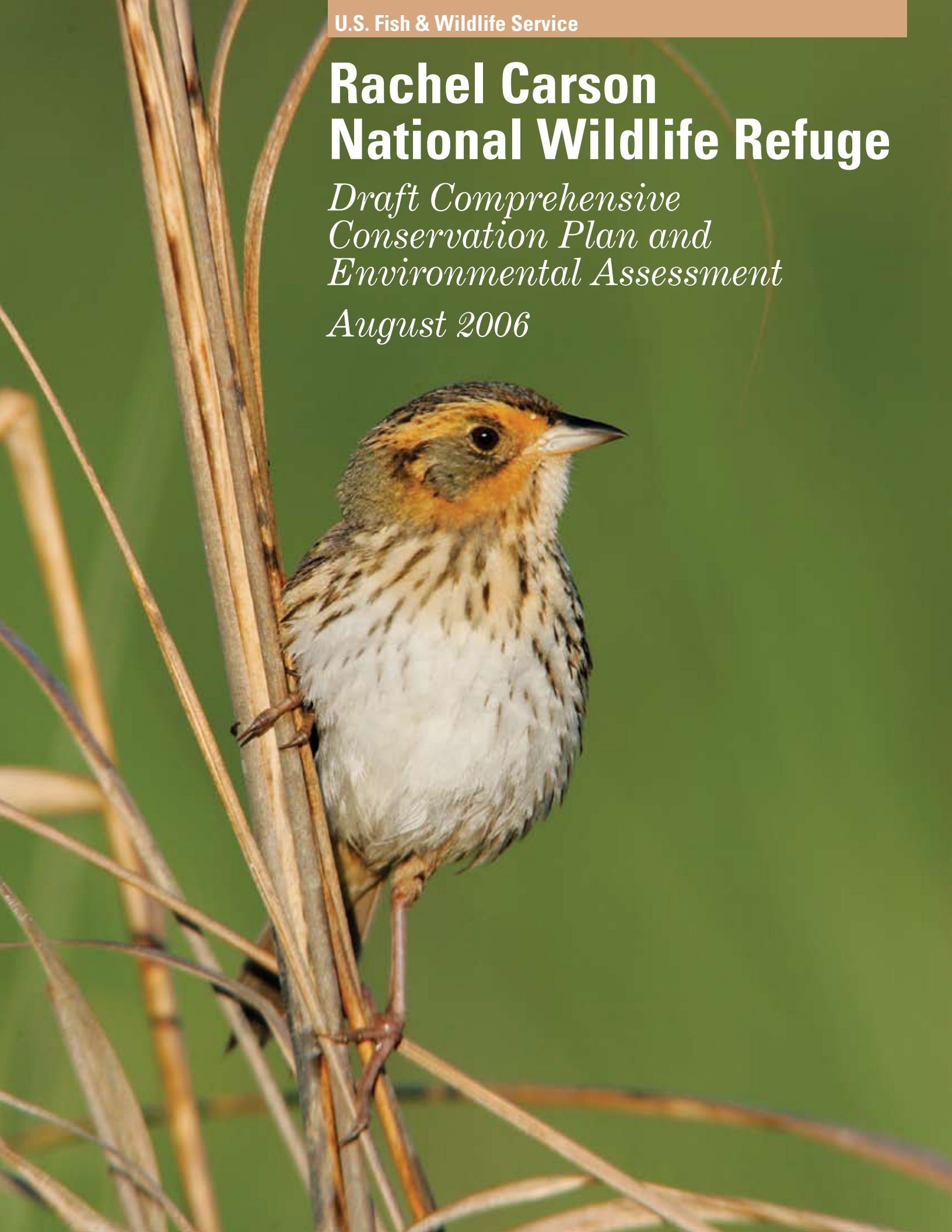
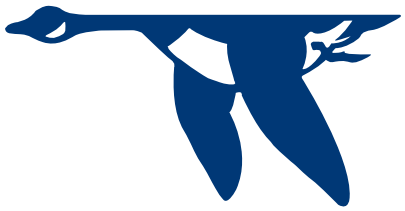
U.S. Fish & Wildlife Service

Rachel Carson National Wildlife Refuge

Draft Comprehensive Conservation Plan and Environmental Assessment

August 2006





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

The U.S. Fish & Wildlife Service is the principal federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service manages the 93-million acre National Wildlife Refuge System comprised of more than 535 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological services field stations. The agency enforces federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restore wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid Program which distributes hundred of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

CCPs provide long-term guidance for U.S. Fish and Wildlife Service management decisions; they set forth goals, objectives, and strategies for accomplishing refuge purposes; and, they identify our best estimate of future needs. They detail levels of program planning that are sometimes substantially above our current budget allocations; as such, they serve primarily in strategic planning and in prioritizing Service programs. They do not constitute a commitment for increases in staffing, operating and maintenance, or future land acquisition funding.

Rachel Carson National Wildlife Refuge

Draft Comprehensive Conservation Plan and Environmental Assessment

Abstract

Type of action: Administrative
Lead agency: U.S. Department of the Interior
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The Draft Comprehensive Conservation Plan and Environmental Assessment for Rachel Carson National Wildlife Refuge fully compares three management alternatives. A brief overview of each alternative follows.

Alternative A

Protection of remaining 3,833 acres within the approved acquisition boundary and continued current management.
This is the "no action" alternative required by regulations under the National Environmental Policy Act of 1969. Selecting this alternative maintains the status quo in refuge management actions over the next 15 years. This alternative portrays current, planned, and approved management and staffing and serves as a baseline for comparing and contrasting the two "action" alternatives. It also incorporates three new facilities to support current and approved management, staffing, and administrative obligations.
This is the current management.

Alternative B

Refuge expansion of 5,558 acres and notably expanded management and public use.
Selecting this alternative will protect the 3,833 acres remaining within the approved acquisition boundary and expand the refuge by 5,558 acres beyond its current approved boundary. It would add additional acreage to the Brave Boat Harbor, Upper Wells, Spurwink, Biddeford, Mousam River, Little River, and Moody divisions, and would establish a new York River Division encompassing the largest undeveloped salt marsh south of Portland. A new administrative complex, including office space, maintenance facilities, and visitor contact station, will be built. This alternative, and alternative C, include combining the Moody, Lower Wells, Upper Wells, and Mousam River divisions into one Wells Bay Division.
This is the preferred alternative.

Alternative C

Refuge expansion of 11,397 acres and greatly expanded management and recreation.
Selecting this alternative will protect the 3,833 acres remaining within the approved acquisition boundary and expand the refuge by 11,397 acres beyond its current approved boundary. The 11,397-acre expansion includes the 5,558 acres in alternative B, and would add acreage to the Brave Boat Harbor, Upper Wells, Spurwink, Biddeford, and Moody divisions. It would establish a new York River Division, encompassing the largest undeveloped salt marsh south of Portland, and build a new administrative complex, including office space, maintenance facilities and visitor center. This alternative would require the greatest increases in budget and staffing.

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Introduction

This Draft Comprehensive Conservation Plan and Environmental Assessment for Rachel Carson National Wildlife Refuge combines two documents required by Federal law: a CCP, required by the National Wildlife Refuge System Improvement Act of 1997 (P.L. 105–57; 111 STAT. 1253); and, an EA, required by the National Environmental Policy Act of 1969 (NEPA). The U.S. Fish and Wildlife Service (Service, we, our) will issue a final decision based on this document to guide our management decisions and actions on the refuge over the next 15 years.

This draft CCP/EA has five chapters and ten appendixes. Chapter 1, "The Purpose and Need for Action," sets the stage for chapters 2 through 4. It

- describes the purpose and need for a CCP for the Rachel Carson NWR,
- identifies national and regional mandates and plans that influenced this document,
- highlights the purposes for which the refuge was established and its land acquisition history,
- identifies the status of refuge management plans,
- presents the vision and goals for the refuge,
- explains the planning process used in developing this document, and
- describes the issues addressed during the planning process.

Chapter 2, "Description of the Alternatives," presents three management alternatives, including current management, (the no-action alternative), and the Service-preferred alternative. Each offers different strategies for meeting goals and objectives and responding to issues.

Chapter 3, "Description of the Affected Environment," describes the physical, biological, and human environment.

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

Chapter 5, "Consultation and Coordination with Others," summarizes the involvement of the public and our conservation partners in the planning process, and lists the planning team.

Ten appendixes provide additional documentation and reference information used in compiling this document.

The Purpose and Need for Action

We propose to develop a CCP for the Rachel Carson refuge that best achieves its purposes, vision, and goals; contributes to the National Wildlife Refuge System mission; adheres to Service policies and mandates; addresses significant issues; and, incorporates sound principles of fish and wildlife management.

This draft CCP/EA evaluates three alternatives or different ways of achieving the criteria above. We designed into each alternative the potential to be fully developed into a final

CCP. Our analysis includes predicting the socioeconomic, physical, cultural, and biological benefits and consequences of implementing each alternative. Chapter 2 describes our proposed action in detail as alternative B, "The Service-Preferred Alternative."

Developing a CCP with partner and public involvement is vital for the future management of every national wildlife refuge. The purpose of a CCP is to provide the Rachel Carson refuge with strategic management direction for the next 15 years, by

- providing a clear statement of desired future conditions for habitat, wildlife, facilities, visitor services, and staffing,
- providing State of Maine agencies, refuge neighbors, visitors, and conservation partners 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 refuge staffing, operations, maintenance, and budget requests.

The present need to develop the CCP for the Rachel Carson refuge is manifold. First, the refuge Improvement Act requires that all national wildlife refuges have CCPs in place by 2012. Second, the refuge lacks a master plan to accomplish the actions noted above in an environment that has changed dramatically since the refuge was first established. For example, significant development pressure and population growth in coastal Maine are impacting the integrity of refuge habitats, and staffing and visitation has increased. Third, we have developed strong partnerships, vital to our continued successes, with land trusts, watershed associations, and other conservation groups throughout the 11-town refuge region. Our responsibility is to clearly develop our priorities through this plan. Finally, we need a CCP to guide us in future habitat management and land protection that promotes the conservation of significant coastal ecosystems and Federal trust species.

Our planning process allows State of Maine agencies, the public, and our conservation partners to engage in resolving management issues and concerns. All of these reasons clearly underscore the need for the strategic direction a CCP provides.

Project Area

The Rachel Carson refuge lies in the heart of the Gulf of Maine watershed, in a region of great biological diversity (map 1–1). The refuge harbors estuaries that provide nurseries for many marine fish. Its tidal rivers provide passage to upstream spawning areas for anadromous fish. Its diverse aquatic and upland habitats support breeding, migrating and wintering birds, and provide essential habitat for nationally threatened and endangered species. Because it lies at the mouth of more than a dozen tidal rivers and their watersheds, the refuge sits at a critical place in an increasingly developed, fragmented region where those rivers meet the sea.

The refuge stretches along 50 miles of coastline in York and Cumberland counties in southern Maine (map 1–2). Our project analysis area includes lands owned by the Service as well as lands evaluated for future Service acquisition.

The 5,293-acre refuge has 10 divisions between Kittery and Cape Elizabeth: approximately 35 percent tidal, 10 percent freshwater wetlands and 55 percent uplands. Tidal habitats include beach, dune, dune grassland, river, rocky shore, estuarine, bay and salt marsh. Freshwater wetlands include cattail marsh, bog, emergent scrub-shrub wetlands, pocket swamps, red maple swamps and floodplain forest. Most of the upland forests consist of mixed oak and pine forest; however, hemlock, spruce and pitch pine stands as well as hickory and maple forests also grow here. Viburnums, winterberry, blueberry, serviceberry, Virginia rose and male berry compose much of the shrub understory. Other upland habitats are composed of grassland units and thicket units. Habitats are quite diverse, containing elements from the more southern oak-pine forests and the softwood forests of the north. Those two community types blend in Southern Maine, creating a wealth of biodiversity.

Service Policies and Legal Mandates Guiding the CCP

This section presents hierarchically, from the national to the local level, highlights of the laws, Service policy, regulations, and resource plans and conservation initiatives that directly influenced the development of this draft CCP/EA.

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

The Service, as part of the Department of 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 such conservation and protection national resources as migratory birds and fish, Federal-listed endangered and threatened species, inter-jurisdictional fishes, wetlands, certain marine mammals, and national wildlife refuges. The Service also enforces Federal wildlife laws and international treaties on importing and exporting wildlife, assists States with their fish and wildlife programs, and helps other countries develop wildlife conservation programs.

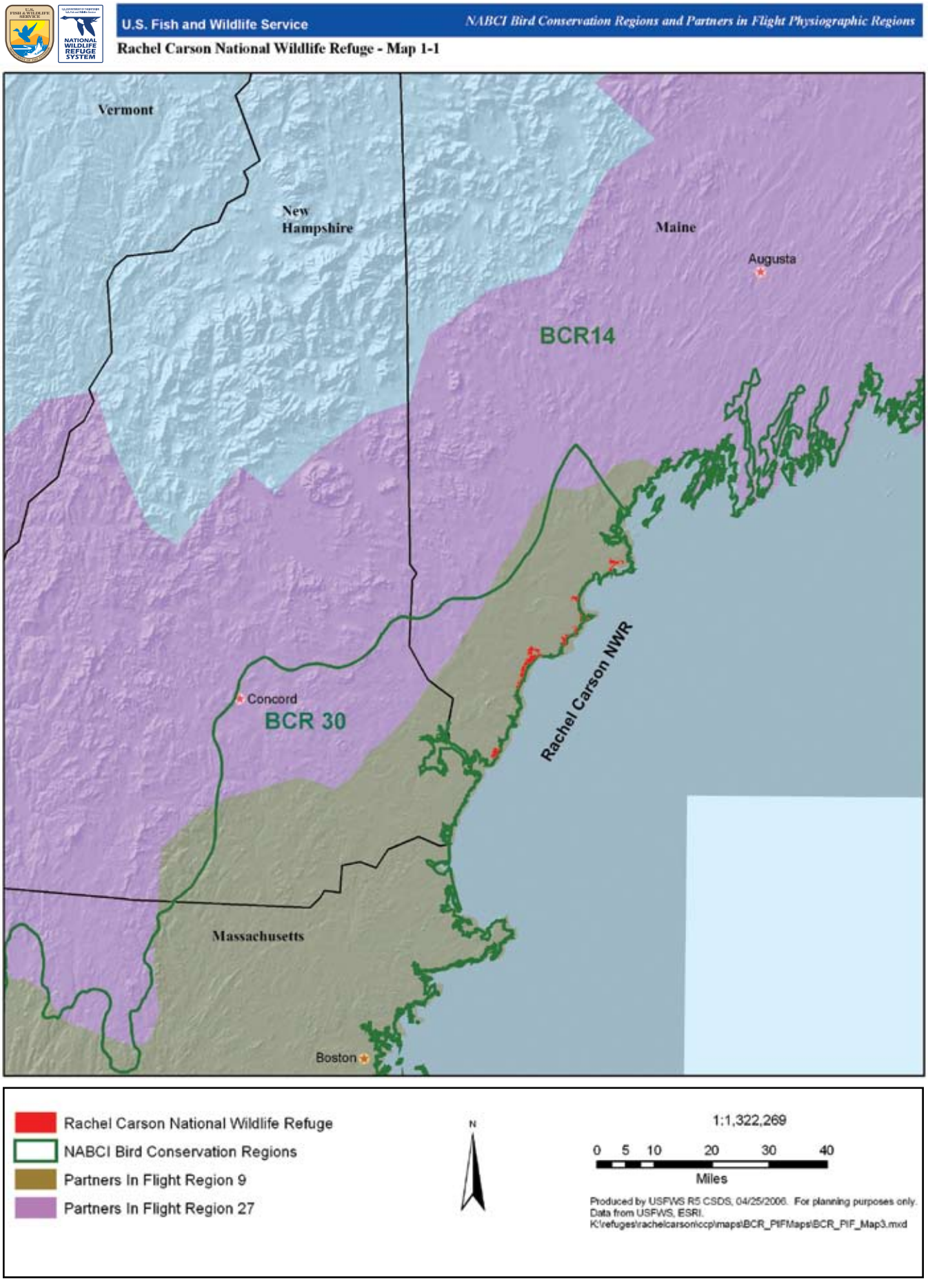
The Service manual contains the standing and continuing directives for implementing those authorities, responsibilities, and activities. The manual can be accessed at http://www.fws.gov.directives/direct.html.

Special Service directives that affect 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. Most of the current regulations that pertain to the Service are issued in 50 CFR parts 1-99. The CFR can be accessed at http://www.access.gpo.gov/nara/cfr/index.html.

❖ The National Wildlife Refuge System and its Mission

The refuge System is the world's largest collection of lands set aside specifically to protect fish and wildlife populations and habitats. It began in 1903, when President Theodore Roosevelt designated 3-acre Pelican Island, a pelican and heron rookery in Florida, as a bird sanctuary. Today, more than 540 national wildlife refuges encompass more than 93 million acres of lands and waters in all 50 states and several U.S. territories. At least 40 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education and interpretive activities on refuges across the nation each year.

When Congress passed the refuge Improvement Act in 1997, it established a unifying mission for the refuge System, a new process for determining compatible public use


U.S. Fish and Wildlife Service
NABCI Bird Conservation Regions and Partners in Flight Physiographic Regions
Rachel Carson National Wildlife Refuge - Map 1-1
Vermont
New Hampshire
Maine
Augusta
BCR14
Concord
BCR 30
Rachel Carson NWR
Massachusetts
Boston
Rachel Carson National Wildlife Refuge
NABCI Bird Conservation Regions
Partners In Flight Region 9
Partners In Flight Region 27
N
1:1,322,269
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Miles
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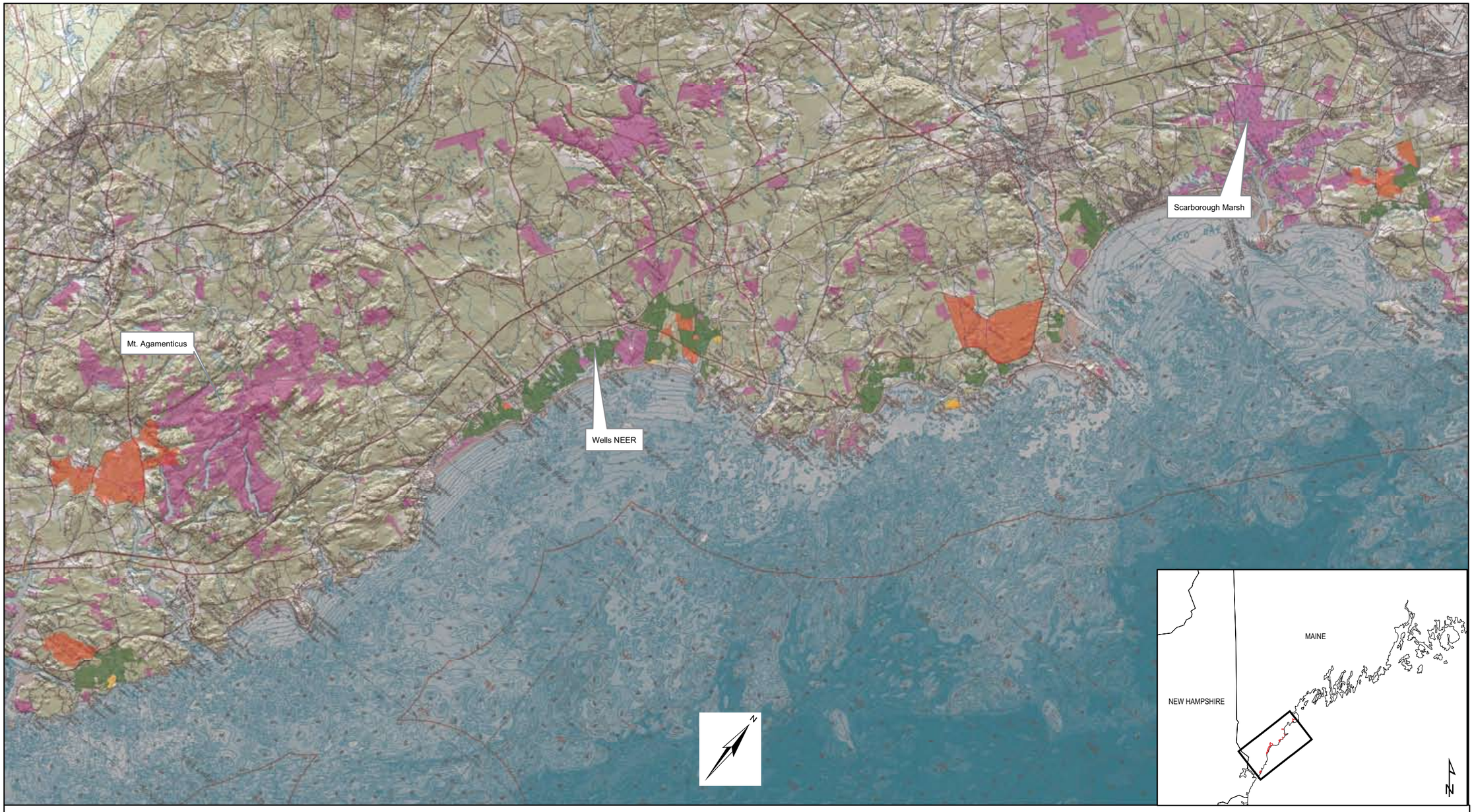
U.S. Fish and Wildlife Service

Conserved Lands

Rachel Carson National Wildlife Refuge - Map 1-2



activities on refuges, and the requirement to prepare a CCP for each refuge in the System. The act 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 each refuge was established, will provide the principal management direction on 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." (P.L. 105–57; 111 STAT. 1253)

The refuge Improvement Act also declares that all existing or proposed refuge uses must be compatible with the refuge purpose and consistent with public safety (see appendix D). Each refuge manager determines the compatibility of an activity by evaluating its potential effect on refuge resources and determining whether it supports the refuge System mission and does not interfere with or detract from refuge purposes and goals. The act designated six priority wildlife-dependent public uses that are to receive enhanced consideration in refuge planning: hunting, fishing, environmental education and interpretation, and wildlife observation and photography.

The Refuge System manual provides a central reference for policy governing the operation and management of the Refuge System not covered by the Service manual, including technical information on implementing refuge polices and guidelines. It can be reviewed at refuge headquarters.

❖ Fulfilling the Promise

A yearlong process involving teams of Service employees who examined the Refuge System within the framework of Wildlife and Habitat, People and Leadership culminated with "Fulfilling the Promise: The National Wildlife Refuge System" (USFWS 1999), a vision for the National Wildlife Refuge System. The first-ever Refuge System Conference in Keystone, Colorado in October 1998, was attended by every refuge manager in the country, other Service employees, and scores of conservation organizations. Many "Promises Teams" formed to develop strategies for implementing the 42 recommendations of the conference report. Information from such teams 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 [Fish and Wildlife Service Manual (602 FW 1,2,3)].

❖ 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). See appendix B for more details on the Integrity Policy, how we used it to determine priority resources of concern, and how that lead to the development of habitat goals and objectives at the Rachel Carson refuge.

❖ Appropriate Refuge Uses Policy

This policy provides a national framework and procedure for refuge managers to follow when deciding if 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). Appendix D 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 Refuge System lands and waters. The Refuge Improvement Act is the key legislation regarding management of public uses and compatibility. 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). This Compatibility Rule changed or modified Service regulations contained in chapter 50, parts 25, 26, and 29 of the Code of Federal Regulations (USFWS 2000b). The compatibility determinations for Rachel Carson refuge can be found in appendix D along with additional information on the process. To view the policy and regulations online, visit http://policy.fws.gov/library/00fr62483.pdf.

❖ Wildlife-Dependent Recreation Policy

The Improvement Act defines and establishes that compatible wildlife dependent recreational uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are the priority general public uses of the Refuge System and will receive enhanced and priority consideration in refuge planning and management over other general public uses. 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 these uses. We are incorporating this policy as Part 605, chapters 1–7, of the Fish and Wildlife Service Manual.

❖ Other Legal Mandates

Although Service and Refuge System policy and the purpose(s) of each refuge provide the foundation for its management, our administration of national wildlife refuges conforms consistent with a variety of other Federal laws, 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 them. It can be accessed at http://laws.fws.gov/lawsdigest/indx.html.

Chapter 4, Environmental Consequences, evaluates compliance with the Clean Water Act, Clean Air Act, the National Historic Preservation Act, the Archeological Resources Protection Act, and the Endangered Species Act. This draft CCP/EA is written to fulfill compliance with NEPA.

National and Regional Plans and Conservation Initiatives Guiding the CCP

❖ North American Waterfowl Management Plan (NAWMP)

This plan outlines the strategies among the United States, Canada, and Mexico to restore waterfowl populations through habitat protection, restoration, and enhancement, and calls on the partners to manage sustainable landscapes, consult and cooperate, and use strong biological foundations to make decisions. Its implementation is accomplished at the regional level in 14 habitat Joint Venture partnerships and 3 species Joint Ventures: Arctic goose, black duck, and sea duck. Our project area lies in the Atlantic Coast Joint Venture, which includes all the Atlantic Flyway states from Maine to Florida and Puerto Rico. Five priority focus areas are identified for Maine. Four are coastal areas, and consist of 51,831 acres of wetlands and associated uplands in need of protection and management. Most of the refuge lies in Maine's West Coast Focus Area. A map of focus areas in Maine can be viewed at http://www.acjv.org.

The waterfowl goal for the Atlantic Coast Joint Venture is

"Protect and manage priority wetland habitats for migration, wintering, and production of waterfowl, with special consideration to black ducks, and to benefit other wildlife in the joint venture area."

The Black Duck Joint Venture Plan is also relevant to our project. Black ducks use the refuge during fall migration. The Final Draft—Strategic Plan (April 1993) can be accessed at http://www.pwrc.usgs.gov/bdjv/bdjvback.htm.

We used these plans as we developed our goals and objectives for waterfowl and their habitats, and for land protection.

❖ North American Waterbird Conservation Plan (Version 1, 2002)

This plan forms an independent partnership among individuals and institutions with the interest and responsibility for conserving waterbirds and their habitats. It is just one element of a multifaceted conservation program. The primary goal of the plan is to ensure 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. The plan provides a framework for conserving and managing colonially nesting water-dependent birds. In addition, it will facilitate continent-wide planning and monitoring, national, state, or provincial conservation action, regional coordination, and local habitat protection and management. Regional planning information is being prepared for the Mid-Atlantic New England Working Group.

We used the plan in developing our objectives, actions and strategies for protecting and managing waterbirds. It can be accessed at http://www.nawcp.org. Additional information is available at http://www.fws.gov/birds/waterbirds/manem/index.html.

❖ U.S. Shorebird Conservation Plan (2004 Update) and Northern Atlantic Regional Shorebird Plan (Draft 2002)

This plan is a partnership being undertaken throughout the United States to ensure that stable, self-sustaining populations of all shorebird species are restored and protected. Collaborators include local, state, and Federal agencies, non-governmental organizations, business-related sectors, researchers, educators, and policy makers. The plan was closely coordinated with NAWMP and Joint Venture professionals, as well as the Partners In Flight and North American Waterbird Plan teams as they concurrently developed their revised national plans. These experts helped set conservation goals for each region of the country, identified important habitat and research needs, and proposed education and outreach programs to increase public awareness of shorebirds and the threats they face. The partnerships responsible for developing the plan remain active, and are working to improve and implement the plan's many recommendations.

The U.S. Shorebird Plan identifies three primary objectives.

1. Development of a standardized, scientifically-sound system for monitoring and studying shorebird populations that will provide practical information to researchers and land managers for shorebird habitat conservation

2. Identification of the principles and practices upon which local, regional and national management plans can effectively integrate shorebird habitat conservation with multiple species strategies

3. Design of an integrated strategy for increasing public awareness and information concerning wetlands and shorebirds

Regional plans, such as the North Atlantic Regional Shorebird Plan, are being developed as part of the overall strategy. The North Atlantic Plan is in draft, but provides detailed information on shorebird species of high conservation concern in the region. Once completed, the plan will enhance shorebird diversity and individual species' populations through regional population, habitat, research, education goals and objectives, and identify specific management needs and projects for implementation.

We used the national and regional plans in developing our Species and Habitats of Concern List (appendix B). The national plan can be accessed at http://shorebirdplan.fws.gov/USShorebird.htm. The website for accessing the regional plan is http://shorebirdplan.fws.gov/RegionalShorebird/RegionalPlans.htm. Additionally, the Program for International Shorebird Monitoring includes sites in and near the Rachel Carson refuge. See http://www.shorebirdworld.org/fromthefield/PRISM/PRISM1.htm for more information.

❖ Partners In Flight Landbird Conservation Plans

In 1990, Partners in Flight (PIF) was conceived as a voluntary, international coalition of government agencies, conservation organizations, academic institutions, private industry, and other citizens dedicated to reversing the population declines of bird species and "keeping common birds common." The foundation of PIF's long-term strategy for bird conservation is a series of scientifically based bird conservation plans, using physiographic provinces as the planning units.

Rachel Carson refuge falls in PIF Physiographic Area 9—Southern New England. Area 9 covers parts of northern New Jersey, southern New York including Long Island, most of Connecticut, all of Rhode Island, most of eastern Massachusetts, the southeastern corner of New Hampshire, and south coastal Maine (map 1–1). This area has experienced the

greatest amount of urbanization of any part of the Northeast, including the entire Boston—New York corridor. Urbanization and associated human activities severely threaten remaining high-priority habitats, especially maritime marshes and dunes, relict grasslands and mature deciduous forests. Forest fragmentation, which is not a major issue in most parts of the Northeast, is a severe factor threatening forest bird populations. Urban land now covers roughly one-third of the physiographic area. Remaining forests are a mixture of oak-hickory and other hardwoods, white pine-red pine forest, and pine-oak woodlands or barrens (Dettmers and Rosenberg 2000).

The goal of each PIF plan is to ensure long-term maintenance of healthy populations of native birds, primarily non-game birds. Within each physiographic area, the plans rank bird species according to their conservation priority, describe desired habitat conditions, develop biological objectives, and recommend conservation measures. Habitat loss, population trends, and vulnerability of a species and its habitats to regional and local threats all factor into the priority ranking. Many of the top-ranked species in the PIF plan either breed or migrate through the Rachel Carson refuge. The PIF plans can be accessed at http://www.partnersinflight.org.

The North American Landbird Conservation Plan (Rich, et al. 2004) identifies a suite of Watch List and Stewardship Species that represent the landbirds of greatest continental importance for conservation action. Many of those are found on the Rachel Carson refuge and other refuges in the Northeast.

❖ Executive Order 13158 on Marine Protected Areas

The Order requires the Department of the Interior and the Department of Commerce to develop "a scientifically-based, comprehensive national system of Marine Protected Areas (MPA) representing diverse marine ecosystems, and the Nation's natural and cultural resources." An inventory of potential MPAs was completed, and the refuge, due in part to its co-location with the Wells National Estuarine Research reserve, is on that list.

❖ North American Bird Conservation Initiative (NABCI)

The NABCI brings together the landbird (PIF), shorebird, waterbird, and waterfowl plans into a coordinated effort to protect and restore all native bird populations and their habitats in North America. All bird conservation partnerships reduce redundancy in the structure, planning and implementation of conservation projects. NABCI uses Bird Conservation Regions (BCRs) to guide landscape-scale, science-based approaches to conserving birds and their habitats (map 1–1).

Rachel Carson NWR lies in the New England Mid Atlantic Bird Conservation Region (BCR 30). This CCP uses the priorities set forth in the PIF Physiographic Area 9 Plan, a subsection of BCR 30, along with priorities of other bird conservation plans. Individual bird conservation plans also help guide bird monitoring, restoration, and habitat management on the refuge. A meeting among conservation partners for BCR 30 was held in December 2004, resulting in consensus on the highest priority species, habitats, geographic areas and conservation actions. The refuge sits on the northern edge of BCR 30, close to BCR 14.

❖ Regional Wetlands Concept Plan—Emergency Wetlands Resources Act (1990)

In 1986, Congress enacted the Emergency Wetlands Resources Act to promote the conservation of our Nation's wetlands. The act directed the Department of 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 using Land and Water Conservation Fund appropriations. In 1990, our Northeast Region completed a Regional Wetlands Concept Plan to provide more specific information about wetlands resources in the Northeast. A total of 850 wetland sites were identified for protection because of their value, scarcity, and vulnerability. In Maine, 71 wetland sites were identified, with 34 sites (43,445 acres) located within 10 miles of the coastline. We used that information as we developed our land protection strategies.

❖ Piping Plover Recovery Plan

Rachel Carson refuge follows recovery plan guidelines for the management of the federal-listed threatened Atlantic Coast piping plover (*Charadrius melodus*) (USFWS 1996a). The refuge manages multiple sites for piping plover, and works with partners to manage off-refuge sites.

❖ Tern Management Plan

The Tern Management Plan provides historic background, a review of factors limiting populations, life history information, and techniques for managing and monitoring the tern species nesting from New York to Newfoundland (USFWS 2000). It also identifies research needs and assesses the size and distribution of tern populations in the region. Primarily, it focuses on coastal populations of common, Arctic, roseate, and least terns. It provides specific management techniques to help achieve the goals set forth in several previous planning approaches that have been developed across the Northeast region. We used this plan in developing our tern objectives and strategies.

❖ Maine Department of Inland Fisheries and Wildlife: Maine's Comprehensive Wildlife Conservation Strategy

In fall 2001, Congress established a new State Wildlife Grants program that provided funds to state wildlife agencies for the conservation of fish and wildlife and their habitats. Each state is charged with developing a comprehensive wildlife conservation plan by October 2005. As mandated by the SWG program, state fish and wildlife agencies are determining which species and habitats are in greatest need of conservation. Rachel Carson refuge staff consulted with Maine Inland Fisheries and Wildlife staff to consider opportunities for the refuge in conserving species identified in Maine's Comprehensive Wildlife Conservation Strategy. We included the state's species priorities in our "Potential Resources of Concern" table in appendix B.

Refuge Purposes and Land Acquisition History

Rachel Carson refuge was established to preserve migratory bird habitat and waterfowl migration routes associated with southern Maine's coastal estuaries. During the mid-1800s, the estuarine habitats teemed with wildlife. The fishing industry supported many people, and commercial hunters made their living from the wildlife that frequented the marshes. Spurred by the arrival of the railroad in 1842, recreational use of the Maine Coast increased in the 19th and 20th centuries. Thousands of visitors came by train, trolley, and later, automobile. Seasonal and vacation homes built on the edge of the salt marsh quickly followed. By the 1950s and early 1960s, land was at a premium for prospective landowners and individuals and groups interested in protecting natural resources.

On December 16, 1966, Congress established the Coastal Maine National Wildlife Refuge under the authority of the Migratory Bird Conservation Act. In a formal dedication ceremony on June 27, 1970, the refuge was renamed in honor of scientist and author Rachel Carson, who spent much of her life along the Maine Coast. During the mid-1970s,

the refuge acquired 4,000 acres, and has expanded its boundary several times over the years to protect coastal salt marshes from encroaching development, and thereby protect vital wildlife habitat. Its 10 divisions stretch 50 miles along the coast, and share more than 5,000 acres with the municipalities of Cape Elizabeth, Scarborough, Old Orchard Beach, Saco, Biddeford, Kennebunkport, Kennebunk, Wells, Ogunquit, York, and Kittery.

Rachel Carson refuge was established under the authority of the Migratory Bird Treaty Act for *"use as an inviolate sanctuary, or for any other management purpose, for migratory birds" 16 USC 715d, Migratory Bird Conservation Act*. Other authorities include:

"*...suitable for - - - 1) incidental fish and wildlife oriented recreational development, 2) protection of natural resources, 3) conservation of endangered or threatened species ...*" 16 USC section 460k-1 Refuge Recreation Act

"*…conservation of wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions…*" 16 USC Section 13901(b) 100 Stat 3583 Emergency Wetlands Resources Act of 1986.

"*…for the development, advancement, management, conservation and protection of fish and wildlife resources ..*" 16 USC Section 742f(a)(1) Fish and Wildlife Act of 1956

"*... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services*" 16 USC Section 742f(b)(1) Fish and Wildlife Act of 1956

The refuge has been very successful over the past two decades in acquiring new lands to meet conservation priorities for the Refuge System. During that period over 2,486 acres have been acquired representing a financial commitment of $20 million dollars. This consistent support in land protection provides a strong indication that the refuge will meet habitat protection goals.

Refuge Operational Plans ("Step-Down" Plans)

The Service Manual, Part 602, Chapter 4, "Refuge Planning Policy," lists more than 25 step-down management plans that are generally required on refuges. Those plans contain specific strategies and implementation schedules for achieving refuge goals and objectives. Some plans require annual revisions; others are revised on a 5- to10-year schedule. Some require additional NEPA analysis, public involvement, and compatibility determinations before they can be implemented. We provide below the current status of step-down plans needed for the refuge, and incorporate by reference those now up-to-date into this draft CCP/EA.

Plans up-to-date

- Fire Management Plan, 1997 (includes prescribed fire and wildfire management direction; annual burn plans are also completed)
- Continuity of Operations Plan, 2004
- Hunt Plan, 1990
- Sport Fishing Plan, 2000

Plans being prepared or now in draft form

- Land Protection Plan (LPP)
- Habitat Management Plan (HMP)

Plans that will need to be completed

- Inventory and Monitoring Plan (IMP)
- Population Monitoring Plan
- Disease Prevention and Control Plan
- Visitor Services Plan
- Law Enforcement Plan
- Integrated Pest Management Plan
- Cultural Resources Management Plan
- Fisheries Resources Management Plan
- Safety Plan
- Water Rights Plan
- Pollution Control Plan
- Compliance Requirements

Wilderness Review

We conducted a Wilderness Review of the refuge in November 2004. Humans have influenced this region for more than 400 years, most recently with dense settlements of roads and houses. As a result, neither the lands that compose the current, approved refuge acquisition boundary, nor the lands within the preliminary project proposal, are suitable for designation as wilderness. We have concluded that none of the wilderness inventory areas at the refuge meet the minimum criteria defined by the Wilderness Act to qualify as wilderness study areas; and, that no further investigation into wilderness designation is needed. For more details on the wilderness review, see appendix C.

Rachel Carson Refuge Vision Statement

Our eponym, Rachel Carson, inspired our vision, which is defined by the mission of the Refuge System. As champions of Rachel Carson's principles, and in recognition of the connectedness of all living things, we are committed to finding reasonable accommodation for the needs of humans and wildlife. Within 15 years, Rachel Carson refuge will have protected 14,684 acres of habitat to benefit trust resources.

Refuge Goals

We developed these goals after consideration of refuge purposes, the Service and Refuge System missions, our vision, and the mandates, plans, and conservation initiatives described above. These are intentionally broad, descriptive statements of purpose. They highlight elements of our vision statement to be emphasized in future refuge management. The biological goals take precedence, but otherwise, the goals are not presented in any particular order.

Goal 1 Perpetuate the biological integrity and diversity of coastal habitats to sustain native wildlife and plant communities, including species of conservation concern.

Goal 2 Perpetuate the biological integrity and diversity of freshwater habitats to sustain native wildlife and plant communities, including species of conservation concern.

Goal 3 Perpetuate the biological integrity and diversity of upland habitats to sustain native wildlife and plant communities, including species of conservation concern.

Goal 4 Develop the Rachel Carson National Wildlife Refuge as an outstanding center for research and demonstration emphasizing land management techniques for restoring and sustaining healthy estuarine ecosystems in concert with the national Land Management Research Demonstration (LMRD) program.

Goal 5 Increase appreciation and stewardship of coastal Maine wildlife and their habitats by providing positive wildlife-dependent experiences for refuge visitors.

Goal 6 Foster off-refuge cooperative actions and partnerships to promote and further refuge goals.

Rachel Louise Carson
writer, scientist, ecologist
(1907–1964)

Rachel Carson began a 15-year career with the U.S. Fish and Wildlife Service in 1936 as an aquatic biologist, and rose to become Editor-in-Chief of all publications for the Service. With the success of her second book, *The Sea Around Us*, she was able to resign from the Service and purchase a cottage on Southport Island, where she researched its beaches and tide pools for *The Edge of the Sea*.

Rachel Carson wrote about the interconnectedness of all living things; each species has its own ties with others, and all are related to the earth. This is the message of *Silent Spring* and the earth-sea trilogy. She simply and convincingly explained the connections between humans and all creatures of the earth. Persevering under industry and government pressure to abandon her research, in *Silent Spring* she linked the unrestrained use of post-World War II chemical pesticides with their fearsome biological consequences. That book is also credited with launching the modern environmental movement.

In formal recognition of her achievements, Congress renamed and dedicated the former Coastal Maine National Wildlife Refuge in her honor on June 27, 1970.

The Comprehensive Conservation Planning Process

Effective conservation usually begins with effective community involvement. To ensure that our future management of the refuge will reflect the issues, concerns, and opportunities expressed by the public, we used a variety of public involvement techniques.

❖ An Early Planning Effort

- We developed and kept updating mailing lists of refuge neighbors, friends, professional contacts, and others for information sharing and updates about this CCP.

- In May and June 1998, refuge staff held a series of morning coffees, inviting visitors to discuss current refuge operations and the planning process. We sent four press releases about the CCP to 15 newspapers in Maine and New Hampshire. Local public access cable stations also ran notices. The York County Coast Star, southern Maine's primary local newspaper, raised public awareness by publishing a long article about our refuge planning. We designed and distributed leaflets about the morning coffees and our upcoming Issues Workbook.

- In summer 1999, we distributed to the public 500 copies of a 12-page Issues Workbook, the backbone of this plan's important public participation component. The workbook provided background information about the planning project and a means for interested citizens to share their concerns and thoughts on important refuge issues. A refuge volunteer recorded and tallied the responses in the more than 100 workbooks returned. In July 1999, we sent to our CCP mailing list an update summarizing the responses, and distributed it from the refuge.

- We also held several information-gathering workshops in 1999. They included a gathering of the Extended Planning Team in March; a Public Use and Community Goals meeting in June; and, a Biological Resources meeting in June. Fifteen stakeholder representatives gathered at our facilitated all-day Alternatives Workshop in August. refuge staff and 10 observers, including congressional representatives and Service administrators, assisted participants with goal setting in the topical areas of wildlife, community, public use, and water quality. We mailed a complete summary of the comments and the materials the workshop generated to participants and observers soon after.

- Refuge planning team members met several times per month to synthesize information and prepare the draft CCP, and briefed the Regional Office in September 1999. Additional updates were provided to the Regional Office in 2001 and 2003. Other staff commitments delayed further work on the draft CCP until 2004.

❖ Our Recent Planning Effort

The planning process was restarted in the summer of 2004. This coincided with the development of a Habitat Management Plan (HMP) that lays the biological foundation for managing habitats, wildlife, and plants on the refuge. We also considered the refuge role in the larger network of conservation lands in southern Maine. Habitat management objectives and strategies were determined for lands currently in refuge ownership using updated vegetation maps prepared by Sewall, Inc. in 2004. The Service evaluated lands proposed for acquisition using National Land Cover Data (NLCD) and a GIS watershed habitat analysis by the USFWS Gulf of Maine Coastal Program.

The core planning team included the refuge staff, regional office planning and GIS staff, a regional biologist, and a representative from the Maine Department of Inland Fisheries

and Wildlife. Our staff continually gathers input from partners at management and conservation meetings and workshops.

As part of the planning process, the refuge initiated a wilderness review (see appendix C) of existing refuge lands as required by Service refuge planning policy. The compatibility determinations (described in appendix D) were also reviewed and updated.

The diagram below depicts the steps in the comprehensive conservation planning process and their relationship to National Environmental Policy Act (NEPA) compliance.

Figure 1.1. The Comprehensive Conservation Planning process and its relationship to the National Environmental Policy Act of 1969

Issues and Opportunities

From the Issues Workbook, public and focus group meetings, and planning team discussions, we developed a list of issues, opportunities, or any other item requiring a management decision. We concentrated further on the issues, as these drive the analysis and comparison of alternatives.

1. Planning issues formed the basis for the development and comparison of different management alternatives. A range of opinions on how to resolve these significant issues and meet objectives generated the different alternatives presented in chapter 2. These issues are resolved differently among the alternatives.

2. Other issues and management concerns were identified by refuge staff as important to address under management alternatives in chapter 2.

❖ Planning Issues

The following issues were generated by the planning team or brought to our attention by our State or other partners, or the public, during scoping activities. The issues matrix in chapter 2 shows how we deal with these issues through actions and strategies in the three alternatives.

1. **How will we provide habitat to protect trust species?**

Federal law charges the Service with sustaining populations of migratory birds, anadromous fish, and species listed as threatened or endangered, collectively referred to as "trust species". In response, the Service seeks to provide habitat to support the life cycles of these species. The Service and its partners who protect wildlife habitat--State agencies, local land trusts, the Maine Audubon Society, and national organizations including The Nature Conservancy and Trust for Public Land--have identified thousands of acres of unprotected habitat in southern coastal Maine that support 43 trust species whose populations are declining. In the preferred action, the Service seeks to protect an additional 5,558 acres of important salt marsh, tidal rivers, shrublands, freshwater wetlands, riparian areas, forests, and grasslands as part of the Rachel Carson NWR (See appendix A). Also, the refuge is actively engaged in watershed and landscape-scale initiatives with conservation partners to support additional land conservation in this region of Maine. Generally, the lands identified for protection are large blocks that provide habitat for the declining species as well as a diverse array of other wildlife. Coastal habitats are in smaller blocks, due to heavy settlement and the paucity of large undeveloped tracts. All these lands proposed for acquisition are vulnerable to changes in land use that threaten to degrade, fragment, or eliminate their wildlife values.

2. **How will we manage fish and wildlife populations and habitats?**

Rachel Carson refuge hosts large numbers of resident and migrant wildlife and plant species. Some of them, including the federal-listed endangered piping plover, Nelson's and saltmarsh sharp-tailed sparrows, and the New England cottontail, among others, depend on the refuge for breeding, feeding, or resting habitat. The refuge assesses and monitors the abundance and distribution of wildlife populations through targeted field surveys such as annual breeding bird surveys or through research by university and state partners. Wildlife species that are sensitive to human disturbance or predation, such as piping plover, receive targeted management including seasonal beach closures and predator control. Some habitats are actively managed to provide a range of habitat conditions necessary to support the suite of native wildlife that occur on the refuge. The habitat goals, objectives, and strategies described in chapter 2 and in more detail in the Habitat Management Plan provide a framework for guiding habitat and wildlife management decisions.

3. **How will we ensure the integrity of water quality and quantity to protect aquatic-dependent species?**

All species, including humans, require water to stay alive. Water is at the center of most management decisions at the Rachel Carson NWR— protecting water quantity and quality to sustain healthy populations of fish, wildlife, and plants that depend on aquatic habitats. Nearly one-third of North America's bird species use wetlands sometime during their lifecycle, many of these use the refuge sometime during the year. Freshwater, estuarine, and marine wetlands are considered some of the most productive ecosystems in the world and all occur on the refuge.

Despite great improvements in water quality in Maine's rivers and other aquatic environments, our understanding of the dynamics of these ecosystems is limited. The

increasing land fragmentation and developments in close proximity to wetlands in coastal Maine adds uncertainty to the health and sustainability of aquatic habitats for wildlife and humans. Baseline information is needed on the quantity and quality of water flowing through the refuge and the habitat requirements of the aquatic species (e.g., anadromous fish) that depend on these waters. The refuge will partner with watershed groups and government entities to develop and implement water monitoring initiatives as well as to assess the impacts of land uses (e.g., stormwater runoff) on aquatic systems. The refuge also monitors and controls invasive aquatic species where feasible.

4. **How will we build community partnerships to protect and manage coastal wildlife habitats?**

We believe that Rachel Carson NWR has more neighbors than any other national wildlife refuge in the System. The refuge has 10 divisions, and owns land in 11 towns: Kittery, York, Ogunquit, Wells, Kennebunk, Kennebunkport, Biddeford, Saco, Old Orchard Beach, Scarborough, and Cape Elizabeth. Our opportunity to work with municipalities is expanding. To achieve its mission, the refuge must be and is engaged in land use and public use decisions by neighboring municipalities and conservation groups.

We have established many valuable partnerships working to protect wildlife and their habitats in southern and coastal Maine. Southern Maine has been continuously settled since 1630, and is now experiencing record growth. The refuge lends its technical expertise to landscape-scale and watershed initiatives on identifying, protecting, and managing important wildlife habitats. Land protection by the refuge and by its conservation partners contributes to the quality of life, by controlling the demand for town services such as road maintenance, schools, and fire and police protection, providing places for the public to understand and appreciate their natural surroundings, and protecting water quality.

5. **How will we provide and maintain high quality programs for the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation)?**

We allow hunting on eight divisions by permit only. More than 300 people buy permits annually from refuge headquarters. About 60 percent are white-tailed deer hunters. The refuge is open to deer, waterfowl, pheasant, and other upland game hunting, and participates in Maine's special archery season. We have two youth hunt days; youth hunt areas allow falconry and are open for the late falcon-hunting season. The refuge follows state regulations although it is more restrictive on some issues. We open new areas to hunting as we acquire them, provided they are sufficiently isolated from developed areas and no biological conflicts exist. We review and usually modify the hunting program each year. Due in part to a long tradition of hunting in the area, the refuge hunting program is generally well accepted. However, refuge neighbors and other landowners contact us each year with their concerns about some hunter behavior and sometimes, about our regulations.

In September 2000, after completing the required process, the refuge was formally opened to sport fishing. After a long consultation with the State of Maine, fishing groups, and anglers, eight bank fishing and access areas were identified and opened on seven of the ten refuge divisions. These areas were selected based on minimizing adverse impacts to habitat and wildlife resources, minimizing conflicts with other existing public uses, and to accommodate as much as possible existing angler interest. Most anglers pursue either sea run brown trout and/or striped bass although other species are occasionally caught as well. In addition to the bank fishing areas, each of the ten refuge divisions has a waterway that is accessible by watercraft. These waterways provide addition opportunity to anglers with their ability to access sections of rivers not open for bank fishing.

A traveler through coastal southern Maine likely will encounter at least one division of the Rachel Carson NWR. However, many visitors and residents may pass by only seeing our boundary signs: "unauthorized entry prohibited." We have an opportunity to bring thousands of travelers and residents onto the refuge to learn about refuge operations, its wildlife and habitats, the Refuge System, and Rachel Carson's legacy. The refuge has informational kiosks and signs at a few trailheads with small parking areas. Responders to our issues workbook favored increasing visitor opportunities for wildlife watching in balance with the protection of wildlife and their habitats. The refuge seeks to expand the number of informational kiosks to enhance understanding of refuge habitats, convey its messages, build support for its programs, and attract wildlife-oriented volunteers.

Responders to our workbook suggested we vastly increase our environmental education and interpretation program. They suggested we establish partnerships with educators, and develop cooperative education programs with local schools and private organizations.

6. **How will we build and maintain an active volunteer program?**

The Friends of Rachel Carson was established in 1988. The small, yet effective group has been instrumental in supporting protection of important coastal habitats by the refuge. Volunteers are essential to the refuge for implementing effective programs and bolstering understanding and support among neighbors and communities. The need for a committed, multi-talented, and geographically dispersed volunteer force is especially important at the refuge because its units are spread across a 50-mile area. We believe strongly that program management and guidance from refuge staff are the keys to building and sustaining a committed, well-trained volunteer force.

7. **How will we manage non-native, invasive species on refuge lands?**

Most people recognize that non-native, invasive plants and animals can displace native species, degrade wetlands and other natural communities, and reduce natural diversity and wildlife habitat values. Non-native plants out-compete native species by dominating light, water, and nutrient resources. We are concerned that, once established, invasive plants are expensive and labor-intensive to eliminate; they are able to establish easily, reproduce prolifically, and disperse readily, making eradication difficult. Preventing new invasions is extremely important for maintaining biological diversity and native plant populations.

The refuge initiated an effort to systematically identify, locate, and map invasive plant species occurring on refuge lands. This information will be used to develop an integrated pest management program to guide control, monitoring and evaluation projects. Twenty non-native invasive plant species that are affecting the quality of native habitats are documented for the refuge. In addition, hemlock woolly adelgid is documented on Gerrish Island near the Brave Boat Harbor Division. This insect pest has decimated hemlock stands in some areas south of New England. Little is currently known about the presence or effect of aquatic invasive species such as the green crab. Further research is needed to understand the effects of all invasive species on the natural habitats of coastal Maine.

❖ Other Issues to Address

1. **How will we resolve potential conflicts managing wildlife habitats and protecting historical resources?**

The refuge is required by law to comply with the Section 106 of the National Historical Preservation Act (NHPA), which requires federal agencies to consider the effects of their undertakings on historic properties that are eligible for inclusion on the National Register of Historic Places. The refuge Improvement Act establishes a mission for the Service:

"Working with others, to conserve, protect, and enhance, fish, wildlife and plants, and their habitats for the continuing benefit of the American people." That mission enables the refuge to contribute to the fulfillment of U.S. obligations to International Treaties.

Current management practices used on the refuge take into consideration possible historical resources. Projects and habitat management plans routinely receive NHPA review from the Regional and State Historic Preservation Officers, and archaeological or historical studies performed as required.

The Maine State Historic Preservation Officer (SHPO) has led the U.S. Army Corps of Engineers to decline issuance of two 404 wetland permits the refuge needs to authorize the restoration of salt marsh on the refuge. The SHPO contends that salt marsh ditches are a historic landscape eligible for inclusion on the National Register, and that restoration work would have an adverse impact on that landscape. Although disagreeing with the SHPO impact opinion, the Service (at SHPO request) has carefully recorded through photographs and measurements the dimensions and configurations of the ditching, and the SHPO recognizes that as sufficient mitigation. However, the Corps still declines to issue the permit without a Memorandum of Agreement between the Service and SHPO. The Service will consult with and seek a Solicitors review and opinion on the legitimacy of the Army Corps of Engineers declining this permit. Additionally, there is indication that the Corps has issued 404 permits for similar activities conducted by other federal agencies and Service offices in Maine, and the Solicitor's review will include an examination of consistency in permit decisions by the Corps. The Solicitor's opinion will establish a basis upon which the Refuge will proceed with marsh restoration activities in the event this permit matter cannot be resolved with the Corps.

2. **How will we respond to harbor dredging and beach nourishment that affect the refuge?**

Currently, only one harbor dredge project, in the Webhannet River in Wells, exists in the refuge. That is an on-going, controversial project.

Several controversial beach nourishment projects have occurred along the southern Maine coast. That involves dredging sand from one location and placing it onto a beach, almost always in front of homes, to replace beach that has eroded.

Both of those practices fail to address the dynamic nature of beach and tidal river systems with natural processes creating constant change in beach conditions. Shoreline home development and its associated rock jetties limit the natural dynamics of these barrier beaches, preventing the natural movement of sand up or down the coast.

The refuge will work with others to review dredging and beach nourishment projects, and will not support new dredging projects in the existing waterways of the refuge. We will encourage towns to adopt more sustainable development patterns that limit or prevent beach development.

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, following the procedures

outlined in Service policy and NEPA requirements. Minor revisions that meet the criteria for categorical exclusions (550 FW 3.3 C) will only require an Environmental Action Memorandum.

USFWS

Chapter 2

Alternatives, Including Our Service-Preferred Alternative

- Introduction
- Formulating Alternatives
- Alternatives, Including the No Actioni Alternative
- Actions Common to All Alternatives
- Alternatives or Actions Considered but not Fully Developed
- Description of Individual Alternatives Analyzed in Detail
- Alternative A. Current Management
- Alternative B. Our Preferred Alternative
- Alternative C
- Comparison of Major Actions by Alternative and Issue

Introduction

This chapter presents

- the process for formulating alternatives,
- the actions common among all alternatives,
- the actions or alternatives we considered but did not fully develop, and
- the descriptions of the three alternatives we analyzed in detail.

At the end of this chapter, you will find a tabular matrix that compares specific management actions and strategies by alternative and issue (table 2.1). We organized that table to show how the actions and strategies address the significant issues identified in chapter 1.

Formulating Alternatives

Goals and objectives define each alternative. Our goals are intentionally broad, descriptive statements of desired future condition for refuge lands. By design, they are less quantitative than prescriptive in defining the targets of our management. They also articulate the principal elements of refuge purposes and our vision statement and the foundation for developing specific management objectives. The same goals appear in each alternative. The alternatives vary in how they accomplish them.

Next, we considered a range of possible management objectives that would help us meet our goals. Essentially, objectives are incremental steps we take to achieve a goal; they further define the management targets in measurable terms. They often vary among the alternatives. Objectives provide the basis for determining more detailed strategies, monitoring refuge accomplishments, and evaluating our successes. Service guidance in "Writing Refuge Management Goals and Objectives: A Handbook" (November 2003), recommends that objectives possess five properties: (1) Specific, (2) Measurable, (3) Achievable, (4) Results-oriented, and (5) Time-fixed." Their initials form the acronym "SMART."

You will notice that the objectives in alternative A do not adhere strictly to the SMART format, because they describe management activities that were already established on the refuge before the Service published its 2003 handbook.

The objectives we considered ranged from those that require only minimum levels of funding and staffing to those that require considerable increases in funding, staffing, and developing infrastructure and partnerships. Some of them relate directly to managing habitat, while others relate to meeting population targets tied to species recovery or other regional plans. We developed them in collaboration with other New England refuges in a Habitat Management Plan (HMP). This chapter also describes that process.

We include a rationale in every objective, so you can understand its context and why we consider it important. We will use the ones our Regional Director selects for the final CCP in refuge step-down plans, including its HMP. Our successes will reflect how well we achieve them.

Finally, we developed strategies for each objective. Strategies are specific actions, tools, techniques, considerations, or a combination of those, that we may use in achieving the objectives. Most likely, we will carry them directly over into subsequent, step-down plans; but, we may revise some of them in the process of developing those plans.

Alternatives, Including the No Action Alternative

After identifying a range of possible management objectives and strategies, we began the process of creating alternatives. Simply put alternatives package complementary management objectives for achieving the Service and Refuge System missions, the purposes for which the refuge was established, and refuge vision and goals, while responding to issues and opportunities identified during the planning process. To that end, we grouped various objectives that fit together in what we loosely called themes. We believe our three alternatives and their respective objectives represent a reasonable range of proposals for achieving the purposes, vision, and goals of the refuge and addressing the significant issues in chapter 1.

NEPA requires our analysis of a "No Action" alternative, which continues our current management of the refuge. In this draft CCP/EA, alternative A fulfills that requirement. We refer to alternative A throughout this plan as the "Current Management Alternative." It provides the baseline for comparing or contrasting the other two action alternatives. In fact, we suggest first reading chapter 3, "Affected Environment," for detailed descriptions of refuge resources.

Actions Common to All Alternatives

We will implement some actions regardless of the alternative selected. Those

- may be required by law or policy,
- represent NEPA decisions that have recently gone through a public and agency review,
- compose administrative actions that do not necessarily require public review, but that we wanted to highlight in this document,
- are considered so fundamentally important in achieving refuge purposes and goals, we determined they should occur regardless of the alternative, or
- fill approved, essential staffing positions, and provide essential maintenance, visitor, and administrative space required to fulfill refuge obligations.

❖ Habitat Management Plan

A Habitat Management Plan (HMP) for the refuge is the requisite first step in achieving the objectives under goals 1 through 3 in all of the alternatives. For example, it establishes what specific strategies are necessary to enhance, restore, and manage important habitats and minimize impacts on significant species assemblages.

It also describes the timing of those actions, and identifies how we will measure our success. We drafted a HMP at the same time as the CCP so their habitat objectives would be consistent. We are still developing specific habitat prescriptions for each management unit of the refuge. However, appendix E includes the range of management prescriptions that the refuge likely will use during the 15-year periods of the CCP and HMP.

❖ Inventory and Monitoring Plan

Completing an Inventory and Monitoring Plan (IMP) for the refuge is also a priority. That plan is vital for measuring our success in meeting our objectives in all of the alternatives. It will outline the methods we will use to assess whether our original assumptions and

proposed management actions are, in fact, supporting our habitat and species objectives. The results of our inventory and monitoring will provide more extensive information on the status of refuge wildlife and their habitats and allow more informed management decisions.

❖ Fire Management Plan

Service policy mandates a Fire Management Plan for refuges that have "vegetation capable of sustaining fire." The fire plan addresses wildland and prescribed fires, with guidelines on the level of protection needed to ensure safety, protect facilities and resources, and restore and perpetuate natural processes. We have revised the refuge FMP, first approved in 1997. The refuge completed the revision in 2005 and expects to have it approved by the end of 2006. We prepare step-down prescribed burn plans each year.

❖ Land Protection

All three alternatives include, at a minimum, the continued acquisition from willing sellers of land in the currently approved refuge boundary. We now have approval to acquire the 3,833 acres that remain in private ownership in that boundary. We believe their acquisition is essential for meeting refuge purposes and goals. Although all three alternatives include those 3,833 acres, they differ in how much additional land they propose for Service acquisition. All the lands we acquire would become part of the refuge (see appendix A).

In addition to Service acquisition, all three alternatives would allow us to continue cooperating with our conservation partners to identify and protect areas of high biodiversity value important for Federal trust resources and other rare or declining species or plant communities. Our working together to complement each other's land protection is important, given the limited funding and resources available.

❖ Refuge Revenue Sharing Payments

Annual refuge revenue sharing payments to the 11 towns in which refuge lands lie will continue under each alternative as law and policy allow. Future payments will be made in accordance with approved, appraised values, considering new acquisitions, and the level of Congressional appropriations each year. Please refer to chapter 3 for additional information on refuge revenue sharing payments.

❖ Partnerships

All three alternatives support partnerships to the fullest possible extent. They are vital in successfully managing all aspects of the refuge, from land protection to habitat and species management to public use. Chapter 5 lists many of our partners.

❖ Friends Group Support

All three alternatives would continue to support the Friends of Rachel Carson association. We expect that group to provide us with valuable assistance in implementing the final CCP.

❖ Volunteer Opportunities

All three alternatives would continue our successful volunteer program. Volunteers perform thousands of hours of work in administration, public use, and the biological program. Volunteers have enhanced our ability to complete many tasks associated with refuge management.

❖ Existing Facilities Maintenance

The periodic maintenance and renovation of existing facilities is a critical need, regardless of the alternative finally selected, to ensure safety and accessibility for refuge staff and visitors. Future maintenance needs vary among the alternatives, since they differ in the amount of new facility construction. Appendix E lists new construction projects from our Refuge Operating Needs Systems (RONS) database and projects from our Maintenance Management System (MMS) that identify repairs, replacements, and other work needed for existing facilities and equipment.

We would seek funds for refuge public use, parking lots, bridges, restrooms, and trails from the Refuge Roads Program (RRP), a Federal Lands Highway Program that Congress funded through the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) (P.L. 109–59; 119 STAT. 1144). Those funds can also be used for interpretive enhancements associated with the projects, as long as the costs for the interpretive facilities do not exceed 5 percent of the project budget. RRP funds can be used as the non-federal match for FHA funds available through state departments of transportation. Refuges can use appropriated Service funds as the non-federal match for those funds, as well. That matching ability can be used to further city, county, and state transportation and transit funds for projects that benefit the refuge.

❖ Refuge Facilities

All three alternatives include the construction of a new administrative facility to support both our present and approved staffing, a new maintenance facility to improve the efficiency of refuge infrastructure maintenance and biological operations, and a pole shed to protect refuge vehicles and equipment from weather and vandalism (see the sidebar on the following page).

❖ Permitting Special Uses

In all of the alternatives, we will continue to allow existing, compatible, approved special use permits. The refuge manager evaluates all requests for special use permits individually for their appropriateness and compatibility. At a minimum, all commercial activities and all research projects require special use permits unless new information indicates they are no longer compatible.

We will encourage research projects that improve or strengthen natural resource management decisions on the refuge. Research on species of concern and their habitats will continue to be a priority. The refuge manager may also consider research not directly related to refuge objectives, but contributes to the broader enhancement, protection, or management of native species and biological diversity in the region and beyond.

We will promote partnerships with local universities and colleges, the USGS and other federal and state research agencies. The refuge manager will determine on a case-by-case basis whether they can directly support a project through funding or in-kind services (e.g., housing or use of other facilities), field assistance, or through sharing data and records.

All present and future researchers on the refuge will be required to submit a detailed research proposal following Service policy in the Refuge Manual, chapter 4, section 6. Special use permits must also identify a schedule for progress reports (at least annually), criteria for determining when a project should cease, and publication or other final reporting requirements. Service divisions and state agencies may be asked to review and

Refuge Facilities—History and Current Needs

Rachel Carson refuge began in 1966 as an unstaffed satellite of Parker River refuge in Newburyport, MA. The first staffed position at the refuge was established in 1977, at a small cabin off Drakes Island Road in the Lower Wells Division. A new office/residence was built in 1980 at its current location on Route 9 in the Upper Wells Division. Three staff occupied a one-room office.

Between 1989 and 1990, a new office was constructed to accommodate the three staff, with private offices for the manager and assistant manager, a general work area for the administrative staff, a small visitor contact area, a garage and a workshop. In 1996, the building was modified, adding approximately 300 square feet for a new visitor contact area and converting the garage into office space for a staff that had grown to four positions.

In 1997 the addition of a visitor services specialist increased the permanent refuge staff to five. That staff continued to grow, adding three permanent positions, two permanent seasonal positions, and as many as seven temporary positions, a YCC crew, and a co-located Wildland-Urban Interface (WUI) coordinator. We converted the maintenance area into offices and built an 18x30-foot addition for staff space. In 2003, the staff total swelled to 22 (10 permanent, 12 seasonal). The present building offers crowded office and work space, no additional file storage, only one bathroom, and inadequate parking for visitor, staff, and work vehicles.

The existing building and parking area cannot accommodate the approved staffing chart strength (see alternative A) of 13 permanent employees plus seasonal employees. In summer, a staff of 22 has only one bathroom. The refuge headquarters lacks adequate space and parking area to host meetings with partners. The only parking available is for the Carson Trail, which has a limit of 15 vehicles.

The refuge needs a new administrative facility to provide safe, adequate facilities for permanent and seasonal staff under all three alternatives, and to increase the overall efficiency of operations. The existing headquarters site, although convenient for the 100,000-plus annual visitors to the Carson Trail, cannot accommodate any additional building or parking because of its proximity to two rivers. A new administrative facility may include co-location with the Service's Gulf of Maine Coastal Program, other Service programs, and possibly other federal agencies. The facility would include a visitor contact area of sufficient size to accommodate and provide information to the approximately 300,000 refuge visitors as well as an estimated 100,000 to 200,000 additional visitors expected at the refuge. The Service's "Suite of Facilities" criteria will be used to determine the appropriate facility.

Executive Order No. 13123, "Greening the Government Through Efficient Energy Management," calls for the federal government to have 20,000 solar energy systems at federal facilities by the end of 2010.The new facility would incorporate various green technologies, such as recycled materials, porous materials for roads and parking, and solar energy. The facility would demonstrate the federal commitment to energy conservation in government facilities, and provide a modern example of Rachel Carson's legacy.

A maintenance facility is also essential to accommodate refuge vehicles and equipment and serve as a refuge workshop. On-going projects now must be moved out of the way to accommodate new or emergency projects. Deliveries of supplies and materials must be placed on the floor, often filling work space or creating obstacles. Current vehicles are wedged among pine and oak trees that occasionally fall down in storms. In 2003, a tree with a diameter between 18 and 24 inches nearly fell on three or four vehicles with a combined value of almost $100,000. A pole building would be constructed to accommodate the more than $600,000 worth of vehicles and equipment now subject to the salt air as well as an annual snowfall over 72 inches. The existing maintenance facility is a storage building that would continue to provide storage.

comment on research proposals. Research results will be shared within the Service, with the MDIFW, and elsewhere as appropriate.

Some projects, such as depredation and banding studies, require additional Service permits. We will not approve them until they have met all the requirements for Service permits and Endangered Species Act consultation. Instances may arise when a special use request is found to be unsuitable for refuge lands. In those instances, the refuge manager may decline to issue the permit.

❖ Adaptive Management

All three alternatives share a strategy of adaptive management to keep the CCP relevant and current through scientific research and management. We acknowledge that our information on species and ecosystems is incomplete, provisional, and subject to change as our knowledge base improves.

Climate plays a significant role in the geographic distribution of ecosystems and wildlife, and most scientists agree that global climate change is already affecting some ecosystems. "Global temperatures increased by over 1°F in the past century and are projected to increase 2.5-10.4°F by 2100 as a result of human emissions of greenhouse gases" (Parmesan and Galbraith 2004). Some recent shifts in wildlife populations are attributed to changing climate conditions, and those impacts are projected to increase. Changes in temperature and precipitation will affect biological diversity, including national wildlife refuges, and challenge land managers.

Our objectives and strategies must be adaptable in responding to new information and spatial and temporal changes. We will continually evaluate our management actions, both formally and informally, through monitoring or research, to reconsider whether their original assumptions and predictions are still valid. In that way, management becomes an active process of learning what really works. Public understanding and appreciation of the adaptive nature of natural resource management is most important, especially in light of the potential large-scale impacts of global climate change. The refuge manager is responsible for changing management actions if they do not produce the desired conditions. Significant changes may warrant additional NEPA analysis. Minor changes will not, but we will document then in annual monitoring or project evaluation reports or the refuge Annual Narrative Report.

Alternatives or Actions Considered But Not Fully Developed

❖ No Service Land Acquisition

We considered an alternative that proposes no acquisition of additional Service land, and forgoes acquiring those tracts in our currently approved refuge boundary. However, we quickly found that alternative would compromise our ability to achieve our refuge purposes and goals. As we noted above in discussing land protection, at a minimum, acquiring the privately owned lands in our currently approved boundary is most important. They are important for their federal trust resource values, and would provide us with more efficient, effective management boundaries. Furthermore, their potential development would adversely impact resources on adjacent refuge lands. Finally, we note that no individual, agency, organization, or elected official has recommended that alternative to us. Therefore, we decided that developing it in further detail was not warranted.

Description of Individual Alternatives Analyzed in Detail

The rest of this chapter presents the three alternatives that we analyzed in detail. We describe each one in overview, and then present its goals, objectives, and strategies, as well as its proposed public use programs and infrastructure.

Following those descriptions, table 2.1 presents a side-by-side comparison of how the alternatives address the significant issues identified in chapter 1. We designed it to provide you with a quick overview of the principal federal actions the alternatives propose, and how those actions distinguish the alternatives. Chapter 4 describes in detail the environmental consequences of implementing those actions.

Alternative A. Current Management

❖ Introduction

This alternative portrays current, planned, approved management activities. It describes projects planned, funded, or underway, and serves as a baseline for comparing the other two alternatives. It would continue these priorities of the biological program: piping plover and least tern management, salt marsh monitoring and restoration, waterfowl management, limited fall shorebird surveys, sharp-tailed sparrow ecology, invasive plant evaluation and eradication, shrubland, thicket and grassland management for migratory birds and New England Cottontail, and rare plant and animal conservation. The refuge gathers baseline data on ecosystems and plant communities and manages these areas with the best sustainable strategies. It would sustain those priorities as completely as possible, within the limitations of our current staffing and the present involvement of our conservation partners.

The refuge first opened for hunting in 1980; its most recent Hunting Plan was approved in 1990. We prepare annual hunt programs, seek State review, and have instituted several changes in the 1990 Hunting Plan. Those include reinstating a permit requirement (1992), implementing a user fee (1995, modified in 1996), closing the refuge to the hunting of New England cottontail and other small game (1998), and opening the Little River Division for archery deer hunting (2001).

Portions of eight divisions on the refuge are now open for shotgun and archery deer hunting in all state seasons, except muzzleloader season. The Moody and Biddeford Pool divisions are closed to all hunting. Migratory bird hunting (waterfowl and woodcock) and falconry are allowed on portions of 6 of the 10 divisions. Upland game bird hunting (pheasant and grouse) is permitted on the same eight divisions above, and in areas that are open for deer hunting.

An annual average of 387 people have hunted on the refuge since the 2000 season. The number of permits issued annually has averaged 423 for the same time period (a hunter can have more than one permit, e.g., for deer and for migratory birds). In fiscal year 2004, hunters spent an estimated 6,600 days on the refuge.

The refuge officially opened for sport fishing in September 2000. It now has designated eight sites for bank fishing on seven divisions. In fiscal year 2004, anglers spent an estimated 1600 days on the refuge, fishing primarily for striped bass and sea-run brown trout. Most anglers either fly fish or use bait, primarily for those two species, although other species can be caught as well. In addition to the sites designated for bank fishing, all of the divisions have a tidal waterway accessible by boat, thus providing more fishing opportunities.

We attempted several times to develop and implement a Public Use/Visitor Services Plan (1990, 1993, and 1994), but none were completed. Despite the lack of that plan, we implemented some visitor opportunities and programs. In the 1980s, we upgraded the Carson Trail at the refuge headquarters in Wells to wheelchair accessibility. It provides year-round wildlife viewing opportunities to an estimated 100,000 visitors annually. We completed a wildlife observation platform on the Goosefare Brook Division in 2002 and the Cutts Island Trail on the Brave Boat Harbor Division in 2003. The Youth Conservation Corps started a wildlife observation platform on the Mousam River Division in 2003 and finished it in 2004. Several other trails owned and maintained by refuge partners cross through or lie adjacent to the refuge (e.g., WNERR in Wells, the Harts Road and Bridle Path in Kennebunk, Atlantic Way Trail, Plymouth Way Trail in Saco, Ted Wells Trail in Old

Orchard Beach), providing recreation opportunities to an estimated 75,000 users. Maps 2–1 through 2–11 on pages 2-24 to 2-34 show the present public use on each division.

An internship program that began in 1996 has provided limited programs, primarily on summer weekends, to visitors at the refuge headquarters in Wells. Refuge staff also provide a small number of programs, depending on their individual workloads and interests. However nothing is routinely scheduled. A partnership with the Kittery Trading Post began in 2002, for an expert from the Trading Post to hold a fly fishing demonstration for kids in late June or early July. In fall 2002, the refuge assumed the responsibility for coordinating and hosting the Federal Junior Duck Stamp Competition in Maine. In 2004, that competition received more than 425 entries.

The refuge comprises 10 divisions and protects more than 5,200 acres of wildlife habitat. We would continue to pursue acquisition from willing sellers of the 3,833 acres of land that remains privately owned in the approved acquisition boundary, potentially bringing its total acreage to 9,126. Those lands include salt marshes and upland edge habitats that provide important resting, nesting, and feeding locations for a host of waterfowl, wading birds, shorebirds, raptors and songbirds, and also include uplands that provide critical buffers for salt marshes, streams and freshwater wetlands.

The refuge staff now consists of seven permanent employees: a refuge manager (GS-13), a deputy refuge manager (GS-12), a wildlife biologist (GS-11), a LMRD biologist (GS-12/13), a maintenance worker (WG-8), an administrative officer (GS-7), and one career-seasonal forestry technician (GS-6)

We now have two vacancies: a visitor services manager (GS-11) and a career-seasonal forestry technician (GS-4). Four additional permanent positions (Tier 1 RONS – see appendix F) are now on the currently approved staffing chart, but are not filled: park ranger/law enforcement officer (GS-9), maintenance worker (WG-9), visitor services specialist (GS-5); and one part time position, administrative support assistant (GS-5). Filling those essential positions is part of alternative A (see appendix F for our staffing charts). One of the two regional wildland-urban interface (WUI) coordinators is co-located at the refuge, and receives administrative support from refuge staff.

The refuge office was built for a staff of three, with a single bathroom and two garage bays, one of which serves as a maintenance shop. Both garages were converted to offices and meeting room/general workspace, and an addition was built for offices. The original visitor contact area was approximately 60 feet square, which we converted to office space when an addition provided a new contact area of 180 square feet.

In the 2003 and 2004 field seasons, more than 20 employees, the wildland-urban interface coordinator, interns, and seasonal and temporary employees filled all available work space. Two or even three shared some areas. Despite earlier additions, only one staff bathroom is available. Available staff parking overflows with service and personal vehicles squeezed among trees and along the access road.

Much of the rationale for each objective is included under alternative B, because that is our preferred action, and documents the need to expand staffing and facilities to meet refuge goals. The strategies in each objective below are those we are now implementing, or already have been identified as priorities in the next few years under our current management (alternative A).

GOAL 1. Perpetuate the biological integrity and diversity of coastal habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Objective 1.1 – Salt Marsh

Manage salt marsh to ensure that its quality and natural functions are sustained and it provides breeding, wintering and migrating habitat for bird species of conservation concern.

Rationale

Coastal salt marshes provide breeding habitat for black ducks. Coastal marshes, estuaries, and sheltered coves are especially important to wintering black ducks for foraging and shelter (Dettmers 2004). Many other species of wading birds, waterfowl, and shorebirds forage in the salt marsh during migrating and breeding seasons. In summer 2004, intensive fall shorebird surveys were conducted. Eight sites were surveyed weekly through the summer and into the fall. The three most common species were semipalmated sandpiper, black-bellied plover, and semipalmated plover.

Over 90 percent of salt marshes in the Northeast were parallel-grid-ditched by 1938 for mosquito control (Bourn and Cottom 1950). Since 1996, the refuge has restored salt marsh on several divisions, primarily by plugging ditches to restore pools and salt pannes. Recent projects also included partnering to restore tidal flow, eradicate invasive plants, or remove fill from impaired marshes. See goal 4, "Land Management Research Demonstration," on page 2-15 for more about our work on salt marshes.

Strategies

- Continue to monitor salt marsh restoration sites
- Identify areas of salt marsh for restoration and implement restoration as resources permit
- Identify and permanently protect high-priority salt marsh habitats
- Continue invasive species (e.g., purple loosestrife, phragmites) monitoring and control using mowing, biological (e.g., beetles), tidal restoration, and hand pulling methods
- Identify high-density areas of sharp-tailed sparrows and continue ecological studies of these birds
- Work with partners each year to control and manage stormwater runoff
- Conduct fall shorebird surveys each year and contribute to the International Shorebird Survey (ISS)
- Plan for oil spill response
- Determine mercury and other contaminant exposure for sharp-tailed sparrows in Maine coastal marshes

❖ Objective 1.2 – Piping Plover

Protect beach berm and associated dune edges, washovers, and intertidal areas for nesting, staging and feeding piping plovers.

❖ Rationale

Piping plovers are federal-listed as threatened and state-listed as endangered in Maine. They nest above the high tide line on open sand, gravel or shell-covered beaches, especially on sand spits and blowout areas in dunes. Fifty percent to 75 percent of the Maine piping plover population nests at three sites on or near the refuge, including Crescent Surf Beach, Goosefare Brook, and Marshall Point at Goose Rocks. Since 2000, the refuge has assumed the primary responsibility for monitoring several piping plover sites on and off the refuge. That involves working cooperatively with private landowners, the Ferry Beach State Park, and the Wells National Estuarine Research Reserve to protect nesting plovers on their lands.

The refuge uses several techniques, including hazing, fencing, trapping, and shooting, to control diurnal predators such as crows and foxes. Fencing around plover nests is occasionally vandalized, and dogs on the beaches can kill plover chicks and cause plovers to abandon their nests. Beachgoers can sometimes cause nest abandonment by sitting too close to them. Refuge staff work to educate the public about the protection necessary to meet piping plover recovery goals, and also work with 12 to 20 beachfront landowners willing to protect nesting plovers.

Strategies

- Continue monitoring the productivity of piping plover nests
- Continue fencing, signing, and patrolling nesting areas
- Continue controlling predators where necessary using lethal (e.g., trapping, shooting) and non-lethal (e.g., live trapping, scarecrows, and effigies) deterrents
- Continue working with private landowners to protect plovers on nesting beaches
- Continue on-site public outreach and education on nesting beaches

❖ Objective 1.3 – Least Tern

Protect beach berm and associated dune edges, washovers, and intertidal areas for nesting, staging and feeding least terns.

Rationale

The least tern is a state endangered species in Maine and is listed as a bird of high conservation concern for BCR 30. They nest in late April and early May, feed on small fish, and congregate and forage by late July and early August (McCollough, et al. 2003).

Crescent Surf Beach is one of the primary least tern nesting colonies within the State. Since 1999, it has hosted the largest colony of nesting terns in the State, with the exception of 2004. In recent years colony productivity has been depressed by crow predation and mammalian predators. The refuges use several management techniques to control predators, including hazing, fencing, trapping and shooting.

Strategies

- Continue fencing and signing nesting areas
- Continue controlling predators where necessary using deterrents both lethal (e.g., trapping, shooting) and non-lethal (e.g., trapping, scarecrows, and effigies)
- Continue on-site public outreach and education on nesting beaches
- Conduct minimal monitoring to estimate population size and productivity

❖ Objective 1.4 – Tidal River, Estuary, and Bay

Through an active role in local and state partnerships, help maintain water quality and quantity of open water habitat in tidal rivers, estuaries and bays to provide resting and foraging habitat for waterfowl, marsh and wading birds and other birds of conservation concern.

Rationale

The refuge was established around a series of tidal rivers and associated estuaries along Maine's southern coast. Those coastal habitats teem with wildlife all year. Black ducks, common eiders, scoters, mallards, red-breasted mergansers, goldeneyes, buffleheads, and loons are the most common wintering waterfowl that forage in the open water areas of the bays and rivers. Management issues include habitat degradation from the development of adjacent and upstream upland habitat, oil spills, stormwater discharge, human disturbance, and contaminants.

Protecting the water quality and ecological integrity of habitats in Maine's tidal rivers and estuaries requires a partnership among government agencies, civic groups, conservation organizations, and residents throughout the watershed. The WNERR developed a series of watershed conservation strategy reports for seven watersheds in southern Maine, providing a baseline of existing information on them (WNERR 2003).

Strategies

- Promote land conservation annually with conservation partners to maintain the ecological integrity of coastal Maine watersheds
- Seek volunteers to complete minimal waterfowl and shorebird surveys

GOAL 2. Perpetuate the biological integrity and diversity of freshwater habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Objective 2.1 – Emergent Marsh, Scrub-Shrub Wetland, Bog, Vernal Pool, Forested Wetland

Maintain emergent marsh, scrub-shrub, bog, forested wetland, and vernal pool habitats to sustain populations of species of conservation concern, including Blanding's turtle, wood frog, and blue-spotted salamander.

❖ Rationale

The undeveloped forests and wetlands in the eastern Biddeford and northern Kennebunkport region contain high concentrations of pocket swamps and vernal pools: habitats that are becoming increasingly rare in Maine. Forests at Brave Boat Harbor and in the Upper Wells divisions also contain high concentrations of vernal pool habitat. Vernal pools offer important breeding habitat for some species of amphibians and invertebrates, including wood frog, spotted and blue-spotted salamander, and fairy shrimp. Several rare species also use them, including the state-listed endangered Blanding's turtle, and the state-listed threatened spotted turtle. Most of those species require a large area of relatively undisturbed upland habitat for nesting, foraging, and dispersal.

Strategies

- Identify and survey vernal pools before actively managing any forest

GOAL 3. Perpetuate the biological integrity and diversity of upland habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Objective 3.1 – Shrubland/Early Successional

Maintain shrubland as early successional habitat to support New England cottontail and to provide nesting and feeding habitat for birds of conservation concern, such as woodcock.

Rationale

The New England cottontail has declined significantly in the past 40 years. In 1989, the Service listed this species as a candidate for threatened or endangered species status, and the Northeast Nongame Technical Committee lists the New England cottontail as a species of high conservation priority. Cottontails now occupy a variety of habitats, including shrubby wetlands, idle farm fields, powerline corridors, and patches of early successional forest.

New England cottontails were found on 5 of 29 sites inventoried on the refuge (see Litvaitis 2003b for site numbers). They are common on the Wells Research Reserve, and occasionally are found near the refuge headquarters.

Woodcock are another early successional species of conservation concern. Long-term trends show a decline of 2.3 percent per year from 1968 to 2003. The major causes for those declines are thought to be the loss and degradation of habitat on the breeding and wintering grounds caused by forest succession and changes in land use (Kelley 2003).

Strategies

- Maintain moderate (>10 ha) to large (>25 ha) shrubland/early successional patches in some of the core habitats identified by Litvaitis et al. (2003b) and other habitat associates using mechanical methods

- Continue to work with partners to identify and manage shrublands using mechanical methods, for high-priority shrubland nesting birds

❖ Objective 3.2 – Grassland

Maintain and manage existing grasslands as nesting and feeding habitat for bobolink and to maintain field conditions for other wildlife.

Rationale

Populations of grassland birds are declining as grassland habitats and other agricultural conditions diminish. Grassland habitats in the northeast are important for these species, given their continental decline and habitat loss in the core of their ranges in the Midwest. Most of the those species (e.g., grasshopper, vesper, and savannah sparrows, and eastern meadowlark) that have declined in the region require 20 acres or more of contiguous grassland habitat (Jones and Vickery 1997). Only the bobolink occupies areas less than 10 acres, although a viable population would require a larger grassland.

Strategies

- Evaluate our grassland bird management and monitoring program to improve conservation benefits
- Mow fields every 1 to 3 years in late fall or spring following the step-down HMP
- Burn fields every 2 to 5 years following the step-down HMP

GOAL 4. Develop the Rachel Carson National Wildlife Refuge as an outstanding center for research and demonstration emphasizing land management techniques for restoring and sustaining healthy estuarine ecosystems in concert with the national Land Management Research and Demonstration (LMRD) program.

❖ Objective 4.1 – Research

Identify high-priority estuarine ecosystem management research needs, develop research proposals, and facilitate and implement research projects.

Rationale

The techniques of land and habitat management are constantly changing and being fine-tuned as our knowledge of species' needs increases and technology advances. Experimenting with new management techniques is essential for the LMRD sites to function as premier examples of habitat-based land management.

Salt marsh ecosystems along the Atlantic coast have been altered and manipulated for the nearly 400 years since the arrival of European settlers. Since 1600, coastal states from Virginia to Maine have lost between 9 and 74 percent of their wetlands. Salt marshes in the mid-Atlantic states (NJ, NY, CT, MA) and elsewhere along the Atlantic coast were extensively ditched and drained before the 1940s for mosquito abatement and for salt marsh haying. By the time ditching was halted during World War II, 9 of every 10 acres of salt marsh in New England had been drained. Nationally, an estimated 105 million acres of wetlands remain, of which only 5 million acres are salt marsh. The potential and need of research into improved management and restoration is high. Research in estuarine ecosystems at this LMRD refuge will benefit many federal trust resources including waterfowl, shorebirds, marsh and wading birds, terns, loons, anadromous and inter-jurisdictional fish and other aquatic resources.

The work of a number of organizations relates to salt marshes and estuarine habitats. Partnering with those groups is a natural process, and benefits the organizations involved (including the Rachel Carson/Parker River LMRDs), salt marsh and estuarine habitats, and the science of restoration and land management. We aim to make the partnerships long-term, to promote the advantages of working with the Rachel Carson/Parker River LMRDs. Particular benefits arise from the ability to employ new management techniques in the field and to use those sites as educational opportunities for other land managers and regulators.

Strategies

- Continue partnerships to further research estuarine ecosystem restoration, management and conservation
- Continue to collaborate with partners to provide financial support for research projects
- Continue research projects on the refuge to test different habitat-specific restoration techniques
- Continue to test habitat management techniques, and ensure that findings are documented, subjected to peer review, and published in appropriate journals
- Review existing work and develop a repository of information on the function and management of estuarine habitats

❖ Objective 4.2 – Demonstration (Internal and External Audiences)

Demonstrate habitat management techniques and advances to other refuges and land managers, the scientific community and the general public, to promote the wider application of estuarine ecosystem restoration and sustainable management.

Rationale

The essential purpose of the Salt Marsh/ Estuary LMRD program is to effectively communicate sound salt marsh management techniques, enabling visiting land managers to understand, evaluate, and duplicate our models. The inter-jurisdictional nature of salt marshes extends that outreach component to an enormous audience. Millions of people live within a short drive of the refuge.

Target audiences primarily include land managers, particularly at all coastal national wildlife refuges. Other agencies, planning commissions, and conservation organizations will also benefit.

Interpreting our work to landowners is essential in our outreach strategies. The refuge is producing salt marsh interpretive signs to complement its current salt marsh management. They will be placed where visitors can learn about restoration. The visitor center at the Parker River refuge will enable it to interpret the Salt Marsh/Estuary LMRD site for 250,000 visitors.

Strategies

- Select appropriate restored salt marsh areas for demonstration sites
- Pursue funding each year to bring on a graduate student, two additional seasonal field assistants, and an intern

- Develop annual programs of workshops and courses designed to educate other land managers about the methods demonstrated at the refuge
- Publish research results in appropriate journals
- Develop educational materials, such as posters, videos, and publications, to explain pertinent land management techniques

❖ Objective 4.3 – Integration

Integrate the LMRD program and refuge operations, management programs and actions, and use adaptive management to respond to new research findings and apply new management techniques.

Rationale

All refuge staff will be well-versed in the specific mission of the LMRD at the Rachel Carson and Parker River refuges as well as its national context, to explain this new, intense endeavor to the public in both formal and informal settings. When LMRD programs are presented, the message of the National Wildlife Refuge System and the refuge will be included, along with the information about the LMRD program.

Because one goal of the LMRD is to demonstrate land management techniques for restoring and sustaining healthy estuarine ecosystems, refuge staff are likely to become involved in implementing cutting-edge management techniques on refuge property. Therefore, the staff's understanding the nature, purpose, and importance of these activities is vital. That awareness will cultivate greater care in implementing the new techniques and improve communication with the LMRD biologist on project successes and difficulties.

Strategies

- Communicate the mission and basic activities of the LMRD program at both the refuge and national level to refuge staff, to keep them informed and involved in on-going projects as appropriate.
- Continue to provide material about LMRD projects to refuge staff for distribution at interpretive programs and in other outreach.

Goal 5. Increase appreciation and stewardship of coastal Maine wildlife and their habitats by providing positive wildlife-dependent experiences for refuge visitors.

❖ Background

The National Wildlife Refuge System Improvement Act of 1997 identifies six priority public uses to receive enhanced consideration in refuge planning: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. Opportunities for visitors to engage in those activities should be provided to the extent they are compatible with the Refuge System mission and the purposes of the refuge.

❖ Objective 5.1 – Interpretation

Maintain opportunities for environmental interpretation on the refuge and provide interpretive materials to visitors at headquarters.

Rationale

Interpretation is one of the most important ways we can raise our visibility, convey our mission, and identify the significant contribution that the refuge makes to wildlife conservation. Interpretation is presently limited to a self-guided trail and, on a few divisions, several interpretive signs that talk about salt marsh restoration, shorebirds, waterfowl, wading birds, and wetlands. In the summer, interns conduct programs on the Carson Trail at the Wells Division, but those are very limited.

Strategies

- Provide interpretative materials at headquarters, including a general refuge leaflet, a Carson Trail guide, and lists of birds, mammals, reptiles and amphibians.
- Provide weekly interpretation programs in the summer
- Update the kiosk at the Carson trailhead

❖ Objective 5.2 – Environmental Education

Continue to provide opportunities for partners to lead environmental education programs on refuge lands.

