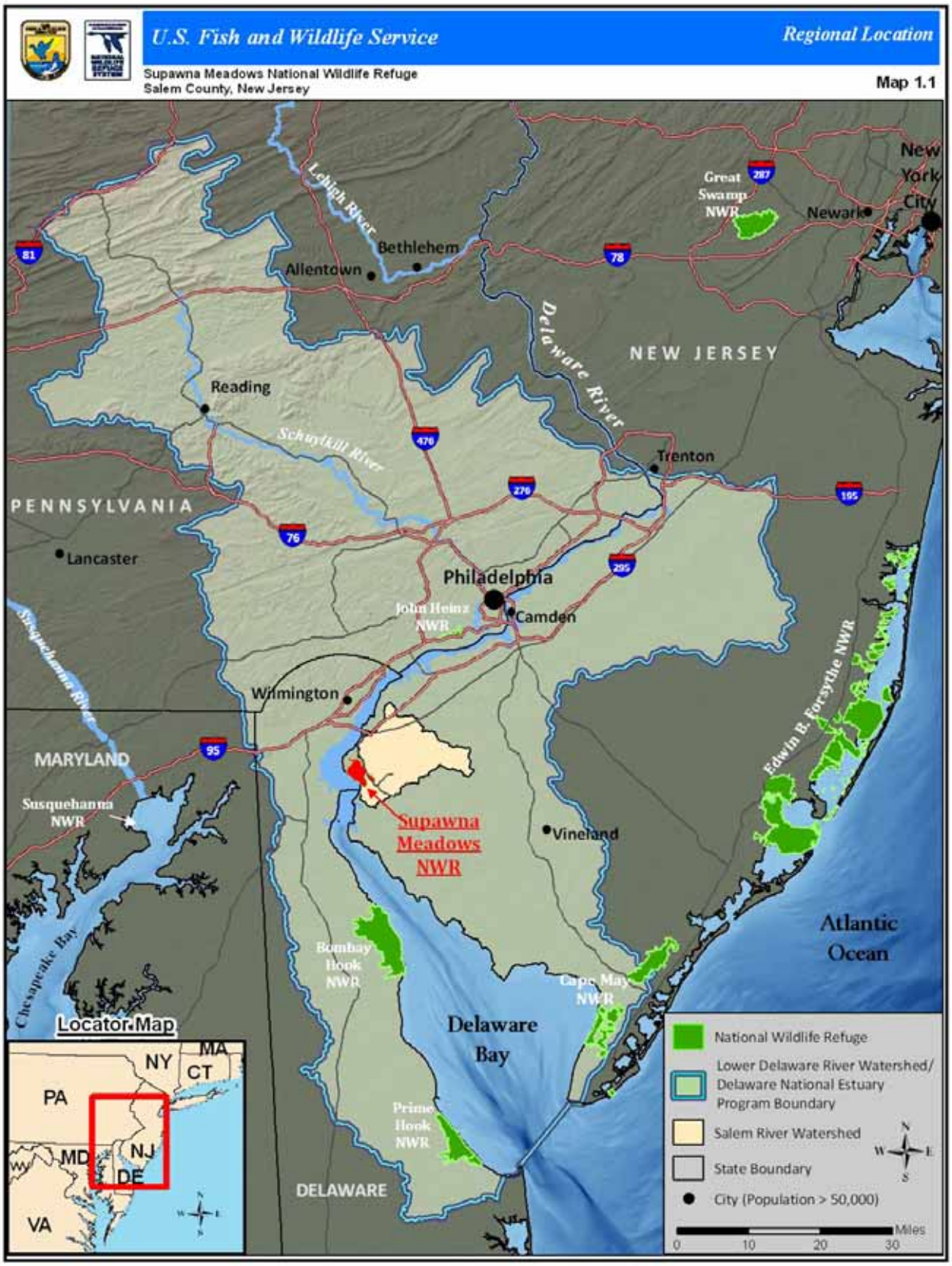
The need to develop a CCP for the refuge is threefold. First, the Refuge Improvement Act requires that all refuges have a CCP in place to help fulfill the mission of the Refuge System. Second, the refuge was administratively complexed with Cape May NWR (located in Cape May Court House, New Jersey) in March of 2004 to increase management efficiencies, which resulted in changes to on-site staffing. The CCP for Cape May NWR was completed separately in June 2004. Third, there is currently no master plan establishing priorities and ensuring consistent and integrated management for Supawna Meadows NWR. A vision statement, goals, objectives, and management strategies are needed to effectively manage the refuge's natural resources. Public and partner involvement is critical to resolving issues related to public use, cultural resources, and habitat management.

Project Area

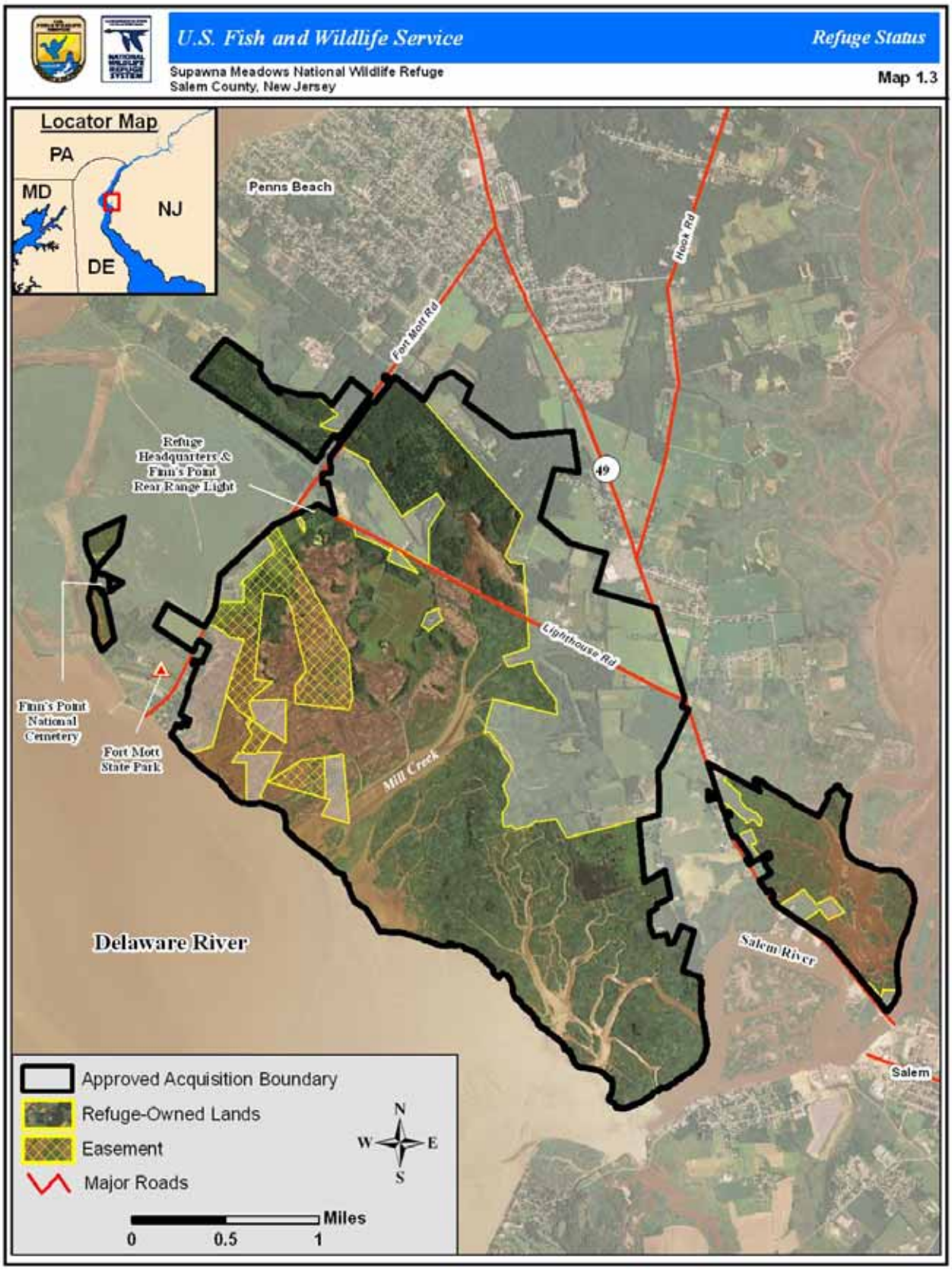
Supawna Meadows NWR is located along the shoreline of the Delaware River where it widens to become the Delaware Bay estuary (Map 1.1) in Salem County, New Jersey (Map 1.2). The refuge currently includes 3,016 acres of tidal waters and marsh[1], grassland, shrubland, and forest habitats. The approved refuge acquisition boundary (Map 1.3) encompasses approximately 4,527 acres along the Upper Delaware Bay and Salem River in Pennsville Township, New Jersey. The refuge boundaries are roughly defined by the Delaware Bay, Salem River, and Fort Mott Road.

Supawna Meadows NWR was originally established in 1971 as the Goose Pond addition to the Killcohook Migratory Bird Refuge. Killcohook Migratory Bird Refuge (also referred to as the Killcohook Coordination Area) was established by Executive Order 6582 on February 3, 1934. The lands acquired as the Goose Pond addition were renamed Supawna Meadows National Wildlife Refuge and officially separated from Killcohook Migratory Bird Refuge on April 10, 1974. On October 30, 1998 the Service's jurisdiction over Killcohook Migratory Bird Refuge was revoked (Public Law 105-312, Sec. 203).

[1]*The state of New Jersey retains ownership over open tidal waters below the mean high tide. In this document, when we refer to Service ownership, or describe refuge management actions in tidal waters, we generally mean tidal marsh areas and areas above mean high tide.*


U.S. Fish and Wildlife Service
Regional Location
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 1.1
New York City
Great Swamp NWR
Newark
Lehigh River
Bethlehem
Allentown
Delaware River
NEW JERSEY
Reading
Schuylkill River
Trenton
PENNSYLVANIA
Lancaster
Philadelphia
John Heinz NWR
Camden
Susquehanna River
Wilmington
MARYLAND
Susquehanna NWR
Supawna Meadows NWR
Vineland
Edwin B. Forsythe NWR
Atlantic Ocean
Bombay Hook NWR
Cape May NWR
Chesapeake Bay
Delaware Bay
Prime Hook NWR
DELAWARE
Locator Map
NY
MA
CT
PA
MD
NJ
DE
VA
National Wildlife Refuge
Lower Delaware River Watershed/ Delaware National Estuary Program Boundary
Salem River Watershed
State Boundary
City (Population > 50,000)
Miles
0
10
20
30

U.S. Fish and Wildlife Service
Refuge Location
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 1.2
Locator Map
PA
MD
NJ
DE
Wilmington
Newport
Christina River
Penns Grove
Carneys Point
Wilmington Manor
Delaware Memorial Bridge
New Castle County Airport
Glenside
New Castle
DELAWARE
Penns Beach
NEW JERSEY
Delaware River
Mannington Meadow
Supawna Meadows NWR
Fort Mott State Park
Fort Delaware State Park (Pea Patch Island)
Delaware City
Salem River
Salem
Fort Dupont State Park
Chesapeake and Delaware Canal
Approved Acquisition Boundary
Interstate Highways
US and Local Highways
0 1 2 3
Miles


U.S. Fish and Wildlife Service
Refuge Status
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 1.3
Locator Map
PA
MD
NJ
DE
Penns Beach
Hack Rd
Fort Mott Rd
Refuge Headquarters & Finn's Point Rear Range Light
49
Lighthouse Rd
Finn's Point National Cemetery
Fort Mott State Park
Mill Creek
Delaware River
Salem River
Salem
Approved Acquisition Boundary
Refuge-Owned Lands
Easement
Major Roads
N
W
E
S
Miles
0
0.5
1

The Service and the Refuge System Policies and Legal Mandates Guiding Planning

This section presents hierarchically, from the national level to the local level, highlights of Service policy, legal mandates, and existing regional, State, and local resource plans that directly influenced development of this draft CCP/EA.

The U.S. Fish and Wildlife Service and Its Mission

The Service, part of the Department of the Interior, administers the National Wildlife Refuge System. The Service 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.*

Congress entrusts the Service with the conservation and protection of national resources such as migratory birds and fish, Federal-listed endangered or threatened species, inter-jurisdictional fish, and certain marine mammals. The Service also manages national wildlife refuges and national fish hatcheries, enforces Federal wildlife laws and international treaties on importing and exporting wildlife, assists with State fish and wildlife programs, and helps other countries develop wildlife conservation programs.

The Service manual contains the standing and continuing directives to implement its authorities, responsibilities and activities. You can access it at *http://www.fws.gov/policy/manuals/*. Special Service directives affecting the rights of citizens or the authorities of other agencies are published separately in the Code of Federal Regulations, and are not duplicated in the Service manual.

The National Wildlife Refuge System and its Mission

The Refuge System is the world's largest collection of lands and waters set aside specifically for conserving wildlife and protecting ecosystems. Since its inception in 1903, the Refuge System has grown to over 550 national wildlife refuges and other lands encompassing more than 150 million acres (USFWS 2009a). The Refuge System has interests in every state and several island territories. Each year, more than 34 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education or interpretation activities on refuges, generating almost $1.7 billion annually (Carver and Caudill 2007). More detailed information on the Refuge System can be found on the Service's website at *http://www.fws.gov/refuges/.*

In 1997, Congress passed the National Wildlife Refuge System Improvement Act (Refuge Improvement Act; Public Law 105-57). The Refuge Improvement Act established a unifying mission for the Refuge System, a new process for determining compatible public use activities on refuges, and required CCPs for all refuges. It states that, first and foremost, the Refuge System must focus on wildlife conservation. It further states that the Refuge System mission, coupled with the purpose(s) for which a refuge was established, will provide the principal management direction for that refuge.

The mission of the Refuge System 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 (Refuge Improvement Act; Public Law 105–57).*

In addition, the Refuge Improvement Act requires that all existing or proposed public uses of a refuge must be compatible with refuge purpose(s). The refuge manager determines compatibility after evaluating an activity's potential impact on refuge resources, and insuring that it does not materially detract from, or interfere with, refuge purpose(s). This act also stipulates six wildlife-dependent public uses that are to receive enhanced consideration in CCPs: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

Fulfilling the Promise

During the late 1980s and 1990s, changes in the guiding mission and vision for the Refuge System, combined with growing concerns for the needs of fish, wildlife, and plants, underscored the need for the Service to articulate what the Refuge System would be over the next century. In 1997, the Service initiated a yearlong process involving four teams of Service employees who examined the Refuge System within the framework of Wildlife and Habitat, People, and Leadership. The teams completed a draft report that focused on these four key areas and was at the center of the first-ever Refuge System Conference in Keystone, Colorado in October 1998. Every refuge manager in the country, other Service employees, and scores of conservation organizations attended the conference. The final report, "Fulfilling the Promise: The National Wildlife Refuge System, Visions for Wildlife, Habitat, People, and Leadership" (USFWS 1999), was completed in 1999. Many "Promises Teams" formed to develop strategies for implementing the 42 recommendations of the final report. Information from teams such as Wildlife and Habitat, Goals and Objectives, Strategic Growth of the Refuge System, Invasive Species, and Inventory and Monitoring helped guide the development of the goals, strategies and actions in this draft CCP/EA.

Refuge System Planning Policy

This policy establishes requirements and guidance for Refuge System planning, including CCPs and step-down management plans. It 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 National Wilderness Preservation System; and meet other mandates. This policy helps to ensure that CCPs are founded on principles of sound fish and wildlife management and available science, and are consistent with legal mandates and our other policies, guidelines, and planning documents. Above all else, it helps ensure that wildlife comes first on national wildlife refuges (602 FW 1, 2, 3).

Appropriate Refuge Uses Policy

This policy provides a national framework and procedure for refuge managers to follow in deciding whether uses are appropriate on a refuge. It also clarifies and expands on the compatibility policy (603 FW 2.10D), which describes when refuge managers should deny a proposed use without determining compatibility. When we find a use is appropriate, we must then determine if the use is compatible before we allow it on a refuge. This policy applies to all proposed and existing uses

in the Refuge System only when we have jurisdiction over the use, and does not apply to refuge management activities or situations where reserved rights or legal mandates provide we must allow certain uses (603 FW 1). The appropriate use requirements of the Refuge Improvement Act were adopted in the Service's Final Appropriate Refuge Uses Policy, published June 26, 2006 (Federal Register, Vol. 71, No. 122, pp. 36408-36418). Appendix B further describes the Appropriate Refuge Uses Policy and describes its relationship to the CCP process.

Compatibility Policy

Federal law and Service policy provide the direction and planning framework to protect the Refuge System from incompatible or harmful human activities and ensure that Americans can enjoy its lands and waters. The Refuge Improvement Act is the key legislation regarding management of public uses and compatibility. The act requires that all existing or proposed public uses of a refuge must be compatible with refuge purpose(s). Specifically, for a use to be found compatible, it must not "materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge" (Refuge Improvement Act; Public Law 105–57).

The compatibility requirements of the Refuge Improvement Act were adopted in the USFWS Final Compatibility Regulations and Final Compatibility Policy, published October 18, 2000 (Federal Register, Vol. 65, No. 202, pp. 62458-62496). That Compatibility Rule changed or modified Service regulations contained in chapter 50, parts 25, 26, and 29 of the Code of Federal Regulations. The compatibility determinations for the Supawna Meadows NWR can be found in appendix B along with additional information on the process. The policy and regulations can be viewed online at *http://www.fws.gov/hanfordreach/documents/compatibility.pdf*.

Maintaining Biological Integrity, Diversity, and Environmental Health Policy

This policy provides guidance on maintaining or restoring the biological integrity, diversity, and environmental health of the Refuge System, including the protection of a broad spectrum of fish, wildlife, and habitat resources found in refuge ecosystems. It provides refuge managers with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and to restore lost or severely degraded environmental components. It also provides guidelines for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem (601 FW 3).

Wildlife-Dependent Recreation Policy

The Refuge Improvement Act establishes six wildlife-dependent priority public uses: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The Refuge Improvement Act further states that, if compatible, these six public uses are to receive enhanced consideration over other public uses in refuge planning and management. The Wildlife-Dependent Recreation Policy explains how we will provide visitors with opportunities for those priority public uses on units of the Refuge System and how we will facilitate the priority public uses (605 FW 1-7).

Other Legal and National Policy Mandates

Although Service and Refuge System policy and each refuge's purpose provide the foundation for management, the administration of national

wildlife refuges conforms to a variety of other Federal laws (e.g., Migratory Bird Treaty Act, Endangered Species Act, Wilderness Act, Archaeological Resources Protection Act, National Historic Protection Act), Executive Orders, treaties, interstate compacts, and regulations pertaining to the conservation and protection of natural and cultural resources. The "Digest of Federal Resource Laws of Interest to the USFWS" lists these and can be viewed on line at *http://www.fws.gov/laws/Lawsdigest.html*.

Wild and Scenic River Review

There are no rivers or segments of rivers that qualify for review within the boundary of the refuge; therefore, a wild and scenic river review was not conducted for this draft CCP/EA.

National and Regional Conservation Plans Guiding the Project

New Jersey Wildlife Action Plan (revised 2008)

In late 2001, the U.S. Congress passed the Department of the Interior and Related Agencies Appropriations Act of 2002 (Appropriations Act; Public Law 107- 63) which created the State Wildlife Grants (SWG) program. State Wildlife Grants are available to State fish and wildlife agencies "for the development and implementation of programs for the benefit of wildlife and their habitat, including species that are not hunted or fished." To continue receiving SWG money, each state was required to develop a Wildlife Action Plan (WAP; officially known as a Comprehensive Wildlife Conservation Strategy) focusing on the species of greatest conservation need by October 1, 2005. To satisfy this Federal requirement, the New Jersey Division of Fish and Wildlife (NJDFW), in collaboration with the general public; New Jersey conservation groups; and other stakeholders, developed the New Jersey WAP for the conservation of the State's species of greatest conservation need. Originally submitted in 2005, the most recent draft is dated January 23, 2008 (NJDFW 2008a).

To better assess conservation needs, goals, and priorities, the New Jersey WAP uses the five landscape regions (or ecoregions) and 26 conservation zones already identified in the State's Landscape Project (NJDFW 2008b). It identifies nearly 200 Species of Greatest Conservation Need, as well as identifying habitat needs and priorities for each region and conservation zone. We discuss the Landscape Project in more detail below. The refuge's tidal marshes supply important resting, feeding, and over-wintering habitat for colonial waterbirds, freshwater wetland birds, and many other special concern wildlife species identified by the State. We used this plan to help develop habitat management goals, objectives, and strategies, and in developing the list of Species of Conservation Concern in appendix A.

North American Waterfowl Management Plan (updated 2004)

The North American Waterfowl Management Plan (NAWMP) is designed to promote partnership-based habitat conservation for waterfowl and other wetland birds. This plan was first developed in 1986 and has been revised twice, most recently in 2004 (USFWS 2004a). Another revision is planned for 2011/2012. The first NAWMP established "joint venture" partnerships across the country (USFWS 1986). Joint venture partnerships involving Federal, State and provincial governments, tribal nations, local businesses, conservation organizations, and individual citizens are assembled for the purpose of protecting habitat and species. Currently, there are 18 habitat-focused joint ventures in the US and three species-focused joint ventures. Supawna Meadows NWR falls within the Atlantic Coast Joint Venture

(ACJV). The current mission of the ACJV is to "…provide a forum for Federal, State, regional and local partners to coordinate and improve effectiveness of bird conservation planning and implementation in the Atlantic Flyway region of the United States" (ACJV 2004).

The ACJV has developed several plans to help step-down the goals and objectives identified by NAWMP including the ACJV Waterfowl Implementation Plans (ACJV 1988, ACJV 2005) and the ACJV Strategic Plan (ACJV 2004). The most recent ACJV Waterfowl Implementation Plan (ACJV 2005) identifies several focus areas, i.e., habitat complexes that are priorities for waterfowl conservation. Seven focus areas have been identified in New Jersey. Portions of the Supawna Meadows NWR fall within one of these focus areas, called the Delaware Bayshores Marshes Focus Area.

North American Waterbird Conservation Plan (2002) and Mid-Atlantic/New England/Maritimes (MANEM) Waterbird Conservation Plan (Review Draft 2006)

The North American Waterbird Conservation Plan (Kushlan et al. 2002) represents a partnership among individuals and institutions with the interest in and responsibility for conserving colonial nesting waterbirds and their habitats. The partnership, known as Waterbird Conservation for the Americas, shares a vision that the distribution, diversity, and abundance of populations and habitats of breeding, migratory, and non-breeding waterbirds are sustained or restored throughout the lands and waters of North America, Central America, and the Caribbean (Kushlan et al. 2002). It provides a framework for conserving and managing colonially nesting water-dependent birds. The plan also facilitates continent-wide planning and monitoring, national, State, and provincial conservation, regional coordination, and local habitat protection and management.

Sixteen waterbird planning regions were identified to allow for planning at a scale that is practical yet provides a landscape-level perspective. Supawna Meadows NWR falls within the Mid-Atlantic/New England/Maritimes (MANEM) region. To facilitate waterbird conservation in the MANEM region of the United States and Canada, a partnership of organizations and individuals has drafted a regional waterbird conservation plan for 2006 – 2010. According to the MANEM Waterbird Conservation Plan, 74 waterbird species utilize habitats in the MANEM region for breeding, migrating and wintering (MANEM Waterbird Working Group 2006). Avian families that occur within the region include loons, grebes, shearwaters, storm-petrels, boobies, pelicans, cormorants, herons, ibises, rails, gulls, terns, skuas, jaegers and alcids. Summarized information on waterbirds and their habitats from this plan provides a regional perspective for local conservation action. We used this plan to help develop objectives and strategies for goals 1 and 3.

U.S. Fish and Wildlife Service Birds of Conservation Concern (2008)

The Birds of Conservation Concern (BCC) identifies nongame migratory birds that, without strong conservation action, are likely to become candidates for listing under the Federal Endangered Species Act (USFWS 2008a). The BCC compiles the highest ranking species of conservation concern from these major nongame bird conservation plans: Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004), the United States Shorebird Conservation Plan (Brown et al. 2001), and the North American Waterbird Conservation Plan (Kushlan et al. 2002). We used the BCC list in compiling appendix

A and to help focus on which species might warrant special management attention.

U.S. Shorebird Conservation Plan (2001, 2nd Edition) and North Atlantic Regional Shorebird Plan (2000)

Concerns about shorebirds led to the creation of the U.S. Shorebird Conservation Plan (Brown et al. 2001). Developed as a partnership with individuals and organizations throughout the United States, the plan presents conservation goals for each United States region, identifies important habitat conservation and research needs, and proposes education and outreach programs to increase public awareness of shorebirds and of threats to them.

In the Northeast, the North Atlantic Regional Shorebird Plan (USFWS 2004b) was drafted to step-down the goals of the continental plan to smaller scales to identify priority species, species goals, habitats, and prioritize implementation projects. We used both plans in developing our objectives and strategies for goals 1 and 3.

Partners-in-Flight Bird Conservation Plan: Physiographic Area 44, Mid-Atlantic Coastal Plain (1999)

Partners in Flight (PIF) began in 1990 as a voluntary, international coalition of government agencies, conservation organizations, academic institutions, private industries, and citizens dedicated to reversing the population declines of bird species. The mission of PIF is to help species at risk, keep common birds common, and encourage voluntary partnerships for birds, habitats, and people (PIF 2009). The foundation of PIF's long-term strategy is a series of scientifically based bird conservation plans using physiographic areas as planning units. The plan for each physiographic area ranks bird species according to their conservation priority, describes their desired habitat conditions, develops biological objectives, and recommends conservation measures. The priority ranking factors include habitat loss, population trends, and the vulnerability of a species and its habitats to regional and local threats.

Supawna Meadows NWR lies in Physiographic Area 44, the Mid-Atlantic Coastal Plain. The PIF plan for this region was completed in 1999 (Watts 1999). We used this plan in compiling appendix A and to help develop our habitat goals, objectives, and management strategies for the refuge.

Mid-Atlantic/ Southern New England Bird Conservation Region (BCR 30) Final Implementation Plan (2008)

Bird Conservation Regions (BCRs) originated from the North American Bird Conservation Initiative (NABCI). NABCI is a coalition of many governmental agencies, private organizations, academic organizations, and private industry leaders in Canada, the United States, and Mexico (NABCI 2009). It was formed to address the need for coordinated bird conservation that will benefit all birds in all habitats. NABCI's approach to bird conservation is regionally based, biologically driven, and landscape-oriented. It fills in knowledge gaps, implements conservation actions through dynamic partnerships, and .draws together the major bird conservation plans already in existence for waterbirds, shorebirds, waterfowl, and landbirds. NABCI members developed BCRs to facilitate regional planning efforts. The primary purposes of BCRs are to facilitate communication among the bird conservation initiatives, facilitate a regional approach to bird conservation, promote new, expanded, or restructured partnerships, and identify overlapping or conflicting conservation priorities. BCRs are ecologically distinct regions in North America with similar bird

communities, habitats, and resource management issues. There are 67 BCRs across the United States, Canada, and Mexico.

Supawna Meadows NWR lies within BCR 30, which includes portions of 10 states and covers approximately 24.4 million acres. Members of the ACJV have developed the Mid-Atlantic/Southern New England Bird Conservation Region (BCR 30) Final Implementation Plan to guide conservation priorities in the region (ACJV 2008). The purpose of this plan is to bring the common goals of many other regional plans (e.g., State Wildlife Action Plans, Partners in Flight Bird Conservation Plan for the Mid-Atlantic Coastal Plain [Physiographic Area 44], U.S. Shorebird Conservation Plan) together into one format that can be used by State agencies, non-governmental organizations, and other bird conservation interests to implement bird conservation activities. The plan identifies the bird species and habitats in greatest need of conservation action in the region, activities thought to be most useful to address those needs, and geographic areas believed to be the most important places for work to occur. It identifies Supawna Meadows NWR as part of a focus area (i.e., important bird area) important to a broad range of shorebirds, waterfowl, and landbirds within BCR 30. We used this plan to help develop objectives and strategies for goals 1 and 2, and to help create appendix A.

The Pea Patch Island Heronry Region: Special Area Management Plan (1998)

Pea Patch Island is a small island located in the mid-channel of the Delaware River near its entrance into Delaware Bay. It is a low, marshy island currently owned by the State of Delaware as Fort Delaware State Park (see Map 1.2). Pea Patch Island is home to the largest wading bird colony on the Atlantic Coast of the United States. The Delaware River, wetlands, and uplands that surround the island support the foraging habits of these birds. The birds nest on the island from March to September and depend on the region's natural resources during this time. The Pea Patch Island Heronry Region Special Area Management Plan (SAMP) was published in July 1998 (Delaware Department of Natural Resources and Environmental Control 1998). The purpose of the SAMP was to outline a broad, ecosystem based approach to protecting and improving the resources that support the Pea Patch Island Heronry, to build knowledge about the heronry, and to ensure the commitments necessary for its long-term protection. The development of the SAMP was a consensus-based effort involving representatives from Federal, State and local government agencies, nonprofit organizations and industry. The SAMP identifies several issues that may positively or negatively affect the health of the heronry population and surrounding area, and uses these issues to guide the development and ranking of 28 management strategies. Birds breeding on Pea Patch Island frequently use the refuge to rest and forage. We used this plan to help develop our habitat goals, objectives, and management strategies for the refuge.

National - State Agency Herpetological Conservation Report (Draft 2004)

The National State Agency Herpetological Conservation Report (NHCR) is a summary report sponsored by Partners in Amphibian and Reptile Conservation (PARC 2004). PARC was created in response to the increasing national declines in amphibian and reptile populations. PARC members come from State and Federal agencies, conservation organizations, museums, the pet trade industry, nature centers, zoos, the power industry, universities, herpetological organizations, research

laboratories, forest industries and environmental consultants. Its five geographic regions - Northeast, Southeast, Midwest, Southwest and Northwest - focus on national and regional herpetofaunal conservation challenges. Regional working groups allow for region-specific communication.

The NHCR provides a general overview of each State wildlife agency's support for reptile and amphibian conservation and research and includes lists of the amphibian and reptile species of concern for each state. Its purpose is to facilitate communication among State agencies and partner organizations throughout the PARC network to identify and address regional and national priorities for reptiles and amphibians. PARC intends to expand the scope of the NHCR to include other states, provinces, and territories. It would also include other State agencies that are supporting conservation and research on amphibians and reptiles, such as transportation departments, park departments, and forest agencies. We used the latest draft NHCR plan in developing objectives and strategies for goals 1 through 3, and in developing appendix A.

U.S. Fish and Wildlife Service Fisheries Program Northeast Region Strategic Plan (2009)

The Service's Fisheries Program maintains healthy populations of coastal and anadromous fish, fish species that cross state or national boundaries, and endangered aquatic animals and their habitats. In 2002, working with its many partners in aquatic conservation through the Sport Fishing and Boating Partnership Council's Fisheries Steering Committee, the Service completed its Strategic Vision (Vision) document, "Conserving America's Fisheries, U.S. Fish and Wildlife Service Fisheries Program Vision for the Future" (USFWS 2002a). The document includes goals, objectives, and action items on a national programmatic scale.

The original Northeast Region Strategic Plan (USFWS 2004c) is an extension of the Service's Fisheries Program Strategic Vision document (USFWS 2002a), describing more specifically how the Region will fulfill the goals and objectives identified in the Vision over five years (2004-2008). This plan, developed in cooperation with over 40 partners and stakeholders, addresses the decline of fish populations and other aquatic resources, and the economic impact of those declines. The plan is implemented with partners through annual project work plans.

Recently, the Service updated the plan (USFWS 2009b) to address 2009-2013. The updated plan uses a more transparent process to show partners and other members of the public how we arrived at various priorities. We have consulted with the Regional Fisheries Program staff and used this plan in developing aquatic objectives and strategies under goals 1 and 2, and in creating appendix A.

Regional Wetlands Concept Plan - Emergency Wetlands Resources Act (USFWS 1990)

In 1986, Congress enacted the Emergency Wetlands Resources Act to promote the conservation of our nation's wetlands. The Act directs the Department of the Interior to develop a National Wetlands Priority Conservation Plan identifying the location and types of wetlands that should receive priority attention for acquisition by Federal and State agencies.

In 1990, the Northeast Region completed a Regional Wetlands Concept Plan to provide more specific information about wetlands resources in the Northeast. It identifies nearly 850 wetland sites that warrant consideration for acquisition to conserve wetland values in our region. The plan was not intended to be an exhaustive list of priority wetlands in the region. A portion of one of these sites, Mannington Meadow, is included within the refuge boundary. We used this plan to help guide management strategies for this and other wetlands within the refuge.

U.S. Fish and Wildlife Service Indiana Bat Draft Recovery Plan: First Revision (2007)

In 1967, the Federal government listed the Indiana bat (*Myotis sodalis*) as endangered because of declines in their numbers documented at seven major hibernacula in the Midwest. At the time of their listing, Indiana bats numbered around 883,300. Surveys in 2005 numbered the population at 458,332. Although population numbers are down, surveys in most States' hibernation sites indicated that populations increased or at least remained stable in 2004 and 2005.

In 2006, the first evidence of a new illness affecting cave-dwelling bats was detected (USFWS 2009c). While the causative agent of this illness is still in question, it is called white-nose syndrome because affected bats usually have a white fungus on their muzzles and other parts of their bodies. Bats with white-nose syndrome frequently lack adequate body fat to survive until spring and exhibit uncharacteristic behavior such as flying during the day or flying when they would normally be hibernating. Smaller bats, such as Indiana bats, appear to be more susceptible to white-nose syndrome than larger bats.

Since the initial detection in 2006, white-nose syndrome has been detected from Vermont to Virginia. In some affected hibernacula, 90 to 100 percent of the bats are dying. Preliminary estimates of the Northeast Region's Indiana bat population indicate that the population has declined approximately 30 percent between 2007 and 2009 (USFWS 2009c).

Long-term effects of this illness on bat species are unknown, but it is possible that entire bat species, including the Indiana bat, may become extinct. Supawna Meadows NWR is home to a maternity colony of about 1,500 bats that use a barn on the refuge. We conducted surveys of the maternity colony in 2004, 2007, and 2008. Using mist nets and harp traps, approximately 250 bats were captured and identified. The majority of bats were identified as little brown bats (*Myotis lucifugus*) and a small number were identified as big brown bats (*Eptesicus fuscus*). To date, we have not confirmed that any of the bats from the Supawna Meadows NWR site have white-nose syndrome and the colony isn't showing signs observed at maternity colonies in affected areas. Signs of white-nose syndrome observed at other maternity colonies include malformed pups, large numbers of dead pups, and little to no reproduction (A. Scherer, Senior Endangered Species Biologist, New Jersey Field Office, USFWS, personal communication).

While no Indiana bats have been documented at the Supawna Meadows NWR, the refuge's forested and upland habitats have a potential for supporting wintering, foraging, and roosting habitats for Indiana bats. The Service would implement recovery plan tasks (USFWS 2007a) for

this species as appropriate if the Indiana bat was documented within the refuge boundary.

National Marine Fisheries Service Final Recovery Plan for the Shortnose Sturgeon (1998)

Shortnose sturgeon (*Acipenser brevirostrum*) were listed as endangered in 1967 under the Endangered Species Preservation Act (32 FR 4001). The original listing did not specify reasons for the decline, but subsequent documents cite water pollution and overfishing, including bycatch in the shad fishery, as principle reasons for the species' decline (NMFS 1998). The National Marine Fisheries Service (NMFS) currently recognizes 19 distinct population segments, including one population in the Delaware River (NMFS 1998). While the Delaware River is not included within the refuge boundary, the river and several tributaries form part of the refuge's border. Therefore, activities occurring on the refuge could have minimal effects on the shortnose sturgeon habitat. We used this plan to help guide management strategies for refuge habitat to ensure potential effects on adjacent sturgeon habitat are neutral or wholly beneficial.

The Landscape Project, New Jersey Endangered and Nongame Species Program, New Jersey Department of Environmental Protection (2002)

In 1994, the New Jersey Division of Fish, Game and Wildlife's Endangered and Nongame Species Program (ENSP) adopted a landscape level approach to rare species protection. The goal is to protect New Jersey's biological diversity by maintaining and enhancing rare wildlife populations within healthy, functioning ecosystems. Five landscape regions have been identified. Supawna Meadows NWR lies within the Piedmont Plains Region. Using an extensive database that combines rare species location information with land cover data, the ENSP has identified and mapped areas of critical habitat for rare species (i.e., State and Federal-listed threatened or endangered species) within each landscape region. Critical areas are ranked by priority. A geographic information system (GIS) database provides baseline information to conservation partners for help in prioritizing habitat protection, open space acquisition, and land management planning. This information was utilized in our land protection planning.

Comprehensive Conservation and Management Plan for the Delaware Estuary (1996)

The Delaware Estuary is faced with continuing threats from toxic substances, habitat loss and fragmentation, and human development. To help address these threats, the Delaware Estuary Program worked with many partners to develop the Comprehensive Conservation and Management Plan (CCMP) for the Delaware Estuary (Delaware Estuary Program 1996). The CCMP is a comprehensive document describing the existing conditions of the Delaware Estuary and providing seven action plans (land management, water use management, habitat and living resources, toxics, education and involvement, and monitoring) and an implementation plan. While the Delaware Estuary Program has since merged with the Partnership for the Delaware Estuary, this reorganized entity is still active and is now responsible for addressing the various actions identified in the CCMP. We used this plan as a reference in developing habitat management and land protection planning objectives.

Refuge Purposes and Land Acquisition History

Refuges can be established by Congress through special legislation, by the President through Executive Order, or administratively by the Secretary of the Interior (delegated to the Director of the Service) who is authorized by Congress through legislation. Refuge System lands may

be acquired under a variety of legislative and administrative authorities.

Supawna Meadows NWR Establishing Legislation

In 1971, the Service purchased the first 653 acres that became the Supawna Meadows NWR from the Philadelphia Conservationists (now known as the Natural Lands Trust). The land was called the Goose Pond addition to the Killcohook Migratory Bird Refuge. On April 10, 1974, the Service renamed the lands as the Supawna Meadows National Wildlife Refuge and officially separated this area from Killcohook Migratory Bird Refuge. Killcohook Migratory Bird Refuge was established by Executive Order 6582 on February 3, 1934. Historically, the U.S. Army Corps of Engineers (ACE) used the area to deposit soil dredged from the Delaware River. On October 30, 1998, the Service's jurisdiction over Killcohook Migratory Bird Refuge was revoked. Currently, this area is called the Killcohook Coordination Area, and is used by ACE to deposit dredged soil. The Service has acquired interests in over 2,300 additional acres for this refuge since 1971.

Supawna Meadows NWR Purposes

Refuge purposes are specified in or derived from the laws, proclamations, executive orders, agreements, public land orders, donation documents, or administrative memoranda that establish, authorize, or expand a refuge, refuge unit, or refuge subunit.

The Supawna Meadows NWR was established for the following purposes:

- as property with particular value in carrying out the national migratory bird management program (The Transfer of Certain Real Property for Wildlife Conservation Purposes Act, as amended [16 U.S.C. §667b-667d; 62 Stat. 240]);
- for use as an inviolate sanctuary, or for any other management purpose, for migratory birds (The Migratory Bird Conservation Act [16 U.S.C. §715D]); and,
- as a refuge 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 (Refuge Recreation Act, as amended [16 U.S.C. 460k-1]).

Refuge Operational Plans ("Step-Down" Plans)

The U.S. Fish and Wildlife Service Manual, Part 602, Chapter 4 (Refuge Planning Policy), identifies more than 25 step-down management plans that generally are required on refuges. Those plans provide the details necessary to "step-down" general goals and objectives to specific strategies and implementation schedules. Some require annual revisions; others are revised on a 5- to 10-year schedule. Some require additional NEPA analysis, public involvement, and compatibility determinations before they can be implemented.

The following step-down plans are completed and up-to-date:

- Hunt Plan (reviewed annually)
- Fishing Plan (reviewed annually)
- Safety Plan
- Continuity of Operations Plan

- Fire Management Plan

The following step-down plans need to be completed for the refuge:

- Habitat Management Plan (the highest priority plan to complete)
- Water Management Plan (to be incorporated into Habitat Management Plan)
- Law Enforcement Plan
- Integrated Pest Management Plan (to be incorporated into Habitat Management Plan)
- Facilities Plan
- Sign Plan
- Visitor Services Plan

Refuge Vision Statement

Our team developed the following vision statement to provide a guiding philosophy and sense of purpose for our planning effort:

> *Supawna Meadows National Wildlife Refuge will continue to provide essential tidal marsh habitat to feed and shelter migrating waterfowl and to feed nearby colonial-nesting wading birds, thereby maintaining its significant role as part of the Delaware Bayshore system of wetlands and upland buffers that is one of the most important migratory bird habitats in the nation.*
>
> *The refuge will continue to serve as an oasis of native biotic communities within sight of the burgeoning industrial, transportation, and residential developments of the lower Delaware River Basin and South Jersey by providing an array of wetland and upland habitats that support a diverse community of breeding and migrating birds, native mammals, and other species.*
>
> *Refuge visitors will be able to hunt and fish, observe and photograph wildlife, and learn of the ecological importance and diversity of wildlife at Supawna Meadows NWR. They will understand the refuge as part of a larger network of protected lands within the National Wildlife Refuge System, set aside specifically for wildlife.*

Refuge Goals

Our planning team developed the following goals for the refuge after a review of legal and policy guidelines, the Service mission, regional plans, refuge purposes, our vision for the refuge, and public comments. All of these goals fully conform with and support national and regional mandates and policies.

Goal 1: Protect, enhance and restore biological integrity, diversity, and environmental health of tidally-influenced habitats to support native wildlife and plant communities including species of conservation concern.

Goal 2: Protect, enhance, and restore biological integrity, diversity and environmental health of upland habitats to support native

wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.

Goal 3: Protect, enhance, and restore biological integrity, diversity, and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on breeding, migrating and overwintering birds and other species of conservation concern.

Goal 4: Provide opportunities for compatible high-quality, wildlife-dependent public uses.

Goal 5: Protect cultural resources on the refuge.

Goal 6: Enhance refuge management through partnerships, friends, volunteers, and community outreach.

The Comprehensive Conservation Planning Process

Service policy establishes an eight-step planning process that also facilitates our compliance with NEPA (Figure 1.1.[2]). Our planning policy and CCP training course materials describe those steps in detail. We followed that process in developing this draft CCP/EA.

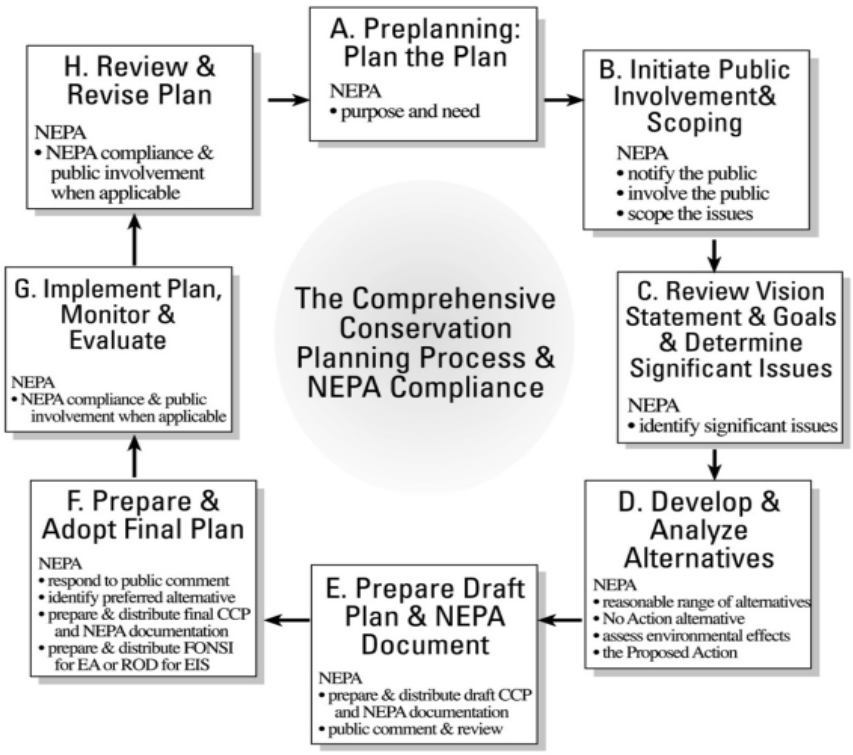


Figure 1.1 The Comprehensive Conservation Planning Process

[2] *"The Comprehensive Conservation Planning Process" (http://policy.fws.gov/602fw3.html)*

Since 1974, we have focused on conserving and managing Supawna Meadows NWR to help sustain migrating waterfowl, wading birds, and other trust species, and to facilitate wildlife-dependent public uses.

We began the CCP process for the refuge in May 2007 with a kick-off meeting. We discussed the current status of the refuge, important issues to be addressed in the CCP, and the status and sources of data for the analysis. We defined a core team to include refuge managers and staff from Cape May NWR, regional planners, and a New Jersey Division of Fish and Wildlife representative.

We held an internal scoping meeting, site visit, and field review in July 2007 to identify issues, concerns, management ideas, and data sources for the development of the CCP and analysis of management strategies.

We published and distributed our first newsletter in August of 2007.

On September 7, 2007, we held two public scoping meetings at the Pennsville Public Library to solicit comments from the community and other interested parties on the scope of the CCP and the issues and impacts that should be evaluated in the draft CCP/EA.

We published an official notice in the Federal Register on September 24, 2007 that announced we were preparing a draft CCP/EA.

On April 15, 2008, we held a biological workshop with representatives of the Service, the New Jersey Division of Fish and Wildlife, and the Delaware Division of Parks to discuss management objectives for the array of refuge habitats.

On May 6, 2008, we held a public use objectives meeting that addressed hunting, access to Finns Point Rear Range Light, and a variety of other public use opportunities, issues, and concerns.

After a review meeting in June 2008 with senior staff at the Service's Northeast Regional headquarters, we revised the biological and public use objectives.

We distributed a second newsletter in July 2008.

We will complete "Step E: Prepare Draft Plan and NEPA Document" by publishing our Notice of Availability (NOA) in the Federal Register announcing the release of this draft CCP/EA and by distributing this document for public review. During a 30-day period of public review, we will hold at least one public meeting to obtain comments. We also expect to receive comments by regular mail, electronic mail, or at the refuge. After the comment period expires, we will review and summarize all of the comments we have received and develop our responses. We will present them in an appendix to the final CCP.

Once we have prepared the final CCP, we will submit it to the Regional Director for review and approval to determine if a Finding of No Significant Impact (FONSI) is appropriate, and whether the final CCP meets agency compliance requirements, achieves refuge purposes, and helps fulfill the mission of the Refuge System. With an affirmative

FONSI and other positive findings, the Regional Director can approve the final CCP. Upon approval, we will publish another Federal Register NOA to announce the availability of the final plan. That will complete "Step F: Prepare and Adopt a Final Plan." "Step G: Implement Plan, Monitor and Evaluate" will then begin.

We will modify the final CCP as warranted following the procedures in Service policy (602 FW 1, 3, and 4) and NEPA requirements as part of "Step H: Review and Revise Plan." Minor revisions that meet the criteria for categorical exclusions (550 FW 3.3C) will require only an Environmental Action Memorandum. We must fully revise CCPs every 15 years.

Issues and Opportunities

From public meeting and planning team discussions, we developed a list of issues, concerns, opportunities, and other items requiring a management decision. We placed them in two categories: key issues and issues outside the scope of the EA.

Key issues - Key issues are those the Service has the jurisdiction and authority to resolve. The key issues, together with refuge goals, form the basis for developing and comparing the different management alternatives we analyze in chapter 3. The varying alternatives were generated by the wide-ranging opinions on how to address key issues and conform with the goals and objectives. We describe them in detail below.

Issues and concerns outside the scope of this analysis - These topics fall outside the jurisdiction and authority of the Service or were deemed impractical. We discuss them after "Key Issues," below, but this plan does not address them further.

Key Issues

We derived the following key issues from public and partner meetings and further team discussions. How they are addressed and how well they support refuge goals primarily distinguishes the three management alternatives in chapter 3.

1. Which species should be a focus for management and how will the refuge promote and enhance their habitats?

Congress entrusts the Service with protecting Federal-listed endangered or threatened plant and animal species, anadromous and inter-jurisdictional fish species, migratory birds, and certain marine mammals, and mandates their treatment as management priorities when they occur on a refuge. Appendix A identifies Federal trust resources on the refuge, as well as other species of special concern.

Numerous species of concern, including those species listed by the New Jersey Division of Fish and Wildlife as endangered, threatened, or a species of special concern, are potentially present in the vicinity of the refuge. The shortnose sturgeon (*Acipenser brevirostrum)* is present in the adjacent Delaware River. Other Federal-listed threatened or endangered species may enter the Delaware Bay and may occasionally travel up the river as far as the refuge. No sea turtle nesting habitat is present on the refuge; however, some turtles including Atlantic hawksbill (*Eretmochelys imbricata),* Atlantic loggerhead (*Caretta*

caretta caretta), Atlantic ridley (*Lepidochelys kempii*), and Atlantic leatherback (*Dermochelys coriacea*) may enter the Delaware Bay. Whales occasionally enter the Delaware Bay and one individual is known to have strayed as far north as Philadelphia, Pennsylvania (Spotila et al. 2007). Sensitive joint-vetch (*Aeschynomene virginica*), a Federal-listed threatened species, was found on the muddy tidal banks of the Delaware River on August 8, 1881. No plants were found during a survey conducted on September 30, 1992. Although these Federal-listed species may be found close to the refuge, their presence is largely limited to the Delaware River and Delaware Bay where the Service does not have jurisdiction. Therefore, the Service is limited in its ability to support recovery objectives for these species.

Migratory birds are also a Federal trust resource. The challenge with migratory bird management lies in determining how each refuge can contribute significantly to the conservation of migratory bird species of concern. One important question we address is, "Which migratory bird species and associated habitat types should be a priority for management on these refuges?" Management emphasis on a certain species or species group may preclude management for other migratory bird species of concern. On the refuge, for example, managing for grassland-dependent bird nesting habitat would likely reduce the habitat potential for interior forest nesting birds. Migratory bird species associated with both habitat types are in decline throughout PIF Area 44.

This CCP identifies the migratory bird species of management emphasis, associated management and land protection, and their impacts on other species of concern. Refuge goals 1-3 address our response to this issue.

2. How will the refuge manage invasive, exotic, and overabundant species?

Invasive plant species such as phragmites (*Phragmites australis*), Japanese stiltgrass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), mile-a-minute vine (*Polygonum perfoliatum*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and Canada thistle (*Cirsium arvense*) threaten refuge habitats by displacing native plant and animal species, degrading wetlands and other natural communities, and reducing natural diversity and wildlife habitat values. They out-compete native species by dominating light, water, and nutrient resources, and are particularly menacing when they affect native habitats, as when phragmites invades tidal marsh habitat.

Invasives are able to establish themselves easily, reproduce prolifically, and disperse readily, which makes eradicating them difficult. Once they have become established, getting rid of them is expensive and labor intensive. Many cause measurable economic impacts, especially in agricultural fields. Preventing new invasions is extremely important for maintaining biological diversity and native plant populations. The control of affected areas will require extensive partnerships with adjacent landowners, State, and local governments.

Invasive animal species, such as mute swans (*Cygnus olor*) and feral cats, also threaten refuge habitats by displacing, harming, or devastating native plant and animal species, degrading wetlands and other natural communities, and reducing natural diversity and wildlife habitat values. The threats of invasive animal and plant species are very similar.

We suspect that several wildlife species on the refuge are adversely affecting natural biological diversity. Native species (e.g., deer, resident Canada geese, and snow geese) and small furbearing mammals (e.g., beavers, raccoons, woodchucks, and muskrats) can become problems when their populations exceed the range of natural fluctuation and the ability of their habitat to support them. In particular, issues surface when these animals directly affect trust species or degrade natural communities. Small mammalian predators have been known to destroy neotropical migratory bird nests. Although we expect some predation in a natural system, concerns arise when it prevents our meeting conservation objectives.

There can be adverse ecological and economical impacts when deer, Canada geese, or snow geese forage excessively on fields or marsh vegetation, or when beaver and woodchuck affect water quality, degrade water control structures or impoundment dikes, or cause flooding where it is not desirable. As adjacent lands are developed for residential or commercial use, the concentrations of deer can rise on less developed lands, like the refuge. An overabundance of deer can produce long-term negative effects such as potential disease epizootics (Demarais et al. 2000), browsing pressure on landscapes, vegetation, and crops, and severe habitat degradation (Cypher and Cypher 1988). When deer populations become excessive, they can also compromise human health and safety. An increase in vehicle-deer collisions or the incidence of Lyme disease raises community concerns. The measures for controlling each species are potentially controversial, and may include lethal removal, visual and acoustic deterrents, and destroying nesting or den sites. Our response to this issue is addressed in refuge goals 1-4.

3. How will the refuge manage impoundments and forested wetlands?

Impoundments are confined bodies of water. The refuge has five impoundments with water control structures (WCS) totaling approximately 84 acres and five impoundments without WCSs totaling approximately 4 acres. Natural changes in water levels can occur from rainfall and natural springs. Water levels can be altered in impoundments with WCSs by inserting or removing boards that either release water or allow tidal water to flow into the impoundments. Currently, the water level is managed in three of the five impoundments with water control structures. Changes in water levels during specific times of the year provide habitat and food for an array of wildlife including shorebirds, wading birds, and waterfowl. Shorebirds benefit from impoundments when water levels are lowered and mudflats are exposed providing foraging habitat. Wading birds and waterfowl benefit when water levels are higher providing food such as aquatic vegetation, invertebrates, and fish.

The refuge has approximately 186 acres of forested wetland habitat. A WCS is located along Xmas Tree Lane in forested wetland habitat. Managing the water levels here would provide additional forested wetland habitat (i.e., a green-tree reservoir). This area represents an excellent example of mature forest quality with great size class diversity. Forested wetlands provide habitat for wood duck nesting and brood rearing, roosting eastern screech owls, and breeding reptiles and amphibians.

Managing areas with WCSs could benefit a variety of species by changing water levels at various times of year. The habitats could also be restored by removing WCSs and dikes to allow the habitat to revert to historic conditions, such as in the Tract 11 impoundment where the habitat surrounding the dike is tidal marsh, or by plugging ditches and restoring the natural hydrology to the forested wetland habitat. The Tract 11D Lighthouse Road impoundment could be managed to benefit wading birds, waterfowl. The Xmas Tree Lane impoundment could be used to provide fishing opportunities to the public. Our responses to these issues are addressed in refuge goals 3 and 4.

4. How will the refuge provide opportunities for compatible wildlife-dependent public uses, realizing that those uses occasionally conflict?

The Refuge System Improvement Act does not establish a hierarchy among the six wildlife-dependent priority public uses of refuges, nor does it establish any clear process for determining such a hierarchy. Unfortunately, those uses sometimes conflict with each other in time, space, or the allocation of resources. For example, environmental education and interpretation programs could conflict with hunting if they occur in an area open to hunting at the same time. In the Northeast Region, we have established “areas of emphasis” to identify where each refuge may make its greatest contribution to the six priority public uses. Supawna Meadows NWR’s areas of emphasis are the same as Cape May NWR’s areas of emphasis - interpretation and wildlife observation and photography.

Some people express concerns when refuge resources are disproportionately allocated toward one use and opportunities for other uses suffer. An additional challenge for the refuge manager is determining the carrying capacity of the refuge to support these uses while still managing to provide a quality experience. Our responses to this refuge issue are addressed in refuge goal 5.

Traditional wildlife-dependent uses of the refuge include fishing and hunting of waterfowl and white-tailed deer. Until 2007, the refuge provided opportunities for limited shotgun, muzzleloader, and bow hunting for white-tailed deer. After the completion of an approved Environmental Assessment and Finding of No Significant Impact (FONSI), deer hunting opportunities were changed to include only bow hunting.

5. How will the refuge manage compatible non-priority public uses on the refuge?

Service policy provides that a use might be inappropriate based on compliance with other laws and policy, the availability of resources to manage the uses, possible conflicts with other uses, safety concerns, or other administrative factors. Inappropriate uses may, nonetheless, be compatible, in the sense that it may not materially interfere with the purposes of the refuge or the Refuge System's mission. Other uses, such as historic uses, might be appropriate and compatible, but may not be priority public uses or wildlife-dependent uses.

During the period 1989 through 2004, we provided public access to the Finns Point Rear Range Light ten weekends (Saturday and Sunday) during the summer months. With the decline in on-site personnel and safety concerns, this activity is currently limited to allowing access only during the New Jersey Lighthouse Challenge, directly sponsored by the Friends of Supawna Meadows and the New Jersey Lighthouse Society. The challenge is held annually one weekend in October.

Visitors have requested permission to participate in a variety of non-priority public uses at Supawna Meadows NWR. A few of these non-priority public uses (e.g., scientific research) have been considered compatible. All other non-priority public uses (for example, horseback riding, bicycling, jogging, physical geocaching, group gatherings not related to wildlife-dependent recreation, and picnicking) have been determined to be inappropriate and incompatible with the refuge's purposes (see appendix B for Findings of Appropriateness and Compatibility Determinations).

6. How will the refuge cultivate an informed and educated public to support the mission of the Service and the purposes for which the refuge was established?

Community involvement in support of our Refuge System mission is both very important and very rewarding. Outreach ties the refuge to local communities, inspiring an interest in the Refuge System and in natural resource conservation and stewardship. It is important that people understand what we are doing, why we are doing it, and how we can work together to improve our communities. Our challenge lies in determining how best to reach out, raise the visibility of the refuge in the local community, and cultivate a relationship. Some people advocate increasing the number of refuge programs open to the public while others promote refuge staff involvement in established community events, government committees, and conservation organizations. Refuge goal 6 addresses our responses to this issue.

7. What additional lands will the refuge protect or acquire?

New Jersey is the most densely populated state in the nation. One of the consequences of that distinction is the extreme pressure it places on natural resources. Previously undeveloped lands are being developed rapidly. During our public scoping process, many individuals encouraged us to expand the refuge for a variety of reasons and many expressed concern over the rapid rate of development. Some spoke of the direct benefits, even the necessity, of maintaining land in its natural state, which the refuge exemplifies.

The refuge's current approved acquisition boundary encompasses 4,527 acres, of which the Service currently owns 3,016 acres in fee title lands. An additional 254 acres is managed under a conservation agreement. We will continue to maintain an active land acquisition program and work with willing sellers to acquire properties within the existing acquisition boundary. The primary funding source for land acquisition comes from the Land and Water Conservation Fund (LWCF), which Congress approves annually. In past years the availability of LWCF funding for Supawna Meadows NWR has been limited. As funds become available, the primary acquisition emphasis will be on those properties within the acquisition boundary.

8. How will the refuge obtain the staffing and funding necessary to complete priority projects?

Between 1998 and 2004, Supawna Meadows NWR was staffed with a refuge manager, a biologist, a maintenance worker with collateral law enforcement responsibilities, and a part time administrative assistant. In March 2004, the refuge was administratively complexed with Cape May NWR. In response to funding shortfalls, the 2006 Regional Work Force Planning Report identified Supawna Meadows NWR as an unstaffed satellite refuge complexed to the Cape May NWR. Therefore, the refuge currently has no on-site staff. Approximately 20 percent of the Cape May NWR staff's time is spent annually providing management, maintenance and law enforcement support to Supawna Meadows NWR.

As the CCP was developed, we had to consider what could be accomplished in the next 15 years without on-site staff. If we are able to hire on-site staff, what positions would we want to fill and what additional management activities would they be able to support?

9. How will we preserve, protect and interpret cultural and historic resources on refuge lands?

The Finns Point Rear Range Light (FPRRL) was listed in the National Register of Historic Places on August 30, 1978. It is a well-known historic feature located on refuge land. The catwalk was open to the public for viewing in the recent past, but engineering inspection has shown it to pose a potential safety hazard that would require substantial funding to correct. Although it is not directly related to the goals of refuge management, the Service recognizes its responsibility to maintain the FPRRL in accordance with the National Historic Preservation Act of 1974. The New Jersey Lighthouse Society and others expressed interest in having the refuge provide opportunities for public access to the lighthouse during the annual Statewide lighthouse challenge. Questions were raised as to how best to meet the needed protection of the lighthouse and provide public access. Would this be more appropriately accomplished through a property transfer agreement with the State Division of Parks and Forestry, or through cooperative agreements with non-government agencies, such as the New Jersey Lighthouse Society, and/or the Friends of Supawna Meadows NWR?

We also recognize the potential of the lighthouse to be a focal point for enhancing the public's knowledge and understanding of the environmental importance that the refuge provides to a variety of wildlife species and habitats, as well as interpreting the historic value of the lighthouse. Efforts in this regard would be subject to maintaining the historic integrity of the lighthouse.

There are two other sites on the refuge that generate cultural and historic interest. The first of these sites is a small family cemetery dating back to the late 1800s, located just off County Route 197 along the entrance road to the location of the old refuge office. The cemetery has not been assessed for eligibility as a site for the National Register of Historic Places; however, we do recognize the importance of maintaining this site suitable for visitor appreciation.

The second of these sites is the previous headquarters, the old farmhouse of the Samuel Urion Farmstead, which has been referred to as the Urion-Yerkes homestead. We will consult with the State Historic Preservation Office (SHPO) about disposition of this building and will comply with any applicable requirements including mitigation if needed. The farmhouse has fallen into extensive disrepair beyond reasonable restoration value over the years; therefore, demolition is the anticipated outcome.

This draft CCP/EA will be sent to the New Jersey SHPO for review of National Historic Act Section 106 compliance, and we will also continue to do Section 106 compliance for all individual projects as needed.

Issues Outside the Scope of This CCP

1. Water Quality – Proposal to dredge the Delaware River

During the public scoping process, some members of the public expressed concerns about water quality in the Delaware and Salem rivers and the potential harmful effects a proposed dredging operation within the Delaware River could have on Supawna Meadows NWR. The project has been proposed for many years by the U.S. Army Corps of Engineers. The proposal to increase the depth of the river from 40 feet to 45 feet is currently involved in various lawsuits from environmental organizations and the States of Delaware, Pennsylvania, and New Jersey. At this point in time, the outcome of the litigation and final dredging operation plan are unclear and cannot be addressed in this CCP. Furthermore, completion of this project is not within the Service's jurisdiction.

2. Will the refuge expand upland hunting opportunities?

During a scoping meeting with New Jersey Division of Fish and Wildlife, it was recommended that we look into expanding hunting opportunities on the refuge, in particular to include wild turkey, American woodcock, eastern gray squirrel, northern bobwhite, ruffed grouse, and rabbit. Although we considered this recommendation, we have eliminated this from detailed evaluation because of the small size of the huntable area within the refuge and the potential conflicts with other public uses.

Plan Amendment and Revision

Periodic review of the CCP will be required to ensure that objectives are being met and management actions are being implemented. Ongoing monitoring and evaluation will be an important part of this process.

Monitoring results or new information may indicate the need to change our strategies. At a minimum, CCPs will be fully revised every 15 years. We will modify the CCP documents and associated management activities as needed and we will follow the procedures outlined in Service policy, the Refuge Improvement Act, and NEPA requirements.

Chapter 2

Beth Goldstein/USFWS

View from Boardwalk at Supawna Meadows NWR

Affected Environment

- Introduction
- Regional Setting
- Socioeconomic Setting
- Refuge Administration
- Biological Resources
- Wildlife Dependent Public Use
- Cultural Resources

Introduction

This chapter describes in detail the physical, cultural, socioeconomic, biological, and administrative environments of the Supawna Meadows NWR and its resources directly related to our goals and key issues. It also provides the context for evaluating our management alternatives in chapter 3, "Alternatives Considered, Including the Service-Preferred Alternative.

Physical Environment

Elements of the physical environment considered include regional setting, air quality, water quality, soil types, and regional conservation lands.

Regional Setting

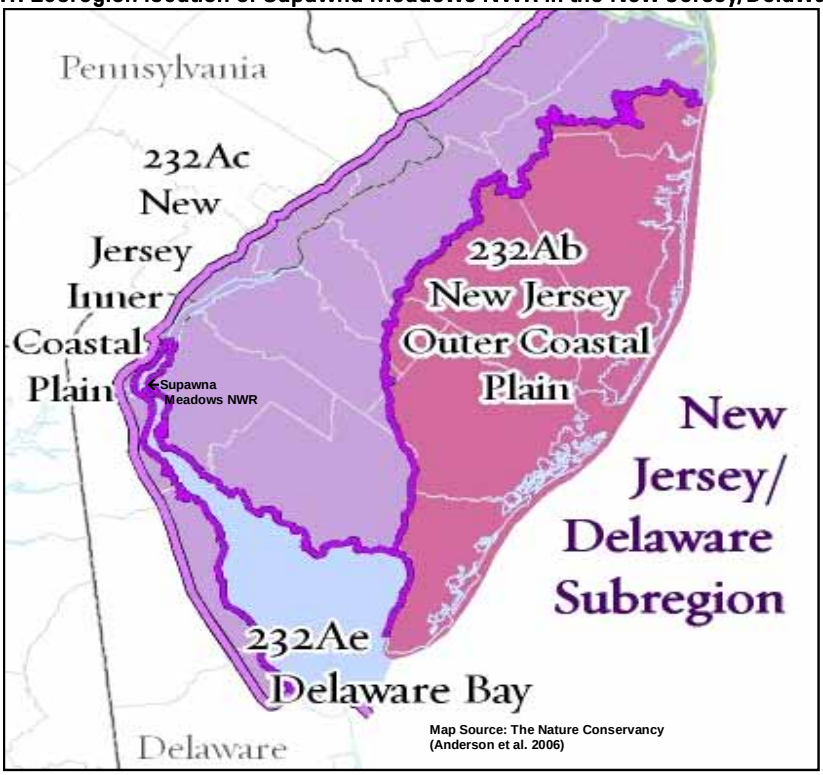
According to The Nature Conservancy, Supawna Meadows NWR is located on the southwestern tidal shore of the Delaware River estuary in Salem County, New Jersey (Anderson et al. 2006). It is on the western edge of the New Jersey Inner Coastal Plain (232Ac) in the North Atlantic Coast Ecoregion (Map 2.1). The New Jersey Wildlife Action Plan (NJDFW 2008a) shows the refuge located at the southwestern-most tip of New Jersey's Southern Piedmont Plains conservation zone within the Piedmont Plains Landscape (Map 2.2). The refuge is approximately ten miles south of Wilmington, Delaware and 35 miles south of Philadelphia, Pennsylvania. The refuge's acquisition boundary encompasses approximately 4,527 acres. The refuge has acquired approximately 3,016 acres within the approved boundary.

