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Alternatives Considered, Including the Service-preferred Alternative

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Introduction

This chapter presents:

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

The alternatives considered, including the Service's preferred alternative are:

- **Alternative A – Current Management.** This alternative fulfills the NEPA requirement for a no action alternative, one that proposes no change in the current management of the refuge. Alternative A is to continue to manage the refuge as we do at the present time.
- **Alternative B – Preferred Alternative.** This alternative will focus on focal species with proactive habitat management and expanded public use. Alternative B is our preferred alternative and the action that we recommend for final selection.
- **Alternative C – Historic Habitat Management.** This alternative proposed to return to habitat management programs which were conducted on the refuge for several decades, but had been stopped in recent years for various reasons. Re-establishment of such programs would require substantial refuge action. This alternative includes some modifications to public use programs.

At the end of this chapter, a matrix compares how each alternative addresses significant issues, supports major programs, and achieves refuge goals and objectives.

Developing Alternatives, Including the No Action Alternative

Management alternatives were developed after identifying a wide range of possible management objectives and strategies that could achieve refuge goals. These alternatives can be described as packages of complementary objectives and strategies designed to meet refuge purposes and the Refuge System mission and goals as described in chapter 1, and stepped down into refuge-specific goals used as the framework for each alternative. Management objectives and strategies developed for each alternative respond to public issues and opportunities identified during the planning process and public scoping meetings.

We fully analyze in this draft CCP/EIS three alternatives that characterize different ways of managing the refuge over the next 15 years. We believe they represent a reasonable range of alternative proposals for achieving the refuge purpose, vision and goals, and addressing the issues described in chapter 1. Unless otherwise noted, all actions would be implemented by refuge staff. The three alternatives are summarized in a matrix at the end of this chapter (table 4-5).

The environmental baseline: It is important to understand that while this EIS was under development, there were major habitat changes within the Refuge. As explained in Chapter 3, the formerly freshwater impoundments in Units II and III (particularly in Unit II) have undergone significant change, due to breaches in the barrier island allowing for the free exchange of salt water in the formerly maintained freshwater marshes. The rapid inundation of salt water killed substantial amounts of freshwater vegetation and has increased the salinity of brackish waters but, to date, has not brought in sufficient sediment to overcome

the sediment deficit incurred over the decades of freshwater management. The refuge continues to assess the biological, chemical, and geological impacts of these changes, specifically exploring whether the underlying peat layers, which were not increasing during the decades of freshwater management, have recently experienced increased subsidence or other biochemical changes. Therefore, while the environmental baseline for these habitats is difficult to fully assess, for this analysis we assume that the baseline is the condition of the refuge as of mid-2012. Thus, alternative A assumes little or few future proactive efforts and assumes that future habitats will evolve on the template of past natural events and earlier human manipulations of the marshes. Alternative B assumes that the service will undertake future proactive measures, geared to restoration of a more natural system than existed in 1988, or even decades before, with the goal of limiting its actions to ones which will result in more naturally sustainable future conditions, i.e. “fix it, and then let it be.” Alternative C assumes a return to former management conditions and recognizes that extensive engineering actions to construct a robust barrier island capable of sustaining freshwater marshes in light of sea level rise and climate change will require construction of a substantial sand barrier with perpetual renourishment actions. Similarly, for upland management, since the refuge has not been engaged in active farming for 6 years, Alternative A assumes that incremental vegetation changes will result in the gradual development of bushes, thickets, and ultimately woodlands, which the Service will not actively manage other than to remove invasives. Alternative B will bring these areas into a forested condition more rapidly by planting certain desired trees and other species. Alternative C anticipates a return to active farming.

Alternative A satisfies NEPA requirements for a no action alternative. It describes the refuge’s existing management activities and serves as a baseline for comparing and contrasting alternatives B and C. Implementing alternative A would continue current habitat management regimes and maintain public use programs in their present format.

Alternative B, the Service-preferred alternative, combines actions that we believe would most effectively achieve refuge purposes, vision and goals, and respond to public needs. Alternative B also incorporates the principles of strategic habitat conservation and focal species management, as both reflect the most recent advances in the fields of conservation science and delivery of conservation actions on the ground by the Service. Under alternative B, the refuge would implement manipulative management tools and interventions that mimic natural processes to enhance habitat restoration where deemed most appropriate. At the same time, the refuge would strategically reduce the use of management actions that are contrary to the directions of the biological integrity, diversity, and environmental health (BIDEH) policy, such as artificial maintenance of extensive freshwater wetlands that are vulnerable to sea level rise, but can pursue careful sediment placement or marsh restoration to enable sediment-deficient salt marshes to subsist in light of sea level rise. Alternative B would include a combination of passive and active management approaches to foster or achieve more ecologically sustainable habitats than occur on the refuge at present.

In alternative B, the habitat condition objectives and general management strategies include the following:

- Managing for natural range of conditions in upland habitats (native forest, early successional grassland, and shrubland habitats) to restore lost elements of BIDEH for priority resources of concern.

- Managing the refuge's wetland marsh systems consistently with BIDEH, and considering their sustainability in light of sea level rise and climate change.
- Developing wetland restoration efforts to restore salt marsh communities in portions of the refuge's impounded wetland complex to promote adaptation in the face of sea level rise.
- Restoring mature upland forested habitats, through planting and active forest management, to manage for priority resources of concern (endangered Delmarva fox squirrel and forest interior-dwelling birds) and improving the environmental health of connecting waterways and wetland habitats.
- Increasing avian diversity and abundance of targeted focal bird species.
- Increasing and enhancing native plant resources that conserve invertebrate resources and pollinators that support avian conservation objectives.
- Reducing chemical use associated with non-target negative effects on invertebrates and pollinators.
- Using certain bird, fish, and insect species as umbrella or indicator species.

Alternative B will enhance visitor services through a proposed expansion of the hunting program with greater administrative efficiency, new hiking trails, expanded fishing opportunities, and environmental education programs. Additional staffing is proposed for the following programs: biological, maintenance, law enforcement, and public use.

Alternative C habitat management emphasizes a return to habitat management programs that were conducted on the refuge through most of its existence, but which were stopped in recent years for a variety of reasons. These historic habitat management programs include the use of cooperative farming in upland refuge fields, and management of freshwater wetland impoundments, both conducted for the benefit of migratory birds. Under this alternative, necessary infrastructure and duneline enhancements to re-establish management of freshwater impoundments would be conducted. Upland fields previously enrolled in the cooperative farming program would once again be managed through farming practices with the cooperation of local farmers.

Under this alternative, public use programs would be modified somewhat from current management, but not as extensively as in alternative B. Compared to alternative A (current management), for visitor services programs and refuge uses, alternative C would expand opportunities for hunting and have a greater emphasis on public outreach and education. Fishing, wildlife observation, and wildlife photography would be similar to alternative A (Map 4-25). Compared to alternative B, proposals for hunting in alternative C would decrease the amount of hunting areas and opportunities.

Under alternative C, we would further enhance local community outreach and partnerships, continue to support a friends group, and continue to provide valuable volunteer experiences. We would also promote research and the development of applied management practices through local universities to sustain and enhance natural composition, patterns and processes within their range on the Delmarva Peninsula.

Formulating Alternatives Using Refuge Resources of Concern (ROCs) and Focal Species Management

Relating Resources of Concern to Goals, Objectives, and Strategies

Refuge goals and objectives define each of the management alternatives identified below. As described in chapter 2, the first step in our planning process was to map out the refuge's resources of concern and prioritize focal management species that were used in developing goals and objectives. Goals are intentionally broad, descriptive statements of the desired future condition for the refuge's resources of concern. By design, they are less quantitative and more prescriptive in defining the future desired habitat conditions of our management.

Our goal statements include the principal elements of the refuge purposes and Refuge System mission and refuge-specific habitat vision statement developed by the public. All these inputs provided the framework for stepping down specific management objectives and strategies.

Our goals are common to all of the alternatives, but objectives and strategies vary between alternatives.

A rationale accompanies each objective to explain its context and why we think it is important. We will use the objectives in the alternative selected for the final CCP in writing refuge step-down plans. We identified strategies for each of the objectives. These are specific actions, tools, techniques, or a combination of these that may be used to achieve the objective. Respective lists of strategies under each objective represent a potential suite of actions to be implemented in step-down plans that will achieve the desired future habitat and wildlife outcomes.

The balance of this chapter is organized as follows. Actions common to all alternatives are described first. Each alternative considers each of the six goals set out in chapter 1 (preservation, restoration, and enhancement of BIDEH in four key habitats, public use, and outreach and public partnerships) and describes the different objectives and strategies that will be utilized to achieve that goal.

Actions Considered but Eliminated from Detailed Analysis

Refuge Boundary Expansion

Prime Hook's 4,000 acres of impoundments represent approximately 40 percent of the total 10,000 acres of impoundments in the State of Delaware and 78 percent of the freshwater impoundments within the State. However, refuge impoundments are extremely vulnerable to sea level rise due to their position immediately behind a dynamic coastal barrier, as described in chapter 3. In the last decade this sand dune system has been breached several times, resulting in the deposition of sand and salt water into the Unit II impoundment during storm tides. More recently, storms have created two inlets south of Fowler Beach Road that have created a constant tidal regime. Consequently, the freshwater impoundment created to provide habitat for migratory birds in Unit II has converted to an open water system, which has also impacted the management of the Unit III impoundment. It would be extremely difficult, costly, and unsustainable to reestablish freshwater impoundment management in these units.

Under the preferred alternative, described later in chapter 4, these impoundments will eventually be restored to a natural salt marsh or brackish wetland complex, with a cessation or significant reduction in communities of freshwater annual plants resulting from impoundment management on the refuge. Although salt marsh and brackish wetlands provide valuable migratory bird habitat, conversion of refuge impoundments creates the potential for significant reduction of waterfowl numbers and loss of shorebird habitat. With the loss of Prime Hook's impoundments, 78 percent of the freshwater impoundments within the State of Delaware will have a reduced function and value as habitat for migratory waterfowl. Since freshwater wetlands have greater diversity than saltwater wetlands, State rare plants are vulnerable due to saltwater intrusion, resulting in the refuge's loss of biodiversity.

Radar research indicates how important the refuge's forests are during the migration of neo-tropical migrants (Dawson and Butler 2010). However, surveys show that the refuge contains 125 to 150 acres of dead, dying or stressed woodland habitat due to saltwater intrusion. Mitigating for the loss of this critical and habitat is an important step toward the refuge purpose as envisioned under the Migratory Bird Conservation Act.

As rising sea levels prompt changing habitat conditions along the refuge coastline, salt marsh and brackish wetlands will migrate landward, which is a natural response mechanism. In order to continue providing valuable impoundment and forest habitats, the refuge must consider expanding the refuge boundary toward the west. The refuge currently owns 10,132 acres and has approval to acquire an interest in 1,101 additional acres. It is prudent for the refuge to continue acquiring lands within the approved acquisition boundary from willing sellers, and to manage newly acquired land in a manner consistent with management proposed in this CCP. However, ultimately the refuge will need to pursue and expand the acquisition boundary westward to permit the purchase of additional lands inland from willing sellers. This would enable the refuge to pursue forest management and the potential creation of new freshwater impoundments. Land acquisition, however, is increasingly expensive.

As described in Chapter 3, some 9,000 years ago the Delaware shoreline was about 3 miles east of its current location east. Since the shoreline of the Refuge has retreated some 500 feet over the past 80 years, it is inevitable that the westward migration of land and saltwater will continue,

Expansion of the refuge's acquisition boundary is a necessary future step to meet habitat needs for trust species such as migratory waterfowl, shorebirds, and neotropical migrants, and to contribute to the network of conservation lands and wildlife resources in the regional landscape. However, with input we received from the public during scoping, coupled with reduced land acquisition funding, we are not planning any major refuge boundary expansion as part of this CCP/EIS. Approval to explore refuge boundary expansion comes from the Service's Director, and then expansion requires development of a Land Protection Plan (LPP). We will continue to consider minor acquisitions adjacent to the refuge from willing sellers if the lands are determined to be biologically important, or provide connections with other protected lands. Land protection efforts that emerge outside of this planning process will include significant public involvement in decision making, involve partners in the protection effort, and will utilize the full range of protection methods, including management agreements, conservation easements, and fee acquisition.

Shoreline Stabilization

All oceanfront and bay shorelines erode over time, in part as a natural process and in part as a process exacerbated and accelerated by human activity. Beaches erode naturally due to physical processes (wind, waves, tides, sea level rise, and subsidence). Higher intensity coastal events such as nor'easters, hurricanes, and storm surges accelerate beach erosion or can reconfigure areas of sediment accumulation and erosion. During storms, sand from the visible beach submerges to form storm bars that protect the beach. During milder weather, sediments moved off shore can move landward, so an eroded beach with substantial submerged sand surrounding it may recover naturally.

Human activities and alterations on the coast can also be as catastrophic as hurricanes but over a longer time interval (Kraft et al. 1975, GSA 2009). Human construction activities have caused substantial erosion on the beach face of barrier islands or along sandy shoreline strands (littoral cells) adjacent to a sandy harbor, like in Lewes. Today coastal beaches are eroding for several reasons, such as human-induced changes in sediment transport processes, sand supply, sea level rise, and increased storminess. Eroding beaches generally migrate landward, which is a natural coastal process even under more recent historic rates of sea level rise.

An ecologically ideal and sustainable management response is to allow natural retreat. However, urbanization of beaches and their associated shorelines have resulted in residents of adjacent coastal communities advocating that state or federal agencies actively intervene through hard armoring or soft engineering solutions that temporarily halt the migration of shorelines. Neither solution is free of negative ecological consequences (Komar 1998a). Increased storminess is a predicted consequence of global climate change and will likely result in significant annual changes to the refuge's sandy beach and bayshore habitats. The roles of both traditional hard and soft armoring methods to stabilize sandy beach shorelines have been considered during the development of the CCP/EIS.