Rationale

Educating students fosters their appreciation of the important role the refuge plays in conserving wildlife and habitat. The refuge provides Service curricula to local teachers by request or as opportunities arise. The refuge website leads to numerous links for learning about wildlife and habitat.

We seek to meet the Service environmental education goals: a process designed to develop a citizenry that has the awareness, concern, knowledge, attitude, skill, motivation, and commitment to work toward solutions for current environmental problems and the prevention of new ones.

Strategies

- Annually provide Service curriculum to local schools by request and as opportunities arise
- Annually support regional environmental education programs, including the Envirothon

❖ Objective 5.3 – Hunting

Continue to provide diverse opportunities to hunt on the refuge.

Rationale

We adjust the refuge hunt program annually to ensure public safety and good wildlife management. When the refuge acquires new lands that traditionally have been hunted, they will remain open at least until we have completed their public use planning. Unless we determine that biological or safety concerns would make hunting incompatible, they would remain open to hunting.

Brave Boat Harbor, Lower Wells, Upper Wells, Mousam River, Goose Rocks, Little River (bow hunting only), Goosefare Brook, and Spurwink divisions all have some areas open

to hunting. The Moody Division is closed to hunting, because it is so close to residential development. Biddeford Pool is also closed to hunting.

Strategies

- Continue to coordinate our annual refuge hunt program with the Maine Department of Inland Fisheries and Wildlife
- Continue to adjust our hunt programs annually to ensure their safety and consistency with good wildlife and habitat management

❖ Objective 5.4 – Fishing

Continue to provide recreational fishing opportunities on the refuge.

Rationale

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (2001) indicates that 376,000 residents and non-residents participated in fishing in Maine in 2001. That group spent $250 million on activities and equipment related to fishing (USFWS 2002). All tidal waters of the refuge are open to fishing, and bank fishing is permitted in several areas; both are increasingly popular. We will continue to provide access for bank fishing at designated areas at the Brave Boat Harbor, Moody, Lower Wells, Upper Wells, Mousam River, and Spurwink divisions. Goosefare Brook Division offers saltwater fishing. All of the divisions allow fishing from boats in tidal waters.

Strategies

- Update the refuge fishing plan and fishing regulations
- Post and disseminate fishing information about the Spurwink, Mousam, Ogunquit, Merriland, and Webhannet rivers at refuge headquarters
- Require lead-free jigs and sinkers at refuge fishing sites

❖ Objective 5.5 – Wildlife Observation and Photography

Maintain the current wildlife observation and photography opportunities provided on the refuge.

Rationale

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (2001) indicates that 778,000 residents and non-residents participated in wildlife watching (i.e., observing, feeding, or photographing) in Maine that year. That group spent $345 million on wildlife watching and related activities and equipment (USFWS 2002).

Nearly 100,000 visitors used the 1–mile Carson Trail at the Wells headquarters, one of four developed trails on the refuge. The headquarters trail in Upper Wells is the only one with an informational kiosk. The 2–mile Cutts Island Trail in Brave Boat Harbor Division has trail signs, but no kiosk or restroom. Carry-in boat access is available on Chauncy Creek at the intersection of Cutts Island and Seapoint Roads, and on the Spurwink River Division by Route 77. Parking is available by verbal agreement with the Town of Kittery. The Goose Fare Brook Trail and its overlook offer parking, a short, stone-dust trail, and an interpreted observation platform with auto-focus binoculars. The Bridle Path and Atlantic Way and Ted Wells trails provide views of refuge habitat in Kennebunk, Saco and Old Orchard Beach.

Those trails are located on or near refuge property, and are maintained by municipal or private, non-profit organizations.

Strategies

- Provide trail information annually at kiosk(s)
- Invite participation periodically in photo contest(s)
- Continue to solicit high-quality wildlife photos of the refuge

GOAL 6. Foster off-refuge cooperative actions and partnerships to promote wildlife conservation and further refuge goals.

❖ Objective 6.1 – Landscape-Scale Conservation

Provide expertise annually to at least one landscape- or watershed-scale project that benefits the coastal ecosystems in the Gulf of Maine watershed.

Rationale

The scientific and conservation communities have become increasingly aware of the influence of human land use practices on ecosystem function, and that native plants and animals require healthy, functioning ecosystems to survive. A larger, landscape perspective is needed to ensure the viability of those plants and animals and the habitats that they depend on. In addition to management actions on the refuge, conserving and managing land through landscape-scale partnerships is essential, to maintain large, unfragmented blocks of habitat and connectivity for wildlife travel and, to ensure the ecological health of upland, freshwater and marine environments.

Strategies

- Continue to take an active role with conservation partners such as the Mountain to the Sea Initiative, Saco Bay Partners, and Wells National Estuarine Research Reserve to further conservation goals.

❖ Objective 6.2 – Habitat Management

Provide technical expertise on wildlife habitat management to private or public landowners, including individuals, towns, organizations and businesses.

Rationale

The refuge provides opportunities for visitors to observe environmentally sound wildlife and habitat management. That impacts how people view the role of management, restoration, and stewardship. The refuge supports critical habitats, yet it cannot provide all the habitat needs. In fact, nearly 70 percent of all fish and wildlife habitat in the United States is in private ownership. The refuge shares its expertise on wetland restoration, invasive species control, prescribed burning, and other techniques to interested landowners. That outreach to landowners helps protect refuge habitats and wildlife.

Strategies

- Continue to work with the Natural Resource Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), Maine Cooperative Extension, and other Service staff on landowner assistance

- Collaborate with partners to identify grants and other funds for habitat management on off-refuge lands

❖ Objective 6.3 – People

Increase public understanding and support for wildlife conservation, habitat management, and land and water stewardship in the 11-community region of the refuge.

Rationale

More than 75 million Americans enjoy watching wildlife and participating in wildlife-related recreation, yet few may understand how best to provide the habitats essential for maintaining our native wildlife diversity. The refuge helps people understand and value wildlife and habitats through workshops and public events in local communities.

Strategies

- Continue to co-sponsor natural resource workshops
- Continue to promote Rachel Carson's legacy of outreach for conservation

Recreational Boating

All 10 refuge divisions encompass part of a tidal waterway popular for a wide variety of recreational boating, from canoes and kayaks to powerboats of various types and horsepower. In fiscal year 2004, an estimated 20,000 boat uses occurred within the refuge. Car-top boat launching is now available at specific sites on the Brave Boat Harbor and Spurwink River divisions. Either town or private landowners provide other boat access sites on all of the refuge divisions except Goosefare Brook and the Upper Wells divisions. No direct access is provided to the Upper Wells or Goosefare Brook waterways except by entering from the ocean.

Recreational boating on the refuge, especially by canoes and kayaks, continues to increase each year. In October 2004, the Round Gerrish Island Boat Race attracted more than 55 kayaks, canoes, and rowboats and more than 175 spectators. Held since the 1980s, the race typically courses through the Brave Boat Harbor Division. According to race coordinators, its participation has increased each year, drawing entrants from all over northern New England. The refuge has issued a special use permit since 2004, and will monitor this event annually for its impacts on refuge resources. We will also explore opportunities for environmental education and interpretation.

Powered watercraft use, especially of jet-skis, also continues to increase. All refuge waterways lie within the water safety zones defined by the State of Maine. Those prohibit more than headway speed within 200 feet of a shoreline. Despite that prohibition, most boaters either do not know of the law, or choose to ignore it and operate at more than headway speed. That increases wave action, which contributes to accelerated shoreline erosion of the refuge tidal salt marshes.

Refuge law enforcement officers have begun contacting boaters to inform them of the state law. We will seek to partner with the Marine Patrol in posting notices at boat ramps and, if feasible, at entrances to each of the waterways.

Other illegal activities associated with boating include the launching of boats, mostly canoes and kayaks, across refuge lands; the illegal anchoring of all types of boats; and their abandonment when they are no longer wanted. Some individuals seek short-cuts from their residences to the rivers by dragging their boats across the salt marsh, thus creating paths devoid of vegetation and disturbing wildlife in the area.

The refuge began a project in 2003 to develop a refuge guide to boating, and will seek to finish it by 2009.

Alternative B. Our Preferred Alternative

❖ Introduction

This alternative includes an array of management actions that, in our professional judgment, works best toward achieving the refuge purposes, System mission, vision, and goals, and the goals of state and regional conservation plans. In our opinion, this alternative would most effectively address the major issues raised during the planning process. We judge it reasonable, feasible, and practical.

Alternative B will enhance the quality and sustainability of current biological and public use programs, promote and enhance partnerships, and protect habitats for species of management concern. Protecting coastal habitats, including salt marsh, tidal rivers, and beach-dune, will remain our top priority (goal 1). We will broaden our understanding and management of other critical habitats and the species of concern that use them. The refuge will continue to evaluate and use the most cost-effective and environmentally sound techniques to manage habitats and conserve wildlife and plants. In addition, we will strengthen our biological inventory and monitoring program to allow us to better evaluate our programs and arrive at more informed management decisions.

Alternative B will increase our land acquisition and cooperative land protection program, including acquisition of the 3,833 acres not yet acquired in our currently approved boundary and an expansion of 5,558 acres that includes a new division (York River). This action will provide increased management capability and habitat protection in the existing divisions. All of the lands proposed for acquisition support trust resources of concern in coastal Maine. Please note that although we know precisely the total amount of land we propose to add to the refuge, the exact breakdown into each habitat category cannot be precisely estimated. Of the 5,558 acres 4,318 are proposed as easements and the balance as fee title acquisitions. Clear opportunities for compatible public use activities will be offered on fee title lands, and there may be opportunities on select easement lands. That expansion also would encompass one more towns, bringing to 12 the number of communities in the refuge planning region. Alternative B also includes removing 101 parcels totaling 164 acres from the current approved boundary that are no longer suitable for Service acquisition.

In addition to Service acquisition, we will work with our land conservation partners to support our collective watershed protection. Appendix A, "Land Protection Plan" (LPP) depicts the proposed acquisition areas for each division. Alternative B also proposes to consolidate the Moody, Lower Wells, Upper Wells, and Mousam River divisions into one, the Wells Bay Division. Those four divisions are biologically and physically linked, and managing them as one will prove more efficient, and more effective in fulfilling our mission.

Alternative B will increase opportunities for priority wildlife-dependent public uses, largely with the help of partners. We will emphasize interpretation and wildlife observation and photography by expanding existing programs, and by adding new interpretive signs, kiosks, nature trails, and parking areas. Additionally, new land acquisitions will provide more fishing and hunting opportunities. Using partnerships, we will improve and provide new opportunities for environmental education. Maps 2–1 through 2–11 on pages 2-24 to 2-34 depict current and proposed public uses on each division.

We will permit cultural resource investigations and on-refuge research where it benefits the refuge through the Service's special use permit system. We may grant permits for rights-of-way and, in cases of risk to human health, mosquito/fly control in accordance with Service policy. Rights-of-way and boat launch activities will be allowed only after we issue a special use permit. The specific decisions associated with rights-of-way or boat launches

may trigger the need for documentation of environmental analysis on a case-by-case basis under NEPA.

We will enhance our outreach and partnerships with local communities, expand the role and numbers of our Friends Group, and strengthen our relationships with our neighbors and elected officials to build support for our management priorities in surrounding communities.

Alternative B includes five new positions, and converts the maintenance worker (WG-9) in the current staffing chart (alternative A) to a facility manager (GS-11) to accomplish the objectives of each of the six goals described below (see staffing chart B in appendix G).

Crucial parts of the management proposed in alternative B are replacing the existing headquarters/visitor contact facility to accommodate existing, essential, and new permanent staff and seasonals and to gain public support; constructing a maintenance facility to improve the maintenance efficiency of refuge infrastructure and biological operations; and building a pole shed to protect vehicles and equipment from weather and vandalism. The facilities are integral in successfully achieving all of the objectives described below in each of these six goals.

GOAL 1. Perpetuate the biological integrity and diversity of coastal habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Background

Southern coastal Maine contains a greater diversity of upland plant and animal species than any other part of the state. Yet, this biologically rich area is the most densely populated part of Maine, and is experiencing continued, rapid growth (Trust for Public Land and USFWS 2001). The refuge, scattered along 50 miles of Maine's southern coast, lies in the heart of that region.

The refuge and the Scarborough Marsh State Wildlife Management Area encompass about 85 percent of all salt marsh habitat in Maine. Residential and industrial development are encroaching on these areas and affecting their fragile integrity (Trust for Public Land and USFWS 2001). Habitat conversion to urban and suburban uses, agriculture, gravel pits and fragmentation from roads and suburbanization are the primary factors affecting biological diversity in southern Maine (Gawler et al. 1996).

Over 90 percent of the salt marshes in the Northeast were parallel-grid-ditched by 1938 for mosquito control (Bourn and Cottom 1950). On several divisions, the refuge has implemented salt marsh restoration since 1996, primarily plugging ditches to restore pools and salt pannes. Recent efforts have also included partnering on several projects to restore tidal flow, eradicate invasive plants and remove fill from impaired marshes.

Climate change currently threatens vital coastal marshes, where salt marsh accretion processes may not always keep pace with projected increases in sea level rise. This can lead to marshes becoming too flooded resulting in extensive plant mortality, peat erosion and loss of elevation. If erosion is significant the marsh may be converted to open water or mudflat.

In other instances where salt marshes accrete at the same pace as sea level rise but where there are not adjacent low lying upland areas marshes may be "squeezed out" between rising sea levels (loss due to flooding) and an inability of marsh vegetation to "jump" steep

elevation grades, particularly those posed by seawalls or other shoreline structures. A recent phenomenon, sudden wetland dieback, also is causing a decrease in salt marsh vegetation. The extent, cause and duration of this problem remain unknown. One such dieback area has been located within a Refuge salt marsh.

The refuge supports other coastal habitats in addition to salt marshes, including dune grassland, beach, subtidal and intertidal mudflat, marine open water, tidal river, maritime shrubland, and upland forest. Those habitats provide critical buffers for the salt marsh as well as critical habitat for many aquatic and upland species of conservation concern.

Thirty-six species of shorebirds have been reported using the Maine coast primarily as staging areas in long-distance migration. The numbers of migrant shorebirds peak between mid-May and early June and between mid-July and mid-September (Tudor 2000). Shorebirds using the Maine coast face potential impacts from recreational disturbances of foraging and nesting birds, oil spills, resource extraction affecting shorebird food supplies, habitat loss to development, predators, and contaminants (Clark and Niles 2000).

❖ Objective 1.1 – Salt Marsh

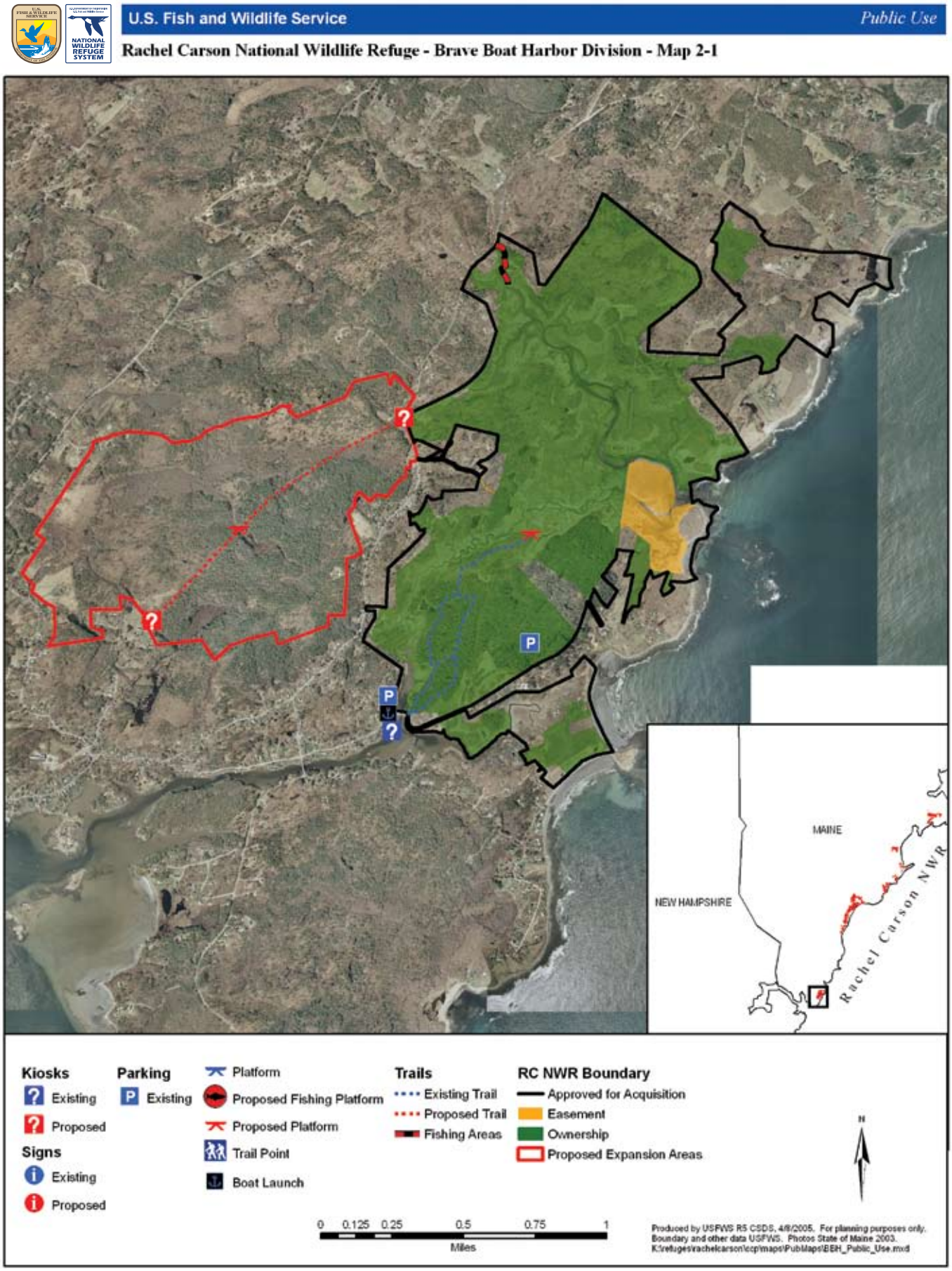
Manage, protect, and restore the integrity of 3,844 acres of salt marsh, including a mix of high and low salt marsh vegetation comprised of less than 5 % overall cover of invasive plants, and pool and panne habitat consistent with local reference sites, to ensure that the quality and natural function of the marsh are sustained and provide breeding, wintering and migration habitat for species of conservation concern including sharp-tailed sparrows, American black duck, marsh and wading birds, migratory shorebirds, and catadromous fish.

Rationale

The Spartina salt marsh and dune grassland along with several other natural communities form a coastal dune-salt marsh ecosystem in southern Maine. The Spartina salt marsh or salt hay is a community dominated by expanses of saltmeadow cordgrass (*Spartina patens*), smooth cordgrass (*S. alterniflora*), and black-grass (*Juncus gerardii*).

Salt marsh (*Ammodramus caudacutus*) and Nelson's (*A. nelsoni*) sharp-tailed sparrows are species of highest conservation priority in PIF Area 9 and 28. Both sparrows are distributed throughout the salt marshes on the refuge. The two sparrows are different in song, morphology, and habitat, with some interbreeding and overlap in range. The salt marsh sharp-tailed sparrow occurs almost exclusively in salt marshes, while the Nelson's also uses inland fresh and brackish marshes. The range overlap extends from Parker River, Massachusetts, north to Weskeag River, Maine (Hodgman et al. 2002).

Partners in Flight lists the salt marsh sharp-tailed sparrow as a "species of continental importance for the U.S. and Canada" and includes it in the top category of watch list species in need of immediate conservation action due to multiple causes for concern across its entire range. The U.S. and Canada population estimate is 250,000 individuals with a continental objective to increase the population by 100 percent (Rich et al. 2004). More than 90 percent of the salt marsh sharp-tailed sparrow global breeding population is in the northeastern U.S. (Dettmers and Rosenberg 2000). Nearly the entire range of the northeastern population of the Nelson's sharp-tailed sparrow occurs in PIF Area 28. The BCR 14 population and habitat objectives for Nelson's sharp-tailed sparrow are to maintain the current population at ~50,000 individuals and maintain existing amounts of salt marsh. Maine's population is estimated at 10,000 individuals with 5,000 hectares (~12,355 acres) of suitable habitat needed to support that population size at an average density of 1.0 hectares (2.5 acres) per pair (Dettmers 2004).


U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Brave Boat Harbor Division - Map 2-1
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Signs
Existing
Proposed
Parking
Existing
Platform
Proposed Fishing Platform
Proposed Platform
Trail Point
Boat Launch
Trails
Existing Trail
Proposed Trail
Fishing Areas
RC NWR Boundary
Approved for Acquisition
Easement
Ownership
Proposed Expansion Areas
N
0 0.125 0.25 0.5 0.75 1
Miles
Produced by USFWS R5 CSDS, 4/8/2005. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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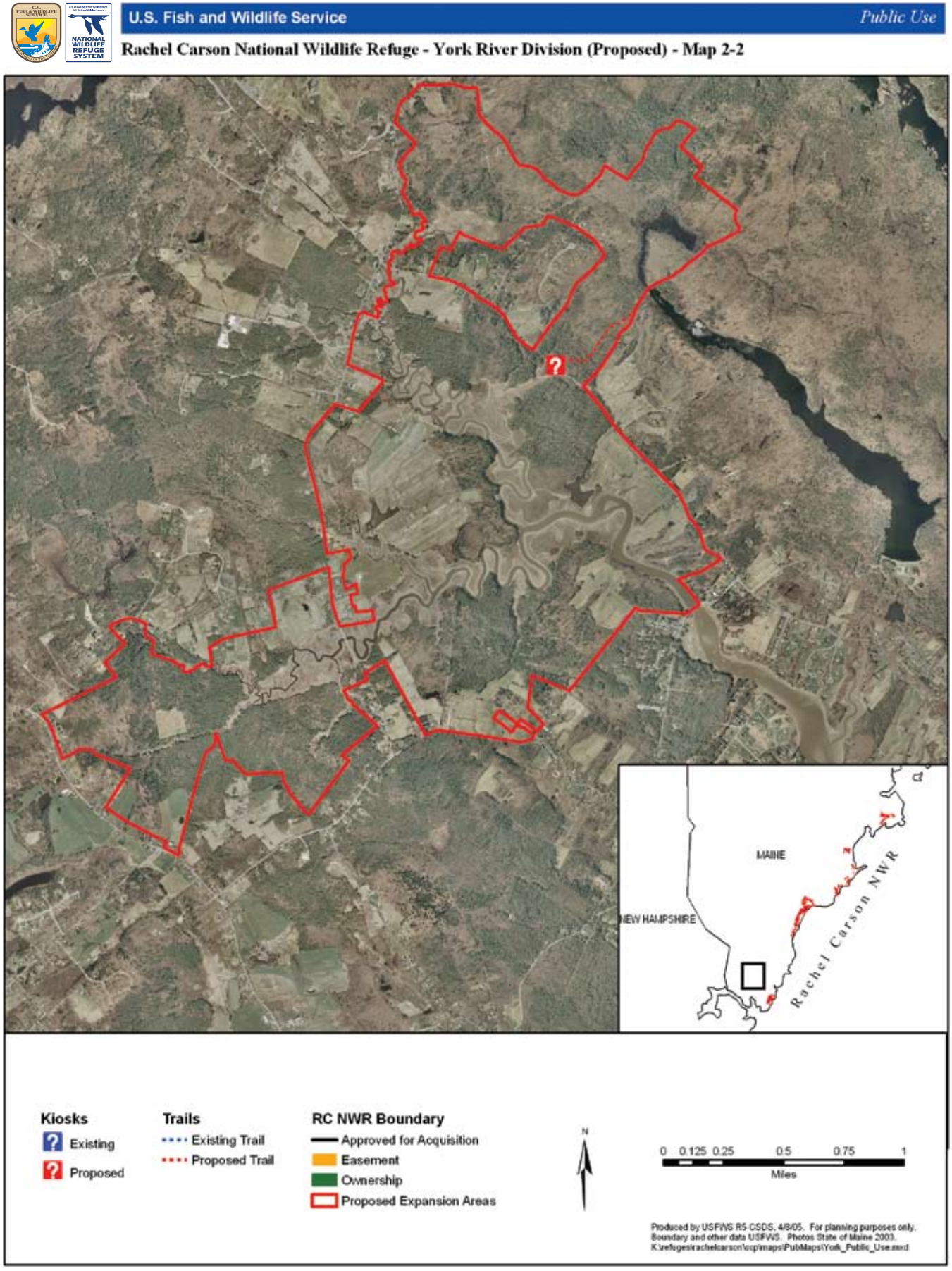
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - York River Division (Proposed) - Map 2-2
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Trails
Existing Trail
Proposed Trail
RC NWR Boundary
Approved for Acquisition
Easement
Ownership
Proposed Expansion Areas
N
0 0.125 0.25 0.5 0.75 1
Miles
Produced by USFWS R5 CSDS, 4/8/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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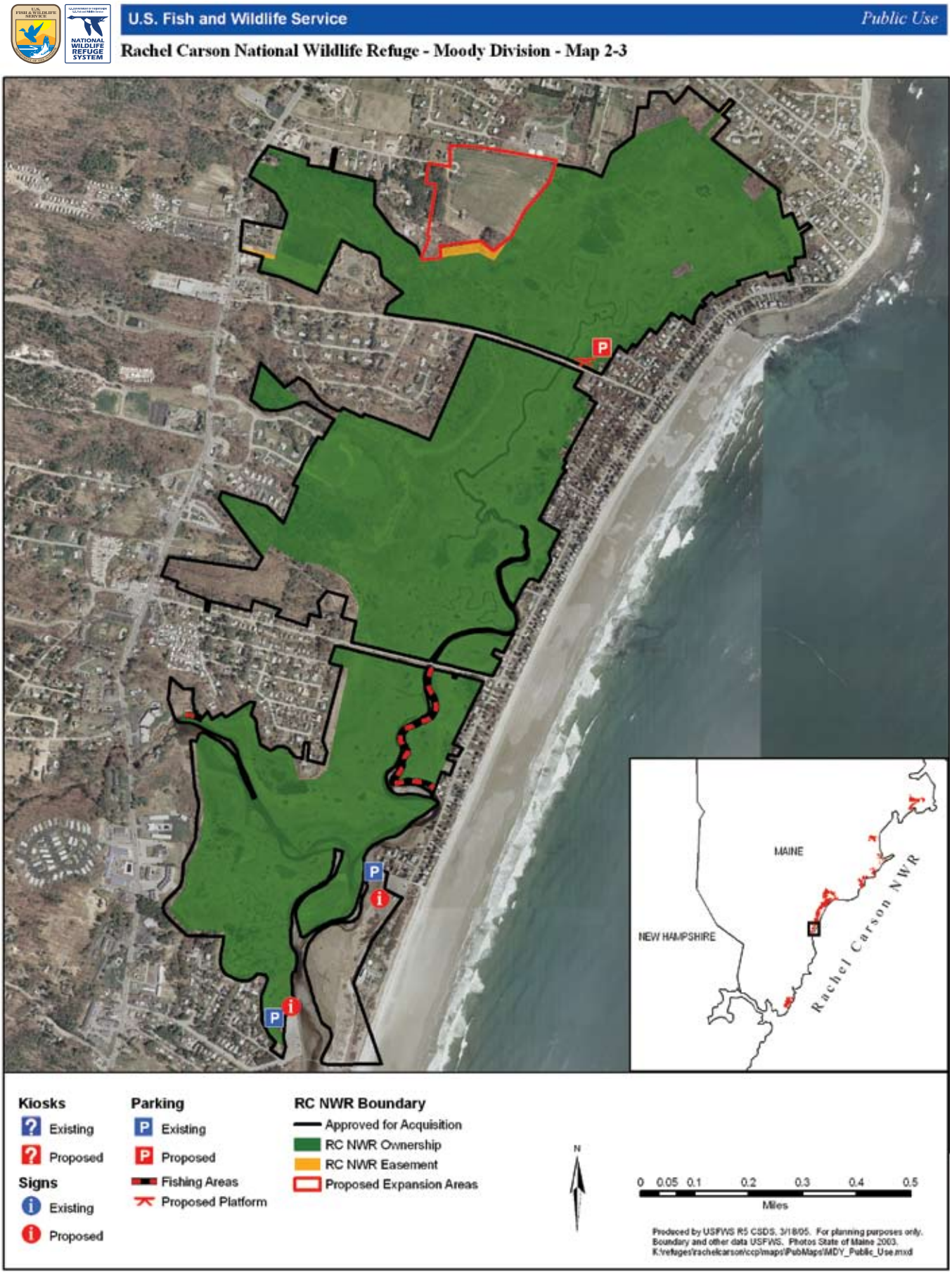
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Moody Division - Map 2-3
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Signs
Existing
Proposed
Parking
Existing
Proposed
Fishing Areas
Proposed Platform
RC NWR Boundary
Approved for Acquisition
RC NWR Ownership
RC NWR Easement
Proposed Expansion Areas
N
0 0.05 0.1 0.2 0.3 0.4 0.5
Miles
Produced by USFWS R5 CSDS, 3/18/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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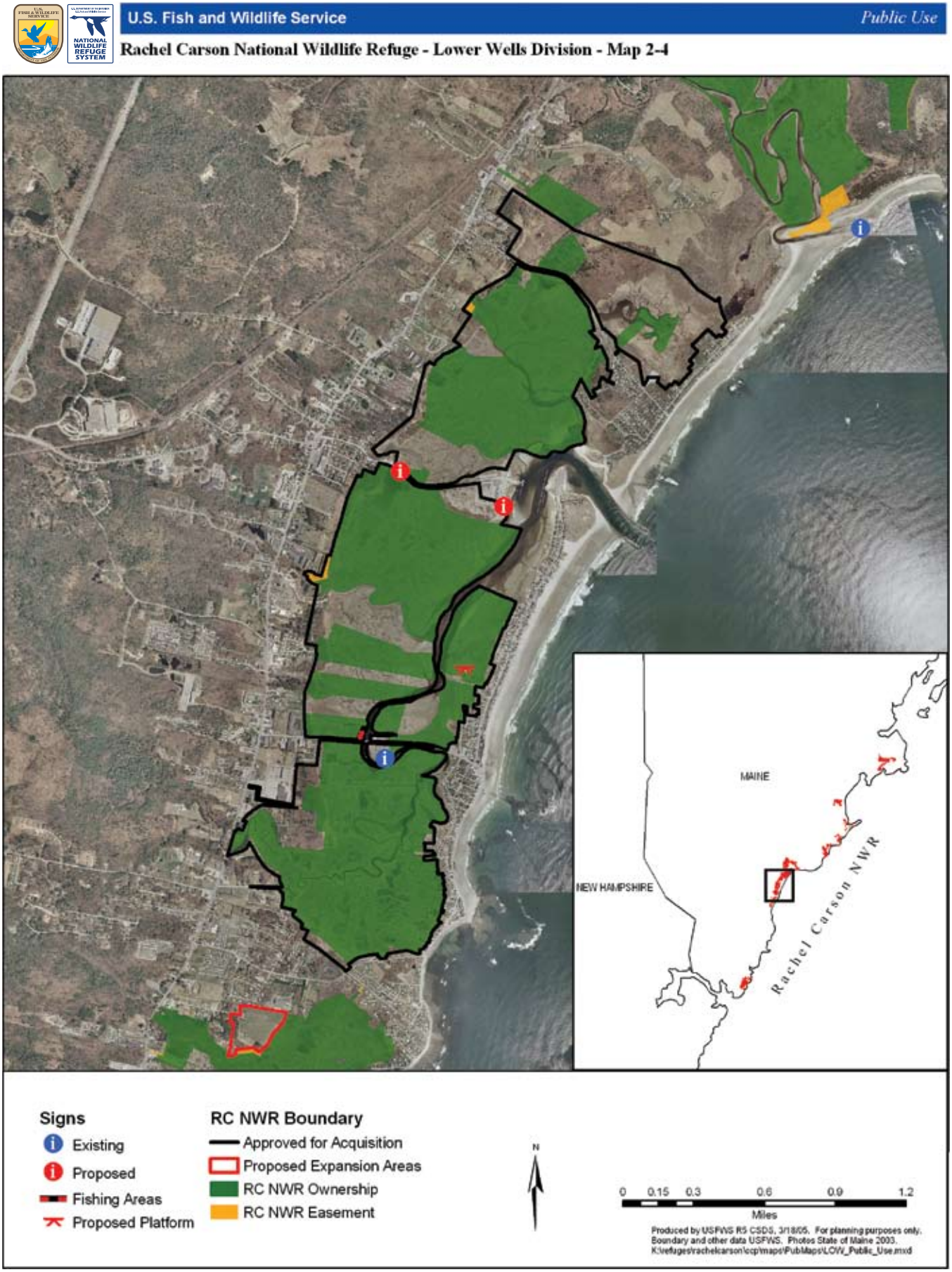
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Lower Wells Division - Map 2-4
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Signs
Existing
Proposed
Fishing Areas
Proposed Platform
RC NWR Boundary
Approved for Acquisition
Proposed Expansion Areas
RC NWR Ownership
RC NWR Easement
N
0 0.15 0.3 0.6 0.9 1.2
Miles
Produced by USFWS R5 CSDS, 3/18/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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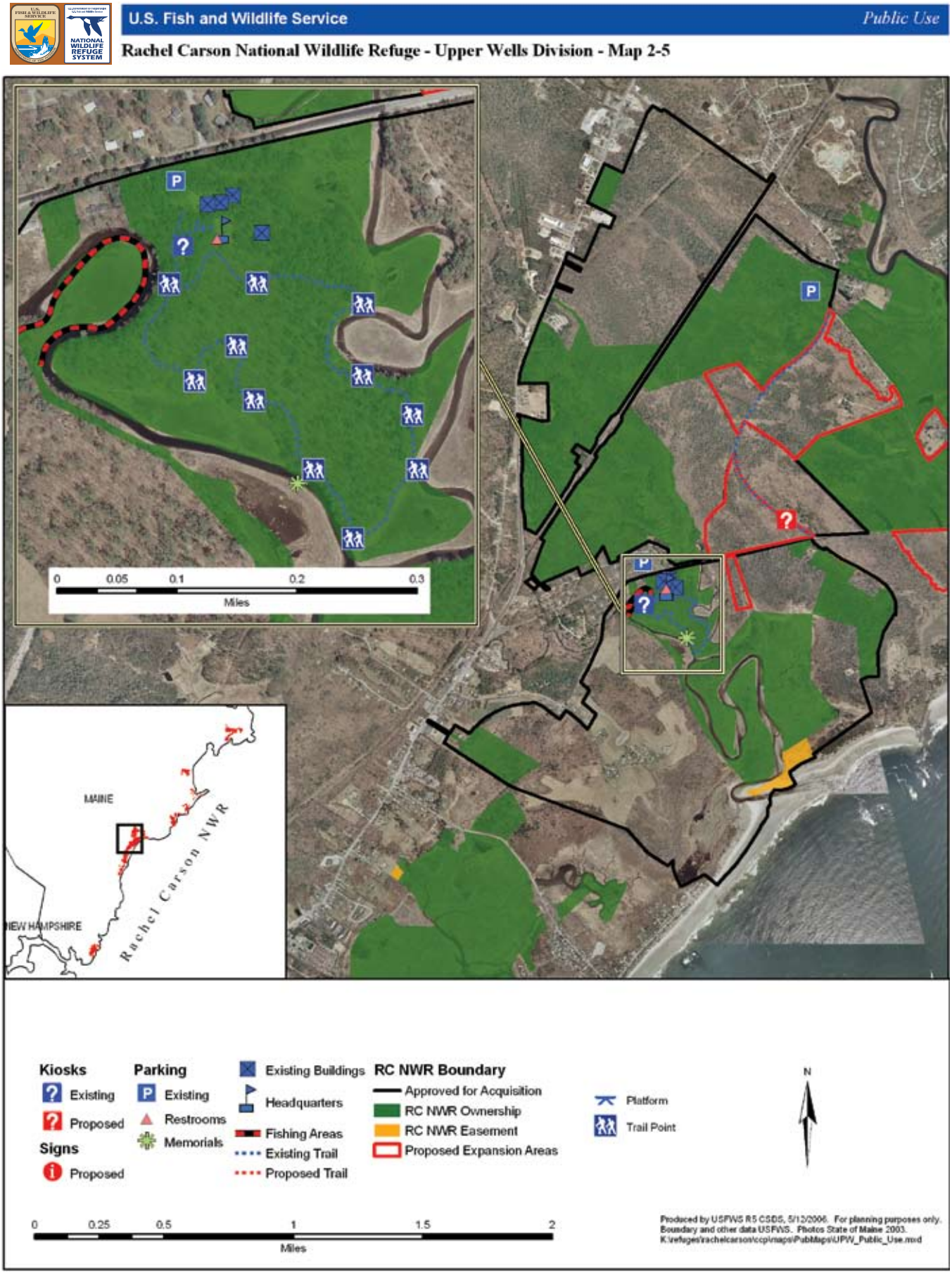
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Upper Wells Division - Map 2-5
0 0.05 0.1 0.2 0.3
Miles
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Signs
Proposed
Parking
Existing
Restrooms
Memorials
Existing Buildings
Headquarters
Fishing Areas
Existing Trail
Proposed Trail
RC NWR Boundary
Approved for Acquisition
RC NWR Ownership
RC NWR Easement
Proposed Expansion Areas
Platform
Trail Point
N
0 0.25 0.5 1 1.5 2
Miles
Produced by USFWS R5 CSDS, 5/12/2006. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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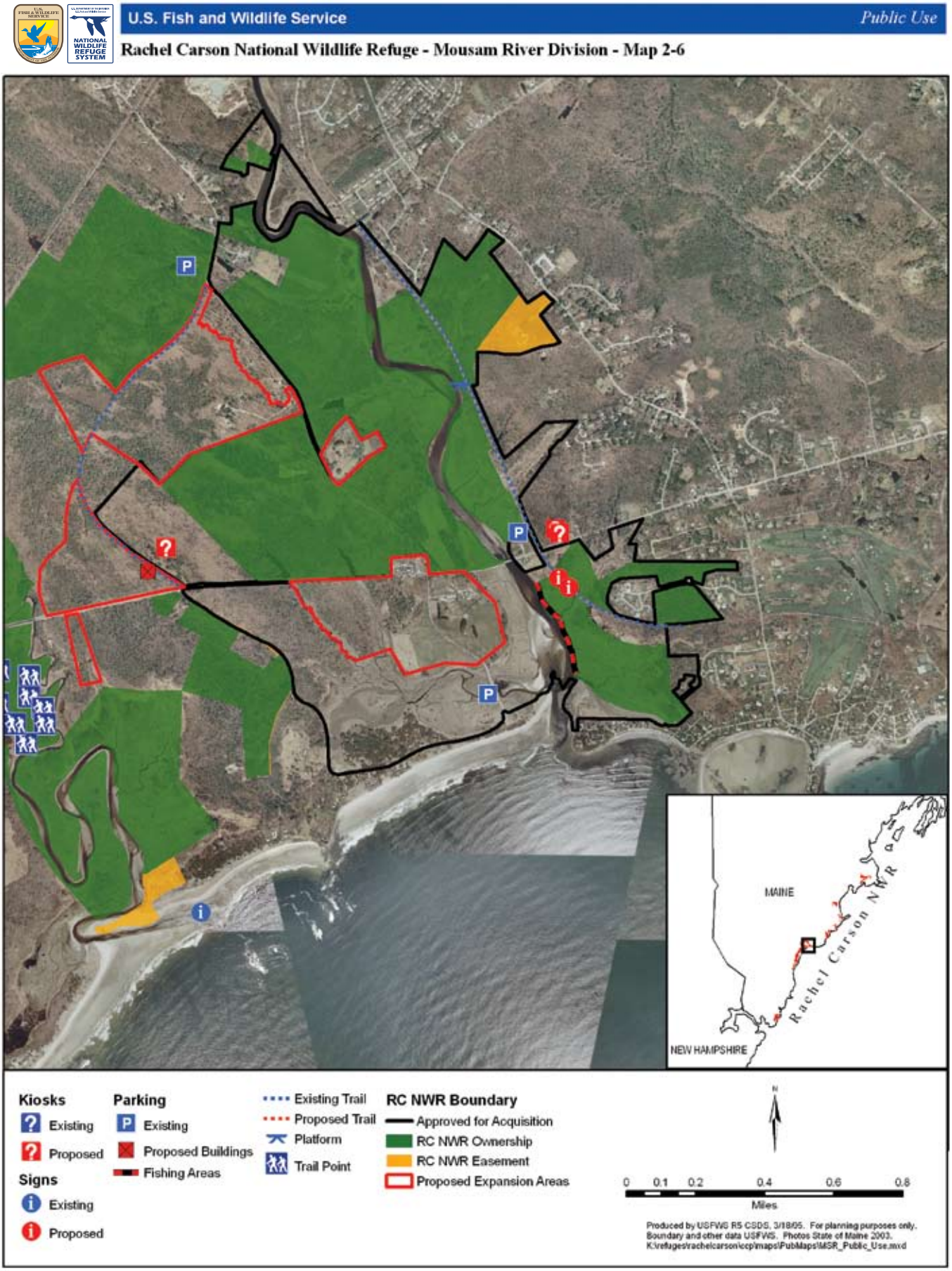
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Mousam River Division - Map 2-6
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Signs
Existing
Proposed
Parking
Existing
Proposed Buildings
Fishing Areas
Existing Trail
Proposed Trail
Platform
Trail Point
RC NWR Boundary
Approved for Acquisition
RC NWR Ownership
RC NWR Easement
Proposed Expansion Areas
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Produced by USFWS R5 CSDS, 3/18/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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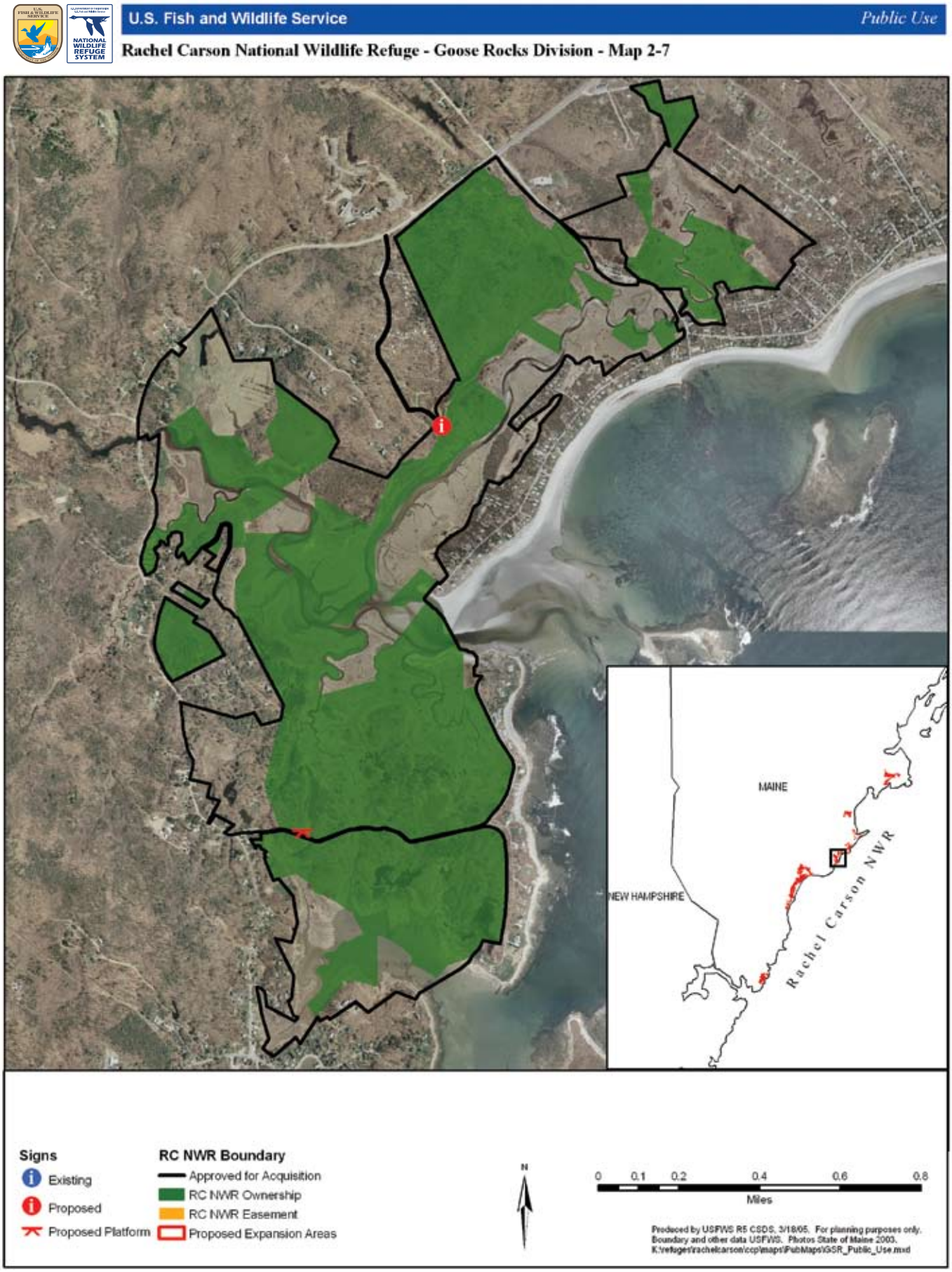
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Goose Rocks Division - Map 2-7
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Signs
Existing
Proposed
Proposed Platform
RC NWR Boundary
Approved for Acquisition
RC NWR Ownership
RC NWR Easement
Proposed Expansion Areas
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Produced by USFWS R5 CSDS, 3/18/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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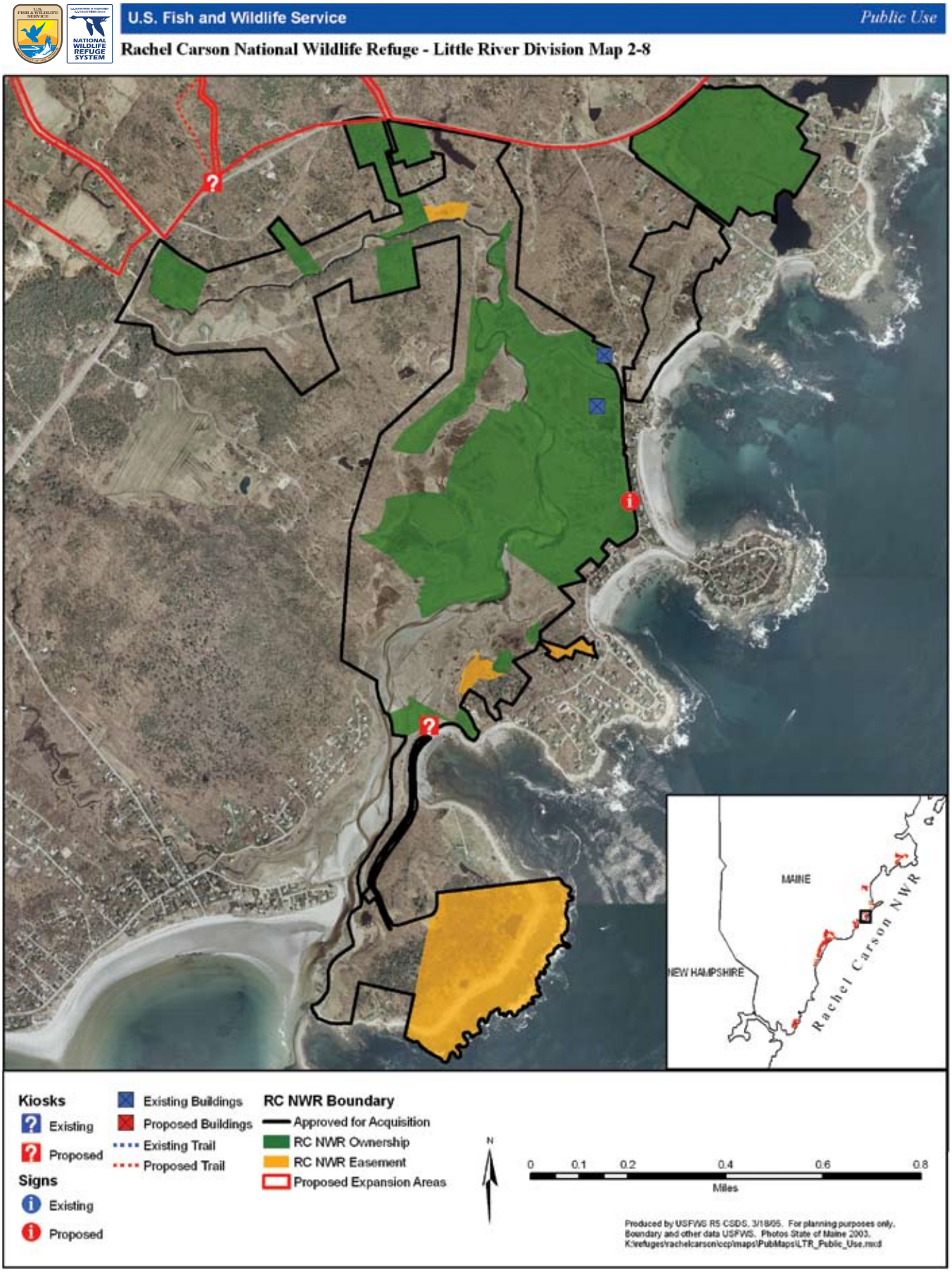
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Little River Division Map 2-8
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Signs
Existing
Proposed
Existing Buildings
Proposed Buildings
Existing Trail
Proposed Trail
RC NWR Boundary
Approved for Acquisition
RC NWR Ownership
RC NWR Easement
Proposed Expansion Areas
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Produced by USFWS R5 CSDS. 3/18/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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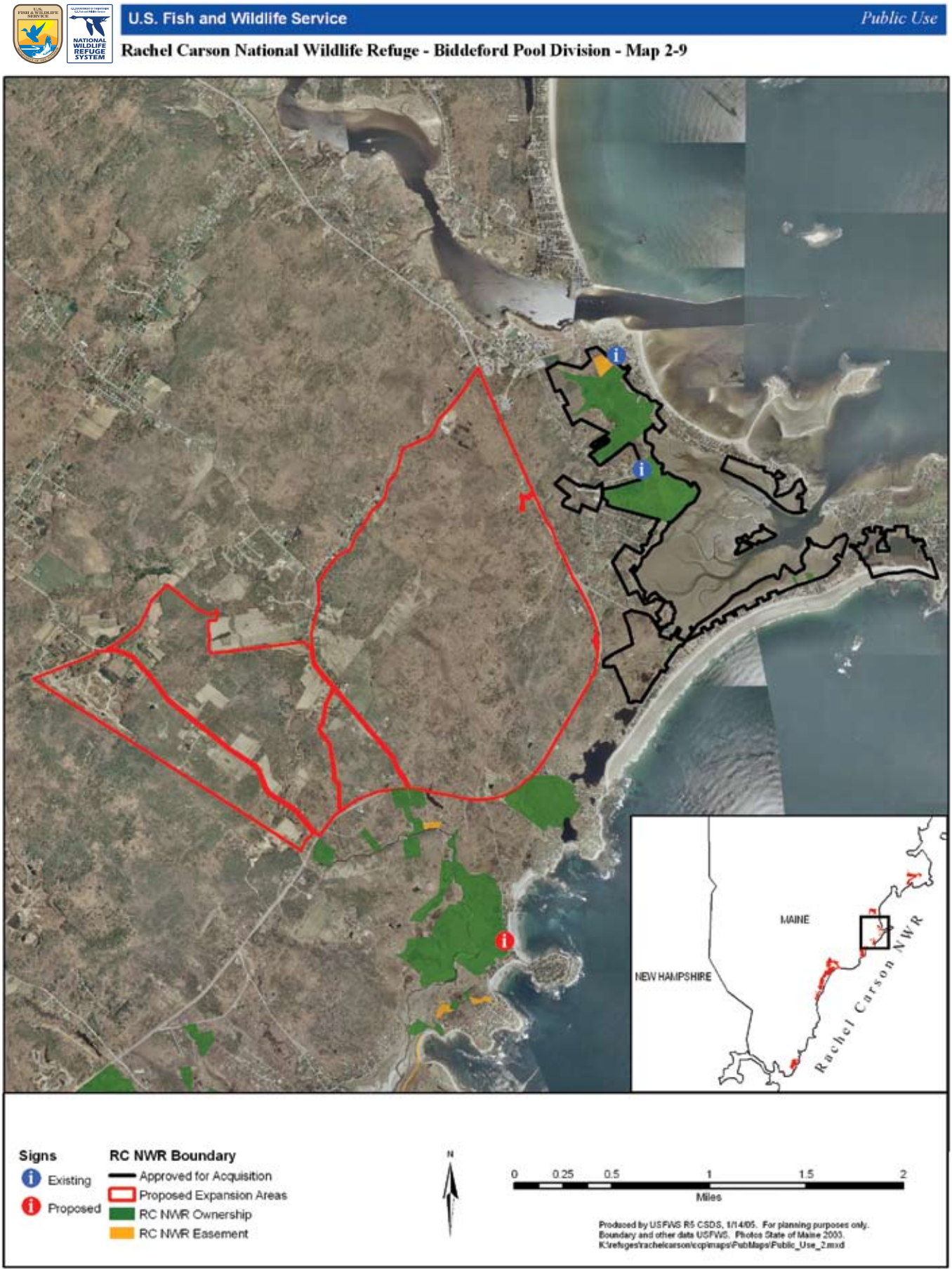
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Biddeford Pool Division - Map 2-9
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Signs
Existing
Proposed
RC NWR Boundary
Approved for Acquisition
Proposed Expansion Areas
RC NWR Ownership
RC NWR Easement
N
0 0.25 0.5 1 1.5 2
Miles
Produced by USFWS R5 CSDS, 1/14/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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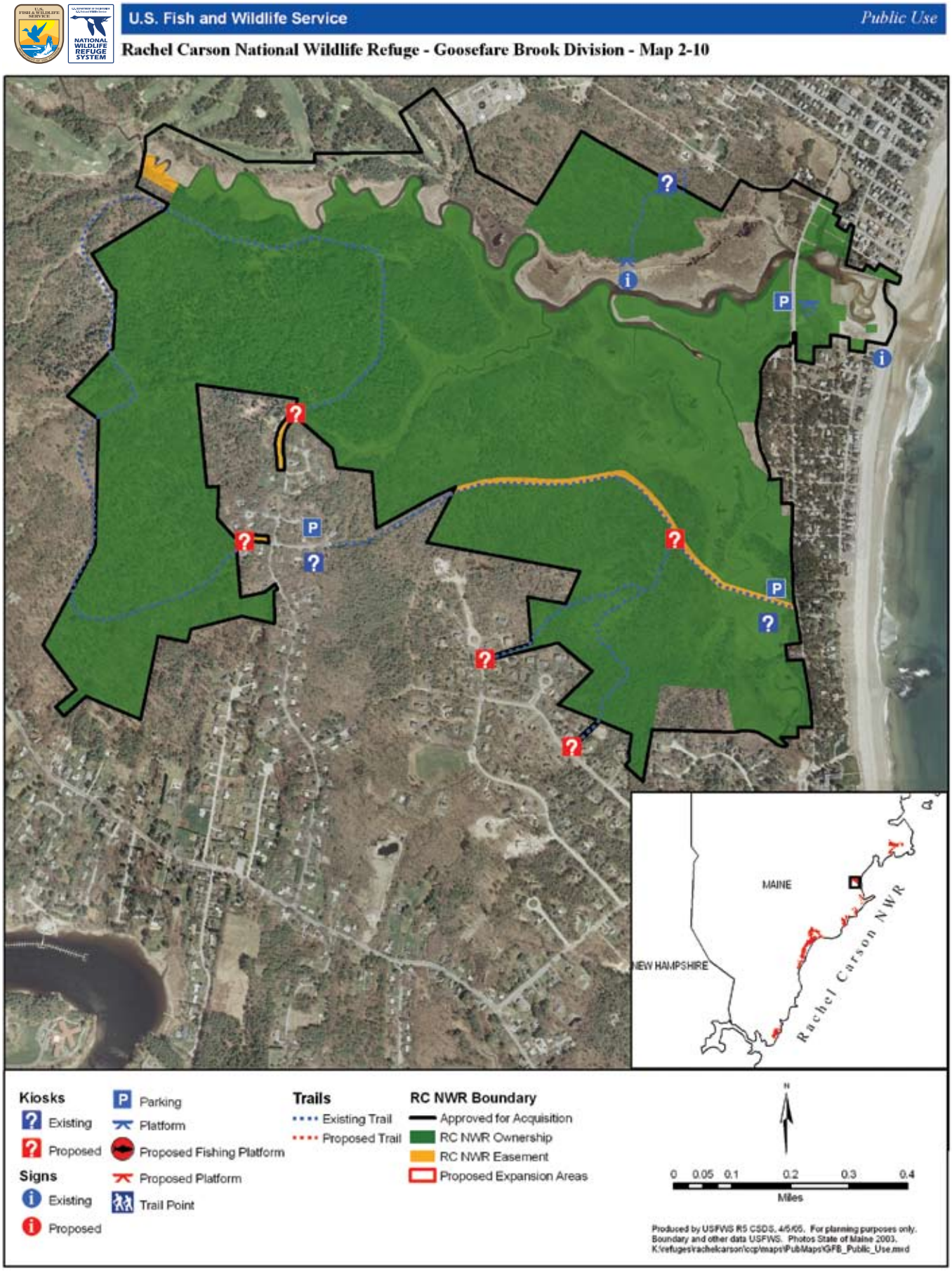
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Goosefare Brook Division - Map 2-10
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Signs
Existing
Proposed
Parking
Platform
Proposed Fishing Platform
Proposed Platform
Trail Point
Trails
Existing Trail
Proposed Trail
RC NWR Boundary
Approved for Acquisition
RC NWR Ownership
RC NWR Easement
Proposed Expansion Areas
N
0 0.05 0.1 0.2 0.3 0.4
Miles
Produced by USFWS R5 CSDS, 4/5/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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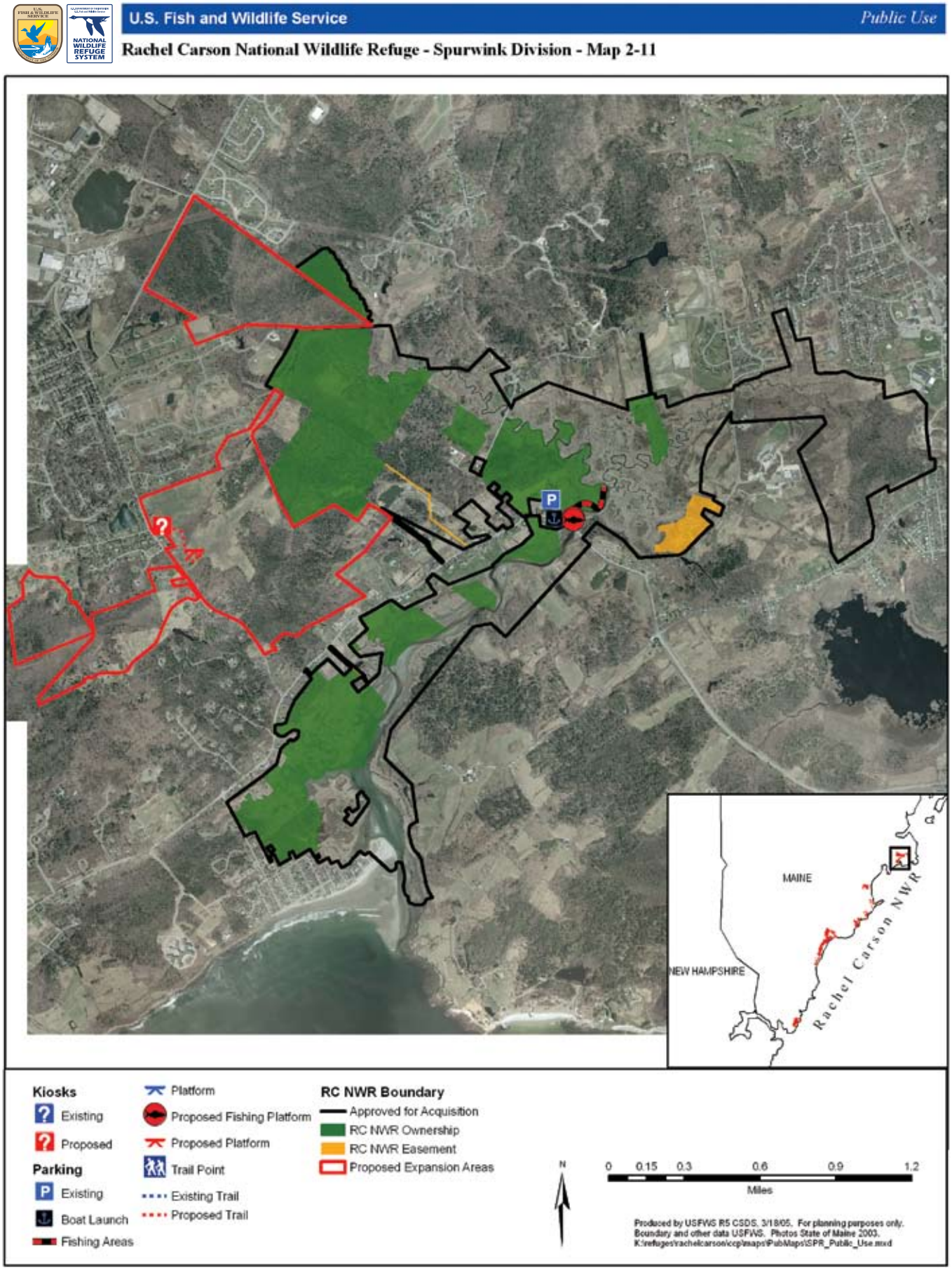
U.S. Fish and Wildlife Service
Public Use
Rachel Carson National Wildlife Refuge - Spurwink Division - Map 2-11
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
Kiosks
Existing
Proposed
Parking
Existing
Boat Launch
Fishing Areas
Platform
Proposed Fishing Platform
Proposed Platform
Trail Point
Existing Trail
Proposed Trail
RC NWR Boundary
Approved for Acquisition
RC NWR Ownership
RC NWR Easement
Proposed Expansion Areas
N
0 0.15 0.3 0.6 0.9 1.2
Miles
Produced by USFWS R5 CSDS, 3/18/05. For planning purposes only.
Boundary and other data USFWS. Photos State of Maine 2003.
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Flooding, particularly new moon tides, is thought to be the primary cause of nest failure for both species, although predation may also be a factor. Shriver et al. (2002) discovered mercury contamination in sharp-tailed sparrows on the coast of Maine. Salt marsh sharp-tailed sparrows had 41 percent greater blood mercury levels than Nelson's sharp-tailed sparrows. Of the five marshes studied, Popham Beach and Ogunquit had the highest blood mercury levels, York intermediate, and Scarborough and Weskeag the lowest consistently for both species (Shriver et al. 2002). More information is needed on the distribution and abundance of sharp-tailed sparrows on the refuge and the factors (e.g., habitat characteristics, environmental contaminants, predation) that affect their populations.

The American black duck (*Anas rubripes*) is a globally vulnerable watch list species and is considered one of the highest priority species of concern according to the Atlantic Coast and Eastern Habitat Joint Ventures and among the state and provincial agencies where it occurs. Coastal salt marshes provide breeding habitat for black ducks, and coastal marshes, estuaries, and sheltered coves are especially important to wintering black ducks for foraging and shelter (Dettmers 2004). During fall migration, modest numbers of black ducks appear in salt marshes and bays throughout the refuge (<200 at each site). The numbers of wintering waterfowl increase: aerial surveys detect more than 1,000 black ducks using marshes throughout the refuge. That usage tends to be moderate but consistent among the divisions.

Many other species of wading birds, waterfowl, and shorebirds forage in the salt marsh during migration and in the breeding season. During the summer of 2004 intensive fall shorebird surveys were conducted. Eight sites were surveyed weekly through the summer and into the fall. A total of 58 bird species were recorded; 26 were shorebird species. Average numbers of birds detected during one survey ranged from 278 at Biddeford Pool, 175 at Oxcart Lane, to a low of 9 off of Mile Road in Wells. The three most common species detected were semipalmated sandpiper, black-bellied plover and semipalmated plover.

The willet (*Catoptrophorus semipalmatus*) recently expanded its breeding range into southern and mid-coastal Maine (Tudor 2000). Willets typically nest in the high salt marsh and occasionally use fields, brushy areas, and sphagnum bogs. Willets are common throughout the refuge and nest in several divisions. Northern harriers (*Circus cyaneus*) are common foragers in the salt marsh during migration. Common mummichogs (*Fundulus heteroclitus)* and other small fish live entirely within estuaries, tolerating low oxygen, high water temperatures, and high salinity. Mummichogs in turn are important prey for birds and other fish (WNERR 2002).

Management issues include maintaining and restoring all salt marsh habitat on the refuge; monitoring focal species populations; protecting marshes from siltation, eutrophication, and other forms of pollution; preserving water quality and wetland function with adequate upland buffer; removing tidal restrictions; and minimizing human disturbance. Landscape/ecosystem level threats include oil spills and other chemical contamination, sudden salt marsh dieback, effects of sea level rise, and invasive species.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- By 2009, work with LMRD and others to develop criteria to identify and rank salt marsh restoration projects; begin implementation of the priority ranked projects

- Identify and protect high-priority salt marsh habitats and acquire from willing sellers approximately 344 acres of salt marsh in addition to acres approved under alternative A

Invasive Species Management

Up to 46 percent of the plants and animals federally listed as endangered species have been negatively impacted by invasive species (Wilcove et al. 1998, National Invasive Species Council 2001). Northeast region Refuges initiated an effort to systematically identify, locate, and map invasive plant species occurring on Refuge lands leading to an effective integrated management plan. Refuges will use this information to guide the development of control, monitoring and evaluation projects.

Rachel Carson NWR will manage invasive species through means consistent with the Rachel Carson legacy. Carson campaigned against the indiscriminate use of chemicals, yet she recognized the need to use substances to maintain the health of natural and human communities. The Refuge will use science-based information to determine the best techniques for controlling invasive species, while avoiding unintended consequences of control efforts. The Refuge will promote alternative environmentally benign pest management strategies to encourage healthy, sustainable ecosystems. In some circumstances chemical control of invasive species may be necessary to maintain vital wildlife habitats or populations. In such circumstances, the Refuge will follow best management practices in recognition of our namesake's message in *Silent Spring*.

- Initiate and support research targeted towards improving the management of sharp-tailed sparrow populations

- Monitor populations of breeding sharptailed sparrows on the Refuge using a standardized point count protocol, evaluate population trends and densities on Refuge and ensure salt marshes that currently have high densities of breeding sharp-tail sparrows continue to provide suitable habitats for these individuals

- Nominate high quality salt marshes with exceptional numbers of breeding Saltmarsh Sharp-tailed Sparrows for inclusion as Globally Important Bird Areas Program.

- Identify and protect high-priority salt marsh habitats through careful review of special use permits and coordination with and education of neighboring landowners and municipalities

- Expand efforts to determine mercury and other contaminant exposure for sharp-tailed sparrows in Maine coastal marshes

- Annually conduct shorebird surveys and contribute to International Shorebird Survey (ISS) and the Program for Regional and International Shorebird Monitoring (PRISM) efforts

- Install and monitor SETs (Sediment Elevation Tables with feldspar marker horizons) to determine if Refuge salt marshes are keeping pace with sea level rise and to ascertain the potential effects of increasing water levels.

- Restore salt marsh health to increase the ability of natural marsh accretion processes to keep pace with sea level rise. Tidally restricted (road crossed) or impounded marshes (N. Pool PKR) subside and are at most risk for destruction due to sea level rise.

- Acquire lands adjacent to salt marshes to ensure long-term salt marsh integrity and viability and to encompass salt marsh formation and migration processes over the long-term.

- Support research to document, analyze and quickly restore areas where sudden wetland dieback has reduced vegetation before long-term damage has occurred.

- Hire a biologist (GS 9, RONS 02007)

<u>Within 5 to 10 years of implementing the CCP</u>

- Evaluate (extent and vegetation type) and maintain vegetative buffers around salt marshes to meet biological objectives

- Analyze current population trends of sharp-tailed sparrows based on research by Shriver (2003)

- Partner with others to conduct studies of mercury exposure pathways and other contaminants, such as polychlorinated biphenyls, and their effects on sharp-tailed sparrow productivity

- Evaluate the appropriate level (i.e., frequency, intensity) of surveys for monitoring waterfowl or identifying concentrations of waterfowl
- Seek opportunities to study turnover rates of migratory shorebirds on the refuge
- Develop a targeted monitoring program for high-priority bird species

Within 15 years of implementing the CCP

- Restore 2/3 of priority ranked salt marsh projects

❖ Objective 1.2 – Dune Grassland, Beach, Rocky Shore, Subtidal and Intertidal

Protect 1,100 acres of naturally functioning dune grassland, beach, sand, rocky shore, and mudflat habitat comprised of >95% native vegetation or bare substrate, to benefit nesting, feeding and staging migratory birds and other marine flora and fauna.

Rationale

Dune grassland is dominated almost exclusively by dune grass (*Ammophila breviligulata*), the plant that anchors the highly exposed sand dune formations. Dune grass dies off if not stimulated to grow by shifting sand (Maine Natural Areas Program 2001a). Dune and fore dune are essential habitat for breeding piping plover (*Charadrius melodus*) and least tern (*Sterna antillarum*), provide staging areas for roseate tern (*S. dougallii*), and migratory habitat for shorebirds including semipalmated plover (*Charadrius semipalmatus*).

Plovers and other shorebirds forage in intertidal mudflats during migration. Twenty percent of Maine's semipalmated plover population uses beach habitat during migration in southern Maine (Clark and Niles 2000): much of that on the refuge. Migrating shorebirds exhibit a high degree of site tenacity for staging areas and require minimal human and animal disturbance at roosting sites that include beaches and sand spits.

Coastal Maine provides critical habitat for fall migrating shorebirds. Shorebirds feed on the mudflats as they follow the tides in and out. Twice a day they spend high tide roosting on rocky shores or sand spits. The U.S. Shorebird Conservation Plan (USFWS 2004b) lists the U.S. and Canadian shorebird populations that are highly imperiled or of high conservation concern. Black ducks also follow the tide in, foraging on invertebrates in the intertidal rockweed and foraging on the mudflats as the tide recedes. Up to 60 different marine animals and plants use rockweed at low tide. As the tide comes in, tiny air bladders along the rockweed stem and branches cause the plant to rise and sway with the current, creating an undersea nursery for as many as 31 fish species. Juvenile herring, pollock, and winter flounder, among other fish species, use rockweed "forests" to escape from predators and feed on invertebrates. Common eiders use rockweed as brood-rearing habitat, feeding on amphipods and periwinkles among the wrack (Daigle and Dow 2000). Loss of habitat, rockweed harvesting, and potential impacts from oil spills are major management concerns for this ecosystem.

Submerged aquatic vegetation (SAV) habitat, located in subtidal areas serves as structure, cover, and forage for a variety of trust species (waterfowl, fish) and other vertebrates and invertebrates. In southern Maine, beds of eelgrass (*Zostera marina*) or widgeon grass (*Ruppia maritima*) are typically found in tidal channels, shallow coastal waters, and salt marsh pools. Submerged aquatic vegetation is threatened by the repercussions of watershed development including nutrient enrichment and sedimentation. Dredging also represents a direct impact to existing SAV beds. Past harvesting efforts have threatened macroalgae (e.g., rockweed, kelp) beds.

Management issues in this habitat type include disturbance to nesting, foraging and roosting birds from recreational and commercial activities, predation on nesting plovers and terns, loss of habitat, effects of resource extraction on prey availability, oil spills, contaminants, and flooding.

Strategies

- Annually provide information to beach goers, clammers, and other beach/dune users about environmentally sustainable use of these habitats
- The refuge will work with others to review dredging and beach nourishment projects

Within 5 years of implementing the CCP

- Inventory, identify, and protect shorebird roosting sites
- Restrict access to roost sites as needed to ensure protection
- Support water quality monitoring efforts by conservation partners to ensure high-quality subtidal and intertidal mudflats
- Assess the condition of dune grassland habitat to determine if active management is needed to maintain its ecological integrity
- Use voluntary agreements, conservation easements, and fee simple acquisition to protect 75 acres of these habitats in addition to acres approved under alternative A

❖ Objective 1.3 – Piping Plover

Protect beach berm and associated dune edges, washovers, and intertidal areas for nesting, staging and feeding piping plovers to maintain a productivity level of at least 1.5 chicks per nesting pair over a five year period, consistent with regional population goals.

Rationale

The piping plover is federally threatened and state endangered in Maine. They nest above the high tide line on open sand, gravel or shell-covered beaches, especially on sand spits and blowout areas in dunes. The birds congregate later in summer to feed in the "splash zone" and in wrack piles at the high tide line. More than two-thirds of Maine's 30 miles of beaches are lost as nesting habitat for piping plovers because of human development including houses, seawalls, and jetties. Even in the remaining suitable habitat, beach goers may crush nests or chicks or leave garbage that attracts predators. Piping plover nesting, feeding, and brood-rearing habitats were given additional legal protection in 1995, when Maine designated them as Essential Habitats (McCollough et al. 2003).

On average, approximately 30% of piping plovers within the State of Maine nest on lands owned or managed cooperatively by the Refuge. An additional 20-40% of the State's nesting plovers occur on beaches which are adjacent to Refuge rivers and marshes, but are managed by the Towns of Wells and Ogunquit. Crescent Surf Beach is the premier plover beach the Refuge holds an easement on and manages, but plovers nest, on Goosefare Brook and Marshall Point beaches as well. Since 2000, the Refuge has assumed primary responsibilities for managing and monitoring plovers at four sites adjacent to Refuge lands. That involves cooperating with private landowners, the Maine Audubon Society, State partners, and the Wells National Estuarine Research Reserve to protect nesting plovers on their lands. Piping plover pairs managed by the refuge have ranged from a high of 18 in 2003 to a low of 6 in 1995. Recently, plovers have declined dramatically within the State.

In 2005, Rachel Carson had eight pairs of plovers nesting on beaches they manage. Six of the eight pairs nested on Refuge lands. The piping plover recovery plan has a recovery objective of 1.5 chicks per pair average over 5 years (USFWS 1996).

In 2003, productivity on beaches the refuge managed fell sharply due to crow predation. Productivity has not rebounded, although on average productivity is higher on Refuge managed beaches than in the remainder of the State. In 2005, 8 plover pairs nested, there were 5 successful nests, 18 chicks hatched, and 8 fledged. This is well below the 1.5 chicks per a pair necessary for population growth. Nesting success was particularly low at Crescent Surf Beach because of predation and heavy storm activity in May. The refuge uses several techniques to boost productivity, including control of predators such as crows and foxes, symbolic fencing and public outreach. Beach goers occasionally disturb nests, vandalize fencing or bring dogs onto Refuge lands. Refuge staff monitor beaches and educate the public about the protection necessary to meet piping plover recovery goals. They also work with willing landowners of beachfront to protect nesting plovers.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Recruit and train volunteer plover stewards
- Actively participate in statewide plover monitoring and conservation
- Provide information to beach goers, clammers, and other beach/dune users about piping plovers
- Use voluntary agreements, conservation easements, and acquisition to protect piping plover habitat
- Conduct on-site and off-site educational programs focused on piping plover conservation
- Hire a biologist (GS 9; same position as in objective 1.1)
- Hire a park ranger-law enforcement officer (GS 5/7; RONS 01008)
- Manipulate habitats by mechanical or prescribed fire to increase the area of sparsely vegetated habitats when nesting habitat is not provided by natural processes such as Nor'easters.
- Initiate management-oriented trapping patterned after the State's Drakes Island deer hunt, when necessary, for the protection of plover and other threatened and endangered species.

❖ Objective 1.4 – Least Tern

Protect beach berm and associated dune edges, washovers, and intertidal areas for nesting, staging and feeding least terns to maintain a productivity level of at least 0.5 chicks per nesting pair over a ten year period.

Rationale

The least tern is a state endangered species in Maine and is listed as a bird of high conservation concern for BCR 30. They arrive on the nesting grounds in late April/early May and build their nest on open sand, gravel, or shell-covered beaches above the high tide

line. Least terns feed on small fish from shallow open water, stream and river outlets, tidal ponds, and salt marshes adjacent to nesting areas. By late July and early August, adults and juveniles are congregating and foraging in bays, estuaries, rivers, creeks, and salt marshes (McCollough et al. 2003).

Least terns are affected by the same habitat loss and human disturbance noted above for the piping plovers, but are more difficult to protect from predators and are more sensitive to disturbance by people and predators. Least tern nesting, feeding, and brood-rearing habitats were given legal protection in Maine by designating these areas as Essential Habitats in 1995. In Maine, the least tern population has fluctuated between 39 (in 1982) and 157 pairs (in 2003) (McCollough et al. 2003).

Crescent Surf beach is generally home to the State's largest colony of least terns. The colony size at Crescent Surf has ranged from 157 pairs to 50 pairs in recent years. The Refuge manages the area specifically to benefit both least terns and piping plovers and provides key habitat for this species in Maine. Early season crow predation and late season owl and coyote predation depressed productivity in 2005. The refuge uses several techniques including hazing, fencing, trapping, and shooting to control diurnal predators such as crows and foxes. Least terns also nest at Laudholm Beach, Goose Rocks, Higgins, and Reid State Park.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Recruit and train volunteer tern stewards
- Use voluntary agreements, conservation easements, and acquisition to protect least tern habitat
- Hire a biologist (GS 9; same position as in objective 1.1)
- Hire a park ranger-law enforcement officer (GS 5/7; same position as in objective 1.3)

Within 5 to 10 years of implementing the CCP

- Develop a monitoring protocol for least tern productivity and population size
- Coordinate with partners to support and participate in statewide monitoring

❖ Objective 1.5 – Tidal River, Estuary, and Bay

Through an active role in local and state partnerships, maintain water quality of open water habitat in tidal rivers, estuaries and bays to provide resting and foraging habitat for waterfowl, marsh and wading birds and other birds of regional conservation priority including the American black duck, common eider, common tern and roseate tern, and to sustain fish nurseries and native plant and invertebrate communities.

Rationale

The refuge was established around a series of tidal rivers and associated estuaries along Maine's southern coast. These coastal habitats are teeming with wildlife throughout the year. Terns, waterfowl, and waterbirds forage in the tidal creeks. The tidal rivers of the refuge support several federal trust fish species that are in decline, including alewife (Alosa pseudoharengus), American eel (Anguilla rostrata), blueback herring (Alosa aestivalis),

rainbow smelt (Osmerus mordax), bluefish (Pomatomus saltatrix), and Atlantic menhaden (Brevoortia tyrannus).

Black duck, common eider, scoters, mallard, red-breasted merganser, bufflehead, and loons are the most common wintering water birds that forage in the open water areas of the bays and rivers. Management issues include habitat degradation through development of adjacent and upstream upland habitat, oil spills, stormwater discharge, and contaminants.

Protecting the water quality and ecological integrity of habitats in Maine's tidal rivers and estuaries requires a partnership among government, civic groups, conservation organizations, and residents throughout the entire watershed. The Wells National Estuarine Research Reserve (WNERR) developed a series of watershed conservation strategy reports for seven watersheds in southern Maine, providing a baseline of existing information on these watersheds (WNERR 2003).

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Enhance and support the collection of water quality and quantity data to establish baseline conditions and measure and track water quality and quantity trends
- Annually conduct waterfowl aerial and ground count surveys
- Acquire lands from interested landowners in the York River watershed
- Promote land conservation efforts with conservation partners to maintain the ecological integrity of coastal Maine watersheds
- Document in-stream flow for Refuge rivers; maintain adequate in-stream flows to support native biota
- Hire a biologist (GS-9; same position as in objective 1.1)
- Hire a refuge operations specialist (GS 5/7)

Within 5 to 10 years of implementing the CCP

- Establish regional partnerships and dedicate staff and time to maintain water quality in tidal rivers and estuaries
- Acquire more information on the ecology and condition of tidal rivers in the refuge to guide the management of anadromous and catadromous fish and other wildlife species of concern

Within 10 to-15 years of implementing the CCP

- Develop and distribute educational information on the ecology and wildlife use of tidal rivers, estuaries, and coastal watersheds
- Identify existing submerged aquatic vegetation (SAV) habitat within and immediately adjacent to refuge waters
- Draft a monitoring and restoration plan for SAV habitat

❖ Objective 1.6 – Maritime Shrubland

Manage 135 acres of maritime shrubland dominated by shadbush, bayberry, elderberry, and other fruiting shrubs to provide nesting and migratory habitat for land birds of conservation concern including eastern towhee, wood thrush, other fruit-eating fall migrants, and New England cottontail.

Rationale

The loss and degradation of naturally maintained shrublands has been extensive throughout the region. Coastal states have the primary responsibility for most of the native shrubland habitat in the region (Dettmers 2003, Litvaitis 2003). Shrub-dominated communities persist the longest at high elevations and in areas exposed to marine salt spray (Latham 2003). Although fragmented by roads and development, coastal Maine supports persistent maritime shrublands, a thin band of vegetation that transitions to salt marsh.

The suite of birds associated with naturally occurring shrublands and early successional forests in the northeastern U.S. accounts for about 15 percent of the total species diversity of the breeding avifauna in the region. Shrubland-associated birds (e.g., brown thrasher, prairie warbler, willow flycatcher) consistently rank near the top of lists of species showing population declines. Vegetation structure, microhabitat conditions, and landscape context are the most important habitat features for birds, rather than specific plant species (Dettmers 2003).

During the breeding season, many migrant land birds shift from a largely insectivorous diet to a diet high in fruits. That shift is particularly well documented in thrushes, vireos, wood-warblers, mockingbirds and their relatives (Parrish 2000). Parrish captured red-eyed vireos, a highly frugivorous migrant, over 10 times more frequently in coastal maritime scrub than in old orchard habitat on Block Island. Observations of migrant land birds feeding on fruits show that they can spend less time and encounter more prey while foraging on fruit, an important implication for a bird's energy budget (Parrish 2000).

Coastal habitats support large concentrations of migrating songbirds, including young of the year. The use of an area as a migratory stopover depends, in part, on its quality (e.g., presence of fruiting shrubs) and its location in relation to ecological barriers (such as large bodies of water). Habitat management and restoration for migrating songbirds may be most beneficial near ecological barriers where migrants are concentrated and may be competing for limited resources. Structurally diverse habitat types generally support greater numbers of migratory species than habitats with low vegetative complexity (Parrish 2000, Petit 2000).

Restoration and maintenance of naturally occurring shrublands is recommended as a priority for coastal states. Managing small patches (< 10ha) as shrubland habitat can be more effective for many of the shrubland breeding birds than managing such relatively small patches for other habitat types such as grassland or forest because of the relatively low patch size sensitivity exhibited by many shrubland birds compared to some of the grassland and forest birds. Consolidating and clustering patches and maintaining some large patches of shrubland habitat will provide habitat for a range of wildlife, including migratory songbirds, American woodcock, and New England cottontail (Dettmers 2003, Litvaitis 2003). Creating a "checkerboard" of small habitat patches should be avoided where possible (Petit 2000).

For further discussion of habitat needs of the New England cottontail see objective 3.1. Maritime and dry shrubland habitats contain invasive species of shrubs including honeysuckles, buckthorn, and others that bear fruit and provide cover. Removing these

invasive shrubs could reduce the habitat suitability for some species in the short term. An assessment is needed prior to removal to determine the short and long term effects of removal and options for restoring native shrubs.

Strategies

Within 5 years of implementing the CCP

- Assess current extent of maritime shrubland habitats as current mapping technologies are not able to quantify
- Identify areas and methods for shrubland restoration and management
- Expand bird monitoring to include new survey points in maritime shrubland during the breeding season and fall migration
- Continue to work with partners to protect and enhance maritime shrub lands for the benefit of species of conservation concern

Within 5 to 10 years of implementing the CCP

- Develop plans for invasive species control including options for restoring native shrubs and maintaining habitat suitability for species of concern
- Determine important areas on the refuge for spring and fall migrating land birds
- Acquire from willing sellers 35 acres of maritime shrubland

❖ Objective 1.7 – Nearshore and Marine Open Water

Protect nearshore and offshore marine waters and identify key sites for the benefit of wintering, migratory and breeding waterfowl and waterbirds, and anadromous fish.

Rationale

Although the Service will not be the lead agency, in 2000 President Clinton signed an Executive Order 13158 on marine protected areas with a goal to strengthen the protection of oceans and coastal resources. The Order requires the Department of the Interior and the Department of Commerce to develop "a scientifically-based, comprehensive national system of Marine Protected Areas (MPA) representing diverse marine ecosystems, and the Nation's natural and cultural resources." An inventory of potential MPAs was completed, and the refuge, due in part to its co-location with the Wells National Estuarine Research reserve, is on that list.

The Pew Oceans Commission, an independent panel, released a seminal report in 2003 calling for a new vision in the stewardship of our oceans (see side bar). There are many jurisdictions and sometimes competing national interests in the marine environment. States have jurisdiction over submerged lands and overlying waters from the shoreline out to the 3-mile limit. Federal territorial sovereignty extends 12 miles offshore, and the federal government controls ocean resources out 200 miles and more. More than 140 federal laws apply to oceans and marine resources (Pew Oceans Commission 2003).

The threats to the oceans include nonpoint source pollution (i.e., oil runoff from streets and driveways and nitrogen release), point source pollution (i.e., waste from feedlots and passenger cruise ships), invasive species, aquaculture (i.e., accidental escape of fish, nitrogen, phosphorus and fecal matter discharge), coastal development, overfishing,

"Oceans are in Crisis"

The Pew Oceans Commission, an independent panel, reports that "oceans are in crisis" and they call for a fundamental change in how we value the oceans (Pew Oceans Commission 2003). They note three major problems with how oceans are currently used and managed: 1) a focus on exploitation with little regard for environmental consequences, 2) a focus on individual species and not on the larger ecosystems, and 3) a fragmented and overlapping governmental and regulatory framework.

"The fundamental conclusion of the Pew Oceans Commission is that this nation needs to ensure healthy, productive, and resilient marine ecosystems for present and future generations. In the long term, economic sustainability depends on ecological sustainability. To achieve and maintain healthy ecosystems requires that we change our perspective and extend an ethic of stewardship and responsibility toward the oceans. Most importantly, we must treat our oceans as a public trust. The oceans are a vast public domain that is vitally important to our environmental and economic security as a nation. The public has entrusted the government with the stewardship of our oceans, and the government should exercise its authority with a broad sense of responsibility toward all citizens and their long-term interests" (Pew Oceans Commission 2003).

habitat alteration from fishing gear that drag the seafloor, bycatch, and climate change (Pew Oceans Commission 2003). The Pew Commission regards runoff of excess nitrogen from farm fields, animal feedlots, and urban areas as the greatest pollution threat to coastal marine life. They document that coastal development and associated sprawl each year destroy and endanger 20,000 acres of coastal wetlands and estuaries that serve as nurseries for fish and "paved surfaces have created expressways for oil, grease, and toxic pollutants into coastal waters."

In addition to raising alarms about the current state of our marine waters, the Pew Commission provides a detailed set of recommendations toward a more sustainable future for coastal ecosystems (Pew Oceans Commission 2003). The refuge can contribute in several key areas including confronting urban sprawl and controlling invasive species. The Pew Commission recommends several ways to address urban sprawl: (1) develop an action plan to address nonpoint source pollution and protect water quality on a watershed basis; and, (2) identify and protect from development habitat crucial for the functioning of coastal ecosystems. Another call to action by the Pew Commission is to enhance "ocean literacy" by expanding marine education. Pollution sources coming from the ocean and the land affect the refuge.

Several species of conservation concern occur in the nearshore and marine open waters of the refuge. Common and roseate terns (*Sterna hirundo* and *S. dougallii*) forage on herring, hake, and sand lance in these waters in the breeding season and when staging during fall migration. Common eiders (*Somateria mollissima*) occur year-round, while common loons (*Gavia immer*) and red-breasted mergansers (*Mergus serrator*) winter here. Alewife, American eel, blueback herring, and rainbow smelt, in decline in the Gulf of Maine, are in the nearshore waters.

Strategies

Within 10 to 15 years of implementing the CCP

- Evaluate the level of refuge involvement and train staff as appropriate in oil spill response
- Work collaboratively with conservation partners on watershed management initiatives
- Work with partners to address and control invasive aquatic species
- Identify key sites for feeding, wintering, and breeding waterbirds.
- Identify and protect, in collaboration with conservation partners, habitat critical for the functioning of coastal ecosystems
- Develop and deliver educational materials and programs on marine ecosystems
- Identify and protect important spawning, nursery, and feeding areas for trust fish species
- Initiate at least annual communication with the Coast Guard's Oil Spill Response Team to ensure information on trust resources and issues important to the refuge are incorporated in the oil spill response plan and are addressed in an oil spill response

- Participate, as appropriate, in establishment and development of the Rachel Carson Marine Protected Area

❖ Objective 1.8 – Biodiversity (Coastal)

Conserve and maintain the refuge's coastal native biodiversity to protect plants, animals, and natural communities of conservation concern.

Rationale

Southern coastal Maine is home to many unique animals and plants not found in other areas of the state. Some of these species are globally rare, while others are reaching the northern limit of their range. Southern Maine is a particularly diverse area, largely due the meeting of two distinct ecosystems, the oak-pine ecosystems of the north Atlantic coast, and the more northern softwood dominated ecosystems of the boreal forest. The refuge lies in that transition zone, creating a unique environment onto itself. Conservation targets from both ecosystems occur on the refuge; some of these species, such as salt marsh and Nelson's sharp-tailed sparrows co-occur here and hybridize.

The Maine Natural Areas Program (MNAP) and the MDIFW identified and mapped several rare, exemplary, or unique natural communities and rare plants or animals at or near the refuge. Within the coastal ecosystems, these include maritime forests, salt-hay salt marsh, and coastal dune-marsh ecosystems.

Maritime forest ecosystems as described by MNAP as narrow bands of forests with stunted trees with contorted branches. Maritime forests occur along the immediate coast or adjacent to salt marsh. Remnant maritime forests are scattered throughout the refuge with good examples occurring on the Goose Rocks, Wells, and Little River divisions. The critically imperiled pitch pine bog community occurs on the refuge, although their size and condition is unknown. These are sparsely forested peatlands with pitch pine (*Pinus rigida*) as the dominant tree species. Sphagnum covers the ground and evergreen shrubs, such as huckleberry (*Gaylussacia* sp.), are common (MNAP 1999).