The refuge has a flat terrain typical of Delaware Estuary tidal areas. Elevations on the refuge range from zero to ten feet above mean sea level (msl) USFWS 2005a); however, in Pennsville, adjacent to the refuge, the elevation is 19 feet above msl.

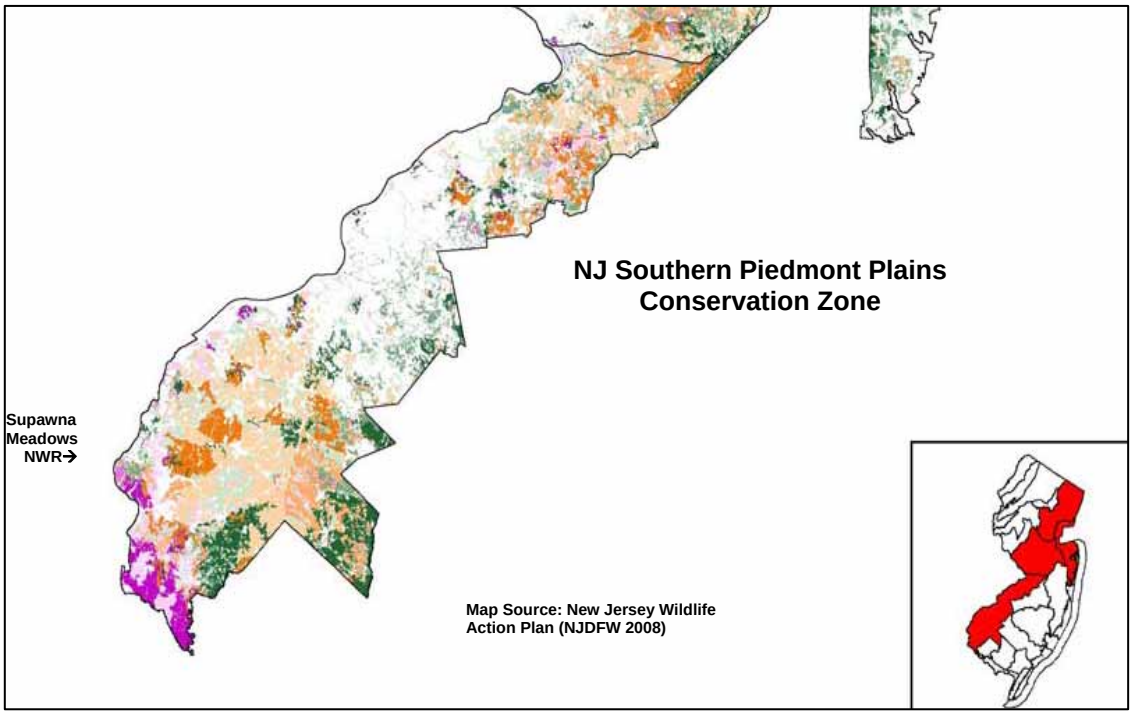
According to the National Oceanic and Atmospheric Administration (NOAA), the tidal amplitude on the Delaware River estuary in the vicinity of the refuge, as measured at a point near the refuge on the Salem River, averages about five feet (5.32 feet at Sinnickson's Landing). The area's climate can best be described as moderate, under a coastal influence (Delaware River/Bay). Days below zero degrees Fahrenheit (F) and above 100 degrees F are rare. The average frost-free period runs from late April to early October. Annual precipitation averages 41 inches per year and snowfall averages about 21 inches per year. Prevailing winds are from the northwest during the winter and from the southwest during the summer.

Lands in the vicinity of the refuge have been in cultivation since the first permanent settlement was established in Salem County by John Fenwick in 1675 and farming is still the predominant land use surrounding the refuge. In the past, dikes were developed to block off the tides so wetlands could be farmed. These dikes required considerable maintenance. Storms and vandalism eventually breached all the dikes around the refuge; however, they remain to some degree between the Delaware River and the refuge. The last efforts by farmers to dike what are now refuge marshes ended in the late 1930s. Other traditional uses of the area include shad and sturgeon fishing, boat building and repair, muskrat trapping, and waterfowl hunting. All these activities, with the exception of sturgeon fishing, continue today.

Map 2.1. Ecoregion location of Supawna Meadows NWR in the New Jersey/Delaware Subregion.



Map 2.2. Ecoregion location of Supawna Meadows NWR in the New Jersey Southern Piedmont Plains zone.



The land surrounding the refuge is primarily residential, commercial, and agricultural. A Ganes Chemical Company facility, a shopping center with a Wal-Mart store, and a U.S. Army Corps of Engineers facility are located on properties either immediately adjacent to the refuge or just outside the refuge acquisition boundary. Agriculture is declining, leaving some lands fallow while others are replaced by development. Recent recreational use of lands adjacent to or near the refuge has included waterfowl hunting, deer hunting, fishing, trapping, wildlife observation, photography, horseback riding, and all terrain vehicle (ATV)/off-road vehicle (ORV) use. All of these lands are in private ownership; general public access to these lands is rare. Recreational uses of waterways adjacent to or near the refuge include canoeing and kayaking, use of motorized boats, and jet skiing. Waterways adjacent to the refuge are under jurisdiction of New Jersey State, which allows public access.

Fort Mott State Park and the Salem River Wildlife Management Area are adjacent to the refuge acquisition boundary. Several other wildlife management areas and private conservation lands are located within a 30-mile radius of the refuge. These lands provide some degree of protection for wetlands, uplands, and deciduous forests.

Air Quality

The U.S. Environmental Protection Agency (EPA) has issued the following air quality standards (Table 2.1):

Table 2.1. Environmental Protection Agency (EPA) air quality standards

Air pollutant	Air Quality Standard*
Carbon monoxide	35 ppm (1-hour average), 9 ppm (8-hour average)
Nitrogen dioxide	0.053 ppm (annual mean)
Ozone	0.12 ppm (1-hour average), 0.075 ppm (8-hour average)
Sulfur dioxide	0.14 ppm (24-hour average), 0.030 ppm (annual mean)
Airborne Particulates (< 2.5 micrometers in diameter)	35 $\mu g/m^3$ (24-hour average), 15.0 $\mu g/m^3$ (annual mean)

* ppm = parts per million

The New Jersey Department of Environmental Protection Bureau of Air Monitoring maintains a network of 44 air monitoring sites throughout the State for continuous monitoring of criteria air pollutants (AIRMON 2008). Air quality monitoring for Salem and Cumberland Counties is conducted at a monitoring site in Millville, New Jersey approximately 30 miles southeast of Supawna Meadows NWR. In operation since 1983, the Millville site is currently monitoring nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (PM) less than 2.5 micrometers in diameter (PM2.5). The Salem/Cumberland County area is in non-attainment for ozone for the 8-hour standard but is in attainment for the other criteria pollutants (EPA 2010). See table 2.2 for 2004 to 2008 ozone measurements at Millville.

Table 2.2. Ozone measurements* closest to Supawna Meadows NWR from 2004 to 2008.

	Ozone (in parts per million)	
Year	2nd Max 1-hour	4th Max 8-hour
2004	0.092	0.083
2005	0.111	0.085
2006	0.103	0.083
2007	0.093	0.083
2008	0.089	0.079

* Measurements taken in Millville, Cumberland County, New Jersey.
Source: Environmental Protection Agency. 2010. US AirData webpage. http://www.epa.gov/air/data/index.html Retrieved 9 July 2010.

Water Quality

New Jersey water quality is monitored and managed within watershed management areas. Watershed Management Area 17 (WMA 17) includes the Cohansey, Maurice, and Salem rivers, and the Alloway, Dividing, Manantico, Manusmuskin, Miles, Mill, Stow, and Whooping creeks. This area includes portions of Atlantic, Cumberland, Gloucester, and Salem Counties, over 39 municipalities, and encompasses 885 square miles. Land use in this watershed is about 40 percent cropland with the rest being woodland, tidal/freshwater marsh, urban, and pasture. Nonpoint sources of water pollution range from agricultural activities such as tree harvesting, crop production, and animal pastures to urban runoff from construction, septic systems, and urban surfaces.

The Salem River drains an area of 114 square miles and flows 32 miles, from Upper Pittsgrove Township west to Deepwater, then south to the Delaware River. The area lies within Salem County, the major population center being the city of Salem. Much of the lower portions of the river are tidal.

The Delaware River is the longest un-dammed river east of the Mississippi, extending 330 miles from the confluence of its east and west branches at Hancock, New York to the mouth of the Delaware Bay where it meets the Atlantic Ocean (DRBC 2008). The river is fed by 216 tributaries, the largest of which are the Schuylkill and Lehigh rivers in Pennsylvania. In all, the basin contains 13,539 square miles, draining parts of Pennsylvania (6,422 square miles; 50.3 percent of the basin's total land area); New Jersey (2,969 square miles; 23.3 percent); New York (2,362 square miles; 18.5 percent); and Delaware (1,004 square miles; 7.9 percent). Included in the total area number is the 782 square-mile Delaware Bay, which lies roughly half in New Jersey and half in Delaware. Nearly 15 million people (approximately five percent of the nation's population) rely on the waters of the Delaware River Basin for a multitude of uses, but the watershed drains only four-tenths of one percent of the total continental U.S. land area. The Delaware River Basin Commission's (DRBC) recreational use standards for fecal coliform and enterococcus bacteria apply in the tidal Delaware River and Delaware Bay (DRBC 2009). August 2009 sampling at Pea Patch Island and Reedy Island showed levels of enterococcus that exceeded the standard of 35 colony forming units (cfu)/100 milliliters.

Currently, fish consumption advisories exist for waters in all states surrounding the Delaware Estuary and along the Delaware River (Delaware Estuary 2008). Contaminants found in estuarine fish that result in consumption advisories include polychlorinated biphenyls (PCBs), mercury, dioxins/furans, and chlorinated pesticides, including dichlorodiphenyltrichloroethane, better known as DDT. Given that fish accumulate many contaminants in their fatty tissues, certain species with higher oil contents can pose more human consumption risks than others.

Soil Types

The U.S. Department of Agriculture's Natural Resource Conservation Services mapped the soils within Salem County, New Jersey in 1996. The major soil types found within the Refuge include Transquaking mucky peat (65 percent of total acres), Mannington-Nanticoke complex (10 percent), Mattapex silt loam (9 percent), and Othello, Falsington, and Trussum soils (9 percent). The remaining soils on the refuge include Mattapex silt loam (2 percent); Othello and Falsington soils (2 percent); Sassafrass-Woodstown complex (2 percent), and Matapeake silt loam (1 percent). The major soil types are described below (USDA 1996, 2002):

Transquaking mucky peat, 0-1 percent slopes-This series consists of very deep, very poorly drained soils formed in thick organic deposits. They are very frequently flooded and occur on the brackish estuarine marshes along tidally influenced rivers and creeks.

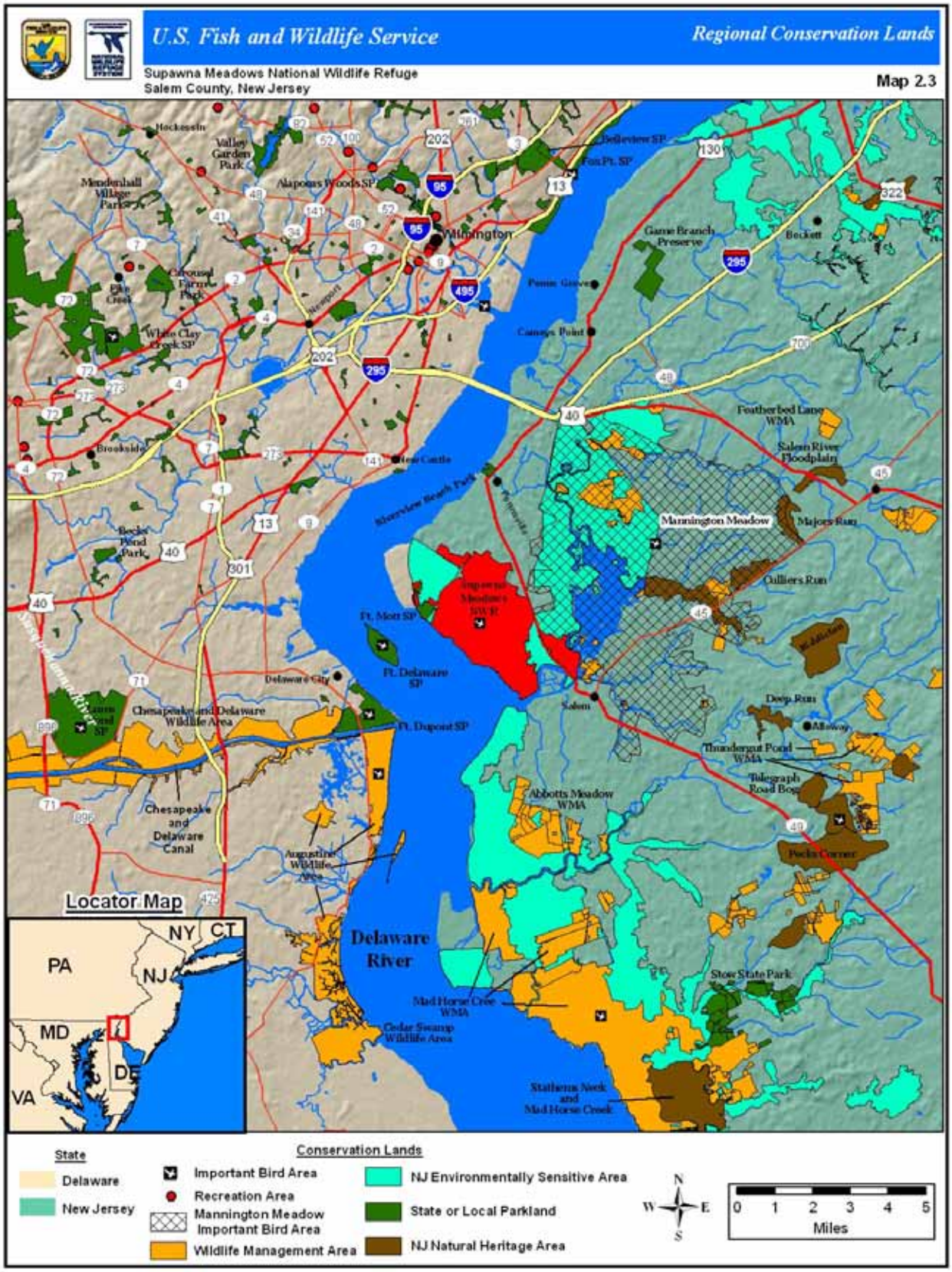
Mannington-Nanticoke complex, 0-1 percent slopes-This series consists of mucky silt loam, formed in silty estuarine deposits over organic, herbaceous material. These soils are non-acidic, fine silty, mixed soils that are very poorly drained, frequently flooded, and occur in tidal flats.

Mattapex silt loam, 2-5 percent slopes-These are very deep, moderately well drained soils formed from silty eolian deposits over coarser fluviomarine deposits. They have moderate to rapid permeability and are slightly acidic.

Othello, Falsington, and Trussum soils, 0-2 percent slopes-Both the Falsington and Othello series are very deep, poorly drained soils formed from silty eolian deposits over fluviomarine deposits. These occur on upland flats and depressions.

Regional Conservation Lands

There are several State, Federal, and locally-managed conservation lands in the vicinity of Supawna Meadows NWR (Map 2.3).


U.S. Fish and Wildlife Service
Regional Conservation Lands
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 2.3
Hockessin
Valley Garden Park
Mendenhall Village Park
Alapocas Woods SP
Wilmington
Bellevue SP
Fox Pt. SP
Game Branch Preserve
Beckett
Carousel Farm Park
Elk Creek
White Clay Creek SP
Penns Grove
Carneys Point
Featherbed Lane WMA
Salem River Floodplain
Brookside
New Castle
Bowlers Beach Park
Mannington Meadow
Majors Run
Becks Pond Park
Culliers Run
Supawna Meadows NWR
Ft. Mott SP
Ft. Delaware SP
Delaware City
Salem
Deep Run
Alloway
Chesapeake and Delaware Wildlife Area
Ft. Dupont SP
Thunderpot Pond WMA
Telegraph Road Bog
Abbotts Meadow WMA
Chesapeake and Delaware Canal
Augustine Wildlife Area
Pecks Corner
Locator Map
NY
CT
PA
NJ
MD
DE
VA
Delaware River
Stow State Park
Mad Horse Creek WMA
Cedar Swamp Wildlife Area
Stathems Neck and Mad Horse Creek
State
Delaware
New Jersey
Conservation Lands
Important Bird Area
Recreation Area
Mannington Meadow Important Bird Area
Wildlife Management Area
NJ Environmentally Sensitive Area
State or Local Parkland
NJ Natural Heritage Area
N
W
E
S
0 1 2 3 4 5
Miles

Socioeconomic Setting

Salem County

Located in the southwestern corner of New Jersey, Salem County is bordered by Gloucester County to the north, Cumberland County to the east and south, and the Delaware River to the west. While only 15 minutes from Wilmington, Delaware and 35 minutes to Philadelphia, Pennsylvania, Salem County remains by far the least populated county in New Jersey. In spite of its close proximity to these urban and regional centers and major roadways (such as the New Jersey Turnpike, I-295, US Routes 40 and 130, and New Jersey State Highways 45 and 49), only 13 percent of the county's land has been developed for residential, commercial, or industrial use. The remaining 90 percent of the county is farmland or tidal and freshwater wetlands, lakes, ponds, and forests (NJDEP 2002b).

Salem County has, for the most part, maintained its traditional industries and land use patterns. The original settlements were made in the western end of the county where a network of rivers, streams, and creeks feed into the Delaware River. Lumber and grain mills were established among the major creeks as early industry was supported by timber and agriculture. Agriculture has played an important role in Salem County, both prior to European settlement, when it was inhabited by the Lenni Lenape tribe, and through the 17th Century arrival of the Swedes, Finns, and Quakers (Salem County Visitors Center 2010).

Approximately 40 percent of the county contains productive farmland today, largely concentrated in the rural central and eastern sections. According to the Census of Agriculture, more than $70.5 million of agricultural products were grown and raised on the 753 farms in Salem County in 2002 (USDA 2002). Salem ranks first in the State for wheat, barley, sweet corn, and potatoes, and second for milk production, soybeans, asparagus, and corn harvested for grain. Representing more than 10 percent of the State's agricultural market, Salem County is among the leaders for many other agricultural products as well (USDA 2002).

While agriculture is the mainstay of the eastern and central sections, western Salem County remains home to industry, the county's major employer. For more than a century, E.I. DuPont de Nemours and Company (DuPont) has formed the backbone of the chemical industry. At its peak in 1917, DuPont reportedly employed 25,000 people. By the 1960s, DuPont Chambers Works was the largest chemical factory in the world and DuPont employed 25 percent of Salem County households. Since then, the manufacturing industry in the United States has declined, as have the payrolls and outputs of DuPont and other companies in Salem County. Global competition and environmental regulations have led DuPont to relocate many of the site's business lines, cease operations of some altogether, and otherwise downsize its operation at the Chambers Works facility. The corresponding reduction in the industrial tax base, diminished employment opportunities, and significant loss of disposable income in the community have compromised the high quality of life associated with Salem County. By 2000, the county's per capita income was $20,874, 23 percent lower then the State's per capita income of $27,006 (US Census 2000).

Pennsville Township

Pennsville Township comprises 23.10 square miles located in the Philadelphia-Camden Metropolitan area. Pennsville had a population of 13,194, according to the 2000 Census. Estimated median household income in 2007 was $57,310, which increased about 17 percent from $47,494 in 2000. The town is predominately white, non-Hispanic (96.1 percent); hispanic is the second largest demographic, at 1.6 percent (City Data 2009).

Contribution of the Refuge to the Local Economy

Refuges provide many benefits to local economies. Property values and associated property taxes often increase near open spaces, benefitting local communities (Gies 2009). In addition, land in public ownership requires little in the way of services from municipalities, yet provides valuable recreation opportunities for local residents. Based on a 2006 report completed by the Service, over 34 million people visited refuges for recreation that year (Carver and Caudill 2007). These visits generated almost $1.7 billion in sales for regional economies, supporting 27,000 jobs and nearly $543 million in employment income. Refuge recreation spending generated an additional $185.3 million in tax revenue at the local, county, State, and Federal levels.

National wildlife refuges also contribute to local economies through shared revenue payments. Under the provisions of the Refuge Revenue Sharing Act (the Act of June 15, 1935, 16 U.S.C. 715s), the Service pays an annual refuge revenue sharing payment to counties that contain lands the Service administers. This payment often equals or exceeds the amount that would have been received if the property remained in private ownership. The exact amount of the annual payment depends on Congressional appropriations, which in recent years have tended to be less than the amount to fully fund the authorized level of payments. All of the alternatives will continue those payments in accordance with the law, commensurate with changes in the appraised market value of refuge lands, and new appropriation levels dictated by Congress. Recent Service revenue sharing payments for Supawna Meadows NWR are presented in table 2.3.

Table 2.3. Supawna Meadows NWR Revenue Sharing Payments

Year Paid	Amount Paid*
2000	$9,396.00
2001	$8,199.00
2002	$8,369.00
2003	$7,818.00
2004	$7,549.00
2005	$6,677.00
2006	$7,541.00
2007	$7,816.00
2008	$7,558.00
2009	$5,864.00

*Paid to Pennsville, Salem County

Refuge Administration

The refuge's approved acquisition boundary encompasses approximately 4,527 acres along the Delaware and Salem Rivers in Pennsville Township, New Jersey. The refuge boundaries are defined by the Delaware River, Salem River, New Jersey Route 49, West Supawna Road, Fort Mott Road, and Lighthouse Road (see Map 1.3) in Chapter 1).

Supawna Meadows NWR Land Acquisition History

Table 2.4 lists the land acquisition history for the refuge. The dates from the 1800s represent when some of the original refuge lands were first transferred from private ownership to the Federal government. These properties were owned by different Federal agencies and were eventually transferred to the U.S. Fish and Wildlife Service.

Table 2.4. Land acquisition history for Supawna Meadows NWR

Acquisition Year	Acres	Price*
1837	18.89	0
1837	19.01	$1,500.00
1876	1.86	0
1935	1.86	0
1941	5.0	0
1973	562.4	0
1973	91.0	$300,000.000
1974	41.8	$15,700.00
1979	1002.3	0
1979	11.9	$154,044.00
1987	367.5	0
1987	114.4	$84,000.00
1990	81.06	0
1990	254.47	$415,000.00
1992	288.4	0
1992	32.8	$327,400.000
2006	121.0	0
2009	254.3**	0
Total	**3,270.05**	**$1,297,644.00**

*Zero price indicates land was donated
**All held in conservation easement

Operating Budget

With the complexing of Supawna Meadows NWR to Cape May NWR in 2004 and the implementation of the Northeast Region's Strategic Workforce Plan in 2006, no specific operating budget has been allocated for Supawna Meadows NWR. All operation and maintenance funding for Supawna Meadows NWR is supported by Cape May NWR's allocated annual budget.

Supawna Meadows NWR Staffing

The staff at Supawna Meadows NWR once consisted of a wildlife biologist, a maintenance worker (with collateral law enforcement duties), and an administrative support assistant. When the Northeast Region's Strategic Workforce Plan was implemented in 2006, the refuge was deemed an unstaffed satellite of Cape May NWR. The plan eliminated the wildlife biologist and administrative support assistant, and, the maintenance worker position was relocated to Cape May NWR.

Supawna Meadows NWR currently has no on-site staff. Cape May NWR currently has six full-time staff. Annually, about 20 percent of each full-time employee's time from Cape May NWR is spent providing management, maintenance, or law enforcement support to Supawna Meadows NWR (for more detailed information on staffing refer to Appendix E).

Facilities and Maintenance

The refuge headquarters office is located along Lighthouse Road adjacent to the Finns Point Rear Range Light (FPRRL). The building design was modeled after the FPRRL keeper's house to compliment this historic structure. It serves as office space for staff as well as a reception area for visitors; however, the building is currently unoccupied because there is no staff assigned to Supawna Meadows NWR. Also located at this site are a 4-bay garage for storing equipment and three other outbuildings, including a small building that used to store oil for FPRRL. Buildings at the previous headquarters site, located approximately 0.5 miles from the refuge headquarters off Lighthouse Road, include a barn, garage, house, and office. The refuge has two housing quarters. One is located off Route 49 and is currently used to house temporary employees. The other, located off Lighthouse Road, is vacant.

Partnerships

The reduced staff time at Supawna Meadows NWR has limited our ability to fully participate in partnerships with agencies and organizations with which we have common conservation goals. We currently maintain partnerships with New Jersey Forest Fire Service, New Jersey Division of Fish and Wildlife, Friends of Supawna Meadows National Wildlife Refuge, and New Jersey Audubon Society.

Volunteer Program

Approximately seven people actively volunteer on the refuge. The primary duties consist of maintenance activities such as mowing around facilities and mowing and maintaining trails. The activities of the volunteers are critical to the operation of the refuge due to the lack of assigned full-time staff. Volunteers also engage in outreach activities sponsored by the Friends of Supawna Meadows NWR.

Friends Program

The Friends of Supawna Meadows National Wildlife Refuge was created in 2003 by local residents and volunteers. The mission of the group is "To enhance this national treasure by fostering community awareness, conducting outreach and environmental education, and supporting habitat and wildlife conservation on the refuge." The group currently consists of about 50 members; however, the number of members is increasing and the group is actively working to raise the profile of the refuge.

The group's primary annual activity is the Youth Fishing Event, usually held in early June. Up to 100 youths attend the fishing derby. Participants are provided the gear and bait needed to fish. They also receive a free lunch and a prize.

Other activities organized by the Friends group include nature walks, trail maintenance days, and off-site outreach at local festivals such as Septemberfest and the Winter Raptor Festival. The Friends Group is also active in educating local and Federal officials about refuge needs and events.

Research

An impoundment study was conducted on the Tract 11 impoundment from 2005 through 2008 in cooperation with 22 other refuges in the northeast and midwest. The objectives of the study were to determine the response of waterbirds, plants, and invertebrates while providing habitat for migratory waterbirds; to use impoundment bathymetric data to meet spring shorebird, fall shorebird or fall waterfowl habitat requirements; and to study vegetation response to spring and summer drawdowns. Water levels in the impoundment were lowered for shorebird use and raised for waterfowl use during various times of year.

Special Use Permits

In general, special use permits are issued for associated wildlife related research projects or studies to cooperating partners such as New Jersey Division of Fish and Wildlife, New Jersey Audubon Society, and others. Proposed research projects and other compatible uses are issued special use permits when they are determined to be beneficial to the refuge mission.

Biological Resources

This section describes the physical characteristics and plant species composition of the principal refuge habitats as well as the invasive plant species that occur. It also identifies the wildlife species of conservation concern that use those habitats. Table 2.5 summarizes the acreage of each habitat type within the refuge. Approximately 87 percent of the refuge is in wetlands and impoundments, the other 13 percent is upland.

Tidal Marsh

The largest single habitat type on Supawna Meadows NWR is slightly brackish (0 - 8 parts per thousand (ppt)) tidal marsh, which comprises 2,423 acres, about 75 percent of the refuge's acreage. This habitat type includes marsh habitat (1,931 acres) and the open water tidal rivers and creeks (492 acres). The tidal marsh soils consist of organic silts and fine to very coarse dredge river material. They occur on flats along the Delaware River to a depth of 20 feet. These features are regularly flushed during high tides. Tidal pools and ponds are generally found in the interior portions of regularly flowing tidal marshes, but these water bodies themselves may not be flooded on every tidal cycle.

The tidal marsh west of Route 49 was diked and drained for farming in the 18th century. Portions of the dike blew out in the 1930s and the marsh reflooded. Originally, there was more sheet flow from the Delaware Bay to Mannington Meadow (to the east of Route 49). However, flow is now restricted to a few locations and Mannington Meadow is fresher than the marshes on the west side of Route 49.

The portion of the refuge east of Route 49 lies within Mannington Meadow and contains a diversity of vegetation. Dominant species include smooth cordgrass (*Spartina alterniflora*), pickerelweed (*Pontederia cordata*), water hemp (*Amaranthus cannabinus*), wild rice (*Zizania aquatica*), rice cutgrass (*Leersia oryzoides*), and common reed or phragmites (*Phragmites australis*). The Baldridge Creek area contains a diversity of vegetation similar to that found in the Mannington Meadow area, but there is a greater amount of phragmites in this area. Several rare plants occur in tidal marshes on the refuge (for example, seashore mallow (*Kosteletzkya virginica*) and long-awned sprangletop (*Leptochloa fascicularis var. maritima*)).

The Mill Creek and Mud Creek areas of the tidal marsh are extensively dominated by phragmites, which is the most prevalent invasive plant found on the refuge. Altogether, about 859 acres of the tidal marsh remains in native marsh vegetation; 762 acres are phragmites-dominated.

Breeding birds that inhabit the tidal marsh include the clapper rail (*Rallus longirostris*), king rail (*Rallus elegans*), least bittern (*Ixobrychus exilis*), coastal plain swamp sparrow (*Melospiza georgiana nigrescens*), seaside sparrow (*Ammodramus maritimus*), and sedge wren (*Cistothorus platensis*). The tidal marsh is an important foraging area for the nine Pea Patch Island colonial nesting wading birds, which include five priority species: little blue heron (*Egretta caerulea*), glossy ibis (*Plegadis falcinellus*), snowy egret (*Egretta thula*), black-crowned night-heron (*Nycticorax nycticorax*), and least bittern.

The tidal marsh supports raptors including the bald eagle (*Haliaeetus leucocephalus*) and osprey *(Pandion haliaetus).* The marsh also provides migrating and wintering habitat for two populations of the Canada goose *(Branta canadensis)*, Atlantic Population Canada geese and North Atlantic Canada geese; and for the tundra swan *(Cygnus columbianus).* It also supports migrating shorebirds such as the semipalmated sandpiper (*Calidris pusilla*), dunlin (*C. alpine*), and greater yellowlegs (*Tringa melanoleuca).*

The tidal marsh supports a diversity of other wildlife species including the marsh rice rat (*Oryzomys palustris*), a New Jersey nongame species of conservation concern (NCC), and the Northern diamondback terrapin (*Malaclemys terrapin terrapin*). It also supports NCC insects of conservation concern such as a geometrid moth *(Eusarca fundaria)* and a noctuid moth (*Meropleon titan).*

Table 2.5. Habitats and refuge acres for Supawna Meadows NWR

Habitat Type	Current Acreage
Developed	**27.26**
Developed	0.42
Levee	5.21
Road	7.29
Rural	14.34
Forested Uplands	**240.14**
Mesic Mixed Oak Forest	22.73
Northeastern Modified Successional Forest	139.16
Norway Spruce Plantation	1.10
Successional Sweetgum Forest	77.15
Forested Wetlands	**181.97**
Red Maple - Sweetgum Swamp	172.03
Red Maple / Lizard's-tail Swamp	9.94
Grassland	**122.02**
Cropland	36.25
Hay	5.22
Northeastern Old Field	77.78
Pasture	2.78
Herbaceous Wetland	**41.61**
Freshwater Phragmites Marsh	38.79
Smartweed Pond	0.35
Successional Wet Meadow	2.48
Impoundments with Water Control Structures	**85.61**
Impoundments without Water Control Structures	**3.98**
Creeping Lovegrass Coastal Plain Pond	1.30
Other Impoundments	2.68
Scrub/Shrub Uplands	**37.87**
Northeastern Modified Successional Shrubland	37.87
Scrub/Shrub Wetlands	**56.00**
Northeastern Modified Successional Shrubland	56.00
Scrub/Shrub Wetlands (Tidal)	**27.66**
Maritime Shrubland (northern bayberry type)	3.90
Northeastern Modified Successional Shrubland	23.76
Tidal Marsh	**1,934.05**
Atlantic Giant Cordgrass Marsh	5.41
Brackish Meadow	2.31
Brackish Tidal Low Marsh	64.63
Cattail Brackish Marsh	370.41
Mesohaline Seepage Marsh	2.53
Oligohaline Marsh	47.27
Tidal Phragmites Marsh	1,438.23
Woolgrass Marsh	0.26
Open Waters	**491.70**
Grand Total	**3,249.89***

* Includes 231 acres held under conservation easement by the refuge. The owners have reserved certain rights on an additional 20 acres of this easement so these acres are not included..

Managed Impoundments and Ponds

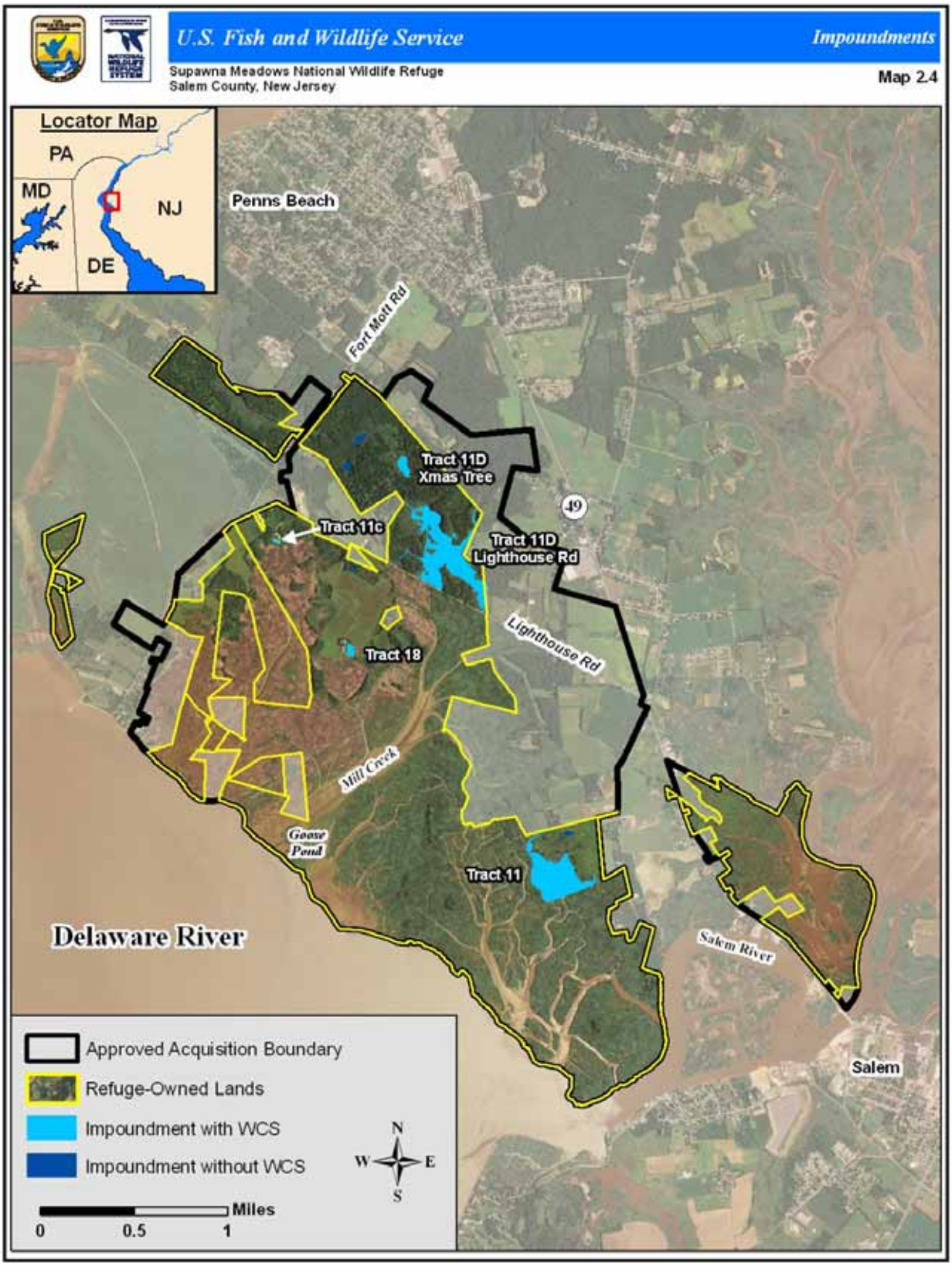
The refuge has five impoundments with water control structures, totaling approximately 84 acres (Table 2.6, Map 2.4). A natural increase in water levels can occur from rainfall and from natural springs. In these impoundments, boards are placed or removed to control the water level; either releasing impounded waters or allowing tidal water to flow into the impoundment. Currently, the water level is managed in three of the five impoundments.

Table 2.6. Managed impoundments of Supawna Meadows NWR

Name	Location	Size (acres)	Habitat:
Tract 11	Off West Supawna Road	30	cattail marsh; surrounded by tidal marsh and farm fields
Tract 11C	Behind new office/quarters	0.3	open water; surrounded by tidal marsh, forested and scrub/shrub wetlands, old field
Tract 11D Lighthouse Rd (LHR)	On Lighthouse Rd	48.5	open water; surrounded by tidal marsh, forest
Tract 18	At old office/barn	1.5	open water; surrounded by grassland and tidal marsh
Tract 11D Xmas Tree Lane (XTL)	Off X-mas Tree Lane/ off Forest Habitat Trail	3.3	open water; surrounded by forest

The Tract 11 impoundment is a 30-acre freshwater emergent wetland adjacent to the tidal marsh. A water control structure at the head of a tidal creek is used to manipulate water levels within the impoundment. Prescribed fire has been used to control vegetation in the impoundment. Mowing and flooding can also be used to reduce overcrowding vegetation. Water levels are managed to provide habitat for trust resources, primarily shorebirds, wading birds, and waterfowl. Plants that occur in this impoundment include Walter's cockspur grass (*Echinochloa walteri*), spreading panic grass (*Panicum dichotomiflorum*), cattail (*Typha* sp.), bulrush (*Scirpus* sp.), and sedges (*Cyperus* sp.). Several rare plants occur in and around this impoundment including hooded arrowhead (*Sagittaria calycina var. calycina*) and giant foxtail (*Setaria magna*). Invasive species such as phragmites, purple loosestrife (*Lythrum salicaria*), Canada thistle (*Cirsium arvense*), and mile-a-minute weed (*Polygonum perfoliatum*) are displacing native species in the impoundments and along the dikes.

Breeding birds that use the impoundments include the little blue heron, marsh wren (*Cistothorus palustris*), American black duck (*Anas rubripes*), wood duck (*Aix sponsa*), and clapper rail.


U.S. Fish and Wildlife Service
Impoundments
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 2.4
Locator Map
PA
MD
NJ
DE
Penns Beach
Fort Mott Rd
Tract 11D
Xmas Tree
Tract 11c
Tract 11D
Lighthouse Rd
49
Lighthouse Rd
Tract 18
Mill Creek
Goose Pond
Tract 11
Delaware River
Salem River
Salem
Approved Acquisition Boundary
Refuge-Owned Lands
Impoundment with WCS
Impoundment without WCS
N
W
E
S
Miles
0
0.5
1

Also supported are spring migrating shorebirds including the semipalmated sandpiper, greater yellowlegs, and dunlin. In response to impoundment management for spring-migrating shorebirds during 2000 – 2001, almost 3,000 shorebirds were observed in the Tract 11 impoundment during late May at the peak of the spring migration. In 2004, weekly shorebird surveys were conducted from March through July at high tide. Greater and lesser yellowlegs (*Tringa melanoleuca* and *T. flavipes*, respectively), semipalmated sandpipers, least sandpipers (*C. minutilla*), dunlin, common snipe (*Gallinago gallinago*), solitary sandpipers (*Tringa solitaria*), spotted sandpipers (*Actitis macularia*), and semipalmated plovers (*Charadrius semipalmatus*) were observed. The greatest number of shorebirds was detected on May 11 when 840 shorebirds, mostly semipalmated and least sandpiper, were observed.

Tract 11 Impoundment

The Pea Patch Island wading birds use the impoundments for foraging. Weekly wading bird surveys were conducted from March through September 2002 at high tide. Great blue herons, (*Ardea herodias*), great egrets (*Ardea alba*), snowy egrets, little blue herons, cattle egrets (*Bubulcus ibis*), and glossy ibis were observed. The greatest number of wading birds was observed in the Tract 11 impoundment on May 14 when 63 individuals of six species were counted.

Weekly waterfowl surveys were conducted January through March and September through December 2002. American black ducks, Canada geese, gadwall (*Anas strepera*), green-winged teal (*Anas carolinensis*), mallards (*Anas platyrhynchos*), Northern pintail (*Anas acuta*), and wood ducks were observed. The greatest number of ducks and geese was observed in the Tract 11 impoundment on November 25 when 326 Canada geese, 15 green-winged teal, 190 mallards, and 329 Northern pintail were counted.

Common snapping turtles (*Chelydra serpentina*), red-eared sliders (*Trachemy scripta elegans*), redbelly turtles (*Pseudemys rubriventris*), Eastern painted turtles (Chrysemys picta picta), Northern water snakes (*Nerodia sipedon*), Southern leopard frogs (*Rana sphenocephala*), and

Northern spring peepers (*Pseudacris crucifer crucifer*) also are present in this impoundment.

A number of amphibian and reptile species use all of the impoundments, including the Fowler's toad (*Bufo woodhousii fowleri*), which is listed as a non-game species of conservation concern by the New Jersey Division of Wildlife.

There are a number of small, unmanaged impoundments that lack water control structures. These consist of old clay pit ponds and other depressions in the forested areas. The ponds are man-made, most have high berms surrounding them, and some have drainage outlets. These impoundments are generally open water and unvegetated. However, the edges contain some plant species, such as Walter's cockspur grass, spreading panic grass, cattail, bulrush, and sedges. Wood duck and eastern screech owls (*Megascops asio*) benefit from nest boxes placed near these unmanaged impoundments.

Forested Wetlands

Forested wetlands comprise about 182 acres of refuge land. These wetlands are closed canopy swamps dominated by deciduous trees. The forest is interspersed with permanent and vernal ponds. Mature trees mostly have a 14-20 inches diameter breast height (dbh); dominant species include red maple (*Acer rubrum*), willow oak (*Quercus phellos*), sweetgum (*Liquidambar stryaciflua*), and sour gum (*Nyssa sylvatica*). Dominant understory plants include southern arrowwood (*Viburnum dentatum*) and sweet pepperbush (*Clethra alnifolia*). Common groundcover plants include New York fern (*Thelypteris noveboracensis*) and false nettle (*Boehmeria cylindrica*). Several rare plant species occur in this habitat (for example, cutleaf water milfoil (*Myriophyllum pinnatum*) and stalked water horehound (*Lycopus rubellus*)). In many areas, the ground cover is dominated by the invasive plant Japanese stiltgrass (*Microstegium vimineum*) (USFWS 2005a).

Upland Forests

Forested uplands, which include small forest openings not counted as scrub/shrub habitat, comprise about 240 acres of refuge land. At least 75 percent of the canopy coverage is from deciduous trees. The average height is at least 20 feet. Plant species include sweetgum, sour gum, black cherry (*Prunus serotina*), black oak (*Quercus velutina*), Southern red oak (*Quercus falcata*), persimmon (*Diospyros virginiana*), American holly (*Ilex opaca*), and red maple (*Acer rubrum*). Dominant understory plants include Southern arrowwood, highbush blueberry (*Vaccinium corymbosum*), and common greenbrier (*Smilax rotundifolia*).

Grassland

Approximately 86 acres of grassland habitat occur on the refuge, excluding cropland. A contiguous 78-acre grassland unit and several grassland patches of less than six acres occur on the refuge. The large grassland, located off Lighthouse Road, includes a diversity of grasses and forbs. It is maintained through mechanical methods, such as mowing, and by prescribed burning. Historically, the grassland was farmed; prior to farming, the conditions were maintained by fire that was periodically caused by lightning or man-made events. Some important plant species include cool season grasses, such as orchard grass (*Dactylis glomerata*); warm season grasses, such as switch grass (*Panicum virgatum*); and forbs, such as goldenrods (*Euthamia* sp. and *Solidago* sp.) and eupatoriums (*Eupatorium* sp.) (USFWS 2005a).

Invasive plants of the grassland include Canada thistle, Chinese lespedeza (*Lespedeza cuneata*), and autumn olive (*Elaeagnus umbellata*). The grassland habitat does not support a large number of breeding birds, but does provide migration and wintering habitat for songbirds such as the bobolink, vesper sparrow, Eastern meadowlark, and savannah sparrow, and for raptors such as the northern harrier and short-eared owl.

Scrub/Shrub Habitat

There are approximately 122 acres of scrub/shrub and early successional habitats spread across the refuge, comprised of 84 acres of wetlands and 38 acres of uplands. These areas are dominated by a mixture of native plants (e.g., blackberry, goldenrod, grapevine, and bayberry (*Myrica pensylvanica*)) and invasive plants (e.g., multiflora rose, autumn olive, Japanese honeysuckle, mile-a-minute weed, and phragmites) (USFWS 2005a).

Forest openings are mostly dominated by invasive plants (e.g., autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass, and mile-a-minute vine). Other common plants in the forest openings include sweetgum, black cherry, blackberry (*Rubus* sp.), and grape vines (*Vitis* spp.). There are large patches within the mature forest where invasives do not occur. These patches host a number of S1[3] and S2[4] plants, including round-fruited hedge-hyssop (*Gratiola virginiana*), southern twayblade (*Listera australis*), stalked water horehound, cutleaf water milfoil (*Myriophyllum pinnatum*), loblolly pine (*Pinus taeda*), and fragrant ladies' tresses (*Spiranthes cernua var. odorata*) (USFWS 2005a).

Invasive Plants

Invasive plants are found in all refuge habitats as discussed under each of the habitat types, but most importantly in the refuge's tidal marsh. The relative predominance of these species is shown in table 2.7, listing the most recent estimates of acreage across the refuge for each species.

[3] S1: At very high risk due to extreme rarity (often 5 or fewer populations or occurrences in the State), very steep declines, or other factors.
[4] S2: At high risk due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

Table 2.7 Important invasive plants* of Supawna Meadows NWR.

Common Name	Scientific Name	Total Acreage	Acres of Dense (Monotypic) Coverage
Phragmites/Common reed**	*Phragmites australis*	531	511
Japanese stiltgrass	*Microstegium vimineum*	78	57
Japanese honeysuckle	*Lonicera japonica*	120	16
Mile-a-minute vine	*Polygonum perfoliatum*	63	6
Autumn olive	*Elaeagnus umbellata*	72	2
Reed canary-grass	*Phalaris arundinacea*	2	2
Asiatic bittersweet	*Celastrus orbiculatus*	16	< 1
Multiflora rose	*Rosa multiflora*	93	< 1
Canada thistle	*Cirsium arvense*	44	< 1
Chinese lespedeza	*Lespedeza cuneata*	2	< 1
Wild Garlic	*Allium vineale*	5	< 1
Johnsongrass	*Sorghum halepense*	1	< 1
Bristled knotweed	*Polygonum caespitosum*	11	< 1
Black locust	*Robinia pseudoacacia**	9	0
Purple loosestrife	*Lythrum salicaria*	1	0

*occupying a minimum of 1 acre as of 2002

** common reed was not entirely mapped; the actual acreage is much higher.

Climate Change and Effects of Relative Sea Level Rise

Global climate change has already had an observable impact in the Northeastern U.S., including an increase in the water temperatures, more days over 90 degrees Fahrenheit, less precipitation as snow fall, and sea level rise (Frumhoff et al. 2007). According to the Intergovernmental Panel on Climate Change (IPCC), sea level has risen worldwide approximately 4.8 to 8.8 inches (12-22 cm) during the last century (IPCC 2007). While there is some variation in projected sea level rise (e.g., Rahmstorf 2007, Pfeffer et al. 2008), the IPCC projects sea levels will rise an additional 7.1 to 23.2 inches, about 0.07 to 0.23 inches per year, between 1999 and 2099 (IPCC 2007). The historic trend for sea level rise for the refuge is 0.136 inches per year, about twice the global average for the last 100 years.

Tidal marshes are highly susceptible to effects of climate change, especially sea level rise. In an effort to address potential effects of seal level rise on national wildlife refuges, the Service contracted the application of Sea Level Affecting Marshes Model (SLAMM) for many refuges in the Northeast, including Supawna Meadows NWR (see Appendix G for SLAMM report). The SLAMM analysis looks at effects of projected sea level rise on the refuge's approved acquisition boundary under five scenarios: 1.28 ft, 2.26 ft, 3.28 ft, 4.92 ft, and 6.56 ft by 2100. Results from SLAMM indicate that by 2025 there will be noticeable changes in refuge habitats under all scenarios. For example, saltwater intrusion will increase salinity and the amount of saltmarsh within the refuge boundary between 140 and 200 percent (adding between 219 and 300 acres). Other tidal marsh habitats will likely decrease between 14 and 18 percent (losing about 300 to 400 acres). Over this same time span, tidal creeks within the refuge will likely increase between 22 and 31 percent (between 150 and 220 acres). Because much of the refuge's

habitat is tidally influenced, sea level rise will likely change the species composition and associated habitat management for much of the refuge. We have not modeled potential effects of increased air temperatures and changes in seasons; however, these are likely to be much smaller compared to sea level rise given the tidal influence over much of the refuge's habitats.

Federal-Listed Threatened or Endangered Species and Other Species and Habitats of Special Management Concern

The following Federal-listed threatened or endangered species may enter the Delaware Bay and may occasionally travel up the river as far as the refuge:

- Atlantic hawksbill (*Eretmochelys imbricata*)
- Atlantic loggerhead (*Caretta caretta caretta*)
- Atlantic ridley (*Lepidochelys kempii*)
- Atlantic leatherback (*Dermochelys coriacea coriacea*)
- shortnose sturgeon (*Acipenser brevirostrum*)

All of these species are under the jurisdiction of the NOAA. No sea turtle nesting habitat is present on the refuge. The shortnose sturgeon is present in the Delaware River; however, this species prefers larger rivers (Dadswell et al. 1984) and is not expected to occur within the refuge boundary. Whales occasionally enter the Delaware Bay and one individual is known to have strayed as far north as Philadelphia, Pennsylvania.

Sensitive joint-vetch (*Aeschynomene virginica*), a Federal-listed threatened species, has been reported at two locations near the refuge. It was found on the muddy tidal banks of the Delaware River on August 8, 1881 and to the north of the refuge in 1934. No plants were found during a brief survey conducted on September 30, 1992 (David Snyder, New Jersey Natural Heritage Program, personal communication, July 21, 2010).

We will continue to consult with the Service's Ecological Services division and NOAA, as appropriate, regarding refuge activities that may affect Federal-listed threatened and endangered species. In addition, to ensure compliance with the Federal Endangered Species Act, this document will be subject to intra-governmental review under Section 7.

New Jersey maintains a State list of threatened or endangered species. Of these species, the osprey successfully nests on the refuge. Great blue heron feed on the refuge throughout the year. Bald eagles have nested on the refuge since 1998. Another pair of bald eagles has been maintaining a nest in the adjacent Salem River Wildlife Management Area. Peregrine falcons (*Falco peregrinus*) nest on the Delaware Memorial Bridge, approximately seven miles north of the refuge. Peregrines may occasionally use the refuge for feeding and are occasionally observed during migration. Coast flatsedge (*Cyperus pseudovegetus*), a State endangered species, was collected along the Delaware River on October 29, 1934. Floating pennywort (*Hydrocotyle ranunculoides*), another State endangered species, was observed on the north side of Lighthouse Road, west/northwest of Harrisonville, in 1967 and again in 1985.

Appendix A lists the animals potentially found on the refuge that are Federal-listed threatened or endangered or are State-listed threatened, endangered, or a species of special concern.

Birds

Supawna Meadows NWR is located in the Atlantic Flyway where birds migrating from interior Canada and the coastal provinces merge to form the main stem of the flyway. The refuge not only serves as an important migration area, but also provides wintering habitat for large numbers of waterfowl. Midwinter waterfowl inventory flights for the Salem River watershed averaged more than 2,000 dabbling ducks and more than 11,500 Canada geese during the 2009 midwinter count (USFWS 2009d). Over 300 species of birds can be observed in Salem County during the year. Supawna Meadows NWR provides habitat for regionally and nationally significant species such as rails, neotropical migrants, and raptors (USFWS 2005a).
In describing the Supawna Meadows National Wildlife Refuge Important Bird Area (IBA), the New Jersey Audubon Society noted the following:

> *The Supawna Meadows IBA provides breeding habitat for the State endangered bald eagle. Over 20 State threatened king rails also breed at this site. Significant numbers of breeding mixed upland forest, shrub/scrub, and forested wetland-dependant species occur at Supawna Meadows. The refuge marshes provide valuable foraging habitat for more than 6000 pairs of colonial wading birds nesting less than a mile away on Delaware's Pea Patch Island. One of the largest heron rookeries on the east coast north of Florida supports nine species: great blue heron, great egret, little blue heron, tricolored heron, snowy egret, cattle egret, black and yellow-crowned night-heron and glossy ibis. The refuge provides important resting and feeding habitat for spring and fall migrants including waterfowl species and passerines. mallards and northern pintails also winter at the refuge (New Jersey Audubon Society 2009).*

Waterfowl

Thousands of waterfowl, including American black duck, American widgeon (*Anas americana*), Canada goose, blue-winged teal (*Anas discors*), green-winged teal, gadwall, mallard, northern pintail, snow goose (*Chen caerulescens*), and tundra swan use the refuge tidal marsh during winter and migration USFWS 2005a).

Coastal salt marsh habitats of the mid-upper Atlantic coast, including the Delaware Bay marshes and Supawna Meadows NWR, have been identified by the Black Duck Joint Venture as the most important habitat for wintering black duck. Coastal wetlands, including the Delaware Bay marshes, are of international importance to wintering waterfowl, annually wintering 34 percent of the entire Atlantic Flyway black duck population (Black Duck Joint Venture 2008).

Raptors

Notable raptor species observed on the refuge include bald eagle, northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipter striatus*), Cooper's hawk (*A. cooperii*), red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and peregrine falcon. A number of State endangered northern harriers and State threatened osprey nest in the refuge tidal marsh (USFWS 2005a). A pair of bald eagles has nested on the refuge since 1998.

Forest Birds

The forest supports breeding wood thrush (*Hylocichla mustelina*), eastern wood-pewee (*Contopus virens*), northern flicker (*Colaptes auratus*), and Baltimore oriole (*Icterus galbula*); and migrating black-and-white warbler (*Mniotilta varia*), hooded warbler (*Wilsonia citrina*), and Kentucky warbler (*Oporornis formosus*), as well as Cooper's hawk.

Grassland Birds

As mentioned previously, the refuge's grassland habitat does not support a large number of breeding grassland birds, but it does support migrating and wintering songbirds, including the bobolink (*Dolichonyx oryzivorus*), vesper sparrow (*Pooecetes gramineus*), eastern meadowlark (*Sturnella magna*), and savannah sparrow (*Passerculus sandwichensis*), as well as raptor species such as northern harrier and short-eared owl (*Asio flammeus*).

Marsh, Wading, and Shorebirds

Supawna Meadows NWR provides foraging habitat for more than 6,000 pairs of nine species of wading birds that nest on Pea Patch Island, one of the largest rookeries on the East Coast. Specifically, black-crowned night-heron, yellow-crowned night-herons (*Nyctanassa violacea*) (State threatened), great egret, and little blue heron (State species of special concern) forage in the tidal marsh throughout the breeding season. The refuge receives significant use by shorebirds during both spring and fall migrations, mostly least sandpiper (*Calidris minutilla*) and semipalmated sandpiper. King rail and least bittern (State species of special concern) breed in the refuge tidal marsh.

Pea Patch Island and the surrounding area, including the refuge, have been designated a Special Management Area by the states of New Jersey and Delaware in accordance with the Coastal Zone Management Act.

The Refuge receives significant use by shorebirds during both spring and fall migrations. Both the New Jersey and Delaware shores of the Delaware Bay are designated as International Shorebird Preserves, based on the importance of the estuary to migrating shorebirds.

Mammals

A large number of New Jersey non-game species of conservation concern mammals are on the refuge, including Eastern small-footed bat (*Myotis leibii*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and southern bog lemming (*Synaptomys cooperi*). Common mammalian species include the meadow vole (*Microtus pennsylvanicus*), white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*), cottontail rabbit (*Sylvilagus floridana*), groundhog (*Marmota monax*), muskrat (*Ondatra zibethica*), opossum (*Didelphis virginiana*), skunk (*Mephitis mephitis*), red fox (*Vulpes fulva*), raccoon (*Procyon lotor*),

mink (*Neovison vison*), long-tailed weasel (*Mustela frenata*), and river otter (*Lontra canadensis*).

White-tailed deer are numerous on the refuge. The New Jersey Division of Fish and Wildlife (NJDFW) estimates the deer density around Salem County, Hunting Management Zone 63, to be 40.4 deer per square mile based on the harvest data for 2003 - 2005 hunting seasons. The overall deer condition and productivity in this zone is considered excellent by the NJDFW. However, the high population of deer on the refuge, which has led to habitat overbrowsing, was the catalyst in initiating a special permit refuge deer hunting season in 1988. At least fifty deer are expected to be harvested annually from the refuge. Prior to 2008, deer hunting was conducted based on a permit system. Limited hunting seasons were open on the refuge for bow, shotgun, and muzzleloader. The number of hunters was limited to 35, 25, and 25 individuals, respectively, and hunters were selected through a random lottery system. Hunters were required to pay a fee for their refuge permit and attend a hunter orientation session. Beginning with the 2008 hunting season, the refuge is closed to all firearm seasons. The refuge is currently open for all of the State bow hunting seasons. There is no longer a lottery, permit, fee, or hunter orientation.

A large maternity colony of more than 1,500 bats, primarily the little brown bat (*Myotis lucifugus*), roosts in a barn on the refuge. The Federal-listed endangered Indiana bat (*Myotis sodalis*) is known to form small colonies within large little brown bat colonies. Indiana bats have been documented within the Highlands region of New Jersey, but little survey work has taken place within the southern portion of the State. It is not yet known if the species is present within the Coastal Plain. The nearest potential natural habitat for these bats is in a forest on the refuge about one mile from the barn (USFWS 2005a).

Reptiles and Amphibians

A number of amphibians and reptiles are found on the refuge, including the eastern painted turtle, common snapping turtle, eastern garter snake *(Thamnophis sirtalis),* black rat snake *(Elaphe obsoleta),* southern leopard frog, green frog *(Rana clamitans melanota),* and American bullfrog (*Rana catesbeiana).* Reptile and amphibian species of conservation concern include northern diamondback terrapin

(Malaclemys terrapin terrapin), eastern box turtle *(Terrapene carolina carolina),* spotted turtle *(Clemmys guttata),* and Fowler's toad (USFWS 2005a).

Fish

The tidal marshes, creeks, and ditches provide spawning, nursery, and feeding habitat for a variety of fish common to the Delaware Bay, Estuary, and River. Mummichog (*Fundulus heteroclitus heteroclitus*) is the most abundant forage fish. Striped bass (*Morone saxatilis*) and white perch (*Morone americana*) are two of the more important anadromous species. American eel (*Anguilla rostrata*), a catadromous species, is currently a species of concern in New Jersey and the Mid-Atlantic Fisheries Council. Prior to the closure of the season on elvers (immature eels), commercial netting of elvers on and around the refuge, and from road right-of-ways within the refuge boundary, was common. Other important fish species found near and potentially affected by refuge activities include the Federal-listed endangered short-nosed

sturgeon, and State listed Atlantic sturgeon. The refuge provides nursery habitat for menhaden (*Brevoortia tyrannus*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), and striped bass. Blue crabs (*Callinectes sapidus*) are also found within tidal waters near the refuge and are part of the local recreational shellfishery.

Invertebrates

A wide diversity of terrestrial and aquatic invertebrate species inhabit the refuge tidal marsh and other habitats, including the eastern amberwing (*Perithemis tenera*), common green darner (*Anax junius*), seaside dragonlet (*Erythrodiplax berenice*), and the calico pennant (*Calithemis elisa*). Butterfly species include the orange sulfur (*Colias eurytheme*), black swallowtail (*Papilio polyxenes*), spicebush swallowtail (*Papilio Troilus*), and eastern tailed-blue (*Everes comyntas*).

Wildlife-Dependent Public Use

The priority public uses of the Refuge System are hunting, fishing, wildlife observation and photography, interpretation and environmental education. The Finns Point Rear Range Light, a historic lighthouse on the refuge, also draws visitors (USFWS 2005a). Further details on the various public uses occurring on the refuge are presented in Chapter 3 (see pgs 3-5 and 3-22) and in appendix B.

Visitor Numbers

In 2009, an estimated 15,000 visits were made to the refuge. A visit is defined as an individual, uninterrupted visit to the refuge for any length of time in a day. One person may make multiple visits to the refuge in one day if they leave and return. Over the past five years, visitation has ranged from 15,000 to 20,000 visits. Visitors participated in the following activities: hunting, fishing, wildlife observation, photography, interpretation, and other refuge approved activities.

Hunting

Portions of Supawna Meadows NWR are currently open for deer and waterfowl hunting. The refuge is open to deer hunting for all four of New Jersey's bow hunting seasons according to the State Deer Management Zone 63 regulations. Portions of the refuge are open to waterfowl hunting per State regulations. Waterfowl are hunted mainly by boat entry to the refuge from the Delaware River and Salem River.

Fishing and Crabbing

Fishing and crabbing in the tidal marsh, according to State laws and regulations, are currently allowed in specific areas of the refuge (see Chapter 3, Map 3.2). While boating is prohibited on all of the freshwater ponds and impoundments within the refuge, an annual youth fishing event is authorized on a freshwater tidal pond (see Chapter 3, alternative A for more details).

Wildlife Observation, Photography, and Interpretation

There are two walking trails for wildlife observation, photography, and interpretation. The Grassland Trail, along Lighthouse Road, offers visitors the opportunity to view grassland, forest, and tidal marsh habitat. A portion of the trail and the marsh overlook are wheelchair-accessible. The Forest Habitat Trail is located off Fort Mott Road on Xmas Tree Lane. This trail goes through a forested upland and wetland section of the refuge through scrub/shrub habitat and surrounds the Tract 11D impoundment. Wildlife observation, photography, and interpretation at the refuge can also be accessed by boat using the tidal streams.

Cultural Resources

Archaeological Resources

Human occupation of the New Jersey coast began with the arrival of Native American hunter-gatherer bands approximately 10,000 B.C. The Lenni Lenape tribe inhabited the land that is now the refuge as well as the surrounding area (USFWS 2005a).

An archaeological study conducted for the U.S. Army Corps of Engineers (ACE) in 1992 (USACE 1994) identified four sites inhabited during the late Woodland period, circa A.D. 700 to A.D. 1600. Two additional pre-European contact sites were reported on current refuge lands in 1915 but they have not been scientifically investigated since that time. One is known to have contained pottery, so may also be Woodland in date.

Permanent settlement of the area by Europeans began in the 17th century. Beginning in the late 18th century, farmers began to extensively dike the tidal marsh and excavate ditches to convert it to salt hayfields. In 1900 a rock dike was built along the marsh edge to prevent erosion that was increasingly damaging the earlier dike system. The rock dike failed early in the 1930s, re-flooding the tidal marsh. Remains of the dike are still present between the marsh and the Delaware Bay, possibly restricting tidal flow and decreasing the quality of the marsh habitat. Some of the drainage ditches and earth dikes are also still present within the tidal marsh, altering its hydrology.

There are 20 historic period archaeological sites recorded on the refuge, only one of which has been identified in the field. The locations of the other 19 are known only from historical maps. Up to five of them, including the Finn's Point Front Range Lighthouse (built in 1876) and a pair of small structures possibly associated with Fort Mott (begun in 1897), may have been lost to late 20th century coastal erosion. The majority of the others are farmsteads established in the mid-19th century or earlier and abandoned in the late 19th and early 20th century, many of which are now in marsh settings due to sea level rise.

There is also a family cemetery on the refuge containing three gravestones that all date from 1880 located along the refuge's Grassland Trail on Tract 18. It is maintained by refuge volunteers and often visited by Pennsville residents (USFWS 2005a).

Historic Period Structures

The Finns Point Rear Range Light, built in 1876 to aid navigation on the Delaware River, is on the National Register of Historic Places. It was extensively restored by the Service in 1983, with additional repairs in 1990 and 2003. In the past, volunteers maintained the site and opened the structure to the public the third Sunday of the month from April through October. Due to staff shortages, the site is currently only open to the public during the New Jersey Lighthouse Challenge in mid-October. A 2007 engineering inspection of the structure indicated a potential safety hazard of the catwalk that would require repair to assure public safety. Therefore, until repair, the catwalk is closed to the public. There is also a small shed located nearby that was historically used to store oil for Finns Point Rear Range Light.

The former Urion farmstead, a 19th century dwelling with 20th century outbuildings, is located on Tract 18. All or part of the farmstead is

potentially eligible for the National Register of Historic Places (NPS 2001). We plan to consult with the State Historic Preservation Office to formally determine its eligibility within fiscal year 2010.

Chapter 3

Steve Maslowski

Northern Bobwhite

Alternatives Considered, Including the Service-preferred Alternative

- Introduction
- Developing Alternatives
- Actions Common to All Alternatives
- Actions Common to Alternative A and B
- Alternative A. Continue Current Management
- Alternative B. The Service-preferred Alternative
- Aternative C. Cease Management
- Comparison of Management Activities Under the Alternatives

Introduction

This chapter presents:

- our process for formulating alternatives;
- actions that are common to all alternatives; and,
- descriptions of the three alternatives we analyzed in detail.

A tabulated comparison at the end of this chapter (Table 3.5) shows how each of the alternatives addresses key issues, supports major programs, and achieves refuge goals.

Formulating Alternatives Relating Goals, Objectives, and Strategies

Refuge goals and objectives define each of the management alternatives identified below. As described in chapter 1, developing refuge goals was one of the first steps in the planning process. Goals are intentionally broad, descriptive statements of the desired future condition for refuge resources. By design, they are more prescriptive than quantitative in defining the targets of refuge management. They also articulate the principal elements of refuge purposes and our vision statement and provide a foundation for developing specific management objectives and strategies. Our goals are common to all the alternatives.