Hard Engineering Methods to Stabilize Shorelines

Hard engineering methods are often positioned in marine environments to offset erosion in sediment-deficient areas, or to prevent accretion in dynamic areas such as inlets. Hard engineering methods to stabilize shorelines include groins, sea walls, revetments, rock armoring, and bulkheads. Often, hard armoring techniques implemented to solve coastal erosion problems result in accelerated erosion rates and measures used to reduce coastal erosion at one location will often create coastal erosion problems at other coastal locations, north or south of the armored areas.

Delaware coastal scientists have noted that if there is an inadequate supply of sand in a given location, hard armoring cannot control erosion (DNREC 2004, Maurmeyer 1978, Kraft et al. 1975). In the absence of an adequate sand supply, hard structures such as seawalls, bulkheads, and revetments may be effective in protecting properties in the upland, but often at the expense of the sandy beach ecosystem and back-barrier island habitats, by curtailing and cutting off sediment flow. Disruption or changes in the littoral drift and flow of sediment negatively impact sediment budgets of natural dune and beach ecosystems. These engineering techniques also impede the natural landward migration of the shoreline (Kraft et al. 1975).

From the 1920s to the late 1970s, shoreline hardening techniques were used in Delaware. For example, groin fields were established on Broadkill Beach in tandem with beach nourishment to protect beach houses. Similar shoreline hardening combined with soft hardening techniques were used from the 1940s through the 1970s in Slaughter Beach, where groin fields, bulkheads, and riprap,

coupled with beach nourishment had been historically employed to stabilize Delaware Bay shorelines immediately north and south of the refuge (DNREC 2004). However, it is pointed out by DNREC coastal scientists that it is the sand and sediment that ultimately serves best to temporarily protect beach properties, not the groins or other shoreline hardening techniques used in the past.

Importantly, if a hard structure diverts the existing sediment supply from other areas, it will be necessary to perpetually add sediment into the system to compensate for such impacts. Thus, this approach does not meet one of the fundamental parameters for a satisfactory alternative, i.e. that the alternative be sustainable ecologically.

Since the late 1970s, the State of Delaware has no longer included shoreline hard armoring of ocean or bay shorelines as part of its primary coastal management strategies. Additionally, Federal coastal scientists suggest that, before using either hard or soft stabilization of any shoreline, the effect of these coastal management techniques on the local sediment budget must be appropriately analyzed to eliminate or reduce adverse environmental problems and negative impacts on barrier beach island integrity and functioning (NOAA 2011).

Shoreline transgression is necessary to maintain the biological integrity, diversity and environmental health (BIDEH) of Barrier Beach Island and salt marsh habitats in the face of rising rates of sea level and climate change. Hard armoring is also a very expensive technique with little to no capability of stemming coastal erosion in the long term. Hard armoring was eliminated as an alternative from detailed analysis in this CCP because of its adverse impacts, its lack of sustainability and the probably need for perpetual sand replenishment to address its like adverse impacts, its inconsistency with BIDEH policies, and the fact that its high cost.

Soft Engineering Methods to Stabilize Shorelines

Beach scraping involves mechanically moving sand from the intertidal zone to the dune or upper beach. Beach scraping is intended to mimic natural beach recovery processes, but at an increased recovery rate, and is regarded by some as being suitable only under certain circumstances for coastal protection, such as when there is sufficient material in the intertidal zone to sustain the beach profile (Wells and McNinch 1991). Beach scraping can have negative consequences on the beach biota (Peterson et al. 2000) and in some situations can worsen shoreline erosion (Kerhin and Halka 1981). Beach scraping is not suitable for severely eroding beaches (Wells and McNinch 1991). In 2010, the community of Primehook Beach was denied a State permit for beach scraping on the basis of several concerns, including the potential for increased erosion (DNREC 2010).

Shoreline stabilization using on-site material can also be accomplished by mechanically moving sand that has washed landward from the dunes back onto the duneline. The material can be reconfigured to create berms and dunes and provide shoreline stabilization without using sand from the intertidal zone as is done with beach scraping. Such stabilization was conducted along Unit II in the fall of 2010, following the preparation of an Environmental Assessment (USFWS 2010). The project had been delayed by litigation, and by the time it was conducted Hurricane Irene had washed away much of the material that was to be utilized for the stabilization. The resulting project was smaller than originally planned and lasted only a short time before the closed inlets were opened again during a high tide event. For this reason, this approach has been dismissed from further consideration. There is no longer enough sandy sediment along the Unit II shoreline to make this technique feasible.

Actions Common to all Alternatives

All of the alternatives share some common actions. Some are required by law or policy, or represent NEPA decisions that have recently gone through public review and are binding in many of our decisions. Other may be administrative actions that do not require public review, but are highlighted in this public document. They may be actions crucial to achieving refuge purposes, vision, and goals. There are at least 17 components of refuge management that are common to all alternatives and are described below. They include:

- conducting adaptive resource management
- managing invasive species
- monitoring and abatement of diseases affecting wildlife and forest health
- control of pest animals
- removing unnecessary structures and site restoration
- coordinating with the State regarding the Prime Hook Wildlife Area
- maintaining regional and community partnerships
- community relations
- conducting appropriate use and compatibility determinations
- facilitating and conducting biological research and investigations
- commercial and economic uses
- providing opportunities for wildlife-dependent recreation
- protection of cultural resources
- refuge wilderness review
- refuge staffing and administration
- distributing refuge revenue sharing payments

Adaptive Resource Management

In all of the alternatives, CCP goals and objectives were developed to support rationales and management strategies by using a thorough assessment of available science derived from scientific literature, on-site refuge data, expert opinion within and outside the Service, and sound professional judgment. Biological objectives describe desired future conditions for wildlife and refuge habitats.

In all the alternatives, it is assumed that we employ adaptive resource management as a strategy to ensure a quick and efficient response to new information and events. The need for adaptive management is compelling because our present knowledge and information on refuge habitats and species is incomplete, provisional, and subject to change as new information is acquired. Adaptive management is a proactive process of learning what works on the ground by constantly adjusting strategies to respond to new information, spatial and temporal changes, and environmental and climatic events, whether foreseen or unforeseen, measured against a clearly defined goal or set of conditions.

On March 9, 2007, the Secretary of the Interior issued Order No. 3270 that provides policy on the procedures for implementing adaptive management in DOI agencies. A published guidebook for managers and practitioners defines adaptive management and the conditions under which we should consider it, and the process for implementing and evaluating its effectiveness. You may view this reference at the following site: <http://www.doi.gov/initiatives/AdaptiveManagement/documents.html>; accessed February 2012. As it relates to refuge management, adaptive management promotes flexible decision-making through an iterative learning process to deal with uncertainty, resulting in more effective decisions. At the refuge level, monitoring habitat management actions and outcomes and key resources of concern will be critical to the process.

Climate change is expected to exacerbate the current rate of habitat fragmentation and loss, change habitat composition and structure, simplify ecosystem function, increase the prevalence of weed and disease species, degrade

water quality, and alter hydrology. It will be especially important to continually evaluate management activities and the status of the refuge's resources in order to respond to negative impacts in a meaningful way as quickly as possible.

At the refuge level, monitoring and assessing management actions and outcomes, and tracking critical resources and indicators of environmental health will be very important. The refuge will be responsible for changing management actions and strategies if they do not produce the desired conditions. Significant changes in management actions and strategies from what we present in our final CCP may warrant additional NEPA analysis and public comment. Minor changes will be documented as an important element of the adaptive management process; NEPA analysis and public comment are not warranted.

Many of our alternative's objectives identify increased monitoring elements. If monitoring activities are conducted by non-Service personnel, these activities must be determined compatible by the refuge manager in a compatibility determination. Our future habitat and species inventory and monitoring plan will detail how and what we monitor and will also incorporate an adaptive management approach to support the goals and objectives of the refuge.

Managing Invasive Species

The establishment and spread of invasive species, especially invasive plants, is a major problem that reaches across all refuge habitat cover-types. We use the definition of invasive species found in the Service Manual (620 FW 1.4E):

Invasive species are alien species whose introduction does or is likely to cause economic or environmental harm, or harm to human health. Alien species, or non-indigenous species, are species that are not native to a particular ecosystem. We are prohibited by Executive Order, law and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction of invasive species in the United States or elsewhere.

The unchecked spread of invasive plants threatens the biological integrity, diversity, and environmental health of all refuge habitats. In many cases, invasive species have a competitive advantage over native plants and out-compete them, reducing the availability of desirable native food and cover plants for wildlife. Invasive plants reproduce rapidly over large areas of the landscape and have few or no natural controls to keep them in check. Invasive vegetation usually spreads aggressively by runners or rhizomes, produces large numbers of seeds and disperses seeds through various means such as wind, water, wildlife, or people. Invasive wildlife, is best held in check through alert monitoring; if found, appropriate techniques need to be matched to the particular species of concern.

Controlling and managing invasive species is a strategy for maintaining the biological integrity and diversity of all habitats. The fulfilling the promise national invasive species management strategy team developed a national strategy for managing invasive species for the National Wildlife Refuge System in 2002. The strategy recommends the following priority order of action for invasive species management:

- 1) Prevent invasion of potential invaders
- 2) Eradicate new or small infestations
- 3) Control or contain large established infestations

Potential management strategies for preventing invasive species, prioritizing control efforts for established invasive species, and controlling invasive species are described in detail below. Prior to the initiation of invasive species control

efforts, refuge staff must understand the biology of the species to be controlled. A number of resources are available on the internet to assist with this. Some sources are included below (all accessed February 2012):

- National Invasive Species Information Center <http://invasivespeciesinfo.gov/index.shtml>
- USGS Invasive Species Program <http://biology.usgs.gov/invasive/>
- Weeds Gone Wild <http://www.nps.gov/plants/alien/index.htm>

Refuge staff should conduct appropriate and applicable pest detection, environmental surveillance, and monitoring before, during, and after any management activity to determine whether pest management goals are achieved and whether activity caused any significant unanticipated effects. The lowest risk, most targeted approach for managing invasive species should always be utilized.

Early Detection and Rapid Response

Where prevention is not possible, early detection and rapid response are the next best strategies. Success will depend in part on participation by all refuge staff, contractors, volunteers, and visitors in efforts to report and respond to invasions. The refuge manager must have access to up-to-date reliable scientific and management information on species that are likely to invade. The Delaware Invasive Species Council of the Delaware Department of Agriculture (DDA) is an important source of information <http://www.delawareinvasives.net>; accessed February 2012.

For some species, an active monitoring protocol may be established to facilitate early detection. For example, artificial substrates may be suspended in water bodies and checked regularly for the early detection of zebra mussel on the refuge. When small plant infestations are spotted, they should be eradicated as soon as possible. Sites must then be monitored for the appropriate time period considering the species involved to ensure the control was effective.

Prioritizing Invasive Plant Species Control Efforts

The first step in prioritizing invasive species control efforts is to determine the abundance and distribution of invasive species on the refuge or management unit. However, control efforts should not be delayed to collect statistically rigorous survey data. Baseline data regarding the location of many invasives on the refuge already may be available from observations of staff, volunteers, contractors, and refuge visitors. These observations should be documented and mapped on refuge GIS. If a more formalized mapping procedure is desired, the North American Weed Management Association (<http://www.nawma.org>; accessed February 2012) has information on mapping procedures.

There are a number of ranking tools to assist land managers with the daunting task of prioritizing their invasive plant control efforts (Morse et al. 2004, Hierbert and Stubbendieck 1993, APRS Implementation Team 2000). The Fulfilling the Promise team recommends using the following order of priority to determine appropriate actions: smallest scale of infestation, poses greatest threat to land management objectives, and greatest ease of control.

When limited resources prevent the treatment of entire populations, the following order of priority is recommended: treat the smallest infestations (satellite populations), treat infestations on pathways of spread, and treat the perimeter and advancing front of large infestations.

To prevent the spread of invasives along transportation corridors, maintain invasive species-free zones along trails, around parking lots and boat launches, and at other related facilities. These areas will be inspected often, and new infestations will be controlled immediately. Minimize the number and size of roads on the refuge. Remove all mud, dirt, and plant parts from all equipment between projects or when equipment is moved from one location to another.

Incorporating Invasive Species Prevention in Impounded and Other Emergent Wetland Areas

To minimize infrastructure development in managed wetland units we will remove or revegetate dikes, waterways, and access roads found to be unnecessary for meeting management objectives. These often are sources of infestation and provide pathways for the spread of invasives. We will plant native grass mixes that establish quickly to stabilize banks and dikes and prevent the establishment of invasive species. Native grass mixes should include annual ryegrass (*Lolium perenne*) so bare soil is not exposed to erosion or invasive plant seeds and rhizomes. This non-native plant will establish quickly and then drop out of the mix after one or two years.

Timing water manipulation activities, such as flooding and drawdowns, to minimize the germination and spread of invasive plant seeds and encourage the growth of native species. Prolonged flooding can be used to stunt the growth of some invasive species. Water level management can also be used to control invasive plants. Robust plants such as *Phragmites* (common reed) require air pockets (carbon dioxide) to survive. Flooding the impoundment through all or part of a growing season, particularly after mowing or chemical application, discourages vegetative re-growth of robust invasives like *Phragmites*.

Mechanical

Mechanical removal of invasive organisms can be effective against some herbaceous plants, shrubs and saplings, and aquatic organisms. This is particularly effective for plants that 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 resprout. Treatments should be timed to prevent seed set and resprouting. 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 (removing cambium layer), mulching, tilling, smothering, 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 and inability to control large areas. For many invasive species, mechanical treatments alone are not effective, especially for mature or well-established plants. For some invasive plants, mechanical treatment alone exacerbates the problem. Mechanical treatments are most effective when combined with herbicide treatments.

