



Cape Cod National Seashore

Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands

Environmental Assessment/Assessment of Effect

CAC0143301



**U.S. Department of the Interior
National Park Service**

**Cape Cod National Seashore
Massachusetts**

**Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands
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May 2010

Proposed Action: Moors Road (State Route 6A) travels approximately 1 mile through the North District of Cape Cod National Seashore and provides access to Provincetown, Herring Cove Beach, and the Province Lands Bike Trail. Because of this connectivity, the road is used heavily by bicyclists and pedestrians as well as vehicles, including heavy vehicles. The use by heavy vehicles that exceed the road's designed weight capacity is causing structural failure of the road. The shared use of the road by bicyclists, pedestrians, and motor vehicles causes congestion and safety concerns. The National Park Service (NPS) proposes to rehabilitate Moors Road with bicycle accommodations to improve the structural integrity of the road; improve bicyclist, pedestrian, and vehicular safety; reduce congestion; encourage alternative forms of transportation; protect natural resources; and maintain or improve upon the historic public use of the national seashore. Actions needed to achieve these goals are rehabilitation of the road's structure, widening of the road corridor, and addition of crosswalks. Implementation of the NPS preferred alternative would result in short-term, negligible, adverse impacts on special status species; short-term, minor, adverse impacts on dune ecosystems and wetland resources; short-term, moderate, adverse impacts on visual resources and public use and experience; long-term, negligible, adverse impacts on operations; long-term, minor, adverse impacts on dune ecosystems and visual resources; and long-term beneficial impacts on dune ecosystems, special status species, visual resources, public use and experience, public safety, and infrastructure. Long-term impacts to wetland resources could be beneficial or minor, adverse depending upon whether or not the culvert is replaced and, if replaced, how.

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Note to Reviewers and Respondents:

If you wish to comment on this Environmental Assessment/Assessment of Effect, you may mail comments within 30 days to the name and address below or you may post them electronically at <<http://parkplanning.nps.gov/caco>>. Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we would be able to do so.

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ACRONYMS AND ABBREVIATIONS

ACEC – Areas of Critical Environmental Concern
CCRTA – Cape Cod Regional Transit Authority
CEQ – Council on Environmental Quality
CZM – Coastal Zone Management
CZMA – Coastal Zone Management Act
CZMP – Coastal Zone Management Program
DEP – Department of Environmental Protection
DO – Director’s Order
DPA – Designated Port Areas
EA/AoE – environmental assessment/assessment of effect
EPA – Environmental Protection Agency
FEMA – Federal Emergency Management Agency
GMP – general management plan
IPCC – Intergovernmental Panel on Climate Change
MassDOT – Massachusetts Department of Transportation
Mass CZM – Massachusetts Office of Coastal Zone Management
MTCO²E – Metric Tons Carbon Dioxide Equivalent
the national seashore – Cape Cod National Seashore
NEPA – National Environmental Policy Act
NHESP – Natural Heritage and Endangered Species Program
NHPA – National Historic Preservation Act
NOI – Notice of Intent
NPDES – National Pollution Discharge Elimination System
NPS – National Park Service
NRCS – Natural Resources Conservation Service
SHPO – state historic preservation officer
SOF – statement of findings
US 6 – U.S. Highway 6
USCOE – U.S. Army Corps of Engineers
USFWS – U.S. Fish and Wildlife Service
WQC – Water Quality Certification

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INTRODUCTION: PURPOSE AND NEED

Cape Cod National Seashore (the national seashore) occupies more than 44,000 acres of the eastern shores of Cape Cod, an arm of land extending 70 miles into the Atlantic Ocean, approximately 100 miles southeast of Boston. The national seashore was established in 1961 to “preserve the nationally significant and special cultural and natural features ... that characterize the Outer Cape, along with the associated scenic ... and recreational values” (NPS 1998). The towns of Chatham, Orleans, Eastham, Wellfleet, Truro, and Provincetown are located on Cape Cod and are, in some cases, surrounded by national seashore land. The national seashore’s general management plan (GMP) notes that between 1970 and 1998, Cape Cod’s population grew at the fastest rate of any county in Massachusetts, nearly doubling in size, and putting pressure on the national seashore in a variety of ways, including its infrastructure (NPS 1998).

Moors Road (State Route 6A) runs through the North District of the national seashore in an area known as the Province Lands and connects Provincetown with U.S. Highway 6 (US 6), Herring Cove Beach, and the Province Lands Bike Trail (Figure 1). Moors Road is owned by and under the jurisdiction of the National Park Service (NPS) within park boundaries, and as such, the NPS proposes to rehabilitate Moors Road to withstand increasing heavy vehicle use and to enhance bicycle and pedestrian access to Herring Cove Beach and the Province Lands Bike Trail from Provincetown.

This Environmental Assessment/Assessment of Effect (EA/AoE) evaluates four alternatives: a no-action alternative and three action alternatives, including the NPS preferred alternative. The EA/AoE further analyzes the potential impacts these alternatives would have on the natural, cultural, and human environment. This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended; regulations of the Council on Environmental Quality (CEQ) (40 CFR 1508.9); and NPS Director’s Order (DO) 12: *Conservation Planning, Environmental Impact Analysis, and Decision-Making*. This EA/AoE also complies with section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended.

Additionally, this document includes a Federal Consistency Certification. The Federal Consistency Certification is required to describe how the proposed action complies with and would be conducted in a manner that is consistent with the Massachusetts Coastal Zone

Management Program policies. As an action within the Massachusetts designated coastal zone, such a certification is required by the Coastal Zone Management Act (CZMA) of 1972, as amended. The Federal Consistency Certification for the proposed action is contained in Appendix B of this EA/AoE.

PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed rehabilitation is to improve the structural integrity of the road; improve bicyclist, pedestrian, and vehicular safety; reduce congestion; encourage alternative forms of transportation; protect natural resources; and maintain or improve upon the historic public use of the national seashore. This project would meet the goals laid out in the national seashore's GMP for access and transportation, which include 1) providing access to public use areas that is environmentally sensitive, safe, and consistent with the desired experience and local intermodal planning initiatives and 2) adopting intermodal transportation goals (NPS 1998).

This project also would help meet the national seashore's goal to encourage visitors and local residents to leave their cars and directly experience the resources of the national seashore. Visitors could enjoy a car-free experience by taking public transportation like the Flex bus or ferry service from Boston and Plymouth to Provincetown. They could then rent and ride bicycles to the national seashore, an activity often enjoyed by residents of Provincetown.

This section of Moors Road between Provincetown and US 6 is heavily used during the visitor season by passenger vehicles, passenger buses, contractor equipment, delivery trucks, bicyclists, and pedestrians. A recent traffic study estimated that during peak season, traffic volumes along Moors Road, specifically during the weekend, range from 3,000 to 6,000 cars per day (VHB 2010a). Several factors within Provincetown have caused a steady increase in the use of Moors Road by tractor trailers, heavy delivery vehicles, construction equipment, and other vehicles whose gross vehicle weight exceeds the design capacity of the existing road profile. The west end of Provincetown has been experiencing increased construction activity, and because of traffic congestion and narrow streets being difficult to negotiate by large trucks within the town, those vehicles mentioned above have chosen to use Moors Road as their primary route of access to this part of town. As a result, the entire roadway is crumbling under the impact of excessive loading. Road rehabilitation is needed to rebuild the roadway to increase its ability to withstand increasing heavy vehicle use.

In addition to motor vehicle traffic, visitors ride their bicycles or walk along Moors Road to access Herring Cove Beach. It is estimated by national seashore staff that during the summer months up to 400 bicyclists a day use Moors Road to go to the national seashore. There were 14 accidents on Moors Road in 2007 that included both vehicle and bicycle accidents (NPS 2007). Moors Road itself is only 24 feet wide, with 1-foot paved shoulders that are often covered by drifting sand. The limited space of the roadway combined with the heavy shared uses creates congestion problems along with safety issues.



Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands

Figure 1
Project Location



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Cape Cod National Seashore

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Because of the safety issues associated with riding a bicycle along Moors Road, visitors to and residents of Provincetown who are otherwise within easy bicycling distance of the national seashore (McMillan Pier is just over a mile from the entrance to the national seashore), may prefer to drive to one of the Herring Cove Beach parking lots instead of riding a bicycle. By improving the safety of Moors Road related to shared use, visitors to the national seashore would be encouraged to use alternative forms of transportation to access Herring Cove Beach or even to continue on to the newly renovated Province Lands Bike Trail.

Finally, the current safety issues for those bicycling or walking to Herring Cove Beach from Provincetown may tempt them to leave the road as soon as possible or at varying points along the road. This leads to increased impacts on natural resources, specifically the dune ecosystems between Moors Road and Herring Cove Beach. Providing accommodations for bicyclists along the road also would provide for increased safety for both bicyclists and pedestrians and would encourage them to use those few beach access points discussed in this document and thus reduce impacts on the natural environment of the national seashore.

The public use of Moors Road and associated national seashore resources is something that visitors to and residents of Cape Cod, specifically Provincetown, have enjoyed for many years. Prior to the national seashore's establishment in 1961, this area was a state park. It provides residents with recreational opportunities and draws visitors to Provincetown so that they may enjoy some of those same opportunities. As one of the five roads leading into and out of Provincetown, residents and visitors have come to rely on this road for deliveries and other services associated with the heavy machinery described earlier. As such, there is a need to at least maintain, if not improve, the historic public use of Moors Road.

HISTORY AND SIGNIFICANCE OF CAPE COD NATIONAL SEASHORE

Cape Cod National Seashore was established in 1961 by President John F. Kennedy to “preserve the nationally significant and special cultural and natural features, distinctive patterns of human activity, and ambience that characterize the Outer Cape, along with the associated scenic, cultural, historic, scientific, and recreational values” and ensure that future generations will have an opportunity to experience, enjoy, and understand these features and values (NPS 1998).

Cape Cod is the largest glacial peninsula in the world. Because most of the national seashore is undeveloped, natural changes caused by wind, waves, tides, and rain are unusually obvious and often dramatic. The Great Beach, on the Atlantic Ocean side, is the longest expanse of uninterrupted sandy shoreline on the United States east coast (NPS 1998).

The Cape has also played an important role in human history. It was first inhabited by the Wampanoag Indians as many as 9,000 years ago, and Provincetown was the site of the first landing of the Pilgrims and signing of the Mayflower Compact in 1620. The first transatlantic cable was laid between Cape Cod and France in 1879, and in 1903 Guglielmo Marconi was instrumental in successfully sending and receiving the first exchange of transatlantic wireless messages between President Theodore Roosevelt and King Edward VII. Finally, the beauty, sense of solitude, and other aesthetic values of the Cape have been a source of inspiration and

renewal for artists and writers such as Edward Hopper, Mark Rothko, Jackson Pollock, Henry David Thoreau, John Dos Passos, and Mary McCarthy (NPS 1998).

STUDY AREA DESCRIPTION

Moors Road runs through the Province Lands portion of the national seashore's North District at the northern tip of the Cape, adjacent to Provincetown (see Figure 1). The study area includes a corridor along Moors Road from the point at which it enters the national seashore approximately 400 feet west of the intersection with Bradford Street near the west end of Provincetown to the point at which the road widens to four lanes and becomes US 6. The length of this segment is 1.17 miles. Several hundred feet to either side of the road was included in the study area during alternatives development to capture potential impacts on the national seashore's natural resources. This includes the wetland area to the north of Moors Road, separated from the moors by a set of culverts under the road (known locally as Mill Pond). The area of abandoned roadway resulting from the recent reconfiguration of the intersection of Moors Road with Province Lands Road is included in this study area. The abandoned section of roadway (formerly the north-bound travel lanes of US 6) travels approximately 1,600 feet from the location at which US 6 narrows and enters the study area. It ends near the southern end of the south Herring Cove Beach parking lot.

The study area also includes three main points at which a majority of visitors leave Moors Road to access Herring Cove Beach or the Province Lands Bike Trail. Access point 1 leaves the road almost immediately upon entering the study area to travel around the first large dune and out into the moors towards the southern portions of Herring Cove Beach. This access point is not a park-sanctioned trailhead or beach access point. Access point 2 is the point at which most bicycle and foot traffic coming from Provincetown leaves the road. This area is approximately 0.2 miles from the national seashore boundary and provides a split rail fence, which many visitors use as a bicycle rack. There is an obvious path through the dunes here that leads out onto the moors where visitors again head towards the southern portions of Herring Cove Beach. This is an official trailhead sanctioned by the national seashore, although there is no specifically identified trail leading through the moors to the beach. Access point 3 is another 0.4 miles from access point 2 and is the terminus of the Herring Cove Beach spur trail of the Province Lands Bike trail, as marked with a small brown bicycle trail sign and a yellow crosswalk. This paved trail leads to the bicycle racks, restrooms, the northern portion of Herring Cove Beach, and the rest of the Province Lands Bike Trail. Finally, access point 4 would be used in the future to cross Moors Road to access the planned connections to other bicycle trails. These study area locations are displayed in Figure 2.

PROJECT BACKGROUND

Previous and related planning studies have been completed for management within national seashore lands and also for cooperative management of nonfederal land. These plans were reviewed to provide additional information and guidance for the proposed action.



Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands

Figure 2
Study Area



National Park Service
U.S. Department of the Interior

Cape Cod National Seashore

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In addition, internal and public scoping was undertaken to allow agencies and interested parties to provide additional information regarding specific portions of the proposed action. The documents examined for background information and scoping efforts undertaken are summarized below.

PREVIOUS AND RELATED PLANNING STUDIES

Several plans and studies have informed and contributed to the development of alternatives for the rehabilitation of Moors Road with bicycle accommodations. These include the *Cape Cod National Seashore GMP* (NPS 1998), the *Cape Cod National Seashore Integrated Bicycle Feasibility Study* (VHB 2010b), and the *Province Lands Bike Trail Renovations EA* (NPS 2006a).

The *Cape Cod National Seashore GMP* (NPS 1998) lays out broad goals and objectives for managing the national seashore in the coming years. It proposes active promotion of a land stewardship ethic and practices to enhance natural and cultural resource protection and emphasizes cooperative efforts with local towns. It also calls for the creation of new educational and interpretive opportunities. Overall, its goals are to 1) preserve national seashore resources, 2) provide for the public enjoyment and visitor experience of the national seashore, 3) ensure organizational effectiveness, and 4) strengthen and preserve natural and cultural resources and enhance recreational opportunities through partnerships.

The GMP recognizes the increasing traffic congestion that the Cape is experiencing, especially during the summer months, and proposes cooperation with localities to reduce traffic congestion, facilitate circulation, enhance safety, and improve air quality by solving problems and promoting alternative transportation modes. The alternatives for the rehabilitation of Moors Road with bicycle accommodations reflect the goals articulated in the GMP for improving access and circulation within the national seashore.

The *Cape Cod National Seashore Integrated Bicycle Feasibility Study* (otherwise known as the *Integrated Bicycle Plan*; VHB 2010b) will help assure that the national seashore attractions, town centers, available transit systems, and other bicycle facilities are connected in an efficient manner and that NPS efforts are coordinated with proposals by the Commonwealth of Massachusetts and local communities. The study identifies potential projects to continue the region's investment in bicycle facilities both outside and inside the national seashore, creating more effective bicycle links to the national seashore and between localities such that a unified and integrated bicycle network can be developed to help mitigate the reliance on automobile travel, particularly for short trips and when visiting national seashore destinations. The connection of MacMillan Pier to national seashore resources, such as Herring Cove Beach and the Province Lands Bike Trail, is identified as one such potential project. The proposed action discussed in this document would provide this connection.

The *Province Lands Bike Trail Renovations EA* (NPS 2006a) evaluated the options for improving the Province Lands Bike Trail, which connects to the Herring Cove Beach parking lots and Moors Road. Issues identified during scoping and evaluation of this trail assisted in the

development of this document and the alternatives for bicycle accommodations. The Finding of No Significant Impact (FONSI) was signed in 2007, which allowed the NPS to proceed with the selected alternative. Implementation of the selected alternative provides a link to the recently improved trail for bicyclists from Provincetown.

SCOPING

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in a NEPA document. Scoping is used to identify which issues need to be analyzed in detail and which can be eliminated from in-depth analysis. It also allocates assignments among the interdisciplinary team members and/or other participating agencies, identifies related projects and associated documents, identifies permits, surveys, consultation, and other requirements, and creates a schedule that allows adequate time to prepare and distribute the environmental assessment/assessment of effect for public review and comment before a final decision is made. Scoping efforts include any public, staff, interested agency, or any agency with jurisdiction by law or expertise; for example, the State Historic Preservation Officer; the Tribal Historic Preservation Officer; the U.S. Fish and Wildlife Service; etc.

Scoping for the proposed rehabilitation of Moors Road began with NPS staff, agencies, and the public in the fall of 2009. This process introduced the purpose and need of the project and potential bike accommodations that could be included with the road rehabilitation. Discussions with interested agencies and individuals were initiated at this time. As part of this scoping effort, several agencies were contacted, including the U.S. Fish and Wildlife Service (USFWS), the Massachusetts Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP), the Massachusetts SHPO, the Tribal Historic Preservation Officer of the Wampanoag of Gay Head – Aquinnah, and the Tribal Chairman of the Mashpee Wampanoag Tribe. Internal NPS scoping between NPS team members and their consultants was an ongoing process.

The NPS held a public scoping meeting in Provincetown on September 24, 2009. At this meeting, the NPS solicited public input on options for better accommodating bicycle and pedestrian traffic along Moors Road. The meeting also provided the public with information on the purpose and need of the project and the planning process that would be followed. Following the public scoping session, the NPS held a 30-day public scoping comment period to solicit input on the proposed action.

The potential options for the proposed actions were presented at a public alternatives meeting in Provincetown on January 28, 2010, where public input helped to refine existing options. These refined options for the proposed action were evaluated during an internal Value Analysis process, including a Choosing By Advantages evaluation. The purpose of this process was to evaluate and recommend how to proceed with the determination of a preferred alternative for the project and to analyze components of the work for value effectiveness. The Value Analysis team included Provincetown governmental representatives in addition to NPS staff. For further scoping and public participation information, see “Chapter 5: Consultation and Coordination” and “Appendix A: Relevant Correspondence.”

PLANNING ISSUES AND CONCERNS

During the scoping process, specific concerns were identified as critical to consider while planning how to best rehabilitate Moors Road and provide bicycle and pedestrian accommodations. The following were identified as most important to the planning process: protecting the national seashore's natural resources, maintaining safe access through a national seashore, and preserving local traffic flows. Along with the purpose and need for the proposed action, these issues guided the development of alternatives and contributed to the selection of impact topics, as identified in the next section.

Protecting the national seashore's natural resources. The Province Lands contain some of Cape Cod National Seashore's most extensive and dynamic dune and swale ecosystems. The dunes are a fragile resource that can be easily damaged by human interference. The wetlands associated with the moors and with Mill Pond are also highly valued by Provincetown residents and national seashore visitors, as is the small section of dune forest just west of access point 2. Therefore, any proposals made in this plan should seek to maintain or enhance the protection of the national seashore's natural resources.

Maintaining safe public access through a national seashore. Moors Road is currently a two-lane road with 1-foot paved shoulders on either side. In many places, the paved shoulder (and possibly some of the traffic lane) is obscured by encroaching sand. Access point 2 is a popular point at which visitors to the park from Provincetown leave the road for Herring Cove Beach. This results in high numbers of bicyclists and pedestrians along the road (Hudson 2002), which conflicts with vehicular traffic. Therefore, any proposals made in this plan should seek to enhance the safe access for bicyclists and pedestrians visiting Herring Cove Beach or using Moors Road for recreational activities.

Preserving local traffic flows. Moors Road is currently one of five roads that can be used to access Provincetown and is the most logical point of entry for those accessing the western end of Provincetown. Therefore, any proposals made in this plan should take into careful consideration how alterations to Moors Road could impact the flow of traffic into and out of Provincetown.

REGULATORY ISSUES AND MANAGEMENT CONCERNS

Based on discussions with NPS staff and planning team members, implementation of the Moors Road Rehabilitation with Bicycle Improvements in the Province Lands EA/AoE should not require any changes to existing legislation or management policies. Prior to the implementation of the proposed action, the NPS would need to obtain appropriate local, state, and federal approval for some of the proposed activities. A list of permits, approvals, and regulatory requirements associated with the proposed action are as follows:

- Massachusetts National Pollution Discharge Elimination System (NPDES) General Permit from the Environmental Protection Agency (EPA)

- Notice of Intent (NOI) will need to be filed with the Provincetown Conservation Commission for any activities affecting wetlands according to the Massachusetts Wetland Protection Act
- Programmatic General Permit Category I or II under Section 404 of the Clean Water Act
- A Water Quality Certification (WQC) for work in salt marsh [314 CMR 9.04(8)] and Outstanding Resource Waters [314 CMR 9.04(2)] under Section 401 of the Clean Water Act
- Federal consistency review under the Massachusetts Coastal Zone Management Program

These requirements are described further in “Chapter 5: Consultation and Coordination,” and the NPS Federal Consistency Certification is included in Appendix B.

IMPACT TOPICS RETAINED FOR ANALYSIS

Impact topics are resources of concern within the project area that could be affected, either beneficially or adversely, by the range of alternatives presented in this EA/AoE. They were identified based on the issues raised during scoping; site conditions; federal laws, regulations, Executive Orders, NPS *Management Policies 2006* (NPS 2006b), and DOs; and staff knowledge of the national seashore’s resources.

Impact topics identified and analyzed in this EA/AoE are listed below along with a brief rationale for the selection of each impact topic. They include natural resources (*e.g.*, dune ecosystems, special status species, and wetland resources), visual resources, public use and experience, public safety, and operations and infrastructure. Each impact topic is further discussed in detail in “Chapter 3: Affected Environment” of this document, while the impacts of the action are described in “Chapter 4: Environmental Consequences.”

Dune Ecosystems. Protection of naturally occurring communities including dune habitat is a goal of the NPS, as stated in the NPS *Management Policies 2006* (NPS 2006b). Moors Road is located within the dynamic dune ecosystem of the Province Lands. The Natural Resources Conservation Service (NRCS) soil survey of Barnstable County, Massachusetts identifies loose sand and loamy sand as the dominant soil types in the study area (NRCS 2010). The proposed actions may involve disturbance, compaction, and exposure of natural soils and grading within the study area. The shifting nature of the dunes in the Province Lands has historically caused circulation problems on both roadways and bicycle trails. Any change in the width of Moors Road has the potential to impact the dunes through which the road passes.

During construction there would be a temporary disturbance and displacement of wildlife as a few trees and naturally shifting sands may be disturbed. Proposed widening also would reduce habitat along the margins of the existing roadway. At most, an acre of habitat along the roadway would be lost. This habitat is already disturbed by clearing the road of shifting sands and thus is not considered high-quality habitat. Unfortunately, additional edge habitat would be created at the edge of the widened roadway. The surrounding land, however, would continue to provide abundant nesting, escape, and protective cover. A few small animals may be forced to adjust to a shift in edge of habitat, but the effect on most local populations would not exceed negligible

adverse impacts in the long term. Because of the potential impacts on the dunes and the habitat they provide, the impact topic of dune ecosystems is addressed.

Special Status Species. In a letter dated November 18, 2009 (USFWS 2009; see Appendix A), the USFWS did not identify any federally listed species that may be found in or around the study area. In a letter dated November 19, 2009 (NHESP 2009; see Appendix A), the Massachusetts Division of Fisheries and Wildlife NHESP identified three state-listed species in the vicinity of the study area: the eastern box turtle (*Terrapene carolina*), eastern spadefoot (*Scaphiopus holbrookii*), and diamond-backed terrapin (*Malaclemys terrapin*). Based on its location relative to these species, the proposed action could impact special status species. Therefore, the impact topic of special status species is addressed.

Wetland Resources. Executive Order 11990, “Protection of Wetlands” and NPS DO-77-1: *Wetland Protection* (NPS 2002a) require an examination of impacts on wetland resources. The proposed action could permanently impact up to 0.004 acres (180 square feet) of wetlands and has the potential to restore tidal flows in Mill Pond. Wetland habitat exists along the current alignment of Moors Road and in the surrounding dunes. Therefore, the impact topic of wetland resources is addressed.

The *NPS Procedural Manual 77-1: Wetland Protection* (NPS 2008a) specifies those conditions under which impacts to wetlands are exempted from requiring that a Statement of Findings (SOF) be required. This project falls into the exception described in Section 4.2.1(g): the impacts mentioned above are associated with the renovation of a currently serviceable road and would impact less than 0.1 acres of wetlands. This NPS exception does not imply exception from compliance with Section 404 of the Clean Water Act or any other relevant laws, regulations, or procedures (these other requirements are described in more detail in “Chapter 5: Consultation and Coordination”).

Visual Resources. The Organic Act states that NPS units are charged with conserving national seashore scenery, along with all the natural and cultural resources that contribute to important views. In the evaluation of visual resources, both the visual character of the study area and the quality of the viewshed within the study area were considered. A viewshed comprises the limits of the visual environment associated with the proposed action including the viewsheds within, into, and out of the study area. Because the proposed actions could result in changes to the viewshed, the impact topic of visual resources is addressed.

Public Use and Experience. Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks (NPS 2006b). The NPS strives to provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the natural and cultural resources found in parks. The proposed action is meant to enhance the public use and experience, which encompasses interpretation, understanding, enjoyment, safety, circulation, and accessibility of the seashore. Because the proposed action would result in changes to the public use and experience, the impact topic of public use and experience is addressed.

Public Safety. NPS *Management Policies 2006* (NPS 2006b) instructs NPS staff to consider public safety in all proposed actions. Public safety concerns currently exist within the study area related to the heavy shared use of Moors Road by bicyclists, pedestrians, and motor vehicles within 24 feet of roadway. Because a primary objective of this project is the improvement of safety, the impact topic of public safety is addressed.

Operations and Infrastructure. Part of providing a quality experience for those visitors to and users of the national seashore is ensuring that infrastructure provides safe and efficient access to national seashore resources without overly burdening national seashore staff. The proposed action could result in widening of Moors Road and installation of traffic calming measures. Therefore, the impact topic of infrastructure and operations is addressed.

IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

Floodplains. Executive Order 11988, “Floodplain Management,” and NPS DO-77-2: *Floodplain Management*, require an examination of impacts on floodplains and potential risk involved in placing facilities within floodplains. The Federal Emergency Management Agency (FEMA) has declared the study area as part of an undeveloped coastal barrier zone. Within that zone, a portion of the proposed development would occur within areas of 100-year flood; however, the proposed action would involve rehabilitation of the existing roadway and would not add any structures to the study area that would result in a change in the ability of the floodplain to convey water. As a result, the impact topic of floodplains is dismissed.

Cultural Resources. Federal agency actions must comply with the NHPA of 1966, as amended. The intent of the NHPA is to integrate consideration of historic preservation issues into the early stages of project planning by a federal agency. Accordingly, under section 106 of the NHPA, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally financed undertaking is required. Before the expenditure of any federal funds on that undertaking, the federal agency must account for its effects on properties (districts, sites, buildings, structures, and objects) included or eligible for inclusion in the National Register of Historic Places. To focus attention on management requirements within these property types, NPS *Management Policies 2006* categorizes cultural resources as cultural landscapes, historic structures, archeological resources, museum collections, and ethnographic resources (per NPS DO-28: *Cultural Resource Management Guidelines*). The area of potential effect is delineated on Figure 3.

Cultural Landscapes. The NPS defines a cultural landscape as a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person exhibiting other cultural or aesthetic values. There are four kinds of cultural landscapes, which are not mutually exclusive: historic site, historic designed landscape, historic vernacular landscape, and ethnographic landscape (NPS DO-28: *Cultural Resources Management Guidelines*). The study area does not include any such landscapes; therefore, the impact topic of cultural landscapes is dismissed from further analysis.



LEGEND

- Cape Cod National Seashore Boundary
- Area of Potential Effect

Note: Location of stormwater infrastructure is approximate and subject to change during the final design phases. This Area of Potential Effect is meant to show the greatest possible extent of disturbance, given current plans.

Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands

**Figure 3
Area of Potential Effect**

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Historic Structures. A historic structure is defined by the NPS as “a constructed work, usually immovable by nature or design, consciously created to serve some human act” (NPS 2002b). In order for a structure or building to be listed on or eligible for listing on the National Register, it must possess historic integrity of those features necessary to convey its significance, particularly with respect to location, setting, design, feeling, association, workmanship, and materials. The National Register Bulletin #15: *How to Apply the National Register Criteria for Evaluation* (NPS 1990) provides a comprehensive discussion of these characteristics. There are no historic structures within the study area. Therefore, the impact topic of historic structures is dismissed from further analysis.

Archeological Resources. No archeological resources have been identified within the study area. Archeological resources are not anticipated in this area that is tidal wetland and encroaching dunes. The migrating of dunes and sand in this area is ongoing, thus somewhat unstable and likely not present in this form during pre Contact or early Historic time. If during construction previously undiscovered archeological resources were uncovered, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed in consultation with the Massachusetts SHPO and the relevant tribes. Archeological resources is dismissed as an impact topic.

Museum Collections. A museum collection is an assemblage of objects, works of art, historic documents, and/or natural history specimens collected according to a rational scheme and maintained so that they can be preserved, studied, and interpreted for public benefit (NPS 2002b). There are no museum collections within the study area. Therefore, the impact topic of museum collections is dismissed from further analysis.

Ethnographic Resources. An ethnographic resource is defined as any “site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it” (NPS 2002b). There are no known ethnographic resources within the study area. Therefore, the impact topic of ethnographic resources is dismissed from further analysis.

Section 106 Summary. After applying the Advisory Council on Historic Preservation regulations for the protection of historic properties (36 CFR Part 800), the NPS finds that there would be no historic properties affected in the implementation of the proposed undertaking to rehabilitate Moors Road with bicycle and pedestrian accommodations. A copy of this EA/AoE with the finding of no historic properties affected will be sent to the Advisory Council on Historic Preservation, the Tribal Historic Preservation Officer of the Wampanoag of Gay Head – Aquinnah, the Tribal Chairman of the Mashpee Wampanoag Tribe, the Provincetown Historical Commission, and the SHPO.

Indian Trust Resources and Sacred Sites. Secretarial Order 3175 requires that any anticipated impacts on Indian Trust resources from a proposed project or action by U.S. Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian Trust responsibility is a legally enforceable obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of

federal laws with respect to Native American tribes. There are no known Indian Trust resources in the study area, and the lands comprising the national seashore are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Additionally, the Tribal Historic Preservation Officer of the Wampanoag of Gay Head – Aquinnah and the Tribal Chairman of the Mashpee Wampanoag Tribe have been contacted, and the NPS has received no responses identifying the study area as a sacred site. Therefore, the impact topic of Indian Trust resources and sacred sites is dismissed from further analysis. In the unlikely event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) would be followed.

Prime Farmland. Prime farmland is one of several designations made by the U.S. Department of Agriculture to identify important farmlands in the United States. It is important because it contributes to the nation’s short- and long-range needs for food and fiber. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, few to no rocks, and permeable soils (designated as prime farmland soils). There are no prime farmland soils within the study area. Therefore, the impact topic of prime farmland is dismissed from further analysis.

Climate Change. Climate change refers to any significant changes in average climatic conditions (such as mean temperature, precipitation, or wind) or variability (such as seasonality, storm frequency, etc.) lasting for an extended period (decades or longer). Recent reports by the U.S. Climate Change Science Program, the National Academy of Sciences, and the United Nations Intergovernmental Panel on Climate Change (IPCC) provide clear evidence that climate change is occurring and will accelerate in the coming decades. There is strong evidence that global climate change is being driven by human activities worldwide, primarily the burning of fossil fuels and tropical deforestation. These activities release carbon dioxide and other heat-trapping gases, commonly called “greenhouse gases,” into the atmosphere (IPCC 2007).

There are two aspects of climate change that must be considered in an environmental impact analysis:

- our impact on climate change: i.e., through our actions, the potential to increase or decrease emissions of greenhouse gases that contribute to climate change
- the impact of climate change on us: i.e., how are the resources that we manage likely to change in response to changing climate conditions, and how does that change or otherwise affect our management actions and the impacts of those actions on the resource

The most recent Cape Cod National Seashore greenhouse gas inventory was completed in 2010 using the Climate Friendly Parks Program's Climate Leadership in Parks tool. This identifies the national seashore's emissions as 1,288 Metric Tons of Carbon Dioxide Equivalent (MTCO²E) for national seashore operations and 3,307 MTCO²E for gross national seashore emissions, which includes operations, concessions, permittees, and leasees (including Provincetown Municipal Airport), and estimated visitor transportation miles. The Moors Road bicycle accommodations

are meant to provide a more safe experience for nonmotorized use, although the NPS does not project either vehicle or bicycle demand to increase as a result of the alternatives. During the construction process, the proposed action could result in a temporary increase in emissions of greenhouse gases from the operation of construction vehicles. After construction, however, the project is not expected to increase the carbon footprint and could modestly reduce emissions. Because the project would have no measurable impacts on climate change, it is dismissed as an impact topic for further analysis.

Impacts of climate change on the project are likely to be of a subtle, gradual nature. A rise in sea level would alter the hydrology of the moors and other wetlands in or near the study area. Changes in climate such as general warming, changes in water availability, and storm frequency, intensity, or duration could cause changes in composition and location of vegetated communities within the dunes over the decades. Most people visiting or passing through the park would be unaware of the changes. Because of the long-range and subtle nature of these impacts, the impacts of climate change on the project are also dismissed from further analysis.

Energy Requirements and Conservation Potential. The CEQ guidelines for implementing NEPA require an examination of energy requirements and conservation potential as a possible impact topic in environmental documents [40 CFR 1502.16(e)]. The national seashore strives to incorporate the principles of sustainable design and development into all facilities and operations. The objectives of sustainability are to design structures to minimize adverse impacts on natural and cultural values; to reflect their environmental setting; to maintain and encourage biodiversity; to construct and retrofit facilities using energy efficient materials and building techniques; to operate and maintain facilities to promote their sustainability; and to illustrate and promote conservation principles and practices through sustainable design and ecologically sensitive use. Essentially, sustainability is living within the environment with the least impact on the environment. Although improving the bicycle and pedestrian accommodations along Moors Road may encourage visitors to the national seashore to utilize those forms of transportation instead of a car, none of the proposed actions are expected to result in noticeable changes to energy requirements or the ability to conserve energy resources. Consequently, any adverse impacts relating to energy use, availability, or conservation would be negligible. Therefore, the impact topic of energy requirements and conservation potential is dismissed from further analysis.

Socioeconomic Resources and Adjacent Lands. Some of the proposed actions are meant to provide improved connectivity with existing and proposed bicycle routes and bicycle trails on adjacent lands. This could potentially lead to an increase in bicycle rentals in Provincetown. Also, the construction associated with the road rehabilitation could provide some temporary employment. However, the proposed actions would not noticeably alter the socioeconomic resources. Neither would the proposed action impact local zoning or adjacent landowners. Therefore, the impact topic of socioeconomic resources and adjacent lands is dismissed from further analysis.

Environmental Justice. Executive Order 12898, “General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires all federal agencies to

incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low income populations and communities. According to the EPA, environmental justice is the "...fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies."

The goal of "fair treatment" is not to shift risks among populations, but to identify potentially disproportionately high and adverse effects and identify alternatives that may mitigate these impacts. Environmental justice is dismissed from further analysis for the following reasons:

- The national seashore staff and planning team solicited public participation as part of the planning process and gave equal consideration to all input from persons regardless of age, race, income status, or other socioeconomic or demographic factors.
- Implementation of the proposed action would not result in any identifiable adverse human health effects. Therefore, there would be no direct or indirect adverse impacts on any minority or low-income population.
- The impacts associated with implementation of the proposed action would not disproportionately affect any minority or low-income population or community.
- Implementation of the proposed action would not result in any identified effects that would be specific to any minority or low-income community.

2

ALTERNATIVES

Chapter 2 describes various alternatives for the rehabilitation of Moors Road with bicycle accommodations in the Province Lands at Cape Cod National Seashore. The alternatives for the proposed action were designed to improve site access, public use and experience, public safety, and national seashore infrastructure. CEQ regulations for implementation of NEPA call for the alternatives considered in a document to include a no-action alternative. The description and evaluation of this alternative provides a baseline to which the action alternatives can be compared. The EA/AoE examines four alternatives: Alternative A (the No-action Alternative) and three action alternatives.

DEVELOPMENT OF ALTERNATIVES

The alternatives presented in this document are meant to fulfill the goals laid out in the national seashore's GMP, which directs the national seashore to provide access to public use areas in a manner that is environmentally sensitive, safe, and consistent with the desired experience and intermodal planning initiatives (NPS 1998). Development of the alternatives presented in this document is the result of scoping within the NPS, coordination with representatives of the Provincetown government, and outreach to the general public during the planning process. The planning process included two public meetings and a Value Analysis. The NPS preferred alternative (Alternative C) was developed during the public alternatives meeting January 28, 2010 in Provincetown by combining several elements that had not previously been evaluated as an option. The advantages provided by this alternative were articulated and documented during the Value Analysis in March 2010. The alternatives vetted through this process are discussed in further detail in the following sections.

ALTERNATIVE A: NO-ACTION

Under the No-action Alternative, Moors Road would remain in its current condition and configuration as displayed on Figure 4. Through most of the study area, Moors Road consists of two 11-foot vehicle travel lanes with 1-foot paved shoulders on either side. The road configuration changes slightly as it turns west in the vicinity of the south Herring Cove Beach parking lot and the intersection with Province Lands Road where the road was recently narrowed from a four-lane divided highway to a two-lane roadway. Where former east-bound lanes of the divided highway used to be, much of the pavement has been removed, and vegetation is becoming established in the sand where the abandoned roadway is evident (see photographs inset

on Figure 4). Under the No-action Alternative, the abandoned roadway would continue to be vegetated by natural processes.

The road is currently riddled with a series of interconnected cracks caused by fatigue failure of the roadway surface, otherwise known as “alligator cracking,” and a patchwork of repaired pavement as use by vehicles exceeding the design capacity of the road causes deterioration of the roadway (see photos on Figure 4). This damage has been repaired in sections as time and funding allowed. Under the No-action Alternative, this targeted maintenance would continue. Stormwater currently either runs off the edge of pavement into the dunes or is directed off the road by asphalt flumes in a few places, particularly adjacent to the Mill Pond culverts (Figure 4). Under the No-action Alternative, this direct runoff of stormwater into the adjacent wetland areas would continue. The three existing culverts (each approximately 24 inches in diameter) at Mill Pond would continue to provide a route of water exchange between the pond and the rest of the moors.

Moors Road would continue to be used as one of the four main access routes into Provincetown by vehicles, including delivery trucks, construction vehicles, commercial buses, and recreational vehicles. It also would remain a main access route to Herring Cove Beach and the Province Lands Bike Trail from Provincetown for bicyclists and pedestrians. The narrow width of roadway would continue to be a source of safety concerns and congestion related to the shared use of the road by vehicles and recreational users, especially during the summer months. The only potential bicycle accommodations that would be included under this alternative would be the addition of “Share the Road” traffic signs at either end of the study area and continued maintenance of the split rail fence currently serving as a bicycle rack at access point 2.

There is split rail fencing intermittently spread along the roadway in areas where the national seashore is discouraging visitors from damaging natural resources. There is a short stretch along the dunes in the middle of the study area, and there is a section discouraging shortcuts between Moors Road and the Herring Cove Beach spur of the Province Lands Bike trail at the northern end of the study area. The fencing that receives the most attention is the portion lining the road on either side of access point 2. This was originally placed there to prevent bicyclists from chaining their bicycles to the trees; however, since the construction of the fence, the fence itself has served as a bicycle rack. It sometimes holds up to 400 bicycles during peak visitation. Under the No-action Alternative, the fence would continue to provide bicycle parking in close proximity to the road (Figure 4).

Finally, there is currently a single brown 3-foot by 4-foot board posted just behind the split rail fence at access point 2 (Figure 4). The information on this board can be changed as the national seashore sees fit. It currently provides information on wayfinding and reduction of impacts for those visitors headed to Herring Cove Beach. Under the No-action Alternative, this board would remain as the primary opportunity for orientation and interpretation within the study area.



*Cape Cod National Seashore
Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands
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ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

There are several elements common to all action alternatives. Under all action alternatives, the abandoned section of US 6 where it enters the project area would eventually be paved within the former footprint of the roadway, creating a 10-foot wide dedicated bicyclist/pedestrian path. This stretch of abandoned roadway is approximately 1,600 feet long and is highlighted on all alternative figures. This could provide a connection to a planned future extension of the Cape Cod Rail Trail; however, until such a connection is made, it will end along the side of US 6 at the edge of the study area. Until the connection to a future trail is made, bicyclists travelling along Moors Road from Provincetown would be directed towards the Province Lands Bike Trail to avoid confusion. The connection to the Province Lands Bike Trail occurs at the crosswalk just south of the South Herring Cove parking lot.

Another element common to all action alternatives is the full-depth rehabilitation of the roadway to better withstand increasing use by heavy vehicles. The rehabilitation would take place from the national seashore boundary closest to the western end of Provincetown to the point at which the road was recently realigned at the entrance to Province Lands Road. The rehabilitation would involve reclaiming the current road, grinding those materials, and reusing them to the greatest extent possible as the gravel base for the new road surface. The current design proposes a 4-inch layer of asphalt on top of the gravel base to increase the structural integrity of the roadway. Any widened areas of the roadway would require the excavation of existing soils along the edge of the existing roadway. The depth of excavation is estimated to be 16 inches; the actual design of the road would not be finalized until after additional technical studies of the existing roadway and underlying geology are undertaken. The width of the rehabilitated road varies by action alternative and is specified in the respective alternative descriptions.

The assumption going into construction of all alternatives is that the existing culvert pipes are in good condition. If, however, during construction it is determined that one or more of the existing three culvert pipes are damaged and need to be replaced, NPS would consider a range of options for replacement. Each option would consider benefits to natural resources, short-term construction impacts, and replacement costs. Options could include either replacing the culvert in kind or replacing it with a larger box culvert type of structure. The in-kind replacement would maintain something similar to the existing three 24-inch pipes. The box culvert structure would be a narrow (approximately 10-foot wide), three-sided concrete box culvert or something similar with a natural bottom. A guard rail would be added along both sides of the culvert for safety. This guard rail would be constructed of wood or weathering steel (otherwise known as corten steel) and would be built to NPS standards.

Measures would be implemented under all action alternatives to better manage stormwater runoff, especially in areas where current drainage may be undermining road stability. The road rehabilitation would include a subtle curb at the edge of the pavement to guide stormwater to either paved swales or catch basins beneath “bicycle safe” grates. The paved swales would be used in the vicinity of the culvert and access point 2. Catch basins would allow sediments to settle out and would be designed to contain oil and floating material from the runoff. During major storm events, the curbs would still allow stormwater to overflow into the adjacent dunes, which provide natural infiltration.

Most of these catch basins would be connected to leach basins located just off the roadway. The catch basins are designed to simply collect and convey stormwater run-off, whereas the leach basins collect and treat run-off through infiltration methods. Preliminary designs call for six leach basins to be installed. The leach basins would be installed in two areas. One would be installed on each side of the roadway just east of access point 1. Another three would be installed on the northeast side of the road at the low point within the forested section of the road, and one would be installed on the southwest side of the road in the same location. The NPS would use best management practices to improve the road design to reduce the impacts from road runoff. When an alternative is selected through the EA process and design moves forward, drainage options may be refined to minimize impacts on the dunes while treating runoff.

Although a number of traffic-calming measures were considered during alternatives development, the team agreed that the most important and efficient measures should focus on measures to slow traffic in the vicinity of pedestrian crossings. All alternatives would include at least one raised crosswalk (as pictured here). It would be elevated a few inches above the road grade with tapers on both sides. The raised table crosswalk would be constructed from a differently colored aggregate than the rest of the roadway and/or would be striped in such a way as to make it noticeable without detracting from the natural setting. An at-grade crosswalk would be painted at access point 4 in conjunction with the construction of the additional bicycle trail connection on the abandoned roadway. Signs may be added to the study area to warn drivers of the crosswalks. The split rail fence also may be moved further from the road to increase safety and potentially increase capacity for bicycles where doing so could be accomplished without any noticeable impacts on the dunes.



Sample photo of a raised crosswalk made of brick. The materials and markings used on Moors Road may vary.

During construction of all alternatives, the portion of road to be rehabilitated would be closed entirely for approximately four to eight weeks during the off season (between Labor Day and Memorial Day). This is would minimize disruption to the contractor by allowing him to work uninterrupted, without needing to manage traffic. This would enable the contractor to mobilize once and make it possible for the project to be completed in one season, during the off-season. This would be the most efficient way, financially and in terms of project length, to accomplish the roadway improvements. Drivers wishing to access Provincetown would likely be redirected onto Shankpainter Road from US 6 during this construction period.

Finally, under all action alternatives, the park may install a second information board next to the existing board to provide additional space for orientation and interpretive information on Herring Cove Beach and its associated resources.

The implementation of all elements within all action alternatives would be dependent upon funding. Portions of each alternative both described in this section and the following sections may be delayed while additional funding is acquired.

ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Alternative B would provide a raised table crosswalk at access points 2 and 3 in addition to providing the future trail connection, the rebuilt road structure, replacement of the existing culverts, modified stormwater infrastructure, additional signs, and a second information board described above. The road would not be widened beyond its existing footprint (24 feet). Both the crosswalks at access points 2 and 3 would be several inches high and include tapers on either side. Because of the wide swath of activity and heavy use at access point 2, the crosswalk would be approximately 20 feet wide. The crosswalk at access point 3 would remain at its current width, approximately 10 feet (not including tapers). Both crosswalks would be constructed, as mentioned above, from a differently colored aggregate as the roadway surface and would be striped in such a way as to be noticeable without detracting from the natural setting of the road. An at-grade crosswalk would only be formalized at access point 1 in the case that national seashore rangers considered it necessary to further improve safety in the study area. This alternative is illustrated on Figure 5.

Estimated net cost of construction: \$1.2 million.

ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED)

Alternative C would provide a raised table crosswalk at access points 2 and 3 in addition to providing the future trail connection, the rebuilt road structure, replacement of the existing culverts, modified stormwater infrastructure, additional signs, and a second information board described above. The crosswalks would be the same as described under Alternative B. The roadway rehabilitation, however, would include the addition of widened paved shoulders. The widening would provide 6-foot paved shoulders on both sides of the road from the national seashore boundary to access point 2. From access point 2 until the South Herring Cove parking lot, the widening would include 4-foot paved shoulders. Since the current road includes 1-foot paved shoulders, the addition of these shoulders would result in a net 10-foot and 6-foot increase in road width for the respective sections. This alternative would increase the width of the road to 34 and 30 feet for each respective section (from the current 24 feet). The elevation of the road would be raised a few feet in the area of frequent sand encroachment to minimize the impacts on adjacent dune topography. This alternative is illustrated on Figure 6.

Estimated net cost of construction: \$1.9 million.

ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

In addition to the future trail connection, the rebuilt road structure, replacement of the existing culverts, modified stormwater infrastructure, additional signs, and a second information board described above, Alternative D would provide a 10-foot separate multiuse path on the southwest side of the road as part of the roadway rehabilitation and a raised crosswalk at access point 1. This alternative includes the existing roadway layout (11-foot vehicle travel lanes with 1-foot paved shoulders), a 2-foot buffer area including a guard rail, and the 10-foot paved pathway. This alternative would increase the width of the road to be 36 feet wide (from the current 24 feet). As in Alternative C, the elevation of the road would be raised a few feet in the area of frequent sand encroachment to minimize the impacts on adjacent dune topography.

A guard rail would separate the vehicular from the nonmotorized traffic. As with the guard rail at the culvert, this guard rail would be constructed of wood or weathering steel and would be built to NPS standards. The placement of the separate path on the southwest side of the road is meant to reduce bicyclist/pedestrian crossing of the road except for the point at which they enter the national seashore, which is why a raised crosswalk is proposed at access point 1 under this alternative. This alternative is illustrated on Figure 7.

Estimated net cost of construction: \$2.6 million.

MITIGATION MEASURES

To minimize environmental impacts related to the action alternatives, the NPS would implement mitigation measures whenever feasible. Most of the mitigation measures would be related to the temporary adverse impacts resulting from construction of the rehabilitated roadway. A number of measures also would be implemented according to Appendix B of the *NPS Procedural Manual 77-1: Wetland Protection* (NPS 2008a) to minimize adverse impacts on wetlands. Although the exact mitigation measures to be implemented would depend upon the final design and approval of plans by relevant agencies, the following is a list of actions that could take place:

- Actions would have only negligible adverse impacts on site hydrology, including flow, circulation, velocities, hydroperiods, water level fluctuations, and so on. Care would be taken to avoid any rutting caused by vehicles or equipment.
- Action is conducted so as to avoid degrading water quality to the maximum extent practicable. Measures would be employed to prevent or control spills of fuels, lubricants, or other contaminants from entering the waterway or wetland. Actions would be consistent with state water quality standards and Clean Water Act Section 401 certification requirements.
- Appropriate erosion and siltation controls would be maintained during construction, and all exposed soil or fill material would be permanently stabilized at the earliest practicable date. To this end, bundles of sticks (otherwise known as wattles) would be used to control erosion in wetland areas and also would be used with silt fence in 100-foot wetland buffer areas to minimize impacts associated with the intrusive installation techniques required for silt fence, and to collect and absorb any oil sheen from the new asphalt surface.

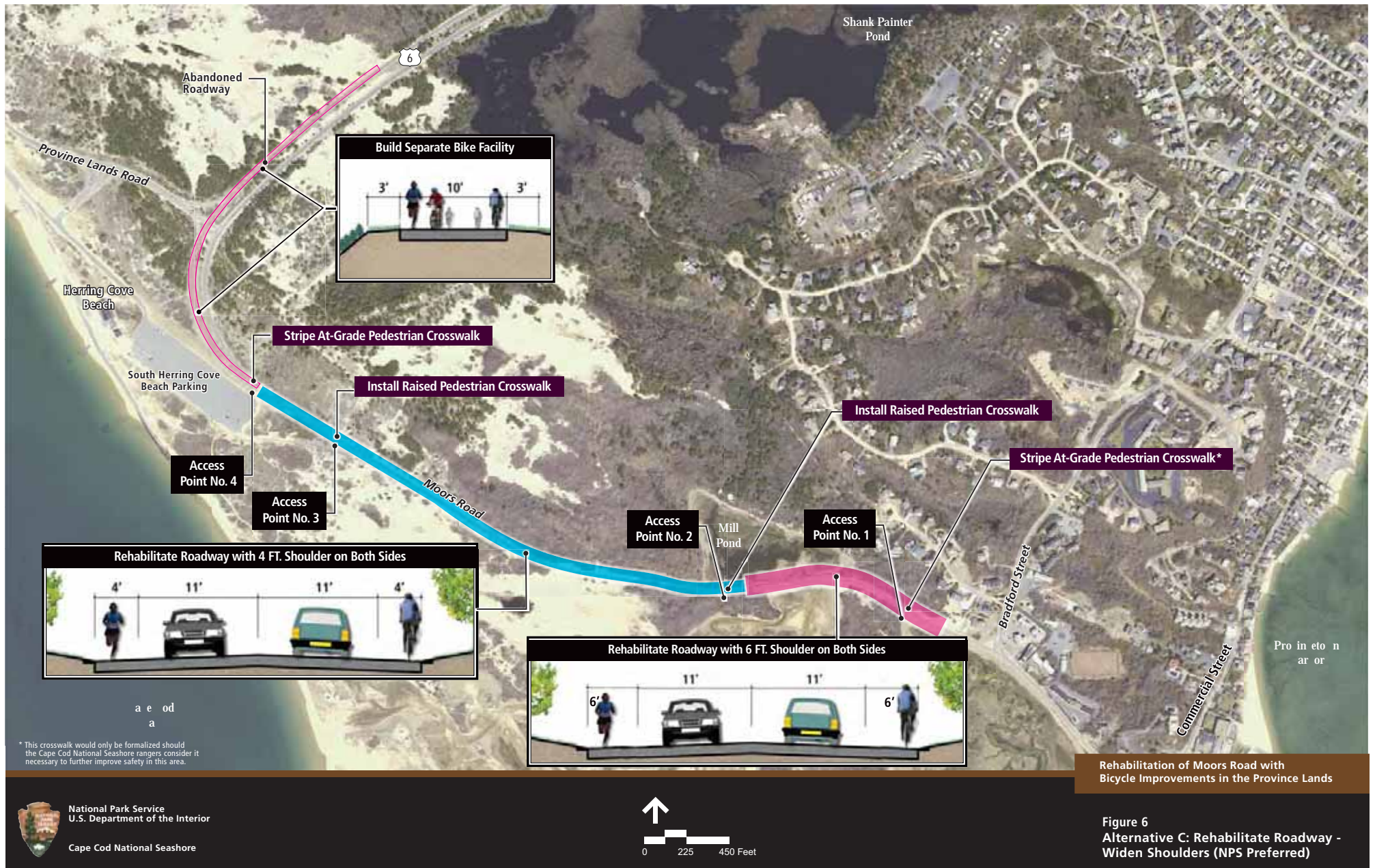


Rehabilitation of Moors Road with Bicycle Improvements in the Province Lands

Figure 5
Alternative B: Rehabilitate Roadway - Maintain Width

*Cape Cod National Seashore
Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands
Environmental Assessment/Assessment of Effect*

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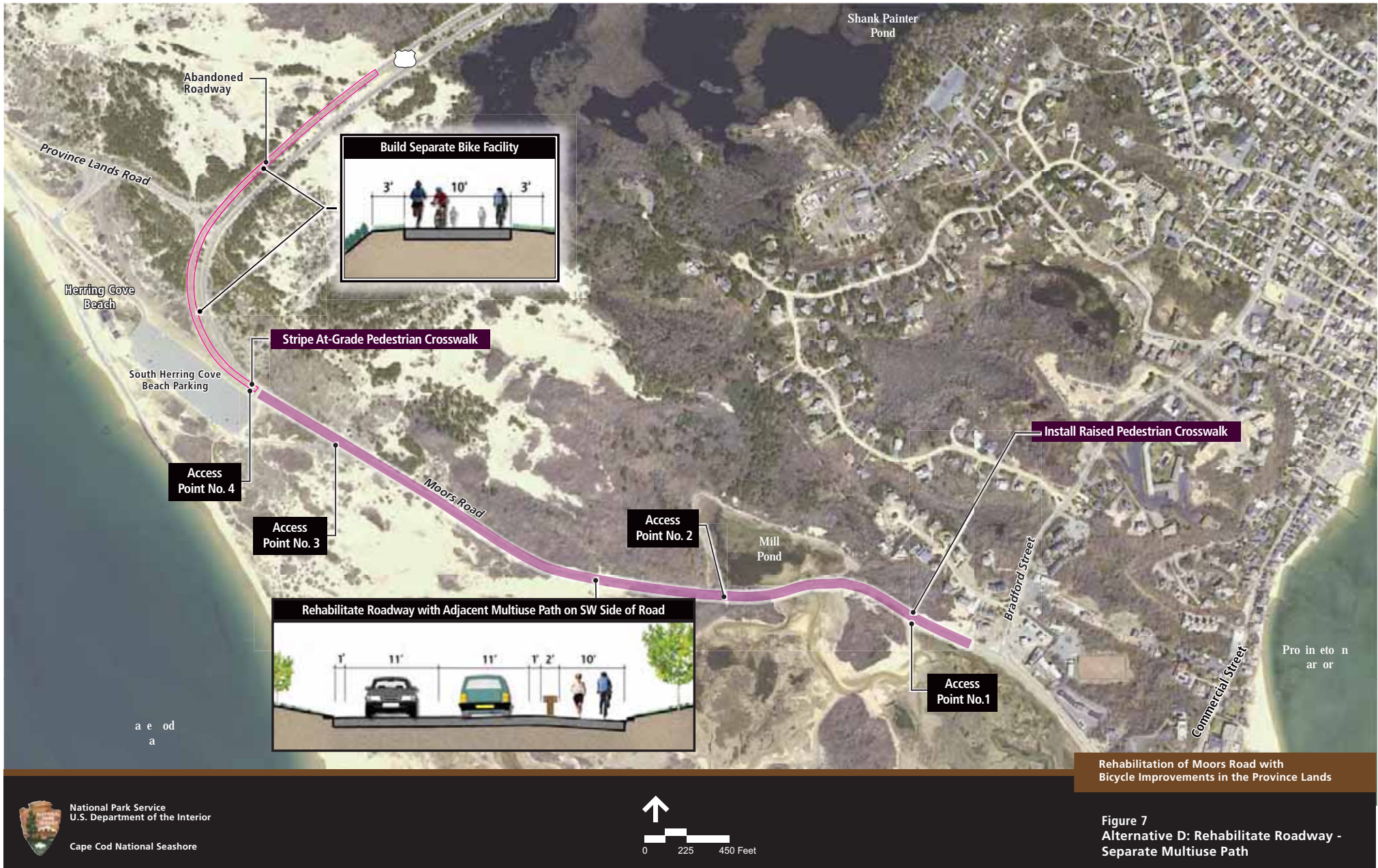
* This crosswalk would only be formalized should the Cape Cod National Seashore rangers consider it necessary to further improve safety in this area.