The next step was to consider a range of possible management objectives that would help us meet those goals. Objectives are essentially incremental steps toward achieving a goal; they further define the management targets in measurable terms. They typically vary among the alternatives and provide the basis for determining more detailed strategies, monitoring refuge accomplishments, and evaluating our success. The Service guidance in "Writing Refuge Management Goals and Objectives: A Handbook" (USFWS 2004d) recommends that objectives possess five properties to be "SMART": (1) specific; (2) measurable; (3) achievable; (4) results-oriented; and (5) time-fixed.

A rationale accompanies each objective to explain its context and why we think it is important. We would use the objectives in the alternative selected for the final CCP and in writing refuge step-down plans. We would measure our successes by how well we achieve those objectives.

We next identified strategies for each of the objectives. These are specific actions, tools, techniques, or a combination of those that we may use to achieve the objective. The list of strategies under each objective represents the potential suite of actions to be implemented. By design, most would be further evaluated as to how, when, and where they should be implemented in refuge step-down plans.

Lastly, for biological objectives we identified a specific subset of strategies as monitoring elements. Monitoring elements are intended to help us measure our success with respect to our objectives. The results may trigger adjustments to management strategies, a reevaluation or refinement of our objectives, or both.

Developing Alternatives, including the "No Action" Alternative

After identifying a wide range of possible management objectives and strategies that could achieve the goals, we began the process of crafting management alternatives. Alternatives are packages of complementary objectives and strategies designed to meet refuge purposes, the Refuge System mission, and the defined goals, while responding to the issues and opportunities identified during the planning process.

In this draft CCP/EA, we analyze three refuge planning alternatives. The first two alternatives, A and B, characterize different ways of actively managing the refuge over the next 15 years. A third alternative closes the refuge to the public and ceases all management activities. We believe alternatives A and B represent a reasonable range of alternative proposals for achieving the refuge purpose, vision and goals, and for addressing the issues described in chapter 1. Alternative C would only partially achieve the refuge purpose, vision, and goals. However, in view of the expected significant Service budgetary constraints that could continue to affect management of refuges across the National Wildlife Refuge System, we believe it is reasonable and important to analyze and discuss what would happen if the refuge were to close. Unless otherwise noted, refuge staff would implement all actions.

Alternative A (Current Management) satisfies the NEPA requirement of a "no action" alternative, which we define as "continuing current management". It describes our existing management priorities and activities, and serves as a baseline for comparing and contrasting alternatives B and C. We suggest you first read chapter 2, "Affected Environment," for detailed descriptions of current refuge resources and programs.

Alternative B (Focus on Species of Conservation Concern) is the Service-preferred alternative. It combines the actions we believe would most effectively achieve refuge purposes, vision and goals, and respond to public issues. It emphasizes management of specific refuge habitats to support Federal trust resources and species of conservation concern in the area. In particular, the priority would be to protect and restore the refuge's native tidal marsh habitat to benefit Pea Patch Island colonial-breeding wading birds, secretive marsh birds, migratory waterfowl, shorebirds, and other birds of conservation concern. A secondary consideration would be to manage a diversity of other refuge wetland and upland habitats to benefit breeding and migrating songbirds, waterfowl, and raptors as well as amphibians, reptiles, and mammals of conservation concern.

Our Visitor Services program would be enhanced to provide more opportunities for a wide variety of compatible wildlife-dependent activities. In 2005, the Northeast Regional Visitor Services Review Team identified visitor programs of emphasis for each refuge. The programs identified for this refuge were interpretation and wildlife observation and photography, the same as Cape May NWR, which administers Supawna Meadows NWR. This determination was based on careful consideration of our natural resources, existing staff, operational funds, existing and potential facilities, and which programs we would be most effective in providing "quality" opportunities for visitors.

Under alternative C (Cease Management and Close Refuge to Public Uses), we would close Supawna Meadows NWR to all public uses and cease all habitat management activities. There would be no funding allocated for any projects at the refuge. The public would be notified of the closure and appropriate signage would be placed on all buildings and along the refuge boundary. Cape May NWR staff would conduct semi-annual site inspections requiring up to 2 percent of a full-time

equivalent position (about 40 staff hours per year). We would continue to meet our trust obligations under the Endangered Species Act (ESA) that requires us to take measures to benefit the recovery of any Federal-listed species that might be found on the refuge in the future. We would also continue to comply with the National Historic Preservation Act (NHPA) by maintaining the National Register listed Finns Point Rear Range Light (FPRRL). Alternative C does not fully meet the purpose and need for agency action we identified in chapter 1; however, possible budgetary constraints may force its adoption and it does meet the purpose and need in part.

We have developed habitat maps (Maps 3.1 and 3.4) for alternatives A and B to help readers visualize how the refuge habitats, as broadly reflected by future vegetation cover, would look over the long-term after managing under each respective scenario. Using Geographical Information Systems (GIS) mapping tools and data sets, our habitat maps are a graphic representation of the potential vegetation that would result under each respective alternative at a coarse scale. While the CCP describes potential vegetation management actions within a 15-year time frame, many of the habitat changes would not be visible until well beyond 15 years.

Actions Common to All Alternatives

The three CCP alternatives have a number of actions in common. Some actions are required by law or policy or are administrative actions that do not necessarily require public review, but we want to highlight them in this public document. They may also be actions we believe are critical to achieving the refuge's purpose, vision, and goals. These actions are described in more detail below.

Acquiring Land within the Current Refuge Acquisition Boundary

The Service would continue its policy of buying land from willing sellers and focus its land acquisition efforts on developable upland properties first. We would continue to purchase portions of the 1,257 acres of inholdings within the 4,527-acre acquisition boundary from willing sellers as funding allows.

Managing Conservation Easements

The refuge purchased a conservation easement in June 2009 on the 254.3-acre Davis Property. A conservation easement is a legal agreement voluntarily entered into by a property owner and a qualified conservation organization such as a land trust or a government agency. The easement contains permanent restrictions on the use or development of land in order to protect its conservation values. The owners have reserved certain rights on 20 acres of this easement.

Many refuges have utilized the Service's "Partners for Fish and Wildlife Program" to work with private landowners to conduct annual invasive species control measures on private lands. The acquisition of this conservation easement has allowed refuge staff to take advantage of this type of opportunity at Supawna Meadows NWR as well. Across all alternatives, the refuge would continue to enforce and monitor the terms of the conservation easement. This includes consultation with the landowner, invasive species control, inventory and survey requirements, and law enforcement. Staff time for this effort amounts to one to two days annually.

Protecting Federal-Listed Threatened and Endangered Species

The following Federal-listed threatened or endangered species occur or have historically occurred on refuge lands or in the tidal Delaware River:

- Atlantic hawksbill (*Eretmochelys imbricata*)
- Atlantic loggerhead (*Caretta caretta*)
- Atlantic ridley (*Lepidochelys kempii*)
- Atlantic leatherback (*Dermochelys coriacea*)
- shortnose sturgeon (*Acipenser brevirostrum*)
- sensitive joint-vetch (*Aeschynomene virginica*)

None of these species are known to currently utilize refuge lands or waters. Shortnose sturgeon occur in the Delaware River and refuge activities could have minimal affects on their habitat or prey. We would continue to work closely with our Ecological Service's New Jersey Field Office, National Marine Fisheries Service (NMFS), the Delaware Bay Estuary Project, and the New Jersey Department of Environmental Protection (NJDEP) if there are confirmed observations of these species or other Federal-listed species (for example, Indiana bats) in the future at the refuge and if we determine that actions taken on the refuge could be of value to their survival or recovery.

Distributing Refuge Revenue Sharing Payments to Salem County

As described in chapter 2, we pay Salem County refuge revenue sharing payments based on the acreage and the appraised value of refuge lands. These annual payments are calculated by a formula determined by Congress with funds appropriated by Congress. All of the alternatives would continue those payments in accordance with the law, commensurate with changes in the appraised market value of refuge lands or new appropriation levels dictated by Congress.

Protecting Cultural Resources

As a Federal land management agency, we are entrusted with the responsibility to locate and protect all cultural resources, specifically archeological sites and historic structures listed or eligible for listing in the National Register of Historic Places. This applies not only to refuge lands, but also on lands affected by refuge activities.

Under all alternatives, we would conduct an evaluation of the potential for our projects to impact archeological and historical resources; we will continue to consult with the Service's archaeologists, architectural historian, and the State Historic Preservation Office (SHPO). This would be especially important for those projects that include moving or displacing soil or removing buildings. A pre-project evaluation of activities would ensure we comply with section 106 of the National Historic Preservation Act, regardless of the alternative implemented. That compliance may require any or all of the following: a State Historic Preservation Records survey, literature review, or field survey.

Animal Damage Control

We would take necessary actions to address animal damage that threaten to destroy refuge resources, jeopardize public safety, or cause potential harm to neighboring properties. Refuge staff would either control these animal populations with refuge resources, invite State-licensed volunteers to control them, or hire commercial trappers.

Conducting a Wilderness Review

The refuge system planning policy requires that we conduct a wilderness review during the CCP process. The first step is to inventory all refuge lands and waters the Service owns in fee simple. Our inventory of this refuge determined that no areas meet the eligibility criteria for a wilderness study area as defined by the Wilderness Act. Therefore, we did not analyze further the refuge's suitability for wilderness designation. See appendix D for the results of the wilderness inventory. The refuge will undergo another wilderness review in 15 years as part of the next comprehensive conservation planning process.

Issuing Special Use Permits

Special use permits (SUPs) may be issued for special or unique activities allowed on national wildlife refuges. Each activity would be evaluated on a case-by-case basis

Vegetation Mapping

Vegetation mapping would be conducted based on National Vegetation Classification System criteria and we would map all habitat types, vegetation communities, and the location of habitats of focal species as identified in this CCP.

Water Quality

Adequate supplies of clean water are critical to plants, wildlife, and people. The Refuge System has a legislative mandate under the National Wildlife Refuge System Administration Act, as amended by the Refuge Improvement Act, to help maintain adequate water quality and quantity to fulfill the mission of the Refuge System and the purposes of each refuge. To better address this, the Refuge System is currently in the process of developing an inventory and monitoring program to document the status, assess conditions, and detect changes in the system's resources, including water quality and quantity. We would implement guidance provided by this effort when completed, provided staffing and funding allow. In addition to this legal mandate, the refuge would also participate in Spill Prevention,

Control, and Countermeasure (SPCC) Plans, or other environmental emergency action plans, to aid in the protection of the Delaware Bay and River as needed.

Actions Common to Alternatives A and B

Certain basic refuge management activities would be undertaken under both alternatives A and B that would not be undertaken under alternative C, because alternative C eliminates all but a minimal number of "caretaker" activities.

Public Use of Land within the Current Refuge Acquisition Boundary

As the Service continues to acquire the remaining 1,254 acres of inholdings within the 4,527-acre acquisition boundary, each individual parcel of property acquired would be subject to authorized public use activities (this includes priority and non-priority public uses) at the levels described for each alternative A and B, unless subject to specific deed restrictions. The added parcels of property would also be subject to all refuge and Service policies and regulations. The Environmental Assessment analysis and Compatibility Determinations for this CCP would apply to these additional parcels.

Priority Public Uses

The 1997 Refuge Improvement Act designated six wildlife-dependent priority public uses on National Wildlife Refuges: hunting, fishing,

wildlife observation, wildlife photography, environmental education, and interpretation. Per the General Guidelines for Wildlife-Dependent Recreation (605FW 1), we will strive to ensure that the wildlife-dependent recreation program:

1. Promotes safety of participants, other visitors, and facilities.
2. Promotes compliance with applicable laws and regulations and responsible behavior.
3. Minimizes or eliminates conflict with fish and wildlife population or habitat goals or objectives in an approved plan.
4. Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation.
5. Minimizes conflicts with neighboring landowners.
6. Promotes accessibility and availability to a broad spectrum of the American people.
7. Promotes resource stewardship and conservation.
8. Promotes public understanding and increases public appreciation of America's natural resources and our role in managing and conserving these resources.
9. Provides reliable/reasonable opportunities to experience wildlife.
10. Uses facilities that are accessible to people and blend into the natural setting.
11. Uses visitor satisfaction to help to define and evaluate programs.

In 2005, the Northeast Regional Visitor Services Review Team identified visitor programs of emphasis for each refuge. The two programs identified for this refuge were wildlife observation and photography, the same as Cape May NWR. This determination was based on careful consideration of our natural resources, existing staff, operational funds, existing and potential facilities, and which programs we would be most effective in providing "quality" opportunities for visitors. While all of the priority public uses are important and offered to some degree on this refuge, wildlife observation and photography will receive greater emphasis when prioritizing refuge resources. As always, we look to our partners, Friends of Supawna Meadows NWR, and other volunteers to develop and assist with all refuge public use programs.

Chapter 1 describes the requirements for appropriateness and compatibility determinations. Appendix B includes draft appropriateness and compatibility determinations to support the activities in alternative B, the Service-preferred alternative. Our final CCP will include the approved findings of appropriateness and compatibility determinations for the alternative selected. We will only allow activities determined appropriate and compatible to meet or facilitate refuge purposes, goals, and objectives.

Non-Priority Public Uses Allowed

In addition to the six priority recreational and educational uses, we have determined that some other activities, for example FPRRL visitation and scientific research, are appropriate and compatible on refuge lands under certain circumstances. These activities are either discussed earlier in this section or described in detail in the next chapter. Draft Findings of Appropriateness and Compatibility Determinations for these activities are in appendix B.

Non-Priority Public Uses Not Allowed

We have received several requests for permission to engage in non-priority, non-wildlife dependent activities on the refuge. Activities evaluated by the refuge manager and determined not to be appropriate on refuge lands include, but are not limited to: bicycling, geocaching, horseback riding, jogging, non-wildlife dependent group gatherings, and organized or facility-supported picnicking. Appendix B documents the refuge manager's decision on appropriate activities. Most of these activities are sufficiently allowed elsewhere on other nearby ownerships, so the lack of access on the refuge does not eliminate the opportunity in the area. According to Service policy 603 FW 1, if the refuge manager determines a use is not appropriate, it can be denied without determining compatibility.

Controlling Animal Pests

At times, certain wildlife species and pest animals interfere with management objectives. The Refuge Manual (7 RM 14.4A) defines a pest as, "Any terrestrial or aquatic plant or animal which interferes, or threatens to interfere, at an unacceptable level, with the attainment of refuge objectives or which poses a threat to human health." In this section, we describe some situations involving native species and under what conditions we would initiate control.

In controlling pests, we use an integrated approach. The Refuge Manual (7 RM 14.4C) defines integrated pest management as "A dynamic approach to pest management which utilizes a full knowledge of a pest problem through an understanding of the ecology of the pest and ecologically related organisms and through continuous monitoring of their populations. Once an acceptable level of pest damage is determined, control programs are carefully designed using a combination of compatible techniques to limit damage to that level."

An integrated approach uses various methods, including natural, biological, cultural, mechanical, and chemical controls. Some examples and potential remedies of pest management follow.

We would use the following general strategies in pest management:

1. Determine the need for site-specific control based on the potential to affect our management objectives for a given area. Although we would employ an adaptive management strategy, we also expect the lethal control or removal of individual animals to be the exception rather than the rule. Unfortunately, to establish general thresholds for that action is difficult. Instead, we would determine our solution on a case-by-case basis.
2. Employ integrated pest management techniques when a species is having a significant impact on an area resulting in major habitat replacement and loss of valuable canopy trees.
3. Monitor results to ensure that pests do not exceed acceptable levels.

Mute Swans

Despite their aesthetic appeal, mute swans can cause problems. The mute swan is native to Europe and Asia, but is an exotic species in the United States. Mute swans (*Cygnus olor*) are established throughout

New Jersey and are responsible for excessive herbivory to submerged aquatic vegetation in wetland habitats during key portions of the growing season. Mute swans are well distributed throughout New Jersey but are most abundant in park ponds and small lakes in northern New Jersey as well as coastal ponds and impoundments along both the Atlantic Coast and Delaware Bay. The New Jersey Wildlife Action Plan (NJWAP) goal (NJDFW 2008a) is to reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments based on population objectives identified for New Jersey in the Atlantic Flyway Mute Swan Management Plan (Atlantic Flyway Council 2003). The New Jersey mute swan population objective is 500 swans statewide. Populations should be particularly reduced in coastal impoundments managed for migrant and wintering waterfowl. Population growth and range expansion of this species has increased the number of swan-related problems for people and native wildlife.

A major concern is the effect of interspecific competition between mute and tundra swans. Mute swans have been observed exhibiting aggression toward tundra swans, driving them from protected coves and feeding areas, which are important habitats for native tundra swans. Since the mid-1970s, Maryland's wintering tundra swan population has declined by about 30 percent (Hindman 2010); however, research is needed to determine if this decline is related to an increase in competition between native tundra swans and exotic mute swans. New Jersey hosts a smaller population of wintering tundra swans than Maryland, and currently there is no evidence to suggest mute swans are outcompeting tundra swans in New Jersey (T. Nichols, NJDFW, personal communication).

The Service worked with states in the Atlantic Flyway to develop the Atlantic Flyway Mute Swan Management Plan (Atlantic Flyway Council 2003). This plan established mute swan population goals for the Atlantic Flyway, along with strategies to begin reducing populations to those levels within the parameters of the Migratory Bird Treaty Act.

In partnership with NJDFW, the refuge's treatment goal is to prevent competition with native migratory waterfowl. Eradication is the definitive goal; however, this may be unachievable if adjacent landowners are not willing or able to control mute swans. It is important to be vigilant in management efforts and monitor all areas throughout the year.

We would:

1. Visually monitor all areas throughout the year, and take appropriate actions to discourage mute swans from becoming established or congregating on the refuge.
2. To the extent possible, eradicate mute swans found on the refuge to reduce competition with native waterfowl. We may limit swan reproduction by oiling or addling eggs and removing adult swans. We would coordinate control efforts with NJDFW and U.S. Department of Agriculture Animal and Plant Health Inspection Services (USDA APHIS).

Snow Goose Monitoring

The greater snow goose population in the Atlantic flyway has increased significantly over the past decade and continues to increase. Damage to winter grain and salt hay fields and marsh areas in New Jersey is also increasing. We are aware of concerns by Service and State waterfowl experts that greater snow geese may be changing their migrating and wintering habits in the Atlantic Flyway; and, their use may dramatically increase on protected areas, such as the refuge, over the next 15 years. With completion of an Environmental Impact Statement (EIS), the Atlantic Flyway Council and individual states have implemented a Light Goose Conservation Order. Light goose is the collective name applied to greater snow geese, lesser snow geese, and Ross's geese. The principal action to be taken in the State of New Jersey is an extended hunting season on light geese. Under all alternatives, we would monitor for increased use of the refuge by snow geese in conjunction with the State mid-winter waterfowl survey.

Refuge marshes and impoundments provide valuable late winter habitat for black ducks and pintails. As snow goose use of the refuge increases, hunting of greater snow geese on designated areas of the refuge may be permitted after the close of the duck season for the southern zone of New Jersey to achieve population goals for greater snow geese or reduce damage to refuge habitats and surrounding marsh and agricultural areas. Hunting during late winter has the potential to disturb wintering ducks, particularly black ducks, and decrease the value of the refuge as wintering habitat. However, impacts to wintering waterfowl would be minimal because greater snow geese are currently found primarily in the marshes, not in the impoundments. Other actions that may be considered include select control of snow geese or other proposals to discourage snow goose, as recommended by Service and State waterfowl experts.

Resident Canada Geese

The USFWS Division of Migratory Bird Management prepared an EIS for Resident Canada Goose Management (USFWS 2005b). This document discusses the problems associated with resident Canada geese along with strategies to begin reducing populations. The following information was taken from this document.

The number of Canada geese that nest and/or reside predominantly within the conterminous United States has increased dramatically in the past 20 years. It has increased to levels that are increasingly coming into conflict with people and causing personal and public property damage.

Most resident Canada goose populations exhibit consistently high annual production and survival because they live in temperate climates with relatively stable breeding habitat conditions and a low number of predators; tolerate human and other disturbances; have a relative abundance of preferred habitat (especially those located in urban and suburban areas with current landscape techniques); and fly relatively short distances to winter (compared to other Canada goose populations). The virtual absence of waterfowl hunting in urban areas provides

additional protection to those urban portions of the resident Canada goose population. Given these characteristics, resident Canada goose populations are increasingly coming into conflict with human activities in many parts of the country, both in rural and urban areas. Conflicts between geese and people affect or damage several types of resources, including property, concerns about human health and safety, agriculture, and natural resources.

Agricultural and natural resource impacts include losses to grain crops, overgrazing of pastures, and degrading water quality. In heavy concentrations, goose droppings can overfertilize lawns and degrade water quality, resulting in eutrophication of lakes and excessive algae growth (Manny et al. 1994). This can lead to oxygen depletion and fish kills. Degradation of water quality also occurs by fecal contamination and by erosion from areas stripped of vegetation by goose grazing and trampling. Habitat impacts from overgrazing by resident Canada geese are also evidenced by the loss of natural vegetation in marshes and impoundments. Resident geese can impact natural wild rice beds, crops, and other habitat maintained as both food sources and cover for migrant geese and other waterfowl.

Concentrations of resident Canada geese threaten wildlife with disease. Local concentrations of resident Canada geese may congregate around impoundments where water levels have been lowered. The remaining stagnant pools can be contaminated by fecal material and are a potential source of avian diseases, especially when temperatures are high. Canada geese serve as a reservoir for the highly contagious disease duck virus enteritis and pose a serious threat to other birds utilizing the habitat.

We would:

1. Visually monitor all areas throughout the year, and take appropriate actions to discourage resident Canada geese from becoming established or congregating on the refuge.
2. To the extent possible, eradicate resident Canada geese found on the refuge to reduce competition with native waterfowl, limit goose reproduction by oiling or addling eggs and removing adult geese, and coordinate control efforts with NJDFW and U.S. Department of Agriculture Animal and Plant Health Inspection Services (USDA APHIS).

Furbearers and Predators

Furbearers such as muskrat (*Ondatra zibethicus*), woodchuck (*Marmota monax*), and beaver (*Castor canadensis*) may cause damage to refuge habitats. These animals may burrow into soils, undermining or otherwise damaging impoundment dikes. Beavers may also dam and flood creeks or other drainage areas, killing native trees or flooding roads and private property, therefore preventing access or threatening public safety.

Mammalian predators such as red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), coyote (Canis latrans), and raccoon (*Procyon lotor*) and avian predators such as crow, grackle, and gulls may cause unacceptable levels of predation on nesting birds. Domestic

or house cats (*Felis catus*), both free ranging domestic and feral, also have negative effects on wildlife. Cats prey on wildlife, compete with native wildlife, and can transmit diseases to wildlife, pets, and people. Cat predation is an added stress to wildlife populations already struggling to survive habitat loss, pollution, pesticides, and other human impacts (ABC 2009). The cumulative negative effects of cats on wildlife are impossible to quantify; however, the growing body of literature strongly indicates that domestic cats are a significant factor in the mortality of native small mammals, birds, reptiles, and amphibians (CDFG 2009).

We do not intend to initiate a public trapping program for furbearers at this time. Because we consider trapping on refuges a commercial activity, it must meet a higher standard of compatibility than priority wildlife-dependent public recreational uses or other non-commercial uses. We would reconsider our position if future situations arise in which we determine public trapping to be an effective, essential element in managing furbearers.

We would:

1. Use predator guards on nest boxes.
2. To the extent possible, remove animals or concentrations of animals that may pose a problem, inviting State-licensed individuals, hiring commercial trappers, or working with partners such as USDA Wildlife Services.
3. Endorse the Cats Indoors! Campaign.
4. Implement a zero tolerance policy for feral cats by visually monitoring all areas of the refuge for feral cats throughout the year and take appropriate actions to euthanize cats found on the refuge.

Monitoring and Abating Wildlife Diseases

The Service Manual chapter on Disease Prevention and Control is not yet published. Until it is, we derive guidance on this topic from the Refuge Manual and specific directives from the Director of the Fish and Wildlife Service or the Secretary of the Interior. Refuge Manual 7-RM-17.3 lists three objectives for disease prevention and control:

- to manage wildlife populations and habitats so the likelihood of disease contraction and contagion are minimized;
- to provide for early detection and identification of disease mortality when it occurs; and,
- to minimize losses of wildlife from disease outbreaks.

These objectives were published in 1982. Since that time, in addition to diseases that cause serious mortality among wildlife, more attention has been given to those diseases that are transmitted through wildlife to humans. One example is Lyme disease. In 2002, a Service Manual chapter on Lyme Disease Prevention was published (242 FW 5) to make employees, volunteers, and national service workers on refuges aware of this disease and how to prevent and treat it.

Another serious wildlife disease receiving considerable attention worldwide is avian influenza. Of particular concern is the highly pathogenic Eurasian form (H5N1). In 2006, all refuges were instructed to prepare an Avian Influenza Surveillance and Contingency Plan. The Supawna Meadows National Wildlife Refuge Avian Influenza

Surveillance and Disease Contingency Plan was approved in October 2007 (USFWS 2007b) and discusses methods for dealing with this disease.

Chronic Wasting Disease (CWD) is a fatal disease that attacks the brain and spinal cord of deer and elk. While the exact cause is unknown, it is believed to be caused by a prion, an altered protein that causes other normal proteins to change and cause sponge-like holes in the brain. CWD was first identified in the 1960s in a Colorado research facility. Since that time, it has been found in numerous states including the nearby States of New York and West Virginia. CWD has not been found in white-tailed deer (*Odocoileus virginianus*) in New Jersey. Prion diseases like CWD do not move easily between species. There is no scientific evidence that CWD has been transmitted to animals other than deer, elk, and moose. The Chronic Wasting Disease Surveillance and Contingency Plan for Supawna Meadows National Wildlife Refuge was approved October 2007 (USFWS 2007c) and discusses early detection and response to any potential CWD occurrence at the refuge.

Supporting Biological and Ecological Research and Investigations

Guidance on conducting and facilitating biological and ecological research and investigations on refuges is found in the Refuge Manual and the Service Manual. In 1982, the Service published three objectives for supporting research on units of the Refuge System in the Refuge Manual (4 RM 6.2):

- to promote new information and improve the basis for, and quality of, refuge and other Service management decisions;
- to expand the body of scientific knowledge about fish and wildlife, their habitats, the use of these resources, appropriate resource management, and the environment in general; and,
- to provide the opportunity for students and others to learn the principles of field research.

In 2006, the Service Manual (603 FW 1.10D (4)) provided supplemental guidance in terms of the appropriateness of research on refuges as follows:

> *"We actively encourage cooperative natural and cultural research activities that address our management needs. We also encourage research related to the management of priority general public uses. Such research activities are generally appropriate. However, we must review all research activities to decide if they are appropriate or not as defined in section 1.11. Research that directly benefits refuge management has priority over other research."*

Unless it is determined to be a management activity, all research conducted on the refuge must be determined in writing to be both appropriate and compatible. As noted in chapter 2 (Affected Environment) we have found several research projects to be appropriate and compatible. We expect that additional opportunities to conduct research on the refuge will arise in the future under any of the alternatives proposed herein. In making determinations on the appropriateness and compatibility of future research proposals, we

would follow guidance in the Refuge and Service Manuals, and would employ the following general strategies:

1. Seek qualified researchers and funding to help answer refuge-specific management questions.
2. Participate in appropriate multi-refuge studies conducted in partnership with the U.S. Geological Survey.
3. Facilitate appropriate and compatible research by providing temporary housing and equipment, if available, for persons conducting field work.
4. Pursue peer-reviewed publications of research, and/or insure the Service is acknowledged as a contributor in research conducted on the refuge by others.

Practicing Adaptive Management

Alternatives A and B will employ adaptive management as a strategy to ensure we respond quickly to new information or events in adherence to the Department of the Interior's Technical Guide on Adaptive Management (Williams et al. 2009). According to this document, "adaptive management [is a decision process that] promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood" (Williams et al. 2009). The need for adaptive management is very compelling today because our present information on refuge species and habitats is incomplete, provisional, and subject to change as our knowledge base improves.

We must adapt our strategies to respond to new information and/or spatial and temporal changes or environmental events that may or may not have been predicted. We would continually evaluate management actions, both formally and informally, through monitoring or research, to consider whether our original assumptions and predictions are still valid. In that way, management becomes a proactive process of learning what really works.

The refuge manager is responsible for changing management strategies if they do not produce the desired conditions. Significant changes may warrant additional NEPA analysis and public comment. Minor changes will warrant documentation in project evaluation reports, or in our annual reports.

Generally, we can increase monitoring and research that support adaptive management without additional NEPA analysis, and assuming the activities, if conducted by non-refuge personnel, are determined compatible by the refuge manager in a compatibility determination. Many of our objectives identify monitoring needs. Our 2004 Wildlife Inventory Plan has determined what is planned in the foreseeable future. We would update this plan based on the final

objectives and strategies in the CCP. See discussion on additional NEPA analysis requirements below. Implementing this strategy supports all refuge goals.

Determining the Appropriateness and Compatibility of Refuge

Chapter 1 describes the requirements for appropriateness and compatibility determinations. Appendix B includes draft appropriateness and compatibility determinations to support the activities in alternative B, the Service-preferred alternative. Our final

Public Uses

CCP would include the approved findings of appropriateness and compatibility determinations for the alternative selected. We would only allow activities determined appropriate and compatible to meet or facilitate refuge purposes, goals, and objectives. Further appropriateness and compatibility determinations will be prepared if new refuge uses are requested by the public.

Conducting Additional NEPA Analysis

NEPA generally requires site-specific analysis and disclosure of impacts for all major Federal actions, which may result in either an EA or an EIS. Other routine activities are categorically excluded from the NEPA requirements to prepare detailed environmental documents. Those generally include administrative actions, and are listed in chapter 4.

Alternative A - Continue Current Management (No Action)

Alternative A is the alternative representing our current management of Supawna Meadows NWR. It provides the baseline of expected wildlife benefits and environmental impacts for comparison with our preferred management, alternative B, and with the refuge closure, alternative C. It assumes that our management of the refuge during the next 15 years generally remains as it is currently conducted. Below is a list of strategies that are common to two or more objectives in alternative A, and therefore are presented separately from the more specific objectives and strategies that follow. The description of alternative A is followed by Maps 3.1, 3.2, and 3.3, which illustrate the proposed habitat management and public use strategies for this alternative.

Wildlife Habitat Management

Under alternative A, we would continue the management strategies that are currently in place. We would focus efforts on managing to provide native tidal marsh habitat to benefit key Federal trust species and groups of species. Specifically, we would provide foraging habitat for Pea Patch Island wading birds during the breeding season and nesting, migratory, and wintering habitats as applicable for marsh birds, waterfowl, shorebirds, raptors, and songbirds. We would actively manage tidal marsh and grassland habitats and would maintain dikes and water levels on our impoundments with water control structures, but we would not actively manage other refuge habitats. We would permit compatible research programs requested by other entities on refuge lands, but would not directly support them. If we are successful in achieving our alternative A habitat management objectives, the habitat composition of the refuge would be that listed in table 3.1 (below) and illustrated in map 3.1 (on page 3-28).

Table 3.1. Alternative A Land Use/Land Cover Acreage

Land Use/Land Cover Type	Current Acreage	Acquisition Acreage	Total Acreage[1]
Tidal Marsh			
1. Native Marsh	493	40	533
2. Phragmites-Dominated	1,441	319	1,759
Total Marsh	**1,934**	**362**	**2,293**
Developed	27	97	124
Forested Uplands	240	174	414
Forested Wetlands	182	156	338
Grassland	122	409	531
Herbaceous Wetland	42	13	55
Impoundment	86	1	87
Impoundment without WCS	4	1	5
Scrub/Shrub Uplands	38	19	57
Scrub/Shrub Wetlands	56	4	60
Scrub/Shrub Wetlands (Tidal)	28	2	30
Open Tidal Waters	492	42	534
TOTAL	**3,250[2]**	**1,277[3]**	**4,527**

[1] Differences in total acres for various habitat types between alternative A and alternative B are due to differences in habitat management strategies.
[2] Includes 231 acres held under conservation easement by the refuge
[3] Includes 20 acres currently held under conservation easement but with certain rights retained by the owners.

We would continue to focus invasive plant management efforts on control of phragmites in the tidal marsh. We would pursue limited invasive plant control elsewhere on the refuge. Specifically, we would coordinate with the New Jersey Department of Agriculture's weevil release program to control mile-a-minute weed in some areas of the refuge. Otherwise, within the constraints of expected limited funding and staff that must work remotely from their base at Cape May NWR, we would address other invasive plants, and injurious or exotic species elsewhere on the refuge only as feasible. Therefore our management program under alternative A would be extremely limited in any additional efforts to actively intervene to restore and manipulate ecosystems, processes, habitats, and species to meet our responsibilities to benefit Service trust resources. Our primary tools would be mowing, prescribed burning, and use of herbicides to control phragmites and other invasive plant species and continuation of hunting to control the white-tailed deer population.

Refuge Staffing and Administration

Under alternative A, Supawna Meadows NWR would continue to be managed exclusively by Cape May NWR staff, which includes a refuge manager, deputy refuge manager, wildlife biologist, law enforcement officer, park ranger (visitor services), a wildlife refuge specialist, and a maintenance worker (see appendix E for staffing chart). Staff hours spent working on projects associated with Supawna Meadows NWR would continue to be allocated at approximately 2008-2009 levels, about 20 percent of each full-time employee (or 6 to 8 work hours per week for each staff member). There would be no substantive increase in project funding.

Refuge Buildings and Facilities

One small outbuilding near the refuge office would be demolished. The refuge's office building would remain closed to the public, but would be available as a work and meeting space for staff and the Friends group. There is a separate visitor contact kiosk for visitors to obtain information. The two garages, (bat) barn, intern house on Route 49, and Finns Point Rear Range Light would all be maintained for occasional use. All other buildings would remain closed.

Resource Protection and Visitor Safety

The current law enforcement staffing level of one full-time park ranger (LE), with a permanent location at Cape May NWR, would be maintained. This ranger would continue to spend about 20 percent of work hours enforcing laws and regulations on Supawna Meadows NWR.

Land Protection

Although the Service would continue its policy of buying acquisition boundary inholdings from willing sellers and focus its land acquisition efforts on developable upland properties first, no additional management on newly acquired lands would occur.

Managing Invasive Plants

Because of major constraints on staff time and funding, we would attempt to accomplish only a limited amount of invasive plant management under alternative A. We would continue to focus our efforts on limiting further encroachment of phragmites on native tidal marsh vegetation and restoring some acreage to native plants in the tidal marsh. We would focus any control efforts we might undertake in the uplands on mile-a-minute weed.

Goal 1

Protect, enhance and restore biological integrity, diversity, and environmental health (BIDEH) of tidally-influenced habitats to support native wildlife and plant communities including species of conservation concern.

Objective 1.1: Tidal Marsh

Objective: Maintain up to 2,293 acres of brackish tidal marsh, with a primary management focus on the area northwest of Mill Creek, to benefit Pea Patch Island wading birds, migrating shorebirds, migrating and wintering waterfowl, and other species of conservation concern.

Rationale: Supawna Meadows NWR provides critical foraging habitat for more than 6,000 pairs of nine species of wading birds that nest on Pea Patch Island, a Continentally Important Bird Area. It is home for the largest heronry of mixed species on the East Coast. The island supports significant populations of breeding pairs of nine species of wading birds, including great blue heron, great egret, little blue heron, snowy egret, cattle egret, yellow-crowned night-heron, black-crowned night-heron, glossy ibis, and tri-colored heron. Pea Patch Island and the surrounding area, including the refuge, have been designated a Special Management Area by the States of New Jersey and Delaware in accordance with the Coastal Zone Management Act.

The refuge receives significant use by shorebirds during both spring and fall migrations. The refuge also provides habitat for the State-listed bald eagle as well as a number of other State-listed species and species of conservation concern.

The refuge is located in the Atlantic Flyway, where birds migrating from interior Canada and the coastal provinces merge to form the main

stem of the flyway. The area not only serves as an important migration area but also provides wintering habitat for large numbers of waterfowl. The 2009 midwinter waterfowl inventory flights for the Salem River watershed averaged more than 2,100 dabbling ducks and more than 11,500 Canada geese.

Our principal management challenge in sustaining the refuge's tidal marsh is control of phragmites. Phragmites invades tidal and non-tidal brackish and freshwater marshes, river edges, shores of lakes and ponds, roadsides, and disturbed areas. Once introduced, phragmites spreads quickly and will crowd out native plants, changing marsh hydrology, altering wildlife habitat, and increasing fire potential. Its high aboveground biomass blocks light to other plants and occupies much of the growing space belowground. Phragmites is also considered a hazardous fuel and easily ignites during arson or wildfire. Based on the 2009 National Vegetation Classification System, phragmites has invaded approximately 74 percent (1,438 of 1,931 acres) of the refuge's tidal marsh.

Strategies:

1. Purchase up to 362 additional acres of tidal marsh within the approved acquisition boundary
2. Treat up to 525 acres of phragmites-dominated tidal marsh northwest of Mill Creek with herbicides, prescribed burning, and mowing as funding and staff time allows. Continue to use one or more treatment options that include use of chemical herbicides, prescribed burning, and mechanical methods to provide the best results. Specific treatment strategies follow:
    - *Chemical:* Treat chemically with imazapyr, glyphosate, or other approved herbicides, and consider in combination with prescribed burning as developed through a prescribed burn plan. If a population can be controlled soon after its establishment, chances of success are much higher because the belowground rhizome network would not be as extensive. Herbicides are best applied in late summer/early fall either as a cut stump treatment or as a foliar spray. It is often necessary to do repeated treatments for several years to prevent any surviving rhizomes from re-sprouting.
    - *Prescribed burning:* Use prescribed fire, in combination with herbicide treatment, to reduce standing dead stem and litter biomass. This might help to encourage germination of native plants in the growing season. Timing of burning would be in accordance with the refuge's approved Fire Management Plan and individual prescribed burn plans.
    - *Mechanical:* Repeated mowing may be effective at slowing the spread of established stands, but is unlikely to kill the plant. This method is most effective when used in combination with herbicide treatments.
3. Continue to ensure compliance with the ESA by coordinating with the Service's New England Field Office on phragmites control efforts annually.
4. Study literature of existing research and its impacts on phragmites control.

Objective 1.2: Tidally-Influenced Scrub/Shrub Habitat

Objective: Protect up to 30 acres of tidal scrub/shrub habitat to benefit coastal plain swamp sparrow, prairie warbler, and other priority breeding, migrating, and wintering birds and other species of conservation concern.

Rationale: Tidal scrub/shrub habitat is an important component of the refuge's tidal marsh complex that provides breeding habitat for birds of conservation concern. The coastal plain swamp sparrow (CPSS) (*Melospiza georgiana nigrescens*) is a subspecies of the swamp sparrow known to breed in Delaware, Maryland, and New Jersey tidal marshes. The refuge population of coastal plain swamp sparrows may constitute a significant portion of the total population of this unique subspecies of swamp sparrow that is being studied as a potential candidate species for listing under the Endangered Species Act. The CPSS is restricted to an often narrow band of shrubby habitat at the interface of upland and high marsh. This habitat is particularly susceptible to recent changes such as rising sea level, ditching, impoundment, the invasion of phragmites, and the development of roads, farm fields, and housing tracts. Research indicates that these birds perch on phragmites; however, they do not nest in it. This species nests in dense grass at the base of shrubs, usually well concealed, and often anchored to the base of a high tide bush such as marsh elder (*Iva frutescens*). A dense tuft of salt hay such as salt meadow grass (*Spartina patens*) often camouflages the nest and provides some structural support (SMBC 2009).

The prairie warbler (*Dendroica discolor*) is a highest priority species in BCR 30, as well as being a high priority species in North America and in Partners in Flight Physiographic Area 44 (PIF 44). This species is experiencing relatively steep population declines. It uses moderately sized patches of shrubland and early successional forest. The PIF 44 report describing shrubland birds of highest conservation concern indicates that the prairie warbler utilizes a range of types from relatively young (abandoned) fields with scattered shrubs and trees to older fields with moderate shrub cover; however, it does not prefer later successional stages where shrubs and samplings form dense continuous tangles (Watts 1999).

The berry-producing shrubs of this habitat type are also beneficial to migrating birds. Other species of conservation concern that would benefit from our continued protection of the tidally-influenced scrub/shrub habitat include the northern diamondback terrapin (*Malaclemys terrapin*). These areas are difficult to access, but are currently maintained by naturally occurring processes.

Strategies:
1. No active scrub/shrub management would occur.
2. Purchase up to 2 additional scrub/shrub acres within the acquisition boundary.

Objective 1.3: Open Tidal Waters

Objective: Protect northern diamondback terrapins, shortnose sturgeon, blue crabs (*Callinectes sapidus)*, and other aquatic species of conservation concern in tidal waters.

Rationale: The refuge's wetlands are bordered by and hydrologically connected to the tidal creeks and the Delaware River. Therefore, refuge

habitats are affected by water quality and refuge management may affect water quality of these waterways. The refuge's tidal marsh supports a wide variety of aquatic organisms, many of which are of conservation concern. The waters of the Delaware River Estuary also support an important recreational fishery and shellfishery, which includes the blue crab. Fish and shellfish also serve as the food source for birds and other species of conservation concern. Fish in the tidal waters support local populations of osprey (*Pandion haliaetus*), bald eagle, and Forster's tern (*Sterna forsteri*). Thousands of waterfowl, including American black duck (*Anas rubripes*), American wigeon (*Anas americana*), Canada goose (*Branta canadensis*), blue-winged teal (*Anas discors*) and green-winged teal (*Anas crecca*), gadwall (*Anas strepera*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), snow goose (*Chen caerulescens*), and tundra swan (*Cygnus columbianus*) use the tidal marsh during winter and migration.

The Federal-listed endangered shortnose sturgeon and the Atlantic sturgeon are fish species of concern near Supawna Meadows NWR. These waters also provide nursery habitat for interjurisdictional fish species such as menhaden (*Brevortia tyrannus*), blueback herring (*Alosa aestivalis*), alewife (*Alosa psuedoharengus*), American shad (*Alosa sapidissima*), and striped bass (*Morone saxatilis*). Also of concern are mussel species including the yellow lampmussel (*Lampsilis cariosa*), tidewater mucket (*Leptodea ochracea*), and triangle floater (*Alasmidonta undulata*), all of which are listed as threatened by the State of New Jersey (NJDFW 2009a).

Strategies:

1. Implement best management practices, such as adhering to instructional labels when applying herbicides, to protect against potential contamination of the tidal rivers and other open tidal waters that could be impacted by refuge management activities.

Goal 2

Protect, enhance, and restore biological integrity, diversity and environmental health of upland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.

Objective 2.1: Early Successional Grassland Habitat

Objective: Manage up to 531 acres of grasslands to benefit northern harriers, short-eared owls, barn owls, and other raptors, wintering grassland birds, and other grassland-dependant species of conservation concern.

Rationale: The Service has the responsibility for protecting migratory birds under international migratory bird treaties with Mexico and Canada. Providing habitats for declining grassland-dependent species on this refuge would counter habitat loss elsewhere within the mid-Atlantic, western coastal plain region.

Birds that depend on early successional habitats such as grasslands and shrubs are one of the fastest declining bird groups because of habitat loss and changes in farming practices. Habitat loss, conversion of pasture to intensive row crops, increased frequency of mowing, and lack of fire are cited as the causes of population declines of grassland-dependent species (Vickery 1996).

Due to regional and local population declines, several national bird conservation organizations and Federal and State agencies advocate management to benefit grassland birds as detailed in such plans as the PIF 44 Plan, the BCR 30 plan, and the NJWAP. We designed our management objectives to provide quality habitat for a wide variety of grassland-dependent birds migrating through or wintering on the refuge.

Strategies:
1. Actively manage grassland by mowing and using prescribed fire. Mow or burn 50 percent of the grassland acreage every 3 years.
2. Purchase up to 409 acres of grassland within the refuge acquisition boundary.

Objective 2.2: Early Successional Scrub/Shrub Habitat

Objective: Protect up to 57 acres of upland scrub/shrub habitat to benefit breeding American woodcock (*Scolopax minor*), prairie warblers (*Dendroica discolor*), migrating blue-winged warblers (*Vermivora pinus*), and other species of conservation concern.

Rationale: American woodcock is a high priority upland game bird that is of conservation concern at the continental, BCR 30, and PIF 44 scales. There is significant interest in managing early successional habitats for this species. Meeting these habitat requirements would also provide good habitat for many other species that use this habitat type. The refuge may also be as important for migratory stopover habitat as it is for breeding habitat for this species. American woodcock nesting habitat varies geographically, including drier woodland sites, young open woodlands, low shrubby cover, old fields, tall herbage bordering clearings, thickets, scrub oaks or pines, open woodland with dead leaf cover on the ground, and flat bottomlands near water. High shrub stem density and presence of edge habitat may be important in nest site selection in some areas.

The prairie warbler is also a high priority species at the continental, BCR 30, and PIF 44 geographic levels. The prairie warbler became a focal species in this CCP because of its geographic importance and its steep population declines. This species uses moderate sized patches of shrubland and early successional forest, which the refuge can be managed to sustain. It usually nests in a shrub, sapling, thicket, or fern clump, from 0.3 to 3 meters above ground, and occasionally higher.

The blue-winged warbler is a 2008 Service listed bird of conservation concern in BCR 30. During migration and winter, blue-winged warblers occur in brushy areas, scrub, and open woodland.

Strategies:
1. Purchase up to 19 additional scrub/shrub acres within the approved acquisition boundary to add to the current 38 acres.
2. No active scrub/shrub management would occur.

Objective 2.3: Upland Forest Habitat

Objective: Maintain up to 414 acres of upland forest habitat to benefit breeding wood thrush (*Hylocichla mustelina*) and northern flicker (*Colaptes auratus*), migrating black-and-white warblers (*Mniotilta varia*) and Kentucky warblers (*Oporornis formosus*), migrating and

wintering rusty blackbirds (*Euphagus carolinus*), roosting bats, and other forest dependent species of conservation concern.

Rationale: The wood thrush is a high priority species at the continental, BCR, and PIF 44 scales. According to the Breeding Bird Survey (BBS), the wood thrush declined during the period of 1966-2007 (Sauer et al. 2008). The mid-Atlantic region is generally a stronghold for wood thrush, and this species is a good representative of many other species needing a structurally diverse understory within mature deciduous forest conditions.

The BBS data indicate a significant northern flicker (*Colaptes auratus)* population decrease in eastern North America between 1966 and 1989 (Sauer and Droege 1990). BBS data for 1966-1993 indicate large declines throughout eastern North America and the prairies. The flicker requires open forest (both deciduous and coniferous), open woodland, open situations with scattered trees and snags, riparian woodland, pine-oak association, and parks (AOU 1983). It nests in dead tree trunks or stumps, or the dead top of a live tree; it sometimes nests in a wooden pole, building, or earth bank. Northern flickers either dig a nest cavity or reuse an old one.

The black-and-white warbler and Kentucky warbler are listed as BCR 30 species of high concern and New Jersey non-game birds of conservation concern. Both species require forest habitats for feeding during migration (NatureServe 2009). During migration and winter, rusty blackbird habitat is primarily wooded wetlands and riparian areas but also includes various open woodlands, scrub, pastures, and cultivated lands (AOU 1983).

Supawna Meadows NWR has a severe infestation problem with the non-native mile-a-minute weed. This plant is an herbaceous trailing vine that is native to India and Eastern Asia. It is an aggressive plant that grows over native vegetation, which blocks light from penetrating to the plant. This reduces photosynthesis capability and may kill native plants (Okay et al. 2010). Under this alternative, we would continue to work with New Jersey Department of Agriculture to maintain this habitat by using an Asian weevil (*Rhinoncomimus latipes)* to control mile-a-minute weed.

Based on results of host-range tests, a limited amount of native foliage was consumed by weevils (between 0.1 and 2.3 cm^2 over 30 days). However, none of the non-target plant species were consumed when the weevils were given a choice between them and mile-a-minute weed. Additionally, no eggs were laid on non-target plant species (Colpetzer 2003). The conclusions from field studies indicate the weevil establishes easily, produces multiple generations per year, and that adults can kill mile-a-minute plants through foraging (Hough-Goldstein 2008). The intention of the releases is that the weevils will consume mile-a-minute weed stems and leaves, which would result in reducing the spread of and, eventually, killing the plants.

The refuge includes an old barn that provides important habitat for bats and owls, wildlife that are dependent on upland forest habitat. A maternity colony of more than 1,500 bats, primarily little brown bats,

roosts in a barn on the refuge. The Federal-listed, endangered Indiana bat is known to form small colonies within large little brown bat colonies. Indiana bats have been documented within the Highlands region of New Jersey, but little survey work has taken place within the southern portion of the State and it is not yet known if the species is present within the Coastal Plain (USFWS 2007a). Regardless of whether or not Indiana bats use the barn, the Service believes the barn should be maintained to support the maternity colony of little brown and big brown bats. If the barn is torn down, displaced bats may make their way into nearby homes and may be susceptible to harm by homeowners not willing to tolerate their presence. The barn would also support barn owls, which is a New Jersey species of concern. Maintaining the barn would allow us to sustain this unique environment on the refuge as a resource for bats, owls, and other wildlife and as a component of refuge diversity in general.

Strategies:

1. Continue to coordinate with New Jersey Department of Agriculture's weevil release program to control mile-a-minute weed in some areas of the refuge, as described in the refuge's 2006 Compatibility Determination (USFWS 2006), and the accompanying U.S Department of Agriculture. Environmental Assessment (Firko 2004) that were completed for this activity. A more recent version of that compatibility determination is in appendix B.
2. Purchase up to 174 additional upland forest acres within the acquisition boundary.
3. Work with State and other partners to conduct limited surveys for bat species of conservation concern and implement appropriate action if White Nose Syndrome is discovered in the colony.
4. Maintain and improve the structural integrity of the barn, located adjacent to the refuge's grasslands and tidal marshes, to continue to provide maternity roosting habitat for little brown and big brown bats, barn owls, and other species of conservation concern.
5. Work with partners to monitor the barn owl nest box in the barn.

Goal 3

Protect, enhance and restore biological integrity, diversity, and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on breeding, migrating and overwintering birds and other species of conservation concern.

Objective 3.1: Non-tidal Scrub/Shrub Wetlands

Objective: Protect up to 60 acres of non-tidal scrub/shrub wetland habitat to benefit yellow-breasted chat (*Icteria virens*), prairie warbler, and other species of conservation concern.

Rationale: Scrub/shrub habitat is essential in supporting a number of bird species of conservation concern. The yellow-breasted chat, a year-round resident of Supawna Meadows NWR, is listed in the NJWAP as a species of concern in the Southern Piedmont Plains region (NJDFW 2008a). It nests in bushes, brier tangles, vines, and low trees, generally in dense vegetation less than 2 meters above ground. In winter, it establishes territories in young second-growth forest and scrub. Early successional habitat is essential to its survival. The prairie warbler, another species of concern, has been described in objective 2.2 above (see page 3-6).

Strategies:
1. No active scrub/shrub management would occur.
2. Purchase up to 4 additional scrub/shrub acres within the acquisition boundary.

Objective 3.2: Non-tidal Herbaceous Wetlands

Objective: Protect up to 55 acres of currently undisturbed, native non-tidal herbaceous wetland habitat to benefit marsh wrens (*Cistothorus palustris*), southern bog lemmings (*Synaptomys cooperi*), and other species of conservation concern.

Rationale: Non-tidal herbaceous wetlands at Supawna Meadows NWR provide habitat for species of conservation concern, including the marsh wren, which inhabits freshwater and brackish marshes in cattails, tule, bulrush, and reeds. Its success may be greatest in marshes with relatively dense vegetation and deep water. Though no longer listed by the Service as a bird of conservation concern in the region, it is considered a non-game species of conservation concern by the State of New Jersey (NJDFW 2008a). The southern bog lemming is also listed by New Jersey as a non-game species of conservation concern (NJDFW 2008a).

Strategies:
1. No active herbaceous wetland management would occur.
2. Purchase up to 13 additional non-tidal herbaceous wetland acres within acquisition boundary.

Objective 3.3: Freshwater Impoundments

Objective: Manage up to 87 acres in impoundments, using existing water control structures, and up to 5 acres of non-tidal open water impoundments (without water control structures) to enhance habitat available for shorebirds, waterfowl, and wading birds during their peak spring and fall migration periods while maintaining essential habitat for other freshwater species of management concern, such as amphibians and dragonflies, through a combination of water level management, wetland restoration, and invasive species control.

Rationale: Supawna Meadows NWR's impoundments and emergent wetlands provide important foraging habitats for wading birds nesting on Pea Patch Island, which is the largest wading bird colony in the mid-Atlantic and one of the largest colonies on the East Coast. Managing these wetlands to provide the necessary food for a subset of these birds would result in resources available to a larger suite of wading birds, such as black-crowned night herons (*Nycticorax nycticorax*), glossy ibis (*Plegadis falcinellus*), least bitterns (*Ixobrychus exilis*), snowy egrets (*Egretta thula*), and little blue herons (*Egretta caerulea*), which are priority species within BCR 30. Also, created wetland environments can provide key life cycle components for a variety of birds and aquatic species.

The Tract 11D Xmas Tree Lane (XTL) impoundment is the largest and only manageable pond in the upland forested portion of the refuge, providing habitat for a wide variety of wildlife species. It may be an important adjunct to the much larger native tidal marsh portion of the refuge in providing quality habitat for wading birds, shorebirds, waterfowl, reptiles, and amphibians.

Our unmanaged refuge ponds are mostly remnant borrow pits that retain water because of the high water table. Nest boxes we maintain in and near these ponds attract wood ducks (*Aix sponsa*) and eastern screech owls (*Otus asio*). The ponds provide habitat for aquatic species such as frogs and salamanders.

Vernal pools are confined wetland depressions, either natural or man-made, that hold water for at least two consecutive months out of the year, and are devoid of breeding fish populations. These unique ecosystems provide habitat to many species of amphibians, insects, reptiles, plants, and other wildlife. Vernal pools come in an array of forms, such as isolated depressions within upland forests, seasonally flooded meadows, floodplain swamps, abandoned gravel pits or quarries, and even derelict swimming pools. However, no matter what the structure or genesis of the pool is, all vernal pools either dry out completely or draw down to very shallow levels unsuitable for sustaining fish. Fish are highly predatory on amphibian eggs and larvae. Over the course of evolution, several species of salamanders and frogs exploited these fish-less water bodies. Today, these species exhibit "hard-wired" instincts and behaviors that are geared exclusively towards fish-free vernal habitats. Amphibians that are dependent upon vernal pools are known as "obligate vernal pool breeders." In New Jersey there are seven species, two frogs and five salamanders, that fit this category. Another 14 of New Jersey's amphibians also use vernal pools for breeding, but unlike the obligate species, these species can successfully reproduce in habitats that contain fish. These species are known as "facultative vernal pool breeders" (NJDFW 2008a).

Reptiles that inhabit vernal pools on a seasonal basis, primarily to eat the eggs and larvae of amphibians, include the spotted turtle (*Clemmys guttata*) (a species of special concern), mud turtle (*Kinosternon subrubrum*), eastern painted turtle (*Chrysemys picta picta*), and common snapping turtle (*Chelydra serpentina serpentina*).

Strategies:

1. Mow and reduce woody vegetation on Tract 11 dike.
2. Keep boards in the following impoundments: Tract 11, Tract 11D Lighthouse Road, Tract 18, Tract 11C, Tract 11D (XTL).
3. Maintain dike and water control structures as needed.
4. Measures such as furbearer control would be taken when necessary to ensure the long-term integrity of the impoundment dike.
5. No active impoundment management would occur in the impoundments without water control structures or vernal pools.

Objective 3.4: Forested Wetlands

Objective: Protect up to 338 acres of forested wetland habitat to benefit breeding wood thrush and wood ducks, migrating and wintering rusty blackbirds, breeding and wintering eastern screech owls, and other forest dependent species of conservation concern.

Rationale: The wood duck is a refuge focal species because it is a high priority species both within the Atlantic Flyway and at the regional scale, and it is a good representative of forest wetland habitat types. Wood duck populations began declining in the late nineteenth century because of overharvest, deforestation, and loss of wetland habitats.

Populations have since stabilized but not recovered, even though harvest rates have declined. Wood ducks prefer quiet inland waters, such as wooded swamps, flooded forest, ponds, marshes, along streams where they nest in holes in large trees in forested wetlands, and in bird boxes, usually within 0.5 kilometers of water and near forest canopy openings. They winter on freshwater and brackish marshes, ponds, streams, and estuaries.

The rusty blackbird breeds in Canada and Alaska and migrates to New Jersey and other Eastern and Central States to winter. During migration and winter, habitat is primarily wooded wetlands and riparian areas but also includes various open woodlands, scrub, pastures, and cultivated lands (AOU 1983). A significant, range-wide decline of approximately 90 percent over the past four to five decades is indicated by data from the Breeding Bird Survey, Christmas Bird Counts, and Quebec Checklist Program (Greenberg and Droege 1999, Niven et al. 2004, Savignac 2004, Sauer et al. 2005). Analyses of abundance classifications in bird distribution books and annotated checklists reveal a long-term decline dating back to at least the early part of the 1900s (Greenberg and Droege 1999).

The eastern screech owl, a non-game species of conservation concern in the State of New Jersey (NJDFW 2008a), is common year round at Supawna Meadows NWR. It prefers open woodland, deciduous forest, woodland/forest edge, swamps, scrub, and riparian woodland. It roosts in tree hollows, among foliage close to trunk, in nest boxes, under eaves, or at similar sites.

Strategies:
1. Work with volunteers to check, refresh, and maintain up to 50 percent of nest boxes to benefit wood ducks and eastern screech owls.
2. Purchase up to 156 additional forested wetland acres within the acquisition boundary.

Goal 4

Provide opportunities for compatible, high-quality, wildlife-dependent public uses.

As described previously under Actions Common to Alternatives A and B, the Refuge System Improvement Act identifies six wildlife-dependent priority public uses: hunting, fishing, environmental education and interpretation, and wildlife observation and photography. The two programs of emphasis identified for this refuge are: wildlife observation and wildlife photography. While these uses will receive enhanced consideration, we would continue to ensure that the wildlife-dependent recreation program meets all of the Service's guidelines (Fish and Wildlife Service Manual 605FW 1; see Actions Common to Alternatives A and B, pg 3-3 for additional details). We would continue to provide high-quality, priority public use opportunities as follows:

Objective 4.1: Hunting

Objective: Provide hunting opportunities for deer and waterfowl hunters.

Rationale: Hunting in southern New Jersey is a traditional outdoor past time and is deeply rooted in our American heritage. A quality hunt program helps develop an appreciation for fish and wildlife. It is also a

tool to assist in deer population control and habitat management efforts on the refuge.

Opportunities for public hunting are decreasing with increasing private land development. Refuge lands thus become increasingly important in the region as a place to engage in this activity.

We would strive to meet the following guiding principles for a refuge hunting program identified in new Service policy (605 FW 2):

- Manage wildlife populations consistent with Refuge System-specific management plans approved after 1997 and, to the extent practicable, State fish and wildlife conservation plans;
- Promote visitor understanding of and increase visitor appreciation for America's natural resources;
- Provide opportunities for quality recreational and educational experiences;
- Encourage participation in this tradition; and,
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

The refuge hunt program is implemented consistent with State regulations and additional refuge regulations stipulated in 50 CFR. Our current deer and waterfowl hunt areas are depicted in Map 3.2. Included in our deer hunt plan objectives is the intent to maintain the deer population at a level commensurate with available habitat, in order to maintain the health of the herd, and prevent habitat degradation that accompanies overpopulation. Included in our waterfowl hunt plan objectives is the intent to provide opportunities for compatible wildlife-dependent recreation as required by the National Wildlife Refuge Improvement Act of 1997, permit use of a sustainable natural resource, and permit hunting as a management strategy to meet State, flyway, and national population goals for non-migratory Canada goose and greater snow goose populations.

Strategies:

1. The current refuge deer hunting program would continue. Only archery deer hunting is allowed on the refuge for all four of New Jersey's bow hunting seasons according to the State Deer Management Zone 63 regulations.
2. Continue to keep the Tract 11 Impoundment and the surrounding land open to archery deer hunting according to State seasons.
3. Continue to prohibit hunting on the area around the new office, the area just north of Mill Creek, and the new AID area (Tract 48).
4. The current waterfowl hunting program would continue in accordance with State regulations and seasons.
5. No other migratory bird or upland game hunting programs would occur on the refuge.

Objective 4.2: Fishing and Crabbing

Objective: Provide fishing and crabbing opportunities for the public.

Rationale: Fishing and crabbing are popular recreational activities along the Delaware Estuary and Salem River shorelines, and the refuge can be accessed by an extensive series of tidal channels that support

both activities. Fishing and crabbing have been historical, consumptive recreational uses on the refuge that we believe are compatible with our resource objectives.

We would strive to meet these guiding principles for a refuge recreational fishing program identified in Service policy (605 FW3 and 4):

- Effectively maintain healthy and diverse fish communities and aquatic ecosystems through the use of scientific management techniques;
- Promote visitor understanding of, and increase visitor appreciation for, America's natural resources;
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality as defined in 605 FW 1.6;
- Encourage participation in this tradition deeply rooted in America's natural heritage and conservation history; and,
- Minimize conflicts with visitors participating in other compatible wildlife-dependent activities.

Strategies:

1. Areas currently open for fishing and crabbing would continue to be open in accordance with State regulations (see Map 3.2). The area in the southern portion of the refuge would continue to be closed seasonally from December 15 to July 31.
2. Freshwater areas would continue to be closed to the public for fishing and crabbing.
3. Continue to hold the one-day refuge youth fishing event at the Tract 18 impoundment if the Friends of Supawna Meadows NWR or other volunteer groups were capable and would agree to completely organize and implement all event activities.

Objective 4.3: Wildlife Observation, Photography, and Interpretation

Objective: Continue to provide wildlife and habitat observation, photography, and interpretation opportunities.

Rationale: The refuge's Public Use Plan was approved August 3, 2000. It states that through the public use program, visitors and local residents will be introduced to the role of the Service as a land management agency. Visitors would be encouraged to visit and learn more about other Service field areas, including refuges in New Jersey, Pennsylvania, and Delaware. Visitors would be introduced to the basic concepts of wildlife management and sustainable public use of natural resources. The public use program would be used to increase visitor understanding of refuge management objectives and programs and to foster support for fulfilling its mandated mission.

We would strive to meet these guiding principles for refuge wildlife observation and photography programs identified in Service policy (605 FW 4 & 5):

- Provide safe, enjoyable, and accessible wildlife viewing and photography opportunities and facilities;

- Promote visitor understanding of, and increase visitor appreciation for, America's natural resources;
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6; and,
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreation activities.

Strategies:

1. Continue to provide wildlife viewing, photography, and interpretation opportunities along existing refuge trails.
2. Continue to provide interpretive signs at all existing refuge public use sites, including the family plot cemetery along the Grassland Trail.
3. Trail maintenance would primarily be conducted by refuge volunteers.
4. Update general refuge brochure.
5. Expand refuge trails to include a spur trail off the Grassland Trail to an observation blind on the pond if feasible with substantial involvement by the Friends of Supawna Meadows NWR.
6. Improve the observation blinds along the Grassland Trail with substantial involvement by the Friends of Supawna Meadows NWR.
7. Continue to prohibit hunting on the area around the new office, the area just north of Mill Creek, and the new AID area (Tract 48).
8. Continue to keep Tract 11 impoundment closed to public use all year except for deer hunting.
9. Continue to seasonally close bald eagle area.
10. Install/upgrade signs along Highway 49 directing motorists to refuge.

Objective 4.4: Environmental Education and Outreach

Objective: Work with partners to provide limited environmental education and outreach opportunities.

Rationale: The Refuge Improvement Act identifies environmental education as a priority wildlife-dependent recreation activity. It stresses the history and importance of conservation and ecological principals and scientific knowledge of our Nation's natural resources. Through that process, we can help develop a citizenry that has the awareness, knowledge, attitudes, skills, motivation, and commitment to work cooperatively toward the conservation of our Nation's environmental resources.

We would strive to meet the following guiding principles for a refuge environmental education program identified in Service policy (605 FW 6):

- Teach awareness, understanding, and appreciation of our natural and cultural resources and conservation history;
- Allow program participants to demonstrate learning through refuge-specific stewardship tasks and projects that they can carry over into their everyday lives;
- Establish partnerships to support environmental education both on- and off-site;

- Support local, State, and national educational standards through environmental education on refuges;
- Assist refuge staff, volunteers, and other partners in obtaining the knowledge, skills, and abilities to support environmental education;
- Provide appropriate materials, equipment, facilities, and study locations to support environmental education;
- Give refuges a way to serve as role models in the community for environmental stewardship; and,
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreation activities.

Strategies:

1. Provide occasional on-site nature walks arranged and sponsored by the Friends of Supawna Meadows NWR. Staff would accommodate occasional requests to lead tours on the refuge.
2. The majority of off-site outreach activities would be conducted by the Friends of Supawna Meadows NWR. These include two to three events the Friends Group uses as an opportunity to educate the public about the refuge.
3. Continue to participate in community and partner discussions about proposed development in the vicinity of the refuge.

Goal 5

Protect cultural resources on the refuge.

Objective 5.1: Finns Point Rear Range Light

Objective: Maintain and protect Finns Point Rear Range Light.

Rationale: Finns Point Rear Range Light is well known in the area as an historic resource of interest and can receive substantial visitation.

Strategies:

1. Continue to maintain FPRRL in compliance with the National Historic Preservation Act.
2. Continue to allow public access to the exterior of FPRRL daily and the interior of FPRRL only during the annual New Jersey Lighthouse Challenge, if deemed feasible by the refuge manager. Refuge staff would only participate in the New Jersey Lighthouse Challenge if the Friends of Supawna Meadows NWR were capable and would agree to completely organize and implement all event activities.
3. Due to safety concerns, continue to prohibit public access of the FPRRL catwalk.
4. With assistance from the New Jersey Lighthouse Society (NJLHS) and Friends of Finns Point Lighthouse (FOFPL), seek to stabilize, protect, and interpret FPRRL lens, if possible, in refuge office.

Objective 5.2: Other Cultural Resources

Objective: Maintain and protect cultural sites and artifacts.