Herbicides

There are many chemicals available to control invasive plants. They may work in different ways and be very target-specific, or affect a wide range of species. Herbicides may be pre-emergent, i.e., applied prior to germination to prevent germination or kill the seedling, or post-emergent and have various modes of action (auxin mimic, amino acid inhibitor, mitosis inhibitor, photosynthesis inhibitor, lipid biosynthesis inhibitor). Products may come in granular, pelleted, dust or liquid forms. Common application methods include foliar spray, basal

bark, hack and squirt, injection, and cut stump. The timing of applications is critical to achieve good control, as the growth stage at which an invasive plant will be most effectively controlled varies with different species.

The advantages are that the right 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 or contaminate surface or groundwater. Proper planning includes using the most target-specific, least hazardous (for humans and the environment), and most effective chemical for the job. Additionally, one should research minimum effective dosage, as the chemical labels often give higher than necessary concentrations. Herbicides often are most effective when used in combination with mechanical methods.

Within refuge lands, all chemicals, including adjuvants designed to enhance effectiveness are covered by Service and Departmental regulations, and a pesticide use proposal (PUP) is required for all pesticide applications. Attention to protective gear, licensing requirements and other regulations is essential.

Prescribed Burning

Fire is a critical tool for managing ecosystems. It recycles vital nutrients, stimulates growth, and provides quality habitat for a variety of species, especially when it is used to control invasive plants like *Phragmites*, in conjunction with other techniques like herbicides and mechanical removal. Regular fires also help check the risk of catastrophic fire by reducing accumulation of hazardous fuels by clearing underbrush and dead vegetation.

Over 90 percent of hazardous fuels reduction on the refuge has been accomplished through strategic use of fire in conjunction with herbicides to reduce large stands of *Phragmites*. A comprehensive monitoring plan was established in 2002 with 45 transects spread across all four management units as part of the initiation of a large wildland urban interface project conducted in 2002 through 2004. These established transects continue to be monitored to track *Phragmites* control in relation to original 2002 treatment sites in all alternatives considered. Maps and the monitoring plan can be located in the refuge's 2009 fire management plan.

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 artificially high numbers of the control agent are fostered and maintained. There are also conservation or augmentation biological control methods in which populations of biological agents already in the environment (native) are maintained or enhanced to target an 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. Appropriate control agents do not exist for all invasive species. Petitions are submitted and approved by the USDA Technical Advisory Group on weed biological control before any proposed biological control agent can be released in the United States.

Methods are in development to biologically control two of our most invasive plant species—common reed (*Phragmites australis*) and mile-a-minute (*Persicaria perfoliata*). Biological control organisms for common reed are still in the experimental stages; therefore that strategy cannot yet be explored. However, mile-a-minute biological control organisms are closer to being ready for field use. Biological control of invasive species is not being pursued under this CCP, but may be explored in the future, pursuant to NEPA compliance at that time.

Mile-a-minute is an annual vine of Asian origin that infests refuge forested areas, roadsides, and drainage ditches. In areas in full sun, by early spring it rapidly outgrows and out-competes native plants, and is often the first colonizer in refuge areas that have been reclaimed from *Phragmites* dominance. It is a weed that poses a particularly strong threat to forest regeneration and could potentially provide considerable setbacks in reforestation and forest enhancement projects.

A biological control program targeting mile-a-minute weed was initiated by the Forest Service in 1996, with field surveys and laboratory host specificity tests conducted in China and subsequent testing continuing under quarantine conditions in Delaware. A stem-boring weevil, *Rhinoncomimus latipes*, was determined to be host-specific to mile-a-minute (Price et al. 2003, Colpetzer et al. 2004), and a permit application for field release was approved in July 2004. Development of a rapid germination protocol and field successes in Delaware have been documented (Colpetzer et al. 2004, Hough-Goldstein et al. 2008).

Of the 426 plant taxa listed for the refuge, 45 are non-native; among those are considered invasive on Prime Hook NWR are:

- (*Centaurea biebersteii*)—spotted knapweed
- (*Cirsium arvense*)—Canada thistle
- (*Hydrilla verticillata*)—hydrilla
- (*Lonicera japonica*)—Japanese honeysuckle
- (*Ludwigia leptocarpa*)—water willow
- (*Microstegium vimineum*)—Japanese stiltgrass
- (*Phalaris arundinacea*)—reed canary grass
- (*Phragmites australis*)—alien common reed
- (*Polygonum perfoliatum*)—mile-a-minute
- (*Pueraria montana*)—kudzu
- (*Rosa multiflora*)—multi-floral rose
- (*Sorghum halepense*)—Johnson grass
- (*Elaeagnus umbellata*)—autumn olive

Spotted knapweed, Canada thistle, and Johnson grass are mostly found on roadside areas, agricultural fields, and early successional habitats throughout the refuge. Water willow, which is adventive in Delaware (i.e., native further south), dominates about 100 to 200 acres within the Unit III impounded emergent marsh along Prime Hook Beach Road. Japanese stiltgrass (approximately 50 acres) is restricted to Oak Island, where it dominates the herbaceous layer. Japanese honeysuckle is ubiquitous on the refuge in wooded habitats. Reed canary grass, another adventive species in Delaware, dominates old field habitats also located in Unit III.

By far, the most problematic invasive plant historically and currently on the refuge is *Phragmites*. Its proliferation in the refuge's marshland and upland interface is a signature of man-made wetland alternations and activities creating constant habitat disturbances (water level management actions, open marsh water management excavations, and eutrophication from off-refuge nutrient sources). These disturbances have made it an annual requirement to monitor and treat *Phragmites*. In 1983, the refuge conducted an environmental assessment on the marsh vegetation rehabilitation and chemical control of *Phragmites*.

A fundamental concern to control *Phragmites* on the refuge is the grave fire hazard it presents as a potential danger to local beach communities adjacent to refuge lands. A second concern is the reduction of environmental health and biodiversity that occurs when native plant species are replaced by aggressive exotics. Competitively superior exotic genotypes have displaced former

indigenous *Phragmites* populations in North America, especially in the mid-Atlantic through heavy shipping channels from European trade (Saltonstall 2002). Commensurate with a shift to an exotic *Phragmites* monoculture is an unhealthy reduction in avian, insect, and other important floral and faunal assemblages.

The biggest invasive problems and accumulation of hazardous fuel-loading has occurred in the refuge's marsh areas. Marsh management practices and lack of funding contributed to a build-up of highly flammable *Phragmites* fuels on refuge lands immediately adjacent to three private beach communities. Dense stands over 15 feet high with accumulation of dead canes created severe fuel hazards, as these canes can persist for up to four years. The exotic m-haploid type prevalent in the mid-Atlantic can grow over 14 feet tall annually and primarily spreads by the growth of rhizomes that can extend 150 feet from a single cane stem per season. The plant can also reproduce via seed; seeds dispersed by wind or water from off-refuge sites are quickly establishing on refuge sites that have high water tables or are seasonally flooded. By the end of the 1999 and 2000 growing seasons, more than 3,000 acres of *Phragmites* persisted on the refuge.

Within the context of Federal wildland fire policy and wildland urban interface protection concerns and habitat conditions on the refuge, it became evident that wildland urban interface fire protection and prevention required immediate attention. The major focus occurs along the refuge's eastern boundary; Prime Hook Beach and Broadkill Beach were identified in 2002 by the Delaware State Forester and included in the vicinity of Federal lands published in the *Federal Register*. In three beach communities, approximately 750 homes are at risk. Periodic arson-set fires also increase fire risks to these communities, each with poor access and lack of defensible space.

The use of fire in invasive species control of *Phragmites* for public safety and natural resource protection is fully addressed in our updated fire management plan, which will be implemented under all three alternatives. The use of prescribed fire and full suppression of all wildfires occurred under previous refuge management. Prescribed fire was used by managers to reduce fuel hazards, achieve resource management objectives, and simulate natural fire processes. Natural ignitions or human caused wildfire will not be allowed to burn without suppression.

In addition, a program for continued monitoring and treatment of hazard fuel zones near the three wildland urban interface communities is now formally included in the refuge's fire plan (2009). This continues fuel management practices initiated in 2001 in primary treatment zones (zero tolerance zones, approximately 800 acres) and secondary treatment zones (limited tolerance zones, approximately 2,000 acres) to continue reduction of hazard fuels to reduce risks and threats to nearby communities.

Monitoring and Abating Wildlife and Plant Diseases

We derive guidance on this topic from the Refuge Manual and directives from the Service Director or the Secretary of the Interior. The Refuge Manual (7 RM 17.3) lists three objectives for the prevention and control of disease:

- Manage wildlife populations and habitats to minimize the contraction and contagion of disease
- Provide for the early detection and identification of disease mortality when it occurs
- Minimize the losses of wildlife from outbreaks of disease

Disease prevention is far more cost-effective and resource protective than disease control. However, when disease outbreaks do occur, aggressive and responsible control activities can save considerable numbers of wildlife (7 RM 17.5).

In 2006, the Service instructed all refuges to prepare an avian influenza (AI) surveillance and disease contingency plan specific to their sites following the criteria established by the national plan. The goal of the national interagency AI plan was to structure a unified national system for the early detection of Asian H5N1-HPAI in migratory birds. Data collected throughout the country were assimilated and used from a national database.

The refuge's approved AI plan (2006) describes local wild avian ecology and management practices and the known risk factors for H5N1-HPAI adjacent to Prime Hook NWR in Sussex County. The poultry industry in Delaware is the most important agricultural business in the state. Delaware ranks tenth in the nation in broiler production (approximately 243,000,000 birds). Statewide, the industry is represented by 900 chicken farms, with the largest portion located in Sussex County (Delmarva Poultry Industry 2008 Factsheet - http://www.dpichicken.org/faq_facts/; accessed February 2012).

Avian influenza sampling of migratory shorebird and waterfowl bird species found on and near the refuge has been ongoing since 2005 in several collaborative efforts with Maryland and Delaware State agencies, universities, and with USDA Wildlife Services. Specific AI disease surveillance and monitoring actions and outbreak responses (bio-containment, work practices, and sanitation protocols) are all described in the refuge's AI surveillance and disease contingency plan. Management actions are the same for all three alternatives.

In Delaware, chronic wasting disease (CWD) is another prevalent wildlife disease of concern. CWD is a transmissible spongiform encephalopathy of deer and elk in North America. It is a rare, fatal, and transmissible disease of the central nervous system whose causative agent is abnormal prion proteins. CWD is spread by direct contact between infected animals and indirectly through contaminated environments.

The Service recognizes that CWD presents a threat to refuge deer populations and deer populations in the surrounding area. The refuge's approved chronic wasting disease surveillance and contingency plan (2008) provides a mechanism for early detection of CWD on the refuge through collaboration with the State of Delaware in detecting and controlling CWD by assisting DNREC with monitoring.

In addition to wildlife diseases, we will be attentive to diseases that affect forest health. Since we place high value on oak hardwood forests on the refuge, diseases pertaining to oaks are of special concern.

Oak trees in the U.S. are affected by more than 80 documented insects and diseases, with escalating international trade likely to introduce new pests. Impacts of these pests range from minor defoliation to rapid mortality. In some years, pests cause the loss of a major portion of the acorn crop, impeding oak regeneration. A few pests have altered or may alter eastern U.S. oak forests on a broad scale. For example, the spread of the introduced gypsy moth, a defoliator, has been aided in the last few decades by the accidental transport of egg masses by humans.

General strategies for disease prevention and control include

- continue to conduct disease surveillance in conjunction with other field work;
- cooperate with State agencies, particularly Delaware Division of Fish and Wildlife and the U.S. Forest Service, in conducting surveillance, providing access for sampling, and following protocols in the event of an outbreak;
- inform volunteers and others who work in the field about the dangers of Lyme disease and measures to avoid contracting the disease;
- monitor forests and other habitats for indicators of increased occurrence of pests or disease. For example, note changes in flowering or fruiting phenology, physical damage, decay, weakening, sudden death, particularly of canopy and source trees of major host species. Note changes in wildlife use of habitats such as the absence of breeding birds that used to be seen regularly;
- use silvicultural practices such as thinning, prescribed burns, and stand improvements that may relieve stress; and
- follow protocols outlined in national, State, and refuge-specific disease prevention and control plans.

Control of Non-Native and Other Pest Animals

Many exotic animals and at times native animals can interfere with management objectives. The Refuge Manual (7 RM 14.4A) defines an animal pest as “any terrestrial or aquatic animal which interferes, or threatens to interfere, at an unacceptable level, with the attainment of refuge objectives or which poses a threat to human health.” In order to meet management objectives under all alternatives, pest animals will be controlled on the refuge to maintain acceptable population sizes. Acceptable population sizes vary with species and management situation. The impacts of specific pest animal species or groups are described further below.

In controlling animal pests, whether alien or native species, we use an integrated approach. Integrated pest management is defined as “a dynamic approach to pest management which utilizes a full knowledge of a pest problem through understanding of the ecology of the pest and ecologically related organisms and through continuous monitoring of their populations. Once an acceptable level of pest damage is determined, control programs are carefully designed using a combination of compatible techniques to limit damage to that level.” We will use integrated pest management to control pests, which is a sustainable ecosystem-based decisionmaking process for managing invasive species, pests, and diseases through a combination of biological, physical, cultural, chemical, and other practices. The goal of integrated pest management is to remove or reduce only the target organism(s) with the least possible risk to other organisms. Pest animals that present problems to refuge management include overabundance of resident Canada geese, mute swans, nutria, beaver, muskrat, and furbearers such as raccoons and foxes and birds such as gulls and crows that can cause unacceptable levels of predation on migrating and breeding shorebirds.

We will use the following strategies in animal pest management:

- Determine the need for site-specific control based on the potential to negatively affect wildlife and habitat management objectives on the refuge.
- Employ integrated pest management techniques when a species is having a significant impact on an area resulting in major habitat replacement or damaging rare species.

- Monitor results to ensure that pests do not exceed acceptable levels.
- Use predator management as one of several actions to support State and federally endangered or threatened migrating birds and to increase the productivity of breeding federally listed and State-listed bird species.