The Wells and Ogunquit marsh complex comprises the second largest salt marsh complex in the state. It is home to many declining plant and animal species and was identified as a focus area by the MNAP. This focus area extends from the Oqunquit marshes to just north of the Mousam River and includes the forested areas between the ocean and Route One. Several areas support large concentrations of sharp-tailed sparrows, pitch pine woodlands, pocket wetlands, bogs and high-quality beach habitat.

Strategies

Within 5 years of implementing the CCP

- Work with partners to conduct a comprehensive baseline botanical survey of refuge lands

- Coordinate with MDIFW and the MNAP to implement surveys for state-listed plants, animals and invertebrates that occur on refuge lands.

- Identify, protect and manage rare natural community features where they occur on refuge lands

- Control non-native, invasive species that degrade habitat function

- Focus on efforts to identify and map locations of maritime forest ecosystems and other rare plant communities
- Build on working relationship in consultation with the MNAP on suitable management strategies to maintain these natural communities

Within 5 to 10 years of implementing the CCP

- Sponsor "bioblitz" event to document as many species as possible that occur on the refuge
- Identify and evaluate the size and condition of pitch pine bog communities
- Conduct a fauna and flora inventory of pitch pine bogs
- Identify, inventory, and evaluate existing pitch pine communities for health and long term viability
- Designate appropriate units to be managed for pitch pine communities
- Work with private landowners to help maintain barrier beach pitch pine communities

GOAL 2. Perpetuate the biological integrity and diversity of freshwater habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Background

Impacts on wetlands, including filling for development, are regulated and restricted by local, state, and federal laws. However, laws to protect the uplands surrounding wetlands, or to protect forested wetlands, are minimal. Freshwater wetlands are biologically diverse and important for many migratory birds. Yet, despite their ecological significance, they are underrepresented on the refuge. Not only are upland areas around wetlands vital for sustaining the health of a freshwater wetlands system, but also, contiguous freshwater wetlands and sufficient uplands are vital for wildlife and the health of downstream, salt marsh ecosystems.

Rivers, streams, emergent wetlands, vernal pools, and other freshwater wetlands on the refuge contribute to the biological diversity of coastal Maine watersheds. Maintaining the health and function of those wetlands systems requires partnerships among the refuge and its neighboring landowners and communities. Protecting water quantity and quality to maintain habitats for wildlife species of concern requires a watershed-wide effort.

❖ Objective 2.1 – Freshwater Rivers and Streams

Protect over 25 river and stream habitats including floodplain forests, to maintain or improve current water quantity and quality and riparian habitat for the benefit of freshwater and anadromous fish, breeding and migratory birds, and downstream estuarine habitats.

Rationale

Freshwater rivers and streams in the refuge provide habitat for a range of aquatic and semi-aquatic organisms. Riparian areas along the waterways also provide habitat, as well

as protecting water quality downstream. Young American eels are common in the streams of the refuge. Concerned about possible declines due to commercial harvesting, variations in ocean currents, contaminants, exotic diseases and parasites, and river passage (Haro et al 2000), the American eel was petitioned for listing under the Endangered Species Act in 2004. The Service completed the 90 day review in July of 2005 and found listing may be warranted. Currently, the Service is in the process of hosting expert panel workshops to determine status of the population, threats to the population and uncertainty focusing around existing data.

Other species common in the freshwater rivers of the refuge include brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), pollock (*Pollachius virens*), winter flounder (*Pseudopleuronectes americanus*) and bluegill (*Lepomis gibbosus*). Those species use the combination of freshwater streams and estuarine channels present on the refuge to meet their lifecycle needs.

Riparian habitats are areas adjacent to rivers, streams, or other water bodies, and are often areas of high species richness with dynamic and complex biophysical processes. Riparian areas provide important structural components, including large nest and perch trees for raptors and cavity trees for wood ducks and songbirds. Many vernal pools lie in these habitats. Without forested shorelines, stream banks are more susceptible to erosion. Riparian areas help control erosion and sediment loading into rivers and streams.

Southern Maine is rapidly developing, and demands on its water resources continue to soar. Residential development, golf courses, and water bottling plants all pose a threat to our

Stormwater Pollution

Stormwater is the water that runs along the ground or through pipes. As this water moves across lawns, driveways, roofs, roads, and parking lots it collects sediment, bacteria, chemicals, debris, and more, until it finally discharges into fresh water and salt water habitats. The Casco Bay Estuary Project finds that stormwater may be the single greatest contributor of contaminants to the bay. Nationwide, stormwater is one of the leading causes of water pollution.

The two primary sources of contaminated stormwater are point and non-point. Point sources carry stormwater through direct, identifiable means such as pipes. Non-point sources include runoff from land or groundwater seepage that enters rivers and estuaries from paved areas, malfunctioning septic systems, and other sources. National studies estimate that non-point source pollution contributes up to 60 percent of stormwater pollutants.

The most common sources of pollution from stormwater runoff throughout the refuge include residential development, construction, and roadways. Industrial, commercial, and agricultural sites contribute to stormwater runoff near some of its divisions.

Stormwater runoff cancontain excessive nutrients and bacteria, causing algal blooms that deplete oxygen levels and kill fish carry animal waste with fecal coliform that can contaminate clam flats act as a source of mercury, other heavy metals, oil and contaminants in salt marshes that may become available in the food chain to sharp-tailed sparrows and other species of wildlife including waterfowl, shorebirds, and wading birds. transport the seeds of invasive species to downstream habitats

In February 2004, the Maine DEP submitted a report to the Maine Legislature titled “Improving the Effectiveness of Stormwater Management in Maine.” That report was the result of a legislative mandate to provide recommendations for improving stormwater management in the state. Appendix 3 of that report lists proposed “Most at Risk” streams in the state, including the Goosefare Brook in Saco that flows through the Goosefare Brook Division.

The refuge must play an active role in the coastal communities and work with the state to encourage and implement best management practices and new technology for stormwater management near the refuge. In doing so, the refuge will reduce the adverse impacts on refuge resources and improve recreational programs for shellfishing and fin-fishing. Alternatively, more waterways on other refuge divisions will appear on “Most at Risk” stream lists.

aquatic resources. The lands of several water companies in York, Wells, Kennebunkport, and Kennebunk protect water quality and quantity. However, their current technologies are not projected to be able to meet all of the future water needs of our area. In the Kennebunk, Kennebunkport and Wells Water District (KKWWD), current demand at its summertime peak is 7 million gallons per day (MGD). In droughts, approximately 3 MGD can be supplied from Branch Brook, and another 3 MGD is available from other neighboring districts. To meet longer term demands, the KKWWD may need to explore other options, such as ground water withdrawal, or supply from Saco River, Sebago Lake, or the Atlantic Ocean (KKWWD 2005).

The state is moving toward creating and implementing "Sustainable Water Use Policies." The Department of Environmental Protection establishes water use standards for maintaining instream flows and lake or pond water levels that protect aquatic life and other uses and establish criteria for designating watersheds most at risk from cumulative water use. Water supply in refuge rivers and streams is critical in protecting our trust resources and ensuring healthy, functioning ecosystems. The refuge will work to establish baseline flow rates in refuge rivers and streams to ensure we can protect its aquatic resources.

Strategies

Within 5 years of implementing the CCP

- Work with municipalities on educating landowners about shoreland protection
- Provide comments on stormwater discharge management actions
- Work with partners on BMPs for stormwater management
- Partner with Maine Inland Fisheries and Wildlife or local universities to evaluate and map the distribution of wood turtles on the refuge
- Hire a refuge operations specialist (GS 5/7; the same position as in objective 1.5)

Within 5 to 10 years of implementing the CCP

- Document baseline in-stream flow for major refuge streams
- Work with partners to protect water quality on waterways that flow through the refuge
- Strengthen partnerships between the refuge and water companies to identify areas where we can work together to protect our aquatic resources
- Evaluate the effects of invasive species carried by stormwater runoff into rivers and streams, and implement invasive species control measures
- Survey for Louisiana waterthrush on the refuge
- Partner with Maine Inland Fisheries and Wildlife or local universities to evaluate and map the distribution of wood turtles on the refuge

❖ Objective 2.2 – Emergent Marsh, Forested and Scrub-Shrub Wetland, Vernal Pool

Maintain 1,445 acres of emergent marsh, scrub-shrub, forested wetland, and vernal pool habitats to sustain populations of species of conservation concern including veery and

willow flycatcher, Blanding's and spotted turtles, obligate amphibians, and rare dragonflies, and to perpetuate native plant communities.

Rationale

The undeveloped forests and wetlands in the eastern Biddeford and northern Kennebunkport region contain high concentrations of pocket swamps and vernal pools, habitats that are becoming increasingly rare in Maine. Vernal pools offer critical breeding habitat for some species of amphibians and invertebrates, including wood frog (*Rana sylvatica*), spotted and blue-spotted salamanders (*Ambystoma maculatum* and *A. laterale*), and fairy shrimp (*Eubranchipus*). Several rare species also use these wetlands, including the state-listed endangered Blanding's turtle (*Emydoidea blandingii*), state-listed threatened spotted turtle (*Clemmys guttata*), and state-listed endangered ringed bog haunter dragonfly (*Williamsonia lintneri*) (Maine Natural Areas Program 2001b).

Most of those species require a large area of relatively undisturbed upland habitat for nesting, foraging, and dispersal. Wood frog juveniles migrate up to 3,800 feet from the vernal pool where they hatched, while adults move up to 1,500 feet from the pool (Tracy Tarr, personal communication). Blanding's turtles may travel more than 1 mile between wetlands (Hunter et al. 1999).

The Blanding's turtle (*Emydoidea blandingii*) is one of the rarest turtles in the Northeast. It is believed to be declining throughout its range, and was listed as a candidate (Category 2) for federal listing throughout its range in the 1980s and early 1990s. The Northeast populations are believed to be highly vulnerable. Threats include the loss of small wetlands, habitat loss and fragmentation, road mortality, and increased nest predation in an increasingly developed landscape. The Blanding's turtle is state-listed as threatened in New York and Massachusetts, endangered in Maine, and a species of special concern in New Hampshire. The Service considers the Blanding's turtle a species of conservation concern, and recently increased support under Endangered Species Act Section 6 to states for research and surveys. Radio-telemetry projects showed that Blanding's turtles use vernal pool complexes and small wetlands in the Northeast, and make significant overland movements between wetlands. Those studies emphasize the importance of conserving wetlands in a matrix of intact, upland forest. If habitat fragmentation increases, the viability of the Northeast population is at serious risk (USFWS unpublished data).

In Maine, Blanding's turtles occur most frequently in complexes of small, acidic wetlands and vernal pools in large blocks of forested habitat (>500 acres). Blanding's turtles are found within 1 mile of refuge lands, and likely occur on several of its divisions. These turtles spend most of their time in the water. Uplands are crucial for nesting, basking, aestivating, and for traveling overland between wetlands. Blanding's turtles have slow reproduction, and therefore, are vulnerable to any source of mortality (McCollough et al. 2003).

This region has a high responsibility for the veery (*Catharus fuscescens*) and willow flycatcher (*Empidonax traillii*), two species of concern, as indicated by their declining population trends. The willow flycatcher prefers open habitat with scattered shrubs or forest edges, including willow thickets along streams, scrub-shrub wetlands, and brushy fields. The veery prefers moist, deciduous forest, including forested wetland with a dense understory of ferns, shrubs, and saplings.

Strategies

Within 5 years of implementing the CCP

- Participate in the development of a regional conservation plan for Blanding's turtle with state and federal partners

- Follow vernal pool best management practices
- Assess Blanding's turtle habitat on the refuge
- Identify and survey all vernal pools on refuge lands
- Survey vernal pools before active forest management occurs and exceed vernal pool best management practices established for Maine by harvesting when ground is dry or frozen, maintaining a minimum of 75% canopy cover of trees of over 20-30 ft tall within 100 feet of the pool, and maintaining coarse woody debris. For areas within 100-400 feet of the vernal pool maintain a minimum of 50% canopy cover.
- Protect nesting habitat for songbirds by controlling the population of white tailed deer through an active hunt program and keeping herd <16 deer per a square mile.

Within 5 to 10 years of implementing the CCP

- Evaluate the current distribution of Blanding's turtles on the refuge
- Develop protection and management techniques to maintain Blanding's turtles on the refuge
- Acquire from willing sellers 995 acres of freshwater wetlands in addition to the acreage approved under alternative A
- Evaluate the effects of invasive species carried by stormwater runoff into freshwater wetlands, and implement invasive species control measures
- Hire a biologist (GS 9; the same position as in objective 1.1)

❖ Objective 2.3 – Biodiversity (Freshwater)

Conserve and maintain refuge native freshwater biodiversity to protect plants, animals, and natural communities of conservation concern.

Rationale

The refuge hosts a diverse array of freshwater habitats, home to many common and uncommon species in streams, bogs, swales, vernal pools, and forested wetlands throughout the refuge. The MNAP and MDIFW have identified and mapped several rare, exemplary, or unique freshwater natural communities and rare plants or animals at or near the refuge. Those include Blanding's and spotted turtles and unusual bogs that support rare invertebrates and plants. In 2004, one of the vernal pools documented on the refuge contained more than 160 spotted salamander egg masses. In 2005, the refuge documented egg masses of blue-spotted salamanders. Scrub-shrub wetlands with high-bush blueberry, winterberry, and swamp rose provide fruits for fall migrating land birds.

Strategies

Within 5 to 10 years of implementing the CCP

- Work with partners to conduct a comprehensive baseline botanical survey on refuge lands
- Coordinate with the MNAP and MDIFW to implement surveys for state-listed plants, animals and invertebrates that may occur on refuge lands.

- Identify, protect and manage rare natural community types where they occur on refuge lands
- Control non-native, invasive plants that threaten the integrity of refuge lands
- Share data from vernal pool surveys to support local and national tracking of changes in amphibian communities

Within 5 to 10 years of implementing the CCP

- Participate in state efforts to survey dragonflies and damselflies
- Sponsor an event such as a "bioblitz", where volunteers survey refuge lands to document as many different species as possible

GOAL 3. Perpetuate the biological integrity and diversity of upland habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Background

Presettlement land surveys of New England from 1620 to the early1800s provide a historical picture of the distribution of forest types. Cogbill et al. (2002) describe the presettlement forest as a regional north-to-south gradient of spruce-beech-pine-oak. Beech was dominant in northern New England, while oak dominated the forests of southern New England. Oak-pine forests with minor components of hemlock, maples, beech, and birches grew in southern coastal Maine. White oak (*Quercus alba*) and pitch pine (*Pinus rigida*) were the dominant tree species in these coastal forests (Cogbill et al. 2002).

Development has eliminated, fragmented, or degraded large areas of upland habitat in coastal Maine. Lands conserved by the refuge, Wells Reserve, and other conservation groups, towns, and landowners are critical for maintaining suitable habitat for wildlife and plants, connectivity across the landscape for animal travel and migration, and enough critical terrestrial habitat to protect the health of salt marsh, freshwater, and marine ecosystems and the trust resources they support.

The refuge also contains important transitional habitats, including maritime shrubland, dry shrubland and early successional forest. The proportion of those habitats in presettlement times is uncertain. However, coastal regions are recognized as important areas for maintaining them, particularly the more stable maritime shrublands. Many species of concern are associated with shrublands and young forests. According to the Service's *Biological Integrity, Diversity, Environmental Health* policy (601 FW 3), refuges should "favor management that restores or mimics natural ecosystem processes or function…" Therefore, we combined the shrubland and grassland objectives in this alternative to provide greater management capability for shrublands. Although grasslands were likely not present historically in northern New England, we will manage for a small percentage since they are recognized as providing an aspect of diversity to the region.

❖ Objective 3.1 – Early Successional (Shrubland-Grassland)

Manage 1,715 acres of early successional habitat, with over 85 percent consisting of shrublands with a moderate-to-high density of shrubs or trees (>10,000 stems/ha), and no more than 15 percent consisting of grasslands, to sustain Maine's New England cottontail population, to provide nesting and feeding habitat for birds of conservation concern,

including eastern towhee, blue winged warbler, prairie warbler, willow flycatcher, and American woodcock, and to provide migratory habitat for land birds.

Rationale

A range of habitat types are included under shrubland/early successional habitat (collectively called "thicket" habitat) ranging from brushy old field conditions to regenerating forests to more naturally maintained, relatively stable shrublands associated with frost pockets, poor soils, swamps, bogs, or coastal plains. Coastal states have the primary responsibility for most of the native shrubland habitat, where thicket-dependent species likely occurred historically in their highest densities. The loss and degradation of naturally maintained shrublands has been extensive throughout the region. Many of the historic conditions which perpetuated shrublands (pre-historic grazing animals, native American burning, large beaver colonies creating beaver meadows, fires, older, mature forests, small scale agriculture and insect outbreaks) are now either non-existent or tightly controlled (Askins 1998).

The suite of birds associated with naturally occurring shrublands and early successional forests in the northeastern United States accounts for about 15 percent of the total species diversity of the breeding avifauna in the region. Shrubland-associated birds consistently rank near the top of lists of species showing population declines. Partners in Flight (PIF) identified 15 shrubland birds as species of conservation responsibility in the northeast (Dettmers 2003). The refuge lies in the breeding range of several of those species, which include eastern towhee, prairie warbler, and willow flycatcher. Shrubland-associated (and forest-associates) birds have a relatively high percentage of the species, with $\geq$10 percent of their total breeding population in the northeastern United States.

New England Cottontail—Petition for Listing on the Federal Endangered Species List

In response to a petition to list the New England cottontail as threatened or endangered, the Service published a "substantial" 90-day finding in the "Federal Register" in June 2004. Whenever the Service publishes a substantial 90-day finding, it initiates a status review of the species to determine whether listing the species is warranted. As noted in the 90-day finding, the Service opened a 60-day public comment period, soliciting information and data on the New England cottontail. That period closed on August 30, 2004.

Region 5 of the Service has recently completed its status review on the cottontail and has forwarded a recommendation that the species be placed on the national candidate species list. That recommendation however, is still under review, so the species is not yet an official candidate, nor has it been proposed for listing at this time.

The New England cottontail (*Sylvilagus transitionalis*) has declined significantly in the past 40 years. In 1989, the Service listed this species as a category 2 candidate species and the Northeast Nongame Technical Committee lists the New England cottontail as a high conservation priority. Currently, cottontails occur as metapopulations in a variety of habitats including shrub-dominated wetlands, idle farm fields, powerline corridors, and other patches of early successional forest. Historically it occupied shrublands associated with rocky outcrops, stream corridors, shrub-dominated wetlands, and forests regenerating after disturbances (Litvaitis et al 2003a).

Although greatly reduced in their geographic range, New England cottontails still occur along the Maine coast from the New Hampshire border to the greater Portland area. Litvaitis et al. (2003b) searched suitable sites (about 10,000 stems or more/ha) on the refuge for New England cottontails in 2003. The remnant populations in Maine use patches that are larger, have a greater density of understory vegetation, and are more frequently associated with idle farmlands than vacant patches. This cottontail species depends on dense understory vegetation to avoid predation (Litvaitis et al. 2003a).

New England cottontails were found on 5 of 29 sites inventoried on the refuge (see Litvaitis 2003b for site numbers). Those included

- Spurwink River (site 32): a 1-ha dense scrub-shrub wetland bordered by mid-successional forest in Cape Elizabeth just beyond the refuge boundary; likely too small to support cottontails in the long term

- Spurwink River (site 35): a >2-ha patch of mixed scrub-shrub wetland and early successional forest interspersed with mid-successional forest; understory stem density exceeded 35,000 stems/ha; good long-term cottontail site

- Wells (site 49): 8 ha dominated by dense scrub-shrub and early successional forest in Wells; understory stem density exceeds 14,000 stems/ha; management is needed to maintain and expand early successional habitat; only a portion of the site is on the refuge; good long-term site, with appropriate management

- Wells (site 50): a 1.5-ha patch of moderately dense (16,000 stems/ha) scrub-shrub habitat in Wells; expansion of site is needed to sustain population

- Spurwink River (site 83): a 0.3-ha patch dominated by a moderate understory (13,000 stems/ha) of autumn olive and surrounded by grasslands at Libby Field; although too small for the long term, other suitable patches lie nearby

The New England cottontail populations associated with the Spurwink River (sites 32, 35, and 83) may be part of a metapopulation in a region south of Portland. Libby Field (site 83) has the potential to support a large, sustainable population of New England cottontails if grasslands are allowed to succeed to shrubland habitat (Litvaitis et al. 2003b). Litvaitis et al. (2003b) recommend establishing and maintaining moderate-to-large patches (>10 ha) to serve as core habitats for cottontails. Smaller patches may help a local cottontail metapopulation, but small patches won't sustain it. In addition to the Spurwink River area as a core habitat, the other area that could also serve that role is near Drakes Island and the Wells National Estuarine Research Reserve (sites 49 and 50), in collaboration with private landowners (Litvaitis et al. 2003b). It is likely that other small populations of NEC inhabit the refuge. We have unconfirmed reports of them at the Goose Rocks and Goosefare Brook divisions.

The number of displaying male American woodcock was unchanged from 2002 to 2003 in the eastern United States, according to singing-ground surveys. Longer trends show a decline of 1.3 percent per year from 1993 to 2003, and 2.3 percent per year from 1968 to 2003. Between 2002 and 2003, Maine reported an increase in the breeding population, yet the overall trend in Maine since 1968 remains negative. Recruitment rates (the number of immatures per adult female) in recent years are 18 percent below the long-term regional average. The major causes for these declines are thought to be the loss and degradation of habitat on the breeding and wintering grounds, resulting from forest succession and changes in land use (Kelley 2003).

The restoration and maintenance of shrublands is recommended as a priority for coastal states. Managing small patches (<10 ha) as shrubland habitat can be more effective for many of the shrubland birds than managing such relatively small patches for other habitat types, such as grassland or forest, because of the relatively low patch size sensitivity exhibited by many shrubland birds compared to some of the grassland and forest birds. Consolidating and clustering patches and maintaining some large patches of shrubland habitat will provide habitat for a range of wildlife, including birds, insects, cottontails, and racers (Dettmers 2003; Litvaitis 2003).

Populations of grassland birds are declining as grassland habitats and other agricultural conditions diminish. Norment (2002) provides an eloquent commentary on the need to approach grassland bird conservation in the Northeast with "particular wisdom and care." He notes that, despite the relatively recent (last 200 years) rise and fall of grassland habitats and associated birds in New England, the region may still be important for those species, given their continental decline and habitat loss in the core of their ranges in the Midwest.

Most of the grassland bird species (e.g., grasshopper, vesper, and savannah sparrows, and eastern meadowlark) that have declined in the region require 20 acres or more of contiguous grassland habitat (Jones and Vickery 1997). Only the bobolink (*Dolichonyx oryzivrous*) occupies areas less than 10 acres, although a viable population would require a larger grassland area. Small grasslands surrounded by forest or shrubland and isolated from each other are unlikely to provide quality nesting and feeding habitat for those birds (Laura Mitchell, personal communication). Grasslands should be fields of at least 10 acres with mixed grass 8 to 12 inches high to benefit nesting bobolink and other grassland birds. Smaller grassland areas managed for viewsheds, terms of easements, public use or biodiversity will total less than 100 acres. We recognize the need to evaluate grassland habitat management in light of other conservation priorities and assess the resources and strategies required to maintain that habitat.

Strategies

Within 5 years of implementing the CCP

- Increase work with partners to secure and expand existing New England cottontail populations around the Spurwink River and Scarborough Marsh
- Intensify efforts to monitor New England cottontail populations by conducting surveys at known and potential sites on the refuge and other suitable habitats
- Identify additional areas on the refuge and on neighboring lands suitable (small, isolated areas, where mid-successional forest patches may occur, but not replacing rare habitats or intact mature (>75 years) forests or old field habitats) for shrubland management
- By 2008, determine management actions to get appropriate habitat and landscape linkages for shrubland species
- Develop early successional management tools, including prescribed fire, mechanical cutting, forest cutting, mowing, and hydroaxing
- Hire a biologist (GS 9; same position as in objective 1.1)
- Hire a refuge operations specialist (GS 5/7; the same position as in objective 1.5)

Within 5 to 10 years of implementing the CCP

- Acquire from willing sellers about 1,110 acres of early successional grassland/ shrubland habitat in addition to the acres approved under alternative A
- Evaluate newly acquired grasslands to optimize the configuration (size and shape) of designated grassland units to benefit area-sensitive birds or determine if they should be managed as a different covertype to contribute more to other wildlife priority species.
- By 2010, in the core habitats identified by Litvaitis et al. (2003b), restore and maintain moderate (>10 ha) to large (>25 ha) shrubland/early successional patches for New England cottontail and other habitat associates
- By 2015, establish a NEC population on at least two new sites on the refuge or partner-owned lands

- Evaluate the role of invasive shrub species in providing cottontail habitat and determine the feasibility of replacing invasive plants with native shrub species

❖ Objective 3.2 – Deciduous Evergreen, and Mixed Forest

Maintain approximately 6,700 acres of mature, deciduous, evergreen and mixed forest habitat in a gradient of dry to moist conditions, with a long term goal of the majority of trees reaching >12 inches dbh (where site capacity enables), consisting of a well-developed understory, abundant dead wood, and a multi-layered canopy to provide breeding habitat for landbirds of highest conservation concern, including wood thrush, scarlet tanager, rose-breasted grosbeak, and black-billed cuckoo.

Rationale

Northern hardwood and mixed forests are the most widely distributed habitat type in the PIF 9 planning region. Bird species associated with that habitat occur throughout the region, yet some show declining population trends. The North American Landbird Conservation Plan identifies wood thrush (*Hylocichla mustelinaas*) as a species of continental importance, and calls for a 50-percent increase in the continental population (Rich et al. 2004).

The refuge is approximately 35 percent tidal, 10 percent freshwater wetlands and 55 percent uplands. Most of the upland forests consist of mixed oak and pine forest; however, hemlock, spruce and pitch pine stands occur as well as hickory and maple forests. Viburnums, winterberry, blueberry, serviceberry, Virginia rose and male berry compose much of the shrub understory. Habitats are quite diverse, containing elements from the more southern oak-pine forests and the softwood forests of the north. Southern Maine is where those two community types blend, and create a wealth of biodiversity.

The wood thrush prefers mature, moist, closed-canopy forest with a shrub-subcanopy understory, moist soil, and leaf litter (DeGraaf and Yamasaki 2001). Other birds of conservation concern in BCR 30 associated with this habitat type include black-and-white warbler (*Mniotilta varia*), rose-breasted grosbeak (*Pheucticus ludovicianus*), scarlet tanager (*Piranga olivacea*), purple finch (*Carpodacus purpureus*), Baltimore oriole (*Icterus galbula*), black-billed cuckoo (*Coccyzus erythropthalmus*), and Louisiana waterthrush (*Seiurus motacilla*) (Rich et al. 2004). A diverse forest structure will benefit a range of species that inhabit mixed forest. Wood thrushes forage in the leaf litter and understory vegetation, while scarlet tanagers forage in the forest canopy.

Strategies

Within 5 to 10 years of implementing the CCP

- Designate large forest blocks to benefit BCR 30 priority nesting and migratory birds

- Continue to work with the Maine Forest Service and other partners on maintaining forest health, including the control of invasive plants and forest pests, such as hemlock wooly adelgid and glossy buckthorn

- Evaluate the health of these forested stands to determine whether active management is needed to enhance their condition and ensure longevity. Develop stand prescriptions, including the consideration of regeneration to maintain desired species composition and stand structure. Also, evaluate the plant species composition in the understory and forest floor, a vital component of the overall habitat quality for many species of conservation concern

- Acquire from willing sellers 2,991 acres of mixed forest, in addition to the acres approved under alternative A
- Protect nesting habitat for songbirds by controlling the population of white tailed deer through an active hunt program and keeping herd below 16 deer per a square mile

❖ Objective 3.3 – Biodiversity (Uplands)

Conserve and maintain refuge upland native biodiversity to protect plants, animals, and natural communities of conservation concern.

Rationale

Upland forests in southern Maine typically are mixed hardwood pine communities. However, species typical of more northern and southern climates (e.g., pitch pine, hemlock, spruce, sassafras, and black tupelo) also occur on the refuge, creating a diverse upland habitat community. Upland thicket, shrubland, and sandplain grassland add to that habitat diversity and support many declining species, such as black racers and rare invertebrates. The MNAP and MDIFW identified and mapped several rare, exemplary, or unique natural communities and rare plants or animals at or near the refuge. Rare plants in upland habitats include black tupelo, sassafras, white wood aster, pale green orchis, and wild coffee. Uncommon animals include ribbon snake and Blanding's turtle. Those natural communities, plants and animals, common and rare, provide a unique and important contribution to the ecological diversity of the area.

Strategies

Within 5 years of implementing the CCP

- Work with partners to conduct a comprehensive baseline botanical survey on refuge lands
- Coordinate with MNAP and MDIFW to implement surveys for state-listed plants, animals and invertebrates that occur on refuge lands.
- Control non-native, invasive plants that threaten the integrity of refuge lands
- Seek appropriate opportunities to participate in the New England Wildflower Society/ MNAP rare plant monitoring program
- Hire a refuge operations specialist (GS 5/7; the same position as in objective 1.5)

Within 5 to 10 years of implementing the CCP

- Inventory bat populations
- Participate in the State of Maine sampling of owl populations
- Sponsor an event such as a "bioblitz", where volunteers survey refuge lands to document as many different species as possible

GOAL 4. Develop the Rachel Carson National Wildlife Refuge as an outstanding center for research and demonstration emphasizing land management techniques for restoring and sustaining healthy estuarine ecosystems in concert with the National Land Management Research and Demonstration (LMRD) program.

❖ Objective 4.1 – Research

Identify high-priority estuarine ecosystem management research needs, develop research proposals, and facilitate and implement research projects.

Rationale

The techniques used in land and habitat management are constantly changing and being fine-tuned as our knowledge of species' requirements increases and technology advances. For the LMRD sites to function as premier examples of habitat-based land management, experimenting with new management techniques is essential. Likewise, the techniques used at these sites must be validated and proven effective before they will be fully implemented by other land managers. That is best accomplished through an active, diverse research program.

Salt marsh ecosystems along the Atlantic coast have been altered and manipulated for nearly 400 years since the arrival of European settlers. Since 1600, coastal states from Virginia to Maine have lost between 9 percent and 74 percent of their wetlands. Salt marshes in the mid-Atlantic states (NJ, NY, CT, MA) and elsewhere along the Atlantic coast were extensively ditched and drained before the 1940s for mosquito abatement and for salt marsh haying operations. For example, by 1934, more than 3,000 miles of ditches had been dug in Massachusetts, of which approximately 1,000 were located between Gloucester and Salisbury. By the time ditching halted in World War II, 9 of every 10 acres of salt marsh in New England had been drained. Nationwide, an estimated 105 million acres of wetlands remain, of which only 5 million acres are salt marsh. The potential and need for research into improved management and restoration is high. Research in estuarine ecosystems at this LMRD refuge will benefit many federal trust resources, including waterfowl, shorebirds, marsh and wading birds, terns, loons, anadromous and inter-jurisdictional fish and other aquatic resources.

As of 2005, we do not know the extent of SAV and macroalgae beds at the refuge. Through the LMRD, we can locate and evaluate the health of existing SAV habitat and identify potential restoration sites, applying new techniques and advancing the science and practice of managing and restoring SAV. This habitat is a resource we need to identify more clearly on the refuge, in order to protect it for use by trust species.

The work of a number of organizations relates to salt marshes and estuarine habitats. Partnering with them benefits the organizations involved (including the Rachel Carson/ Parker River LMRD), salt marsh and estuarine habitats, and restoration and land management science. Present partnerships include the National Park Service, Natural Resource Conservation Service, Environmental Protection Agency, National Oceanic and Atmospheric Agency, Wells National Estuarine Research Reserve, University of New Hampshire, University of Rhode Island, University of Connecticut, University of New England, and Ducks Unlimited. These partnerships are often project-specific and very fluid. Our aim is to make them more long-term, to promote the advantages of working with the LMRD areas of the Rachel Carson and Parker River refuges.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Develop a methodology for evaluating the condition and restoration potential of salt marsh and ranking a list of areas to be restored
- Identify restoration methods and best management practices for areas on that ranked list
- Obtain funding to support a graduate student through such programs as the National Fish and Wildlife Foundation scholarship program
- Test and develop new habitat management techniques, and ensure that findings are documented, subjected to peer review, and published in appropriate journals
- By 2006, identify and incorporate into the design of a new administrative office building the needs of our facility to support field and laboratory research, including housing for visiting researchers

Within 5 to 10 years of implementing the CCP

- Expand further partnerships to advance research in restoring, managing, and conserving estuarine ecosystems
- Expand collaborations that provide financial support of research projects
- Identify existing SAV and macroalgae sites and evaluate their restoration potential

Land Management Research Demonstration (LMRD)

In 1999, *Fulfilling the Promise* Recommendation WH 18 launched the nationwide Land Management Research and Demonstration (LMRD) Program so that state-of-the-art land management techniques aimed at providing healthy habitats for fish, wildlife, and plants could be developed and implemented at participating national wildlife refuges (USFWS 1999). The LMRD program also seeks to bring those techniques to key audiences outside and inside the Service, through a variety of outreach methods, including tours, workshops, collaborative research projects and publications. Although the ultimate goal is to establish two LMRD programs in each region, only five existed in the country in 2005. Therefore, the Rachel Carson—Parker River LMRD program is in a leadership position to craft the future shape of the program as well as specific innovations in estuarine habitat management and restoration.

Each LMRD program was enacted on a competitive basis. Given the national concern about the threats to and importance of salt marsh, the Rachel Carson-Parker River LMRD proposal, with its focus on salt marsh and associated estuarine habitat, ranked first among 14 applications from around the nation. Rachel Carson NWR salt marshes occur south of Portland, Maine and include the Webhannet/Ogunquit system, the second largest salt marsh complex in the state. Associated estuarine waters run from tidal freshwater streams and rivers to small coastal embayments.

These areas have been degraded by human alteration including increasing development (see goal 1). Nevertheless, the salt marshes and associated waters support large numbers of the Refuge's trust species including salt marsh and Nelson's sharp-tailed sparrows, willet, black duck and other waterfowl, shorebirds, and wading birds. Trust fish species include American eel and anadromous fish such as alewife, blueback herring and menhaden.

❖ Objective 4.2 – Demonstration (Internal and External Audiences)

Demonstrate advances in habitat management techniques to other refuges and land managers, the scientific community, and the general public, to promote the wider application of estuarine ecosystem restoration and sustainable management.

Rationale

The essential purpose of the Salt Marsh/Estuary LMRD program is to effectively communicate sound salt marsh management techniques, enabling visiting land managers to understand, evaluate, and duplicate our models. The inter-jurisdictional nature of salt marshes extends that outreach component to an enormous audience. Millions of people live within a short drive of the refuges.

Target audiences primarily include land managers, particularly at all coastal national wildlife refuges. Other agencies, such as the National Park Service, permitting agencies such as the Army Corps of Engineers and Environmental Protection Agency, Massachusetts and Maine state parks and wildlife areas, planning commissions and other conservation organizations will also benefit.

The refuge has already established relationships with its 11 neighboring coastal municipalities in Maine, and would include them in its outreach. In Massachusetts, the Parker River refuge is working on a similar plan with nearby Newbury, Newburyport, Ipswich, Rowley, and other municipalities.

Interpreting our work to landowners is essential in our outreach strategies. We are now producing interpretive signs about salt marshes to complement our current salt marsh management. We will place them where visitors can learn about restoration, including the new refuge contact station that enables us to interpret the Salt Marsh/Estuary LMRD site for 260,000 people who visit the refuge.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Demonstrate at least one salt marsh restoration project every 2 years by restoring tidal flow, removing fill, creating pools, plugging ditches, or restoring tidal creeks on refuge- or partner-owned lands
- By 2006, incorporate management assessment and adaptive management options in all projects using new field techniques, in order to determine their long-term effects and potential, unintended consequences. That will serve both the research and demonstration functions of the LMRD.
- By 2007, use the Internet to disseminate relevant habitat management information
- By 2008, establish library materials accessible to resource practitioners and researchers
- Hire a biologist (GS 9; RONS 02007)

Within 5 to 10 years of implementing the CCP

- Monitor the health and integrity of salt marsh habitat, including changes in marsh elevation in relation to sea-level rise or sudden salt marsh dieback

❖ Objective 4.3 – Integration

Integrate the LMRD program with refuge operations, management programs and actions, and use adaptive management in responding to new research findings or applied management techniques.

Rationale

All staff will be well versed in the specific missions of the LMRDs at both Rachel Carson and Parker River refuges, as well as the national context of this new, intense program, in order to explain them to the public in both formal and informal settings. For that to succeed, we anticipate that staff at both stations will provide input on the production of audience-specific outreach tools. Integrating the results of the LMRD program with refuge outreach programs is ideal. However, will also require short- and long-term planning with existing and proposed staff. When they present the program, they will integrate with it the message of the Refuge System and the refuges.

Because one goal of the LMRD is to demonstrate land management techniques for restoring and sustaining healthy estuarine ecosystems, refuge staff will be involved in implementing cutting-edge management techniques on refuge lands. That refuge staff understand the nature, purpose, and importance of those activities is vital. Their awareness will enable them to implement the new techniques and improve communication with the LMRD biologist on project successes and difficulties.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Integrate new or refined estuarine management techniques with on-going management efforts (e.g., advances should be adopted by the refuge as part of best management practices and to demonstrate the mission of the LMRD)
- Direct LMRD staff to seek external funding for outreach, to complement assistance from outreach staff
- By 2006, include LMRD information on the refuge website

GOAL 5. Increase appreciation and stewardship of coastal Maine wildlife and their habitats by providing positive wildlife-dependent experiences for refuge visitors.

❖ Background

The refuge offers countless wildlife-related experiences. However, more visitors bring more human impacts, and we need to implement ways to minimize their potentially damaging effects on habitat and wildlife. We and our grandchildren can use and enjoy these natural treasures by following the wilderness principles of "Leave No Trace," modified here for the refuge.

- Plan Ahead and Prepare
- Travel on Durable Surfaces
- Dispose of Waste Properly

- Leave What You Find
- Be Careful with Fire
- Respect Wildlife
- Be Considerate of Other Visitors

Recreational uses also require the maintenance, replacement, or repair of trails, observation platforms, parking areas, directional and interpretive or other signs, and printing brochures, trail guides, and maps. Visitation is expected to grow beyond its present level of 300,000 and, concurrently, the requests it brings for recreational services.

The refuge will institute a pilot program to charge a user fee for refuge trails. Our trial fee program will be established under the Federal Lands Recreation Enhancement Act (REA), 16 U.S.C. 6803(c), Consolidated Appropriations Act (PL 108-447). This law grants the Secretary authority to collect recreation fee revenues for public recreation. REA replaces the Recreation Fee Demonstration Program and authorizes the Recreation Fee Program (Fee Program) for 10 years (through 2014). At least 80% of the funds raised from user fees on a particular refuge in this region stay at the refuge. That money is reinvested back into the refuge to enhance visitor services and reduce the backlog of maintenance needs for recreation facilities such as trail maintenance, toilet facilities, boat ramps, hunting blinds, and interpretive signs and programs. Recreation fees may not be used to pay for biological monitoring of threatened and endangered species. The other 20% is sent to the region to be distributed to other refuges. In previous years, Rachel Carson refuge has received money from these regional funds for public use facilities.

The REA instructs the Service, along with other federal land management agencies, to develop the America the Beautiful Pass, which covers the entrance fee and standard amenity fee for federal recreational lands. The new pass replaces the current Golden Eagle, Golden Age, and Golden Access Passports, as well as the National Parks Pass and will let visitors gain entrance to federal lands managed by the five participating bureaus or agencies that are open to recreation. Existing National Park passes, Golden Eagle, Golden Age, and Golden Access Passports will be grandfathered in under their existing benefits and will remain valid until expired. These passes will continue to be sold until the new pass is available. Details of the America the Beautiful Pass still need to be determined and the pass will not be available until 2007. Site specific and regional passes, such as the Federal Duck Stamp, will remain valid and will continue to be available under this Act.

The following fee program would be initiated at the fee areas of the refuge:

- A single trail user fee will be charged per person. Our proposed fee would be $1 per day.
- An annual pass for the Carson Trail at Headquarters in Wells and the Cutts Island trail in Brave Boat Harbor Division would be available for $12.
- A 5-year Refuge Wide Pass would be available for $250.00. This special use permit will allow access to all but the most sensitive areas of the refuge year-round. Pass holders must comply with refuge rules and will be issued maps showing access areas.
- Daily entrance fees will be collected at self-service fee collection stations.
- Self-service fee collection stations will likely consist of a secure box with envelopes to register and pay the daily or annual fee.

- The total access pass is only available at the refuge headquarters.

The following Fishing Permit Fee Program will be implemented in conjunction with the fishing program. We will charge an annual fee of $10 for a refuge fishing permit. This permit will be valid for all bank access areas open on the refuge. Anglers must possess a valid fishing license and comply with State regulations. There may be a need to limit fishing during certain seasons or conditions to ensure a safe, high-quality program. Details of these restrictions and any application requirements will be outlined in the Fishing Management Plan. Based upon these restrictions, purchase of a permit does not guarantee the ability to fish all refuge access sites during all seasons.

We realize that the new fee program will require an adjustment period. Our plan for instituting the fee includes: an educational period, a warning period, and finally a transition to full enforcement. We will post a notice at the collection site informing the public of the use or anticipated use of recreation fees collected during the previous year. We may adjust fees periodically to reflect changes in administrative costs or management goals.

❖ Objective 5.1 – Interpretation

Starting in 2015, at least 90 percent of refuge visitors will be exposed to interpretive information about the refuge and its significance for wildlife conservation. They will be introduced to at least one action that benefits refuge habitat types, migratory birds and other trust resources.

Rationale

Interpretation is one of the most important ways we can raise our visibility, convey our mission, and identify the significant contributions of the Refuge System and this refuge to wildlife conservation. Public understanding of the Service and its activities in the State of Maine is now very low. Refuge visitors often confuse our agency with the Maine Department of Inland Fisheries and Wildlife. Many are unaware of the Refuge System and its scope, and most do not understand the importance of the refuge in the conservation of migratory birds and other wildlife and their habitats.

A refuge named for Rachel Carson has a special responsibility to the interconnectedness of all living things. Through an expanded interpretive program, visitors will gain a better understanding of its unique, important contribution to local, regional, and national wildlife conservation. That greater awareness will lead to more support for wildlife conservation on and off the refuge. Our proposed future programs will achieve our objectives by increasing visitor contacts, on-site programs, and a new, improved infrastructure. To accomplish that critical link in our refuge mission effectively, we will build and staff a new visitor contact station and refuge headquarters.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Install interpretive signs or kiosks along roadsides at each of the 11 divisions
- Interpret trust resources and refuge management actions on all trails.
- Develop interpretive programs that incorporate information from regional conservation plans (e.g., Bird Conservation Regions) and refuge documents (e.g., Habitat Management Plan)
- Develop interpretative signs at Cutts Island Trail

- By 2007, host summer interpretive programs, and expand them once the new contact station is built
- Maintain and expand the refuge internship program
- Explore cost-sharing staff positions, such as a shared volunteer coordinator, with the Wells National Estuarine Research Reserve
- Continue to host non-residential Youth Conservation Corps camps to build trails, control invasive species, and achieve maintenance standards
- Hire a Park Ranger/Law Enforcement (GS 5/7; same position as in objective 1.5)

Within 5 to 10 years of implementing the CCP

- Develop trails on newly acquired land, using Hart Road in Upper Wells Division, the trolley line in Brave Boat Harbor, and the woods trails in Little River Division and Greenbelt in the Spurwink Division.
- Link northwest and southeast Kennebunkport by extending the Conservation Trust trail through Goose Rocks Division
- Provide water access on York River Division, explore municipal open space plans and, where possible, link trails and wildlife conservation messages with conservation partners

❖ Objective 5.2 – Environmental Education

Within 10 years of completing this plan, and by working with our neighbors and the schools in the 12 towns near the refuge, 50 percent of all 4th to 6th graders, landowners, and elected officials in those communities will perceive (1) the refuge as a local and national treasure, (2) the refuge as a place where wildlife comes first, and (3) the refuge as part of a national system, the world's largest collection of land and water managed specifically for wildlife.

Rationale

Over 1 million visitors arrive in southern Maine each year, adding to the combined 500,000 permanent residents of York and Cumberland Counties. Rachel Carson NWR currently receives over 250,000 visitors annually. Each year, these visitors come from almost every state in the US, province in Canada, and from all corners of the world. Most are drawn by the name, Rachel Carson, named by Time magazine as one of the 100 most influential people of the 20th Century. In fact, Rachel Carson the former Editor-in-Chief of the Fish and Wildlife Service, is credited with starting the modern environmental movement after publishing her book Silent Spring.

The Rachel Carson refuge is in a unique position among other refuges within the northeast region, and nationally, to take advantage of the refuge namesake and draw thousands of visitors to the refuge and educate them about man's affect on the environment and wildlife conservation in general. An environmental education program at the Refuge will introduce, and expose visitors and residents alike to the work of the Fish and Wildlife Service, National Wildlife Refuge System, and the refuge. They will come away with a greater awareness and understanding of how important work such as wetland protection and restoration, invasive species control, fish passage, endangered species management, and water quality are and what they can do to support those and other programs.

Educating students will foster their appreciation of the important role the refuge plays in wildlife and habitat conservation. Our goal is to inspire students to make responsible environmental decisions now and in the future. To achieve that, we will work with the communities, increase outreach to teachers, and assure high-quality supplements for Maine elementary and secondary curricula.

Benefiting from the generosity of the private sector, the refuge will receive a parcel of land in the Wildwood section of Saco, Maine. Private-sector contributors will build a structure to Service specifications. Our Division of Engineering will provide plans of environmentally friendly buildings and other input necessary to build a structure suitable for accommodating the needs of approximately 30 students of on-site environmental education. That structure will meet all applicable codes; provide lavatory facilities and sufficient space for tools, equipment, and the supplies associated with environmental education.

The refuge will enter into a partnership with University of New England and other institutions of higher learning to provide environmental education instructors in the Wildwood building and for field trips in the immediate area. The curriculum will be based on wildlife science and the refuge. We will refine that content by working with local schools to meet Maine learning needs, and offset our costs with Nature of Learning Grant, National Fish and Wildlife Foundation grants or similar programs.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Maintain and establish new partnerships with organizations who will lead environmental education programs on refuge lands
- Use the conference room in the new administrative facility for public meetings and educational programs
- Meet annually with decision-makers in the 12-town region and statewide to review and discuss current natural resource issues affecting the refuge and the region
- Establish a corps of volunteers through the Friends Group or by other means to assist in environmental education and other programs
- Utilize the Youth Conservation Corps Program
- Support and sponsor annual, regional, environmental education programs, including an Envirothon

Within 5 to 10 years of implementing the CCP

- Integrate refuge-specific lessons into school curriculums in collaboration with local teachers for their use in schools or at the refuge
- Reach out to and interact with teachers to ensure that refuge-related lessons meet Maine Learning Results and teacher needs

Within 10 to 15 years of implementing the CCP

- Provide outdoor classroom study guides on species of concern and their habitats
- Use the environmental education facility, proposed for donation at the Goosefare Brook Division, for refuge education programs

❖ Objective 5.3 – Hunting

Provide high-quality hunting opportunities that minimize conflicts with neighbors and refuge programs and ensure that at least 90 percent of the hunters have a positive experience.

Rationale

The refuge adopts state regulations for deer, migratory bird, and upland bird (grouse, pheasant, quail) hunting; although in some cases the Service is more restrictive. The refuge permits hunting in compliance with a hunt program that is annually adjusted to ensure safety and good wildlife management. In addition, the refuge manager will expand the review process for the annual hunt plan to include the evaluation of lands that are now closed but may have the potential to accommodate safe hunting. This alternative will open additional lands to hunting that can biologically, ecologically, and safely accommodate hunting within state guidelines. New lands acquired by the refuge that traditionally have been hunted will remain open until we have completed their public use planning. If newly acquired lands need to be closed, we will complete a separate public review process. The park ranger will oversee hunters in the field, to ensure compliance with refuge and other hunting regulations.

Approximately 400 people applied for hunting permits on the refuge in 2003. The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (2001) indicates that 164,000 residents and non-residents participated in hunting in Maine that year. They spent $162 million on related activities and equipment (USFWS 2002). We recognize hunting as a healthy, traditional, outdoor pastime that is deeply rooted in American heritage and, when managed appropriately, can instill a unique understanding and appreciation of wildlife, their behavior, and their habitat needs. Hunting is a priority public use on national wildlife refuges, where compatible.

According to the draft policy on hunting on national wildlife refuges, issued in the January 16, 2001 Federal Register, a quality hunting experience is one that

1. maximizes safety for hunters and other visitors;

2. encourages the highest standards of ethical behavior in taking or attempting to take wildlife;

3. is available to a broad spectrum of the hunting public;

4. contributes positively to or has no adverse effect on population management of resident or migratory species;

5. reflects positively on the individual refuge, the System, and the Service;

6. provides hunters un-crowded conditions by minimizing conflicts and competition among hunters;

7. provides reasonable challenges and opportunities for taking targeted species under the described harvest objective established by the hunting program;

8. minimizes the reliance on motorized vehicles and technology designed to increase the advantage of the hunter over wildlife;

9. minimizes habitat impacts;

10. creates minimal conflict with other priority wildlife-dependent recreational uses or refuge complex operations; and

11. incorporates a message of stewardship and conservation in hunting opportunities.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Carry on with annual refuge hunt program with the MDIFW
- Adaptively manage hunt programs annually to ensure safety and consistency with good wildlife and habitat management

Within 5 to 10 years of implementing the CCP

- Seek opportunities to provide hunting experiences for disabled and youth hunters
- By 2010, open all lands that can biologically, ecologically, and safely accommodate hunting within state guidelines
- By 2010, evaluate feasibility of offering other hunting opportunities (such as wild turkey) in accordance with our biological, ecological, and safety criteria
- By 2011, in partnership with the state and local groups, host a hunter education class annually
- By 2010, coordinate with the MDIFW to participate in local hunter education program annually
- Hire a Park Ranger/Law Enforcement (GS 5/7; same position as in objective 1.3)
- Hire a refuge operations specialist (GS 5/7; the same position as in objective 1.5)

❖ Objective 5.4 – Fishing

Provide high-quality sport fishing opportunities that minimize conflicts with neighbors and refuge programs and ensures that at least 90 percent of the anglers have a positive experience.

Rationale

All tidal waters of the refuge are open to fishing, and bank fishing is permitted in several areas; both are increasingly popular. We will continue to provide fishing access sites and will improve the access and interpretive signs at the nine areas now available to anglers. A new refuge fishing brochure with maps, facts, rules, and helpful hints will help anglers enjoy this wildlife-dependent recreation. We will work with the sport fishing community to review potential fishing sites throughout the refuge, and determine the feasibility of providing bank fishing at three additional sites where it can be biologically, ecologically, and safely accommodated. The park ranger will oversee anglers in the field, to ensure compliance with Maine fishing regulations, the use of non-lead jigs and sinkers to prevent waterbird poisoning, fishing from dawn until dusk, and other conditions. Refuge areas will be open for fishing using criteria identified in the step-down management plan.

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (2001) indicates that 376,000 residents and non-residents participated in fishing in Maine that year. They spent $250 million on related activities and equipment (USFWS 2002).

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- By 2007, post and disseminate fishing information for the Spurwink, Mousam, Ogunquit, Merriland, and Webhannet Rivers at refuge headquarters
- By 2008, build a universally accessible fishing pier with interpretive features where Route 77 crosses the Spurwink River, upstream on the Scarborough side
- By 2008, build and maintain a partnership with the state and local recreational fishing groups to promote and identify refuge fishing opportunities and maintain related facilities
- By 2010, update the refuge fishing plan and fishing regulations
- By 2010, analyze the feasibility of providing bank fishing at three additional sites where it can be biologically, ecologically, and safely accommodated
- Hire a Park Ranger/Law Enforcement (GS 5/7; same position as in objective 1.3)
- Hire a refuge operations specialist (GS 5/7; the same position as in objective 1.5)

Within 5 to 10 years of implementing the CCP

- By 2013, host a second fishing event annually in partnership with the state and other groups

❖ Objective 5.5 – Wildlife Observation and Photography

Create and enhance opportunities for high-quality wildlife observation and photography on the refuge, while ensuring that at least 90 percent of our visitors have a positive experience.

Rationale

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (2001) indicates that 778,000 residents and non-residents participated in wildlife watching (e.g., observing, feeding, or photographing) in Maine that year. They spent $345 million on related activities and equipment (USFWS 2002).

We can enhance the existing opportunities for wildlife-watchers on the refuge by adding carry-in, non-motorized boat launches, improving and adding trails, information kiosks, and other visitor facilities such as restrooms. Nearly 100,000 visitors walked the 1-mile Carson Trail at the Wells headquarters, one of the four developed trails on the refuge. Its parking lot is full or overflowing many times in the summer and fall. In the winter, snowshoeing and skiing provide a popular, compatible method to use refuge trails for wildlife observation and photography. The headquarters trail in Upper Wells is presently the only one with an information kiosk. The 2-mile Cutts Island Trail in Brave Boat Harbor Division has trail signs, but no kiosk nor restroom. Carry-in boat access is available on Chauncy Creek at the intersection of Cutts Island and Seapoint Roads, and on the Spurwink Division at Route 77. Parking is available by verbal agreement with Town of Kittery. The Goose Fare Brook Trail and overlook offers parking, a short, stone-dust trail, and an interpreted observation

platform with auto-focus binoculars. The Bridle Path and Atlantic Way and Ted Wells Trails provide views of refuge habitat in Kennebunk, Saco and Old Orchard Beach. Those trails are located on or near refuge property, and are maintained by municipal or private non-profit organizations.

For many years, portable toilets have been the only bathroom facilities available at the Carson Trail. The contract for two portalets (one accessible for disabled visitors) has become increasingly expensive. Also, they are designed to accommodate fewer visitors than the refuge attracts, which sometimes leads to long lines and unsanitary conditions. Many visitors opt not to use them for these and other reasons, or complain that the portalets were an unpleasant aspect of their visit. No public facilities are available anywhere near the Brave Boat Harbor trailhead.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- By 2007, install long-needed, year-round, public rest rooms at the Upper Wells Division, which receives high public use
- By 2007, begin installing interpretive structures (kiosks or signs) at the Mousam River, Lower Wells, Little River, and Moody divisions
- By 2007, promote refuge wildlife viewing and photography by regular media press releases and participating in the Watchable Wildlife Program
- By 2008, improve the tread and interpretative signs on Cutts Island Trail at the Brave Boat Harbor Division
- By 2010, build an observation platform and small parking area at Marshall Point at the Goose Rocks Division
- By 2010, partner with others to install an interpretive panel and wildlife viewing area at Biddeford Pool

Within 5 to 10 years of implementing the CCP

- By 2013, build a photography blind and interpretive trail at the Upper Wells Division

❖ Objective 5.6 – Furbearer Management

In conjunction with the state, review existing furbearer trapping opportunities within the new expansion areas and, when compatible, establish a furbearer management program within these areas.

Rationale

Trapping is a technique that can be used to assist in achieving habitat and population management objectives. In some instances, trapping may be contracted to achieve very specific goals or objectives while in others there could be greater flexibility that would allow for the consideration of a recreational program. This alternative will establish a process, working with the state, to evaluate the proposed expansion areas for the possibility of establishing a furbearer management/trapping program. If the evaluation results in the identification of expansion areas that can biologically, ecologically, and safely accommodate trapping within state guidelines, then a program may be established. New lands acquired by the refuge that traditionally have been trapped will remain open until we have

completed their planning. If newly acquired lands need to be closed, we will complete a separate public review process. The park ranger will oversee trappers in the field, to ensure compliance with refuge and other trapping regulations.

Strategies

Within 5 years of implementing the CCP

- With the state, evaluate feasibility of establishing a furbearer management trapping program on proposed expansion areas that can biologically, economically and safely accommodate trapping within state guidelines
- Hire a Park Ranger/Law Enforcement (GS 5/7; same position as in objective 1.3)
- Hire a refuge operations specialist (GS 5/7; the same position as in objective 1.5)

GOAL 6. Foster off-refuge cooperative actions and partnerships to promote wildlife conservation and further refuge goals.

❖ Background

The landmark National Wildlife Refuge System Improvement Act of 1997 prepared a renewed vision for the future of the Refuge System, where

- wildlife comes first
- refuges are anchors for biodiversity and ecosystem-level conservation
- lands and waters of the System are biologically healthy
- refuges are national and international leaders in habitat management and wildlife conservation.

Meeting the wildlife conservation challenges of the 21st century and fulfilling the System mission and vision requires planning and partnerships. The need for partnerships is especially relevant for the refuge. In the heart of the Gulf of Maine watershed, and in a region of great biological diversity in Maine, the refuge sits at a critical place in that increasingly developed and fragmented region. To fulfill its promise to preserve wildlife and habitat for its own sake and for the benefit of the American people, the refuge must collaborate with its neighbors, local communities, landowners, and conservation partners.

❖ Objective 6.1 – Landscape-Scale Conservation

Provide expertise annually to at least two landscape- or watershed-scale projects that benefit the coastal ecosystems of the Gulf of Maine watershed

Rationale

The scientific and conservation communities have become increasingly aware of the influence of human land use practices on ecosystem function, and that native plants and animals require healthy, functioning ecosystems to survive. Since natural resources do not organize themselves according to political boundaries, a larger landscape perspective is needed to ensure the viability of the plants and animals and the habitats on which they depend. In addition to management actions on the refuge, conserving and managing land through landscape-scale partnerships is essential, to maintain large unfragmented habitat

blocks and connectivity for wildlife travel and ensure the ecological health of upland, freshwater and marine environments.

Refuge staff are involved in the Mount Agamenticus to the Sea Conservation Initiative centered around the York River and environs in southern Maine. That collaboration helps the refuge and its partners identify and protect the most significant ecological features. The refuge is also a close partner with the Wells National Estuarine Research Reserve in their watershed-based initiatives.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Continue to participate with conservation organizations such as the Mountain to the Sea Initiative, Saco Bay Partners, and Wells National Estuarine Research Reserve to achieve conservation goals

- Partner with other conservation organizations, such as land trusts and NGOs, for land conservation

Within 5 to 10 years of implementing the CCP

- By 2013, facilitate watershed-wide or multi-town management efforts, such as purple loosestrife control using beetles or the management of federal-listed threatened or endangered species

❖ Objective 6.2 – Habitat Management

Provide technical expertise on wildlife habitat management annually to private or public landowners, including individuals, towns, organizations and businesses in each of the 12 communities of the refuge.

Rationale

The refuge provides opportunities for visitors to observe environmentally sound wildlife and habitat management. That makes an important impact on how people view the role of management, restoration, and stewardship. The refuge supports critical habitats, yet it cannot provide all the habitat needs. In fact, nearly 70 percent of all available fish and wildlife habitat in the United States is in private ownership. The refuge can extend its expertise on wetland restoration, invasive species control, prescribed burning, and other techniques to other public and private landowners. That outreach will help in protecting refuge lands as well as maintaining the habitats, linkages, and corridors necessary to sustain native biological diversity across the landscape.

Surveys show that landowners have a great interest in protecting wildlife and their habitats. Landowners can aid in preserving habitat for New England cottontails, work with refuge staff on protecting nesting piping plovers on their beach, control invasive species on their lands, and much more. Many land trusts are active in southern Maine, and when they acquire lands, they look to the refuge for guidance on managing them.

The refuge lies in both York and Cumberland counties, which encompass approximately 1,826 of Maine's 30,862 square miles. One coordinator provides technical assistance for all private lands throughout the state of Maine. Covering such a large area limits the scope of work this important program can achieve.

We propose implementing the Private Lands Program in southern Maine which would cover both York and Cumberland counties. The private lands biologist we propose for the refuge would lead in implementing our Private Lands Program (Partners for Fish and Wildlife) in that area. Working closely with landowners and our state coordinator would greatly expand our ability to conduct more projects and provide more assistance to landowners and partners, thus providing benefits to trust resources as well as the refuge.

We modeled our district concept on the Private Lands Program in Wisconsin and Minnesota, where the local Service offices coordinate the program. This proposal has already won the support of our private lands coordinator for the State of Maine.

In addition to the strategies in alternative A

- By 2011, implement the Private Lands Program in southern Maine
- By 2010, work with the Natural Resource Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), University of Maine Cooperative Extension, and other Service staff on a coordinated landowner assistance program
- By 2010, collaborate with partners in identifying grants and other funds for habitat management on off-refuge lands, including Partners for Wildlife, Wildlife Habitat Incentive Program (WHIP), and other programs.
- Partner with local land trusts to encourage the management of lands to benefit species of conservation concern
- Restore a minimum of 50 acres of freshwater wetland, scrub-shrub, grassland, or forested habitats annually
- Hire a private lands habitat biologist (GS 9/11; RONS 03002)

❖ Objective 6.3 – People

Increase public understanding and support of wildlife conservation, habitat management, and land and water stewardship in the 12-community region of the refuge.

Rationale

More than 75 million Americans enjoy watching wildlife and participating in wildlife-related recreation, yet few may understand how best to provide the habitats essential for maintaining our native wildlife diversity. The refuge can help people understand and value the wildlife and habitats of their community. As they begin to value those places and the role of land conservation and management in protecting the wildlife they like to watch, they are more apt to take action to support our efforts.

Visitors are attracted to the refuge for its wildlife experiences and for its solitude. However, many people, even local residents, often are unaware that they have a refuge in their community. To enhance those connections and draw people into the refuge and its mission, refuge staff can reach out by participating in workshops with partners, joining in community celebrations, and creating exhibits for events.

In addition to the strategies in alternative A

Within 5 years of implementing the CCP

- Co-sponsor natural resource workshops

- Host one local or statewide annual contest, such as a Junior Duck Stamp or Photo Contest

- Develop and host an annual Rachel Carson Festival with a launch in 2007, the 100 birth anniversary of Rachel Carson

Within 5 to 10 years of implementing the CCP

- Coordinate volunteers to develop and staff exhibits annually at four or more local events, such as Kittery's Septemberfest, York's Harvestfest, Portland's Old Fort fest, Market Square Days in Portsmouth, the PunkinFiddle and Laudholm Craft Fair, or WNERR Earth Day.

- Coordinate volunteers to develop and staff exhibits annually with other Maine refuge staff at two major statewide events, such as the Fryeburg and Common Ground Fairs.

- Train volunteers to provide an educational program or materials annually to at least one school per town

Valuable Wildlife Habitat

35,000 acres in southern Maine

Our Gulf of Maine Program mapped valuable habitats for federally listed endangered and threatened species, declining migratory songbirds, shorebirds, waterfowl, and anadromous fishes in southern Maine and throughout the U.S. portion of the Gulf of Maine watershed (USFWS 2001). In southern Maine, those lands with highest value for wildlife encompass about 35,000 acres. That analysis guided the proposed expansion of the acquisition boundary for the Rachel Carson refuge. The 5,558-acre and 11,397-acre expansions proposed in alternatives B and C, are part of the 35,000 acres the Service identified. We selected the top 25 percent of lands proposed for acquisition based on their highest aggregate habitat values (e.g., ecological diversity) and the conservation potential of specific parcel sizes.

Alternative C

❖ Introduction

Alternative C expands on alternative B, under the premise that more funding and staffing would allow us to implement more extensive biological programs, more than double the land in the approved acquisition boundary, and appreciably increase the number and quality of our priority public use programs. Its objectives under each goal resemble those in alternative B. They differ, in that alternative C would protect and manage more acres of most habitat types, and the strategies involve a greater commitment of resources, allowing us to reach our goals and objectives sooner and more comprehensively. Alternative C also uses technology and remote sensing more extensively to aid in achieving our goals more effectively.

The protection of coastal habitats will remain a top priority. As in alternative B, we will broaden our understanding and management of other critical habitats and species of concern that use them, and the refuge will continue to evaluate and use the most cost-effective and environmentally sound techniques to manage habitats and conserve wildlife and plants. In particular, alternative C greatly expands the protection of contiguous upland habitat. Our biological inventory and monitoring program would expand even beyond the one we propose in alternative B.

Alternative C will increase our land acquisition and cooperative land protection program, including the 3,833 acres privately owned within the approved acquisition boundary, the expansion of the refuge by 5,558 acres, as described in alternative B, and by an additional 5,839 acres that protects more land in the proposed York River Division and offers greater protection around the existing divisions. In addition to Service acquisition, we will expand our assistance to conservation partners to support collective efforts in watershed protection.

Alternative C would notably increase opportunities for priority, wildlife-dependent public uses, especially in wildlife observation and photography, environmental education and interpretation, and hunting. It would also create more interpretive signs and kiosks, nature trails, and parking areas.

Alternative C would provide more focused attention, guidance, and encouragement to the Friends Group and local communities.

In addition to filling the essential staff positions identified in alternative A (p. 11) and the positions identified in alternative B, alternative C adds nine new staff to meet the expanded opportunities described under each of its six goals.

Critical parts of the management proposed in alternative C include replacing the existing headquarters/visitor contact facility to accommodate present and essential new staff and seasonal staff, constructing a maintenance facility to improve our efficiency in maintaining the refuge infrastructure and biological operations, and building a pole shed to protect vehicles and equipment. This alternative also includes a visitor center. Its facilities are integral in successfully achieving all of the objectives described below. Because alternative C primarily builds on the goals and objectives in alternative B, our descriptions below highlight the differences among them to minimize redundancy.

GOAL 1 Perpetuate the biological integrity and diversity of coastal habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Objective 1.1 – Salt Marsh

Same as alternative B, except we increase this objective to 4,044 acres.

In addition to alternative B strategies

- Inventory all salt marsh nesting birds
- Survey all salt marshes for shorebirds, and enroll all areas in ISS
- Complete aerial flights to identify and protect shorebird roost sites
- Acquire from willing sellers an additional 200 acres of salt marsh
- Hire a wildlife biologist to conduct shorebird studies and surveys (GS 7/9)
- Hire a secretary (GS 3/4)

❖ Objective 1.2 – Dune Grassland, Beach, Rocky Shore, Subtidal and Intertidal

Same as alternative B, except we increase this objective to 1,200 acres

In addition to alternative B strategies

- Acquire from willing sellers an additional 100 acres of this habitat

❖ Objective 1.3 – Piping Plover

Same as alternative B

In addition to alternative B strategies

- Hire additional technicians to support piping plover and tern management on three more private beaches

❖ Objective 1.4 – Least Tern

Same as alternative B

In addition to alternative B strategies

- Develop multi-state least tern monitoring network for New England
- Conduct banding studies to determine where Maine fledged birds return to nest

❖ Objective 1.5 – Tidal River, Estuary, and Bay

Same as alternative B

In addition to alternative B strategies

- Identify key areas used as nurseries for trust fishery resources and commercially important fish (shell and fin) species and implement monitoring of those areas
- Conduct fish surveys of all waters every 5-10 years to assess use by trust and commercially important species

❖ Objective 1.6 – Maritime Shrubland

Same as alternative B, except we modify the acreage in this objective to 435 acres

In addition to alternative B strategies

- Examine nest productivity in relation to shrubland size and shape to determine optimal shrubland management strategies.
- Acquire from willing sellers an additional 250 acres of maritime shrubland

❖ Objective 1.7 – Nearshore and Marine Open Water

Same as alternative B

In addition to alternative B strategies

- Expand the scope of the Rachel Carson MPA beyond refuge boundaries
- Promote and participate in the creation of a system of interconnected Marine Protected Areas in the Gulf of Maine to enhance and protect marine bird and fish trust resources

❖ Objective 1.8 – Biodiversity (Coastal)

Same as alternative B

GOAL 2. Perpetuate the biological integrity and diversity of freshwater habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Objective 2.1 – Freshwater Rivers and Streams

Same as alternative B

In addition to alternative B strategies

- Evaluate dams and fish passages on rivers and streams and work with state partners to enhance fish passage where it is blocked or hampered
- Evaluate culverts, dams, recreational boating, waste discharge, and other impacts to all rivers and streams in the refuge to identify areas of degradation and work with partners to implement remediation
- Work with partners to influence upstream land uses that degrade water quality

- Advance locally supported watershed management that identifies nonpoint source pollution sources and promotes best management practices (BMPs) and other actions to conserve and restore water quality
- Identify and remediate fish and eel passage impediments on and off refuge lands
- Hire a refuge operations specialist (GS 7/9)

❖ Objective 2.2 – Emergent Marsh, Forested and Scrub Shrub Wetland, Vernal Pool

Same as alternative B, except we modify this objective to 1,945 acres

In addition to alternative B strategies

- Work with towns to enhance turtle and other wildlife crossings to reduce wildlife road mortality
- Identify and survey all vernal pools on refuge and establish long term monitoring surveys.
- Acquire from willing sellers an additional 400 acres of this habitat
- Hire a refuge operations specialist (GS 7/9; the same position as in objective 2.1)
- Hire a secretary (GS 3/4; the same position as in objective 1.1)
- Hire a maintenance worker (WG 5)

❖ Objective 2.3 – Biodiversity (Freshwater)

Same as alternative B

GOAL 3. Perpetuate the biological integrity and diversity of upland habitats to sustain native wildlife and plant communities, including species of conservation concern.

❖ Objective 3.1 – Early Successional (Shrubland)

Same as alternative B, except we modify this objective to 1,215 acres

In addition to alternative B strategies

- Start research on the productivity of shrubland nesting birds in relation to shrubland size and quality
- Establish a nursery for propagating native shrubs and other plants including collecting native seed sources and raising seedlings
- Establish 4 additional core habitats for New England cottontail management
- Acquire from willing sellers an additional 500 acres of shrubland habitat
- Hire a refuge operations specialist (GS 7/9; the same position as in objective 2.1)

- Hire a secretary (GS 3/4; the same position as in objective 1.1)
- Hire a maintenance worker (WG 5; the same position as in objective 2.2)

❖ Objective 3.2 – Deciduous and Mixed Forest

Same as alternative B, except we modify this objective to 10,691 acres

In addition to alternative B strategies

- Hire a forester to evaluate the health of these forested stands to determine whether active management is needed to enhance their condition and ensure longevity. Develop stand prescriptions, including the consideration of regeneration to maintain desired species composition and stand structure. Also, evaluate the plant species composition in the understory and forest floor, a vital component of the overall quality of habitat for many species of conservation concern.
- Acquire from willing sellers an additional 4,189 acres of this habitat
- Remove all invasive species from this habitat
- Monitor all hemlock stands on the refuge for hemlock wooly adelgid

❖ Objective 3.3 – Grassland

Same as alternative B, except we modify this objective to 1,218 acres

In addition to alternative B strategies

- Work with private landowners to survey and monitor grassland bird nesting activity and productivity.
- Restore grasslands through active plantings of native grasses.
- Begin trials to see if native warm season grasslands could be restored in areas with appropriate droughty soils.
- Acquire from willing sellers an additional 200 acres of grassland habitat.

❖ Objective 3.4 – Biodiversity

Same as alternative B

In addition to alternative B strategies

- Restore former pitch pine habitats lost to forest succession since the fire of 1947
- Survey invertebrates and develop management plans for rare species
- Hire a refuge operations specialist (GS 7/9; the same position as in objective 2.1)

GOAL 4. Develop the Rachel Carson National Wildlife Refuge as an outstanding center for research and demonstration emphasizing land management techniques for restoring and sustaining healthy estuarine ecosystems in concert with the national Land Management and Research Demonstration (LMRD) program.

❖ Objective 4.1 – Research

Same as alternative B

In addition to alternative B strategies

- Pursue funding to sponsor two graduate students and one post-doctoral student
- Establish a research laboratory capable of nutrient and organic analysis
- Develop and implement long-term, automated, remote monitoring for salt marsh/estuarine vital signs
- Hire a resource specialist (GS 5/7) to assist in field studies, collect samples, manage the laboratory, perform sample analysis, coordinate and assist use by visiting scientists
- Hire a biologist/GIS specialist (GS 9) to manage and analyze geographic data, assist in report preparation, and assist in field research for this and all goals

❖ Objective 4.2 – Demonstration (Internal and External Audiences)

Same as alternative B

In addition to alternative B strategies

- Develop an interactive web page for salt marsh ecology and restoration
- Acquire distance learning capabilities with video opportunities
- Develop and maintain a research-caliber library for salt marsh and estuarine LMRD topics
- Develop and implement an interagency restoration team to identify, evaluate, rank, and seek funding for salt marsh/estuarine restoration projects in Maine and New Hampshire (such teams exist for Massachusetts and Rhode Island)
- Export that interagency team system to other geographic areas

❖ Objective 4.3 – Integration

Same as alternative B

In addition to alternative B strategies

- Invite staff members from this and other refuges and other Service offices to serve on details in this LMRD program
- Establish a mentoring program to cultivate and train the next generation of estuarine restoration professionals and LMRD biologists

GOAL 5. Increase appreciation and stewardship of coastal Maine wildlife and their habitats by providing positive wildlife-dependent experiences for refuge visitors.

❖ Objective 5.1 – Interpretation

Same as alternative B

In addition to alternative B strategies

- Install interactive touch-screen displays about refuge wildlife in the visitor center
- Develop interpretative brochures or signs for all trails
- Provide interpretative panels at all overlooks, waysides
- Make all interpretative materials available at the refuge website
- Build a refuge visitor center
- Hire one additional visitor services specialist/recreational aide
- Help partners with wildlife and habitat interpretation needs
- Develop interpretive materials on marsh management and restoration, federal trust resources, and riparian habitat values, among other subjects
- Hire a secretary (GS 3/4; the same position as in objective 1.1)

❖ Objective 5.2 – Environmental Education

Same as alternative B

In addition to alternative B strategies

- Expand environmental education classes to increase the pace in reaching local 4th to 6th graders
- Arrange continuing education credit for teachers using the Service curriculum
- Develop an educational curriculum for additional grade levels
- Work with schools annually to promote the Refuge System
- Subsidize Leave No Trace courses

❖ Objective 5.3 – Hunting

Same as alternative B

In addition to alternative B strategies

- Expand hunting program to allow all state seasons and methods that are safe and biologically and ecologically sound

- Continue traditional hunting programs on newly acquired lands that are safe, biologically and ecologically sound
- Hire a third park ranger/law enforcement officer
- Develop and provide information on the condition and numbers of the deer herd to hunters
- Build permanent stands and blinds for permitted users
- Teach hunter education classes
- Teach archery and Bowhunter Landowner Incentive Program courses
- Administer hunts on partner-owned properties to provide recreational opportunities and manage species numbers

❖ Objective 5.4 – Fishing

Same as alternative B

In addition to alternative B strategies

- Sponsor fishing workshops
- Provide hard surfaces at fishing access sites to minimize negative environmental impacts
- Subsidize Leave No Trace courses tailored for anglers
- Provide information on tides and conditions for anglers
- Expand fishing access to include all refuge lands where it is biologically and ecologically sound

❖ Objective 5.5 – Wildlife Observation and Photography

Same as alternative B

In addition to alternative B strategies

- Teach wildlife photography classes
- Permit photo excursions to various habitats
- Publish the refuge story in photographs
- Display award-winning refuge photos
- Provide additional materials on wildlife observation
- Collect the definitive, published works on wildlife in our area for a refuge reference library
- Open all refuge lands to wildlife observation that is biologically and ecologically sound

- Provide photography blinds at refuge locations to provide opportunities to photograph rare or secretive wildlife
- Provide observation platforms at refuge locations to provide opportunities to view rare or secretive wildlife

GOAL 6. Foster off-refuge cooperative actions and partnerships to promote wildlife conservation and further refuge goals.

❖ Objective 6.1 – Landscape-Scale Conservation

Provide expertise annually to all landscape-scale projects or watershed-scale projects that benefit the ecosystems in York and Cumberland counties of the Gulf of Maine watershed.

Strategies

- Participate as a member of the board or steering committee for all watershed projects in York and Cumberland counties
- Coordinate and provide assistance to the Southern Maine Regional Planning Office

❖ Objective 6.2 – Habitat Management

Provide technical expertise and assistance on wildlife habitat management to private or public landowners, including individuals, towns, organizations and businesses at the local, state and federal levels.

Strategies

- Hire a second private lands habitat biologist to provide technical assistance to landowners on wildlife habitat management
- Work with the Natural Resource Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), Maine Cooperative Extension, and other federal, state, and local Service staff on a coordinated landowner assistance program
- Collaborate with partners to identify grants and other funds for habitat management on off-refuge lands, including Partners for Wildlife, Wildlife Habitat Incentive Program (WHIP), and other programs.
- Establish and provide funds to landowners for habitat management and restoration
- Restore a minimum of 100 acres of freshwater wetland, scrub-shrub, grassland, or forested habitats annually.

❖ Objective 6.3 – People

Increase public understanding and support for wildlife conservation, habitat management, and land and water stewardship in the York and Cumberland counties region of the refuge.

Strategies

- Develop or sponsor natural resource workshops with others
- Host at least one annual natural resource workshop

- Develop and staff exhibits annually at 10 or more local events, such as Kittery's Septemberfest, York's Harvestfest, Portland's Old Fort fest, Market Square Days in Portsmouth, PunkinFiddle and Laudholm Craft Fair, and WNERR Earth Day.

- Develop and staff exhibits annually with other Maine refuge staff at major statewide events, including the Fryeburg and Common Ground fairs.

Table 2.1. Comparison of Management Actions by Alternative for Issues Identified During the Planning Process

Alternative A *Current Management*	*Alternative B* *Our Preferred Alternative*	*Alternative C*
Issue 1. How will we provide habitat to protect trust species?		
Acquire the 3,833 acres remaining within the refuge's approved acquisition boundary to permanently protect those lands from development and provide a total of 9,126 acres of habitat for trust species and other native wildlife.	Acquire the 3,833 acres remaining within the refuge's approved acquisition boundary and an additional 5,558 acres beyond that boundary, for a total of 14,684 acres of habitat for trust species and other native wildlife.	Acquire the 3,833 acres remaining within the refuge's approved acquisition boundary and an additional 11,397 acres, for a total of 20,523 acres of habitat for trust species and other native wildlife.
Issue 2. How will we manage fish and wildlife populations and habitats?		
Manage dune grassland, beach, rocky shore, tidal river, estuary, bay, subtidal and intertidal and open water/mudflat habitats by monitoring, protecting, limiting access, enforcing no-wake zones, promoting vegetative critical edge, controlling stormwater discharge and supporting water quality monitoring. Manage maritime shrubland/forest and upland shrublands through land protection, the control of invasive non-native species, mowing, burning, hydro-axing, brush hogging and by limiting access to sensitive habitats. Manage invasive plants, animals or diseases by an Integrated Pest Management Plan, with either cultural, biological mechanical or chemical control methods. Invasive plant control methods to include mowing, burning, the use of galerucella beetles, hand pulling, covering, chipping or chemicals. Manage grassland habitat by mowing, burning or haying and treatment of invasive plant species through the development of an Integrated Pest Management Plan. Manage forested habitat by controlling white-tailed deer populations, burning, silvicultural techniques, and controlling invasive plant, insect and animal species and invasive non-native disease. Manage the pitch pine bog community and rare plant sites by monitoring the health, managing vegetation and removing non-native invasive plants. *(continued on next page)*	In addition to alternative A, Acquire uplands adjacent to salt marsh and hydrologically connected areas by such measures as conservation easements and purchase. Conduct outreach to adjacent homeowners regarding critical edge zone management. Evaluate the condition and restoration potential of salt marsh and rank a list of areas to be restored; monitor the health and integrity of salt marsh habitat, including changes in marsh elevation in relation to rises in sea level. Protection and management actions for sandy beach habitat include the monitoring of endangered species, protecting nesting habitat and limiting access to sensitive areas. Conduct on- and off-site educational programs focused on piping plover and least tern conservation. Evaluate the health of forested stands to determine whether active management is needed to enhance their condition and ensure longevity. Develop stand prescriptions, including the consideration of regeneration to maintain desired species composition and stand structure. Also, evaluate the plant species composition of the understory and forest floor, a vital component of the overall habitat quality for many species of conservation concern. Determine which early successional habitats to maintain as shrubland and which are of a condition and size to benefit grassland birds. *(continued on next page)*	In addition to alternative B, Inventory all salt marsh nesting birds, survey all salt marshes for shorebirds, and complete aerial flights to identify shorebird roost sites. Expand off-refuge assistance to landowners to protect additional piping plover and least tern nests, and hire additional technicians to support plover and tern management on three more private beaches. Identify and survey all vernal pools on the refuge and establish long-term monitoring surveys. Begin research on the productivity of shrubland- nesting birds in relation to shrubland size and quality, and establish a nursery for propagating native shrubs and other plants, including collecting native seed sources and raising seedlings. Restore grasslands through active plantings of native cool season grasses and begin trials to see if native warm season grasslands could be restored in areas with appropriate droughty soils. Conduct surveys of rare plants and exemplary communities; restore former pitch pine habitats; and conduct surveys of invertebrates and develop management plans for rare species.

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Issue 2. How will we manage fish and wildlife populations and habitats? *(continued)*		
Monitor populations of nesting piping plover and least tern populations. Cooperate with landowners and beach users to protect nest sites from human and animal disturbance. Survey and monitor other species of conservation concern including New England cottontail, sharp-tailed sparrow, migrating shorebirds, water birds and waterfowl, and Blanding's turtle. Continue the implementation of the Land Management Research Demonstration (LMRD) program, emphasizing management techniques for restoring and sustaining healthy estuarine ecosystems.	Work with partners in a comprehensive baseline botanical survey and implement surveys for state-listed plants, animals and invertebrates that occur on the refuge. Continue and expand partnerships to further research in estuarine ecosystem restoration, management and conservation as part of the LMRD program.	
Issue 3. How will we ensure the integrity of water quality and quantity to protect aquatic-dependent species?		
Manage freshwater wetland (emergent marsh, scrub-shrub wetland, bog, vernal pool, forested wetland) and freshwater mudflats/open water habitat by protecting land and limiting access to sensitive areas, monitoring, protecting, enforcing a no-wake zone, promoting vegetative critical edge, controlling stormwater discharge and supporting water quality monitoring.	In addition to alternative A, Adopt best management practices for high-value vernal pools and limit access to sensitive areas; monitor, protect, and enforce a no-wake zone along waterways; promote vegetative critical edge, control stormwater discharge, and support water quality monitoring efforts. Invasive species are to be controlled using the techniques included in an Integrated Pest Management Plan. Enhance and support the collection of water quality data to establish baseline conditions and measure and track water quality trends. Acquire more information on the ecology and condition of tidal rivers in the refuge to guide the management of anadromous and catadromous fish and other wildlife species of concern. Initiate at least annual communication with the Coast Guard Oil Spill Response Team to ensure information on trust resources and issues important to the refuge are incorporated in the oil spill response plan and are addressed in an oil spill response. Work with municipalities on educating landowners about shoreland protection.	In addition to alternative B, Identify key nurseries for trust fishery resources and commercially important shellfish and fin fish species, and monitor those areas. Conduct fish surveys of all waters every 5 to 10 years to assess their use by trust species and commercially important species. Promote and participate in the creation of a system of interconnected Marine Protected Areas in the Gulf of Maine to enhance and protect marine bird and fish trust resources. Evaluate dams and fish passages on rivers and streams, and work with state partners to enhance fish passage where it is blocked or hampered. Evaluate culverts, dams, recreational boating, waste discharge, and other impacts on all rivers and streams in the refuge to identify areas of degradation, and work with partners to implement remediation. Work with partners to influence upstream land uses that degrade water quality.

(continued on next page)

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Issue 3. How will we ensure the integrity of water quality and quantity to protect aquatic-dependent species? *(continued)*		
		Advance locally supported watershed management that identifies nonpoint source pollution and promotes best management practices and other actions to conserve and restore water quality. Identify and remediate fish and eel passage impediments on and off refuge lands.
Issue 4. How will we build community partnerships to protect and manage coastal wildlife habitats?		
Maintain strong partnerships with the MDIFW, WNERR, local land trusts, communities, private landowners, and other federal agencies. Continue to be an active member of the Board or other Steering Committee for the Mountain to the Sea Initiative, Saco Bay Partners, and Wells National Estuarine Research Reserve. Continue to work with the Natural Resource Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), Maine Cooperative Extension, and other Service staff on landowner assistance for habitat management on off-refuge lands.	In addition to alternative A, Collaborate with conservation partners on watershed management initiatives. Annually meet with decision-makers in the 12-town region and statewide to review and discuss current natural resource issues affecting the refuge and the region. Facilitate watershed-wide or multi-town management efforts such as purple loosestrife control using beetles or management of federally threatened and endangered species. Establish the Rachel Carson Private Lands District, and work with the Natural Resource Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), University of Maine Cooperative Extension, and other Service staff on a coordinated, landowner assistance program.	In addition to alternative B, Work with towns to enhance turtle and other wildlife crossings to reduce wildlife road mortality. Participate as a member of the board or steering committee for all watershed projects in York and Cumberland Counties. Coordinate and provide assistance to the Southern Maine Regional Planning Office.
Issue 5. How will we provide and maintain high-quality programs for the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation)?		
Provide interpretive materials at headquarters for the Carson Trail and provide Service curricula to local schools. Conduct volunteer-led summer programs at the Carson Trail. Continue to coordinate annual refuge hunt program with the Maine Department of Inland Fisheries and Wildlife and adjust hunt programs annually to ensure their safety and consistency with good wildlife and habitat management. *(continued on next page)*	In addition to alternative A, where compatible: Install interpretive signs or kiosks along roadsides at each of the refuge divisions Host summer interpretive programs and expand them once the new contact station is built. *(continued on next page)*	In addition to alternative B, where compatible: Install interactive touch-screen displays about refuge wildlife; develop interpretative brochures or signs for all trails; provide interpretive panels at all overlooks, waysides; and make all interpretive materials available at our refuge website. *(continued on next page)*

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Issue 5. How will we provide and maintain high-quality programs for the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation)? *(continued)*		
Post and disseminate fishing information for the Spurwink, Mousam, Ogunquit, Merriland, and Webhannet rivers at refuge headquarters. Build a new headquarters/visitor center to handle visitor services demands.	Develop trails on newly acquired land utilizing Hart Road in Upper Wells Division, the trolley line in Brave Boat Harbor, and woods trails in Little River Division and Greenbelt in Spurwink Division; link northwest and southeast Kennebunkport by extending the Conservation Trust trail through Goose Rocks Division; and provide water access on York River Division, explore municipal open space plans and, where possible, link trails and wildlife conservation messages with conservation partners. Seek opportunities to provide hunting experiences for disabled and youth hunters; open additional lands that can safely, biologically and ecologically accommodate hunting within state guidelines; and, in partnership with the state and local groups, host a hunter education class annually. Build a universally accessible fishing pier with interpretive features; analyze the feasibility of providing bank fishing at three additional sites where it can be biologically, ecologically, and safely accommodated; and, build and maintain a partnership with local recreational fishing groups to promote refuge fishing and maintain related facilities. Improve the walkways and interpretive signs on Cutts Island Trail at the Brave Boat Harbor Division; build an observation platform and small parking area at Marshall Point at Goose Rocks Division; begin installing interpretive structures (kiosks or signs) at the Mousam River, Lower Wells, Little River, and Moody divisions; build a photography blind and interpretive trail at the Upper Wells Division; partner with others to install an interpretive panel and wildlife viewing area at Biddeford Pool; install long-needed, year-round, public rest rooms at the Upper Wells Division, a location that receives high public use; promote refuge wildlife viewing and photography in regular media press releases and by participating in the Watchable Wildlife Program.	In addition to alternative B, where compatible: Install interactive touch-screen displays about refuge wildlife; develop interpretative brochures or signs for all trails; provide interpretive panels at all overlooks, waysides; and make all interpretive materials available at our refuge website. Expand environmental education classes to increase pace of reaching local 4th – 6th graders and develop educational curriculum for additional grade levels. Expand the hunting program to allow all state seasons and methods that are safe and biologically and ecologically sound; build permanent stands and blinds for permitted hunters; teach hunter education, archery and Bowhunter Landowner Incentive Program courses; and administer hunts on our partners' properties to provide recreational opportunities and manage species numbers. Expand fishing access to include all refuge lands that is biologically and ecologically sound. Open all refuge lands to wildlife observation that is biologically and ecologically sound, and provide photography blinds at refuge locations to provide opportunities to photograph rare or secretive wildlife.

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Issue 6. How will we build and maintain an active volunteer program?		
Continue to support and encourage the Friends of Rachel Carson National Wildlife Refuge.	In addition to alternative A, Work with Friends of Rachel Carson National Wildlife Refuge to expand their membership and the scope of their volunteer efforts. Establish a corps of volunteers through the Friends Group or by other means to assist with environmental education and other programs. Explore cost-sharing staff positions with the Wells National Estuarine Research reserve, such as a shared volunteer coordinator position.	Same as alternative B
Issue 7. How will we manage non-native, invasive species on refuge lands?		
Under all three alternatives, the refuge will manage invasive species through means consistent with the Rachel Carson legacy. Carson campaigned against the indiscriminate use of chemicals, yet she recognized the need to use substances to maintain the health of natural and human communities. The refuge will use science-based information to determine the best techniques for controlling invasive species, while avoiding unintended consequences of that control. The refuge will promote alternative, environmentally benign pest management strategies to encourage healthy, sustainable ecosystems. In some circumstances, the chemical control of invasive plants or animals may be necessary to maintain vital wildlife habitats or populations. In such circumstances, the refuge will follow best management practices in recognition of our namesake's message in "Silent Spring." The refuge surveyed and mapped invasive plant species on the refuge from 2002 to 2004. Table 3.5 lists all the invasive plants found on each refuge division. The refuge will manage invasive species according to an Integrated Best Management Plan. Invasive plant control will include cultural, mechanical, biological and, where necessary, chemical techniques. Specific mechanical control methods include mowing, burning, hand pulling, covering, and chipping.		

Edward Henry/USFWS

Chapter 3

Description of the Affected Environment

- Landscape-Level Features
- Socioeconomic Environment
- Refuge Administration and Resources
- Biological Resources

Landscape-Level Features

❖ Gulf of Maine Ecosystem

The refuge lies in the Gulf of Maine watershed, an immense area extending from eastern Quebec to Cape Cod, Massachusetts. Its land base is 69,115 square miles; its water surface, 33,054 miles. Maine is the only state located entirely within that watershed (USFWS 2004).

The watershed includes various, interconnected coastal habitats: salt marshes, mudflats, sandy beaches, intertidal and near-shore subtidal zones and islands. They all play a vital role in sustaining the natural environment and human activity in the watershed. Estuaries, where fresh river water and salty ocean water mingle, provide productive nurseries for many marine species and important feeding and nesting areas for migrating waterfowl, wading birds, and songbirds. For example, estuaries provide homes for 70 percent of all commercially harvested fish in the Gulf. Salt marshes also produce abundant nutrients through decomposition, and provide food and cover for marine and terrestrial animals and a natural water purification system. Mudflats, which may look barren on first glance, abound with animal life just below the surface. Huge concentrations of worms, clams, mollusks, crustaceans and migrating shorebirds depend on healthy mudflats to survive.