Rationale: Besides FPRRL, there are other cultural resources on the refuge, such as a family cemetery and the Yerkes farmstead. While not actually listed, New Jersey Historical Preservation Office staff determined that the Yerkes farmstead is eligible for listing on the National Register of Historic Places under the National Historic Preservation Act. There may be other historical or archeological

resources that come to light in the course of refuge management in the future. By law, we must consider the effects of our actions on archeological and historic resources. No matter which alternative is selected, we would comply with Section 106 of the NHPA before disturbing any ground.

Strategies:
1. Allow Friends of Supawna Meadows NWR to continue maintaining the family cemetery located on refuge lands.

Goal 6

Enhance refuge management through partnerships, friends, volunteers, and community outreach.

Objective 6.1: Refuge Partnerships

Objective: Maintain active involvement in partnerships among all public land management agencies in South Jersey and the Lower Delaware River and Estuary to achieve refuge habitat and public use management objectives.

Rationale: Fully achieving refuge goals in many instances can be feasible only through successful partnering with other agencies and groups.

Strategies:
1. Communicate and coordinate regularly with the other agencies to discuss common goals, issues and concerns, share technical information, and identify opportunities for cooperative management with other agencies.
2. Pursue formal Memorandum of Understanding/ Memorandum of Agreements (MOU/MOA) and cooperative agreements with partnering agencies where warranted to facilitate sharing of resources and implementation of programs.
3. Maintain the existing MOU with Salem County to share in law enforcement.

Objective 6.2: Refuge Friends Group

Objective: Continue to seek opportunities to enhance our relationship with the Friends of Supawna Meadows NWR.

Rationale: There are over 50 Friends groups in the Northeast Region of the U.S. Fish and Wildlife Service. These groups are private non-profit organizations formed and managed by local citizens to support the mission of a refuge and advocate for their local refuge and the National Wildlife Refuge System. The work these groups do is invaluable to our wildlife mission as well as the public activities that take place on refuges, fish hatcheries, and other Service stations.

Friends members enjoy a variety of benefits depending on the group. Benefits include interacting with other people who share a common interest in wildlife and conservation, engaging in opportunities to learn more about refuge management and conservation practices, and notification of upcoming Friends and refuge events.

Strategies:
1. Conduct monthly information and strategy meetings.
2. Contribute information to the Friends' newsletter and website.

3. Support the Friends' efforts at sponsoring community events and programs.
4. Encourage the Friends to work with other local citizens groups as an extension of the refuge's community outreach program.

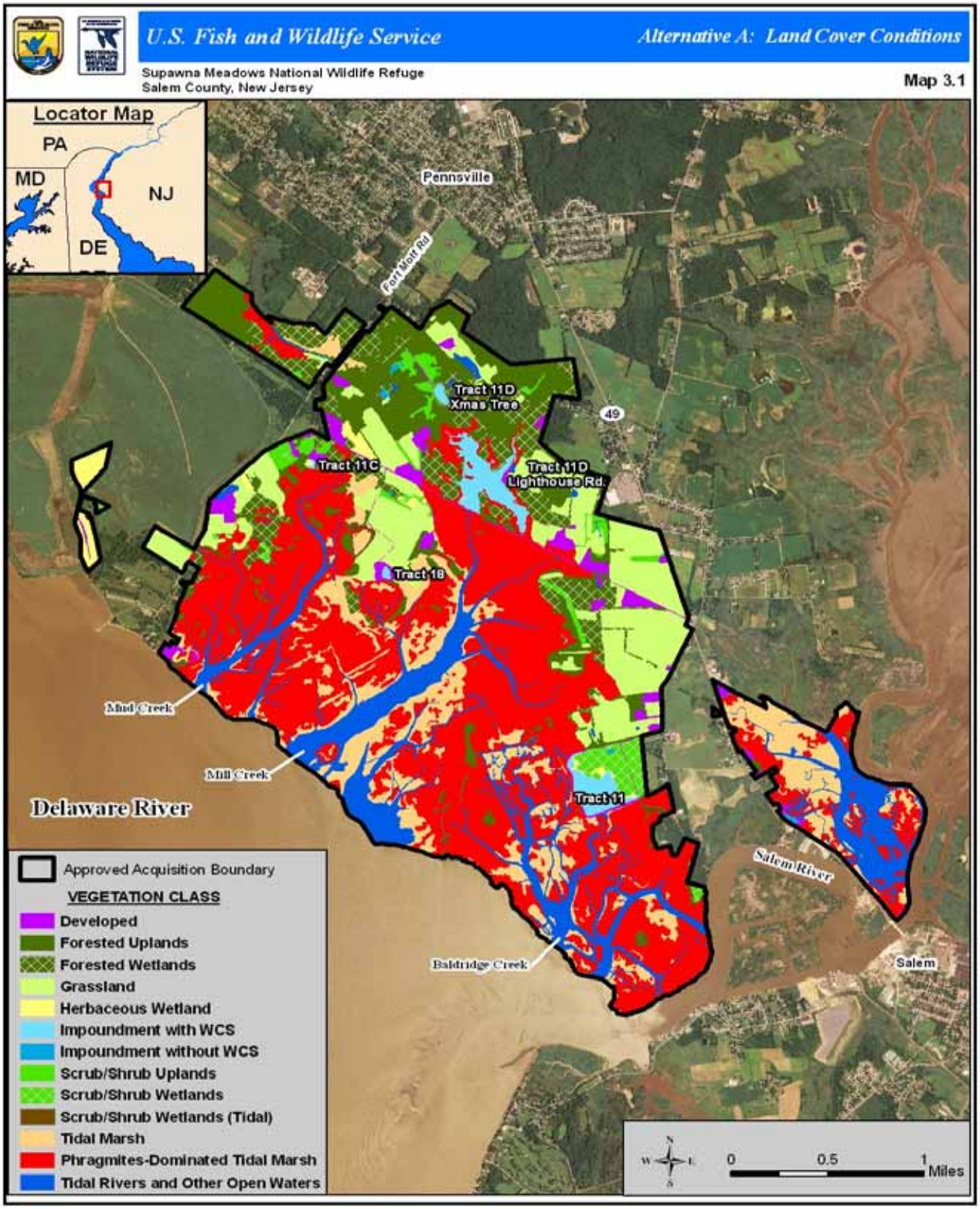
Objective 6.3: Volunteers

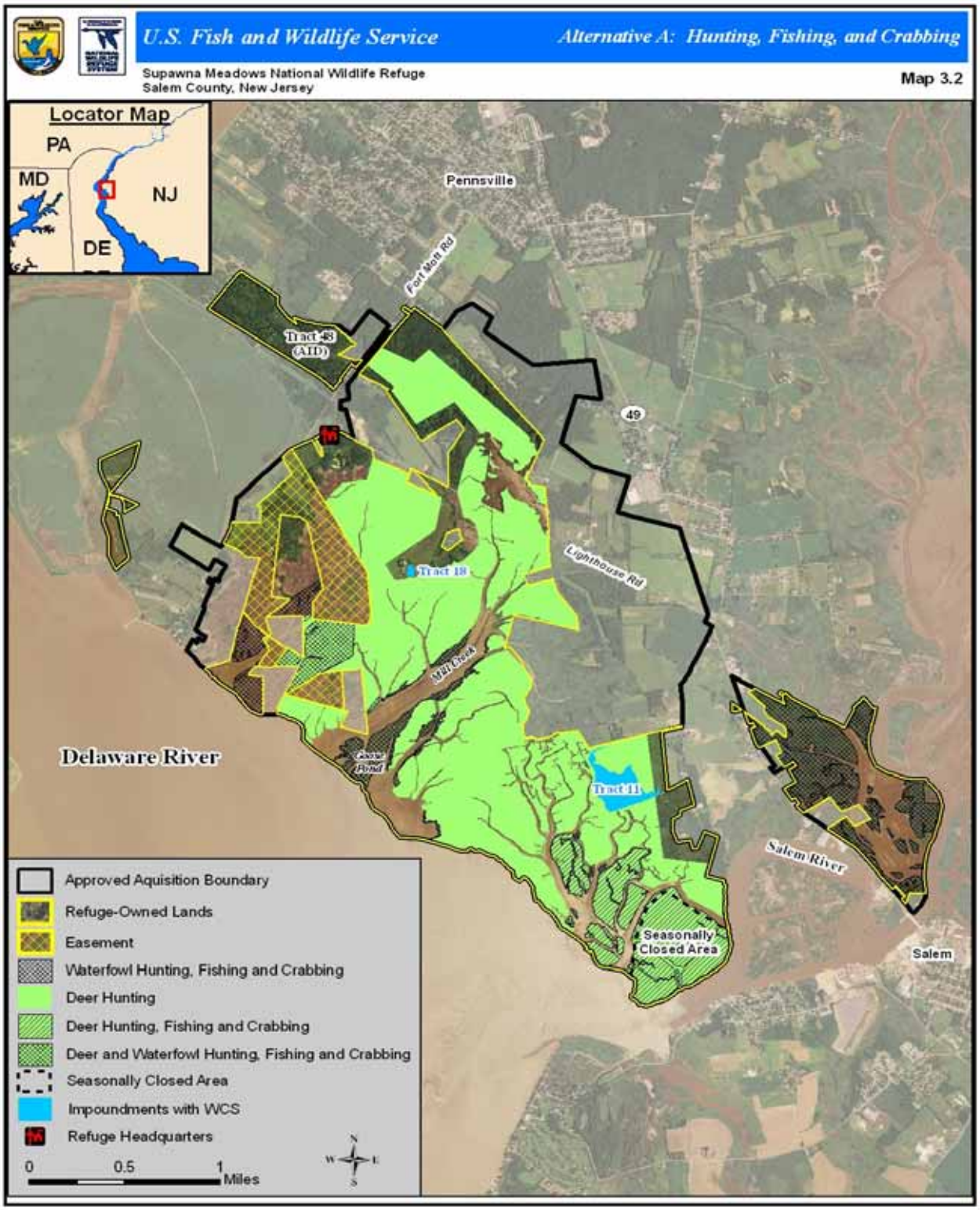
Objective: Continue to seek the assistance of volunteers to address specific management requirements at Supawna Meadows NWR.

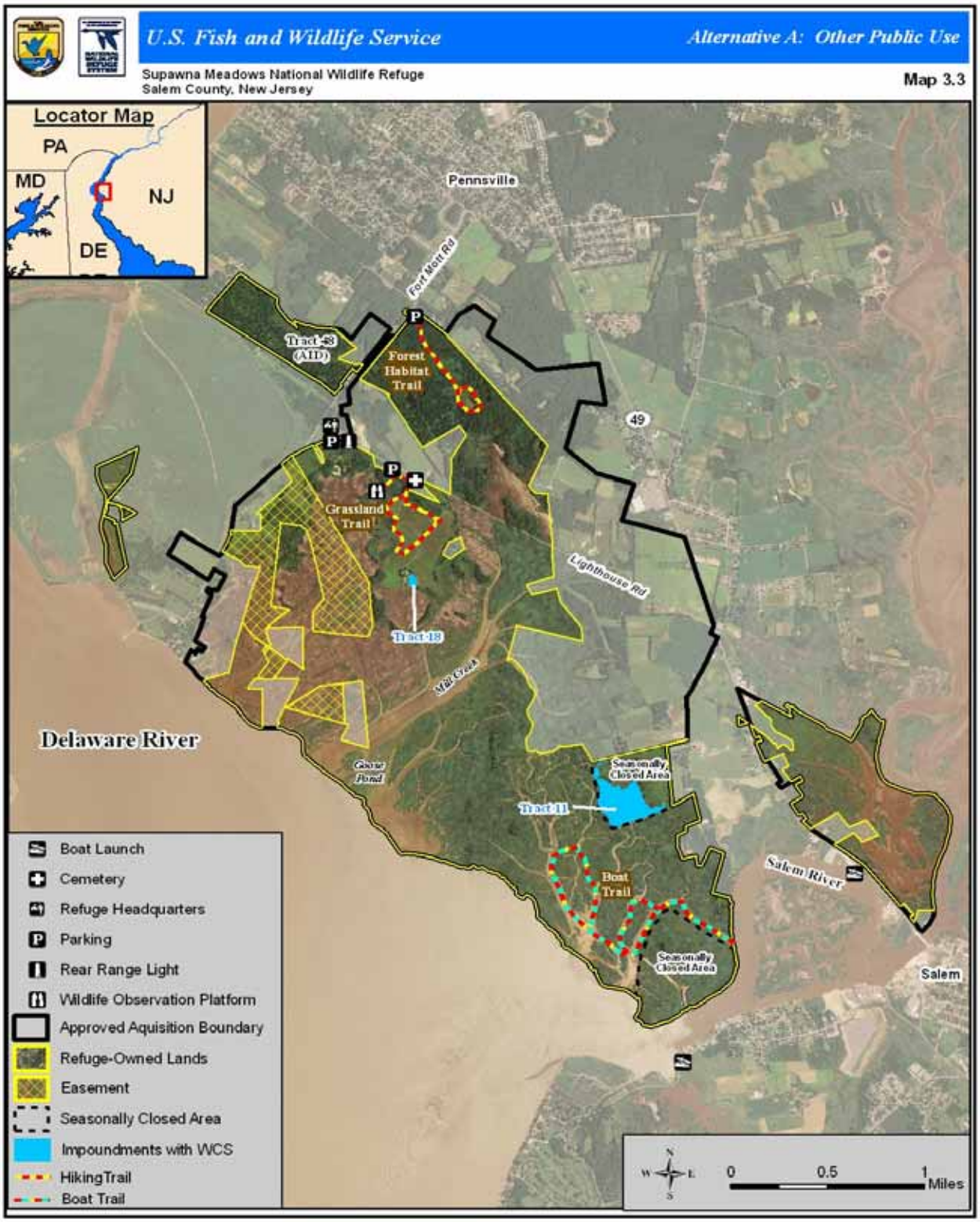
Rationale: The Fish and Wildlife Act of 1956, as amended by the Fish and Wildlife Improvement Act of 1978, and the National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1988 authorize the Service to accept volunteer services. Volunteers help the Service in a variety of ways. Some work full-time, while others assist a few hours per week or month or during a special event. Many volunteers conduct fish and wildlife population surveys, band ducks, lead tours, provide information to school groups and other visitors, work on cultural resources projects, perform clerical and administrative duties, work with computers and other technical equipment, and much more.

Strategies:

1. Continue to work with volunteers who assist in managing the biological and public use programs on the refuge.


U.S. Fish and Wildlife Service
Alternative A: Land Cover Conditions
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 3.1
Locator Map
PA
MD
NJ
DE
Pennsville
Fort Mott Rd
Tract 11D
Xmas Tree
49
Tract 11C
Tract 11D
Lighthouse Rd.
Tract 18
Mud Creek
Mill Creek
Delaware River
Tract 11
Salem River
Baldridge Creek
Salem
Approved Acquisition Boundary
VEGETATION CLASS
Developed
Forested Uplands
Forested Wetlands
Grassland
Herbaceous Wetland
Impoundment with WCS
Impoundment without WCS
Scrub/Shrub Uplands
Scrub/Shrub Wetlands
Scrub/Shrub Wetlands (Tidal)
Tidal Marsh
Phragmites-Dominated Tidal Marsh
Tidal Rivers and Other Open Waters
0
0.5
1
Miles


U.S. Fish and Wildlife Service
Alternative A: Hunting, Fishing, and Crabbing
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 3.2
Locator Map
PA
MD
NJ
DE
Pennsville
Fort Mott Rd
Tract 43 (AID)
49
Lighthouse Rd
Tract 18
Mill Creek
Delaware River
Tract 11
Salem River
Seasonally Closed Area
Salem
Approved Aquisition Boundary
Refuge-Owned Lands
Easement
Waterfowl Hunting, Fishing and Crabbing
Deer Hunting
Deer Hunting, Fishing and Crabbing
Deer and Waterfowl Hunting, Fishing and Crabbing
Seasonally Closed Area
Impoundments with WCS
Refuge Headquarters
0 0.5 1 Miles
N
W
E
S


U.S. Fish and Wildlife Service
Alternative A: Other Public Use
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 3.3
Locator Map
PA
MD
NJ
DE
Pennsville
Fort Mott Rd
Tract 48 (AID)
Forest Habitat Trail
49
Grassland Trail
Lighthouse Rd
Tract 18
Mill Creek
Delaware River
Goose Pond
Seasonally Closed Area
Tract 11
Boat Trail
Salem River
Salem
Boat Launch
Cemetery
Refuge Headquarters
Parking
Rear Range Light
Wildlife Observation Platform
Approved Aquisition Boundary
Refuge-Owned Lands
Easement
Seasonally Closed Area
Impoundments with WCS
Hiking Trail
Boat Trail
0
0.5
1
Miles

Alternative B – Focus on Species of Conservation Concern (Service-Preferred Alternative)

Alternative B is our preferred alternative. We believe it best fulfills the refuge's purposes, vision and goals, and responds to public issues. It emphasizes management of specific refuge habitats to support federal trust resources and species of conservation concern in the area. In particular, the priority would be to protect and restore the refuge's native tidal marsh habitat to benefit Pea Patch Island colonial-breeding wading birds, as well as secretive marsh birds, migratory waterfowl, shorebirds, and other birds of conservation concern. Below is a list of strategies that are common to two or more objectives in alternative B, and therefore are presented separately from the more specific objectives and strategies that follow. The description of alternative B is followed by maps 3.4, 3.5 and 3.6, which illustrate the proposed habitat management and public use strategies for this alternative.

Wildlife Habitat Management

Under alternative B, we would expand our management to benefit trust species and other species of conservation concern in all refuge habitats. We would focus management efforts on providing native tidal marsh habitat to benefit key Federal trust species and groups of species. Specifically, we would provide foraging habitat for Pea Patch Island wading birds during the breeding season and nesting, migratory, and wintering habitats for marsh birds, waterfowl, shorebirds, raptors, and songbirds. We would actively manage tidal marsh and grassland habitats and would maintain dikes and water levels on our impoundments with water control structures, but we would not actively manage other refuge habitats. We would permit compatible research programs requested by other entities on refuge lands, but would not directly support them. If we are successful in achieving our alternative B habitat management objectives, the habitat composition of the refuge would be that listed in table 3.2 and illustrated in map 3.4 (see page 3-60).

We would expand our invasive plant management efforts to include more extensive control of phragmites in the tidal marsh and use of a variety of treatment methods for invasive plant control elsewhere on the refuge. Specifically, we would coordinate with the New Jersey Department of Agriculture's weevil release program to control mile-a-minute weed in some areas of the refuge.

Our primary tools would be mowing, prescribed burning, and use of herbicides to control phragmites and other invasive plant species and the continuation of hunting to control the white-tailed deer population.

Table 3.2. Alternative B Land Use and Land Cover Acreage

Land Use/Land Cover Type	Current Acreage	Acquisition Acreage	Total Acreage[1]
Tidal Marsh			
Native Marsh	902	131	1033
Phragmites-Dominated	1029	231	1260
Total Marsh	**1931**	**362**	**2293**
Developed	26	97	123
Forested Uplands	242	174	416
Forested Wetlands	190	156	346
Grassland	123	409	532

Herbaceous Wetland	42	13	55
Managed Impoundments	86	1	87
Unmanaged Impoundment	4	1	5
Scrub/Shrub Uplands	36	19	55
Scrub/Shrub Wetlands	48	4	52
Scrub/Shrub Wetlands (Tidal)	28	2	30
Open Tidal Waters	492	42	534
TOTAL	**3,247[2]**	**1,280**	**4,527**

[1] Differences in habitat acres between alternative A and alternative B are due to differences in habitat management strategies.

[2] Includes 231 acres held under conservation easement by the refuge. An additional 20 acres held in easement have a future building clause and are not included.

We would:

1. Monitor known infestation sites for significant adverse impacts on wildlife habitat.
2. Seed or plant disturbed sites with native species.
3. Control 60 percent of phragmites where native plants are inhibited or where fire hazards need to be reduced. Control will be applied in any area where water level and wildlife habitat is unacceptable due to phragmites growth. Target control is based on specific situations.
4. Maintain healthy stands of native plants.

Staffing and Project Funding

We used the NWRS 2008 national staffing model to guide proposed staffing under alternative B. Staffing models were developed to answer the question, "What level of staffing is needed to operate and manage a station to achieve the station's purpose, contribute to the mission and goals of the Refuge System, and comply with the Refuge Improvement Act and other laws, regulations, and policy?" Earlier efforts suggest there are ten functional categories that describe the work we do or need to do on stations in the Refuge System. These are: wildlife and habitat, visitor services, facilities and equipment, maintenance, realty, planning, communications, business management, information technology, law enforcement, and fire management. The model gives a total number of full time employees needed at a station to do the work, but management must still decide the best mix of disciplines to do that work and whether to deploy part-time, seasonal, or permanent employees.

In addition to this national staffing model, the Refuge System and the International Association of Chiefs of Police began working together in 2003 on a law enforcement staffing and deployment model. The goal for this effort was to develop a defensible staffing model to quantify law enforcement resource needs for the Refuge System, help refuge managers deploy law enforcement resources, and justify budget requests. The result was a "Deployment Model for the National Wildlife Refuge System" (International Association of Chiefs of Police), completed in May 2005 and slated for updating every 5 years.

Under alternative B, our preferred alternative, the refuge would continue to be administered as a satellite refuge with management responsibility residing at Cape May NWR. We used the national staffing model to help determine the appropriate level of non-law enforcement staffing for alternative B, the Service-preferred

alternative, and the law enforcement deployment model to determine the proposed number of law enforcement staff. Based on our priorities, we are proposing four full-time staff stationed at Supawna Meadows NWR, and one full-time staff person that would be stationed at Cape May NWR and shared between the Cape May NWR and Supawna Meadows NWR. Under alternative B, Supawna Meadows NWR would have an assistant refuge manager, a wildlife biologist, a park ranger (law enforcement), and a maintenance worker. A park ranger (visitor services) position would be shared with Cape May NWR. While the staff at Supawna Meadows NWR would continue to be supported by the current and any new staff at Cape May NWR, we anticipate that the visitor services position would spend substantial time at Supawna Meadows NWR to improve and implement the public use programs proposed under alternative B. Please see appendix E for the proposed staffing chart for alternative B.

Refuge Buildings and Facilities

We would operate and maintain the refuge office, both garages, (bat) barn, intern house on Route 49, and Finns Point Rear Range Light. We propose demolition of all other buildings on refuge lands. We would work with the New Jersey Historical Preservation Office and the Service's regional archaeologists to ensure compliance with applicable state and federal laws and regulations. The demolition of refuge facilities would result in the conversion of developed land into wildlife habitat such as grassland and shrub/scrub upland habitat.

The refuge headquarters office would be used full time by refuge staff, would be available for use by the Friends group as requested, and would be open to the public on a regularly scheduled basis. The four-bay garage at the refuge office and the garage at the previous headquarters site would be maintained. The quarters on Route 49 would be maintained for occasional use as needed. The barn currently used by bats would also be maintained.

Resource Protection and Visitor Safety

As described under staffing and project funding, we would add one full-time law enforcement officer to enforce laws and regulations on Supawna Meadows NWR. New on-site staff and a visitor services professional stationed at Cape May NWR would help to install and maintain appropriate signage and prepare and distribute resource protection information as appropriate.

Land Protection

Under alternative B, we would continue to purchase portions of the 1,257 acres of inholdings within the 4,527-acre acquisition boundary as funding allows. The Service would continue its policy of accepting donations and buying from willing sellers and would focus on acquiring developable upland properties first.

In addition, within three years of final approval of the CCP, we would begin to re-evaluate the refuge's acquisition boundary through the Service's Preliminary Project Proposal process to address rising sea level caused by climate change because much of what is currently within the refuge boundaries would likely be under water in the next 50 to 100 years. Therefore, we need to start acquiring adjacent uplands to continue our stewardship of vital marsh habitat as the marsh gradually migrates inland. Additional impetus for land purchase would be:

1. To maintain the ecological integrity of the current refuge by protecting the natural resources on adjacent lands.
2. To acquire important nearby upland and wetlands areas that would expand our protection of those habitats and the trust resources and other sensitive species that rely on them.
3. To expand opportunities for public uses particularly wildlife observation and photography and interpretation.

We would apply appropriate management to benefit species of conservation concern to any newly acquired lands.

Baseline Flora and Fauna Surveys

We would conduct surveys and develop comprehensive inventories of all flora and fauna found on the Supawna Meadows NWR including data on species abundance and distribution as staff and funding is made available. A Wildlife Inventory Plan was developed for Supawna Meadows NWR in 2004 (USFWS 2004e). This plan identifies the priority surveys and monitoring that should be completed on the refuge based on enabling legislations, Service initiatives, unit objectives, management plans, and related management activities. Under this alternative, we believe we would have the staffing and funding necessary to implement this plan. The surveys to be completed, ranked in order of importance, are shown below in table 3.3.

Table 3.3. Baseline Flora and Fauna Surveys to be Completed

Surveys	Priority Species Involved
1. Saltmarsh Sparrow Breeding Bird	coastal plain swamp sparrow seaside sparrow marsh wren
2. Landbird Breeding	coastal plain swamp sparrow marsh wren wood thrush yellow-breasted chat Baltimore oriole
3. Herptile Inventory	bog turtle eastern tiger salamander spotted turtle eastern box turtle northern diamondback terrapin Fowler's toad
4. Marshbird Callback	black-crowned night-heron great blue heron king rail least bittern little blue heron yellow-crowned night-heron
5. Nonbreeding Bird Use of Tidal Marshes	little blue heron yellow-crowned night-heron black rail
6. Nonbreeding Bird Use of Grasslands	northern harrier short-eared owl horned lark vesper sparrow bobolink

	grasshopper sparrow savannah sparrow eastern meadowlark
7. Grassland Breeding Bird	horned lark bobolink grasshopper sparrow savannah sparrow eastern meadowlark
8. Wading Bird Impoundment	great blue heron little blue heron
9. Shorebird Migration Impoundment	solitary sandpiper short-billed dowitcher
10. Anuran Call Count	Fowler's toad
11. Wintering Waterfowl Impoundment	American black duck
12. Christmas Bird Count	migratory birds
13. Butterfly and Dragonfly Inventory	dotted skipper Harris' checkerspot Hessel's hairstreak two-spotted skipper
14. Fish Inventory	unknown
15. Small Mammal Inventory	unknown
16. Woodcock Singing Ground	American woodcock
17. Muskrat Ground Dwelling	muskrat

Other priority surveys identified during scoping meetings that should be conducted (not in order of importance) are shown in table 3.4.

Table 3.4. Other Priority Surveys Identified During Public Scoping

Surveys	Priority Species Involved
Marsh Rice Rat	marsh rice rat
Bird Productivity in Phragmites Control Areas	clapper rail northern harrier marsh wren coastal plain swamp sparrow
Coastal Plain Swamp Sparrow	coastal plain swamp sparrow
Biological, Chemical, Sediment, and Contaminant (Contaminant Assessment Process) Baseline	tidal marsh habitat fish open water
Fish Inventory in Impoundments	alewife herring sturgeon
Native Animals and Plants in Scrub/Shrub Wetlands (Tidal)	northern harrier sedge wren
Plants	sensitive joint vetch

Managing Invasive Plants

The establishment and spread of invasive plants is a significant problem that reaches across all habitat types on the refuge. Under alternative B, we would pursue a broad program of invasive plant management based on Service principles. For the purposes of this discussion, we use the definition of invasive species contained in the Service Manual (620 FW 1.4E): "Invasive species are alien species whose introduction does or is likely to cause economic or environmental harm, or harm to human health. Alien species, or non-indigenous

species, are species that are not native to a particular ecosystem." We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere.

The unchecked spread of invasive plants threatens the biological diversity, integrity, and environmental health of all refuge habitats. In many cases, these plants have a competitive advantage over native plants and form dominant cover types, reducing the availability of native plants as food and cover for wildlife. Over the past several decades, government agencies, conservation organizations, and the general public have become more acutely aware of the negative effects of invasive species. There are many plans, strategies, and initiatives targeted toward more effective management of invasive species, including The National Strategy for Management of Invasive Species for the National Wildlife Refuge System (USFWS 2003a), Silent Invasion – A Call to Action by the National Wildlife Refuge Association (NWRA 2002), and Plant Invaders of Mid-Atlantic Natural Areas by the Service and the National Park Service (Swearingen et al. 2002). New information and updates on recent advances in control techniques are continually provided through the Refuge System biological discussion database and relevant workshops. There are also more funding sources, both within the Service's budget and through competitive grants, to conduct inventories and control programs.

Guidance for managing invasive species on refuges is found in the Service Manual (620 FW 1.7G). These actions serve to define our general strategies on the refuge:

1. Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and prevent new and expanded infestations of invasive species.
2. Conduct refuge habitat management activities to prevent, control, or eradicate invasive species using techniques described through an integrated pest management plan, or other similar management plan, which comprehensively evaluates all potential integrated management options, including defining threshold/risk levels that will initiate the implementation of proposed management actions.
3. Evaluate native habitat management activities with respect to their potential to accidentally introduce or increase the spread of invasive species and modify our habitat management operations to prevent increasing invasive species populations.
4. Refuge integrated pest management planning will address the abilities and limitations of potential techniques including chemical, biological, mechanical, and cultural techniques.
5. Manage invasive species on refuges under the guidance of the National Strategy for Invasive Species Management and within the context of applicable policy.

More specific strategies for the refuge include:

6. Continue treatment of the most problematic species as funding and staffing permit.
7. Maintain early-detection/early-response readiness regarding new invasions.

8. Remove parent sources of highly invasive species (species that are high seed producers, or vigorous rhizome producers) from along edges of management units.
9. Maintain accessibility to affected areas for control and monitoring.
10. Continue and increase efforts to involve the community in promoting awareness of invasive species issues, and to seek assistance for control programs on and off the refuge.

In addition to these general strategies, we would refine our control program to address the most critical problems first. Further, our priorities may be adjusted to reflect regional Service priorities, and/or based on new information or resource availability. We would continue to track the spread and control of all invasive plants on the refuge using GIS, GPS, permanent vegetation monitoring plots, and photo points.

Goal 1

Protect, enhance and restore biological integrity, diversity, and environmental health of tidally-influenced habitats to support native wildlife and plant communities including species of conservation concern.

Objective 1.1: Tidal Marsh

Objective: Maintain up to 2,293 acres of brackish tidal marsh, with primary management focus on the area northwest of Mill Creek, providing critical foraging habitat for Pea Patch Island wading birds (for example, little blue heron (*Egretta caerulea*), glossy ibis (*Plegadis falcinellus*), snowy egret (*Egretta thula*), black-crowned night heron (*Nycticorax nycticorax*), least bittern (*Ixobrychus exilis*)), migrating shorebirds (for example, semipalmated sandpiper (*Calidris pusilla*), greater yellowlegs (*Tringa melanoleuca*), dunlin (*Calidris alpina*)), migrating and wintering waterfowl, and other species of conservation concern (for example, bald eagles).

- Increase cover to 60 percent native emergent plant cover such as smooth cordgrass (*Spartina alterniflora*), pickerelweed (*Pontederia cordata*), water hemp (*Amaranthus cannabinus*), wild rice (*Zizania aquatic*), rice cutgrass (*Leersia oryzoides*).
- Reduce cover of phragmites so that it comprises less than 40 percent cover of the tidal marsh.

Rationale; ***In addition to rationale presented in alternative A:***
The hydrology of Supawna Meadows NWR tidal marsh has historically been influenced by humans and continues to be affected today. The tidal marsh west of Route 49 was diked and drained in the 18th century. The dike failed in the 1930s and the marsh reflooded. Originally, there was more sheet flow from the Delaware Bay to Mannington Meadow (to the east of Route 49), but flow is now restricted to a few points and Mannington Meadow is fresher than the marshes on the west side of Route 49. These hydrologic factors are thought to influence the degree to which phragmites has been able to colonize and supplant native marsh plants on major portions of the refuge.

The changes to tidal marsh habitat over the course of this CCP would be a decrease in the phragmites dominated tidal marsh. Due to control of phragmites in the 500 acres of tidal marsh habitat west of Mill Creek, 70-80% of the phragmites-dominated tidal marsh in that area would be restored to native tidal marsh habitat. Due to the control of phragmites

in the 17 acres of tidal marsh west of Fort Mott Road, the area would be restored to native tidal marsh habitat.

Strategies:

1. Purchase up to 362 additional acres of tidal marsh within the approved acquisition boundary.
2. Within five years of CCP approval, evaluate removal of the remnant farm dike to restore tidal flow and reestablish natural marsh function.
3. Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. The refuge will be using an integrated approach to phragmites control, which would consider restoration of natural processes, herbicides, prescribed burning, biological control, and other tools as they are developed.
4. Continue to ensure compliance with the ESA by coordinating with the Service's New England Field Office on phragmites control efforts annually.
5. Work with adjacent private landowners to reduce phragmites on their properties.

Monitoring Elements:

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as prescribed burning and mowing to achieve structural and species diversity of native emergent wetland species. Results may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Begin collection of baseline data to evaluate the existing tidal marsh BIDEH and parameters related to sea level rise (vegetation, elevation, sediment accretion, salinity, tidal fluctuation, water quality, and mean sea level rise changes along the Delaware River). Utilize data and evaluate trends to assess the impact of climate change and/or management activities in order to appropriately adjust management as necessary.
2. Prevent new invasive species from becoming established within the tidal marsh by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
3. Conduct inventories and monitoring of shorebirds, waterfowl, waterbirds, and wading birds use and abundance in the tidal marsh. Utilize data to document the effectiveness of management activities and adjust management protocols as necessary.
4. Conduct callback surveys for secretive marsh birds to monitor overall diversity, evaluate habitat use patterns and identify potential areas for habitat protection or enhancement projects for focal species.
5. Conduct baseline small mammal inventory to obtain baseline

information on species diversity and habitat utilization.

Objective 1.2: Tidal Scrub/Shrub Wetlands

Objective: Manage up to 30 acres of tidal scrub/shrub habitat, containing a mix of shrub species including bayberry (*Myrica pensylvanica*) and marsh elder consistent with local reference sites, to ensure that the quality and natural function of the marsh are sustained, provide breeding habitat for coastal plain swamp sparrow, and are comprised of less than 30 percent overall cover of invasive plants.

Rationale; ***In addition to rationale presented in alternative A:***
Invasive plants are the greatest threat to this high quality habitat. Thickets contain autumn olive (*Elaeagnus umbellate)* and phragmites. Maintaining scrub/shrub habitat on the refuge is problematic for a number of reasons that include:

- ditches that drain the wetlands do not allow natural hydrology to support native plants;
- water level management options are limited due to concerns with flooding neighboring properties;
- woody trees are encroaching in scrub/shrub areas;
- scrub/shrub has historically comprised a small habitat area. The refuge cannot support much of this habitat due to approximately 75 percent of refuge habitat being tidal marsh; and,
- there is overbrowse from deer limiting regeneration and exacerbating invasive plant species problems.

Within mid-Atlantic estuaries, coastal plain swamp sparrows are restricted to an often narrow band of shrubby habitat at the interface of upland and high marsh. This habitat is particularly susceptible to recent changes such as rising sea level, ditching, impoundment, the invasion of phragmites, and the development of roads, farm fields, and housing tracts. This is an important management consideration for the species (Beadell et al. 2003).

Management intervention may be necessary to enhance or restore habitat. Since poorly drained sections of tidal wetlands where medium-length cordgrass grows is favored, managers should consider blocking selected ditches on altered marshes to create additional habitat. Intervention that forms a mosaic of habitat patches consisting of favorable nesting substrate and suitable foraging sites should increase local populations significantly. Predator control may be necessary in some areas. On high marshes, shallow pools constructed near spoil deposits, which tend to be colonized by native shrubs, such as *Iva spp.*, should encourage sparrows to settle, albeit at relatively low densities (Greenlaw 1992, Post and Greenlaw 1994). Controlled burning during the August-November wet season maintains favorable habitat (Post and Greenlaw 1994). Densely vegetated areas should be burned every five years and less dense areas every 8-10 years, with no more than 10 percent of the available habitat for a population burned in any given year (NatureServe 2009).

Strategies:

1. Purchase up to 2 additional tidal scrub/shrub wetland acres within the acquisition boundary.
2. Maintain scrub/shrub habitat through selective cutting and/or herbicide to set back succession and if necessary, treat invasive plants so that 70 percent of scrub/shrub habitat is in native species. The exact number of acres treated would depend on funding and management capability. Keep records of treated areas in GIS.
3. Coordinate with regional efforts and initiatives where possible and applicable with respect to climate change and sea level rise.
4. Manage 16,000 linear feet of scrub/shrub habitat along the high-tide line specifically to benefit CPSS.

Monitoring Elements:

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as selective cutting and herbicide treatments, to achieve structural and species diversity of tidal scrub/shrub wetland species. Results may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within tidal scrub/shrub wetlands by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. Conduct inventories and monitoring of priority passerine species, such as the coastal plain swamp sparrow, to establish a baseline and research use of habitat by these species.
3. Conduct inventories and monitoring of landbirds and wading birds use and abundance in the scrub/shrub habitat. Utilize data to document the effectiveness of management activities and adjust management protocols as necessary.
4. Conduct callback surveys for secretive marsh birds to monitor overall diversity, evaluate habitat use patterns, and identify potential areas for habitat protection or enhancement projects for focal species.
5. Using Sea Level Affecting Marshes Model Analysis (SLAMM) results, monitor and evaluate conditions in the marshes over the next 15 years with respect to climate change and sea level rise.
6. To evaluate the effectiveness of prescribed burning conduct post-burn surveys to measure the area, the intensity, and the success of the burn.
7. To determine the effectiveness of the white-tailed deer hunting program, evaluate regeneration of native shrubs and forbs by conducting vegetation surveys to gather information on species composition, abundance, and diversity.

Objective 1.3: Open Tidal Waters

Objective: Maintain and improve water quality and available aquatic habitat of tidally influenced rivers and estuaries through an active role

in local, State, and Federal partnerships in order to reduce contaminants and to continue to provide year-round habitat for northern diamondback terrapins, shortnose sturgeon, blue crabs, and other aquatic species of conservation concern in the area's tidal waters.

Rationale; ***In addition to rationale presented in alternative A:***
As noted under objective 1.1, the human-altered hydrology of the marsh appears to be an important factor in the success of invasive phragmites. Numerous other factors influence the refuge marsh and the water quality of tidal waters, including personal watercraft impacts, lack of major flooding, siltation/sedimentation, contaminants in the water and soil from past usage, temperature changes, sea level rise, mosquito control both on and off the refuge, upstream non-point source contaminants, and oil and hazardous material spills along the Delaware River, the second largest oil transport channel on the East Coast.

Due to the regional scale of water quality impacts, the refuge is reliant on actively engaging in partnerships with local communities, anglers, watershed associations, conservation groups, and researchers in order to meet this habitat objective.

Strategies:
Same as alternative A, plus:
1. Actively engage in partnerships with local communities, anglers, watershed associations, conservation groups, and researchers to help address water quality and other issues in the watershed.
2. Using SLAMM analysis results, monitor and evaluate conditions at Supawna Meadows NWR over the next 15 years with respect to climate change and sea level rise. Coordinate with regional efforts and initiatives where possible and applicable.

Monitoring Elements:
Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Conduct inventorying and monitoring of biological elements, chemical elements, sedimentation, and contaminants to benefit tidal marsh habitat, fish and open water.
2. Work in partnership with local universities, as well as State and Federal agencies, to complete a series of fish inventories to obtain baseline biological information of fish species diversity and species health in order to evaluate impacts of tidal marsh water quality changes.
3. Work with NJDEP and other appropriate agencies to develop data on the presence and distribution of fish and other aquatic species within the refuge.

Goal 2

Protect, enhance, and restore biological integrity, diversity and environmental health of upland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.

Objective 2.1: Early Successional Grassland Habitat

Objective: Manage up to 532 acres of grassland habitat to create a mix of cool and warm season grasses and forbs to provide habitat diversity, forage, and cover for migrating and wintering grassland birds, such as bobolink (*Dolichonyx oryzivorus*), vesper sparrow (*Pooecetes gramineus*), eastern meadowlark (*Sturnella magna*), savannah sparrow (*Passerculus sandwichensis*); raptors, such as northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*); and habitat for pollinators, such as bronze copper butterfly (*Lycaena hyllus*). Focus grassland management on fields larger than 20 acres, with an emphasis on those fields with minimal edge, less surrounding forest, and more surrounding open habitats (old fields, emergent wetlands), and where possible maintain grasslands in close proximity to one another. Encourage cover of desirable grassland plants as such:

- increase cover to 80 percent desirable grassland plant cover (for example, switch grass (*Panicum virgatum*), goldenrod spp., eupatorium spp.); and,
- reduce cover of invasive species (for example, Canada thistle (*Cirsium arvense*), autumn olive) so that they comprise less than 20 percent cover of grassland habitat.

Rationale: Birds that depend on early successional habitats, such as grasslands and shrublands, are one of the fastest declining birds groups due to habitat loss and changes in farming practices in the Northeast. Habitat loss, conversion of pasture to intensive row crops, increased frequency of mowing, and lack of fire are cited as the causes of population declines in grassland-dependent species (Vickery 1996). Grasslands on the refuge are used extensively by migrating and wintering obligate grassland birds. Bobolink, eastern meadowlark, northern harrier, savannah sparrow, and vesper sparrow are examples of grassland bird species that increase in abundance during migration and in the winter.

In addition, the refuge would also emphasize monitoring pollinators in early successional habitats (particularly butterflies, which play a crucial role in plant pollination) using the refuge as many of these species are of conservation concern due to losses in habitat and nectar corridors that facilitate migration. A recent study of the status of pollinators in North America by the National Academy of Sciences found that populations of some native pollinators are declining, which may in part result from habitat loss, degradation, fragmentation, non-target effect of pesticides, competition from invasive species, and introduced diseases (National Academy of Sciences 2007). Flower-visiting Lepidoptera, many of which are actual or potential pollinators, currently dominate the list of endangered species: 17 species of butterfly and 3 species of moth constitute more than half of all insect species listed as endangered (USFWS 2010). The State endangered bronze copper butterfly, State threatened frosted elfin butterfly (*Callophrys irus*), and a number of other moths and butterflies have been documented in Supawna Meadow NWR's grassland habitat.

The northern diamondback terrapin is not Federal-listed; however, it is a State species of concern. While not traditionally considered a grassland species, members of the refuge staff have observed individuals in this habitat. It is possible that terrapins are attempting

to use the grassland habitat for nesting purposes, which may negatively affect reproductive success. Terrapin nests in grassland areas may be subject to increased predation associated with increased predator access, as well as decreased hatch rates because of suboptimal hatching conditions (for example, nest temperature, environmental exposure).

Although total acres and patch sizes are less stringent during migration and winter, larger blocks (>20 acres) of grassland are recognized as optimal for grassland bird species survival requirements. Service biologists consider the grasslands at Supawna Meadows NWR to be limited in quality for breeding birds, so management measures would be employed to continue to provide grassland habitat for migrating and wintering birds.

Grasslands, being an early successional community type, require significant maintenance and time inputs to be maintained over a long-term period. In some areas, it would be more economically and ecologically beneficial to manage existing grassland habitats in a successional trajectory toward shrubland and ultimately coastal or floodplain forest. Each individual grassland patch would require evaluation based on existing and potential habitat benefits.

Strategies:

1. Purchase up to 409 additional grassland acres within the acquisition boundary.
2. Actively manage grasslands through the use of mowing and prescribed fire. Mow or burn 50 percent of the grassland acreage every 3 years.
3. Evaluate the potential for allowing managed grasslands, particularly those less than 20 acres in size, to succeed through natural processes to scrub/shrub habitat for priority migratory species.
4. Determine the value of grassland habitats to wintering and migrating birds using an adaptive management approach.
5. Use information gathered from Christmas Bird Counts and other non-standardized but repeated observations to determine habitat use and distribution.
6. Control Canada thistle, autumn olive, and other invasive plants to establish 80 percent cover of native species. The exact number of acres treated would depend on funding and management capability. Keep records of treated areas in GIS.
7. Provide a shrubland component to the fields, for migrating and breeding shrubland species, by creating a softer transition zone from grass to shrubs to forest at the edges of fields. Cull woody and invasive plants periodically to ensure native shrub species dominate.
8. Determine the value of grasslands for butterflies and other pollinators using refuge grassland habitat, and incorporate surveys and/or monitoring efforts.

Monitoring Elements:

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Conduct winter grassland transect surveys for measuring composition and relative abundance of grassland birds and raptors in grassland fields.
2. Prevent new invasive species from becoming established within early successional grassland habitats by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
3. To evaluate quality of grasslands for migrating grassland-dependent songbirds, conduct periodic vegetation surveys at landbird point counts for height, density measurements, and species composition or grass-forb ratio.
4. To evaluate achievement of the objective for migrating and wintering birds, conduct migration and winter bird counts.
5. Conduct baseline inventories of butterflies and other pollinator species to determine species abundance, density, and diversity as needed.
6. Conduct baseline small mammal inventory to obtain baseline information on species diversity and habitat utilization.
7. To evaluate the effectiveness of prescribed burning on grassland habitats, conduct post-burn surveys to measure the area, the intensity, and the success of the burn.
8. Monitor grasslands to determine if northern diamondback terrapins are using this habitat. If terrapins are using refuge grasslands, monitor individuals to determine how they are using this habitat and determine if management activities are appropriate to help protect this species.
9. Monitor presence of mute swans and Canada geese and work with APHIS or other licensed agent to control these species as necessary to meet objectives.

Objective 2.2: Early Successional Scrub/Shrub Habitat

Objective: Protect and manage up to 55 acres of upland scrub/shrub habitat to benefit migrating landbirds (for example, blue-winged warblers, American woodcock), breeding landbirds (for example, American Woodcock, prairie warblers), and other species of conservation concern with the following habitat attributes:

- >70 percent of a mixture of desirable native fruit-producing shrubs, such as blackberry (*Rubus* spp), Viburnum spp., and bayberry (*Myrica pensylvanica*); forbs, such as goldenrods; vines, such as grapevines and greenbrier (*Smilax laurifolia*); and tree species, such as sweetgum (*Liquidambar styraciflua*) and black cherry (*Prunus serotina*) < 20 feet in height;
- >50 percent of unmanipulated residual cover remaining annually for nesting species; and,
- <30 percent cover of invasive species (for example, autumn olive, multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), mile-a-minute weed).

Rationale; ***In addition to rationale presented in alternative A:***
The New Jersey Wildlife Action Plan identifies the protection, maintenance, enhancement, and/or restoration of scrub/shrub habitats as a conservation goal necessary to maintain viable populations of declining scrub/shrub species (NJDFW 2008a). Shrub habitat comprised of various shrub species, or a diverse mix of young trees, provides an abundance of insect food for breeding birds, and fruit for fall migrating birds. Many species of birds rely on shrub habitats at various times throughout the year. Because of this, responsibility for providing quality shrubland bird habitat is not limited to their breeding season. The refuge lies in an important migratory bird pathway along the Atlantic flyway and provides an important stopover site for many migrating bird species. Many scrub/shrub plant species bear fruit in the fall, which helps boost the fat reserves for migrating or wintering birds. During migration, vegetation structure, microhabitat conditions, and landscape context are the most important habitat features for these birds, rather than specific plant species (Dettmers 2003). In a study in Central New Jersey, Suthers et al. (2000) found that of the different successional habitat types, the one most frequently used by fall migrating birds were shrublands. Factors that contributed to the selection or abandonment of these habitats included vegetation structure and abundance and quality of resources. The study showed that migrant birds abandoned habitats that were shaded out by invading trees. It also showed that migrant birds were attracted to areas by abundance and quality of fruits.

As shrub habitats are transitional in nature, active management is necessary to periodically set back succession through mechanical treatments (for example, selective cutting) to provide a continued source of shrub habitat. Management actions even on smaller tracts can be effective as shrub dependent birds are not typically sensitive to habitat patch size and many will use small patches of shrub habitat (Watts 2000).

Strategies:
1. Purchase up to 19 additional scrub/shrub acres within the acquisition boundary.
2. Maintain scrub/shrub habitat through selective cutting and/or herbicide to set back succession.
3. Conduct invasive species control on scrub/shrub habitat so that 70-80 percent of habitat is in native species. The exact number of acres treated would depend on funding and management capability. Keep records of treated areas in GIS.
4. Continue the use of biological control measures to control invasive plant species.

Monitoring Elements:
Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:
1. Prevent new invasive species from becoming established within early successional scrub/shrub habitats by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the

appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.

2. To evaluate achievement of the objective for breeding and migrating birds, conduct landbird surveys, migration and winter bird counts.
3. To evaluate achievement of the objective for migrating landbirds, conduct surveys during peak migration to determine bird abundance, density and diversity. Surveys include area searches, constant-effort mist-netting and banding, and activity budgets.
4. Conduct woodcock singing ground surveys to evaluate habitat quality and utilization, and species abundance on the refuge.
5. To evaluate quality of shrubland habitat for migrating landbirds, conduct periodic vegetation surveys for plant species composition, community structure and berry production.
6. Gather baseline data on butterflies and other pollinators using refuge scrub/shrub habitat, and incorporate annual surveys and/or monitoring efforts.

Goal 3

Protect, enhance and restore biological integrity, diversity, and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on breeding, migrating and overwintering birds and other species of conservation concern.

Objective 3.1: Non-tidal Scrub/Shrub Wetlands

Objective: Protect up and manage up to 52 acres of non-tidal scrub/shrub wetland habitat to benefit migrating landbirds such as eastern towhee (*Pipilo erythrophthalmus*), gray catbird (*Dumetella carolinensis*), brown thrasher (*Toxostoma rufum*), and other species of conservation concern with the following attributes:

- >75 percent cover of native fruit-bearing shrubs (for example, dangleberry (*Gaylussacia frondosa*), southern arrowwood);
- <20 percent cover of native moist soil grasses and forbs (for example, coast cockspur (*Echinochloa walteri*), spike-rush (*Elocharis* spp), smartweed (*Polygonum* spp), switch grass); and,
- <30 percent cover of invasive plants (for example, mile-a-minute weed, common velvetgrass (*Holcus lanatus* L), autumn olive).

Rationale; ***In addition to rationale presented in alternative A:***
Scrub/shrub habitats are becoming increasingly rare in the Delaware Estuary region and correspondingly less able to sustain healthy populations of birds and other species of conservation concern. See objective 2.2 for additional rationale for scrub/shrub habitat management.

It is anticipated that management of shrublands for migrating landbirds would continue to provide habitat for breeding landbirds, such as gray catbirds and eastern towhees, and other species of conservation concern dependant on shrublands.

Strategies:

1. Purchase up to four additional scrub/shrub acres within the acquisition boundary.

2. Maintain scrub/shrub habitat through selective cutting and/or herbicide to set back succession.
3. Control invasive plants so that 70 percent of scrub/shrub habitat is comprised of native species. The exact number of acres treated would depend on funding and management capability. Keep records of treated areas in GIS.
4. Continue the use of biological control measures to control mile-a-minute weed.

Monitoring Elements:
Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as selective cutting and herbicide treatments to achieve structural and species diversity of non-tidal scrub/shrub wetland habitat. Results may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within non-tidal scrub/shrub habitat by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. To evaluate achievement of the objective for breeding and migrating birds, conduct landbird surveys, migration and winter bird counts.
3. To evaluate achievement of the objective for migrating landbirds, conduct surveys during peak migration to determine bird abundance, density, and diversity every five years. Surveys include area searches, constant-effort mist-netting and banding, and activity budgets.
4. To evaluate quality of shrubland habitat for migrating landbirds, conduct periodic vegetation surveys for plant species composition, community structure and berry production every three to five years.
5. Gather baseline data on butterflies and other pollinators using refuge non-tidal scrub/shrub wetland habitat, and incorporate annual surveys and/or monitoring efforts within five to ten years.

Objective 3.2: Non-tidal Herbaceous Wetlands

Objective: Protect up to 55 acres of non-tidal herbaceous wetland habitat to benefit marsh wrens (*Cistothorus palustris*), southern bog lemmings (*Synaptomys cooperi*) and other species of conservation concern with the following attributes:

- >70 percent cover of herbaceous wetland species, such as rice cutgrass *(Leersia oryzoides),* Polygonum spp., Juncus spp., Drosera spp., and Serracenia spp; and,
- <30 percent cover of invasive plants, such as phragmites and reed canary grass (*Phalaris arundinacea*)

Rationale; ***In addition to rationale presented in alternative A:***
Non-tidal herbaceous wetlands are a small but important habitat component of the refuge because of the relative scarcity of this type of

habitat in the vicinity of the refuge and the diversity of vertebrate and invertebrate species and plant life these wetlands typically support. Overbrowse from white-tailed deer limits regeneration of native herbaceous plants and exacerbates invasive plant species problems.

Strategies:

1. Purchase up to 13 additional non-tidal herbaceous wetland acres within acquisition boundary.
2. Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. The refuge would be using an integrated approach to phragmites control, which would consider restoration of natural processes, herbicides, prescribed burning, biocontrol, and other tools as they are developed.
3. Monitor habitat destruction impacts of white-tailed deer. Implement population control measures on white-tailed deer if significant habitat destruction is observed.

Monitoring Elements:

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, such as prescribed fire and herbicide treatments to achieve structural and species diversity of non-tidal herbaceous wetland habitat. Results may trigger a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within non-tidal scrub/shrub habitat by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. To determine the effectiveness of the white-tailed deer hunting program, evaluate regeneration of native shrubs and forbs by conducting vegetation surveys to gather information on species composition, abundance, and diversity.
3. Work with the State on white-tailed deer control.

Objective 3.3: Freshwater Impoundments

Objective: Manage the existing five impoundments consisting of up to 87 acres using existing water control structures, and up to 5 acres of non-tidal open water impoundments (without water control structures), to enhance habitat available for shorebirds, waterfowl, marsh birds, and wading birds during their peak spring and fall migration periods while maintaining essential habitat for other species of management concern, such as amphibians and dragonflies, through a combination of water level management, wetland restoration, and invasive species control. These measures would include:

- Annually provide high quality foraging habitat for wading and marsh birds, specifically black-crowned night-herons, glossy ibis, least bitterns, snowy egrets, and little blue herons (Summer: July-late August). This habitat would consist of open, shallow water (2-10

inches water depth) with patches of emergent wetland plants that support fish, invertebrates, and amphibians.

- Annually support migratory shorebirds through a mix of shallow water (<6 inches water depth), mudflat with sparse vegetation (<10 percent cover), and mudflats with no vegetation, at times of peak migration (spring: May, and fall: mid-Aug-Sept).
- Annually support migratory waterfowl through a mix of shallow (6-24 inches water depth) flooded vegetation (*Carex, Polygonum, Peltandra*) at times of peak migration (spring: late March, and fall: late October).
- Annually support migratory wading birds through a mix of shallow remnant pools (6-12 inches water depth) at times of peak migration (spring: late March, and fall: late August).

Rationale; ***In addition to rationale presented in alternative A:***
Invasive plant species, such as phragmites, purple loosestrife (*Lythrum salicaria*), Canada thistle, and mile-a-minute weed are increasingly displacing native species in the impoundments and along the dikes. Water levels are controlled using water control structures. An increase in water levels can occur from allowing tidal water to flow into the impoundment, rainfall, and natural springs. The water levels in impoundments without water control structures are influenced by rainfall, natural springs, and drying conditions such as drought. Prescribed fire can be used to control vegetation in the impoundments. Mowing, prescribed fire, and flooding can be used to reduce overcrowding vegetation.

The Service has a policy emphasizing restoring the biological integrity, diversity, and environmental health of refuges (601 FW 3). We also need to think about creating and restoring natural systems that have resilience (that is, the capacity to absorb disturbance while retaining basic structure and function) to help address predicted sea level rise and other climate change issues. As sea level rises, management and maintenance of coastal wetland impoundments will become increasingly challenging and expensive. Due to the continued high cost of managing impoundments and maintaining associated infrastructure and coupled with the natural forces that strive to eliminate them, Supawna Meadows NWR would continue to study the feasibility of whether or not to continue individual impoundment management. Returning impoundments to more natural hydrological regimes would result in impoundments and the surrounding habitats becoming slightly brackish.

Strategies:

1. For each impoundment, evaluate potential for restoring or reverting to non-impounded natural marsh or forested wetland habitats (natural hydrology) rather than continuing impoundment management. Participate in a regional Structured Decision-Making Study to make a determination of the highest conservation value for each impoundment. Where restoring natural processes is not feasible, the refuge would strive to mimic natural processes within impoundments.
    - *Begin evaluation with Tract 11C impoundment for potential to restore natural hydrologic conditions.*

- *In impoundments without water control structures, evaluate potential for creating vernal pool-like shallow waters for amphibians and implement if feasible.*

1. Until the habitat management plan is developed, actively manage Tract 11 and Tract 11D Lighthouse Road Impoundments. Vary water level management schemes on each impoundment year-to-year to benefit priority species, particularly Pea Patch Island wading birds.
2. Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. The refuge would be using an integrated approach to phragmites control, which would consider restoration of natural processes, herbicides, prescribed burning, biocontrol, and other tools as they are developed.
3. Actively manage impoundments using mowing, prescribed fire, flooding, and biological control for purple loosestrife and mile-a-minute weed as needed to achieve objectives.
4. Maintain dike and water control structures as needed. Mow and reduce woody vegetation on Tract 11 dike.
5. Collect data and assess habitat and dikes to determine damage by furbearers, such as muskrat and groundhog. Determine threshold that requires species management. Issue a SUP if trapping is needed.
6. In impoundments without water control structures, maintain nearby nest boxes for wood ducks and eastern screech owls.
7. In Tract 11D Xmas Tree Lane Impoundment, determine appropriate water level management of impoundment and implement control measures.
8. In Tract 11D Xmas Tree Lane Impoundment, monitor habitat destruction of beaver. Implement beaver population control measures if significant habitat destruction is observed.

Monitoring Elements:

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or trigger a re-evaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within impoundments by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. Conduct inventories and monitoring of shorebirds, waterfowl, waterbirds, and wading birds use and abundance within the impoundments. Utilize data to document the on-going effectiveness of water level management activities and adjust management protocols as necessary.
3. Conduct fish inventories to obtain baseline information of fish species diversity.

4. To evaluate habitat use and monitor overall diversity of anuran species, conduct call count surveys to evaluate impoundment protection and management.
5. In early spring, identify and map areas of concentration of amphibians and impoundments to ensure their conservation and protection.
6. Monitor habitat destruction of Canada goose, mute swan, and beaver, and work with APHIS or other licensed agents to control these species as necessary to protect public safety and refuge resources.

Objective 3.4: Forested Wetlands

Objective: Protect up to 346 acres of forested wetland habitat to benefit breeding wood thrush and wood ducks, migrating and wintering rusty blackbird, breeding and wintering eastern screech owls and other forest-dependent species of conservation concern. Forested wetland habitat is characterized by the following attributes:

- Understory with 30 to 50 percent cover of native shrubs (3-12 feet tall), such as southern arrowwood (*Viburnum dentatum*) and sweet pepperbush (*Clethra alnifolia*), with scattered openings containing native herbaceous species, such as New York fern (*Thelypteris noveboracensis*) and false nettle (*Boehmeria cylindrica*);
- <20 percent cover of invasive plants (for example, Japanese stiltgrass) in understory/herbaceous layer; and,
- >90 percent canopy cover of native trees (>12 feet tall), such as red maple (*Acer rubrum*), willow oak (*Quercus phellos*), sweetgum (*Liquidambar styraciflua*), and sour gum (*Nyssa sylvatica*).

Rationale; ***In addition to rationale presented in alternative A:***
A large number of bird species, including the wood duck, rusty blackbird, and eastern screech owl, use forested wetlands. Birds use the refuge's forested wetlands for breeding, migration, and wintering. The refuge's mature forested wetland habitat represents an excellent example for the area of great quality and size class diversity. A water control structure is located within forested wetland habitat along the Forest Habitat Trail. Managing the water levels here would provide additional forested wetland habitat, as in a Green-tree Reservoir. The forest has been ditched in some areas, thus altering the original hydrology. Encroachment of invasive species threatens this habitat. Also, the habitat north of the Tract 11 impoundment contains a wooded section within the shrub/scrub habitat that will be converted to forested wetlands for the benefit of short-eared owls. Additional management actions under alternative B would allow us to better sustain this important habitat type.

Major threats to the refuge's forest health and condition are overbrowse caused by white-tailed deer overabundance and infestation of invasive plant species. White-tailed deer thrive in fragmented non-urban areas and the resulting overbrowse in forested landscape severely limits forest regeneration (NJDFW 2008c). White-tailed deer selectively browse native vegetation, giving invasive species (for example, mile-a-minute weed, etc.) a competitive edge in the forest understory (NJDFW 2008c). Deer browse pressure significantly impacts the regeneration of native woody species. Regeneration is essential to the success of the development of Supawna Meadow NWR's forest understory. Numerous

studies have found when white-tailed deer browse pressure is high, it can alter the growth, reproduction (Knight 2003), diversity (Lathan et al. 2005), and ultimately survival of plants within a specific population (Alverson and Waller 1997, Cote et al. 2004). In areas where deer density exceeds 20 deer per square mile, deer herbivory is related to declines in mid-story bird species (deCalesta 1994).

Strategies:

1. Purchase up to 156 additional acres of forested wetlands within the acquisition boundary.
2. Conduct an adaptive management study to determine if natural hydrology should be restored.
3. Remove wood duck nest boxes as boxes fall into disrepair.
4. Expand invasive species control on current and additional acreage of Japanese stiltgrass and other dominant invasive species so that 70-80 percent native vegetation cover is achieved. The exact number of acres treated would depend on funding and management capability. Keep records of treated areas in GIS
5. Continue the use of biological control measures to control mile-a-minute weed.
6. Monitor habitat destruction by white-tailed deer and beaver. Implement population control measures on white-tailed deer and beaver if significant habitat destruction is observed.

Monitoring Elements:

Conduct appropriate monitoring and survey programs, as funding and staffing permit, to measure our success with respect to our objectives. The results may trigger adjustments to management strategies, or a reevaluation or refinement of our objectives. Examples of monitoring or surveys that we may implement include:

1. Prevent new invasive species from becoming established within forested wetland habitat by utilizing Early Detection Rapid Response Techniques that detect newly established invasive species and immediately addresses those populations through the appropriate control measure. This strategy would incorporate a combination of plant identification and inventories, maintaining updates of new invasive species present in the region, as well as having knowledge of the appropriate management techniques prior to conducting control efforts.
2. Conduct amphibian and reptile inventories to obtain baseline information on species diversity and habitat utilization.
3. To evaluate habitat use and monitor overall diversity of anuran species, conduct call count surveys to evaluate vernal pool protection and management.
4. In early spring, identify and map areas of concentration of amphibians and vernal pools to ensure their conservation and protection.
5. Monitor habitat destruction of Canada goose, mute swan, and beaver, and work with APHIS or other licensed agents to control these species as necessary to protect refuge resources.
6. To determine the effectiveness of white-tailed deer hunting program, evaluate regeneration of native trees, shrubs, and forbs by conducting vegetation surveys to gather information on species composition, abundance, and diversity.

Goal 4

Provide opportunities for compatible, high-quality, wildlife-dependent public uses.

Objective 4.1: Hunting

Objective: Expand hunting opportunities for deer and waterfowl hunters.

Rationale; ***In addition to rationale presented in alternative A:***
Our current program is an archery-only deer hunt. Our deer and waterfowl hunts follow State seasons. In general, we believe the extent of our current programs meets the needs of our public and provides a quality experience. However, we would continue to evaluate the programs on an annual basis and modify them, as warranted, given new biological or visitor data.

The refuge would rely on State hunting regulations to define hunting safety zones, remove hunting closure signage, and reassess closed areas. Since the refuge owns a limited amount of upland habitat, this would permit hunting on additional lands inhabited by deer in a safe manner.

The open water in the Tract 11 Impoundment would be closed to hunting as well as all other public use. This would provide undisturbed habitat for waterfowl, while allowing public use in the upland portion of this area, which was previously only open to hunters.

Portions of the Supawna Meadows NWR were designated, acquired, reserved, or set apart as an inviolate sanctuary; therefore, we may only allow hunting of migratory game birds on no more than 40 percent of the refuge. The waterfowl hunting zone would be reconfigured and 1,206 acres would be open to waterfowl hunting. During scoping meetings, the NJDFW asked the refuge to open tidal streams with a 150-foot buffer to allow hunting from the marsh habitat. In order to protect resources of concern while allowing adequate hunting areas, a new waterfowl hunting zone was delineated.

Providing new hunting opportunities on Tract 48 (AID) and any other new properties would be accomplished by updating the 2006 White-Tailed Deer Hunt Management Plan and the 2000 Waterfowl Hunting Plan and conducting additional NEPA analysis.

Strategies:

1. Continue deer and waterfowl hunting on the refuge according to State regulations. Only archery deer hunting is allowed on the refuge for all four of New Jersey's bow hunting seasons according to the State Deer Management Zone 63 regulations.
2. Monitor the deer population and its effects on refuge habitats. If the herd needs to be further culled, work with the State to offer a doe-first season, a firearms season, or another method for taking more deer off the refuge.
3. Continue to keep the upland areas of Tract 11 Impoundment open to archery deer hunting according to State seasons. The open water habitat and dike around the open water would be closed to hunters.
4. Remove hunting closure signage; rely on State hunting regulations to define hunting safety zones.
5. Reconfigure the waterfowl hunting zone so that 1,206 acres would be open to hunting. Access would be from the water. No blinds would be allowed to be built on the marsh.

6. Within three years of completing the final CCP, conduct additional NEPA analysis to open Tract 48 (AID) property, and any other new properties as identified in the draft CCP/EA, to deer and waterfowl hunting.

Objective 4.2: Fishing and Crabbing

Objective: Expand fishing and crabbing opportunities for the public.

Rationale; *In addition to rationale presented in alternative A:*
In 2009, approximately 750 fishing and crabbing visits were made to the refuge; however, this number tends to fluctuate with the quality and availability of crabbing. We believe that on-site staff and additional funding would allow us to expand fishing and crabbing on the refuge.

In order to protect resources of concern and set aside 60 percent of the refuge as an inviolate sanctuary to wildlife, fishing and crabbing would occur in the same areas as waterfowl hunting so as to keep the sanctuary areas free of disturbance from fishing and hunting. Also, we would open Tract 11D Xmas Tree Lane impoundment (XTL) to freshwater fishing and conduct additional NEPA analysis, as needed, within one year of the final CCP. This would be the only freshwater fishing site available at Supawna Meadows NWR. Finally, we would prohibit fishing at Lighthouse Road due to safety concerns, such as the lack of parking and the lack of suitable habitat for bank fishing.