Although we will employ an adaptive management approach to pest animal problems, we also expect that lethal control or removal of individual animals will be required. Unfortunately, establishing general thresholds for lethal action is difficult. Instead, a case-by-case analysis and specific site characteristics will be used to determine the best solutions as needed to fulfill habitat and wildlife management objectives. For example, an annual predator management program would be used to increase the productivity of listed State endangered and threatened shorebird species and protect migrating shorebird species using refuge beach habitats. In the case of lethal control of resident Canada geese for habitat protection, the appropriate permits are acquired annually from the Service Migratory Bird Office.

Trapping or lethal control of mammals will be relied on as a management practice to control predators and manage pest animals that negatively impact refuge habitats or impoundment infrastructure (e.g., nutria or muskrat that burrow in refuge dikes). Trapping to control beaver, muskrats, or nutria can help to protect desirable vegetation, achieve desirable interspersion of wetland vegetation, and protect rarer species. Reasons for using trapping as a major tool for controlling animal pests on the refuge include protection of migratory birds and threatened or endangered species, habitat or wildlife population management, and rare vegetation communities and associated invertebrate species. Trapping is also useful for surveys and monitoring of some species, facilities protection, research, feral animal control, disease control, and public health and safety.

Resident Non-Migratory Canada Geese

Herbivory by resident Canada geese during the growing season impacts wetland vegetation, rendering the resident individual of this species as a pest at that time of the year. Research at nearby refuges has shown a reduction in the amount of plant biomass that would be available to migrant birds at the end of the growing season (Laskowski et al. 2002). To address well-documented concerns regarding the impacts of resident Canada geese on habitats and public property, the Service issued new regulations for control of non-migratory resident geese [(vol#71 *Federal Register* page#45964-45993(2006))].

Mute Swan

Similarly, the non-native mute swan's feeding behaviors pose a threat to the ecological integrity of wetland habitats. Introduced to North America in the 1800s, mute swans escaped captivity and established wild populations, which have grown exponentially in recent decades (Atlantic Flyway Council 2003). Mute swans can consume large quantities of submerged aquatic vegetation, damaging sensitive wetland areas and reducing food availability for native bird and fish species. They can exhibit aggressive territorial behavior toward native bird species and humans. The Atlantic Flyway Council mute swan management plan (Atlantic Flyway Council 2003) recommends that the U.S. Fish and Wildlife Service and other land managers actively control this species. The species was removed from Federal protection by the Migratory Bird Treaty Act Reform of 2004 and is excluded from State protection under State regulation, permitting their control as the refuge deems necessary. Any apparent invasion of mute swan on refuge lands or waters will warrant an immediate lethal removal program.

Nutria

Nutria are native to South America and were first introduced into the United States to California in 1899 and then to southern states in the early 20th century for fur farming and weed control. Nutria use marsh vegetation to create resting platforms and consume whole plants, including roots and tubers, creating holes in the marsh which eventually become open water when the fluid sediment erodes with tidal action (Harris and Webert 1962, Foote and Johnson 1993, Linscombe and Kinler 1997). Since their introduction, nutria have contributed to the destruction of more than 7,000 acres of marsh on the Blackwater NWR (TCBNWG 2003). Fortunately, at this time, there have been limited sightings of nutria in the State of Delaware, though they have become a serious pest in the Maryland portions of the Chesapeake Bay, and may yet find easy access to Delaware through the Choptank and Nanticoke River drainages. The refuge will be monitored for nutria. Any apparent invasion of nutria into refuge marshes will warrant an immediate lethal removal program.

Beaver and Muskrat

Beaver and muskrat are native aquatic rodents and as such, are an important component of the refuge ecosystem. However, at times both species do pose a nuisance for human and refuge management infrastructure. When nuisance animals are impacting refuge management capabilities, they may be trapped and removed.

Red Fox, Raccoon, Gulls and Crows

Red fox, raccoon, gulls, and crows have been documented as predators upon nesting birds, eggs, and chicks. Predation is a natural process and is not normally considered a management issue for the continued productivity and survival of species across a biologically diverse and healthy landscape. However, some habitats have been so fragmented and reduced by human impacts that intervention is considered critical for the continued survival of some species. Some shorebirds, such as the federally threatened piping plover and colonial beach nesting bird populations, are especially vulnerable to loss of suitable nesting habitat due to high sensitivity to human disturbance.

Given the plight of migratory birds requiring beach or island nesting habitats, the refuge may utilize a predator management program for the benefit of these species. The program would entail lethal removal of animals that frequent specific tracts or habitats where birds would likely nest, i.e., problem predators. Removal will be conducted by refuge staff or contractual employees, immediately prior to or during the nesting season.

Maintaining Regional and Community Partnerships

Partnerships are essential for this refuge to accomplish natural resource conservation mandates and meet wildlife, habitat, and visitor service objectives. Working in partnership encourages broader cooperation between the Service and local communities, interest groups, and other agencies. The Service can be a resource to the community in providing valuable technical assistance to area conservation groups. Sharing resources where mutually compatible conservation objectives are apparent is cost-effective and in the best interest of the Service, the partner organization, and the public.

All the alternatives would maintain the existing partnerships identified in chapter 3 while also seeking new ones consistent with refuge goals and objectives. The Delaware Division of Fish and Wildlife, Ducks Unlimited, the Nature Conservancy of Delaware, the Conservation Fund, U.S. Geological Survey, Southern Delaware Tourism, local Chambers of Commerce, and many others have been particularly important and valued partners. These relationships are vital to our success in managing all aspects of the refuge—conserving land,

managing habitats and protecting species, outreach and education, and providing wildlife-dependent recreation.

Under all alternatives, we will continue to work cooperatively with the Delaware Division of Fish and Wildlife to develop a management plan for wildlife management and public recreational use of this area and associated waters, including Prime Hook Creek. We will also work with them to complete a memorandum of understanding to coordinate activities within the State boundary.

We will continue to work closely with other offices within the Service on mutually important issues and seek new opportunities to find cooperative solutions to problems that affect the refuge but are beyond the ability of the refuge alone to address. One important example is the management of snow goose populations, which will require cooperation with the Migratory Bird Office, as well as State agencies and private landowners. On this issue, we will work with State and local partners on outreach, and with regional and MBO biologists on monitoring and developing population targets.

Citizen involvement is critical to the well-being of the Refuge System and the natural resources that depend on those lands. When local citizens and other stakeholders of a refuge can see firsthand our conservation work, they become an informed constituency on behalf of conservation.

The Friends of Prime Hook National Wildlife Refuge, Inc. (friends group) and refuge volunteers have been extremely helpful in promoting an appreciation of natural and cultural resource conservation and facilitating the implementation of priority refuge projects. The friends group is instrumental in conducting outreach about the refuge and its opportunities to the community and in accomplishing many programs through their hard work, dedication, and fundraising efforts. Refuge volunteers are instrumental in refuge management activities including maintenance, habitat management, visitor services, and outreach programs.

Refuge volunteers and the friends group play a vital role in the conservation and management of our natural and cultural resources. The refuge currently has an active volunteer program involving more than 100 citizens. These volunteers contribute 6,000 hours annually, assisting with a full range of administrative, biological monitoring, invasive species control, and visitor services tasks. The nurturing and use of volunteers will continue as a vital component of many of the objectives outlined in the draft CCP/EIS. The Friends of Prime Hook, a citizen-based friends group, also raises funds for needed projects, conducts special programs which support the goals of the refuge and the mission of the Refuge System, and works to educate the public. Like volunteers, the friends group will play an important role in the strategies to achieve many of the objectives outlined in this document.

Strategies Common to All Alternatives

- Continue to maintain the collaborative relationship with Federal, State, and local governmental agencies to meet natural resource mandates and objectives. Examples include providing office space for USDA Wildlife Services; coordinating the waterfowl hunting program on the adjacent Prime Hook Wildlife Area of the Delaware Division of Fish and Wildlife; accomplishing refuge projects with the aid of crews from the Delaware Department of Corrections, water level management projects with Ducks Unlimited, land acquisition with The Conservation Fund and The Nature Conservancy of Delaware, and biological and visitor surveys with U.S. Geological Survey.

- Work with conservation partners to achieve common goals; establish memorandums of understanding (MOU), memorandums of agreement (MOA), and cooperative agreements as appropriate.
- Share resources, equipment, and/or expertise with State and private landowners.
- Continue to support and offer guidance to the Friends of Prime Hook National Wildlife Refuge organization.
 - ✱ Work with the friends group to continue to seek outside support for refuge projects, develop public use programs, coordinate refuge projects, operate the sales outlet, plan and conduct public events, conduct community outreach, promote national Service initiatives as they develop, and respond to public inquiries about the refuge.
 - Continue to partner with the Friends of Prime Hook, refuge volunteers, and other partners to assist with maintenance of trails, observation platforms, photography blinds, and benches and to promote opportunities in wildlife observation and photography.
 - Continue to partner with the Friends of Prime Hook to host the nature photography contest and exhibition.
 - ✱ Continually update the memorandum of agreement between the friends group and the Service.
 - ✱ Continue to provide a primary liaison between the friends group and the Service.
 - ✱ Continue to support the friends group newsletter, distributed to their membership by regularly providing information, articles, and photos about refuge management and visitor services programs.
 - ✱ Continue to work with the friends group on a regular basis to seek alternative funding sources and partnerships for various projects to benefit the refuge.
- Continue to offer volunteer opportunities to assist with accomplishing projects in the refuge's biological, maintenance, and visitor services program areas and in carrying out the mission of the Service and Refuge System.
 - ✱ Continue to implement volunteer recruitment, training, and appreciation/recognition events.
 - ✱ Continue to implement the resident volunteer work-camper program.
 - ✱ Continue to maintain and observe tree swallow and bluebird nest boxes for public viewing, pending volunteer support.
 - ✱ Continue to provide refuge-sponsored guided birding field trips by volunteers.
- Continue to collaborate with educational institutions to conduct research and investigations seeking answers to important natural resource issues on the refuge and within the Refuge System, and contribute our basic understanding of important natural resource issues worldwide.

Community Relations and Outreach

Community Outreach

From the results of a refuge visitor and community survey conducted in 2004 and 2005 by U.S. Geological Survey (Sexton et al. 2007), nearly a quarter of the community members and refuge visitors are unsure about their level of trust in decisions that the Service makes about managing the refuge. The community surrounding the refuge is aware of and engaged in natural resources decision making in both passive activities, such as signing a petition, and active activities, such as joining a special interest group or attending a public meeting. It is important, if we are to be a valued part of the communities we serve, that we communicate often with our local citizens. News articles and personal appearances inform our neighbors about what we are doing and why, which we hope will lead to increased understanding, appreciation, and support of our programs. Feedback we receive from these outreach efforts allows us to better understand issues that are important in our communities, and how our management may affect them. A planning process such as development of the CCP is an opportunity to build relationships and improve trust not only with visitors and community residents with whom the refuge has established relationships, but also with those who are less familiar with the refuge or have not engaged in the process due to lack of trust in the agency or uncertainty of their role in the process.

Strategies Common to All Alternatives

- Continue to conduct outreach in conjunction with refuge interpretive programs highlighted under goal 5.
- Continue to work within community forums such as the Milton, Milford, and Lewes Area Chambers of Commerce; Southern Delaware Tourism; town meetings; State Fish and Wildlife Advisory Council meetings; and other venues.
- Continue to co-host or partner with local Chambers of Commerce and the Friends of Prime Hook NWR to conduct the following annual community events: horseshoe crab-shorebird festival in May, youth fishing tournament in June, nature photography contest in October, and the Vandegrift memorial series in summer/fall. While the main venues for some of these programs are in town, onsite programs are included when staffing and funding are available.
- Continue to issue news releases on significant accomplishments and to promote special events and announce major initiatives.
- Continue to maintain the refuge's website and post information on refuge kiosks.
- Continue to honor requests for speaking engagements by local community and civic organizations to inform members about refuge purposes and activities.

Private Landowner Assistance

Our *Phragmites* control and education program, in conjunction with the wildland urban interface program, is one example of our successes in working with private landowners. We have partnered with more than 150 private landowners to control hundreds of acres of *Phragmites* on the refuge. We hope to continue this effort over time to keep this invasive plant from increasing its territory, and to use it as a model to assist landowners in controlling other invasive plants on private lands. We believe there are many landowners adjacent to the refuge boundary area who would gladly take on more responsibility to manage their lands to benefit wildlife whether for invasive species control or habitat restoration and enhancement, if they had assistance to get started. Under any of the alternatives we will continue

to utilize the Service's wildland urban interface program and seek assistance from the Service's private lands biologist.

Strategies Common to All Alternatives

- Continue our current level of *Phragmites* control and other invasive plant initiatives on private land through programs such as wildland urban interface.
- Continue to provide technical assistance to private landowners on invasive species identification and control, wetland protection, and habitat restoration and management.
- Seek grants and other funding sources to assist private landowners.

Appropriateness and Compatibility Determinations

Chapter 1 describes appropriate refuge uses policy (section 1.422) and specific requirements necessary to prepare written compatibility determinations (section 1.423). Appendix E includes draft appropriateness records and compatibility determinations to support the activities in alternative B, the Service-preferred alternative. The final CCP will include the approved refuge-specific compatibility determinations for the alternative selected.

Compatibility determination analyses must consider impacts of the use analyzed. The compatibility determination section titled Anticipated Impacts of the Use summarizes the short—and long-term and cumulative impacts of the use and how the use will affect:

- refuge purposes(s) and the Refuge System mission;
- refuge goals, objectives and management strategies;
- fish, wildlife, plants and their habitats;
- biological integrity, diversity, and environmental health of the refuge and Refuge System;
- other refuge uses; and
- public safety.