Rehabilitation of Moors Road with Bicycle Improvements in the Province Lands

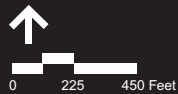
Figure 6
Alternative C: Rehabilitate Roadway - Widen Shoulders (NPS Preferred)

*Cape Cod National Seashore
Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands
Environmental Assessment/Assessment of Effect*

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National Park Service
U.S. Department of the Interior
Cape Cod National Seashore



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- Stockpile materials would be placed in the South Herring Cove Beach parking lot to avoid impacting any natural features. Wattles would be placed down-gradient of each area to contain any potential spills or sediment run-off.
- Where plantings or seeding are required, native plant material would be obtained and used in accordance with NPS policies and guidance. Management techniques would be implemented to foster rapid development of target native plant communities and to eliminate invasion by exotic or other undesirable species.
- Construction equipment would be restricted to the road corridor to avoid impacts on natural resources, including spadefoot toad and box turtle habitat.
- Erosion controls would include "critter-gaps" to facilitate species movement and avoid entrapment in the work zone.
- No construction would occur between April 15th and August 30th to avoid the spadefoot toad breeding season and minimize activity during the box turtle active season.
- Visual sweeps of the construction limits would occur daily during construction through November, and any turtles found would be relocated from the construction limits. These activities would be conducted under the supervision of the national seashore's Wildlife Biologist.
- If during construction previously undiscovered archeological resources were uncovered, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed in consultation with the Massachusetts SHPO.
- Temporary advanced warning signs would be installed to warn of road closure during construction and would provide a detour for through traffic to Provincetown.

ELEMENTS CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS

The options for potential bicyclist and pedestrian accommodations to be incorporated with the structural rehabilitation of Moors Road were narrowed through internal scoping, meetings with Provincetown representatives, and meetings with the public. During this process, the objectives of the project and the planning issues were kept in mind. Several elements that could have been included but that were dismissed from further analysis are the seasonal conversion of Moors Road to one-way vehicle traffic, a heavy vehicle restriction, additional traffic calming measures, and a separate multiuse path through the dunes or around Mill Pond.

ONE-WAY TRAFFIC

The conversion of the road to one-way traffic during the peak visitation months would provide a way to accommodate bicyclist and pedestrian traffic without widening the road and impacting the national seashore's natural resources. However, a traffic study conducted as part of the background for this project found that altering the circulation pattern of Moors Road to one-way (either way) has the potential for substantial traffic impacts along Shank Painter Road and Conwell Street in Provincetown; two roadways that already operate under congested conditions during the summer months. Mitigation measures that would add capacity to accommodate the additional demand at these locations are not feasible without substantial impacts on adjacent properties and would not be

in keeping with the traditional setting of a Cape Cod community (VHB 2010a). Therefore, this alternative was determined infeasible and dismissed from further consideration.

HEAVY VEHICLE RESTRICTION

As part of the alternatives development process, the team considered placing a heavy vehicle restriction on Moors Road. As a component of one of the action alternatives, a heavy vehicle restriction could reduce the stress on the structure of Moors Road and could improve safety within the national seashore; however, it would force delivery trucks and construction vehicles to use other, often more narrow, roads to access Provincetown. Implementing this restriction would go against the project's purpose of maintaining this historic public use of Moors Road. The action alternatives proposed provide a more comprehensive method of meeting the purpose and need of the project. Therefore, this element was determined infeasible as part of this project and dismissed from further consideration, although the national seashore reserves the right to implement such a restriction in the future should it become necessary.

ADDITIONAL TRAFFIC CALMING MEASURES

During the course of scoping and alternatives development, the team considered a number of different traffic calming measures to slow traffic, increase awareness of the heavy pedestrian and bicyclist use of the roadway, and otherwise improve safety within the study area. A roundabout was considered as part of the one-way traffic alternative; however, it would have increased the footprint of the project and increased the damage on natural resources. Speed bumps and speed humps were considered but are undesirable along a roadway with so much bicycle traffic. The raised table crosswalks were considered the most effective and efficient way of calming traffic and therefore were included in all action alternatives. The other methods would impose additional natural resource impacts and could potentially decrease safety if they caused bicycle crashes. Therefore, these elements were determined infeasible and dismissed from further consideration.

MULTIUSE PATH THROUGH THE DUNES

A multiuse path through the surrounding dunes and physically separate from Moors Road would provide the greatest separation of bicycle and foot traffic from vehicular traffic. A 10-foot wide multiuse path meandering around Mill Pond and the dunes to the north of Moors Road or meandering through the dunes to the south of the road was considered; however, the path would not be consistent with the national seashore's goals, as articulated in the GMP, to maintain the natural resources of the national seashore. A separate path would have impacts in pristine areas and could potentially encourage the creation of new social trails from the path. This alternative is not considered feasible due to environmental impacts and incompatibility with national seashore mandates.

SUMMARY OF THE ALTERNATIVES

Table 1 provides a summary of the alternatives presented above.

Table 1: Summary of Alternatives				
	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Road Condition	The road would continue to deteriorate and be patched or resurfaced in sections.	The road would be rehabilitated to withstand heavy vehicle use. Road surface would be smooth and uniform.	Same as Alternative B.	Same as Alternative B.
Road Width	The road would remain 24 feet. This includes two 11-foot travel lanes and two 1-foot paved shoulders.	Same as Alternative A.	The road would be widened to 34 feet from the national seashore boundary to access point 2. This includes two 11-foot travel lanes and two 6-foot paved shoulders. The road would be widened to 30 feet from access point 2 to the abandoned roadway. This would include two 11-foot travel lanes and two 4-foot paved shoulders.	The road would be widened to 36 feet from the national seashore boundary to the abandoned roadway. This would include two 11-foot travel lanes (with two 1-foot shoulders) and an adjacent 10-foot multiuse path. There would be 2 feet of paved separation between the roadway and the multiuse path.
Stormwater Treatment	None. Runoff percolates naturally at the roadside.	Preliminary plans call for a total of 6 leach basins to be installed at 2 locations adjacent to the road to provide treatment of stormwater. Paved swales would guide stormwater off the road in two additional locations.	Same as Alternative B.	Same as Alternative B.

Table 1: Summary of Alternatives (continued)				
	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Bicycle/Pedestrian Accommodation	There are yellow diamond bicycle road signs on both sides of the crosswalk at the terminus of the Province Lands Bike Trail spur. “Share the Road” signs may be added at both ends of the study area.	Similar to Alternative A. Signs also would be added to warn of the raised crosswalks. The split rail fence functioning as a bicycle rack would be moved back from the road where possible to provide additional room for bicycle parking. The abandoned roadway in the northern end of the study section would be paved to provide a 10-foot connector bicycle trail.	The addition of 6-foot shoulders in the most heavily traveled section of roadway and 4-foot shoulders until the abandoned roadway provides space for bicyclists and pedestrians to be removed from travel lanes. Signs posted, additional room for bicycle parking, and connector bicycle trail would be provided as described under Alternative B.	The addition of the 10-foot multiuse path adjacent to the travel lanes but separated by a 2-foot buffer and a guard rail would provide a way to physically separate pedestrians and bicyclists from the travel lanes. Signs posted, additional room for bicycle parking, and connector bicycle trail would be provided as described under Alternative B.
Traffic Calming and Safety Structures	There would be no traffic calming or safety structures installed with the possible exception of some signs.	Two raised crosswalks would be installed, one at access point 2 and one at access point 3. An at-grade crosswalk would be striped at access point 4. Guard rails would be added along both sides of the road at the Mill Pond culverts.	Same as Alternative B.	A raised crosswalk would be installed at access point 1 (not at access points 2 or 3). At-grade crosswalk would be striped at access point 4. Guard rails would be added along both sides of the road at the Mill Pond culverts and would separate the multiuse path from the travel lanes.
Wayfinding/ Interpretation	One board (3 feet by 4 feet) provides space for the park to post orientation and/or interpretive information.	One additional board of the same size would be added next to the existing board to provide additional space for orientation and/or interpretive information.	Same as Alternative B.	Same as Alternative B.

Table 1: Summary of Alternatives (continued)				
	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Meets Purpose and Need?	No. The structure of the road remains inadequate, and no additional bicycle accommodations are included.	Yes. The structure of the road would be improved, and the addition of traffic calming devices and additional signs provide minimal bicycle accommodations.	Yes. The structure of the road would be improved, and the addition of widened shoulders and traffic calming measures provides bicycle accommodations.	Yes. The structure of the road would be improved, and the addition of widened shoulders and traffic calming measures provides bicycle accommodations.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Table 2 provides a summary of the environmental consequences related to each alternative. A more detailed explanation of the impacts is presented in “Chapter 4: Environmental Consequences.”

Table 2: Summary of Environmental Consequences

For a complete description of impacts, see "Chapter 4: Environmental Consequences"

Resource	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Dune Ecosystems	<p>The toes of dunes along the roadway would continue to be destabilized due to current maintenance practices of clearing sand from the road. Visitors would continue to enter the dunes at any convenient area along Moors Road causing additional destabilization. Vegetation outside the area impacted by sand clearing would remain mostly unaffected.</p> <p>Overall Impact: long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse increment to a long-term, minor, adverse cumulative impact</p>	<p>Erosion at dune toes at the edge of the road would continue, as in Alternative A; however, the addition of crosswalks would focus pedestrian traffic into the dunes along specific access. This would reduce low-threshold substrate compaction. Construction would cause temporary disturbance of soils and vegetation.</p> <p>Overall Impact: short-term, minor, adverse impacts and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes an imperceptible beneficial increment to a long-term, minor, adverse cumulative impact</p>	<p>Pedestrian traffic would be focused by crosswalks, and dunes would be somewhat stabilized by the increased road profile; however, the widening of the road would result in soil excavation and compaction and removal of vegetation, include 8-12 trees through the dune forest.</p> <p>Overall Impact: short-term, minor, adverse impacts; long-term, beneficial impacts; and long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes a noticeable adverse increment to a long-term, minor, adverse cumulative impact</p>	<p>Dunes would be somewhat stabilized by the increased road profile; however, the widening of the road would result in soil excavation and compaction and removal of vegetation, including 20-25 trees through the dune forest.</p> <p>Overall Impact: short-term, minor, adverse impacts; long-term, beneficial impacts; and long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes a noticeable adverse increment to a long-term, minor, adverse cumulative impact</p>

Table 2: Summary of Environmental Consequences (continued)

For a complete description of impacts, see "Chapter 4: Environmental Consequences"

Resource	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Special Status Species	<p>Visitors dispersing through the dunes may impact potential habitat for eastern box turtle and eastern spadefoot.</p> <p>Overall Impact: long-term, negligible, adverse impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse increment to a long-term, negligible, adverse cumulative impact</p>	<p>Crosswalks could minimize social trails through the dunes, which function as potential habitat for eastern box turtle and eastern spadefoot. Construction would also cause temporary disturbance to dune habitat adjacent to the road.</p> <p>Overall Impact: short-term, negligible, adverse impacts and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes an imperceptible beneficial increment to a long-term, negligible, adverse cumulative impact</p>	<p>Same as Alternative B. Roadway widening would result in a loss of approximately 26,000 square feet of dune habitat. Installation of the roadway stabilization would reduce approximately 90 square feet of wetland habitat for the diamondback terrapin.</p> <p>Overall Impact: short-term, negligible, adverse impacts and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes an imperceptible beneficial increment to a long-term, negligible, adverse cumulative impact</p>	<p>Same as Alternative B. Roadway widening would result in a loss of approximately 43,000 square feet of dune habitat. Installation of the roadway stabilization would reduce approximately 180 square feet of wetland habitat for the diamondback terrapin.</p> <p>Overall Impact: short-term, negligible, adverse impacts and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes an imperceptible beneficial increment to a long-term, negligible, adverse cumulative impact</p>

Table 2: Summary of Environmental Consequences (continued)

For a complete description of impacts, see "Chapter 4: Environmental Consequences"

Resource	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Wetland Resources	<p>Stormwater would continue to run off the road into wetlands unattenuated. This results in low levels of water quality degradation related to sedimentation that is generally below levels of detection. Restricted flows caused by the existing culvert would continue to cause slight impacts to the functions of the associated wetlands.</p> <p>Overall Impact: long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse increment to a long-term, minor, adverse cumulative impact</p>	<p>Installation of riprap at runoff locations in the vicinity of the wetlands would reduce sedimentation. Replacement of the culvert could restore hydrology and approximately 0.005 acres (240 square feet) of tidal wetland channel. Mitigation measures would minimize potential sedimentation and runoff associated with asphalt paving during construction of the rehabilitated roadway.</p> <p>Overall Impact: short-term, minor, adverse impacts and, depending on culvert replacement, long-term adverse or long-term, beneficial impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse or beneficial increment to a long-term, minor, adverse cumulative impact</p>	<p>Same as Alternative B with approximately 0.002 acres (90 square feet) of wetlands impacted due to bank stabilization associated with road widening.</p> <p>Overall Impact: short-term, minor, adverse impacts and, depending on culvert replacement, long-term adverse or long-term, beneficial impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse or beneficial increment to a long-term, minor, adverse cumulative impact</p>	<p>Same as Alternative B with approximately 0.004 acres (180 square feet) of wetlands impacted due to bank stabilization associated with road widening.</p> <p>Overall Impact: short-term, minor, adverse impacts and, depending on culvert replacement, long-term adverse or long-term, beneficial impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse or beneficial increment to a long-term, minor, adverse cumulative impact</p>

Table 2: Summary of Environmental Consequences (continued)

For a complete description of impacts, see "Chapter 4: Environmental Consequences"

Resource	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Visual Resources	<p>Viewsheds within and surrounding the study area are mostly unchanged; however, the road surface is deteriorating and patched. The persistence of this condition would require increased frequency of heavy trucks to patch or resurface sections of the road as time and funding allows.</p> <p>Overall Impact: short-term, minor, adverse and long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes a imperceptible adverse increment to a long-term, beneficial cumulative impact</p>	<p>There would be minor changes to the views along the roadway associated with the addition of minimal safety measures such as raised crosswalks, signs, and a guard rail along the open area at the culvert; however, the appearance of the road itself would be improved.</p> <p>Overall Impact: short-term, minor, adverse impacts and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable beneficial increment to a long-term, beneficial cumulative impact</p>	<p>Safety features in Alternative B would detract slightly from the natural setting of the road. The paved road corridor would be 10 feet wider in the southern study area and 6 feet wider through the dune forest and rest of the study area. Approximately 8-12 trees would be cleared through the dune forest; however the canopy would be expected to fill in, and visitors would become accustomed to the slightly more developed roadway.</p> <p>Overall Impact: short-term, moderate, adverse impacts; long-term, minor, adverse; and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable beneficial increment to a long-term, beneficial cumulative impact</p>	<p>Similar to Alternative C. The paved road corridor would be increased by 12 feet throughout the study area, and a guard rail would be added along the entire road to separate the road from the multiuse path. Only one crosswalk would be added instead of three. Approximately 20-25 trees would be cleared through the dune forest. Even with the recovery of the overstory, the change in canopy would be readily apparent.</p> <p>Overall Impact: short-term, moderate, adverse impacts; long-term, moderate, adverse; and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable adverse increment to a long-term, minor, adverse cumulative impact</p>

Table 2: Summary of Environmental Consequences (continued)

For a complete description of impacts, see "Chapter 4: Environmental Consequences"

Resource	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Public Use and Experience	<p>Visitors use Moors Road to access recreation at Herring Cove Beach or Province Lands Bike Trail. Walking or biking along the road can serve as an extension of that recreation; however current safety concerns detract from the visitors' enjoyment of this activity.</p> <p>Overall Impact: long-term, moderate, adverse impacts</p> <p>Cumulative Impact: contributes a noticeable adverse increment to a long-term, beneficial cumulative impact</p>	<p>Addition of three crosswalks and "Share the Road" signs provide minor safety improvements. Visitors may be able to enjoy their time on Moors Road slightly more than under Alternative A. Construction would require temporary closure of the road.</p> <p>Overall Impact: short-term, moderate, adverse and long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse increment to a long-term, beneficial cumulative impact</p>	<p>The safety improvements of Alternative B would be implemented along with the widening of the roadway to provide 6-foot shoulders in the southern portion of the study area and 4-foot shoulders in the northern section. Visitors would be more able to enjoy their trip along Moors Road as part of their recreational experience. Construction would require temporary closure of the road.</p> <p>Overall Impact: short-term, moderate, adverse and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable beneficial increment to a long-term, beneficial cumulative impact</p>	<p>Alternative D would provide for total separation of uses. By being physically separated from vehicle traffic, pedestrians and bicycles could more readily enjoy their trip along Moors Road as part of their recreational experience.</p> <p>Overall Impact: short-term, moderate, adverse and long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable beneficial increment to a long-term, beneficial cumulative impact</p>

Table 2: Summary of Environmental Consequences (continued)

For a complete description of impacts, see "Chapter 4: Environmental Consequences"

Resource	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Public Safety	<p>Heavy shared use of Moors Road by bicyclists, pedestrians, and motor vehicles would continue to cause safety concerns. Addition of "Share the Road" signs could potentially alert drivers to this condition.</p> <p>Overall Impact: long-term, moderate, adverse impacts</p> <p>Cumulative Impact: contributes a noticeable adverse increment to a long-term, moderate, adverse cumulative impact</p>	<p>Same road width would not provide additional separation of bicyclists and pedestrians from vehicle travel lanes. "Share the Road" signs and three raised crosswalks would increase driver awareness of bicyclists and pedestrians. Pedestrians would be provided with a safe way to cross the road.</p> <p>Overall Impact: long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes an imperceptible adverse increment to a long-term, moderate, adverse cumulative impact</p>	<p>The roadway would be widened to provide 6-foot shoulders from the park boundary at Provincetown to access point 2 and 4-foot shoulders from access point 2 to the abandoned roadway. This would provide some separation of bicyclists and pedestrians from motor vehicles. The signs and crosswalks described in Alternative B also would be added.</p> <p>Overall Impact: long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable beneficial increment to a long-term, negligible, adverse cumulative impact</p>	<p>A 10-foot wide paved multiuse path would be provided adjacent to the existing road but separated from it by a guard rail and a 2-foot paved buffer. This would provide the most separation of bicyclists and pedestrians from motor vehicles. Only one raised crosswalk would be provided at access point 1, since this is the point at which pedestrians would be expected to enter the multiuse path.</p> <p>Overall Impact: long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable beneficial increment to a long-term, negligible, adverse cumulative impact</p>

Table 2: Summary of Environmental Consequences (continued)

For a complete description of impacts, see "Chapter 4: Environmental Consequences"

Resource	Alternative A: No-action	Alternative B: Rehabilitate Road – Maintain Width	Alternative C: Rehabilitate Road – Widen Shoulders (NPS Preferred)	Alternative D: Rehabilitate Road – Separate Multiuse Path
Operations and Infrastructure	<p>Infrastructure within the study area would remain in its current state. The roadway would continue to crack and develop potholes and would be maintained as time and funding allowed.</p> <p>Overall Impact: long-term, moderate, adverse impacts</p> <p>Cumulative Impact: contributes a noticeable adverse increment to long-term, beneficial cumulative impacts</p>	<p>The roadway would be rehabilitated within the existing footprint but would be engineered to better withstand use by heavy vehicles. A raised crosswalk would be added at access points 2 and 3, and an at-grade crosswalk would be added at access point 4. Guard rails would be added along the Mill Pond culvert area. Traffic signs would be added to warn of bicyclists on the road and of the crosswalks. Catch basins and leach basins would be installed to improve stormwater drainage and treatment. The culvert may be replaced, if needed.</p> <p>Overall Impact: long-term, beneficial impacts</p> <p>Cumulative Impact: contributes a noticeable beneficial increment to long-term, beneficial cumulative impacts</p>	<p>The roadway would be rehabilitated to withstand increasing use by heavy vehicles and would be widened by 10 feet from the park boundary nearest Provincetown to access point 2 and by 6 feet from access point 2 to the abandoned roadway. The same guard rails, crosswalks, and signs would be added as described under Alternative B. The same stormwater infrastructure would be added as described under Alternative B. The culvert may be replaced, if needed.</p> <p>Overall Impact: long-term, beneficial and long-term, negligible, adverse impacts</p> <p>Cumulative Impact: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts</p>	<p>The roadway would be rehabilitated to withstand increasing use by heavy vehicles and would be widened by 12 feet from the park boundary nearest Provincetown to the abandoned roadway. Only the crosswalk at access point 1 would be constructed. In addition to the signs and guard rails described under Alternative B, a guard rail would separate the 10-foot multiuse path from the travel lanes throughout the study area. The same stormwater infrastructure would be added as described under Alternative B. The culvert may be replaced, if needed.</p> <p>Overall Impact: long-term, beneficial and long-term, minor, adverse impacts</p> <p>Cumulative Impact: contributes an appreciable beneficial increment to long-term, beneficial cumulative impacts</p>

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The CEQ defines the environmentally preferred alternative as "the alternative that will promote the national environmental policy as expressed in NEPA's Section 101." In NEPA's Forty Most Asked Questions, CEQ further clarifies the identification of the environmentally preferred alternative, stating "Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (Q6a). Based on the analysis of environmental consequences of each alternative presented in Chapter 4 and summarized in Table 2 above, Alternative B is the environmentally preferred alternative. Alternative B rehabilitates the roadway and provides minimal bicycle accommodations with the least disturbance to the national seashore's natural and visual resources, including dunes and the dune forest.

NPS PREFERRED ALTERNATIVE

Alternative C was selected as the NPS preferred alternative because of the way in which it balances protection of natural and visual resources with the public benefits of road rehabilitation and bicycle accommodations. Although Alternative C would likely result in some additional adverse impacts on dune ecosystems and visual resources, national seashore managers believe that the improvements to public use and experience, site access and circulation, and public safety are both necessary and substantial, and that the mitigation measures incorporated into the alternative would effectively minimize the additional adverse impacts. Therefore, Alternative C has been identified as the NPS preferred alternative.

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3

AFFECTED ENVIRONMENT

Moors Road is located in the North District of Cape Cod National Seashore. The stretch of road within the national seashore is approximately 1 mile long and provides access to Provincetown, Herring Cove Beach, and the Province Lands. The proposed action is confined to the study area, which includes the road itself; associated infrastructure such as the culverts at Mill Pond; the four beach access points; and those resources adjacent to the road such as the dunes, trees, and Mill Pond. Organized by resource topic, this chapter describes the resources that could be impacted by the proposed action. Resources examined in detail include dune ecosystems, special status species, wetland resources, visual resources, public use and experience, public safety, and operations and infrastructure. Resources dismissed from further analysis are discussed in “Chapter 1: Purpose and Need.”

DUNE ECOSYSTEMS

Dunes are terrestrial landforms that develop from buildup of wind-deposited sands (Foster 1975). The NRCS soil survey of Barnstable County, Massachusetts identifies loose sand and loamy sand as the dominant soil types in the study area. Throughout the Province Lands, dunes represent the most prominent feature on the landscape. This is because of the relatively abundant supply of sand provided by the prevailing longshore currents that formed the Province Lands Hook, in combination with exposure to high winds that direct and deposit sand inland (Zeigler et al. 1965; Schwarzman 2002). Although dunes in general tend to migrate over time (Bauer and Sherman 1999), the dune fields at Cape Cod are relatively stable due to the abundance of colonizing vegetation, as well as man-induced stabilization measures (Schwarzman 2002).

Dune ecosystems are characterized by a prevalence of vegetation adapted for life in dry soil conditions (Martinez et al. 2004). This is due to the fact that the substrate is predominantly composed of sand, which is highly permeable and therefore has very low water holding capacity. In addition to dry conditions, plants in coastal dune habitats must be adaptable to low soil fertility, salt spray, and physical abrasion from wind-borne particulates (Maun 2009). Under such conditions, the vegetative community is typically reduced to drought-tolerant herbaceous species or dry scrub/thicket assemblages (Bertness 1999). However, at Cape Cod, pollen studies indicate that forested areas dominated by pitch pine (*Pinus rigida*) and oaks (*Quercus* spp.) were common on the dunes prior to English settlement, and these species can still be found locally abundant in sheltered back-dune areas (Parshall et al. 2003).

DUNE PIONEER AND SHRUB/THICKET ZONES

Within the study area, areas of shifting sands along the edge of Moors Road and at lower elevations along adjacent dune slopes are characterized as pioneer zones (Bertness 1999). Such areas are extremely stressful to plant life due to the unstable substrate and low water availability, and are therefore vegetated with stress-tolerant pioneer species capable of rapid recruitment and high growth rate such as

American beachgrass (*Ammophila breviligulata*), switchgrass (*Panicum virgatum*), and wavy hairgrass (*Deschampsia flexuosa*). In addition, a host of non-native weedy species is able to persist in this zone, particularly along the road edge where sand compaction from foot and vehicular traffic is common. Such species include dusty miller (*Artemisia stellaria*), knapweed (*Centaurea* spp.), clover (*Trifolium* spp.), and Queen Anne's lace (*Daucus carota*).



Dune pioneer (beachgrass area in foreground) and shrub/thicket zone along Moors Road.

At higher elevations, conditions become more stable due to reduced wind stress, stabilizing sediments, and a consequent increase in soil moisture (Duncan and Duncan 1987; Bertness 1999). The resultant community is characterized as dune shrub/thicket, with shrubs and low, stunted trees often forming dense colonies. Species include beach plum (*Prunus maritima*), bayberry (*Morella pensylvanica*), eastern red cedar (*Juniperus virginiana*), and a nonnative species, rugosa rose (*Rosa rugosa*). Common understory associates in this zone include beach pea (*Lathyrus japonicus*), seaside goldenrod (*Solidago sempervirens*), bearberry (*Arctostaphylos uva-ursi*), Virginia creeper (*Parthenocissus quinquefolia*), black huckleberry (*Gaylussacia baccata*), and poison ivy (*Toxicodendron radicans*).