We would open fishing and crabbing opportunities on Tract 48 (AID), and any other new areas as identified in this draft CCP/EA, within three years of the final CCP and only after updating the 2000 Sport Fishing Plan and conducting any additional NEPA analysis.

Strategies:
1. Rezone fishing and crabbing to occur where waterfowl hunting areas occur. Conduct additional NEPA analysis, as needed, within 3 years of the final CCP. Areas open for saltwater fishing and crabbing would be open in accordance with State regulations.
2. Open Tract 11D Xmas Tree Lane impoundment to freshwater fishing and conduct additional NEPA analysis within one year of final CCP.
3. Close fishing at Tract 11D Lighthouse Road impoundment because of safety hazards associated with access.
4. Continue to host the one-day refuge youth fishing event at the Tract 18 impoundment. Seek assistance from the Friends and/or volunteers.

Objective 4.3: Wildlife Observation, Photography and Interpretation

Objective: Expand wildlife observation, photography, and interpretation opportunities.

Rationale; *In addition to rationale presented in alternative A:*
While our primary mission is to protect wildlife and promote wildlife conservation, the 1997 Refuge Improvement Act directs us to provide six priority wildlife-dependent recreational uses in the Refuge System: hunting, fishing, wildlife observation and photography, and environmental education and interpretation where it is compatible. By providing the public with safe, accessible quality opportunities and well-maintained facilities for those uses, we hope to raise public awareness, understanding, appreciation, and stewardship of the Delaware Estuary ecosystem and the benefits of its conservation for fish, wildlife, and

people. Ultimately, these would contribute to the mission of the refuge and the Refuge System. Wildlife observation, photography, and interpretation are major public uses of the refuge throughout the year. Over 15,000 people visit the refuge each year, and given our informal monitoring, most come to the refuge on the land side to view and photograph wildlife. Maintaining quality infrastructure and providing some new facilities would enhance visitor opportunities to view the relationships among resource management, wildlife, habitat, and people. Our facilities for public visitation include parking, information kiosks, nature trails, photo blinds, boardwalks, and interpretive literature/signs.

We would work with partners to facilitate quality wildlife observation and photography opportunities. The boat trail would be eliminated since all of the tidal creeks are open to public use and there is no need to highlight a specific area for boating. Upland habitat surrounding the Tract 11 impoundment would be opened to the public to permit viewing of this habitat. An observation platform would be constructed so visitors could also view the open water in the impoundment without disturbing the wildlife that utilize the impoundment.

We would open Tract 48 (AID) property to wildlife observation within three years of completing the final CCP. This may require additional NEPA analysis.

Strategies:

1. Continue to provide wildlife viewing, photography, and interpretation opportunities along existing refuge trails.
2. Continue to provide interpretive signs at all existing refuge public use sites, including the family plot cemetery along the Grassland Trail.
3. Improve the observation blinds along the Grassland Trail.
4. Continue to seasonally close bald eagle area.
5. Install/upgrade signs along Highway 49 directing motorists to the refuge.
6. Consider extending the current trail system onto newly acquired lands and providing observation blinds along new trails. Conduct additional NEPA analysis as necessary.
7. Expand refuge boundary signage on newly acquired lands.
8. Develop new brochures specific to trails.
9. Update website.
10. Construct a spur trail from the Grassland Trail into the wetland, with help from the Friends group if needed.
11. Eliminate the designation of a Boat Trail and remove trail markers, but continue to allow public boat access in the tidal streams.
12. Improve or install additional observation facilities on the refuge, for example:
    - *Install an observation platform for wildlife observation and photography at the impoundment at Tract 11 and upgrade the nearby grassy parking area to accommodate 8-10 vehicles. The open water portion of the Tract 11 impoundment and the dike surrounding the open water would remain closed to the public all year. Gates would be installed to define the closed area.*
    - *Construct a wheelchair accessible photo-blind and other amenities to improve facilities for wildlife photographers at the Grassland Trail.*

9. Construct a trail linking the FPRRL site to the Grassland Trail to connect visitors to wildlife viewing areas.
10. Use FPRRL to expand opportunities for refuge interpretation with panels and brochures on ground level and in the interior of FPRRL, if approved by SHPO. Take advantage of landscape view from FPRRL to interpret refuge marshlands, invasive plants, and a mosaic of other cover types as well as viewing birds in flight on the refuge.
11. Work with a neighboring private landowner to enhance viewing opportunities at the Sinnickson Landing boat ramp site for eagle viewing.
12. Seek year-round local New Jersey residents for volunteer-based interpretative programs.
13. Open Tract 48 (AID) property to wildlife observation, photography, and interpretation within one year of completing the final CCP. Conduct additional NEPA analysis as necessary.

Objective 4.4: Environmental Education and Outreach

Objective: Expand and enhance environmental education and outreach programs.

Rationale: The refuge offers a unique opportunity to explore, in close proximity, tidal and non-tidal wetlands, grassland, and forested habitats, as well as to learn about managing those landscapes to benefit wildlife. We believe we can facilitate other educators to use the refuge and offer excellent environmental education opportunities without expending significant refuge staff or funding resources.

County School Districts at other refuges in the Region have curricula that include field trips to the refuge for elementary grade students. In recent years, no staff has been available to assist at Supawna Meadows NWR for these types of visits. Development of environmental education lessons tailored to State curriculum would provide programs and activities for schools and other groups while increasing public understanding of wildlife needs, ecosystems, conservation, and habitat management for wildlife. Using our educational partners to assist in this endeavor has many benefits. These partners also act as supporters of the refuge and natural resource conservation, advocates for environmental education, and help us conduct outreach to the local community.

Service policy identifies six guidelines on which to base environmental educational programs. These guidelines include connecting people's lives to the natural world, strengthening conservation literacy and knowledge, stressing the role of the Refuge System in conservation, and instilling a sense of stewardship and understanding of our conservation history.

In order to build a stronger base of public understanding, support, and activism beyond the portion of the American public who visit refuges, the Service has actively supported nationwide strategies, partnerships, legislation, and departmental mandates with a strong emphasis on community outreach. These include the 100-On-100 Outreach Campaign, the National Outreach Strategy: A Master Plan for Communicating in the U.S. Fish and Wildlife Service, the Cooperative

Alliance for Refuge Enhancement (CARE), the Volunteer and Community Partnership Act, and the Challenge Cost-Share Program.

We are particularly interested in outreach to the local communities in Salem County. Our desire is to be a welcomed and valued asset to these communities. A positive community relationship is a crucial link between public support for refuges and effective management of the Refuge System. We are aware that there are many residents who either do not know that a national wildlife refuge is nearby, or do not recognize its regional importance to the Delaware Estuary ecosystem.

We are striving for a well-rounded program of public outreach to enable large and diverse segments of the public to learn about the importance of refuge wetland and upland habitats, species of conservation concern, cultural resources, refuge management, and the refuge's role in the Refuge System. An effective public outreach program can also help win friends and proactively deal with controversial refuge management activities. Outreach can be used to anticipate and avoid potential conflicts between the needs of wildlife and other refuge uses.

We believe that regular communications within the community are very important. News articles and personal appearances inform our neighbors about what we are doing and why, which would lead to increased understanding, appreciation, and support of our programs. Feedback we would receive from these outreach efforts allows us to better understand issues that are important in our communities, and how our management may affect them.

We also believe that actively engaging people in meaningful refuge programs or projects would make a more lasting impression. We would offer many opportunities for people to get involved. Partners, volunteers, and members of the Friends of Supawna Meadows NWR are vital to accomplishing our outreach activities. They would assist us in community events and refuge visitor programs as well as support data gathering and maintenance projects. This assistance would support us in meeting the refuge's goals and objectives, supporting the missions of the Refuge System and the Service, and fostering good community relationships.

Visitors would be introduced to the concept of ecosystem management and the role of the refuge in the Delaware River and Bay Ecosystem. The Visitor Services program would be used to enhance local interest in wildlife and to increase understanding of the social and economic benefits that wildlife and open space bring to the area.

Strategies:

1. Actively work with schools and other organizations to develop and encourage on-site programs.
2. Refuge staff would actively participate in off-site outreach activities.
3. Expand volunteer base and Friends group programs.
4. Open Tract 48 (AID) property to environmental education and outreach within three years of completing the final CCP. Conduct additional NEPA analysis as necessary.

Goal 5

Protect cultural resources on the refuge.

Objective 5.1: Finns Point Rear Range Light

Objective: Maintain and protect Finns Point Rear Range Light.

Rationale: Under alternative B, we believe it would become feasible and beneficial to retain ownership of the FPRRL and to integrate it into the interpretive program for the refuge. See alternative A for additional rationale language.

Strategies:
1. Continue to maintain the FPRRL in compliance with the National Historic Preservation Act.
2. Pursue expanding public access to and interpretative use of the FPRRL to promote refuge values.
3. Prioritize repair/restoration of the FPRRL in Service's Asset Maintenance System (SAMMS) in concert with recordation and demolition of other deteriorated structures on the refuge.
4. Consider entering an agreement with NJLHS to assist the refuge in supporting the use of FPRRL and associated interpretative programs.
5. Coordinate with Friends of Supawna Meadows NWR to integrate history of FPRRL into interpretive programs.
6. Repair FPRRL catwalk to allow public access.
7. Incorporate history of FPRRL into staff-led interpretive programs.
8. Update FPRRL information and enhance interpretive signage.
9. With assistance from the NJLHS and Friends of Finns Point Lighthouse (FOFPL), seek to stabilize, protect, and interpret FPRRL lens, if possible, in the refuge office.

Objective 5.2: Other Cultural Resources

Objective: Maintain and protect cultural sites and artifacts.

Rationale; *In addition to rationale presented in alternative A:*
Service-initiated actions likely to affect archaeological sites are routinely reviewed and assessed under the provisions of Sec. 106 of the National Historic Preservation Act. To date, projects requiring such review on the refuge have been confined to the siting of facilities and impoundments. Refuge lands have never had a systematic archaeological survey in their entirety.

Strategies:
Same as alternative A plus:
1. Hire a contractor to conduct a paleo-environmental review of the refuge. This review would include in-depth discussions of the refuge's archaeological sites and past history.

Goal 6

Enhance refuge management through partnerships, friends, volunteers, and community outreach.

Citizen involvement is critical to the well-being of the Refuge System and to the natural resources that depend on those lands. Working in partnership with other government agencies, and academic institutions, organizations, and individuals is vital to our operations. When local citizens and other stakeholders of a refuge can see firsthand our conservation work, they become an informed constituency on behalf of conservation.

Working in partnership with others also provides additional resources with which we can achieve our refuge goals and objectives. Our volunteers, Friends Group, and other conservation partners provide valuable assistance in accomplishing refuge projects in all our program areas.

Objective 6.1: Refuge Partners

Objective: Maintain active involvement in partnerships among all public land management agencies in South Jersey and the Lower Delaware River and Estuary to achieve refuge habitat and public use management objectives.

Rationale: Achieving refuge goals in many instances is feasible only through successful partnering with other agencies and groups.

Strategies:
Same as alternative A, plus:
1. Evaluate opportunities for new partnerships with conservation organizations, educators, research and academic institutions, and other State and Federal agencies who share similar missions and goals.
2. With existing and future partners, make a greater effort to highlight our programs, opportunities, and successes through the use of media links (for example, websites) and the development of quality outreach materials that contain clear and consistent messages.

Objective 6.2: Refuge Friends Group

Objective: Enhance our relationship with the Friends of Supawna Meadows NWR to ensure we have a mutually beneficial working relationship and one that cooperatively promotes an appreciation of natural and cultural resource conservation and facilitates the implementation of priority refuge projects.

Rationale; ***In addition to rationale presented in alternative A:***
The Friends of Supawna Meadows NWR have been valuable supporters of the refuge purposes and the Refuge System mission. Many important programs and projects get accomplished each year through their hard work, dedication, and fundraising. Since many members live in the local community, they are also very effective in helping us conduct outreach about opportunities on the refuge and in providing us feedback from the community.

Strategies:
Same as alternative A, plus:
1. Work with the Friends of Supawna Meadows NWR to seek outside support for refuge projects, develop public use programs, coordinate refuge projects, plan and conduct public events, conduct community outreach, promote national Service initiatives as they develop, and respond to public inquiries about the refuge.
2. Appoint a primary liaison between the Friends of Supawna Meadows NWR and the Service.
3. Provide resources, as needed, to help the Friends create and distribute their regular newsletter. Provide photographs illustrating habitat management and visitor services programs to include in the newsletter.

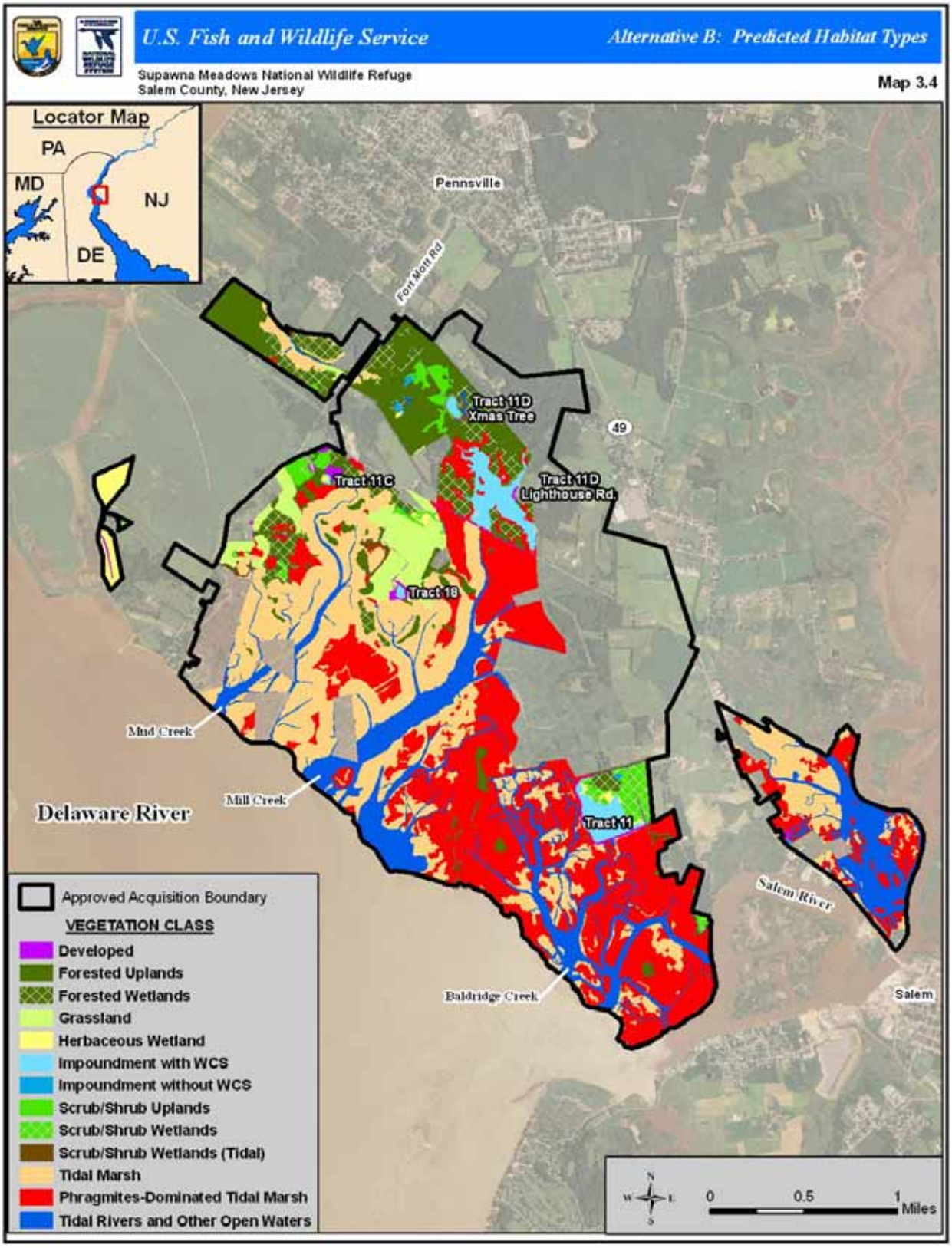
4. Work with the Friends of Supawna Meadows NWR on a regular basis to seek alternative funding sources and partnerships for various projects to benefit the refuge.

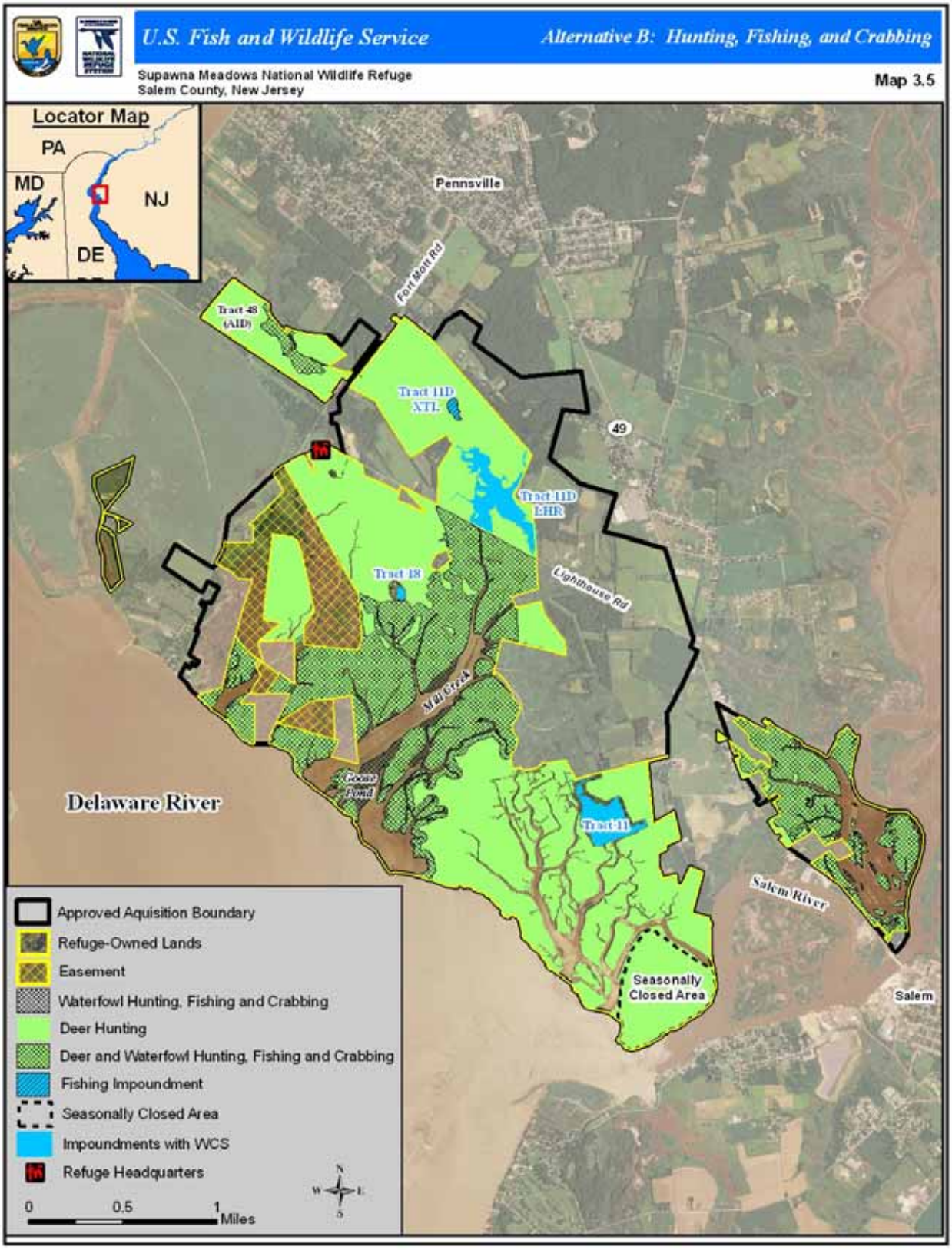
Objective 6.3: Refuge Volunteers

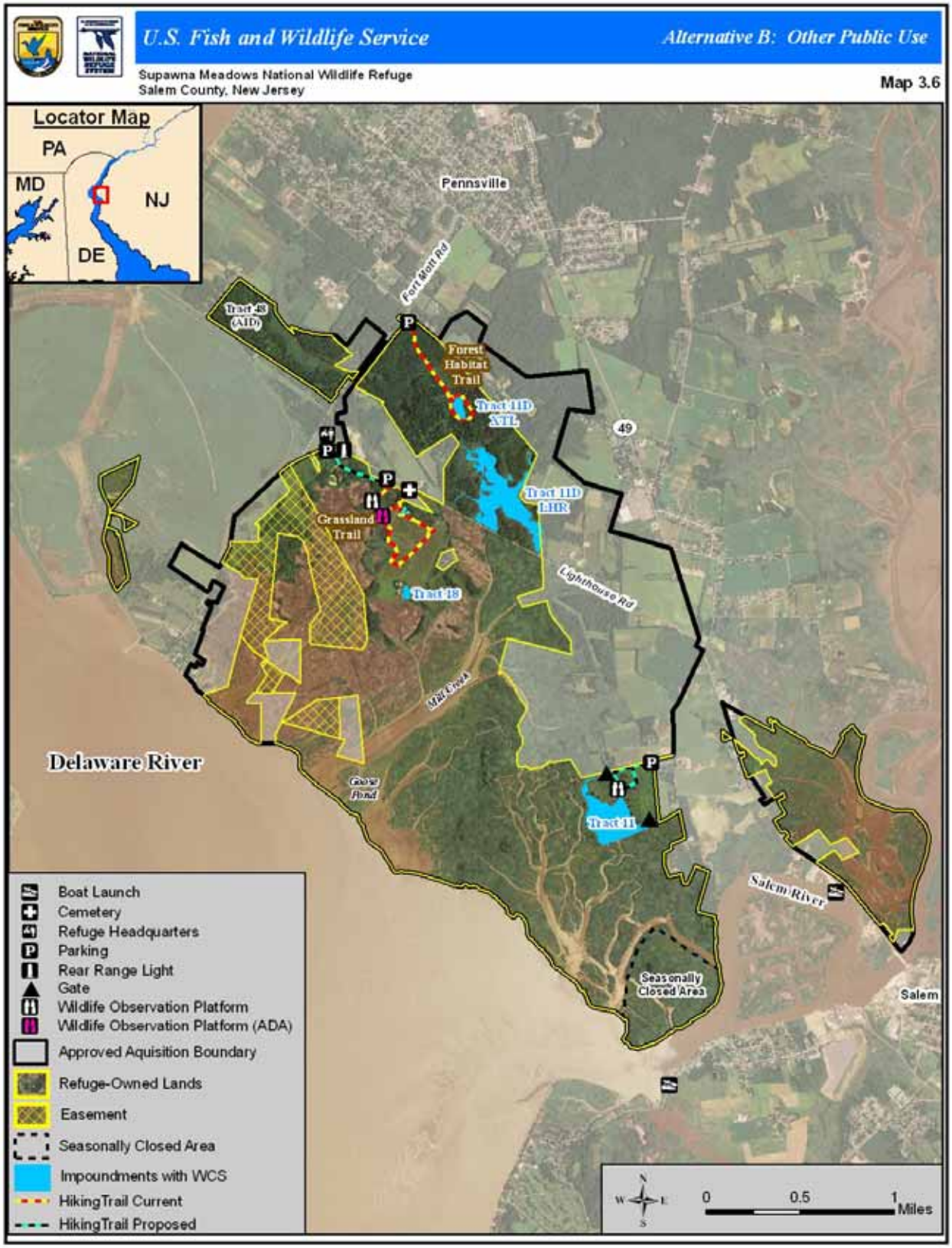
Objective: Encourage and facilitate an active, quality volunteer program that supports biological, maintenance, and visitor services priorities.

Rationale; *In addition to rationale presented in alternative A:*
Volunteers are integrated into all aspects of refuge management including maintenance, habitat management, and visitor services and outreach programs. Their hard work and enthusiasm enhances which programs we can offer. In fact, many of the Service's visitor use programs at Supawna Meadows NWR are run by volunteers, thus making it feasible for the refuge to offer these programs at all.
Strategies:

1. Actively recruit volunteers at events, through existing partners, the media, and the refuge website.
2. Develop and implement annual volunteer recruitment, training, and appreciation/recognition events.
3. Utilize volunteers in annual community events as deemed necessary and appropriate.
4. Utilize volunteers in meaningful refuge work such as performing various biological surveys, assisting with maintenance, and visitor services activities.


U.S. Fish and Wildlife Service
Alternative B: Predicted Habitat Types
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 3.4
Locator Map
PA
MD
NJ
DE
Pennsville
Fort Mott Rd
Tract 11D
Xmas Tree
49
Tract 11C
Tract 11D
Lighthouse Rd.
Tract 18
Mud Creek
Mill Creek
Delaware River
Tract 11
Salem River
Baldridge Creek
Salem
Approved Acquisition Boundary
VEGETATION CLASS
Developed
Forested Uplands
Forested Wetlands
Grassland
Herbaceous Wetland
Impoundment with WCS
Impoundment without WCS
Scrub/Shrub Uplands
Scrub/Shrub Wetlands
Scrub/Shrub Wetlands (Tidal)
Tidal Marsh
Phragmites-Dominated Tidal Marsh
Tidal Rivers and Other Open Waters
0
0.5
1
Miles


U.S. Fish and Wildlife Service
Alternative B: Hunting, Fishing, and Crabbing
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 3.5
Locator Map
PA
MD
NJ
DE
Pennsville
Fort Mott Rd
Tract 48 (AID)
Tract 11D XTL
49
Tract 11D LHR
Tract 18
Lighthouse Rd
Mill Creek
Goods Pond
Delaware River
Tract 11
Salem River
Seasonally Closed Area
Salem
Approved Aquisition Boundary
Refuge-Owned Lands
Easement
Waterfowl Hunting, Fishing and Crabbing
Deer Hunting
Deer and Waterfowl Hunting, Fishing and Crabbing
Fishing Impoundment
Seasonally Closed Area
Impoundments with WCS
Refuge Headquarters
0
0.5
1
Miles


U.S. Fish and Wildlife Service
Alternative B: Other Public Use
Supawna Meadows National Wildlife Refuge
Salem County, New Jersey
Map 3.6
Locator Map
PA
MD
NJ
DE
Pennsville
Fort Mott Rd
Tract 48 (AID)
Forest Habitat Trail
Tract 11D XTL
49
Tract 11D LHR
Grassland Trail
Tract 18
Lighthouse Rd
Mill Creek
Delaware River
Cow Road
Tract 11
Salem River
Seasonally Closed Area
Salem
Boat Launch
Cemetery
Refuge Headquarters
Parking
Rear Range Light
Gate
Wildlife Observation Platform
Wildlife Observation Platform (ADA)
Approved Aquisition Boundary
Refuge-Owned Lands
Easement
Seasonally Closed Area
Impoundments with WCS
HikingTrail Current
HikingTrail Proposed
0
0.5
1
Miles

Alternative C - Cease Management and Close Refuge to Public Uses

Under this alternative, we would close Supawna Meadows NWR to all public uses and cease all habitat management activities. There would be no funding allocated for any projects at the refuge. Alternative C partially meets the purpose for agency action identified in chapter 1 in that it continues to protect these lands from development and we would continue to acquire new properties within the acquisition boundary as parcels and funding become available. However, alternative C would fail to meet a majority of the goals identified in our purpose for agency action. Without active management of the refuge's habitats, invasive species would spread, and grassland and scrub/shrub habitats would decrease as they change into shrub habitat then forest. This alternative also fails to provide opportunities for high quality, wildlife-dependent public uses. We considered this alternative because budget constraints could force its selection. See below for additional information on specific program components for alternative C.

Wildlife Habitat Management

Under alternative C, we would cease management of all habitat types. This includes tidal marsh and tidally-influenced scrub/shrub, all upland habitats, and all non-tidal wetlands. For example, there would be no active management of forested wetlands – nest boxes would be abandoned. There would be no management related to the barn. We would cease management of the impoundments but leave the water-control structure boards in place. There may be instances when we must take action to address a public health or safety issue or to maintain the integrity of the impoundments or other infrastructure on the refuge. For example, we would remedy problems related to the integrity of the impoundment dikes such as rodent activity if the dikes are jeopardized.

Staffing and Project Funding

Under alternative C, Supawna Meadows NWR would be closed. There would be no funding allocated for projects at Supawna Meadows NWR. Cape May NWR staff would conduct semi-annual site inspections requiring up to 2 percent of an FTE (about 40 hours annually). The public would be notified and appropriate signage would be placed on all buildings and along the refuge boundary.

Refuge Buildings and Facilities

We would maintain the refuge office, both garages, (bat) barn, intern house on Route 49, and FPRRL. These buildings would remain closed to the public, but would be maintained for occasional use by refuge staff. We propose demolition of all other buildings on refuge lands. We would work with the New Jersey Historical Preservation Office and the Service's regional archaeologists to ensure compliance with applicable state and federal laws and regulations.

Resource Protection and Visitor Safety

There would be no staff time spent working on resource protection, public uses, or visitor safety. We would conduct semi-annual site inspections to monitor the effectiveness of the closure. We would prevent vandalism and unauthorized uses such as ATVs, dirt bikes, and poaching through our periodic inspections and with cooperative assistance from the local Police Department and State Conservation Officers.

Land Protection

Lands within our existing acquisition boundary would be purchased if the opportunity and funding became available. The Service would continue its policy of buying from willing sellers and focus its land acquisition efforts on developable upland properties first. No management would occur on any newly acquired lands.

Public Uses

We would prohibit all public uses. The refuge would be permanently closed to deer hunting and waterfowl hunting, to fishing and crabbing, and to wildlife observation, photography, and interpretation. The public would be notified about these closures. The closures would be marked with signage and enforced through our periodic inspections and with cooperative assistance from the local Police Department and State Conservation Officers. No environmental education or outreach activities would be conducted.

Historic and cultural Resources

We would continue to maintain the Finns Point Rear Range Light in compliance with the National Historic Preservation Act and we would pursue transferring ownership and responsibility of FPRRL to a suitable organization, such as the NJDEP Division of Parks and Forestry. Public access to FPRRL would be prohibited until such a transfer is made. The new owner would determine whether to open the FPRRL to the public or not. Non-historic resources, such as the cemetery, would be protected. The cemetery would be marked with signage and the closure enforced through our periodic inspections and with cooperative assistance from the local Police Department and State Conservation Officers.

Partners, Friends, and Volunteers

We would partner with specific agencies that would assist in maintaining the refuge closure and enforce the prohibition of public uses. While the Friends group could continue to function as an advocacy group, it would likely dissolve because of little or no support from the refuge staff.

Pest Control

Under alternative C, we would not have an active pest control program. All control measures would be undertaken on a case-by-case basis. We may control beavers if we get complaints that they are flooding out roads or if our inspections indicate they are damaging one of the impoundments. We may control muskrats or woodchucks if they are damaging impoundments. Otherwise, no animal control measures would be conducted under alternative C.

Monitoring and Abating Wildlife Diseases

No wildlife disease monitoring or abatement measures would be conducted under alternative C.

Supporting Biological and Ecological Research and Investigations

No research or investigations would be supported under alternative C.

Adaptive management

No adaptive management measures would be undertaken under alternative C. They would be unnecessary because no habitat or species management programs would be in effect.

Conducting Additional NEPA Analysis

There would be no major programs or projects undertaken under alternative C. Therefore, it is expected that no additional NEPA analysis would be required. The activities that are likely to be required under alternative C, such as impoundment damage repair and removal of pest animals, would be categorically excluded from the NEPA requirements.

Comparison of Management Actions under the Alternatives

Table 3.5 below lists the Goals, Objectives, and Strategies proposed under each alternative for comparative purposes.

Table 3.5 Summary comparison of management actions by alternative

Common to all Alternatives
We would continue to purchase portions of the 1,280 acres of in-holdings within the 4,527 acre acquisition boundary from willing sellers as funding allows. We would take necessary actions to address animal damage that threatens to destroy refuge resources, jeopardize public safety, or cause potential harm to neighboring properties. Refuge staff would either control these animal populations with refuge resources, invite state-licensed volunteers to control them, or hire commercial trappers.

Common to Alternatives A and B
Visually monitor all refuge areas for mute swans and Canada geese throughout the year, and take appropriate actions to discourage these species from becoming established or congregating on the refuge. Limit mute swan and Canada geese reproduction by oiling or addling eggs and removing adult swans. Allow snow geese to be hunted during the regular State hunt seasons and during any extended State hunt seasons. Use predator guards on nest boxes to protect against avian predators such as crow, grackle, and gulls. Monitor damage from furbearers such as muskrat, woodchuck, and beaver on refuge habitats. When possible, eradicate these animals on a case-by-case basis by using refuge resources, inviting state-licensed individuals, hiring commercial trappers, or working with partners such as USDA Wildlife Services. Endorse the Cats Indoors! campaign supported by the American Bird Conservancy. Monitor the refuge for feral cats throughout the year and take appropriate actions to control feral cats found on the refuge.

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
Refuge Staffing and Administration		
Cape May NWR staff would continue to spend about 20 percent of their time, or about 6 to 8 hours per week, managing Supawna Meadows NWR.	The refuge would continue as a satellite refuge of Cape May NWR, but would have 4 full-time staff: • an assistant refuge manager, • a park ranger (LE), • a wildlife biologist, and, • a maintenance worker. The staff at Supawna Meadows NWR would also continue to be supported by the staff at Cape May NWR, which includes a newly-hired visitor services professional.	Supawna Meadows NWR would be closed. There would be no funding allocated for projects at Supawna Meadows NWR. Cape May NWR staff would conduct semi-annual site inspections requiring up to 2 percent of a full-time employee (about 40 hours annually)
Refuge Buildings and Facilities		
One small outbuilding near the refuge office will be demolished. The refuge office, both garages, (bat) barn, intern house on Route 49, and Finns Point Rear Range	We would maintain the refuge office, both garages, (bat) barn, intern house on Route 49, and Finns Point Rear Range Light.	We would maintain the refuge office, both garages, (bat) barn, intern house on Route 49, and Finns Point Rear Range Light.

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
Light would be maintained and available for limited use. All other refuge buildings would be closed.	We propose demolition of all other buildings on refuge lands. We would work with the New Jersey Historical Preservation Office and the Service's regional archaeologists to ensure compliance with applicable state and federal laws and regulations. After demolition, these areas would be restored to provide wildlife habitat such as grassland and shrub/scrub upland habitat.	We propose demolition of all other buildings on refuge lands. We would work with the New Jersey Historical Preservation Office and the Service's regional archaeologists to ensure compliance with applicable state and federal laws and regulations.
Resource Protection and Visitor Safety		
The current law enforcement staffing level of one full-time park ranger (Law Enforcement; LE), with a permanent location at Cape May NWR, would be maintained. This ranger would continue to spend about 20 percent of work hours enforcing laws and regulations on Supawna Meadows NWR.	Add 1 full-time LE to enforce laws and regulations on Supawna Meadows NWR	There would be no staff hours spent working on resource protection, public uses, or visitor safety. We would conduct semi-annual site inspections to monitor the effectiveness of the closure. We would prevent vandalism and unauthorized uses such as ATVs, dirt bikes, and poaching through our periodic inspections and with cooperative assistance from the local Police Department and State Conservation Officers.
Goal 1: Protect, enhance and restore biological integrity, diversity, and environmental health of tidally-influenced habitats to support native wildlife and plant communities including species of conservation concern.		
Objective 1.1 Tidal Marsh Habitat		
Maintain up to 2,293 acres of brackish tidal marsh to benefit Pea Patch Island wading birds, migrating shorebirds, migrating and wintering waterfowl, and other species of conservation concern. Purchase up to 362 additional acres of tidal marsh within the approved acquisition boundary. Treat up to 525 acres of phragmites-dominated tidal marsh with herbicides, prescribed burning, and mowing.	Maintain up to 2,293 acres of brackish tidal marsh to benefit Pea Patch Island wading birds, migrating shorebirds, migrating and wintering waterfowl, and other species of conservation concern. Purchase up to 362 additional acres of tidal marsh within the approved acquisition boundary. Within five years of CCP approval, evaluate removal of the remnant farm dike to restore tidal flow and reestablish natural marsh function.	Acquired acres would be protected, but management activities would cease

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
Study literature of existing research and its impacts on phragmites control.	Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. Work with adjacent private landowners to reduce phragmites on their properties Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	
Objective 1.2 Tidally Influenced Scrub/Shrub Habitat		
Protect up to 30 acres of tidal scrub/shrub habitat to benefit coastal plain swamp sparrow, prairie warbler, and other priority breeding, migrating, and wintering birds and other species of conservation concern. Purchase up to 2 additional scrub/shrub acres within the acquisition boundary. No management activities would occur.	Protect up to 30 acres of tidal scrub/shrub habitat to benefit coastal plain swamp sparrow, prairie warbler, and other priority breeding, migrating, and wintering birds and other species of conservation concern. Purchase up to 2 additional scrub/shrub acres within the acquisition boundary. Maintain scrub/shrub habitat to set back succession and if necessary, treat invasive plants so that 70 percent of scrub/shrub habitat is in native species. Coordinate with regional efforts and initiatives where possible and applicable with respect to climate change and sea level rise. Manage 16,000 linear feet of scrub/shrub habitat along the high-tide line specifically to benefit coastal plain swamp sparrow. Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	*Same as alternative A*

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
Objective 1.3 Open Tidal Waters		
Protect northern diamondback terrapins, shortnose sturgeon, blue crabs, and other aquatic species of conservation concern by implement best management practices, such as adhering to instructional labels when applying herbicides, to protect against potential contamination of the tidal rivers and other open tidal waters that could be impacted by refuge management activities.	*Same as alternative A plus:* Partner with local communities, anglers, watershed associations, conservation groups, and researchers to help address water quality issues in the watershed. Using SLAMM analysis results, monitor and evaluate conditions at Supawna Meadows NWR over the next 15 years with respect to climate change and sea level rise. Coordinate with regional efforts and initiatives where possible and applicable. Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	Tidal rivers and open tidal waters would not be affected because management activities on the refuge would cease
Goal 2: Protect, enhance, and restore biological integrity, diversity and environmental health of upland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.		
Objective 2.1 Early Successional Grassland Habitat		
Manage up to 531 acres of grasslands to benefit northern harriers, short-eared owls, barn owls, and other raptors, wintering grassland birds, and other grassland-dependant species of conservation concern. Purchase up to 409 acres of grassland acres within the refuge acquisition boundary. Actively manage 50 percent of the grassland acreage every 3 years by mowing and using prescribed fire.	*Same as alternative A plus:* Expand habitat management priorities to include habitat for pollinators Focus grassland management on large (>20 acres) fields, fields with minimal edge, less surrounding forest, and more surrounding open habitats, and maintain grasslands in close proximity to one another where possible Evaluate the potential for allowing managed grasslands, particularly those < 20 acres in size, to succeed through natural processes to scrub-shrub habitat for priority migratory species. Determine the value of grassland habitats to wintering and migrating	Acquired acres would be protected, but management activities would cease

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
	birds using an adaptive management approach. Use information gathered from Christmas Bird Counts and other non-standardized but repeated observations to determine habitat use and distribution. Control Canada thistle, autumn olive, and other invasive plants to establish 80 percent cover of native species. Provide a shrubland component to the fields, for migrating and breeding shrubland species Determine the value of grasslands for butterflies and other pollinators using refuge grassland habitat, and incorporate surveys and/or monitoring efforts. Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details) Within 3 years of final approval of the CCP, we would begin to re-evaluate the refuge's acquisition boundary because much of what is currently within the refuge boundaries would likely be under water in the next 50 to 100 years.	
Objective 2.2 Early Successional Scrub/Shrub Habitat		
Protect up to 57 acres of upland scrub/shrub habitat to benefit migrating and breeding landbirds and other species of conservation concern Purchase up to 19 additional scrub/shrub acres within the approved acquisition boundary No active scrub/shrub	Protect and manage up to 55 acres of upland scrub/shrub habitat to benefit migrating and breeding landbirds and other species of conservation concern Purchase up to 19 additional scrub/shrub acres within the acquisition boundary. Maintain scrub/shrub habitat through selective cutting and/or herbicide to	*Same as alternative A*

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
management would occur.	set back succession. Conduct invasive species control on scrub/shrub habitat so that 70-80 percent of habitat is in native species Continue the use of biological control measures to control invasive plant species (i.e., weevils to control mile-a-minute weed) Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	
Objective 2.3 Upland Forest Habitat		
Maintain up to 414 acres of upland forest habitat to benefit breeding, migrating, and wintering birds, roosting bats, and other forest dependent species of conservation concern Purchase up to 174 additional upland forest acres within the acquisition boundary. Continue to coordinate with NJ Department of Agriculture's weevil release program to help control mile-a-minute on the refuge. Work with State and other partners to conduct limited surveys for bat species of conservation concern and implement appropriate action if White Nose Syndrome is discovered in the colony. Maintain and improve the structural integrity of the barn to continue to provide maternity roosting habitat for little brown and big brown bats, barn owls,	*Same as alternative A plus:* Maintain two additional (up to 416 acres) acres of upland forest to benefit breeding, migrating, and wintering birds, roosting bats, and other forest dependent species of conservation concern Expand invasive species control on current and additional acreage on mile-a-minute, Japanese stiltgrass, multiflora rose, and Japanese honeysuckle so that 70-80 percent native vegetation is achieved Identify, locate, and manage additional native bat habitat Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	Acquired acres would be protected, but management activities would cease

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
and other species of conservation concern. Work with partners to monitor the barn owl nest box in the barn.		
Goal 3: Protect, enhance, and restore biological integrity, diversity and environmental health of non-tidal wetland habitats to support native wildlife and plant communities with emphasis on migrating and wintering birds and other species of concern.		
Objective 3.1 Non-tidal Scrub/Shrub Wetlands		
Protect up to 60 acres of non-tidal scrub/shrub wetland habitat to benefit yellow-breasted chat, prairie warbler, and other species of conservation concern Purchase up to 4 additional scrub/shrub acres within the acquisition boundary. No active scrub/shrub management would occur.	Protect up to 60 acres and manage up to 52 acres of non-tidal scrub/shrub wetland habitat to benefit migrating landbirds such as eastern towhee, gray catbird, brown thrasher, and other species of conservation Purchase up to 4 additional scrub/shrub acres within the acquisition boundary. Maintain scrub/shrub habitat through selective cutting and/or herbicide to set back succession Control invasive plants so that 70 percent of scrub/shrub habitat is comprised of native species Continue the use of biological control measures to control mile-a-minute weed Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	*Same as alternative A*
Objective 3.2 Non-tidal Herbaceous Wetlands		
Protect up to 55 acres of currently undisturbed, native non-tidal herbaceous wetland habitat to benefit marsh wrens, southern bog lemmings, and	Protect up to 55 acres of currently undisturbed, native non-tidal herbaceous wetland habitat to benefit marsh wrens, southern bog lemmings, and other species of conservation	*Same as alternative A*

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
other species of conservation concern Purchase up to 13 additional non-tidal herbaceous wetland acres within acquisition boundary No active management would occur	concern Purchase up to 13 additional non-tidal herbaceous wetland acres within acquisition boundary Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness Monitor habitat destruction impacts of white-tailed deer. Implement population control measures on white-tailed deer if significant habitat destruction is observed. Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	
Objective 3.3 Freshwater Impoundments		
Manage up to 87 acres in impoundments, using existing water control structures, and up to 5 acres of non-tidal open water impoundments (without water control structures) to enhance habitat available for shorebirds, waterfowl, and wading birds while maintaining essential habitat for other freshwater species of management concern. Mow and reduce woody vegetation on Tract 11 impoundment dike. Keep boards in the following impoundments: Tract 11, Tract 11D Lighthouse Road, Tract 18, Tract 11C, Tract 11D (XTL) Maintain water control structures and Tract 11 impoundment dike as needed.	Manage up to 87 acres in impoundments, using existing water control structures, and up to 5 acres of non-tidal open water impoundments (without water control structures) to enhance habitat available for shorebirds, waterfowl, and wading birds while maintaining essential habitat for other freshwater species of management concern. Maintain dike and water control structures as needed. Mow and reduce woody vegetation on Tract 11 dike. Evaluate the potential for restoring or reverting to natural hydrology for each impoundment Participate in a regional Structured Decision-Making Study to make a determination of the highest conservation value for each impoundment. Where restoring natural processes is not feasible, the	We would cease management of the impoundments but leave the water-control structure boards in place. If needed, we would take action to address a public health or safety issue or to maintain the integrity of the impoundments or other infrastructure on the refuge.

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
Measures such as furbearer control would be taken when necessary to ensure the long-term integrity of the Tract 11 impoundment dike. No active impoundment management would occur in the impoundments without water control structures or vernal pools.	refuge would strive to mimic natural processes within impoundments. a. Begin evaluation with Tract 11C impoundment b. In impoundments without water control structures, evaluate potential for creating vernal pool-like shallow waters for amphibians and implement if feasible. Until the habitat management plan is developed, actively manage Tract 11 and Tract 11D Lighthouse Road Impoundments by varying water levels on each impoundment year-to-year to benefit priority species, particularly Pea Patch Island wading birds. Develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. Actively manage impoundments using mowing, prescribed fire, flooding, and biocontrol for purple loosestrife and mile-a-minute weed Collect data and assess habitat and dikes to determine damage by furbearers. Issue a SUP if trapping is needed. In impoundments without water control structures, maintain nearby nest boxes for wood ducks and eastern-screech owls. In Tract 11D Xmas Tree Lane Impoundment, determine appropriate water level management of impoundment and implement control measures In Tract 11D Xmas Tree Lane Impoundment, monitor habitat destruction of beaver. Implement beaver population control measures if significant habitat destruction is	

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
	observed. Implement a variety of monitoring and survey programs, including baseline data collection, as funding and staffing permits to measure our success with respect to our objectives (see text for details)	
Objective 3.4 Forested Wetlands		
Protect up to 338 acres of forested wetland habitat to benefit breeding, migrating, and wintering birds (e.g., wood thrush, wood ducks, screech owls) and other forest dependent species of conservation concern Purchase up to 156 additional forested wetland acres within the acquisition boundary Work with volunteers to check, refresh, and maintain up to 50 percent of nest boxes to benefit wood ducks and eastern screech owls	Protect up to 346 acres of forested wetland habitat to benefit breeding, migrating, and wintering birds (e.g., wood thrush, wood ducks, screech owls) and other forest dependent species of conservation concern Purchase up to 156 additional acres of forested wetlands within the acquisition boundary. Conduct an adaptive management study to determine if natural hydrology should be restored Remove wood duck nest boxes as boxes fall into disrepair Expand invasive species control on current and additional acreage of Japanese stiltgrass and other dominant invasive species so that 70-80 percent native vegetation cover is achieved Continue the use of biocontrol measures to control mile-a-minute weed Monitor habitat destruction by white-tailed deer and beaver. Implement population control measures on white -tailed deer and beaver if significant habitat destruction is observed. Implement a variety of monitoring and survey programs, including baseline data collection, as funding and	Acquired acres would be protected, but nest boxes would be abandoned No active management would occur

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
	staffing permits to measure our success with respect to our objectives (see text for details)	
Goal 4: Provide opportunities for compatible, high-quality, wildlife-dependent public uses.		
Objective 4.1 Hunting		
Archery deer hunting would continue to be allowed on the refuge for all four of New Jersey's bow hunting seasons according to the State Deer Management Zone 63 regulations. Continue to keep the Tract 11 Impoundment and the surrounding land open to archery deer hunting according to State seasons. The current waterfowl hunting program would continue in accordance with state regulations and seasons. Continue to prohibit hunting around the area of the new office, north of Mill Creek, and the new AID area (Tract 48). No other migratory bird or upland game hunting programs would occur on the refuge.	Continue deer and waterfowl hunting on the refuge according to State regulations. Only archery deer hunting is allowed on the refuge according to the State regulations. Monitor the deer population and its effects on refuge habitats. If the herd needs to be further culled, work with the State to offer a doe-first season, a firearms season, or another method for taking more deer off the refuge. Continue to keep the upland areas of Tract 11 Impoundment open to archery deer hunting according to State seasons. The open water habitat and dike around the open water would be closed to hunters. Remove hunting closure signage; rely on State hunting regulations to define hunting safety zones. Reconfigure the waterfowl hunting zone so that 1,206 acres would be open to hunting. Access would be from the water. No blinds would be allowed to be built on the marsh. Within three years of completing final CCP, conduct NEPA analysis to open Tract 48(AID) property and any other new properties as identified in the draft CCP/EA, to deer and waterfowl hunting.	Supawna Meadows NWR would be closed to all public uses, including hunting. The public would be notified and appropriate signage would be placed on all buildings and along the refuge boundary.
Objective 4.2 Fishing and Crabbing		
Areas currently open for	Rezone the fishing and crabbing areas	Supawna Meadows NWR would be

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
saltwater fishing and crabbing would continue to be open in accordance with state regulations. Freshwater areas would continue to be closed to the public for fishing and crabbing. Continue to hold the one-day refuge youth fishing event at the Tract 18 impoundment only with assistance from Friends of Supawna Meadows NWR or other volunteer groups.	to occur where waterfowl hunting areas occur. Conduct additional NEPA analysis, as needed, within 3 years of final CCP. Open Tract 11 D Xmas Tree lane impoundment to freshwater fishing and conduct additional NEPA analysis within one year of final CCP. Close fishing at Tract 11D Lighthouse Road impoundment because of safety hazard associated with access. Hold the one day refuge youth fishing event at the Tract 18 impoundment. Seek assistance from the Friends and/or volunteers.	closed to all public uses, including fishing and crabbing. The public would be notified and appropriate signage would be placed on all buildings and along the refuge boundary.
Objective 4.3 Wildlife Observation, Photography, and Interpretation		
Continue to provide wildlife viewing, photography, and interpretation opportunities along existing refuge trails. Continue to provide interpretive signs at all existing refuge public use sites, including the family plot cemetery along the Grassland Trail. Trail maintenance would primarily be conducted by refuge volunteers. Update general refuge brochure. Expand refuge trails to include a spur trail off the Grassland Trail to an observation blind on the pond if feasible with substantial involvement by the Friends of Supawna Meadows NWR. Improve the observation blinds along the Grassland Trail with substantial involvement by the Friends of Supawna Meadows NWR.	Continue to provide wildlife viewing, photography, and interpretation opportunities along existing refuge trails. Continue to provide interpretive signs at all existing refuge public use sites, including the family plot cemetery along the Grassland Trail. Improve the observation blinds along the Grassland Trail. Continue to seasonally close bald eagle area. Install/upgrade signs along Highway 49 directing motorists to the refuge. Consider extending the current trail system to newly acquired lands and providing observations blinds along new trails, conducting additional NEPA analysis as necessary. Expand refuge boundary signage on newly acquired lands.	Supawna Meadows NWR would be closed to all public uses, including wildlife observation, photography, and interpretation. The public would be notified and appropriate signage would be placed on all buildings and along the refuge boundary.

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
Continue to close the area around the new office, the area just north of Mill Creek, and the new AID area (Tract 48). Continue to keep Tract 11 impoundment closed to public use all year except for deer hunting. Continue to seasonally close bald eagle area. Install/upgrade signs along Hwy 49 directing motorists to refuge.	Develop new brochures specific to trails. Develop a new website. Construct a spur trail from the Grassland Trail into the wetland, with help from the Friends group if needed. Eliminate the designation of a Boat Trail and remove trail markers, but continue to allow public boat access in the tidal streams. Improve or install additional observation facilities on the refuge, for example: Install an observation platform at the impoundment at Tract 11 and upgrade the nearby grass parking area to accommodate 8-10 vehicles. The open water portion of the Tract 11 impoundment and the dike surrounding the open water would remain closed to the public all year. Gates would be installed to define the closed area. Construct a wheelchair-accessible photo-blind and other amenities to improve facilities for wildlife photographers at the Grassland Trail. Construct a trail linking the FPRRL site to the Grassland Trail to connect visitors to wildlife viewing areas Use FPRRL to expand opportunities for refuge interpretation with panels and brochures on ground-level and in interior of FPRRL if approved by SHPO Work with a neighboring private landowner to enhance eagle viewing opportunities at the Sinnickson Landing boat ramp Seek year-round local NJ residents for volunteer-based interpretative programs	

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
	Open Tract 48 (AID) property to wildlife observation, photography, and interpretation within one year of completing final CCP, conducting additional NEPA analysis as needed	
Objective 4.4 Environmental Education and Outreach		
Provide occasional on-site nature walks arranged and sponsored by the Friends of Supawna Meadows NWR. Staff would accommodate occasional requests to lead tours on the refuge. The majority of off-site outreach activities would be conducted by the Friends of Supawna Meadows NWR, including 2 to 3 events the Friends Group uses as an opportunity to educate the public about the refuge. Participate in community and partner discussions about proposed development in the vicinity of the refuge.	Actively work with schools and other organizations to develop and encourage on-site programs Refuge staff would actively participate in off-site outreach activities Expand volunteer base and Friends group programs Open Tract 48 (AID) property to environmental education and outreach within three years of final CCP, conducting additional NEPA analysis as needed.	No environmental education or outreach activities would be conducted
Goal 5: Protect Cultural Resources		
Objective 5.1 Finns Point Rear Range Light (FPRRL)		
Continue to maintain the FPRRL in compliance with the National Historic Preservation Act. Continue to allow public access to FPRRL only during the annual New Jersey Lighthouse Challenge, if deemed feasible by the refuge manager. Due to safety concerns, continue to prohibit public access of the FPRRL catwalk. With assistance from the NJLHS and Friends of Finns Point	Continue to maintain the FPRRL in compliance with the National Historic Preservation Act. Pursue expanding public access to and interpretative use of the FPRRL to promote refuge values. Prioritize repair/restoration of the FPRRL in Service's Asset Maintenance System (SAMMS). Consider entering an agreement with NJLHS to assist the refuge in supporting the use of FPRRL and associated interpretative programs.	Continue to maintain the FPRRL in compliance with the National Historic Preservation Act Pursue transferring ownership and responsibility of FPRRL to a suitable organization, such as the NJDEP Division of Parks and Forestry. Public access to FPRRL would be prohibited until such a transfer is made. If ownership is transferred, the new owner would determine whether to open the FPRRL to the public or not.

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
Lighthouse (FOFPL), seek to stabilize, protect, and interpret FPRRL lens, if possible, in refuge office.	Coordinate with Friends of Supawna Meadows NWR to integrate history of FPRRL into interpretive programs. Repair FPRRL catwalk to allow public access. Incorporate history of FPRRL into staff-led interpretive programs. Update FPRRL information and enhance interpretive signage. With assistance from the NJLHS and Friends of Finns Point Lighthouse (FOFPL), seek to stabilize, protect, and interpret FPRRL lens, if possible, in refuge office.	
Objective 5.2 Other Cultural Resources		
Allow Friends of Supawna Meadows NWR to continue maintaining the family cemetery located on refuge lands. Work with the New Jersey Historical Preservation Office and the Service's regional archaeologists to determine future course of action regarding the Yerkes farmstead and FPRRL oil storage shed.	*Same as alternative A plus:* Hire a contractor to conduct a paleoenvironmental review of the refuge. Work with the New Jersey Historical Preservation Office and the Service's regional archaeologists to properly document then demolish the Yerkes farmstead and FPRRL oil storage shed.	Other cultural resources, such as the cemetery, would be protected. The cemetery would be closed to the public and marked with signage. Work with the New Jersey Historical Preservation Office and the Service's regional archaeologists to properly document then demolish the Yerkes farmstead and FPRRL oil storage shed.
Goal 6: Enhance refuge management through partnerships, Friend, volunteers, and community outreach.		
Objective 6.1 Refuge Partnerships		
Maintain active involvement in partnerships among all public land management agencies in South Jersey and the Lower Delaware River and Estuary to achieve refuge habitat and public use management objectives. Communicate and coordinate	*Same as alternative A plus:* Evaluate opportunities for new partnerships with conservation organizations, educators, research and academic institutions, and other state and federal agencies With existing and future partners, make a greater effort to highlight our	We would partner with specific agencies who could assist in maintaining the refuge closure and enforce the prohibition of public uses

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
regularly with the other agencies to discuss common goals, issues and concerns, share technical information, and identify opportunities for cooperative management with other agencies. Pursue formal Memorandum of Understanding/ Memorandum of Agreements (MOU/MOA) and cooperative agreements with partnering agencies where warranted to facilitate sharing of resources and implementation of programs Maintain the existing MOU with Salem County to share in law enforcement.	programs, opportunities, and successes through use of media links (e.g., website) and quality outreach materials with clear and consistent messages.	
Objective 6.2 Refuge Friends Group		
Conduct monthly information and strategy meetings with Friends of Supawna Meadows NWR. Contribute information to the Friends' newsletter and website. Support the Friends' efforts at sponsoring community events and programs. Encourage the Friends to work with other local citizens groups as an extension of our community outreach program.	*Same as alternative A plus:* Work with the Friends of Supawna Meadows NWR to seek outside support for refuge projects, develop public use programs, coordinate refuge projects, plan and conduct public events, conduct community outreach, promote national Service initiatives as they develop, and respond to public inquiries about the refuge. Appoint a primary liaison between the Friends of Supawna Meadows NWR and the Service. Provided resources, as needed, to help the Friends create and distribute their regular newsletter. Provide photographs illustrating habitat management and visitor services programs to include in the newsletter. Work with the Friends of Supawna Meadows NWR consistently to seek alternative funding sources and	The Friends group could continue to function as an advocacy group; however, with little or no support from the refuge staff, partnerships would likely dissolve

Alternative A Current Management	Alternative B Management for Trust Resources (The Service-Preferred Alternative)	Alternative C Cease Management
	partnerships for various projects to benefit the refuge.	
Objective 6.3 Volunteers		
Continue to work with volunteers who assist in managing the biological and public use programs on the refuge.	Actively recruit volunteers at events, through existing partners, the media, and the refuge website. Develop and implement annual volunteer recruitment, training, and appreciation/recognition events. Utilize volunteers in annual community events as deemed necessary and appropriate. Utilize volunteers in meaningful refuge work such as performing various biological surveys, assisting with maintenance, and visitor services activities.	With little or no support for the refuge, the need for volunteers would decrease and the number of volunteers would likely decrease or disappear

Chapter 4

Gene Nieminen/USFWS

Supawna Meadows NWR Impoundment

Environmental Consequences

- Introduction
- Impacts on the Refuge Vicinity
- Water Quality and Aquatic Biota Impacts
- Socioeconomic Impacts
- Refuge Specific Impacts
- Impacts to Biological Integrity, Biological Diversity, and Environmental Health
- Cultural Resources Impacts
- Public Use Management
- Cumulative Impacts
- Relationship Between Short-term Uses of the Human Environment and Enhancement of Long-Term Productivity
- Summary of the Impacts of the Alternatives

Introduction

This chapter describes the environmental consequences we predict from implementing the refuge management alternatives presented in chapter 3. Where detailed information is available, we present a scientific and analytic comparison between alternatives and their anticipated consequences, which we describe as "impacts" or "effects." In the absence of detailed information, we make comparisons based on our professional judgment and experience.

We focus our discussion on the impacts associated with the goals and key issues identified in chapter 1, "Purpose and Need for Action". Direct, indirect, short-term, beneficial and adverse effects likely to occur over the 15-year life span of the plan are discussed. Beyond the 15-year planning horizon, we give a more speculative description of the direct, indirect, and cumulative effects. The chapter identifies cumulative impacts, any irreversible and irretrievable commitment of resources and the relationship between short-term uses of the environment and its long-term productivity. At the end of this chapter, table 4.2 summarizes the effects predicted for each Supawna Meadows National Wildlife Refuge (Supawna Meadows NWR) Comprehensive Conservation Plan (CCP) alternative and allows for a side-by-side comparison.

As required by the Council on Environmental Quality (CEQ) and U.S. Fish and Wildlife Service (Service) regulations implementing the National Environmental Policy Act (NEPA), we assessed the importance of the effects of the CCP alternatives based on their context and intensity. The context of the impacts ranges from site-specific to broader regional and ecoregional scales (Table 4.1). Although refuge lands comprise a small percentage of these larger regional area contexts, all alternatives were developed to contribute towards conservation goals in these larger contexts.

Table 4.1. Contexts for Impacts Analyses at Supawna Meadows National Wildlife Refuge

Regional Context for Impacts	Area
Tract 11 Impoundment	1.46 acres (0.002 miles^2)
Refuge Tidal Marsh	1,621 acres (2.5 miles^2)
Supawna Meadows NWR	3,016 acres (4.7 miles^2)
Pennsville (Census-Designated Place), New Jersey	15,872 acres (24.8 miles^2)
Mannington Meadows Important Bird Area	18,593 acres (29 miles$^{2)}$
Salem County, New Jersey	216,320 acres (338 miles^2)
Partners in Flight Landbird Conservation Plan Physiographic Region 44 (Mid Atlantic)	13,891,658 acres (21,700 miles^2)
Bird Conservation Region 30	24,428,000 acres (38,170 miles^2)

The proposed species and habitat actions are consistent with the State, regional, ecosystem, and watershed conservation plans identified in chapter 1. At varying levels, each of the alternatives would make positive contributions to these larger landscape-scale conservation endeavors.

We evaluated the intensity of impacts based on the expected degree or percentage of resource change from current conditions, the frequency and duration of the effect, the sensitivity of the resource to such an effect or the natural resiliency of the resource to recover from such an effect, and the potential for implementing effective preventative or mitigation measures to reduce the effect. Duration of effects vary from those that would occur only once for a brief period of time during the 15-year planning horizon, such as the effects of trail construction, to those that would occur every day during a given season of the year, such as effects from hunting or fishing.

The following list of management activities are not analyzed in detail in this document because they are both trivial in effect and common to all alternatives. These would qualify for categorical exclusion under applicable regulations if independently proposed:

- operations and maintenance of existing infrastructure and facilities (unless major renovation is involved);
- issuance of new or revised management plans when only minor changes are planned; and,
- law enforcement activities

The following list of activities is common to alternatives A and B, but would not occur under alternative C. These activities are not analyzed in detail in this document because they are considered trivial in effect. These would also qualify for categorical exclusion under applicable regulations if independently proposed:

- environmental education and interpretative programs (unless major construction is involved, or a significant increase in visitation is expected);
- research, resource inventories, and other resource information collection activities;
- routine, recurring management activities and improvements, including managing invasive plants, implementing a zero tolerance policy for feral cats, and managing mute swan populations;
- small construction projects (for example, fences, berms, small stream and wetland restoration projects, trail maintenance, interpretative kiosks, and development of access for routine management purposes);
- minor vegetation plantings;
- reintroducing native plants and animals; and,
- Minor changes in amounts or types of public use.

“Extraordinary circumstances” in 43 CFR 46.215 are exceptions to our categorical exclusions. If any of these exceptions apply, we will conduct a further NEPA analysis of the proposed action.

Actions that are not categorically excluded and that will require additional NEPA analysis beyond this draft CCP and EA are:

- reconfiguring the waterfowl and deer hunt zones;
- opening Tract 48 (AID) and any other new lands to public use, including deer hunting, waterfowl hunting, fishing and crabbing, and wildlife observation and photography;
- expanding the refuge trail system to include a spur trail off the Grassland Trail; and,
- installing an observation platform and parking lot by the Tract 11 impoundment.

We have organized this chapter by major resource heading so that each section describes the impacts of all management activities proposed under each of the three alternatives that would likely have an effect on a given resource, such as an impact on air quality or on waterfowl. Under each heading, we discuss the resource context and the types of benefits and adverse impacts of management actions that we evaluated. We then discuss the benefits and adverse effects that would occur regardless of which alternative is selected and the benefits and adverse effects of each of the CCP alternatives.

Impacts in the Refuge Vicinity

Chapter 2, "Affected Environment," discusses the status of air quality in the landscape around the refuge. We evaluated the management actions each alternative proposes for their potential positive or negative effects on air quality by assessing:

Air Quality Impacts

- the potential of continuing and expanding our energy efficiency practices to reduce the refuge contribution to emissions; for example, the use of fluorescent lighting, solar power, and hybrid vehicles;
- the potential of refuge land conservation to limit the growth of development, thereby limiting sources of emissions and reducing losses of forest vegetation; and,
- the potential of refuge forest management to enhance carbon sequestration and reduce greenhouse gases

The potential adverse effects of the management alternatives we evaluated included increases in:

- emissions from staff vehicles or equipment;
- emissions from visitor vehicles; and,
- emissions from buildings.

Air Quality Impacts that would not Vary by Alternative

Our management activities should not adversely affect regional air quality. None of the alternatives would violate Federal Environmental Protection Agency (EPA) standards; all three would comply with the Clean Air Act. There would be no major stationary or mobile sources of air pollutants at the refuge created under any of the refuge management alternatives. On the contrary, the Service limits public uses of the refuge to compatible wildlife-oriented activities and thus curtails man-made sources of emissions by maintaining more than 95 percent of refuge area in vegetative cover. The analysis of air quality impacts considered only how the Service's actions at the refuge might affect criteria air pollutants, visibility, and climate change to a minimal

degree, focusing on the potential for localized air quality impacts or improvement.

Visibility concerns due to emission-caused haze at the nearest Class I airshed, Brigantine Wilderness Area in Atlantic County, New Jersey, would not be affected by any of the proposed management alternatives. Management actions and public uses at the refuge under all alternatives would contribute a negligible increment to the overall Salem County or regional air emissions levels.

Supawna Meadows NWR has no history of catastrophic wildfire. Nevertheless, we would seek to minimize the possibility of serious fires and their associated health and safety concerns. We would assess the hazards associated with the wildland-urban interface along the refuge boundaries with privately owned land to ensure that our management practices are not creating excessive fuel loading that would lead to severe fires.

Air quality may be at some minimal risk of being indirectly affected by Service activities from leaks or spill accidents involving chemicals or petroleum products used in refuge management operations. However, we would assiduously follow our leak and spill prevention and emergency clean-up procedures to ensure that such occurrences are rare and are addressed immediately, with short-term effects limited to the immediate location.