Sandy beaches, rocky intertidal and near-shore subtidal zones, and islands also play an important role in sustaining the natural environment. Sand beaches provide habitat for two rare bird species: the least tern and piping plover. Intertidal and near-shore subtidal habitats support marine algae that provide a home for a broad array of organisms, including scallops, flounders, urchins, lobsters and waterfowl (USFWS Gulf of Maine Coastal Program).

❖ Maine's Coastline

Maine has more miles of coastline than any other state in the continental United States: 250 miles in a straight line from border to border; but, 7,039 miles including the shores of all its bays and headlands (Conkling 1999). In contrast with its downeast coast, which is a mix of gradual slopes, rocky shorelines, and abrupt cliffs as high as 100 feet, miles of sandy beaches and tidal marshes characterize the southern coast of Maine. Most of its salt marshes occur from Cape Elizabeth south. We believe most of them developed behind protective barrier beaches at the mouths of tidal waterways and rivers. The barrier beaches developed offshore, often across the mouths of inlets and smaller streams, creating basins that eventually became freshwater ponds that gradually filled with vegetation. In time, the ocean breached the barrier beaches and tidal flow resumed, allowing the present-day salt marshes to develop.

❖ Geology

The Maine coast has experienced continental collisions, uplifting, folding, weathering, submersion, and deformation by many glacial events, inundation by the sea, and rebounding from retreating glaciers. It is still being subjected to waves, wind, and rising sea levels. During the most recent glaciation, continental ice sheets scoured and shaped the resistant bedrock, depositing boulders, sand, and till. Ice sheets covered an area extending well beyond the present shoreline of the Atlantic Ocean. When ice receded from the coast of Maine, the Atlantic flooded the land, still warped from the weight of the massive ice sheets. Even so, the sea level was several hundred feet lower than it is today, because of the vast amounts of water still held in glacial ice. Huge rivers of meltwater deposited thick beds of fine glacial flour, the ice-ground silt and clay that now underlie the coast and areas up to 64 miles inland.

❖ Topography and Soils

The topography of the refuge ranges from 0 feet to 20 feet above mean sea level. Soils that form the tidal marshes are mostly sulfihemists: deep, poorly drained organic soils inundated by the tides. Sulfihemists consist of peat that developed from hundreds of years of plant growth and senescence in salt marshes. Other common soil types in and on the edge of the refuge marshes are Lyman rock outcrop complex, Adams loamy sand, Croghan loamy sand, and Naumburg sand. The average slopes range between 0 percent over much of the marsh and beach areas to 20 percent where the wetlands give way to the sloped bank of upland ridges and low hills. Elevations range from mean sea level to more than 30 feet.

❖ Hydrology

One-half of the average annual precipitation becomes run-off, settling in the upper reaches of the marshes. The refuge receives fresh water from direct precipitation, run-off from surrounding areas, and rivers and streams that pass through refuge boundaries. The mean tidal fluctuation is 8.7 feet in this part of Maine. Spring tides average 11 feet, with higher storm tides. Periodically, tides greater than 12 feet completely flood all refuge salt marshes.

❖ Climate

The ocean strongly influences Maine's climate. Average coastal temperatures tend to be cooler in summer and warmer in winter than in the interior of the state. Prevalent sea breezes moderate those temperatures. The average annual temperature along the coast varies from 40 degrees in the north to 45 degrees in the south. The coastal region enjoys the longest growing season in the state, averaging 140 to 160 days. On average, Maine receives 42 inches of precipitation. Along the coast, the cooling effect of the ocean suppresses precipitation in the summer, and nor'easters enhance it in the winter (USFWS 2004).

❖ Water Quantity and Quality

The tidal streams and rivers that meander through the refuge marshes drain more than 250 square miles of land. Approximately half the water coming into these marshes originates as rainfall on adjacent uplands. That run-off may contribute to decreasing water quality. Developed areas show faster rates of storm water run-off. Faster water carries more sediment and pollutants, and erodes topsoil. Sediments cover aquatic plants, block sunlight from reaching the bottom, and clog the filtering and respiratory organs of aquatic animals. Run-off from uplands carries excess nutrients that can destroy that fragile ecosystem and, eventually, deplete the oxygen in backwaters and coastal ponds. Increased run-off may also cause changes in plant communities along upland edges. Freshwater plants, such as cattail (*Typha* spp.), may increase in breadth or establish themselves in new areas because of that increased run-off.

Two state agencies primarily assess in estuarine, riverine, lacustrine, and coastal water quality: the Department of Marine Resources (DMR) and the Department of Environmental Protection (DEP). The DMR extensively monitor pathogen indicators and phytotoxins. The purpose of that program is to manage the risk of human illness caused by the consumption of contaminated fish or shellfish. The DEP Marine Environmental Monitoring Program monitors and researches other water quality issues in the 7,039 miles of shoreline and near-coastal waters. Three other coastal projects also collect site-specific or project-specific water quality information. The Casco Bay Estuary Project has supported several monitoring projects in Casco Bay. The Shore Stewards Program supports a diverse array of volunteer monitoring groups that operate in specific

embayments and estuaries. The Gulf of Maine Council Gulfwatch Project surveys toxic contamination in coastal waters from Cape Cod to Yarmouth, Nova Scotia.

Both point and nonpoint source pollution affect the quality of Maine's waters. Point source pollution originates from a single discharge point; nonpoint pollution sources can originate from numerous sources in the watershed, typically as runoff from the land. Point source pollution includes sewer overflows, sewage pipes leading directly to the water, and industrial discharges from paper mills and other manufacturers. Nonpoint source pollution includes nutrients, bacteria, sediment, oil, and heavy metals that are transported to water bodies from different sources by runoff from storms. That threat is much harder to manage and control, and is exacerbated by development and increased impervious and polluted surfaces. We have not done systematic, refuge-wide water quality and quantity testing.

Socioeconomic Environment

Some say that Maine's seacoast is the backbone of the state economy. Maine's southern coast and mid-coast regions grew at almost twice the rate of the rest of the state between 1990 and 1996. Their natural beauty and the rich resources of the shore and ocean draw people to the coast. Most Maine residents live in coastal counties.

❖ Demographics

The estimated population of Maine is 1,274,923, at an average density of 41.3 persons/ square mile (U.S. Census, 2000; http://quickfacts.census.gov/ qfd/states/23000.html). The three counties with the highest population densities are Cumberland (318 persons/square mile), Androscoggin (221 persons/square mile), and York (188 persons/square mile). All are located in southern and mid-coastal Maine, in the heart of the Rachel Carson refuge.

A Brookings Institution report in July 2001 listed Portland as the ninth fastest growing metropolitan area in the nation. Between 1982 and 1997, its population increased by 17 percent. Between 1990 and 2000, the state population increased by only 3.8 percent. Other populated cities or towns along the coast are Kittery, York, Wells, Kennebunkport, Biddeford, Saco, Yarmouth, Freeport, Brunswick, Bath, Boothbay Harbor, Damariscotta, Rockland, Camden, Belfast, Bucksport, Ellsworth, Bar Harbor, Machias, and Calais.

The State Planning Office estimates that between 1970 and 1990, land development in Maine proceeded at four times the rate that the population increased. People are moving away from villages and city centers into the countryside. That creates sprawl, characterized by low-density, sporadic development, strip malls, and traffic congestion. If unchecked and unplanned, sprawl impacts our health, our environment, our communities, and our productive agricultural and natural areas. The City of Portland serves as a prime example. Between1982 and 1997, when Portland's population increased by 17 percent, the amount of farmland and forestland converted to urban uses increased by 108 percent.

According to the 2000 U.S. Census, the majority of the people in Maine are employed in the management/professional/and related occupations, followed by "sales and office occupations." The mean household income, including benefits, is approximately $47,000. Approximately 95 percent of the population is white, and retirees are disproportionately concentrated in the southern coastal towns.

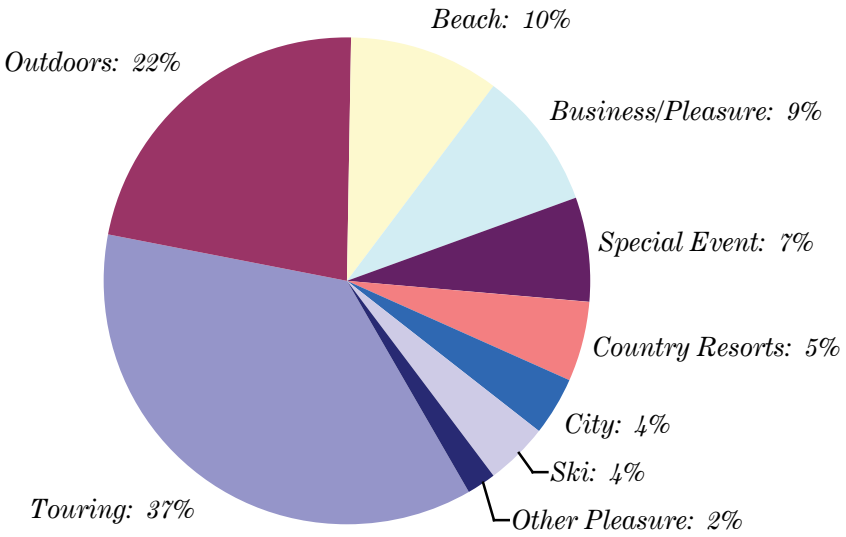
The characteristic land use in some areas around the refuge is strip commercial, as along Route 1 in Wells. Extensive primary and secondary residential development has occurred on the seacoast, as along York Beach. Other areas are characterized as rural with scattered development, as along sections of Route 9 in Kennebunkport, or a series of small towns or village centers, such as York Harbor, Ogunquit, Kennebunkport, and the historic

resort village of Biddeford Pool. Others have extensive recreational land uses, theme attractions, as in Old Orchard Beach, and recreational beaches, as in Scarborough Beach and Ferry Beach. Suburban residential development characterizes areas near Portland and Biddeford/Saco. A series of visitor attractions ranges from York's Wild Kingdom, the Wells National Estuarine Research Reserve, and the Rachel Carson refuge. Most of those are outdoor attractions for both local and tourist populations. Other land uses include tourist and summer resident housing, which ranges from rustic cabins to luxury hotels and condominiums.

❖ Recreational Use

Predominant outdoor recreational activities include hunting, fishing, boating, and wildlife observation. The Portland Press Herald reported in September 1999 that statewide tourism accounts for $8 billion a year in sales. It employs 104,000 people at a payroll of $2.3 billion. The Maine Office of Tourism estimates that more than 7 million people visit the state each year; about two-thirds go to coastal areas. See figure 3.1 below for more information.

Figure 3.1. Maine tourism activities
Source: Maine Office of Tourism



❖ Cultural Resources

Humans have played an integral role in the environment within and beyond the boundaries of the refuge since the glaciers retreated from the Northeast about 13,000 years ago. The refuge contains diverse ecosystems that provided humans subsistence on wide ranges of flora and fauna. Changes in the environment during the end of the Pleistocene and throughout the Holocene caused dynamic changes in the refuge landscape. Human choices about where and how to foster their livelihood have caused anthropogenic changes in the landscape throughout history. Humans have been active agents in species representation in the biosphere in historic times by choosing which flora and fauna they exploit, clearing land by fire to provide fresh, green forage for deer, and clearing large expanses of land for farming. Each generation has acted upon the landscape differently than the previous one, thus creating subtle or obvious changes that affect future environments (Victoria Barr, USFWS, personal communication).

The prehistoric period began about 11,500 years ago, with the settlement of the Paleoindians, and ended with the arrival of European explorers, such as Samuel de Champlain around 1604. During that period, human cultures shifted from primarily gatherer-hunter economies to the horticultural cultures of the Late Ceramic period that grew the three sisters: maize, beans and squash. Humans also used coastal, inland and ocean resources. The prehistoric people of Maine produced a wide, complex variety of artifacts, which includes stone material for tool-making, which was traded from far-away places such as Labrador, a wide variety of groundstone tools, and toward the end of the prehistoric period, a diverse array of ceramic styles, which represents the complexity of the various indigenous cultures of Maine.

The Historic Period began with the arrival of fur trappers in the late 16th century. The Massachusetts Bay Colony established authority over Maine between 1652 and 1658, a position that it held with several brief interruptions until Maine achieved statehood in 1820. Early European settlers focused mostly on coastal resources for their livelihood. By 1760, the Maine frontier opened rapidly, and the economy thrived on its timber industry. Timber was used for the ship-building industry, which remained active in York County until the 1840s. In the late 19th century, tourism was beginning to replace most traditional economic activities in York County. That tradition of tourism in the 20th century has increased, hastening the development of coastal areas in York County.

The refuge contains 50 known archaeological sites, 13 of which are eligible for inclusion in the National Register of Historic Places. Only a small percentage (less than 1 percent) of refuge lands has been evaluated for the presence of archaeological resources. The number of sites will likely increase as more archaeological surveys are completed. The landforms and various environments within the refuge, through time and space, have the potential of yielding archaeological sites from Paleoindian through late colonial times.

A detailed archeological report, “Rachel Carson National Wildlife Refuge Historic and Prehistoric Archeological Resource Survey” (1995), is on file at the refuge headquarters. It identifies areas of high, moderate, and low or unknown sensitivity of archeological resources. For more information, see Appendix H, “Cultural Resources Report.”

Refuge Administration and Resources

❖ Administration and Office

The refuge stretches along 50 miles of coastline in York and Cumberland counties in southern Maine (map 1-2). Ten divisions encompass 5,293 acres between Kittery and Cape Elizabeth. Each division initially was created to protect a tidal river or an estuary resource. Subsequent boundary expansions included adjacent uplands, to protect wetlands and water quality and provide critical wildlife habitat. The present refuge headquarters and small visitor contact area is located in Wells, Maine.

We began in 1966 as an unstaffed satellite of Parker River refuge in Newburyport, MA. The first staff position at the Rachel Carson refuge occupied a small cabin off Drakes Island Road in the Lower Wells division in 1977. A new office/residence was built in 1980 at its present location on Route 9 in the Upper Wells division. Three staff occupied a one-room office.

From 1989 to 1990, a new office was constructed to accommodate the three staff, with private offices for the manager and assistant manager, a general work area for the administrative staff, a small visitor contact area, a garage and a workshop. In 1996, the building was modified to add about 300 square feet for a new visitor contact area and convert the garage into office space for a staff that had grown to four positions.

In 1997, the permanent refuge staff increased to five, with the addition of a visitor services specialist. Our staff continued to grow, adding three permanent positions, two permanent seasonal positions, and as many as seven temporary positions, a YCC crew, and a co-located wildland urban interface (WUI) coordinator. The maintenance area was converted into offices, and an 18'x30' addition was built for staff space. In 2004, the staff total swelled to 22. The present building has crowded office and workspace, no additional file storage, only one bathroom, and inadequate parking for visitor, staff, and work vehicles.

❖ Staffing and Budgets

The current refuge staff consists of nine permanent employees: a refuge manager (GS-13), a deputy refuge manager (GS-12), a wildlife biologist (GS-11), a LMRD biologist (GS-12/13), a visitor services specialist (GS-11), a maintenance worker (WG-8), an administrative officer (GS-7), and two career-seasonal forestry technicians (GS-6 and GS-4). The visitor services specialist and forestry technician (GS-4) positions are vacant.

Four additional permanent positions that have been approved as essential staff at the refuge have not yet been funded. Those are located in the RONS Tier 1 list, and include three full time positions: park ranger/law enforcement (GS-9), maintenance worker (WG-9), and visitor services specialist (GS-5); and, one part time position: administrative support assistant (GS-5). One of two regional wildland urban interface (WUI) coordinators is co-located at the refuge, and receives administrative support from our staff.

The table below shows permanent staff, operating, and maintenance budgets over the past 7 years. Operations funding (1261) includes funds for salaries, new purchases, contracts, and new construction. Maintenance funding (1262) maintains the refuge infrastructure.

Table 3.1. Refuge budgets from 1999 to 2005

Year	*Permanent Staff*	*Operations Funds*	*Maintenance Funds*
1999	5.3	$344,700	$16,000
2000	6.6	$503,300	$127,000
2001	7.9	$399,400	$102,000
2002	7.1	$429,400	$155,000
2003	7.1	$550,200	$117,000
2004	7.1	$538,000	$102,300
2005	7.4	$469,000	$107,700

❖ Refuge Revenue Sharing Payments to Towns

The refuge contributes directly to the economies of several coastal towns in coastal Maine. The fiscal year 2003 revenue sharing checks for Service-owned land in each town are paid in accordance with the Refuge Revenue Sharing Act. That act provides for the Service to pay the greater of three-quarters of 1 percent of the fair market value, 25 percent of net receipts, or $0.75 per acre. The payments are meant to partially offset the tax revenues lost to local jurisdictions as a result of Service land ownership. In 2004, revenue receipts and a supplemental Congressional appropriation provide for slightly less than one-half of what would be full payment amounts based on the current, appraised fair-market value; so the payments were approximately 46.6 percent of full value. That is down slightly from 2003.

Table 3.2. Rachel Carson revenue sharing payments in fiscal year 2004

Town/City	*Payment*
Biddeford	$5,665.00
Cape Elizabeth	$94.00
Kennebunk	$16,137.00
Kennebunkport	$5,321.00
Kittery	$6,178.00
Ogunquit (precinct of)	$104.00
Old Orchard Beach	$118.00
Saco	$9,872.00
Scarborough	$4,399.00
Wells	$7,883.00
York	$2,248.00
Total	**$58,019.00**

❖ Research and Special Uses

Because we are located near many universities and the Wells National Research Reserve, it is not surprising that we have an active research and special use permit program. In 2004, 34 permits were issued: 22 of them for research projects. The remaining permits were granted for surveys, education, or access to refuge lands. We track projects, and require that reports documenting their findings be filed. Several research projects on the refuge have appeared in peer-reviewed publications. We strive to ensure that permitted activities do not adversely impact wildlife or habitat resources. Given the large volume of research requests for low-impact and manipulative research, we plan to track their cumulative impacts and designate some parts of the refuge as high value wildlife areas that receive no manipulation and limited disturbance.

❖ Refuge Divisions

Each refuge division was initially created to protect a tidal river or an estuary resource. Subsequent boundary expansions included adjacent uplands to protect wetlands and water quality and provide important edge habitat for wildlife

Brave Boat Harbor Division.—The division encompasses 707 acres in fee title and an additional 41 acres managed under a conservation easement (map 2–1). This division is located in the towns of York and Kittery. Oak-pine forest with vernal pools and old field upland habitats surround salt marsh and estuary habitat. Portions of upland forest have a dense understory of serviceberry (*Amelanchier canadensis*), bayberry (*Myrica pensylvanica*), sweet gale (*M. gale*), high bush blueberry (*Vaccinium corymbosum*), male-berry (*Lyonia ligustrina*), and spirea (*Spirea latifolia*). Some forested areas have an understory of speckled alder (*Alnus rugosa*), winterberry (*Ilex veticillata*), honeysuckle (*Lonicera morrowi*), sweet gale, spirea, poison ivy (*Toxicodendron rydbergii*), and Virginia rose (*Rosa virginiana*) (Lortie and Pelletier 1988). Several rare plants, including white wood aster (*Aster divericatus*), saltmarsh false-foxglove, wild coffee (*Triosteum aurantiacum*), and dwarf glasswort (*Saliconia bigelovii*), are found at Brave Boat.

This area was nominated for inclusion in the Maine Ecological Reserves program because of its saltmarsh ecosystem, and the presence of oak-pine forest, exemplary white oak-red

oak forest and perched hemlock-hardwood swamp, acidic fen, shrub swamp, and vernal pool communities (McMahon 1998). It also lies within a Maine Beginning With Habitat Focus Area (Greater Brave Boat Harbor/Gerrish Island) known to harbor rare natural communities, including red oak-white oak forest, dune grassland, and spartina saltmarsh (Maine Department of Inland Fisheries and Wildlife). Brave Boat Harbor falls within the Mount Agamenticus to the Sea Conservation Initiative, a region in southern Maine that encompasses the York River, the Brave Boat Harbor Estuary, Gerrish Island, and the largest intact coastal forest between Acadia and the New Jersey Pine (Mount Agamenticus to the Sea Conservation Initiative).

Moody Division.—This division encompasses 399 acres in fee title, and manages an additional 4 acres under a conservation easement (map 2–3). The division lies in the towns of Ogunquit and Wells. The Ogunquit River flows through it, and it is almost entirely salt marsh, with some old field and coastal scrub-shrub habitat.

Lower Wells Division.—This division is 997 acres in fee title, with an additional 6 acres under easement in the town of Wells (map 2-4). Lower Wells is almost entirely salt marsh, with some maritime forest edges, coastal shrublands, and open fields. This division includes the Webhannet salt marshes, one of the largest salt marsh systems in the state. It is an important black duck wintering area, and also has concentrations of breeding sharp-tailed sparrows. Most of the historic barrier beach is now dense residential and commercial development. Scoters congregate in winter in the near-shore shore marine waters.

Upper Wells Division.—This division in the town of Wells encompasses 653 acres in fee title and an additional 14 acres under easement (map 2-5). It is approximately 50 percent mixed pine and hardwood forest, with the remaining lands in salt marsh, beach dune, old field and shrub habitat. Several rivers run through it: the Little and Merriland rivers, and Branch Brook. Crescent Surf Beach lies within this division, and usually supports the largest concentration of nesting least terns in Maine. Up to 8 pairs of federally listed threatened piping plovers have nested on the beach, and it is a staging area for the federally listed endangered roseate tern. New England cottontails live in the scrub-shrub habitat. Upper Wells encompasses parts of a pitch pine bog natural community, a sparsely forested peatland. Upland forests contain an overstory of pitch pine, white pine, red maple, and red oak. Their understory contains dense thickets of serviceberry bayberry, sweet gale, high bush blueberry, male-berry, and spirea (Lortie and Pelletier 1988).

Mousam River Division.—This division encompasses 500 acres in fee title and 16 acres under conservation easement (map 2–6). It lies in the town of Kennebunk. The division is primarily forested uplands with abundant vernal pools. Remaining habitats include salt marsh, river, estuary, open field and scrub-shrub.

Goose Rocks Division.—This division, in the town of Kennebunkport, encompasses 541 acres in fee title and 1 acre under easement (map 2–7). Its habitats include salt marsh, river, beach, estuary and coastal shrubland, Smith Brook, Batson River, Goose Rocks Creek, and Sampson Cove. Piping plovers historically nested at the end of Marshall Point Road. Upland forests contain an overstory of pitch pine, white pine, red maple, and red oak. Their understory contains dense thickets of serviceberry, bayberry, sweet gale, high bush blueberry, male-berry, and spirea. Some forested areas have an understory of speckled alder, winterberry, honeysuckle, sweet gale, spirea, poison ivy, and Virginia rose (Lortie and Pelletier 1988).

Little River Division.—This division encompasses 207 acres in fee title and 59 acres under conservation easement (map 2–8) in Kennebunkport and Biddeford. Most of this division is tidal (about 60 percent); the remaining acres are forested upland and scrubland. The Little River runs through the division.

Biddeford Pool Division.—This division in Biddeford encompasses 121 acres in fee title and 5 acres under easement (map 2–9). Biddeford Pool holdings protect some of the state's most important estuarine habitats, and it is superb shorebird, waterbird and waterfowl habitat. Most of this area is salt marsh, coastal shrublands, and grasslands with some pitch pine forest.

Goosefare Brook Division.—This division, in the Towns of Saco and Old Orchard Beach, consists of 494 acres in fee title and 8 acres under easement (map 2–10). It consists of a small beach, salt marshes, and several hundred acres of pitch pine and mixed pine/hardwood forest. Goosefare Brook runs through this area. One pair of nesting piping plovers commonly uses the beach.

Spurwink River Division.—This division, in the Towns of Scarborough and Cape Elizabeth, encompasses 493 acres in fee title and 27 acres under easement (map 2–11). It is centered along the Spurwink River, Pollack Creek, and several other small waterways. It consists of high-quality salt marsh with high densities of sharp-tailed sparrows, upland shrublands supporting a population of New England cottontail, fields, and some mature forest.

Biological Resources

❖ Habitats

Refuge habitat is about 35 percent tidal, 10 percent freshwater wetlands and 55 percent uplands. Tidal habitats include beach, dune, dune grassland, river, rocky shore, estuarine, bay and salt marsh. Freshwater wetlands include cattail marsh, bog, emergent scrub-shrub wetland, pocket swamp, red maple swamp and floodplain forest. Most of the upland forest consists of mixed oak and pine; however, hemlock, spruce and pitch pine stands, as well as hickory and maple forests, also occur. Viburnums, winterberry, blueberry, serviceberry, Virginia rose and male berry comprise much of the shrub understory. Other upland habitats are composed of grassland and thicket. Habitats are quite diverse, containing elements of the more southerly oak-pine forests and the softwood forests of the north. Those two community types blend here, creating a wealth of biodiversity.

❖ Threatened and Endangered Wildlife Species

Federally designated endangered or threatened species at the refuge include piping plover, roseate tern, and bald eagle. State-listed endangered species at the refuge, not already federal-listed, include the black tern, least tern, American pipit, peregrine falcon, black racer, blanding's turtle, and the ringed boghaunter. State-listed threatened species at the refuge, not already federal-listed, include the arctic tern, harlequin duck, upland sandpiper, and the northern bog lemming. The New England cottontail is currently under review for listing as federal-threatened or endangered. See chapter 2, page 2-47 for details.

The federal-listed endangered shortnose sturgeon are found in large rivers and associated estuaries throughout their range. In Maine, populations of shortnose sturgeon inhabit the Sheepscot, Kennebec, Androscoggin, and Penobscot rivers, and Merrymeeting Bay, although no formal surveys have been performed.

Piping Plover

The piping plover is federally listed threatened and state-listed endangered in Maine. Fifty percent to 75 percent of the Maine piping plover population nests at sites on or near the refuge, including Crescent Surf Beach, Goosefare Brook, and Marshall Point at Goose Rocks. Since 2000, we have assumed the primary responsibility for monitoring piping

plover sites on and off the refuge at Parsons, Laudholm, and Ferry beaches. That involves cooperating with private landowners, the Maine Audubon Society, state partners, and the Wells National Estuarine Research Reserve to protect nesting plovers on their lands. The piping plover recovery plan has a recovery objective of 1.5 chicks per pair average over 5 years (USFWS 1996a).

In 2003, 19 plover pairs nested, resulting in 26 nesting attempts, and 8 successful nests: 27 chicks hatched, and 20 fledged. Nesting success was particularly low at Crescent Surf Beach because of crow predation, where crows learned how to enter the twine-topped exclosures and eat eggs. We control diurnal predators such as crows and foxes with several techniques, including hazing, fencing, trapping, and shooting. Occasional vandalism of the fencing around plover nests by people or by dogs to kill plover chicks causes plovers to abandon the nests. Refuge staff work with willing beachfront landowners and the public to protect nesting plovers.

Human development, including houses, seawalls, and jetties, has caused the loss of more than two-thirds of Maine's 30 miles of beaches as nesting habitat for piping plovers. Even in the suitable habitat remaining, beach goers may inadvertently crush nests or chicks or leave garbage that attracts predators. Piping plover nesting, feeding, and brood-rearing habitats were given legal state protection in 1995, when Maine designated them as Essential Habitats (McCollough et al. 2003).

Roseate Tern

The northeastern population of the roseate tern is federal- and state-listed as endangered. Together with Arctic and common terns, roseate tern populations were decimated in the Gulf of Maine in the late 1800's due to a combination of shooting and egging for food and bait, and feather collection for the millinery trade (Drury 1973). Conservation legislation passed in the early 1900's provided protection from human persecution, but expanding gull populations soon caused tern numbers to again decrease significantly (Kress 1983).

By 1977, within the entire Gulf of Maine, all three tern populations had decreased to 5,321 total pairs while the number of island supporting nesting terns had decreased by half. Cooperative efforts by members of the Gulf of Maine Seabird Working Group (GOMSWG) to attract new birds to islands and to control gull predation have reversed this decline and all three species are experiencing population growth. After 15 years of active management, the roseate tern population in Maine has risen, from a low of 76 pairs to a record high of 289 pairs in 2001. This represents a 278% increase in Maine's population. In 2002, 379 pairs of roseate terns nested at six sites in the Gulf of Maine (including Canada).

While the numbers of breeding pairs has increased in recent years, we continue to be concerned over the poor distribution of nesting pairs across the region. Approximately 87% of the Northeast roseate tern population breeds on three islands: Bird and Ram islands in Massachusetts and Great Gull Island in New York. In Maine, roseate terns only nest on three or four islands. The terns' limited nesting distribution significantly increases the potential for a single catastrophic event to affect a major percentage of the population.

Roseate terns have historically nested on two islands adjacent to Rachel Carson NWR, one in Biddeford and the other in Kennebunkport. Currently, the majority of use is by post-breeding and migrating birds which use refuge beach habitat for resting.

Given the increases in nesting pairs in recent years, we are optimistic that the population will continue its current growth trend over the next 15 years, resulting in significant progress towards recovery of this species.

Bald Eagle

The northern population of the bald eagle is federal- and state-listed as threatened. Historically, threats to bald eagles have included environmental contaminants, shooting, habitat loss, and human disturbance at nest sites. Extensive public education efforts and federal and state legislation have significantly reduced many of these threats. The bald eagle population in Maine has responded to this protection, and the population has increased nearly 8% per year for the past 10 years. The state now supports over 290 pairs of eagles (MDIFW 2002). MDIFW has identified permanent protection of eagle nesting areas as the top priority for the future recovery of this species in Maine. In particular, they have specified a recovery objective of at least 50 nesting areas under permanent habitat protection (conservation ownership or easement), with an additional 100 nesting areas under permanent protection or cooperative agreement (MDIFW 2001).

Current bald eagle use of the refuge and adjacent lands is primarily during the migration and wintering season. Over the last several years, use of the many tidal rivers and estuaries has increased as the population within the state has expanded.

❖ Rare Plants and Exemplary Natural Communities

Although we have not completed a comprehensive botanical survey, we know that several state-listed rare plants live on the refuge. See table 3.3. Table 3.4 lists exemplary natural communities found at the refuge.

Table 3.3. Rare plants

Scientific Name	*Common Name*
Aster divericatus	white wood aster
Carex silicea	sea beach sedge
Eupatorium fistulosum	hollow joe-pye weed
Ilex laevigata	smooth winterberry
Iris prismatica	slender blue flag iris
Nyssa sylvatica	black tupelo
Platanthera flava	pale green orchis
Prunus Maritima	beach plum
Rhododendron viscosum	clammy azalea
Saliconia bigelovii	dwarf glasswort
Sassafra albidum	sassafras
Suaeda calceoliformis	American sea blight
Suaeda richii	Rich's sea blight
Triosteum aurantiacum	wild coffee

Table 3.4. Exemplary natural communities

Coastal dune marsh ecosystem
Spartina saltmarsh
White oak – red oak forest
Dune grassland
Pitch pine bog

❖ Other Wildlife on the Refuge

Salt Marsh Birds

In 1995, sharp-tailed sparrows were divided into two separate species: the Nelson's sharp-tailed sparrow, and the saltmarsh sharp-tailed sparrow. Saltmarsh sharp-tailed sparrows are found in salt marshes along the Atlantic coast from the Delmarva Peninsula north to southern Maine. Nelson's sharp-tailed sparrows are found in saltwater and freshwater marshes from Nova Scotia south to southern New Hampshire and, occasionally, in northern Massachusetts. The two species are thought to overlap from the Weskeag River in Maine south to Parker River, Massachusetts (Hodgman 2002).

In 1997, the MDIFW initiated surveys in southern salt marshes to assess the status, range, and distribution of both species. They established more than 200 survey points on salt marshes from Kittery to Georgetown, which were surveyed two or three times during the summer. We cooperated in that survey; more than 100 survey points were located within the refuge boundary. In 1998, the state expanded their research northward along the coast. In 1999, we began sparrow surveys on marshes at those previously established points. In 2004, we helped collect nesting data for a graduate student from the University of New Hampshire. Her work strives to help us understand the relationship between nest density, nest fate and other abiotic and biotic factors. Nests were monitored in Wells and Ogunquit. However, nesting sharp-tailed sparrows were also found at Granite Point and the Spurwink River. In 2004, follow up work with BioDiversity Research, Inc. and the State of Maine examined the levels of mercury in saltmarsh sparrows at Scarborough Marsh WMA, and the Rachel Carson, Parker River, Stewart B. McKinney and Ninigret refuges. Rachel Carson refuge assisted by writing the grant to support that work and assisting in capturing and processing birds.

Data obtained since 1997 has expanded the range of the salt marsh sharp-tailed sparrow northward along the coast to the Weskeag River. Nelson's sharp-tailed sparrows have been found as far south as Newburyport, Massachusetts. Field observations and genetic testing of individuals with markings of both species indicate hybridization. Although the Nelson's sharp-tailed sparrow primarily occurs in freshwater wetlands in the northern portion of their range, within the refuge both species are found only on salt marshes. In fact, the salt marsh sharp-tailed sparrow is an obligate salt marsh species that spends its entire life cycle on salt marshes.

Waterbirds and Marsh Birds

Common loons (*Gavia immer*) frequent the lower reaches of tidal creeks in all refuge divisions from late fall through early spring. They are commonly observed feeding on green crabs and small fish. During spring, summer and fall migration, 11 species of wading birds use the estuarine systems of the refuge. Great blue herons (*Ardea herodias*) and snowy egrets (*Egretta thula*) are the species most commonly observed feeding in salt pannes and tidal creeks, and are often seen in groups of 10 to 15 birds. The overall significance of those habitats to these migrating or breeding birds is not very well understood. It is possible that snowy egrets, great egrets (*A. alba*), little blue heron (*E. caerulea*), and glossy ibis (*Plegadis falcinellus*) nest on offshore islands and visit refuge salt marshes to feed. Green herons (*Butorides striatus*) nest on several of the refuge divisions along the edge of the salt marsh and adjacent forested community. These birds are commonly observed feeding along the edge of salt pannes during the summer. Breeding black-crowned night-herons (*Nycticorax nycticorax*) were first recorded here in the early 1980s. Virginia rails (*Rallus limicola*) breed at a few divisions on the refuge, and are more commonly seen during migration. Clapper rails (*R. longirostris*) were observed on Drakes Island in 1999, but sightings are exceedingly rare. American bitterns (*Botaurus lentiginosus*) are often found

using refuge marshes during fall migration, although their breeding on the refuge has not been documented.

Waterfowl

Twenty-six species of waterfowl have been recorded on the refuge. Those most commonly observed are American black duck (*Anas rubripes*), Canada goose (*Branta canadensis*), mallard (*A. platyrhynchos*), green-winged teal (*A. crecca*), common goldeneye (*Bucephala clangula*), bufflehead (*B. albeola*), and red-breasted merganser (*Mergus serrator*). Dabbling ducks use salt pannes and the upper reaches of tidal creeks, while diving ducks prefer the deeper parts of the tidal creeks and the mouths of rivers and streams. Black ducks, mallards, and increasing numbers of Canada geese breed on each division of the refuge. Wood ducks (*Aix sponsa*) breed on the Upper Wells and Mousam River divisions each year. Canada geese were first recorded breeding on the Upper Wells Division in 1987. During spring and fall migrations, small numbers of approximately 25 species of waterfowl may be seen on the refuge, particularly during inclement weather.

Hundreds of black ducks use the refuge in winter. They occupy unfrozen tidal creeks, where they feed on snails, nine-spine sticklebacks (*Pungitius pungitius*), and mummichogs (*Fundulus heteroclitus*). Small numbers of mallards, Canada geese, and the occasional green-winged teal also winter on the refuge. Its tidal creeks, river mouths, and onshore intertidal waters commonly host many rafts of common eiders (*Somateria mollissima*), white-winged, black, and surf scoters (*Melanitta fusca*, *M. nigra*, and *M. perspicillata*), long-tailed ducks (*Clangula hyemalis*), common goldeneyes, buffleheads, and red-breasted mergansers. In winter, common loons are sighted in moderate numbers (10–15) at the mouth of the Mousam River and elsewhere on the refuge.

Shorebirds

Southern coastal Maine is a migrating and staging area for many species of shorebirds that breed in North America, particularly during fall migration. Thousands of shorebirds feed along coastal beaches and mud flats as they migrate through the state. Biddeford Pool serves as one of the top shorebird staging areas in southern Maine. In 2004, we conducted a weekly fall migration shorebird survey at several spots on the refuge. That survey documented an average of 555 shorebirds at 8 sites, with peak numbers (>1400 birds) in late August. Thirty-six species of shorebirds are recorded for the refuge: five of those are considered regular breeders. Most of the use by shorebirds occurs during fall migration, beginning in early July and continuing through early November in a variety of habitats within the estuarine community, but the greatest use occurs in tidal mudflats and salt pannes. Areas used during major fall migrations include the Webhannet River at low tide, several salt pannes on the Lower Wells and Upper Wells divisions, the Batson River and Goose Rocks tidal mudflats, and numerous locations at the Biddeford Pool Division. The great diversity of shorebirds found in those areas compares to only a few other sites in Maine.

The most common species observed in the fall include semipalmated plover (*Charadrius semipalmatus*), black-bellied plover (*Pluvialis squatarola*), least sandpiper (*Calidris minutilla*), greater yellowlegs (*Tringa melanoleuca*), short-billed dowitcher (*Limnodromus griseus*), and semipalmated sandpiper (*Calidris pusilla*). These species and others typically feed in the mudflats at low tide. Most shorebirds feed in salt panes, and roost in pannes and adjacent uplands during high tides. Shorebirds roost on several islands near the Biddeford Pool Division at high tide.

Spotted sandpipers (*Actitis macularia*) most likely nest on all the refuge divisions. They are commonly sighted scurrying along tidal creek channels in the summer. In the mid-1980s, willets (*Catoptrophorus semipalmatus*) first began nesting on the Lower Wells,

Upper Wells, Little River, Goose Rocks, Biddeford Pool, and Spurwink River divisions. Their numbers are increasing in Maine: they are now found on almost every refuge salt marsh during the breeding season. Willet chicks feed in salt marsh pannes in the Little River Division. Willets typically nest in the salt hay community. Killdeer (*Charadrius vociferus*) occasionally nest in the salt marsh, although typically they are found in drier, open fields adjacent to the estuary.

The American woodcock (*Scolopax minor*) is found in suitable habitat on all refuge divisions. Spring surveys of "peenting" males and spring, summer, and fall observations of flushed birds have shown that they use old fields, shrub swamp, transitional hardwood, and early successional forest communities. The development of upland areas adjacent to refuge marshes and the abandonment or succession of old farms has reduced the amount of woodcock habitat.

Gulls and Terns

Herring gulls (*Larus argentatus*) and great black-backed gulls (*L. marinus*) are the most common gull species sighted on the refuge. They frequent all divisions throughout the year, but are most abundant in the fall and winter when they roost on the marsh and tidal flats, and occasionally steal food from diving ducks in tidal creeks. Ring-billed gulls (*L. delawarensis*) also are common throughout the refuge, particularly during non-breeding season. During fall and winter migration, Bonaparte's gulls (*L. philadelphia*) feed and roost at the mouths of tidal creeks and rivers throughout the refuge, but they are most abundant on the Biddeford Pool, Upper Wells, and Lower Wells divisions.

Least terns nest on the refuge in several locations. (See "Threatened and Endangered Wildlife Species" above for more on least terns.) In the mid-1980s, common terns nested in the salt marsh on the Lower Wells and Little River divisions. Roseate terns (*Sterna dougallii*) nested on West Goose Rocks Island in 1985, and lately, have been observed along Crescent Surf Beach in the Upper Wells Division. In 2003, Crescent Surf Beach hosted the largest nesting colony (157 pairs) of least terns in Maine. Early season crow predation and late season owl and coyote predation depressed productivity. We control diurnal predators such as crows and foxes with several techniques, including hazing, fencing, trapping, and shooting. Least terns also nest at Laudholm Beach, Goose Rocks, Higgins, and Reid State Park. During migration, large numbers of common terns, along with smaller numbers of roseate terns (15), stage at Crescent Surf Beach

Landbirds

Forests, woodlands, and swamps surrounding the refuge salt marshes provide habitat for many raptors. Many migrating raptors use forested areas next to marshes as hunting perches and feeding areas. Sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperii*), and broad-winged hawk (*Buteo platypterus*) have nested in forested habitat on the refuge. Northern goshawks (*A. gentilis*) and red-tailed hawks (*B. jamaicensis*) nest in the area. During migration (primarily fall), many raptors move through the refuge. Northern harriers are the only raptor species thought to breed in the estuarine communities of the refuge. During the mid-1980s, the "30-acre" marsh, a brackish marsh north of Drakes Island Road in Wells, hosted courting harriers in the spring and juvenile harriers in mid-summer—evidence that breeding probably did occur at that time. However, sightings of harriers during the breeding season since then have not been documented. Ospreys nested on a platform in the Upper Wells Division in 2003 and 2004.

Great horned owls (*Bubo virginianus*), barred owls (*Strix varia*), and northern saw-whet owls (*Aegolius acadicus*) are common throughout the refuge, but only great horned owls are confirmed nesters. Long-eared owls (*Asio otus*) are occasionally sighted on or near the Upper and Lower Wells divisions. In the winter, American bald eagles (*Haliaeetus*

leucocephalus) infrequently linger on some divisions, where they feed primarily on herring gulls and black ducks. Rough-legged hawks (*Buteo lagopus*), northern harriers, and sharp-shinned hawks can also be seen hunting over the salt marshes in winter. Short-eared owls (*Asio flammeus*), great horned owls, and snowy owls (*Nyctea scandiaca*) feed on small mammals and birds in the salt marsh in winter.

Ruffed grouse (*Bonasa umbellus*) use forested areas on or near all of the divisions. In spring, drumming grouse frequently are heard, particularly in previously cut oak-pine forests. A wild turkey (*Meleagris gallopavo*) reintroduction program initiated nearly 20 years ago in southern Maine was successful. Their abundance and distribution are expected to continue to increase; they may become more common in oak-pine forests on the refuge.

Diverse habitats around refuge estuarine communities support more than 120 passerine birds. Year-round residents, short-distance migrants, and Neotropical migrants alike find nesting, feeding, and roosting habitat in the uplands close to refuge estuaries. A visitor checklist, "Birds: Rachel Carson National Wildlife Refuge," provides a comprehensive list of birds identified on or seen from the refuge. Landbird surveys have been conducted on many of the refuge divisions. Many of the species detected are on the North American Landbird Conservation Plan Watch List for our area.

Mammals

White-tailed deer (*Odocoileus virginianus*) are the mammal most commonly observed on the refuge. Their trails cut through certain portions of the salt marsh on each division, although they more typically are observed along marsh edges and in surrounding forests. According to the MDIFW "White-tailed Deer Assessment and Strategic Plan" (1997), the 1985–1996 statewide goal for a winter deer population was 9 to 11 deer per square mile. During that period, a statewide level of about 8 deer per square mile was achieved.

The refuge lies entirely within Wildlife Management District (WMD) No. 24, which had an estimated winter population of 30 deer/mi^2 in 1997. The Wildlife Division Research and Management Report (2000) stated that the herd has continued to grow at 15 percent per year, and the wintering population is now nearly 40 deer/mi^2.

In certain areas of the refuge, hunting (including white-tailed deer) is prohibited because of state-designated Game Sanctuaries. Deer populations in those areas are estimated from 50 to more than 100 deer/mi^2. Those populations far exceed the state target of 50 percent to 60 percent of carrying capacity. The report further states that the actual biological carrying capacity in southern Maine may be underestimated, and that 25 deer/mi^2 is less than the targeted 50 percent of maximum carrying capacity. The state implemented a limited experimental hunt in 2002 to reduce the habitat and health impacts of a large deer herd in Wells.

Raccoon (*Procyon lotor*) tracks and scats abound on all divisions. Their sign most often appears along the edges of tidal creeks and salt pannes, where they search for green crabs and small fish. Care must be taken to distinguish raccoon sign from that of river otters (*Lutra canadensis*), another mammal that forages extensively in the marshes, and is infrequently observed in the salt hay along the edges of tidal creeks. Most recently, river otters were seen in the Merriland River and Branch Brook in the Upper Wells Division.

Mink (*Mustela vison*), striped skunk (*Mephitis mephitis*), red fox (*Vulpes fulva*), and coyote (*Canis latrans*) also hunt in the estuary. Beaver (*Castor canadensis*) and muskrat (*Ondatra zibethica*) are occasionally seen swimming in tidal creeks. A few harbor seal (*Phoca vitulina*) haul-out sites exist on the Brave Boat Harbor, Lower Wells, Mousam River, and Goose Rocks divisions. Peak use occurs during the winter, but individuals are

observed throughout the year. The Lower Wells haul-out site receives the most use, with peak counts of 30 seals. During the winter months harp seals (*Pagophillus groenlandicus*), and occasionally hooded (*Cystophora cristata*) and grey seals (*Halichoerus grypus*), can be found basking on refuge salt marshes and in offshore waters. Seal strandings are a common occurrence, and are reported to marine animal rescue agencies.

Many large mammals are found on or near the refuge. Moose (*Alces alces*) and black bear (*Ursus americanus*) are becoming more common in southern Maine as their populations continue to grow. They have been sighted on all refuge divisions except Moody. A bobcat (*Lynx rufus*) was reported as sporadically using the Upper and Lower Wells divisions in 1991 and 1992. Fishers (*Martes pennanti*) are increasingly sighted on the refuge; a vehicle killed a fisher near refuge headquarters in 1998, and several sightings around our headquarters have occurred since then. Gray fox (*Urocyon cinereoargenteus*) and short-tailed weasel (*Mustela erminea*) most likely use several refuge divisions. Porcupines (*Erethizon dorsatum*) and woodchucks (*Marmota monax*) are found throughout the refuge, where they occur in varied habitats.

Snowshoe hare (*Lepus americanus*) are found in forests throughout the refuge in areas with dense understory. The species of rabbit found in Maine is the New England cottontail (*Sylvilagus transitionalis*), not the Eastern cottontail. Cottontails inhabit early successional habitat that was relatively abundant in the early to mid-20th century. As farms were abandoned, the species did very well. Subsequently, increased development and reforestation has led to a population decline as this type of habitat became increasingly rare. We prohibited rabbit hunting starting in 1998 because of ongoing population declines. Subsequently, the Service was petitioned in 2000 to list the New England cottontail under the Endangered Species Act.

White-footed mice (*Peromyscus leucopus*), meadow jumping mice (*Zapus hudsonius*), and meadow voles (*Microtus pennsylvanicu*s) occasionally use the edge of salt marsh habitat. Masked shrews (*Sorex cinereus*), short-tailed shrews (*Blarina brevicauda*), red-backed voles (*Clethrionomys gapperi*), and pine voles (*Microtus pinetorum*) have also been caught in salt marshes.

Other small mammals that commonly are found on the refuge include eastern chipmunk (*Tamias striatus*), red squirrel (*Tamiasciurus hudsonicus*), and grey squirrel (*Sciurus carolinensis*). These species are most common in oak-pine forests where acorns are abundant. Southern flying squirrel (*Glaucomys volans*) is recorded for the Upper Wells and Brave Boat divisions, but they probably also occur in other areas with mature oak-pine forest. Other small mammals that are known or are likely to occur on the refuge include hairy-tailed mole (*Parascalops breweri*), star-nosed mole (*Condylura cristata*), smoky shrew (*Sorex fumeus*), and house mouse (*Mus musculus*). Refuge staff provide visitors a guide listing 47 refuge mammals.

Reptiles and Amphibians

The refuge has a limited amount of freshwater cattail marsh or pond habitat. However, within its uplands, the refuge protects an extensive network of rivers, uplands and vernal pools, which provide important amphibian and reptile habitat.

Anuran call counts and limited vernal pool surveys were conducted on the refuge. American toad (*Bufo americanus*) , green frog (*Rana clamitans*), wood frog (*R. sylvatica*), pickerel frog (*R. palustris*), bullfrog (*R. catesbeiana*), gray treefrog (*Hyla versicolor*) and spring peeper (*Pseudacris crucifer*) are documented as breeding on most refuge divisions. In addition, yellow-spotted salamanders (*Ambystoma maculatum*), red-backed salamanders (*Plethodon cinereus*) and eastern newts (*Notophthalmus viridescens*) are recorded as

common breeders. The blue-spotted salamander (*A. laterale*) and Northern leopard frog (*R. pipiens*) are uncommon, but likely are breeders on the refuge.

We have yet to conduct any formal surveys for turtles or snakes. However, the following species are documented on the refuge: garter snake (*Thamnophis sirtalis*), ribbon snake (*T. sauritus,* Maine—Special Concern), smooth green snake (*Liocholrophis vernalis*), redbelly snake (*Storeria occipitomaculata*), painted turtle (*Chrysemys picta*), snapping turtle (*Chelydra serpentina*) and spotted turtle (*Clemmys guttata*, Maine—Threatened).

Species that are likely to use the refuge but are not documented include ringneck snake (*Diadophis punctatus*), milk snake (*Lampropeltis triangulum*), northern water snake (*Nerodia sipedon*), brown snake (*Storeria dekayi,* Maine Special Concern), Blanding's turtle (*Emydoidea blandingii,* Maine Endangered) and possibly, eastern racer (*Coluber constrictor,* Maine—Endangered), wood turtle (*Clemmys insculpta,* Maine—Special Concern) and common musk turtle (*Sternotherus odoratus*). Records indicate that both Blanding's turtle and spotted turtle occur in many locations along the refuge boundary. Wood turtle and black racer records are much less common, and musk turtle records in the vicinity of the refuge are nonexistent. Surveys targeted at detecting turtles and snakes should be developed and implemented on refuge lands with particular attention to the occurrence of the rare, secretive Blanding's turtle. Lands within the proposed acquisition boundary in Kennebunk and Biddeford have extensive vernal pool habitat that will benefit several species of concern.

Fish

Coastal marshes, bays, tidal creeks and rivers support diverse shellfish and finfish populations. Sunfish (*Lepomis* spp.), creek chub (*Semotilus atromaculatus*), cunner (*Tautogolabrus adspersus*), golden shiner (*Notemigonus crysoleucas*), common mummichog, American eel (*Anguilla rostrata*) and white sucker (*Catostomus commersoni*) abound. Brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) are stocked in rivers and estuaries each year.

The Ogunquit River sustains alewife (*Alosa pseudoharengus*), blueback herring (*A. aestivalis*), pollock (*Pollachius virens*), bluefish (*Pomatomus saltatrix*), longhorn sculpin (*Myoxocephalus octodecimspinosus*), and winter flounder (*Pleuronectes americanus*). The Webhannet River has native species such as winter flounder, northern pipefish (*Syngnathus fuscus*), Atlantic herring (*Clupea harengus*), common mummichog, Atlantic silversides (*Menidia menidia*) and Atlantic mackerel. The Merriland River sustains populations of American eel, brown trout, and brook trout. The Mousam River attracts little skate (*Raja erinacea*), American shad (*Alosa sapidissima*), striped bass (*Morone saxatilis*), bluefish, cunner, Atlantic mackerel (*Scomber scombrus*), pollock, and rainbow smelt (*Osmerus mordax*). The Spurwink River supports blueback herring, Atlantic menhaden (*Brevoortia tyrannus*), American shad, pollock, cunner, winter flounder, and little skate. Striped bass and brown trout are popular recreational fishing resources in the area.

The National Marine Fisheries Service has designated as "essential fish habitat" areas that provide substrate necessary for fish spawning, breeding, feeding, or growth to maturity. Estuaries within the refuge boundaries are part of that essential fish habitat.

❖ Invasive Plants

The Service identifies an "invasive species" as a species (1) that is non-native (or alien) to the ecosystem under consideration and, (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order No. 13112). That order requires the National Invasive Species Council to produce a National Invasive Species Management Plan every 2 years. In January 2001, the Council released its first

plan, which serves as a blueprint for all federal action on invasive species. It focuses on those non-native species that cause or may cause significant negative impacts and do not provide an equivalent benefit to society. One report estimates the economic cost of invasive species in the United States at $137 billion every year (Pimentel et al. 2000). Invasive species have negatively impacted up to 46 percent of the plants and animals federally listed as endangered species (Wilcove et al. 1998; National Invasive Species Council 2001).

Our Northeast Region began to systematically identify and map invasive plant species on refuge lands for an effective, integrated management plan. Our refuges will use that information to guide their development of control, monitoring and evaluation projects. It will also be instrumental in developing refuge CCPs, HMPs and Integrated Pest Management Plans. We provided the survey data for Rachel Carson refuge to our Regional GIS specialist to develop GIS coverage. Regional coverage will be consolidated for the purposes of prioritizing regional initiatives for controlling species, monitoring their rates of spread, and evaluating both. For example, hemlock is a subcanopy species in low abundance at Gerrish Island, where hemlock woolly adelgid has been documented.

Data collection began in 2002, and was completed in 2004. The acreage of phragmites includes native and non-native stands. In general, refuge salt marshes are practically free of invasive plant species. More appear in the uplands, brackish waters, and freshwater areas. The refuge appears to be quite clean; however, that is due largely to our abundant, clean salt marsh habitats. Invasive plants covering more than 20 acres throughout the refuge include Asiatic bittersweet, bush honeysuckle, common barberry, glossy buckthorn, Japanese barberry and reed canary grass. Less than 15 acres of non-native and native phragmites and less than 3 acres of purple loosestrife are found on the refuge. Of all the refuge divisions, Brave Boat Harbor has the worst invasive plant problem: non-native plants cover about 33 percent of its land mass.

To date, invasive plant management on the refuge has focused on largely on removal by hand, biological control, and mechanical treatments. We try to target new invasions of plants before they get out of control. Table 3.5 on the next page lists those found on the refuge. We derived its “percent clean” from areas covered by one or more invasive plants divided by clean areas.

Table 3.5. Invasive species found on the refuge

Species	*BB*	*MD*	*LW*	*UW*	*MR*	*GR*	*LR*	*BP*	*GFB*	*SR*
Asiatic Bittersweet *(Celastrus orbiculata)*	24.07	3.30	3.40	1.43	0.90	0.02	0.14	5.56	0.63	5.73
Autumn Olive *(Elaeagnus umbellate)*	0.01	<0.01	0	0.34	0	0	<0.01	0	3.19	4.27
Black Locust *(Robinia pseudoacacia)*	0.11	0	0.13	<0.01	<0.01	0	0	0.03	0.43	0
Black Swallow-wort *(Cynanchum louiseae)*	0	0	0	0	0	0	0	0	0	0.02
Burning Bush (*Euonymous alata)*	0.16	0.20	0	<0.01	<0.01	0	0	<0.01	0	0
Canada Thistle *(Cirsium arvense)*	0.19	0	<0.01	0	0	0	0	0	0	0
Climbing Nightshade *(Solanum dulcamara)*	1.95	1.33	0.04	<0.01	<0.01	<0.01	0.04	0.01	0.62	0.63
Common Barberry *(Berberis vulgaris)*	29.22	0.02	<0.01	<0.01	<0.01	0	0	<0.01	0	0
Common Buckthorn *(Rhamnus cathartica)*	<0.01	0	<0.01	<0.01	<0.01	0	0	0	0	0
Creeping Buttercup *(Ranunculus repens)*	0	0	<0.01	0	0	0	0	0	0	0
Cypress Spurge *(Euphorbia cyparissias)*	0	0.11	0	0	0	0	0	0	0	0
European Privet *(Ligustrum vulgare)*	<0.01	0	0	0	0	0	0	0	0	0
Garlic Mustard *(Alliaria petiolata)*	0.64	0	0	0	0	0	0	0	0	0
Glossy Buckthorn *(Frangula alnus)*	162.64	0	<0.01	43.72	14.32	0	0	0	2.17	0
Goutweed *(Aegopodium podagraria)*	0	0	0	0	<0.01	0	0	0	0	0
Honeysuckle *(Lonicera sp.)*	18.70	9.21	14.11	30.63	13.33	8.18	0.23	12.26	2.69	44.40
Japanese Barberry *(Berberis thunbergii)*	60.29	1.55	2.77	33.79	6.90	0.49	0	<0.01	<0.01	<0.01
Japanese Knotweed (*Polygonum cuspidatum)*	<0.01	0.66	<0.01	1.83	<0.01	0	0	0	0.70	0.22
Japanese Honeysuckle *(Lonicera japonica)*	0	0	<0.01	0	0	0	0	0	0	0
Multiflora Rose *(Rosa multiflora)*	4.24	0.24	0.04	0.93	0.46	0	0	0	0	0.09
Common Reed *(Phragmites australis)*	0.16	4.30	7.24	0.23	<0.01	1.70	0.36	0	0.24	0.09
Purple Loosestrife *(Lythrum salicaria)*	<0.01	0.81	1.15	0	0	0	0	0.01	<0.01	0.50
Ragged Robin *(Lychnis floscucli)*	0	0	0	<0.01	0	0	0	0	0	0
Reed Canary Grass *(Phalaris arundinacea)*	0	1.58	0.39	7.28	0.01	3.60	2.00	0.37	<0.01	6.04
Reed Manna Grass *(Glyceria grandis)*	0	0	0	<0.01	0	0	0	0	0	0
Rugosa Rose *(Rosa rugosa)*	<0.01	2.43	0.72	2.52	<0.01	0.02	0.11	0.13	5.30	0
Total	302.41	25.74	30.00	122.72	35.94	14.11	2.88	18.39	15.99	62.01
Percent Clean	67.76	92.89	97.45	85.26	97.22	96.81	90.76	83.89	95.68	75.28

BB=Brave Boat Harbor MD=Moody LW=Lower Wells UW=Upper Wells MR=Mousam River
GR=Goose Rocks LR=Little River BP=Biddeford Pool GFB=Goosefare Brook SR=Spurwink River

❖ Special Management Areas

In 2000, President Clinton signed an Executive Order on marine protected areas with a goal of strengthening the protection of oceans and coastal resources. An inventory of potential Marine Protected Areas (MPA) was completed, although none have been officially designated. Rachel Carson refuge and neighboring Wells National Estuarine Research Reserve are on the list of potential MBAs.

❖ Relationship between Rachel Carson refuge and Other Protected Areas (see map 1–2)

Kennebunk Plains

Located five miles west of the Mousam Division in Kennebunk, Maine, the Plains is an important grassland nesting area and also globally significant for unique vegetation. Unique for its size in southern Maine, Kennebunk Plains is a 1,600-acre barrens and woodland. Formed from a glacial marine delta, this site includes extensive grasslands and a pitch pine–scrub oak forest. It supports birds and habitat found nowhere else in the state. Formerly commercially managed for blueberries, the Plains are jointly managed for plants and wildlife by The Nature Conservancy and the MDIFW. More than 87 bird species are recorded nesting at the barrens; 50 additional species are listed as migrants. Kennebunk Plains supports the largest population of northern blazing star (*Liatris scariosa v. novae-angliae*) in the world. Declining grassland-nesting birds such as upland sandpiper (*Bartramia longicauda*), Eastern meadowlark (*Sturnella magna*), and bobolink (*Dolichonyx oryzivorus*) breed here.

Mount Agamenticus

Although Mount Agamenticus and Second and Third hills are located in York and Wells, the mountain can be seen from most of coastal southern Maine. The mount and the land around it (more than 5,000 acres) is protected by the town of York, the York and Kittery Water Districts, York Land Trust, MDIFW, The Nature Conservancy, Great Works Regional Land Trust, and devoted citizens. It lies in a transition zone between the southern hardwood forest and northern woodlands characterized by conifers. This forest is largely unfragmented, providing watershed protection and rich habitat for a diversity of wildlife. "Mount A" is well known as a hawk migration site. According to "A Birder's Guide to Maine" (1996), a yearly average of almost 4,000 hawks is recorded during fall migration. The surrounding woodland provides habitat for nearly 40 species of breeding birds. It is Maine's southernmost breeding area for dark-eyed junco and common ravens. Blanding's and spotted turtles listed respectively as endangered and threatened in Maine, occur here.

Scarborough Marsh

This dominant marsh is located between Goosefare Brook and Spurwink divisions where the Scarborough and Nonsuch Rivers converge. Owned and managed by the MDIFW, Scarborough Marsh is the largest salt marsh in the state. It comprises more than 3,100 acres of mudflats, brackish marsh, and salt meadow. More than 200 species of birds are recorded at the marsh, which is managed primarily for waterfowl including American black ducks, northern pintails, blue- and green-winged teals, and common and red-breasted mergansers. Concentrations of shorebirds pass through between mid-May and early June. Wading birds, such as snowy egrets, great blue herons, glossy ibis, and green herons, are common during summer months. Saltmarsh sharp-tailed and Nelson's sharp-tailed sparrows nest in high densities at the marsh.

Wells National Estuarine Research Reserve

The Wells National Estuarine Research Reserve, adjacent to the Wells Division of the refuge across the Merriland and Little Rivers, conducts research and education on 1,600 acres of estuarine waters, marshes, shoreland, and adjacent uplands. The Reserve is an overlay of portions of the Upper and Lower Wells divisions. It was established in 1986 as part of the National Estuarine Reserve System "to improve the ecological health of coastal habitats and resources through a unique, integrated program of research, education and resource management."

Water District Lands (Wells and Kennebunk)

The York and Kittery Water Districts own important habitat in the Mount Agamenticus to the Sea Initiative focus area. Their management for water quality and recharge is a great benefit for plants and wildlife in the region. The water district lands are among the most scenic in these towns. The Wells-Kennebunk-Kennebunkport Water District (KKW) is the most important landowner along Branch Brook and the Merriland River. KKW has systematically purchased land for more than 100 years to achieve their mission of providing clean water to their customers. They have taken a lead role in determining 100- and 200-day transport distances, and have based their land conservation on the best information available.

Land Trust and Town Properties

Local land trusts are very active, and have protected thousands of acres of land in the 11 towns. We work closely with the trusts, especially on the wildlife values of proposed acquisitions and stewardship. The Maine Natural Areas Program has combined the Service trust resources identified in the Important Habitats of Southern Maine (USFWS 2001) with plant and wildlife of state significance; this is the reference most frequently used by land trusts to determine habitat values.

USFWS

Chapter 4

Environmental Consequences

- Introduction
- Effects on Water Quality and Soils
- Effects on Air Quality
- Effects on the Local and Regional Economy
- Effects on Public Use Opportunities
- Effects on Cultural Resources
- Effects on Native Wildlife and Their Habitats
- Environmental Justice
- Cumulative Impacts
- Relationship between Short-Term Uses and Long-Term Productivity
- Unavoidable Adverse Effects
- Potential Irreversible and Irretrievable Commitment of Resources

Introduction

This chapter describes the foreseeable environmental consequences of implementing the three management alternatives in chapter 2. When detailed information is available, we present a scientific and analytic comparison between alternatives and their anticipated consequences, which we describe as "impacts" or "effects." When detailed information is not available, we base those comparisons on our professional judgment and experience.

As you read our descriptions of impacts, we ask that you also keep in mind the relative size of the refuge in proportion to the entire Gulf of Maine ecosystem. The refuge now comprises 5,293 acres, a relatively small land base compared to the 26-million-acre ecosystem. We generally describe the direct and indirect environmental effects on a finer, or more local, geographic scale, because those are easier to determine with certainty. However, refuge lands are not isolated units, and our predictions on the extent or duration of impacts may be less accurate when considering their influence on the larger, surrounding landscape. In other words, we may have overstated some effects in their larger geographic context.

Although the refuge composes only 0.02 percent of the ecosystem, we developed all of the alternatives to contribute to conservation goals in a larger, geographic context. Their proposed species and habitat actions are consistent with the state, regional, ecosystem and watershed conservation plans identified in chapter 1. At varying levels, each would contribute positively to that landscape-scale conservation.

When we lack reliable, quantitative information, we use the terms "positive," "negative," and "neutral" as qualitative measures of how an action could impact resources of concern. A positive impact implies an action we predict would enhance or benefit the resources under consideration and help accomplish goals and objectives over the short (<15 years) or long term (>15 years). A negative impact would be detrimental to a resource over the short or long term, possibly affecting our ability to achieve goals and objectives. A neutral impact means either (a) no discernible effect, positive or negative, on the resources under consideration; or, (b) positive and negative effects would cancel each other out.

We analyze and compare each of the three alternatives for their impacts on water quality and soils, air quality, the local and regional economy, public use opportunities, cultural resources, and wildlife and their habitats. Tables 4.1 through 4.6 summarize the effects we predict for each alternative, and present a side-by-side comparison. This chapter also addresses environmental justice and cumulative impacts. Finally, it identifies irreversible or irretrievable commitments of resources and the relationship of short-term uses to long-term productivity.

Effects on Water Quality and Soils

Protecting the water quality and ecological integrity of the tidal rivers and their estuaries along Maine's southern coast requires a partnership among government, civic groups, conservation organizations, and residents throughout the entire watershed. Wetland impacts, including filling for development, are regulated and restricted by local, state, and federal laws. However, they afford the uplands minimal protection. Freshwater wetlands are biologically diverse, and support common and rare species. Not only are upland areas around wetlands vital for sustaining the health of a freshwater wetlands system, but also, contiguous freshwater wetlands and sufficient uplands are vital in maintaining water quality of downstream saltmarsh ecosystems.

Coastal Maine is the most important resource for the tourism and recreation industries in the state (Colgan and Plumstead 1995). Commercial and private development along Maine's

coast continues to increase, with additional development of the waterfront for summer homes, piers, and docks. Direct impacts on coastal habitats include filling, dredging, dragging, riprapping, damming, covering, impounding, scraping, or other physical alterations (Ward 1999). That development, combined with associated human activities, can degrade water quality and remove natural vegetation, resulting in increased soil disturbance and erosion, increased storm water runoff, and changed hydrology patterns. Although individual building projects may appear small and those losses minimal, their cumulative effect is significant, and often diminishes habitat quality for native species.

Stormwater is the water that runs along the ground or through pipes. As that water moves across lawns, driveways, roofs, roads, and parking lots, it collects sediment, bacteria, chemicals, debris, and more, until it finally discharges into fresh water and saltwater habitats. The Casco Bay Estuary Project finds that stormwater may be the single greatest contributor of contaminants in the bay. Nationalwide, stormwater is one of the leading causes of water pollution. The two primary sources of contaminated stormwater are point and non-point source pollution. Point sources carry stormwater through direct, identifiable means such as pipes. Non-point sources include runoff from land or groundwater seepage that enters rivers and estuaries from paved areas, malfunctioning septic systems, and other sources. National studies estimate that non-point source pollution contributes up to 60 percent of stormwater pollutants. The most common sources of pollution from stormwater runoff throughout the refuge include residential development, construction, and roadways. Industrial sites, commercial development, and agriculture also contribute to stormwater runoff near some divisions.

The Pew Oceans Commission, an independent panel, says “oceans are in crisis” (Pew Oceans Commission 2003). The threats include nonpoint source pollution (e.g., oil runoff from streets and driveways and nitrogen release), point source pollution (e.g., waste from feedlots and passenger cruise ships), invasive species, aquaculture (e.g., the accidental escape of fish, nitrogen, phosphorus and fecal matter discharge), coastal development, overfishing, habitat alteration from fishing gear that drags the seafloor, bycatch, and climate change. The commission regards the runoff of excess nitrogen from farm fields, animal feedlots, and urban areas as the greatest pollution threat to coastal marine life. That coastal development and associated sprawl each year destroys or endangers 20,000 acres of coastal wetlands and estuaries that serve as nurseries for fish. “Paved surfaces have created expressways for oil, grease, and toxic pollutants into coastal waters” (Pew Oceans Commission 2003).

At the local level, refuge management can help maintain and improve water quality and soils in several ways: (1) acquire wetlands and associated uplands threatened with development; (2) facilitate the protection by our conservation partners of important coastal habitats; (3) exchange technical information on best management practices with landowners; and (4) restore degraded areas. However, some of the management practices we employ, (such as prescribed fire), have the potential to negatively impact water quality and soils.

In all three alternatives, the refuge will follow carefully designed management plans to prevent or minimize any adverse affects on water quality and soils. Our goal is to restore water quality. We would use wetland restoration techniques according to approved wetlands permits, and restore already degraded ecosystems. We designed trails and parking areas to minimize water quality and soil degradation and maximize interpretive opportunities to build public awareness about protecting those resources.

The boat launch could degrade water quality up and down stream (tidal) through bank or streambed erosion, or introduction of potentially toxic materials. Dormant or unavailable toxins or heavy metals could be in existence in the muddy bottom and could be stirred and

become available to aquatic species. Activities in the vicinity of the launch sites can result in compaction of soils, trampled vegetation and erosion to habitats, especially in riparian zones.

Table 4.1 presents both the beneficial and the potential adverse consequences of our proposed management in the three alternatives.

Table 4.1. The effects of the proposed alternatives on water quality and soils

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Proposed acquisition of the remaining 3,833 acres within the refuge's approved acquisition boundary will permanently protect these lands from development. This protection will eliminate or minimize the impacts of point and non-point pollution and other degradation, protecting water quality and soils long-term on the refuge. We will continue to participate in the Mountain to the Sea Conservation Initiative centered on the York River and work with the Wells National Estuarine Research Reserve and their watershed-based initiatives.	Proposed acquisition of the remaining 3,833 acres within the refuge's approved acquisition boundary and an additional 5,558 acres will permanently protect these lands from development. Alternative B provides a greater ability to eliminate or minimize the impacts of point and non-point pollution and other degradation, protecting water quality and soils long-term on and adjacent to the refuge. We will actively participate as a member of the Board or other Steering Committee for the Mountain to the Sea Initiative, Saco Bay Partners, and Wells National Estuarine Research Reserve and facilitate watershed-wide or multi-town conservation efforts to protect water quality in coastal Maine.	Proposed acquisition of the remaining 3,833 acres within the refuge's approved acquisition boundary and an additional 11,397 acres will permanently protect these lands from development. Alternative C provides the greatest ability to eliminate or minimize the impacts of point and non-point pollution and other degradation, protecting water quality and soils long-term on and adjacent to the refuge. Similar to alternative B, we will be actively involved and help facilitate land conservation efforts in southern Maine.
Salt marsh restoration practices include plugging or filling ditches, changing culverts to restore tidal flow, and restoring pool, panne, and tidal creek habitat. Upland habitat management actions include mowing, burning, hydro-ax, brush-hog, and mechanical, biological, and chemical controls of invasive species according to an Integrated Pest Management Plan.	In addition to the salt marsh restoration actions in alternative A, this alternative includes control of invasive species using Integrated Pest Management. Control methods may include mowing, burning, biological, direct removal, hand pulling, covering, whipping, chipping, or chemical. Upland habitat management in alternative B also includes silvicultural prescriptions to maintain forest habitats.	Salt marsh restoration and upland habitat management same as alternative B.
The habitat management actions in all three alternatives are intended to restore, maintain, and protect water quality.		
We will continue our current management of restricted public use of the refuge, including parking areas and trails, to minimize soil compaction and erosion and prevent runoff and water quality degradation. Some soil compaction will occur from use of public trails on the refuge, but will be offset by "Leave No Trace" outreach program.	We will continue our current management of restricted public use of the refuge, including locating new parking areas and trails, to minimize soil compaction and erosion and prevent runoff and water quality degradation. *(continued on next page)*	Trail impacts are the same as in alternative B.

Table 4.1. The effects of the proposed alternatives on water quality and soils *(continued)*

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
	Some additional soil compaction results from existing and new planned parking areas and trails on refuge lands and on lands proposed for acquisition, but will be offset by "Leave No Trace" outreach program. A new visitor contact station and refuge headquarters will provide enhanced public outreach and environmental education on importance of protecting water quality and other public resources. The boat launch could degrade water quality up and down stream (tidal) through bank or streambed erosion, or introduction of potentially toxic materials. Dormant or unavailable toxins or heavy metals could be in existence in the muddy bottom and could be stirred and become available to aquatic species. Activities in the vicinity of the launch sites can result in compaction of soils, trampled vegetation and erosion to habitats, especially in riparian zones.	
No violations of Federal or State Clean Water Act standards.		

Effects on Air Quality

The release of mercury into the environment has been documented as causing health problems in wildlife and humans. Northern New England and the Canadian Maritime Provinces are subjected to the local, regional, national, and global input of mercury. Historically, 47 percent of the mercury in Maine comes from regional and local sources (Maine Department of Environmental Protection 2002). A research project in 2000 focused on sharp-tailed sparrow nesting ecology, but also sampled blood mercury in a few individuals. Researchers found that salt marsh sparrows captured in the Ogunquit marshes on the refuge showed blood mercury levels comparable to those of tree swallows breeding next to a highly contaminated lake. During limited sampling in 2001, sharp-tailed sparrows at the refuge had the "highest elevated levels of mercury in their blood than any known passerine in the northeast" (Shriver et al. 2002).

The Hubbard Brook Research Foundation released both new and existing information that shows the connections between air emissions of mercury and mercury in fish and other aquatic life (HBRF 2002). HBRF also reported on the impacts of nitrogen pollution from food, wastewater, fertilizers, links between nitrogen pollution and acid rain, air quality, climate change, groundwater contamination, nitrogen saturation in forests, and the eutrophication of coastal waters (Driscoll et al. 2001, 2003). The growing consensus is that global climate change occurs as a result of emissions of carbon dioxide and other greenhouse gases from human activities that may lead to significant impacts across the

United States, including sea-level rise adding stress to coastal communities and ecosystems (Wigley 2004).

Where feasible, refuge activities will help document and remediate the impacts of air pollutants. The refuge positively impacts air quality primarily by protecting natural lands. Natural vegetation and wetlands help offset pollution by acting as filters in the environment. Any potential, negative impacts on air quality from refuge activities are likely to result from using prescribed fire to manage habitat, and attracting visitors in vehicles. Prescribed fires and vehicle emissions directly impact air quality in three principal ways: (1) decreased visbility; (2) increased particulates; and (3) increased pollutants. The State of Maine is addressing vehicle pollutants with programs to reduce automobile emissions. Although refuge visitors' vehicles directly contribute air pollutants, they are not a principal cause of poor conditions. Most refuge visitors are either local residents or summer visitors on vacation in the area.

We project a 66-percent increase in visitation (approximately 200,000 people) with the new administrative complex on the refuge over the next 15 years. Increased visitation and vehicle emissions from all new and existing programs may have long-term negative impacts on air quality. However, that increase in emissions will not have a significant effect on the surrounding residential areas, compared with the urban areas and already high vehicle use nearby. Furthermore, refuge visitation is mostly incidental to other primary destinations.

The new administrative complex would be constructed based on the standard design selection justification. It would be a state-of-the-art active and passive solar facility incorporating various green technologies, such as recycled materials, porous materials for roads and parking, and solar energy. The new energy efficient facility would produce much less air pollution than our current facility.

Visibility and clean air are important natural resource values on the refuge, and their protection 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 in section 118 of the Clean Air Act, as amended (42 U.S.C. 7418). Further guidance can be found in the Fire Management Handbook (USFWS 2001). The plan stipulates the required conditions for prescribed fires, to control their size, minimize or eliminate their impacts on visibility, and reduce their potential for adding particulates and pollutants to the air. All of the required conditions are geared toward minimizing smoke emissions, and follow Best Available Control Technology. The following measures would minimize the impacts on air quality from prescribed fires.

- We would only permit burning if the prevailing wind speed, wind direction, and atmospheric conditions would not create nuisance smoke conditions.

- We would identify and address smoke-sensitive areas in our Annual Prescribed Fire Plan, and select wind vectors that would transport smoke and other particulate emissions away from sensitive areas.

- We would conduct prescribed burning only when mixing heights are greater than 1,500 feet, and ventilation rates (mixing height x transport wind speed) is 7,500 or greater. A minimum transport wind speed of 5 mph is recommended. A daily spot forecast is required, and is obtained from the National Weather Service.

- We would not conduct burns if any government agency has issued an air pollution health advisory, alert, warning, or emergency for the area around the refuge.

- We would use backing and flanking fires, when possible, to minimize particulate emissions.
- We would keep media sources informed of fire and smoke dispersal conditions throughout any fire event.

Offsetting the short-term adverse effects on air quality resulting from our prescribed fire program, the pollution-filtering benefits derived from maintaining those areas in natural vegetation would last in perpetuity.

Table 4.2 compares the expected impacts on air quality under the three alternatives.

Table 4.2. The effects of the proposed alternatives on air quality

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Results in the Service acquiring and protecting 3,833 acres of natural land from willing sellers. While difficult to quantify, Service acquisition of these lands would eliminate the direct and indirect threats to air quality associated with increased development, and would permanently maintain the pollution-filtering effects of natural vegetation.	Compared to alternative A, greater benefits to air quality would result from implementing alternative B since an additional 5,558 acres would be permanently protected from development and would continue to filter air pollutants in perpetuity.	Compared to alternative A, substantially greater benefits to air quality would result from implementing alternative C since an additional 11,397 acres would be permanently protected from development and would continue to filter air pollutants in perpetuity.
Potential for contributing direct and indirect short-duration air pollution from prescribed burning; however implementation would adhere to a Fire Management Plan.	Same as alternative A.	Same as alternative A.
Minor contribution to air pollution from refuge visitor vehicle emissions; however, refuge visitation is mostly incidental to other primary destinations.	Slight increase in vehicle emissions predicted from increased visitation in summer and fall tourist seasons; however, refuge visitation is mostly incidental to other primary destinations. Energy efficient visitor facility would reduce the amount of air pollutants generated from administrative offices.	Greatest increase in vehicle emissions predicted from increased visitation on summer and fall; however, refuge visitation is mostly incidental to other primary destinations.
No violations of Federal or State Clean Air Act standards		

Effects on the Local and Regional Economy

Maine's southern and mid-coast regions grew at almost twice the rate of the rest of the state between 1990 and 1996. The natural beauty and rich resources of the shore and ocean draw people to the coastal counties, where most residents live. That biologically rich area, the most densely populated in Maine, is experiencing continued rapid growth (Trust for Public Land and USFWS 2001). Likewise, the need to conserve its rich, natural biodiversity has attracted the Service efforts in wildlife conservation in this area.

Tourism, with the highest percentage along the coast, also has increased substantially in recent years, and is now significant in the Maine economy. In 2000, nonresident visitors to Maine directly and indirectly generated $8.8 billion in sales of goods and services, more than 116,000 jobs, and $2.5 billion in total payroll (Maine Office of Tourism, www.visitmaine.com). Our projected 66-percent increase in visitation (approximately 200,000 people) over the next 15 years from the new administrative complex on the refuge may increase the total revenue to the local economy somewhat.

We recognize that there may be losses of property tax revenue to the local communities but expect those potential losses to be offset in part, or entirely, by the Refuge Revenue Sharing program. Table 3.2 in chapter 3 lists revenue sharing payments made to towns in fiscal year 2004. In addition, those lands acquired may provide recreational opportunities that may also generate other revenue in the local areas.

Table 4.3 compares the effects of each alternative on the local and regional economy.

Table 4.3. The effects of the proposed alternatives on the local and regional economy

Alternative A *Current Management*	*Alternative B* *Our Preferred Alternative*	*Alternative C*
Protecting the remaining 3,833 acres within the approved acquisition boundary will permanently protect these lands from residential and commercial development, thus limiting the burden of the cost of community services such as schools, fire protection, and police had these lands been developed.	The additional land proposed for acquisition will further reduce costs of community services to the 12 communities affected by the refuge.	This alternative protects the greatest amount of land from development and potentially has the greatest effect of minimizing the costs of community services to the 12 refuge communities for these lands.
No appreciable increases in benefits to local economies from refuge visitation through wildlife-recreation expenditures (see "effects on public use opportunities below).	A modest increase in benefits to local economies from wildlife-recreation expenditures through increased refuge visitation (see "effects on public use opportunities" below).	A moderate increase in benefits to local economies from wildlife-recreation expenditures through increased refuge visitation (see "effects on public use opportunities" below).

Effects on Public Use Opportunities

The "National Survey of Fishing, Hunting, and Wildlife-Associated Recreation" (2001) reveals that 975,000 Maine residents and nonresidents 16 years old and older fished, hunted, or watched wildlife in Maine. Of that number, 376,000 fished, 164,000 hunted, and 778,000 participated in wildlife-watching activities, including observing, feeding, or photographing wildlife (USFWS 2003). The refuge was an important destination for some of that wildlife-dependent recreation.

Nearly 100,000 visitors hiked the 1-mile Carson Trail at the Wells headquarters, one of four developed trails on the refuge. Many times in the summer and fall, the parking lot is full or overflowing. The headquarters trail in Upper Wells is the only refuge trail with an informational kiosk. The 2-mile Cutts Island Trail in Brave Boat Harbor Division has trail signs, but no kiosk or restroom. Carry-in boat access only is available on Chauncy Creek, at the intersection of Cutts Island and Seapoint Roads. Parking is available by verbal agreement with the Town of Kittery. The Goose Fare Brook Trail and overlook offer parking, a short, stone-dust trail, and an interpreted observation platform with auto-focus binoculars. The Bridle Path and Atlantic Way and Ted Wells Trails provide views of refuge habitat in Kennebunk and Saco and Old Orchard Beach. Those trails, located on and near refuge property, are maintained by municipal or private non-profit organizations.

Some activities are not compatible with refuge purposes, and are prohibited on the refuge to protect sensitive habitats and wildlife. Prohibited activities include driving off-road vehicles, camping, building fires, horse-back riding, mountain biking, and collecting any plants or animals not covered by a permit. Table 4.4 compares the effects of each alternative on public use opportunities.

Table 4.4. Effects of proposed alternatives on public use opportunities

Alternative A *Current Management*	*Alternative B* *Our Preferred Alternative*	*Alternative C*
Maintain current access and public use policies on the 10 refuge divisions. The number of hunting permits issued annually is expected to continue to average just over 400 permits. Moody and Biddeford Pool Divisions will continue to be closed to hunting. Bank fishing will continue at the eight designated sites. Wildlife observation, photography and interpretive opportunities will continue primarily at the headquarters Carson Trail. Refuge staff will provide environmental education curriculum material to local schools upon request and as feasible.	Alternative B will increase opportunities for priority wildlife-dependent public uses, especially in wildlife observation and photography, environmental education and interpretation, and hunting. We propose new interpretive signs and kiosks, nature trails, parking areas, and the new acquisitions will provide expanded hunting opportunities. Appreciable increase in visitation in response to increased visitor services and programs, including new visitor contact station and more school groups participating in environmental education programs.	Same as alternative B, with additional access and public use opportunities on the additional lands to be acquired.

Effects on Cultural Resources

In protecting our cultural and historic resources, we are guided by specific executive orders, policies, laws, regulations, standards, and guidelines. Our efforts to protect and manage cultural resources on the refuge will comply with all appropriate legal mandates. We routinely review and assess our actions likely to affect archaeological and historic sites, under the provisions of section 106 of the National Historic Preservation Act. We are continuing our salt marsh restoration as described in alternative B, objectives 1.1 and 4.2. Table 4.5 compares the effects of each alternative on cultural resources.

Table 4.5. Effects of proposed alternatives on cultural resources

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Alternative A does not provide sufficient resources for further cultural resource inventories or studies. Alternative A provides for some additional outdoor recreation planning staff and some improvement in the visitor contact station, enhancing opportunities for cultural resource interpretation and education of known sites.	Same as alternative A.	Same as alternative A.

Effects on Native Wildlife and Their Habitats

The Rachel Carson refuge and the Scarborough Marsh State Wildlife Management Area encompass about 85 percent of all salt marsh habitat in Maine. Residential and industrial development are encroaching on the salt marshes and affecting the integrity of these fragile systems (Trust for Public Land and USFWS 2001). Habitat conversion to urban and suburban uses, agriculture, and gravel pits, and fragmentation from roads and suburbanization are the primary factors affecting biological diversity in southern Maine (Gawler et al. 1996).

In addition to salt marshes, the refuge supports other coastal habitats, including dune grassland, beach, subtidal and intertidal mudflat, marine open water, tidal river, maritime shrubland and upland forest. Those provide critical buffers for the salt marsh, and shelter many aquatic and upland species of conservation concern. Table 4.6 compares the effects of each alternative on native wildlife and their habitats. Table 4.7 (page xx) compares the acreage of each habitat type we will be managing under each alternative.

Thirty-six species of shorebirds have been reported on the Maine coast, primarily staging for long-distance migration. The numbers of migrant shorebirds peak from mid-May to early June and from mid-July to mid-September (Tudor 2000). Shorebirds using the Maine coast face potential impacts from recreational disturbances, oil spills, resource extraction affecting shorebird food supplies, habitat loss to development, predators, and contaminants (Clark and Niles 2000).

The piping plover, federal-listed as threatened and state-listed as endangered, nests above the high tide line on open sand, gravel- or shell-covered beaches, especially on sand spits and blowout areas in dunes. Fifty percent to 75 percent of the Maine piping plover population nests at three sites on or near the refuge, including Crescent Surf Beach, Goosefare Brook, and Marshall Point at Goose Rocks.

The least tern is a state-listed endangered species. In 2003, Crescent Surf Beach hosted the largest nesting colony (157 pairs) of least terns in Maine.

❖ Effects from hunting

Adverse effects on wildlife (waterfowl) populations from hunting are not expected because of the regulations and bag limits set in place by federal and state agencies (USFWS Migratory Bird Office and the Maine Department of Inland Fisheries and Wildlife) that manage the harvest of waterfowl populations. Significant conservation measures and extensive pre- and post-season population monitoring and the institution of Adaptive Harvest Management are safeguards inherent in waterfowl management. Adverse effects on other game species are not expected, because hunting will occur under state regulations. The MDIFW sets harvest limits that take into account game species population data collected by state biologists and wildlife species assessments.

Hunting results in the direct take of the target game up to a daily limit in accordance with state regulations. The direct disturbance of wildlife is expected, as is true for all human-wildlife interactions. Those impacts affect individuals, not populations.

Thirty-six species of shorebirds are reported using the Maine coast primarily as staging areas during long distance migration. The numbers of migrant shorebirds peak from mid-May to early June and from mid-July to mid-September (Tudor 2000), outside hunting seasons. The impacts to wildlife are at a level that will not interfere with wildlife populations. Endangered or threatened species and species of special concern are also present on the refuge. However, no threatened or endangered species are using the areas identified for hunting during hunting seasons. The status of the New England cottontail is being reviewed; its habitat is dense upland thickets. Rabbit hunting is not permitted on the refuge.

❖ Effects from fishing

Some wildlife disturbance is created by fishing activity. Disturbance during the summer is limited waterfowl, shorebirds, aquatic species, marsh and wading birds. The fishing access points have been selected to coincide with existing uses to help reduce any additional impact. Wetlands will be minimally impacted by construction of the pier which would serve to promote this priority use on the site.

The federal-listed threatened and state-listed endangered piping plover and several different species of terns are present during the refuge's fishing seasons. Conflicts are avoided by geographically separating the activities. If fishing activities are in conflict with where plovers nest at this beach, the activity will be curtailed until the young plovers fledge. Most fishing pressure is late in the summer and in the fall after plovers and terns have finished nesting. Other threatened and endangered species may be present but will not be affected by fishing.

❖ Effects from wildlife observation, photography, environmental education, interpretation

Direct disturbance to wildlife is anticipated, as is true for all human/wildlife interactions. Wildlife observation, photography, environmental education, and interpretation occurring on the refuge can only influence the small proportion of the migratory bird populations which are present on the refuge at any one time. The impacts to other wildlife are at a level that will not interfere with wildlife populations. Location of waysides, layout and construction of trails and overlooks will attempt to minimize habitat degradation. There are no threatened and endangered species known to use the areas identified for wildlife observation, photography, environmental education and interpretation.

❖ Effects from the boat launch

Direct disturbance to waterfowl, notably wintering black duck, is likely along the refuge waterways as is disturbance to other waterfowl, wading birds and salt marsh species. Both areas are patrolled and visited frequently by refuge staff. Intense levels of use, should they occur, will result in reexamination of this determination.

In the spring and summer months nesting waterfowl and shorebirds in the immediate area would be affected by launching and paddling. These disturbances, however, would be minimal since restrictions built into execution of this project, i.e. recreational, no-motor boats only, are designed to lessen impacts. Refuge visitors will be inconvenienced by Maine's 9 to 11 foot tidal range.

Refuge visitors could find this activity creates temporary direct disturbance to wildlife and/or habitat which may impact their intended uses. Anglers may take advantage of this launch area to access state-controlled waters. Although the striped bass fishing season is January 1 - December 31, most fishing takes place in the spring and early summer. During peak fishing seasons, any activity can startle or repel fish.

The New England Cottontail occurs in the Spurwink Division and is proposed for listing, however, the rabbit does not occur in the immediate vicinity of the boat launch ramp. Federal-listed threatened piping plover nest on beaches and feed on the mudflats behind the beach, but the birds are not found near either boat launch. Other threatened and endangered species may be present but will not be affected by this activity.

❖ Effects from cultural resource investigations

Direct disturbance to wildlife is anticipated, as is true for all human-wildlife interactions. Permitted activities will be conducted in such a manner as to minimize impacts on wildlife. Due to the short time-period for investigations and the ability to schedule these activities, no negative impacts on populations or habitats are anticipated. Threatened and endangered species may be present but will not be affected by this activity.

❖ Effects from mosquito/fly control

Generally, refuges will not conduct mosquito monitoring or control, but these activities may be allowed under special use permits. When necessary to protect the health of a human, wildlife, or domestic animal population, we will allow management of mosquito populations on National Wildlife Refuge System (Refuge System) lands using effective means that pose the lowest risk to wildlife and habitats.

❖ Effects from research by non-Service personnel

Disturbance to wildlife and vegetation by researchers could occur through observation, banding, and accessing the study area by foot or vehicle. However, standardized special use permit conditions are designed to minimize negative impacts to wildlife, habitat and visitors. The impacts to individual wildlife will not interfere with wildlife populations. It is possible that direct mortality could result as a by-product of research activities. For example, least tern chick mortalities can occur when chicks pile on top of each other and suffer from heat exhaustion and stress. Least terns are territorial and active in nest protection. These birds are easily spooked and will readily fly off their nest when a researcher approaches, even from a long distance. Nest abandonment can leave eggs or chicks vulnerable to heat or predators. Special Use Permit conditions prevent negative impacts on threatened and endangered species.

❖ Effects from skiing and snowshoeing

The impacts to wildlife are at a level that will not interfere with wildlife populations. Impacts to habitat are minimal from travel over snow cover. Endangered and/or threatened species and species of special concern are also present on the refuge but not on trails during winter months.