As previously noted, hunting, fishing, wildlife observation and photography, and environmental education and interpretation are priority wildlife-dependent uses of the Refuge System. The refuge manager has determined that all six priority public uses are compatible, although some have stipulations as detailed in each determination. As priority uses, they will receive preferential consideration in refuge planning and management before the refuge manager analyzes and considers other recreational opportunities for appropriateness and compatibility.

Permitted non-priority uses common to all alternatives are discussed later under Other Recreational Uses found in the Wildlife-Dependent Recreational Programs section.

Activities Not Allowed

We have reviewed prior uses and evaluated recent requests for non-priority, non-wildlife-dependent activities. Activities evaluated by the refuge manager, and determined not to be appropriate or compatible on refuge lands, include recycling trash using State-sponsored recycle containers located on the refuge, ice skating, camping, horseback riding, geocaching/metal detecting, off-road and mountain biking, off-road vehicles including ATVs, commercial dog walking, operation of

model boats and airplanes, swimming and sunbathing, waterskiing, personal watercraft, air thrust boats, soliciting of funds (per 50CFR 27.97 for private operations and per 50CFR 27.86 for begging), and other activities identified in 50CFR part 27. Of these uses, the only one with a documented appropriateness finding is “recycling trash using State-sponsored recycle containers on the refuge.” The other uses listed here were never formally evaluated and documented under current management; however, it is our professional judgment that these uses were never allowed. Appendix E documents the refuge manager’s decision on their appropriateness. Most of these activities are provided elsewhere nearby, so the lack of access on the refuge does not eliminate the opportunity. According to Service policy 603 FW 1, if the refuge manager determines a use is not appropriate, it can be denied without determining compatibility.

Specialized Uses

These uses require specific authorization from the Refuge System, often in the form of a special use permit. We make appropriateness findings for specialized uses on a case-by-case basis. Before we consider a specialized use, we must make an appropriateness finding as defined in section 1.11A(3) of the appropriate refuge use policy. For example, in addition to the six priority recreational and educational uses, we have determined that several other activities are appropriate and compatible under certain conditions. These include research, allowing the State to collect rare plant species seeds to benefit the Delaware Division of Fish and Wildlife’s Landowner Incentive Program, mosquito population monitoring and limited use of chemicals to control mosquitoes, and operation of a Federal Aviation Administration tower. All of these activities require a special use permit and adherence to specific conditions to ensure the compatibility of these uses.

Facilitating and Conducting Research and Investigations

The Refuge Manual and the Service Manual both contain guidance on conducting and facilitating biological and ecological research and investigations on refuges. The Service published three objectives in the Refuge Manual (1982) for supporting research on units of the Refuge System (4 RM 6.2):

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

In 2006, the Service Manual provided further guidance on the appropriateness of conducting research on refuges in part 603, the appropriate refuge uses policy. It states that:

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

All research conducted on the refuge must be determined in writing to be both appropriate and compatible, unless we determine it to be an administrative activity. Research projects must contribute to a need identified by the refuge or the Service. In the past we have conducted many research projects on the refuge and expect additional research opportunities to arise under all the alternatives we propose in this draft CCP. Non-Service organizations and personnel conducting research on the refuge must provide the Service with a copy of all data collected and/or reports. The research organization/agency in conjunction with the Service will retain the use and ownership of all data and reports. In determining the appropriateness and compatibility of future research activities, we will follow Service policy guidance and employ the following objectives:

- Seek qualified researchers and funding to help answer refuge-specific management questions.
- Participate in appropriate multi-refuge studies conducted in partnership with USGS.
- Facilitate appropriate and compatible research by providing temporary housing and equipment, if available, for persons conducting fieldwork.
- Pursue peer-reviewed publications of research and ensure the Service is acknowledged as a contributor in research conducted on the refuge by others.

Commercial and Economic Uses

All commercial and economic uses will adhere to 50 CFR, Subpart A, §29.1 and Service policy which allow these activities if they are necessary to achieve the Refuge System mission, or refuge purposes and goals. Allowing these activities also requires the Service to determine appropriateness and prepare a compatibility determination and an annual special use permit outlining terms, conditions, fees, and any other stipulations to ensure compatibility. The following policies and regulations were consulted:

- Appropriate use policy
- Compatibility policy
- 5 RM 17 (Refuge Manual)
- 16USC668dd, 50 CFR 27.97 Private Operations: Soliciting business or conducting a commercial enterprise on any national wildlife refuge is prohibited except as may be authorized by special permit.
- 16USC668dd, 50 CFR 27.86 Begging: Begging on any national wildlife refuge is prohibited. Soliciting of funds for the support or assistance of any cause or organization is also prohibited unless properly authorized.
- 16USC668dd, 50 CFR, subpart A, 29.1 Allowing Economic Uses on National Wildlife Refuges: We may only authorize public or private economic use of the natural resources of any national wildlife refuge, in accordance with 16 U.S.C. 715s, where we determine that the use contributes to the achievement of the national wildlife refuge purposes or the National Wildlife Refuge System mission.
- Proposed standardized fee schedule for special use permits – Memorandum 4/19/93 ARD Donald Young – finalized in 8/93

A fee will be required for appropriate and compatible commercial uses, except for fee exemptions specified in the USFWS Refuge Manual 5 RM 17.9C. Fees will be required for commercially guided canoeing, birding, or nature tours, and

commercial photography. Examples include interpretive guided tours on refuge waterways and guided birding trips by non-profit organizations (e.g., Chambers of Commerce). Fees will be waived for guided tours (with or without fees) that are sanctioned as continuing education from a recognized organization, and public use of the auditorium for wildlife-dependent oriented organizations. Examples include bus tours, classes from Sussex Academy of Lifelong Learning, Elder Hostel, etc. A fee may be required if the cost to the Service in preparation for the activity is unreasonable. See the compatibility determination for additional detail.

For commercially guided recreational uses, a non-refundable administrative fee of \$100 will be charged, comparable to fees issued by refuges in other regions. This fee is based on the salaries, plus 22 percent overhead, for a GS-13 refuge manager (\$37.22 an hour at Step 1) and a GS-6 administrative assistant (\$15.88 an hour at Step 1), plus a proportionate share of the average cost to operate the refuge (including construction cost, utilities, maintenance, equipment, vehicles, supplies, travel, and training), which is estimated at approximately \$40.00. The staff is required to determine fair market value and cost recovery or to conduct competitive bids. In determining the fee, the staff could easily exceed the \$100 administration fee. In addition to the administration fee, the permit fee will be 5 percent of gross revenues or \$50, whichever is greater. Guides will be required to meet certain conditions before they are permitted to guide on the refuge. These conditions include certifications in an organization such as the American Canoeing Association, first aid/CPR, State or Federal licenses, and interpretive guide certification. Liability insurance will also be required for all commercial operations.

**Wildlife-dependent
Recreational Programs**

The National Wildlife Refuge System Improvement Act of 1997 designated six priority public uses that are to receive enhanced consideration on national wildlife refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. We will strive to meet the criteria for a quality wildlife-dependent recreational program on the refuge as specified in the Service Manual (605 FW 1) and as stated in chapter 1.

The refuge provides opportunities for all six priority recreational uses. We believe we are offering quality programs that meet public demand and our wildlife population and habitat goals. In chapter 3 (affected environment), we described in detail the facilities and programs we offer to support these uses. As always, we look to our partners, friends group, and volunteers to assist with our public use programs. We will provide these opportunities in ways that do not adversely impact wildlife resources.

A detailed visitor and community survey and final refuge report conducted by U.S. Geological Survey in 2007 indicated that hunting, photography, and wildlife observation were highly desired in the area. Although all the priority public uses are important and the refuge offers them to some degree, hunting, wildlife observation, and photography will receive the greatest emphasis in prioritizing refuge resources for visitor services.

In addition to published 50CFR regulations and State regulations, refuge-specific regulations also apply and are highlighted below in the following strategies and throughout each alternative.

Strategies Common to All Public Use Programs in All Alternatives

- Evaluate newly acquired refuge lands for potential quality wildlife-dependent recreational opportunities, if deemed compatible.
- Provide effective outreach and communication for and about the refuge's existing public use programs

- ✳ Coordinate with State and other partners to develop or participate in host programs that encourage new user groups, e.g., Becoming an Outdoors Woman, youth hunts, youth fishing event with Lower Sussex Bassmasters in Milton to celebrate National Fishing Week.
- ✳ Monitor and evaluate the public use programs through staff observation and visitor contact.
- ✳ Continue yearly review of refuge public use regulations with staff and State partners to ensure clarity and address any emerging issues or concerns.
- ✳ Continue to work toward developing one brochure for hunting regulations and one brochure for all other public use regulations to inform the public of public use opportunities and refuge-specific regulations.
- ✳ Ensure public notification of public use program changes through news releases and other means.
- Provide adequate law enforcement to enforce regulations, and continue to collaborate with enforcement officers from the Delaware Division of Fish and Wildlife.
- Maintain existing infrastructure, including accessible facilities, to support wildlife-dependent recreation. These include hiking and canoeing trails, roadside pull-offs, observation platform, photography blind, wheelchair-accessible fishing pier, visitor contact station, parking areas, boat ramps, boardwalks, kiosks, roads, and benches.
- Provide access to launch boats, canoes, and kayaks at the headquarters boat ramp, Turtle Pond, Fleetwood Pond, and Slaughter Canal at Fowler Beach Road. Additional access provided at the Prime Hook Wildlife Area and Brumbley's Family Campground near Waples Mill Pond (the ramp at this location is on Service lands; however, access and parking are through the campground).
- Evaluate the future management of the Prime Hook Wildlife Area with the Delaware Division of Fish and Wildlife. Refuge staff have issued waterfowl hunting permits for the Prime Hook Wildlife Area, which is managed by the Delaware Division of Fish and Wildlife, through the refuge's permitting system. State and Federal personnel maintain the facilities (duck blind construction and grassing) yearly. A portion of Prime Hook Creek borders both the refuge and Prime Hook Wildlife Area, which is used by anglers, wildlife observers, hunters, and photographers. No formal agreement exists. An evaluation of the cooperative management of the State area should occur and, if necessary, a formal agreement should be developed.
- General regulations common to all public use programs in all alternatives
 - ✳ Except for hunting, the refuge is open from one-half hour before sunrise to one-half hour after sunset except all boats must be off the water at sunset.
 - ✳ Areas may be closed on the refuge without prior warning.
 - ✳ Boat motor restrictions
 - The maximum permitted motor on Prime Hook Creek and Slaughter Canal is 30 horsepower.

- Air thrust boats and jet skis are not permitted.
- A slow no wake zone of one-half mile has been established on the Headquarters Ditch.
- Except for hunting, only electric motors or manual propulsion is allowed on Turtle and Fleetwood Ponds
- * All boaters are required to operate their craft and possess all safety equipment in accordance with Delaware State and U.S. Coast Guard regulations.
- * Designated beach dunes and overwash areas will be closed from March 1 through September 1 due to nesting State-endangered least terns and American oystercatchers, and the potential for use by federally endangered piping plovers. Areas may be reopened if no nesting activity occurs or when nesting ends for the season.
 - Beach access will only occur on refuge-owned lands on the sandy part of the beach from the toe of the dunes to the Delaware Bay (mean high water demarcation to mean low water demarcation). One parking lot with a dune crossover provides access to the beach. Access on the dune and adjacent marshes is prohibited.
- * Overnight camping and open fires are prohibited.
- * Dog walking is not permitted on the refuge.

Hunting

Hunting on the Delmarva Peninsula is a traditional outdoor pastime and is deeply rooted in our American and Delaware heritage. Opportunities for public hunting are decreasing with increasing private land development. Refuge lands have become increasingly important in the region as a place to engage in this activity. Hunting has and will continue to be an integral component of the public use program at the refuge. When managed responsibly, this activity can instill a unique understanding and appreciation of wildlife, their behavior, and habitat needs, as well as their role in the surrounding environment. General hunting information can be found in chapter 3, Affected Environment, Refuge Administration – Refuge Visitor Services Program.

Section 605 (FW 2) of the Fish and Wildlife Service Manual states that hunting programs will be compatible, provide quality experiences, and to the extent practicable, be consistent with State fish and wildlife laws and regulations. After careful review and consideration, we have determined that the refuge's previous hunting program was inefficient and overly complex, requiring a significant amount of staff resources. A recently conducted regional visitor services review found the hunt program to be "out of balance with other priority refuge needs and services," such as habitat management, maintenance, and public use programs such as environmental education. Another finding from the review identified that "the amount of station resources going into this activity (hunting) seems to far exceed what is necessary to provide for a quality hunting program." The review also mentioned that the "care and maintenance of refuge blinds and tree stands....seems to put an undue burden on staffing resources."

The opinions by the visiting public and community landowners were surveyed in 2004 and 2005 by the U.S. Geological Survey on behalf of the refuge (Sexton et al. 2007). About 35 percent of visitor respondents indicated that they hunted

on the refuge and had been hunting there an average of 11 years. When asked about the importance of hunting activities, more than half of the responses rated it as moderately to very important, and most hunters (85 percent) feel the refuge provides a quality hunting experience. Dove hunting and upland game hunting appear much less important than other hunting activities, and hunting ducks and hunting deer with muzzleloader and shotgun were more important than other hunting activities.

In the survey, hunters were also asked about the desirability of changing some hunting services or regulations, but did not appear to be very interested in making changes. The most desirable of the suggested changes was the provision of more areas where portable deer stands could be used as well as areas where individuals could set up their own waterfowl blinds. Some were only slightly interested in adding a preseason drawing for waterfowl hunting. Consumptive-use visitors asked to see increases in hunting and fishing areas and access.