Alternative A - Continue Current Management (No Action)

Benefits

There would be continuing benefits to air quality under alternative A from maintaining the natural vegetation on up to 2,293 acres of refuge tidal marsh and up to 2,234 acres of other habitats (based on total acreage within acquisition boundary). The air quality benefits would be twofold. Natural vegetation serves to filter air pollutants, and maintaining the refuge lands precludes development and the introduction of attendant sources of pollutant emissions on the land. There would also be some benefit from protecting up to 338 acres of forested wetlands and uplands in terms of maintaining its contribution to carbon sequestration. Trees serve as long-term carbon “sinks” that reduce atmospheric carbon that causes climate change. Under alternative A, energy efficient practices would be continued and additional practices adapted as feasible.

Adverse Impacts

Ongoing trail and other maintenance activities would cause negligible short-term, localized effects from dust and vehicle and equipment exhausts. Continued operation of the refuge buildings would continue to contribute negligibly to local stationary source emissions. Vehicles and equipment used by staff would contribute a negligible amount to local mobile source air emissions and particulates.

While emissions from heating and cooling refuge facilities and from visitor and employee travel will contribute to air pollution, those impacts can be reduced through use of energy efficient systems and vehicles. With our current facilities and vehicles, we have implemented actions such as installing energy efficient windows, fluorescent lighting, and motion-activated night lighting. We use bio-degradable solvents

whenever feasible and we have achieved a 60-percent level of recycling of materials on the refuge complex. We have also recently replaced older vehicles with new, more energy efficient vehicles.

In alternative A, we expect up to a 10 percent increase in annual visitation over the estimated fiscal year (FY) 2009 level of 15,000 visitors, that is, up to 16,500 visitors. This increase in annual refuge visitor use would slightly increase vehicle emissions on refuge lands in the longer term. These localized increases from refuge activities would be negligible compared to current off-refuge contributions to pollutant levels and likely increases in air emissions in the Salem County airshed from land development over the next 15 years. Any adverse air quality effects from refuge activities would be more than offset by the benefits of maintaining the refuge in natural vegetation.

Prescribed burns that would be conducted under alternative A as one method to control phragmites on 525 acres of tidal marsh could adversely affect air quality and visibility locally. The major pollutants from prescribed burning are particulates (small particles of ash, partly consumed fuel, and liquid droplets), and gases including carbon monoxide, carbon dioxide, hydrocarbons, and small quantities of nitrogen oxides. These would occur to lesser and greater extents based on timing, fuel loading, and whether or not other control measures were also implemented. The primary effect on air quality resulting from burning would be particulate matter emissions that result in visible smoke. Particulate emissions limit visibility, absorb harmful gases, and can aggravate respiratory conditions in sensitive individuals (USFS 1989). Smoke production is directly related to the amount of fuel consumed. Burning technique and efficiency of combustion also influence the amount of smoke produced.

Visibility and clean air are important natural resource values on the refuge, and the protection of these resources would be given full consideration in fire management planning and operations. We would comply with all applicable Federal, State, and local air pollution requirements, as specified within Section 118 of the Clean Air Act, as amended (42 USO 7418). In addition, further guidance can be found in the Fire Management Handbook (USFWS 2010). The plan stipulates required conditions under which prescribed fires would occur, to control its size, to minimize or eliminate impacts on visibility, and to reduce the potential for adding particulates and pollutants into the air created by the burning. All the required conditions are geared to minimize smoke emissions and follow Best Available Control Technology.

The following measures would minimize the impacts to air quality from prescribed fires:

- Burning would only be permitted provided that the existing wind speed, wind direction, and atmospheric conditions do not create nuisance smoke conditions.
- Smoke sensitive areas would be identified and addressed within the Prescribed Fire Plan. The direction of wind vector selected would be such that smoke and other particulate emissions are transported away from sensitive areas.

- Burning would not occur if any government agency has issued an air pollution health advisory, alert, warning, or emergency for the area surrounding the refuge.
- Backing and flanking fires would be used when possible to minimize particulate emissions.
- Coordination with the New Jersey Forest Fire Service would be conducted prior to any prescribed burn operation on the refuge.

Although there would be short-term adverse effects on air quality resulting from our prescribed fire program, the pollution-filtering benefits derived from maintaining these areas in natural vegetation conditions would last in perpetuity. In addition, there is a long-term advantage to reducing fuels under controlled conditions as this strategy lessens the risk of wildfires that produce greater amounts of smoke under uncontrolled conditions.

Carbon emissions from all prescribed burns at the refuge would constitute a negligible increment in greenhouse gas emissions.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits

Benefits to air quality under alternative B are similar to alternative A. There would be continuing benefits to air quality under alternative B from maintaining the natural vegetation on up to 2,293 acres of refuge tidal marsh and up to 2,234 acres of other habitats (based on total acreage within acquisition boundary). Natural vegetation serves to filter air pollutants, and maintaining the refuge lands precludes development and the introduction of attendant sources of pollutant emissions on the land. There could also be some minor additional benefit to carbon sequestration compared to alternative A by allowing an additional 10 acres to become forested (two additional acres of forested uplands and eight additional acres of forested wetlands). Trees serve as long-term carbon “sinks” that reduce atmospheric carbon that causes climate change. Under alternative B, energy efficient practices would be continued and additional practices adapted as feasible.

Adverse Impacts

Ongoing trail maintenance activities would cause negligible short-term, localized effects from dust and vehicle and equipment exhausts. Operation of refuge facilities would contribute negligibly to local stationary source emissions. While emissions from heating and cooling refuge facilities and from visitor and employee travel will contribute to air pollution, those impacts can be reduced through use of energy efficient systems and vehicles. As described in alternative A, we would continue to improve energy efficiency of refuge facilities and vehicles, use biodegradable solvents whenever possible and recycle materials used on the refuge.

Also, permanent and seasonal staffing and numbers of volunteers would increase. Refuge visitation would also increase by up to 20 percent over estimated FY 2009 levels (up to 18,000 visitors) based on our predictions. The associated increased vehicle use by staff, volunteers and visitors, and increased equipment use by staff, under alternative B would contribute some minimal additional but negligible increment to local mobile source air emissions.

There would be increased impacts from use of prescribed fire to control any additional phragmites over above what we control in alternative A. Air quality impacts would be minimized as described in current management in alternative A. By coordinating prescribed burn operations with the State Forest Fire Service, it is anticipated impacts from burning will be minimal.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits

Closing the refuge and eliminating all public uses would reduce the production of air emissions associated with authorized refuge activities. There would continue to be some minimal emissions associated with law enforcement and other staff activities, but these would be lower than current levels.

Adverse Impacts

Under alternative C there would be a greater risk of unauthorized users entering the property and using motorized equipment or vehicles that would produce air emissions, these would not likely exceed current emission levels. Service law enforcement personnel would work with local police departments and State conservation officers to minimize illegal entry and activities on the refuge.

Water Quality and Aquatic Species Impacts

Good water quality is essential to sustaining healthy ecosystems on the refuge and within the Delaware River Basin. Water quality problems in the basin caused by nutrient and sediment loading and chemical pollutants are a concern. These impacts, in turn, may contribute to a decline or loss of aquatic species on the refuge and in the basin.

We evaluated the benefits of actions that would maintain or restore native plant cover in the refuge's tidal wetlands and their role in filtering water pollutants, and to otherwise maintain or improve water quality including:

- phragmites control efforts; and,
- improved water quality monitoring for early problem identification.

We evaluated and compared the impacts of the refuge's management actions with the potential to cause adverse effects to water quality including the:

- use of herbicides to manage invasive species;
- refuge maintenance and construction projects; and,
- changes in recreational use that might lead to contamination with petroleum products.

Water Quality and Aquatic Species Impacts that would not Vary by Alternative

Regardless of the alternative implemented, none of the proposed actions would cause direct adverse impacts to water quality or to aquatic species in the vicinity of the refuge or elsewhere in the Delaware River. Rather, our management practices on the refuge and our projects partnering with local communities and other conservation agencies and organizations would continue to benefit water quality.

Clean water is a critical and essential resource value on the refuge, and its protection would be given full consideration in management

planning and operations. We would comply with all applicable Federal, State, and local water quality requirements, as specified within Sections 305(b) and 319 of the Clean Water Act, 33 U.S.C. § 1251 *et seq,.* as amended. All of the alternatives propose sufficient monitoring to insure that no activities would cause a decline in water quality over the long-term, either on refuge lands or in the larger tidal Delaware River Basin.

Benefits

Our ongoing protection of refuge lands and purchase of additional lands within the acquisition boundary would continue to benefit water quality in the Delaware River Basin by excluding development in this portion of the watershed and sustaining natural, water-filtering vegetation.

Adverse Effects

Regardless of alternative, there would continue to be negligible impacts to refuge water quality from the use of vehicles and equipment by refuge staff and local authority in surveillance and monitoring activities on the refuge property. Trace amounts of petroleum products from vehicles and equipment may be carried into refuge water in rainfall runoff; minimal soil disturbance might also lead to negligible amounts of turbidity in runoff waters. Impacts from use of herbicides would apply only under alternatives A and B.

Alternative A - Continue Current Management (No Action)

Benefits

We would treat up to 525 acres of phragmites-dominated tidal marsh north of Mill Creek with herbicides, prescribed burning, and mowing as funding and staff time allows. There would be benefits to water quality and aquatic species in the tidal marsh from continued efforts to control and eliminate phragmites. There would be continued benefits to wetland habitats and aquatic species from protection of the native plant communities on the refuge uplands which filter runoff from operations on the refuge and adjacent roadways and developed areas.

Adverse Impacts

Under alternative A, there would be a minimal level of risk from herbicides used in invasive plant control contaminating wetland habitats. We would treat up to 525 acres of phragmites-dominated tidal marsh north of Mill Creek with herbicides, prescribed burning, and mowing as funding and staff time allows. In the short term, these treatments would have some minimal potential to affect water quality as discussed below. Any potential risk would be mitigated through proper application procedures, and because we would use only aquatic certified herbicides approved by the Service. Herbicide use has occurred on the refuge for many years without any accidental spills or detectable non-target impacts.

There is a negligible risk that petroleum products used in staff or visitor vehicles, or other chemicals used in operations at the refuge, would adversely affect water quality or harm aquatic species, including shortnose sturgeon, in the tidal marsh or in wetlands within the refuge. Risks from the use of selected low-toxicity chemical herbicides for aquatic weed control are also low because only chemicals approved for aquatic use will be applied, and best management practices will be followed (e.g., applying according to label instructions). Risks from the use of other herbicides for control of terrestrial invasive plants are low

because precautions would be taken to keep them out of any wetlands (see "Contaminants from Routine Operations" below). While refuge management has the potential to affect shortnose sturgeon habitat, we have determined that following best management practices (e.g., for herbicide application) will avoid adverse effects.

While some potential risk exists from the increased visitor activities and numbers that we are predicting, we believe these would be negligible when managed properly. Wildlife observation activities have the highest likelihood of affecting water quality and aquatic biota over the long-term with an increase in the number of vehicles being driven to the refuge. The refuge has only four parking areas located away from tidal and non-tidal water sources for access to the refuge. This minimizes the distribution of potential runoff from vehicle fluids.

Contaminants from Routine Operations

In managing the refuge, we would closely monitor and mitigate all of our routine activities that have some potential to result in chemical contamination of water, either directly through leakage or spills, or indirectly through soil runoff. These include control of weeds and insects around structures, use of chemicals for deicing roads and walkways, and use of soaps and detergents for cleaning vehicles and equipment. Refuge staff will take the following precautions to minimize the potential for the chemicals and petroleum products becoming a water quality problem:

- pouring or mixing of chemicals or petroleum products will be conducted no closer than 25 feet from surface water; and,
- obtain training in spill prevention and spill response.

Our leak and spill prevention and emergency clean-up procedures should ensure that such occurrences are rare and are addressed immediately, with short-term effects limited to the immediate location.

Wetland Invasive Plant Control with Herbicides

The herbicide active ingredient glyphosate and the herbicide active ingredient imazapyr, or other approved herbicides, may be used as one method to control phragmites in the refuge tidal marsh. Both active ingredients are known to have low aquatic toxicity. Herbicides that would be used to control other invasive plant species on the refuge would not be used for aquatic weed control and do not pose a direct risk to water quality or aquatic species. Those terrestrial plant herbicides are reviewed in the Soils section of this chapter. Each application proposal for pesticide use is reviewed and approved in accordance with Service policy.

Glyphosate Effects on Aquatic Species

Glyphosate is quickly adsorbed to suspended soil particles in water, making it rapidly biologically unavailable. There would be some potential for herbicide concentrations in sediments and backwaters to build up over time. The potential depends on the balance of herbicide input and removal from the aquatic system. Herbicide inputs may occur either through direct application, water inflow, or through resuspension and diffusion from the sediment layer. Herbicide removal from the

system may occur through outflow, degradation, volatilization, and settling or diffusion into the underlying sediment (Neitsch et al. 2001).

The rate of herbicide degradation is an important consideration for assessing the effects of a given herbicide on aquatic systems. Glyphosate degrades with a reported half-life in water that ranges from 35 to 70 days depending on the rate of transfer to the sediment layer and testing source (USDA 1997). Based on the relatively short half-life and the large flux in water volume of the tidal marshes, it is not expected that any greater than negligible effects would occur as a result of herbicide treatments.

According to a United States Department of Agriculture Forest Service (Forest Service) risk assessment, glyphosate in less toxic formulations appears to have a very low potential to cause any adverse effects in aquatic animals (USFS 2003). The use of less toxic formulations results in hazard quotients that do not approach a level of concern for any species. Nevertheless, use of glyphosate near bodies of water where sensitive species of fish may be found should be conducted with substantial care to avoid contamination of surface water. The likelihood of direct acute toxic effects on aquatic invertebrates or longer term direct effects on any fish species seems extremely remote based on central estimates of the hazard quotient and unlikely based on upper ranges of the hazard quotient (USFS 2003).

Aquatic plants appear to be somewhat less sensitive to glyphosate than the most sensitive aquatic animals. There is no indication that adverse effects on aquatic plants are plausible. Unlike the case with aquatic animals, even short-term toxicity studies in aquatic plants use endpoints involving changes in population density (USFS 2003).

Imazapyr Effects on Aquatic Species

According to the Forest Service risk assessment, imazapyr appears to have a very low potential to cause any adverse effects in aquatic animals (USFS 2004). Modeled concentrations of imazapyr in ambient water over prolonged periods of time are estimated to be no greater than 0.00045 milligrams/liter and peak concentration of imazapyr associated with runoff or percolation are estimated to be no more than 0.036 milligrams/liter. Monitoring data from a field application similar to those that may be used in Forest Service programs was used as the basis for the peak concentrations that might be expected. All of the hazard quotients for aquatic animals are extremely low. Thus, there is no basis for asserting that effects on non-target aquatic species are plausible. The highest hazard quotient of 0.01 is below the level of concern (LOC) at the typical application rate (LOC=1.0) by a factor of 100 and below the level of concern at the highest application rate (LOC=0.36) by a factor of 36. In the case of an accidental spill of a large amount of imazapyr into a relatively small body of water, mortality in sensitive species of fish is plausible. Actual concentrations in the water after a spill would depend on the amount of compound spilled and the size of the water body into which it is spilled (USDA FS 2004).

Aquatic plants, particularly macrophytes, are much more sensitive than aquatic animals to imazapyr exposure. For aquatic macrophytes, the upper range of the hazard quotient (HQ) for peak concentrations

(HQ=3) is above the level of concern by a factor of three at the typical application rate (LOC=1) and a factor of about eight at the highest application rate (LOC=0.36, 3÷0.36=8.3). Thus, under foreseeable worst case conditions, acute effects could be seen in aquatic macrophytes. Longer term concentrations of imazapyr, however, result in hazard quotients for macrophytes that are well below a level of concern. Hazard quotients for sensitive species of unicellular algae are below a level of concern based either on peak concentration of imazapyr in water (a hazard quotient of 0.02 at the upper range of exposure) as well as longer term concentrations that might be expected (hazard quotient of 0.003 at the upper range of exposure). Thus, at both the typical application rate (LOC=1) and the maximum application rate (LOC=0.36), the upper ranges of the hazard quotients for sensitive species of algae are substantially below the LOC. Accidental spills of large quantities of imazapyr into relatively small bodies of water could lead to much higher concentrations, that is, 3 milligrams/liter to 4 milligrams/liter. After spills of this magnitude, adverse effects on aquatic plants could be anticipated from imazapyr in both macrophytes and sensitive species of algae.

Terrestrial Invasive Plant Control with Herbicides

There is some slight risk that herbicides used for invasive plant control in upland areas of the refuge may reach the tidal marsh and affect water quality or harm aquatic species. Two of the herbicides that are used on the refuge, triclopyr and imazamox are non-toxic or of low toxicity to aquatic species.

Triclopyr is applied in broadcast, spot treatment, cut stump, and basal treatments with backpack and skid sprayers. It cannot be applied to open water or where runoff may occur. It is relatively non-toxic to terrestrial vertebrates and invertebrates, but can be extremely toxic to fish and aquatic invertebrates. For this reason, we use it only as a basal or cut stump application directly on the base of trees and do not use it as a broadcast spray. In soils, it is degraded by photolysis, microbial metabolism, and hydrolysis to the parent compound, triclopyr acid. Triclopyr acid has an intermediate adsorption potential, limiting movement of the acid in the environment. The acid degrades with an average half-life of 30 days. The ester formulation is not water-soluble and can take significantly longer to degrade in water (Tu et al. 2007).

Imazamox, another herbicide used on the refuge, has been found to be relatively non-toxic and minimally hazardous to non-target organisms (EPA, 1997). Plant absorption of imazamox occurs through both the foliage and roots and degrades aerobically in the soil to a non-herbicidal metabolite which is immobile or moderately mobile. Leaching of imazamox in the field studies was very limited. Tests indicate that imazamox is practically non-toxic to avian species, finfish, aquatic invertebrates (EPA 1997).

Research

Aquatic habitats and biota may also be impacted by research. Sampling activities may cause soil compaction and the trampling of vegetation near waterways. The establishment of temporary foot trails and boat trails through aquatic vegetation beds, disruption of bottom sediments, and minor vegetation damage when equipment is temporarily placed is

possible. The removal of vegetation or sediments by core sampling methods may cause increased localized turbidity and disrupt non-target plants and animals. Installation of posts, equipment platforms, collection devices and other research equipment in open water may present a hazard if said items are not adequately marked and/or removed at appropriate times or upon completion of the project. Negligible vehicle emissions, contaminants from vehicle fluids, and very minor erosion from roads may result from vehicle access to the research sites. To minimize the potential for impacts, all research projects will operate under a special use permit with stipulations as warranted to insure planned activities would not impact aquatic resources. As new and innovative techniques become available, we would encourage researchers to use the least intrusive research methodologies and techniques.

In alternative A, we expect up to a 10 percent increase in annual visitation over the next 15 years from current levels based on our predictions and regional recreational trend information. This presents an increased potential for contamination through runoff of petroleum products from roads and parking areas and through litter. Staff would remain observant of risks and would minimize threats where possible. In particular, littering would be an enforcement priority.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits

Compared to alternative A, there would be increased benefits to water quality and aquatic species from protection of the tidal marsh vegetation and native plant communities on the refuge uplands. We also would more actively engage in efforts with refuge partners to address water quality issues in the Delaware River Basin.

Adverse Impacts

Trail maintenance and interpretive panel maintenance or installation activities would increase the potential for sedimentation and turbidity in down gradient marsh and shallow waters from erosion of exposed soils. Because these activities would not be conducted immediately adjacent to the shoreline, the potential for these impacts to occur would be low. Proper site preparation and use of standard mitigation practices such as silt fences would further limit any potential for impacts.

Under alternative B, we would likely increase the acreage treated with herbicides for invasive plant control to the extent that funding and staffing would allow, although we would predict an upper limit of 20 acres/year. As such, there would be an increased risk for herbicides to contaminate aquatic habitats compared to alternative A; however, all the provisions for using best management practices (e.g. application rates and spill prevention) would be in place.

Under alternative B, hunting, wildlife observation and photography would likely increase by up to 20 percent over the next 15 years. Compared to alternative A, this presents a slightly increased potential for contamination of the surrounding shallow water through runoff of petroleum products from roads and parking areas. Similar to alternative A, refuge staff would minimize threats to water quality and actively enforce against littering.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits
Elimination of all public uses would reduce disturbance to wildlife and habitats.

Adverse Impacts
Decreasing the Service's presence at the refuge has a potential to increase poaching, vandalism, and other unauthorized activities. Alternative C would pose a higher risk of short-term adverse impacts to water quality and aquatic species from unauthorized uses that might introduce trash or chemicals into the water. Under alternative C, habitats would not be managed to prevent introduction or expansion of invasive plant species. This may lead to degraded water quality because of overgrown habitats, reduction in protective plant cover on erodible soils, plant detritus reaching water bodies and resulting algal blooms.

Socioeconomic Impacts

We evaluated socioeconomic impacts in terms of the degree to which the proposed Supawna Meadows NWR CCP alternatives might affect the local economy, social structures, or quality of life of the local community, Pennsville, New Jersey.

To evaluate potential benefits or adverse effects to the local economy from each alternative, we considered changes in:

- jobs and income to the local community from changes in refuge staffing;
- jobs and income from jobs in temporary construction work on the refuge;
- expenditures into the local economy from changes in public uses of the refuge;
- expenditures into the economy from changes in hunting; and,
- the availability of opportunities for recreational activities that are in high demand by the public.

Socioeconomic Impacts that would not Vary by Alternative

Regardless of which alternative we select, we would continue to make revenue sharing payments to Salem County. The amount of payment is determined by Congress each year; however, these revenue sharing payments would have only a negligible effect on the county budget.

Alternative A - Continue Current Management (No Action)

Benefits
The local economy would continue to benefit minimally from recreationist expenditures for deer hunting, from wildlife observation and photography, and from visitor participation in interpretation and education programs. These benefits would materialize by way of visitor expenditures for auto fuel, meals, hunting gear, binoculars and other wildlife equipment purchases, though many of these latter purchases would likely be made outside the local area. Non-resident visitors to the refuge would continue to spend some money in Salem County on their way to and from the refuge, thereby benefiting that economy.

We would also continue to contribute to the local economy of communities near the refuge in terms of refuge staff expenditures.

We would also continue to meet a substantive portion of the public's demand for some, though not all, wildlife-oriented recreational

activities, primarily hunting, wildlife observation and photography, interpretation, and to a lesser extent environmental education. Hunting opportunities in particular are becoming harder to find on public lands elsewhere in the region because of widespread and pervasive development and population growth. We would expect that fishing opportunities would continue to be provided on public lands and waters elsewhere on the peninsula. Providing these activities add to the quality of life of the local community and other recreationists and wildlife enthusiasts in the region. These social benefits would continue to positively affect the refuge in terms of sustaining the public goodwill needed to garner long-term support for refuge management efforts.

We would also continue to communicate with the local community on the values of the refuge and opportunities for recreation but on a limited basis due to staffing and funding constraints.

Adverse Impacts

No substantive management changes are planned and no staffing increases are proposed under this alternative. Thus, no appreciable changes to the refuge's contribution to the local economy would occur. We would likely see a minimal increase in public uses of the refuge, which we predict could be up to a 5 to 10 percent increase, which would minimally increase expenditures by those users in the local economy.

We would fall short of meeting some substantial portion of the public's increasing demands for wildlife-dependent recreational opportunities we would not be able to provide under alternative A. We could not provide the additional environmental education, staff-led interpretation, or wildlife photography opportunities. We would not provide any expansion in hunting opportunities to offset the diminishing availability of those opportunities elsewhere in the area.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits

Enhanced participation in partnering to protect water quality in the Delaware River Basin would help to better sustain migrating and wintering waterfowl and contribute to successful waterfowl hunting as well as wildlife observation. Our actions on the refuge to improve wetland habitats would increase the use of the refuge by geese and ducks. This too would contribute to increased economic benefits of sustained waterfowl populations in the Basin. There would also be increased observation opportunities on and off the refuge benefitting the local economy in terms of expenditures for food, lodging, transportation and equipment.

Adding refuge staff will minimally increase benefits to the local economy in jobs, income, and demand depending on where the staff members chose to live. Work to upgrade refuge management infrastructure would also add expenditures to the local economy for labor, materials, and services.

Expanding refuge programs would increase public use and public involvement in refuge activities thereby increasing their expenditures and the resulting jobs and income in the local economy. Improved refuge programs would also attract more visitors. We estimate up to a 20 percent increase in visitation over current levels. The local economy

would experience minimally increased benefits in terms of retail expenditures for purchasing auto fuel and related expenses in the local economy. These increases would be negligible compared to the overall expenditures on these factors in the local economy.

Expanded recreational programs would increase the appeal of the refuge to the public in terms of further enhancing their quality of life, and thereby add to the positive feedback needed to sustain refuge programs in the longer term. Additional hunting opportunities here would help offset the loss of those opportunities at other locations. Expanded interpretive and educational programs would provide public benefits in terms of better understanding of the values of the refuge resources and the Refuge System in general. We would also be in a better position with additional staffing and funding to communicate with the community about the values of the refuge and opportunities for recreation under this alternative.

Adverse Impacts
We would expect an increase in visitation under alternative B that would constitute an additional burden in terms of local expenditures for road maintenance, traffic enforcement, and related infrastructure maintenance and law enforcement expenditures from county tax revenues. These minimal incremental expenditures would be more than offset by refuge revenue sharing and local economic benefits described above.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits
As noted above, refuge revenue sharing would continue to contribute to the Salem County economy.

Adverse Impacts
The refuge would offer no benefits to the local economy in terms of recreational expenditures or expenditures on staff, equipment or materials, except for what minimal amount may be spent on infrastructure maintenance.

Refuge-Specific Impacts

Soil Impacts

Soils are the structural matrix and nutrient source for plant productivity and must be protected to sustain the variety of upland and wetland habitats that would meet refuge habitat and species management goals. Overall, the soils of the refuge are productive and in good condition, with little or no compaction or contamination problems. However, certain areas, particularly the shorelines, are experiencing erosion and are susceptible to disturbance. We would continue to manage these areas to minimize human disturbance and to mitigate for natural processes that result in loss of valuable habitats, particularly at bald eagle and heron nesting sites.

We evaluated and compared the management actions proposed for each of the refuge CCP alternatives on the basis of their potential to benefit or adversely affect refuge soils.

We considered the benefits from:

- protection of soils from conversion to impervious surfaces or restoration of disturbed sites; and,
- reduction of erosion along interior water courses and refuge tidal areas and shore.

We considered the potential adverse impacts to soils from:

- habitat management activities to benefit eagles, great blue herons, waterfowl and other migratory birds;
- realignment and construction of interpretive trails and panels; and,
- refuge visitor activities.

Soil Impacts that would not Vary by Alternative

The soils of the refuge are in good condition and would remain so under all alternatives. Regardless of which CCP alternative we select, the refuge protective vegetative cover that minimizes soil losses through erosion would remain.

Alternative A - Continue Current Management (No Action)

Benefits

We would continue to prohibit recreational activities, such as ATV's or mountain biking, that would damage soils on the refuge. Hiking trails, wildlife observation areas, parking areas, and other high-use areas would continue to be well maintained to keep soil effects to a minimum. Any erosion problems will be noted during routine refuge monitoring and corrected as soon as feasible.

There would be no loss or damage to soils on the upland portions of the refuge under alternative A. Maintaining the naturally vegetated portions of the refuge would continue to protect the soils in those areas. We would continue to use best management practices in all management activities that might affect refuge soils to ensure that we maintain soil productivity. Site conditions including soil composition, condition and hydrology will be the ultimate determinant of the management potential for any particular site on the refuge. No site would be managed in a manner inconsistent with its recognized potential.

In general, no soil from off-site will be brought onto the refuge unless bringing in clean soil is determined to be less disturbing to refuge resources than using on-site soils.

Adverse Impacts

There is a potential for adverse impacts from the management tools we propose to use at varying scales under all alternatives to help maintain, enhance, or create wildlife habitat. These tools include replanting with native species, mowing, and use of herbicides. Soils in the upland areas could be affected by trail, parking lot or other maintenance or construction projects.

We anticipate minimal adverse impacts on refuge soils from continuing current refuge management using best management practices. Refuge staff would continue to mow the grassland to maintain the area, but would conduct that mowing under conditions that minimize compaction and soil displacement, for example, avoiding excessively wet periods.

Herbicides
All chemicals used on the refuge would first be approved through the Pesticide Use Proposal process. The refuge manager, Regional Pest Management Coordinator, and National Pest Management Coordinator have approval authority, depending on the chemical, application procedure, and whether the application is in a wetland or upland location. In all cases, herbicides will be applied according to label directions and best management practices will be followed. The following four herbicides are the most likely to be used on the refuge, and so have been analyzed in more detail. Their potential effects on soils and water are derived mainly from the products' labels and material safety data sheets, except where noted.

Glyphosate (Roundup, Rodeo): Applied in broadcast or spot treatment with backpacks or skid sprayer. It is degraded by microbial action in both soil and water, and degrades in soil with an estimated half-life of 30 days. It is highly soluble, but adsorbs rapidly and tightly to soil (USFS 2003). Numerous soil bacteria, fungi, invertebrates, and other microorganisms have been studied for effects of glyphosate application. There is nothing to suggest glyphosate would adversely affect soil organisms. Glyphosate is readily metabolized by soil microorganisms and some species can use glyphosate as a sole source of carbon (SERA 2003). Glyphosate degrades in soil, with an estimated half-life of 30 days. Glyphosate is highly soluble, but adsorbs rapidly and tightly to soil. Glyphosate has low leaching potential because it binds so tightly to soil. Modeling results indicate glyphosate runoff is highest in loam soils with peaks after the first rainfall (SERA 2003).

Imazapyr: There are no studies on the effects of imazapyr on soil invertebrates and incomplete information on the effects on soil microorganisms. One study indicates cellulose decomposition, a function of soil microorganisms, can be decreased by soil concentrations higher than concentrations expected from Forest Service applications. There is no basis for asserting adverse effects to soil microorganisms (SERA 2004b). Degradation rates are highly dependent on microbial action. Anaerobic conditions slow degradation. Imazapyr is weakly bound to soil, but adsorption increases with lower pH and increasing clay and organic matter content. Adsorption increases with time as soil dries and is reversible. Field studies indicate that imazapyr remains in the top 20 inches of soil. Studies do not indicate any potential for imazapyr to move with surface water. In forest field studies, imazapyr did not run off and there was no evidence of lateral movement. Modeling results indicate imazapyr runoff is highest in clay and loam soils with peaks after the first rainfall. Imazapyr percolation is highest in sandy soils (SERA 2004b).

Triclopyr (Garlon): The five commercial formulations of triclopyr contain one of two forms of triclopyr; BEE (butoxyethyl ester) or TEA (triethylamine). Triclopyr BEE is much more toxic to aquatic organisms than triclopyr TEA. A breakdown product, TCP (3,5,6-trichloro-2-pyridinol), is more toxic than either form of triclopyr. Site-specific

cumulative effects analysis buffer determinations need to consider the form of triclopyr used and the proximity of any aquatic triclopyr applications, as well as toxicity to aquatic organisms (SERA 2010). Triclopyr has not been studied on soil invertebrates. Soil fungi growth was inhibited at concentrations two to five times higher than concentrations expected from Forest Service application rates. Triclopyr has an average half-life in soil of 46 days, while TCP has an average half-life in soil of 70 days. Warmer temperatures decrease the time to degrade triclopyr. Soil adsorption is increased as organic material increases and decreased as pH increases. Triclopyr is weakly adsorbed to soil, though adsorption varies with organic matter and clay content. Both light and microbes degrade triclopyr (SERA 2010)

Imazamox (Raptor Herbicide): Plant absorption of imazamox occurs through both the foliage and roots and degrades aerobically in the soil to a non-herbicidal metabolite which is immobile or moderately mobile. Leaching of imazamox in the field studies was very limited. (EPA 1997). Imazamox is hydrolytically stable at higher pH. Photodegradation is rapid in water (half-life of 6.8 hours) but slow on soil. Volatilization is not significant (EPA, 1997).

Public Uses

The hunt program for deer under alternative A has the potential to cause some soil compaction since off-trail foot travel occurs. However, with a limited number of hunters dispersed across the refuge during the archery season, impacts would be minimal based on our observations of past hunting impacts. Vehicles would continue to be confined to existing refuge roads and parking lots to minimize impacts outside of that developed footprint.

Visitation under alternative A is expected to increase so visitor activities that might impact soils, such as hiking off designated trails would pose a minimally higher concern than at present. We would continue to monitor public use areas to determine if soil erosion may be a problem and will take steps to mitigate the problem if it occurs.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits

The expanded refuge management program and on-site staffing under alternative B would provide greater ability for refuge staff to note and identify potential impacts to soils and to more quickly respond to implement whatever remedial actions are necessary.

Adverse Impacts

We would continue to follow best management practices to reduce those risks to soils. We would use management methods and equipment that may lead to localized soil compaction and short term soil losses from erosion but would employ best management practices to ensure that no long-term major soil problems, such as unchecked erosion, result.

Increased visitation under alternative B would increase the likelihood of disturbance and compaction of soils in areas of the refuge where visitation is allowed. It would also increase the likelihood of unauthorized entry to areas where visitation is not allowed. Design features that factor in the potential for soils effects and monitoring of these more intensive public use areas, and effective signage and

brochures to reduce entry to unauthorized areas would mitigate against any the potential for long-term impacts.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits
Elimination of all habitat management activities and closure of the refuge to public uses may decrease human-caused soils impacts because of a decrease in visitation.

Adverse Impacts
Failure to actively manage refuge habitats would allow localized soil impacts due to environmental factors to grow larger and cause potentially greater impacts than would likely be the case under alternatives A or B. Decreasing the Service's presence at the refuge has a potential to increase poaching, vandalism, and other unauthorized activities which may lead to additional soil erosion, compaction, and disturbance, particularly if unauthorized activities occur off established trails and parking areas.

Tidal Marsh Impacts

The Service currently manages a total of 1,931 tidal marsh acres comprising 493 acres of native tidal marsh and 1,438 acres of phragmites-dominated tidal marsh. We evaluated the benefits and adverse impacts of the management actions under the three CCP alternatives on these tidal wetlands. We considered the benefits from:

- protecting and restoring tidal marsh habitat; and,
- treating invasive species.

We considered the potential adverse impacts of:

- wetlands habitat management activities;
- upland habitat management activities;
- visitor facility, trail construction and maintenance; and,
- public refuge uses.

Freshwater Marsh Impacts That Would Not Vary by Alternative

Supawna Meadows NWR tidal marsh supports breeding bald eagles, wading birds and marsh birds. It provides protective cover for migrating and wintering waterfowl, shorebirds, and other species of conservation concern, and serves as reproductive habitat for fish and other aquatic species in the tidal Delaware River. Regardless of the management alternative we select, we would continue to conserve these wetlands and the wildlife they support as one of our highest priorities. Regardless of alternative, we would acquire and protect as much as 362 additional tidal marsh acres from within our acquisition boundary.

Alternative A - Continue Current Management (No Action)

Benefits
Protection of up to 2,293 acres of tidal marsh under alternative A would conserve the wildlife habitat values described above, though no major improvements in management and protection of these wetland areas would be feasible under alternative A. We would continue our efforts to control phragmites and would treat up to 525 acres of phragmites - dominated tidal marsh north of Mill Creek with herbicides, prescribed burning, and mowing as funding and staff time allows.

Adverse Impacts
There would be negligible direct impacts to the tidal marsh currently managed by the Service on the refuge under alternative A. There are currently no plans to modify this habitat, whether directly through a restoration or habitat improvement project, or indirectly through other Service projects.

The marsh areas may be at some minimal risk of being indirectly affected by Service activities in adjacent upland areas that drain into them from leaks or spill accidents involving chemicals (e.g., herbicides) or petroleum products used in refuge management operations. Our leak and spill prevention and emergency clean-up procedures should ensure that such occurrences are rare and are addressed immediately, with short-term effects limited to the immediate location.

Under alternative A, there would be a minimal level of risk of herbicide used in invasive plant control contaminating wetland habitats. We would treat up to 525 acres of phragmites -dominated tidal marsh north of Mill Creek with herbicides, prescribed burning, and mowing as funding and staff time allows. In the short term, these treatments would have some minimal potential to affect water quality as discussed in the "Water Quality and Aquatic Species" section. Any potential risk would be mitigated through proper application procedures, and because we would use only aquatic certified herbicides approved by the Regional Contaminants Coordinator. Herbicide use has occurred on the refuge for many years without any accidental spills or detectable non-target impacts.

Public users of the tidal marsh, including waterfowl hunters and persons fishing or crabbing could damage marsh grasses or disturb nesting or foraging marsh birds or otherwise degrade these areas, for example through deposit of used fishing line, tackle, or other trash or by disturbance to bank areas and creation of turbidity. Refuge signage, flyers, and other public information materials would continue to be used to ensure that the public is aware of these issues and does not engage in harmful activities.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits
We would increase benefits to the tidal marsh habitat and marsh-dependent species under alternative B as compared to alternative A. We would implement a more comprehensive program of treatment of phragmites affecting the marsh by developing an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. Our objective is to achieve 70-80 percent native vegetation in the tidal marsh at the end of the CCP's 15-year cycle.

Water quality issues would be addressed as they arise in the Delaware River through our partnering work with State and Federal agencies.

Adverse Impacts
As in alternative A, there would be negligible direct impacts to the tidal marsh currently managed by the Service on the refuge under alternative B. There would be no alteration of these habitats by cutting, filling, or other means to achieve any other Service goals.

The marsh areas may still be at some minimal risk of indirect effects from Service activities in adjacent upland areas that drain into them from leaks or spill accidents involving chemicals or petroleum products used in refuge management operations. Our leak and spill prevention and emergency clean-up procedures should ensure that such occurrences are rare and are addressed immediately, with short-term effects limited to the immediate location.

With a more comprehensive control program, there may be a slightly higher risk to native marsh vegetation from increased use of herbicides, as compared to use under alternative A, to control invasive plants in the marsh or to control other invasive plants in nearby upland areas. We would use only approved herbicides in the marsh if necessary to control invasive plants that pose a threat to displace native marsh vegetation. These herbicides are generally non-toxic to fish and other aquatic species and would be used only with strict precautions taken to minimize the potential to affect non-target native plants. See the section in this chapter on "Water Quality and Aquatic Species" for additional information.

Compared to alternative A, we expect increased visitation under alternative B. This would likely result in an increased potential for impacts to the marsh from users of adjacent trails who may leave trash that could get into the marsh. Visitors also might go off-trail and enter marsh areas from trail access points. We would continue to maintain signage and monitor impacts in restored areas to insure adverse impacts are kept to a minimum area.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits

Closing the refuge and eliminating public uses under alternative C is expected to decrease disturbance to wildlife associated with public uses and potential littering of the marsh.

Adverse Impacts

Eliminating the tidal marsh management program would ensure that encroachment of phragmites and loss of native marsh vegetation continues unimpeded. Decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in tidal marsh areas. Unauthorized users may degrade the tidal marsh habitat by littering, chemical contamination, causing soil erosion which may lead to increased levels of sediment in tidal marsh waters, and possibly other negative effects.

Non-tidal Wetland and Successional Habitat Impacts

There is a limited acreage of non-tidal scrub/shrub and herbaceous wetlands as well as 38 acres of scrub/shrub uplands that support a variety of breeding birds and other native fauna. Although our management efforts at Supawna Meadows NWR are focused primarily on the tidal marsh, these secondary habitats support a diversity of wildlife species and contribute substantively to the values of the refuge.

Non-Tidal Wetland Impacts That Would Not

Continued protection of the non-tidal wetlands and upland scrub/shrub habitat would benefit a variety of birds and other wildlife in terms of

Vary by Alternative

providing habitat elements specific to their life cycle needs. We would purchase up to 36 additional herbaceous wetland acres, non-tidal scrub/shrub wetland acres and upland scrub/shrub acres combined within the acquisition boundary to add to the current 136 acres.

Alternative A - Continue Current Management (No Action)

Benefits
Same as "Impacts that would not Vary by Alternative."

Adverse Impacts
An increase in refuge visitation would minimally elevate the potential for impacts to the refuge. The potential for disturbance from refuge maintenance projects and staff using motor vehicles to monitor these habitats would be negligible.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Benefits
Increasing our monitoring of on-site and off-site threats to water quality and vegetation, coupled with invasive plant control and greater vigilance of visitor impacts, would increase protection of the health and integrity of these refuge areas. This, in turn, would directly benefit many species who utilize these valuable habitat areas year round on the refuge.

Adverse Impacts
An increase in refuge visitation because of expanded public use programs under alternative B would minimally elevate the potential for impacts to these habitats. Even with an anticipated increase in staffing, the potential for disturbance from management and maintenance projects and from staff using motor vehicles in support of this work would be negligible. Management and maintenance of these habitats may include the use of physical, mechanical and/or chemical actions. The impacts from these actions on the non-tidal wetlands and upland scrub/shrub habitats would be similar as described for previously identified habitats.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits
Eliminating public uses of the refuge would eliminate the potential for any disturbance to these habitats associated with authorized public uses. Decreased management and oversight by refuge staff would also decrease disturbance.

Adverse Impacts
Closing the refuge and eliminating habitat management could lead to degradation or ultimately loss of these habitats to invasive plants or natural succession. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing wildlife using these habitats.

Grassland Habitat Impacts

The 122 acres of grassland habitat currently under ownership on the refuge provides foraging and migratory habitat for birds, as well as habitat for a variety of other native wildlife and invertebrates. The small size and dispersed configuration of grassland habitat patches, however, limits their benefits to breeding grassland birds. We evaluated

the benefits and adverse impacts of the management actions under the three CCP alternatives on grassland habitat by considering the benefits from:

- maintenance and restoration of grassland habitat; and,
- allowing natural succession to occur on existing grassland areas.

We considered the potential for adverse impacts from:

- mowing and prescribed fire used to maintain grasslands; and,
- allowing natural succession to eliminate grassland or early successional habitats.

Grassland Habitat Impacts That Would Not Vary by Alternative

Grassland habitat would benefit in the short term under all alternatives by the protection afforded by Service ownership because we would continue to acquire up to 409 acres of additional grassland from willing sellers as funding permits. Otherwise, because under alternative C we propose to eliminate management of grasslands and all other habitats on the refuge, there would be no other benefits or adverse impacts to grasslands that would not vary by alternative.

Alternative A - Continue Current Management (No Action)

Benefits

All refuge lands would continue to be afforded protection from development and managed with a mandate to promote wildlife habitat. Continuing to manage 122 acres of grasslands on the refuge and acquiring as much as 409 additional grassland acres would maintain or minimally enhance the refuge's minor role in maintaining grassland habitat in the mid-Atlantic ecoregion and also help to sustain the overall biodiversity this habitat type represents on the refuge.

Adverse Impacts

Because of the more intensive management methods required to maintain grasslands, there would continue to be some minimal level of risk of damage to grassland soils and vegetation involved with use of mowing, burning, or herbicides to manage the habitat. Best management practices would continue to be followed for these methods. The potential for impacts to soils are discussed in a previous section. Mowing and the use of other mechanized equipment or vehicles on grassland, for example, herbicide spray equipment, would be allowed only when soil moisture conditions would not result in extensive compaction or rutting. We would adhere assiduously to detailed burn plans to ensure that prescribed fire risks remain low. Herbicides would be used only under strict application precautions to ensure that only the targeted plants are affected.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Benefits

Benefits to grasslands would increase under alternative B. We would manage up to 531 acres of grassland habitat to benefit northern harriers, short-eared owls, barn owls and other raptors, wintering grassland birds, and other grassland-dependent species of conservation concern. By consolidating grassland management to a limited number of larger fields (by allowing smaller fields to revert to scrub/shrub or forest habitat), we would focus our management effort on the larger fields that are known to provide higher quality habitat. We would control Canada thistle, autumn olive and other invasive plants to establish 70-80

percent cover of native species, although the number of acres treated will depend on funding and management capability. This increased overall management would provide substantial additional benefits to foraging and migrating birds, butterflies, and other native wildlife that use this habitat type. Benefits would also be realized by refuge visitors since grasslands typically afford quality viewing areas.

Adverse Impacts

Best management practices would be followed for prescribed burns and mowing that could impact grassland soils and cause localized habitat damage. Native species would be used to restore any damaged areas. Long-term management to promote the habitat would offset any such localized short-term adverse effects.

Increased visitation might result in increased trampling or localized impact areas affecting grassland health and vigor. However, we do not expect any major increase in public use of the grassland areas. We would continue to advise people to use our designated trails to minimize those impacts and monitor for effects on grasslands.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits

All impacts caused by grassland maintenance practices as described under alternatives A and B would be eliminated. Eliminating public uses of the refuge would eliminate the potential for any disturbance to these habitats associated with authorized use.

Adverse Impacts

Grassland is a disturbance-dependent habitat on the refuge. Active management is necessary to maintain it. Under alternative C, grassland habitat would largely disappear on the refuge within the 15 year planning horizon. Closing the refuge and eliminating habitat management would lead to degradation and ultimately loss of this habitat to invasive plants and natural succession. Without management, the grasslands would shift to scrub/shrub then forest. Some small grassland patches may occur on the refuge as a result of natural disturbances. With the loss of grasslands, the existing biodiversity of the refuge would be diminished, although this is difficult to quantify. Further, the refuge's minimal contribution to sustaining grassland habitats in the ecoregion would also be eliminated.

In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing wildlife using these habitats.

Forest Habitat Impacts

The 240 acres of upland forested habitats on the refuge provide a diversity of habitat components to support bald eagles, colonial nesting birds, forest interior breeding birds, neo-tropical migrants, and other wildlife. We evaluated the benefits and adverse impacts of the management actions under the three alternatives on forest habitats.

We considered the benefits from:

- management actions to maintain forest health such as thinning;
- fuels management; and,
- controlling invasive plants.

We considered the potential for adverse impacts from:

- potential for herbicides to affect forest vegetation; and,
- potential for invasive plants to continue to adversely affect forest vegetation.

Forest Habitat Impacts That Would Not Vary by Alternative

Under all alternatives, we would continue efforts to acquire the remaining 174 acres of upland forested habitat within the current refuge acquisition boundary. Wherever practicable, we would replace non-native plant species with native forest species capable of growing under the current site conditions to restore the ecological integrity and diversity of the refuge.

Alternative A - Continue Current Management (No Action)

Also, see Public Use Section (pg 4-23) for additional information on benefits and adverse effects on this resource.

Benefits

Under alternative A, benefits would be limited to protection of refuge lands. Priorities would continue to be maintaining forest cover. Protection of the existing 240 acres of forested upland under this alternative, and a potential 174 additional forested upland acres within the current acquisition boundary, would benefit the habitat through long-term Service management and conservation. Wherever practicable, we would replace non-native plant species with native forest species capable of growing under the current site conditions.

As adjacent lands are developed for residential or commercial use, the concentrations of deer can rise on less developed lands, such as the refuge. Overabundance of deer can produce long-term negative effects such as potential disease epizootics (Demarais et al. 2000), browsing pressure on landscapes, vegetation, and crops, and severe habitat degradation (Cypher and Cypher 1988). Cumulative effects of grazing over successive years may result in reduced plant reproduction, growth (Augustine and Frelich 1998), and height (Anderson 1994), which exposes sensitive plants and places them at risk of complete destruction (Augustine and Frelich 1998). When deer become overabundant they browse forest understory, including emerging seedlings of canopy tree species, thereby reducing forest regeneration. When deer populations become excessive, they can also compromise human health and safety. An increase in vehicle-deer collisions or the incidence of Lyme disease raises community concerns. Maintaining the refuge deer hunt would continue to mitigate the potential for the adverse effects of diminished forest regeneration on long-term forest health.

Adverse Impacts

There would continue to be some minimal level of risk of loss or damage to forest vegetation involved with the use of the habitat management methods such as replanting with native species, mowing, and use of

herbicides. In the long-term, however, these methods would maintain or improve forest habitat.

Because of its toxicity to trees, imazapyr would not be used to control phragmites or other invasive plant species where there is a risk of trees being inadvertently sprayed. Herbicides would be used only under strict application precautions to ensure that only the targeted plants are affected.

Routine maintenance of roads and trails may result in the loss of individual trees, but we do not expect the number of trees felled would affect the quality or diversity of forest habitat present.

Although the deer hunt is important for reducing vegetation browse, deer hunting could have long-term impacts because hunters move through major portions of the refuge, potentially introducing or spreading invasive species. In fact, all visitors have the potential to cause these types of impacts. Once established, invasive plants can out-compete native plants, thereby altering habitats and impacting wildlife. The threat of invasive plant establishment will always be an issue and will require annual monitoring, treatment and hunter and visitor education.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Benefits

Compared to alternative A, we would protect an additional two acres of upland forest and would more actively manage the forest habitat. The active program of forest health inventory and implementation of management practices proposed under alternative B would provide the most beneficial impacts to refuge forest habitat. Through best management forest practices, fuel reductions, and invasive plant control, we would enhance the health and vigor of the forest, including thinned or newly established stands. Over the long-term, forest habitats would result in less risk of an environmental impact from cultural and habitat management practices compared to more intensely managed habitats like grasslands, since less intervention is necessary to sustain them. We would maintain or enhance deer management through our public deer hunting program and by other means, if necessary to assure forest health objectives are met.

Adverse Impacts

There would continue to be some minimal level of risk of loss or damage to forest vegetation involved with use of the habitat management methods described above to reduce forest fuel loads or invasive plants or to maintain the grassland site. Because of its toxicity to trees, imazapyr would not be used to control phragmites or other invasive plant species where there is a risk of trees being inadvertently sprayed. Herbicides would be used only under strict application precautions to ensure that only the targeted plants are affected.

Routine maintenance of roads and trails may result in the loss of individual trees, but we do not expect the number of trees felled would affect the quality or diversity of forest habitat present. Trail improvements and creation of additional trails would have negligible impacts. All work would be conducted in a manner to minimize loss or damage to trees along the trails.

Alternative C. Cease Management and Close Refuge to Public Uses

Benefits

Under alternative C, benefits would be limited to protection of refuge lands. Priorities would continue to be maintaining forest cover. Protection of the existing 242 acres of forested upland habitat and an additional 174 forested upland acres within the current acquisition boundary would benefit habitat through long-term Service conservation. No active management would occur, so there would be no risk to this habitat associated with herbicide use, or other habitat management methods. Eliminating public uses of the refuge would eliminate the potential for any disturbance to these habitats associated with authorized use.

Adverse Impacts

Closing the refuge and eliminating habitat management would allow the unchecked growth and infiltration of invasive species, degrading this habitat. Discontinuing the deer hunt program would likely result in an increase in the refuge deer population. When deer become overabundant they browse forest understory, including emerging seedlings of canopy tree species, thereby reducing forest regeneration, and affecting long-term forest health. The refuge would also serve as a safe haven for local deer during hunting season, potentially resulting in lower deer harvest in the surrounding area and higher deer populations overall.

In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing wildlife using these habitats.

Waterbird and Waterfowl Impacts

We evaluated the management actions we propose for the alternatives for their potential to benefit waterbirds, including marsh birds, shorebirds, wading birds, and waterfowl or their habitat. This evaluation included potential benefits and adverse effects to birds that might be nesting, birds from Pea Patch Island foraging, and birds roosting on the refuge.

The benefits we considered included:

- protection and restoration efforts in the refuge tidal marsh;
- protection, maintenance and improvement of the refuge impoundments; and,
- constraints on public uses of the refuge tidal marsh and impoundments.

We evaluated the potential adverse effects on these birds from the management alternatives, including impacts from:

- construction and maintenance projects that might affect species habitats; and,
- public activities on the refuge that might damage habitat or disturb wildlife.

Waterbird and Waterfowl Impacts That Would Not Vary by Alternative

Benefits

Regardless of which alternative we select, protection of the refuge marshes and impoundments will continue to benefit marsh birds, shorebirds, wading birds and migratory and wintering waterfowl. These areas will remain undeveloped and in some mix of native vegetation and phragmites in the long-term, thereby sustaining a reserve of migratory and wintering habitats in the tidal Delaware River Basin that otherwise might be developed.

Adverse Impacts

Water quality affects the aquatic invertebrates, plants, and fish on which wintering and migrating waterfowl depend. The water quality of the tidal Delaware River will continue to reflect the level of point and non-point source pollution and the effectiveness of pollution controls in the different communities of the watershed overall. We will continue to partner with agencies that address water pollution but we would not directly control any major upstream sources.

Alternative A - Continue Current Management (No Action)

Benefits

Continued protection of the tidal marsh, acquisition of additional tidal marsh acreage and treatment of up to 525 acres of phragmites-dominated marsh under alternative A would benefit marsh birds, shorebirds, wading birds, and waterfowl by ensuring these habitats exist for the long-term. Efforts to control invasive species in the freshwater wetland areas should benefit waterbirds and waterfowl by encouraging native marsh species and improving habitat quality.

Adverse Impacts

Under alternative A, removal of invasive plants may cause minor, short-term water quality impacts such as increased turbidity and elevated nutrient levels. These effects would not likely add measurably to general turbidity and nutrient levels in the tidal Delaware River.

Visitors using the refuge for consumptive and non-consumptive wildlife related uses may cause some minor level of disturbance of these birds at locations on the refuge where members of the public are present near habitats used by the birds.

According to a study at the J.N. “Ding” Darling NWR in Florida, resident waterbids are less sensitive to human disturbances than migrant birds; however, sensitivity varies among species and individuals within species. Herons and bitterns were quite tolerant of people, but were disturbed as they took terrestrial prey. In addition, great blue herons, tricolored herons, great egrets, and little blue herons were observed to be disturbed to the point of flight more than other birds (Klein 1989). The need of these birds to move frequently while feeding may disrupt interspecific and intraspecific relationships (Kushlan 1978). The avoidance response in birds increased as the level of human disturbance increased (Klein 1993), and vehicular traffic is less disruptive than out of vehicle activity (Vaske 1983, Freddy et al. 1986, Klein 1993). Wading birds have been found to be extremely sensitive to disturbance (Batten 1977; and Burger 1981); whereas sandpipers (Klein 1989) and various gull species (Burger 1981) appear to be insensitive to human disturbance. Shorebirds use exposed mudflats and would mostly be feeding during low tide or on edges of the

creeks. Visitors engaged in public use activities on the open water would mostly be using the refuge during high tide when they can boat into the creeks, thus limiting disturbance to shorebirds.

Boating causes disturbance to waterfowl and would continue to be prohibited on freshwater areas within the refuge. Boating is allowed on tidal creeks, but there are no boat launching facilities located on the refuge. Recreational fishing opportunities along the shoreline may cause temporary disturbances such as the flushing of feeding, resting, or nesting birds, especially waterfowl, and other wildlife species. Many waterfowl species avoid disturbance by feeding at night instead of during the day (McNeal et al. 1992). Migratory dabbling ducks appear to be the most sensitive to disturbance and migrant ducks to be more sensitive when they first arrived in the late fall than later in winter (Klein 1989). This disturbance may displace individual animals to other parts of the refuge; however, this disturbance would be limited in scope due to the limited number of areas accessible to anglers. Most visitors understand the protection afforded by the refuge, and the Service will continue to provide educational materials and adequate signage. These instances should remain rare. We have not observed that the level of visitor activity would to any degree constitute a substantive adverse impact to species survival or reproduction. Through refuge literature and signage, people are directed to stay on trails and to be sensitive to disturbing wildlife. Outreach, education, and if necessary, law enforcement, will continue to be tools to insure significant impacts do not occur.

Mute swans are invasive species that often out-compete native waterfowl for forage and nesting areas. Under alternatives A and B, mute swans would be controlled with a goal of zero productivity to reduce, if not eliminate, their threat to native waterfowl.

An increase in refuge visitation would minimally elevate the potential for impacts to the refuge freshwater marsh and disturbance to marsh birds, shorebirds, wading birds, and waterfowl. The potential for disturbance from refuge maintenance projects and staff using motor vehicles to monitor the marsh would be negligible.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Benefits

Increasing our monitoring of on-site and off-site threats to water quality and vegetation, coupled with expanded phragmites control and greater vigilance of visitor impacts (e.g., litter control) would increase protection of the health and integrity of these refuge tidal wetlands. This, in turn, would directly benefit many species of marsh birds, shorebirds, wading birds, and waterfowl. To minimize impacts to waterbirds, fishing and waterfowl hunting areas would be collocated within the refuge's tidal marsh.

Adverse Impacts

An increase in refuge visitation because of expanded public use programs under alternative B would minimally elevate the potential for impacts to the refuge tidal marsh and disturbance to marsh birds, shorebirds, wading birds, and waterfowl. The potential for disturbance from refuge maintenance projects and staff using boats to monitor the marsh would be negligible.

Alternative C.- Cease Management and Close Refuge to Public Uses

Benefits
Elimination of public uses on the refuge would decrease disturbance to waterbirds and waterfowl associated with these uses.

Adverse Impacts
Eliminating habitat management, specifically eliminating phragmites control efforts, would allow expansion of this and other invasive plants in the tidal marsh, supplanting the native tidal vegetation. This would constitute a degradation of the habitat which would gradually diminish its value as nesting, foraging, and winter cover for the birds. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in wetland habitats used by these species. Unauthorized users may have negative effects on these species by illegal harvesting, littering, or disturbing feeding, resting, or nesting behavior.

Breeding, Migrating, and Wintering Bird Impacts

The refuge is an important site for breeding, migrating and wintering birds which use various habitats throughout the refuge. Many of these species are listed as birds of conservation concern by the Service and/or the New Jersey Division of Fish and Wildlife (NJDFW).

Bird Impacts That Would Not Vary by Alternative

Regardless of which alternative we select, the refuge would continue to provide a natural landscape with habitats that support a diversity of bird species. Continued protection of the 3,247 acres of the refuge's habitats under all alternatives would benefit birds using the refuge to breed, winter, or migrate through.

Alternative A - Continue Current Management (No Action)

Benefits
Under alternative A, we would continue to benefit refuge bird species by managing for and ensuring protection of the current 3,247 acres owned by the refuge and protecting an additional 1,280 acres of habitat in the long-term.

Adverse Impacts
There would be short-term localized impacts to bird habitat and temporary displacement of birds from management practices such as mowing or herbicide treatments for invasive plant control. Trail maintenance activities would also cause negligible short-term, localized effects from disturbance. Impacts from visitor disturbance may increase minimally due to a general increase in refuge visitation.

Breeding, wintering, and migrating birds may be adversely affected by management methods, such as mowing or use of herbicides to control invasive plants. These methods would at least temporarily displace birds from treated locations and if any active nests are present they could be damaged or destroyed. The impacts would be minor, highly localized, and short-term, with no threats to bird populations in terms of adult mortality or breeding success. Treated habitats would be improved in the long-term and this would benefit bird populations.

The refuge priority public uses - hunting, fishing, wildlife observation, photography, interpretation, and environmental education - may cause minor negative impacts on the refuge's physical resources such as trails

and roads, and on natural resources such as vegetation and wildlife. Impacts may include erosion, deterioration, trampling, and temporary disturbance. Wildlife disturbances typically result in a temporary displacement without long-term effects on individuals or populations. Some species will avoid the areas people frequent, such as the developed trails and the buildings, while others seem unaffected by or even drawn to the presence of humans.

Long-term impacts are anticipated to be minimal since only certain areas are open to the public and sensitive areas, such as bald eagle nesting sites, would be closed as needed.

The singing behavior of some species of songbirds has been found to be altered by low levels of human intrusion (Gutzwiller et al. 1994). Some studies have found that some bird species habituate to repeated intrusion; frequently disturbed individuals of some species have been found to vocalize more aggressively, have higher body masses, or tend to remain in place longer (Cairns and McLaren 1980). Disturbance may affect the reproductive fitness of males by hampering territory defense, male attraction and other reproductive functions of song (Arrese 1987). Disturbance, which leads to reduced singing activity, would make males rely more heavily on physical deterrents in defending territories which are time and energy consuming (Ewald and Carpenter 1978).

Travel routes can disturb wildlife outside the immediate trail corridor (Miller et al. 2001) and bird abundance and nesting activities, including nest success, increases as distance from a recreational trail increased in both grassland and forested habitats (Miller et al. 1998). Bird communities in this study were apparently affected by the presence of recreational trails, where “generalists” (American robins) were found near trails and “specialist” species (i.e., grasshopper sparrows) were found farther from trails. Nest predation was also found to be greater near trails (Miller et al. 1998).

Disturbance can cause shifts in habitat use, abandonment of habitat and increase energy demands on affected wildlife (Knight and Cole 1991). Flight in response to disturbance can lower nesting productivity and cause disease and death. Hammitt and Cole (1998) conclude that the frequent presence of humans in “wildland” areas can dramatically change the normal behavior of wildlife mostly through “unintentional harassment”.

Seasonal sensitivities can compound the effect of disturbance on wildlife, examples include regularly flushing birds during nesting. The Delaware Natural Heritage Program, Division of Fish and Wildlife and the Department of Natural Resources and Environmental Control prepared a document on the “The Effects of Recreation on Birds: A literature Review” which was completed in April of 1999 (Bennett and Zuelke 1999). The following information was referenced from this document:

Several studies have examined the effects of recreationists on birds using shallow-water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981; Burger 1986; Klein 1993; Burger et al. 1995; Klein et al.

1995; Rodgers and Smith 1995, 1997; Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbance from recreation activities always has at least temporary effects on the behavior and movement of birds within a habitat or localized area (Burger 1981, 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1997; Burger and Gochfeld 1998). The findings that were reported in these studies are summarized as follows in terms of visitor activity and avian response to disturbance.

- *Presence:* Birds avoided places where people were present and when visitor activity was high (Burger 1981; Klein et al. 1995; Burger and Gochfeld 1998).
- *Distance:* Disturbance increased with decreased distance between visitors and birds (Burger 1986), though exact measurements were not reported.
- *Approach Angle:* Visitors directly approaching birds on foot caused more disturbance than visitors driving by in vehicles, stopping vehicles near birds, and stopping vehicles and getting out without approaching birds (Klein 1993). Direct approaches may also cause greater disturbance than tangential approaches to birds (Burger and Gochfeld 1981; Burger et al. 1995; Knight and Cole 1995; Rodgers and Smith 1995, 1997).
- *Type and Speed of Activity:* Joggers and landscapers caused birds to flush more than fishermen, clammers, sunbathers, and some pedestrians, possibly because the former groups move quickly (joggers) or create more noise (landscapers). The latter groups tend to move more slowly or stay in one place for longer periods, thus birds likely perceive these activities as less threatening (Burger 1981, 1986; Burger et al. 1995; Knight and Cole 1995). Alternatively, birds may tolerate passing by with unabated speed whereas if the activity stops or slacks birds may flush (Burger et al. 1995).
- *Noise:* Noise caused by visitors resulted in increased levels of disturbance (Burger 1986; Klein 1993; Burger and Gochfeld 1998), though noise was not correlated with visitor group size (Burger and Gochfeld 1998).

We would take all necessary measures to mitigate these effects, specifically where group educational activities are involved. Activities would be held in areas where minimal impact would occur. Periodic evaluation of sites and programs will be conducted to assess if objectives are being met and to prevent site degradation. If evidence of unacceptable adverse impacts appears, the location(s) of activities would be rotated with secondary sites, curtailed or discontinued. Refuge regulations will be posted and enforced. Closed areas will be established, posted and enforced. The known presence of a threatened or endangered species would preclude the use of an area until the refuge manager determines otherwise.

Special use permits will be issued to organizations conducting environmental education or interpretive and/or wildlife observation and photography tours or activities on the refuge. The areas used by such tours will be closely monitored to evaluate the impacts on the resource; if adverse impacts appear, the activity would be moved to secondary locations or curtailed or discontinued. Specific conditions may apply

depending upon the requested activity and would be addressed through the special use permit.

No baits, calls, or scents would be allowed. All litter would have to be removed daily. Law enforcement patrol of public use areas would continue to minimize the above-mentioned types of violations.

Research activities that would be supported under alternatives A and B may disturb fish and wildlife through observation, a variety of wildlife capture techniques, banding, and accessing the study area by foot or vehicle. For example, the presence of researchers may cause disruption of birds on nests or breeding territories, or increase predation on nests. Efforts to capture birds may cause disturbance, injury, or death to groups or to individual birds. The energy cost of disturbance may be appreciable in terms of disruption of feeding, displacement from preferred habitat, and the added energy expended to avoid disturbance. It is possible that direct or indirect mortality could result as a by-product of research activities. Mist-netting or other wildlife capture techniques, for example, may cause mortality directly through the capture method or in-trap predation, and indirectly through capture injury or stress caused to the organism. Even if such mortalities to individual birds do occur, there would be no impact to the overall population. To minimize disturbance, all research must be approved through the refuge's special use permit process.

An indirect long-term impact is the potential for visitors to unintentionally introduce and/or spread invasive species. Once established, invasive plants can out-compete native plants, thereby altering habitats and adversely affecting birds and other wildlife. The threat of invasive plant establishment will likely continue be an issue in the long-term and will require annual monitoring, treatment and public education.

Alternative B. Management for Trust Resources (Service-preferred Alternative)

Benefits

There would be increased long-term benefits to birds under alternative B because we would take additional steps to manage, maintain or restore habitat to support a diversity of bird species. Increased effort would be devoted to identifying management practices that would help sustain healthy viable habitats while preventing the degradation of habitats.

Adverse Impacts

Management methods used to maintain or restore habitats or prevent encroachment of invasive species may affect individual birds by temporary displacement of the birds and short-term loss of their specific habitat. These effects would be highly localized, limited reductions in the small numbers of these birds on the refuge and should not affect any species populations regionally. These management measures would not be employed during the major portion of the nesting season when the majority of birds are building nests, incubating eggs or feeding nestlings, so adverse impacts to bird reproduction would not occur. Habitat improvements, particularly control of invasive plants, would benefit other bird species in the longer term.

There would be some removal of vegetation to place any new trails or trail improvements, observation platforms or photo blinds under alternative B. These activities would cause an increased degree of disturbance to birds and remove some additional minimal acreage from natural habitat compared to alternative A. Placement of interpretive panels may impact small areas of vegetation. Panels would be placed where minimal disturbance would occur.

In the event of persistent disturbance to habitat or to wildlife, the activity would be restricted or discontinued. Little energy would be expended by wildlife leaving areas of disturbance. Visitor disturbance would also increase because of the increase in visitation and the increased access from new and improved refuge amenities. However, these effects would be more than offset by the overall protection afforded these birds on refuge lands.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits

Under alternative C, benefits would be limited to protection of refuge lands. No active management would occur, so there would be no risk to this habitat associated with herbicide use, or other habitat management methods. Closing the refuge and eliminating public uses would eliminate sources of authorized human disturbance to birds.