Table 4.6. Effects of proposed alternatives on native wildlife and their habitats

Alternative A Current Management	*Alternative B Our Preferred Alternative*	*Alternative C*
Proposed acquisition of the remaining 3,833 acres within the refuge's approved acquisition boundary will permanently protect these lands from development and provide habitat for a wide diversity of native wildlife. The biological program priorities would continue to be piping plover and least tern management, salt marsh monitoring, limited fall shorebird surveys, sharp-tailed sparrow ecology, invasive plant evaluation and eradication, shrubland, thicket and grassland management, and rare plant and animal conservation. These priorities would be continued as completely as possible realizing the limitations of current staffing and partners.	Proposed acquisition of the remaining 3,833 acres within the refuge's approved acquisition boundary and an additional 5,558 acres provides a 61-percent increase in the amount of habitat acres protected beyond the current approved acquisition boundary. This alternative will permanently protect these lands from development, further minimize habitat fragmentation, and provide greater buffers to freshwater and saltwater habitats. This alternative expands the protection of habitats around refuge divisions, and creates a new division around the biologically diverse and ecologically significant York River. Alternative B will enhance the quality and sustainability of current biological programs and protect habitats for species of management concern. The protection of coastal habitats, including salt marsh, tidal rivers, and beach-dune, will remain our top priority (Goal 1). We will broaden our understanding and management of other critical habitats and species of concern that use these habitats. The refuge will continue to evaluate and use the most cost-effective and environmentally sound techniques to manage habitats and conserve wildlife and plants. In addition, we will strengthen our biological inventory and monitoring program to allow us to better evaluate our programs and make more informed decisions. Hunting, fishing, wildlife observation, photography, environmental education, interpretation, boat launch, cultural resource investigations, mosquito/fly control, research by non-Service personnel, skiing and snowshoeing will have some impacts on wildlife, but will not affect populations.	Proposed acquisition of the remaining 3,833 acres within the refuge's approved acquisition boundary and an additional 11,397 acres will permanently protect these lands from development, and this is the alternative that affords the greatest protection of habitat and wildlife trust species. The biological program priorities for alternative C are similar to alternative B.

Table 4.7. Comparison of habitats among the three alternatives based on approved and proposed land acquisition

Habitat	*Alternative A Current Management*	*Alternative B Our Preferred Alternative*	*Alternative C*
salt marsh	Manage up to 3,500 acres	Manage up to 3,845 acres	Manage up to 4,045 acres
dune grassland, beach, rocky shore, tidal river, estuary, bay subtidal, and intertidal habitats and open water/mudflat habitat	Manage up to 1,025 acres	Manage up to 1,100 acres	Manage up to 1,200 acres
maritime shrubland/ forest	Manage up to 100 acres	Manage up to 135 acres	Manage up to 385 acres
upland shrubland	Manage up to 500 acres	Manage up to 715 acres	Manage up to 1,215 acres
freshwater wetland and freshwater mudflats/ open water	Manage approximately 450 acres	Manage approximately 1,445 acres	Manage approximately 1,845 acres
grassland	Manage up to 125 acres	Manage up to 1,018 acres	Manage up to 1,218 acres
upland forest	Manage up to 3,700 acres	Manage up to 6,691 acres	Manage up to 10,880 acres
pitch pine bog community and rare plant sites	Manage approximately 10 acres and up to 25 sites	Manage approximately 10 acres and up to 45 sites	Manage approximately 10 acres up to 60 sites

Environmental Justice

In accordance with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," federal agencies must identify and address disproportionately high, adverse effects of their programs, policies, and activities on human health or the environment for minority and low-income populations. After presenting the context of minority and low-income populations in Maine coastal counties, we address environmental justice as it relates to refuge programs.

Maine's 1,305,728 residents are disproportionately white, according to the U.S. Census 2000 (http://quickfacts.census.gov). The refuge lies in two counties that have slightly less (York County) and slightly more (Cumberland County) ethnic diversity than the state as a whole. Cumberland County includes the greater Portland area. See table 4.8 below for details.

Table 4.8. White and minority populations in Maine and two coastal counties

Populations by Percent	*Maine*	*York County*	*Cumberland County*
White	96.9	97.6	95.7
Black or African American	0.5	0.4	1.1
American Indian and Alaska Native	0.6	0.2	0.3
Asian	0.7	0.7	1.4
Hispanic or Latino	0.7	0.7	1.0

Also according to the 2000 national census, 10.9 percent of Maine residents live below the poverty level; the national average is 12.4 percent. Table 4.9 shows the percent of residents living below the poverty level in the same two coastal counties.

Table 4.9. Percent of individual residents living below the poverty level in two coastal counties in southern Maine

	Maine	*York County*	*Cumberland County*
Percent Below Poverty	10.9	8.2	7.9

We are not aware that our land acquisition program has caused any adverse health or economic impacts on any specific populations since its inception; and, we predict no future health risks and no significant changes in industry, taxes, or revenues that might affect residents. We do not expect Service land acquisition to impact disproportionately the health or the environment of minority or low-income populations.

We predict that our proposals for public use and access management would not disproportionately affect minority or low-income residents, regardless of the alternative. Given the refuge's proximity to large, more diverse populations (e.g., Portland) than in other parts of the state, we expect our public use and environmental education and interpretation programs to benefit minority and low-income populations.

We described earlier in this chapter the herbicides and prescribed fires that could have health implications, and we predicted that neither would pose a risk to any population. Both would be used on a limited basis, under strict Service guidelines designed to minimize health and safety risks. We would alert refuge visitors and local residents about those activities, and we feel their risks are negligible, regardless of race or income status. We do not predict any impacts from our proposed wildlife population management program on any human populations.

Cumulative Impacts

Cumulative impacts on the physical, biological, and human environment result from the incremental impact of the proposed actions when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions over a period of time.

This assessment of cumulative impacts includes other agencies' or organizations' actions if they are interrelated and influence the same environment. Thus, this analysis considers the interaction of activities at the refuge with other actions over a larger spatial and temporal frame of reference. We describe the potential, cumulative impacts of the proposed alternatives below.

❖ Air Quality

We expect none of the proposed alternatives to have significant, cumulative, adverse impacts on air quality in coastal Maine or elsewhere in New England. We expect some short-term, local deterioration in air quality from management-ignited prescribed burns and from refuge visitors' automobile emissions. However, prescribed burns would only occur under the stipulations of a Fire Plan completed by the refuge, specifically designed to minimize air quality impacts. The effect of refuge-related activity, as well as other management activities, on overall air quality in the region is relatively insignificant, compared to the contributions of industrial centers, power plants, and non-refuge vehicle traffic.

With our partners, we contribute to improving air quality through cooperative land protection and management of natural vegetation and wetlands. Protecting land from development and maintaining it in natural vegetation or as natural wetlands ensures those areas will continue to filter out many air pollutants harmful to humans and the environment.

❖ Soils, Hydrology, Wetlands, and Water Quality

A cooperative, watershed-level approach to protecting and managing these resources offers the greatest opportunity to cumulatively improve conditions. We work closely with the Wells National Estuarine Research Reserve, local communities, regional land trusts, and other Gulf of Maine Partners to protect and maintain soils, hydrology, wetlands, and water quality in the watersheds of southern coastal Maine. Chapter 5 lists the many conservation partners we work with on watershed conservation initiatives.

We can contribute to watershed protection in several ways: acquire critical uplands and wetlands threatened with development; support local communities and land trusts in their conservation; and provide technical information and public outreach to landowners and the public on best management practices for protecting watershed resources.

Alternatives A, B, and C all propose to continue our acquisition of the 3,833 acres from willing sellers in the approved refuge acquisition boundary. Alternatives B and C propose the acquisition of an additional 5,558 acres and 11,397 acres, respectively. Both include protecting the biologically diverse and ecologically sensitive York River. Appendix A describes in detail the land acquisition proposal in alternative B, our preferred alternative.

Each of the alternatives proposes various levels of participation in ongoing, watershed-based land protection partnerships. All of the alternatives propose increasing private-public land partnerships, primarily to share technical information on restoration, habitat management, etc. When combined with actions by other federal, state, and local

organizations working in coastal Maine, we expect all of the alternatives to have a positive cumulative effect on soils, hydrology, wetlands, and water quality in their respective watersheds.

❖ Biological Resources

All of the alternatives are intended to maintain or improve biological resources on the refuge, in coastal Maine, and within the Gulf of Maine ecosystem. The combination of our management actions with those of other organizations could result in significant, beneficial cumulative effects by (1) increasing protection and management for federal- and state-listed threatened or endangered species, (2) protecting uplands and wetlands habitats that are regionally declining, and (3) reducing invasive, exotic plants and animals.

Since 2000, the refuge has assumed the primary responsibility for monitoring piping plover at several sites on and off the refuge. That involves working cooperatively with private landowners, Maine Audubon Society, state partners, and the Wells National Estuarine Research Reserve to protect nesting plovers on their lands. The three alternatives propose varying levels of increased protection and management of plover and least tern nests on coastal beaches.

We used the Bird Conservation Region plans, Partners in Flight, shorebird, waterbird and waterfowl plans, The Nature Conservancy Ecoregion plans, and state wildlife and natural heritage programs in determining the highest resource priorities for the refuge to protect and manage. That process allows the refuge to focus its conservation and management actions on those resources of concern that are both regionally and locally important. We expect positive cumulative impacts on Neotropical migratory birds, waterfowl, fish, and other wildlife and their habitats from refuge actions.

❖ Cultural Resources

We expect none of the alternatives to have significant adverse cumulative impact on cultural resources in Maine. Beneficial impacts would accrue at various levels, depending on the alternative, because of our proposed environmental education and interpretation programs and increased field surveys to identify and protect any sites discovered.

We conducted an archaeological assessment in 1995 to determine the presence or likelihood of historical features on the refuge. Few areas or resources were identified and, since then, only one tract acquired by the refuge had known historical resources.

Under all of the alternatives, management practices on the refuge would consider potential historical resources. Projects requiring excavation are sampled using test pits in the affected area before work begins. Our regional archaeologist reviews annual prescribed burn plans before we implement them and, even then, we select methods to avoid impacts on any resources. We also need to resolve various interpretations of what constitutes a historical resource.

❖ Human Resources

We expect none of the alternatives to have significant, adverse, cumulative impacts on the economy of coastal Maine. Although federal land acquisition reduces property tax revenue, it compensates affected towns with refuge revenue sharing payments, and should also reduce the costs of community services. Also, the acquisitions we propose make up only a small portion of any town. We expect increased refuge visitation and increased tourism to bring additional revenues to local communities, but we do not predict a significant increase in overall revenue in any area.

Alternatives B and C will increase opportunities for priority, wildlife-dependent, public uses, especially in wildlife observation and photography, environmental education and interpretation, and hunting. All three alternatives include a proposal for a new, expanded visitor contact station.

Relationship Between Short-Term Uses and Long-Term Productivity

This section evaluates the relationship between local, short-term uses of the human environment and maintaining long-term productivity of the environment. By long-term, we mean that the impact would extend beyond the 15-year planning horizon of this draft CCP/EA. Short-term means less than 15 years.

All of the alternatives strive to maintain or enhance the long-term productivity and sustainability of natural resources on the refuge. To varying degrees, they propose actions that promote watershed- or ecosystem-wide partnerships aimed at identifying and protecting important coastal habitats. The alternatives strive to protect our federal trust species and the habitats they depend on, evidenced by the limits on public access during certain seasons and in some locations. All three alternatives would maintain the plover and tern protection strategies that have successfully protected those nesting bird populations from human disturbance. Environmental education and interpretation are priorities in each alternative, to encourage refuge visitors and neighbors to support and participate in environmental stewardship.

All of the alternatives propose stepped-up outreach and enforcement to prevent inappropriate, incompatible uses, such as horseback riding, driving ATVs, or dragging boats through the salt marsh. Their purpose is to reduce impacts on wildlife and habitats and enhance the long-term productivity of those sites. Although the intent is the same, alternative A would not provide the staffing or funding levels to ensure that those uses can be eliminated.

The construction of new refuge facilities, such as a visitor contact station, trails, observation platforms, and kiosks, will result in both short- and long-term impacts on soils and vegetation. Those would be localized, confined to the immediate construction sites. The new refuge facilities will provide greater environmental education and interpretation, leading to a more positive land ethic among visitors and surrounding communities. In summary, we predict that all of the alternatives would contribute positively to maintaining or enhancing the long-term productivity of the environment of coastal Maine.

Unavoidable Adverse Effects

Unavoidable adverse effects are those that could cause significant harm to the human environment and cannot be avoided, even with mitigation measures. We considered property tax losses to towns, increased visitation, and prescribed fire as the principal activities that could have unavoidable adverse effects. We described losses in property tax revenue to towns in "Effects on the Local and Regional Economy," above. Although the impact on individual towns varies, none of the alternatives would contribute to a significant cumulative loss in any one town. Enhanced services and facilities for refuge visitors will draw more people to the area; in particular, we are predicting more groups will attend our increased environmental education and interpretive programs. Even under a carefully designed program, increased visitation would cause higher levels of disturbance to wildlife, although most of those in localized areas. We intend to manage our visitor use programs to minimize those effects. Because the impacts from prescribed burning would impact visual quality for a short time each year, and will be implemented under conditions that comply

with the state Clean Air Act and federal EPA standards, we predict their effects would not be significant.

We will undertake biological monitoring as part of all alternatives, to enable our staff to adapt management actions and address any unforeseen situations. As a result, none of the alternatives would result in any significant unavoidable, adverse environmental impacts.

Potential Irreversible and Irretrievable Commitment of Resources

Except perhaps in the extreme long term or under unpredictable circumstances, irreversible commitments of resources cannot be reversed. One example is an action that contributes to the extinction of a species. Once extinct, it can never be replaced.

By comparison, irretrievable commitments of resources can be reversed, given sufficient time and resources; but, they represent a loss in production or use for a period of time. One example is the maintenance of forest and shrubland as open field and grasslands. If for some reason grasslands no longer were an objective, they would gradually revert to shrub land and forest, or plantings could expedite that process.

The alternatives propose only a few actions that would irreversibly commit resources. One is committing land to the construction of the proposed new refuge headquarters and visitor contact station. All of the alternatives propose that action. Once we have selected a construction site, a separate environmental assessment will evaluate its site-specific impacts.

Another example is Service land acquisition. Alternatives A, B, and C all propose increasing levels of refuge expansion. Once those lands become part of the refuge, their reversion to private ownership is unlikely. However, once placed in public ownership in the Refuge System, they will provide a new set of benefits to a much broader group of people. Those benefits include watershed protection, wildlife conservation, the preservation of rural character and the expansion of wildlife-dependent recreational uses. Our proposed management of the refuge will result in irretrievable and irreversible commitments of staffing and funding for the acquisition and stewardship of refuge lands.

USFWS

Chapter 5

Consultation and Coordination with Others

- Public Involvement Summary
- Land Conservation Partners
- Rachel Carson NWR CCP Planning Team

Public Involvement Summary

Effective conservation usually begins with effective community involvement. To ensure that our future management of the refuge considers the issues, concerns, and opportunities expressed by the public, we used a variety of public involvement techniques in our planning process.

- We kept updated mailing lists of refuge neighbors, friends, professional contacts and others to share information and updates about this CCP.

- In May and June 1998, we invited visitors to discuss current refuge operations and the planning process at a series of morning coffees. We sent four press releases about the CCP to 15 newspapers in Maine and New Hampshire, and ran notices on local public access cable stations. The York County Coast Star, southern Maine's primary local newspaper, raised public awareness by publishing a long article about our refuge planning. We designed and distributed leaflets about the morning coffees and our upcoming Issues Workbook.

- In summer 1999, we distributed nearly 500 12-page Issues Workbooks, the backbone of this plan's important public participation component. Those workbooks provided background information about the planning project and a means for the public to share its concerns and thoughts about important refuge issues. A refuge volunteer tallied the responses in the more than 100 workbooks returned. In July 1999, we sent a summary of those responses to our CCP mailing list, and also distributed it from the refuge office.

- Several information-gathering workshops in 1999 included a gathering of the extended planning team in March, a meeting on public use and community goals in June, and a meeting on biological resources, also in June. Our facilitated, all-day Alternatives Workshop gathered 15 stakeholder representatives in August. Refuge staff and 10 observers, including congressional representatives and Service administrators, and assisted those participants with setting goals in the topical areas of wildlife, community, public use, and water quality. We mailed a complete summary of the comments and the materials the workshop generated to participants and observers soon after.

- Refuge planning team members met several times each month to synthesize information and prepare the CCP, and briefed our Regional Office in September 1999.

- As part of the CCP process we have been working with our Maine Field Office to evaluate potential impacts of our proposed management to threatened or endangered species. An intra-service Section 7 biological evaluation form will be completed for the final CCP and included as an appendix.

- This draft CCP is now available for public review and comment, providing you another opportunity to discuss issues and offer solutions. Those interested will have 60 days to comment.

The refuge manager and staff will use this plan to guide their decisions on managing the refuge during the next 15 years. The plan also conveys our refuge management direction to other agencies, groups, and individuals. We must formally revise it every 15 years, or sooner, if the Secretary of the Interior determines that conditions affecting the refuge have changed significantly. We will monitor the results of our actions under this plan to ensure that our decisions accomplish the strategies and directions it conveys, and will use the data we collect in routine inspections or program evaluations to continually update and adjust our management activities.

Land Conservation Partners

Conserving wildlife habitat in southern coastal Maine requires partnerships. Some of our land conservation partners and refuge conservation stakeholders appear below.

❖ Biddeford Pool Improvement Association

Mission.—Hold property and easements for conservation and preservation for the benefit of the general public.

❖ Cape Elizabeth Land Trust (CELT)

CELT is a nonprofit organization dedicated to the preservation of open spaces for the benefit of its citizens.

❖ The Conservation Fund

The fund forges partnerships to preserve our nation's outdoor heritage: America's legacy of wildlife habitat, working landscapes and community open space. It pioneers a unique brand of conservation driven by effectiveness, efficiency, and environmental and economic balance.

❖ Friends of Rachel Carson NWR

Mission.—Support refuge acquisition funding; assist in the pursuit of acquisitions; increase public awareness of the needs and benefits of the refuge; provide monitoring of refuge divisions; comment on refuge activities; identify other, similar areas that warrant the same type of protection; assist in refuge projects as they arise; identify means and locations for education and the visitor center.

❖ Great Works Regional Land Trust

Mission.—Protect wildlife habitat, open space, and agricultural, forestry, recreational, and historic properties.

❖ Kennebunk Land Trust

Mission.—Acquire, receive, and administer property, easements, and funds to establish protected or unmanaged natural preserves and other appropriate areas for the promotion and advancement of conservation and education.

❖ Kennebunkport Conservation Trust

Mission.—Acquire undeveloped lands in our community so they might remain in their natural state forever and provide retreats in an increasingly urbanized society.

❖ Kittery Land Trust

Mission.—Preserve land through voluntary cooperation with landowners, educate the public on land preservation and conservation, and facilitate family estate planning through the use of land trust practices and options.

❖ Laudholm Trust

Mission.—Provide resources and enable the Wells National Estuarine Research Reserve to serve as a research and education site and a passive recreational preserve by raising and allocating funds; aid in protecting the preserve's estuaries and other estuarine areas to the extent resources permit.

❖ Maine Audubon Society

Mission.—Dedicated to the protection, conservation, and enhancement of Maine's ecosystems through the promotion of individual understanding and actions.

❖ Maine Coast Heritage Trust

Mission.—Protect the shoreline and islands that define the character of Maine and enhance the well-being of its communities.

❖ Mt. Agamenticus to the Sea Conservation Initiative (MtA2C)

MtA2C brings together 10 national, regional and local conservation partners to conserve a mosaic of critical, threatened lands, waterways and working landscapes encompassing a six-town area stretching from the Tatnic Hills in Wells to Gerrish Island in Kittery Point.

❖ National Park Service Rivers and Trails

The Rivers, Trails, and Conservation Assistance Program, also known as the Rivers & Trails Program or RTCA, is a community resource of the National Park Service. Rivers & Trails staff work with community groups and local and state governments to conserve rivers, preserve open space, and develop trails and greenways.

❖ The Nature Conservancy

Mission.—Preserve plants, animals, and natural communities that represent the diversity of life in Maine and on Earth by protecting the lands and water they need to survive.

❖ Saco Bay Partners

A regional coalition of organizations dedicated to the conservation of land, water and other natural resources in the Saco Bay watershed.

❖ Saco Land Trust

Mission.—Preserve scenic, historic, recreational and environmental resources in the Upper Sandy River watershed by acquiring interests in land; protect open space, scenic area water quality, wildlife, and plant habitat for the public good.

❖ Saco Valley Land Trust

Preserve scenic, historic, recreational and environmental resources in the Biddeford, Saco, and Old Orchard Beach area by acquiring interests in land; protecting open space, scenic areas and water quality, wildlife, and plant habitat for the public good.

❖ Scarborough Land Conservation Trust

Its mission continues to be the acquisition, preservation, and management of unique land in Scarborough for the benefit and enjoyment of the public.

❖ State of Maine Department of Inland Fisheries and Wildlife

Mission.—Protect and enhance the state's inland fisheries and wildlife; provide for the wise use of those resources.

❖ The Trust for Public Land

Mission.—Conserve land for people to improve the quality of life in our communities and protect our natural and historic resources for future generations.

❖ Wells National Estuarine Research Reserve

Mission.—Improve the ecological health of coastal habitats and resources through a unique, integrated program of research, education, and resource management.

❖ York Land Trust, Inc.

Mission.—Promote the protection of natural resources for the benefit of the general public–and for future generations.

❖ York Rivers Association

The York Rivers Association is a group of local citizens committed to raising awareness of the character of the York River region among area residents and landowners. Their mission is to protect and enhance the natural, scenic, and historic qualities of the York River, and instill a sense of stewardship and ownership among all.

Rachel Carson NWR CCP Planning Team

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Glossary

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Female bobolink

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.]

aggregate — many parts considered together as a whole

agricultural land — nonforested land that is now or recently in orchards, pastures, crops, or other farm products

alternative — a reasonable way to fix an identified problem or satisfy a stated need [40 CFR 1500.2]

amphidromous fish — fish that can migrate from fresh water to the sea or the reverse, not only for breeding, but also regularly at other times during their life cycle

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 to be appropriate as specified in section 1.11 of the act.

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 that 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

aquifer — a formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs

area-sensitive species — species that require large areas of contiguous habitat

assemblage — in conservation biology, a predictable and particular collection of species within a biogeographic unit (e.g., ecoregion or habitat)

barrens — a colloquial name given to habitats with sparse vegetation or low agricultural productivity

basin — the land surrounding and draining into a water body

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; 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

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 biological processes that shape genomes, organisms and communities

bog — a poorly drained area rich in plant residues, usually surrounded by an area of open water, and having characteristic flora; a type of peatland

breeding habitat — habitat used by migratory birds or other animals during the breeding season

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 — species for which we have sufficient information on file about their biological vulnerability and threats to propose listing them as threatened or endangered

catadromous fish — fish that spend most of their lives in fresh water, but migrate to sea to reproduce

categorical exclusion[CE, CX, CATEX, CATX] — pursuant to the National Environmental Policy Act (NEPA), a category of Federal agency actions that do not individually or cumulatively have a significant effect on the human environment [40 CFR 1508.4]

CFR — the Code of Federal Regulations

Challenge Grant Cost Share Program — a Service administered grant program that provides matching funds for projects supporting natural resource education, management, restoration, or protection on Service lands, other public lands, and private lands

citizen monitoring projects — projects coordinated locally to conduct environmental inventories; their data expand what agencies know, and are available to anyone interested

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 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 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]

conifer — a tree or shrub in the phylum Gymnospermae whose seeds are borne in woody cones. There are 500–600 species of living conifers

conservation — managing natural resources to prevent loss or degradation; includes 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 legal agreement between a landowner and a land trust (e.g., a private, nonprofit conservation organization) or government agency that permanently limits the uses of a property to protect its conservation values. 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.

cool-season grass — introduced grass for crop and pastureland that grows in spring and fall and is dormant during hot summer months

cooperative agreement — a usually long-term habitat protection action, which can be modified by either party, in that no property rights are acquired. Lands under a cooperative agreement do no 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; 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

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

designated wilderness area — an area designated by Congress as part of the National Wilderness Preservation System [FWS Manual 610 FW 1.5 (draft)]

diadromous — fish that migrate from freshwater to saltwater or the reverse; a generic term that includes anadromous, catadromous, and amphidromous fish

digitizing — the process of converting maps into geographically referenced electronic files for a geographic information system (GIS)

disturbance — any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment

division — an administrative unit of the refuge defined by a geographic feature, usually a river or other body of water

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

drumlin — a ridge or oval hill with a smooth summit composed of material deposited by a glacier

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]. 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.

ecological processes — a complex mix of interactions among animals, plants, and their environment that ensures maintenance of an ecosystem's full range of biodiversity. Examples include population and predator-prey dynamics, pollination and seed dispersal, nutrient cycling, migration, and dispersal

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 socioeconomic 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; this concept considers interactions among the plants, animals, and physical characteristics of the environment in making decisions about land use or living resource issues

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

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 [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 [40 CFR 1508.11]

estuaries — deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from land

estuarine wetlands — includes deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land

exemplary community type — an outstanding example of a particular community type

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

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

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

Federal-recognized Native American Tribe — A group of Native American Indians recognized by the United States as an Indian Tribe. This recognition establishes a tribe as an entity with the capacity to engage in government-to-government relations with the United States, or individual states, and also as one eligible to receive federal services. Federal recognition is established as a result of historical and continued existence of a tribal government; by Executive Order or Legislation; and through the federal recognition process recently established by Congress.

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).

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 within a given ecoregion or habitat

fish passage project — providing a safe passage for fish around a barrier in the upstream or downstream direction

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

forbs — flowering plants (excluding grasses, sedges, and rushes) that do not have a woody stem and die back to the ground at the end of the growing season

forest association — the community described by a group of dominant plant (tree) species occurring together, such as spruce-fir or northern hardwoods

forest land — land dominated by trees

forested wetlands — wetlands dominated by trees

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.

GAP analysis — the use of various remote sensing data sets to build overlaid sets of maps of various parameters (e.g., vegetation, soils, protected areas, species distributions) to identify spatial gaps in species protection and management programs

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.]

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

grassland — a habitat type with landscapes dominated by grasses

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. 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 where a particular type of plant or animal lives. 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 judgment, were present prior to substantial human-related changes to the landscape

hydrologic or flow regime — characteristic fluctuations in river flows

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, that 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.

indigenous — native to an area

indigenous species — a species that, other than as a result of an introduction, historically occurred or currently occurs in a particular ecosystem

informed consent — "the grudging willingness of opponents to go along with a course of action that they actually oppose."—Bleiker

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

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

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]. A CCP should document, describe, and analyze issues even if they cannot be resolved during the planning process (FWS Manual 602 FW 1.4).]

kettle hole — a generally circular hollow or depression in an *outwash plain* or *moraine*, believed to have formed where a large block of subsurface ice has melted

keystone species — species that are critically important for maintaining ecological processes or the diversity of their ecosystems

lacustrine wetlands — includes wetlands and deepwater habitats with all of the following characteristics.

1. situated in a topographic depression or a dammed river channel;

2. lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and

3. total area exceeds eight ha (20 acres)

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, that 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 — an aggregate of landforms, together with its biological communities

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 plan — a plan that guides future land management practices on a tract.

management strategy — a general approach to meeting unit objectives. 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).

mesic soil — sandy-to-clay loams containing moisture retentive organic matter, well drained (no standing matter)

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 wetland or creates a new wetland.]

moraine — a mass or ridge of earth scraped up by ice and deposited at the edge or end of a glacier

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 (40 CFR 1500).]

National Wildlife Refuge Complex (Complex) — an internal Service administrative linking of refuge units closely related by their purposes, goals, ecosystem, or geopolitical boundaries

National Wildlife Refuge System (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 for the protection and conservation of fish and wildlife, including those that are threatened with extinction

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

Neotropical migrant — birds, bats, or invertebrates that seasonally migrate between the Nearctic and Neotropics

non-consumptive, wildlife-oriented recreation — wildlife observation and photography and environmental education and interpretation

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]

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

old fields — areas formerly cultivated or grazed, where woody vegetation has begun to invade

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

outwash plain — the plain formed by deposits from a stream or river originating from the melting of glacial ice that are distributed over a considerable area; generally coarser, heavier material is deposited nearer the ice and finer material carried further away

palustrine wetlands — 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 percent

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

payment in lieu of taxes — see Revenue Sharing Act of 1935, Chapter One, Legal Context

pelagic — living in the water column, well above the bottom and some distance from land, as do oceanic fish or birds (contrast *demersal* and *benthic*)

phytoplankton — the ensemble of tiny plants that float or drift in marine waters. These tiny plants can produce such dense blooms in the Gulf of Maine that they turn our waters green. Phytoplankton are the base of the food chain on which ultimately most shellfish, fish, birds, and marine mammals depend (the exceptions being those that feed mostly on detritus from benthic plants). (See also *Zooplankton.*)

point source — a source of pollution that involves discharge of waste from an identifiable point, such as a smokestack or sewage-treatment plant

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 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

public — individuals, organizations, and non-government groups; officials of Federal, State, and local government agencies; Native American tribes, and foreign nations

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

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

Record of Decision — (ROD) a concise public record of a decision by a Federal agency pursuant to NEPA. 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

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

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; such as reestablishing habitat for native plants and animals

restoration ecology — the process of using ecological principles and experience to return a degraded ecological system to its former or original state

riparian — referring to the interface between freshwater habitats and the terrestrial landscape

riparian agricultural land — agricultural land along a stream or river

riparian forested land — forested land along a stream or river

riparian habitat — habitat along the banks of a stream or river

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

runoff — water from rain, melted snow, or agricultural or landscape irrigation that flows over a land surface into a water body

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

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

shrublands — habitats dominated by various species of shrubs

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.]

source population — a population in a high-quality habitat where the birth rate greatly exceeds the death rate, and the excess individuals emigrate

special focus area — an area of high biological value. We normally direct most of our resources to special focus areas that were delineated because of

1. 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;
2. their importance as migrant landbird stopover or breeding habitat;
3. the presence of unique or rare communities; or
4. the presence of important fish habitat

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 species being considered for Federal listing as threatened or endangered (formerly, a "candidate species")

species of concern — species not Federal-listed as threatened or endangered, but about which we or our partners are concerned

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

State agencies — natural resource agencies of State governments

State land — State-owned public land

State-listed species — see "Federal-listed species"

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

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 wellbeing, and the need for humans to live on the income from nature's capital rather than the capital itself."

telecommunications — communicating via electronic technology

telecommunications project — any cooperative venture that combines financial and staff resources to develop and use computer-based applications for exchanging information about a watershed with others

terrestrial — living on land

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. 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.

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

unfragmented habitat — large, unbroken blocks of a particular type of habitat

unit objective — desired conditions that must be accomplished to achieve a desired outcome. 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)

upland meadow or pasture — upland pastures are areas maintained in grass for livestock grazing; upland meadows are hay production areas. Meadows may occur naturally in tidal marshes and inland flooded river valleys or, more frequently, at upland sites where vegetation has been cleared and grasses planted. Eventually, meadows will revert to old fields and forest if they are not mowed, grazed, or burned. Grasses in both managed meadows and pastures usually are similar, but pasture herbs often differ because of selective grazing.

upwelling — a process whereby nutrient-rich waters from the ocean depths rise to the surface; it commonly occurs along continental coastlines

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 — depressions holding water for a temporary period, usually in the spring, and in which various amphibians lay eggs

vision statement — a concise statement of what the unit could achieve in the next 10 to 15 years

warm-season grass — native grass that grows the most during summer, when cool-season grasses are dormant

watchable wildlife — all wildlife is watchable. 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.

well protected — in CCP analysis, a rare species or community type is considered well protected if 75 percent or more of its occurrence sites are on dedicated open space

wet meadows — meadows located in moist, low-lying areas, often dominated by large colonies of reeds or grasses. Saltmarsh meadows are subject to daily coastal tides.

wetlands — lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. These areas are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted to life in saturated soil conditions.

wilderness study areas — lands and waters identified by inventory as meeting the definition of wilderness and being evaluated for a recommendation they be included in the Wilderness System. 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 human 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)].

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 interpretation."—National Wildlife Refuge System Improvement Act of 1997].

working landscape — the rural landscape used for agriculture, forestry, or fishing all contribute to the working landscape.

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USFWS

Moose

Appendix A

Draft Land Protection Plan

- Introduction
- Project Area Description
- Status of Resources to be Protected
- Our Proposed Action
- Protection Options Considered
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I. Introduction

This draft Land Protection Plan (LPP) provides detailed information about our proposal to expand Rachel Carson National Wildlife Refuge along the southern Maine coast. The refuge is part of the National Wildlife Refuge System (Refuge System) administered by the U.S. Fish and Wildlife Service (Service, we, our). We are distributing this plan for a 30-day period for public review and comment. Our main audience is affected landowners, interested individuals, organizations, federal and state agencies, and local officials. The comments we receive will help our Regional Director select among the alternatives for the final CCP. Once it has been approved, this LPP will allow us to acquire from willing sellers 5,558 acres of nationally significant wildlife habitat.

The purposes of this LPP are, to

- inform affected landowners and other interested parties about the resource protection needs, location, size, and acquisition priority of those 5,558 acres of nationally significant wildlife habitat;
- inform owners of land in our current, approved acquisition boundary that we are interested in acquiring that land, and remind them of our policies, priorities, options, and methods for protecting it;
- inform landowners whose properties we propose for acquisition about our policies, priorities, options, and methods for protecting their lands; and,
- inform them about our long-standing policy of acquiring land only from willing sellers,
- removes land from our current approved refuge boundary that is no longer suitable for Service acquisition.

The 5,558 acres we propose to acquire are considered nationally significant, under a set of biologically based criteria for identifying and mapping habitat for Service trust resources. Those lands now lack permanent, long-term protection by a conservation organization or agency. We believe their high natural resource values merit their inclusion within the Refuge System. As the Service acquires those lands, we will manage them for their wildlife resources, emphasizing the protection of such federal trust resources as federal-listed endangered or threatened species and migratory birds.

II. Project Area Description

❖ Existing Refuge Lands

The refuge lies along 50 miles of coastline in York and Cumberland counties in southern Maine, in the heart of the Gulf of Maine watershed, a region of great biological diversity. The refuge comprises 10 divisions in the towns of Cape Elizabeth, Scarborough, Old Orchard Beach, Saco, Biddeford, Kennebunkport, Kennebunk, Wells, Ogunquit, York, and Kittery. Those divisions include the following acreage we own outright or in easement.

- Brave Boat Harbor Division: 748 acres; Towns of Kittery and York
- Moody Division: 403 acres; Towns of Ogunquit and Wells
- Lower Wells Division: 1,003 acres; Towns of Wells and Kennebunk
- Upper Wells Division: 667 acres; Town of Kennebunk
- Mousam River Division: 516 acres; Towns of Kennebunk and Kennebunkport

- Goose Rocks Division: 542 acres; Town of Kennebunkport
- Little River Division: 266 acres; Towns of Kennebunkport and Biddeford
- Biddeford Pool: 126 acres; Town of Biddeford
- Goosefare Brook: 502 acres; Towns of Saco and Biddeford
- Spurwink River: 520 acres; Towns of Scarborough and Cape Elizabeth

Each of the divisions was established for the protection and conservation of migratory birds, and each protects a tidal river or an estuary resource. We have yet to acquire 3,833 acres in our 9,126-acre approved refuge acquisition boundary.

❖ Biological Significance

Distributed at the mouths of more than a dozen tidal rivers and their watersheds, the refuge occupies a crucial place in this increasingly developed, fragmented region where the rivers meet the sea. Refuge estuaries provide nurseries for many marine fish. Its tidal rivers provide pathways for fish moving upstream and downstream to spawn. Fifty-five species of fish live in refuge estuaries and streams, including American eel, alewife, and blueback herring. The federal-listed shortnose sturgeon once may have lived in the York River.

The diverse aquatic and upland habitats on the refuge support breeding, migrating and wintering birds, and provide essential habitat for threatened or endangered species. Fifty percent to 75 percent of the Maine piping plover population nests on or near the refuge. Its coastal habitats include rocky and sandy shores, rivers, beaches, salt marshes, mudflats, and salt pannes. The Wells and Ogunquit marshes form the second largest salt marsh complex in the state, and have been identified as a focus area of statewide conservation significance.

Refuge salt marshes, mudflats, and salt pannes provide nesting, feeding, and staging habitat for more than 45 species of shorebirds and wading birds. The American black duck is the most common wintering waterfowl species, and can be found on open water on every marsh and river. Thousands of other waterfowl winter on the refuge, including common eider, scoter, bufflehead, common goldeneye, and common loon.

Lands on or near the refuge provide food and habitat for more than 250 species of birds. Maine Audubon and the State of Maine designated parts of the refuge an Important Bird Area: a place that supports habitat for rare or threatened species, a diverse assemblage of birds, or large concentrations of birds. Its upland forests of oak, hemlock, red spruce, pitch pine, and white pine and early successional grasslands and shrublands support such migrating birds—for which the refuge was established—as warblers, thrushes, and other songbirds, where they revitalize themselves in route to or from northern breeding areas.

❖ Current Acquisition Boundary

Maps A–1 through A–6 depict lands owned by the refuge and the current approved acquisition boundary. We reviewed the current approved acquisition boundary to identify lands that are no longer suitable for Service acquisition. Table A.1 provides a summary of the privately owned lands within the boundary and the privately owned lands to be removed from the boundary. Appendix I provides a list of the privately owned lands within the boundary.

Table A.1. A summary of lands still in private ownership within the approved refuge boundary

Mainland Division	Private Land Tracts		Private Land Tracts to be Removed		New Total of Land Within Approved Refuge Boundary
	Parcels	Acres	Parcels	Acres	
Brave Boat Harbor	51	267	1	11	256
Moody	122	59	3	15	44
Lower Wells	51	421	3	13	408
Upper Wells	80	980	4	4	976
Mousam River	35	346	3	4	342
Goose Rocks	95	339	?	11	328
Little River	47	233	8	39	194
Biddeford Pool	129	282	62	33	249
Goosefare Brook	27	94	N/A	0	94
Spurwink River	41	812	17	34	778
Total	678	3,833	101	164	3669

❖ Proposed Expansion Lands

Our proposal expands by 5,558 acres the Service acquisition of significant wetland and upland migratory bird habitat (maps A–1 through A–6). All of the land we acquire will become part of the refuge.

The Service identified important fish and wildlife habitats in southern Maine with geographic information system (GIS) habitat suitability models: an innovative and biologically sound approach to protecting habitat. The expansions below will contribute significantly to the conservation of federal trust resources in coastal Maine. They will also enhance opportunities for public use, including wildlife observation, interpretation, nature photography and recreational hunting. Our proposal focuses on expanding the 10 divisions and creating a new division around the highly significant York River.

York River—2,211 acres

The 23-square-mile York River watershed, an area of concern in southern Maine, lies in the Mt. Agamenticus (Mt. A.) conservation planning area. The Mt. Agamenticus to the Sea initiative forms a partnership among state, federal and local groups to conserve the largest unfragmented block of coastal wildlife habitat between Portland and the New Jersey Pine Barrens. It harbors 24 rare plant species and 11 rare animal species in a center of biological diversity in Maine. The proposed York River Division will build upon the 7,000 acres of habitat now conserved in public or quasi-public ownership by linking our Brave Boat Harbor Division through the York River to Mt. A. conservation lands.

That new division will provide a corridor of wildlife habitat from the mountain to the sea. The tidal portion of the York River extends from York harbor inland about 5 miles, then widens to encompass a salt marsh dominated by cordgrass and needle rush. A white pine-red oak forest with some pitch pine and red maple, containing patches of shrubland, grassland, and freshwater wetland, borders the salt marsh.

The refuge identified habitats in the York River watershed that support federal trust resources, and is working with conservation partners, local communities, and landowners to protect it. We propose to create the York River Division by acquiring the most significant 2,211 acres of that wildlife habitat: contiguous and disjunct fingers of salt marsh along the main channel and tributaries of the river, and critical terrestrial uplands.

Waterfowl, particularly black ducks, use the tidal river and salt marsh during migration. The winding, protected river is especially important as habitat for black ducks in harsh weather. Greater and lesser yellowlegs, semipalmated and least sandpipers, and black-bellied and semipalmated plovers forage on the tidal river mudflats. Commercially and recreationally important finfish and shellfish rely on the salt marsh as nursery habitat, including American eel, alewife, and rainbow smelt.

New England cottontail, a species petitioned for listing under the Endangered Species Act, lives in several of the shrubland borders of the river's tributaries. Those pockets of thicket habitat also provide habitat for American woodcock, prairie warbler, and chestnut-sided warbler. Protecting that habitat also benefits the saltmarsh sharp-tailed sparrow. That species, a top conservation priority for Partners in Flight Planning Area 9, is identified as a species of Continental Importance in the Eastern Avifaunal Biome, and is designated in need of immediate conservation action.

Biddeford Pool—1,272 acres

Of the 5,558 acres we propose to acquire, 1,272 lie in the Biddeford expansion area, roughly defined along Route 9 to Newtown Road, south to West Street, south to the Little River (or branch), then along the river back to Route 9. Habitats in that area include early successional grassland and shrubland, high-quality wetland (forested wetland, pocket swamp, vernal pool), river, and mixed upland forest. Due to its high concentrations of wetlands and rare plants and animals, this is also a state focus area of ecological significance. Its habitats fulfill the needs at various life cycle stages for key focal species such as bobolink, willow flycatcher, wood thrush, American woodcock, prairie warbler, alewife, Blandings turtle, and New England cottontail.

Brave Boat Harbor—534 acres

Five hundred thirty-four acres lie in the Brave Boat Harbor expansion area. Refuge land to the east, a large, undeveloped area to the north, and development to the south and west border that area. Its habitats include a large, freshwater wetland, forested wetland, upland forest, shrubland, and grassland. Those fulfill the needs at various life cycle stages for such key federal trust resources as American black duck, Louisiana waterthrush, American woodcock, blue-winged warbler, and wood thrush, among others. The state-listed spotted turtle also dwells here.

Spurwink River—537 acres

Five hundred thirty-seven acres lie in two locations in the Spurwink River expansion area. One is roughly defined along Pleasant Hill Road, then east to existing refuge lands. The second runs along Hillside Avenue, then east, connecting other refuge lands. Those two locations include the last large blocks of land that remain undeveloped adjacent to the refuge in Scarborough. One landowner holds about 24 percent of that land. The property along Pleasant Hill Road would complete a wildlife corridor connecting the refuge with the Scarborough Marsh State Wildlife Management Area.

Habitats in the 537 acres include early successional grassland, shrubland, forested wetland, river, and mixed forest. Those fulfill the needs at various life cycle stages for such key federal trust resources as bobolink, American woodcock, blue-winged warbler, alewife, and New England cottontail, among others.

Upper Wells/Mousam River—255 acres

Two hundred fifty-five acres lie in the Upper Wells/Mousam River expansion area. That area includes five small segments surrounded by or adjacent to the refuge or its approved acquisition boundary. Those segments will improve the management capabilities of the refuge for a multitude of wildlife species. Habitats include freshwater wetland, forested wetland, bog, upland forest, grassland, shrubland, and tidal stream. Those fulfill the needs at various life cycle stages for such key federal trust resources as American black duck, Louisiana waterthrush, bobolink, American woodcock, blue-winged warbler, alewife, and wood thrush, among others.

Moody—21 acres

Twenty-one acres owned by one landowner lie in the Moody expansion area. They provide additional buffer for refuge lands to the south and east. That acreage is primarily grassland, and has been cooperatively managed for more than 12 years by the landowner and the refuge to maintain habitat for bobolink and other grassland species of concern.

Little River—728 acres

Seven hundred twenty-eight acres lie in the Little River expansion area. They abut the proposed Biddeford expansion area, and are roughly defined along Route 9 south from the Little River to the Biddeford/Kennebunkport line, then northwest along the town line, then northeast back to the Little River. Their habitats include early successional grassland and shrubland, high-quality wetland (forested wetland, pocket swamp, vernal pool), river, and mixed upland forest. This area is a state focus area of ecological significance, because of its high concentrations of wetlands and rare plants and animals,. Those habitats fulfill the needs at various life cycle stages for such key focal species as bobolink, willow flycatcher, wood thrush, American woodcock, prairie warbler, alewife, Blanding's turtle, and New England cottontail.

III. Status of Resources to be Protected

Our Gulf of Maine Program mapped valuable habitats for federal-listed endangered or threatened species, declining migratory songbirds, shorebirds, waterfowl, and anadromous fish in southern Maine and throughout the U.S. portion of the Gulf of Maine watershed (USFWS unpublished data). That analysis guided our proposed expansion of the refuge acquisition boundary. About 34,000 acres encompass the lands with the highest value for wildlife in 12 towns in southern Maine.

We initially investigated acquiring approximately 25,800 acres, or 75 percent of those lands with the highest wildlife value, by purchasing fee title or conservation easements. We subsequently refined that land protection to focus on the wildlife habitats of highest value on 5,558 acres adjacent to the approved refuge acquisition boundary, and a new division encompassing the wildlife habitat of highest value in the York River watershed. We selected that subset of lands based on their highest aggregate habitat values and their conservation potential, given their parcel sizes.

The land acquisition we propose will benefit the quality of life in the communities around the refuge. The rapid growth of urban sprawl is a leading factor in the decline of quality of life in the region. Southern Maine's coastal areas continue to face numerous threats and pressures. Those include the development of permanent and seasonal camps, homes, and other structures, recreational boating and kayaking, the presence of humans during waterbird nesting seasons, unleashed pets, and the exploitation of cultural resources. Sources of pollution include septic systems, animal waste, urban runoff, construction, agricultural chemicals, logging, mining, hazardous material spills, sand and gravel extractions, junkyards,

landfills, litter, and debris. The growing human population exacerbates those stresses, which accumulate over time.

Threats to refuge fish and wildlife resources will come primarily from outside the refuge boundaries, through increased boating, non-point source pollution runoff, nutrient loading and habitat fragmentation. To ensure that we maintain the quality of the refuge environment, and people continue to experience quality visits, we will restrict public use to specific sites and well-marked trails. Service acquisition of these lands will minimize those threats, and accomplish the goals and objectives of many national and regional conservation plans or initiatives.

❖ Land Conservation Partners

We will expand our partnerships with such state agencies as the Maine Department of Inland Fisheries and Wildlife, Parks and Conservation, and the Land for Maine's Future on prioritizing, conserving, and managing high-value wildlife habitats. We will expand our partnerships with land trusts in the 12 towns neighboring the refuge and non-governmental organizations, including The Nature Conservancy, Maine Audubon Society, The Trust for Public Land, the Maine Coast Heritage Trust, and the Friends of Rachel Carson Refuge. We will also assist local communities in identifying parcels for conservation that support important trust resources.

❖ Habitat Suitability Model

We used the Gulf of Maine Program Habitat Suitability Model to define the proposed expansion boundary for the refuge. It is also a valuable planning tool for other conservation partners, including the Wells National Estuarine Research Reserve. We mapped the habitats of 43 endangered species, migratory birds (including non-game birds of management concern, shorebirds, and waterfowl), and migratory (inter-jurisdictional and anadromous) fishes. Then we combined those individual maps to identify areas with high richness and habitat quality for those evaluation species. We also mapped large, contiguous areas of undeveloped land and protected land in the study area.

For our analysis, we selected a subset of the federal "trust species": those with seriously reduced populations nationwide, in the Gulf of Maine watershed, or in the State of Maine. We included trust species if they were known to appear in the study area more than occasionally, and were (1) federal-listed as threatened or endangered, or (2) state-listed by two of the three states in the Gulf of Maine watershed, or (3) state-listed by Maine, or (4) experiencing persistent, long-term declines in populations over much of their U.S. range.

We used the biological survey information to identify habitats and test certain habitat maps derived from the models. We developed simple habitat models, similar to the Service habitat suitability index models, for use in our GIS. For each species, that development included review of the literature and discussions with experts to identify and estimate the relative suitability of such habitat features as landcover types, water depths, or soil types. The suitability of each factor was expressed as an index ranging from 0 (least suitable) to 1.0 (most suitable), relative to conditions available in southern Maine.

Those models compute habitat suitability according to the correspondence of the type or level of each environmental factor with the preferred conditions. Thus, the identification of habitat depends on the accuracy of both the models and the environmental base maps to which the models are applied. We used the draft models to produce habitat maps for all 43 species, 16 of which had multiple coverages (e.g., roosting and feeding; reproducing and wintering). To interpret that complex array of data, we produced a composite coverage that included habitat information for all species.

The composite displayed the overall range of habitat values regardless of the underlying land cover type. To display habitat value by cover type (e.g., show the relatively highest value grasslands, or the highest value forested areas) we made composites of habitat scores for each of four major landcover classes: (1) grass, shrub, and bare land; (2) forest; (3) freshwater aquatic and fresh emergent wetlands; and (4) saltwater, estuarine and saline emergent wetlands, so that we could select highly scored examples of one or all cover classes.

For our preferred alternative in the CCP, we derived subsets of those areas with the highest aggregate habitat values that offer ecological diversity and conservation potential based on the extent of the tracts.

❖ Links to Recovery Plans and Other Conservation Initiatives

Piping Plover Recovery Plan (USFWS 1996)

The primary objectives in this recovery plan is to achieve well-distributed increases in plover numbers and productivity, and to provide long-term protection for breeding and wintering plovers and their habitats. The approved refuge acquisition boundary includes multiple nesting beaches for the federal-listed threatened piping plover on the Upper Wells, Goose Rocks, and Goosefare Brook divisions. The Mousam River Division provides additional areas for foraging. The expanded acquisition boundary does not include piping plover nesting habitats, but would protect foraging grounds and provide additional buffers for the nesting areas. Protecting these lands from development also protects the water quality and high-value estuarine systems required by plovers.

Northern Bald Eagle Recovery Plan (USFWS 1983)

The primary objective in this recovery plan is to re-establish self-sustaining populations of bald eagle throughout the northern states, including Maine. Our proposal supports that objective by providing roosting, perching and feeding areas for migratory bald eagles in all 10 divisions and the proposed York River Division.

Roseate Tern Recovery Plan (USFWS 1998)

The primary recovery objective in this plan is to increase the northeast nesting population of the federal-listed endangered roseate tern to 5,000 breeding pairs. That total should include at least six large colonies with high productivity. A large colony consists of at least 200 nesting pairs. The roseate tern population in Maine is considered one large colony, with a record high of 289 pairs in 2001. We are striving to expand their geographic distribution and increase their nesting population in Maine. The refuge holds conservation easements on several parcels in the Crescent Surf Beach and Parsons Beach area in the Upper Wells Division that support the loafing, feeding and staging of roseate terns.

New England Cottontail

This candidate species for federal listing appears year-round on the refuge and surrounding lands. Our land protection proposal includes early successional habitat to be managed for large blocks of thicket habitat to benefit New England cottontail. We think the primary reason for that species' steep decline is the lack of thicket habitat in blocks larger than 15 to 20 acres.

Partners in Flight (PIF) Plan for Physiographic Area 9 (Dettmers and Rosenberg 2000) and Bird Conservation Region 30 priorities (2004, unpublished data)

The PIF Area 9 plan identifies bird species of conservation concern in the southern New England physiographic area. The refuge lies at the northernmost extent of that physiographic area. Its priority habitats include maritime marshes, beaches and dunes, mature hardwood forests, shrublands, pitch pine barrens, and grasslands. Forest fragmentation, urbanization, and human use severely threaten

them. We propose their protection for the benefit of species for which our region has high conservation responsibility.

Saltmarsh

Our land protection proposal supports protecting this priority habitat by acquiring salt marsh and its critical surrounding upland. The threats to this habitat and the wildlife species associated with it include pollution, human disturbance, sea-level rise, invasive species, and predation. Enhancing the protection of salt marsh habitat will benefit PIF priority species, including salt marsh sharp-tailed sparrow and American black duck. Salt marsh sharp-tailed sparrows and Nelson's sharp-tailed sparrows both breed in salt marshes in the refuge. Egrets, ibises, and herons use them extensively as foraging sites both while breeding and migrating. Ospreys and northern harriers forage in refuge marshes during migration. Those marshes also provide critical feeding, migrating, wintering and, to a lesser extent, breeding habitat for American black duck. The salt marsh along the York River will help protect aquatic habitat for American eel, alewife, and other fish species.

Mature Mixed Forest

Our plan protects larger blocks of unfragmented, mature, mixed forest. Forest fragmentation is one of the largest threats in PIF Area 9. Protecting the remaining forested blocks is suggested for halting the decline of many of their priority bird species. The following PIF priority birds will benefit: rose-breasted grosbeak, Baltimore oriole, veery, scarlet tanager, wood thrush, black-and-white warbler, hairy woodpecker, black-billed cuckoo, blackburnian warbler, and eastern wood-pewee.

Early Successional Shrub/Grassland/Pitch Pine

Our proposal will increase our shrubland management capability, and enable us to create and maintain shrubland habitats for the following priority bird species in PIF Area 9: American woodcock, prairie warbler, eastern towhee, and whip-poor-will. Those species need management to stabilize or reverse declines in their population. Shrubland habitat also supports breeding populations of New England cottontail on the refuge. The lands we propose for protection include grassland and other open habitats. The PIF Area 9 plan recommends the identification, protection, and management of large grasslands such as those to reverse the decline of such grassland birds as the bobolink in the northeast.

Beaches/Dunes

The lands we included in our land protection proposal do not include beach or dune systems. Much of the beaches are in town, state, or federal ownership. The remaining beaches generally are developed and in private ownership. However, our land protection proposal does include buffers of maritime marsh and salt marsh that in turn protect water quality and quantity in the tidal rivers and estuaries. Good water quality in those estuarine ecosystems is important for piping plovers, least, common, and roseate terns, and American oystercatchers.

Freshwater Wetlands

Forested freshwater wetlands and emergent marsh are conserved in this land protection proposal, benefiting American black duck, American bittern, great blue heron, and Blanding's turtle.

North Atlantic Regional Shorebird Conservation Plan (2000)

Goals in this plan include maintaining or enhancing "current or historic population levels and diversity of shorebirds" and protecting or managing "sufficient area of high priority habitats to support current populations of breeding, migrating and wintering shorebirds." Our proposal protects breeding habitat

for American woodcock, piping plover, willet, common snipe and killdeer, and migratory habitat for semipalmated plover, semipalmated sandpiper, greater yellowlegs, and others.

North Atlantic Waterfowl Management Plan (2004)

The 2004 update for this plan identifies 14 waterfowl priorities for BCR 30. Our land protection proposal provides important breeding, migrating and wintering grounds for American black duck, wood duck, and mallard. Another nine species benefit from protected migrating, foraging and wintering grounds: common eider, greater scaup, lesser scaup, black scoter, common goldeneye, long-tailed duck, surf scoter, white-winged scoter, red-breasted merganser, and the Atlantic breeding population of Canada goose.

North American Waterbird Conservation Plan (2002)

This plan identifies 55 priority species of concern in North America. Our proposal supports that plan's species and population goals for the sustainable distribution, diversity, and abundance of waterbirds throughout North America and for restoring populations of priority species, including those in decline. Our proposal will also support that plan's habitat goal to secure, maintain, and enhance sufficient high-quality habitat throughout the year to achieve and maintain sustainable populations of waterbirds throughout North America.

Our protection plan benefits 12 waterbird species of conservation concern, including breeding habitat for least tern, a species of high concern. It also provides salt marsh protection for migrating and summer foraging habitat for immature and mature little blue heron, snowy egret, tricolored heron, and roosting and staging habitat for roseate tern. For species of moderate concern, our plan provides foraging habitat for Bonaparte's gull, black-crowned night-heron, common tern, and great cormorant.

Maine Department of Inland Fisheries and Wildlife (MDIFW) Species Assessments and Management Plans

The MDIFW has developed species assessment and management plans for wild turkeys, migratory shorebirds, passerines, ruffed grouse, woodcocks, common eiders, waterfowl, bald eagles, peregrine falcons, piping plovers, black racers, Blanding's turtles, grasshopper sparrows, spotted turtles, moose, deer, coyotes, river otters, snowshoe hares, beavers, minks, bobcats, raccoons, muskrats, red foxes, woodchucks, gray foxes, and short-tailed and long-tailed weasels. Our proposal conforms to those plans by supporting permanent habitat protection for those species.

Shortnose Sturgeon Recovery Plan (1998)

The recovery objective in this plan is to recover populations to levels of abundance at which they no longer require protection under the Endangered Species Act. For each population segment, the minimum population size will be large enough to maintain genetic diversity and avoid extinction. The York River supports potential, high-quality habitat for shortnose sturgeon, and it probably once lived in the river. Although no sturgeons recently have been documented in the York River, it can serve as a recovery site as the recovery plan is implemented.

IV. Our Proposed Action

With the support of our conservation partners, we will acquire 5,558 acres of land from willing sellers. We believe that acreage represents a realistic objective over the next 15 years, given our past rate of acquisition. We will continue to cooperate with the state and those partners in seeking ways to protect the remaining 28,442 acres (of the 34,000 acres of priority lands) of land that supports important trust resources and can accommodate priority public uses. We may participate in managing some of those lands, but we do not anticipate the need for the Service to acquire them.

Maps A–1 through A–6 and associated tables A2.1 through A2.7 show our proposed expansion areas. The tables list map lots by division and provide other information we thought would be of interest, including

- Town
- Map number
- Current ownership: public or private, non-governmental organization (NGO), Coast Guard (CG) or Navy
- Acreage
- Service priority for acquisition
- Proposed acquisition method

Most of the parcels that support nationally significant trust resources in our proposal are privately owned. We placed each parcel in one of two priorities for acquisition: Priority 1 or Priority 2. We identified 3,347 acres as Priority 1. Those are either unacquired parcels in our currently approved acquisition boundary, or lie immediately adjacent to that boundary.

We identified 2,211 acres as Priority 2. Those are parcels that lie within the proposed York River Division.

We will use those priorities only when two parcels are available for acquisition, and we have funding to purchase only one. Those priorities do not reflect a landowner's preference to sell the land. Because Service policy is to acquire land only from willing sellers, the order of actual land acquisition will be based on availability.

❖ York River Division

The York River is located in the southern third of York County, and traverses its width. The York River watershed is an area of concern in southern Maine. The Mt. Agamenicus to the Sea Initiative involves many local and state land trusts in the cooperative protection of this area. The Service identified areas of the York River that support federal trust resources, and will partner with conservation groups in protecting them. That area lies adjacent to and west of U.S. Route 1 and the Maine Turnpike, and is bounded by the Town of York and the Atlantic Ocean to the east. The York River system contains substantial, undeveloped expanses of salt marsh reaching from the sea inland past the Maine Turnpike. The land valuable to wildlife includes contiguous and disjunct fingers of salt marsh along the main channel and tributaries of the river.

The proposed new division and most of the other division expansion areas are composed of about 60 percent tidal marsh (creek, flat, emergent wetland, field). The remaining lands consist mostly of forest. Elevation rises from sea level to 11 feet above sea level. The wetlands and adjacent uplands provide the most valuable wildlife habitat. The target habitat is high salt marsh dominated by cordgrass and needle rush.

The forest community includes lowland red maple, pitch pine, and white pine-red oak stands, and small tracts of shrublands, grasslands, freshwater wetlands, and uplands. Those occur on sandy soils and rocky slopes adjacent to the shores. The dominant trees are red and white oak, although white pine, pitch pine, and red maple are also present. Patches of huckleberry, lowbush, and velvet-leaf blueberry grow in moist hollows. Hemlock mixes with an understory of gray birch. Other understory shrubs include beaked hazelnut, witch hazel, and wild raisin. Canada mayflower, bunchberry, starflower, and teaberry are common herbs in this natural community.

The riverine system meanders more than 10 miles through low marshes and gently sloping banks. The salt marsh and protected shores benefit migratory birds. Waterfowl, particularly black ducks, use the tidal river and salt marsh during migration. The winding, protected river is especially important as habitat for black ducks in harsh weather. Other abundant species include Canada goose, mallard, bufflehead, red-breasted merganser, and common goldeneye. Most puddle ducks use the salt pannes and the upper reaches of tidal creeks, while diving ducks prefer the deeper parts of the tidal creeks and the mouths of rivers and streams.

Greater and lesser yellowlegs, semipalmated and least sandpipers, and black-bellied and semipalmated plovers forage on the tidal river mudflats. Commercially and recreationally important finfish and shellfish rely on the salt marsh as nursery habitat, including American eel, alewife, and rainbow smelt.

New England cottontail, a species petitioned for listing under the Endangered Species Act, inhabits several of the shrubland borders of the tributaries of the York River. Those pockets of thicket habitat also provide habitat for American woodcock, prairie warbler, and chestnut-sided warbler. Protecting that habitat will also benefit the saltmarsh sharp-tailed sparrow, a species of top conservation priority in Partners in Flight Planning Area 9 and a species of Continental Importance in the Eastern Avifaunal Biome, designated in need of immediate conservation action.

Various northern bird species winter in the area, and it is also important to a variety of migratory passerines, shorebirds, wading birds, gulls, terns, and raptors. Virginia and sora rails are present, and grouse, pheasants, and turkeys use the area. Northern harriers breed in the estuary communities, and Cooper's and broad-winged hawks nest in the upland forest. Infrequently during the winter, bald eagles stay in parts of the area, where they feed primarily on herring gulls and black ducks. Rough-legged hawks, northern harriers, and sharp-shinned hawks hunt over the salt marshes in winter. Short-eared, great horned, and snowy owls feed on small mammals and birds in the salt marsh during winter. Great horned, barred, and northern saw-whet owls are fairly common throughout the area, but only great horned owls have been confirmed as nesters.

Commercially and recreationally important finfish and shellfish species that rely on coastal wetlands for important nursery areas will also benefit, including American eel and alewife. A rich assemblage of mammals, including deer, river otter, mink, striped skunk, raccoon, red fox, moose, fisher, gray fox, beaver, porcupine, snowshoe hare, New England cottontail, and other small mammals live in the York River watershed. Our proposed new division will provide continued, wildlife-dependent recreation, including wildlife observation, and waterfowl and deer hunting.

V. Protection Options Considered

The following discussion identifies the protection options that are available to us. We evaluated each of them before developing our proposed action, which we present in detail in attachments 1 and 2. Our policies are to acquire only the minimal interest necessary to meet refuge goals and objectives, and to acquire land only from willing sellers. We believe our proposed action is a cost-effective way of providing the minimal level of protection needed to meet those objectives, given the information now available to us. However, as lands become available in the future, changes in their protection options may be warranted to ensure we are using the best option at that time.

❖ Option 1. No Service Acquisition; Protection by Others

Under option 1, we will maintain present refuge acquisition boundaries, and not expand the refuge or protect additional lands. However, we will continue to purchase lands within the approved land acquisition

boundary through fee title or conservation easement. Our draft CCP/EA evaluates this "no new acquisition" option in alternative A.

Under that option, we will cooperate with such state agencies as the Maine Department of Inland Fisheries and Wildlife, State Parks, and Conservation and the Land for Maine's Future, as well as land trusts in our 12 neighboring towns, national non-government organizations like The Nature Conservancy, Maine Audubon Society, The Trust for Public Land, Maine Coast Heritage Trust, and Friends of Rachel Carson Refuge to support their land protection and management programs of mutual interest and benefit to the Service.

Our concern with this option is that, although ownership by those groups affords some level of protection, they often do not have the financial or administrative resources to buy all the significant lands, nor can they actively manage the lands as needed to protect priority species. Without our contribution to land protection, many of the lands we identified would likely be developed. Conservation groups and the public have stated that Service acquisition and management is vital for ensuring the long-term protection of nationally significant lands that support trust resources.

In summary, we do not propose to use option 1 because

- It would not adequately protect federal trust resources on the refuge;
- It does not support the refuge vision, goals, and objectives; and
- It is not supported by the state or the majority of the public, our partners, or elected officials.

❖ Option 2. Less-than-Fee Acquisition by the Service

In option 2, we will protect and manage lands by purchasing only a partial interest, typically in the form of a conservation easement. That option keeps the land in private ownership, while allowing the refuge some control over its use. We will negotiate with each landowner the extent of the rights we are interested in buying. Those may vary, depending on the configuration and location of the land, the current extent of development, the nature of wildlife activities nearby, the needs of the landowner, and other considerations. Attachment 2 identifies the parcels that we propose to acquire through conservation easements.

Easements are most appropriate for use when

- The parcel is large, and only minimal management of the resource is needed, and development is the greatest threat;
- The landowner wants to maintain ownership; or
- Only a portion of the parcel contains lands of interest to the Service.

❖ Option 3. Full Fee Simple and Less-than-Fee Acquisition by the Service

In option 3, we will use a combination of full fee simple and less-than-fee acquisition, the latter in the form of conservation easements. We propose to acquire 237 parcels totaling 1,240 acres in full fee simple and 106 parcels totaling 4,318 acres via easement. This option provides us the utmost flexibility in managing priority parcels, and ensures the permanent protection of nationally significant federal trust resources. Generally, the lands we buy require active management. We propose fee acquisition when adequate land protection is not assured under other ownerships, or active land management is required, or the parcel is

too small to sell a conservation easement. Attachment 2 identifies, parcel by parcel, what we propose to acquire in full fee simple and through conservation easements.

We should also note that as future transactions progress, a conservation easement could be converted to full fee simple acquisition: for example, when an owner is interested in selling the remainder of interest in the land; or when changes to zoning or land use regulation compromise resource values; or, when our management objectives change so that more active management is necessary to meet refuge goals and objectives. We will evaluate that need on a case-by-case basis.

VI. Acquisition Methods

We may use four methods of acquiring either a full or a partial interest in the parcels identified for Service acquisition: (1) fee purchase (e.g., complete title, or a partial interest like a conservation easement); (2) donation; (3) exchange; or (4) transfer.

❖ Purchase

Fee purchase involves buying a full (fee simple) or partial interest (conservation easement) in land from willing sellers as our funding permits. Fee simple ownership assures the permanent protection of resources, and allows the complete control necessary for habitat management activities, providing public use opportunities, and managing public access. Conservation easements will ensure the permanent protection of resources and allow for the minimum control necessary for management activities. Generally, we purchase at least the development rights, and possibly, the ability to control access during the nesting season.

A conservation easement refers to the purchase of limited rights (less-than-fee) from a willing landowner. That landowner retains ownership of the land, and sells certain rights to the Service, after agreement by both parties. Easements are property rights, and are usually perpetual. If a landowner later sells the property, the easement continues as part of the title. Properties subject to easements generally remain on the tax rolls, although the assessment may be reduced by the reduction of market value if the town gives the landowner a tax abatement for that easement.

Much of our funding to buy land in either fee or conservation easement comes from the Land and Water Conservation Fund, which is composed of certain user fees, proceeds from the disposal of surplus federal property, the federal motor boat fuels tax, and oil and gas lease revenues. About 90 percent of that fund now derives from Outer Continental Shelf oil and gas leases. Another source of funding is the Migratory Bird Conservation Fund, which derives from Federal Duck Stamp revenue. We plan to use primarily the Land and Water Conservation Fund to purchase the land our proposal identifies.

❖ Donation

We generally encourage donations in fee title or conservation easement for lands, provided that such management concerns as contaminants are not major issues. We are not aware of any present opportunities to accept donations.

❖ Exchange

We have the authority to exchange land in Service ownership for other land that has equal or greater wildlife habitat value. Inherent in that concept is the requirement to get dollar-for-dollar value, occasionally by an equalization payment. Exchanges are attractive because they usually do not increase

federal holdings or require purchase funds. However, they also may be very labor-intensive, and take a long time to complete. We are not aware of any present opportunities for an exchange.

❖ **Transfer**

Transfers may occur in the future, as lands become excess to the needs of other federal agencies; however, we are not currently aware of any opportunities.

VII. Service Land Acquisition Policies

Once our Director approves a new refuge acquisition boundary, we contact affected landowners to determine if they are interested in selling their properties. If an owner expresses an interest in selling, a real estate appraiser will appraise that property to determine its market value. Once appraisals have been completed and funding becomes available, we can present an offer for the landowner's consideration. Unless sold, donated, or transferred to the Service, lands within the approved acquisition boundary do not automatically become part of the refuge.

The Service, like other Federal agencies, has the power of eminent domain. We rarely use that approach, because our established policy is to work with willing sellers as funds become available. On rare occasions, we have used eminent domain, or condemnation, to clear title on unknown ownerships or to establish value. Our proposal assumes the continuation of our long-standing, willing-sellers-only policy.

Appraisals are conducted by Service appraisers or private appraisers under contract to the Service, and must meet federal as well as professional standards. We are required by law to appraise properties at market value, based on comparable sales of similar properties.

A landowner may choose to sell land to the Service in fee simple, but retain the right to occupy an existing residence, referred to as a "life-use reservation." As their name implies, life-use reservations apply to the seller's lifetime, but they can also apply to a specific number of years. After the appraisal is approved, and before making the offer, we would discount from the appraised value of the buildings and land the value for life use, based on the age of the owner and the term of the reservation. The occupant would be responsible for the upkeep on the reserved premises.

VIII. Coordination

In 1998, we began to evaluate the need for additional protection at the refuge as part of its CCP. We started an Environmental Assessment (EA) to study protecting federal trust resources on lands adjacent to the refuge and establishing a new division in the York River watershed, and officially announced our planning in a Notice of Intent in the "Federal Register."

Effective conservation usually begins with effective community involvement. To ensure that our future management of the refuge will reflect the issues, concerns, and opportunities expressed by the public, we kept updated mailing lists of refuge neighbors, friends, professional contacts, and others for sharing information and updates about the CCP process.

In May and June 1998, refuge staff invited visitors to a series of morning coffees, to discuss current refuge operations and the planning process. We sent four press releases about the CCP to 15 newspapers in Maine and New Hampshire. Local public access cable stations also ran notices. The York County Coast Star, southern Maine's primary local newspaper, raised public awareness by publishing a long article about our refuge planning. We also designed and distributed leaflets about the morning coffees and our upcoming Issues Workbook.

In summer 1999, we distributed to the public 500 copies of a 12-page Issues Workbook, the backbone of this plan's important public participation component. That workbook provided background information about the planning project and a means for interested citizens to share their concerns and thoughts on important refuge issues. A refuge volunteer tallied the responses in the more than 100 workbooks that returned. In July 1999, we sent to our CCP mailing list an update summarizing the responses, and distributed it from the refuge office. Refuge planning team members met several times per month to synthesize information and prepare the CCP, and briefed the Regional Office in September 1999.

We also held several information-gathering workshops in 1999. They included a gathering in March of the extended planning team, a public use and community goals meeting in June, and, a biological resources meeting, also in June. Our facilitated, all-day Alternatives Workshop in August gathered 15 stakeholder representatives. Refuge staff and 10 observers, including congressional representatives and Service administrators, assisted the workshop participants in setting goals in the topical areas of wildlife, community, public use, and water quality. We mailed a complete summary of their comments and the materials the workshop generated to participants and observers soon after.

Throughout our draft CCP/EA planning process, we solicited and carefully considered public comments on Service land acquisition. We worked with the MDIFW, statewide conservation organizations, local municipalities, local land trusts and national conservation organizations that are directly involved in land protection strategies in coastal Maine. Their continuing work will preserve additional federal trust resources. Specifically, the State of Maine helped us develop the Habitat Suitability Model and prioritize lands for Service acquisition.

We have prepared this draft LPP to support the land protection proposal in our draft CCP/EA for the refuge. We are distributing it to affected landowners, our conservation partners, State of Maine and local agencies, and other interested individuals and groups for a 30-day public review and comment period. We will also hold public meetings during that period.

IX. Socioeconomic and Cultural Impacts

Some say Maine's seacoast is the backbone of the state economy. That is not surprising, as Maine's southern coast and mid-coast regions are growing at a faster rate (1.7 percent between 1990 and 1996) than the state as a whole (0.9 percent between 1990 and1996), with most of its1.2 million people living in coastal counties (State Planning Office, 2000). Most certainly, the natural beauty and rich resources of the shore and ocean draw people to the coast.

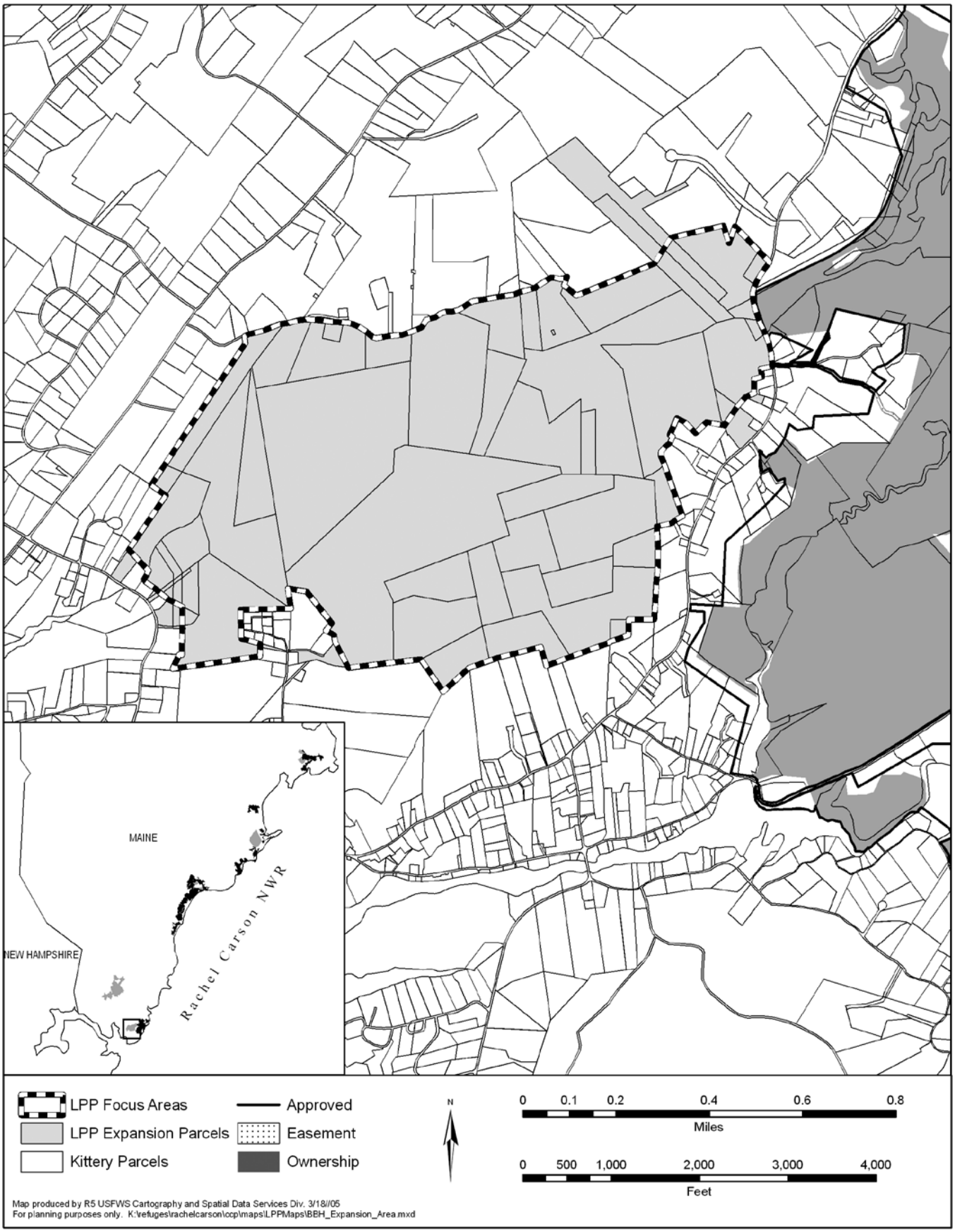
The refuge directly contributes to the economies of 11 towns in coastal Maine. Since 1966, the Service has paid refuge revenue sharing to counties or towns for refuge land it administers. Lands acquired by the Service are removed from the tax rolls. However, under the provisions of the Refuge Revenue Sharing Act, the county or other local unit of government receives an annual revenue sharing payment that often equals or exceeds the amount that would have been collected from property taxes if the land had stayed in private ownership. In 2004, the Service paid $58,019 to communities in Maine for refuge lands. If the Service acquires all the additional lands in this proposal, it would add $65,000 to Maine communities in refuge revenue sharing, projecting the 2004 distribution rate Congress allocated. This figure does not take into account property tax losses, if any.

Wildlife-dependent uses of the refuge include consumptive and non-consumptive recreational activities. Consumptive activities include sport hunting for waterfowl (including eiders), upland gamebirds, and deer, as well as fishing and shellfishing. Non-consumptive activities include wildlife observation and photography and environmental education and interpretation. This proposal will expand opportunities for hunting, watching, and photographing wildlife, and environmental education and interpretation.

The industries of coastal Maine include lobstering and other commercial fisheries, commercial seabird viewing, other natural resource-based industries such as timber and blueberries, environmental education, aquaculture, real estate and land development. In some areas, such as Route 1 in Wells, the characteristic land use is commercial strip development. In others, such as York Beach, there is extensive primary and secondary residential development. Still others, such as sections along Route 9 in Kennebunkport, are characterized as rural with scattered development, or series of small town or village centers, such as York Harbor, Ogunquit, Kennebunkport, and the historic resort village of Biddeford Pool. Other areas have extensive recreational land uses, theme attractions such as Old Orchard Beach, and recreational beaches such as Scarborough Beach and Ferry Beach. A series of visitor attractions range from York's Wild Kingdom to the Wells National Estuarine Research Reserve. Most of those are outdoor attractions, catering to both local and tourist populations.

The Service routinely reviews and assesses archaeological and historic sites under Section 106 of the National Historic Preservation Act (NHPA), when ground-disturbing activities are likely. A detailed archaeological report, "Rachel Carson National Wildlife Refuge Historic and Prehistoric Archaeological Resource Survey" (1995), is on file at refuge headquarters. It identifies areas of high, moderate, and low or unknown archaeological resource sensitivity.

Our proposal would increase the protection of cultural resources, because refuge lands would not be developed, and because we adhere to the protection requirements of the NHPA. Service ownership would protect known cultural sites against vandalism, and would protect as yet unidentified or undeveloped sites from disturbance or destruction. Our environmental education and interpretation programs will also continue to promote public understanding and appreciation of the area's rich cultural resources. In summary, we do not predict any significant, adverse, socioeconomic or cultural impacts from our proposed action.


U.S. Fish and Wildlife Service
Land Protection Plan Expansion Areas
Rachel Carson National Wildlife Refuge - Brave Boat Harbor Division Kittery, ME - Map A-1
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
LPP Focus Areas
LPP Expansion Parcels
Kittery Parcels
Approved
Easement
Ownership
N
0 0.1 0.2 0.4 0.6 0.8
Miles
0 500 1,000 2,000 3,000 4,000
Feet
Map produced by R5 USFWS Cartography and Spatial Data Services Div. 3/18//05
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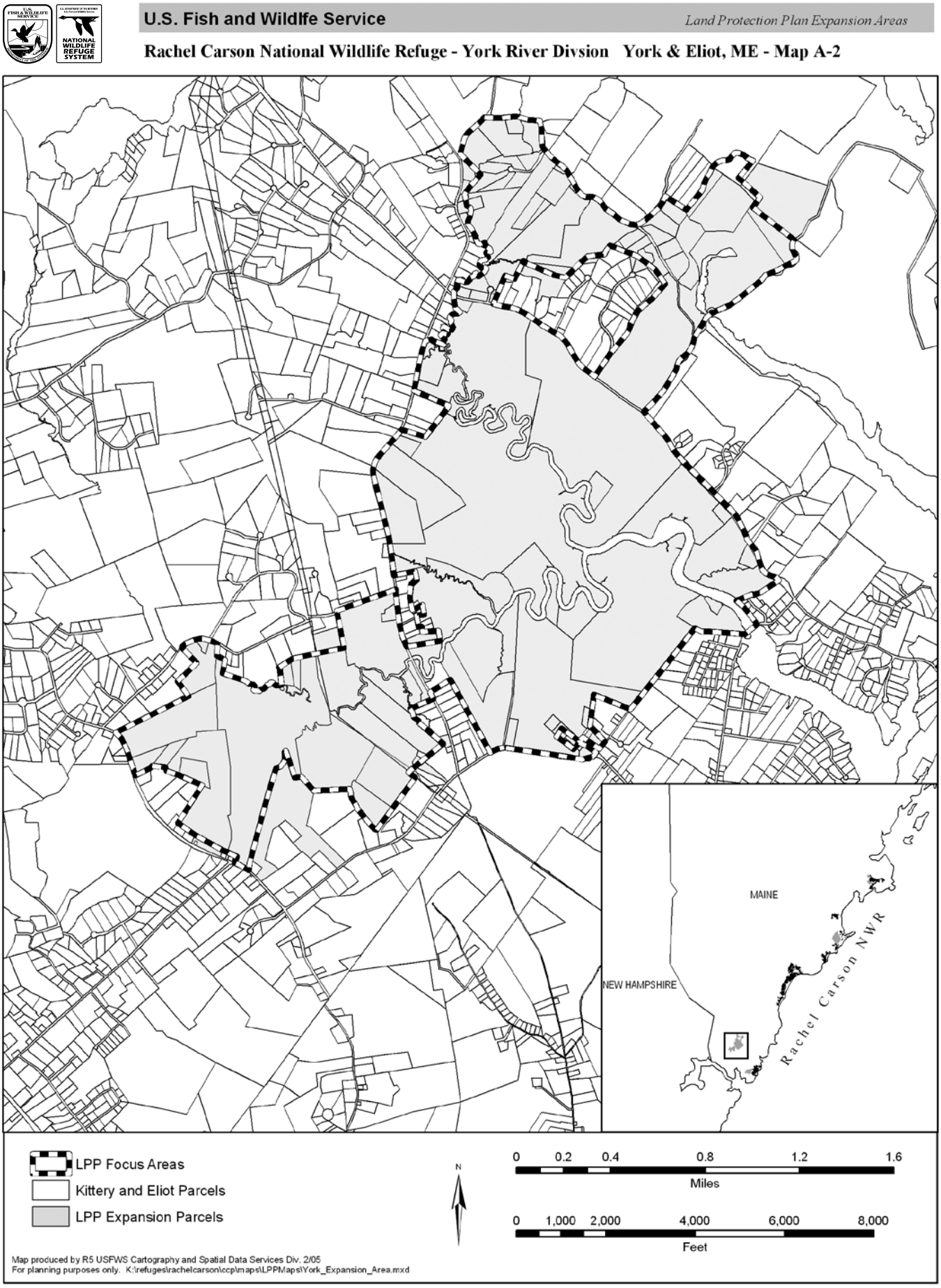
U.S. Fish and Wildlife Service
Land Protection Plan Expansion Areas
Rachel Carson National Wildlife Refuge - York River Divsion York & Eliot, ME - Map A-2
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
LPP Focus Areas
Kittery and Eliot Parcels
LPP Expansion Parcels
N
0 0.2 0.4 0.8 1.2 1.6
Miles
0 1,000 2,000 4,000 6,000 8,000
Feet
Map produced by R5 USFWS Cartography and Spatial Data Services Div. 2/05
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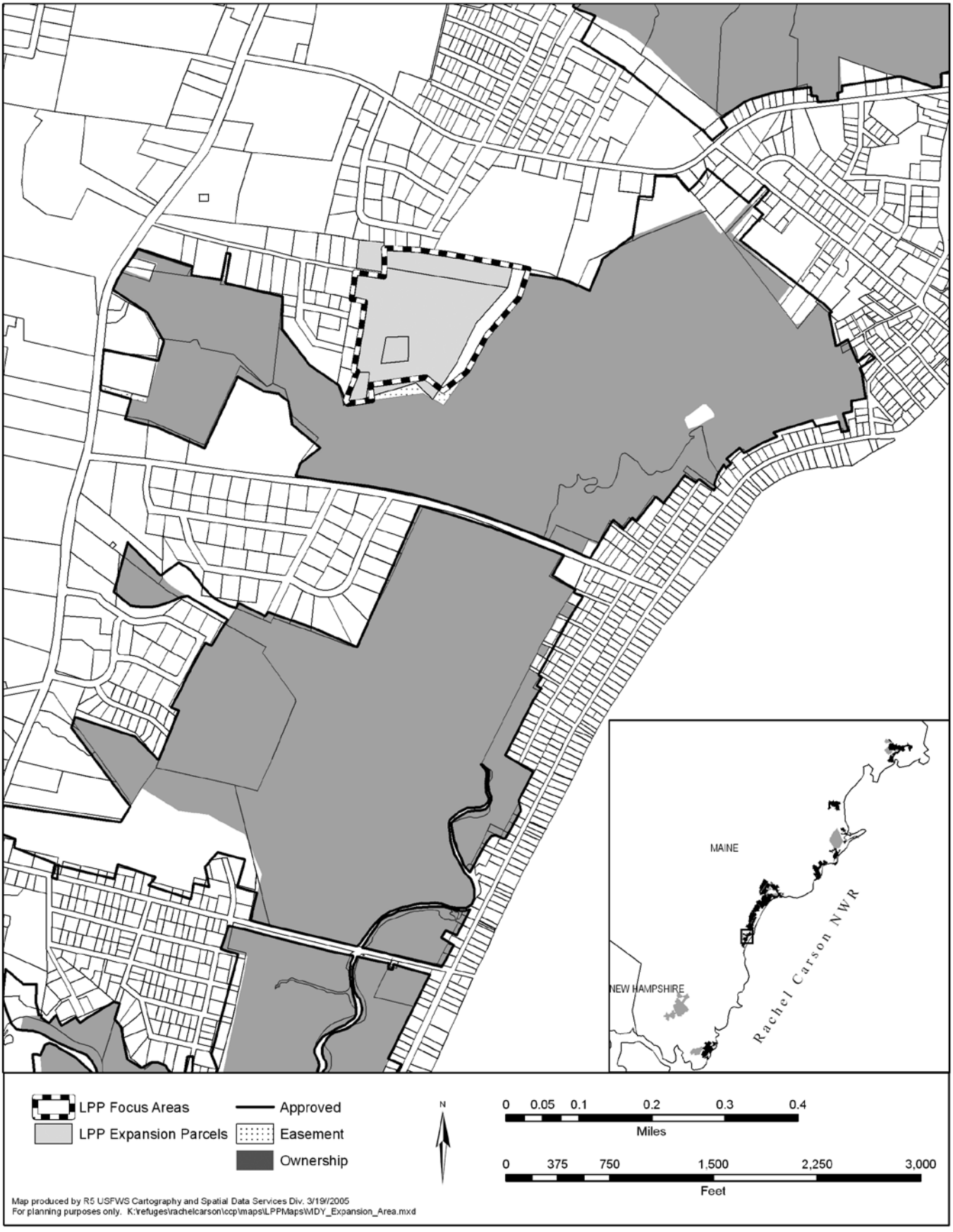
U.S. Fish and Wildlife Service *Land Protection Plan Expansion Areas*

Rachel Carson National Wildlife Refuge - Moody Divsion Wells, ME - Map A-3

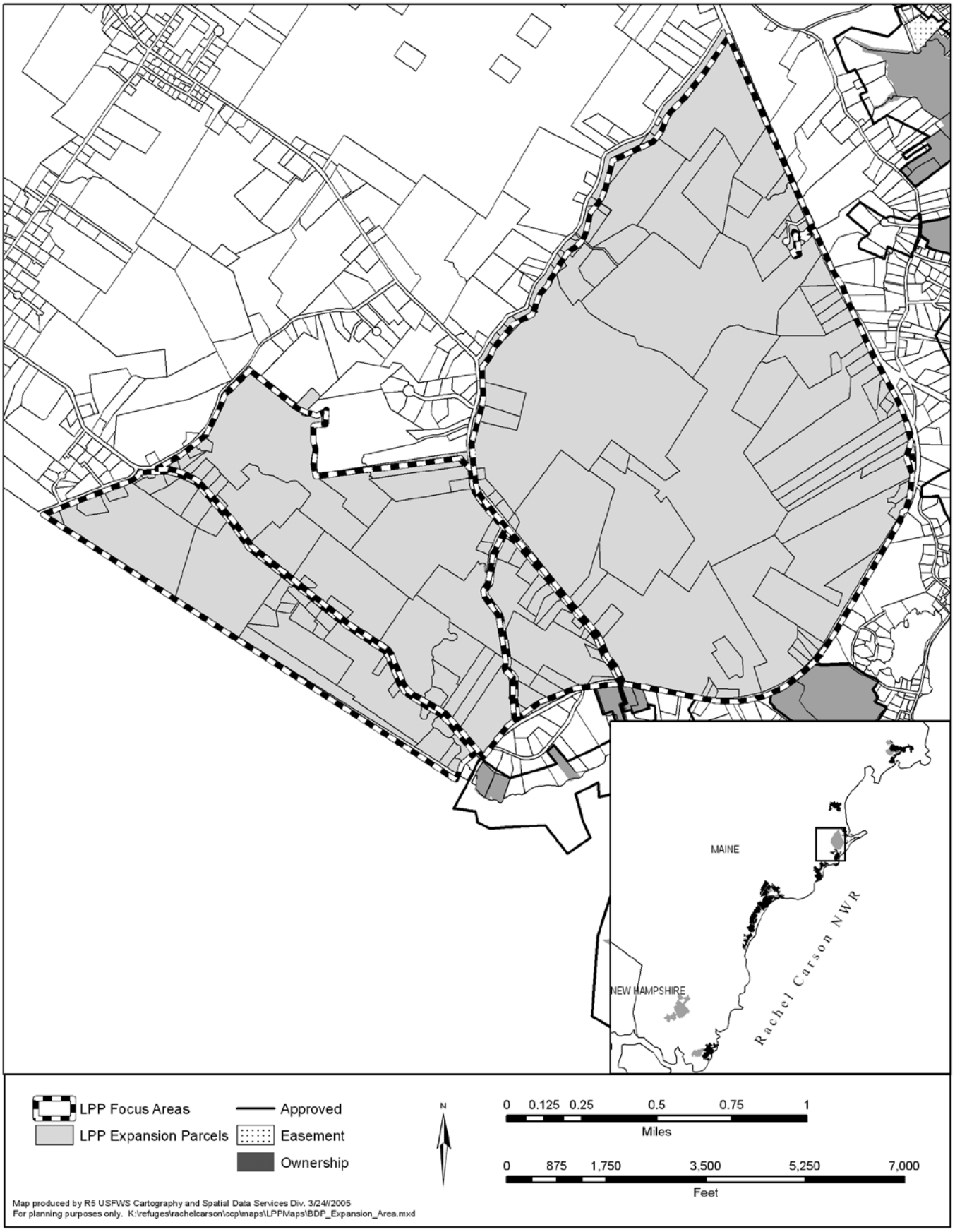


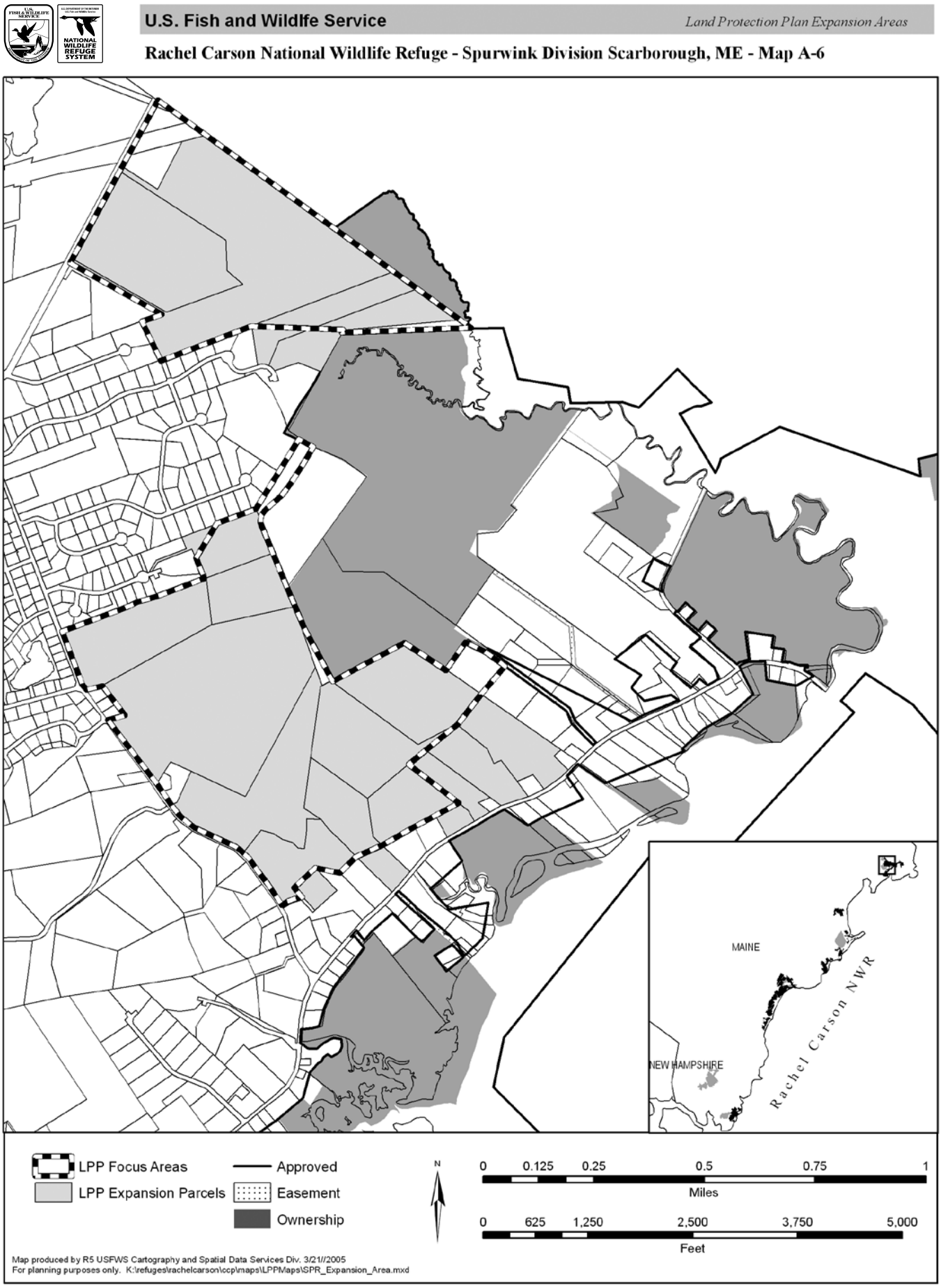
U.S. Fish and Wildlife Service *Land Protection Plan Expansion Areas*

Rachel Carson National Wildlife Refuge - Upper Wells and Mousam River Divsions Wells, ME - Map A-4

U.S. Fish and Wildlife Service *Land Protection Plan Expansion Areas*

Rachel Carson National Wildlife Refuge - Biddeford Pool Division Biddeford, ME - Map A-5




U.S. Fish and Wildlife Service
Land Protection Plan Expansion Areas
Rachel Carson National Wildlife Refuge - Spurwink Division Scarborough, ME - Map A-6
MAINE
NEW HAMPSHIRE
Rachel Carson NWR
LPP Focus Areas
LPP Expansion Parcels
Approved
Easement
Ownership
N
0 0.125 0.25 0.5 0.75 1
Miles
0 625 1,250 2,500 3,750 5,000
Feet
Map produced by R5 USFWS Cartography and Spatial Data Services Div. 3/21//2005
For planning purposes only. K:\refuges\rachelcarson\ccp\maps\LPPMaps\SPR_Expansion_Area.mxd

Key to Tables

Parcel ID (Map Lot)	Map, block, and lot numbers from town tax maps.
Town	The town where the parcel is located.
Map #	The map in attachment 1 that shows the parcel.
Ownership	All parcels in the proposed acquisition area are privately owned, i.e. owned by individuals, corporations, conservation organizations, etc.
Acres	Estimated acreage for each parcel from our Geographic Information System (GIS) database. This estimate may not exactly match town tax records; some parcels lack detailed information.
Priority 1	Parcels not yet acquired within the currently approved Refuge boundary.
Priority 2	All other parcels in the proposed refuge boundary and the new York River Division.
Acquisition Method	Whether we would pursue acquisition in full fee simple (fee) or a partial fee conservation easement (see discussion in "Acquisition Methods"). We identify what we believe, given the information now available, is the minimal level of Service interest needed for project objectives that are also cost-effective. However, as lands become available in the future, changes may be warranted to ensure we are using the option that best fits the situation at that time and meets our and landowner needs.