Strategies Common to All Alternatives

- Continue to provide hunting opportunities for deer, waterfowl, upland game (rabbit, quail, pheasant) and webless migratory birds (mourning dove, snipe, and woodcock).
 - * Continue to provide deer and waterfowl hunting opportunities for disabled hunters.
- Maintain waterfowl sanctuaries (no hunting) in Unit II impoundment to provide undisturbed areas for feeding and resting.
- Clearly sign all areas closed to hunting.
- Enforce general regulations for all hunting programs.
 - * The refuge will follow all State youth hunting requirements.
 - * No vegetation may be cut on the refuge for shooting lanes, camouflaging, etc.
 - * The use of natural vegetation for camouflaging a blind is prohibited.
 - * Practice or target shooting on the refuge is prohibited.
 - * Hunting blinds/stands must be portable and removed at the end of each day.
 - * No hunting is permitted in designated safety zones.
 - * Non-toxic shot is required for all hunting except lead slugs for deer.
 - * The refuge manager will monitor, evaluate, and make necessary adaptations to the hunting program to ensure that the refuge is meeting resource management objectives and continuing to offer quality experiences. The refuge manager has the authority to extend or close hunting opportunities on the refuge within the established hunting seasons of the Delaware Division of Fish and Wildlife, while ensuring compatibility.

White-tailed Deer Hunting

In addition to being a traditional outdoor pastime, deer hunting aids statewide efforts to control deer populations and complements habitat management on the refuge. We intend to consult with the Delaware Division of Fish and Wildlife

to maintain the deer population at a level commensurate with available habitat, to maintain the health of the herd and prevent the habitat degradation that accompanies overpopulation.

Strategies Common to All Alternatives

- The refuge will continue to participate in all State hunting seasons and bag limits except the October antlerless deer season and January handgun season. State hunting seasons and harvest limits for deer are based on guidelines found in the Delaware Deer Management Plan 2010 to 2019 (Rogerson 2010), written by the Delaware Division of Fish and Wildlife.
- ✱ The refuge will consider participating in the October antlerless season if the refuge can provide a quality hunting experience, if an overabundance of deer arises as determined by the Delaware Division of Fish and Wildlife and concurrence by the refuge, and conflicts are minimized with other user groups.
- The refuge will participate in the Statewide youth deer hunt.

Waterfowl Hunting

Much of the rationale for waterfowl hunting is discussed under Hunting in this section.

Strategies Common to All Alternatives

- The refuge will participate in the Statewide youth waterfowl hunt.

Upland Game and Webless Migratory Bird Hunting

Much of the rationale for upland game and webless migratory bird hunting is discussed under Hunting in this section.

Strategies Common to All Alternatives

- The hunting of squirrel is prohibited due to presence of the endangered Delmarva fox squirrel on the refuge.

Wildlife Observation and Photography

Wildlife observation constitutes the majority of the use on the refuge throughout the year. Wildlife observation is the primary reason both visitor and community residents visit the refuge, as indicated by the survey conducted on behalf of Service (Sexton et al. 2007). The survey also found that being in a natural, undeveloped area and experiencing a serene environment are equally important to the refuge experience as are the trails that afford this opportunity (Sexton et al. 2007). Both visitors and community residents (consumptive and non-consumptive users) appear satisfied with the level of services or features currently offered by the refuge; however, a number of respondents indicated that they would like to see increases or improvements in wildlife viewing opportunities, environmental education, interpretive exhibits, and hiking or nature trails (Sexton et al. 2007).

Strategies Common to All Alternatives

- Continue to provide wildlife observation and photography opportunities
 - ✱ Refuge headquarters area
 - Maintain 5.1 miles of hiking trails that include the Blue Goose Trail, Photography Blind Trail, Dike Trail, Black Farm Trail, Pine Grove Trail, and Boardwalk Trail.

- Maintain the photography blind on the Photography Blind Trail and observation platform (wheelchair accessible) on the Dike Trail.
- Provide canoeing and kayaking access on Turkle and Fleetwood Ponds.
- Maintain the visitor contact station at refuge headquarters and allow the sale of refuge approved items by the Friends of Prime Hook through a signed memorandum of agreement.
- Area open year-round except when closed for deer hunts.
- ✱ Prime Hook Creek and associated ditches
 - Maintain the 7-mile Canoe Trail and associated boat ramps for canoeing and kayaking
- ✱ Slaughter Canal
 - Provide opportunities along the canal from Fowler Beach Road to Slaughter Beach Road. Access is by boat only.
- ✱ Fowler Beach
 - Continue to permit use by the general public on beach except during seasonal closures.
- ✱ Prime Hook Beach Road and Broadkill Beach Road
 - Maintain and enhance existing roadside pull-offs
 - Area is open year-round
- ✱ Water control structures at Petersfield Ditch, Slaughter Canal, and Cods Road are open year-round.
- Enforce general regulations for wildlife observation and photography
 - ✱ No refuge-specific permits are required.
 - ✱ Visitors must stay on the designated trail routes.
 - ✱ Bicycling is allowed only on roads open to public vehicular traffic.
 - ✱ The visitor contact station is open weekdays from 7:30 am to 4:00 pm and seasonally on weekends.

Recreational Fishing and Crabbing

Fishing and crabbing on the Delmarva Peninsula are traditional outdoor pastimes and are deeply rooted in our American and Delaware heritage. Fishing accounts for 10 percent of the total visitation to the refuge (or nearly 10,000 annual visitors). Fishing has and will continue to be an integral component of the public use program at the refuge.

The opinions by the visiting public and community landowners were surveyed in 2004 and 2005 by US Geological Survey on behalf of the refuge (Sexton et al. 2007). About 20 percent of visitor respondents indicated that they fished on the refuge and had been fishing there an average of 11 years. When asked about

the importance of fishing activities, all of the responses rated it as moderately important, and most anglers (89 percent) feel the refuge provides a quality fishing experience. Fishing on Prime Hook Creek was slightly more important than fishing at the water control structures and at Fleetwood and Turtle Ponds. Very few comments regarding improvements were made. A few respondents mentioned water levels, better access to some fishing areas, and providing catch-and-release fishing areas.

Strategies Common to All Alternatives

- Continue to provide fishing and crabbing opportunities in accordance with the State of Delaware fishing, crabbing, and boating regulations and seasons to include the following areas:
 - * Slaughter Canal between Fowler Beach Road and Slaughter Beach Road (boat access only)
 - * Slaughter Creek at Cods Road and water control structures at Petersfield Ditch and Slaughter Canal (shore access only; boats are not allowed at Slaughter Creek and Petersfield Ditch) open year-round
 - * Prime Hook Creek (boat access only)
 - * Turtle and Fleetwood Ponds in headquarters area (boat and shore access): open year-round except when closed for deer hunts
 - * Fowler Beach (surf fishing from shore only)
- Provide information about fish consumption advisories and water level management on refuge waterways at the refuge office, refuge kiosks, and on the refuge's Web site.
- Harvest information is not required.
- Restrict bank fishing (where permitted) to designated areas off of State-maintained highways at Petersfield Ditch, Slaughter Creek, and Slaughter Canal.
- No check-in/out required.

Environmental Education and Interpretation

Interpreting the resources and challenges of the refuge to the general public and incorporating these topics into school curricula are important ways to influence the future well-being of the refuge and the Delmarva Peninsula. Only through understanding and appreciation will people be moved to personal and collective action to ensure a healthy refuge for the future. Interpretation and environmental education are also key to changing attitudes and behavior, which affect the refuge through off-refuge land-use decisions and on-refuge conduct and use.

The refuge provides onsite and offsite environmental education and interpretive programs to visitors of all ages and abilities. Programs include structured educational field programs tied to national and State education standards, guided interpretive canoe and hiking trips, special events, lecture programs, self-guided interpretive hiking trails, interpretive signs and displays, the visitor contact station/friends group sales outlet, refuge website, and refuge brochures. The refuge also conducts interpretive programs to local civic organizations and displays refuge information at numerous offsite events. Refuge volunteers and

friends group members play a considerable role in the success of these programs, which would not be possible without their assistance. Interpretive refuge themes focus on the awareness and importance of the conservation of waterfowl and other migratory birds, the endangered Delmarva fox squirrel and other threatened or endangered species, and their habitats.

Strategies Common to All Alternatives

- Conduct environmental education and interpretive programs in the following areas of the refuge: hiking and canoeing trails, visitor contact station, Turkle and Fleetwood Ponds, Fowler Beach, and at roadside pull-offs along Prime Hook and Broadkill Beach Roads.
- Continue to facilitate educator-led environmental education programs that focus on refuge key resources and messages for local schools, scout troops, and other organized education-oriented groups.
 - ✱ Integrate existing Service national education programs into the refuge's education program. In particular, consider the Shorebirds Sister Schools program, especially in combination with the Delaware Aquatic Resources Center's Green Eggs and Sand program. Other programs to consider include Hands on the Land and the Nature of Learning.
 - ✱ Continue to partner with local educational institutions, refuge volunteers, Friends of Prime Hook, and other partners to plan, develop, and implement environmental education programs. This network would act as supporters of the refuge, advocates for environmental education, and as a liaison to the community.
 - ✱ Continue to respond to requests for onsite and offsite environmental education and interpretive programs when staffing and funding allows.
- Continue to enhance detailed environmental education and interpretive programs for the refuge.
- Continue to provide interpretive materials and programs explaining the historic, cultural, and natural resources of the refuge to gain public awareness and understanding of their value.
 - ✱ Develop a tear sheet with public use regulations and a map that includes fishing information.
 - ✱ Develop a hunting brochure containing regulations and associated maps.
 - ✱ Develop a new general refuge brochure.
 - ✱ Develop an annual schedule of interpretive activities.
 - ✱ Provide regularly guided field trips for nature, birding, fishing, photography, etc.
 - ✱ Continue An Evening at the Hook monthly lecture series.
 - ✱ Continue partnership with Friends of Prime Hook in hosting the Vandegrift memorial lecture series and annual nature photography contest and exhibition.

- * Continue to provide self-guided interpretive facilities and materials, including signs, maps, kiosks, etc., for the Blue Goose Trail, Photography Blind Trail, Dike Trail, Black Farm Trail, Pine Grove Trail, Boardwalk Trail, Canoe Trail, and the trail and observation platform off Route 16 near Vergie's Pond.
- * Continue to provide information to the public through the refuge's website.
- * Continue to partner with Delaware Department of Transportation for maintenance of directional highway signage for the refuge.
- * Continue to maintain a universally accessible full-service visitor contact station with a sales outlet operated by the Friends of Prime Hook. The visitor contact station will continue to include interpretive displays and various mounted species of animals found on the refuge and will be staffed mainly through volunteer support.
- * Participate in national interpretive events such as National Fishing Week and International Migratory Bird Day.
 - Continue partnership with Milton Chamber of Commerce in hosting the Horseshoe Crab-Shorebird Festival in May.
 - Continue partnership with Lower Sussex Bassmasters to host an annual youth fishing tournament in Milton to celebrate National Fishing Week and promote fishing to youngsters.
- Conduct routine condition reviews of interpretive signs and information kiosks, and complete maintenance and sign replacement as needed.

Other Recreational Use

Public entry and use regulations serve to protect fish, wildlife, plants, and habitat. Public use regulations were last reviewed and amended in 1993. However, the resources and public use of the refuge are dynamic, and periodic review would ensure that regulations are needed, clear, and effective. In addition, new regulations may be required to safeguard resources or address new or emerging problems recognized by managers and law enforcement officers. An annual review would provide a more systematic process than in the past.

Some uses are not dependent on the presence of fish and wildlife; however, these activities are allowed to continue at designated locations in a manner that would give maximum consideration to the fish and wildlife purpose of the refuge and the wildlife focus of each alternative.

Strategies Common to All Alternatives

- Refer to prohibited non-priority uses that are discussed earlier in the Appropriateness and Compatibility Determinations section.
- Allow the following non-priority uses that were found to be compatible on the refuge: research, mosquito control, and public leases of the Federal Aviation Administration tower.
- * Canoeing (includes boat and kayaking), walking, hiking, and jogging are uses allowed across all alternatives. These uses were individually found compatible in alternative A, but were considered as a means of access under the compatibility determinations in alternatives B and C.

- Allow commercially guided tours for wildlife observation (including commercially guided tours for continuing education). Adhere to Commercial Wildlife Observation Guide Program Stipulations found in appendix E and to information found in Specialized Uses in the section titled, Actions Common to All Alternatives.
 - * Will require a special use permit and appropriate fee and minimal disturbance to wildlife resources and their habitat.
 - * Will be covered by compatibility determinations for their respective uses (wildlife observation, wildlife photography, etc.)
- Provide the public and State of Delaware ample opportunity to review and comment on any new or substantially changed regulation.
- Use national guidance and *Federal Register* process for codifying any changes and make them a part of the Code of Federal Regulations governing national wildlife refuges.
- Post pertinent regulations at boat landings and other public use areas, such as trailheads, informational kiosks, and the visitor contact station.
- Be proactive with law enforcement to inform and educate the public on refuge regulations and seek their compliance.

Protecting Cultural Resources

As a Federal land management agency, we are responsible for locating and protecting all historic resources, specifically archeological sites and historic structures eligible for, or listed in, the National Register of Historic Places. This applies not only to refuge lands, but also to lands affected by refuge activities, including museum properties. As described in greater depth in chapter 3, Affected Environment, consultation with the Delaware State Historic Preservation Office and regional historic preservation office and data collected from several field investigations and archeological studies (1982, 1984, 2004), indicate that, to date, 14 prehistoric archeological sites and 31 historic sites have been identified at Prime Hook NWR.

Under all the alternatives, we will evaluate the potential for impact on archeological, prehistoric and historical resources, and will consult with the regional historic officer before new refuge activities or actions are planned. We will be especially thorough in upland areas along waterways or areas surrounded by marsh, where the probability of locating new cultural resources is higher. This care will ensure that we comply with section 106 of the National Historic Preservation Act, regardless of the alternative.

Conduct a Refuge Wilderness Review

The Service revised its Wilderness Stewardship Policy in November of 2008, to improve the National Wildlife Refuge System's management of lands considered for designation as wilderness under the Wilderness Act of 1964. The revision provides refuge managers with the first-ever guidance on wilderness review of Refuge System lands and whether areas should be recommended to Congress for wilderness designation.