DUNE FOREST

Within the study area, an area just west of the Mill Pond culverts on Moors Road supports a zone of dune forest on either side of the road edge. Trees of modest stature overreach Moors Road along this stretch, providing an abundance of shade that is typically lacking throughout much of the remaining study area. Common tree species include pitch pine (*Pinus rigida*), bear oak (*Quercus ilicifolia*), scarlet oak (*Q. coccinea*), black oak (*Q. velutina*), serviceberry (*Amelanchier arborea*), black gum (*Nyssa sylvatica*), black cherry (*Prunus serotina*), and red maple (*Acer rubrum*), with understory associates such as black huckleberry, Virginia creeper, bracken fern (*Pteridium aquilinum*), catbrier (*Smilax glauca*), roundleaf greenbrier (*S. rotundifolia*), bearberry, wild sarsaparilla (*Aralia nudicaulis*), and Canada mayflower (*Maianthemum canadense*).



The dune forest zone along Moors Road provides the most overstory over the roadway just west of the Mill Pond culvert.

SPECIAL STATUS SPECIES

During the agency scoping process for this project, comments were solicited from the USFWS and the Massachusetts NHESP. Other information on potential rare species was researched from the NHESP website (<http://www.mass.gov/dfwele/dfw/nhosp/nhosp.htm>), which maintains lists of rare plants and animals and information on distribution within the state.

WILDLIFE SPECIAL STATUS SPECIES

Correspondence from the USFWS indicates that no federally listed or proposed threatened or endangered wildlife species or critical habitats are known to occur within, or in the immediate vicinity of, the project corridor. Based on this information, the USFWS has indicated that further consultation under the Endangered Species Act, including preparation of a Biological Assessment, will be unnecessary for this project. The letter from USFWS is included in Appendix A.

Correspondence from the Massachusetts NHESP suggests that three special status species could occur within the project area: eastern box turtle (*Tarrapene carolina*), diamond-backed terrapin (*Malaclemys terrapin*), and eastern spadefoot (*Scaphiopus holbrookii*). The eastern box turtle is a special concern species with a fairly broad distribution in Massachusetts although, according to NHESP documentation, populations are in decline. This species of turtle could occur in a variety of habitats throughout the project area. The diamond-backed terrapin is a state threatened species that inhabits salt marshes along the East Coast, with Massachusetts at the very northern limit of its range. The species has a distinctive wedge-shaped shell with pronounced raised sections along the central axis. Though diamond-backed terrapins are found most often within the confines of brackish marshes, adjacent, dry sandy upland habitat is required for nesting. The eastern spadefoot is a state-listed threatened toad that burrows in dry sandy areas with some forest or scrub cover in close proximity to temporary ponds. The namesake of this species is its horn-like, rear-foot “spades” that assist in digging its deep, sheltering burrows.

PLANT SPECIAL STATUS SPECIES

As discussed above, the USFWS provided comment on the lack of federally listed species within the project area (Appendix A). The potential for state special status plant species was addressed through a field survey conducted by qualified botanists in September 2009. Prior to conducting fieldwork, information on special status plants was researched from the NHESP website. Table 3 provides a summary of species that have been documented within the region according to the NHESP website: <<http://www.mass.gov/dfwele/dfw/nhesp/nhesp.htm>>

Table 3: Massachusetts Special Status Species Known to Occur Within the Project Vicinity		
Species	Habitat	MA State Rarity *
<i>Carex oligosperma</i>	Bogs, fens	E
<i>Corema conradii</i>	Sandy soils	SC
<i>Crocianthemum dumosum</i>	Sandy soils, roadsides	SC
<i>Dichantherium ovale</i> ssp. <i>pseudopubescens</i>	Sandy soil, dunes	SC
<i>Juncus debilis</i>	Dune swales, pond shores	E
<i>Leymus mollis</i> ssp. <i>Mollis</i>	Dunes	E
<i>Mertensia maritime</i>	Beaches	E
<i>Nabalus serpentarius</i>	Forest	E
<i>Ophioglossum pusillum</i>	Wet meadows	T
<i>Opuntia humifusa</i>	Dunes	E
<i>Sisyrinchium fuscatum</i>	Sand plain grasslands	SC

* E = Endangered; T = Threatened; SC = Special Concern

Based on field reviews, none of the species listed in Table 3 was found within the project corridor. A checklist of species encountered during the survey is provided in Appendix C. General habitat conditions, including common species and vegetation assemblages, are discussed in the preceding section (dune ecosystems) and under wetland resources below.

WETLAND RESOURCES

As part of a detailed wetland delineation, background data was collected from such sources as U.S. Geological Society topographic maps, the National Wetland Inventory (as published by the USFWS), and the Massachusetts state wetland inventory (available from the Massachusetts Department of Environmental Protection [DEP]). The NRCS soil survey mapping shows that the project corridor is underlain by several soil types, including Freetown mucky peat, Ipswich-Pawcatuck-Matunuck peats, Hooksan sand and dune complexes, and other nonspecific mapping categories (Urban land, saline water). Among these, Freetown, Ipswich, Pawcatuck, and Matanuck soils are classified as hydric by the NRCS, which indicates that these soil types are likely to underlie wetland areas.

The delineation was performed in September of 2009 using the technical criteria and procedures outlined in the 1987 *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987). Wetland classification was based on Cowardin et al. (1979) as mandated by the *Procedural Manual 77-1: Wetland Protection* (NPS 2008a). Where appropriate, sampling protocols were revised to maintain consistency with the Massachusetts DEP (1995) publication *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act: A Handbook*.

Based on the detailed wetland delineation, three wetland areas were delineated as shown on Figure 8. Representative data points and photographs are provided in Appendix D. Wetland areas A, B, and C are irregularly flooded intertidal salt marsh systems dominated by saltmarsh cordgrass, with halophytic associates such as sea blite (*Suaeda maritima*), sea lavender (*Limonium carolinianum*), glasswort (*Salicornia depressa*), and saltmeadow hay (*Spartina patens*). Soils in intertidal wetland areas are characterized by a thin organic surface horizon underlain by reduced sands. Hydric soil indicators include hydrogen sulfide odor, high organic content, organic streaking, and low chroma (Munsell soil color notation). Evidence of wetland hydrology includes drift lines (evidenced by wrack deposits along the tidal fringe), soil saturation, shallow, free standing water in an unlined borehole, and sediment deposits.

Wetland Area A is an occluded tidal inlet which maintains a sluggish tidal connection via the culverts under Moors Road. Due to the poor hydrologic exchange via the three 24-inch concrete culverts, portions of Area A are no longer in sediment-transport equilibrium with the remaining areas of the marsh on the downstream side of the culvert (i.e., Area B). The result is an intertidal system marked by a mosaic of partially vegetated bars, open water, and nonvegetated sand and mud flats. A similar condition persists within Area B on the downstream side, with the exception that nonvegetated sections in Area B are restricted to the channel proper, and to sandy overwash zones where recent sand deposits have not yet been colonized. The low levels of hydrologic exchange in Areas A and B are likely due, in part, to the presence of a U.S. Army Corps of

Engineers (USCOE) breakwater just south of the study area connecting to Wood End. The wetlands in Area C are similar to Area B but lack an intertidal channel.

WETLAND FUNCTIONS AND VALUES

Wetland functions and values were evaluated using the assessment model in the New England Highway Methodology (USCOE 1995), which assesses 13 functions and values through a “descriptive approach.” The 13 functions and values include: groundwater recharge/discharge, floodflow alteration/attenuation, fish and shellfish habitat, sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, wildlife habitat, recreation, educational/scientific value, uniqueness/heritage, visual quality/aesthetics, and endangered species habitat. The Highway Methodology data sheets summarizing the results of this assessment are included in Appendix D. Descriptions of the relative functional status of the three wetland areas evaluated within the project corridor are provided below.

Wetland Area A: This tidal wetland area is characterized by sluggish tidal exchange due to the constriction caused by the culvert under Moors Road. Because of the occluded nature of this inlet, production export functions typically attributed to tidal wetlands are somewhat limited. However, sediment/shoreline stabilization and wildlife habitat functions are provided by the existing emergent vegetation and mosaic of open water/edge habitats. Principal values include recreation and visual quality/aesthetics at this important shoreline entryway to the Cape Cod National Seashore from Provincetown.

Wetland Area B: Wetland Area B provides similar principal functions and values as noted for Area A, with the potential addition of fish and shellfish habitat based on observations of the channel in the area just downstream of the culvert. Again, recreation and visual quality/aesthetics are important, as this is a key wildlife observation point for many local residents and park visitors throughout the year.

Wetland Area C: Wetland Area C is similar in principal functions and values to Area B; however, due to the close proximity of the adjacent developed landscape at the Provincetown border, recreation values are limited by access issues and distance to more functional recreation elements in the park.

VISUAL RESOURCES

The aesthetics of the natural landscape at Cape Cod National Seashore have been a source of inspiration for generations of artists and writers such as Henry David Thoreau, Jackson Pollock, Edward Hopper, Mark Rothko, John Dos Passos, and Mary McCarthy, among others. The Cape itself is known for its “beauty of land, sea, and sky.” The popularity of the Cape attracts increasing numbers of tourists and new residents. This has caused an increase in commercialism and development that many consider a threat to the traditional, isolated Cape Cod experience. The mission goals for Cape Cod National Seashore include the maintenance of natural and cultural resources and their associated values as well as ensuring that development within the national seashore is of a quality and scale that is appropriate to the traditional Cape character (NPS 1998).



Rehabilitation of Moors Road with Bicycle Accommodations in the Province Lands

**Figure 8
Wetlands A, B, and C**



National Park Service
U.S. Department of the Interior
Cape Cod National Seashore

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The setting of Moors Road is a relatively natural one, with the exception of the development at the northern portion of the study area. As visitors and users enter the study area from Provincetown, they are presented with views over the moors, punctuated by large vegetated dunes, to the distant line of dunes separating the moors from Herring Cove and the Cape Cod Bay. These views are unimpeded by any structures associated with the road. As the road crosses the culvert, views to the bay dominate to the south and the wetland area known as Mill Pond is to the north, bordered by small trees and a few homes on the edge of Provincetown.

As Moors Road reaches access point 2, it becomes lined on either side by the small trees of the dune forest and passes through a shaded stretch of road approximately 450 feet long where the trees provide an overstory. The overstory provides a canopy which is not continuous over the top of the road, but from certain angles, it appears to be. Given the generally open nature of the dune ecosystems that dominate the Province Lands, such pockets of forest are of a natural scenic value to those using the road.

After passing through this forested area, the road continues over a rise and around a gentle curve to the north as it winds through dunes on its way to the Herring Cove parking lots. As visitors go over the rise, the large (approximately 3 acres) South Herring Cove parking lot becomes readily apparent. Included in the view of the parking lot are a small restroom facility, an automated arm regulating traffic at the “exit only” lane leaving the parking lot, and the currently closed Herring Cove bath house and associated facilities. A 10-foot wide yellow crosswalk at the head of the Province Lands Bike Path and the intersection of Moors Road with Province Lands Road also come into view at the same time as the parking lot. A yellow diamond bicycle sign warns of this crosswalk to both directions of traffic. This is the point at which the highly natural setting of the road ends for those visitors travelling northwest. Shortly thereafter, Moors Road widens to become the 4-lane highway US 6 just outside the study area. Visitors traveling into the study area from US 6 experience the same visual resources in the reverse order.

PUBLIC USE AND EXPERIENCE

For those visitors traveling to the national seashore by vehicle from US 6 and wishing to use the Herring Cove Beach parking lots or Province Lands Road, their experience is limited to approximately one-quarter mile from the point at which US 6 narrows to the turn onto Province Lands Road. For many users of Moors Road, however, the objective is ingress to or egress from Provincetown. A recent traffic study estimated that during peak season traffic volumes along Moors Road, specifically during the weekend, range from 3,000 to 6,000 cars per day (VHB 2010a). Moors Road is one of only five roads connecting Provincetown to US 6 and is the simplest and often least congested access route to the western end of Provincetown. As these users travel along Moors Road to drive into or out of Provincetown, they are likely to encounter a number of bicyclists and pedestrians. During peak season, the heavy shared use of Moors Road by pedestrians, bicyclists, and vehicles causes congestion and hence impedes circulation through the study area. The heavy shared use of the road also causes safety concerns that are discussed in more detail in the following section.

Visitors to this portion of Cape Cod National Seashore are generally seeking to use Herring Cove Beach for both active and passive recreation while experiencing the natural landscapes and resources of the Cape. In 2009, Herring Cove Beach attracted over 650,000 recreational users (NPS 2010). In order to experience the national seashore by way of nonmotorized means, many visitors travel to Herring Cove Beach either on foot or by bicycle from Provincetown. These travelers use Moors Road for varying lengths to reach one of the four access points. Many pedestrians walking from Provincetown cross the road as soon as possible at access point 1 for a stroll through the sandy moors on their way to southern Herring Cove Beach. This access point is not a park-sanctioned beach access point.

Some pedestrians and most bicyclists travel at least 0.2 miles along Moors Road to access point 2. Although the views of the moors are pleasant along the stretch of road between the park boundary and access point 2, visitors must stay alert for vehicles. Sand encroachment often eliminates the 1-foot shoulder, forcing pedestrians and bicyclists to use the travel lane. Even in areas that are clear of dunes where pedestrians can walk along the sandy shoulder, bicyclists are not able to use the unpaved shoulders because of the sandy soils.

The trailhead at access point 2 is an official beach access point, although there is no official trail between it and Herring Cove Beach. There is a single board (approximately 2 feet by 3 feet) with interpretive information on the dunes and guidance on how to minimize impacts on them. This is the only source of interpretation within the study area. Visitors pass by or use the split rail fence, which doubles as natural resource protection and bicycle rack, and funnel through a small area of short trees and shrubs into the sandy open moors. Counts conducted in 1999 noted approximately 100 bicyclists per hour using this trailhead during peak hours in peak season. The same study noted that, on average, 50 to 100 pedestrians used that access point per hour, with peak counts of 244 per hour (Hudson 2002). Many of the bicyclists also stop here to secure their bicycles and hike out to Herring Cove Beach. Very few pedestrians continue past access point 2 on Moors Road.

Some bicyclists do not use Moors Road for a leisurely trip to the beach. Some use Moors Road for active recreation as a link between Provincetown and the Province Lands Bike Trail, which extends to access point 3. While some of these users are still seeking a leisurely recreational bicycle ride, others use the route regularly for exercise. These users have varying comfort levels when it comes to sharing the road with vehicles. Sand encroachment and sandy shoulders continue to be a problem. Access point 3, the access point that is least used within this study area, is the only access point that is formalized by a crosswalk at the trail head and yellow diamond traffic signs warning of bicycle traffic.

PUBLIC SAFETY

A recent traffic study estimated that during peak season traffic volumes along Moors Road, specifically during the weekend, range from 3,000 to 6,000 cars per day (VHB 2010a). Access to the western portion of the study area is provided by US 6, Province Lands Road, and the Herring Cove Beach spur of the Province Lands Bike Trail. Access to the study area in the east is the road itself with connections to Bradford Street and Commercial Street.

Heavy use of Moors Road by pedestrians, bicyclists, and vehicles is a source of safety concern for NPS staff, the Town of Provincetown, and visitors themselves. Many visitors to and residents of Provincetown walk or bicycle along Moors Road to either access point 1 or 2, with a relatively small proportion continuing on to access point 3. Within the national seashore, bicycles and pedestrians share the paved roads with vehicular traffic. There are several pedestrian social trails between Moors Road and the beach area, the majority of which connect to the Herring Cove Beach. Only one designated crosswalk exists along Moors Road for pedestrians crossing from the town side to the beach. Bicycle trails are accessible on the north side of Moors Road and US 6. Traffic volumes (particularly during summer months) and the lack of adequate pedestrian and bicycle facilities along Moors Road often put motorized (vehicles) and nonmotorized transportation users (pedestrians, bicyclists, etc.) in direct conflict with one another. This is largely because there is a lack of signage warning motorists of sudden bicyclist/pedestrian movements and pedestrians and bicyclists often cross at will assuming a vehicle will be able to stop.

There is no separation between vehicles, pedestrians, and bicyclists on Moors Road, and there is minimal signage to warn motorists who may be unfamiliar with the national seashore of the high number of pedestrians and bicyclists they are likely to encounter. One-foot shoulders are provided along Moors Road. In many locations, the adjacent dunes not only prevent foot and bicycle traffic from getting off the road, it encroaches upon the road and reduces the width of the shoulder and travel lanes. Bicycle signs are posted along Moors Road only in the immediate vicinity of the existing crosswalk at access point 3.

Park records indicate that in 2007, there were 14 accidents involving either vehicles or bicycles (NPS 2007). These are state records from the area immediately surrounding the park. One crash involved a bicyclist, but not on park land. A review of crash statistics over the past three years does not reveal any patterns that indicate a specific or prevalent safety hazard or concern at this time. However, general observations and anecdotal evidence from national seashore staff point to a number of factors that can contribute to a decrease in safety. These factors include increased bicycle and pedestrian traffic, an increased need for bicycle parking, and increased vehicle trips and observed travel speeds. Little historic traffic volume information is available on Moors Road, but the data available show an increase in traffic volume from 2,750 vehicles per day on a Saturday in July 1999 (Hudson 2002) to an estimated 5,400 vehicles per day on a Saturday in July 2009 that corresponds to the anecdotal evidence provided by national seashore rangers (VHB 2010a).

Between 2006 and 2008, the Provincetown police responded to seven crashes on Moors Road between US 6 and Bradford Street (VHB 2010a). Three of these crashes occurred in 2008. While none of these crashes were identified as involving a bicycle or pedestrian, six crashes were classified as major in nature. Incidents included vehicles going off the road or hitting fixed objects; with one crash requiring medflight. These crashes support the observations of national seashore rangers that speeding and safety is becoming an increasing issue and potential hazard on Moors Road. It should be noted that only one crash occurred during the summer.

OPERATIONS AND INFRASTRUCTURE

Moors Road is owned by and is under the jurisdiction of the NPS within the boundaries of the national seashore. It is classified as a rural major collector and is under the jurisdiction of the NPS. The posted speed limit along Moors Road is 30 miles per hour, and signs are posted at each entrance to the national seashore. The infrastructure within the study area is limited. Moors Road is a total of 24 feet wide. The two lanes are each 11 feet wide with a 1-foot shoulder on each side. Sand encroaches on the road in many places, reducing the amount of shoulder and in some places travel lane. Stormwater currently drains directly off the road either into the surrounding soils or into the wetland areas at the Mill Pond culverts.

As an important access route into and out of Provincetown, Moors Road is open to the public all day, every day, year-round, with the exception of closures prompted by severe weather or maintenance. Park staff clear the road of encroaching sand on an as-needed basis (on average once or twice per year). Park staff also repair the road surface where the use of the road by heavy vehicles has caused interconnected cracks caused by fatigue failure of the roadway surface, otherwise known as “alligator cracking,” and potholes. These repairs take place as time and funding become available. Law enforcement rangers also patrol the area as part of their regular duties and provide accident response when necessary.

In addition to the pavement itself, there are three 24-inch precast culverts at the location where water crosses under the road into the wetland known as Mill Pond. About a quarter mile northeast of Bradford Street, there is a split rail fence approximately 200 feet long. This is the location of beach access point 2, the trailhead of a popular social trail to Herring Cove Beach. The fence was originally placed there to prevent visitors from chaining their bicycles to the trees; however, visitors now chain their bicycles to the fence instead. The park plans to continue to allow this for the foreseeable future.

The Herring Cove Beach spur of the Province Lands Bike Trail ends approximately 900 feet southeast of the exit from the southern Herring Cove Beach parking lot on Moors Road. The trail enters the study area from the southernmost corner of the south Herring Cove Beach parking lot, where there are bicycle racks and restrooms, and ends at a 10-foot wide crosswalk on Moors Road. There are reflective yellow diamond traffic signs warning of bicycle use on the road, approximately 350 feet on either side of the crosswalk, along Moors Road. There is some split rail fencing along the bicycle trail and the road in this area to discourage visitors from taking shortcuts that would damage the natural resources in that area.

In the northern portion of the study area, recent rehabilitation of the intersection with Province Lands Road resulted in the narrowing of four divided lanes into a two-lane road. The abandoned section of this road leads from approximately where US 6 enters the national seashore until Moors Road turns parallel to the south Herring Cove Beach parking lot. A short stretch of this is still paved, albeit in disrepair. Most of the pavement, however, has been removed, leaving a disturbed but graded sandy path.

There are also utility lines running underground near Moors Road within the study area. These include a 6-inch water pipe located under the pavement surface from Bradford Street to a point

approximately 300 feet south of the Herring Cove parking lot. The water pipe diverts away from the roadway towards the parking lot and continues north to the former Herring Cove Beach House. There also are buried electrical lines and telephone cables along the west side (ocean side) of Moors Road, connecting the Herring Cove Beach facilities with Provincetown.

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4

ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental consequences associated with the alternatives presented in “Chapter 2: Alternatives.” It is organized by impact topic, which distills the issues and concerns into distinct subjects for discussion analysis. NEPA requires consideration of context, intensity, and duration of adverse and beneficial impacts (direct, indirect, and cumulative) and measures to mitigate for impacts. NPS policy also requires that impairment of resources be evaluated in all environmental documents; therefore, an impairment determination is made in the “Conclusions and Findings on Impairment” section under each applicable impact topic.

GENERAL METHODOLOGY FOR ASSESSING IMPACTS

Potential impacts are described in terms of type (beneficial or adverse), context (site specific, local, or regional), duration, and level of intensity (negligible, minor, moderate, or major). Both indirect and direct impacts also are described; however, they may not be identified specifically as direct or indirect. These terms are defined below. Overall, these impact analyses and conclusions were based on the review of existing literature and studies, information provided by on-site experts and other government agencies, professional judgments, and national seashore staff insight.

Type

Impacts can be beneficial or adverse. Beneficial impacts would improve resource conditions, while adverse impacts would deplete or negatively alter resources.

Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Direct: An impact that is caused by an action and occurs at the same time and place.

Indirect: An impact that is caused by an action but is later in time or farther removed in distance, but still reasonably foreseeable.

Context

Context is the setting within which an impact occurs and can be site specific, local, parkwide, or regionwide. Each of these categories are defined below.

Site specific: The impact would occur within project area.

Local: The impact would occur within the general vicinity of the project area.

Parkwide: The impact would affect a greater portion outside the project area yet within the national seashore.

Regional: The impact would affect localities, cities, or towns surrounding the national seashore.

Duration

Impacts can be either short term or long term. A short-term impact would be temporary in duration and would be associated with the construction process. Depending on the resource, impacts would last as long as construction was taking place, or up to one year after construction is completed. Long-term impacts last beyond the construction period, and the resources may need more than one year after construction to resume their previous condition. Impact duration for each resource may differ and is presented for each resource topic, where applicable.

Short-term: Impacts that occur only during construction or last less than one year.

Long-term: Impacts that last longer than one year.

Level of Intensity

Level of intensity means the severity or magnitude of an impact. Because the levels of intensity definitions (negligible, minor, moderate, major) vary by resource, separate definitions are provided for each impact topic analyzed. Beneficial impacts are described but are not assigned a level of intensity.

CUMULATIVE IMPACT METHODOLOGY

Cumulative impacts are defined as impacts which result when the impact of the proposed action is added to the impacts of past, other present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions (40 CFR 1508.7).

Cumulative Impact Scenario

To determine the potential cumulative impacts, existing and anticipated future projects in the vicinity of the study area were identified. These included lands administered by the NPS, the Commonwealth of Massachusetts, Barnstable County, and the Town of Provincetown. Potential projects identified as cumulative actions include planning or development activity currently being implemented or expected to be implemented in the reasonably foreseeable future. The projects identified as contributing to cumulative impacts on the resources addressed by this EA/AoE include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the

Province Lands Bike Trail renovations, Herring Cove Beach facilities development, and the *Capital Improvements Plan for the Provincetown Municipal Airport EA*.

The ***Cape Cod National Seashore Integrated Bicycle Feasibility Study*** (otherwise known as the *Integrated Bicycle Plan*; VHB 2010b) is currently being drafted. It will help assure that the national seashore attractions, town centers, available transit systems, and other bicycle facilities are connected in an efficient manner and that NPS efforts are coordinated with proposals by the Commonwealth of Massachusetts and local communities. The study identifies potential projects to continue the region's investment in bicycle facilities both outside and inside the park, creating more effective bicycle links to the national seashore and between localities such that a unified and integrated bicycle network can be developed to help mitigate the reliance on automobile travel, particularly for short trips and when visiting national seashore destinations. This action has previously and currently impacted and has the potential to impact dune ecosystems, public use and experience, public safety, and operations and infrastructure.

The **Province Lands Bike Trail renovations** are currently being completed. *The Province Lands Bike Trail Renovations EA* was completed in December 2006. This plan calls for renovation of the 7.34 miles of the loop and its spur trails to address general design deficiencies, improve safety, and enhance resource protection (NPS 2006a). Since the completion of the EA, the first stage of renovations has been completed, and the second stage is currently underway. The project has previously and currently impacted and has the potential to impact dune ecosystems, special status species, public use and experience, public safety, and operations and infrastructure.

Herring Cove Beach facilities development is expected as a reasonably foreseeable future action. The *Electrical Supply for Herring Cove Beach EA* was completed for renovation of the source of electricity at the Herring Cove Beach facilities in May of 2008 since the current lines that carry electricity from Provincetown along Moors Road are old and unreliable. The preferred alternative would provide electricity to Herring Cove Beach facilities by use of photovoltaic cells and a small-scale wind turbine (NPS 2008b). Plans are also underway to improve the existing bath house and associated facilities. This development has the potential to impact dune ecosystems, visual resources, public use and experience, and operations and infrastructure.

The ***Capital Improvements Plan for the Provincetown Municipal Airport EA*** is currently being drafted. The airport is located on NPS land in the Province Lands. The Town of Provincetown leases the land from the NPS and operates the airport under a Special Use Permit. The Provincetown Municipal Airport Commission is in the process of completing a Capital Improvements Plan to improve safety and implement facility improvements (FAA 2010). The associated projects have a potential to impact wetland resources.

Cumulative Impact Contribution Methodology

In defining the contribution of each alternative to cumulative impacts, the following terminology is used:

- Imperceptible:** The incremental effect contributed by the alternative to the overall cumulative impact is such a small increment that it is impossible or extremely difficult to discern.
- Noticeable:** The incremental effect contributed by the alternative, while evident and observable, is still relatively small in proportion to the overall cumulative impact.
- Appreciable:** The incremental effect contributed by the alternative constitutes a large portion of the overall cumulative impact.

FINDINGS ON IMPAIRMENT OF PARK RESOURCES AND VALUES

As stated in *NPS Management Policies 2006* section 1.4.7:

“Before approving a proposed action that could lead to an impairment of park resources and values, an NPS decisionmaker must consider the impacts of the proposed action and determine, in writing, that the activity will not lead to an impairment of park resources and values. If there would be an impairment, the action must not be approved.”

As stated in the *NPS Management Policies 2006* section 1.4.5:

“The impairment that is prohibited...is an impact that, in the professional judgment of the responsible National Park Service manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values...”

An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:

- 1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- 3) identified as a goal in the park’s general management plan or other relevant NPS planning documents as being of significance.”

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also

result from sources or activities outside the park, but this would not be a violation of the Organic Act unless the NPS was in some way responsible for the action.

In this EA/AoE, an impairment determination is made in the “Conclusions and Findings on Impairment” section under the impact topics related to natural and cultural resources. Impairment findings are not made for public safety and operations and infrastructure because impairment findings relate back to park resources and values, and these impact areas are not generally considered to be park resources or values. Impairment findings are not made for the impact topics related to public use and experience because, according to the Organic Act, enjoyment cannot be impaired in the same way that an action can impair park resources and values.

DUNE ECOSYSTEMS

METHODOLOGY

Dune ecosystems within and surrounding the project area have been described in “Chapter 3: Affected Environment.” Dunes represent an abiding aspect of the physical landscape at Cape Cod National Seashore, the character of which is a focal point for preservation and maintenance of the natural resources in this unique coastal setting. In general, the dune ecosystem is a complex environment exposed to conditions that are inherently stressful to biological organisms, such as low soil water availability, low soil nutrient content, salt spray, high winds, and exposure to physical abrasion from airborne sand. The resultant biological community is composed of “stress-tolerant” organisms that have adapted to these often extreme conditions.