Table A2.1. Brave Boat Harbor Division - Kittery

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
63,0,29	Kittery	A-1	Private	12.0	1	Easement
63,0,31	Kittery	A-1	Private	8.0	1	Fee
63,0,23	Kittery	A-1	Private	42.0	1	Easement
63,0,32	Kittery	A-1	Private	6.0	1	Fee
63,0,34	Kittery	A-1	Private	8.3	1	Fee
63,0,11A	Kittery	A-1	Private	12.0	1	Easement
56,0,6	Kittery	A-1	Private	9.5	1	Fee
63,0,11	Kittery	A-1	Private	21.0	1	Easement
63,0,27	Kittery	A-1	Private	7.8	1	Fee
56,0,1	Kittery	A-1	Private	40.0	1	Easement
63,0,25	Kittery	A-1	Private	17.0	1	Easement
57,0,24	Kittery	A-1	Private	8.0	1	Fee
57,0,22	Kittery	A-1	Private	19.0	1	Easement
57,0,1	Kittery	A-1	Private	0.0	1	Fee
57,0,4	Kittery	A-1	Private	6.2	1	Fee
57,0,5	Kittery	A-1	Private	8.3	1	Fee
57,0, 20	Kittery	A-1	Private	6.7	1	Fee
57,0,18	Kittery	A-1	Private	7.0	1	Fee
57,0,6	Kittery	A-1	Private	13.6	1	Easement
57,0,11	Kittery	A-1	Private	0.0	1	Fee
57,0,14	Kittery	A-1	Private	1.0	1	Fee
63,0,39	Kittery	A-1	Private	13.8	1	Easement
63,0,28	Kittery	A-1	Private	8.3	1	Fee
63,0,37	Kittery	A-1	Private	10.9	1	Easement
63,0,42	Kittery	A-1	Private	1.2	1	Fee
63,0,31	Kittery	A-1	Private	3.0	1	Fee
63,0,22	Kittery	A-1	Private	1.2	1	Fee
63,0,21	Kittery	A-1	Private	0.7	1	Fee
56,0,9	Kittery	A-1	Private	6.5	1	Fee
56,0,08-1	Kittery	A-1	Private	1.0	1	Fee
56,0,08-2	Kittery	A-1	Private	4.0	1	Fee
43,0,2	Kittery	A-1	Private	26.7	1	Easement
63,0,15	Kittery	A-1	Private	3.4	1	Fee
63,0,25-1	Kittery	A-1	Private	2.8	1	Fee
63,0,3	Kittery	A-1	Private	3.3	1	Fee
42,0,18	Kittery	A-1	Private	4.6	1	Fee
63,0,4	Kittery	A-1	Private	4.1	1	Fee
42,0,24	Kittery	A-1	Private	2.0	1	Fee
42,0,16	Kittery	A-1	Private	1.4	1	Fee
57,0,8	Kittery	A-1	Private	6.2	1	Fee

Table A2.2. York River Division - York

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
218-057	York	A-2	Private	3.134	2	Fee
218-055	York	A-2	Private	6.452	2	Fee
218-059	York	A-2	Private	13.510	2	Easement
218-061	York	A-2	Private	10.241	2	Easement
218-060	York	A-2	Private	3.008	2	Fee
218-135	York	A-2	Private	25.143	2	Easement
218-063	York	A-2	Private	3.013	2	Fee
218-062	York	A-2	Private	3.051	2	Fee
218-064	York	A-2	Private	3.378	2	Fee
402-003	York	A-2	Private	54.458	2	Easement
218-133	York	A-2	Private	0.701	2	Fee
401-065	York	A-2	Private	5.857	2	Fee
218-131	York	A-2	Private	8.217	2	Fee
218-065	York	A-2	Private	6.255	2	Fee
218-068	York	A-2	Private	3.003	2	Fee
218-066	York	A-2	Private	3.025	2	Fee
401-067	York	A-2	Private	25.156	2	Easement
218-127	York	A-2	Private	0.360	2	Fee
218-125	York	A-2	Private	33.029	2	Easement
218-073	York	A-2	Private	17.642	2	Easement
401-069	York	A-2	Private	12.246	2	Easement
218-129	York	A-2	Private	5.090	2	Fee
218-067	York	A-2	Private	0.772	2	Fee
218-069	York	A-2	Private	3.440	2	Fee
218-123	York	A-2	Private	34.871	2	Easement
401-055	York	A-2	Private	5.656	2	Fee
402-001	York	A-2	Private	55.006	2	Easement
218-071	York	A-2	Private	0.979	2	Fee
401-053	York	A-2	Private	3.664	2	Fee
219-061	York	A-2	Private	3.165	2	Fee
219-063	York	A-2	Private	3.428	2	Fee
401-071	York	A-2	Private	3.820	2	Fee
219-027	York	A-2	Private	3.747	2	Fee
218-096	York	A-2	Private	8.812	2	Fee
218-111	York	A-2	Private	12.851	2	Easement
219-049	York	A-2	Private	80.606	2	Easement
218-093	York	A-2	Private	3.936	2	Fee
219-051	York	A-2	Private	8.123	2	Fee
218-089	York	A-2	Private	1.419	2	Fee
218-091	York	A-2	Private	1.840	2	Fee
215-040	York	A-2	Private	1.719	2	Fee
215-067	York	A-2	Private	91.363	2	Easement
215-069	York	A-2	Private	188.934	2	Easement
215-049	York	A-2	Private	1.900	2	Fee
215-051	York	A-2	Private	8.452	2	Fee
215-053	York	A-2	Private	12.398	2	Easement

Table A2.2. York River Division - York *(continued)*

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
215-055	York	A-2	Private	4.836	2	Fee
215-065	York	A-2	Private	221.558	2	Easement
215-063	York	A-2	Private	3.898	2	Fee
207-045	York	A-2	Private	36.285	2	Easement
214-035	York	A-2	Private	43.818	2	Easement
215-071	York	A-2	Private	5.932	2	Fee
207-043	York	A-2	Private	25.126	2	Easement
214-033	York	A-2	Private	2.310	2	Fee
208-045	York	A-2	Private	148.325	2	Easement
214-029	York	A-2	Private	2.998	2	Fee
208-001	York	A-2	Private	19.310	2	Easement
208-005	York	A-2	Private	3.393	2	Fee
208-003	York	A-2	Private	17.414	2	Easement
214-028	York	A-2	Private	17.475	2	Easement
208-017	York	A-2	Private	51.110	2	Easement
208-049	York	A-2	Private	5.661	2	Fee
208-047	York	A-2	Private	11.523	2	Easement
207-041	York	A-2	Private	44.836	2	Easement
214-003	York	A-2	Private	1.835	2	Fee
208-025	York	A-2	Private	12.299	2	Easement
207-042	York	A-2	Private	2.624	2	Fee
208-023	York	A-2	Private	29.170	2	Easement
206-022	York	A-2	Private	0.905	2	Fee
206-019	York	A-2	Private	3.792	2	Fee
206-021	York	A-2	Private	4.438	2	Fee
206-019	York	A-2	Private	9.154	2	Fee
206-009	York	A-2	Private	26.235	2	Easement
206-013	York	A-2	Private	23.302	2	Easement
208-032	York	A-2	Private	1.657	2	Fee
206-049	York	A-2	Private	2.997	2	Fee
208-031	York	A-2	Private	2.087	2	Fee
206-004	York	A-2	Private	3.019	2	Fee
207-039	York	A-2	Private	29.516	2	Easement
401-056	York	A-2	Private	5.233	2	Fee
401-070	York	A-2	Private	4.778	2	Fee
206-047	York	A-2	Private	34.934	2	Easement
208-036	York	A-2	Private	2.145	2	Fee
208-029	York	A-2	Private	2.059	2	Fee
208-035	York	A-2	Private	0.991	2	Fee
208-027	York	A-2	Private	1.983	2	Fee
208-033	York	A-2	Private	2.129	2	Fee
208-034	York	A-2	Private	103.427	2	Easement
406-017	York	A-2	Private	7.904	2	Fee

Table A2.3. York River Division - Eliot

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
76,17	Eliot	A-2	Private	1.3	1	Fee
57,0,8	Eliot	A-2	Private	130.0	1	Easement
76,9	Eliot	A-2	Private	3.2	1	Fee
76,10	Eliot	A-2	Private	3.3	1	Fee
66,47	Eliot	A-2	Private	6.9	1	Fee
58,01	Eliot	A-2	Private	116.0	1	Easement
57,5	Eliot	A-2	Private	53.0	1	Easement
66,48	Eliot	A-2	Private	3.6	1	Fee
58,0,3	Eliot	A-2	Private	18.6	1	Easement
56,5	Eliot	A-2	Private	14.6	1	Easement
58,0,2	Eliot	A-2	Private	10.0	1	Easement

Table A2.4. Moody Division - Wells

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
00111-014.	Wells	A-3	Private	4.39	1	Fee
00111-015.	Wells	A-3	Private	14.78	1	Easement
00111-015.A	Wells	A-3	Private	0.75	1	Fee
00111-016.2	Wells	A-3	Private	0.58	1	Fee

Table A2.5. Upper Wells and Mousam - Kennebunk

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
22 2A	Kennebunk	A-4	Private	49.60	1	Fee
22 103	Kennebunk	A-4	Private	5.22	1	Fee
22 102	Kennebunk	A-4	Private	5.79	1	Fee
21 16	Kennebunk	A-4	Private	17.88	1	Fee
22 101	Kennebunk	A-4	Private	4.38	1	Fee
22 4	Kennebunk	A-4	Private	26.35	1	Fee
22 5D	Kennebunk	A-4	Private	24.62	1	Fee
22 2B	Kennebunk	A-4	Private	7.27	1	Fee
22 5	Kennebunk	A-4	Private	5.09	1	Fee
22 5E	Kennebunk	A-4	Private	5.97	1	Fee
12 3	Kennebunk	A-4	Private	31.84	1	Fee
12 2	Kennebunk	A-4	Private	12.44	1	Fee
22 3	Kennebunk	A-4	Private	3.43	1	Fee
23 1	Kennebunk	A-4	Private	15.56	1	Fee
23 1B	Kennebunk	A-4	Private	5.60	1	Fee
22 1	Kennebunk	A-4	Private	59.79	1	Fee
23 1C	Kennebunk	A-4	Private	20.52	1	Fee
12 12	Kennebunk	A-4	Private	5.59	1	Fee
23 12	Kennebunk	A-4	Private	1.74	1	Fee
23 11	Kennebunk	A-4	Private	1.55	1	Fee
23 13	Kennebunk	A-4	Private	1.58	1	Fee

Table A2.5. Upper Wells and Mousam - Kennebunk *(continued)*

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
12 13	Kennebunk	A-4	Private	10.60	1	Fee
23 14	Kennebunk	A-4	Private	2.12	1	Fee
23 15	Kennebunk	A-4	Private	2.14	1	Fee

Table A2.6. Biddeford Pool Division

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
4-56-2	Biddeford	A-5	Private	0.97	1	Fee
4-56-1	Biddeford	A-5	Private	1.74	1	Fee
4-56	Biddeford	A-5	Private	5.07	1	Fee
4-40	Biddeford	A-5	Private	6.68	1	Fee
4-73	Biddeford	A-5	Private	0.63	1	Fee
4-72	Biddeford	A-5	Private	0.88	1	Fee
4-70	Biddeford	A-5	Private	2.99	1	Fee
4-61-9	Biddeford	A-5	Private	1.00	1	Fee
4-61-1	Biddeford	A-5	Private	1.77	1	Fee
4-61-6	Biddeford	A-5	Private	1.06	1	Fee
4-61-5	Biddeford	A-5	Private	3.03	1	Fee
4-61-3	Biddeford	A-5	Private	1.96	1	Fee
4-61-7	Biddeford	A-5	Private	1.21	1	Fee
4-61-8	Biddeford	A-5	Private	1.26	1	Fee
4-61-2	Biddeford	A-5	Private	3.00	1	Fee
4-61	Biddeford	A-5	Private	19.98	1	Easement
4-58-1	Biddeford	A-5	Private	14.99	1	Easement
4-57-1	Biddeford	A-5	Private	0.95	1	Fee
4-58	Biddeford	A-5	Private	0.83	1	Fee
4-57	Biddeford	A-5	Private	34.46	1	Easement
4-53-1	Biddeford	A-5	Private	2.88	1	Fee
4-53	Biddeford	A-5	Private	1.77	1	Fee
9-18	Biddeford	A-5	Private	127.11	1	Easement
5-10	Biddeford	A-5	Private	0.67	1	Fee
5-13-1	Biddeford	A-5	Private	1.41	1	Fee
5-13-4	Biddeford	A-5	Private	104.07	1	Easement
5-13-2	Biddeford	A-5	Private	5.66	1	Fee
5-18	Biddeford	A-5	Private	28.27	1	Easement
5-15	Biddeford	A-5	Private	1.28	1	Fee
4-74	Biddeford	A-5	Private	55.71	1	Easement
4-36-2	Biddeford	A-5	Private	2.95	1	Fee
4-36-3	Biddeford	A-5	Private	2.90	1	Fee
4-36-4	Biddeford	A-5	Private	2.83	1	Fee
4-32	Biddeford	A-5	Private	1.20	1	Fee
4-31	Biddeford	A-5	Private	2.98	1	Fee
4-32-1	Biddeford	A-5	Private	2.03	1	Fee
4-30-1	Biddeford	A-5	Private	2.21	1	Fee
4-30-2	Biddeford	A-5	Private	1.03	1	Fee

Table A2.6. Biddeford Pool Division *(continued)*

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
4-37	Biddeford	A-5	Private	42.47	1	Easement
4-30	Biddeford	A-5	Private	69.16	1	Easement
4-29	Biddeford	A-5	Private	15.84	1	Easement
4-28-1	Biddeford	A-5	Private	8.53	1	Fee
4-75	Biddeford	A-5	Private	3.59	1	Fee
4-74-1	Biddeford	A-5	Private	2.06	1	Fee
4-67	Biddeford	A-5	Private	4.52	1	Fee
4-68	Biddeford	A-5	Private	7.05	1	Fee
4-64	Biddeford	A-5	Private	3.86	1	Fee
4-63	Biddeford	A-5	Private	50.10	1	Easement
4-62	Biddeford	A-5	Private	3.21	1	Fee
4-78	Biddeford	A-5	Private	1.42	1	Fee
4-69	Biddeford	A-5	Private	1.14	1	Fee
4-66-3	Biddeford	A-5	Private	1.95	1	Fee
4-66-1	Biddeford	A-5	Private	1.70	1	Fee
4-66-2	Biddeford	A-5	Private	1.67	1	Fee
4-65	Biddeford	A-5	Private	0.62	1	Fee
4-66	Biddeford	A-5	Private	26.94	1	Easement
4-71-1	Biddeford	A-5	Private	0.41	1	Fee
4-71	Biddeford	A-5	Private	0.80	1	Fee
4-82-5	Biddeford	A-5	Private	1.39	1	Fee
4-82-3	Biddeford	A-5	Private	1.62	1	Fee
4-82-6	Biddeford	A-5	Private	0.95	1	Fee
4-82	Biddeford	A-5	Private	85.68	1	Easement
4-59	Biddeford	A-5	Private	18.08	1	Easement
4-59-1	Biddeford	A-5	Private	0.94	1	Fee
4-39	Biddeford	A-5	Private	0.79	1	Fee
4-59-2	Biddeford	A-5	Private	2.14	1	Fee
4-59-4	Biddeford	A-5	Private	41.00	1	Easement
4-59-3	Biddeford	A-5	Private	29.61	1	Easement
4-48-3	Biddeford	A-5	Private	7.05	1	Fee
4-48-2	Biddeford	A-5	Private	7.11	1	Fee
4-48	Biddeford	A-5	Private	19.67	1	Easement
4-44	Biddeford	A-5	Private	5.74	1	Fee
4-43	Biddeford	A-5	Private	3.59	1	Fee
4-38-3	Biddeford	A-5	Private	1.16	1	Fee
4-38-1	Biddeford	A-5	Private	0.73	1	Fee
4-38-2	Biddeford	A-5	Private	2.93	1	Fee
4-36-1	Biddeford	A-5	Private	2.98	1	Fee
4-36	Biddeford	A-5	Private	2.49	1	Fee
4-26-1	Biddeford	A-5	Private	0.93	1	Fee
4-38	Biddeford	A-5	Private	30.89	1	Easement
4-38-5	Biddeford	A-5	Private	0.62	1	Fee
4-23-1	Biddeford	A-5	Private	1.21	1	Fee
4-24-3	Biddeford	A-5	Private	6.14	1	Fee
4-25-3	Biddeford	A-5	Private	1.39	1	Fee

Table A2.6. Biddeford Pool Division *(continued)*

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
4-25-9	Biddeford	A-5	Private	1.33	1	Fee
4-25-7	Biddeford	A-5	Private	0.94	1	Fee
4-33	Biddeford	A-5	Private	0.78	1	Fee
4-35	Biddeford	A-5	Private	4.89	1	Fee
4-111	Biddeford	A-5	Private	55.76	1	Easement
5-13-5	Biddeford	A-5	Private	3.37	1	Fee
5-11	Biddeford	A-5	Private	0.62	1	Fee
5-15-1	Biddeford	A-5	Private	1.40	1	Fee
5-15-2	Biddeford	A-5	Private	1.27	1	Fee
5-15-3	Biddeford	A-5	Private	1.25	1	Fee
5-27	Biddeford	A-5	Private	0.81	1	Fee
4-25	Biddeford	A-5	Private	205.33	1	Easement
10-25	Biddeford	A-5	Private	3.88	1	Fee
4-112	Biddeford	A-5	Private	3.80	1	Fee
5-23-1	Biddeford	A-5	Private	1.42	1	Fee
5-23	Biddeford	A-5	Private	1.99	1	Fee
5-19	Biddeford	A-5	Private	44.70	1	Easement
5-28	Biddeford	A-5	Private	26.72	1	Easement
5-28-1	Biddeford	A-5	Private	3.67	1	Fee
5-29-1	Biddeford	A-5	Private	7.28	1	Fee
5-29-3	Biddeford	A-5	Private	12.04	1	Easement
5-34-1	Biddeford	A-5	Private	0.82	1	Fee
5-33-1	Biddeford	A-5	Private	2.81	1	Fee
5-39	Biddeford	A-5	Private	1.37	1	Fee
5-40	Biddeford	A-5	Private	30.78	1	Easement
10-45	Biddeford	A-5	Private	3.13	1	Fee
10-46	Biddeford	A-5	Private	2.35	1	Fee
10-47	Biddeford	A-5	Private	2.30	1	Fee
10-48	Biddeford	A-5	Private	2.82	1	Fee
9-18-3	Biddeford	A-5	Private	32.39	1	Easement
9-18-1	Biddeford	A-5	Private	19.28	1	Easement
0-0	Biddeford	A-5	Private	5.66	1	Fee
9-7	Biddeford	A-5	Private	1.02	1	Fee
9-7-1	Biddeford	A-5	Private	1.27	1	Fee
9-10	Biddeford	A-5	Private	17.64	1	Easement
9-11	Biddeford	A-5	Private	1.78	1	Fee
9-14	Biddeford	A-5	Private	13.03	1	Easement
9-15	Biddeford	A-5	Private	54.66	1	Easement
4-23	Biddeford	A-5	Private	11.40	1	Easement
4-28	Biddeford	A-5	Private	14.30	1	Easement
4-28-2	Biddeford	A-5	Private	1.75	1	Fee
4-38-4	Biddeford	A-5	Private	0.70	1	Fee
5-37	Biddeford	A-5	Private	10.64	1	Easement
9-18-2	Biddeford	A-5	Private	31.05	1	Easement
9-7-3	Biddeford	A-5	Private	2.12	1	Fee
9-7-2	Biddeford	A-5	Private	1.31	1	Fee

Table A2.6. Biddeford Pool Division *(continued)*

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
9-7-4	Biddeford	A-5	Private	6.99	1	Fee
5-35	Biddeford	A-5	Private	17.63	1	Easement
5-41	Biddeford	A-5	Private	2.51	1	Fee
4-48-5	Biddeford	A-5	Private	2.26	1	Fee
4-48-1	Biddeford	A-5	Private	4.50	1	Fee
4-48-4	Biddeford	A-5	Private	11.07	1	Easement
4-25-6	Biddeford	A-5	Private	0.86	1	Fee
4-25-8	Biddeford	A-5	Private	0.87	1	Fee
4-25-2	Biddeford	A-5	Private	0.95	1	Fee
4-25-4	Biddeford	A-5	Private	7.40	1	Fee
4-25-10	Biddeford	A-5	Private	4.77	1	Fee
4-25-5	Biddeford	A-5	Private	0.87	1	Fee
4-25-1	Biddeford	A-5	Private	1.43	1	Fee
4-35-1	Biddeford	A-5	Private	60.33	1	Easement
4-24-4	Biddeford	A-5	Private	1.10	1	Fee
5-13-3	Biddeford	A-5	Private	126.35	1	Easement
5-13	Biddeford	A-5	Private	43.74	1	Easement
4-24-1	Biddeford	A-5	Private	0.26	1	Fee
5-38	Biddeford	A-5	Private	21.99	1	Easement
5-29	Biddeford	A-5	Private	36.77	1	Easement
5-29-2	Biddeford	A-5	Private	11.19	1	Easement
5-34-2	Biddeford	A-5	Private	1.51	1	Fee
5-34	Biddeford	A-5	Private	2.32	1	Fee
4-24	Biddeford	A-5	Private	1.75	1	Fee
4-24-2	Biddeford	A-5	Private	8.87	1	Fee

Table A2.7. Spurwink Division

Map Lot	*Town*	*Map #*	*Ownership*	*Acres*	*Priority*	*Acquisition Method*
RO96,0,9	Scarbourgh	A-6	Private	76.0	1	Easement
RO96,0,5	Scarbourgh	A-6	Private	47.5	1	Easement
RO96,0,18	Scarbourgh	A-6	Private	15.0	1	Easement
RO96,0,19	Scarbourgh	A-6	Private	15.5	1	Easement
RO95,0,5	Scarbourgh	A-6	Private	12.4	1	Easement
RO95,O,5A	Scarbourgh	A-6	Private	13.5	1	Easement
RO95,0,6	Scarbourgh	A-6	Private	31.6	1	Easement
RO95,0,10	Scarbourgh	A-6	Private	81.5	1	Easement
RO98,0,20	Scarbourgh	A-6	Private	43.0	1	Easement
R099,0,42	Scarbourgh	A-6	Private	30	1	Easement
R098,0,18	Scarbourgh	A-6	Private	37.4	1	Easement
RO98,016A	Scarbourgh	A-6	Private	6.7	1	Fee
RO98,0,13	Scarbourgh	A-6	Private	14.3	1	Easement
RO98,0,16	Scarbourgh	A-6	Private	14.4	1	Easement
RO99,0,44A	Scarbourgh	A-6	Private	15.0	1	Easement
RO99,0,43	Scarbourgh	A-6	Private	3.0	1	Fee

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Nelson's sharp-tailed sparrow and saltmarsh sharp-tailed sparrow

Appendix B

Resources of Concern

- Introduction
- Potential Resources of Concern for the Rachel Carson NWR
- Priority Resources of Concern
- Adaptive Management

I. Introduction

The Service is entrusted by Congress to conserve and protect migratory birds and fish, federally listed threatened and endangered species, inter-jurisdictional fishes, wetlands, and certain marine mammals. These are known as "trust resources." In addition to this Service mandate, each refuge has one or more purposes for which it was established that guide its management goals and objectives. Further, refuges support other elements of biological diversity including invertebrates, rare plants, unique natural communities, and ecological processes that contribute to biological diversity, integrity and environmental health at the refuge, ecosystem, and broader scales (USFWS 1999, 2003).

Given the multitude of purposes, mandates, policies, regional, and national plans that can apply to a refuge, there is a need to identify the potential resources of concern and then prioritize those resources that the refuge is best suited to focus on in its management strategies. The following is the process that Rachel Carson NWR used to identify priority resources of concern and develop habitat goals, objectives, and strategies to benefit these resources.

The Habitat Management Plan policy (620 FW) defines "resources of concern" as

> "All plant and/or animal **species, species groups, or communities** specifically identified in Refuge purpose(s), System mission, or international, national, regional, State, or ecosystem conservation plans or acts. For example, waterfowl and shorebirds are a resource of concern on a refuge whose purpose is to protect 'migrating waterfowl and shorebirds.' Federal or State threatened and endangered species on that same refuge are also a resource of concern under terms of the respective endangered species acts."

Resources of concern are synonymous with "conservation targets" and the terms can be used interchangeably.

II. *Potential* Resources of Concern for the Rachel Carson NWR

In collaboration with other refuges in Northeast New England we developed a matrix of *potential* resources of concern for the region. To determine the potential resources of concern that would guide the management priorities at each refuge we examined a multitude of guiding documents and other information sources. These documents, plans, or policies typically identify focal species, species groups, or habitats. These sources fall into three categories:

- Legal Mandates
- USFWS Trust Resources
- Biological Integrity, Diversity, and Environmental Health Policy

❖ Legal Mandates

Statutory Authority

The National Wildlife Refuge Improvement Act of 1997 states that each refuge shall be managed to fulfill the mission of the Refuge System: *"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."* (Refuge Improvement Act; Public Law 105-57)

Enabling Legislation (Establishing Orders)

The enabling legislation is the legal authority by which the refuge was initially established and lands acquired within the refuge.

On December 16, 1966, Congress established the Coastal Maine NWR under the authority of the Migratory Bird Conservation Act of 1929, which authorized the purchase of lands for refuges *"for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (16 USC 715d, Migratory Bird Conservation Act)*.

In a formal dedication ceremony on June 27, 1970, the refuge was renamed in honor of scientist and author Rachel Carson, who spent much of her life along the Maine Coast.

Refuge Purposes

The National Wildlife Refuge Improvement Act of 1997 also states that each refuge *"…shall be managed to fulfill…the specific purposes for which the refuge was established…"* Purposes of a refuge are those 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 sub-unit.

The relationship of the System Mission and the purpose(s) of each refuge is defined in Section 3 of the FWS Director's Order No. 132 that states: *"we view the System mission, goals, and unit purpose(s) as symbiotic; however, we give priority to achieving a unit's purpose(s) when conflicts with the System mission or a specific goal exist."* Section 13 of this order indicates *"Where a refuge has multiple purposes related to fish, wildlife, and plant conservation, the more specific purpose will take precedence in instances of conflict."* As stated in Section 14, *"When we acquire an addition to a unit under an authority different from the authority used to establish the original unit, the addition also takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the addition."*

Rachel Carson NWR was established for the following purposes:

- "use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (Migratory Bird Conservation Act).
- " ...suitable for - - - 1) incidental fish and wildlife oriented recreational development, 2) protection of natural resources, 3) conservation of endangered or threatened species ..." (16 USC section 460k-1 Refuge Recreation Act)
- " …conservation of wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions…" (16 USC Section 13901(b) 100 Stat 3583 Emergency Wetlands Resources Act of 1986)
- "…for the development, advancement, management, conservation and protection of fish and wildlife resources..." (16 USC Section 742f(a)(1) Fish and Wildlife Act of 1956)

❖ USFWS Trust Resources

Although the refuge purposes are the first obligation, managing for trust resources (defined above) is also a priority for the refuge. Trust resources are further defined as follows:

Migratory Birds

A list of all species of migratory birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703–711)

and subject to the regulations on migratory birds are contained in subchapter B of title 50 CFR § 10.13. The Migratory Birds Program also maintains subsets of this list that provide priorities at the national, regional, and ecoregional (bird conservation region) scales.

The primary sources of information that the refuge used to identify potential migratory birds species of concern included:

- Bird Conservation Region (BCR) 30 and 14 Plans (Rachel Carson is within the transition zone between these two BCR regions).
- Continental and Regional Plans for landbirds, waterfowl, shorebirds, and marshbirds
- Rocky Mountain Bird Observatory Species Assessment Database
- USFWS Birds of Conservation Concern
- Federal Threatened and Endangered species
- Status and Trend Information from refuge bird surveys

Interjurisdictional Fish

Those "…populations that two or more States, nations, or Native American tribal governments manage because of their geographic distribution or migratory patterns (710 FW 1.5H)." Examples include anadromous species of salmon and free-roaming species endemic to large river systems, such as paddlefish and sturgeon (FWS Director's Order No. 132, Section 6[c]).

A standard set of information resources is not currently available for fish. However, we used the best available information from the following sources:

- USFWS Regional Fisheries Office
- USFWS Gulf of Maine Coastal Program

Marine Mammals

The Marine Mammal Protection Act of 1972 (16 U.S.C. 13611407) prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The following is a list of marine mammals under the jurisdiction of the USFWS:

- West Indian Manatee (Antillean and Florida)
- Polar Bear (AK Chukchi/Bering Seas and Beaufort Sea)
- Pacific Walrus (AK)
- Sea Otter (South Central AK, Southeast AK, Southwest AK, CA, and WA)

Rachel Carson is a coastal refuge in the Gulf of Maine where many marine mammals are found, however none of these are the species listed under the USFWS jurisdiction.

Wetlands

The Emergency Wetlands Resources Act of 1986. This Act, Public Law 99-645 (100 Stat. 3582), approved

November 10, 1986, authorized the purchase of wetlands from Land and Water Conservation Fund monies, removing a prior prohibition on such acquisitions. It required the Secretary to establish a National Wetlands Priority Conservation Plan, required the States to include wetlands in their Comprehensive Outdoor Recreation Plans, and transferred to the Migratory Bird Conservation Fund amounts equal to the import duties on arms and ammunition.

Rachel Carson NWR wetlands are included in the list of wetlands that warrant protection (USFWS Regional Wetlands Concept Plan, Emergency Wetlands Resources Act, October 1990).

Threatened and Endangered Species

The Endangered Species Act (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984 and 1988) states in Sec. 8A.(a) that "*The Secretary of the Interior (hereinafter in this section referred to as the "Secretary") is designated as the Management Authority and the Scientific Authority for purposes of the Convention and the respective functions of each such Authority shall be carried out through the United States Fish and Wildlife Service."* The Act also requires all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act.

To identify Federal threatened or endangered species of relevance to Rachel Carson NWR we reviewed:

- Federal Threatened and Endangered Species List
- Recovery Plans for Federal-listed species in our region

❖ Biological Integrity, Diversity, and Environmental Health

The 1997 National Wildlife Refuge System Improvement Act states that in administering the System the Service shall *"… ensure that the biological integrity, diversity, and environmental health of the System are maintained…"* (601 FW 3; also known as the "Integrity Policy"). The USFWS (2003) defines these terms as:

Biological Diversity.-–the variety of life and its processes, including the variety of living organisms, the genetic differences between 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 biological processes that shape genomes, organisms, and communities.

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.

Where possible management on the refuge restores or mimics natural ecosystem processes or functions and thereby maintains biological diversity, integrity, and environmental health. Given the continually changing environmental conditions and landscape patterns of the past and present (e.g., rapid development, climate change, sea level rise), relying on natural processes is not always feasible nor always the best management strategy for conserving wildlife resources. Uncertainty about the future requires that the refuge manage within a natural range of variability rather than emulating an arbitrary point in time. This maintains mechanisms that allow species, genetic strains, and natural communities to evolve with changing conditions, rather than necessarily trying to maintain stability.

As stated by Meretsky et al. (2006), the Integrity Policy directs refuges to assess their importance across landscape scales and to "forge solutions to problems arising outside refuge boundaries." Some of these regional land use problems include habitat fragmentation/lack of connectivity, high levels of contaminants, and incompatible development or recreational activities.

To assess the historical condition, site capability, current regional landscape conditions, and biological diversity and environmental health data pertinent to Rachel Carson NWR we used the following resources:

- Maps and associated data on site capability
    - Kuchler's (1964) potential natural vegetation
    - Soils, topography, and hydrology
    - History of natural disturbance patterns: e.g., fire, insect outbreaks, storms
- Map of current landscape condition showing conserved lands network, connectivity, land use patterns, and management/ownership trends surrounding the refuge
- Map of existing vegetation on the refuge, including distribution and abundance of invasive species
- Regional/Global Environmental Trends
    - Climate Change
    - Air pollution: e.g., mercury
    - Water pollution (Maine Department of Conservation)
- Maine Natural Areas Program information on rare, declining, or unique natural communities and plant populations
- Maine Wildlife Action Plan
- Status and Trend Information from refuge surveys and studies of sharp-tailed sparrows, waterfowl, shorebirds, breeding Neotropical landbirds, marsh and wading birds, piping plovers and least terns, rare plants, anuran call counts, vernal pools, and New England cottontail.

❖ Summary Table

Table B.1 is a list of the *potential wildlife species* of concern for Rachel Carson NWR based on the information compiled and analyzed in this section as described under legal mandates, trust resources, and integrity policy. For rare plants and natural communities we were able to directly identify the *priority rare plants and natural communities* since these are more site-specific than wildlife (see table B.2).

Guide to Table B.1

[1]**Seasons on the Refuge**	**B**=Breeding **W**=Wintering **M**=Migration **YR**=Year-Round
[2]**Federal T&E**	Federal Endangered Species List **T**=Threatened **E**=Endangered
[3]**State T&E**	State of Maine Threatened and Endangered Species List **T**=Threatened **E**=Endangered **SC**=Special Concern
[4]**BCR30**	December 6-9, 2004, Cape May, New Jersey Bird Conservation Region 30 Meeting **HH**=Highest Priority **H**=High Priority **M**=Moderate Priority
[5]**BCR 14**	Bird Conservation Region 14: Atlantic Northern Forest; Dettmers 2004. Draft: Blueprint for the Design and Delivery of Bird Conservation in the Atlantic Northern Forest. USFWS.
[6]**USFWS Birds of Conservation Concern**	USFWS 2002. Birds of conservation concern 2002 (for BCR 14 and BCR 30). Division of Migratory Birds, Arlington, Virginia.
[7]**Federal Trust Fish Species** (USFWS Trend Data)	-----. 2003. Attachment I – Federal Trust Species and Trends – Atlantic Anadramous Species in the document called *Strategic Growth – **L**and **A**cquisition **P**riority **S**ystem*, Fiscal Year 2005 – Budget Cycle. **D**=Decreasing **I**=Increasing
[8]**Maine Wildlife Action Plan Priorities** (Draft 2005)	**1**=Very High **2**=High
[9]**Shorebird Plan-Atlantic Flyway**	Clark and Niles 2000 North Atlantic Regional Shorebird Plan .
[10]**Waterbird Plan**	James A. Kushlan, Melanie J. Steinkamp, Katharine C. Parsons, Jack Capp, Martin Acosta Cruz, Malcolm Coulter, Ian Davidson, Loney Dickson, Naomi Edelson, Richard Elliot, R. Michael Erwin, Scott Hatch, Stephen Kress, Robert Milko, Steve Miller, Kyra Mills, Richard Paul, Roberto Phillips, Jorge E. Saliva, Bill Sydeman, John Trapp, Jennifer Wheeler, and Kent Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas. Washington, DC, U.S.A. **H**=High Risk **M**=Moderate Risk **L**=Low Risk **NR**=Not Currently At Risk
[11]**Waterfowl Plan**	North American Waterfowl Management Plan: Strengthening the Biological Foundation: 2004 Strategic Guidance. Population Trends. **I**=Increasing **D**=Decreasing **NT**=No Trend

Table B.1. Potential Resources of Concern for Rachel Carson NWR

Species (gray highlight indicates focal species of concern identified in our habitat objectives)	Seasons on Refuge[1]	Federal T&E[2]	Maine T&E[3]	BCR 30 & PIF 9[4]	BCR 14 & PIF 27[5]	USFWS Birds of Conservation Concern[6]	Federal Trust Fish Species (USFWS Trend Data)[7]	Maine Wildlife Action Plan Priorities[8]	Shorebird Plan-Atlantic Flyway[9]	Waterbird Plan[10]	Waterfowl Plan[11]
WATERBIRDS											
American bittern	B, M			HH	M			2			
American coot								2			
Arctic tern	M		T		H			2		H	
Black-crowned night-heron	B, M		SC	M	H			2		M	
Black tern	M		E					1		M	
Clapper rail	B, M			M							
Common loon	M, W				M			2			
Common moorhen	M		SC					2			
Common tern	B, M		SC		H	X		2		L	
Glossy ibis								2			
Great cormorant	W		SC		HH			2		M	
Horned grebe	W			H	M						
Least bittern								2			
Least tern	B, M		E	HH		X		1		H	
Little blue heron	B, M			H						H	
Northern gannet	M				H					NR	
Pied-billed grebe								2			
Red-necked grebe	W				H						
Red-throated loon	W			HH	M						
Roseate tern	B, M	E	E	HH	H			1		H	
Snowy egret	B, M			HH				2		H	
WATERFOWL											
American black duck	B, W			HH	HH			2			D
Atlantic brant	M?			HH	M						NT
Atlantic Canada goose	M, W			HH	H						I
Barrow's goldeneye	W		SC		HH			2			NT
Black scoter	M, W			H	H						D
Bufflehead	M, W			H							I
Common eider	B, M, W			HH	HH			2			D
Common goldeneye	M, W			M	M						NT
Greater scaup	M, W			H	M			2			NT
Harlequin duck	W		T	H	HH			2			NT
Hooded merganser	B, M			H							I
Lesser scaup	M, W			H							D
Long-tailed duck	M, W			H	M						D
Mallard	B, M, W			H							NT
North Atlantic Canada goose	M, W			H							NT
Red-breasted merganser	M, W			M							I
Ruddy duck								2			
Surf scoter	M, W			H	M						D
White-winged scoter	M, W			H							D
Wood duck	B, M				M						I
SHOREBIRDS											
American oystercatcher	B?, M			HH	M	X		1	5		
American golden plover	M			H	H				4		
American woodcock	B, M			HH	HH			2	5		
Black-bellied plover	M			H	H				3		
Buff-breasted sandpiper	M			H		X			4		
Common snipe	M								3		
Dunlin	M			H					3		
Greater yellowlegs	M			H				2	4		
Hudsonian godwit	M			H	M	X			4		
Killdeer	B, M			M	M				2		
Least sandpiper	M			M	M				3		
Lesser yellowlegs	M			M					2		
Long-billed dowitcher	M								2		
Marbled godwit	M			H		X			4		

Table B.1. Potential Resources of Concern for Rachel Carson NWR *(continued)*

Species (gray highlight indicates focal species of concern identified in our habitat objectives)	Seasons on Refuge[1]	Federal T&E[2]	Maine T&E[3]	BCR 30 & PIF 9[4]	BCR 14 & PIF 27[5]	USFWS Birds of Conservation Concern[6]	Federal Trust Fish Species (USFWS Trend Data)[7]	Maine Wildlife Action Plan Priorities[8]	Shorebird Plan-Atlantic Flyway[9]	Waterbird Plan[10]	Waterfowl Plan[11]
Pectoral sandpiper	M								2		
Piping plover	B	T	E	HH	HH			1	5		
Purple sandpiper	M, W			H	HH	X		2	3		
Red-necked phalarope	M		SC	H	HH			2	3		
Red knot	M			HH	H	X		2	5		
Red phalarope	M			M	H				3		
Ruddy turnstone	M			HH				2	4		
Sanderling	M			HH	M			2	4		
Semipalmated plover	M			M	M				2		
Semipalmated sandpiper	M			H	HH			2	4		
Short-billed dowitcher	M			H	H				3		
Solitary sandpiper	M			H					3		
Spotted sandpiper	M			M					3		
Stilt sandpiper	M								3		
Upland sandpiper	M		T	M	H	X		1	4		
Whimbrel	M		SC	HH	H	X		2	5		
White-rumped sandpiper	M			H					3		
Willet	B, M			H	M			2	4		
Wilson's phalarope	M			M					4		
Wilson's plover	M			H		X			4		
LANDBIRDS											
American redstart	B				H						
American pipit	M?		E					2			
Bald eagle	M, W	T	T	M	M			2			
Baltimore oriole	B, M			H		X		2			
Bank swallow	B, M				M						
Barn swallow	B. M				M			2			
Barred owl								2			
Bay-breasted warbler	M				HH	X		2			
Black-and-white warbler	B, M			H				2			
Black-billed cuckoo	B, M				M			2			
Blackburnian warbler	B, M			M	M			2			
Blackpoll warbler	M				M	X					
Black-throated-blue warbler	M				H			2			
Black-throated-green warbler	B, M				M			2			
Blue-gray gnatcatcher								2			
Blue-winged warbler	B?		SC	HH	H	X		1			
Bobolink	B, M				H			2			
Broad-winged hawk	B, M			H							
Brown creeper	B, M				M						
Brown thrasher	B, M			H				2			
Canada warbler	B, M			M	HH	X		2			
Cape May warbler	M				H	X		2			
Chestnut-sided warbler	B, M				H	X		2			
Chimney swift	B, M				H			2			
Common nighthawk	B, M				H			2			
Cooper's hawk	B, M		SC								
Eastern screech owl	YR		SC								
Eastern kingbird	B, M			H				2			
Eastern meadowlark	B, M		SC					2			
Eastern screech owl								2			
Eastern towhee	B, M			H				2			
Eastern wood-pewee	B, M				H						
Field sparrow	B, M		SC	H				2			
Golden eagle	M, W		E					2			
Grasshopper sparrow								2			
Gray catbird	B, M			M							
Great-crested flycatcher	B, M			H				2			
Hairy woodpecker	YR										

Table B.1. Potential Resources of Concern for Rachel Carson NWR *(continued)*

Species (gray highlight indicates focal species of concern identified in our habitat objectives)	Seasons on Refuge[1]	Federal T&E[2]	Maine T&E[3]	BCR 30 & PIF 9[4]	BCR 14 & PIF 27[5]	USFWS Birds of Conservation Concern[6]	Federal Trust Fish Species (USFWS Trend Data)[7]	Maine Wildlife Action Plan Priorities[8]	Shorebird Plan-Atlantic Flyway[9]	Waterbird Plan[10]	Waterfowl Plan[11]
Horned lark	M, W				M			2			
Ipswich savannah sparrow	W				HH						
Loggerhead shrike	M, W		SC	M				2			
Long-eared owl								2			
Louisiana waterthrush	B?, M			H				2			
Marsh wren	B, M			H		X		2			
Nelson's sharp-tailed sparrow	B, M			M	HH	X		2			
Northern bobwhite	B?			H							
Northern flicker	B, M				M			2			
Northern goshawk	B, M				M						
Northern harrier	M				M						
Northern parula	B, M				M			2			
Olive-sided flycatcher	B, M		SC		H	X		2			
Ovenbird	B, M				M						
Palm warbler	M				M						
Peregrine falcon	M		E		M	X		1			
Pine grosbeak	B, M				M						
Purple finch	B, M				H			2			
Purple martin	B		SC					2			
Prairie warbler	B, M			HH		X		2			
Red-shouldered hawk	B, M		SC								
Rose-breasted grosbeak	B, M				M			2			
Ruffed grouse	YR				M						
Rusty blackbird								2			
Saltmarsh sharp-tailed sparrow	B, M		SC	HH		X		1			
Scarlet tanager	B, M			H				2			
Seaside sparrow			SC	HH		X					
Sedge wren			E	M		X		1			
Short-eared owl								1			
Veery	B, M				H			2			
Vesper sparrow	B, M				M			2			
Whip-poor-will	B, M		SC	H	M	X		2			
Willow flycatcher	B, M			H				2			
Wood thrush	B, M			HH	HH	X		2			
Yellow-bellied flycatcher	M				M						
Yellow-bellied sapsucker	M				H			2			
Yellow-throated vireo								2			
MAMMALS											
Eastern red bat	B, M		SC								
Eastern small-footed bat	YR?		SC					2			
Eastern pipistrelle	B, M		SC								
Southern flying squirrel	YR		SC								
Hoary bat	B, M		SC								
Harbor porpoise	YR										
New England cottontail	YR		SC					1			
Northern bog lemming	YR		T					2			
Silver-haired bat	B, M		SC								
AMPHIBIANS											
Blue-spotted salamander	YR							2			
Northern leopard frog	YR										
REPTILES											
Black racer	?		E					2			
Blanding's turtle	YR		E					1			
Brown snake	YR		SC								
Eastern hognose snake	?										
Eastern ribbon snake	YR		SC								
Spotted turtle	YR		T					2			

Table B.1. Potential Resources of Concern for Rachel Carson NWR *(continued)*

Species (gray highlight indicates focal species of concern identified in our habitat objectives)	**Seasons on Refuge[1]**	**Federal T&E[2]**	**Maine T&E[3]**	**BCR 30 & PIF 9[4]**	**BCR 14 & PIF 27[5]**	**USFWS Birds of Conservation Concern[6]**	**Federal Trust Fish Species (USFWS Trend Data)[7]**	**Maine Wildlife Action Plan Priorities[8]**	**Shorebird Plan-Atlantic Flyway[9]**	**Waterbird Plan[10]**	**Waterfowl Plan[11]**
Wood turtle	YR ?		SC					2			
FISH											
Alewife	YR						D				
American eel	YR						D	1			
American shad	YR						D	2			
Atlantic salmon	YR						D	1			
Blueback herring	YR						D				
Rainbow smelt	YR						D	2			
Shortnose sturgeon	?	E					D	1			
Striped bass	YR						I	1			
INVERTEBRATES											
Ringed boghaunter	YR		E					1			
Ebony boghaunter	YR		SC								

Guide to Table B.2

[1]**State Status**	State of Maine Threatened and Endangered Species List
	T=Threatened **E**=Endangered **SC**=Special Concern
[2]**Srank**	State Rarity Ranks (determined by the Maine Natural Areas Program)
	S1=Critically imperiled in Maine because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because some aspect of its biology makes it especially vulnerable to extirpation from the State of Maine
	S2=Imperiled in Maine because of rarity (6-20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline
	S3=Rare in Maine (on the order of 20-100 occurrences)
	S4=Apparently secure in Maine
	S5=Demonstrably secure in Maine
	SH=Occurred historically in Maine, and could be rediscovered; not known to have been extirpated.
	SU=Possibly in peril in Maine, but status uncertain; need more information
	SX=Apparently extirpated in Maine (historically occurring species for which habitat no longer exists in Maine)
[3]**Grank**	Global Rarity Ranks (determined by The Nature Conservancy)
	G1=Critically imperiled globally because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because some aspect of its biology makes it especially vulnerable to extirpation from the State of Maine
	G2=Globally imperiled because of rarity (6-20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline
	G3=Globally rare (on the order of 20-100 occurrences)
	G4=Apparently secure globally
	G5=Demonstrably secure globally
	T=Subspecies rank
	Q=Questionable rank
	HYB=Hybrid species

Table B.2. Rare Plants and Exemplary Natural Communities on Rachel Carson NWR*

Rare Plant Species	*State Status*[1]	*Srank*[2]	*Grank*[3]
American Sea Blight, *Suaeda calceoliformis*	T	S1	G5
Beach Plum, *Prunus Maritima*	E	S1	G4
Dwarf Glasswort, *Salicornia Bigelovii*	SC	S1	G5Q
Eastern Joe Pye Weed, *Eupatorium dubium*	E	S2	G5
Hollow Joe Pye Weed, *Eupatorium fistulosum*	E	S2	G5?
Pale Green Orchis, *Platanthera flava*	SC	S2	G4T4
Rich's Sea Blight, *Suaeda maritima ssp Richii*	SC	S1	G5T3
Sassafras, *Sassafras albidum*	SC	S2	G5
Sea-beach Sedge, *Carex silicea*	SC	S3	G5
Slender Blue Flag Iris, *Iris prismatica*	E	S2	G4/G5
Smooth Winterberry Holly, *Ilex laevigata*	SC	S3	G5
White Wood Aster, *Aster divaricatus*	T	S3	G5
Wild Coffee, *Triosteum aurantiacum*	E	S1	G4
Exemplary Natural Communities			
Coastal Dune-Marsh Ecosystem		S3	
Dune Grassland		S2	G4?
Pitch Pine Bog		S2	G3G5
White Oak – Red Oak forest		S3	

*Special thanks to Don Cameron, Maine Natural Areas Program for reviewing our list and providing clarification on occurrences

III. *Priority* Resources of Concern

The potential resources of concern table (B.1) that was developed in Section II contains a large number of species with a broad array of habitat needs. The refuge needs to prioritize these species and their associated habitats to determine what the refuge is best suited to focus on in its management strategies. To guide us in prioritizing this list, we considered the following concepts:

- Achieving refuge purposes, and managing for trust resources as well as biological diversity, integrity, and environmental health can be addressed through the habitat requirements of "focal species" or species that may represent guilds that are highly associated with important attributes or conditions within habitat types. The use of focal species is particularly valuable when addressing USFWS trust resources such as migratory birds.

- The Bird Conservation Region (BCR) plans are increasing their effectiveness at ranking and prioritizing those migratory birds most in need of management of conservation focus. Although all species that make it to a ranked BCR priority list are in need of conservation attention, we selected **focal species** that were ranked High or Moderate in Continental concern with a High to Moderate BCR Responsibility. See www.abcbirds.org/nabci for BCR rules used to rank birds.

- Focal species selected which were not birds (i.e. New England cottontail, American eel, Blandings turtle) were identified as resources of concern due to rangewide concern over their population status or because they are currently under review for inclusion on the federal Endangered or Threatened Species list. Fish species were reviewed using criteria from USFWS Land Acquisition priority System, Federal Trust Species and Trends – Atlantic Anadramous Species.

- Habitat conditions on or surrounding the refuge may limit the refuge's capability to support or manage for a potential species of concern. The following site-specific factors were evaluated:
    - Patch size requirements
    - Habitat connectivity
    - Incompatibility surrounding land uses
    - Environmental conditions: soils, hydrology, disturbance patterns, contaminants, predation, invasive species
    - Specific life history needs
- The likelihood that a potential species of concern would have a positive reaction to management strategies.
- The ability to rely on natural processes to maintain habitat conditions within a natural range of variability suitable to the focal species
- The ability to use adaptive management (flexibility and responsiveness of the refuge and the habitats) in the face of changing environmental conditions (e.g., climate change).

❖ High and Moderate Priority Habitat Types

Refuge management is most often focused on restoring, managing, or maintaining habitats or certain habitat conditions to benefit a suite of focal species or a suite of plants and animals associated with a particular habitat. Rachel Carson NWR identified the high and moderate priority habitats on the refuge based on information compiled in Section I (e.g., site capability, historic condition, current vegetation, conservation needs of wildlife associates). As part of this process we identified any limiting factors that affect the refuge's ability to maintain these habitats (see table B.3).

Table B.3. High and Moderate Priority Habitats on Rachel Carson NWR

High Priority Habitat Types	*Reason for Selecting as High Priority**	*Limiting Factors for Maintaining this Habitat*
Dune grassland, beach, rocky shore, subtidal and intertidal	1=Purposes: Migratory Birds (shorebirds) 2=Threatened, Endangered and candidate Species (piping plover) 3=Trust Resources (multiple focal species) 4=BIDEH (marine ecosystem)	Keeping pace with sea level rise, overuse by public, development, climate change, invasive species.
Salt marsh	1=Purposes: Migratory birds (wading and shorebirds); Wetlands 2=Trust Resources (multiple focal species) 4=BIDEH (marine ecosystem)	Keeping pace with sea level rise, development, climate change, invasive species, and contaminants.
Tidal rivers	1=Purposes: Migratory Birds (waterfowl) 2=Threatened, Endangered, and candidate Species (American eel under review for listing) 3=Trust Resources (interjurisdictional fish) 4=BIDEH (marine ecosystem)	Contaminants, residential/ commercial development, siltation, water quantity and quality.
Freshwater wetlands: emergent marsh, scrub shrub wetland, bog, vernal pool, forested wetland	1=Purposes: Wetlands, Migratory Birds (breeding landbirds) 4=BIDEH (wetland ecosystems, Blandings turtle)	Invasive species, residential and commercial development, water quantity and quality.
Early Successional: Shrubland	1=Purposes: Migratory Birds (migrating and breeding landbirds 2=Threatened, Endangered, and candidate Species (New England cottontail – under review for Federal listing) 3=Trust Resources (priority breeding landbirds)	Invasive species, succession to forest.
Mixed forest	1=Purposes: Migratory Birds (landbirds) 3=Trust Resources (breeding focal landbirds),	Invasive species, forest fragmentation.
Moderate Priority Habitat Types	*Reason for Selecting as a Moderate Priority*	
Freshwater rivers	Minimal freshwater river habitats available on refuge 4=BIDEH	Water quality and quantity and invasive species.
Nearshore and marine open water	Limited capacity to influence Trust Resources 4=BIDEH	Climate change, invasive species, water quality.
Early Successional: Grassland	Minimal habitat available on refuge 3=Trust Resources (1 focal species)	Invasive species, succession.

* 1=Legal Mandates: Purposes 2=Federal Endangered, Threatened, and candidate species
3=USFWS Trust Resources/Focal Species 3=Biological Integrity, Diversity, and Environmental Health Policy (BIDEH)

Based on the habitat types identified on the refuge as described in table B.3, we then developed a table of the priority species of concern with their associated habitat types (table B.4). This table also described the habitat structured required by each priority or "focal" species and identifies other species that would benefit from the same or similar habitat conditions.

Table B.4. Priority Resources of Concern, Habitat Structure, and Other Benefiting Species on Rachel Carson NWR

Priority Resources of Concern		*Habitat Structure*	*Other Benefiting Species*
Species or Species Group	*Habitat Type*		
Piping plover	Dune grassland – beach – rocky shore, tidal and intertidal	Breeding: Nest above the high tide line on open sand, gravel or shell-covered beaches, especially on sand spits and blowout areas in dunes. Feed in the "splash zone" and in wrack piles at the high tide line.	Waterfowl and wading birds
Least tern		Breeding: Nest on open sand, gravel, or shell-covered beaches above the high tide line.	
Migratory shorebirds		Migration: feeding and roosting	
Nelson's sharp-tailed sparrow	Saltmarsh, tidal creeks, estuaries, and bays	Breeds in salt, freshwater, and brackish marshes; Females wedge or suspend a nest in medium high cordgrass just above the substrate or water near the mean high-tide line.	Willet, wading birds, anadromous fish, other migratory waterfowl
Saltmarsh sharp-tailed sparrow		Breeds almost exclusively in salt marsh; Females wedge or suspend a nest in medium high cordgrass just above the substrate or water near the mean high-tide line.	
Black duck		Migration, Wintering: In winter in New England and Maritime Provinces of Canada, uses tidal habitats exclusively. Tides, icing, time of day, and human disturbance interact to affect use of coastal habitats. During spring and fall migration use estuarine wetlands, tidal flats, shallow freshwater wetlands, among other wetlands	
Roseate and common terns		Migration: feeding	
Common eider		Year-round: feeding areas utilized extensively	
Blanding's turtle	Freshwater wetlands	Year-round: Vernal pool complexes and small wetlands; wetlands in a matrix of intact upland forest; shallow, dark, heavily-vegetated waters with soft muddy bottoms; nests in sandy or loamy uplands including plowed fields; basks on logs, stumps, and banks; May travel to as many as 6 different wetlands in a year, traveling as far as a mile or more	Spotted turtle
Willow flycatcher		Breeding: Fairly open areas with scattered shrubs or forest edges; moist or wet shrubby areas; dense stands of shrubs > 2.1 m in height; nest is ~1.2 m off the ground. Territory size 2.6 to 4.5 acres	Marsh wren

Table B.4. Priority Resources of Concern, Habitat Structure, and Other Benefiting Species on Rachel Carson NWR *(continued)*

Priority Resources of Concern		*Habitat Structure*	*Other Benefiting Species*
Species or Species Group	*Habitat Type*		
New England cottontail	Early successional: shrubland	Year-Round: Patches > 10 ha; Native shrublands and regenerating forests with dense understory cover at least 0.5 m tall and less than 7.5 cm (3 inches) in diameter and stem densities of ~10,000 stems/ha	Willow flycatcher, blue-winged warbler, field sparrow, migrating songbirds
Eastern towhee		Breeding: Dense, brushy dry areas, pitch pine-scrub oak forests, utility rights-of-way; nests on or near ground; well-developed litter layer	
American woodcock		Breeding: Open second growth, young forests in close proximity to singing grounds	
Prairie warbler		Breeding: Usually associated with poor soils, shrublands and thickets, overgrown fields with scattered trees, pine plantations (especially Christmas tree plantings), oak clearcuts, and powerline right-of-ways	
Rose-breasted grosbeak	Mixed forest	Breeding: Edges of mature moist deciduous or mixed forests with understory of shrubs or saplings; closed canopy (~85%); canopy height ~70 feet	Baltimore oriole, blackburnian warbler, eastern wood pewee, hairy woodpecker, broad-winged hawk, indigo bunting, black-and-white warbler
Black-billed cuckoo		Breeding: Shrublands, thickets, and other woodlands with dense, shrubby vegetation; Numbers fluctuate with caterpillar outbreaks	
Scarlet tanager		Breeding: Mixed and deciduous mature forest (particularly oak-pine forests); closed canopy; trees > 23 cm (9 inches) dbh; minimum forest area needed to sustain a viable population 10–12 ha	
Wood thrush		Breeding: Mature deciduous and mixed forests, particularly near wetlands; tall trees (~53 feet or more); a shrub-subcanopy layer, shade, moist soil and leaf litter; closed canopy	
Veery		Breeding: Damp, second growth, young forests with open canopy and dense understory. Will use hardwood and hemlock forests	
American eel	Freshwater rivers	Migration: females migrate upstream to mature in freshwater wetlands. Males prefer freshwater rivers and brackish waters until both mature males and females return to the Sargasso Sea to breed.	Freshwater mussels, wood turtle
Louisiana waterthrush		Breeding: Extensive deciduous and mixed bottomland forests along fast-flowing streams; moss covered logs, thick understory; area sensitive – minimum 250 acres to sustain breeding population	
Bobolink	Early successional: grassland	Breeding: Prefers a mixture of grasses and broad-leaved forbs with high grass-forb ratio. Densities significantly higher in fields with relatively low amounts of total vegetative cover, low alfalfa cover, and low total legume cover. These vegetative characteristics occur in hay fields $\geq$ 8 yr old. Fields > 10 ha (~25 acres) preferred	Eastern meadowlark

IV. Adaptive Management

The priority resources of concern and their respective habitat attributes were used to develop specific habitat objectives. Refuge habitat management objectives must be achievable. Many factors, such as lack of resources, existing habitat conditions, species response to habitat manipulations, climatic changes, contaminants or invasive species, may reduce or eliminate the ability of the refuge to achieve objectives. Although these limiting factors were considered during the development of refuge objectives, conditions may and are likely to change over the next 15 years and beyond.

The refuge will use adaptive management to respond to changing conditions that impair our ability to measure and achieve the habitat objectives. This requires that we establish and maintain a monitoring program to ensure that we can detect and respond to changing conditions.

References

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John & Karen Hollingsworth/USFWS

Appendix C

Wilderness Review

- Wilderness Inventory Areas
- Summary of Wilderness Inventory Findings
- Conclusion
- Wilderness Review Team

Wilderness Inventory Areas

Our wilderness inventory team identified 10 Wilderness Inventory Areas (WIAs) in the Rachel Carson National Wildlife Refuge. Our findings for each WIA follow.

Note: Each refuge division was initially created to protect a tidal river or an estuary resource. Subsequent boundary expansions included adjacent uplands to protect wetlands and water quality and provide critical wildlife habitat.

❖ Brave Boat Harbor Division

1. **Describe the division in a general manner (acres, habitats etc.). Is the area in federal fee title ownership?**

The Brave Boat Harbor Division encompasses approximately 700 acres in the towns of York and Kittery, and manages an additional 40 acres under a conservation easement. Oak-pine forest with vernal pools and old field upland habitats surround salt marsh and estuary habitat. Portions of upland forest have a dense understory of serviceberry (*Amelanchier canadensis*), bayberry (*Myrica pensylvanica*), sweet gale (*Myrica gale*), high bush blueberry (*Vaccinium corymbosum*), male-berry (*Lyonia liqustrina*), and spirea (*Spirea latifolia*). Some forested areas have an understory of speckled alder (*Alnus rugosa*), winterberry (*Ilex veticillata*), honeysuckle (*Lonicera morrowi*), sweet gale, spirea, poison ivy (*Toxicodendron rydbergii*), and Virginia rose (*Rosa virginiana*) (Lortie and Pelletier 1988). Several rare plants, including white wood aster, saltmarsh false-foxglove, and dwarf glasswort, are found at Brave Boat.

This area was nominated for inclusion in the Maine Ecological Reserves program because of its saltmarsh ecosystem and the presence of oak-pine forest, exemplary white oak-red oak forest and perched hemlock-hardwood swamp communities, acidic fen, shrub swamp, and vernal pool (McMahon 1998). It also lies within a Maine Beginning With Habitat Focus Area (Greater Brave Boat Harbor/Gerrish Island) known to harbor rare natural communities, including red oak-white oak forest, dune grassland, and spartina saltmarsh (Maine Department of Inland Fisheries and Wildlife).

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

None of the divisions are undivided, contiguous habitat blocks. Brave Boat Harbor is defined and divided by Seapoint Road, Raynes Neck Road, Short Farm Road, and others.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

Each division is located at the wildland-urban interface. However, homes lie next to and, in some cases, within blocks of protected habitat. We believe Rachel Carson refuge has more neighbors than any

other national wildlife refuge. Hundreds of homes lie within a mile of this division. Homes and other improvements are visible from most places on it. It has no known human-created hazards and no known ordnance. Refuge prescribed fire units are located in this division.

5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Moody Division

1. **Describe the division in a general manner (acres, habitats, etc.). Is the area in federal fee title ownership?**

The Moody Division comprises 391 acres in the towns of Ogunquit and Wells, and manages 4 acres under a conservation easement. The division is almost entirely salt marsh, with some old field and coastal scrub-shrub habitat.

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Furbish Road and Borne Avenue bisect the division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Lower Wells Division

1. **Describe the division in a general manner (acres, habitats, etc.). Is the area in federal fee title ownership?**

The Lower Wells Division comprises 1,000 acres, with 6 acres under easement in the town of Wells. Lower Wells is almost entirely salt marsh, with some maritime forest edges, coastal shrublands, and open fields. This division includes the Webhannet salt marshes, one of the largest salt marsh systems in the state, and an important black duck wintering area. Most of the historic barrier beach is now dense residential and commercial development. Scoters congregate in winter in the nearshore marine waters.

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Drakes Island Road, Upper Landing Road, Lower Landing Road, and Mile Road all cross the division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Upper Wells Division

1. **Describe the division in a general manner (acres, habitats, etc.). Is the area in federal fee title ownership?**

This division, in the town of Wells, encompasses 643 acres and an additional 13 acres under easement. The division is approximately 50 percent mixed pine and hardwood forest and 50 percent salt marsh, beach dune, old field and shrub habitat. Several rivers run through it: the Little and Merriland rivers, and Branch Brook. Crescent Surf Beach in this division usually supports the largest concentration of nesting least terns in Maine. Up to eight pairs of federal-listed threatened piping plovers have nested on the beach, and it is a staging area for the federal-listed endangered roseate tern. New England cottontails live in the scrub-shrub habitat. Upper Wells encompasses portions of a pitch pine bog natural community, a sparsely forested peatland. Upland forests contain an overstory of pitch pine, white pine, red maple, and red oak. The understory has dense thickets of serviceberry bayberry, sweet gale, high bush blueberry, male-berry, and spirea (Lortie and Pelletier 1988).

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Western Avenue (Route 9), Skinner Mill Road, Harts Road and the Boston and Maine Railroad all cross the division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Mousam Division

1. **Describe the division in a general manner (acres, habitats, etc.). Is the area in federal fee title ownership?**

The Mousam River Division, in the town of Kennebunk, contains 431 acres and has an additional 64 acres under conservation easement.. The division is primarily forested uplands with abundant vernal pools. Remaining habitats include salt marsh, river, estuary, open field and scrub-shrub.

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Western Avenue (Route 9), Brown Street, Harts Road, Hawthorne Lane, Caspar Lane, Ocean View road and the Bridle Path all cross the division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Goose Rocks Division

1. **Describe the division in a general manner (acres, habitats, etc.) Is the area in federal fee title ownership?**

This division, in the town of Kennebunkport, encompasses 540 acres, plus 1 acre that is under easement. Three-fourths of this division is 75-percent tidal. Habitats include salt marsh, river, beach, estuary and coastal shrubland. Smith Brook, Batson River, Goose Rocks Creek, and Sampson Cove are in this division. Piping plovers historically nested at the end of Marshall Point Road. Upland forests contain an overstory of pitch pine, white pine, red maple, and red oak. The understory has dense thickets of serviceberry, bayberry, sweet gale, high bush blueberry, male-berry, and spirea. Some forested areas have an

understory of speckled alder, winterberry, honeysuckle, sweet gale, spirea, poison ivy, and Virginia rose (Lortie and Pelletier 1988).

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Marshal Point Road, Dyke Road, Kings Highway, Goose Rocks Road, Sunset Lane, Norwood Lane, Whittemore Road, and several paved, private roads cross the division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Little River Division

1. **Describe the division in a general manner (acres, habitats, etc.) Is the area in federal fee title ownership?**

This division, in Kennebunkport and Biddeford, encompasses 156 acres, with an additional 59 acres under conservation easement. The Little River runs through the division, which is mostly tidal habitat (about 60 percent); the rest is forested upland and scrubland.

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Granite Point Road, Fortunes Rocks Road, Elizabeth Road and numerous private roads cross this division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Biddeford Pool division

1. **Describe the division in a general manner (acres, habitats, etc.). Is the area in federal fee title ownership?**

This division, in Biddeford, encompasses 71 acres with an additional 5 acres under easement. Its Biddeford Pool holdings protect some of the state's most important estuarine habitats. Most of the area is salt marsh, coastal shrubland, and grassland with some pitch pine forest.

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Old Pool Road, Salt Marsh Lane, Days Landing, Channel Cove, Lane, Bridge Street, Mile Stretch Road, and Hills Beach Road all cross this division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Goosefare Brook Division

1. **Describe the division in a general manner (acres, habitats, etc.) Is the area in federal fee title ownership?**

This division, in the Towns of Saco and Old Orchard Beach, consists of 494 acres and an additional 8 acres under easement. It consists of a small beach, salt marshes and several hundred acres of pitch pine and mixed pine/hardwood forest. Goosefare Brook runs through this area. One pair of nesting piping plovers commonly uses the beach.

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Seaside Avenue, Shore Avenue, Cottage Avenue, Marshview Road, Atlantic Way Trail, Palmer Avenue, Pineywoods Road, Meadow Avenue, Richards Way and Wildwood Drive all cross or intersect this division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

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5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

❖ Spurwink Division

1. **Describe the division in a general manner (acres, habitats, etc.). Is the area in federal fee title ownership?**

This division, in the Towns of Scarborough and Cape Elizabeth, encompasses 493 acres and another 27 acres under easement. It is centered along the waters of the Spurwink River, and Pollack Creek, and consists of upland fields, salt marsh, shrublands, and some mature forest.

2. **Describe why the division does not meet the roadless criteria (number of roads, total miles). Are the roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use?**

Spurwink Road, Wiley Way, Starbird Road, Spurwink Avenue, Stanford Lane, Quarry Road, Ivory Hill Road, Heron Point Road, Sawyer Street, and Salt Marsh Way, all cross or intersect this division. None of the divisions are undivided, contiguous habitat blocks.

3. **Is the division of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management?**

No.

4. **Describe why the division does not meet the naturalness criteria (number of structures, including all imprints of mans work). Does the division appear to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable? Are the human impacts substantially unnoticeable in the unit as a whole? Does the division contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity? Describe the presence of physical impacts of refuge management facilities and activities.**

Each division is located at the wildland-urban interface. However, homes lie next to and, in some cases, within blocks of protected habitat. We believe Rachel Carson refuge has more neighbors than any other national wildlife refuge. Hundreds of homes lie within a mile of this division. Homes and other improvements are visible from most places on it. It has no known human-created hazards and no known ordnance. Refuge prescribed fire units are located in this division.

5. **Does the area meet the solitude criteria? Does the division provide opportunities for solitude or primitive and unconfined recreation? Does the area offer the opportunity to avoid the sights, sounds and evidence of other people?**

No. Homes and other improvements are visible from most places on this division.

6. **Please address any supplemental values (identified above) that occur in this WIA.**

None.

Summary of Wilderness Inventory Findings

This area has been settled for nearly 400 years. Because of that infringement by humans, mostly taking the form of roads and houses, none of the lands that compose the current, approved refuge acquisition boundary or the lands in the preliminary project proposal are suitable for designation as wilderness.

Conclusion

The Service finds that none of the WIAs at the Rachel Carson National Wildlife Refuge, Wells, Maine, meet the minimum criteria to qualify as a WSA as defined by the Wilderness Act. No further investigation into wilderness designation is needed at the refuge.

Wilderness Review Team

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Graham Taylor, Deputy Refuge Manager, Rachel Carson NWR, Wells, ME

Steve Funderburk, Chief, Division of Conservation Planning and Policy, Hadley, MA.

Barry Brady, Regional Wilderness Coordinator, Hadley, MA.

USFWS

Appendix D

Appropriate Use and Compatibility Determinations

Introduction

❖ About the Appropriate Refuge Uses Policy

This policy describes the initial decision process the refuge manager follows when first considering whether or not to allow a proposed use on a refuge. The refuge manager must find a use is appropriate before undertaking a compatibility review of the use. This policy clarifies and expands on the compatibility policy (603 FW 2.10D(1)), which describes when refuge managers should deny a proposed use without determining compatibility. If we find a proposed use is not appropriate, we will not allow the use and will not prepare a compatibility determination.

By screening out proposed uses not appropriate to the refuge, the refuge manager avoids unnecessary compatibility reviews. By following the process for finding the appropriateness of a use, we strengthen and fulfill the Refuge System mission. Although a refuge use may be both appropriate and compatible, the refuge manager retains the authority to not allow the use or modify the use. For example, on some occasions, two appropriate and compatible uses may be in conflict with each other. In these situations, even though both uses are appropriate and compatible, the refuge manager may need to limit or entirely curtail one of the uses in order to provide the greatest benefit to refuge resources and the public. See the compatibility policy (603 FW 2.11G) for information concerning resolution of these conflicts.

For proposed uses not considered during the preparation of this CCP, we will apply the procedure contained in this policy and make an appropriateness finding without additional public review and comment. However, if we find a proposed use is appropriate, we must still determine that the use is compatible. The compatibility determination includes an opportunity for public involvement. See the planning policy (602 FW 1, 3, and 4) for detailed policy on refuge planning.

❖ About Compatibility Determinations

The Refuge Improvement Act and its regulations require an affirmative finding by the refuge manager of the compatibility of an activity before it is allowed on a national wildlife refuge. This finding is documented in a report called a "compatibility determination." A compatible use is one "…that will 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). The Act defines six priority, wildlife-dependent uses that are to be given enhanced consideration on refuges: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. These priority uses may be authorized on a refuge when they are compatible and not inconsistent with public safety.

At the time the compatibility determination is made, the refuge manager will insert the required maximum 10-year re-evaluation date for uses other than wildlife-dependent recreational uses, or a 15-year maximum re-evaluation date for wildlife-dependent recreational uses. However, the refuge manager may re-evaluate the compatibility of a use at any time (602 FWS 2, Parts 2.11 and 2.12). For example, a decision may be revisited sooner than the mandatory date, or even before the CCP process is completed, if new information reveals unacceptable impacts or incompatibility with refuge purposes.

Moreover, not all uses that are determined compatible may be allowed. The refuge manager has the discretion to allow or deny any use based on other considerations such as public safety, policy, or available funding. Nevertheless, all uses that are allowed must be determined compatible. Except for consideration of consistency with State laws and regulations as provided for in subsection (m) of the Act, no other determinations or findings are required to be made by the refuge official under this Act or the Refuge Recreation Act for wildlife dependent recreation to occur.

Please note that archaeological and historic structure research the Service conducts itself does not need a compatibility determination. However, archaeological research by non FWS personnel on refuge property will need a compatibility determination. Such other projects require an Archaeological Resource Protection Act (ARPA) Permit application to the Regional Historic Preservation Officer and a Special Use Permit from the Refuge Manager. Compatibility can be determined at that time.

603 FW 1
Exhibit 1

Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Boat Launching

This exhibit is not required for wildlife-dependent recreational uses, forms of take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No_____

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** X

Refuge Manager:_____ Date:_____

If found to be Not Appropriate, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found Not Appropriate outside the CCP process, the refuge supervisor must sign concurrence.

If found to be Appropriate, the refuge supervisor must sign concurrence:

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

Justification for a Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Boat Launching

Narrative

Rachel Carson is a coastal refuge. Surface waters in the State of Maine are the property of the state and the refuge cannot regulate this activity. Since the refuge is surrounded by water, these facilities are offered to accommodate our wildlife oriented visitors. These activities would be conducted in such a manner to minimize impacts on established programs, including hunting, fishing, wildlife and observation programs, on the rest of the refuge. The refuge fishing program is in its fourth year. Permitting recreational boat launch will benefit fishing. Safety continues to be of paramount importance in all of our management decisions.

603 FW 1
Exhibit 1

Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Mosquito Control

This exhibit is not required for wildlife-dependent recreational uses, forms of take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No_____

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** X

Refuge Manager:_____ Date:_____

If found to be Not Appropriate, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found Not Appropriate outside the CCP process, the refuge supervisor must sign concurrence.

If found to be Appropriate, the refuge supervisor must sign concurrence:

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

Justification for a Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Mosquito Control

Narrative

Rachel Carson may have more neighbors than any other national wildlife refuge. The refuge hosts between 260,000 and 330,000 visitors annually. Many of our neighbors occupy seasonal housing and most of our visitors enjoy the refuge during warm weather, which coincides with the time period when mosquitoes are present.

Arthropods such as mosquitoes pose an annoyance to humans and worldwide can have consequences such as mosquito-borne infections (eastern equine encephalitis, West Nile virus). Service Policy is to allow mosquito control on refuge lands when it is necessary to protect the health and safety of the public or a wildlife or domestic animal population. We will allow management of mosquito populations on Refuge System lands using effective means that pose the lowest risk to wildlife and habitats.

603 FW 1
Exhibit 1

Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Research Conducted by Non-Refuge Personnel

This exhibit is not required for wildlife-dependent recreational uses, forms of take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No_____

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** X

Refuge Manager:_____ Date:_____

If found to be Not Appropriate, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found Not Appropriate outside the CCP process, the refuge supervisor must sign concurrence.

If found to be Appropriate, the refuge supervisor must sign concurrence:

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

Justification for a Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Research Conducted by Non-Refuge Personnel

Narrative

The Service encourages and supports research and management studies on refuge lands that will improve and strengthen decisions on managing natural resources. The refuge manager encourages and seeks research that clearly relates to approved refuge objectives, improves habitat management, and promotes adaptive management. Priority research addresses information on better managing the Nation's biological resources that generally are important to agencies of the Department of Interior, the National Wildlife Refuge System, and State Fish and Game Agencies that address important management issues, or demonstrate techniques for managing species or habitats.

Researchers will submit a final report to the refuge on completing their work. For long-term studies, we may also require interim progress reports. We expect researchers to publish in peer-reviewed publications. All reports, presentations, posters, articles or other publications will acknowledge the Refuge System and the Rachel Carson refuge as partners in the research. All posters will adhere to Service graphics standards. We will insert this requirement to ensure that the research community, partners, and the public understand that the research could not have been conducted without the refuge having been established, its operational support, and that of the Refuge System.

603 FW 1
Exhibit 1

Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Skiing and Snowshoeing

This exhibit is not required for wildlife-dependent recreational uses, forms of take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D. for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will generally not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes X No_____

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** X

Refuge Manager:_____ Date:_____

If found to be Not Appropriate, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found Not Appropriate outside the CCP process, the refuge supervisor must sign concurrence.

If found to be Appropriate, the refuge supervisor must sign concurrence:

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

Justification for a Finding of Appropriateness of a Refuge Use

Refuge Name: Rachel Carson National Wildlife Refuge

Use: Skiing and Snowshoeing

Narrative

Wildlife observation, photography, and interpretation are priority public uses as defined by the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) and if compatible, are to receive enhanced consideration over other general public uses.

Rachel Carson National Wildlife Refuge is located in Maine where the ground can be covered with snow from November to April. In Maine, the traditional means of access to outdoor destinations during winter months is via ski and snowshoe. Refuge trails are open to public use daylight hours year round. Due to the snow cover, visitor impact is minimized during winter months in that trail tread is not being compressed and fewer species and fewer numbers of wildlife are present. These activities are encouraged at Rachel Carson NWR, and year around access requires use of snowshoes or skis.

Compatibility Determination

Use
Hunting

Refuge Name
Rachel Carson National Wildlife Refuge

Establishing and Acquisition Authorities
The Rachel Carson refuge was established on December 16, 1966, under the authority of the Migratory Bird Conservation Act (16 U.S.C. 715–715r).

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 U.S.C. 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 U.S.C. 460k-1), "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b); 100 Stat. 3583), the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if the Secretary deems such terms to be in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use
(a) What is the use? Conduct and allow access for hunting on refuge lands: specifically, for deer, migratory birds and upland game birds in accordance with state regulations. **Is the use a priority public use?** Yes. Hunting is one of the six priority public uses in the National Wildlife Refuge System Improvement Act of 1997 (Pub. L. 105–57).

(b) Where would the use be conducted? Six of the 10 refuge divisions are open for migratory bird hunting and falconry: the Brave Boat Harbor, Lower Wells, Upper Wells, Mousam, Goose Rocks, Little River, Goosefare Brook, and Spurwink River divisions. Eight of the 10 divisions are open for deer and upland game hunting: all the divisions open for migratory bird hunting plus the Little River and Goosefare Brook divisions. Our Hunt Plan, Annual Program, and refuge-specific regulations further

identify the areas open to hunting.

(c) When would the use be conducted? The refuge adapts state regulations for species hunted. The state determines hunting seasons annually: usually within a September-to-February time frame.

(d) How would the use be conducted? The refuge permits hunting within state guidelines and in compliance with a hunt program that we adjust each year to ensure safety and good wildlife management. New lands acquired by the refuge that traditionally have been hunted will remain open until we have completed their public use planning. If they cannot biologically, ecologically and safely accommodate hunting within state guidelines, then we will complete a separate public review process.

The refuge ownership in Maine extends to the mean low tidal mark; thus, it encompasses intertidal lands that lie between the high and low tidal ranges. Those intertidal lands are considered Public Trust Lands of the people of Maine, and certain rights (fishing, fowling, and navigation) are held in common by the people of Maine. The Legislature of Maine states that these rights held in public trust generally are derived from English Common Law and from the Massachusetts Colonial Ordinance of 1641–1647 (State of Maine Bureau of Public Lands). Those recreational uses held in trust are among the most important to the people of Maine today. The Service recognizes those rights, and will allow such uses, unless evidence shows that they detract from the Service mission to protect those lands.

(e) Why is this use being proposed? Hunting is a priority public use in the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) and, if compatible, is to receive enhanced consideration in refuge planning.

Availability of Resources

Costs associated with administering this use include

Preparation of Annual Hunt Plan (24 staff hrs @ $39.50/hr)	$708.00
Preparation of Refuge Hunting Information/maps (16 staff hrs @ $39.50/hr)	$632.00
Law Enforcement (80 staff hrs @ $33.18/hr)	$2,654.00
News Releases (8 staff hrs @ $26.87/hr)	$215.00
Preparation of Annual Hunting Maps and Regulations (16 staff hrs @ $39.50/hr)	$632.00
Program Cost	**$4,481.00**

FY 2005 Refuge Budget Allocation included

Salaries	$429,812
Fixed Costs	$39,602
Annual Maintenance	$30,184
Total Available Funds	**$499,598**

Based on a review of the budget allocated for recreational use management, I certify that funding is adequate to ensure compatibility, administer and manage the recreational use listed.

Sufficient resources are available to continue the existing hunting program. Our existing staff and budget have provided sufficient resources to continue current management, although we anticipate increased capacity necessitated by the addition of new lands for hunting and fishing access. Managing those activities falls within the projected budget and staffing capabilities of the refuge.

Anticipated Impacts of the Use

Hunting is consistent with the purposes of the refuge when it is carried out within established regulations and is a priority use in the Refuge Improvement Act. The *2001 National Survey of Fishing, Hunting,*

and Wildlife-Associated Recreation reveals that 975,000 Maine residents and nonresidents 16 years old and older fished, hunted, or watched wildlife in Maine. Of that total, 376,000 fished, 164,000 hunted, and 778,000 participated in wildlife-watching activities, including observing, feeding, and photographing wildlife (USFWS 2003). The Rachel Carson refuge was an important destination for some of that wildlife-dependent recreation.

Adverse effects on wildlife (waterfowl) populations are not expected because of the hunting regulations and bag limits that have been set in place by the federal and state agencies (USFWS Migratory Bird Office and the Maine Department of Inland Fisheries and Wildlife) that manage the harvest of waterfowl populations. Significant conservation measures and extensive pre- and post-season population monitoring and the institution of Adaptive Harvest Management are safeguards inherent in waterfowl management. Adverse effects on other game species are not expected, because hunting will occur under state regulations. The MDIFW sets harvest limits that take into account game species population data collected by state biologists and wildlife species assessments.

Hunting results in the direct take of the target game up to a daily limit in accordance with state regulations. The direct disturbance of wildlife is expected, as is true for all human-wildlife interactions. Those impacts affect individuals, not populations.

Thirty-six species of shorebirds are reported using the Maine coast primarily as staging areas during long distance migration. The numbers of migrant shorebirds peak from mid-May to early June and from mid-July to mid-September (Tudor 2000), outside hunting seasons. The impacts to wildlife are at a level that will not interfere with wildlife populations. Endangered or threatened species and species of special concern are also present on the refuge. However, no threatened or endangered species are using the areas identified for hunting during hunting seasons. The status of the New England cottontail is being reviewed; its habitat is dense upland thickets. Rabbit hunting is not permitted on the refuge.

Public Review and Comment

As part of the CCP process for the refuge, this compatibility determination will undergo extensive public review, including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

- The refuge employs a hunt permit system to avoid conflicts. Issuing permits to all hunters ensures that all hunters receive a copy of the current refuge regulations and maps of open areas. The maps and regulations are especially valuable in avoiding conflicts with neighbors.

- Compliance with regulations will be achieved through education, signage and law enforcement, which will result in minimizing negative impacts on refuge habitat and wildlife.

- Refuge regulation of hours (daylight hours) and access-restricted areas will be enforced. Some activities are not compatible, and are prohibited on the refuge to protect sensitive habitats and wildlife. Prohibited activities include driving off-road vehicles, camping, building fires, horse-back riding, and mountain biking.

Justification

Hunting is a wildlife dependent priority public use with minimal impact on refuge resources, and is conducted under state regulations, thereby reducing the amount of staff time and effort needed to oversee it. The staff time and resources needed are identified during annual work planning to minimize impacts on other refuge programs. In addition, hunting is consistent with the purposes for which the refuge was established, the Service policy on hunting, the National Wildlife Refuge System Improvement Act of 1997, and the broad management objectives of the National Wildlife Refuge System. Hunting is compatible with and will not detract from the mission of the Refuge System or the objectives of the refuge. Furthermore, hunting on public lands in Maine is a popular, traditional recreation activity that is strongly supported by the Maine Department of Inland Fisheries and Wildlife, which strongly supports hunting on national wildlife refuges in Maine. Allowing hunting within the refuge will not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

Rachel Carson refuge hosts over 250 species of birds, 53 mammals and 40 reptiles and amphibians. Here, too, this species biodiversity provides management flexibility. These activities are not thought to be disturbances which will jeopardize this resource. The refuge hunt program is in its 11th year in current format. Using annual programs, the hunt has been evaluated and modified every year. The hunt is increasingly popular with more hunters every year. This activity does not obviously raise safety issues due to the large size of the hunting opportunity.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

References

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Compatibility Determination

Use
Fishing

Refuge Name
Rachel Carson National Wildlife Refuge

Establishing and Acquisition Authorities
The Rachel Carson refuge was established on December 16, 1966, under the authority of the Migratory Bird Conservation Act (16 U.S.C. 715–715r).

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 U.S.C. 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 U.S.C. 460k-1), "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . ." (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b); 100 Stat. 3583), the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if the Secretary deems such terms are in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use
(a) What is the use? Conduct and allow access for fishing on refuge lands. Fishing for bass, salmon, trout, pickerel, whitefish, smelt and other species is permitted in accordance with state regulations. **Is the use a priority public use?** Yes. Fishing is one of the six priority public uses in the National Wildlife Refuge System Improvement Act of 1997 (Pub. L. 105–57).

(b) Where would the use be conducted? All navigable waters on the refuge are owned by the State of Maine and are open to fishing. There are currently nine fishing access points on the refuge. The appendix to this compatibility determination contains the most recent fishing access points.

(c) When would the use be conducted? The refuge adopts state regulations for species fished. The state fishing season traditionally opens on April 1 and closes on September 30, with the exception of Mousam River from Route 1 to tidewater, which is open year-round.

(d) How would the use be conducted? All tidal waters of the Refuge are open to fishing and bank fishing is currently permitted in nine areas (appendix contains the most recent fishing access points); both types of fishing are increasingly popular.

The refuge permits fishing by rod and reel or hook and line only, from bank fishing access points, a pier (not yet constructed), and from all Maine state waters. We expect to accommodate a maximum number of 100 users at any given time. It is unlikely that we will reach those numbers except during events such as Fishing Derby Day.