The updated policy ensures consistency with several new refuge management policies established in recent years including Refuge System mission, goals and refuge purposes, appropriate use and wildlife-dependent recreation, and the Wilderness Act and Refuge Improvement Act. It also reflects other developments in the policy and science of managing the Refuge System and wilderness.

The Service priorities in implementing the wilderness policy consider the following order when conducting wilderness reviews on refuge lands: the Refuge

Administration and Improvement Act, the Endangered Species Act, and the Wilderness Act. We first determine what needs to be accomplished to meet refuge purposes, ensure these activities comply with the Endangered Species Act, and ensure these activities comply with the Wilderness Act (610 FW 1.4).

Chapter 610 of the Service Manual addresses wilderness stewardship policy in the Refuge System, where wilderness is defined in 610 FW 1.7:

A wilderness, in contrast to those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act as an area of undeveloped Federal lands retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with imprint of man substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is sufficient in size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

The Refuge System planning policy requires that we conduct a wilderness review during the CCP process. One of the eight goals stated in this policy is to ensure that we preserve the wilderness character of refuge lands (602 FW 1.5(H)). Part of the CCP planning policy is that we help achieve the goals of the National Wilderness Preservation System (NWPS) and specifically address the potential for any new special designations (602 FW 3.4). We do this by conducting a wilderness review and evaluating any new information about refuge lands that may warrant wilderness study (appendix F). Roadless islands of any size are also eligible for wilderness designation. The wilderness review in Appendix F concluded that three small roadless islands located within Unit II fail to meet the criteria for wilderness designation due to the impacts of human manipulation of the surrounding marsh areas for mosquito control and the impoundments, the proximity of roads and aural impacts of vehicles and boats, and the non-natural fluctuation of water levels and reduced salinity when the barrier was intact thereby creating an artificial freshwater system,

Refuge Staffing and Administration

Congress determines the annual budgets that our Washington headquarters and regional offices distribute to the field stations. The activities shared among the alternatives described in this chapter pertain to staffing, administration, and operations that include the integration of Prime Hook NWR with Bombay Hook NWR into the Coastal Delaware National Wildlife Refuge Complex. Implementing any of the listed alternatives and associated activities supports refuge goals and implements habitat and wildlife objectives.

Permanent Staffing and Operational Budgets

Under all the alternatives, our objective is to sustain levels of annual funding and staffing that allow us to achieve refuge purposes, as interpreted by the goals, objectives, and strategies in this CCP. We have achieved our most highly visible projects, like the construction of our headquarters office and visitor center, through special project funds that typically have one—to two-year duration. These funds are important but their flexibility is limited because they cannot be used for any needs that may arise. Funding for land acquisition derives from two sources: the Land and Water Conservation Fund and the Migratory Bird Conservation Fund. These funds are directed toward specific land acquisitions.

In response to declines in operational funding nationwide, Region 5 developed a *Strategic Workforce Plan for the National Wildlife Refuges in Region 5* (2006-2007) to support a base budget approach. Its goal is a maximum of 75 percent of a refuge station budget to cover salaries and fixed costs, while the remaining 25 percent or more will be for operating and maintenance funds. The strategy is to improve the capability of each refuge manager to do project work of the highest priority, and not have the refuge's budgets tied to inflexible fixed costs.

Appendix H lists our refuge operations needs system (RONS) and service asset maintenance management system (SAMMS) construction and maintenance projects currently listed in those databases. We also included new projects not yet in the databases, but proposed under alternative B. Once approved, if funding is not available, we will continue to seek alternate means of accomplishing our projects, for example, through our volunteer program, challenge cost share grants, or other partnership grants and internships. The SAMMS projects include a list of backlogged maintenance needs.

Under all alternatives, and within the guidelines of the new base budget approach, we would seek to fill our currently approved but vacant positions, which we believe are needed to accomplish our highest priority projects. Alternative B also proposes additional staff to provide depth in our biological and visitor services programs. We identify our recommended priority order for new staffing in appendix H. Under alternative B, we also seek an increase in our maintenance staff since they provide invaluable support to all program areas.

Facility and Fleet Management

All of the alternatives include the periodic maintenance and renovation of existing facilities to ensure the safety and accessibility for staff and visitors. Our current facilities are described in chapter 3. They include administrative facilities such as the refuge office, maintenance shop, pole buildings, office trailer, hunter check-in station, biological lab, and several small storage sheds. Visitor facilities to be maintained under all alternatives include visitor contact station (includes auditorium and store), volunteer/friends group office, hiking trails, canoe trail, roadside pull-offs along Broadkill Beach and Prime Hook Beach Roads, observation platforms, photography blind, kiosks, boat launch ramps, and numerous interpretive signs. Any new facilities recommended in the final CCP, once constructed, will be placed on the maintenance schedule. All facilities and equipment maintenance and upgrades would incorporate ecologically beneficial technologies, tools, materials, and practices.

Refuge Operating Hours

All of the alternatives will open the refuge for public use from one-half hour before sunrise to one-half hour after sunset, seven days a week, to insure visitor safety and protect refuge resources. However, the refuge manager does have the authority to issue a special use permit to allow others access outside these timeframes. For example, research personnel or hunters may be permitted access at different times, or organized groups may be permitted to conduct nocturnal activities, such as wildlife observation and educational and interpretive programs. Designated areas may be closed for public safety or to avoid conflicts with other user groups, such as the closure of the headquarters area for deer hunts.

Distributing Refuge Revenue Sharing Payments

As we describe in chapter 3, we pay annual refuge revenue sharing payments to Sussex County based on the acreage and appraised value of refuge lands in our jurisdiction. These annual payments are calculated by formula determined by, and with funds appropriated by, Congress. All of the alternatives will continue those payments in accordance with the law, commensurate with changes in the appraised market value of refuge lands, or new appropriation levels dictated by Congress.

Alternative A. Current Management

This alternative primarily portrays current management, representing a “No Action” alternative. It is the baseline for comparing the other two alternatives. Our habitat management program would continue in its present manner, which involves no active management of wetlands due to recent extensive changes along the refuge shoreline, no active forest management, and no agricultural management of upland fields. This means that natural succession would occur in most upland habitats instead of proactive restoration actions, and that natural ecological processes would be allowed to proceed with no human intervention. In this alternative’s scenario, no attempts would be made to manage freshwater impoundments, nor would the refuge conduct any active restoration within impounded wetland areas. While natural resource protection and conservation actions would continue, generally speaking, the only habitat manipulation programs we would conduct would be the removal of invasive species and enhancement actions for federally listed endangered and threatened species.

Current biological program priorities include monitoring waterfowl and shorebird populations and habitats, maintaining habitat for the Delmarva fox squirrel, cooperating with State partners in monitoring bald eagles and fox squirrels, protecting bald eagle and osprey active nest sites from human disturbance on refuge lands, using prescribed fire to reduce fuel hazards near beach communities, simulating natural fire processes on refuge habitats, and conducting wildlife and habitat monitoring. We would continue these conservation actions with the help of volunteers, conservation partners, and refuge personnel as funding and staffing allow. Biological research studies would continue if they benefit the resources and are determined to be compatible by the refuge manager.

The refuge can be described as an elongated coastal strand covering 10,000 acres that lies parallel to the Delaware Bay (Map 1-1).

Map 4-1 through Map 4-5 depict the broad habitat types we predict would result under implementation of alternative A management objectives and strategies. The acreage figures presented in the alternatives matrix at the end of this chapter (table 4-5) are approximations based on GIS mapping from several data sources.

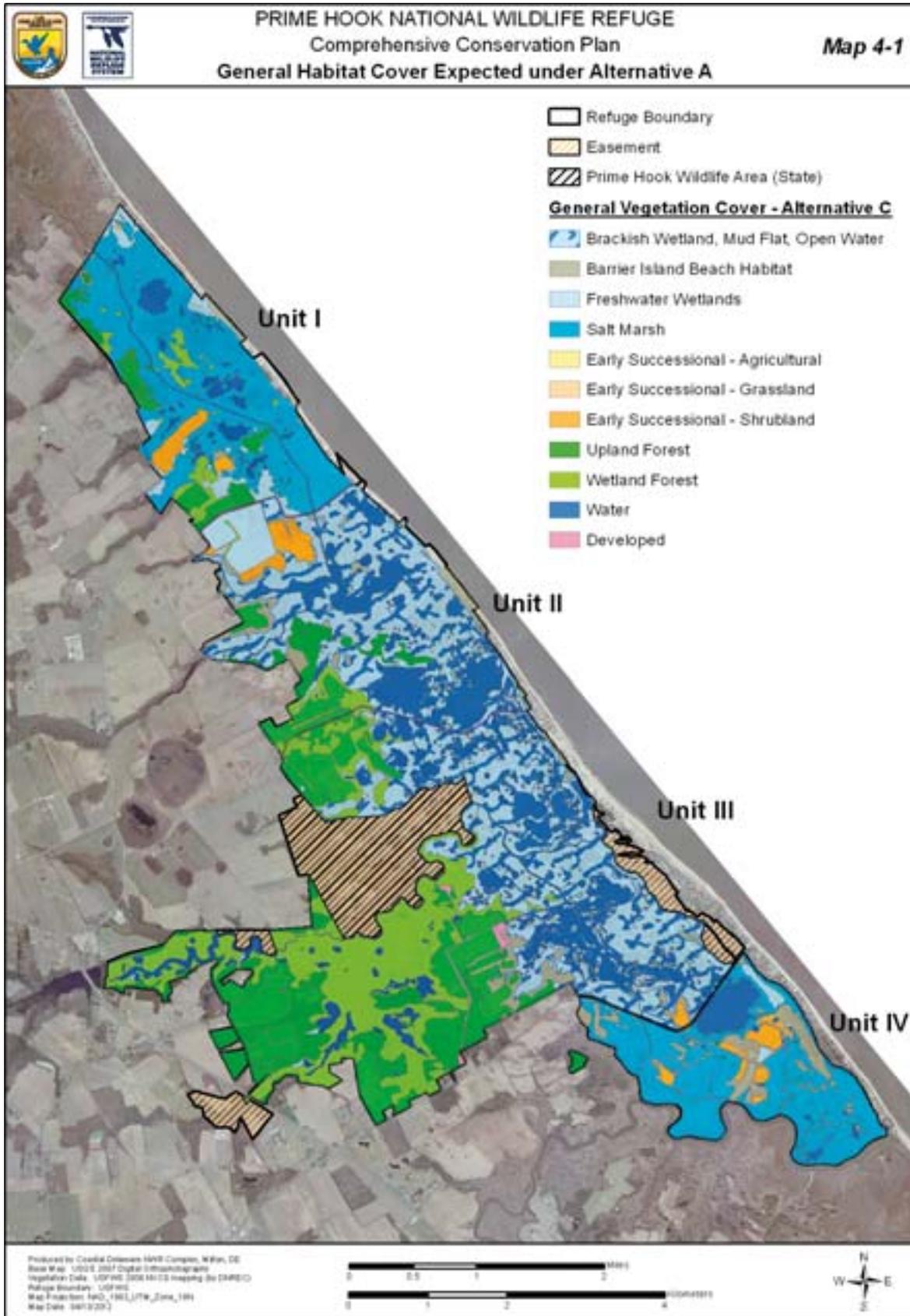
We would continue to offer hunting and fishing opportunities on refuge lands, and respond to requests for interpretive and school programs. The refuge would continue to provide 5 miles of walking trails, 7 miles of canoe trail, and associated viewing and photography infrastructures. Educational and interpretive programs, such as the monthly lecture series and annual photography contest would also continue. We would continue to partner with the Milton Chamber of Commerce to host an annual community event the Horseshoe Crab-Shorebird Festival, and with the Lower Sussex Bassmasters to host an annual youth fishing event. Map 4-6 depicts the public-use facilities present under current management.

GOAL 1.