This section analyzes the impacts of the proposed action on dune ecosystem resources within the study area, including wildlife and wildlife habitat. The study area is generally restricted to the Moors Road corridor. The study area includes the adjacent dunes but does not include the entire moors between the road and Herring Cove Beach. The thresholds of change for the intensity of an impact are as follows:

- Negligible:** Dune ecosystems would not be affected or the impacts would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the dune ecosystem.

- Minor:** Impacts on dune ecosystems would be detectable, although the impacts would be localized and would be small and of little consequence to the dune ecosystem. Mitigation measures, if needed to offset adverse impacts, would be simple and likely successful.

- Moderate:** Impacts on dune ecosystems would be readily detectable and localized, with consequences to the dune ecosystem. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.

Major: Impacts on dune ecosystems would be obvious and would have substantial consequences to the dune ecosystem in the region. Extensive mitigation measures would be needed to offset any adverse impacts, and their success would not be guaranteed.

IMPACTS OF ALTERNATIVE A: NO-ACTION

Impacts

Under Alternative A, the existing dune resources along Moors Road would remain generally unchanged. Pedestrians would continue to leave the road at the earliest opportunity, access point 1, to walk through the moors to Herring Cove beach. This access point is not a park-sanctioned trail head and such “social trails” cause low-threshold compaction of dune soils. This also disturbs vegetation. Both the disturbance of the sediments and vegetation as well as the presence of humans along these opportunistic social trails degrade potential wildlife habitat.

Additionally, because there are areas of active dune erosion and sand encroachment over existing Moors Road, the no-action alternative would perpetuate the prevailing management cycle in these areas, which currently involves physical removal of sand from the road following storm-induced erosion events. This type of management is necessary to keep the road unobstructed for safety and free movement of vehicular traffic. Such activities effectively maintain a somewhat destabilized condition at the foot of the dunes along Moors Road due to mechanical removal and/or piling of fresh sand in and around these areas. The long-term maintenance required to keep Moors Road clear of obstruction in areas of actively eroding dunes would result in destabilization of the dune toe, an unavoidable chronic condition exacerbated by the inability for vegetation to become established at these locations.

The current vegetative cover, including pioneer, shrub/thicket, and forest zones, would remain unchanged in the short term. In the long term, the actively eroding areas described above could incur mortality of species along the base of the dune from reduction of rooting substrate, or smothering as sand is piled along the edge of the road. In addition, some of the trees at the edge of the road have been damaged by automobile collisions or are unhealthy due to natural causes. These trees would be removed by storms or by national seashore staff if they pose a safety hazard. Remaining trees would be likely to take advantages of gaps in the canopy and thus fill them in. Visitors would continue to disperse into the dune wherever they consider convenient, thus causing low-threshold substrate compaction from beachgoers which results in damage to dune vegetation and additional destabilization of the dunes.

Overall, Alternative A would result in long-term, minor, adverse impacts on dune resources due to continuous sand disturbance in erosion-prone areas along the road alignment.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the dune ecosystems within the study area. These actions include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and the Herring Cove Beach facilities development. Implementation of the *Cape*

Cape Cod National Seashore Integrated Bicycle Feasibility Study and completion of the Province Lands Bike Trail renovations could draw additional people into the seashore by providing better connections to Herring Cove Beach. Depending on how these visitors chose to recreate within the national seashore, they have the potential to adversely impact the dunes by contributing to destabilization and trampling of vegetation. The facilities development at Herring Cove Beach could require an increase in the development footprint at this location, which would be an encroachment on existing dune ecosystem resources. These conditions, along with Alternative A, could have a long-term, minor, adverse cumulative impact on dune ecosystem resources. Alternative A would contribute an imperceptible adverse increment to this cumulative impact by not providing any further protection.

IMPACTS OF ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Impacts

Under Alternative B, the existing dune resources along Moors Road would remain generally unchanged, similar to Alternative A. Though improvements to the road surface would occur under this alternative, the roadway footprint would not change, with the exception of minor impacts related to stormwater management structures and installation of small leach basins in a few places along the edge of the roadway. Impacts related to maintenance in actively eroding areas would be similar to those described above for Alternative A. There would be no impacts on the dune forest area associated with this alternative.

The addition of raised crosswalks at access points 2 and 3 would reduce opportunistic foot traffic over the dunes by concentrating pedestrian access at specified points. This would reduce low-threshold substrate compaction from beachgoers creating opportunistic paths through the dunes and would reduce disturbance to potential wildlife habitat. The use of elevated crosswalks as traffic calming devices may also result in less damage to trees from vehicle collisions.

Overall, Alternative B would result in short-term, minor, adverse impacts related to disturbance of soil and vegetation during construction and long-term, beneficial impacts on dune ecosystem resources by focusing foot traffic in specified locations.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the dune ecosystems of the study area. These projects and their impacts are described under Alternative A and include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and the Herring Cove Beach facilities development. These conditions, along with Alternative B, would have a long-term, minor, adverse cumulative impact on dune ecosystem resources. Alternative B would contribute an imperceptible beneficial increment to cumulative dune ecosystem impacts by concentrating foot traffic at specified points.

IMPACTS OF ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED ALTERNATIVE)

Impacts

Under Alternative C, the dune ecosystem resources along Moors Road would be subject to changes related to the addition of paved road surface and proposed stormwater leach basins along the shoulders. Under this alternative, the road would be widened a total of 10 feet from the national seashore boundary to the split rail fence at access point 2. This would allow for 6-foot paved shoulders on each side of the road. The portion of the road that passes through the wooded section until the point at which the abandoned roadbed becomes available for connections to future bicycle trails would be widened a total of 6 feet in order to accommodate 4-foot paved shoulders on either side of the road. This would result in the clearing of approximately 26,000 square feet of dune habitat. The proposed action has minimized, to the extent possible, loss of habitat. Planned national seashore efforts, including building demolition and site restoration projects, would address habitat loss to offset the very minor habitat loss associated with this project.

The habitat that would be removed is in part “edge habitat.” It is currently subject to compaction from vehicle, bicycle, and foot traffic and as a result, the species inhabiting the roadside zone are mostly nonnative exotic and/or weedy problematic species as described in “Chapter 3: Affected Environment.” The widening of the road would create a new area of linear edge habitat along the road corridor; however, it would not increase the amount of edge habitat within the study area as the removal of a large, contiguous patch of habitat would. It is possible that by providing a designated bicyclist/pedestrian throughway, the national seashore would decrease incidental traffic in adjacent vegetated dune areas by potentially decrease the amount of edge habitat that is disturbed by this type of use. Also, as described above for Alternative B, the addition of raised crosswalks at access points 2 and 3 would concentrate beachgoers at specified access points and thereby reduce opportunistic foot traffic through and over the dunes.

Additionally, approximately 18 inches of substrate where additional pavement would be added would be excavated. In other words, approximately 39,000 cubic feet of sand would be excavated and stockpiled temporarily in the South Herring Cove Beach parking lot. This sand could be used in part for fill associated with road rehabilitation; the rest would be disposed of by the contractor.

On both sides of this pavement, an additional 2 feet would be cleared of any vegetation that could pose a safety hazard to bicyclists and pedestrians. This would result in the clearing of approximately 5 feet from the current edge of pavement (it is possible that the road may be shifted slightly one way or the other to minimize impacts on natural resources); this translates to the loss of 8 to 12 trees, mostly oak species (*Quercus* spp.). This would noticeably reduce the amount of tree cover through this section of roadway, which could result in a short-term change in understory species composition along the edge of the road due to increased light availability. Over time, the overstory would be expected to “fill in” due to gap phase replacement from existing or regenerating trees, a process that would occur over several years to decades.

Alternative C proposes an increase in road elevation along areas where sand actively encroaches onto the road surface, which may slightly reduce dune encroachment in these areas. This would be a long-term, beneficial impact on dune resources, as roadway sand may become less frequent and therefore less disruptive to the dune resources along the road alignment.

Overall, Alternative C would result in short-term, minor, adverse impacts related to disturbance of soil during construction; long-term, beneficial impacts due to reduction of off-road traffic and dune stabilization by the raised road profile; and long-term, minor, adverse impacts due to removal of vegetation and disturbance and compaction of soils adjacent to the road.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the dune resources of the study area. These projects and their impacts are described under Alternative A and include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and the Herring Cove Beach facilities development. These conditions, along with Alternative C, would have a long-term, minor, adverse cumulative impact on dune resources. Alternative C would contribute a noticeable adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

Impacts

Under Alternative D, the dune ecosystem resources along Moors Road would be subject to some changes related to the addition of a 10-foot wide multiuse path on the southwest side of the road and stormwater leach basins in certain locations. The roadway would be widened to include the 10-foot paved path, with 2 feet of paved buffer with the guard rail. The road would be widened by a total of 12 feet from the national seashore boundary to the point at which the abandoned roadway becomes available. This would result in the clearing of approximately 43,000 square feet of dune habitat. As discussed under Alternative C, the proposed action has minimized, to the extent possible, loss of habitat. Planned national seashore efforts, including building demolition and site restoration projects, would address habitat loss to offset the very minor habitat loss associated with this project.

The addition of the paved path would result in the permanent removal of dune vegetation and grading of existing dune slopes adjacent to the road to accommodate a level path alignment. However, once in place, the availability of a dedicated bicyclist/pedestrian pathway would serve to reduce opportunistic foot and vehicular traffic on the dunes adjacent to Moors Road.

This alternative would install a raised crosswalk at access point 1, because that is the point at which the separate multiuse path (and the associated guard rail separating it from the vehicle lanes) would start. This has the unfortunate consequence of encouraging pedestrians to cross the road at a location where many pedestrians currently use the unauthorized trailhead. The national seashore intends for pedestrians and bicyclists to continue along the multiuse path from this point to access

point 2 (or beyond); however, some pedestrians may chose to leave the road at this point and hence contribute to the low-threshold compaction and habitat disturbance described under Alternative A.

As under Alternative C, up to approximately 18 inches of soil would be excavated where additional pavement would be added. In other words, approximately 64,500 cubic feet of sand would be excavated and stockpiled temporarily in the South Herring Cove Beach parking lot. This sand could be used in part for fill associated with road rehabilitation; the rest would be disposed of by the contractor.

Again, 2 feet on either side of the pavement would be cleared of any vegetation that could pose a safety hazard. This would result in the clearing of approximately 8 feet from the current edge of pavement (it is possible that the road may be shifted slightly one way or the other to minimize impacts on natural resources); this translates to the loss of approximately 1 acre of dune ecosystem along the road's edge and 20 to 25 trees (mostly oak species). This would noticeably reduce the amount of tree cover through this section of roadway, which could result in a change in understory species composition along the edge of the road due to increased light availability.

Alternative D proposes an increase in road elevation along areas where sand actively encroaches onto the road surface, which may serve to reduce dune erosion in these areas as described under Alternative C.

Overall, Alternative D would result in short-term, minor, adverse impacts related to disturbance of soil during construction; long-term, beneficial impacts due to reduction of off-road traffic and dune stabilization by the raised road profile; and long-term, minor, adverse impacts due to removal of vegetation and disturbance and compaction of soils adjacent to the road.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the dune resources of the study area. These projects and their impacts are described under Alternative A and include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and the Herring Cove Beach facilities development. These conditions, along with Alternative D, would have a long-term, minor, adverse cumulative impact on dune resources. Alternative D would contribute a noticeable adverse increment to cumulative dune ecosystem impacts due to the addition of a 10-foot paved multiuse path.

CONCLUSIONS AND FINDINGS ON IMPAIRMENT FOR DUNE ECOSYSTEM RESOURCES

Alternative A

Alternative A would result in long-term, minor, adverse impacts on dune resources due to management in erosion-prone areas along the road alignment. Alternative A would contribute an imperceptible adverse increment to a long-term, minor, adverse cumulative impact on dune ecosystems by not providing any further improvements.

Implementing Alternative A would not result in an impairment of dune ecosystem resources, because impacts would be limited to unavoidable minor destabilization of dune toes related to road maintenance. Areas outside the area impacted by sand clearing would remain mostly unaffected.

Alternative B

Alternative B would result in short-term, minor, adverse impacts related to disturbance of soil and vegetation during construction and long-term, beneficial impacts on dune ecosystem resources by focusing foot traffic in specified locations and minimizing destabilization of dunes and trampling of vegetation. Alternative B would contribute an imperceptible beneficial increment to a long-term, minor, adverse cumulative impact on dune resources.

Implementing Alternative B would not result in an impairment of dune ecosystem resources, because impacts would be limited to unavoidable minor destabilization of dune toes related to road maintenance. The addition of crosswalks at designated access points would reduce opportunistic foot traffic over the dunes. Areas outside the area impacted by sand clearing would remain mostly unaffected.

Alternative C

Alternative C would result in short-term, minor, adverse impacts related to disturbance of soil during construction; long-term, beneficial impacts due to reduction of off-road traffic and dune stabilization by the raised road profile; and long-term, minor, adverse impacts due to removal of vegetation and disturbance and compaction of soils adjacent to the road. Alternative C would contribute a noticeable adverse increment to a long-term, minor, adverse cumulative impact on dune resources.

Alternative C would not result in an impairment of dune ecosystem resources because the loss of approximately 26,000 square feet of common vegetation and 8 to 12 trees along the road corridor would not result in the loss of important wildlife habitat nor would it affect the viability of wildlife populations that typically use that type of vegetation. Although some individuals may be permanently displaced, the overall populations would not be noticeably affected.

Alternative D

Alternative D would result in short-term, minor, adverse impacts related to disturbance of soil during construction; long-term, beneficial impacts due to reduction of off-road traffic and dune stabilization by the raised road profile; and long-term, minor, adverse impacts due to removal of vegetation and disturbance and compaction of soils adjacent to the road. Alternative D would contribute a noticeable adverse increment to a long-term, minor, adverse cumulative impact on dune resources.

Alternative D would not result in an impairment of dune ecosystem resources because the loss of approximately 43,000 square feet of common vegetation and 20 to 25 trees along the road corridor would not result in the loss of important wildlife habitat nor would it affect the viability

of wildlife populations that typically use that type of vegetation. Although some individuals may be permanently displaced, the overall populations would not be noticeably affected.

SPECIAL STATUS SPECIES

METHODOLOGY

As discussed in “Chapter 3: Affected Environment,” no special status plant species were identified during detailed field surveys conducted by qualified botanists in 2009. Further, correspondence from the USFWS indicated that no federally listed or proposed threatened or endangered plant or wildlife species, or critical habitats, are known to occur within, or in the immediate vicinity of, the project corridor.

Correspondence from the Massachusetts NHESP suggests that three special status species could occur within the project area: eastern box turtle (*Tarrapene carolina*), diamond-backed terrapin (*Malaclemys terrapin*), and eastern spadefoot (*Scaphiopus holbrookii*). The eastern box turtle is a state-listed special concern species that could occur in a variety of habitats adjacent to the project corridor. The diamond-backed terrapin is a state-listed threatened species that inhabits salt marshes and nests in adjacent dry sandy uplands. The eastern spadefoot is a state-listed threatened toad that burrows in dry sandy areas with some forest or scrub cover in close proximity to temporary ponds.

This section analyzes the impacts of the proposed action on special status species within the study area. The study area is generally restricted to the Moors Road corridor. The study area includes the adjacent dune and wetlands habitat but does not include the entire moors between the road and Herring Cove Beach. The thresholds of change for the intensity of an impact are as follows:

- Negligible:** The action could result in a change to a population or individuals of a species or designated critical habitat, but the change would be so small that it would not adversely impact a given species.
- Minor:** The action could result in a change to a population or individual of a species or designated critical habitat. The change would be measurable but is not likely to adversely impact a given species.
- Moderate:** The action would result in some change to a population or individual of a species or designated critical habitat. The change would be measurable and could adversely impact a given species.
- Major:** The action would result in a noticeable change to a population or individuals of a species or resource or designated critical habitat. The change would be measurable and would adversely impact a given species.

IMPACTS OF ALTERNATIVE A: NO-ACTION

Impacts

Under Alternative A, the existing environmental conditions along Moors Road would remain unchanged. Therefore, there would be no direct impact on habitat for special status species within the project corridor. However, because there are no current bicycle/pedestrian accommodations or crosswalks along this stretch of road, visitors using the road would be more inclined to access the dunes at opportunistic locations. This could result in indirect impacts on potential habitat for eastern box turtle and eastern spadefoot. Such impacts could include compaction of potential burrow sites and destruction of vegetation that would otherwise provide cover for these species.

Overall, Alternative A would result in long-term, negligible, adverse impacts on special status species due to the potential for disturbance from opportunistic foot traffic within the dunes where certain special status wildlife species could occur.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on special status species within the study area. These actions include the Province Lands Bike Trail renovations, which could have a long-term adverse impact on special status species through construction projects related to bicycle trail renovations that preempt potential habitat, including removal of substrate and vegetative cover. These conditions, along with Alternative A, would have a long-term, negligible, adverse cumulative impact on special status species. Alternative A would contribute an imperceptible adverse increment to this cumulative impact by continuing to allow pedestrian traffic through potential habitat in the dunes without concentrated access points for beachgoers.

IMPACTS OF ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Impacts

Under Alternative B, the existing environmental conditions along Moors Road would remain unchanged. Further, the addition of crosswalks at designated access points would reduce opportunistic foot traffic over the dunes by concentrating pedestrian access at specified points. This would reduce low-threshold substrate compaction from beachgoers creating opportunistic paths through the dunes, which could otherwise affect habitat for special status species that could inhabit the dunes (such as eastern box turtle and eastern spadefoot).

Construction activities could disrupt activities such as nesting, which occurs in dry sandy upland habitats adjacent to the marsh. However, such impacts would be negligible and temporary in nature, due to the prevalence of potential habitat available to this species outside of the project area, and to the temporary nature of the construction activities. In addition, to avoid or minimize impacts, a time-of-year restriction on construction activities would be observed during breeding and nesting seasons for special status species in potential habitat areas.

Overall, Alternative B would result in short-term, negligible, adverse impacts during construction and long-term, beneficial impacts related to a potential reduction in off-road foot traffic through the dunes.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on special status species within the study area. These actions and their impacts are described under Alternative A and include the Province Lands Bike Trail renovations. These conditions, along with Alternative B, would have a long-term, negligible, adverse cumulative impact on special status species. Alternative B would contribute an imperceptible beneficial increment to cumulative special status species impacts by concentrating access for beachgoers and reducing the potential for pedestrian-induced disturbance in potential special status species habitat through the dunes.

IMPACTS OF ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED ALTERNATIVE)

Impacts

Under Alternative C, roadside areas along Moors Road would be subject to changes related to the addition of paved road surface, particularly along the shoulders. This would result in the clearing of approximately 26,000 square feet of dune habitat. The proposed action has minimized, to the extent possible, loss of habitat. Planned national seashore efforts, including building demolition and site restoration projects, would address habitat loss to offset the very minor habitat loss associated with this project.

As discussed under the previous impact topic, the habitat that would be removed is in part “edge habitat.” The widening of the road would create a new area of linear edge habitat along the road corridor; however, it would not increase the amount of edge habitat within the study area as the removal of a large, contiguous patch of habitat would. It is possible that by providing a designated bicyclist/pedestrian throughway, the national seashore would decrease incidental traffic in adjacent vegetated dune areas by potentially decrease the amount of edge habitat that is disturbed by this type of use. Also, as described above for Alternative B, the addition of raised crosswalks at access points 2 and 3 would concentrate beachgoers at specified access points and thereby reduce opportunistic foot traffic through and over the dunes. Finally, the raised surface of the crosswalks would serve as traffic calming devices, which would reduce the potential for traffic-related mortality of special status species by slowing vehicular traffic through the corridor.

Alternative C would result in a minor reduction in potential salt marsh habitat for the diamond-backed terrapin with the placement of riprap associated with roadway stabilization and energy dissipation at stormwater swales. This would result in up to 90 square feet of wetland habitat. Further, construction activities could disrupt activities such as nesting, which occurs in dry sandy upland habitats adjacent to the marsh.

Impacts would be negligible and temporary in nature, due to the prevalence of potential habitat available to this species outside of the project area and to the temporary nature of the construction activities. In addition, to avoid or minimize impacts, a time-of-year restriction on construction activities would be observed during breeding and nesting seasons for special status species in potential habitat areas.

Overall, Alternative C would result in short-term, negligible, adverse impacts on special status species due to the addition of paved shoulders through the corridor and negligible impacts on wetland habitat, and long-term, beneficial impacts by reducing the frequency of off-road pedestrian and bicycle traffic, and by adding traffic calming devices via raised elevation crosswalks.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on special status species within the study area. These actions and their impacts are described under Alternative A and include the Province Lands Bike Trail. These conditions, along with Alternative C, would have a long-term, negligible, adverse cumulative impact on special status species. Alternative C would contribute an imperceptible beneficial increment to cumulative special status species impacts by concentrating access for beachgoers, reducing the potential for pedestrian-induced disturbance in potential special status species habitat through the dunes, and decreasing the risk of vehicle-induced mortality through the addition of traffic-calming measures.

IMPACTS OF ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

Impacts

Under Alternative D, the roadside areas along Moors Road would be subject to some changes related to the addition of a 10-foot wide multiuse path on the southwest side of the road. The addition of this paved pathway would result in the permanent removal of dune vegetation and grading of existing dune slopes adjacent to the road to accommodate a level path alignment. Approximately 43,000 square feet of dune habitat would be cleared. As discussed under Alternative C, the proposed action has minimized, to the extent possible, loss of habitat. Planned national seashore efforts, including building demolition and site restoration projects, would address habitat loss to offset the very minor habitat loss associated with this project.

This alternative would install a raised crosswalk at access point 1, because that is the point at which the separate multiuse path (and the associated guard rail separating it from the vehicle lanes) would start. As mentioned under the previous impact topic, formalizing this crosswalk has the unfortunate consequence of encouraging pedestrians to cross the road at a location where many pedestrians currently use the unauthorized trailhead. The national seashore intends for pedestrians and bicyclists to continue along the multiuse path from this point to access point 2 (or beyond); however, some pedestrians may choose to leave the road at this point and hence contribute to the habitat disturbance described under Alternative A and thus have a beneficial effect on potential special status species habitat in the dunes.

Alternative D would result in a minor reduction in potential salt marsh habitat for the diamond-backed terrapin associated with the placement of riprap associated with roadway stabilization and energy dissipation at stormwater swales. This would result in the loss of up to 180 square feet of wetland habitat. Further, construction activities could disrupt activities such as nesting, which occurs in dry sandy upland habitats adjacent to the marsh. However, such impacts would be negligible and temporary in nature, due to the prevalence of potential habitat available to this species outside of the project area and to the temporary nature of the construction activities. In addition, to avoid or minimize impacts, a time-of-year restriction on construction activities would be observed during breeding and nesting seasons for special status species in potential habitat areas.

Overall, Alternative D would result in short-term, negligible, adverse impacts on special status species through the removal of potential habitat during multiuse path construction, and long-term, beneficial impacts by reducing the frequency of off-road pedestrian and bicycle traffic in potential habitat areas.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on special status species within the study area. These actions and their impacts are described under Alternative A and include the Province Lands Bike Trail renovations. These conditions, along with Alternative D, would have a long-term, negligible, adverse cumulative impact on special status species. Alternative D would contribute an imperceptible beneficial increment to cumulative special status species impacts by concentrating access for beachgoers and reducing the potential for bicycle/pedestrian-induced disturbance in potential special status species habitat through the dunes.

CONCLUSIONS AND FINDINGS ON IMPAIRMENT FOR SPECIAL STATUS SPECIES

Alternative A

Alternative A would result in long-term, negligible, adverse impacts on special status species due to the potential for disturbance from foot traffic within the dunes where the box turtle and spadefoot could occur. Alternative A would contribute an imperceptible adverse increment to a long-term, negligible, adverse cumulative impact.

Implementing Alternative A would not result in an impairment of special status species because the disturbance of habitat is minimal and limited to foot traffic within the dunes. Direct impacts on specific individuals are not anticipated; therefore, special status species populations are not expected to be affected.

Alternative B

Alternative B would result in short-term, negligible, adverse impacts during construction and long-term, beneficial impacts related to a potential reduction in off-road foot traffic through the

dunes. Alternative B would contribute an imperceptible beneficial increment to a long-term, negligible, adverse cumulative impact.

Implementing Alternative B would not result in an impairment of special status species because the disturbance of habitat is minimal and limited to foot traffic within the dunes. Direct impacts on specific individuals are not anticipated; therefore, special status species populations are not expected to be affected. Additionally, these impacts would be reduced by focusing foot traffic by adding formalized crosswalk locations.

Alternative C

Alternative C would result in short-term, negligible, adverse impacts during construction and long-term, beneficial impacts related to a potential reduction in off-road foot traffic through the dunes. Alternative C would contribute an imperceptible beneficial increment to a long-term, negligible, adverse cumulative impact.

Implementing Alternative C would not result in an impairment of special status species because the loss of habitat would be limited to approximately 26,000 square feet, and the national seashore would implement a number of mitigation measures to limit impacts on special status species during construction. Although the implementation of this alternative would result in the loss of habitat and the development of new edge habitat along the widened roadway corridor and some individuals may be permanently displaced, the overall populations would not be noticeably affected.

Alternative D

Alternative D would result in short-term, negligible, adverse impacts during construction and long-term, beneficial impacts related to a potential reduction in off-road foot traffic through the dunes. Alternative D would contribute an imperceptible beneficial increment to a long-term, negligible, adverse cumulative impact.

Implementing Alternative D would not result in an impairment of special status species because the loss of habitat would be limited to approximately 43,000 square feet, and the national seashore would implement a number of mitigation measures to limit impacts on special status species during construction. Although the implementation of this alternative would result in the loss of habitat and the development of new edge habitat along the widened roadway corridor and some individuals may be permanently displaced, the overall populations would not be noticeably affected.

WETLAND RESOURCES

METHODOLOGY

The NPS has adopted a goal of “no net loss” of wetlands and also has set goals for a long-term net gain of wetlands service wide (NPS 2002b). Wetland resources are present within the project area in association with intertidal zones, including nonvegetated and vegetated marsh surface along a section of Moors Road near the Provincetown border. This includes Mill Pond, an

occluded tidal inlet that is connected to salt marshes on the seaward side of Moors Road through three 24-inch diameter culverts. The wetland resources within the study area are described in greater detail in “Chapter 3: Affected Environment,” along with a functions and values assessment which was used, in part, to assess the wetland impacts of the various alternatives.

The *NPS Procedural Manual 77-1: Wetland Protection* (NPS 2008a) specifies those conditions under which impacts to wetlands are excepted from requiring that a Statement of Findings be required. This project falls into the exception described in Section 4.2.1(g): the impacts mentioned above are associated with the renovation of a currently serviceable road and would impact less than 0.1 acres of wetlands. This NPS exception does not imply exception from compliance with Section 404 of the Clean Water Act or any other relevant laws, regulations, or procedures (these other requirements are described in more detail in “Chapter 5: Consultation and Coordination”).

This section analyzes the impacts of the proposed action on wetland resources. The thresholds of change for the intensity of an impact are as follows:

- Negligible:** Wetland resources would not be affected or the impacts on the resources would be below or at the lower levels of detection.
- Minor:** The impacts on wetland resources would be detectable and relatively small in terms of area and the nature of change. The action would affect a limited number of individual plant or wildlife species within the wetlands.
- Moderate:** The impacts on wetland resources would be readily apparent over a relatively small area, but the impact could be mitigated by restoring previously degraded wetlands. The action would have a measurable impact on plant or wildlife species within the wetlands, but all species would remain indefinitely viable.
- Major:** The impacts on wetland resources would be readily apparent over a relatively large area. The action would have measurable consequences for the wetland area that could not be mitigated. Wetland species dynamics would be upset, and plant and/or animal species would be at risk of extirpation from the area.