Adverse Impacts

Elimination of management practices, including invasive plant control, could continue to lead to diminishing habitat values in the long-term. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing wildlife using these habitats.

Impacts to Other Native Wildlife

Mammals at the refuge (e.g., white-tailed deer, muskrats, woodchucks, squirrels, bats, shrews, and mice) are important management concerns because they are an integral part of the natural ecosystems we work to sustain on the refuge, and are therefore a part of the refuge biological diversity, integrity and environmental health. Many of the small mammals serve as prey base for diurnal and nocturnal raptors; deer are the only mammals that are permitted to be hunted on the refuge.

Reptiles and amphibians are also important components of the diverse ecosystems of the refuge. Most species on the refuge are relatively common in the region. However, six species, the Coastal Plains milk snake intergrade, northern diamondback terrapin, eastern box turtle, spotted turtle, and eastern kingsnake, are listed as species of concern by NJDFW. Four amphibians - eastern mud salamander, eastern tiger salamander, marbled salamander, and Fowler's toad - are listed as endangered, threatened, or species of special concern by the State of New Jersey.

Native Wildlife Impacts That Would Not Vary by Alternative

Regardless of which alternative we select, the refuge would continue to provide a natural landscape with habitats that support mammalian, amphibian, and reptile species. Impoundments, marshes and vernal pools on the refuge provide breeding habitats for amphibians. Native vegetation provides cover and breeding substrate for reptiles.

Alternative A - Continue Current Management (No Action)

Benefits
Mammalian, reptilian, and amphibian species would continue to benefit as we continue to protect refuge habitats for the benefit host of wildlife species under alternative A.

Adverse Impacts
Physical, mechanical, and chemical management actions to control invasive plants throughout the refuge habitats would cause some displacement and potential mortality. Management actions to maintain grassland and successional habitat would occasionally injure or kill individual small mammals, reptiles, or amphibians.

Deer populations would be reduced during the deer hunt but the deer population on the refuge would not be adversely affected because we would continue to monitor the status of the population in coordination with NJDFW and would reduce the hunt if it appeared warranted to allow the herd to rebuild.

Beaver, woodchuck, muskrat, and other furbearers may need to be removed if they are causing road flooding, damage to refuge impoundments, or other serious refuge management problems. We would remove problem animals through lethal means when necessary. Outreach and education programs would continue to be used to inform the general public and nearby landowners of the need for and ecological soundness of hunting and animal damage control measures.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits
Mammals, reptiles, and amphibians would benefit to a greater degree from refuge management under alternative B than under the other alternatives because we would devote substantial effort to inventorying and managing for the benefit of these species consistent with our objectives.

Adverse Impacts
Mowing or other mechanical treatments and prescribed burning could disturb, displace, and occasionally injure or kill individual small mammals, reptiles or amphibians in the grassland area or in invasive plant control in the forest or elsewhere on the refuge. Management methods used to maintain or restore habitats or prevent encroachment of invasive species may affect individual mammals, reptiles, and amphibians by temporary displacement and short-term loss of their specific habitat. These effects would be highly localized, limited reductions in the small numbers of these species on the refuge and should not affect any species populations regionally. Habitat improvements, particularly control of invasive plants, would benefit other wildlife species in the longer term.

There would be some removal of vegetation to place any new trails or trail improvements, observation platforms or photo blinds under alternative B. These activities would cause an increased degree of disturbance to mammals, reptiles, and amphibians and remove some additional minimal acreage from natural habitat compared to alternative A. Placement of panels may impact small areas of vegetation. Panels would be placed where minimal disturbance would occur.

In the event of persistent disturbance to habitat or to wildlife, the activity would be restricted or discontinued. Little energy would be expended by wildlife leaving areas of disturbance. Visitor disturbance would also increase because of the increase in visitation and the increased access from new and improved refuge amenities. However, these effects would be more than offset by the overall protection and increased management and inventory efforts afforded these species on refuge lands.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits

Under alternative C, benefits would be limited to protection of refuge lands. No active management would occur, so there would be no risk to this habitat associated with herbicide use or other habitat management methods. Eliminating public uses of the refuge would eliminate the potential for any disturbance to these habitats associated with authorized use. Human disturbance would be limited to infrequent staff entry.

Adverse Impacts

Elimination of habitat management would lead to further encroachment of invasive plants and loss of habitat values that currently benefit these species. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on this habitat by littering, illegal harvesting, using off-trail areas and causing erosion, and disturbing sensitive wildlife using these habitats.

Invertebrate Impacts

The refuge and adjacent tidally-influenced river and bay waters is host to a wide variety of invertebrate species, from the butterflies that populate our forested, grassland, and brushy areas to the freshwater mussels in the shallow waters of the marshes. This great diversity of form and habitat provide a major portion of the food biomass on which refuge wildlife species depend. A number of invertebrate species are rare or declining, either in New Jersey or nationally, and are of special management concern.

We considered the benefits from:

- refuge habitat protection; and,
- measures to improve water quality.

We considered the potential for adverse impacts from:

- refuge habitat management activities;
- construction or maintenance projects; and,
- visitor activities.

Invertebrate Impacts That Would Not Vary by Alternative

Regardless of which alternative we select, the refuge would continue to provide a natural landscape with habitats that support a variety of invertebrate species. For example, refuge impoundments and tidal marsh would continue to benefit dragonflies and damsel flies and other aquatic-dependent native insect species.

Alternative A - Continue Current Management (No Action)

Benefits
Under alternative A, maintaining 160 total acres of grassland and scrub/shrub habitat, and potentially acquiring 428 additional acres of these habitat types, would maintain a diversity of native invertebrate species. Furthermore, we would continue to manage our current refuge lands to support a diversity of ecosystem components, including a wide array of insects, spiders, earthworms, aquatic arthropods, freshwater mollusks, and other invertebrates. Although there are not refuge inventories documenting invertebrate diversity, we know that invertebrates are critical food items for insectivorous birds, bats, moles, shrews, raccoons, fish and a number of other native wildlife species.

Adverse Impacts
Physical, mechanical, and chemical methods for invasive plant control or habitat management would cause short term impacts, killing numbers of insects and other invertebrates on managed sites, but these areas would begin to recover rapidly and no long-term effects would occur.

There would continue to be some losses of invertebrates, for example, ants and earthworms, from measures used to control invasive plants and in mowing to maintain the grassland area. These losses would be negligible, highly localized, and short-term and no invertebrate species populations would be affected.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Benefits
Management of the 159 acres of grassland and scrub/shrub habitat, and potentially up to another 428 acres of these habitats combined, would provide the same benefits predicted under alternative A. Increased protection and management of the health and integrity of wetlands and forest on the refuge would commensurately increase the habitat quality benefits to native aquatic and forest insects.

Adverse Impacts
Physical, mechanical, and chemical methods for invasive plant control, fuels, management and maintenance of the habitat would cause similar short-term impacts to insects and other invertebrates that are not mobile on managed sites, as under alternative A.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits
Under alternative C, benefits would be limited to protection of refuge lands. No active management would occur, so there would be no risk to these species associated with herbicide use, or other habitat management methods. Eliminating public uses of the refuge would eliminate the potential for any disturbance to these habitats associated with authorized use. Human disturbance would be limited to infrequent staff entry.

Adverse Impacts
Elimination of habitat management would lead to further encroachment of invasive plants and loss of habitat values that currently benefit these species. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized

users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing sensitive wildlife using these habitats.

Impacts to Biological Integrity, Biological Diversity, and Environmental Health (BIDEH)

Service policy 601 FW 3 provides guidance for maintaining and restoring, where appropriate, the biological integrity, diversity, and environmental health (BIDEH) within the National Wildlife Refuge System. The policy is an additional directive for refuge managers to follow while achieving refuge purpose(s) and Refuge System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. Further, it provides refuge managers with an evaluation process to analyze their refuge and recommends the best management direction to prevent further degradation of environmental conditions; and where appropriate and in concert with refuge purposes and Refuge System mission, restore lost or severely degraded components.

Service policy 601 FW 3 also defines the following key terms:

- **Biological integrity** - "Biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities."
- **Biological diversity** - "The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur."
- **Environmental health** - "Composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment."
- **Historic conditions** - "Composition, structure, and functioning of ecosystems resulting from natural processes that were present prior to substantial human related changes to the landscape."
- **Native** - "With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem."

BIDEH can be described at various landscape scales from refuge to ecosystem, national, and international. Individual refuges contribute to BIDEH at larger landscape scales, especially when they support populations and habitats that have been lost at those large landscape scales. When evaluating the appropriate management direction for refuges, refuge managers will consider their refuges' contribution to BIDEH at multiple landscape scales. Service policy stipulates that, first and foremost, refuge managers will maintain existing levels of biological integrity, diversity, and environmental health at the refuge scale. Secondarily, refuge managers will restore lost or severely degraded elements of integrity, diversity, environmental health at the refuge scale and other appropriate landscape scales where it is feasible and supports achievement of refuge purpose(s) and System mission. At times, in pursuit of refuge purposes, individual refuges may compromise elements of BIDEH at the refuge scale in support of those components at larger landscape scales.

BIDEH Impacts That Would Not Vary by Alternative

We predict that none of the alternatives would result in an extirpation of any native wildlife over the 15 years this plan would be implemented. Although significant shifts in species composition would not be predicted under any alternatives for at least 10 years (which is when the major habitat changes would be well underway), resulting species composition over the long-term would be different because on the difference in habitat management (or, in the case of alternative C, lack of habitat management). Regardless of those differences, we would strive for the highest degree of BIDEH achievable given staffing, funding, and the management direction proposed under each respective alternative.

Alternative A - Current Management

Alternative A contributes to biological diversity in that it includes objectives that at least maintain current management actions that benefit species of conservation concern. For example, continuing current management to protect tidal marsh and shallow waters would result in some benefits for improving and expanding native habitat conditions for bald eagles and diamondback terrapins. Furthermore, the continued presence of grasslands introduces a measure of habitat diversity to the refuge's uplands. This habitat is used by songbirds and butterflies for foraging and resting, especially during migration.

Also under alternative A, invasive plant control efforts would be maintained, thus supporting efforts to help protect ecosystem function and processes associated with tidal waters. The refuge would continue practices that minimize impacts to soils and water quality from such things as chemical pollution and runoff, the latter which could be the result of soil disturbance from habitat management practices.

Alternative A, like alternative B, emphasizes managing native species at densities that are stable and sustainable, within habitat capabilities, and are not excessive, in order to minimize disease, nutrient accumulation, and competitive exclusion of other species. Only native plant species would be used in habitat improvement projects.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Alternative B would be more beneficial for maintaining or restoring BIDEH than alternative A. We would develop an Adaptive Management Framework for phragmites control so that treatments are monitored and evaluated for effectiveness. This effort would provide important benefits to many wildlife and aquatic species dependent on this habitat type. Species of conservation concern that may benefit from these increased acres of tidal marsh and shallow water include bald eagles and diamondback terrapins.

Alternative B would be more beneficial for BIDEH than alternative A with respect to restoration of natural conditions on the grassland, forest, and scrub/shrub habitat. Maintaining the 123-acre grassland habitat would benefit a host of wildlife. Invasive plant control measures would increase the amount of native habitat on the refuge.

Alternative C - Cease Management and Close Refuge to Public Uses

Under alternative C, benefits would be limited to protection of refuge lands. No active management would occur, so there would be no risk to this habitat associated with herbicide use, or other habitat management methods. Eliminating public uses of the refuge would eliminate the potential for any disturbance to these habitats associated with

authorized use. Human disturbance would be limited to infrequent staff entry.

Elimination of habitat management would lead to further encroachment of invasive plants and loss of habitat values that currently benefit these species. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing sensitive wildlife using these habitats.

Cultural Resources Impacts

The Service recognizes the importance of continued compliance with the National Historic Preservation Act (NHPA) and other Federal laws and mandates protecting these resources to assure that known sites are protected and any sites that are found in the course of refuge management and public use are properly addressed.

Cultural Resources Impacts That Would Not Vary by Alternative

We would continue to protect Finns Point Rear Range Light (FPRRL) under all alternatives, so long as it remains under our ownership. This document will be sent to the New Jersey State Historic Preservation Office (New Jersey SHPO) for review of NHPA Section 106 compliance, and we will also continue to do Section 106 compliance for all individual projects.

Alternative A - Continue Current Management (No Action)

Benefits

Continued Service protection of refuge lands would benefit cultural resources by ensuring that none of the substantial impacts related to development for other uses would affect known or as yet undiscovered cultural, archeological, and historic resources on those lands. We would continue to maintain the FPRRL in compliance with the National Historic Preservation Act but would allow public access inside FPRRL only during the annual New Jersey Lighthouse Challenge, if deemed feasible by the refuge manager. Participation would only occur if the Friends of Supawna Meadows NWR were capable and would agree to completely organize and implement all event activities. Public access to the exterior of FPRRL would be available.

Adverse Impacts

We would likely get substantial negative comments from the interested public concerning our inability to offer the greater public access to FPRRL.

There is some risk that refuge visitors may inadvertently or intentionally damage or disturb known or as yet undiscovered cultural artifacts or historic properties on the refuge. We would manage these resources to protect sites, structures, and objects of importance for scientific study, public appreciation and socio-cultural interpretation by complying with Section 106 of the NHPA, as amended, promoting academic research on, or relating to, refuge lands, adding Archeological Resource Protection Act (ARPA) language to appropriate public use materials to warn visitors about illegal looting, and by maintaining law enforcement personnel trained in ARPA enforcement.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits

Wildlife may benefit indirectly from an enhanced program for dealing with the FPRRL as we plan to use it as the basis for refuge interpretation and as an attraction to expand knowledge of the presence of the refuge and its values. We would retain ownership of FPRRL and expand public access to and interpretative use of the FPRRL to promote refuge values and would prioritize the structure's repair or restoration in the Service's maintenance program. We would also consider entering an agreement with the New Jersey Lighthouse Society to assist the refuge in supporting FPRRL use and refuge interpretative program and coordinate with the Friends of Supawna Meadows NWR to integrate the history of FPRRL into interpretive programs.

Adverse Impacts

Unless it is managed efficiently and well funded, our integration of the FPRRL into refuge interpretation could cause us to expend resources that would be more efficiently spent elsewhere. We would perform archaeological reviews, surveys, or studies of trail construction and improvement projects and other proposed projects as needed or recommended by the Service's Regional Archeologist and consult with the New Jersey SHPO regarding refuge undertakings that have potential to affect archaeological resources. Increased visitation and increased opportunities for consumptive and non-consumptive uses would combine to increase the likelihood of damage or disturbance of cultural and historic resources on the refuge. We would monitor known archeological and historic sites on the refuge to protect them from looting and other ARPA violations.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits

The refuge would be closed and public uses would be eliminated. We would continue to maintain the FPRRL in compliance with the National Historic Preservation Act. The Service would pursue transferring ownership and responsibility of FPRRL to a suitable organization, such as the New Jersey Department of Environmental Protection Division of Parks and Forestry.

Adverse Effects

The public would be denied any opportunities to interpret the refuge history or the FPRRL unless its ownership is transferred to an entity that can maintain and manage it for public access. There may be increased risk of trespassing and vandalism associated with a further reduction in Service presence on site compared to alternatives A and B.

Public Use Management – Hunting

Hunting Impacts that would not Vary by Alternative

Because hunting would be eliminated under alternative C along with all other public uses on the refuge, there are no impacts that would be common to all alternatives.

Alternative A - Continue Current Management (No Action)

Approximately 1500 hunting visits occur annually in the refuge's deer and waterfowl hunting programs.

Deer hunting is currently the most effective tool we have to manage the health of the deer population and sustain the integrity, diversity, and health of forest habitats on the refuge. We implement a hunt program in coordination with NJDFW to sustain healthy deer populations and forest habitat conditions.

Deer hunting also provides a wildlife-dependent recreational opportunity that is in decline within the urbanizing setting of southern New Jersey. Providing this opportunity helps preserve the cultural heritage of the refuge area, where people have hunted for generations, and allows people to connect with nature in an outdoor natural setting where it is becoming increasingly difficult to find access to undeveloped lands. We would continue to utilize this program to inform hunters about the value of our inter-agency partnership in managing deer populations and the direct benefit to refuge habitats and other native species.

Waterfowl hunting also has a long tradition in this area of the Atlantic flyway. The refuge contributes substantially to sustaining healthy waterfowl populations in the tidal Delaware River region, thus ensuring recreational opportunities for waterfowl hunting are foremost consistent with waterfowl population levels.

Benefits

If allowed to progress unchecked by natural predators or management, deer reproductive potential can be very high. For example, just one mating pair can grow to 1,000 in 10 years, including natural mortality (Yarrow and Yarrow 1999). Although a weak correlation exists between density and fertility rates (reproduction declines at high densities), substantial reproduction still occurs when densities exceed 130 deer per square mile (Swihart et al. 1998). This is because of a higher number of adult does in the population, and even though they have lowered reproduction, collectively they produce a large number of offspring each year. Overabundance of deer can produce long-term negative effects such as potential disease epidemics (Demarais et al. 2000), increase in automobile accident rates, browsing pressure on landscapes, vegetation and crops, and severe habitat degradation (Cypher and Cypher 1988).

Hunting would benefit vegetation by keeping resident deer populations in balance with the carrying capacity of the habitat. Impacts on physical resources resulting from trampling of vegetation are expected to be minimal and temporary as vegetation would recover. In addition to a general decrease in habitat quality, impacts of high deer densities include a decline in overall deer population health as evidenced by decreased body weights, increased occurrence of deformities, increased levels of internal and external parasitism, decreased body fat deposits, and disease transmission (Cypher and Cypher 1988, Demarais et al. 2000). The goal of the refuge is not to only manage the deer herd to protect habitat but also to protect the overall health of the herd for future recreation and ecosystem balance. Based on our observations of habitat condition and NJDFW's evaluation of deer health from deer

harvested on the refuge, the current deer hunt program is maintaining the existing habitat conditions and deer health on the refuge.

The primary waterfowl species harvested are mallard, American black duck, green-winged teal, and Canada goose. Heusmann (1974) concluded that: "During the past 100 years, the status of the mallard (*Anas platyrhynchos*) in the Northeast has changed from that of rare migrant to major game bird.... The close relationship between mallards and black ducks (*Anas rubripes*) is leading to increasing hybridization as the species come in contact, particularly in inland park situations. The black duck possesses few traits to prevent hybridization, and its continued existence as a distinct species is threatened." Increased mallards in an area may cause a decline in black ducks through introgressive hybridization and competitive exclusion; the removal of drake mallards during hunting season in areas where black ducks and mallards interact may decrease hybridization (Ankney et al. 1987). Black ducks also use the refuge as overwintering habitat. During the majority of this overwintering period, which is a sensitive time for the black duck, about 60 percent of the refuge will be closed to further protect them.

New Jersey, northern Delaware, and southeastern Pennsylvania are currently experiencing a population explosion of non-migratory Canada geese. Canada geese have a high intrinsic survival rate in Utah, in the absence of hunting (Rexstad 1992). Resident Canada geese can create local problems with droppings and feather litter, particularly near open water (Conover and Chasko 1985). Excessive goose droppings can degrade water quality (Manny et al. 1994), and geese have been implicated in losses to grain crops and overgrazing and trampling of habitat restoration areas (Paulin and Drake 2003, USFWS 2005b). Current regulations, focused on harvesting non-migratory Canada geese, allow hunting during the month of September. Hunting is a way to help control this expanding population, and its associated negative effects.

The greater snow goose population in the Atlantic flyway has increased significantly over the past decade and continues to increase. Damage to winter grain and salt hay fields and marsh areas in New Jersey is increasing. The refuge marshes and impoundments are not currently used by greater snow geese. Refuge marshes and impoundments provide valuable late winter habitat for black ducks and pintails. Hunting during late winter has the potential to disturb wintering ducks, particularly black ducks, and decrease the value of the refuge as wintering habitat. If snow goose use of the refuge increases, hunting of greater snow geese on designated areas of the refuge may be permitted after the close of the duck season for the southern zone of New Jersey to achieve population goals for greater snow geese or reduce damage to refuge habitats and surrounding marsh and agricultural areas.

Hunters on the refuge continue to enjoy an outdoor recreational opportunity in an area where such opportunities are diminishing on other public lands. Hunters also benefit from the harvesting of game for personal consumption. Hunters who come from outside the local area also contribute to the local economy by staying at local hotels and eating in local restaurants.

The refuge would remain open to all users during the hunting season, thereby concurrently allowing priority public uses.

Hunting would not likely affect any cultural resources that are located on the refuge.

Adverse Effects

The impacts of allowing hunting (either waterfowl or deer) may include disturbance of target and non-target species, trampling of vegetation, possible creation of unauthorized trails by hunters and subsequent erosion, littering, and possible vandalism. Vegetative communities would experience direct adverse impacts from hunters crushing the plants themselves. Short-term effects consist of the deterioration of plant material, whereas long-term effects of trampling include direct and indirect effects on vegetation and soils like diminishing soil porosity, aeration, and nutrient availability through soil compaction (Roovers et al. 2004, Kuss 1986). Compaction of soils limits the ability of plants, particularly rare and sensitive species, to re-vegetate affected areas (Hammitt and Cole 1998). Kuss (1986) found plant species adapted to wet or moist habitats are the most sensitive, and increased moisture content reduces the ability of the soil to support recreational traffic.

To discourage unauthorized activities and enforce regulations, the refuge law enforcement officer conducts patrols throughout the hunting season. Assistance is provided by State conservation officers and the area special agent, currently located in Pleasantville, New Jersey.

Waterfowl hunters confine their activities to boats in the refuge waterways and usually do not directly affect refuge habitats, although their activities temporarily disturb waterfowl and other wildlife in the tidal marsh and they kill or injure individual birds in pursuit of their sport. Deer hunters usually hunt in the upland areas of the refuge. However, refuge, State, and Federal hunting regulations and bag limits are designed to ensure appropriate harvest levels for game species, protecting the viability of these populations (USFWS 1988).

Wildlife species may be alarmed by firearm hunters because of the noise from firearms. Deer hunting is limited to bow hunting only, so potential adverse effects of firearms would be limited to waterfowl season. These effects are expected to be minimal because most shorebirds and wading birds that share habitat with waterfowl have commenced or completed migration by the opening of the waterfowl hunting season. Bald eagles may also share habitat with waterfowl, using the tidal and non-tidal areas of the refuge to feed. Since 1998, an eagle nest has been located on the refuge; however, it is located outside of the area designated for waterfowl hunting.

Deer populations can fluctuate; a more flexible and expanded deer hunt program, as considered under alternative B, may be more effective at maintaining desired deer health and population levels.

Because the refuge would remain open to all users during the hunting season, conflicts may arise between different user groups. Non-hunting

visitors may be in the hunt area at the same time as recreational hunters. Some non-hunting visitors have expressed concern about their safety on the refuge on the days the hunt is underway. Conflicts are most likely to occur during deer hunting, as hunters and non-hunters tend to use the upland areas. State law prohibiting hunting on Sunday also provides an opportunity for non-consumptive users to visit the refuge on a non-hunting day during the hunting season. Limiting the deer hunt to bow-only also increases public safety and minimizes the chance that hunters will disturb non-target wildlife and non-hunting visitors. Because non-hunting visitors to the refuge generally visit the upland or grassland trail areas of the refuge, they are not likely to be aware of the waterfowl hunters except possibly hearing a firearm discharge.

Conflicts also may arise if non-hunting visitors disturb deer, other wildlife, or hunters, or if a hunter disturbs deer or other wildlife that a non-hunting visitor was watching or photographing. We also recognize there is a segment of the public that does not support hunting for moral and/or ethical reasons. Maintaining the hunt program would likely continue to meet with the disapproval of people who have this opinion.

All or part of the refuge may be closed to hunting at any time, if necessary, for public safety, to provide wildlife sanctuary, or for other urgent reasons. All hunting seasons are coordinated with, and within the framework of, the New Jersey Division of Fish and Wildlife, and hunters must follow all appropriate refuge, State, and Federal regulations. Some refuge hunting regulations may be more restrictive than State regulations to meet refuge objectives. If necessary, modifications may be made to refuge-specific regulations and/or the hunt program based on harvest data and/or public use issues.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Benefits

Benefits would be the same as alternative A. In addition, we would strive to meet and sustain NJDFW herd health and deer population goals, and refuge goals and objectives for quality forested habitat by considering using a variety of new strategies, including diversifying the hunting season. We would monitor the deer population and its effects on refuge habitats. If the herd needs to be further culled, we would work with the State to offer a doe-first season, a firearms season or another method for taking more deer off the refuge under alternative B. This may offer a new opportunity for many hunters and one that has been regularly requested over the years. Service discussions over the years with hunters indicate when hunters understand how the hunt contributes to larger ecological and conservation goals, their experience is enhanced and their overall satisfaction increases. Hunters would also directly benefit over the long run from harvesting healthier more robust deer.

Deer hunters would benefit from expansion of the deer hunting area by removing the hunting closure signage and relying on State hunting regulations to define hunting safety zones.

Waterfowl hunters would benefit from expansion of the waterfowl hunting area, which would allow more hunters with the same or greater spacing of boats to better sustain a high quality recreational experience.

Opening Tract 48 (AID) property, and any other new areas as indicated in alternative B, to deer and waterfowl hunting within three years of completing the final CCP would benefit both types of hunters. The AID property has been closed to public use activities since the 2006 acquisition.

Adverse Effects
The adverse impacts described under alternative A related to inter-user conflicts and on people opposed to hunting could potentially increase under alternative B since the hunt program may be expanded. Expanding the hunting program may increase the total number or people hunting on the refuge and may increase negative effects on habitat associated with this use. For example, there may be associated increases in vegetation trampling, soil erosion, and littering. To minimize impacts to waterfowl, fishing and waterfowl hunting areas would be collocated within the refuge's tidal marsh.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits
Eliminating hunting and all other public uses on the refuge would eliminate the potential for any conflict between hunters and other refuge users.

Adverse Effects
The deer population on the refuge would grow unchecked, thereby threatening overbrowsing impacts, potentially interfering with natural forest regeneration, and contributing to the spread of invasive plants by overfeeding on native species. The increase in local deer densities may result in a decline in overall deer population health as evidenced by decreased body weights, increased occurrence of deformities, increased levels of internal and external parasitism, decreased body fat deposits, and disease transmission (Cypher and Cypher 1988, Demarais et al. 2000). Waterfowl hunting provides a method for controlling the resident Canada goose population. Eliminating this control may result in higher goose populations and possible increases in associated negative effects (that is, degraded water quality and overgrazing). This alternative also removes the option of controlling snow geese on the refuge, should they become problematic.

In addition to the potential environmental effects of closing the refuge to hunting, the area would experience socio-economic effects as well. The refuge would no longer provide visitors an opportunity to connect with nature through hunting. Hunting opportunities are in decline within the urbanizing setting of southern New Jersey. The refuge would no longer be able to help preserve this aspect of the cultural heritage of the refuge area, where people have hunted for generations. Hunters who would normally come from outside the local area would not contribute to the local economy by staying at local hotels and eating in local restaurants.

Lastly, further decreasing the Service's presence at the refuge has a potential to increase poaching, vandalism, and littering.

Public Use Management - Fishing and Crabbing

Fishing and Crabbing Impacts That Would Not Vary by Alternative

Because fishing and crabbing on the refuge would be eliminated under alternative C along with all other public uses on the refuge, there are no impacts that would be common to all alternatives.

Alternative A - Continue Current Management (No Action)

Approximately 750 fishing and crabbing visits occur annually.

Benefits

Sensitive habitat and wildlife resources are protected by controlling the location and time of day when fishing and crabbing are permitted. Fishing and crabbing would be permitted in various tidal marsh areas within the refuge (see Map 3.2 for locations). Fishing areas within the refuge are usually accessed by boat; however, there are no boat launching sites on the refuge. Boat access is available from various public and private boat ramps located in the Pennsville and Salem areas. A freshwater tidal pond located near the barn will be open only for an annual youth fishing event. Boats and fishing are prohibited on all other freshwater ponds and impoundments.

Recreational fishermen on the refuge are a potential audience for refuge outreach and information efforts. Public involvement in this priority public use will result in a better appreciation of refuge wildlife and habitats, which in turn, translates into more widespread, stronger support for the refuge, the Refuge System, and the Service.

Adverse Effects

Similar to hunting, public fishing and crabbing may result in disturbance of target and non-target species, trampling of vegetation, possible creation of unauthorized trails by anglers and crabbers and subsequent erosion, littering (including old fishing line, bait, and weights), and possible vandalism. Problems associated with site compaction and denuding (or stripping) of vegetation will be addressed by area closures as necessary to protect sensitive areas. Problems associated with littering and vandalism can be countered through effective public education and law enforcement programs and limiting access to upland areas to daylight hours.

Recreational fishing opportunities along the shoreline may cause temporary disturbances such as the flushing of feeding, resting, or nesting birds, especially waterfowl, and other wildlife species. Many waterfowl species avoid disturbance by feeding at night instead of during the day (McNeal et al. 1992). Klein (1989) found migratory dabbling ducks to be the most sensitive to disturbance and migrant ducks to be more sensitive when they first arrived, in the late fall, than later in winter. This disturbance may displace individual animals to other parts of the refuge; however, this disturbance would be limited in scope due to the limited number of areas accessible to anglers. Most visitors understand the protection afforded by the refuge, and the Service will continue to provide educational materials and adequate signage to orient and inform visitors. For these reasons, instances of

disturbance should remain rare. We have not observed that the level of recreational fishing and crabbing would to any degree constitute a substantive adverse impact to species survival or reproduction. Through refuge literature and signage, people are directed to stay on trails and to be sensitive to disturbing wildlife. Outreach, education, and if necessary, law enforcement, will continue to be tools to insure significant impacts do not occur.

Sensitive habitat and wildlife resources are protected by controlling the location and time of day when fishing and crabbing are permitted. Fishing and crabbing are permitted by boat; however, there are no trailored boat launching sites on the refuge. Boat access is available from various public and private boat ramps located in the Pennsville and Salem areas. A freshwater tidal pond located near the barn will be open only for an annual youth fishing event. Boats are prohibited on all freshwater ponds, and all other freshwater ponds and impoundments are closed to fishing.

Wildlife disturbances vary with the species involved and the type, level, frequency, duration, and time of year such activities occur. Wildlife response to disturbances can include attraction, habituation, and avoidance (Whittaker and Knight 1998). Human-induced avoidance by wildlife can prevent animals from using otherwise suitable habitat (Pomerantz et al. 1988). Individuals fishing and crabbing disturb wildlife the least compared to other refuge visitors, presumably because they do not attempt to approach wildlife (Klein 1993). Human disturbance of wintering black ducks may impair their physiological conditions, thereby reducing winter survival and nutrient reserves carried to the breeding grounds (Morton et al. 1989). Because of the cold climate, little fishing activity occurs on the refuge from the middle of November through the middle of March, when black ducks are overwintering on the refuge. Additionally, about 60 percent of the refuge is closed to hunting and fishing during waterfowl season. For additional discussion of potential effects of fishing and crabbing on waterfowl, see the section in the chapter on Waterbirds and Waterfowl.

Impacts to wildlife may be indirectly caused through erosion and subsequent sedimentation of streams and ponds because of foot travel over bare soils and around drainages. Several species of frogs and turtles that use the refuge are experiencing population declines. Conserving these species achieves refuge purposes, addresses the general concern about these population declines, and also increases the likelihood that more wildlife will be available for viewing. By closing most of the freshwater ponds to fishing, amphibians and turtles will not be impacted by fishing activity. The upland areas of the refuge will be closed to all uses between dusk and dawn. Prohibiting night fishing in freshwater areas will decrease illegal and unauthorized activities on the refuge.

Federal-listed, endangered shortnose sturgeon are found in larger rivers, estuaries, and nearshore sea environments (Dadswell et al. 1984). Individuals from the Delaware River population spawn in the freshwater section of the Delaware River from mid-winter to early spring and spend the summer near the mouth of Delaware Bay (Hastings and O'Herron 1987 et al., NMFS 1998). Because this species

prefers larger rivers, sturgeons are not expected to occur in waters passing through the refuge. Individuals may be present in the Delaware River bordering the refuge. Fishing and crabbing within the Delaware River is controlled by the states of New Jersey and Pennsylvania, both of which prohibit sturgeon fishing (NJDFW 2009b, PFBC 2010), and is not under the Service's jurisdiction. Adult sturgeon may forage in shallow water areas near or on the refuge (Dadswell et al. 1984). However, accidental hook and line catches of shortnose sturgeon in the proposed refuge fishing areas are unlikely because sturgeon are bottom feeders, feeding on small clams, amphipods, and juvenile crabs in the bottom sediment (Dadswell et al. 1984). Prey is not considered to be a limiting resource (NMFS 1998); therefore, it is unlikely that the limited, localized crabbing in refuge waters would affect the sturgeon's prey base. Lastly, fishing and crabbing on the refuge are conducted in accordance with applicable State regulations to help protect sensitive species, including the shortnose sturgeon.

Anticipated disturbances to wildlife are likely to be short term and infrequent based on the current level of use. Sedimentation impacts will likely be minor from foot travel and limited to the few areas open to pedestrian fishing access. Long-term impacts may include certain wildlife species avoiding trail corridors as a result of this use over time. All visitors participating in fishing or crabbing must comply with applicable refuge, State, and Federal regulations to ensure appropriate harvest levels for game species, protecting the viability of these populations. Based on the current level of fishing and crabbing, it is not expected that disturbance impacts will be significant.

Alternative B - Management for Trust Resources (Service-preferred Alternative)

Benefits

Benefits to fishing and crabbing would be similar to those described under alternative A. Sensitive habitat and wildlife resources are protected by controlling the location and time of day when fishing and crabbing are permitted. Fishing and crabbing would be permitted in various tidal marsh areas within the refuge along the banks of one freshwater pond located along the Forest Habitat Trail (see Map 3.5 for locations). Fishing areas within the refuge are usually accessed by boat; however, there are no boat launching sites on the refuge. Boat access is available from various public and private boat ramps located in the Pennsville and Salem areas. Access to the pond along the Forest Habitat Trail is available by foot from a parking area off of Xmas Tree lane. A freshwater tidal pond located near the barn will be open only for an annual youth fishing event. Boats and fishing are prohibited on all other freshwater ponds and impoundments.

Under this alternative, we would open Tract 11D Xmas Tree Lane impoundment to freshwater fishing and conduct an additional NEPA analysis within one year of final CCP. We would also open Tract 48 (AID property), and any other new areas as indicated in alternative B, to fishing and crabbing within three years of completing the final CCP. The AID property has been closed to public use activities since its 2006 acquisition. Both these actions would provide additional opportunities for fishing on the refuge.

Adverse Effects
Under alternative B, fishing and crabbing visits could increase by up to 20 percent above current levels (or up to 900 visits). This presents a slightly increased potential above alternative A for disturbance to wildlife (that is, waterfowl) and sedimentation from foot traffic. To minimize impacts to waterfowl, fishing and waterfowl hunting areas would be collocated within the refuge's tidal marsh. As under alternative A, sedimentation impacts will likely be minor from foot travel, and limited to the few areas open to pedestrian fishing access. Prohibiting boating and fishing on most of the refuge's impoundments and tidal ponds will protect sensitive species using these areas, as will prohibiting use of boats on all freshwater ponds and impoundments within the refuge. As in alternative A, all refuge visitors who wish to fish or crab must comply with applicable refuge, State, and Federal regulations to ensure appropriate harvest levels for game species and minimizing unintentional take of non-game species, protecting the viability of these populations.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits
Alternative C would have similar long-term benefits to water quality and aquatic species from the refuge continuing to support natural vegetation as described for alternative A. Elimination of all public uses would reduce the potential for pollution from user-discarded refuse or chemicals reaching impoundments or tidal streams.

Adverse Impacts
Under alternative C, all public uses would be eliminated, including fishing and crabbing, so these recreational activities would not be supported at all on the refuge. This would likely result in increased fishing and crabbing pressure on areas outside the refuge and may reduce the quality of the recreational experience at those other locations. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in this habitat. Unauthorized users may have negative effects by littering, illegal harvesting, using off-trail areas and causing erosion, poaching, and disturbing sensitive wildlife.

Public Use Management - Wildlife Observation, Photography, and Environmental Education and Interpretation

Providing opportunities for compatible public uses, including hunting, fishing and crabbing, wildlife observation, photography, and environmental education and interpretation is integral to our overall management of the refuge. These uses are priority uses of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

We evaluated the alternatives by considering the extent to which refuge access for pursuing wildlife observation, photography, and environmental education and interpretation would change under each alternative, as well as the opportunities for appropriate and compatible non-priority uses. Given regional recreational trend information, and our expectations of what would result based on current and proposed visitor services, we predict that over the next 15 years annual visitation to the refuge would increase by up to 10 percent under alternative A

and up to 20 percent under alternative B. We would eliminate all these public use opportunities under alternative C.

Wildlife Observation and Photography Impacts that would not Vary by Alternative

Benefits

Because all public uses would be eliminated under alternative C, there would be no impacts that do not vary regardless of the alternative.

Alternative A – Continue Current Management (No Action)

Benefits

There would be no changes to public use as it is currently conducted under alternative A. The same opportunities considered benefits would continue. We would continue to provide public wildlife observation, photography, and environmental education and interpretation opportunities. We would continue to maintain refuge facilities including the foot trails and parking areas, observation platforms, and interpretive signage. We believe, despite predicted increases in annual visitation over the next 15 years, that we can accommodate those increases without impacting natural resources or diminishing the quality of experience for other visitors. This would be managed by encouraging group activities and programs, attempting to distribute those activities throughout the year, and increased outreach and education.

Public involvement in these priority public uses will positively result in a better appreciation and more complete understanding of refuge wildlife and habitats, which in turn, translates into more widespread, stronger support for the refuge, the Refuge System, and the Service.

Adverse Impacts

Non-consumptive public uses can have a variety of negative effects on wildlife and habitats. Possible impacts include disturbing wildlife, removing or trampling of plants, littering, vandalism, and entrance into closed areas. In addition, energy is expended by wildlife leaving areas of disturbance.

Human disturbance to migratory birds has been documented in many studies in different locations. Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). The responses of wildlife to human activities include departure from the site (Burger 1981), the use of sub-optimal habitat (Erwin 1980), altered behavior (Burger 1981), and an increase in energy expenditure (Belanger and Bedard 1990).

Disturbance can cause shifts in habitat use, abandonment of habitat and increase energy demands on affected wildlife (Knight and Cole 1991). Flight in response to disturbance can lower nesting productivity and cause disease and death. The frequent presence of humans in wild areas can dramatically change the normal behavior of wildlife mostly through unintentional harassment (Hammitt and Cole 1998).

To protect wildlife from disturbance during sensitive times of the year (that is, nesting), seasonal area closures are implemented. This may result in a few complaints by some visitors who want access, but most

people understand the need and value of this inconvenience and respect our decision.

On-site activities by teachers and students using trails and environmental education sites may impose low-level impacts such as trampling of vegetation, removing vegetation, littering, and temporary disturbance to wildlife. In the event of persistent disturbance to habitat or wildlife, the activity will be restricted or discontinued.

There continues to be increasing development pressure and a concomitant demand for outdoor recreational opportunities in Salem County. These could possibly lead to an increase in user conflicts and enforcement issues on the refuge if no improvements or additional opportunities are provided.

Various public uses of the refuge may at times conflict. We do not predict any major conflicts between or among visitors engaged in various activities on the refuge under this alternative. This is based on our observations that no conflicts have been documented to date under our current programs, and we are not proposing to appreciably change existing programs to the extent we would predict a new conflict.

Alternative B - Management for Trust Resources (Service-Preferred Alternative)

Benefits

Benefits to public users would increase under alternative B. We plan to increase public use opportunities in a few areas and improve the quality of existing programs. With the hiring of visitor services and maintenance staff and additional volunteer involvement, we would be able to provide substantially increased efforts to support wildlife photography, observation, and environmental education and interpretation opportunities on the refuge under alternative B. These efforts would benefit the public by increasing their understanding of the natural features and processes at work on the refuge and would benefit the refuge and the Refuge System by engendering an increased understanding and support for the work of the refuge staff, Refuge System, and natural resources in general.

As with alternative A, public involvement in these priority public uses will result in a better appreciation and more complete understanding of refuge wildlife and habitats, which in turn, may translate into more widespread, stronger support for the refuge, the Refuge System, and the Service. Providing additional interpretive and educational brochures as well as increasing involvement with local groups in the area may result in increased knowledge of the refuge and its resources. This awareness and knowledge may improve the willingness of the public to support refuge programs, resources, and compliance with regulations.
Under this alternative, we would open Tract 48 (AID property) to wildlife observation, photography, environmental education, and interpretation within three years of completing the final CCP. This tract has been closed to public use activities since the 2006 acquisition.

Adverse Impacts

Potential adverse effects of alternative B are similar to alternative A. However, increased refuge visitation, and increased, compatible, wildlife-oriented opportunities for non-consumptive uses, would combine to increase the risk of human-wildlife conflicts and the

potential for localized habitat damage. Environmental education and interpretation opportunities would likely involve larger groups, so the wildlife disturbance might be higher than it would be with individuals or smaller groups. However, these groups would be led by educators, refuge staff, or other sponsors and location, time of year, and type of access (that is, walking, bus) would be evaluated and authorized by refuge staff through a special use permit. Therefore, these activities are not expected to have detrimental effects on sensitive species or habitats.

Placement of new kiosks and expansion of trails would affect small areas of vegetation. Kiosks will be placed where minimal habitat disturbance will occur, and routes for trail expansions will be chosen to minimize effects on habitat and wildlife as well.

There may be more instances of trespassing in unauthorized areas of the refuge. There would be a greater likelihood of minor injuries or accidents by trail and off-trail users. There may be associated parking issues during times of heavy use if parking areas fill and people attempt to park in unauthorized locations.

Alternative C - Cease Management and Close Refuge to Public Uses

Benefits

Eliminating these public uses of the refuge would eliminate the potential for any disturbance to habitats and wildlife associated with authorized public uses. Human disturbance would be limited to infrequent staff entry.

Adverse Impacts

Alternative C would result in elimination of all wildlife photography, observation, and environmental education and interpretation programs and opportunities on the refuge. Residents and visitors to the area would not have an opportunity to experience nature on the refuge and would not have an opportunity to learn about the refuge, the Refuge System, or wildlife there. In addition, decreasing the Service's presence at the refuge has a potential to increase the risk of trespassing on the refuge, and may result in unauthorized activities occurring in sensitive habitat. Unauthorized users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing sensitive wildlife using refuge habitats.

Cumulative Impacts

According to the Council on Environmental Quality NEPA implementing regulations at 40 CFR 1508.7, "Cumulative impact" is the impact on the environment which results from the incremental impact of the action 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. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

This cumulative impacts assessment includes other agencies' or organizations' actions if they are interrelated and influence the same environment. Thus, this analysis considers the interaction of activities at Supawna Meadows NWR with other actions occurring over a larger spatial and temporal frame of reference.

Air Quality

Short-term, negligible, localized air quality effects would be expected from air emissions of motor vehicles used by staff and refuge visitors and from equipment such as mowers used by Refuge staff in maintenance and habitat management projects. However, none of the activities on the refuge is expected to contribute to any measurable incremental increase in air pollutant levels. None of the alternatives are expected to cause any greater than negligible cumulative adverse impacts on air quality locally in the vicinity of Supawna Meadows NWR or regionally.

We predict no cumulative impacts to Class I airsheds from our actions. Visibility due to emission-caused haze at the nearest Class I airshed would not be affected by any of the proposed management alternatives. Although prevailing weather patterns are from the west, air emissions from Salem County would be completely dispersed before reaching that Class I area.

With our partners, we will continue to contribute to improving air quality through management of native upland and wetland vegetation which assures these areas will continue to filter out many air pollutants harmful to humans and the environment.

Water Quality

There would be no significant adverse cumulative impacts to water quality under any of the alternatives. Best management practices and erosion and sediment control measures would be used in any of our projects that would disturb the soils to ensure impacts are minimized.

Socioeconomic Resources

We expect none of the alternatives to have a significant adverse cumulative impact on the economy of the Pennsville community and Salem County, New Jersey. None of the three proposed alternatives would be expected to substantially alter the local community's demographic characteristics. As a result, no impacts would be associated with changes in the community character or demographic composition.

Implementation of any of the alternatives would result in several minor beneficial impacts for the social communities near the refuge and in the region as a whole. Public use of the refuge would be expected to increase, thereby increasing the number of visitor days spent in the area and the level of visitor spending in the local community. Fully funding the additional staffing under alternatives B and C would also make a small, incremental contribution to employment and income in the local community.

Soils

The greatest past, present, and foreseeable future adverse impacts on the refuge soils occurred in the past from agriculture and development. We will continue to use best management practices to minimize impacts from our management program under all alternatives while keeping the remainder of the refuge in native plant communities that would otherwise have been under development if the refuge had not been created.

Protected Habitats and Species

There would be beneficial cumulative effects of marsh protection programs under alternatives A and B because we would continue

maintaining marsh that might otherwise be lost to development along the Delaware River and tributaries in the longer term.

Biological resources that we would manage to control, prevent, or eliminate, such as invasive plants or mute swans, are not natural components of the tidal marsh or upland ecosystems, so losses of those biotic components where they occur would not be considered adverse under any of the alternatives.

The habitats that we would maintain under alternatives A and B would all contribute at least minimally to sustaining those habitats in the tidal Delaware River watershed and Delaware Bay region and would be a long-term beneficial cumulative impact.

Our active management of the deer herd under alternatives A and B would contribute to several refuge goals and objectives related to maintaining the biological diversity, integrity and health of forest habitats and native wildlife, and providing a compatible wildlife-dependent recreational opportunity through hunting. It is important that we work with NJDFW and those other public landowners to enhance our annual monitoring of refuge conditions and better evaluate the effectiveness of our hunt program and other deer management strategies. We will employ an adaptive management decision and implementation process to take advantage of, and respond to, what we learn.

Public activities on the refuge associated with wildlife observation, wildlife photography, interpretation, and environmental education would cause cumulative impacts: minor when considered alone, but potentially important when considered collectively. Our principal concern is repeated disruptions of nesting, resting, or foraging bald eagles, foraging wading birds, and other birds of conservation concern. Our knowledge and observations of the affected areas on the refuge show no evidence that these four priority, wildlife-dependent uses cumulatively would adversely affect the wildlife resource. We also have not observed significant resource degradation, long-term consequences, or cumulative effects on any of the refuges with established programs. However, opening refuge lands to public use can often result in littering, vandalism, or other illegal activities on the refuges.

Although we do not expect substantial cumulative impacts from these four priority uses in the near term, it is important that refuge staff monitor those uses and, if necessary, respond to conserve high-quality wildlife resources. Refuge staff, in collaboration with volunteers, will monitor and evaluate the effects of these priority public uses to discern and respond to any unacceptable impacts on wildlife or habitats. To mitigate those impacts, the refuge will close areas where bald eagles and other species of concern are nesting.

Cultural Resources

We expect none of the alternatives to have significant adverse cumulative impact on cultural resources on the refuge. Finns Point Rear Range Light would be protected under all circumstances. Transfer of ownership and management of FPRRL would most likely occur under alternatives A and C.

Climate Change

Department of the Interior Secretarial Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making…. This Order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making." Additionally, it calls for the incorporation of climate change into long-term planning documents such as the CCP: "Each bureau and office of the Department will consider and analyze potential climate change impacts when undertaking long-range planning exercises, when setting priorities for research and investigations, when developing multi-year management plans, and /or when making major decisions regarding the potential utilization of resources under the Departments purview. Departmental activities covered by this Order include, but are not limited to, programmatic and long-term environmental reviews undertaken by the Department, management plans and activities developed for public lands, planning and management activities associated with oil, gas and mineral development of public lands, and planning and management activities of water projects and water resources (USFWS 2008)."

The effects of climate change on populations and range distributions of wildlife are expected to be species-specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife will generally move upwards in elevation and northward as temperature rises. Species with small and/or isolated populations and low genetic variability will be least likely to withstand impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This will vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components of climate change (Inkley et al. 2004). The report notes that developing precise predictions for local areas is not possible due to the scale and accuracy of current climate models, which is further confounded by the lack of information concerning species-level responses and to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment. In other words, only imprecise generalizations can be made about the implications of our refuge management on regional climate change.

In our professional judgment, the vast majority of management actions we propose would not exacerbate climate change in the region or project area, and in fact, some might incrementally prevent or slow down local impacts. One recommendation for climate change adaptation is to prevent and control invasive species (Inkley et al. 2004). This recommendation emphasizes the increased opportunities for invasive species to spread because of their adaptability to disturbance. Invasive species control will be essential, including extensive monitoring, to preclude larger impacts. Invasive species control is a major initiative within the Service. The Northeast Region, in particular, has taken a very active stand on controlling invasive species. In chapter 3, we provide detailed descriptions of our current and future plans on the refuge to control existing invasive plant infestations. We will continue to monitor and analyze the available information about sea-level rise and potential effects in the tidal Delaware River basin recognizing that

rising tidal levels in the long-term would incrementally jeopardize current refuge habitats, particularly the tidal marsh, and we would have to prepare to address that eventuality. Decisions on locating future conservation areas should take into account potential climate change and variability. In chapter 3 under alternative B, we discuss land acquisition in consideration of climate change. In addition, Supawna Meadows NWR is one of several refuges in the northeast that underwent Sea Level Affecting Marsh Model (SLAMM) (refer to appendix G) analysis designed to project potential coastal habitat changes correlated with sea-level rise. Based on the SLAMM analysis, we would incorporate actions to mitigate potential outcomes resulting from global climate change and rises in sea level as deemed necessary and appropriate.

Relationship Between Short-term Uses of the Human Environment and Enhancement of Long-term Productivity

In this section, we consider the relationship between local, short-term uses of the human environment and maintaining long-term productivity of the environment (NEPA, Public Law 91-190, as amended). By long-term we mean that the impact would extend beyond the 15-year planning horizon of this draft CCP/EA.

Under all of the alternatives, our primary aim is to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge, in the Delaware River Basin, and for migratory birds, interjurisdictional fish, and other far ranging species, across the whole range of each species. Short term human uses of the refuge are of a far lower, secondary importance. According to law and Service policy, we allow those uses only if they are compatible with the resource protection goals (Refuge Improvement Act, Public Law 105-57; 603 FW 2). The Service strives to protect Federal trust species and the habitats they depend on, as evidenced by the public use restrictions on access and prohibition of types of use other than foot traffic. Outreach and environmental education in alternatives A and B would encourage visitors to be better stewards of our environment.

The dedication of certain areas for new trails and parking areas on the refuge represents a loss of long-term productivity in a few localized areas, most of which do not fully support natural habitats, but this is not considered significant given the comparative refuge size.

In summary, we predict that all of the alternatives would contribute positively to maintaining or enhancing the long-term productivity of the environment.

Unavoidable Adverse Impacts

According to the Council on Environmental Quality, unavoidable adverse effects are the effects of those actions that could cause harm to the human environment and that cannot be avoided, even with mitigation measures (NEPA, Public Law 91-190, as amended). There would continue to be property tax losses to the local community under all alternatives. Under alternatives A and B, the minor localized effects of fuels management activities, grassland maintenance, and invasive plant control would be unavoidable as would the effects of the projected increase in refuge visitation. However, none of these effects would rise to the level of significant. Furthermore, all of these impacts would be mitigated, so there would in fact be no significant unavoidable adverse impacts under any of the alternatives.

Potential Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those which cannot be reversed, except perhaps in the extreme long-term or under unpredictable circumstances (NEPA, Public Law 91-190, as amended). An example of an irreversible commitment is an action which contributes to a species' extinction. Once extinct, it can never be replaced.

In comparison, irretrievable commitments of resources are those which can be reversed, given sufficient time and resources, but represent a loss in production or use for a period of time (NEPA, Public Law 91-190 as amended; 40 CFR 1502.16). An example of an irretrievable commitment is the continued maintenance of the dikes which surround impoundments to benefit bald eagles, colonial nesting birds, and other birds under all the alternatives. If for some reason in the future these birds were no longer considered a high priority for management or if the impoundments are found to no longer provide a productive foraging area for the birds, we may consider removing the dikes and returning the impoundments to tidal marsh. Removal of the historic farm house may constitute an irreversible commitment of resources. As stated previously, we would comply with all appropriate state and federal requirements before proceeding with demolition of any refuge buildings.

Summary of the Impacts of the Alternatives

Table 4.2 below summarizes the benefits and adverse impacts of the alternatives.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
Air Quality		
Maintenance activities would cause negligible short-term, localized effects from dust and vehicle and equipment exhausts. Operation of the refuge buildings would continue to contribute negligibly to local stationary source emissions. Vehicles and equipment used by staff would contribute a negligible amount to local mobile source air emissions and particulates. Energy efficient practices (e.g., efficient lighting, more efficient vehicles), will be implemented as appropriate and feasible. Prescribed burns to control phragmites on up to 525 acres of tidal marsh could have short-term, adverse effects on air quality and visibility locally. These are offset by benefits of reducing fuel load and lessening the risk of wildfires that produce greater amounts of smoke under uncontrolled conditions. Estimated increase of about 10 percent in annual refuge visitor use (above 2009 estimate of 15,000 visitors) would slightly increase vehicle emissions on refuge lands in the longer term.	*Same as alternative A except:* Benefits associated with maintaining natural vegetation would be slightly higher because of increased invasive plant control and resulting increase in native species. Potential for increased impacts if prescribed fire is used to control phragmites above what we propose in alternative A Permanent and seasonal staffing and numbers of volunteers would increase compared to alternative A. Refuge visitation would also increase by up to 20 percent over estimated FY 2009 levels (or up to 18,000 visitors). Increased vehicle use by staff, volunteers, and visitors, and increased equipment use by staff, would contribute some minimal additional but negligible increment to local mobile source air emissions.	Closing the refuge and eliminating all public uses would reduce the production of air emissions associated with authorized refuge activities. There would continue to be some minimal emissions associated with law enforcement and other staff activities, but these would be lower than current levels. There would be greater risk of unauthorized users entering the property and using motorized equipment or vehicles that would produce air emissions. These would not likely exceed current emission levels.
Impacts that would not vary among alternatives		
Air quality would benefit by maintaining up to 4,527 acres in natural vegetation. Benefits include: 1) protecting natural habitat from development and associated sources of pollution, 2) maintaining natural vegetation, so it can serve as a filter for air pollutants, and 3) maintaining forest cover, contributing to carbon sequestration. All alternatives would comply with EPA standards for air quality and the Clean Air Act. No major stationary or mobile sources of air pollutants would be created at the refuge under any of the refuge management alternatives. Visibility at the nearest Class I airshed— Brigantine Wilderness Area in Atlantic County, New Jersey— would not be affected by any of the proposed management alternatives.		

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
Management actions and public uses at the refuge under all alternatives would contribute a negligible increment to the overall Salem County or regional air emissions levels, and would be less than if refuge lands were not protected from development. Energy efficient systems (e.g., recycling, energy efficient lighting and windows) and vehicles will be (and have been) incorporated when feasible and appropriate.		
Water Quality and Aquatic Biota		
Native aquatic species in the tidal marsh would benefit from continued efforts to control or eliminate non-native phragmites. Wetland habitats and aquatic species would benefit from protection of the native plant communities on the refuge uplands which filter runoff from operations on the refuge and adjacent roadways and developed areas. We would treat up to 525 acres of phragmites-dominated tidal marsh with herbicides, prescribed burning, and mowing. These treatments would have some minimal potential to affect water quality through herbicide contamination and soil erosion. There is a slight risk that herbicides used for invasive plant control in upland areas of the refuge may reach the tidal marsh and affect water quality or harm aquatic species. We follow established best management practices (BMPs) to minimize risks associated with invasive species control efforts. Vehicles and equipment used by staff and minor increase in visitor vehicles would slightly increase risk of contaminating waters and adversely affecting aquatic species compared to FY 2009 levels. Scientific research may have short-term, negative effects on refuge	*Same as alternative A except:* Increased benefits to water quality and aquatic species from increased invasive species control in tidal marsh and on the refuge uplands. We also would more actively engage in efforts with refuge partners to address water quality issues in the Delaware River Basin. Trail maintenance and interpretive panel maintenance or installation activities would increase the potential for sedimentation and turbidity in aquatic habitats. Because these activities would not be conducted immediately adjacent to the shoreline, the potential for these impacts to occur would be low. Proper site preparation and use of standard mitigation practices such as silt fences would further limit any potential for impacts. We predict a maximum of 20 additional acres could be treated for invasive species. Compared to alternative A, there would be a minimal increase in risk from herbicides used in phragmites or aquatic invasive plant control in marsh or from runoff of herbicides used in upland applications. Compared to alternative A, there is a slight increase in the risk of contaminating refuge waters through littering and runoff of petroleum products from roads and parking areas due to increased	We would not control spread or prevent introduction of invasive plant species (e.g., phragmites). This may lead to degraded water quality because of overgrown habitats, reduction in protective plant cover on erodible soils, plant detritus reaching water bodies and resulting algal blooms. Alternative C would pose a higher risk of short-term adverse impacts to water quality and aquatic species from unauthorized (e.g., trespassing, vandalism) uses that might introduce trash or chemicals into the water. Closing the refuge and eliminating all public uses would reduce disturbance to wildlife and habitats. Overall, potential negative effects to water quality and aquatic species are not expected to exceed current levels.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
waters and aquatic habitat (e.g. low levels of soil compaction, vegetation trampling, disturbance to non-target species). To minimize these potential risks, research on refuge property must be authorized through a special use permit.	public use.	
Impacts that would not vary among alternatives		
We would comply with all applicable Federal, State, and local water quality requirements. Water quality on the refuge and within the watershed would benefit by continuing to protect up to 4,527 acres of undeveloped land and sustaining natural, water filtering vegetation There would be negligible impacts to refuge water quality from the use of vehicles and equipment by refuge staff and local authorities in surveillance and monitoring activities on the refuge property, including potential trace runoff from petroleum products or minimal soil disturbance.		
Socioeconomic		
Local economy would benefit from off-refuge expenditures by visitors including lodging, meals, equipment, and fuel. We would continue to contribute to the local economy of communities near the refuge in terms of refuge staff expenditures. We would continue to meet a substantial level of public demand in providing wildlife-dependent recreational activities, adding to the quality of life of the local community and other recreationists and wildlife enthusiasts in the region. We could not provide additional environmental education, staff-led interpretation, or wildlife photography opportunities. We would not provide any expansion in hunting opportunities.	Additional partnering to protect water quality in the Delaware River Basin would help to better sustain migrating and wintering waterfowl and contribute to successful waterfowl hunting as well as wildlife observation. Successful hunting and wildlife observation would contribute to increased economic benefits to the local economy generated from increased out of town visitors and related expenditures. Additional refuge staff will minimally increase benefits to the local economy in jobs, income, and demand. Upgrades to refuge management infrastructure would also add expenditures to the local economy for labor, materials, and services. Additional refuge programs would increase visitation (about 10 percent more than alternative A). The local economy would experience minimally increased benefits in terms of retail expenditures for purchasing auto fuel and related	The refuge would offer no benefits to the local economy in terms of recreational expenditures or expenditures on staff, equipment or materials, except for what minimal amount may be spent on infrastructure maintenance.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
	expenses in the local economy. Expanded interpretive and educational programs would provide public benefits in terms of better understanding of the values of the refuge resources and the Refuge System in general. Additional hunting opportunities would help offset the loss of those opportunities at other locations. Additional staffing and funding would improve our ability to communicate with the community about the values of the refuge and opportunities for recreation under this alternative. Increased visitation under alternative B could require additional local expenditures for road maintenance, traffic enforcement, and related infrastructure maintenance and law enforcement expenditures from county tax revenues. These minimal incremental expenditures would be more than offset by refuge revenue sharing and local economic benefits described above.	
Impacts that would not vary among alternatives		
We would continue to make revenue sharing payments to Salem County; however, these revenue sharing payments would have only a negligible effect on the county budget.		
Soils		
We would continue to prohibit recreational activities (i.e. ATVs or mountain biking) that would damage soils on the refuge. Management tools such as replanting with native species, mowing, and use of herbicides could potentially impact the soils on the refuge. Mowing would occur under conditions that minimize compaction and soil displacement.	We would continue to prohibit recreational activities (i.e. ATVs or mountain biking) that would damage soils on the refuge. Compared to alternative A, the expanded refuge management program and on-site staffing under Alternative B would provide greater ability for refuge staff to note and identify potential impacts to soils and to more quickly respond to implement whatever remedial	Elimination of all habitat management activities and closure of the refuge to public uses may decrease some human-caused soils impacts because of a decrease in visitation. Because refuge habitats would not be managed, localized soil impacts due to environmental factors could increase and cause potentially greater impacts than would likely be the case under

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
All chemicals (including herbicides) used on the refuge would first be approved through the Pesticide Use Proposal process. Soils in upland areas could be affected by trail, parking lot, or other maintenance or construction projects. Impacts from the hunt program on soil compaction and erosion would be minimal because numbers of hunters are limited and they are dispersed across the refuge during the archery season. Increased visitor activities could pose a higher concern for soil impaction and would be monitored and mitigated if necessary. We would continue to use best management practices in all management activities that might affect refuge soils to ensure that we maintain soil productivity; therefore, we anticipate minimal adverse impacts on refuge soils from current refuge management activities.	actions are necessary. We would continue to follow best management practices to reduce risks to soils associated with the expanded management activities and visitation proposed in alternative B.	Alternatives A or B. Decreasing the Service's presence at the refuge may increase poaching, vandalism, and other unauthorized activities which may lead to additional soil erosion, compaction, and disturbance, particularly if unauthorized activities occur off established trails and parking areas.
Impacts that would not vary among alternatives		
We would continue to protect the current 1,931 acres of tidal marsh under refuge management and would acquire and protect as much as 362 additional tidal marsh acres from within our acquisition boundary.		
Tidal Marsh		
We would continue our efforts to control phragmites by treating up to 525 acres of phragmites -dominated tidal marsh with herbicides, prescribed burning, and mowing as funding and staff time allows. The marsh areas may be at minimal risk of being indirectly affected by Service activities in adjacent upland areas that drain into them from leaks or spill accidents involving chemicals (e.g., herbicides) or petroleum products	In alternative B, we would implement a more comprehensive program of treatment of phragmites in the marsh with the objective of obtaining 70-80 percent native vegetation in the tidal marsh areas within 15 years. Water quality issues would be addressed as they arise in the Delaware River through our partnering work with state and federal agencies. As with alternative A, the marsh	Closing the refuge and eliminating public uses under alternative C is expected to decrease disturbance to wildlife associated with public uses and potential littering of the marsh. Eliminating the tidal marsh management program would increase encroachment of phragmites and loss of native marsh vegetation. Compared to alternatives A and B,

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
used in refuge management operations. There would be minimal risk of herbicide used in invasive plant control contaminating wetland habitats. Any potential risk would be mitigated through proper application procedures, and because we would use only aquatic certified herbicides approved by the Regional Contaminants Coordinator. Public use, including waterfowl hunting, fishing and crabbing, could damage marsh grasses or disturb nesting or foraging marsh birds. We would provide public information materials to reduce the risk of this damage.	areas may be at minimal risk of indirect effects from Service activities in adjacent upland areas that drain into them from leaks or spill accidents involving chemicals or petroleum products used in refuge management operations. With a more comprehensive control program, there may be a slightly higher risk to native marsh vegetation from increased use of herbicides to control invasive plants in the marsh or to control other invasive plants in nearby upland areas, as compared to alternative A. Increased refuge visitation above that expected under Alternative A would result in an increased potential for impacts to the marsh from users of adjacent trails who may leave trash and go off-trail and enter the marsh areas from these trail access points. We would continue to maintain signage and monitor trails and habitats to insure adverse impacts are kept to a minimum area.	the risk of trespassing and unauthorized activities on the refuge would increase. This may degrade the tidal marsh by littering, chemical contamination, and soil erosion.
Impacts that would not vary among alternatives		
The soils of the refuge are in good condition and would remain so under all alternatives. The refuge would continue to protect vegetative cover that minimizes soil losses through erosion.		
Non-tidal Wetland and Successional Habitats.		
An increase in refuge visitation would minimally elevate the potential for impacts to these habitats. Negative effects from refuge maintenance projects and staff using motor vehicles to monitor these habitats would be negligible.	Increasing our monitoring of threats to water quality and vegetation, coupled with invasive plant control and greater vigilance of visitor impacts, would increase protection of the health and integrity of these refuge areas, compared to alternative A. An increase in refuge visitation because of expanded public use programs under alternative B would minimally elevate the potential for impacts to these habitats.	Eliminating public uses of the refuge would eliminate the potential for any disturbance to these habitats associated with authorized public uses. Compared to alternatives A and B, decreased management and oversight by refuge staff would also decrease associated disturbance. Eliminating habitat management could lead to degradation or ultimately loss of these habitats to

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
	Even with an anticipated increase in staffing the potential for disturbance from management and maintenance projects, and staff using motor vehicles in support of this work would be negligible. Management and maintenance of these habitats may include the use of physical, mechanical and/or chemical actions. The impacts from these actions on the non-tidal wetlands and upland scrub/shrub habitats would be similar as described for tidal marsh habitat.	invasive plants or natural succession. Decreasing the Service's presence at the refuge may increase the risk of unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on habitat by littering, using off-trail areas and causing erosion, trampling vegetation and disturbing wildlife.
Impacts that would not vary among alternatives		
We would continue to protect the current 136 acres of non-tidal wetlands and successional habitats. We would purchase up to 36 additional herbaceous wetland acres, non-tidal scrub/shrub wetland acres and upland scrub-shrub acres combined within the acquisition boundary		
Grassland Habitat		
Continue to manage 122 acres of grasslands on the refuge; acquire and manage up to 409 additional acres of grassland habitat. There would continue to be some minimal level of risk of damage to grassland soils and vegetation involved with use of mowing, burning, or herbicides to manage the habitat. Best management practices would continue to be followed for these methods.	*Same as alternative A plus:* We would focus on managing larger fields and controlling invasive species. Increased overall management would provide substantial additional benefits to foraging and migrating birds, and for butterflies and other native wildlife, that use this habitat type. Benefits would also be realized by refuge visitors since grasslands typically afford quality viewing areas. Additional management activities incur a slightly higher risk of damage to grassland soils and vegetation. As with alternative A, best management practices would be followed for prescribed burns and mowing to minimize potential negative effects to grassland soils and vegetation Long-term management to promote the habitat would offset any	Active management of grassland habitat would cease. Within the15 year planning horizon, the managed grasslands would be eliminated, although some grassland may occur on the refuge as a result of natural disturbances. Biodiversity on the refuge would be diminished. All impacts caused by grassland maintenance practices as described under Alternatives A and B would be eliminated. The refuge would be closed to the public, eliminating the potential for any disturbance to these habitats associated with authorized use. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring in this habitat. Unauthorized users may have