The refuge is building a fishing pier on the Spurwink River. The planned pier design calls for a 12' x 20' wooden, fully-accessible structure. We are improving a parking lot located adjacent to this site. With the possible exception of a kiosk, we do not anticipate any further supporting facilities. Other uses proposed for the site include wildlife observation, photography, and interpretation. The refuge will continue to provide fishing access sites and will improve the nine areas now available to anglers with access and interpretive signs.

(e) Why is this use being proposed? Fishing is a priority public use as defined by the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) and if compatible, this activity is to receive enhanced consideration over other general public uses.

Availability of Resources

Costs associated with administering this use include

Annual review of Fishing Plan (24 staff hrs @ $39.50/hr) $708.00
Signing and monitoring fishing access sites (40 staff hrs @$26.87/hr) $1075.00
Law Enforcement (80 staff hrs @ $33.18/hr) $2,654.00
News Releases (4 staff hrs @ $26.87/hr) $108.00
Program Cost $4,545.00

FY 2005 Refuge Budget Allocation included

Salaries $429,812
Fixed Costs $39,602
Annual Maintenance $30,184
Total Available Funds $499,598

Based on a review of the budget allocated for recreational use management, I certify that funding is adequate to ensure compatibility and to administer and manage the recreational use listed.

Sufficient resources are available to continue the existing fishing program. Existing staff and budget have provide sufficient resources to continue with current management, although the refuge anticipates increased capacity needs necessitated by the additional of new lands for fishing access. We do not anticipate charging fees to fish.

Anticipated Impacts of the Use

Fishing is consistent with the purposes of the Refuge when carried out within established regulations and is a priority use identified in the Refuge Improvement Act. Some wildlife disturbance is created by fishing

activity. Disturbance during the summer is limited to waterfowl, shorebirds, aquatic species, marsh and wading birds. The fishing access points have been selected to coincide with existing uses to help reduce any additional impact.

The *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* revealed that 975,000 Maine residents and nonresidents 16 years old and older fished, hunted, or wildlife watched in Maine. Of the total number of participants, 376,000 fished, 164,000 hunted, and 778,000 participated in wildlife-watching activities, including observing, feeding, and photographing wildlife (USFWS 2003). Rachel Carson refuge was an important destination for some of this wildlife-dependent recreation.

Wetlands will be minimally impacted by construction of the Spurwink River pier which would serve to promote this priority use on the site. We consulted with the Corps of Engineers and Maine Department of Environmental Protection on the wetland impacts. We submitted a Natural Resources Protection Act permit in August, 2005 and the MDEP accepted the submittal as a complete application. We do not anticipate any permit problems associated with this pier and boardwalk

Endangered and/or threatened species and species of special concern are also present on the refuge. The **piping plover** is federal-listed threatened and state-listed endangered in Maine. They nest above the high tide line on open sand, gravel or shell-covered beaches, especially on sand spits and blowout areas in dunes. Piping plover has traditionally nested at Goosefare Brook. If fishing activities are in conflict with where the birds nest at this beach, the fishing will be curtailed until the young plovers fledge. The plovers and terns are present during the refuge's fishing seasons. Conflicts are avoided by geographically separating the activities. Most fishing pressure is late in the summer and in the fall after plovers and terns have finished nesting. Other threatened and endangered species may be present but will not be affected by this activity.

Public Review and Comment

As part of the CCP process for Rachel Carson refuge this compatibility determination will undergo extensive public review, including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

- Fishing will be permitted only in designated areas to prevent erosion and degradation of wetlands and water quality. The refuge provides a handout identifying the fishing access areas.
- Fishing access areas have been designated and signed.
- Compliance with regulations will be achieved through education, signage and law enforcement which will result in minimizing negative impacts to refuge habitat and wildlife.
- Lead sinkers and other lead tackle are prohibited to prevent ingestion, and possible lead poisoning, by wildlife.
- Refuge regulation concerning hours (daylight hours) and restricted access will be enforced.

- Some activities are not compatible and are prohibited on the Refuge to protect sensitive habitats and wildlife. Prohibited activities include using off-road vehicles, camping, building fires, horse-back riding, mountain biking, and collection of any plants or animals not covered by a permit.

Justification

Fishing is a wildlife dependent priority public use with minimal impact on refuge resources. Fishing is conducted under state regulations, so anglers do not have to learn a second set of regulations on the refuge. Staff time and resources needed are identified during annual work planning to minimize impacts on other refuge programs. In addition, fishing is consistent with the purposes for which the Refuge was established; the Service policy on fishing; the National Wildlife Refuge System Improvement Act of 1997; and the broad management objectives of the National Wildlife Refuge System. Fishing is a popular traditional wildlife-dependent activity in Maine. Allowing fishing to occur within the Rachel Carson refuge will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

Attachment: Fishing Sites at Rachel Carson National Wildlife Refuge

References

U.S. Fish and Wildlife Service. 2005. *Draft Comprehensive Conservation Plan*. Rachel Carson National Wildlife Refuge, Maine.

U.S. Fish and Wildlife Service. 2000. *Environmental Assessment, Fishing*. Rachel Carson National Wildlife Refuge, Maine.

State of Maine. 2005. *Open Water Fishing Regulations*. Maine.

Wells National Estuarine Research Reserve Fish Species of the Wells Reserve. *Checklist of finfish*. Wells, Maine.

U.S. Fish and Wildlife Service, 2005. *Department of Environmental Protection Natural Resources Protection Act permit application.* Wells, Maine.

U.S. Fish and Wildlife Service. 2005. *Designated Recreational Fishing Sites*. Rachel Carson National Wildlife Refuge, Maine.

Fishing Sites at Rachel Carson National Wildlife Refuge

The following sites may be used by anglers. All Maine fishing regulations apply. Use of all areas contingent upon user cooperation. Refuge regulations require use of non-lead jigs and sinkers to prevent waterbird poisoning. Areas open dawn until dusk only. Carry out all litter, including monofilament, which can be dangerous to birds and other wildlife. Obey refuge signs and private property. Locations are described from south to north.

Chauncey Creek—Kittery

Carry-in boat access only at the intersection of Cutts Island and Seapoint Roads. Note that tidal changes in this area may cause previously navigable channels to become treacherous or impassable. Park adjacent to the site on Seapoint Road.

Brave Boat Tidal Creek—York

Fishing permitted on north side of stream bank from Brave Boat Harbor Road to the first trestle downstream, approximately 1000 feet. Park at pull-off northeast of Brave Boat Harbor Road, south of Payne Road, adjacent to creek. No refuge parking available.

Ogunquit River—Ogunquit/Wells

Anglers may fish on the north bank of the Ogunquit River, east of Route 1. Access is limited to the marked and posted areas at the refuge boundary corner behind the Ogunquit River Plantation Hotel east (downstream), on the Wells side of the river, for approximately 500 feet. No refuge parking available.

Stevens Brook—Wells

The east side of Stevens Brook is open for fishing from Bourne Avenue to the point where Stevens Brook approaches Ocean Avenue (approximately 1/4 mile). Approach from the public parking lot on Ocean Avenue.

Webhannet River—Wells

Fishing permitted along the west bank of the Webhannet River. The area begins at the north side of Mile Road and continues approximately 400 feet north (downstream), ending at the first tidal creek.

Merriland River/Skinner Mill—Wells

Anglers may fish from the refuge boundary, east (downstream) for approximately 1000 feet, which includes the oxbow. Access is by an existing trail on the south side of the river across private property. Park on Skinner Mill Road; no refuge parking available.

Mousam River—Kennebunk

Fishing permitted east of Route 9, on the north side of the river, west to our posted boundary and east to the point opposite Great Hill Road (approximately 3/10 mile). Access will be from the bridle path along the first tidal creek. Fishing is currently allowed on the opposite bank and at the mouth of the Mousam River. Park on Route 9; no refuge parking available.

Goosefare Brook—Saco

Anglers may fish on the south side of the Goosefare Brook outlet. There is very little parking in the immediate area; use the public parking lot at the end of Bayview Road.

Spurwink River—Scarborough

Fishing permitted along the west bank of the Spurwink River, north of the Route 77 bridge. The area extends approximately 1000 feet, ending at a point near the fork in the river. Limited parking available just off Route 77.

Compatibility Determination

Use
Wildlife Observation, Photography, Environmental Education, Interpretation

Refuge Name
Rachel Carson National Wildlife Refuge

Establishing and Acquisition Authorities
The Rachel Carson refuge was established on December 16, 1966. The authority which established the refuge is16 U.S.C. 715–715r, The Migratory Bird Conservation Act, as amended.

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 U.S.C. 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 U.S.C. 460k-1), "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b); 100 Stat. 3583), the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if such terms are deemed by the Secretary to be in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use
(a) What is the use? Conduct and allow access for priority public uses (Wildlife Observation, Photography, Environmental Education, and Interpretation) as provided for under the NWRS Improvement Act of 1997. **Is the use a priority public use?** Yes, wildlife observation, photography, environmental education and interpretation are four of the six priority public uses in the National Wildlife Refuge System Improvement Act of 1997 (Pub. L. 105–57).

(b) Where would the use be conducted? The primary public uses will occur as follows: Waysides, overlooks and opportune situations on all divisions will provide the public with chances to observe wildlife. Refuge trails in Brave Boat Harbor, Upper Wells and Goosefare Brook Divisions; shared trails in Mousam and Goosefare Brook Divisions. Interpreted trails such as Carson and Ted Wells trails enhance visitor's

experiences. Schools and other organized groups are the target for environmental education, on and off refuge.

(c) When would the use be conducted? Most public use occurs during the high season, i.e. approximately July 4 to Labor Day. Wildlife observation, photography, environmental education and interpretation are year around activities.

(d) How would the use be conducted? The Carson Trail and Ted Wells trails are currently interpreted with brochures to add wildlife and environmental insights to visitor's experiences. The Cutts Island trail is scheduled for upgrade to an interpreted trail with interpretive panels. Interpretative signs at several locations (Lower Wells, Biddeford Pool, Little River, Goosefare Brook) provide management oriented information to visitors. The trail and observation platform at Goosefare Brook provide information on wildlife observation. Wildlife/nature photography is encouraged on all public use areas of the refuge. Environmental education is conducted on refuge, mainly at Carson Trail, and may be conducted off refuge, such as at local school settings. The CCP contains information on an environmental education center to be located in Saco in the proposed alternative. See chapter 2, alternative B, objective 5.2 for details.

(e) Why is this use being proposed? Wildlife observation, photography, environmental education and interpretation are priority public uses as defined by the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) and if compatible, are to receive enhanced consideration over other general public uses.

Availability of Resources

Facilities or materials needed to support these four uses include the following:

Service Standards-Trails:	$26,000. Upgrading with boardwalks where needed and improving the tread on Cutts Island trail and tread on Goosefare Brook trail.
Carson Trail Restroom:	$32,000. This is for a double, composting, fully-accessible restroom. This facility will Service visitors to Refuge Headquarters as well.
Supplies and materials:	$8,500. We will produce 15,000 copies of the Carson Trail. We will produce 3,000 copies of the refuge mammal list. We will produce 10,000 copies of the refuge bird list. We will modify the reptile and amphibian list to fit Service format and produce 1,500 copies of this brochure; we will do this in house, with assistance from the Regional External Affairs office.
Parking area (obligated):	$55,000. As part of an ongoing project to provide universal fishing access and wildlife observation at the Spurwink Unit. This project is funded through a Visitor Services initiative and these funds are obligated.
Routine maintenance (annual):	$4,700. This is the expected cost to maintain the parking area at Carson, Goosefare Brook and Spurwink parking lots by grading and filling low spots, repairing handrails and vandal damage, as well as general upkeep and maintenance.
Total:	$66,500 new funds, plus up to $4,700 annually; $55,000 funded through Visitor Services and already obligated.

These facilities will be used by the public engaged in all six priority uses of the Refuge system. With the exception of annual maintenance, all expenditures are enumerated in the Refuge Management Information System. We calculated hunting and fishing program costs in separate compatibility determinations. We have plans to charge entrance fees, and those plans can be found in the CCP, chapter 2, alternative B, goal 5. These fees could help offset annual maintenance costs. Funds for the Spurwink parking lot are already obligated or expended. The refuge anticipates increased capacity with the development of additional wildlife observation, photography, interpretation and environmental education opportunities as projected in the Comprehensive Conservation Plan.

Anticipated Impacts of the Use

Direct disturbance to wildlife is anticipated, as is true for all human – wildlife interactions. United States' treaty migratory bird obligations will not be adversely affected since actions taken on the refuge can only influence the small proportion of the migratory bird populations which are present on the refuge at any one time and the initiatives described in this determination are designed to minimize impacts on individuals and habitats. We will be satisfying our proposed conservation plan objectives, and a goal of the Refuge System Improvement Act, by providing opportunities for compatible wildlife -dependent recreation. Thirty-six species of shorebirds are reported using the Maine coast primarily as staging areas during long distance migration. Peak numbers of migrant shorebirds occur from mid-May to early June and from mid-July to mid-September (Tudor 2000), which is also the start of the peak visitor use season. Shorebirds using the Maine coast face potential impacts from recreational disturbances to foraging and nesting birds, as well as oil spills, resource extraction affecting shorebird food supplies, habitat loss to development, predators, and contaminants (Clark and Niles 2000). The impacts to wildlife are at a level that will not interfere with wildlife populations. Location of waysides, layout and construction of trails and overlooks will attempt to minimize habitat degradation.

Nearly 100,000 visitors used the one-mile foot Carson Trail at the Wells headquarters; one of four developed trails on the Refuge. There are many times during the summer and fall when the parking lot is full or overflowing. The headquarters trail in Upper Wells is currently the only Refuge Division with an informational kiosk. The two-mile Cutts Island Trail in Brave Boat Harbor Division has trail signs, but no kiosk nor restroom. Carry-in boat access only is available on Chauncy Creek at the intersection of Cutts Island and Seapoint Roads. Parking is available through verbal agreement with Town of Kittery. The Goose Fare Brook Trail and overlook offers parking, a short stone-dust trail and interpreted observation platform with automatic-focus binoculars. The Bridle Path and Atlantic Way and Ted Wells Trails provide views of Refuge habitat in Kennebunk and Saco and Old Orchard Beach. These trails are located on and adjacent to Refuge property and are maintained by municipal or private non-profit organizations. New signs, new trails and other opportunities will continue to impact wildlife and wildlife habitat.

Endangered and/or threatened species and species of special concern are present on the refuge. However, there are no threatened and endangered species known to use the areas identified for wildlife observation, photography, environmental education and interpretation.

Public Review and Comment

As part of the CCP process for Rachel Carson refuge this compatibility determination will undergo extensive public review, including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

- Compliance with regulations will be achieved through education, signage and law enforcement which will result in minimizing negative impacts to refuge habitat and wildlife.
- Refuge regulation concerning hours (daylight hours) and access restricted to permitted areas will be enforced.
- Some activities are not compatible and are prohibited on the Refuge to protect sensitive habitats and wildlife. Prohibited activities include using off-road vehicles, camping, building fires, horse-back riding, mountain biking, and collection of any plants or animals not covered by a permit.

Justification

Environmental education, wildlife observation, interpretation, and photography are four of the six priority public uses of the National Wildlife Refuge System and have been determined to be compatible activities on hundreds of other refuges nationwide. The Refuge System Improvement Act of 1997 instructs refuge managers to seek ways to accommodate these six activities. A small portion of the refuge is open to general public use, while other areas may be accessible for specific activities through the special use permit process.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

References

Clark and Niles, 2000. *North American Shorebird Plan*.

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Tilden, Freeman. 1957 *Interpreting Our Heritage*. University of North Carolina Press, North Carolina.

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Compatibility Determination

Use
Boat Launching

Refuge Name
Rachel Carson National Wildlife Refuge

Establishing and Acquisition Authorities
The Rachel Carson refuge was established on December 16, 1966. The authority which established the refuge is16 U.S.C. 715–715r, The Migratory Bird Conservation Act, as amended.

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 U.S.C. 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 U.S.C. 460k-1), "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b); 100 Stat. 3583), the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if such terms are deemed by the Secretary to be in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use
(a) What is the use? Visitors launch and land non-motorized canoes and kayaks from two locations on the refuge. **Is the use a priority public use?** No. Boating is not a priority public use; however, this launch activity is allowed to support wildlife observation and fishing.

(b) Where would the use be conducted? The launch sites are in the southern- and northernmost refuge divisions; Brave Boat Harbor and Spurwink. 1) the southern refuge car-top launch area is located on Cutts Island, Seapoint Road, Kittery and 2) the Spurwink river boat launch immediately west of Route 77. The use takes place on navigable tidal water within the boundaries of the Refuge.

(c) When would the use be conducted? The Cutts Island and Spurwink launches are open daylight hours, year round. Practically, the areas are open prior to and following freeze-up. Both areas are tidally influenced and will not be suitable (low, high and fast water levels) for launching at all times. Special care is needed at the Cutts Island site where the rapid tidal exchange can effectively prevent users from returning to the launch site.

(d) How would the use be conducted? Both areas are for the launch of recreational crafts. The Cutts Island site requires carrying the boat, canoe or kayak some 30 feet from the parking area (on Town of Kittery property) to the water's edge. The Spurwink launch ramp is suitable for trailer launching small boats directly into the river.

(e) Why is the use being proposed? Rachel Carson is a coastal refuge. Surface waters in the State of Maine are the property of the state and the refuge cannot regulate this activity. Since the refuge is surrounded by water, these facilities are offered to accommodate our wildlife oriented visitors. These activities would be conducted in such a manner to minimize impacts on established programs, including hunting, fishing, wildlife and observation programs, on the rest of the refuge.

Availability of Resources
Both launch facilities directly support priority public uses. Neither site has required, nor is expected to require, extensive maintenance. Continuation of this activity and issuance of this boat launch determination is within the budget and staff capacity of the refuge.

Anticipated Impacts of the Use
Brave Boat Harbor Division – The Brave Boat Harbor Division encompasses approximately 750 acres. This Division is located within the towns of York and Kittery. Oak-pine forest with vernal pools and old field upland habitats surround salt marsh and estuary habitat.

This area was nominated for inclusion in the Maine Ecological Reserves program because of its saltmarsh ecosystem, and presence of oak-pine forest, exemplary white oak-red oak forest and perched hemlock-hardwood swamp communities, acidic fen, shrub swamp, and vernal pool (McMahon 1998). It also lies within a Maine Beginning With Habitat Focus Area (Greater Brave Boat Harbor/Gerrish Island) that is known to harbor rare natural communities including red oak-white oak forest, dune grassland, and spartina saltmarsh (Maine Department of Inland Fisheries and Wildlife). Brave Boat Harbor lies within the Mount Agamenticus to the Sea Conservation Initiative, a region in southern Maine that surrounds the largest coastal forest on the eastern seaboard between Acadia and the New Jersey pine barrens (Mount Agamenticus to the Sea Conservation Initiative).

Threatened and endangered species may be present but will not be affected by this activity.

Spurwink Division, in the Towns of Scarborough and Cape Elizabeth, encompasses 520 acres. This Division is centered along the waters of the Spurwink River, Pollack Creek and several other small waterways. It consists of upland fields, high quality salt marsh, shrublands, and some mature forest.

Direct disturbance to waterfowl, notably wintering black duck, is likely along the refuge waterways as is disturbance to other waterfowl, wading birds and salt marsh species. Both areas are patrolled and visited frequently by refuge staff. Intense levels of use, should they occur, will result in reexamination of this determination. Water quality up and down stream (tidal) could be degraded through bank, or streambed erosion or introduction of potentially toxic materials. Dormant or unavailable toxins or heavy metals could be in existence in the muddy bottom and could be stirred and become available to aquatic species.

In the spring and summer months nesting waterfowl and shorebirds in the immediate area would be affected by launching and paddling. These disturbances, however, would be minimal since restrictions

built into execution of this project, i.e. recreational, no-motor boats only, are designed to lessen impacts. Refuge visitors will be inconvenienced by Maine's 9 to 11 foot tidal range.

Refuge visitors could find this activity creates temporary direct disturbance to wildlife and/or habitat which may impact their intended uses. Anglers may take advantage of this launch area to access state-controlled waters. Although the striped bass fishing season is January 1 - December 31, most fishing takes place in the spring and early summer. During peak fishing seasons, any activity can startle or repel fish. Activities in the vicinity of the launch sites can result in compaction of soils, trampled vegetation and erosion to habitats, especially in riparian zones.

Endangered and/or threatened species and species of special concern are also present on the refuge. The New England Cottontail occurs in the Spurwink Division, however, the rabbit does not occur in the immediate vicinity of the boat launch. Federal-listed threatened piping plover nest on beaches and feed on the mudflats behind the beach, but the birds are not found near either boat launch. Other threatened and endangered species may be present but will not be affected by this activity.

Public Review and Comment

As part of the CCP process for Rachel Carson refuge, this compatibility determination will undergo extensive public review, including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

- Project will be adequately publicized and accommodations for pedestrians will comply with applicable safety regulations.
- Enforcement will occur on refuge use, taking and disturbance provisions to assure compliance with regulations and minimize negative impacts to refuge habitat and wildlife.
- Refuge regulation concerning hours (daylight hours) and access restricted to permitted areas will be enforced.
- There are countless opportunities for wildlife related experiences on the refuge. Unfortunately, the impact of humans is becoming ever more present. We must all learn how to minimize our damaging effects and how to preserve our natural and wild environment. We can use and enjoy these treasures and so can our grandchildren if we practice the Leave No Trace principles, modified here for the refuge.
    - Plan Ahead and Prepare
    - Travel on Durable Surfaces
    - Dispose of Waste Properly
    - Leave What You Find
    - Be careful with Fire
    - Respect Wildlife
    - Be Considerate of Other Visitors

Justification

The fishery resource at Rachel Carson refuge is plentiful and species abundant with native species such as winter flounder (*Pleuronectes americanus*), alewife (*Alosa pseudoharengus*), blueback herring (*A. aestivalis*), pollock (*Pollachius virens*), bluefish (*Pomatomus saltatrix*), American shad (*A. sapidissima*),

striped bass (*Morone saxatilis*), as well as stocked species such as brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) These renewable resources can be utilized and maintained at optimum levels. This species biodiversity, which is important in maintaining a healthy ecosystem, also provides management flexibility. This site specific, time limited disturbance will not jeopardize this resource.

The fishing program is in its fourth year. Permitting recreational boat launch will benefit fishing. Safety continues to be of paramount importance in all of our management decisions. Allowing visitors to launch and land non-motorized canoes and kayaks from two locations within the Rachel Carson refuge will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

References

U. S. Fish and Wildlife Service. 2005. *Draft Comprehensive Conservation Plan*. Rachel Carson National Wildlife Refuge, Maine.

U. S. Fish and Wildlife Service. 2000. *Environmental Assessment, Fishing*. Rachel Carson National Wildlife Refuge, Maine.

State of Maine. 2005. *Open Water Fishing Regulations*. Maine.

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Compatibility Determination

Use
Use of Bacillus thurigiensis (Bti), a larvacide to control mosquito and flies in emergency public and/or wildlife health situations (hereafter "mosquito control" will include mosquitoes, flies, and similar species).

Refuge Name
Rachel Carson National Wildlife Refuge

Establishing Authority
Rachel Carson National Wildlife Refuge was established on December 16, 1966. The authority which established the refuge is 16 U.S.C 715-715r, The Migratory Bird Conservation Act, as amended.

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 USC 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 USC Section 460k-1), suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species . . ." (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 USC Section 3901(b) 100 Stat. 3583, the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 USC Section 742f (a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 USC Section 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if such terms are deemed by the Secretary to be in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use
(a) What is the Use? Is the use a priority public use? The use is mosquito management which includes surveillance and, if warranted, mosquito control. Mosquito surveillance and control are not a priority public uses of the National Wildlife Refuge System (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).

Mosquitoes and other insects provide a food source, directly or indirectly, for Service trust species (migratory birds, threatened and endangered species, and anadromonous fish).

(b) Where would the use be conducted? The refuge hosts saltwater and freshwater mosquitoes, greenhead flies and black flies. Much of the refuge is saltmarsh, so most mosquito breeding habitat is in areas best suited to saltwater mosquitoes. Because of this, the mosquito control would take place in the saltmarsh areas.

(c) When would the use be conducted? Seasonally, on an irregular and short-term basis when it is necessary to protect the health and safety of humans, wildlife, or domestic animals. We will allow State or local vector control agencies to conduct mosquito control on refuge lands using effective compatible means that pose the lowest risk to wildlife and habitats.

When necessary to protect the health and safety of the public or a wildlife or domestic animal population, we will allow management of mosquito populations on the refuge

The surveillance activities associated with this use would be conducted from April through early October under the conditions of this Compatibility Determination, a Special Use Permit and the Service Mosquito policy. Some mosquito control activities could occur throughout the mosquito/fly season (top minnows, swallows, etc).

(d) How would the use be conducted? The mosquito control will be applied to the marsh by hand spraying or hand dispersal. Except in cases of officially determined health emergencies, any method we use to manage mosquito populations within the refuge will conform with applicable Federal laws such as the Endangered Species Act. Habitat management and pesticide uses for mosquito control will give full consideration to the integrity of non-target populations and communities. They will also be consistent with integrated pest management strategies and with existing pest management policies of the Department of the Interior and the Service.

We will allow pesticide treatments for mosquito population control on Refuge System lands only when local, current mosquito population monitoring data are collected and the data indicate that refuge-based mosquito populations are contributing to a human, wildlife, or domestic animal health threat.

State/local public health or mosquito control agencies will conduct any surveillance, the methods to include dip samples, light/CO_2 traps, and landing rates. *Bacillus thurigiensis* application would be made following the limitations included in the product EPA label, an annual Fish and Wildlife Service Pesticide Use Permit, and an annual Refuge Special Use Permit.

(e) Why is this use being proposed? In rare circumstances mosquitoes can serve as disease vectors presenting a threat to human health. It is the policy of the National Wildlife Refuge System that we will allow native mosquito populations to function unimpeded and we may allow mosquito populations to be controlled only in the following circumstances:

- There is a need to manage a public or wildlife health threat from a specific mosquito-borne disease that mosquito and disease monitoring data have documented as enumerated in Service policy.
- There are tires, tanks, or other similar debris/containers that may serve as artificial breeding sites for native or non-native species of mosquitoes. We may remove these or treat them with pesticides.
- We are enhancing, restoring, or managing habitat for other wildlife species to achieve refuge purposes. This may be in the form of habitat restoration or water level manipulations where there is a definable benefit to other wildlife over not undertaking such actions. We prohibit habitat modifications or management actions designed specifically for mosquito control that impact other wildlife species or habitats and are detrimental to refuge purposes or System goals. These modifications or actions include, but not limited to, inappropriate draining,

maintaining high water levels that are inappropriate for wildlife, and the importing or enhancing of non-native predators.

- There is a need to manage a threat to public health and safety from extreme numbers of biting mosquitoes when advised to do so by the Centers for Disease Control and Prevention (CDC) and/or the Federal Emergency Management Agency (FEMA). Such mosquito control may be necessary following natural or human-caused disasters when biting mosquitoes may hamper recovery efforts.

Availability of Resources

Refuge staff time and resources are finite and work is planned annually. The mandate for all national wildlife refuges is to consider wildlife first. The Service provides the refuge with no funds or support for mosquito control. The preparation of annual Pesticide Use and Special Use Permits, reviewing monitoring reports, and reviewing annual action-reports are functions that can be accomplished with assistance from Regional biologists.

Anticipated Impacts of the Use

Generally, refuges will not conduct or allow mosquito monitoring or control, but these activities may be allowed under special use permits. When necessary to protect the health of a human, wildlife, or domestic animal population, we will allow surveillance and if warranted reduction of mosquito populations on Refuge System lands using effective means that pose the lowest risk to wildlife and habitats.

Mosquitoes, flies and other insects are a food source to wildlife, especially birds, fish, reptiles and amphibians. Mosquito eggs, larvae and pupae provide a significant food source to *Fundulus* living in saltmarsh pools and pannes which in turn compose an important part of the diet for marsh and wading birds such as egrets and herons. These and similar food chain relationships, when combined with the wildlife first mandate, results in a determination against mosquito control on the refuge.

Rachel Carson wrote about the interconnectedness of all living things; each species has its own ties with others and all are related to the earth. This is the message of *Silent Spring* and the earth-sea trilogy. She simply and convincingly explained the connections between humans and all creatures of the earth. Preserving under industry and government pressure to abandon her research, in *Silent Spring*, she linked the unrestrained use of post-World War II chemical pesticides with their disastrous biological consequences. With this book Ms. Carson launched the modern environmental movement. Congress renamed and dedicated this refuge in her honor. Consequentially, this refuge is very conservative concerning pesticides, due to both the direct effects of chemicals on the interrelatedness of all living things and the perception of using pesticides on a refuge named for Rachel Carson.

The resources most at risk can be characterized as follows: Southern coastal Maine is a migration and staging area for much of the North American shorebird population. Thousands of shorebirds feed along coastal beaches and mud flats as they migrate through the State. Biddeford Pool serves as one of the top shorebird staging areas in southern Maine. In 2004, a fall migration shorebird survey was conducted weekly at several spots on the refuge. The survey documented an average of 555 shorebirds per a survey (at 8 sites) with peak numbers (>1400 birds) occurring in late August. Thirty-six species of shorebirds are recorded for the refuge, with five of these considered regular breeders. Most shorebird use occurs during fall migration, beginning in early July and continuing through early November. Utilization occurs in a variety of habitats within the estuarine community, but the greatest use occurs in tidal mudflats and salt pannes. Areas used during major fall migrations include the Webhannet River at low tide, several salt pannes on the Lower Wells and Upper Wells Division, the Batson River and Goose Rocks tidal mudflats, and numerous locations at the Biddeford Pool Division. The great diversity of shorebirds found in these areas compares to only a few other sites in Maine.

Endangered and/or threatened species and species of special concern are also present on the refuge, but will not be affected by this action. The **piping plover** is federally threatened and state endangered in Maine. They nest above the high tide line on open sand, gravel or shell-covered beaches, especially on sand spits and blowout areas in dunes. Fifty to 75% of the Maine piping plover population nests at three sites on or near the refuge, including Crescent Surf Beach, Goosefare Brook, and Marshall Point at Goose Rocks. The **least tern** is a state endangered species in Maine. In 2005, Crescent Surf Beach hosted the largest nesting colony (51 pairs) of least terns in Maine. New England cottontail rabbit status is being reviewed; their habitat is dense upland thickets.

Toxicity and Effects to Non-target Organisms

There is little information available regarding non-target species affects of Bti in salt marsh application (Higgins, 2003, personal communication). Results of a Canadian study, in publication, indicate that salt marsh application of Bti reduced the numbers of some non-target benthic species, but that the numbers of other benthic community species increased so that overall biomass was not affected (Higgins, 2003, personal communication).

From studies conducted in fresh water wetlands, the bacterium Bti is a microbial insecticide that, when ingested, is toxic to mosquitoes, black flies and several other members of the nematocera suborder within the order diptera. The intact toxin is not active against vertebrates (Boisvert and Boisvert 2000). The greatest degrees of susceptibility are within a few families: the Culicidae (mosquitoes), the Simuliidae (black flies) and the Chironomidae (midges), with mosquitoes and black flies being the most susceptible (Boisvert and Boisvert 2000).

Bti is used widely because of its reportedly high specificity for target species and environmental safety (Ali 1981; Merritt et al. 1989). Laboratory and field studies have shown that Bti is toxic to some larval chironomids, but many factors, such as temperature, water depth, aquatic vegetation and suspended organic matter, may act to reduce it toxicity to chironomids in the environment (Charbonneau et al. 1993; Merritt et al. 1989).

Numerous studies have been conducted on the effects of Bti on fresh water, non-target organisms (anything other than mosquitoes or black flies). A recent comprehensive review of 75 of these studies (Boisvert and Boisvert 2000) found that 37 had documented that some non-target organisms can be affected to a certain extent after a Bti treatment. The other 38 studies show no effects to non-target organisms studied. Some members of the diptera suborder nematocera have been shown to be the most common species susceptible to Bti. The susceptibility of chironomid larvae to Bti could be between 15 to 75 times less than mosquito or black fly larvae, but the studies indicated that a high dosage of Bti will affect chironomid populations. Although many of the studies were done either at high dosage or under laboratory conditions, 9 of the 23 studies reporting an effect on chironomid populations were done using actual operating conditions (in the field at operational doses). Apart from Chironomidae, seven other dipteran families were affected by Bti. During many experiments or trials using higher dosages, some of these families show significant mortalities. All these families are dipeteran and may possess the capacity to capture, ingest and digest toxic crystals. In sufficient quantity, this can produce enough toxic proteins to induce cellular damage that could lead to death.

A long-term study on the effects of repeated Bti treatments on non-target organisms in freshwater wetlands was performed by Hershey et al. (1998) over 4 years in Minnesota. Bti was applied for 3 consecutive years using 6 applications each year between mid-April and mid-July at recommended label rates. Boisvert & Boisvert (2000) consider this frequency of applications as “intensive” and “higher than normal.” Highly significant reductions were observed in several insect groups in the second year and eventually the intensive treatments resulted in wetland communities that were depleted of most insects

during the third year. Since Bti was likely to be directly toxic to only Nematocera diptera, the effects of Bti on other insect groups may have resulted in disruption of the invertebrate food web (Hershey et al. 1998). Because the application was repeated 6 times per season at 3 week or shorter intervals, non-target insects were much more likely to have been exposed to the direct or indirect effects of Bti. Boisvert & Boisvert (2000) believe that the recent study by Su and Mulla (1999) provides some explanation for these Hershey et al. (1998) results. Su and Mulla (1999) found that shortly after a single Bti treatment the growth of two species of green algae was inhibited for nearly three weeks. Considering the type of habitat treated and the frequency of Bti applications by Hershey et al. (1998), it is likely that primary production of algae was almost totally inhibited for three years resulting in the dramatic changes in diversity indices that they observed. No such food web effects have been documented during "normal" use of the materials or in saline environments (Lawler et al. 1999).

In conclusion, there are little data regarding the effects of Bti in salt marsh applications. In fresh water wetlands, Bti is thought by many to be a selective mosquito control treatment. However, there may be some effects to chironomids under normal operating conditions. Repeating treatments at longer intervals may give the non-target community time to recover in case there are any effects (Mulla et al. 1979). In addition, chironomids were the most abundant group in the freshwater wetlands of that study (Hershey et al. 1998). Thus, the results of that study do not necessarily apply to the saline conditions at the refuge. Therefore, at the level of treatment proposed, adverse impacts to non-target organisms are expected to be negligible or nonexistent. However, Hershey's study does demonstrate the need for long term research to better understand the consequences of Bti application on the invertebrate food web.

Public Review and Comment

As a part of the CCP process for Rachel Carson refuge, this compatibility determination will undergo extensive public review, including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

The refuge will abide by the following national guidance:

- Mosquito management can occur only when local and current monitoring data indicate that refuge-based mosquitoes are contributing to a human, wildlife, or domestic animal health threat.
- Refuges may use compatible non-pesticide options to manage mosquito populations that represent persistent threats to health.
- Refuges will collaborate with Federal, State, or local public health authorities and vector control agencies to identify refuge-specific health threat categories. These categories will represent increasing levels of health risks, and will be based on monitoring data.
- Management decisions for mosquito control will be based on meeting or exceeding predetermined mosquito abundance or disease threshold levels that delimit threat categories.
- In the case of officially determined mosquito-borne disease emergencies, we will follow the guidelines described in this document. Monitoring data are still required to ensure that intervention measures are necessary.

- All pesticide treatments will follow Service and Department of the Interior pest management and pesticide policies. In an emergency, the pesticide approval process can be expedited.

- Refuges must comply with Federal statutes and Service policies by completing the appropriate documentation prior to mosquito management activities taking place.

A modified Open Marsh Water Management is used to manage saltmarshes on the refuge. This management tool uses techniques such as plugging ditches to mimic natural hydrology. Unlike the salt hay harvesting and "mosquito control "ditching in the late 1800's and early 1900's, modified OMWM involves plugging or in other ways modifying ditches and excavating shallow ponds. Pond excavation includes a 3+ foot sump to provide over-winter habitat for *Fundulus*. This pond and over-wintering habitat for *Fundulus* increases a food source to wading birds, but it also increases numbers of *Fundulus* which prey on mosquito larvae and pupae.

When necessary to protect the health of a human, wildlife, or domestic animal population, we will allow surveillance of mosquito populations on Refuge System lands by public health personnel. Sites will be checked for the presence of larval or adult mosquitoes through use of standard dip samples, light/CO2 traps, searching for new larval habitat, or noting landing rates to obtain counts of mosquitoes, to obtain samples for viral analyses, and to identify species present.

Only foot access to the salt marsh is allowed. Further stipulations will be contained in the required Special Use Permit.

Copies of monitoring data and lab results will be made available to the refuge manager on a weekly basis or as soon as they are available. Dip counts and enumeration of numbers by species will be required prior to each application of Bti.

The Refuge Manager will be contacted at least one day in advance of each application of Bti so that, at his or her discretion, the manager may accompany the applicators during work on the refuge or may delay application for the protection of refuge resources existent at any particular time. The Refuge Manager, in consultation with the public health authorities and Service personnel, may authorize application of Bti in instances where the number of larva present, the species present, the incidence of West Nile Virus positive mosquitoes, EEE positive mosquitoes, or West Nile Virus positive birds indicate there is a potential risk to public health.

Application of Bti will be limited to a maximum of two times per month following the spring tides during the months of June, July, August, and September. Application of Bti will be by hand spraying a liquid formulation or hand dispersal of a granular formulation of Bti. Application will be performed by trained personnel, and will be in strict conformance with the product label.

Application of Bti will be limited to the areas shown on the Special Use Permit map.

The State/local public health officials will provide a written summary report of the season's work to the refuge manager by December 31 of each year. The report will include the results of all monitoring and surveillance data, as well as a table showing (for each application): the number of acres treated, the rate of active ingredient applied per acre (pounds or ITUs), the target species, and the results (percent effectiveness).

Justification

Rachel Carson refuge is one unit in a system of national wildlife refuges. This system has rules and procedures; in this case, national policy is to allow mosquito control on refuge lands when a human, wildlife or domestic animal health concern can be directly linked to the refuge habitat. Despite anticipated

negative reactions due to the teachings of Rachel Carson, and only in the very narrowest interpretation of Service policy will allowing mosquito control to occur within the Rachel Carson refuge not materially interfere with or detract from the mission of the Refuge System or the purposes for which the refuge was established.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

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Compatibility Determination

Use
Research conducted by non-refuge personnel

Refuge Name
Rachel Carson National Wildlife Refuge

Establishing Authority
The Rachel Carson refuge was established on December 16, 1966. The authority which established the refuge is16 U.S.C 715-715r, The Migratory Bird Conservation Act, as amended.

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 U.S.C. 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 U.S.C. 460k-1), "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b); 100 Stat. 3583), the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if such terms are deemed by the Secretary to be in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use
(a) What is the use? Is the use a priority public use? The use is research conducted by non-Service personnel. It is not a priority public use of the National Wildlife 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.

Rachel Carson refuge supports natural resource research on refuge lands when it does not materially interfere with or detract from the purposes of the refuge or the mission of the National Wildlife Refuge System. All research proposals are required to complete the standard Service special use permit, as amended by the refuge.

Allow colleges, universities, partners and other credentialed researchers the opportunity, by permit, to conduct wildlife, habitat, or human resources related research activities within the Refuge boundary. Research conducted by non-Service personnel is not a priority public use of the Refuge System.

Research may contribute to a body of knowledge and not relate to priority public uses. Wildlife research may compliment hunting or fishing which are primary public uses. Habitat related research may compliment wildlife observation or photography which are primary public uses. Human resources research may compliment environmental education or interpretation which are priority public uses.

As part of the Land Management Research and Demonstration program at the Refuge, identify high-priority estuarine ecosystem management research needs, develop research proposals, and facilitate and implement research projects.

(b) Where would the use be conducted? Research will be conducted throughout the refuge and throughout the year consistent with special use permit conditions. Areas showing signs of impending degradation will be closed or altered to reduce or stop adverse impacts as necessary to protect habitat and populations. If a research project occurs during the refuge hunting season, special precautions will be required and enforced to ensure public health and safety. Individuals will stay within the areas designated by staff and restrictions of SUP.

(c) When would the use be conducted? Research may be conducted at any period of the year. Special Use Permit conditions will limit negative impacts to wildlife, habitat, visitors and other programs. SUP will control numbers of individuals, areas of use, frequency of use, seasonal use, equipment and collections. The timing of each individual research project will be limited to the minimum required to complete the project.

(d) How would the use be conducted? Written research proposals will be required for review and approval before permits will be issued. If approved, access to Refuge lands and waters will be limited to least invasive means required to accomplish the activities. All disturbances will be at the minimal level necessary to accomplish goals of the proposed research. Off-road study areas will be accessed by boat or foot.

(e) Why is this use being proposed? Research by non-Service personnel is conducted by colleges, universities, federal, state, and local agencies, non-governmental organizations, and qualified members of the general public to further the understanding of the natural environment and to improve the management of the refuge's natural resources. Much of the information generated by the research is applicable to management on and near the refuge. Management oriented research results in long-term benefits to the wildlife populations of the refuge. The collection of detailed information on the wildlife, habitats and systems within the Refuge is integral to being able to maximize the habitat benefits of the existing landscape for the wildlife species utilizing the refuge.

The Service will encourage and support research and management studies on refuge lands that will improve and strengthen natural resource management decisions. The refuge will encourage and seek research relative to approved refuge objectives that clearly improves land management and promotes adaptive management. Priority research addresses information that will better manage the nation's biological resources and are address important management issues or demonstrate techniques for management of species and/or habitats.

The refuge will also consider research for other purposes which may not be directly related to refuge-specific objectives, but contribute to the broader enhancement, protection, use, preservation and

management of native populations of fish, wildlife and plants, and their natural diversity within the region or flyway.

The refuge will maintain a list of research needs that will be provided to prospective researchers or organizations upon request. Refuge support of research directly related to refuge objectives may take the form of funding, in-kind services such as housing or use of other facilities, direct staff assistance with the project in the form of data collection, provision of historical records, conducting of management treatments, or other assistance as appropriate.

Availability of Resources
The staff time for fulfillment of planned development and administration of the refuge is committed and available. The additional time needed to review and monitor research proposals and issue special use permits is flexible, i.e. it is moderated by the value of the research to System and refuge goals. The administrative burden for timely and consistent reporting is placed on the researcher. The Refuge biologists spend an average of two weeks a year reviewing, approving, coordinating and following-up on report requests for research projects conducted by outside researchers. At a rate of $40.66, the cost is $3250.00. Additionally, refuge management expends an average of three days a year on research SUPs, for a cost of $1200. Administrative and maintenance involvement adds another $800 per year for a total estimated cost of just over $5,000.

Anticipated Impacts of the Use
The Service encourages approved research to further the understanding of the natural resources. Research by other than Service personnel adds greatly to the information base for Refuge Managers to make proper decisions. Disturbance to wildlife and vegetation by researchers could occur through observation, banding, and accessing the study area by foot or vehicle. It is possible that direct mortality could result as a by-product of research activities. For example, least tern chick mortalities can occur when chicks pile on top of each other and suffer from heat exhaustion and stress. Least terns are territorial and active in nest protection. These birds are easily spooked and will readily fly off their nest when a researcher approaches, even from a long distance. Nest abandonment can leave eggs or chicks vulnerable to heat or predators.

Standardized special use permit conditions are designed to minimize negative impacts to wildlife, habitat and visitors. The impacts to individual wildlife will not interfere with wildlife populations.

Endangered and/or threatened species and species of special concern are also present on the refuge. Special Use Permit conditions prevent negative impacts on threatened and endangered species. The **piping plover** is federal-listed threatened and state-listed endangered in Maine. They nest above the high tide line on open sand, gravel or shell-covered beaches, especially on sand spits and blowout areas in dunes. Fifty to 75% of the Maine piping plover population nests at three sites on or near the Refuge, including Crescent Surf Beach, Goosefare Brook, and Marshall Point at Goose Rocks. The **least tern** is a state-listed endangered species in Maine. In 2003, Crescent Surf Beach hosted the largest nesting colony (157 pairs) of least terns in Maine. Other threatened and endangered species may be present but will not be affected by this activity. New England cottontail rabbit status is being reviewed; their habitat is dense upland thickets. American eel populations are being reviewed, their habitats include the creeks, steams, rivers, salt marsh pools and grasses on the refuge.

Public Review and Comment
As a part of the CCP process for Rachel Carson refuge, this compatibility determination will undergo extensive public review including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

- All research proposals will be reviewed for their potential benefits to future refuge management activities and impacts to current refuge and system purposes.
- Continuation of each study will be contingent upon acceptable annual review by refuge staff. Review includes impacts to habitat and wildlife populations.
- Active LE program, in addition to SUP, will ensure regulation compliance, protection of refuge resources and promote safe and quality experience
- Some activities are not compatible and are prohibited on the Refuge to protect sensitive habitats and wildlife. Prohibited activities include using off-road vehicles, camping, building fires, horse-back riding, mountain biking, and collection of any plants or animals not covered by a permit.
- We will require all researchers to submit a detailed research proposal that follows Service Policy. Researchers must give us at least 45 days to review proposals before the research begins. If the research involves the collection of wildlife, the refuge must be given 60 days to review the proposal. Researchers must obtain all necessary scientific collecting or other permits before starting the research. We will prioritize and approve proposals based on the need, benefit, compatibility, and funding required for the research.

Proposals

We will expect researchers to submit a final report to the refuge on completing their work. For long-term studies, we may also require interim progress reports. We also expect that research will be published in peer-reviewed publications. All reports, presentations, posters, articles or other publications will acknowledge the Refuge System and the Rachel Carson refuge as partners in the research. All posters will adhere to Service graphics standards. We insert that requirement to ensure that the research community, partners, and the public understand that the research could not have been conducted without the refuge having been established, its operational support, and that of the Refuge System.

We will issue SUPs for all research conducted by non-Service personnel. The SUP will list all conditions necessary to ensure compatibility. The SUPs will also identify a schedule for annual progress reports and the submittal of a final report or scientific paper.

We may ask our regional refuge biologists, other Service divisions, state agencies, or academic experts to review and comment on proposals. We will require all researchers to obtain appropriate state and federal permits.

Justification
The Service encourages approved research to further understanding of refuge natural resources. Research by non-Service personnel adds greatly to the information base for Refuge Managers to make proper decisions. Research conducted by non-Service personnel will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

Attachments: Special Use Permits and conditions

SPECIAL USE PERMITS - RHC

Special Conditions – All general permits please initial box (**FDR**) to affirm compliance

☐ Location of work will be specified to the appropriate level of detail.

☐ All materials including flagging, transect markers, etc. are to be removed by end of permit period and area restored to pre-permit conditions.

☐ To protect wildlife and vegetation, disturbances to habitat are to be kept to a minimum.

☐ Unless excepted in the permit, all refuge regulations apply.

SPECIAL USE PERMITS – RHC FOR COLLECTING BIOLOGICAL SAMPLES

No Manipulation Areas:

- Drakes Island Road and Mile Road
- Spurwink River Division east of Spurwink Road [Rt. 77]

Special Conditions – All Research Permits ***Initial Each Block***

☐ An update or final report is required from every permittee by December 31.

☐ USFWS/RHC will be appropriately recognized in all written reports

☐ Location of work will be specified to the appropriate level of detail. Research sites require GPS coordinates (UTM NAD83 Zone 19).

☐ All materials including flagging, transect markers, etc. are to be removed by end of research project or permit period and area restored to pre-permit conditions.

☐ To protect wildlife and vegetation, disturbances [including trampling] to habitat are to be kept to a minimum.

☐ Unless excepted in the permit, all refuge regulations apply.

☐ Inform the refuge biologist in advance if there are any changes in your plan of research to maintain the validity of your permit

☐ You may use specimens collected under this permit, any components of specimens (including natural organisms, enzymes, genetic materials of seeds), and research results derived from collected specimens for scientific or educational purposes only, and not for commercial purposes unless you have entered into a Cooperative Research and Development Agreement (DRADA) with us. We prohibit the sale of collected research specimens or other transfers to third parties. Breach of any terms of this permit will be grounds for revocation of this permit and denial of future permits. Furthermore, if you sell or otherwise transfer collected specimens, any components thereof, or any products or research results developed from such specimens or their components without a CRADA, you will pay us a royalty rate of 20 percent of gross revenue from such sale. In addition to such royalty, we may seek other damages and injunctive relief against you.

We encourage permittees and their assistants to notify the refuge staff of unusual observations or occurrences that they encounter on the refuge. In addition, as part of our efforts to preserve and restore native habitats on Rachel Carson NWR, refuge staff have been identifying and treating infestations of non-native plants, and we encourage permittees and their assistants to report new outbreaks of invasive

plants, as well as non-native animal sightings on the refuge. To prevent the transfer of noxious invasives, all boots and other equipment must be rinsed clean prior to use on the refuge.

SPECIAL USE PERMITS – RHC

No Manipulation Areas:

- Drakes Island Road and Mile Road
- Spurwink River Division east of Spurwink Road [Rt. 77]

Special Conditions – Research Permits ***Initial Each Block***

☐ An update or final report is required from every permittee by December 31.

☐ USFWS/RHC will be appropriately recognized in all written reports

☐ Location of work will be specified to the appropriate level of detail. Research sites require GPS coordinates (UTM NAD83 Zone 19).

☐ All materials including flagging, transect markers, etc. are to be removed by end of research project or permit period and area restored to pre-permit conditions.

☐ To protect wildlife and vegetation, disturbances [including trampling] to habitat are to be kept to a minimum.

☐ Unless excepted in the permit, all refuge regulations apply.

☐ Inform the refuge biologist in advance if there are any changes in your plan of research to maintain the validity of your permit

We encourage permittees and their assistants to notify the refuge staff of unusual observations or occurrences that they encounter on the refuge. In addition, as part of our efforts to preserve and restore native habitats on Rachel Carson NWR, refuge staff have been identifying and treating infestations of non-native plants, and we encourage permittees and their assistants to report new outbreaks of invasive plants, as well as non-native animal sightings on the refuge. To prevent the transfer of noxious invasive species, all boots and other equipment must be rinsed clean prior to use on the refuge.

Compatibility Determination

Use
Skiing and Snowshoeing

Refuge Name
Rachel Carson National Wildlife Refuge

Establishing and Acquisition Authorities
The Rachel Carson refuge was established on December 16, 1966. The authority which established the refuge is16 U.S.C. 715–715r, The Migratory Bird Conservation Act, as amended.

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 U.S.C. 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 U.S.C. 460k-1), "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b); 100 Stat. 3583), the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if such terms are deemed by the Secretary to be in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use:
(a) What is the use? Facilitate wildlife observation, wildlife photography, and interpretation by allowing skiing and snowshoeing on refuge trails. The use simply involves foot-travel over the surface of the snow with the use of snowshoes and cross country skis on the refuge trail systems. **Is the use a priority public use?** No, however this use would facilitate wildlife observation, wildlife photography, and interpretation during winter months (priority public uses).

(b) Where would the use be conducted? Refuge trails in Brave Boat Harbor, Upper Wells and Goosefare Brook Divisions. Shared trails in Mousam and Goosefare Brook Divisions.

(c) When would the use be conducted? Use would be determined by snow accumulation. Typically in southern Maine, use would be limited to November through March. Wildlife observation, photography, and interpretation are year around activities.

(d) How would the use be conducted? The refuge's Carson, Cutts Island, Goosefare Brook Overlook trails and the Ted Wells, Atlantic Way and Bridle Path which we share with partners, are open to snowshoeing and skiing as a part of the wildlife dependent activities of wildlife observation, photography and interpretation. Interpretative brochures for the Carson and Ted Wells trails are available year-round.

(e) Why is this use being proposed? Wildlife observation, photography, and interpretation are priority public uses as defined by the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) and if compatible, are to receive enhanced consideration over other general public uses. These activities are encouraged at Rachel Carson refuge, and year around access requires use of snowshoes or skis.

Availability of Resources

Snowshoeing and skiing on trails has little effect on the trail tread. Costs for trail maintenance are enumerated in a separate compatibility determination (Wildlife Observation, Photography, Environmental Education, Interpretation). Existing staff and budget have provided sufficient resources to manage current uses. These low impact activities are within the projected budget and staffing capabilities of the Refuge to manage.

Anticipated Impacts of the Use

Direct disturbance to wildlife is anticipated, as is true for all human – wildlife interactions. Many trust resources, migratory birds and threatened and endangered species, migrate south during the period of use (November to March). The impacts to wildlife are at a level that will not interfere with wildlife populations. Impacts to habitat are minimal from travel over snow cover.

Nearly 100,000 visitors used the one-mile foot Carson Trail at the Wells headquarters. There are many times during the summer and fall when the parking lot is full or overflowing. During the winter months there are typically just a few automobiles in the plowed parking lot.

Endangered and/or threatened species and species of special concern are also present on the refuge but not on trails during winter months. New England cottontail rabbit status is being reviewed; their habitat is dense upland thickets.

Public Review and Comment

As part of the CCP process for Rachel Carson refuge this compatibility determination will undergo extensive public review, including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

- Snowshoers and cross-country skiers will only use established trails. Public use is limited to designated trails.
- Compliance with regulations will be achieved through education, signage and law enforcement which will result in minimizing negative impacts to refuge habitat and wildlife.

- Refuge regulation concerning hours (daylight hours) and access restricted to permitted areas will be enforced.
- Some activities are not compatible and are prohibited on the Refuge to protect sensitive habitats and wildlife. Prohibited activities include using off-road vehicles, camping, building fires, horse-back riding, mountain biking, and collection of any plants or animals not covered by a permit.

Justification

Wildlife observation, interpretation and photography are priority public uses. Rachel Carson refuge is located in Maine where the ground can be covered with snow from November to April. In Maine, the traditional means of access to outdoor destinations during winter months is via ski and snowshoe. Refuge trails are open to public use daylight hours year round. Due to the snow cover, visitor impact is minimized during winter months in that trail tread is not being compressed and fewer species and fewer numbers of wildlife are present. Allowing Skiing and Snowshoeing to occur within the Rachel Carson refuge will not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

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U.S. Fish and Wildlife Service. 1985. *Refuge Manual*. Washington, D.C.: U.S. Government Printing Office.

Compatibility Determination

Use
Furbearer Management

Station Name
Rachel Carson National Wildlife Refuge

Establishing Authority
Rachel Carson refuge was established on December 16, 1966. The authority which established the refuge is16 U.S.C 715-715r, The Migratory Bird Conservation Act, as amended.

Refuge Purposes
For lands acquired under the Migratory Bird Conservation Act (16 USC 715d), the purpose of the acquisition is for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.

For lands acquired under the Refuge Recreation Act (16 USC Section 460k-1), "suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species..." (16 U.S.C. 460k-1).

For lands acquired under the Emergency Wetlands Resources Act of 1986 (16 USC Section 3901(b) 100 Stat. 3583, the purpose of the acquisition is for the conservation of the wetlands of the Nation in order to maintain the public benefits they provide to help fulfill international obligations contained in various migratory bird treaties and conventions.

For lands acquired under the Fish and Wildlife Act of 1956 (16 USC Section 742f (a)(1)), the purpose of the acquisition is for the development, advancement, management, conservation, and protection of fish and wildlife resources.

For lands acquired under the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(b)(1)), the purpose of the acquisition is for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if such terms are deemed by the Secretary to be in accordance with law and compatible with the purpose for which acceptance is sought.

National Wildlife Refuge System Mission
"To administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." (National Wildlife Refuge System Administration act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Proposed Use
(a) What is the use? Is it a priority public use? The use is furbearer management. We consider furbearer management a refuge management economic activity. It is not a priority public use of the National Wildlife 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.

(b) Where would the use be conducted? Furbearer management would be conducted on the expansion areas of the refuge, primarily Biddeford and York River divisions. Furbearer management will also be conducted in the Upper Wells, Mousam and Goosefare Brook divisions where the targeted species cause damage to refuge resources, such as raccoons feeding on the eggs and chicks of federally threatened piping plover and State endangered least terns and/or muskrat causing damage to marsh habitats. The

proposed locations are where it will accomplish the goals and objectives of our Habitat Management Plan, such as the balance of predator-to-prey levels and marsh ecosystem dependence.

We will work with the Maine Department of Inland Fisheries and Wildlife seasonally to inventory targeted species activity and determine trapping locations. A permit system and refuge law enforcement would ensure that trappers on the refuge comply with state and refuge regulations and that the data submitted to the refuge is accurate. Designating management zones and limiting the number of trappers in each zone may help prevent conflicts between trappers. In addition, designating trapping zones would allow the refuge to either concentrate or reduce trapping in areas where management intervention is desirable. Designating locations where specific trappers are permitted on the refuge will facilitate the enforcement of refuge and state regulations. That zoning may also provide better quality trapping experiences by preventing overlap with other trappers. However, if necessary, trapping may be concentrated or zoning eliminated to meet our goals for protecting refuge resources.

(c) When would the use be conducted? Furbearer management would be conducted in accordance with the Maine state seasons. Maine furbearer management seasons run from late October to the end of March. The annual occurrence of furbearer management on the refuge will be at the discretion of the refuge manager, and will depend on the population size of the targeted species and management objectives.

(d) How would the use be conducted? The refuge will be open to furbearer management for the following species: beaver, coyote, fisher, fox, mink, muskrat, otter, raccoon, skunk, and weasel.

The furbearer management program will closely mimic the Maine Department of Inland Fisheries and Wildlife's sanctuary deer hunt in Wells, Maine. We would conduct furbearer management following Maine state regulations and specific refuge regulations issued through a refuge special use permit (SUP). Only select permitted trappers may participate. The refuge would allow furbearer management during state seasons under state limits for the targeted species. The refuge manager reserves the authority to regulate the numbers of target species taken in any one location. Target species may include but are not limited to: raccoon, mink, opossum, fox, skunk, etc.

We would manage the furbearer management program through the SUP process and, if needed, will work with the State to have special furbearer management regulations or extended seasons. Administering the program under an annual SUP will allow the refuge manager to have a ready list of contacts for requests for specific management needs to accomplish refuge objectives.

We will require a harvest report from each trapper following the close of trapping season but before December 31 each year. The report will include data about the trapping effort, the time span of trapping by species, the number of target and non-target species harvested, the refuge areas trapped, and remarks on observations of wildlife or other noteworthy ecological information. Those data can provide a basis for catch-per-unit and population trend analyses. If the required information is lacking for a trapper from the previous year, we would not issue the SUP for the next year.

(e) Why is this use being proposed? We will conduct furbearer management first as a tool to maintain habitat and keep the predator-to-prey balance. A regulated furbearer management program on the refuge also affords a potential mechanism to collect survey and monitoring information or contribute to research on furbearer (and other wildlife) occurrence, activity, movement, population status, and ecology. By maintaining a trained, experienced group of trappers, the Service can use their skills and local knowledge to perform or assist in valuable management or research functions. Trappers who participate in the refuge program would provide assistance with the implementation of structured management objectives, such as the alleviation or reduction of wildlife damage conflicts, negative interactions among

species, and habitat modifications. Refuge trappers typically have a stake in proper habitat and wildlife conservation and protection of the ecological integrity of the refuge so they can continue trapping. Accordingly, they are valuable assets for the refuge manager in providing on-site reports concerning the fundamental status of habitat, wildlife, and refuge conditions.

Furbearers are considered a renewable natural resource with cultural and economic values (Andelt et al 1999, Boggess et al. 1990 Northeast Furbearer Resources Technical Committee 1996, Payne 1980). Several human dimensions studies have documented trapper profiles, cultural aspects of trapping, and the socioeconomic role of trapping in the United States (Andelt et al. 1999, Boggess et al. 1990, Daigle et al. 1998, Gentile 1987). A regulated trapping program on the refuge could also foster the appreciation of wildlife and nature, wildlife observation, environmental education, a greater understanding of ecological relationships, stewardship of natural resources, and inter-generational passage of the methodologies of renewable resource use. Trapping is an activity in which family members and friends often participate and share joint experiences that broaden appreciation of natural resources and ecological awareness (Daigle et al. 1998).

Availability of Resources

The financial resources necessary to provide and administer this use at its current level are now available, and we expect them to be available the future. The refuge manager would provide overall administration of the program. A wildlife biologist, working with State personnel, would be required to evaluate furbearer activity and potential and current impacts on refuge resources. The biologist would also evaluate trapper data and compile trapping reports. An administrative assistant is required to help process SUPs and enter trapping data into a database. A refuge law enforcement officer would be required to check refuge trappers and ensure compliance with state and refuge regulations.

We estimate below the annual costs associated with administering the furbearer management program on the refuge.

Refuge Biologist (GS12) (recommendations, surveys, data analysis)—1 week/yr	$2,000
Deputy Refuge Manager (GS12) (program administration)—1 week/yr	$2,000
Law Enforcement Officer (GS 9) (trapper compliance)—12 days	$3,000
Administrative Assistant (GS6) (office administration, permit issuance)—1 week/yr	$900
Total	**$7,900**

Anticipated Impacts of the Use

The impacts of furbearer management on the purposes of the refuge and mission of the Refuge System can be either direct or indirect, and may have negative, neutral, or positive impacts on refuge resources.

Indirect impacts may include displacing migratory birds during the pair bonding/nesting season or the destruction of nests by trampling. Direct impacts may include the catch of target and non-target species that are predators on migratory birds or nests, or the removal of species that induce habitat change (e.g., beavers).

Because of the temporal separation of trapping activities and breeding wildlife using the refuge, indirect impacts on those resources by trappers would be negligible. Trappers using the refuge in early March may disturb individual early nesting waterfowl on occasion, and cause their temporary displacement from specific, limited areas. Those impacts are occasional, temporary, and isolated to small geographic areas. Owls initiate nesting activates on the refuge in February, but no evidence suggests that trapping has affected owl nesting success.

Indirect impacts on wildlife nesting and breeding success can result from the removal of animals under

a furbearer management program. In many instances, those impacts are positive. Reductions in the populations of nest predators such as raccoon, fox, skunk, and mink have positive impacts on nesting birds. The degree to which predator management benefits migratory bird production can vary widely depending on the timing of the removal of predators, the size of the habitat block, habitat isolation and adjacent land use.

The removal of plant-eating species such as beaver and muskrat can have both positive and negative impacts on refuge resources. Muskrats will dig bank dens into embankments, causing considerable damage and adding costs to the operations of the refuge. Beavers will sometimes plug water control structures, causing damage, limiting access, and could compromise the capabilities of the refuge to manage habitat. Managing beaver and muskrat populations at reasonable levels through a furbearer management program can reduce refuge costs in managing wildlife.

However, those same animals can enhance habitat management. Muskrats build houses and dens using aquatic vegetation, thus creating openings for fish, waterfowl and other migratory birds. Beaver dams create pond habitat, and their lodges are associated with openings in aquatic vegetation beds. Beavers are keystone species for cycling small wetland systems from pond to meadow to scrub-shrub and forested successional stages back to pond. That cycling benefits other species, including woodcock and black duck. Those benefits minimize the need to commit refuge resources to achieve those habitat conditions.

When considering impacts on refuge purposes, the impacts of the furbearer management program obviously include those on the furbearer populations themselves. Trapping harvests and removes individuals of the species. Yet state natural resources agencies indicate that, with exceptions, furbearer populations are stable or increasing. The anticipated direct impacts of trapping on wildife would be a reduction of furbearer population in those areas where surplus furbearers exist. The removal of excess furbearers from those areas would maintain furbearer populations at levels compatible with the habitat and with refuge objectives, minimize furbearer damage to facilities and wildlife habitat, minimize competition with or interaction among wildlife populations and species that conflict with refuge objectives, and minimize threats of disease to wildlife and humans.

Non-target furbearer species could be taken through this trapping program. Traps will be set specifically around areas of targeted species activity to reduce the risk of taking species other than targeted species. The experience of the trappers and the selection of the appropriate trap size will reduce non-target furbearer captures (Northeast Furbearer Resources Technical Committee 1996, Boggess et. al 1990

A national program operated under the guidance of the Fur Resources Technical Subcommittee of the International Association of Fish and Wildlife Agencies (IAFWA 1998) systematically improves the welfare of animals in trapping through trap testing and the development of "Best Management Practices (BMPs) for Trapping Furbearers in the United States." The refuge would cooperate with and contribute to the development and implementation of those BMPs by practicing an integrated, comprehensive approach to furbearer management, wherever and whenever possible.

Public Review and Comment

As a part of the CCP process for Rachel Carson Refuge, this compatibility determination will undergo extensive public review including a comment period of 30 days following the release of the Draft CCP/EA.

Determination

_____ Use is not compatible

__X__ Use is compatible, with the following stipulations

Stipulations Necessary to Ensure Compatibility

- Permittees must comply with all conditions of the refuge furbearer management special use permit and all state trapping regulations of the state in which the trapping would occur.
- Traps shall be set only where traps or trapped furbearers are not visible from public highways, overlooks, or other visitor facilities.
- Trappers, when requested by federal or state enforcement officers, must display for inspection their state trapping license, refuge trapping permit, trapping equipment, and all animals in their possession.
- One sub-permittee is allowed. The sub-permittee must be listed on the permit and have all applicable state licenses. The sub-permittee may trap the unit without the permittee only if prior approval is granted to the permittee by the refuge manager.
- Ingress to and egress from the refuge shall be only by routes that are currently open for travel. No motorized vehicles are allowed behind gates or off designated routes.
- Permittees shall, no later than 10 days after the last day of the refuge trapping season but in all cases before December 31, submit to the refuge manager the trapping report form provided with the trapper permit on which the number of each species of animals taken and the location where the animal was taken is correctly stated.
- Permittees may cut small trees or brush on the refuge for use only as trap stakes. Cutting is prohibited along public roads and trails or near visitor facilities.
- Unless otherwise stated by the refuge manager, the refuge trapping season will run concurrently with the state season.
- The Fish and Wildlife Service assumes no responsibility for the theft of equipment or animals.
- Failure by permittees or sub-permittees to comply with any of the provisions above or the violation of any refuge regulations or state laws or regulations applicable to trapping on the refuge, shall render him or her subject to prosecution under said laws and regulations and shall be cause for the revocation of this permit and for refusal of a trapping permit for the next 3 years.
- This permit may be terminated at any time by agreement between the issuing officer and the permittee; it may be revoked by the issuing officer for any violation of refuge or state laws or regulations applicable to trapping on the refuge or any conditions of the trapping permit; that permit may be revoked by the issuing officer for non-use.
- Snaring is prohibited.
- The use of exposed bait and setting traps adjacent to naturally occuring carcasses are prohibited.
- Permittees must immediately release non-target species that are uninjured and report those captures by species and number as part of the annual report. Injured species are to be reported to the refuge manager or designee within two business days. Permittees must turn over to the refuge manager or designee within 24 hours non-target species injured or killed through trapping activities.
- Foothold traps set on land must be staked with chains less than 9½ inches equipped with two swivels to prevent an incidentally captured lynx from entangelment around a solid object. Drag sets are prohibited.
- Traps must be checked at least once every 24 hours.

- For land sets, only foothold traps #2 or smaller and 110 and 120 conibear for landsets are permitted to help avoid incidental capture of lynx.

- Leaning pole sets for martin and fisher will be on poles no larger than 4 inches in diameter and set at a 45-degree or greater angle. The use of exposed bait on leaning poles is prohibited. If bait is used with conibear traps set for martin and fisher, bait will be hidden at the back of a box at least 15 inches in depth and the conibear will be set at least 6 inches from the front of the box.

Justification

Furbearer management on the refuge is a useful tool in maintaining balance between furbearers and habitat, safeguarding refuge infrastructure, and preventing the spread of disease. High populations of predators can decrease the nesting success of ground-nesting migratory birds, thus compromising one purpose of the refuge. Furbearer populations, with local exceptions, are stable or increasing in the two states in which the refuge lies. The furbearer management program on the refuge does not have any appreciable negative impacts on furbearer populations.

Furbearer management contributes to the purposes of the refuge and the mission of the Refuge System by maintaining the vigor and health of furbearer populations and safeguarding the refuge infrastructure critical to habitat for scores of fish and wildlife species.

Project Leader_____ _____
(Signature) (Date)

Concurrence

Regional Chief_____ _____
(Signature) (Date)

Mandatory 10 or 15 year Re-evaluation Date _____
(for all uses other than priority public uses) (Date)

Literature Cited

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USFWS

Appendix E

Habitat Management Plan Potential Management Prescriptions

- Upland Forests, Shrublands, and Grasslands
- Tidal and Freshwater Wetlands

A. Upland Forests, Shrublands, and Grasslands

❖ Strategy 1. Manipulate Plant Species Composition

1.1 Silvicultural Prescriptions

1.1a Clearcutting

Clearcutting is the removal of an entire stand of trees in one cutting with reproduction obtained naturally or artificially (i.e. planting, broadcast seeding, or direct seeding). Two common methods of clearcutting are patch or block clearcuts and strip clearcuts. This regeneration method is considered to be even-age management. Although, somewhat coarse multi-aged stands can be accomplished through progressive patch or progressive strip clearcut systems. Clearcut size does have an effect on regeneration. As clearcuts increase in size they tend to favor shade intolerant regeneration. As they become smaller they gravitate towards encouraging intermediately tolerant and tolerant species. The size and shape of the clearcut can have an effect on bird species richness as well as influence herbivore utilization.

Patch Clearcut

Patch or block clearcuts can be many different shapes and sizes depending on management objectives, forest type, terrain, or boundaries. Natural regeneration from the adjacent stands is not heavily relied upon, but can have varying degrees of influence depending on patch size. All stems 2" dbh and greater should be removed unless some advanced regeneration of desired species exists. Although somewhat difficult to apply, an alternate or progressive patch clearcut approach can be an option. These approaches are more often associated with the strip clearcut method. Application of these options should follow the respective strip clearcut strategy substituting the strips with patches.

Strip Clearcut

Strip clearcutting is used to promote natural regeneration and growth in the harvested strips through the adjacency of the unharvested area. In the harvest areas, all stems 2" dbh and greater should be removed unless some advanced regeneration of desired species exists. The unharvested strips act as a seed source and protection for the harvested areas. As regeneration is established in the harvested areas, the unharvested areas are progressively removed. Concerns related to wind damage are warranted when using this method of clearcutting because of the increase in amount of edge that is exposed. This can be avoided by minimizing the width of the strips being harvested (50-100 feet on stable soil and 30-50 feet on wet soil or questionable sites), ensuring at least one end of the strip is closed, and harvest as soon as cleared strips are regenerated. Strip clearcuts are more successful when applied to healthy forests found on deep, well-drained soils. These harvests can be designed in an alternate or progressive fashion.

Alternate Strip Clearcut

Alternate strip clearcuts are accomplished in two stages. The first harvest removes vegetation in long narrow clearcuts leaving unharvested leave-strips in between. The second harvest removes the leave strips once regeneration is established in the first-pass harvest areas. This technique does not allow for much regenerative influence on the second-pass areas, and may require artificial means to accomplish specific regenerative objectives. This requirement can be minimized if a seed source is in reasonable proximity, or advanced regeneration is present. To minimize windthrow, the strips should be oriented at right angles to the prevailing winds. Width of the strips should be influenced by seed dissemination ability for the preferred species and potential to wind damage.

Progressive Strip Clearcut

Progressive strip clearcuts accomplish results similar to the alternate strip clearcuts, but in three or more passes rather than in two. There are a number of advantages when using this method over the alternate strip clearcut method. One is the strips can be progressively harvested into the prevailing wind, reducing the exposed edge and windthrow. Another is more area has the ability to regenerate naturally resulting in

less are requiring potential for costly artificial regenerative techniques. To some this may also have less negative aesthetic impact.

1.1b Single Tree Selection

Single tree selection is the removal of individual trees uniformly throughout a stand. This technique is often used to promote the quality and growth of the remaining trees. This method can also result in regeneration of mostly shade tolerant species due to the small canopy openings created during the harvest. Use of this technique, on a continual harvesting cycle, is considered un-even aged management. Actively managing a stand in un-even ages can result in reducing the stands natural ability to resist insect, disease, and other debilitating health issues. Careful extraction of the trees is necessary to help limit residual stand damage, which can create an opportunity for insects and disease to enter otherwise healthy trees. Root damage by soil compaction also needs to be considered. This technique can also be used during even-aged management and when done so is commonly referred to as an intermediate thinning. Single tree selection can be used to mirror a small scale disturbance. When only large trees are selected, the large opening produced in the canopy will typically be utilized quickly by the crowns of adjacent older trees.

1.1c Group Selection

Group selection is the removal of small groups of trees to maintain an un-even aged forest. Normally to be considered a group selection, as opposed to a patch clearcut, the size of the harvest group should be less than or equal to twice the height of the adjacent mature trees. This method will encourage regeneration of intermediately tolerant and tolerant species, but some intolerant species can appear towards the center of the harvest areas when the groups are at the maximum size. The likelihood of the harvest areas regenerating combined with the ability to schedule continual harvest entries, results in this technique being a method of choice to convert even-aged stands to un-even aged stands when desired. Actively managing a stand in un-even ages can result in reducing the stands natural ability to resist insect, disease, and other debilitating health issues. Careful extraction of the trees is necessary to help limit residual stand damage, which can create an opportunity for insects and disease to enter an otherwise healthy stand. Root damage by soil compaction also needs to be considered.

1.1d Shelterwood System

Shelterwood is a series of harvests carried out with the intent of regenerating a stand utilizing mature trees that are removed at the end of the scheduled rotation. This technique is typically used to regenerate intermediately tolerant (mid successional) and tolerant (late successional) species, but in certain instances can be used for intolerant (early successional) species. Use of this technique is considered even-aged management, although variations more often found in the irregular shelterwood system can result in a multi-aged stand. In order for a shelterwood system to be considered, a stand should be reasonably well stocked with a moderate to high component of the species desired for regeneration. A number of shelterwood system applications exist. The more commonly used is the open shelterwood system. Although less commonly used, the dense shelterwood, deferred shelterwood, irregular shelterwood, natural shelterwood, and nurse tree shelterwood systems are also useful in accomplishing specific regenerative needs as well as other resource management objectives.

2-Stage Open Shelterwood System

The 2-stage open shelterwood system consists of an initial harvest (stage 1) used to encourage regeneration, and an overstory removal harvest (stage 2) once regeneration is established. This technique usually results in regeneration with a higher component of intermediately tolerant species. In a well-stocked stand this translates into removing 30 to 50 percent of the stand in the first harvest. Residual crown closure should be between 30 to 70 percent. The harvest should focus on undesirable species, suppressed, co-dominant, and unhealthy dominant trees. The residual should be an evenly distributed stand of large crowned, healthy dominant and co-dominant trees. This will provide the greatest potential for seed production and resiliency to windthrow. Regeneration is considered established when it is found to be, at a minimum, > 1 foot tall

for softwoods and > 3 feet tall for hardwoods and hemlock. A minimum of 5,000 well-distributed seedlings per acre should be established before the overstory removal (stage 2) is conducted. The overstory removal should be conducted during a winter season, with adequate snow depth, to help minimize damage to the regeneration.

3-Stage Open Shelterwood System
The 3-stage open shelterwood system consists of a preparatory harvest (stage 1) to encourage tolerant regeneration. A secondary harvest (stage 2) used to encourage intermediately tolerant and tolerant regeneration, and an overstory removal harvest (stage 3) once regeneration is established. This technique usually results in regeneration with a higher component of tolerant species. In a well-stocked stand this translates into removing a maximum of 15 percent of the stand in the initial harvest (stage 1). The harvest should focus on undesirable species and suppressed stems. An additional 15-30 percent of the residual stand should be removed in the secondary harvest (stage 2). Residual crown closure should be between 30-70 percent. The harvest should focus on undesirable species, suppressed, co-dominant, and unhealthy dominant trees. The residual should be an evenly distributed stand of large crowned, healthy dominant and co-dominant trees. This will provide the greatest potential for seed production and resiliency to windthrow. Regeneration is considered established when it is found to be, at a minimum, > 1 foot tall for softwoods and > 3 feet tall for hardwoods and hemlock. A minimum of 5,000 well-distributed seedlings per acre should be established before the overstory removal (stage 2) is conducted. The overstory removal should be conducted in the winter to help minimize damage to the regeneration.

Dense Shelterwood System
The dense shelterwood system consists of an initial harvest used to encourage tolerant regeneration, and an overstory removal harvest once regeneration is established. This technique usually results in regeneration with a higher component of tolerant species. In a well-stocked stand this translates into removing 15-30 percent of the stand in the first harvest. Residual crown closure should be around 80 percent. The harvest should focus on undesirable species, suppressed, co-dominant, and unhealthy dominant trees. The residual should be an evenly distributed stand of large crowned, healthy dominant and co-dominant trees. This will provide the greatest potential for seed production and resiliency to windthrow. Regeneration is considered established when it is found to be, at a minimum, > 1 foot tall for softwoods and > 3 feet tall for hardwoods and hemlock. A minimum of 5,000 well-distributed seedlings per acre should be established before the overstory removal (stage 2) is conducted. The overstory removal should be conducted during a winter season, with adequate snow depth, to help minimize damage to the regeneration.

Deferred Shelterwood System
The deferred shelterwood system consists of an initial harvest (stage 1) used to encourage regeneration, and a delayed overstory removal harvest (stage 2) once established regeneration is well advanced. This technique can be catered to encourage a high regenerative composition of either intermediate or tolerant species by adjusting the intensity of the initial harvest. In a well-stocked stand this translates into removing 15 to 50 percent of the stand in the first harvest. Residual crown closure should be between 30 to 80 percent. The harvest should focus on undesirable species, suppressed, co-dominant, and unhealthy dominant trees. The residual should be an evenly distributed stand of large crowned, healthy dominant and co-dominant trees. This will provide the greatest potential for seed production and resiliency to windthrow. Regeneration is considered well advanced when it is found to be, at a minimum, > 10 feet tall for softwoods and > 15 feet tall for hardwoods and hemlock. A minimum of 5,000 well-distributed seedlings/saplings per acre should be established before the overstory removal (stage 2) is conducted.

Irregular Shelterwood System
The irregular shelterwood system consists of an initial harvest used to encourage regeneration, optional intermediate harvests used to encourage supplemental regeneration, and an overstory removal harvest once regeneration is established. This technique usually results in regeneration with a higher component of intermediately tolerant or tolerant species. This technique differs from other shelterwood systems by introducing the concept of leaving a component of the original stand that can either be removed

during subsequent harvests or left throughout the series of harvests and beyond. The long-term residual component can be left singularly or in groups. Harvests can be applied in a variety of fashions including harvesting uniformly, in groups, or strips. The harvest should focus on undesirable species, suppressed, co-dominant, and unhealthy dominant trees. This will provide the greatest potential for seed production and resiliency to windthrow.

1.1e. Seed Tree System

Seed tree system is the removal of the majority of a stand while retaining a minority of seed producing trees, left standing to retain some component of the desired species in the regenerating stand. Seed trees can be left singularly and/or in groups, and should be distributed as uniformly as possible throughout the stand. This technique is usually prescribed when desired species are lacking as a seed source in the overstory (negating shelterwood as an option), or regeneration composition is not a primary objective. This technique could also be used, somewhat more unpredictably, to convert species composition to an earlier successional variety while retaining a small component of desired species (eg softwood to mixed wood). Desired species that are healthy, dominant, large crowned, and well rooted should be targeted to leave standing. The rest of the stand should be removed in its entirety (2" dbh and greater). The residual trees/groups can be removed after regeneration is established or may be left to accomplish other stand objectives. Residual trees are subject to harsh environmental conditions with very little protection. Sudden exposure to light can stimulate epicormic sprouting in hardwoods, which should be addressed and/or expected. A common approach to reduce epicormic sprouting is to leave adjacent trees that will provide immediate shade to the bole of the seed tree. The more shallow rooted softwoods have the least resilience to wind and other environmental factors, and are less likely to perpetuate until natural resilience is reestablished with the regenerating stand.

1.2 Stand Improvement

Stand improvement consists of entering an even or uneven aged stand at any stage of development with the intent of tending to habitat needs through thinning, weeding, cleaning, liberation, sanitation, or other improvement methods. The primary function of this method is to control species composition and reduce an overabundance of stems per acre to a more desired stocking level. Another function of this method should be to consider other habitat needs during these stand entries, and introduce methods to help meet desired criteria. This translates into thinning young stands (pre-commercially) to control species composition, conducting intermediate thinnings in middle aged stands to maintain accelerated growth and remove unwanted vegetation, and control stocking levels of habitat features such as snag trees, cavity trees, den trees, downed wood and other features.

1.3 Herbivore Control

Selective feeding or browsing by wild herbivores can negatively impact woody plant species composition and stand structure. Deer are the most common species that cause impacts of concern to wildlife and forest managers. Methods to reduce negative impacts include deterrents, exclusion, or population reduction. Deterrents (e.g., chemical application, scare devices) and exclusion (e.g., fencing, seedling tubes) are labor intensive and costly to employ, chemicals can create environmental hazards, and both methods usually are not practical or satisfactory except in small-scale situations such as nurseries or small plantations. Population reduction methods include reproductive controls (e.g., chemosterilants, contraceptives) that are costly and require continual reapplication, and public hunting. Hunting is the most widely practiced tool for reducing negative impacts of herbivory in these settings. Hunting must be regulated (e.g., hunting methods, timing of seasons, hunting pressure) and harvests monitored to prevent negative impact to long-term survival of target herbivore populations.

In some situations, beavers can conflict with certain refuge management objectives through excessive tree felling and girdling, and flooding of sensitive habitats. Beavers can also create wonderful wetland habitats. Installing anti-flooding/damming devices (e.g., "beaver bafflers") at culverts, water control structures, or bridges can sometimes be effective in mitigating undesired flooding.

1.4 Mechanical and Herbicidal Treatments for Native Vegetation

Many treatments and numerous types of equipment are available for mechanically manipulating upland sites from one covertype to another. Selection of the type of mechanical treatment often depends on your habitat goals. Do you want to have all vegetative material left on the ground, have it removed from the site, piled in slash, broadcast spread, burned or chipped? If an area is cut from young forest and with the intention of creating a permanent shrubland, should stumps be removed?

Strategies and tools:

- Drum mowers for removal of small trees
- Hydro-Axe – this piece of equipment consists of an articulated tractor with a mower mounted on the front. It is generally able to cut trees up to approximately 6-8 ” dbh. Woody material is reduced to fine chips, often finer then those resulting from a roller mower.
- Roller Chopper Mower
- Mowing and brush hogging – mowing is an appropriate treatment for grass, forbes and small shrubs and saplings. Vegetation > 4 inches often needs a higher powered machine.
- Girdling – Girdling can be appropriate to kill single trees to create snags and open up the canopy for further development of understory. It can also cause stump sprouting.
- Chainsaws – Saw work can be appropriate to remove single trees or groups of trees and pen up the canopy for further development of understory. Stump sprouting may occur.
- Coarse Woody Debris Management – different prescriptions will leave differing amounts of woody debris. Objectives will drive the best management technique for dealing with the debris. Often times, it can be left to decay on the forest floor, however if conversion to another habitat type is desired (grassland or shrubland) the woody materials left must not complicate future management actions (i.e. leaving large logs in unit may make it hard to brush hog).
    - Chipping – materials can be chipped and broadcast on site. Depth of chips should not exceed 2-3 inches.
    - Piling – native vegetation may be piled on site and left for habitat or burned in a slash pile.
    - Removal from site – materials can be chipped and removed from site, removed as whole logs or shrubs
    - Spreading small slash will not make future treatments difficult and returns nutrients to the soil.
- Herbicides for Stable Shrublands – in some cases where the structure of a stable shrubland is desired selective herbicides are applied to tree species. This eventually results in the selection of a dense shrub overstory and the development of a minimal amount of trees. This can create habitat which will remain in the shrub stage for longer then most other management techniques.

Maryland Partners in Flight Committee. 1997. *Habitat Management Guidelines for the benefit of landbirds in Maryland.* Maryland Partners in Flight.

1.5 Invasive Plant Control

Manual and Mechanical Control

Mechanical removal of plants can be effective against some herbaceous plants, shrubs and saplings, and aquatic plants, especially if they are annuals or have a taproot. Care should be taken to minimize soil

disturbance to prevent creating conditions ideal for weed seed germination. Repeated cutting over a growing period is needed for effective control of many invasive plant species. Care should be taken to properly remove and dispose of any plant parts that can re-sprout. Treatments should be timed to prevent seed set and re-sprouting. The following methods are available: hand-pulling, pulling with hand tools (weed wrench, etc.), mowing, brush-hogging, weed-eating, stabbing (cutting roots while leaving in place), girdling, mulching, tilling, burning using a hand held tool, smothering (black plastic or other), and flooding.

The advantages of mechanical treatment are low cost for equipment and supplies and minimal damage to neighboring plants and the environment. The disadvantages are higher costs for labor, increased soil disturbance and inability to control large areas. For many invasive species, mechanical treatments alone are not effective, especially for mature plants, those with extensive rhizomes, or well-established plants. Mechanical treatments are most effective when combined with herbicide treatments (e.g. girdle and herbicide treatment).

Prescribed Fire
Fire can either suppress or encourage any given plant species, so great care must be taken to understand the ecosystem and the life histories of the native and invasive plants before using this tool. This tool is most successful when it is used to mimic natural fire regimes. Proper timing of prescribed burns is essential for controlling target invasive species. The most effective fires for invasive plant control occur just prior to flower or seed set, or at the young sapling/seedling stage. Repeated burns or a combination of burning and herbicide treatments may be needed to effectively control the invasive plant and seedlings that may sprout after the burn.

This tool requires a good deal of pre-planning (including permitting) and requires a trained crew available on short notice during the burn window. Spot burning using a propane torch can be a good method to control small infestations of invasive plants. It can be advantageous where it is too wet or where there is little fuel to carry a prescribed fire.

Biological control
Biological control is the use of animals or disease organisms that feed upon or parasitize the invasive species target. Usually, the control agent is imported from the invasive species' home country, and/or artificially high numbers of the control agent are fostered and maintained. There are also "conservation" or "augmentation" biological control methods where populations of biological agents already in the environment (usually native) are maintained or enhanced to target an invasive species.

The disadvantage of biological control is the small chance that an introduced control agent can itself become an invasive species. Great care is taken in selecting appropriate biocontrol agents, they are regulated by the USDA. Appropriate control agents may not even exist for all invasive species. The advantages of this method are that it avoids the use of chemicals and can provide relatively inexpensive and permanent control over large areas. More effort is placed on using "conservation" approach to biological control; and this has great promise as an effective, long-term control method. If biological control methods are used, ensure all State and Federal permits are in place.

Herbicides
There are a wide variety of chemicals that are toxic to plant and animal species. They may work in different ways and be very target specific, or affect a wide range of species. Herbicides may be "pre-emergent," that is, applied prior to germination to prevent germination or kill the seedling, or "post-emergent" and may have various modes of action (auxin mimic, amino acid inhibitor, mitosis inhibitor, photosynthesis inhibitor, lipid biosynthesis inhibitor). Products may come in granular, pellet, dust or liquid forms. Liquid herbicides are commonly diluted to an appropriate formula and mixed with other chemicals that facilitate mixing, application or efficacy. Common application methods include foliar spray, basal bark, hack and squirt, injection, and cut stump.

The advantages are that the correct chemicals, applied correctly, can produce desired results over a large area for a reasonable cost. The disadvantages are that the chemicals may affect non-target species at the site (including the applicator) and/or contaminate surface or groundwater. Proper planning includes using the most target-specific, least hazardous (humans and the environment), and most effective chemical for the job. Additionally, attention to protective gear, licensing requirements and other regulations and is essential. Herbicides are most effective when used in combination with non-chemical methods described above.

1.6 Planting or Seeding

Planting or seeding areas can change the species composition. Some examples are converting cool season grass fields to warm season through planting, restoring areas which have been damaged either by wildfire or erosion, introducing native ground cover to outcompete non-native plant species or jump starting areas to a new habitat type by planting shrubs or trees.

Tools and Equipment

The tools and equipment chosen will depend on the type of planting stock you are using. Warm season grass mixes may be broadcast seeded or a seed drill may be used. If seeds are broadcast spread the field should be lightly disked or packed to incorporate seed. Attachments on tractors can assist with shrub or tree planting. To minimize soil disturbance a large auger may be used to dig planting 18" holes. For bare root seedlings or whips, dibble sticks can be used to manually plant.

Site Preparation

Many native grass species are not good competitors with aggressive weedy species. The seed bed should be free of weeds and noxious plants before seeding. For native trees and shrubs, grass competition should be reduced by mowing and invasive shrubs and trees removed before planting. Minimizing soil disturbance during planting will help prevent the establishment of new nonnative plants. Follow up control of undesirable plants may be necessary.

Planting Technique

Stock

Season: Planting is best completed during times when there will be ample precipitation, either in early spring or fall. Avoid summer planting when possible as new transplants and tender seedlings are prone to drought damage.

Monitoring

Appropriate monitoring plans must be in place to measure plant survivorship and establishment of communities.

Pfaff, S. and M.A. Gonter. *Florida Native Plant Collection, Production and Direct Seeding Techniques*. 1996. US Department of Agriculture. 61 pgs.

❖ Strategy 2. Maintain or Provide Structural Components of the Woody Uplands

2.1 Retain or Provide Coarse Woody Debris

Snags or live trees that fall to the forest floor are known as coarse woody debris (CWD). CWD, ranging in size from branches to bole to entire trees, adds structural diversity, serving as hiding and thermal cover, den sites, foraging substrate, and winter access to subnivean (i.e. below the snow surface) habitats. As the wood decays essential nutrients such as sulphur, phosphorous, and nitrogen are released. The need for creating CWD depends on the forest type, stage of succession, and management history. Allowing snags to fall naturally, felling and leaving live trees, and/or leaving non-merchantable tops, limbs, and products other than logs during commercial logging can augment CWD levels.

2.2 Retain or Create Snags

Snags play an important ecological role for at least 149 bird species, 73 mammalians, and 93 herptiles (Thomas et al. 1979). Based on the state of decomposition, snags can be hard (sound sapwood, rotting heartwood) or soft (rotting sapwood and heartwood). Snag abundance can be compromised in commercially managed forests because they are considered safety hazards. There are several ways to "create" snags, or initiate the decomposition process. Each is an effort to damage a healthy tree's integrity by creating a pathway for fungal infection. These include girdling, topping, branch removal, fungal inoculation, and herbicide injection. The density and size of suitable snags depends on the individual forest types and natural disturbance patterns. Snag retention must be done in appropriate places (i.e. not within felling distance to public walking paths).

Thomas, J. W. 1979. *Wildlife habitats in managed forests, the Blue Mountains of Oregon and Washington*. USDA, Forest Service, Agriculture Handbook No. 553.