IMPACTS OF ALTERNATIVE A: NO-ACTION

Impacts

Under Alternative A, the existing wetland resources along Moors Road would remain unchanged. There is currently no stormwater management infrastructure along this section of Moors Road. As a result, stormwater runoff would continue to move into the adjacent wetlands unabated. The point source runoff causes slow levels of erosion and sedimentation local to discharge points. Generally, such effects caused by this runoff would be below the levels of detection. However, the localized effect of erosion and sedimentation to the wetlands adjacent to

Moors Road results in the degradation of the receiving wetland resources, which results in a slight reduction in functions and values over time.

In addition, the existing culvert crossing has created a restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road, resulting in uneven patterns of sediment/sand accretion and erosion on both sides of the culvert. The sediment balance on both sides of the culvert is therefore unstable, and this reduces the functional capacity of the tidal wetlands to some degree by preventing regular tidal flushing, disrupting normal vegetation colonization patterns, and causing subsidence of marsh surfaces that are currently starved of normal sediment supply.

Overall, Alternative A would result in long-term, minor, adverse impacts on wetland resources related to roadside runoff and the current hydrodynamic/sediment supply conditions at the culvert under Moors Road.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on wetland resources within the study area. These actions include the Capital Improvement Plan for Provincetown Municipal Airport. Though the Airport Capital Improvements Plan does not propose activities that would overreach the project area, changes to the regional environment initiated by development activities could affect wetland resources in the project area by influencing dynamic regional conditions such as groundwater availability and species distributions. These conditions, along with Alternative A, would have a long-term, minor, adverse cumulative impact on wetland resources. Alternative A would contribute an imperceptible adverse increment to this cumulative impact by not providing any further improvements.

IMPACTS OF ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Impacts

Under Alternative B, roadway rehabilitation would avoid the existing wetland resources along Moors Road. However, because there is currently no functioning stormwater management along this section of Moors Road, the proposed swale and riprap infrastructure would improve conditions by reducing the amount of unattenuated runoff into the adjacent wetland resources. As mentioned under Alternative A, unattenuated stormwater flowing into a wetland system tends to create erosional problems adjacent to and within the wetland. The proposed riprap slope stabilization along Moors Road would serve as energy dissipation for roadside runoff at this location. This would result in a slight improvement in the functions and values of the wetland resources currently being impacted by unattenuated roadside runoff.

Under Alternative B, the existing culvert under Moors Road would be examined during construction to determine whether or not it is damaged and needs to be replaced. Should the existing culvert need replacing, the national seashore would consider a range of options for replacement. Each option would consider benefits to natural resources, short-term construction

impacts, and replacement costs. Options currently being considered are replacement of the culvert in kind and the replacement of the culvert with a larger, more open structure such as a box culvert.

Should the culvert be replaced in kind, the impacts on wetland resources would be similar to those described under Alternative A. This type of culvert has created a restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road, resulting in uneven patterns of sediment/sand accretion and erosion on both sides of the culvert. The sediment balance on both sides of the culvert is therefore unstable, and this reduces the functional capacity of the tidal wetlands to some degree by preventing regular tidal flushing, disrupting normal vegetation colonization patterns, and causing subsidence of marsh surfaces that are currently starved of normal sediment supply. This would result in a long-term, minor, adverse impact on wetland resources within the study area.

Should the culvert be replaced with a narrow (approximately 10-foot wide), three-sided concrete box culvert with a natural bottom or something similar, the impacts would be different from those described under Alternative A. Opening the channel under Moors Road in that way would be likely to restore the normal tidal flood and ebb regime and provide natural flushing processes for Mill Pond and the channel. This condition would improve tidal flushing at the culvert, as well as allow for sand/sediment to move more freely between Mill Pond and the downstream resources resulting in a long-term improvement in wetland functions. If a naturalized bottom was used, it would effectively restore 0.005 acres (240 square feet) of intertidal channel underneath and immediately adjacent to the proposed natural bottom culvert. This option would result in long-term, minor, beneficial impacts on wetland resources within the study area.

Regardless of the culvert inspection results, the NPS would ensure that appropriate erosion and sediment control plans were developed and implemented during construction; however, there could be temporary impacts on wetland resources associated with these actions. Wattles (bundled sticks used for stabilization) would be used to control erosion in wetland areas and also would be used with silt fence in 100-foot wetland buffer areas to minimize impacts associated with the intrusive installation techniques required for silt fence, and to collect and absorb any oil sheen from the new asphalt surface. Additionally, staging and material stockpiling would be limited to existing parking areas. Wattles would be placed down-gradient of each area to contain any potential spills or sediment run-off.

Overall, Alternative B would result in short-term, minor, adverse impacts during culvert replacement and placement of riprap stabilization at the stormwater swales. Depending upon the option selected for culvert replacement (if deemed necessary), Alternative B would result in either long-term, minor, adverse impacts related to continued restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road or long-term, beneficial impacts on wetland resources related to energy dissipation of roadside runoff, as well as the restoration of intertidal channel underneath and immediately adjacent to the proposed natural bottom culvert.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on wetland resources within the study area. These actions and their impacts are described under Alternative A and include the Capital Improvement Plan for Provincetown Municipal Airport. These conditions, along with Alternative B, would have a long-term, minor, adverse cumulative impact on wetland resources. Alternative B would contribute either an imperceptible adverse or beneficial increment to cumulative wetland resource impacts, depending upon culvert replacement options.

IMPACTS OF ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED ALTERNATIVE)

Impacts

Under Alternative C, the wetland resources adjacent to Moors Road would be subject to changes related to a minor wetland encroachment for roadway widening. As described for Alternative B, the proposed roadside swale and riprap infrastructure would improve runoff conditions to the adjacent wetlands along Moors Road by providing peak runoff attenuation through the energy dissipation provided by the riprap outfall protection. The same erosion and sedimentation control measures described under Alternative B also would be implemented under this alternative.

The design elevation for Moors Road and the proposed paved shoulders is as close as possible to the existing elevation of the road on either side of the culvert at Mill Pond. This would allow roadway improvements to match the existing grade through this area, thereby minimizing the need for embankment fills within the adjacent marshes. The only adverse wetland impacts associated with Alternative C would be: 1) temporary disturbance to replace the existing culvert (if necessary) and 2) permanent conversion of approximately 0.002 acre (90 square feet) of marsh surface to rip-rap toe protection to prevent erosion of the marsh along the embankment.

As described under Alternative B, the existing culvert would only be replaced if it was found during construction to be damaged in some way. If the culvert needed to be replaced, the width of the replacement culvert would be the same as the current culvert, which would allow for widening of the roadway without the need to extend the pipes any further into the wetland resources. DO-77-1 puts forth a goal of no net loss of wetland resources. Although the loss of wetland resources is minimal (0.002 acres), this alternative could be a self-mitigating proposal if the culvert was found to be damaged and replaced with a box culvert-type structure with a naturalized bottom, as the improvements to tidal flow and sand/sediment movement through the proposed natural bottom culvert would restore approximately 0.005 acres (240 square feet) of tidal channel underneath and immediately adjacent to the culvert.

Overall, Alternative C would result in short-term, minor, adverse impacts due to the conversion of marsh surface for the encroachment of the road embankment and construction activities. Depending upon the option selected for culvert replacement (if deemed necessary), Alternative C would result in either long-term, minor, adverse impacts related to continued restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road or

long-term, beneficial impacts on wetland resources related to energy dissipation of roadside runoff, as well as the restoration of intertidal channel underneath and immediately adjacent to the proposed natural bottom culvert.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on wetland resources within the study area. These actions and their impacts are described under Alternative A and include the Capital Improvement Plan for Provincetown Municipal Airport. These conditions, along with Alternative C, would have a long-term, minor, adverse cumulative impact on wetland resources. Balancing net environmental effects, Alternative C would contribute either an imperceptible adverse or beneficial increment to cumulative wetland impacts depending upon culvert replacement.

IMPACTS OF ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

Impacts

Under Alternative D, the wetland resources adjacent to Moors Road would be subject to changes related to a minor wetland encroachment as described for Alternative C. However, because Alternative D includes a slightly wider road design, placement of fill within approximately 0.004 acres (180 square feet) of marsh surface would be required to stabilize the roadway embankment. The fill material would be riprap installed on a 1:1 slope. As described under Alternative C, Alternative D has the potential to be a self-mitigating activity due to the restoration of natural tidal channel with the proposed culvert replacement.

As described for Alternative B, the proposed roadside swale and riprap infrastructure would improve runoff conditions to the adjacent wetlands along Moors Road by providing peak runoff attenuation through the energy dissipation provided by the riprap erosion protection. The same erosion and sedimentation control measures described under Alternative B also would be implemented under this alternative.

Overall, Alternative D would result in short-term, minor, adverse impacts due to the conversion of marsh surface for the encroachment of the road embankment and construction activities. Depending upon the option selected for culvert replacement (if deemed necessary), Alternative D would result in either long-term, minor, adverse impacts related to continued restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road or long-term, beneficial impacts on wetland resources related to energy dissipation of roadside runoff, as well as the restoration of intertidal channel underneath and immediately adjacent to the proposed natural bottom culvert.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on wetland resources within the study area. These actions are and their impacts described under Alternative A and include the Capital Improvement Plan for

Provincetown Municipal Airport. These conditions, along with Alternative D, would have a long-term, minor, adverse cumulative impact on wetland resources. Balancing net environmental effects, Alternative D would contribute either an imperceptible adverse or beneficial increment to cumulative wetland impacts depending upon culvert replacement.

CONCLUSIONS AND FINDINGS ON IMPAIRMENT FOR WETLAND RESOURCES

Alternative A

Alternative A would result in long-term, minor, adverse impacts on wetland resources related to roadside runoff and the current hydrodynamic/sediment supply conditions at the culvert under Moors Road. Alternative A would contribute an imperceptible adverse increment to a long-term, minor, adverse cumulative impact.

Alternative A would not result in the impairment of wetland resources because the wetlands within the study area are continuing to function despite the generally undetectable amounts of sedimentation and contamination from the unattenuated runoff and the hydrodynamics imbalance caused by the existing culvert.

Alternative B

Alternative B would result in short-term, minor, adverse impacts during culvert replacement and placement of riprap. Depending upon the option selected for culvert replacement (if deemed necessary), Alternative B would result in either long-term, minor, adverse impacts related to continued restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road or long-term, beneficial impacts on wetland resources related to energy dissipation of roadside runoff, as well as the restoration of intertidal channel underneath and immediately adjacent to the proposed natural bottom culvert. Alternative B would contribute an imperceptible beneficial or adverse increment to a long-term, minor, adverse cumulative impact.

Alternative B would not result in the impairment of wetland resources because the functions and values of the wetlands within the study area would be improved by the reduction in sedimentation due to riprap providing energy dissipation at the paved swales and due to the restoration of the hydrodynamics via the replaced culvert.

Alternative C

Alternative C would result in short-term, minor, adverse impacts due to the conversion of marsh surface for the encroachment of the road embankment and construction activities. Depending upon the option selected for culvert replacement (if deemed necessary), Alternative C would result in either long-term, minor, adverse impacts related to continued restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road or long-term, beneficial impacts on wetland resources related to energy dissipation of roadside runoff, as well as the restoration of intertidal channel underneath and immediately adjacent to the proposed

natural bottom culvert. Alternative C would contribute either an imperceptible adverse or beneficial increment to a long-term, minor, adverse cumulative impact.

Alternative C would not result in the impairment of wetland resources because the functions and values of the wetlands within the study area would be improved by the reduction in sedimentation due to riprap providing energy dissipation at the paved swales and due to the restoration of the hydrodynamics via the replaced culvert.

Alternative D

Alternative D would result in short-term, minor, adverse impacts due to the conversion of marsh surface for the encroachment of the road embankment and construction activities. Depending upon the option selected for culvert replacement (if deemed necessary), Alternative D would result in either long-term, minor, adverse impacts related to continued restriction in normal tidal flow between Mill Pond and the wetlands on the downstream side of Moors Road or long-term, beneficial impacts on wetland resources related to energy dissipation of roadside runoff, as well as the restoration of intertidal channel underneath and immediately adjacent to the proposed natural bottom culvert. Alternative D would contribute either an imperceptible adverse or beneficial increment to a long-term, minor, adverse cumulative impact.

Alternative D would not result in the impairment of wetland resources because the functions and values of the wetlands within the study area would be improved by the reduction in sedimentation due to riprap providing energy dissipation at the paved swales and due to the restoration of the hydrodynamics via the replaced culvert.

VISUAL RESOURCES

METHODOLOGY

Under the topic of vista management, Cape Cod National Seashore's GMP states that the national seashore will provide access to views that occur naturally in open areas (NPS 1998). The national seashore's enabling legislation calls for managers to maintain the "ambiance that characterizes the Outer Cape." This is consistent with the values expressed by the general public during scoping. This section analyzes the impacts of the proposed action on those resources. The thresholds of change for the intensity of an impact are as follows:

- Negligible:** The visual quality of the landscape would not be affected or the impacts would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the visual experience.
- Minor:** Impacts on the visual quality of the landscape would be detectable, although the impacts would be localized and would be small and of little consequence to the visual experience. Mitigation measures, if needed to offset adverse impacts, would be simple and likely successful.

Moderate: Impacts on the visual quality of the landscape would be readily detectable and localized, with consequences to the visual experience. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.

Major: Impacts on the visual quality of the landscape would be obvious and would have substantial consequences to the visual experience in the region. Extensive mitigation measures would be needed to offset any adverse impacts, and their success would not be guaranteed.

IMPACTS OF ALTERNATIVE A: NO-ACTION

Impacts

Under Alternative A, the visual resources along Moors Road would remain generally unchanged. Views of the moors, the dunes, and Mill Pond would be unobstructed and the roadway would not distract from these views, with the possible exception of minor road repairs in areas suffering from structural failures. Some visitors may not notice the condition of the roadway, but it may cause a distraction to others, especially bicyclists who would need to watch where they ride. The increasing deterioration also would result in the increasing presence of large vehicles being used to patch or resurface sections of the roadway as time and funding allow. The presence of those trucks would temporarily distract from the natural landscape.

The trees and the canopy they provide would remain unchanged in the short term. In the long term, some of the trees at the edge of the road have been damaged by automobile collisions or are unhealthy due to natural causes. These trees would be removed by storms or by national seashore staff if they pose a safety hazard. Remaining trees would be likely to take advantage of gaps in the canopy and thus fill them in over the long term.

Overall, Alternative A would result in short-term, minor, adverse impacts related to the patching of the roadway and long-term, minor, adverse impacts related to the irregular appearance of the road.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the visual resources of the study area. The facilities development at Herring Cove Beach could eventually provide an improved bath house facility, solar panels, and even a small wind turbine. This would increase the developed feeling at the northern end of the project area; however, the viewsheds of this area have already been impacted by man-made structures, and the new facilities are likely to be more pleasant than the existing, aging facilities. These actions, along with Alternative A, would have a long-term, beneficial cumulative impact on visual resources by improving the man-made viewsheds at the northern end of the study area. Alternative A would contribute an imperceptible adverse increment to this cumulative impact by detracting from the visual quality of the study area.

IMPACTS OF ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Impacts

Under Alternative B, the visual resources along Moors Road would be subject to subtle changes related to the road surface, the addition of signs, and the installation of guard rails. The rehabilitation of the entire roadway within the study area would eliminate any unsightly potholes or roadway patches. Several changes related to safety improvements may cause a temporary distraction from the natural visual resources surrounding the road. At least two new crosswalks would be added at access points 2 and 3. These crosswalks would be raised slightly above the road grade to double as traffic calming measures. These raised table crosswalks would be constructed with a differently colored aggregate than the rest of the roadway and demarcated with relatively subtle white lines. Bright colors that would detract from the natural setting would be avoided. A few new “Share the Road” signs would be placed along the roadway. A guard rail would be added along either side of the culvert. The guard rail would likely be wooden or weathering steel in order to blend with the natural setting. Such guard rails are used throughout the park and would be built to NPS standards. These safety measures may initially cause a distraction from the natural setting; however, the distraction would decrease as visitors became accustomed to them.

There would be no impacts on the dune forest area associated with this alternative. Impacts from continued vehicle traffic and natural cycles would be similar to those described under Alternative A. However, with the addition of traffic calming devices, there may be less damage to trees due to vehicle collisions.

Construction would take place in the off-season and would involve closing the road to all visitors and users during the four to eight week period for construction to be completed. Visitors to or residents of Provincetown who walk to Herring Cove Beach may be able to see construction activities taking place on the road. As such, construction activities would have a short-term, negligible, adverse impact on visual resources within the study area.

Overall, Alternative B would result in short-term, minor, adverse impacts on visual resources during construction and as visitors adjusted to the addition of the safety measures and long-term, beneficial impacts on visual resources related to the uniformly improved roadway.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the visual resources of the study area. These actions and their impacts are associated with the Herring Cove Beach facilities development and are described under Alternative A. These conditions, along with Alternative B, would have a long-term, beneficial cumulative impact on visual resources. Alternative B would contribute a noticeable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED ALTERNATIVE)

Impacts

Under Alternative C, the visual resources along Moors Road would be subject to some changes related to the road surface, the addition of signs, the installation of guard rails, and the widening of the paved shoulders. Impacts related to the road surface, the addition of signs, and the addition of guard rails would be the same as those discussed under Alternative B.

Under this alternative, the road would be widened a total of 10 feet from the national seashore boundary to the split rail fence at access point 2. This would allow for a 6-foot paved shoulder on both sides of the road. The portion of the road that passes through the wooded section until the point at which the abandoned roadbed becomes available for connections to future bicycle trails would be widened a total of 6 feet to accommodate a 4-foot paved shoulder on both sides of the road. On both sides of this pavement, an additional 2 feet would be cleared of any vegetation that could pose a safety hazard to bicyclists and pedestrians. This would result in the clearing of approximately 5 feet from the current edge of pavement (it is possible that the road may be shifted slightly one way or the other to minimize impacts on natural resources); this translates to the loss of 8 to 12 trees, mostly oak species (*Quercus* spp). This would noticeably reduce the amount of canopy shading the road through this section of roadway and would contribute to a slightly more developed appearance of the road corridor when compared to Alternatives A and B. The impacts on the wooded area as a visual resource are expected to be temporary, however, as the remaining trees would most likely fill in the newly available space and thus return the appearance to something similar to the current appearance.



Top: Existing view, looking southeast along Moors Road at access point 2. Bottom: Simulation of widened shoulders and a raised crosswalk in the same location.

As under Alternative B, construction would take place in the off-season and would involve closing the road to all visitors and users during the four to eight week period for construction to be completed. Visitors to or residents of Provincetown who walk to Herring Cove Beach may be able to see construction activities taking place on the road. As such, construction activities would have a short-term, negligible, adverse impact on visual resources within the study area.

Overall, Alternative C would result in short-term, moderate, adverse impacts during construction and as visitors adjusted to the more developed viewshed; long-term, minor, adverse impacts on visual resources related to the permanent widening of the roadway and removal of trees; and long-term, beneficial impacts related to the uniformly improved roadway.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the visual resources of the study area. These actions are associated with the Herring Cove Beach facilities development and are described under Alternative A. These conditions, along with Alternative C, would have a long-term, beneficial cumulative impact on visual resources. Alternative C would contribute a noticeable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

Impacts

Under Alternative D, the visual resources along Moors Road would be subject to some changes related to the surface of the road, the addition of signage, the installation of guard rails, and the paving of the adjacent pathway. Impacts related to the road surface, the addition of signs, and the addition of guard rails would be similar to those discussed under Alternative B, with a few exceptions. Instead of adding three raised-table crosswalks, this alternative would only add one raised crosswalk at access point 1. Only one crosswalk is planned for this alternative because the park intends for pedestrians and bicyclists to cross the road to enter the separate path here and not cross in other areas. In addition to the guard rails planned at the culvert, a similar guard rail would physically separate the vehicle travel lanes and the bicyclist/pedestrian pathway. The presence of this guard rail throughout a majority of the study area would contribute to a more developed appearance of the roadway, despite the use of wood or weathered steel to blend with the setting.

The roadway itself also would be widened to include the 10-foot paved path, with 2 feet of paved buffer with the guard rail. The road would be widened by a total of 12 feet from the national seashore boundary to the point at which the abandoned roadway becomes available. Again, 2 feet on either side of the pavement would be cleared of any vegetation that could pose a safety hazard. This would result in the clearing of approximately 8 feet from the current edge of pavement (it is possible that the road may be shifted slightly one way or the other to minimize impacts on natural resources); this translates to the loss of approximately 20 to 25 trees, mostly oaks. This would noticeably reduce the amount of canopy shading the road through this section of roadway and would contribute, along with the continuous guard rail, to a more developed appearance of the road corridor when compared to Alternatives A, B, and C. The most noticeable impacts on the wooded area as a visual resource are expected to be temporary, however, as the remaining trees would most likely fill in the newly available space and thus return the appearance to something similar to the current appearance. Reduction in the overstory resulting from this alternative is likely to be more noticeable in the long term than any reduction that might result from Alternative C.

As under Alternative B, construction would take place in the off-season and would involve closing the road to all visitors and users during the four to eight week period for construction to be completed. Visitors to or residents of Provincetown who walk to Herring Cove Beach may be able to see construction activities taking place on the road. As such, construction activities would have a short-term, negligible, adverse impact on visual resources within the study area.

Overall, Alternative D would result in short-term, moderate, adverse impacts during construction and as visitors adjusted to the more developed viewshed; long-term, moderate, adverse impacts on visual resources related to the permanent widening of the roadway and removal of trees; and long-term, beneficial impacts related to the uniformly improved roadway.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the visual resources of the study area. These actions are associated with the Herring Cove Beach facilities development and are described under Alternative A. These conditions, along with Alternative D, would have a long-term, minor, adverse cumulative impact on visual resources. Alternative D would contribute a noticeable adverse increment to this cumulative impact.

CONCLUSIONS AND FINDINGS ON IMPAIRMENT FOR VISUAL RESOURCES

Alternative A

Alternative A would result in short-term, minor, adverse impacts related to the patching of the roadway and long-term, minor, adverse impacts related to the irregular appearance of the road. Alternative A would contribute an imperceptible adverse increment to a long-term, beneficial cumulative impact on visual resources by improving the man-made viewsheds at the northern end of the study area.

Alternative A would not result in impairment of visual resources because the views of and within the study area would retain a natural feel, although the roadway surface would not be improved. The presence of sporadic patches and the cracking roadway as well as heavy machinery used for maintenance would be a slight distraction for some users.

Alternative B

Alternative B would result in short-term, minor, adverse impacts on visual resources during construction and as visitors adjusted to the addition of the safety measures and long-term, beneficial impacts on visual resources related to the uniformly improved roadway. Alternative B would contribute a noticeable beneficial increment to a long-term, beneficial cumulative impact on visual resources. Alternative B would not result in an impairment of visual resources because there would be an improvement to the road's appearance without altering the natural viewshed of the road.

Alternative B would not result in impairment of visual resources because the views of and within the study area would be either maintained or improved. The roadway would not be widened,

which would maintain the undeveloped, natural atmosphere of the study area. Additions of safety facilities would blend with the natural setting. The road surface also would be repaired (and strengthened) during one comprehensive rehabilitation, which would eliminate any distractions from the natural setting related to road surface irregularities.

Alternative C

Alternative C would result in short-term, moderate, adverse impacts during construction and as visitors adjusted to the more developed viewshed; long-term, minor, adverse impacts on visual resources related to the permanent widening of the roadway and removal of trees; and long-term beneficial impacts related to the uniformly improved roadway.

Alternative C would not result in impairment of visual resources because the views of and within the study area would maintain a natural atmosphere. The roadway would be widened by 10 feet from the entrance to the national seashore from Provincetown to access point 2 and by 6 feet from access point 2 until the abandoned roadway. This widened road corridor would require the removal of an estimated 8 to 12 trees and contribute to a slightly more developed viewshed. Additions of safety facilities would blend with the natural setting. As in Alternative B, the road surface would also be repaired (and strengthened) during one comprehensive rehabilitation, which would eliminate distractions from the natural setting related to road surface irregularities.

Alternative D

Alternative D would result in short-term, moderate, adverse impacts during construction and as visitors adjusted to the more developed viewshed; long-term, moderate, adverse impacts on visual resources related to the permanent widening of the roadway and removal of trees; and long-term, beneficial impacts related to the uniformly improved roadway. Alternative D would contribute a noticeable adverse increment to a long-term, minor, adverse cumulative impact on visual resources.

Alternative D would not result in impairment of visual resources because the views of and within the study area would maintain a natural atmosphere. The roadway would be widened by 12 feet from the entrance to the national seashore from Provincetown to the abandoned roadway. This widened road corridor would require the removal of an estimated 20 to 25 trees and contribute to a more developed viewshed. Additions of safety facilities would blend with the natural setting. As in Alternative B, the road surface would also be repaired (and strengthened) during one comprehensive rehabilitation, which would eliminate distractions from the natural setting related to road surface irregularities.

PUBLIC USE AND EXPERIENCE

METHODOLOGY

NPS *Management Policies 2006* (NPS 2006b) states that enjoyment of national seashore resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for the

public to enjoy parks. While visual resources, site access and circulation, and public safety all affect public use and experience along Moors Road, they are addressed in more detail under those impact topics. This section focuses on the ways in which those topics combine to provide an experience and judge the outcome on its consistency with the Cape Cod National Seashore's purpose of preserving scenic, natural, and recreational values and providing opportunities for present and future generations to experience, enjoy, and understand these values and associated resources (NPS 1998).

Past planning documents provided background on changes to public use and experience over time. Anticipated impacts on public use and experience were analyzed using information from previous studies. Based on these findings, the following intensity levels were developed:

- Negligible:** Changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the impacts associated with the alternative.
- Minor:** Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be slightly aware of the impacts associated with the alternative.
- Moderate:** Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the impacts associated with the alternative and would likely be able to express an opinion about the changes.
- Major:** Changes in visitor use and/or experience would be readily apparent and would be severely adverse. The visitor would be aware of the impacts associated with the alternative and would likely express a strong opinion about the changes.

IMPACTS OF ALTERNATIVE A: NO-ACTION

Impacts

Under Alternative A, the way in which the public uses and experiences the national seashore would remain unchanged. The natural views would remain readily available, although visitors travelling along Moors Road would continue to be distracted from experiencing the natural setting by the necessity of sharing the road, sometimes in congested conditions, and possibly by areas in poor repair. This applies to both those users simply passing through on their way into or out of Provincetown or those visitors riding their bicycles or walking along the road on their way to the beach or as a recreational activity itself. In many areas, sand encroachment would continue to force bicyclists and pedestrians into the travel lane, which causes all users of the road to focus their attention on the safety of themselves and those around them instead of the natural setting of the road. The only location at which bicyclists and pedestrians can feel relatively safer is at the crosswalk at access point 3, which is rarely used by pedestrians. This situation has caused the current use pattern, where many visitors leave the road as soon as possible at access point 1 and others walk on the sandy shoulder to distance themselves from vehicles.

In terms of educational opportunities, the national seashore would continue to provide orientation information on the seashore on the single 3-foot by 4-foot board posted at the trail head of this popular social trail. This information includes guidance on how to minimize impacts on the dunes and provides a location map, although these postings are subject to change.

Overall, Alternative A would result in long-term, moderate, adverse impacts on public use and experience related to the persistence of safety concerns that distract from enjoyment of the Cape's natural viewshed and the missed interpretive opportunity related to the natural resources and processes at work in this area.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the public use and experience of the study area. These actions include the implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. Implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study* and the completion of the Province Lands Bike Trail renovations would provide limited connections between the study area and other areas on the Cape. The development of the Herring Cove beach facilities would provide additional accommodations for visitors to Herring Cove Beach, specifically those parking at or passing through the southern Herring Cove Beach parking lot. These actions, along with Alternative A, would have a long-term, beneficial cumulative impact on public use and experience. Alternative A would contribute a noticeable adverse increment to this cumulative impact by not improving an essential bicycle link between beach access 2 and the Province Lands Bike Trail.