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
	localized short-term adverse effects. Increased visitation might result in increased trampling or localized impact areas affecting grassland health and vigor. However, we do not expect any major increase in public use of the grassland areas. We would continue to advise people to use our designated trails to minimize those impacts and monitor for effects on grasslands.	negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing wildlife using these habitats.
Impacts that would not vary among alternatives		
We would continue to protect the current 122 acres of grassland habitat. We would purchase up to 409 additional grassland acres within the acquisition boundary.		
Forest Habitat		
Maintaining the refuge deer hunt would continue to mitigate potential adverse effects of over-browse by deer which diminishes forest regeneration, affecting long-term forest health. Deer hunters and other refuge visitors may unintentionally introduce and/or spread invasive species which can have negative effects on native species. The threat of invasive plant establishment will require annual monitoring, treatment and hunter and visitor education. Wherever practicable, we would replace non-native plant species with native forest species capable of growing under the current site conditions There would continue to be some minimal level of risk of loss or damage to forest vegetation involved with the use of the habitat management methods such as replanting with native species, mowing, and use of herbicides. In the long-term, however, these	Compared to alternative A, we would protect an additional 2 acres of upland forest in this alternative, and we would more actively manage the forest habitat. Through best management forest practices, fuel reductions, and invasive plant control, we would enhance the health and vigor of the forest. We would maintain or enhance deer management through our public deer hunting program and by other means if necessary to assure forest health. As with alternative A, there would be some minimal level of risk of loss or damage to forest vegetation involved with use of the habitat management methods described above. Routine maintenance of roads and trails may result in the loss of individual trees, but we do not expect the number of trees felled would affect the quality or diversity of forest habitat present. Trail improvements and creation of additional trails would have negligible impacts. All work would be conducted in a manner to	No active management would occur, so there would be no risk to this habitat associated with herbicide use, or other habitat management methods. Eliminating public uses of the refuge would eliminate the potential for human disturbance associated with public uses. Discontinuing the deer hunt program would likely result in an increase in the local deer population. This may result in over-browse of forest habitat, diminishing forest regeneration, and negative effects on long-term forest health. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on this habitat by littering, using off-trail areas and causing erosion, and disturbing wildlife using these habitats.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
methods would maintain or improve forest habitat. Routine maintenance of roads and trails may result in the loss of individual trees, but we do not expect the number of trees felled would affect the quality or diversity of forest habitat present.	minimize loss or damage to trees along the trails.	
Impacts that would not vary among alternatives		
We would continue to protect the existing 240 acres of forested upland habitat. We would continue efforts to acquire the remaining 174 acres of upland forested habitat within the current acquisition boundary.		
Waterbird and Waterfowl		
Continued protection of the tidal marsh, acquisition of additional tidal marsh acreage and treatment of up to 525 acres of phragmites-dominated marsh under Alternative A would benefit marsh birds, shorebirds, wading birds, and waterfowl by ensuring these habitats exist for the long-term. Management efforts to control invasive plants may cause minor, short-term water quality impacts such as increased turbidity and elevated nutrient levels. These effects would not likely add measurably to general turbidity and nutrient levels in the tidal Delaware River. Native species would benefit from control of invasive mute swans. The goal is zero productivity to reduce, if not eliminate, their threat to native waterfowl. Visitors may cause some minor level of disturbance of these birds at locations on the refuge where members of the public are present near habitats used by the birds. An increase in refuge visitation would minimally elevate the potential for	*Same as alternative A, plus:* Increasing our monitoring of threats to water quality and vegetation, coupled with expanded phragmites control and greater vigilance of visitor impacts (e.g. litter control) would increase protection of the health and integrity of refuge tidal wetlands, directly benefiting many species of marsh birds, shorebirds, wading birds, and waterfowl. To minimize impacts to waterbirds, fishing and waterfowl hunting areas would be co-located within the refuge's tidal marsh. An increase in refuge visitation because of expanded public use programs under alternative B would minimally elevate the potential for impacts to the refuge tidal marsh and disturbance to marsh birds, shorebirds, wading birds, and waterfowl.	Elimination of public uses on the refuge would decrease disturbance to waterbirds and waterfowl associated with these uses. Disturbance from refuge maintenance projects and staff using motor vehicles to monitor the marsh would be negligible. Eliminating habitat management would allow expansion of invasive plants in the tidal marsh, degrading habitat which would gradually diminish its value as nesting, foraging, and winter cover for the birds. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on these species by illegal harvesting, littering, using off-trail areas and causing erosion, or disturbing feeding, resting, or nesting behavior.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
impacts to the refuge freshwater marsh and disturbance to marsh birds, shorebirds, wading birds, and waterfowl. Boating causes disturbance to waterfowl and so would continue to be prohibited on freshwater areas within the refuge. Boating is allowed on tidal creeks, but there are no boat launching facilities located on the refuge. Fishing along the shoreline may cause temporary disturbances to waterfowl, and other wildlife species. Outreach, education, and if necessary, law enforcement, will continue to be tools to insure significant visitor impacts do not occur. Disturbance from refuge maintenance projects and staff using motor vehicles to monitor the marsh would be negligible.		
Impacts that would not vary among alternatives		
We would continue to protect the refuge marshes and impoundments which benefit marsh birds, shorebirds, wading birds and migratory and wintering waterfowl. These areas will remain undeveloped and in some mix of native vegetation and phragmites in the long-term. We would purchase additional wetlands within the acquisition boundary to benefit waterbirds and waterfowl. We will continue to partner with agencies that address water pollution but we would not directly control any major upstream sources.		
Breeding, Migrating, and Wintering Birds		
We would continue to benefit refuge bird species by managing and protecting habitat in the long-term. There would be short-term, localized impacts to bird habitat and temporary displacement of birds from management practices such as mowing or herbicide treatments for invasive plant control. Treated habitats would be	*Same as alternative A, plus:* Alternative B would have increased benefits to bird species because we would take additional steps to manage, maintain, or restore habitat to support a diversity of bird species. Compared to alternative A, there would be a slightly higher risk of short-term, localized impacts to bird habitat and temporary displacement	No active management would occur so benefits would be limited to protection of refuge lands. There would be no risk to habitat or birds associated with herbicide use, or other habitat management methods. Closing the refuge and eliminating public uses would eliminate

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
improved in the long-term and this would benefit bird populations. Trail maintenance activities would also cause negligible short-term, localized effects from disturbance. Impacts from visitor disturbance may increase minimally due to a general increase in refuge visitation. Long-term impacts are anticipated to be minimal since only certain areas are open to the public, and sensitive areas, such as bald eagle nesting sites, would be closed as needed. Research activities may disturb these species. To minimize disturbance, all research must be approved through the refuge's special use permit process. Visitors may unintentionally introduce and/or spread invasive species which can have negative effects on native species or habitat. The threat of invasive plant establishment will require annual monitoring, treatment, and visitor education.	of birds from increased management practices. These effects would be highly localized—limited reductions of small numbers of these birds on the refuge—and should not affect any species populations regionally. Small amounts of vegetation would be removed to place any new trails or trail improvements, observation platforms or photo blinds under alternative B. These activities would cause an increased degree of disturbance to birds and remove some additional minimal acreage from natural habitat than alternative A. Placement of panels may impact small areas of vegetation. Panels would be placed where minimal disturbance would occur. Visitor disturbance would also increase because of the increase in visitation and the increased access from new and improved refuge amenities.	sources of authorized human disturbance to birds. Elimination of management practices including invasive plant control could lead to diminishing habitat values and associated negative effects on birds species in the long-term. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on these species by littering, using off-trail areas and causing erosion, or disturbing feeding, resting, or nesting behavior.
Impacts that would not vary among alternatives		
Continued protection of the current 3,247 acres of the refuge's habitats would benefit birds using the refuge to breed, winter, or migrate through. We will continue to purchase up to 1,280 additional acres within the acquisition boundary to benefit these species.		
Other Native Wildlife		
Physical, mechanical, and chemical management actions to control invasive plants throughout the refuge habitats would cause some displacement and potential injury or mortality for some wildlife, particularly individual small mammals, reptiles or amphibians. Management actions to maintain grassland and successional habitat	Same as alternative A, plus: Mammals, reptiles, and amphibians would benefit to a greater degree from refuge management under Alternative B than under the other alternatives because we would devote substantial effort to inventorying and managing for the benefit of these species. Habitat improvements, particularly	No active management would occur so benefits would be limited to protection of refuge lands. There would be no risk to habitat or wildlife associated with herbicide use, or other habitat management methods. Closing the refuge and eliminating public uses would eliminate

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
would occasionally injure or kill individual small mammals, reptiles, or amphibians. Deer populations would be reduced during the deer hunt; however, the deer hunt is managed in conjunction with NJDFW to ensure a healthy deer population is maintained. Furbearers (e.g., beaver, muskrat) may need to be removed if they cause serious refuge management problems. We would remove problem animals through lethal means when necessary. Populations of these species are robust and minimal furbearer control efforts on the refuge are not expected to have effects on the area populations.	control of invasive plants, would benefit other wildlife species in the longer term. Increased management efforts would result in minimal increases in risk of negative effects to wildlife compared to alternative A. Effects would be highly localized, i.e., limited reductions in small numbers of these species on the refuge, and should not affect any species populations regionally. Small amounts of vegetation would be removed to place any new trails or trail improvements, observation platforms or photo blinds under Alternative B. These activities would cause an increased degree of disturbance to mammals, reptiles, and amphibians and remove some additional minimal acreage from natural habitat than alternative A. Visitor disturbance would also increase because of the increase in visitation and the increased access from new and improved refuge amenities. However, these effects would be more than offset by the overall protection and increased management and inventory efforts.	sources of authorized human disturbance to wildlife. Elimination of management practices including invasive plant control could lead to diminishing habitat values and associated negative effects on wildlife in the long-term. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on these species by littering, illegal harvesting, using off-trail areas and causing erosion, or disturbing sensitive wildlife.
Impacts that would not vary among alternatives		
The refuge would provide up to 4,527 acres of habitat that supports mammalian, amphibian, and reptile species.		
Invertebrates		
Maintaining 160 total acres of grassland and scrub/shrub habitat, and potentially acquiring 428 additional acres of these habitat types, would maintain a diversity of native invertebrate species. Continuing to manage our current refuge lands would support a diversity of ecosystem components including a wide array of insects,	*Same as alternative A, plus:* Increased protection and management of wetlands and forest on the refuge would increase the habitat quality benefits to native aquatic and forest insects. Habitat management activities would cause similar short term impacts, to insects and other invertebrates that are not mobile on managed sites, as	No active management would occur so benefits would be limited to protection of refuge lands. There would be no risk to habitat or invertebrates associated with herbicide use, or other habitat management methods. Closing the refuge and eliminating public uses would eliminate sources of authorized human

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
spiders, earthworms, aquatic arthropods, freshwater mollusks and other invertebrates. This in turn will benefit insectivorous birds, bats, moles, shrews, raccoons, fish and a number of other refuge wildlife species that depend on invertebrates for their diet. Physical, mechanical, and chemical methods for invasive plant control or habitat management would cause short term impacts, killing numbers of insects and other invertebrates on managed sites, but these areas would begin to recover rapidly and no long-term effects would occur. There would continue to be some losses of invertebrates, for example, ants and earthworms, from measures used to control invasive plants and in mowing to maintain the grassland area. These losses would be negligible, highly localized, and short-term and no invertebrate species populations would be affected.	under alternative A	disturbance to invertebrates. Elimination of management practices including invasive plant control could lead to diminishing habitat values and associated negative effects on native invertebrate species in the long-term. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring in this habitat. Unauthorized users may have negative effects on these species by littering, using off-trail areas and causing erosion, or disturbing sensitive species.
Impacts that would not vary among alternatives		
Regardless of which alternative we select, the refuge would continue to provide a natural landscape with habitats that support a variety of invertebrate species. For example, refuge impoundments and tidal marsh would continue to benefit dragonflies and damsel flies and other aquatic-dependent native insect species.		
Biological Diversity, Biological Integrity, and Environmental Health (BIDEH)		
Continuing current habitat management objectives would continue to maintain current BIDEH. Maintaining current invasive species control helps protect ecosystem function and processes associated with tidal waters. Continue minimizing impacts to soils and water quality from chemical pollution, runoff, etc. Emphasize managing for native	In addition to Alternative A: Developing an Adaptive Management Framework for phragmites control would insure treatments are monitored and evaluated for effectiveness Controlling invasive plant species through monitoring and adaptive management would restore forest, grassland and shrub/scrub habitats to natural conditions.	Eliminating public use and decreasing staff hours would significantly decrease human disturbance to wildlife and habitats. Eliminating habitat management would result in an increase of invasive plants and loss of habitat value. Decreasing the Service's presence could increase trespassing and may result in

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
species.		unauthorized activities, such as ATVs and littering, that could disturb wildlife and habitats.
Impacts that would not vary among alternatives		
No extirpation of any native wildlife over the life of the plan. No significant changes in species composition for at least 10 years.		
Cultural Resources		
We would continue to maintain the Finns Point Rear Range Light (FPRRL) in compliance with the National Historic Preservation Act. We would allow public access to the interior of FPRRL only during the annual New Jersey Lighthouse Challenge, if deemed feasible by the refuge manager. We would likely get substantial negative comments from the interested public concerning our inability to offer the greater public access to FPRRL. Visitors may inadvertently or intentionally damage or disturb known or undiscovered cultural artifacts or historic properties on the refuge.	Wildlife may benefit indirectly from an enhanced program for interpreting FPRRL as we plan to use it for refuge interpretation and as an attraction to expand knowledge of the presence of the refuge and its values. We would retain ownership of FPRRL and expand public access to and interpretative use of the FPRRL. We would prioritize repair/restoration of the FPRRL in the FWS maintenance program. We would consider entering an agreement with New Jersey Lighthouse Society to assist the refuge in supporting FPRRL use and refuge interpretative programs and coordinate with the Friends of Supawna Meadows NWR to integrate the history of FPRRL into interpretive programs. Integration of the FPRRL into refuge interpretation could expend resources that would be more efficiently spent elsewhere. Increased visitation would combine to increase the likelihood of damage or disturbance of cultural and historic resources on the refuge. We would monitor known archeological and historic sites on the refuge to protect from looting and other ARPA violations.	The refuge would be closed and public uses would be eliminated. We would continue to maintain the FPRRL in compliance with the National Historic Preservation Act. The Service would pursue transferring ownership and responsibility of FPRRL to a suitable organization. The public would be excluded from any opportunities to interpret the refuge history or the FPRRL unless its ownership is transferred to an entity that can maintain and manage it for public access. There may be increased risk of trespassing and vandalism associated with a further reduction in Service presence on site compared to alternatives A and B.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
Impacts that would not vary among alternatives		
We would continue to protect Finns Point Rear Range Light under all alternatives so long as it remains under our ownership. We would take all necessary precautions to comply with Federal (e.g., NHPA) and state requirements for protecting cultural resources and demolishing refuge buildings as needed. This EA will be sent to the NJ SHPO for review, and we will also continue to comply with Section 106 for all individual projects.		
Public Use Management— Hunting		
Deer hunting would benefit vegetation by keeping resident deer populations in balance with the carrying capacity of the habitat. High deer densities have negative effects on the overall health of deer populations. Deer hunting helps maintain the overall health of the deer herd by ensuring deer density remains at appropriate levels on the refuge. The potential impacts of allowing hunting include disturbance of target and non-target species, trampling of vegetation, possible creation of unauthorized trails by hunters and subsequent erosion, littering, and possible vandalism. Impacts on physical resources resulting from hunters trampling of vegetation are expected to be minimal and temporary as vegetation would recover. Black ducks using the refuge to overwinter may be disturbed by hunters. To protect this species during this sensitive time of year, about 60 percent of the refuge will be closed during waterfowl season, the majority of the time black ducks are wintering there. Waterfowl species of concern may benefit from harvest of more abundant species that can compete for resources (e.g. Canada geese)	*Same as alternative A, plus:* We would consider using a variety of new strategies, including diversifying the hunting season, to better manage deer herd health and protect refuge habitat Deer hunters would benefit from expansion of the deer hunting area by relying on State hunting regulations to define hunting safety zones. Waterfowl hunters would benefit from expansion of the waterfowl hunting area. Opening Tract 48 (AID) property, and any other new areas, to deer and waterfowl hunting within three years of completing the final CCP, would benefit hunters. Expanding the hunting program may increase the total number or people hunting on the refuge, and may increase negative effects on habitat associated with this use. To minimize impacts to waterfowl, fishing and waterfowl hunting areas would be collocated within the refuge's tidal marsh. Conflicts between user groups could potentially increase under alternative B since the hunt program would likely be expanded.	Eliminating hunting and all other public uses on the refuge would eliminate the potential for any conflict between hunters and other refuge users. The deer population on the refuge would grow unchecked thereby threatening overbrowsing impacts, potentially interfere with natural forest regeneration, and contribute to spread of invasive plants by overfeeding on native species. The increase in local deer densities may result in a decline in overall deer population health. Waterfowl hunting provides a method for controlling the resident Canada goose population. Eliminating this control may result in higher goose populations and possible increases in associated negative effects (e.g., degraded water quality and overgrazing). The refuge would no longer provide visitors an opportunity to connect with nature through hunting. Hunters who would normally come from outside the local area would not contribute to the local economy by staying at local hotels and eating in local restaurants.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
or hybridize (mallards). Hunters also benefit from the harvesting of game for personal consumption. Hunters who come from outside the local area contribute to the local economy. Hunting would not likely affect any cultural resources that are located on the refuge. Hunting provides a wildlife-dependent recreational opportunity that is in decline within southern New Jersey. Because the refuge would remain open to all users during the hunting season, conflicts may arise between different user groups.		Decreasing the Service's presence at the refuge has a potential to increase poaching, vandalism, and littering.
Public Use Management— Fishing and Crabbing		
The minor impacts to vegetation and wildlife which may occur. Provide an opportunity for the public to experience nature. Fishing and crabbing may result in disturbance of target and non-target species, trampling of vegetation, possible creation of unauthorized trails and subsequent erosion, littering, and vandalism. These will be monitored and addressed as needed. Sensitive habitat and wildlife resources are protected by controlling the location and time of day when fishing and crabbing are permitted. Fishing and crabbing are permitted by boat; however, there are no trailored boat launching sites on the refuge. Recreational fishing opportunities along the shoreline may cause temporary disturbances such as	*Same as alternative A, plus:* Opening Tract 11D Xmas Tree Lane impoundment to freshwater fishing within one year of the final CCP, and opening Tract 48 (AID property), and any other new areas as indicated in alternative B, to fishing and crabbing within three years of completing the final CCP, would provide additional opportunities for fishing and crabbing on the refuge. The increase in fishing and crabbing could cause increased risk of disturbance to wildlife (e.g., waterfowl) and sedimentation from foot traffic. To minimize impacts to waterfowl, fishing and waterfowl hunting areas would be collocated within the refuge's tidal marsh.	Elimination of all public uses would reduce the potential for pollution from user-discarded refuse or chemicals reaching impoundments or tidal streams. Fishing and crabbing would not be supported at all on the refuge. This would likely result in increased fishing and crabbing pressure on areas outside the refuge and may reduce the quality of the recreational experience at those other locations. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring on the refuge. Unauthorized users may have negative effects on this habitat by littering, illegal harvesting, using off-trail areas and causing erosion, and disturbing wildlife.

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
the flushing of feeding, resting, or nesting birds, especially waterfowl, and other wildlife species. This disturbance may displace individual animals to other parts of the refuge; however, this disturbance would be limited in scope due to the limited number of areas accessible to anglers. Impacts to other wildlife may be indirectly caused through erosion and subsequent sedimentation of streams and ponds because of foot travel over bare soils and around drainages. Most of the freshwater ponds are closed to fishing, ensuring that sensitive amphibians and turtles will not be impacted by fishing activity. Fishing and crabbing on the refuge are conducted in accordance with applicable state regulations to help protect sensitive species, including the shortnose sturgeon. Anticipated disturbances to wildlife are likely to be short term and infrequent based on the current level of use. Sedimentation impacts will likely be minor from foot travel, and limited to the few areas open to pedestrian fishing access. Long-term impacts may include certain wildlife species avoiding trail corridors as a result of this use over time. The upland areas of the refuge will be closed to all uses between dusk and dawn. Prohibiting night fishing in freshwater areas will decrease illegal and unauthorized activities on the refuge.		
Public Use Management— Wildlife Observation, Photography & Environmental Education and Interpretation		
We believe that we can accommodate predicted increases in visitors without impacting natural	Compared to alternative A, benefits to public users would increase under	Eliminating these public uses of the refuge would eliminate the potential for any disturbance to

Table 4.2 Summary and comparison of impacts for the three alternatives presented in the Supawna Meadows NWR CCP

Alternative A Current Management	Alternative B The Service-Preferred Alternative	Alternative C Cease Management
resources or diminishing the quality of experience for other visitors using existing infrastructure and staff. Possible impacts associated wildlife observation, photography, environmental education and interpretation include disturbing wildlife, removing or trampling of plants, littering, vandalism and entrance into closed areas. In addition, energy is expended by wildlife leaving areas of disturbance. To protect wildlife from disturbance during sensitive times of the year (e.g., nesting), seasonal area closures are implemented. Increased visitation could lead to an increase in user conflicts and enforcement issues on the refuge if no improvements or additional opportunities are provided. Various public uses of the refuge may at times conflict. We do not predict any major conflicts between or among visitors engaged in various activities on the refuge under this alternative.	Alternative B: We would increase public use opportunities in a few areas, including opening Tract 48 (AID property) to wildlife observation, photography, environmental education, and interpretation within three years of completing the final CCP. Additional staff and volunteers would allow us to provide substantially increased efforts to support wildlife photography, observation, and environmental education and interpretation opportunities on the refuge under Alternative B Compared to alternative A, increased refuge visitation, and increased, compatible, wildlife-oriented opportunities for non-consumptive uses would combine to increase the risk of human-wildlife conflicts and the potential for localized habitat damage. Placement of new kiosks and expansion of trails would affect small areas of vegetation. Kiosks will be placed where minimal habitat disturbance will occur, and routes for trail expansions will be chosen to minimize effects on habitat and wildlife as well.	habitats and wildlife associated with authorized public uses. Visitors would not have an opportunity to experience nature on the refuge and would not have an opportunity to learn about the refuge, the Refuge System, or wildlife there. Decreasing Service presence at the refuge may increase the risk of unauthorized activities occurring on the refuge. Unauthorized users may have negative effects by littering, using off-trail areas and causing erosion, and disturbing wildlife.

Chapter 5

Mark Wilson

Black Duck

Consultation and Coordination with Others

- Introduction
- Planning to Protect Land and Resources

Introduction

This chapter describes how we included others in developing this draft CCP and EA and how we plan to continue consulting and coordinating with others in the future. It details how we first invited, and will continue to encourage, the partnership of other Federal and State agencies, civic, public, and private conservation and education organizations, and the affected public in our decisions about managing the Refuge.

As we mentioned in chapters 1, 2, 3, and 4, we must comply with the National Environmental Policy Act (NEPA) in seeking public input on proposed Federal actions. A 30-day period for public review will follow our release of this draft CCP and EA. We encourage you to give us your responses and ideas about the plan. As before, we will host an open house at a location near the Refuge to gather your opinions and answer your questions about its future management. We will weigh carefully the responses we receive before we write the final CCP.

Planning to Protect Land and Resources

We began the CCP process for Supawna Meadows refuge in May 2007 with a kick-off meeting at the refuge. We discussed the current status of the refuge, important issues to be addressed in the CCP, and the status and sources of data for the analysis. We defined a core team to include refuge managers and staff from Cape May refuge, regional planners, and a NJ Division of Fish and Wildlife representative.

We held an internal scoping meeting, site visit, and field review in July of 2007 to identify issues, concerns, management ideas, and data sources for the development of the CCP and analysis of management strategies.

We published and distributed our first newsletter in August of 2007.

On September 7, 2007, we held two public scoping meetings at the Pennsville Public Library to solicit comments from the community and other interested parties on the scope of the CCP and the issues and impacts that should be evaluated in the CCP/EA.

We published an official notice in the Federal Register that we were preparing a CCP/EA on September 24, 2007.

On April 15, 2008, we held a biological workshop with representatives of the Service, the NJ Division of Fish and Wildlife and Delaware Division of Parks to discuss management objectives for the array of refuge habitats.

On May 6, 2008, we held a public use objectives meeting that addressed hunting, access to Finns Point Light, and a variety of other public use opportunities, issues and concerns.

We distributed a second newsletter July 2008.

We held a review meeting with Senior Region 5 staff in June 2008 and formulated a revised series of biological and public use objectives.

We will complete "Step E: Prepare Draft Plan and NEPA document," by publishing our Notice of Availability (NOA) in the Federal Register announcing the release of this draft CCP/EA and by distributing this document for public review. During a 30-day period of public review, we will hold a public meeting to obtain comments. We also expect to receive comments by regular mail, electronic mail, or at public meetings. After the comment period expires, we will review and summarize all of the comments we have received and develop our responses. We will present them in an appendix to the final CCP.

Once we have prepared the final CCP, we will submit it to our Regional Director for his review and approval. He will determine whether a Finding of No Significant Impact (FONSI) is appropriate, and certify whether the final CCP meets agency compliance requirements, achieves refuge purposes, and helps fulfill the mission of the Refuge System. With an affirmative FONSI and other positive findings, the Regional Director can approve the final CCP. If that happens, we will publish another Federal Register NOA to announce the availability of the final plan. That will complete "Step F: Prepare and Adopt a Final Plan." We can then begin "Step G: Implement Plan, Monitor and Evaluate."

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Chapter 6

Phil Sczerzenie/Mangi Environmental Group, Inc.

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Finns Point Rear Range Light

Glossary and Acronyms

GLOSSARY

accessibility the state or quality of being easily approached or entered, particularly as it relates to complying with the Americans With Disabilities Act

accessible facilities structures accessible for most people with disabilities without assistance; facilities that meet UFAS standards; ADA-accessible
[e.g., parking lots, trails, pathways, ramps, picnic and camping areas, restrooms, boating facilities (docks, piers, gangways), fishing facilities, playgrounds, amphitheaters, exhibits, audiovisual programs, and wayside sites.]

adaptation adjustment to environmental conditions

adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable ecosystems.

Adaptive management:

- helps science managers maintain flexibility in their decisions, knowing that uncertainties exist and provides managers the latitude to change direction
- will improve understanding of ecological systems to achieve management objectives
- is about taking action to improve progress towards desired outcomes.

(source: Williams, B. K., R. C. Szaro, and C. D. Shapiro. 2007. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.)

aggregate many parts considered together as a whole

alternative a reasonable way to fix an identified problem or satisfy a stated need [40 CFR 1500.2 (cf. "management alternative")]

appropriate use a proposed or existing use on a refuge that meets at least one of the following three conditions:

1. the use is a wildlife-dependent one;
2. the use contributes to fulfilling the refuge purpose(s), the System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the National Wildlife Refuge System Improvement Act was signed into law; or
3. the use has been determined appropriate as specified in section 1.11 of that act.

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approved acquisition boundary a project boundary that the Director of the U.S. Fish and Wildlife Service approves upon completion of the planning and environmental compliance process. An approved acquisition boundary only designates those lands which the Service has authority to acquire or manage through various agreements. The approval of an acquisition boundary does not grant the Service jurisdiction or control over lands within the boundary, and it does not make lands within the refuge boundary part of the National Wildlife Refuge System. Lands do not become part of the System until the Service buys them or they are placed under an agreement that provides for their management as part of the System.

anadromous fish from the Greek, literally "up-running"; fish that spend a large portion of their life cycle in the ocean and return to freshwater to breed

aquatic growing in, living in, or dependent upon water

aquatic barrier any obstruction to fish passage

avian of or having to do with birds

avifauna all birds of a given region

barrier cf. "aquatic barrier"

basin the land surrounding and draining into a water body (cf."watershed")

benthic living at, in, or associated with structures on the bottom of a body of water

best management practices land management practices that produce desired results [N.b. Usually describing forestry or agricultural practices effective in reducing non-point source pollution, like reseeding skidder trails or not storing manure in a flood plain. In their broader sense, practices that benefit target species.]

biological diversity or biodiversity the variety of life and its processes and includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur

biological integrity biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural

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	biological processes that shape genomes, organisms and communities
biodiversity conservation	the goal of conservation biology, which is to retain indefinitely as much of the earth's biodiversity as possible, with emphasis on biotic elements most vulnerable to human impacts
biota	the plant and animal life of a region
breeding habitat	habitat used by migratory birds or other animals during the breeding season
buffer species	alternate prey species exploited by predators when a more preferred prey is in relatively short supply; i.e., if rabbits are scarce, foxes will exploit more abundant rodent populations
buffer zones	land bordering and protecting critical habitats or water bodies by reducing runoff and nonpoint source pollution loading; areas created or sustained to lessen the negative effects of land development on animals, plants, and their habitats
candidate species	plants and animals for which the U.S. Fish and Wildlife Service (FWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act (ESA), but for which development of a proposed listing regulation is precluded by other higher priority listing activities (Source: http://www.fws.gov/endangered/factsheets/candidate_species.pdf)
canopy	the layer of foliage formed by the crowns of trees in a stand. For stands with trees of different heights, foresters often distinguish among the upper, middle and lower canopy layers. These represent foliage on tall, medium, and short trees. The uppermost layers are called the overstory.
community	the locality in which a group of people resides and shares the same government
community type	a particular assemblage of plants and animals, named for its dominant characteristic
compatible use	"The term 'compatible use' means a wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission

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of the System or the purposes of the refuge."—National Wildlife Refuge System Improvement Act of 1997 [Public Law 105-57; 111 Stat. 1253]

compatibility determination a required determination for wildlife-dependent recreational uses or any other public uses of a refuge

Comprehensive Conservation Plan mandated by the 1997 Refuge Improvement Act, a document that provides a description of the desired future conditions and long-range guidance for the project leader to accomplish purposes of the refuge system and the refuge. CCPs establish management direction to achieve refuge purposes. [P.L. 105-57; FWS Manual 602 FW 1.4]

concern cf. "issue"

conifer a tree or shrub in the phylum Gymnospermae whose seeds are borne in woody cones. There are 500–600 species of living conifers (Norse 1990)

connectivity community occurrences and reserves have permeable boundaries and thus are subject to inflows and outflows from the surrounding landscape. Connectivity in the selection and design of nature reserves relates to the ability of species to move across the landscape to meet basic habitat requirements. Natural connecting features within the ecoregion may include river channels, riparian corridors, ridgelines, or migratory pathways.

conservation managing natural resources to prevent loss or waste
[N.b. Management actions may include preservation, restoration, and enhancement.]

conservation agreements written agreements among two or more parties for the purpose of ensuring the survival and welfare of unlisted species of fish and wildlife or their habitats or to achieve other specified conservation goals. Participants voluntarily commit to specific actions that will remove or reduce threats to those species.

conservation easement a non-possessory interest in real property owned by another imposing limitations or affirmative obligations with the purpose of returning or protecting the property's conservation values.

conservation status assessment of the status of ecological processes and of the viability of species or populations in an ecoregion.

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consultation a type of stakeholder involvement in which decision makers ask stakeholders to comment on proposed decisions or actions.

cooperative agreement a usually long-term habitat protection action, which can be modified by either party, in which no property rights are acquired. Lands under a cooperative agreement do not necessarily become part of the National Wildlife Refuge System

critical habitat according to U.S. Federal law, the ecosystems upon which endangered and threatened species depend

cultural resource inventory a professional study to locate and evaluate evidence of cultural resources within a defined geographic area
[N.b. Various levels of inventories may include background literature searches, comprehensive field examinations to identify all exposed physical manifestations of cultural resources, or sample inventories for projecting site distribution and density over a larger area. Evaluating identified cultural resources to determine their eligibility for the National Register follows the criteria in 36 CFR 60.4 (cf. FWS Manual 614 FW 1.7).]

cultural resource overview a comprehensive document prepared for a field office that discusses, among other things, project prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement of how program objectives should be met and conflicts resolved
[An overview should reference or incorporate information from a field offices background or literature search described in section VIII of the Cultural Resource Management Handbook (FWS Manual 614 FW 1.7).]

database a collection of data arranged for ease and speed of analysis and retrieval, usually computerized

dbh (diameter at breast height) — the diameter of the stem of tree measure at breast height (usually 4.5 feet above the ground). The term is commonly used by foresters to describe tree size.

dedicated open space land to be held as open space forever

degradation the loss of native species and processes due to human activities such that only certain components of the original biodiversity persist, often including significantly altered natural communities

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designated wilderness area an area designated by Congress as part of the National Wilderness Preservation System [FWS Manual 610 FW 1.5 (draft)]

desired future condition the qualities of an ecosystem or its components that an organization seeks to develop through its decisions and actions.

digitizing the process of converting maps into geographically referenced electronic files for a geographic information system (GIS)

distribution pattern the overall pattern of occurrence for a particular conservation target. In ecoregional planning projects, often referred to as the relative proportion of the target's natural range occurring within a give ecoregion (e.g. endemic, limited, widespread, disjunct, peripheral).

disturbance any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment

donation a citizen or group may wish to give land or interests in land to the Service for the benefit of wildlife. Aside from the cost factor, these acquisitions are no different than any other means of land acquisition. Gifts and donations have the same planning requirements as purchases.

easement a non-possessory interest in real property that permits the holder to use another's land for a specified purpose. It may also impose limitations or affirmative obligations on the holder of the land subject to the easement. An agreement by which landowners give up or sell one of the rights on their property
[e.g., landowners may donate rights-of-way across their properties to allow community members access to a river (cf. "conservation easement").]

ecological integrity native species populations in their historic variety and numbers naturally interacting in naturally structured biotic communities. For communities, integrity is governed by demographics of component species, intactness of landscape-level ecological processes (e.g., natural fire regime), and intactness of internal community processes (e.g., pollination).

ecological processes a complex mix of interactions among animals, plants, and their environment that ensures maintenance of an ecosystem's full range of biodiversity.

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Examples include population and predator-prey dynamics, pollination and seed dispersal, nutrient cycling, migration, and dispersal

ecological process approach an approach to managing for species communities that manages for ecological process (e.g., flooding, fire, herbivory, predator-prey dynamics) within the natural range of historic variability. This approach assumes that if ecological processes are occurring within their historic range of spatial and temporal variability, then the naturally occurring biological diversity will benefit.

ecological system Dynamic assemblages of communities that occur together on the landscape at some spatial scale of resolution, are tied together by similar ecological processes, and form a cohesive, distinguishable unit on the ground. Examples are spruce-fir forest, Great Lakes dune and swale complex, Mojave desert riparian shrublands.

ecoregion a territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.

ecosystem a natural community of organisms interacting with its physical environment, regarded as a unit

ecosystem service a benefit or service provided free by an ecosystem or by the environment, such as clean water, flood mitigation, or groundwater recharge

ecotourism visits to an area that maintains and preserves natural resources as a basis for promoting its economic growth and development

ecosystem approach a way of looking at socio-economic and environmental information based on the boundaries of ecosystems like watersheds, rather than on geopolitical boundaries

ecosystem based management an approach to making decisions based on the characteristics of the ecosystem in which a person or thing belongs
[N.b. This concept considers interactions among the plants, animals, and physical characteristics of the environment in making decisions about land use or living resource issues.]

edge effect the phenomenon whereby edge-sensitive species are negatively affected near edges by factors that include edge-generalist species, human influences, and abiotic factors associated with habitat edges. Edge effects are site-specific and factor-specific and have variable depth effects into habitat fragments.

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emergent wetland wetlands dominated by erect, rooted, herbaceous plants

endangered species a Federal- or State-listed protected species in danger of extinction throughout all or a significant portion of its range

endemic a species or race native to a particular place and found only there

environment the sum total of all biological, chemical and physical factors to which organisms are exposed

environmental education curriculum-based education aimed at producing a citizenry that is knowledgeable about the biophysical environment and its associated problems, aware of how to help solve those problems, and motivated to work toward solving them

environmental health the composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment

Environmental Assessment (EA) a public document that discusses the purpose and need for an action, its alternatives, and provides sufficient evidence and analysis of its impacts to determine whether to prepare an environmental impact statement or a finding of no significant impact (q.v.) [cf. 40 CFR 1508.9]

Environmental Impact Statement (EIS) a detailed, written analysis of 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 [cf. 40 CFR 1508.11]

evaluation examination of how an organization's plans and actions have turned out — and adjusting them for the future.

even-aged a stand having one age class of trees

exemplary community type an outstanding example of a particular community type

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extinction the termination of any lineage of organisms, from subspecies to species and higher taxonomic categories from genera to phyla. Extinction can be local, in which one or more populations of a species or other unit vanish but others survive elsewhere, or total (global), in which all the populations vanish (Wilson 1992)

extirpated status of a species or population that has completely vanished from a given area but that continues to exist in some other location

exotic species a species that is not native to an area and has been introduced intentionally or unintentionally by humans; not all exotics become successfully established

extant in biology, a species which is not extinct; still existing

fauna all animal life associated with a given habitat, country, area or period

federal land public land owned by the Federal Government, including national forests, national parks, and national wildlife refuges

federal-listed species a species listed either as endangered, threatened, or a species at risk (formerly, a "candidate species") under the Endangered Species Act of 1973, as amended

fee-title acquisition the acquisition of most or all of the rights to a tract of land; a total transfer of property rights with the formal conveyance of a title. While a fee-title acquisition involves most rights to a property, certain rights may be reserved or not purchased, including water rights, mineral rights, or use reservation (e.g., the ability to continue using the land for a specified time period, such as the remainder of the owner's life).

fen A type of wetland that accumulates peat deposits. Fens are less acidic than bogs, deriving most of their water from groundwater rich in calcium and magnesium

Finding of No Significant Impact (FONSI) supported by an environmental assessment, a document that briefly presents why a Federal action will have no significant effect on the human environment, and for which an environmental impact statement, therefore, will not be prepared [40 CFR 1508.13]

fire regime the characteristic frequency, intensity, and spatial distribution of natural fires

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within a given ecoregion or habitat

fish passage project providing a safe passage for fish around a barrier in the upstream or downstream direction

flora all the plants found in a particular place

floodplain flat or nearly flat land that may be submerged by floodwaters; a plain built up or in the process of being built up by stream deposition

flyway any one of several established migration routes of birds

focal species a species that is indicative of particular conditions in a system (ranging from natural to degraded) and used as a surrogate measure for other species of particular conditions. An element of biodiversity selected as a focus for conservation planning or action. The two principal types of targets in Conservancy planning projects are species and ecological communities.

focus areas cf. "special focus areas"

forest association the community described by a group of dominant plant (tree) species occurring together, such as spruce-fir or northern hardwoods

forested land land dominated by trees
[For impacts analysis in CCP's, we assume all forested land has the potential for occasional harvesting; we assume forested land owned by timber companies is harvested on a more intensive, regular schedule.]

fragmentation the disruption of extensive habitats into isolated and small patches. Fragmentation has two negative components for biota: the loss of total habitat area; and, the creation of smaller, more isolated patches of habitat remaining.

geographic information system (GIS) a computerized system to compile, store, analyze and display geographically referenced information
[e.g., GIS can overlay multiple sets of information on the distribution of a variety of biological and physical features.]

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grant agreement the legal instrument used when the principal purpose of the transact-ion is the transfer of money, property, services, or anything of value to a recipient in order to accomplish a public purpose of support or stimulation authorized by Federal statute and substantial involvement between the Service and the recipient is not anticipated (cf. "cooperative agreement") (Grants and Cooperative Agreement Act at 31 U.S.C. § 6305)

grassroots conservation organization any group of concerned citizens who act together to address a conservation need

groundwater water in the ground that is in the zone of saturation, from which wells and springs and groundwater runoff are supplied

guild a group of organisms, not necessarily taxonomically related, that are ecologically similar in characteristics such as diet, behavior, or microhabitat preference, or with respect to their ecological role in general

habitat block a landscape-level variable that assesses the number and extent of blocks of contiguous habitat, taking into account size requirements for populations and ecosystems to function naturally. It is measured here by a habitat-dependent and ecoregion size-dependent system

habitat fragmentation the breaking up of a specific habitat into smaller, unconnected areas
[N.b. A habitat area that is too small may not provide enough space to maintain a breeding population of the species in question.]

habitat conservation protecting an animal or plant habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced

habitat The place or type of site where species and species assemblages are typically found and/or successfully reproduce.
[N.b. An organism's habitat must provide all of the basic requirements for life, and should be free of harmful contaminants.]

historic conditions the composition, structure and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgement, were present prior to substantial human-related changes to the landscape

hydrologic or flow regime characteristic fluctuations in river flows

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hydrology the science of waters of the earth: their occurrences, distributions, and circulations; their physical and chemical properties; and their reactions with the environment, including living beings

important fish areas the aquatic areas identified by private organizations, local, state, and federal agencies that meet the purposes of the Conte Act

impoundment a body of water, such as a pond, confined by a dam, dike, floodgate, or other barrier, which is used to collect and store water for future use

indicator species a species used as a gauge for the condition of a particular habitat, community, or ecosystem. A characteristic or surrogate species for a community or ecosystem

indigenous native to an area

indigenous species a species that, other than a result as an introduction, historically occurred or currently occurs in a particular ecosystem

interjurisdictional fish populations of fish that are managed by two or more States or national or tribal governments because of the scope of their geographic distributions or migrations

interpretive facilities structures that provide information about an event, place, or thing by a variety of means, including printed, audiovisual, or multimedia materials [e.g., kiosks that offer printed materials and audiovisuals, signs, and trail heads.]

interpretive materials any tool used to provide or clarify information, explain events or things, or increase awareness and understanding of the events or things [e.g., printed materials like brochures, maps or curriculum materials; audio/visual materials like video and audio tapes, films, or slides; and, interactive multimedia materials, CD-ROM or other computer technology.]

interpretive materials projects any cooperative venture that combines financial and staff resources to design, develop, and use tools for increasing the awareness and understanding of events or things related to a refuge

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introduced invasive species non-native species that have been introduced into an area and, because of their aggressive growth and lack of natural predators, displace native species

invasive species an alien species whose introduction causes or is likely to cause economic or environmental harm or harm to human health

inventory a list of all the assets and liabilities of an organization, including physical, financial, personnel, and procedural aspects.

invertebrate any animal lacking a backbone or bony segment that encloses the central nerve cord

issue any unsettled matter that requires a management decision
[e.g., a Service initiative, an opportunity, a management problem, a threat to the resources of the unit, a conflict in uses, a public concern, or the presence of an undesirable resource condition.]
[N.b. A CCP should document, describe, and analyze issues even if they cannot be resolved during the planning process (FWS Manual 602 FW 1.4).]

Land Protection Plan (LPP) a document that identifies and prioritizes lands for potential Service acquisition from a willing seller, and also describes other methods of providing protection. Landowners within project boundaries will find this document, which is released with environmental assessments, most useful.

Land trusts organizations dedicated to conserving land by purchase, donation, or conservation easement from landowners

landform the physical shape of the land reflecting geologic structure and processes of geomorphology that have sculpted the structure

landscape A heterogeneous land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout.

landscape approach an approach to managing for species communities that focuses on landscape patterns rather than processes and manages landscape elements to collectively influence groups of species in a desired direction. This approach assumes that by managing a landscape for its components, the naturally occurring species will persist.

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large patch Communities that form large areas of interrupted cover. Individual occurrences of this community type typically range in size from 50 to 2,000 hectares. Large patch communities are associated with environmental conditions that are more specific than those of matrix communities, and that are less common or less extensive in the landscape. Like matrix communities, large-patch communities are also influenced by large-scale processes, but these tend to be modified by specific site features that influence the community.

late-successional species, assemblages, structures, and processes associated with mature natural communities that have not experienced significant disturbance for a long time

limiting factor an environmental limitation that prevents further population growth

limits of acceptable change a planning and management framework for establishing and maintaining acceptable and appropriate environmental and social conditions in recreation settings

local land public land owned by local governments, including community or county parks or municipal watersheds

local agencies generally, municipal governments, regional planning commissions, or conservation groups

long-term protection mechanisms like fee title acquisition, conservation easements, or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintaining species populations over the long term

macroinvertebrates invertebrates large enough to be seen with the naked eye (e.g., most aquatic insects, snails, and amphipods)

management alternative a set of objectives and the strategies needed to accomplish each objective [FWS Manual 602 FW 1.4]

management concern cf. "issue" and "migratory nongame birds of management concern"

management opportunity cf. "issue"

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management plan a plan that guides future land management practices on a tract
[N.b. In the context of an environmental impact statement, management plans may be designed to produce additional wildlife habitat along with primary products like timber or agricultural crops (cf. "cooperative agreement").]

management strategy a general approach to meeting unit objectives
[N.b. A strategy may be broad, or it may be detailed enough to guide implementation through specific actions, tasks, and projects (FWS Manual 602 FW 1.4).]

marshlands areas interspersed with open water, emergent vegetation (hydrophytes), and terrestrial vegetation (phreatophytes).

matrix forming (or matrix community) communities that form extensive and contiguous cover may be categorized as matrix (or matrix-forming) community types. Matrix communities occur on the most extensive landforms and typically have wide ecological tolerances. They may be characterized by a complex mosaic of successional stages resulting from characteristic disturbance processes (e.g. New England northern hardwood-conifer forests). Individual occurrences of the matrix type typically range in size from 2000 to 500,000 hectares. In a typical ecoregion, the aggregate of all matrix communities covers, or historically covered, as much as 75-80% of the natural vegetation of the ecoregion. Matrix community types are often influenced by large-scale processes (e.g., climate patterns, fire), and are important habitat for wide-ranging or large area-dependent fauna, such as large herbivores or birds

mesic soil sandy-to-clay loams containing moisture-retentive organic matter, well drained (no standing matter)

metapopulation a network of semi-isolated populations with some level of regular or intermittent migration and gene flow among them, in which individual populations may go extinct but can then be recolonized from other populations.

migratory nongame birds of management concern species of nongame birds that (a) are believed to have undergone significant population declines; (b) have small or restricted populations; or (c) are dependent upon restricted or vulnerable habitats

mission statement a succinct statement of the purpose for which the unit was established; its reason for being

mitigation actions to compensate for the negative effects of a particular project
[E.g., wetland mitigation usually restores or enhances a previously damaged

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wetland or creates a new wetland.]

mosaic an interconnected patchwork of distinct vegetation types.

National Environmental Policy Act of 1969 (NEPA) requires all Federal agencies to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in planning and implementing environmental actions [Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (cf. 40 CFR 1500).]

National Wildlife Refuge System (Refuge System) all lands and waters and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas managed to preserve a national network for the conservation and management of fish, wildlife and plant resources of the United States, for the benefit of present and future generations (National Wildlife Refuge System Improvement Act, 16 USC 668dd).

native a species that, other than as a result of an introduction, historically occurred or currently occurs in a particular ecosystem

native plant a plant that has grown in the region since the last glaciation, and occurred before European settlement

natural disturbance event any natural event that significantly alters the structure, composition, or dynamics of a natural community: e.g., floods, fires, and storms

natural range of variation a characteristic range of levels, intensities, and periodicities associated with disturbances, population levels, or frequency in undisturbed habitats or communities

niche the specific part or smallest unit of a habitat occupied by an organism

Neotropical migrant birds, bats, or invertebrates that seasonally migrate between the Nearctic and Neotropics

non-consumptive, wildlife-oriented wildlife observation and photography and environmental education and interpretation (cf. "wildlife-oriented recreation")

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recreation

non-native species See "exotic species."

non-point source pollution a diffuse form of water quality degradation in which wastes are not released at one specific, identifiable point but from a number of points that are spread out and difficult to identify and control

nonforested wetlands wetlands dominated by shrubs or emergent vegetation

nonpoint source a diffuse form of water quality degradation produced by erosion of land that causes sedimentation of streams, eutrophication from nutrients and pesticides used in agricultural and silvicultural practices, and acid rain resulting from burning fuels that contain sulfur

Notice of Intent (NOI) an announcement we publish in the Federal Register that we will prepare and review an environmental impact statement [40 CFR 1508.22]

objective cf. "unit objective"

obligate species a species that must have access to a particular habitat type to persist

occurrence site a discrete area where a population of a rare species lives or a rare plant community type grows

outdoor education project any cooperative venture that combines financial and staff resources to develop outdoor education activities like labs, field trips, surveys, monitoring, or sampling

outdoor education educational activities that take place in an outdoor setting

palustrine wetlands "The Palustrine system includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0%." - Cowardin et al. 1979

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Partners for Wildlife Program a voluntary, cooperative habitat restoration program among the Service, other government agencies, public and private organizations, and private landowners to improve and protect fish and wildlife habitat on private land while leaving it in private ownership

partnership a contract or agreement among two or more individuals, groups of individuals, organizations, or agencies, in which each agrees to furnish a part of the capital or some service in kind (e.g., labor) for a mutually beneficial enterprise

passive management protecting, monitoring key resources and conducting baseline inventories to improve our knowledge of the ecosystem

payment in lieu of taxes cf. Revenue Sharing Act of 1935, Chapter One, Legal Context

point source a source of pollution that involves discharge of waste from an identifiable point, such as a smokestack or sewage-treatment plant (Eckhardt, 1998)

population an interbreeding group of plants or animals. The entire group of organisms of one species.

population monitoring assessing the characteristics of populations to ascertain their status and establish trends on their abundance, condition, distribution, or other characteristics

prescribed fire the application of fire to wildland fuels, either by natural or intentional ignition, to achieve identified land use objectives [FWS Manual 621 FW 1.7]

priority general public use a compatible wildlife-dependent recreational use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation

private land land owned by a private individual or group or non-government organization

private organization any non-government organization

proposed wilderness an area of the Refuge System that the Secretary of the Interior has

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	recommended to the President for inclusion in the National Wilderness Preservation System
protection	mechanisms like fee title acquisition, conservation easements, or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintaining species populations at a site (cf. "long-term ~")
public	individuals, organizations, and non-government groups; officials of Federal, State, and local government agencies; Native American tribes, and foreign nations—includes anyone outside the core planning team, those who may or may not have indicated an interest in the issues, and those who do or do not realize that our decisions may affect them
public involvement	offering an opportunity to interested individuals and organizations whom our actions or policies may affect to become informed; soliciting their opinions. We thoroughly study public input, and give it thoughtful consideration in shaping decisions about managing refuges.
public involvement plan	long-term guidance for involving the public in the comprehensive planning process
public land	land owned by the local, State, or Federal Government
rare species	species identified for special management emphasis because of their uncommon occurrence within a watershed
rare community types	plant community types classified as rare by any State program; includes exemplary community types
recharge	refers to water entering an underground aquifer through faults, fractures, or direct absorption
recommended wilderness	areas studied and found suitable for wilderness designation by both the Director (FWS) and Secretary (DOI), and recommended by the President to Congress for inclusion in the National Wilderness System [FWS Manual 610 FW 1.5 (draft)]

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Record of Decision (ROD) a concise public record of a decision by a Federal agency pursuant to NEPA
[N.b. A ROD includes:
* the decision;
* all the alternatives considered;
* the environmentally preferable alternative;
* a summary of monitoring and enforcement, where applicable, for any mitigation; and,
* whether all practical means have been adopted to avoid or minimize environmental harm from the alternative selected (or if not, why not).]

refuge goals "descriptive, open-ended, and often broad statements of desired future conditions that convey a purpose but do not define measurable units." (Writing Refuge Management Goals and Objectives: A Handbook, FWS January 2004)

refuge purposes "the terms 'purposes of the refuge' and 'purposes of each refuge' mean the purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit." (National Wildlife Refuge System Improvement Act of 1997)

refuge lands lands in which the Service holds full interest in fee title or partial interest like an easement

regenerating establishing a new age class. Silviculture does this in a way that controls the species composition, seedling density, and other characteristics consistent with the landowner's objectives.

relatively intact the conservation status category indicating the least possible disruption of ecosystem processes. Natural communities are largely intact, with species and ecosystem processes occurring within their natural ranges of variation.

relatively stable the conservation status category between vulnerable and relatively intact in which extensive areas of intact habitat remain, but local species declines and disruptions of ecological processes have occurred

restoration management of a disturbed or degraded habitat that results in the recovery of its original state
[e.g., restoration may involve planting native grasses and forbs, removing shrubs, prescribed burning, or reestablishing habitat for native plants and animals on degraded grassland.]

restoration ecology the process of using ecological principles and experience to return a degraded ecological system to its former or original state

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riparian	referring to the interface between freshwater habitats and the terrestrial landscape
riparian forested land	forested land along a stream or river
riparian habitat	habitat along the banks of a stream or river [cf. note above]
riverine	within the active channel of a river or stream
riverine wetlands	generally, all the wetlands and deepwater habitats occurring within a freshwater river channel not dominated by trees, shrubs, or persistent emergents
rotation	the period of time from establishment of an even-aged stand until its maturity
runoff	water from rain, melted snow, or agricultural or landscape irrigation that flows over a land surface into a water body (cf. "urban runoff")
scale	the magnitude of a region or process. Refers to both spatial size—for example, a (relatively small-scale) patch or a (relatively large-scale) landscape; and a temporal rate—for example, (relatively rapid) ecological succession or (relatively slow) evolutionary speciation
Selection cutting/selection system	The silvicultural system used to regenerate and maintain uneven-aged stands. Selection cuttings are used to remove individual or small groups of mature trees to regenerate a new cohort, as well as to thin the immature age classes to promote their growth and improve their quality.
Service presence	Service programs and facilities that it directs or shares with other organizations; public awareness of the Service as a sole or cooperative provider of programs and facilities
shifting mosaic	an interconnected patchwork of distinct vegetation types that may shift across the land surface as a result of dynamic ecosystem processes, such as periodic wildfire or flooding.

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shrublands habitats dominated by various species of shrubs, often with many grasses and forbs

silviculture tending and regenerating forest stands to realize sought after benefits and sustain them over time

site improvement any activity that changes the condition of an existing site to better interpret events, places, or things related to a refuge
[E.g., improving safety and access, replacing non-native with native plants, refurbishing footbridges and trailways, and renovating or expanding exhibits.]

small patch communities that form small, discrete areas of vegetation cover. Individual occurrences of this community type typically range in size from 1 to 50 hectares. Small patch communities occur in very specific ecological settings, such as on specialized landform types or in unusual microhabitats. The specialized conditions of small patch communities, however, are often dependent on the maintenance of ecological processes in the surrounding matrix and large patch communities. In many ecoregions, small patch communities contain a is proportionately large percentage of the total flora, and also support a specific and restricted set of associated fauna (e.g., invertebrates or herpetofauna) dependent on specialized conditions.

source population a population in a high-quality habitat where the birth rate greatly exceeds the death rate, and the excess individuals emigrate

spatial pattern within an ecoregion, natural terrestrial communities may be categorized into three functional groups on the basis of their current or historical patterns of occurrence, as correlated with the distribution and extent of landscape features and ecological processes. These groups are identified as matrix communities, large patch communities, and small patch communities.

special focus area an area of high biological value
[N.b. We normally direct most of our resources to SFA's that were delineated because of: the presence of Federal-listed endangered and threatened species, species at risk (formerly, "candidate species"), rare species, concentrations of migrating or wintering waterfowl, or shorebird stopover habitat;
4. their importance as migrant landbird stopover or breeding habitat;
5. the presence of unique or rare communities; or
6. the presence of important fish habitat.]

special habitats wetlands, vernal pools, riparian habitat, and unfragmented rivers, forests and grasslands
[N.b. Many rare species depend on specialized habitats that, in many cases, are being lost within a watershed.]

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special riparian project restoring, protecting, or enhancing an aquatic environment in a discrete riparian corridor within a special focus area

species the basic category of biological classification intended to designate a single kind of animal or plant. Any variation among the individuals may be regarded as not affecting the essential sameness which distinguishes them from all other organisms.

species assemblage the combination of particular species that occur together in a specific location and have a reasonable opportunity to interact with one another

species at risk A general term referring to species listed under the Endangered Species Act (ESA), as well as for unlisted species that are declining in population. Sometimes the term is used interchangeably with "species of concern". Such species, unless already listed under ESA, receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing (Source: http://www.fws.gov/endangered/glossary.html).

species of concern an informal term referring to a species that might be in need of conservation action. This may range from a need for periodic monitoring of populations and threats to the species and its habitat, to the necessity for listing as threatened or endangered under the Endangered Species Act. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing (Source: http://www.fws.gov/endangered/glossary.html).

species diversity usually synonymous with "species richness," but may also include the proportional distribution of species

species richness a simple measure of species diversity calculated as the total number of species in a habitat or community (Fiedler and Jain 1992)

stand an area of trees with a common set of conditions (e.g., based on age, density, species composition, or other features) that allow a single management treatment throughout

state agencies natural resource agencies of State governments

state land State-owned public land

state-listed species cf. "Federal-listed species"

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step-down management plan a plan for dealing with specific refuge management subjects, strategies, and schedules, e.g., cropland, wilderness, and fire [FWS Manual 602 FW 1.4]

stopover habitat habitat where birds rest and feed during migration

strategy a specific action, tool, technique, or combination of actions, tools, and techniques for meeting unit objectives

strategic management the continual process of inventorying, choosing, implementing, and evaluating what an organization should be doing.

stratification thermal layering of water both in lakes and streams

structure the horizontal and vertical arrangement of trees and other vegetation having different sizes, resulting in different degrees of canopy layering, tree heights, and diameters within a stand.

succession the natural, sequential change of species composition of a community in a given area

surface water all waters whose surface is naturally exposed to the atmosphere, or wells or other collectors directly influenced by surface water

sustainable development the attempts to meet economic objectives in ways that do not degrade the underlying environmental support system. Note that there is considerable debate over the meaning of this term…we define it as "human activities conducted in a manner that respects the intrinsic value of the natural world, the role of the natural world in human well-being, and the need for humans to live on the income from nature's capital rather than the capital itself."

terrestrial living on land

territory an area over which an animal or group of animals establishes jurisdiction

thinning reducing the density of trees in a stand primarily to improve the growth and

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condition of residual trees and prevent mortality. The term describes treatments in immature even-aged stands that do not attempt to establish regeneration.

threatened species a Federal-listed, protected species that is likely to become an endangered species in all or a significant portion of its range

tiering incorporating by reference the general discussions of broad topics in environmental impact statements into narrower statements of environmental analysis by focusing on specific issues [40 CFR 1508.28]

tributary a stream or river that flows into a larger stream, river, or lake, feeding it water

trust resource a resource that the Government holds in trust for the people through law or administrative act
[N.b. A Federal trust resource is one for which responsibility is given wholly or in part to the Federal Government by law or administrative act. Generally, Federal trust resources are nationally or internationally important no matter where they occur, like endangered species or migratory birds and fish that regularly move across state lines. They also include cultural resources protected by Federal historic preservation laws, and nationally important or threatened habitats, notably wetlands, navigable waters, and public lands like state parks and national wildlife refuges.]

trust responsibility In the federal government, a special duty required of agencies to hold and manage lands, resources, and funds on behalf of Native American tribes.

turbidity refers to the extent to which light penetrates a body of water. Turbid waters are those that do not generally support net growth of photosynthetic organisms

understory the lower layer of vegetation in a stand, which may include short trees, shrubs, and herbaceous plants

uneven-aged a stand having three or more age classes of trees with distinctly different ages

unfragmented habitat large, unbroken blocks of a particular type of habitat

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unit objective desired conditions that must be accomplished to achieve a desired outcome [N.b. Objectives are the basis for determining management strategies, monitoring refuge accomplishments, and measuring their success. Objectives should be attainable, time-specific, and stated quantitatively or qualitatively (FWS Manual 602 FW 1.4).]

upland dry ground (i.e., other than wetlands)

urban runoff water from rain, melted snow, or landscape irrigation flowing from city streets and domestic or commercial properties that may carry pollutants into a sewer system or water body

vernal pool a type of seasonal wetland formed by isolated depressions in the landscape that hold water in the winter and spring and are usually dry by midsummer or fall. There are no permanent surface connections to flowing water. Water sources include rainfall, snowmelt and elevated water tables. Although fish are usually absent, vernal pools in riparian floodplains may contain fish periodically. vernal pools are important breeding sites for amphibians. The woody debris and emergent grasses provide attachment sites for egg masses. (source: Mitchell, J.C., A.R. Breisch, and K.A. Buhlmann. 2006. Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern U.S. Partners in Amphibian and Reptile Conservation, Technical Publication HMG-3, Montgomery, Alabama, 108 pp)

vision statement a concise statement of what the unit could achieve in the next 10 to 15 years

watchable wildlife program [N.b. A watchable wildlife program is one that helps maintain viable populations of all native fish and wildlife species by building an active, well informed constituency for conservation. Watchable wildlife programs are tools for meeting wildlife conservation goals while at the same time fulfilling public demand for wildlife-dependent recreational activities (other than sport hunting, sport fishing, or trapping).]

watershed the geographic area within which water drains into a particular river, stream, or body of water. A watershed includes both the land and the body of water into which the land drains.

watershed-wide education networks systems for sharing educational information, like curriculum development projects, student activities, and ongoing data gathering; a combination of telecommunications and real-life exchanges of information

well-protected in CCP analysis, a rare species or community type is considered well protected

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if 75 percent or more of its occurrence sites are on dedicated open space

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.
"Wetlands are 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."—Cowardin et al 1979

wilderness study areas lands and waters identified by inventory as meeting the definition of wilderness and being evaluated for a recommendation they be included in the Wilderness System (cf. "recommended wilderness")
[N.b. A wilderness study area must meet these 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;
3. has at least 5,000 contiguous, roadless acres, or sufficient size to make practicable its preservation and use in an unimpaired condition. (FWS Manual 610 FW 1.5 (draft)).]

wilderness cf. "designated wilderness"

wildfire a free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands [FWS Manual 621 FW 1.7]

wildland fire every wildland fire is either a wildfire or a prescribed fire [FWS Manual 621 FW 1.3]

wildlife-dependent recreational use a use of a national wildlife refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation (National Wildlife Refuge System Administration Act of 1966).

wildlife management manipulating wildlife populations, either directly by regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors

wildlife-oriented recreation recreational activities in which wildlife is the focus of the experience
["The terms 'wildlife-dependent recreation' and 'wildlife-dependent recreational use' mean a use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and

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interpretation."—National Wildlife Refuge System Improvement Act of 1997]

working landscape the rural landscape created and used by traditional laborers [N.b. Agriculture, forestry, and fishing all contribute to the working landscape of a watershed (e.g., keeping fields open by mowing or by grazing livestock).]

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Acronyms

ABC = American Bird Conservancy
ACE = U.S. Army Corps of Engineers
ACJV = Atlantic Coast Joint Venture
AID = Tract 48
AP = Atlantic Population (Canada geese)
ARPA = Archaeological Resources Protection Act of 1960
ATV = All-terrain vehicle

BBS =Breeding Bird Survey
BCC =Birds of Conservation Concern
BCR = Bird Conservation Region
BIDEH = Biological integrity, diversity, and environmental health
BMPs = Best Management Practices

CCMP = Comprehensive Conservation and Management Plan
CCP = Comprehensive Conservation Plan
CEQ = Council on Environmental Quality
CFR = Code of Federal Regulations
CWD = Chronic Wasting Disease
CPSS = Coastal plain swamp sparrow

DRBC = Delaware River Basin Commission
DU = Ducks Unlimited

EA = Environmental Assessment
EIS = Environmental Impact Statement
ENSP =Endangered and Nongame Species Program
EPA = U.S. Environmental Protection Agency
ESA = Endangered Species Act

FONSI = Finding of No Significant Impact
FPRRL =Finns Point Rear Range Light
FTE = Full-time equivalent
FWS = U.S. Fish and Wildlife Service
FY = Fiscal Year

GCN = Greatest Conservation Need
GIS = Geographic information system
GS = General Schedule

HMP = Habitat Management Plan

IBA = Important Bird Area
IPCC = Intergovernmental Panel on Climate Change

LWCF =Land and Water Conservation Fund

MANEM = Mid-Atlantic/New England/Maritimes region
MBTA = Migratory Bird Treaty Act
MHT = Mean high tide
MOA = Memorandum of Agreement
MOU = Memorandum of Understanding
MWWS = Mid-winter waterfowl survey

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NABCI = North American Bird Conservation Initiative
NAS = National Audubon Society
NAWCP = North American Waterbird Conservation Plan
NAWMP = North American Waterfowl Management Plan
NEPA = National Environmental Policy Act of 1969
NGO = Non-governmental organization
NHCR = National-State Agency Herpetological Conservation Report
NHPA = National Historic Preservation Act of 1966
NJDEP = New Jersey Department of Environmental Protection
NJDFW = New Jersey Division of Fish and Wildlife
NJWAP = New Jersey Wildlife Action Plan
NJLHS = New Jersey Light House Society
NMFS = National Marine Fisheries Service
NOA = Federal Register Notice of Availability
NOAA = National Oceanic and Atmospheric Administration
NOI = Federal Register Notice of Intent
NPS = National Park Service
NRCS = Natural Resources Conservation Service
NWR = National Wildlife Refuge
NWPS = National Wilderness Preservation System
NWRS = National Wildlife Refuge System

ORV = off-road vehicle

PARC = Partners in Amphibian and Reptile Conservation
PIF = Partners in Flight

RONS = Refuge Operations Needs System

SAMMS = Service Assist Maintenance System
SAMP =Special Area Management Plan
SHPO = State Historic Preservation Office
SLAMM = Sea Level Affecting Marshes Model
SUP =Special Use Permit
SWG = State Wildlife Grant programs

TNC = The Nature Conservancy

USDA = U.S. Department of Agriculture
USFS = U.S. Forest Service
USFWS = U.S. Fish and Wildlife Service
USGS = U.S. Geological Survey

WAP = Wildlife Action Plan
WCS =Water Control Structure
WG = Wage grade
WMA = Watershed Management Area

XTL = Xmas Tree Lane

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Signage on the Refuge

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