2.3 Patch Retention

Patch retention is leaving groups within a stand with the primary purpose of satisfying structural or other non-regenerative objectives. This can be applied in combination with other silvicultural systems. Patch size can vary and should be determined on how effectively it will meet the objective. Trees can be left singularly, but should be left in conjunction with groups to form a mosaic as opposed to uniform singular use that will resemble other silvicultural systems. Patches can be removed in a variety of scheduled intervals, but to set this method aside from variations that can be found in other silvicultural systems, longevity is vital.

2.4 Control Deer Populations

Selective feeding or browsing by deer in particular can negatively impact woody plant species composition and stand structure in Northern Forest habitats. Methods to reduce negative impacts include deterrents, exclusion, or population reduction. Deterrents (e.g., chemical application, scare devices) and exclusion (e.g., fencing, seedling tubes) are labor intensive and costly to employ, chemicals can create environmental hazards, and both methods usually are not practical or satisfactory except in small-scale situations such as nurseries or small plantations. Population reduction methods include reproductive controls (e.g., chemosterilants, contraceptives) that are costly and require continual reapplication and are often ineffective except within island environments, and public hunting. Hunting is the most widely practiced tool for reducing negative impacts of herbivory in these settings. Hunting must be regulated (e.g., hunting methods, timing of seasons, hunting pressure) and harvests monitored to prevent negative impact to long-term survival of target herbivore populations. In general, shotgun seasons are more effective then bow seasons when the goal is to reduce deer populations. However, bow hunting is more acceptable within heavily developed areas. Doe only harvests are effective at reducing and controlling populations. Harvest of bucks will do little to control population growth.

❖ Strategy 3. Manipulate Site Conditions

3.1 Site Preparation

See 1.6, these techniques can be applied at a smaller scale to increase structural objectives.

3.2 Prescribed Fire

Ecological Role of Fire

Refuge managers will generally seek to reconstruct or maintain a forest mosaic that closely resembles the natural, historic conditions of the Northern forest. Although it is not possible to perfectly mimic natural disturbances, strategies that preserve their associated processes and diversity should be implemented where possible, in northern forest ecosystems (Bergeron et al. 1998).

(WE WILL ADAPT TO BCR 30 THIS IS FOR BCR 14) Spruce-fir forests (red spruce, balsam fir, white spruce, aspen) dominate northerly and higher elevation areas, while northern hardwoods (maples, American

beech, birches) dominate the other areas of northern New England and the Adirondack Mountains (BCR website). Natural fire has never been a major ecological factor in development of these ecosystems (Lorimer 2001), in contrast to the pitch pine and oak-hickory forests of southern New England, whose modal fire regimes have been estimated at between 5-50 years (Jordan et al.). Bonnicksen (2000) estimates that light surface fires crept through the typical Northern Forest about once in 600 years, and severe fires only burned it once in 3,000 years. In the spruce-fir forests, the average area in northern New England burned only every 200-400 years; some areas escaped a major fire for as long as 800 years (Bonnicksen 2000). Cogbill (2000, 2001) estimates that the pre-settlement fire return interval for forests in northeastern Vermont, for example, was in the order of "several millennia" based on witness tree reports from colonial land surveys. Cogbill admits, however, that there is some uncertainty about the pre-settlement role of fire in shaping the lowland conifer forests. These "black spruce swamps" have environmental and floristic similarities to boreal systems in Canada, which burn regularly.

In summary, frequent or low-severity fires did not play a significant role as a natural disturbance in most Northern forest habitats, with the exceptions of the uncommon pitch pine and oak-hickory forests on sandy soils or rocky outcrops (e.g. the Ossipee and Concord Pine Barrens of NH and ME, the Montague Plains of central MA), jack pine stands, and black spruce bog habitats. Therefore, the use of fire in restoring historic ecological conditions, such as on a large-scale in wildlands or natural areas, is limited. Prescribed fire is more likely to be used in typical Northern forest habitats, in wildfire suppression, and for small-scale habitat manipulation.

Hazardous fuel reduction
Prescribed fire may be used to reduce scattered concentrations of dead-down woody materials, which pose a significant wildfire hazard to natural resources of concern (e.g. habitats for endangered species) or cultural resources of concern (e.g. historic buildings or archaeological sites), public resources (such as refuge administrative buildings or facilities), or adjacent private lands. Heavy fuel loads may be caused by natural events, such as ice storms, blow-downs, or insect outbreaks, yet may still pose significant threats to these important, and oftentimes, irreplaceable resources.

Fire is used to reduce hazardous fuel threats by focusing burns in significantly altered habitats, such along the wildland urban interface (the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels) along roads, or along existing or constructed fuel breaks. Controlled burns in such areas may reduce the Crowning Index (the wind speed at which active crown fire is possible) and fire intensity, and facilitate vehicular access for suppression actions, when unplanned ignitions occur.

Prescribed fire is generally used in conjunction with other forestry treatments to reduce hazardous fuels. For example, projects to reduce the threat of wildland crown fire in pitch pine forests to housing communities in Massachusetts involve first thinning mature mixed pine/hardwood stands, reducing original stocking densities from 100-170 ft^2 basal area/acres to 25-30 ft^2 basal area/acre (fuel objectives), increasing the crowning index from 30 to 60 mph. Heavy equipment is used to grind or pile slash after thinning; prescribed fire is then used to consume slash, and dramatically reduce wildfire behavior. Fire is generally reapplied on a short-term rotation ($\sim$ 5 years), to maintain low canopy density and well-spaced understory woody shrubs and saplings, and to maintain low downed fuel loads (Patterson and Crary 2004).

Even-aged stand management
Prescribed fire may augment even-aged silvicultural prescriptions (i.e. to create/maintain stands with trees representing one age class, or a narrow range of age classes). Most northern hardwood forests were dominated by old-growth forest in presettlement times, with young forest habitat (up to 15 years old) occupying <1% to 13% of the landscape (Lorimer 2001). Therefore, even-aged stand management, through a combination of cutting and fire, is likely to be applied in small patches, simulating the scale of natural disturbances that historically shaped the Northern Forest: deaths of single-trees (gaps) and blowdowns (larger gaps). The intended composition of these forests is thick, young woody growth, in full sunlight, dominated by shade-intolerant trees (e.g. jack pine, red pine, aspen) and shrubs (e.g. willow and cherry,

Prunus spp). Management for temporary shrubby openings and young forests, on the order of 1- 2 ha, creates ephemeral habitats important for early successional forest species such as woodcock, eastern towhee, and yellow-breasted chat (Ehrlich et al. 1988, Dessecker and McAuley 2001, NatureServ 2005).

In this context, prescribed fire is mainly used in post-cutting treatments, once small patches of softwoods (red/white/black spruce, balsam fir, hemlock, northern white cedar, eastern tamarack, eastern white and red pines) or hardwoods (aspen species, paper birch, gray birch, red maple, silver maple, sugar maple, red/white oak, ash, and beech as principal species or associates) have been harvested through clearcut, shelterwood, or seed-tree methods (Dessecker and McAuley 2001, USFWS 2001). Timber harvest treatments remove sufficient canopy to promote dense sapling and shrub growth, while follow-up prescribed fire may be used to remove logging residue and slash. After a few years, most clearcuts become too thick for early successional forest birds. At this point, an understory prescribed may be used to thin out the vegetation but leave enough patchiness for species such as woodcock (Krementz and Jackson 1998). Fire should be applied at regular return intervals (approximately 10 years), to provide a disturbance to maintain low residual basal areas, on the order of <4.9 m2 (Dessecker and McAuley 2001).

Forest Restoration
Prescribed fire may be used to prepare degraded sites (e.g. heavily logged areas, former forest roads, mined sites), for natural and artificial tree regeneration. In general, burned-over surfaces and mineral soil are excellent sites for seed germination. In contrast, unburned organic layers on the forest floor, depending on their moisture content, provide less favorable sites for seed germination, and, depending on their composition, can impede the planting and development of artificial regeneration. Undisturbed organic materials often favor the establishment of heavy-seeded plants (with seeds that can penetrate the heavy organic layers) and advance regeneration. Conifers and deciduous tree species have differential responses to forest floor disturbance, as do shrub and forb species. Some species become established primarily from seed (e.g. jack pine, pitch pine), whereas others regenerate from sprouts (aspen). Prescribed fires that remove organic layers from the forest floor can be used to influence the composition and quantity of regenerating trees, favoring early-successional species such as pines (Graham et al. 1998).

Early successional habitats
Fire has historically been used on refuges in BCR 30 to maintain grassland openings for grassland birds and woodcock, such as abandoned pastures, old fields, and blueberry barrens. Prescribed fire may be used to: increase grass biomass (e.g. by eliminating woody shade plants, extending the growing season by removing litter, and buffering soil chemistry); selectively control tall forbs or fire-sensitive woody plants (by topkilling or causing mortality); mineralize litter; and increase community diversity (by altering the composition of early-flowering or late-flowering plants). Prescribed fire also may used to maintain an interspersion of shrub- and grass-dominated communities attractive to shrubland passerines, by topkilling shrubs in old fields, and allowing them to resprout into thickets. And finally, fire may be used to help eradicate exotic, invasive plants from open habitats, in some cases precluding the need to use chemical herbicides.

When using prescribed fire to alter woody plant cover in early successional habitats it is important to consider that many woody plants, especially shrubs, are adapted to disturbance, regenerating new shoots prolifically. Fire can increase or decrease shrub stem density in a habitat. Thus, fire can either help eliminate (through direct mortality) or maintain shrub-scrub habitat structure (by pruning tall woody plants back, killing less-fire adapted trees, encouraging shrub sprouts). The key to predicting fire effects on woody plants is fire regime (frequency, seasonal timing, severity, and geographic size of fire). The fire regime will affect: differential shrub and sapling mortality (which species dies, which doesn't); mortality vs. top-kill effects; and post-fire vegetative regeneration.

There are several principles that should be considered when employing prescribed fire to control woody plants in early successional habitats:

1. Plant mortality is strongly tied to death of "growth points" (i.e. meristems/buds), which are more sensitive to heat damage when actively growing, and when tissue moisture is high (Miller 2000). Therefore, applying

fire during spring, when target woody plants are mobilizing water/nutrients and breaking dormancy of leaf/flower buds, or during fall cold-acclimation periods, is more likely to kill growth points than Rx fire during dormant periods.

2. Total plant mortality is often the result of injury to **several different** parts of the plant, (i.e. crown damage coupled with stem tissue mortality). Many prescribed fires (often executed in the dormant season) "top-kill" shrubs, but fail to kill the entire plant, which re-sprouts from dormant buds. New shoots can originate from dormant buds located both above the ground surface (i.e. epicormic sprouts, root collar sprouts), and from various levels within the litter, duff, and mineral soil layers (i.e. rhizomes, root crowns). It is the severity of fires (depth of fire and ground char) that directly affects shrubs' re-sprouting ability from these buds. Moderate severity fires (moderate ground char, consumes litter layer, partially consumes duff layer) frequently cause the greatest increase in stem numbers from root sprouters such as rhizomatous shrubs, by pruning rhizomes below the surface, causing several new shoots develop per rhizome. High Severity fires (deep ground char, removes duff layer and large woody debris) are more likely to eliminate species with regenerative structures in duff layer or at duff/soil interface. In such fires, re-sprouting is eliminated from shallowly buried tissues, often delayed from deep rhizomes or roots (Miller 2000).

Therefore, if the goal is to increase density of shrub stems, a moderate severity, dormant season fire is probably preferred. If the goal is to decrease shrub stems, a high severity, growing season fire is probably best. If a management unit contains shrubs to be controlled, as well as shrubs to be maintained, no one burn prescription is going to accomplish this, and selective treatments will be necessary.

3. Concentrations of metabolic compounds, i.e. sugars, salts, lignins, vary seasonally, and have been shown to relate to seasonal effects on shrubs. Consequently, timing of treatments may be more important than the type (cutting versus burning) in controlling shrubs. To maximally reduce woody stems, fires should be applied during periods of low below ground carbohydrate storage (i.e. immediately after spring flushing and growth) and should be followed with a second growing season treatment (such as mowing, herbicide, or more prescribed fire) before total non-structural carbohydrate (TNC) levels are replenished. Repeated burning (several consecutive years) during the low point of a plant's TNC cycle can amplify the negative effects of the treatment (Richburg and Patterson 2003, 2004).

4. Fire reduces cover and thickness of organic soil layers; this can increase light (and, seasonally, temperatures) at the soil surface, causing an increase in sprouting from woody rhizomes (Miller 2000). Thus, to control shrubs, a follow-up treatment (herbicide, mowing) is almost always required, post-fire (Patterson 2003).

5. Invasive plants are well-adapted to disturbance, often surviving fire and rapidly spreading through a disturbed landscape. Studies in northeastern successional habitats have generally shown that fire alone *will not* remove invasive shrubs. Additional herbicide and/or cutting treatments are necessary (Patterson 2003).

6. In general, drought conditions (either normal lows in precipitation during summer/fall, or abnormal winter/spring droughts) dry large fuels and duff, increasing the potential for duff consumption and subsurface heating, and mortality for buried shrub regenerative structures (Miller 2000). Burning when litter layers, duff, and upper soil layers are saturated (i.e. winter and early spring) is not likely to suppress shrub stems.

7. Prolonged heating, such as that experienced during a slow, backing fire (versus a fast-moving head-fire) causes greater burn severity, and plant tissue death. Slow, backing fires, in general, cause more woody tissue damage than rapid head-fires (Miller 2000). However, the warmer the Wx conditions, the shorter the heating duration necessary to cause shrub tissue death, and the greater likelihood of suppressing shrub stems.

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❖ Strategy 4. Allow Natural Succession and Processes

Natural disturbances, such as wind throw, herbivory, beaver activities, native disease and insect outbreaks, major wind and ice storms, succession and flooding may provide desired structure for many upland habitats. Natural processes like succession and wind throw may result in the development of micro-habitats, while other natural processes such as outbreaks of native insects and hurricanes may result in stand replacing events. Often, these techniques can assist managers reach their desired habitat type. It is important to monitor these habitats though, to ensure that hands off approaches result in high value habitats for wildlife.

For many habitats freshwater marshes, shrublands and grasslands, natural processes may drive these habitats towards more mature stages. Site capacity, soil types, aspect ratio, climate, prior management will influence how stable these communities are. Some may require infrequent management (vegetation occurring on sandy or stressed soils like pine barrens and native shrublands), while other types, old field thickets, may progress rapidly. Monitoring and adaptive management of habitats where natural processes are the primary management tool is critical.

B. Tidal and Freshwater Wetlands

❖ Strategy 1. Restore tidal hydrology to salt marshes

Restricted tidal flow can result in severe tidal marsh degradation as demonstrated by expansion/domination by invasive *Phragmites australis*, surface subsidence, conversion to open water, or conversion to brackish or freshwater plants (Roman et al. 1984). Such degradation can result in loss of habitat for salt marsh fish species, particularly *Fundulus heteroclitus*, and decreased use by shorebirds and wading birds. Restoration of tidal hydrology must proceed cautiously accounting for changes in marsh elevation (subsidence) that developed since the occurrence of restricted flow; immediate restoration of full tidal volumes could result in creation of mud flats or permanent open water. Full tidal restoration could also result in negative impacts such as flooding of human structures built on low lying elevations during the time of tidal restriction, and flooding of sharp-tailed sparrow and seaside sparrow nests (DiQuinzio et al. 2002). Installation of self-regulating tide gates has been used to address potential flooding of human structures (Roman et al. 1995). Benefits of tidal restoration include restoration of salt marsh habitat, control of invasive *Phragmites*, increased number and abundance of nekton species, increase use by shorebirds, wading birds, and sharp-tailed sparrows.

DiQuinzio, D. A., P.W.C. Paton, and W.R. Eddleman. 2002. *Nesting ecology of saltmarsh sharp-tailed sparrows in a tidally restricted salt marsh*. Wetlands 22:179-185.

❖ Strategy 2. Control native aquatic vegetation community composition

- Altering Salinities - Freshwater species such as cattail can be controlled by allowing salt water into an area or an impoundment to increase salinity levels. This can set back vegetation either temporarily, in the case of impoundment management or permanently, in the case of tidal restoration. Changes in salinity can result in fish kills, and if done during the summer months can cause botulism. Changes in salinity will likely impact all freshwater biota and should be untaken with caution. Rachel Carson NWR does not manage impoundments, and is unlikely to alter salinities in freshwater environments.

- Setting back succession -

  - Use of prescribed burn, herbicides or mechanized equipment may be used to set succession back in areas where vegetation is too rank for wildlife use. This approach may be appropriate in cattail marshes which are so dense they are reverting to upland vegetation types. Mechanized equipment for use in wetlands is specially adapted with a low ground pressure so that habitats are not damaged.

❖ Strategy 3. Restoring natural hydrology within the salt marsh

Natural hydrology within salt marshes has been altered since colonial times through ditching and diking. Over 90% of all eastern marshes have been ditched by 1938, though that percentage is somewhat lower in Maine. Ditches have been constructed for salt haying, mosquito control and other purposes. Ditches drain surface water and groundwater from this tidally flooded habitat and have also been found to impound water on salt marshes through formation of peat spoil levees and clogging of ditches with debris and slumped peat blocks.

Natural, unditched salt marshes are characterized by large, highly sinuous creek and runnel systems. These drainage features remove surface water from a marsh without draining natural pools. While restoration of tidal flow *to* a marsh is often restricted to one small area (such as a culvert), restoring natural hydrology *within* a marsh is complicated by direct (surface water drainage) and indirect (impoundment, peat drainage) effects of ditching as well as their physical size and number.

While techniques historically employed to "restore" ditched marshes, such as filling and plugging, have increased surface water habitat, they have not restored pre-ditching hydrology. Ditch plugging has also led to saturation of peat up to 15 m perpendicularly away from a ditch resulting in the conversion of high marsh vegetation to low marsh vegetation. While this may be a desirable outcome in some circumstances, it does highlight the need to develop new techniques to restore ditched marshes. Public health officials in the late 1930s noted that ditching replaced one form of marsh hydrology (creeks) with another (ditches). In order to *restore* salt marshes we must consider the need to restore natural creek hydrology, i.e., remove ditches and return panne and pool habitat. Additionally, restoration efforts to date have highlighted the unique nature of each marsh site. Extensive site investigations and measurements must be part of the *planning* process in order increase the likelihood of project success and move the science of restoration forward.

Small impoundments, whether constructed incidentally as part of the ditching process or purposefully through diking for agriculture or other ends, also represents an alteration to natural within-marsh hydrology. Restoration of impounded or diked areas must proceed with the same cautions noted in strategy 1.

Pools are common features on unditched marshes but not ditched sites. They occur throughout New England and the mid-Atlantic coastal marshes. Ditching has led to their filling, drainage or loss. Restoration of pool habitat is a significant concern since they provide important habitat for fish, invertebrates, mammals and birds. Pool creation through excavation does increase surface water habitat on marshes. Careful consideration must be given, however, to correct pool dimension, particularly size, sidewall slope, and depth. Most natural pools contain less than 30 cm of water and have soft organic sediment bottoms. When creating pools, it is imperative not to excavate through the peat to underlying sediments (otherwise pools will not retain water). Furthermore, natural pools exist in a variety of depths -- though few over xx cm. The construction of sumps in man-made pools may be desirable but should be executed judiciously. Since peat excavation results in acute redox conditions deleterious to nekton, naturally formed pools should be left intact.

Adamowicz and Roman 2005

Bourn & Cottam 195x

Rozsa et al. 198x

Miller & Egler 1950

Taylor, J. 1998. *Guidance for meeting U.S. Fish and Wildlife Service trust resources needs when conducting coastal marsh management for mosquito control on Region 5 National Wildlife Refuges*. U.S. Fish and Wildlife Services. 20 pp.

❖ Strategy 4. Restore freshwater or salt water wetland native vegetation

4.1 Planting or seeding

Successful restoration of native marshes in New England depends on hydrology, salinity regime (for estuarine environments), and relative competitive strengths of native versus invasive plants. Planting or seeding a salt marsh restoration area is more expensive than allowing natural reseeding to occur but has several advantages. Planting or seeding provides a competitive advantage to native vegetation by occupying a space first. This is particularly important if a natural native seed source is at some distance. Purchased plant and seed stock should be carefully selected to ensure correct province, temperature tolerances, and other local genetic features. Plant material should be installed at the beginning of the growing season to allow plants sufficient time to establish before winter. One drawback of planted material is that it is often attractive to grazers such as snow and Canada geese.

4.2 Fill Removal

Salt marshes have often been used as dumping grounds for dredge, sanitary landfill, and toxic materials. Removal of this material can range from simple and straightforward to highly regulated and complex. As with tidal flow restoration, it is imperative to establish correct elevations for tidal input and restored marsh surfaces. Because of the disturbed nature of many of these sites, hydrology and elevation are critical in controlling invasion of nearby *Phragmites*. The benefits of removing fill material can be significant – conversion of a disturbed fill area to high quality salt marsh habitat. Since fill areas often occur in urbanized locations, restored areas substantially increase available salt marsh habitat by a large percentage.

Niedowski, N.L. 2000. *New York State salt marsh restoration and monitoring guidelines*. New York State Department of State, Division of Coastal Resources and New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources. 172 pp.

Thunhorst, G., and D. R. Biggs. 1993. *Wetland planting guide for the Northeastern United States*. Environmental Concern, Inc. 179 pp.

4.3 Control invasive plants

The majority of techniques for control of invasive plants in uplands are appropriate for wetlands with the caveat that required wetland permits are in place and that chemical control methods are labeled for wetland use.

❖ Strategy 5. Manage tidal marsh dieback

The occurrence of tidal marsh dieback appears to be a new phenomenon in the North East. Dieback can occur gradually, over the course of decades as in Jamaica Bay, NY, or rapidly, over the course of one growing season as in several locations in Connecticut, Massachusetts and Maine (Adamowicz and Wagner 2005). Successful strategies to manage dieback depend on identifying the causal agent(s) in each case. No specific causes have yet been identified in the Northeast. Footwear, gear and machinery decontamination has been recommended after visiting a dieback site as a minimum precaution until causal agents and remedies have been determined (Adamowicz and Wagner 2005). For additional information see www.brownmarsh.net and www.NEERS.org.

Adamowicz, S. C. and L. Wagner. 2005. *Northeast sudden wetland dieback workshop proceedings*. U.S. Fish and Wildlife Service. 69 pp.

❖ Strategy 6. Manage contaminants

In addition to toxic materials (organic chemicals, heavy metals), salt marsh contaminants include nutrient and freshwater runoff (introducing reduced salinity regimes). Nutrient additions commonly occur through both atmospheric deposition and stormwater runoff. Successful strategies for controlling stormwater runoff include offsite treatment; correct location of discharge point; and maintenance of an adequately wide,

naturally vegetated upland buffer (Bertness et al. 2004). Freshwater marshes can also have contaminant issues based on prior usages or location.

Bertness, M., B. R. Silliman, and R. Jefferies. 2004. *Salt marshes under siege*. American Scientist 92: 54-61.

Schueler, T.R. 1987. *Controlling urban runoff: a practical manual for planning and designing urban BMPs*. Metropolitan Washington Council of Governments, Washington, DC.

Schueler, T.R., P.A. Kumble, and M.A. Heraty. 1992. *A current assessment of urban best management practices - techniques for reducing non-point source pollution in the coastal zone*. Metropolitan Washington Council of Governments, Department of Environmental Programs, Anacostia Restoration Team, Washington, DC.

❖ Strategy 7. Allow Natural Succession and Processes

Many natural wetland types are relatively stable and are driven by natural processes, tides, soil type, surface water runoff, ground water and precipitation collecting in depressions or slopes. Seasonal changes in hydrology, or changes through the tidal cycle, create a fluctuating water table, resulting in wetland vegetation development. When these systems are functioning naturally, are devoid of invasive plants and are not heavily impacted by human development they often are not actively managed.

Tiner, R.W. 1994. *Maine Wetlands and Their Boundaries*. Institute for Wetland and Environmental, Education and Research. Sherborn, Massachusetts.

❖ Strategy 8. Mimicking Natural Freshwater Wetland Processes in Impoundments

Rachel Carson NWR has one small impoundment, a former fire pond, which is currently not managed as a moist soil unit. The impoundment is approximately one acre in size. Due to management constraints, the size of the impoundment and invasive plants, at this time the Refuge will not manage this unit for moist soil vegetation. If conditions management constraints are alleviated, the Refuge may consider managing the impoundment for fall migration by lowering water levels in the spring and slowly bringing them up after moist soil vegetation grows.

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Appendix F

Refuge Operations Needs System (RONS) and Service Asset Maintenance Management System (SAMMS)

- Refuge Operations Needs System Databases
- Proposed Projects Not Currently in the RONS Database and Their Relationship to Respective CCP Alternatives and Refuge Goals
- Service Asset Maintenance Management System Database

Refuge Operations Needs System Databases

Table F.1. Proposed projects currently in RONS Tier 1 database (FY04) and their inclusion in respective CCP alternatives.

Project #	*Project Description*	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
98034	Improve Refuge ID and Boundary Posting - Hire LE officer	1.0	148		15	X	X	X
99008	Restore Coastal Habitats & Associated Water quality – Hire Facility Manager	1.0	123		15	X	X	X
98056	Increase Biological knowledge of Refuge Species and related habitat	0	37		15	X	X	X
97005	Improve Public Understanding of refuge goals and mission - Hire ORP	1.0	110		15	X	X	X
98022	Expand exotic plant eradication and monitoring program on the refuge	0	51		15	X	X	X
98060	Improve ability to effectively and efficiently accomplish station and service goals - Hire Administrative assistant	0.5	58.5		15	X	X	
98040	expand bird studies and banding program	0	33		15	X	X	
98052	Develop and print brochures to increase outreach and educational opportunities	0	105		15	X	X	

Table F.2. Proposed projects currently in RONS Tier 2 database (FY05) and their inclusion in respective CCP alternatives.

Project #	*Project Description*	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
02005	Control and monitor invasive species with partners	0	48	20	15	x	x	x
03001	Manage habitat for New England cottontail - Hire biologist	1.0	139	84	15		x	
01001	Piping plover and least tern management	0	52	18	15	x	x	x
01007	Improve baseline data collection of surveys for priority bird species	1.0	61	45	15			x
99007	Restore salt marsh habitat	0	56	20	15	x	x	x
99009	Ecology of salt marsh and Nelson's sharp-tailed sparrows	0	70	30	15	x	x	
98017	Manage grasslands effectively throughout the refuge	0	17	4	15		x	
03002	Rachel Carson partners for Wildlife Program - Biologist	1.0	147	92	15		x	x
01004	maintain early successional scrub/ shrub habitat	0	73	15	15		x	x

Table F.2. Proposed projects currently in RONS Tier 2 database (FY05) and their inclusion in respective CCP alternatives *(continued).*

Project #	*Project Description*	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
99017	Restore refuge grasslands to native grasses	0	45	3	15		x	
01003	Restore early successional scrub/ shrub habitat	0	47	15	15		x	x
01005	Conduct fish surveys of refuge rivers	0	66	13.5	5		x	
98043	Conduct aerial waterfowl and habitat surveys	0	22	15	5			x
98054	Maintain and update refuge GIS database	1.0	160	90	15			x
02007	LMRD Program - Hire assistant Biologist	1.0	144	79	15		x	
03003	Protect and Manage Water and Wetlands	0	100	30	15		x	x
02004	Expand awareness of refuge and NWRS	0	100	30	15		x	x
99010	Restoration and management of freshwater wetlands	0	90	11	15			x
02006	Establish the Rachel Carson NWR marine Protected Area (MPA)	0	20	15	5			x
99014	Improve community relations and understanding of refuge's presence	0	36	8	15		x	x
98011	Improve visitor services	1.0	140	100	15			x
98014	Investigate the ecology and importance of vernal pools and associated wildlife	0	35	5	5		x	
98075	Provide opportunities for visually impaired visitors	0	32	0	1		x	x
98033	Review project proposals for refuge and adjacent lands-Hire Secretary	1.0	80	46	15			x
98005	Develop a water quality monitoring plan	0	85	10	15		x	
03004	Secure station facilities, equipment and staff safety	0	44	10	15	x	x	x
98027	Manage 3000 acres of Forest Habitats	0	50	30	15			x
98029	Improve and evaluate habitat through the use of prescribed fire	0	90	25	15		x	
00201	Inventory resources and apply adaptive management techniques	0	45	15	15		x	x
01002	Implement water quality monitoring program	0	75	20	15		x	x
01008	Protect refuge resources and visitors - Hire LE Officer	1.0	144	71	15		x	
98003	Expand refuge fire management program	0	45	20	15		x	x
00202	Protect resources and ensure public safety	1.0	136	66	15			x

Table F.2. Proposed projects currently in RONS Tier 2 database (FY05) and their inclusion in respective CCP alternatives *(continued).*

Project #	*Project Description*	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
00203	Manage Habitat/Maintain Facilities - Hire Maintenance Worker	1.0	128	54	15			x
02003	Implement a Youth Conservation Corps Program	0.3	50	31	15		x	
97004	Expand planning efforts for the station visitor center	6	1129	335	15			x
98002	Expand archaeological survey to additional refuge lands	0	96	0	1		x	
98032	Improve cooperative resource management opportunities on tribal lands	0	10	0	1			x
98053	Increase volunteer efforts at the refuge	0	20	10	15	x	x	x
98024	Investigate relationship between deer density and the incidence of Lyme disease	0	17	0	1	x		
98041	white-tail deer studies	0	35	22	1			x
98021	Increase waterfowl surveys of refuge lands throughout the year to weekly	0	19	5	5	x		
97002	Improve trust resource protection by improved oil spill prevention planning	0	70	17	15		x	x
99006	Implement Wells Harbor Dredge Interagency agreement	0	67	11	5	x		
02001	Visitor and resource protection improvement	0	60	10	15		x	x
02002	Law enforcement equipment	0	26	2	15	x	x	x
98073	Improve efficiency and cost effectiveness of refuge habitat management operations	0	73	10	15	x	x	x
00002	Enhance wetland restoration capabilities	1	114	56	15			x
98016	Improve water quality and restore wetland habitat on the refuge	0	36	5	15		x	x
99004	Provide watchable wildlife viewing stations	0	75	5	1		x	
01006	Construct a fire equipment storage building	0	68	3	1		x	x
99005	Develop wheelchair accessible fishing platform and observation platform	0	129	4	1		x	x
05001	Manage 10,000 acres of Uplands - Hire Assistant Manager	1	109	67	15		x	x

Proposed Projects Not Currently in the RONS Database and Their Relationship to Respective CCP Alternatives and Refuge Goals

Table F.3. Goal 1. Perpetuate the biological integrity and diversity of coastal habitat to sustain native wildlife and plant communities, including species of conservation concern.

Project Description	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
Conduct monitoring and research of salt marsh to address marsh die, back, sea level rise, and other issues, function of vegetated shoreline buffers	0	40	20	15		x	x
Stormwater management and control with partners,	0	25	20	15		x	
Determine mercury and other contaminant exposure, and pathways and the effects on sharp-tailed sparrows	0	30	18	15		x	
Shorebird Management including ISS and PRISM surveys, turnover rates, roosting sites	0	25	15	15		x	x
Waterfowl Management including evaluate level of surveys required	0	20	9	15		x	
Manage Dune Grasslands to maintain ecological integrity, and educate recreational users	0	15	7	15		x	x
Use agreements, easements, and acquire to protect dune grassland habitat, piping plovers, least terns	0	10	5	15		x	x
Investigate the ecological and management requirements of tidal rivers for anadromous, catadromous fish species and other species of concern	0	30	20	15		x	
Maintain ecological integrity of coastal Maine watersheds with partners by promoting land conservation efforts and working collaboratively on management initiatives; identify and protect critical habitats with partners	0	35	18	15		x	x
Manage tidal habitats including identifying, monitoring and restoring SAVbeds	0	25	9	15		x	x
Manage and monitor Maritime Shrub habitat with partners; conduct avian surveys during migration and breeding, broaden land conservation initiatives	0	40	20	15		x	x
Document and understand legal jurisdiction for protecting trust resources within the Marine Protected Area; evaluate implications of energy development (i.e., wind turbines)	0	25	9	15		x	
Manage and Monitor Biodiversity; conduct botanical surveys, working with state agencies implement surveys for listed plants, animals, and invertebrates on refuge; identify and protect rare natural communities and features; sponsor "bioblitz"	0	35	12	15		x	x
Manage and monitor pitch pine bog communities, conduct flora and fauna surveys, work with neighbors to maintain the habitat	0	20	9	15		x	x

Table F.3. Goal 1. Perpetuate the biological integrity and diversity of coastal habitat to sustain native wildlife and plant communities, including species of conservation concern *(continued)*.

Project Description	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
Expand Shorebird Management and surveys	0	15	8	15			x
Hire seasonal technicians to manage/monitor piping plover and least terns	0	45	35	15			x
Establish multi-state least tern monitoring network, conduct banding studies	0	40	18	15			x

Table F.4. Goal 2. Perpetuate the biological integrity and diversity of freshwater habitats to sustain native wildlife and plant communities, including species of special concern.

Project Description	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
Work with municipalities on educating landowners on shoreland protection	0	15	7	15		x	x
Stormwater management including discharge, BMP's	0	25	15	15		x	x
Partner with water companies to identify areas to work together to protect aquatic resources	0	30	18	15		x	x
Work with the state to map distribution, protect and manage Blanding's and wood turtles	0	15	8	15		x	x
Manage and Monitor Biodiversity; conduct botanical surveys, working with state agencies implement surveys for listed plants, animals, and invertebrates on refuge; identify and protect rare natural communities; sponsor "bioblitz"; survey dragonflies and damselflies	0	25	13	15		x	x
Evaluate fish barriers and work with partners to enhance fish passage; evaluate impacts to rivers and streams from boating; work with partners to influence upstream land uses to improve water quality	0	45	20	15			x
Survey all vernal pools, enhance turtle and wildlife crossings with partners	0	15	8	15			x

Table F.5. Goal 3. Perpetuate the biological integrity and diversity of upland habitats to sustain native wildlife and plant communities, including species of conservation concern.

Project Description	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
Manage New England Cottontail (NEC); survey known and potential sites; establish NEC populations at two new sites; evaluate role of invasive plants on habitat and feasibilty of replacing invasives with native shrubs	0	50	30	15		x	x
Evaluate and refine bird and vegetation monitoring in grassland units	0	7	7	15		x	
Manage and Monitor Biodiversity; conduct botanical surveys, working with state agencies implement surveys for listed plants, animals, and invertebrates on refuge; Continue with New England Wildflower Society/state rare plant monitoring; sponsor "bioblitz"; conduct bat and owl surveys	0	12	12	15		x	x
Conduct surveys for black racers, research nest productivity of shrubland birds	0	5	5	15			x
Establish nursery for propagating native shrubs and other native plants	0	12	12	15			x
With landowners monitor grassland nesting birds, evaluate restoration of native warm season grasslands	0	15	15	15			x
remove all invasives from deciduous forest, monitor hemlock stands for wooly adelgid	0	45	45	15			x
Restore pitch pine habitats lost to succession since the 1947 fire	0	30	30	15			x

Table F.6. Goal 4. Develop the Rachel Carson National Wildlife Refuge as an outstanding center for research and demonstration emphasizing land management techniques for restoring and sustaining healthy estuarine ecosystems in concert with the National Land management Research and Demonstration (LMRD) program.

Project Description	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
Identify, continue, and expand partnerships and collaborations to: further research in estuarine ecosystem restoration, management and conservation; provide financial support to research projects	0	80	30	15		x	x
Fund graduate student program, field assistants, interns	0	50	30	15		x	x
Review existing work and develop an electronic repository of information on the function and management of estuarine habitats; establish a library of materials and holdings available to managers and researchers	0	75	20	8		x	x
Identify existing SAV and macroalgae sites and evaluate for restoration potential	0	50	25	8		x	x
Establish research projects on refuges and other sites to test habitat-specific restoration techniques; develop and test new techniques and insure that findings are documented and published.	0	80	40	15		x	x
Identify facility needs including administrative, research, and housing needs	0	10	10	1			x
Conduct outreach for managers and others through workshops; develop and produce scientific and lay publications, posters, and videos; use the Internet to provide and disseminate habitat management information	0	20	20	15		x	x
Conduct inreach to the refuge and NWRS about the LMRD program	0	15	7	15		x	x
Develop and Implement automated remote monitoring of salt marshes	0	100	75	15			x
Conduct field studies, analyze samples, work with visiting scientists - Hire Resource Specialist	1.0	109	67	15			x
Manage and analyze data, maintain and manage GIS data, conduct field studies - Hire Biologist/ GIS specialist	1.0	144	79	15			x
Establish inter-agency restoration team for salt marsh restoration	0	50	25	15			x
Establish mentoring program and details for NWRS employees on LMRD	0	10	5	15			x

Table F.7. Goal 5. Increase appreciation and stewardship of coastal Maine wildlife and their habitats by providing positive wildlife-dependent experiences for Refuge visitors.

Project Description	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
Evaluate existing and future fees for hunting and other uses	0	3	2	15		x	
Install interpretive signs, kiosks; develop and install interpretive signs at existing trails on management and trust resources	0	50	20	15		x	x
Develop and host interpretive programs on a variety of subjects	0	35	15	15		x	x
Maintain and expand internship program, YCC program, volunteer program including Friends group	0	50	40	15		x	x
Develop trails on newly acquired land using existing infrastructure, and connecting to partner facilities where possible	0	70	30	15		x	x
Meet with decision makers in the 12 town region on issues of joint interest/concern; utilize new administrative facility for public meetings and educational programs	0	15	10	15			x
Sponsor and support regional environmental education programs including Envirothon;	0	15	10	15		x	x
Utilize proposed donated environmental education facility at the Goosefare Brook division	0	25	10	15		x	
Develop and distribute refuge specific lessons for use in schools or at the refuge, interact with teachers to ensure that refuge specific lessons meet Maine Learning Results and teacher needs	0	30	15	15			x
Manage Refuge hunting program by continuing to coordinate with the state, adjusting the program for safety and sound wildlife and habitat management, to provide opportunities for disabled and youth hunters, and to host education classes annually.	0	10	5	15		x	x
Manage Refuge fishing program by providing on-site information to anglers, evaluating additional sites, developing partnerships with local interest groups, and hosting a second fishing event annually	0	10	5	15		x	x
Manage wildlife observation and photography program by improving trails where needed, constructing a new observation platform/blinds on identified units, and by promoting activities through regular media contact	0	20	10	15		x	x
Provide year round ecologically sound rest room facilities at the Carson Trail	0	65	12	15		x	
Install interactive displays about wildlife, develop brochures and/or signs for all trails, develop interpretive panels at all overlooks	0	100	30	5			x
Develop educational curriculum for additional grade levels	0	20	10	5			x
provide hunting blinds and stands, teach BLIP course	0	20	10	15			x
Sponsor fishing workshops and provide commercial fishing access	0	15	8	15			x
Teach wildlife photography classes, and establish a reference library on wildlife in the area	0	5	2	15			x

Table F.8. Goal 6. Foster off-Refuge cooperative actions and partnerships to promote wildlife conservation and further Refuge goals.

Project Description	*Staffing (FTE's)*	*Cost Year 1 (x1000)*	*Cost, Recurring (x1000)*	*Project Duration (years)*	*Alt A*	*Alt B*	*Alt C*
Participate as a member of regional initiatives to further land conservation, habitat management, and wildlife management for trust species and species of conservation concern	0	8	5	15		x	x
Facilitate watershed wide invasive species control programs	0	30	15	15		x	x
Restore a minimum of 50 acres annually of various habitats	0	50	40	15		x	
Sponsor or co-sponsor with partners regional natural resource workshops	0	10	6	15		x	x
Host one local or statewide annual contest such as the Junior Duck Stamp contest	0	10	5	15		x	x
Develop and staff exhibits at four or more major regional or state events annually	0	25	5	15		x	
Develop and host an annual Rachel Carson Festival beginning in 2007	0	25	10	14		x	
Develop and staff exhibits at ten more major regional or state events annually	0	25	9	15			x
Restore a minimum of 100 acres annually of various habitats	0	70	45	15			x
Expand Rachel Carson Private Lands Program - Hire Biologist	1	85	60	15			x

Service Asset Maintenance Management System Database

Table F.9. Projects currently backlogged in the Service Asset Maintenance Management System (SAMMS) database (FY05) for Rachel Carson NWR

Project #	*SAMMS Work Order #*	*Project Description*	*Cost Estimate ($1,000)*
97004	97110304	Construct Visitor Contact Station	1200
99016	99104248	Replace Kiosks	29
03001	03126303	Construct Facility to Replace SAMMS 10024177	1253
98530	98104237	Rehabilitate Boat Ramp/Fishing Pier	78
99003	99123773	Construct year round Restrooms at Carson Trail	45
98513	98104245	Replace Carson Trail Observation Platforms	34
99004	99	Construct 4 wildlife viewing overlooks	78
98529	98104234	Rehabilitate Hiking Trails	27
99005	99	Construct accessible fishing and observation platform	135
01010	01	Construct a fire equipment storage building	157
99001	99123772	Construct Trail and Restroom at Brave Boat Harbor	161
01002	01113370	Replace Marooka MST-600 Dump Carrier	31
98073	98	Construct Storage Facility	125
98524	98104252	Replace damaged Ford explorer	37

Table F.9. Projects currently backlogged in the Service Asset Maintenance Management System (SAMMS) database (FY05) for Rachel Carson NWR *(continued)*

Project #	*SAMMS Work Order #*	*Project Description*	*Cost Estimate ($1,000)*
03004	03130707	Construct "Environmentally Green" Rachel Carson/Saco Trails EE building	63
00002	00104236	Replace International Tractor Truck	175
03005	03130712	Construct Pre-fabricated pedestrian bridge for Bridle Path along Mousam River	63
92009	92104242	Replace Signs and posts	26
99012	99104240	Remove rubbish on refuge lands	26
99011	99104260	Rehabilitate Access Roads	37
01003	01113371	Replace supplemental equipment, trailers, attachments	26
98544	98104255	Replace old 1988 snowplow and snow blower	26
98517	98104258	Replace 4x4 Chevrolet Truck and trailer	99
00003	00104253	Replace worn 1994 Ford explorer	38
00001	00104254	Replace unstable lowboy trailer	55
98537	98104251	Rehabilitate office/sub-headquarters HVAC and replace oil tanks	58
98515	98104249	Replace identification/directional signs	26
98500	98104235	Replace culverts	32
94013	94109430	Rehabilitate trails, boardwalks at Carson Trail	26
02014	02121126	Rehabilitate Harts Road East	80
01007	01113574	Replace Duranautic Boats, outboard motor and trailer	26
01008	01113601	Replace 1977 gasoline fork lift	69
01009	01113603	Replace Big Joe 1 ton electric lift	11
02005	02120582	Replace 1987 20 ton dump truck	52
02008	02121068	Rehabilitate Carson trail public use road and parking area	26
02012	02121093	Rehabilitate public use parking lots	33
02009	02121071	Rehabilitate Spurwink River Road and parking lot	31
04010	04134036	Replace 1988 Dodge Dakota 4x2 with cab	30
01006	01113386	Replace 1992 1 ton diesel crewcab pickup	31
02001	02120574	Replace 1998 Jeep Grand Cherokee	31
02003	02120580	Replace 2000 Ford expedition 4x4	33
02013	02121100	Rehabilitate Mousam River public access parking lots	26
02004	02120581	Replace 2001 Ford 4x4 Regular Cab pickup	29
02011	02121082	Rehabilitate Oxcart lane	34
02006	02120586	Replace 2002 Ford Escape 4x4	26
02010	02121076	Repair brave Boat Harbor West Public Use road	104
03002	03126310	Repair Truck with a towed/transport body	26
02007	02120880	Replace 1996 John Deere 310SE Backhoe/loader	63
02015	02121128	Rehabilitate Furbish Road parking lot	30
02002	02120576	Replace 1998 Ford Stake body truck	47
04001	04133750	Replace Trimble Model TSC1 GPS unit	15
04006	04133782	Repair and rehab Houston Garage/Storage building	47
04002	04133751	Replace 2004 Honda Civic hybrid	20
04004	04133766	Replace 2003 John Deere 6420 tractor	55
04005	04133767	Replace ASV 2810 Posi Track	70
05001	05137479	Replace 2004 Dodge 2500 pickup	33
		Grand Total	**5,302**

Appendix G

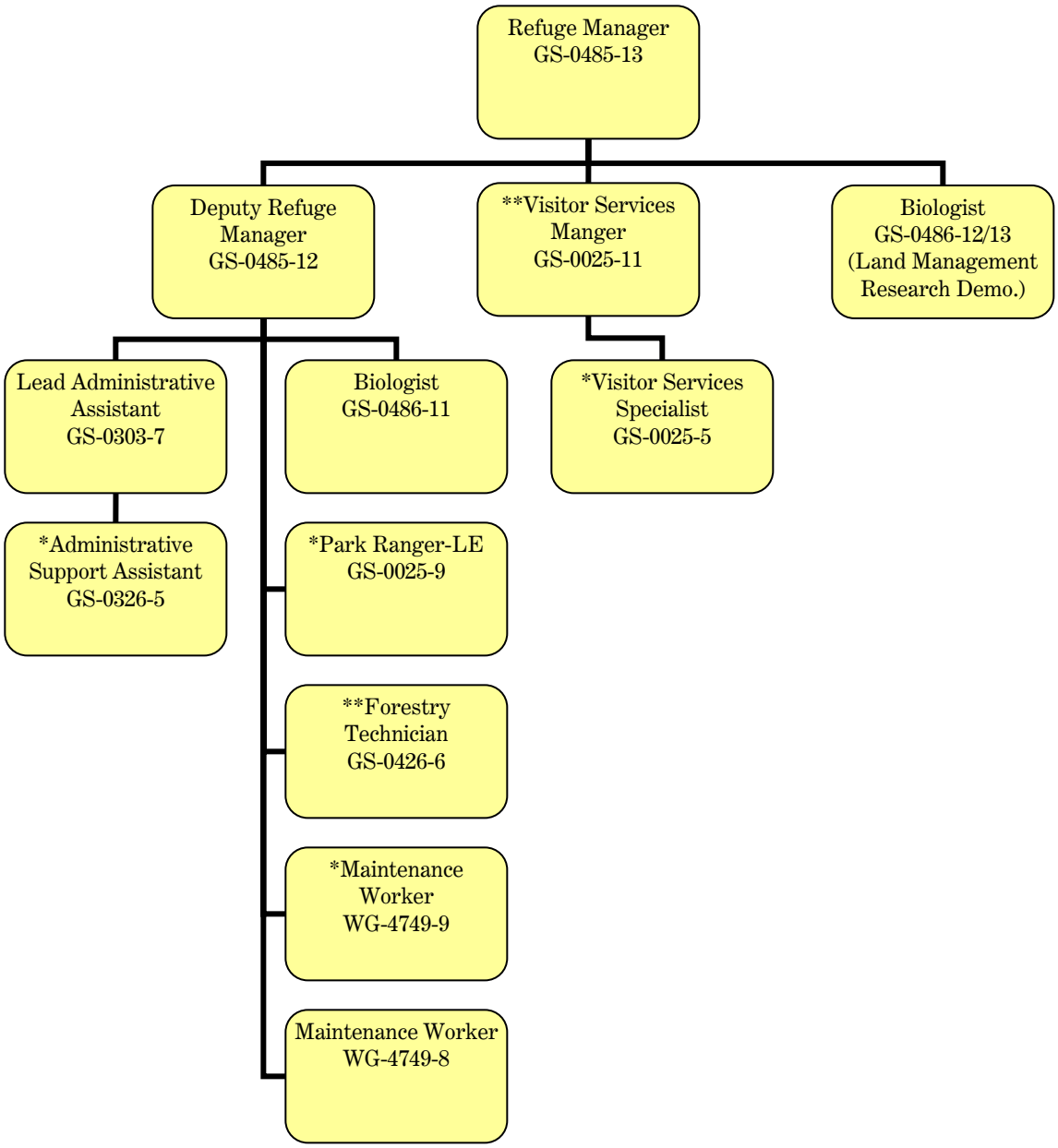
Jordan Perkins/USFWS

Least tern chick

Staffing Charts

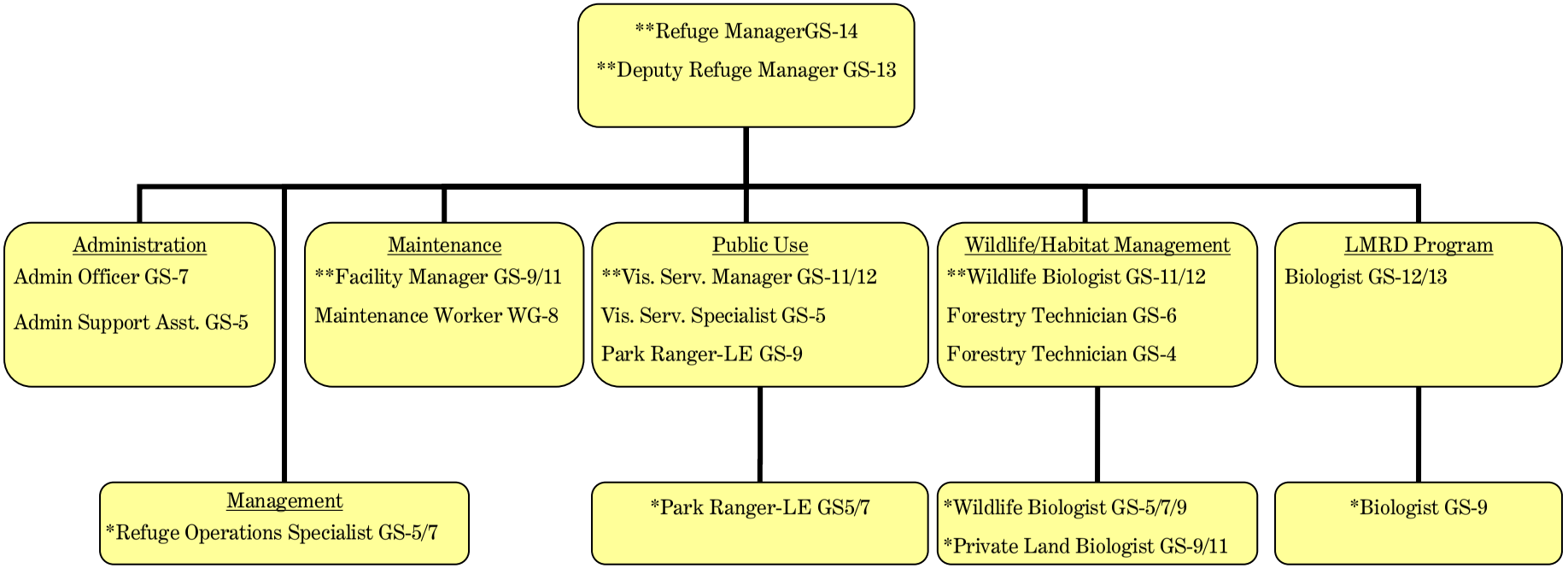
- Alternative A
- Alternative B
- Alternative C

Alternative A. Current Management



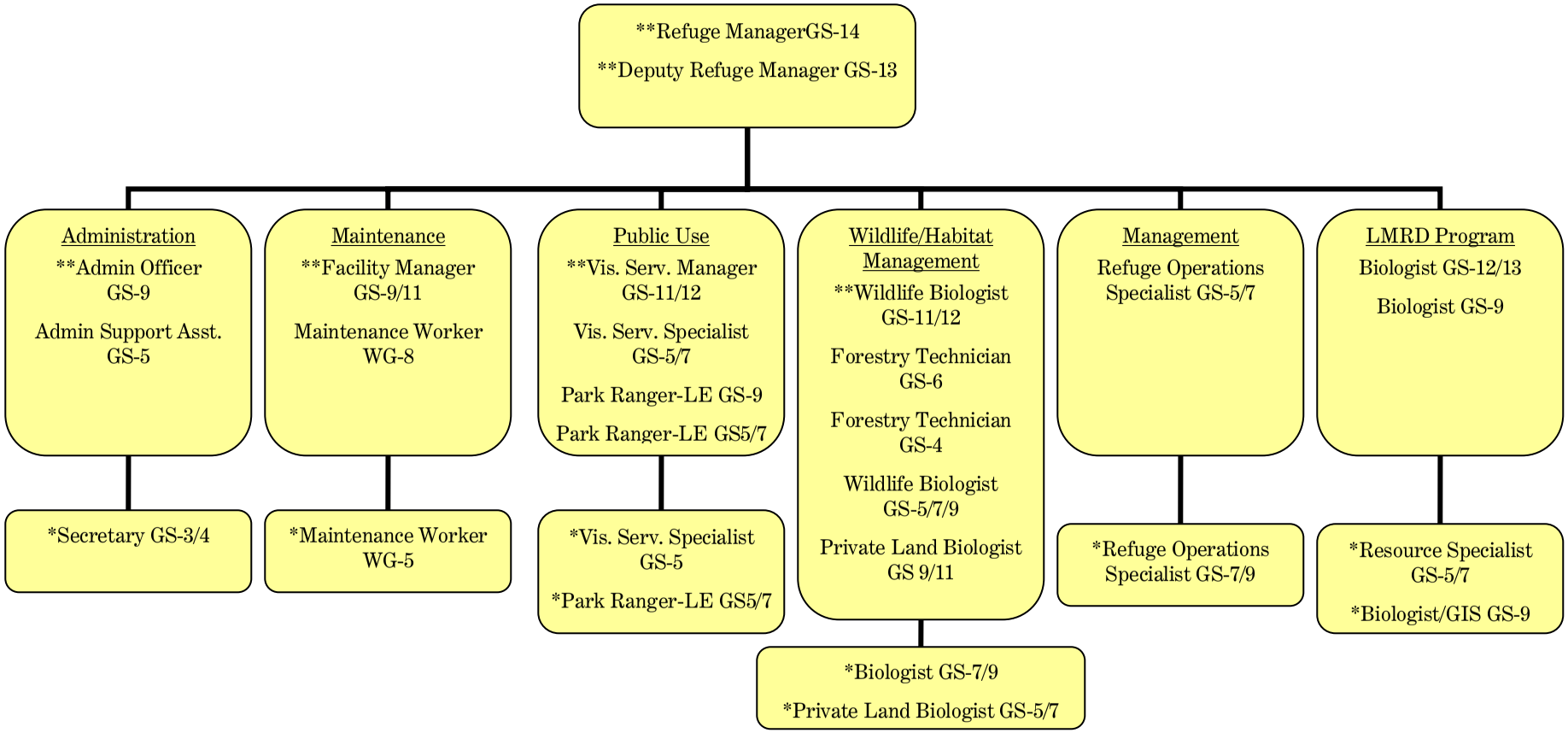
* Approved tier 1 projects
** Current vacant positions

Alternative B. Preferred Alternative



** New grade level or title for existing position
* New position for CCP Alternative B
All other positions are current and approved.

Alternative C



** New grade level or title for existing position
* New position for CCP alternative C
All other positions are current, approved, or proposed in alternative B

USFWS

Appendix H

Cultural Resources Report

- Introduction
- Geologic Setting
- Prehistoric Setting
- European Contact and History

Written by Victoria Jacobson, U.S. Fish and Wildlife Service

Introduction

Humans have played an integral role in the environment within and beyond the boundaries of Rachel Carson National Wildlife Refuge since the deglaciation of the Northeast about 13,000 years ago. The refuge contains diverse ecosystems that have provided humans with wide ranges of flora and fauna for them to subsist upon. The landscape at Rachel Carson has been dynamic, as a result of changes in the environment during the end of the Pleistocene and throughout the Holocene. Humans have also caused anthropogenic changes upon the landscape throughout history by their choices about where and how to foster their livelihood. They have been active agents in species representation in the biosphere through choosing which flora and fauna they exploit, clearing land by fire to provide fresh, green forage for deer, and clearing large expanses of land for farming in historic times. Each generation has acted upon those landscapes differently than the previous, creating subtle or obvious changes which affect future environments.

Because professional archaeologists have surveyed less than 1 percent of the refuge, only 49 archaeological sites have been recorded. Of those, 13 are eligible for inclusion in the National Register of Historic Places. One study (Will et. al. 1995) identified several land forms that may contain archaeological resources dating as long ago as 11,500 years. The various periods described below outline the cultural periods that are either directly represented in archaeological site records, or most likely exist within the refuge boundary, but have yet to be identified. Each section identifies cultural attributes that can be extrapolated to represent what occurred on the refuge through time.

The Maine coastline has never been static. It will be slightly different tomorrow and next year, and was vastly different 5,000 and 12,000 years ago. Toward the end of the Pleistocene glacial epoch, the Laurentian ice sheet flowed south-southeast across the present coastline to reach a terminal position in the Gulf of Maine at Georges Bank some 18,000 to 20,000 years ago (Hughes et. al. 1985). The ice began wasting, and is believed to have receded to the present coast, sometime between 13,800 and 13,200 years ago (Stuiver and Borns 1975).

Geologic setting

As the ice receded from a landscape that was still isostatically depressed by that colossal glacial weight, marine waters flowed well into the interior of present-day Maine. Plumes of fine rock flour flowed from the ice margin, spreading and blanketing the till with silty clay sediments across much of the refuge area. Those deposits have been termed the “Presumpscot Formation,” and their internal characteristics, fossil assemblages and chronological relationships with other surficial materials have greatly enhanced understanding of the evolution of the present landscape.

Moraines mark standing positions of ice retreat in areas of the refuge, such as along Goosefare Brook (Clinch and Thompson 1990a). Proglacial sandy outwash moved out of the ice in meltwater streams, filling valleys or forming deltas in areas such as the refuge center at Little River. Finally, as landscape rebound exceeded sea level rise, the retreating ice sheet was grounded (Thompson 1982, Smith and Hunter 1989), and the retreating sea produced shoreline features as well as a sandier surface to the Presumpscot Formation throughout much of the refuge (Clinch and Thompson 1990a, 1990b; Hildreth 1990a, 1990b; O’Toole et al. 1988).

The refuge Falls within the “arcuate embayment” compartment of coastal Maine that extends from Portland into New Hampshire (Tuttle 1960, Kelley et. al. 1988). That unique coastal area is composed

of a series of arcuate (curved like a bow) sandy beaches separated by rocky headlines. In this sand-rich region, barrier beach spits and tombolos separate low water energy pools and salt marshes from the ocean. Salt marsh growth began to keep pace with slowing sea level rise during the Mid-Holocene. As a result, most existing salt marsh peat began to grow around 3,500 to 4,000 years ago (Kelley et. al. 1989). Thus, human living surfaces and water oriented activity areas created since that period may have been capped by landward accreting and vertically accumulating marsh peat in quiet environments.

The dynamic nature of the Maine coast has provided a challenging and exciting environment for humans during the past 11,500 years. The changing landscape upon which humans acted required intimate knowledge of flora, fauna, climatic and hydrologic cycles for survival. Human subsistence strategies adapted to new environments, expressed in their tools and social structures, which are somewhat preserved in the archaeological record. We can understand that variation by looking at each archaeological time period to analyze those changes expressed through the material culture.

Prehistoric setting

❖ *Paleoindian* (11,500-9,500 years before present (BP))

The first inhabitants of Maine are labeled Paleoindians. The Paleoindian tradition is widespread throughout the Americas from Alaska to Tierra del Fuego. In some parts of the Americas, Paleoindians hunted now extinct mega fauna such as Mammoth, Mastodont, and *Bison antiquus.* In the Northeast, although available for part of the time, no mega fauna bones have been recovered from archaeological sites, only fish and smaller mammal bones, including woodland caribou and beaver. Recently, at the Nevers Site in northern New Hampshire, various kinds of water tuber type plants were recovered by Dr. Lucinda McGweeney, in a Paleoindian hearth (personal communication). Those finds, plus the lack of mega faunal remains at Northeastern Paleoindian sites, indicate that they were not practicing the subsistence strategies of their western counterparts, but were rather adapting to a more generalized subsistence pattern and exploiting the various flora and fauna of the Northeast. As more information is acquired and data recovery techniques improve, the Paleoindian diet will be better defined.

Most Paleoindian sites in the Northeast represent small numbers of people (5–15) traveling together. Those groups would have been composed of women, children and men, probably related to each other. They would live in areas for short periods of time and practiced a gathering and hunting subsistence strategy. In addition to gathering and hunting, they produced various kinds of tools to process their foods, plus items to express ideology, such as bone or stone beads (Gramly 1998). Their stone for making tools, would be acquired from sources as much as 500 miles distant. The most notable Paleoindian tool is the fluted point, unique to the Americas and, specifically, to Paleoindians. Therefore, it is useful to identify a site when other means, such as a reliable radio-carbon assay, are not available. By the end of the Paleoindian period, fluted spearpoints were replaced

by smaller styles that lacked basal fluting.

There are a few very large Paleoindian sites that are unique to the Northeast. Those areas may have been staging camps for large groups initially arriving into the area. Large groups of people could travel into unknown terrain, and then subsequently disperse into smaller bands. Other theories on the nature of those large sites include aggregation camps for people to acquire mates, exchange exotic lithic raw materials, or perhaps communally hunt herd species, such as caribou (Dincauze 1995).

In Maine, archaeologists have identified only smaller sites. They consist of campsites that vary is size from less than 300 m^2 to 18,000 m^2. Some of the best reported sites include Michaud, located in Auburn (Spiess and Wilson 1987), Vail and Adkins, located on the shores of Aziscohos Lake in western Maine (Gramly 1982, 1988), and Hedden, located on the Kennebunk Plains not far from the refuge (Spiess and Mosher 1994, Spies et. al 1995). Shared characteristics among them include the use of very fine-grained crypto-crystalline rocks, such as chert, and a preference for a well-drained, sandy living area.

There is very little published evidence for late Paleoindian sites in Maine. Two sites recently have been found: one in the town of Turner, along the Nezinscot River, and the other in Oxford, near the Little Androscoggin River. They were excavated in 1993 and 1994, and have yet to be fully published. Both overlook small river drainages, and their sizes suggest short-term occupation by a band (Will et. al. 1995).

❖ The Archaic (9,500–2,800 BP)

Archaeological sites representing the Early and Middle Archaic periods (9,500–6,000 BP) are uncommon in Maine. In fact, archaeologists argued for many years about their existence in Maine at all (see Sanger 1977, Spiess et. al. 1983). During these periods, mixed softwood and hardwood began to replace conifer forests. Recent improvements in archaeological excavation methods and a growing awareness of regional geology have allowed archaeologists to identify Early and Middle Archaic sites.

Early and Middle Archaic sites are most commonly present in deeply buried alluvial deposits. In fact, many are found at depths of more than 1.5 meters (Peterson 1991). An Early Archaic site radiocarbon dated to 8,470 +/- 110 years BP (Beta 75010), and excavated by Dr. Richard Will in 1994, was discovered at a depth of 2 meters below ground surface along the Little Ossipee River in East Limington, Maine.

The Early Archaic assemblages in Maine differ from those found elsewhere in the Northeast. Many of the tool forms recovered are chipped and ground into shape from relatively soft rocks such as phyllite. Those tools contrast sharply to Paleoindian tools and Early Archaic tools elsewhere in both style and material type. Their projectile points usually have a stem on the base that has been ground and flaked. Some also have a notch in the center, creating a bifurcate base. Assemblages of ground-stone tools in association with pecking or hammering stones are fairly diagnostic and particular to Maine. Based on the distribution and frequency of Early Archaic sites, most likely the settlement pattern involved people traveling in small bands exploiting wetland-type environments where the most predictable food supplies could be harvested.

The Middle Archaic is more archaeological visible than its predecessor, and sites are distributed both along the coast and the interior (Bourque and Cox 1981). The stone tools are similar to those found in other parts of New England. The first cemeteries appear during

this time, indicating that people may be starting to identify a set territory. Visible cemeteries are clear markers that the land is associated with a certain group when visited by outsiders. The burials contain red ochre and grave offerings of ground stone tools, including woodworking gouges, celts, slate spear points and ground stone rods.

Based upon the diversity of the materials found at Middle Archaic sites, archaeologists can infer the people were building things such as dug-out canoes and sturdy dwellings. People had probably begun to establish seasonal rounds for gathering and hunting. They also were becoming more reliant upon coastal resources such as shell fish and fish. The population is also beginning to increase during this time.

Late Archaic sites are more numerous in Maine and they have been documented in York County (Will and Cole-Will 1985). During that period, between 6,000 and 2,800 years ago, an environmental transformation changed forest composition and the kinds of wild food plants and animals available for gathering and hunting (Will et. al. 1995). The best known archaeological group in Maine during that time is the Moorehead Phase, more commonly known as the "Red Paint People". That term was coined by Warren Moorehead who conducted extensive excavations throughout Maine in the early twentieth century (Moorehead 1922). He used the term to describe the extensive use of red ochre for burial ceremonialism, perhaps a tradition the began during the Middle Archaic. Numerous cemetery sites from this time period are known (see Willoughby 1898, Moorehead 1922, Snow 1969, Sanger 1973, Bourque 1976), but their interpretation of cultural affiliation and significance vary. Habitation sites are also recorded from a variety of locations including coastal shell middens, lake margins and along large and small waterways. The appearance of larger sites indicates that the population is rising and the people are living in one place for longer periods of time. During the Late Archaic, there is evidence for marine resource exploitation, including the taking of swordfish (Bourque 1976), which also indicates that people are making vessels capable of short-term sea ventures.

During the Terminal Archaic period, another archaeological assemblage appears, which suggests that a new group of people moved into the region. Their material culture suggests a different life style than the Mooorehead phase culture. This tradition has been identified as the Susquehanna tradition. This culture often cremated corpses rather than buried them, and their diagnostic tool kit included large chip-stone spear points rather than ground stone tools. Their subsistence economy seems to have been more focused on terrestrial rather than marine sources (Will et. al. 1995).

The relationship among the various cultures of the Late Archaic continues to be controversial among archaeologists. What is clear is that more than one distinct culture is present in terms of style of artifacts, population is increasing, a wide range of plants and animals are being exploited, and people are living in areas for longer periods of time. Territories are being established and expressed through culturally unique mortuary practices, and cultures are becoming economically stratified, in that some individuals are buried with prestigious grave goods, while others are not. Other questions regarding the cultural change are whether it was an indigenous change or if a new group of people moved into the region. What is definite is that a highly visible change occurred 3,900 years ago.

❖ Ceramic Period (2,800-500 BP)

The Ceramic Period refers to the time when pottery-making first appears in the archaeological record. In the Northeast and other parts of the country, this is referred to as the Woodland Period. Ceramics first appear in the Maine archaeological record around 2,800 years ago, and they persist until the time of European contact, when they were replaced with copper and iron kettles.

The environment during this time was very similar to modern-day environments (Davis and Jacobson 1985). Ceramic period sites are abundant, indicating a high population density that was semi-sedentary (Sanger 1979). The most visible type of Ceramic Period site is shell middens along the coast. Those contain the discarded shells of clams, oysters, mussels and quahogs, in addition to broken bone and stone tool implements, pot sherds and food bone remains, and sometimes human and dog burials (e.g. Spiess and Hedden 1983). Shell midden sites have been reported in several areas of York County including York Harbor and the York River (Mercer 1897, Will and Cole-Will 1985,1986, Will 1995).

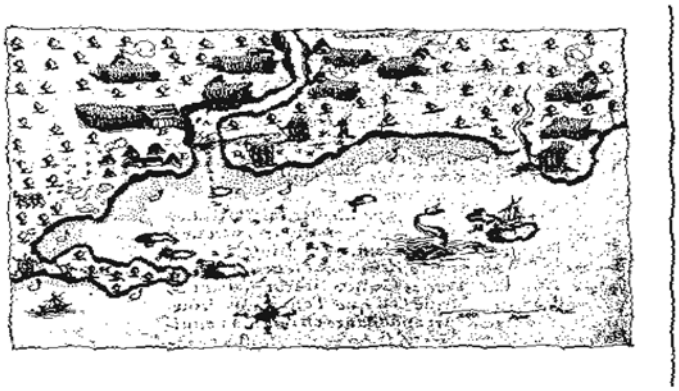
Cermaic period sites are also common in the interior along waterways and around ponds and lakes (e.g. Sanger 1979). They have also been found in upland areas in the foothills of western Maine (Eldridge et. al 1999). People during the Ceramic Period were living in villages and trading with people to the north, west and south. That long-distance trade is evidenced by the presence of Rhama Chert, which is only found in Labrador, and other exotic items present at Ceramic Period sites. By the end of the Ceramic period, historical evidence shows that the people of Maine were practicing horticulture. While their diet continued to include marine resources, game and wild plants, plants such as maize, beans and squash were grown. The Ceramic Period ends with European contact around 450 years ago.

European Contact and History

Southern coastal Maine did not become the target of explorers until the first decade of the seventeenth century, although in the sixteenth century, a few Europeans probably traveled along the coast of Maine (Churchill 1978). The first explorer to extensively travel and record the coast of Maine was Samuel de Champlain in 1604. Sailing along the coast, Champlain observed that the Kennebec River was a major political and economic boundary for the natives of Maine. East of that line lived the Etchemin, a group who subsisted by hunting and gathering. West of that boundary lived the Almouchiquios, farmers who congregated in large villages (Will et. al. 1995).

The Almouchiqous were the northernmost Indians who planted the native trilogy of corn, beans and squash. In the 1600s, agriculture was not viable north of the Kennebec River, probably because of the shortened growing season due to the Little Ice age (1350–1650 AD). Although their settlement appeared to be a stable, traditional situation to Champlain, in actuality it was not. Corn agriculture had only arrived about 700 years earlier, coming in from the south and west. At the time of introduction, it might have spread well east and north of the Kennebec River. However, the climatic cooling condition by 1600 meant that the northern limit of agriculture moved south to the Kennebec River.

Champlain drew a map of the lower Saco River, describing in detail the native settlement pattern of that time (Champlain 1880). A large, principal village was surrounded by agricultural fields. The habitation included a palisaded compound to protect the villagers and their crops from raiding tribes, principally the Micmac of present-day Nova Scotia and New Brunswick. Smaller villages or hamlets were strung along the shoreline, each with its own fields. Champlain indicated that Choacoet, the name of the village on the Saco, was a permanent establishment. However, other lines of evidence suggest groups may have dispersed upriver and into the interior from time to time during the year to take advantage of deer, moose, anadromous fish runs, and other seasonal natural resources (Baker 1986a:10-33).



The active village life depicted by Champlain quickly came to an end. A major intertribal war between the Indians of Maine and the Micmac devastated Choacoet and other settlements. The war seems to have ended about 1615, only to be followed by an even greater disaster. From 1616 to 1619, a European-introduced epidemic that rampaged though New England included the coastal tribes of northern New England. As a result of warfare and disease, the native population of coastal York County may have been reduced by as much as 70 percent from 1600 to 1620 (Snow and Lanphear 1988:15-33).

A smallpox outbreak in 1634 made further inroads on the population. The effect of these epidemics was so great that in 1640 John Winter observed that, aside from the natives at the mouth of the Saco River, there were no Indians within 40 or 50 miles of his post at Richmond's Island (Baxter 1884:III, 461). Aside from a greatly reduced village at Choacoet, only a relict population survived, scattered across the area. As early as 1623, Christopher Levett observed that along the banks of the York River was "good ground, and much already cleared, fit for planting of corn and other fruits, have heretofore been planted by the savages who are all dead" (Levett 1988:39).

The fields were not abandoned for long. A large influx of English settlers in the early 1630s began settlements in present-day Kittery, York, Biddeford, Saco, and Scarborough. Wells was first occupied in the early 1640s. The settlers principally occupied the land directly adjacent to the ocean and along other bodies of navigable waters. Although an occasional early settler did move into the interior to trade furs or cut timber, virtually all inhabitants live at or below the fall line of the numerous rivers until the eighteenth century (Will et.al. 1995). The refuge is located completely within this coastal margin, an area that has remained an important landform for settlement.

Most of this territory was the Province of Maine, granted to Sir Ferdinando Gorges. Gorges never visited his colony, relying instead on a series of lieutenant governors and agents to act in his stead. As a result, settlement and the formation of a sound government in the region suffered. Gorges divided Maine into a series of patents, which were given to proprietors. Usually, there were two or more proprietors per lot, who were given the lands on the condition that they could plant a certain number of settlers within a specified time limit. In the 1630s, settlement proceeded slowly (Reid 1981).

In the 1640s, the English Civil Wars stopped migration to New England and led to a depression in Maine. Some settlers left for more prosperous colonies, or to return home. Indeed, in 1642 Lieutenant Governor Thomas Gorges returned to England to accept a commission in the Parliamentary Army. The Civil Wars also took the time and energy of Sir Ferdinando Gorges. When he died, his colonies were in a state of disarray (Baker 1994).

From 1652 to 1658, the Massachusetts Bay Colony established authority over Maine, a position which it held with several brief interruptions until statehood in 1820. Settlers rapidly moved into the Bay Colony's newest county of York. In fact, the large number of new arrivals in the late 1650s, 1660s and 1670s may in large part explain why hostilities broke out between the English and native Indians of Maine in 1676 (Baker 1986a). That conflict, generally know as King Philip's war, raged until 1678. During that time, all settlements in Maine north of Biddeford Pool were abandoned or burned by the Indians, and raids burned parts of other settlements as well.

Peace after 1678 was short-lived. In 1688, King William's War started, a series of colonial conflicts in which the French allied with Native Americans against the English. A lasting peace did not return until 1713. During this period, some settlements north of Wells were burned. Salmon Falls (present-day Berwick) was burned in a raid in 1690, and much of York was destroyed in the Candlemas Raid of 1692 (Reid 1981: 164-83). Later in 1692, the setters of Wells held off a large combined force of French and Indians, but apparently only a small number of garrison houses actually survived that and subsequent attacks (Mather 1853).

The wars were equally disastrous for the Indians, whose village and fields were repeatedly destroyed by colonial militia units. Many natives died in combat or by starvation. Others migrated out of the area, seeking refuge in French-protected reserves on the St. Lawrence, or among their kinsmen on the Kennebec and Penobscot Rivers. A very limited native population had survived in parts of the region until the 1690s. After 1713, the only ones who remained were a small band on the Saco River, who apparently spent most of their time far upriver (Day 1981).

The time after 1713 is generally referred to as the Resettlement Period, when English families returned to abandoned homesteads and new settlers arrived in great numbers as well. Indian raids still occurred, and several wars would occur until the fall of France in 1760 (Clark 1970). That constant threat meant that settlement remained largely below the fall line in the coastal zone.

The coastal zone below the fall line was abundant in resources for the European settlers to make an adequate living. Saw and grist mills were constructed in strategic spots along the fall line and at tidal outlets. Coastal mud flats became prime spots for shipyards. River and stream banks were accessible, and thus became the first areas to be logged. Until better road networks were developed in later colonial time, the sea, rivers and beach served as the principal thoroughfares. Fishermen gathered along these rocky harbors, and farmers also used the area, harvesting salt water hay off the marshland and planting the adjacent uplands. Milling, shipbuilding, and salt water hay farming remained important economic activities until well into the nineteenth century. Thus, a variety of economic resources attracted people to the coastline (Will et. al 1995:14).

In 1760, the Maine frontier rapidly opened, with people pushing far inland (Leamon 1993). The process ceased during the American Revolution, but resumed in the 1780s and continued through the early nineteenth century (Smith 1988). Timber cleared in the interior made its way to the coast, where it was sawn into limber or used in the booming shipbuilding industry of York County. As settlers pushed inland, the coastal trading towns grew in size and importance. The conditions in Portland magnified that effect. Burned by the British in 1775, it took several decades for Portland to reestablish itself as the principal port of Maine. In the meantime, the coastal York County towns took advantage of their opportunity to become important regional economic centers (Butler 1986).

President Jefferson's Embargo in 1808 and the ensuing war of 1812 signaled the beginning of the end of the glory days of the York County ports. Still, some remained fairly active as either trading or shipbuilding ports until the 1840s. At that point, the shipbuilding industry began decline. The demand of increasingly larger ships shut out shipyards located in coastal York County, which did not have deep

enough harbors or large enough facilities to build bigger craft. Farming also went into decline in the nineteenth century because small Maine farmsteads could not compete with the growing agribusiness of the Midwest and West. The principal remaining business of coastal Maine was fishing.

By the late nineteenth century, tourism was beginning to replace most traditional economic activities in the refuge study area. Summer visitors were drawn to the coast for its cool climate, beaches, scenic shores, and relative lack of development (Brown 1992). As twentieth century tourism has thrived, the pace of development has quickened and closed in on the coastal margin that comprises the refuge.

The refuge contains 49 recorded archaeological sites, 13 of which are eligible for inclusion in the National Register of Historic Places. Only a small percentage of refuge lands have been evaluated for the presence of archaeological resources. The number of sites is surely going to increase as more archaeological surveys are completed. The land forms and various environments within the refuge have the potential to yield archaeological sites from Paleoindian through late colonial times. The refuge has provided habitats vital to humans for their livelihood, demonstrated by the artifacts they have left behind, whether a shell midden, a colonial farm site, or the remains of a nineteenth-century wharf or railway trestle.

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Dave Menke/USFWS

Female and male common eider

Appendix I

Privately Owned Lands Within the Acquisition Boundary

- Upper Wells Division–Town of Kennebunk
- Upper Wells Division–Town of Wells
- Brave Boat Harbor Division–Town of York
- Brave Boat Harbor Division–Town of Kittery
- Spurwink River Division–Town of Cape Elizabeth
- Goose Rocks Division, Little River Division–Town of Kennebunkport
- Goosefare Brooks Division–Town of Old Orchard Beach
- Goosefare Brooks Division–Town of Saco

Table I.1. Upper Wells Division–Town of Kennebunk

Map Lot	*Acres*	*Map Lot*	*Acres*
20 11	43.63	11 5	11.74
20 8	5.71	11 3	10.67
30 3A	12.77	12 1	62.41
20 11B	1.25	12 3A	47.25
21 13	43.90	11 7	6.09
20 11A	1.64	12 102	1.84
30 2	1.40	12 6	45.31
21 1	15.67	12 12	5.59
21 9	79.31	12 10	0.98
21 14	10.93	12 6C	32.75
21 19	4.46	12 11	3.61
21 12	11.06	12 6D	5.31
21 19B	8.21	12 13	10.60
21 3	4.02	12 14	7.94
21 2	0.82	12 22	11.95
21 2A	6.47	12 21	13.54
21 19E	6.25	12 20A	6.36
21 2	13.94	12 20	6.21
21 19D	6.44	12 6F	6.96
21 11	8.86	14 12A	4.44
21 14	8.60	14 12C	3.82
21 2	0.91	14 12B	3.57
21 9	0.29	14 12	3.73
21 7	1.67	14 13A	2.04
21 19C	3.04	14 13	2.01
21 7	3.07	13 1	3.63
21 8	9.27	13 2	14.39
11 3A	3.06		

Table I.2. Upper Wells Division–Town of Wells

Map Lot	*Acres*	*Map Lot*	*Acres*
00154-007. -	0.107	00148-002.3 -	0.142
00154-008. -	0.083	00148-002. -	0.073
00154-009. -	0.088	00148-001.1 -	1.946
00153-022.EXE-	0.059	00148-002.5 -	0.123
00154-033. -	0.073	00148-002.4 -	0.165
00154-036. -	0.071	00147-023.B -	0.229
00154-037. -	0.144	00148-005. -	1.215
00151-001. -	0.064	00154-040.EXE-	0.021
00151-002. -	0.049	00148-001.EXE-	13.143
00151-003. -	0.018	00148-003. -	0.339
00151-003. -	0.027	00148-005.10 -	0.006
00151-002.11 -	0.124	00148-004. -	0.468
00148-001.2 -	6.286	00147-023. -	0.235
00151-002.10 -	0.032	00147-025. -	0.250
00147-018. -	2.549	00149-001.EXE-	13.734
00148-002.1 -	0.198	00149-001.EXE-	13.734
00148-002.2 -	0.153		

Table I.3. Brave Boat Harbor Division–Town of York

Map Lot	*Acres*	*Map Lot*	*Acres*
202-097	0.866	202-127	14.470
202-099	3.511	202-121	6.144
201-005	3.077	202-123	40.780
202-103	0.482	201-019	80.263
202-131	14.617	201-023	19.348
202-129	4.951	201-025	5.535
202-119	16.139	201-027	1.250
201-001	7.912	201-029	17.431

Table I.4. Brave Boat Harbor Division–Town of Kittery

Map Lot	*Acres*	*Map Lot*	*Acres*
69_10	2.5	57_25	2.9
69_14A	5.5	45_14	2.6
69_14C	0.9	45_26	5.4
69_14B	0.2	45_28B	3.5
69_12	0.7	64_27	0.7
69_13	0.2	58_06	7.5
69_14E	1.1	64_26	1.9
69_14	2.4	58_07	3.4
63_44D	5.3	58_09	3.8
63_44A	18.2	45_29	1.1
63_44F	2.3	64_25	2.1
63_45	4.3	58_09-3	2.0
63_46	7.5	58_38	36.9
63_49	4.4	45_30B	0.5
64_12	22.6	58_05	0.1
63_54	2.9	58_09-2	13.7
64_WATER	0.1	58_04A	0.4
63_54A	1.3	45_30	0.8
64_08	5.1	58_37	7.7
63_64	10.8	58_04	2.7
63_54C	2.4	58_09-1	2.6
63_54B	1.3	58_02-1	2.2
64_05	17.4	58_38A	1.5
64_09	5.4	58_38F	1.2
64_13	1.0	58_38B	1.1
64_11A	0.7	58_38D	1.1
63_65	2.6		

Table I.5. Spurwink River Division–Town of Cape Elizabeth

Map Lot	*Acres*	*Map Lot*	*Acres*
U21,12	62	R06,1	122
U54,9	7	R05,45	4
R05,2	32	R05,54	6
U45,4	5	R05,47	3
R05,56	29	R05,11	168
U45,6	4	U20,11	19
R05,31	47	R05,33	8
U21,12	33	U20,3	3
R05,33	21	U20,11	2
U45,4	1	U20,6	1
U45,7	6	U20,6	0
R05,51	3	U19,19	5
R05,36	15	U19,17	1
R05,51	2	U19,16	1
R05,41	3	U19,15	3
R05,41	4	U19,18	2
R05,41	2	U19,14	2
R05,41	2	R05,13	41
R05,38	2	U19,13	1
U45,9	7	U19,12	2
R05,39	2	U19,11	2
R05,41	2	U44,34	2
R05,55	9	U19,9	2
R05,44	2	U44,33	2
U52,1	3	U44,32	2
R05,10	82	R06,45	511
U52,3	6	U44,31	2
U52,2	4	U44,30	2
R05,45	1	U44,29	2

Table I.6. Goose Rocks Division, Little River Division–Town of Kennebunkport

Map Lot	*Acres*	*Map Lot*	*Acres*
22,8,28	2.2	33,3,28	0.6
22,8,34	1.6	33,3,20	9.0
23,6,36B	4.9	33,3,30	6.4
23,6,36A	28.6	33,2,9	5.0
23,6,6	1.5	33,2,1	1.2
23,6,4	0.8	34,2,24	1.4
24,4,2	30.8	34,2,26	0.3
24,3,1	0.5	37,1,3	4.0
24,3,2	0.5	41,6,1	15.7
24,3,3	0.7	41,2,44	7.2
24,4,27	1.6	41,2,38	59.0
24,4,6	9.9	42,2,1A	4.1
24,4,26	1.4	42,2,1B	4.4
24,4,5	1.3	42,2,1D	4.0
30,3,13A	3.5	42,2,1E	3.4
30,3,13C	2.8	42,2,1C	4.4
30,3,13D	1.9	42,2,12	5.1
30,3,38	5.7	42,2,12A	5.0
33,2,4	1.9	42,2,14	3.0
33,2,2	6.4	42,2,13	7.3
33,2,3	1.1	42,2,15	7.0
33,2,27	2.0	42,2,11D	32.5
33,3,27	0.5	42,2,19	5.5

Table I.7. Goosefare Brooks Division–Town of Old Orchard Beach

Map Lot	*Acres*	*Map Lot*	*Acres*
108-1-4	108.1	108-1-3	6.0
108-1-2	103.1	108-1-1	23.4
108-1-7	0.1	108-1-12	7.0
325-4-3	0.8		

Table I.8. Goosefare Brooks Division–Town of Saco

Map Lot	*Acres*	*Map Lot*	*Acres*
024006000000	3.5	011026000000	0.1
016002000000	17.7	011001001000	1.0
016001000000	5.4	011004001000	0.2
011126000000	2.9	011001000000	0.5
011126000000	0.5	009003012000	3.1
011029000000	0.3	010005002000	1.6
011126000000	0.5	010005000000	3.0
011032000000	0.1	009003013000	0.5
011027000000	0.3	009003014000	0.6
011024000000	0.1	009003015000	0.5
011025000000	0.1		

Steve Maslowski/USFWS

Prairie warbler

Appendix J

Breeding Landbird Survey Data

The data in the table below was compiled by reviewing the landbird survey data for Brave Boat Harbor and Upper Wells (1994-1998) and Spurwink River and Goosefare Brook (2000-2002) and grassland bird data (1999-2002) and cross referencing it with the list of priority birds for BCR 30 and BCR 14.

It is important to note that surveys were conducted for landbirds in forests and grasslands, and are biased towards those habitats and species within those habitats. Waterfowl, marsh and wading birds, and salt marsh bird numbers are not included in this analysis. Saltmarsh sharp-tailed sparrows, Nelson's sharp-tailed sparrows, piping plovers, least terns, black ducks, common eider and willets are common occurrences on the Refuge and are some of the birds of highest conservation concern within BCR 30 and/or 14. Separate survey efforts document their usage of Refuge lands.

Table J.1. Breeding Landbird Frequency (points detected/all points surveyed) by Division and Refuge Relative Abundance (number of individuals of a species/number of all individual birds).

Species	*BCR 30*	*BCR 14*	*Habitat*	*Refuge Relative Abundance*	*BBH Frequency*	*U. Wells Frequency*	*GFB Frequency*	*Spurwink Frequency*
American Redstart		High	MD/MF	0.58%	16.36	4.27	0.00	0.00
Baltimore Oriole	High		MD/MF	0.69%	12.93	0.37	0.00	35.29
Black and White Warbler	High		MD/MF	1.62%	17.69	29.30	41.67	47.06
Black-billed Cuckoo		Moderate	MD/MF	0.03%	1.36	0.00	0.00	2.94
Blackburnian Warbler		Moderate	MD/MF	0.02%	0.00	1.10	0.00	0.00
Black-throated Blue Warbler		High	MD/MF	0.04%	0.00	0.73	2.38	0.00
Black-throated Green Warbler		Moderate	MD/MF	3.68%	34.22	64.1	21.43	3.13
Bank Swallow		Moderate	FW, G/A	0.09%	0.00	4.27	0.00	0.00
Barn Swallow		Moderate	FW, G/A	1.03%	10.95	12.82	0.00	0.00
Bobolink		High	G/A	0.27%	2.38	7.25	0.00	5.88
Brown Creeper		Moderate	MD/MF	0.34%	6.84	7.27	4.76	0.0
Canada Warbler	Moderate	Highest	MD/MF	0.64%	7.48	13.55	7.14	11.76
Chestnut-sided Warbler		High	SPP	0.71%	7.55	14.1	3.57	21.88
Chimney Swift	High	High	U/S	0.07%	4.75	1.83	0.00	2.94
Eastern Towhee	High		SPP	0.09%	21.77	11.36	22.62	47.06
Eastern Wood-pewee		High	MD/MF	0.96%	28.57	13.19	2.38	17.65
Eastern Kingbird	High		SPP	0. 7%	8.88	8.12	5.95	28.13

Table J.1. Breeding Landbird Frequency (points detected/all points surveyed) by Division and Refuge Relative Abundance (number of individuals of a species/number of all individual birds) *(continued).*

Gray Catbird	Moderate		SPP	0.06%	31.5	18.38	3.57	37.5
Great crested Flycatcher	High		MD/MF	0.07%	23.88	14.1	23.81	12.5
Northern Flicker		Moderate	MD/MF	0.07%	2.72	4.27	11.9	9.38
Ovenbird		Moderate	MD/MF	0.37%	52.75	64.96	89.29	6.25
Pine Warbler	Moderate		MD/MF	0.15%	15.71	38.03	5.95	0.00
Prairie Warbler	Highest		SPP	0.01%	0.00	0.73	0.00	0.00
Purple Finch		High	MD/MF	0.09%	8.84	8.42	4.76	17.65
Scarlet Tanager	High		MD/MF	0.05%	21.09	11.36	21.43	12.50
Veery		High	MD/MF	0.09%	13.68	29.92	30.95	34.38
Willow Flycatcher	High		SPP	0.03%	0.0	3.85	0.0	6.25
Wood Thrush	Highest	Highest	MD/MF	0.10%	2.04	0.73	16.67	5.88

MM=maritime marshes B/D=beach/dune MD/MF=mature deciduous and mixed forest
SPP=early successional shrub/pitch pine barren G/A=grassland/agricultural U/S=urban/suburban
FW=freshwater wetland/river and lake

Acronyms

ACOE	Army Corps of Engineers
ADA	Americans with Disabilities Act
ANP	Acadia National Park
ARPA	Archaeological Resources Protection Act
ATV	all-terrain vehicle
BBS	Breeding Bird Survey
BCR	bird conservation region
BMP	best management practices
CCP	Comprehensive Conservation Plan
CIREG	Coastal Island Registry number
CWS	Canadian Wildlife Service
DMR	Department of Marine Resources
DEP	Department of Environmental Protection
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FAA	Federal Aeronautics Administration
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GIS	Geographic Information System
GOMP	Gulf of Maine Program
GOMSWG	Gulf of Maine Seabird Working Group
GPS	Geographic Positioning System
HIOBS	Hurricane Island Outward Bound School
HMP	Habitat Management Plan
IMP	Inventory and Monitoring Plan
ISS	International Shorebird Survey
LE	Law Enforcement
LPP	Land Protection Plan
LWCF	Land and Water Conservation Fund
MAPS	Monitoring Avian Productivity and Survivorship
MCHT	Maine Coast Heritage Trust
MDIFW	Maine Department of Inland Fisheries & Wildlife
MDOT	Maine Department of Transportation
MITA	Maine Island Trail Association
MMS	Management Maintenance System
MNAP	Maine Natural Areas Program
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAP	Natural Areas Program
NAS	National Audubon Society
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRPA	Natural Resource Protection Act
NWPS	National Wilderness Preservation System
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
PID	Project Information Document
PIF	Partners in Flight
PRISM	Program for Regional and International Shorebird Monitoring
RONS	Refuge Operations Needs System
RRP	Refuge Roads Program
RRS	Refuge Revenue Sharing
SMART	**(Objectives)** Specific, Measurable, Achievable, Results-oriented, Time-fixed
TNC	The Nature Conservancy
UNB	University of New Brunswick
USCG	U.S. Coast Guard
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WNERR	Wells National Estuarine Research Reserve
WSA	wilderness study area
WUI	Wildland Urban Interface

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Salt Marsh Sharp-Tailed Sparrow