IMPACTS OF ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Impacts

Under Alternative B, impacts on public use and experience would be similar to those described under Alternative A with a few minor improvements. This alternative would not allow any additional space for separation of vehicles and pedestrians/bicyclists; however, "Share the Road" signs would be posted at both ends of the study area to give drivers advance notice that this is a high bicycle traffic area. It would also formalize access point 2 with crosswalks and would raise this crosswalk and the existing crosswalk at access point 3. It would also include an at-grade crosswalk at access point 4 once the connector trail along the abandoned roadway is paved. These crosswalks, especially the raised tables, would double as pedestrian crosswalks and traffic calming devices. Some bicyclists and pedestrians may feel safer knowing that vehicles would be less likely to speed around blind curves or hills and would thus be more able to enjoy the natural setting of the road. The current use patterns as described under Alternative A would be likely to continue.

A couple other improvements to public use and experience would be common to all action alternatives. Where it is possible to do so without additional adverse impacts on the dunes and associated vegetation, the split rail fence at access point 2 would be moved away from the road's

edge to provide additional space for bicycle parking. A second interpretive board of the same size as the existing interpretive board may be added at the same location to provide visitors with an opportunity to better understand the natural resources and processes relevant to this part of the Cape.

Although Moors Road would be closed for the estimated four to eight weeks required for the construction period, visitors would be able to use alternate routes to access Herring Cove Beach and the Province Lands Bike Trail from the Herring Cove Beach parking lots. Advanced warning signs would advise the public of the road closures and provide detour routings.

Overall, Alternative B would result in short-term, moderate, adverse impacts on public use and experience during closure of the road for construction of the improvements and long-term, minor, adverse impacts on public use and experience related to the slight reduction in but persistence of safety concerns distracting from enjoyment of the area by users.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the public use and experience within the study area. These projects are described under Alternative A and include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. These conditions, along with Alternative B, would have a long-term, beneficial cumulative impact on visual resources. Alternative B would contribute an imperceptible adverse increment to this cumulative impact by only providing minimal safety improvements.

IMPACTS OF ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED ALTERNATIVE)

Impacts

Under Alternative C, visitors would be able to better enjoy use of Moors Road within the study area. The widening of the roadway would provide pedestrians and bicyclists the much-needed room to remove themselves from the vehicle travel lanes, although it also would contribute to a slightly more developed viewshed. The crosswalks and “Share the Road” signs described under Alternative B would be added under this alternative as well. Although these signs and the widened roadway may at first be distracting from the natural landscape, bicyclists and pedestrians would be more able to relax and enjoy their trip than be concerned for their safety. The interpretive board at access point 2 described under Alternative B also would be added under this Alternative. Visitor use patterns may favor using park-sanctioned beach access points and staying on the paved road under this alternative.

Although Moors Road would be closed for the estimated four to eight weeks required for the construction period, visitors would be able to use alternate routes to access Herring Cove Beach and the Province Lands Bike Trail from the Herring Cove Beach parking lots. Advanced warning signs would advise the public of the road closures and provide detour routings.

Overall, Alternative C would result in short-term, moderate, adverse impacts on public use and experience during closure of the road for construction of the improvements and long-term, beneficial impacts on public use and experience related to the reduction of safety concerns to a point that visitors are more able to enjoy the surrounding resources.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the public use and experience within the study area. These projects and their impacts are described under Alternative A and include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. These conditions, along with Alternative C, would have a long-term, beneficial cumulative impact on public use and experience. Alternative C would contribute a noticeable beneficial increment to this cumulative impact by providing an essential connection between access point 2 and the Province Lands Bike Trail.

IMPACTS OF ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

Impact Analysis

Under Alternative D, the provision of a separate multiuse path would effectively remove most of the pedestrian and bicyclist use from the travel lanes by physically separating the adjacent pathway with a guard rail. This would provide pedestrians with the greatest sense of safety. Some bicyclists may prefer to share the multiuse path with pedestrians; however, some may prefer riding with traffic than have to dodge pedestrians on the multiuse path. In this case, there would only be the 1-foot shoulders off the travel lanes to accommodate bicyclists sharing the road with vehicles. This alternative would still provide relief from peak season congestion by providing the separate path. Visitor use patterns may favor using park-sanctioned beach access points and staying on the paved road under this alternative although providing the raised crosswalk at access point 1 instead of the latter access points may enable continued use of the unofficial trailhead in that area.

While striving to separate the uses of Moors Road for a more enjoyable experience of the Cape's natural resources, this alternative may be viewed by some to be a disruption to those same resources. This alternative calls for the most widening and the addition of the guard rail for the length of the multiuse trail. While this guard rail would be constructed in such a way to blend with its natural surroundings, some visitors may find that this alternative contributes an urbanized experience to the study area. There also is a chance that trail users may lock their bicycles to the guard rail near the access points, which would constitute a safety hazard.

Although Moors Road would be closed for the estimated four to eight weeks required for the construction period, visitors would be able to use alternate routes to access Herring Cove Beach and the Province Lands Bike Trail from the Herring Cove Beach parking lots. Advanced warning signs would advise the public of the road closures and provide detour routings.

Overall, Alternative D would result in short-term, moderate, adverse impacts on public use and experience during the construction of the improvements and long-term, beneficial impacts related to provision of a safe pathway for bicyclists and pedestrians that is physically separated from vehicle traffic.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on the public use and experience within the study area. These projects and their impacts are described under Alternative A and include the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. These conditions, along with Alternative D, would have a long-term, beneficial cumulative impact on public use and experience. Alternative D would contribute a noticeable beneficial increment to this cumulative impact.

CONCLUSIONS FOR PUBLIC USE AND EXPERIENCE

Alternative A

Alternative A would result in long-term, moderate, adverse impacts on public use and experience related to the persistence of safety concerns that distract from enjoyment of the Cape's natural viewshed and the missed interpretive opportunity related to the natural resources and processes at work in this area. Alternative A would contribute a noticeable adverse increment to the long-term, beneficial cumulative impact on public use and experience by not improving an essential bicycle link between beach access 2 and the Province Lands Bike Trail.

Alternative B

Alternative B would result in short-term, moderate, adverse impacts on public use and experience during closure of the road for construction of the improvements and long-term, minor, adverse impacts on public use and experience related to the slight reduction in but persistence of safety concerns detracting from visitor enjoyment of the area. Alternative B would contribute an imperceptible adverse increment to a long-term, beneficial cumulative impact on public use and experience by only providing minimal safety improvements.

Alternative C

Alternative C would result in short-term, moderate, adverse impacts on public use and experience during the construction of the improvements and long-term, beneficial impacts on public use and experience related to the reduction of safety concerns to a point that visitors are more able to enjoy the surrounding resources. Alternative C would contribute a noticeable beneficial increment to a long-term, beneficial cumulative impact on public use and experience by providing an essential connection between access point 2 and the Province Lands Bike Trail.

Alternative D

Alternative D would result in short-term, moderate, adverse impacts on public use and experience during the construction of the improvements and long-term, beneficial impacts

related to provision of a safe pathway for bicyclists and pedestrians that is physically separated from vehicle traffic. Alternative D would contribute a noticeable beneficial increment to long-term, beneficial cumulative impact on public use and experience.

PUBLIC SAFETY

METHODOLOGY

The NPS *Management Policies 2006* state that, “while recognizing that there are limitations on its capability to totally eliminate all hazards, the Service . . . will seek to provide a safe and healthful environment for visitors and employees.” The policies also state, “the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education” (NPS 2006b).

The purpose of this impact analysis is to identify the level of impact that implementing each of the proposed alternatives would have on the safety of users at Cape Cod National Seashore. Past crash data were used to assess the impacts of the alternative actions on the safety of visitors and users. The impact thresholds for public safety are defined below.

- Negligible:** There would be no discernible impact on public safety. If adverse, slight injuries could occur, but none would be reportable.
- Minor:** The impact would be detectable but would be of a magnitude that would not have an appreciable impact on public safety. If adverse, any reported injury would require first aid that could be provided by national seashore staff.
- Moderate:** The impacts would be readily apparent and would result in a substantial change in public safety in a manner noticeable to staff and the public. If adverse, any reported injury would require further medical attention beyond what is available at the seashore staff.
- Major:** The impacts would be readily apparent. If adverse, an injury would result in permanent disability or death.

IMPACTS OF ALTERNATIVE A: NO-ACTION

Impacts

Under Alternative A, the existing conditions would persist. Users on foot or bicycle would be forced to share the road with vehicles along Moors Road. Motorists would have little warning of this heavy pedestrian and bicyclist use. Drivers travelling north would have no warning of the heavy bicycle use until passing out of the most heavily utilized bicycle corridor. Those drivers travelling south would be warned just before access point 3 and are likely to think that the sign only pertains to the existing crosswalk. Pedestrians and bicyclists would continue to be forced into vehicle travel lanes in areas where the dunes encroach on the road.

Under this alternative, the national seashore may choose to post additional “Share the Road” signs on either end of the study area to provide better warning of the heavy shared use. Even with the addition of these signs, motorists may not be effectively warned of the heavy pedestrian and bicycle use that occurs further down the road. No traffic calming measures would be implemented to encourage motorists to obey the posted speed limit of 30 miles per hour.

Overall, Alternative A would result in long-term, moderate, adverse impacts on public safety.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on public safety within the study area. These actions include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study* and the Province Lands Bike Trail renovations. These actions would likely increase the use of bicycles within the national seashore and along Moors Road. The increase in bicycle traffic adds additional points of conflict with motor vehicles. Without improvements to Moors Road, these actions, along with Alternative A, would have a long-term, moderate, adverse cumulative impact on public safety. Alternative A would contribute a noticeable adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Impacts

Under Alternative B, the impacts on public safety would be similar to Alternative A. The road would not be widened to accommodate bicyclist and pedestrian use of the road. The “Share the Road” signs mentioned under Alternative A would be added at either end of the study area to warn drivers of the bicycle traffic they may encounter. Access point 1 is not a park-designated trailhead, and use of that area as such has caused natural resource damage. The park would like to discourage people from using this access point and would therefore only formalize that crosswalk if safety issues in that particular area became an issue. The existing crosswalk at access point 3 would be raised several inches above grade (with foot tapers on both sides), and another raised crosswalk of a similar configuration would be installed at access point 2. This crosswalk may be wider than the crosswalk at access point 3 to better incorporate heavy use during peak season. When the bicycle trail connections became available and the national seashore implemented their plans to pave the abandoned roadway to connect to these bicycle trails, a crosswalk would be striped at access point 4. Although these crosswalks would be constructed in a way to blend with the natural setting of the roadway, they would be noticeable enough by drivers to slow vehicular traffic and would thus increase safety within the study area. Finally, guard rails would be constructed at the Mill Pond culverts to increase safety in that area.

Overall, Alternative B would result in improvements over Alternative A, however, conflict would still exist and would result in long-term, minor, adverse impacts on public safety.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on public safety within the study area. These actions and their impacts are described under Alternative A and include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study* and the Province Lands Bike Trail renovations and are described under Alternative A. These actions, along with Alternative B, would have a long-term, moderate, adverse cumulative impact on public safety. Alternative B would contribute an imperceptible adverse increment to this cumulative impact.

IMPACTS OF ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED ALTERNATIVE)

Impacts

Under Alternative C, the same traffic calming measures (signs and raised crosswalks) and guard rails as described under Alternative B would be added to the road within the study area. Additionally, the road would be widened to provide pedestrians and bicyclists with an improved shoulder where they are separated from the vehicle travel lanes, except under heavy use scenarios. The paved shoulders would be widened from 1 foot on each side to 6 feet on each side along the stretch of road from Provincetown to access point 2, because this is the section most heavily utilized by pedestrians and bicyclists. After access point 2, the paved shoulders would be widened to 4 feet on each side to accommodate those pedestrians and bicyclists continuing on to access point 3 and eventually to the separate bicycle path when future connections with other facilities are completed. Additionally, the grade of the road would be raised several feet in the area where dune encroachment is a regular problem. This may reduce dune encroachment and would thus leave more of the paved shoulder for pedestrian and bicyclist use.

Overall, Alternative C would result in improvements over Alternative B and long-term, beneficial impacts on public safety.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on public safety within the study area. These projects and their impacts are described under Alternative A and include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study* and the Province Lands Bike Trail renovations. These actions, along with Alternative C, would have a long-term, negligible, adverse cumulative impact on public safety. Alternative C would contribute a noticeable beneficial increment to this cumulative impact.

IMPACTS OF ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

Impacts

Under Alternative D, a separate 10-foot multiuse path would be constructed for pedestrians and bicyclists travelling along Moors Road. A guard rail would be constructed with a 2-foot paved buffer zone between the guard rail and the multiuse path to protect path users. This would remove a large amount of the pedestrian and bicycle traffic from the travel lanes; however, some bicyclists might prefer to ride on the road rather than have to maneuver around novice path users. Once they chose to stay on the road, the barrier would hinder access to the separate facility or access point 2, and bicyclists would be likely to remain with vehicles using the travel lanes until access point 3. Also, if bicyclists began to chain their bicycles to the guard rail, it could obstruct the trail and/or the road and thus constitute a safety hazard. Only one of the three raised crosswalks described under Alternative B would be constructed. There would be a single raised crosswalk constructed at access point 1 because this is where pedestrians and bicyclists would enter the multiuse path. The same guard rail described in Alternative B would be constructed to protect the culvert.

Given the solid barrier between uses and the lack of traffic calming measures, drivers may feel that higher speeds are appropriate and could be unaware that some bicyclists may still be using the vehicle travel lanes.

Overall, Alternative D would result in long-term, beneficial impacts on public safety.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on public safety within the study area. These projects and their impacts are described under Alternative A and include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study* and the Province Lands Bike Trail renovations. These actions, along with Alternative D, would have a long-term, negligible adverse cumulative impact on public safety. Alternative D would contribute a noticeable beneficial increment to this cumulative impact.

CONCLUSIONS FOR PUBLIC SAFETY

Alternative A

Alternative A would result in long-term, moderate, adverse impacts on public safety. Bicyclists and pedestrians would continue to share a road of insufficient width with motor vehicles. Alternative A contributes a noticeable adverse increment to a long-term, moderate, adverse cumulative impact.

Alternative B

Alternative B would result in improvements over Alternative A, however, conflict would still exist and would result in long-term, minor, adverse impacts on public safety. Similar to

Alternative A, bicyclists and pedestrians would continue to share a road of insufficient width with motor vehicles. The implementation of traffic calming strategies alleviates impacts somewhat. Alternative B still contributes an imperceptible adverse increment to a long-term, moderate, adverse cumulative impact.

Alternative C

Alternative C would result in long-term, beneficial impacts on public safety. The provision of paved shoulders would allow pedestrians and bicyclists to be largely separated from motor vehicles, which lessens safety concerns and allows for better separation by user type. Alternative C contributes a noticeable beneficial increment to a long-term, negligible, adverse cumulative impact.

Alternative D

Alternative D would result in long-term, beneficial impacts on public safety. A separate, dedicated facility for pedestrians and bicyclists would provide an alternative that completely removes a bicyclist or pedestrian from the vehicular travel lanes. This is beneficial to novice, recreational users who are unaccustomed to biking or walking with traffic. Alternative D contributes a noticeable beneficial increment to a long-term, negligible, adverse cumulative impact.

OPERATIONS AND INFRASTRUCTURE

METHODOLOGY

Operations, for the purpose of this analysis, refer to the quality of effectiveness of the infrastructure and the ability to maintain the infrastructure used in the operation of the national seashore in order to adequately protect and preserve vital resources and provide for an enhanced visitor experience. This includes an analysis of the condition and usefulness of the facilities and developed features used to support the operations of the national seashore. The thresholds of change for the intensity of this impact are defined as follows:

- Negligible:** Operations and infrastructure would not be affected, or the impacts would be at low levels of detection and would not have a noticeable impact on operations and infrastructure.
- Minor:** The impact would be detectable but would be of a magnitude that would not have an appreciable impact on operations and infrastructure.
- Moderate:** The impacts would be readily apparent and would result in a substantial change in operations and infrastructure in a manner noticeable to staff and the public.
- Major:** The impacts would be readily apparent, would result in a substantial change in national seashore infrastructure in a manner noticeable to staff and the public, and be markedly different from existing operations and infrastructure.

IMPACTS OF ALTERNATIVE A: NO-ACTION

Impacts

Under Alternative A, Moors Road would continue to be maintained on an as-needed basis. It would be cleared of sand and repaired as time and funding become available. The road condition would continue to deteriorate and repairs would be needed with increasing frequency. Safety concerns related to the shared use of the road would persist and would require attention by law enforcement rangers, as needed. Stormwater would continue to drain into the adjacent soils or directly into the wetland areas near the Mill Pond culverts. The existing culverts would remain in place. The abandoned roadway in the northern portion of the study area would remain as is. Repairs to the split rail fencing would be made as needed.

Overall, Alternative A would result in long-term, moderate, adverse impacts on operations and infrastructure related to increasing maintenance needs and a deteriorating roadway.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on operations and infrastructure. These actions include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. The *Cape Cod National Seashore Integrated Bicycle Feasibility Study* would make further recommendations on specific infrastructure improvements. The infrastructure associated with the Province Lands Bike Trail has recently been improved. The planned Herring Cove Beach development would provide additional improvements to infrastructure in close proximity to the study area. These projects, along with Alternative A, would have a long-term, beneficial cumulative impact on operations and infrastructure in the vicinity of the study area. Alternative A would contribute a noticeable adverse increment to these cumulative impacts.

IMPACTS OF ALTERNATIVE B: REHABILITATE ROADWAY – MAINTAIN WIDTH

Impacts

Under Alternative B, Moors Road would be rebuilt within the same footprint as the current road. The road would be rebuilt with a thicker base, which would allow it to withstand increasing use by heavy vehicles. The level of effort required for roadway repair would be greatly reduced. At least three crosswalks would be added as traffic calming and safety measures. One at-grade crosswalk would be striped at access point 4 when the connector bicycle trail is paved along the abandoned roadway. The raised crosswalk at access point 3 would be approximately 10 feet across, several inches wide, with tapers on both sides. The raised crosswalk at access 2 may be wider to accommodate anticipated heavy use during peak season. These crosswalks would be constructed of a differently colored aggregate and have minimal striping in order to both reduce viewshed changes and also reduce maintenance effort. These traffic calming measures may alleviate safety concerns and thus not require as many accident responses by law enforcement rangers. Sand would still be removed from the roadway and split rail fencing would be repaired

on an as-needed basis. The level of effort related to these tasks is not expected to change in comparison to Alternative A. The three 24-inch diameter culverts at Mill Pond could be replaced either in kind or by a 10-foot wide three-sided box culvert with a naturalized bottom if it is found to be damaged.

In addition to those changes directly related to roadway rehabilitation, there would be a few other infrastructure additions related to safety and stormwater management. Signs would caution drivers of the crosswalks, and an additional reflective yellow diamond “Share the Road” road sign would be placed at both ends of the study area to warn drivers of heavy bicycle traffic in this stretch of road. A guard rail would be provided along either side of the roadway in the vicinity of the Mill Pond culverts. This guard rail would likely be constructed of wood or weathering steel. Park staff would maintain the guard rails and signs on an as-needed basis.

Finally, a total of up to seven stormwater leach basins in up to two different locations along the road would be added to capture stormwater, move it away from the roadway base, and provide modest treatment in the form of settling and oil separation. These leach basins would require occasional maintenance by national seashore staff every 5 to 10 years. A number of catch basins, manhole covers, bicycle-safe grates, and 12-inch reinforced concrete piping would be included in the stormwater systems.

During construction of the rehabilitated roadway, care would be taken to avoid damaging the existing utility lines. They would be avoided where possible, or if disturbance is unavoidable, they would be placed back in their approximate previous location. Coordination would be undertaken with the relevant utility companies.

Overall, Alternative B would result in long-term, beneficial impacts on operations and infrastructure related to safer, more efficient facilities.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on operations and infrastructure. These actions and their impacts are described under Alternative A and include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. These projects, along with Alternative B, would have a long-term, beneficial cumulative impact on operations and infrastructure in the study area. Alternative B would contribute a noticeable beneficial increment to these cumulative impacts.

IMPACTS OF ALTERNATIVE C: REHABILITATE ROADWAY – WIDEN SHOULDERS (NPS PREFERRED ALTERNATIVE)

Impacts

Under Alternative C, impacts on infrastructure would be similar to those described under Alternative B. In addition to those impacts, road rehabilitation would include road widening. The road would be widened 5 feet on either side to accommodate 6-foot paved shoulders from the

southern edge of the study area to access point 2. From this point on, the road would be widened 3 feet on either side to accommodate 4-foot paved shoulders. This may further reduce the burden on law enforcement rangers to respond to accidents when compared to Alternative B; however, approximately 26,000 additional square feet of pavement translates eventually to additional maintenance needs. Raising the road grade by approximately 4 feet in the area just northwest of the dune forest where dune encroachment on the road is a frequent problem may somewhat reduce that encroachment and thereby could slightly reduce the maintenance needed to remove that sand. Such a reduction is not considered to be a large change in operations.

As in Alternative B, care would be taken to avoid damaging the existing utility lines during construction of the rehabilitated roadway. They would be avoided where possible, or if disturbance is unavoidable, they would be placed back in their approximate previous location. Coordination would be undertaken with the relevant utility companies.

Overall, Alternative C would result in long-term, beneficial impacts related to safer, more efficient infrastructure and long-term, negligible, adverse impacts related to additional maintenance of a wider road with additional structures such as crosswalks and guard rails.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on operations and infrastructure. These actions and their impacts are described under Alternative A and include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. These projects, along with Alternative C, would have a long-term, beneficial impact on operations and infrastructure in the study area. Alternative C would contribute an appreciable beneficial increment to these cumulative impacts.

IMPACTS OF ALTERNATIVE D: REHABILITATE ROADWAY – SEPARATE MULTIUSE PATH

Impacts

Under Alternative D, impacts on infrastructure would be similar to those described under Alternative B with some removal of alternative elements. Only the raised crosswalk at access point 1 would be constructed because of the park's desire to guide pedestrians and bicyclists onto the multiuse path on the southwest side of Moors Road. This would result in less signs being added to the study area. Under Alternative D, the road would be widened by 12 feet to accommodate a 10-foot multiuse path and a 2-foot buffer zone between the path and vehicle travel lanes. The entire span of the road, buffer, and multiuse path would be paved as part of the roadway rehabilitation. This would add approximately 43,000 square feet of pavement to the study area.

A guard rail would be added along the 2-foot buffer to physically separate the road from the path. Since this guard rail would be included along the entire length of the study area and would be only 1 to 2 feet from the south-bound vehicle lane, it is likely that maintenance of this guard rail would require a higher level of effort than those guard rails in the vicinity of the culvert.

As in Alternative C, raising the road grade by approximately 4 feet in the area just northwest of the dune forest where dune encroachment on the road is a frequent problem may reduce that encroachment and thereby reduce the maintenance needed to remove that sand; however, the addition of a guard rail along the entire study area may considerably increase the level of effort needed to remove sand from the road.

As in Alternative B, care would be taken to avoid damaging the existing utility lines during construction of the rehabilitated roadway. They would be avoided where possible, or if disturbance is unavoidable, they would be placed back in their approximate previous location. Coordination would be undertaken with the relevant utility companies.

Overall, Alternative D would result in long-term, beneficial impacts related to safer, more efficient infrastructure; however, the additional paved areas and associated facilities would require more maintenance than any other alternative and would thus impose a long-term, minor, adverse impact on operations.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions have and continue to contribute to the cumulative impact on operations and infrastructure. These actions and their impacts are described under Alternative A and include implementation of the *Cape Cod National Seashore Integrated Bicycle Feasibility Study*, the Province Lands Bike Trail renovations, and Herring Cove Beach facilities development. These projects, along with Alternative D, would have a long-term, beneficial cumulative impact on operations and infrastructure in the study area. Alternative D would contribute an appreciable beneficial increment to these cumulative impacts.

CONCLUSIONS FOR OPERATIONS AND INFRASTRUCTURE

Alternative A

Alternative A would result in long-term, moderate, adverse impacts on operations infrastructure related to increasing maintenance needs and a deteriorating roadway. Alternative A would contribute a noticeable adverse increment to a long-term, beneficial cumulative impact on infrastructure in the vicinity of the study area.

Alternative B

Alternative B would result in long-term, beneficial impacts related to safer, more efficient infrastructure. Alternative B would contribute a noticeable beneficial increment to a long-term, beneficial cumulative impact on operations and infrastructure in the study area.

Alternative C

Alternative C would result in long-term, beneficial impacts related to safer, more efficient infrastructure and long-term, negligible, adverse impacts related to maintenance of additional facilities. Alternative C would contribute an appreciable beneficial increment to a long-term, beneficial impact on operations and infrastructure in the study area.

Alternative D

Alternative D would result in long-term, beneficial impacts related to safer, more efficient infrastructure and long-term, negligible, adverse impacts related to maintenance of additional facilities. Alternative D would contribute an appreciable beneficial increment to a long-term, beneficial cumulative impact on operations and infrastructure in the study area.

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CONSULTATION AND COORDINATION

NPS DO-12 requires the NPS to make “diligent” efforts to involve the interested and affected public in the NEPA process. This process, known as scoping, helps to determine the important issues and eliminate those that are not; allocate assignments among the interdisciplinary team members and/or other participating agencies; identify related projects and associated documents; identify other permits, surveys, consultations, etc. required by other agencies; and create a schedule that allows adequate time to prepare and distribute the environmental document for public review and comment before a final decision is made. This chapter documents the scoping process for the proposed action, identifies future compliance needs and permits, includes a CZM Federal Consistency Certification, and includes the list of preparers for the document.

THE SCOPING PROCESS

The scoping process is initiated at the beginning of a NEPA project to identify the range of issues, resources, and alternatives to address in the EA. Typically, both internal and public scoping is conducted to address these elements. State and federal agencies were also contacted in order to uncover any additional planning issues and to fulfill statutory requirements. The planning process for the proposed action was initiated during the internal, agency, and public scoping in the fall of 2009. This process introduced the purpose and need of the project and potential bicycle accommodations that could be included with the road rehabilitation. Discussions with interested agencies and individuals were initiated at this time.

Cape Cod National Seashore’s GMP directs the national seashore to conduct planning in a cooperative way with the local towns. The proposed action has the potential to affect access to and from Provincetown as well as affect the experience that visitors to and residents of Provincetown have as they seek recreation at Herring Cove Beach or the Province Lands Bike Trail; therefore, the NPS took steps to include both the local public and official representatives of Provincetown during scoping.

INTERNAL SCOPING

Internal scoping for the proposed action was initiated as part of the NEPA process. An internal scoping meeting was held at the national seashore on September 23, 2009. Park staff and other NPS personnel met with their consultants to develop goals and potential approaches to this project. During the development of this EA/AoE, NPS personnel conducted a Value Analysis on

March 2-3, 2010 to fully review the options for the road rehabilitation and bicycle accommodations. During the value analysis, the study team conducted a Choosing by Advantages evaluation to weigh the different options for the road and bicycle improvements and surrounding landscape and identify the NPS preferred alternative presented in this document.

PUBLIC SCOPING

The public scoping process for the proposed action began in August 2009, when the national seashore issued a press release announcing the public scoping meeting on September 24, 2009. This meeting was attended by 19 members of the public. During this meeting, the NPS solicited public input for better accommodating bicycle and pedestrian traffic along Moors Road. The meeting also provided the public with information on the purpose and need of the project and the planning process that would be followed. The public was given 30 days after this meeting to provide comments. Seven formal comments were received during the public comment period. The primary concerns articulated during this scoping period were safety, natural resource protection, and aesthetics within the national seashore. All commenters seemed to agree that the combination of bicycles, pedestrians, and automobiles in such close proximity on Moors Road is a safety hazard. The idea of changing Moors Road to a one-way road (in either direction) was not supported despite the way in which this option would minimize impacts on natural resources because such an option also would limit access to and from the national seashore and to and from Provincetown.