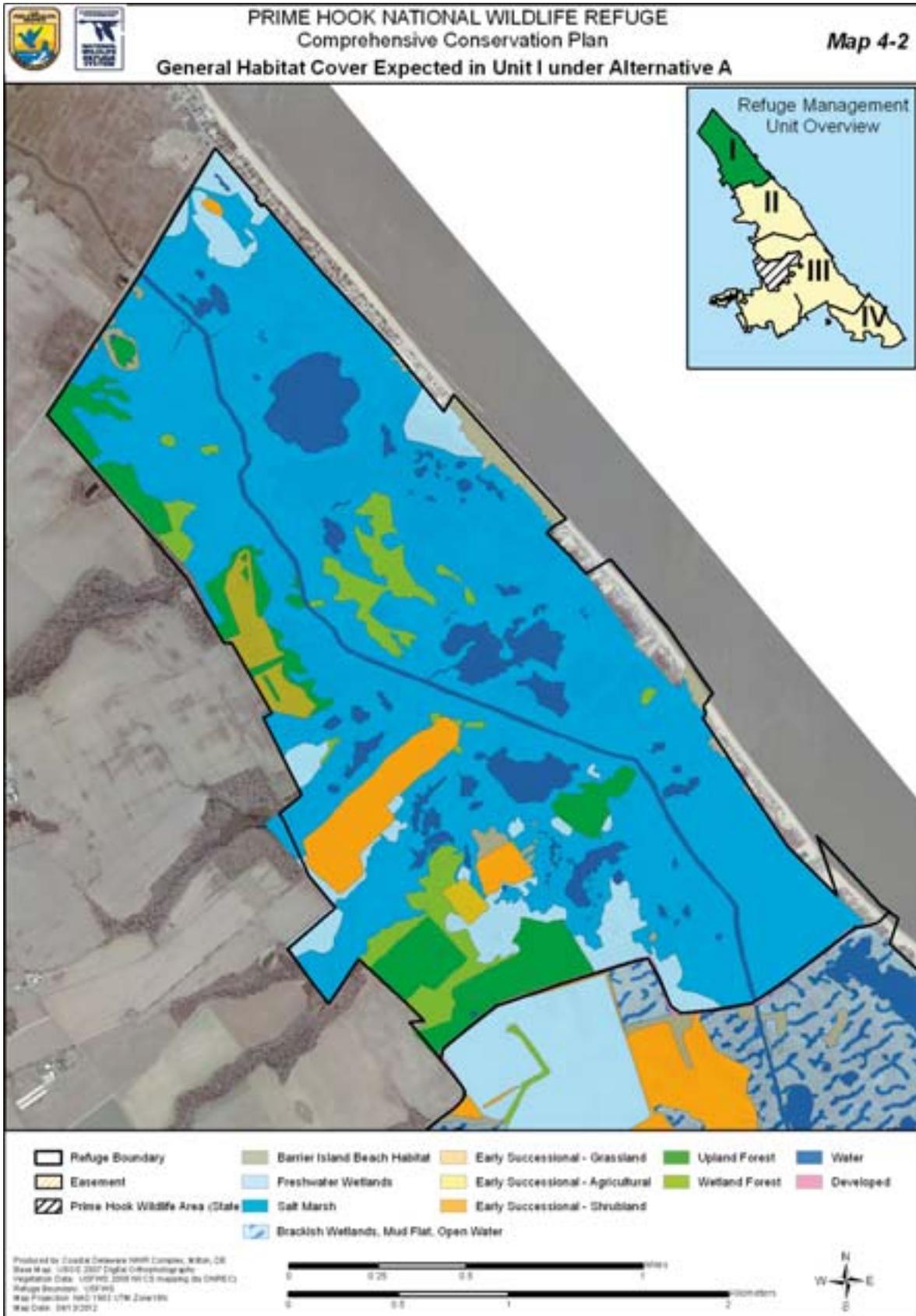
Barrier Beach Island and Coastal Salt Marsh Habitats

Manage, enhance, and protect the dynamic barrier beach island ecosystem for migratory and breeding shorebirds and other marine fauna and flora. Perpetuate and restore the biological integrity, diversity, and environmental health of North Atlantic low and high salt marsh habitats.

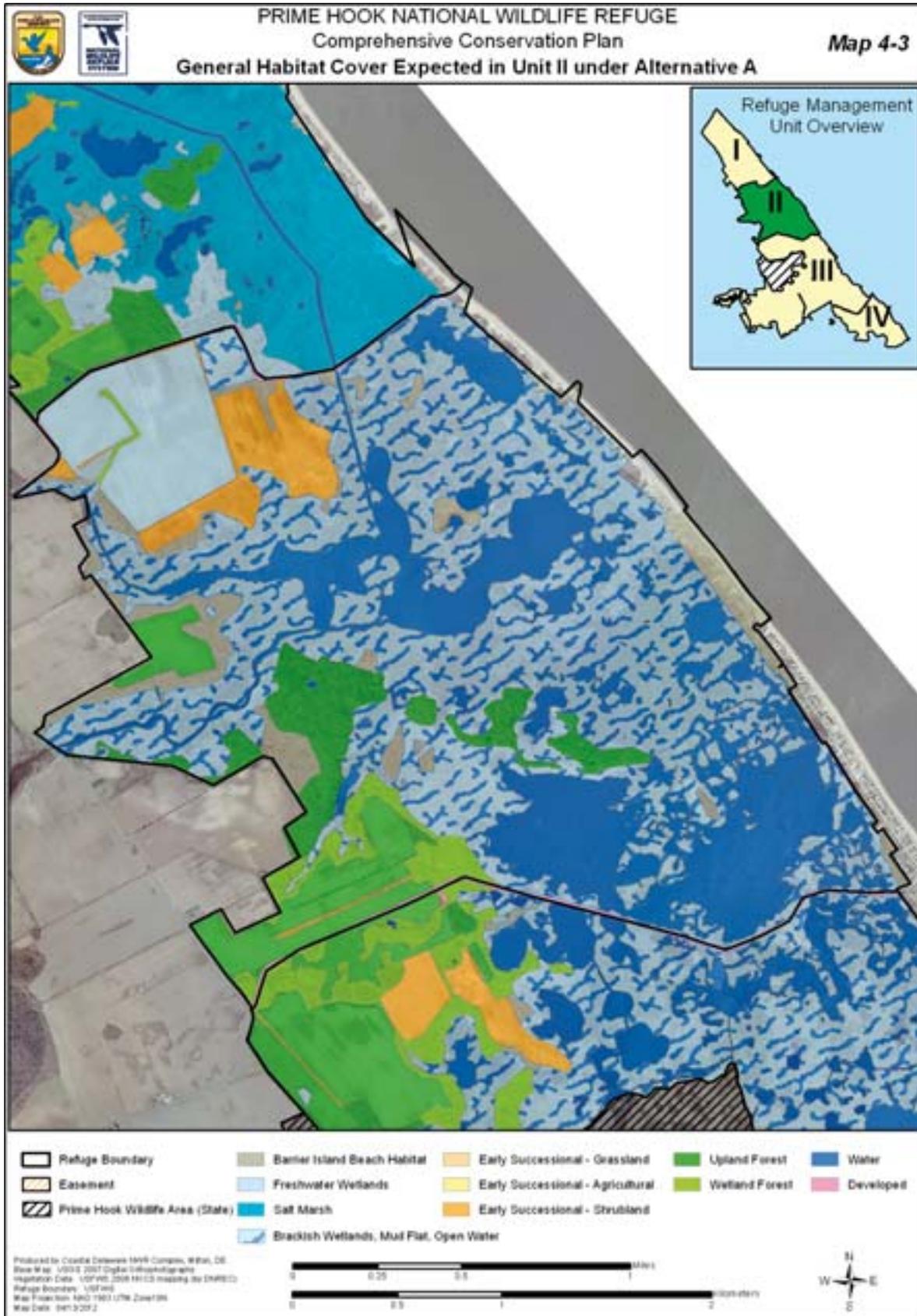
Map 4-1. Overview of general habitat cover under alternative A



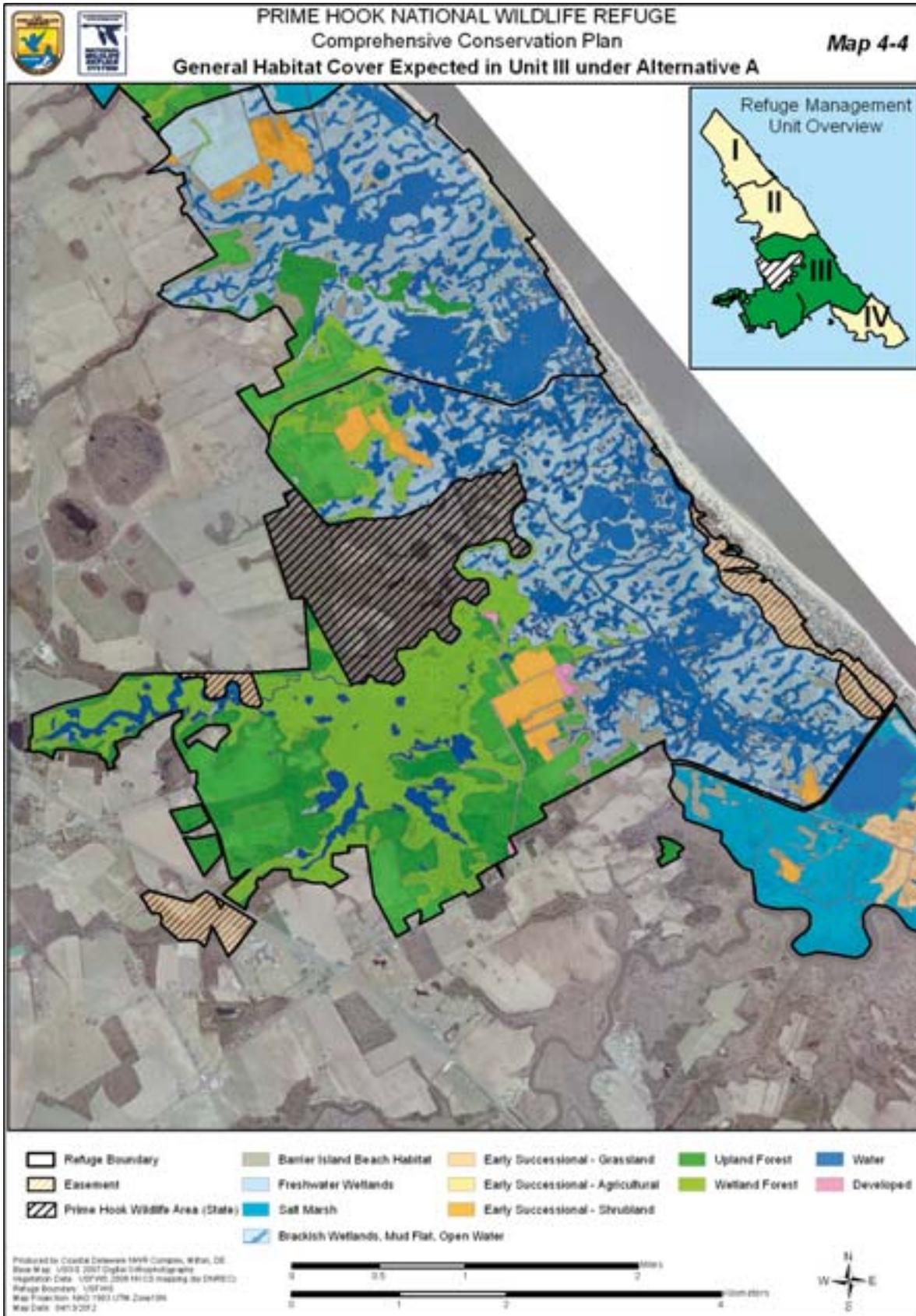
Map 4-2. General habitat cover in Unit I under alternative A



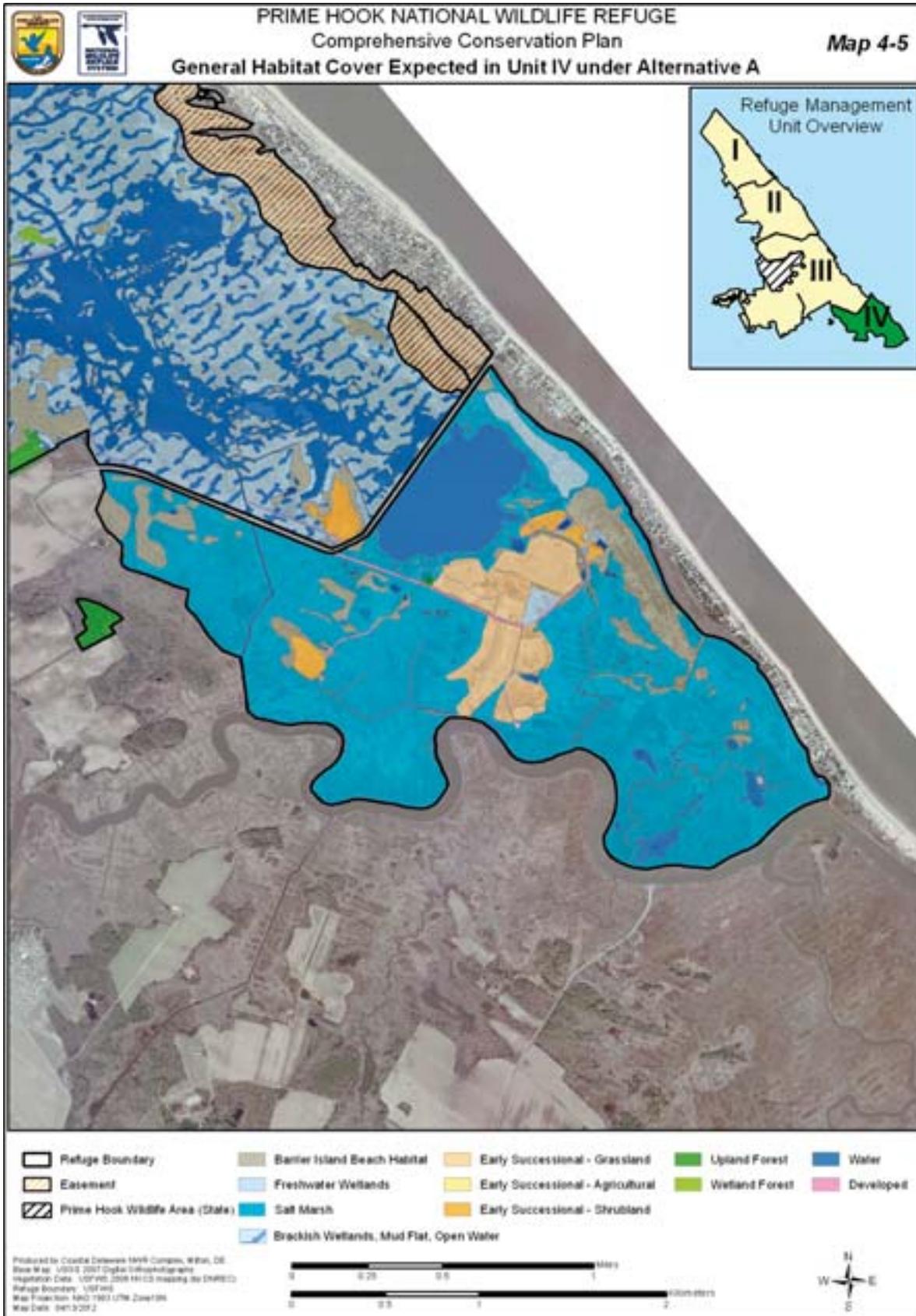
Map 4-3. General habitat cover in Unit II under alternative A



Map 4-4. General habitat cover in Unit III under alternative A



Map 4-5. General habitat cover in Unit IV under alternative A



Map 4-6. Public use facilities under alternative A