The NPS solicited public comment again during alternatives development in January 2010. A press release was issued on January 12, 2010 announcing a public alternatives meeting on January 28, 2010 in Provincetown. The public was asked to submit their comments by February 13, 2010. Alternatives presented at this meeting included 1) the Road Rehabilitation (or “Low Build”) option, 2) a version of the “Road Widening” option where the road would include 4-foot paved shoulders, and 3) the “Multiuse Path” option with the adjacent but separated paved path. Public input supported prior viewpoints and resulted in the revision of the second option into Alternative C, as presented in this document.

AGENCY CONSULTATION

Agencies contacted via letter during the planning process included the USFWS, the Massachusetts Division of Fisheries and Wildlife’s NHESP, the Advisory Council on Historic Preservation, and the SHPO. The agency consultation is discussed by statutory category below.

Section 7 of the Endangered Species Act

Responses regarding special status species were received from both the USFWS and the Massachusetts NHESP. The USFWS response was received on November 23, 2009 and stated that, due to the lack of federal special status species expected to be impacted by the proposed action, preparation of a Biological Assessment or further consultation under Section 7 of the Endangered Species Act was not required. This response is included in “Appendix A: Relevant

Correspondence.” The response from NHESP did not indicate any federally listed species. The state-listed species are summarized under “Other Coordination” below.

Section 106 of the National Historic Preservation Act

The national seashore sent letters to the Advisory Council on Historic Preservation and the SHPO on November 2, 2009. The letters sent out by the national seashore are included in “Appendix A: Relevant Correspondence.” The park will provide the Advisory Council and the SHPO with a copy of this document and will continue to coordinate with both agencies as the project moves forward.

Other Consultation

The national seashore coordinated with the NHESP on state-listed special status species in addition to federally listed species. The response from NHESP was received on November 23, 2009 and stated a portion of the study area is located within Priority Habitat 15 and Estimated Habitat 79. Their records indicate that three species of state special concern may be found within the vicinity of the study area: the eastern box turtle (*Terrapene carolina*), the eastern spadefoot (*Scaphiopus holbrookii*), and the diamond-backed terrapin (*Malachlemys terrapin*). The spadefoot and terrapin are both state-listed threatened species, while the turtle is species of special concern. This response is included in “Appendix A: Relevant Correspondence.”

The planning team has continued to communicate with Provincetown officials throughout the development of this document and has invited Provincetown officials to meet with them during benchmark planning stages. This included inviting two Provincetown officials to participate in the Value Analysis meetings.

TRIBAL CONSULTATION

The national seashore sent letters to the Tribal Historic Preservation Officer of the Wampanoag of Gay Head – Aquinnah and the Tribal Chairman of the Mashpee Wampanoag Tribe on November 2, 2009. The letters sent out by the national seashore are included in “Appendix A: Relevant Correspondence.” The park will provide the tribes with a copy of this document and will continue to coordinate with them as the project moves forward.

FUTURE COMPLIANCE NEEDS/PERMITS

OVERVIEW OF STATE AND FEDERAL COMPLIANCE

The proposed action has been evaluated for consistency with applicable federal laws, regulations, and programs. A brief description of the project’s compliance with state and federal governing items is provided in Tables 4 and 5 below. The NPS will continue to coordinate with Provincetown officials to ensure that the action is compatible with local plans, as well.

Table 4: Consistency with Applicable Federal Laws, Regulations, and Programs	
Law, Regulation, or Program	Brief Description of Compliance
Executive Order 11988 – Floodplain Management	The project would result in no impact on floodplains in accordance with Executive Order 11988 and NPS DO-77-2.
Executive Order 11990 – Protection of Wetlands	The proposed actions would be implemented and managed to comply with Director’s Order 77-1: Wetland Protection and the related Procedural Manual 77-1 (NPS 2002a), including the applicable best management practices and conditions listed in Appendix 2 of the procedural manual. In accordance with DO-77-1, provision for activities in wetlands, the project is excepted from an SOF.
National Historic Preservation Act of 1966 as amended (16 USC 470 et seq.)	The project would result in no historic properties affected to National Register eligible or listed cultural resources. Section 106 coordination has been initiated with the Massachusetts SHPO and the Advisory Council on Historic Preservation.
Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972)	To the greatest extent practicable, the project would include avoidance and minimization of impacts on wetlands subject to jurisdiction under Section 404 of the Clean Water Act. Unavoidable impacts on Section 404 jurisdictional resources would be permitted through the USCOE and mitigated through methods approved by the USCOE and in accordance with NPS guidance on management of wetland resources.
Endangered Species Act of 1973, as amended (16 USC 1531 et seq.)	Correspondence from the USFWS indicates no federally listed threatened and endangered species or critical habitat within the study area.
Executive Order 12898 – Environmental Justice	The proposed activities would increase safety of the road for all levels of users and all levels of bicyclists. Meetings were held to receive input from the public, and equal consideration was given to input from all parties regardless of age, race, income status, or other socioeconomic or demographic factors. Environmental justice has not been identified as a relevant issue.
Migratory Bird Treaty Act (16 U.S.C. 703-712)	The project area is owned and protected by the federal government. Long-term impacts on avian habitat are expected to be minimal.

Table 5: Consistency with Applicable State Laws, Regulations, and Programs	
Law, Regulation, or Program	Brief Description of Compliance
Massachusetts Clean Waters Act: M.G.S. C. 21, §§ 26-53 and regulations at 314 CMR 3.00 (Surface Water Discharge Permit Program), 314 CMR 4.00 (Surface Water Quality Standards), 314 CMR 9.00 (Water Quality Certification)	The project would comply with the Massachusetts Stormwater Performance Standards through best management design considerations and the implementation of a sedimentation and erosion control program during construction. The project would not result in an exceedence of any surface water quality standard.
Massachusetts Wetlands Protection Act: M.G.L. c. 131, § 40 and regulations at 310 CMR 10.00	To the greatest extent practicable, the project would include avoidance and minimization of impacts on wetlands subject to jurisdiction under the Massachusetts Wetlands Protection Act. Unavoidable impacts on wetland jurisdictional resources would be permitted through the local Conservation Commission and the Massachusetts DEP and would be mitigated through methods approved by those agencies and in accordance with NPS guidance on management of wetland resources.
Massachusetts Office of CZM: M.G.L. c. 21A, § 4A and regulations at 301 CMR 20.00-26.00	The federal consistency review through the Massachusetts Office of Coastal Zone Management (Mass CZM) under the CZMA, Section 307 (c) and 15 CFR Part 930, sub-part C, would be obtained after coastal zone management (CZM) review and concurrence that the project has complied with all CZM program policies. This determination is made to ensure compliance with the CZMA and to ensure that the project would not negatively affect the Massachusetts coastal zone. A CZM consistency certification is included in Appendix B.
Massachusetts Endangered Species Act – M.G.L. C. 131A	Correspondence from NHESP indicates state protected species in the vicinity of the project. Potential impacts on these species have been addressed in this EA/AoE.

REQUIRED PERMITS AND APPROVALS

Prior to the implementation of the proposed action, the NPS would obtain appropriate land disturbance permits and abide by local and state erosion and sediment control standards. In addition, several approvals would be required from local, state, and federal authorities prior to construction.

A Massachusetts NPDES General Permit would be required for Construction Period Stormwater Discharges from the United States EPA, Region 1.

Under regulatory authority of the Massachusetts Wetland Protection Act, a Notice of Intent (NOI) would need to be filed for any activities affecting wetlands along the Moors Road corridor. The NOI is reviewed locally by the Provincetown Conservation Commission under the auspices of the Massachusetts DEP. The NOI has a public hearing requirement. The Provincetown Conservation Commission may issue an Order of Conditions, which serves as the Section 401 Water Quality Certification under the federal Clean Water Act. The DEP has authority to appeal an Order of Conditions if it disagrees with the decisions of the local Conservation Commission. If impacts are proposed to salt marsh or Outstanding Resource

Waters pursuant to state regulations (314 CMR 9.04), an Order of Conditions cannot be used as the Section 401 Water Quality Certification, and a separate permit will need to be acquired from the DEP.

Federal review under Section 404 of the Clean Water Act is coordinated through the New England District of the USCOE via the Commonwealth of Massachusetts general permit process. The proposed project would likely qualify for a Programmatic General Permit Category I or II.

Additional agency consultations would be required in the following areas:

- Section 106 of the National Historic Preservation Act requires consultation with the Massachusetts SHPO and the Advisory Council on Historic Preservation
- Tribal legislation may require further consultation with Tribal Historic Preservation Officer(s)
- The CZMA requires coordination with Mass CZM
- The Massachusetts Endangered Species Act may require additional coordination with the Massachusetts NHESP

Because any proposed activities would be occurring in a non-navigable waterway, coordination with the U.S. Coast Guard would not be required.

COASTAL ZONE MANAGEMENT CONSISTENCY

CZM for the proposed action is federally authorized by the CZMA, as amended. The coastal zone management program (CZMP) federal consistency review process is described in federal regulation 15 CFR 930: Federal Consistency with Approved Coastal Management Programs. The Coastal Programs Division within the National Oceanic and Atmospheric Administration Office of Ocean and Coastal Resource Management is in charge of the program. The Coastal Programs Division is responsible for advancing national coastal management objectives and maintaining and strengthening state and territorial coastal management capabilities. It supports states through financial assistance, mediation, technical service and information, and participation in priority state, regional, and local forums. The CZMP leaves day-to-day management decisions at the state level in the 34 states and territories with federally approved coastal management programs, including Massachusetts.

The Massachusetts coastal program under 301 CMR 21.00 authorizes the secretary of the Executive Office of Environmental Affairs to carry out the purposes of the federal CZMA, which is managed by the Mass CZM. The Massachusetts CZMP identifies federal licenses or permits that are routinely reviewed for consistency with state coastal policies.

In addition, the federally approved Massachusetts CZMP lists several management principles. These policy statements are not currently enforceable through existing state statutes and regulations. They are published as guidance to proponents of activities in the coastal zone and represent the preferred policy direction of the Mass CZM, which reviews all federal projects for consistency with management principles and may recommend alternatives or changes to projects in order to achieve consistency with the management principles. This certification is included in Appendix B.

LIST OF PREPARERS AND CONTRIBUTORS

This document was prepared by Vanasse Hangen Brustlin, Inc. with input from staff at Cape Cod National Seashore, the NPS Denver Service Center, and the NPS Northeast Region Office.

Vanasse Hangen Brustlin, Inc.		
Margaret Beavers	Environmental Scientist	Graphics and GIS analysis
Laura Castelli	Senior Transportation Engineer	Transportation review and analysis
Doug DeBerry	Senior Environmental Scientist	Natural resource review and analysis
Tracy Hamm	Environmental Planner	Document preparation; natural resources review and analysis
Timothy Hogan	Senior Engineer	Document support
Stephen Farr	Senior Engineer	Document support
Tricia Wingard	Project Manager	Guidance of NEPA process; document review; and project management

CONTRIBUTORS AND REVIEWERS

Cape Cod National Seashore	
George Price	Superintendent
Kathy Tevyaw	Deputy Superintendent
Karst Hoogeboom	Chief of Maintenance
Lauren McKean	Management Assistant/Planner
Erin Der-McLeod	Planning Assistant
Tim Smith	Restoration Ecologist
Craig Thatcher	Supervisory Park Ranger
Stephen Smith	Ecologist
Bob Grant	Ranger Supervisor
Bob Cook	Biologist
Sue Moynihan	Chief of Interpretation and Cultural Resources
Frederica Dimmick	Archeologist

NPS Denver Service Center	
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Brian Frailey	Project Specialist (Landscape Architecture)
Margo Davis	Environmental Compliance Specialist
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Ginger Molitor	Natural Resource Specialist

Northeast Region Office	
Jacki Katzmire	Environmental Protection Specialist
Amanda Jones	Resource Planning Specialist

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REFERENCES

BIBLIOGRAPHY

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APPENDIX A: RELEVANT CORRESPONDENCE

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United States Department of the Interior



FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
<http://www.fws.gov/newengland>

November 18, 2009

Reference: Project Location
Road reconstruction, bicycle accommodations Cape Cod National Seashore, MA

George E. Price, Jr.
National Park Service
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667

RECEIVED
NOV 23 PM 2:00
CAPE COD
NATIONAL SEASHORE

Dear Mr. Price:

This responds to your recent correspondence requesting information on the presence of federally-listed and/or proposed endangered or threatened species in relation to the proposed activity(ies) referenced above.

Based on information currently available to us, no federally-listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area(s). Preparation of a Biological Assessment or further consultation with us under Section 7 of the Endangered Species Act is not required.

This concludes our review of listed species and critical habitat in the project location(s) and environs referenced above. No further Endangered Species Act coordination of this type is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

In order to curtail the need to contact this office in the future for updated lists of federally-listed or proposed threatened or endangered species and critical habitats, please visit the Endangered Species Consultation page on the New England Field Office's website:

www.fws.gov/newengland/endangeredspec-consultation.htm

In addition, there is a link to procedures that may allow you to conclude if habitat for a listed species is present in the project area. If no habitat exists, then no federally-listed species are present in the project area and there is no need to contact us for further consultation. If the above conclusion

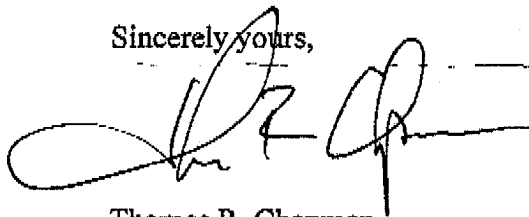
George E. Price, Jr.
November 18, 2009

2

cannot be reached, further consultation with this office is advised. Information describing the nature and location of the proposed activity that should be provided to us for further informal consultation can be found at the above-referenced site.

Thank you for your coordination. Please contact Anthony Tur at 603-223-2541 if we can be of further assistance.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'Thomas R. Chapman', written over a horizontal dashed line.

Thomas R. Chapman
Supervisor
New England Field Office



Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, Director

November 19, 2009

George E. Price, Jr.
Cape Cod National Seashore
National Park Service
99 Marconi Site Rd
Wellfleet MA 02667

RECEIVED
2009 NOV 23 PM 2:00
CAPE COD
NATIONAL SEASHORE

RE: Project Location: Moors Road - Bicycle Accommodations
Town: PROVINCETOWN
NHESP Tracking No.: 07-22904

Dear Mr. Price:

Thank you for contacting the Natural Heritage and Endangered Species Program ("NHESP") of the MA Division of Fisheries & Wildlife for information regarding state-listed rare species in the vicinity of the above referenced site. Based on the information provided, this project site, or a portion thereof, is located within *Priority Habitat 15* (PH 15) and *Estimated Habitat 79* (EH 79) as indicated in the *Massachusetts Natural Heritage Atlas* (13th Edition). Our database indicates that the following state-listed rare species have been found in the vicinity of the site:

<u>Scientific name</u>	<u>Common Name</u>	<u>Taxonomic Group</u>	<u>State Status</u>
<i>Terrapene carolina</i>	Eastern Box Turtle	Reptile	Special Concern
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot	Amphibian	Threatened
<i>Malaclemys terrapin</i>	Diamond-backed Terrapin	Reptile	Threatened

The species listed above are protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife are also protected under the state's Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for most state-listed rare species can be found on our website (www.nhesp.org).

The NHESP requests the opportunity to review full project plans as they become available. In addition, the NHESP requests to review the NOI when it is filed with the local Conservation Commission. If you have any questions regarding this letter please contact Mike Jones, Endangered Species Review Biologist, at (508) 389-6386.

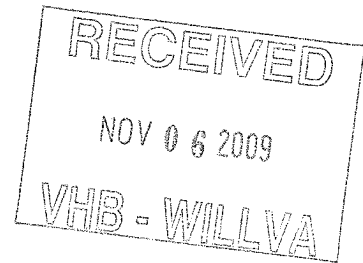
Sincerely,

Thomas W. French, Ph.D.
Assistant Director

www.masswildlife.org

United States Department of the Interior

NATIONAL PARK SERVICE
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667
508.771.2144
508.349.9052 Fax



IN REPLY REFER TO:

L7617

November 2, 2009

John Fowler, Director
Advisory Council on Historic Preservation
1100 Pennsylvania Avenue NW, Suite 803
Old Post Office Building
Washington, D.C.

Re: Reconstruction of Moors Road with Bicycle Accommodations in the Province Lands,
Provincetown, MA, Cape Cod National Seashore

Dear Mr. Fowler:

Under the terms of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, the National Park Service (NPS) at Cape Cod National Seashore (the park) is preparing an Environmental Assessment/Assessment of Effect (EA/AoE) for the reconstruction of Moors Road in the Province Lands with bicycle accommodations.

The stretch of Moors Road between Provincetown and State Route 6 has recently seen an increase in use by heavy vehicles whose weight exceeds the road's design limit, which has led to deterioration in the road condition. The road also is used heavily by bicyclists and pedestrians, especially during the peak season. The volume of bicyclists and pedestrians utilizing the road—which has very narrow, sandy shoulders—creates congestion and safety concerns. The park is initiating the planning process to reconstruct Moors Road to withstand heavy vehicles and to better accommodate bicycle and pedestrian users while having minimal impacts to the park's sensitive resources.

This letter serves as notification that we have begun the compliance process and are proposing to have an EA/AoE available for public and regulatory review in the summer of 2010. In accordance with section 800.8 (3) (c) of the Advisory Council on Historic Preservation's regulations (36 CFR 800), I am notifying your office in advance of the park's intention to use the EA/AoE to meet its obligations under Section 106. We appreciate your input on this project and will provide a copy of the review draft EA as soon as it is available. If you have any questions regarding the project, please contact Bill Burke, Cultural Resources Program Manager, at Bill_Burke@nps.gov or (508) 255 – 3421, ext 14.

Sincerely,

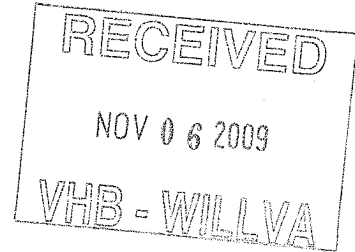
A handwritten signature in black ink, appearing to read "G. Price, Jr.", with a stylized flourish at the end.

George E. Price, Jr.
Superintendent

cc: Wampanoag Tribe of Gay Head - Aquinnah
Mashpee Wampanoag Tribe
Massachusetts Historical Commission
Wampanoag Tribe of Gay Head – Aquinnah
Karst Hoogeboom, NPS-CACO
Margo Muhl Davis, NPS-DSC
Pat Sacks, NPS-DSC
Tricia Wingard, VHB

United States Department of the Interior

NATIONAL PARK SERVICE
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667
508.771.2144
508.349.9052 Fax



IN REPLY REFER TO:

L7617

November 2, 2009

Ms. Brona Simon
State Historic Preservation Officer
Massachusetts Historical Commission
220 Morrissey Blvd.
Boston, MA 02215

Re: Reconstruction of Moors Road with Bicycle Accommodations in the Province Lands,
Provincetown, MA, Cape Cod National Seashore

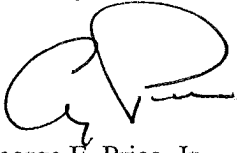
Dear Ms. Simon:

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Sincerely,

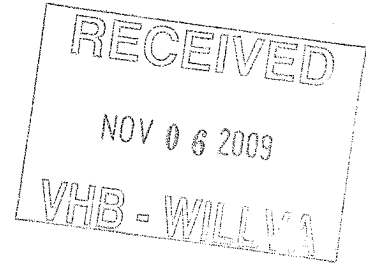
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George E. Price, Jr.
Superintendent

cc: Wampanoag Tribe of Gay Head-Aquinnah
Mashpee Wampanoag Tribe
Advisory Council on Historic Preservation
Karst Hooeboom, NPS-CACO
Margo Muhl Davis, NPS-DSC
Pat Sacks, NPS-DSC
Tricia Wingard, VHB

United States Department of the Interior

NATIONAL PARK SERVICE
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667
508.771.2144
508.349.9052 Fax



IN REPLY REFER TO:

L7617

November 2, 2009

Bettina Washington
Tribal Historic Preservation Officer
Wampanoag Tribe of Gay Head - Aquinnah
20 Black Brook Road
Aquinnah, MA 02534-1546

Re: Reconstruction of Moors Road with Bicycle Accommodations in the Province Lands,
Provincetown, MA, Cape Cod National Seashore

Dear Ms. Washington:

Under the terms of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, the National Park Service (NPS) at Cape Cod National Seashore (the park) is preparing an Environmental Assessment/Assessment of Effect (EA/AoE) for the reconstruction of Moors Road in the Province Lands with bicycle accommodations.

The stretch of Moors Road between Provincetown and State Route 6 has recently seen an increase in use by heavy vehicles whose weight exceeds the road's design limit, which has led to deterioration in the road condition. The road also is used heavily by bicyclists and pedestrians, especially during the peak season. The volume of bicyclists and pedestrians utilizing the road—which has very narrow, sandy shoulders—creates congestion and safety concerns. The park is initiating the planning process to reconstruct Moors Road to withstand heavy vehicles and to better accommodate bicycle and pedestrian users while having minimal impacts to the park's sensitive resources.

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Sincerely,

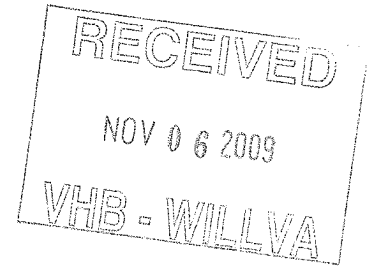
A handwritten signature in black ink, appearing to be 'G. Price, Jr.', written in a cursive style.

George E. Price, Jr.
Superintendent

cc: Mashpee Wampanoag Tribe
Massachusetts Historical Commission
Advisory Council on Historic Preservation
Karst Hooeboom, NPS-CACO
Margo Muhl Davis, NPS-DSC
Pat Sacks, NPS-DSC
Tricia Wingard, VHB

United States Department of the Interior

NATIONAL PARK SERVICE
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667
508.771.2144
508.349.9052 Fax



IN REPLY REFER TO:

L7617

November 2, 2009

Cedric Cromwell
Tribal Chairman
Mashpee Wampanoag Tribe
P.O. Box 1048
Mashpee, MA 02649

Re: Reconstruction of Moors Road with Bicycle Accommodations in the Province Lands,
Provincetown, MA, Cape Cod National Seashore

Dear Mr. Cromwell:

Under the terms of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, the National Park Service (NPS) at Cape Cod National Seashore (the park) is preparing an Environmental Assessment/Assessment of Effect (EA/AoE) for the reconstruction of Moors Road in the Province Lands with bicycle accommodations.

The stretch of Moors Road between Provincetown and State Route 6 has recently seen an increase in use by heavy vehicles whose weight exceeds the road's design limit, which has led to deterioration in the road condition. The road also is used heavily by bicyclists and pedestrians, especially during the peak season. The volume of bicyclists and pedestrians utilizing the road—which has very narrow, sandy shoulders—creates congestion and safety concerns. The park is initiating the planning process to reconstruct Moors Road to withstand heavy vehicles and to better accommodate bicycle and pedestrian users while having minimal impacts to the park's sensitive resources.

This letter serves as notification that we have begun the compliance process and are proposing to have an EA/AoE available for public and regulatory review in the summer of 2010. We appreciate your input on this project and will provide a copy of the review draft EA/AoE as soon as it is available. If you have any questions regarding the project, please contact Bill Burke, Cultural Resources Program Manager, at Bill_Burke@nps.gov or (508) 255 – 3421, ext 14.

Sincerely,

A handwritten signature in black ink, appearing to read 'G. Price, Jr.', with a large, stylized initial 'P'.

George E. Price, Jr.
Superintendent

cc: Wampanoag Tribe of Gay Head – Aquinnah
Advisory Council on Historic Preservation
Massachusetts Historical Commission
Karst Hooeboom, NPS-CACO
Margo Muhl Davis, NPS-DSC
Pat Sacks, NPS-DSC
Tricia Wingard, VHB

APPENDIX B: CZM FEDERAL CONSISTENCY CERTIFICATION

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COASTAL ZONE MANAGEMENT FEDERAL CONSISTENCY CERTIFICATION

A federal consistency certification is included below and describes how the proposed action complies with the applicable regulatory policies of the Massachusetts Office of Coastal Zone Management (Mass CZM). Mass CZM will review the application for consistency certification and would either concur or object to the application. Any federal permits issued for the proposed action would be conditioned upon the consistency of the Mass CZM should a license be approved for the proposed action before a consistency determination has been made. Mass CZM may object to an application if the proposed action is not consistent with their program policies. Mass CZM shall notify the application and the Director of Ocean and Coastal Resources Management of its objection. Such notification shall include:

- A statement as to how the proposed action is inconsistent with specific elements of the Massachusetts CZM program policies.
- Alternative measures which, if adopted by the applicant agency, would permit the proposed action to be conducted in a manner consistent with the CZM program policies.
- If the objection is based on the failure of the applicant agency to supply adequate information under these regulations, the nature of the information requested and the necessity of having such information.
- A statement informing the applicant of a right of appeal to the Secretary of Commerce in accordance with 15 CFR 930 Subpart H, as amended (301 CMR 21.09, Review Procedures).

CZM CONSISTENCY CERTIFICATION

Water Quality

Water Quality Policy #1: Ensure that point-source discharges in or affecting the coastal zone are consistent with federally approved state effluent limitations and water quality standards.

There are no point-source effluent discharges included in the proposed action.

Water Quality Policy #2: Ensure that nonpoint pollution controls promote the attainment of state surface water quality standards in the coastal zone.

The proposed action is not expected to be a significant source of nonpoint source pollution. The proposed work area currently has minimal stormwater management infrastructure in place; the proposed action would improve nonpoint source pollution controls through the use of infiltration basins and other measures. In addition, an erosion and sedimentation control plan would be included in the final design phase and fully implemented during the construction phase. All erosion and sedimentation and stormwater management measures would be designed in accordance with local, state, and federal requirements.

Water Quality Policy #3: Ensure that activities in or affecting the coastal zone conform to applicable state and federal requirements governing subsurface waste discharges.

There are no subsurface waste discharges anticipated with the proposed action.

Habitat

Habitat Policy #1: Protect coastal resource areas including salt marshes, shellfish beds, dunes, beaches, barrier beaches, salt ponds, eelgrass beds, and fresh water wetlands for their important role as natural habitats.

The proposed action has been planned in such a way as to impose minimal impacts on the dunes and wetlands within the study area while providing bicycle accommodations. There would be some impacts on dune ecosystems along the edge of the road related to widening; however, formalizing crosswalks would focus pedestrian traffic on existing social trails. There also would be temporary impacts on wetlands during replacement of the culvert, and approximately 0.002 acres (90 square feet) of marsh surface would be impacted by development of a stormwater outfall. NPS provisions under Executive Order 11990 and DO-77-1 require no net loss of wetland resources.

The proposed action has the potential to be a self-mitigating proposal. The existing culvert would be examined during road rehabilitation, and if it were found to be damaged, it would be replaced either in kind or with something similar to a 3-sided box culvert with a naturalized bottom. Should the latter option be selected, it would facilitate improvements to tidal flow and sand/sediment movement though the proposed natural bottom culvert would restore approximately 0.005 acres (240 square feet) of tidal channel underneath and immediately adjacent to the culvert.

Habitat Policy #2: Restore degraded or former wetland resources in coastal areas and ensure that activities in coastal areas do not further wetland degradation but instead take advantage of opportunities to engage in wetland restoration.

The proposed action would have minimal impact on wetland resources (0.002 acres or 90 square feet of direct impact). With the proposed plan, avoidance and minimization of wetland impacts would be maximized through design elements such as attempting to match the current roadway elevation adjacent to wetland areas in the vicinity of Mill Pond (i.e., to avoid additional roadway embankment impacts that would be incurred by increasing the elevation of the roadway prism). The replacement of the current culverts with a culvert with a naturalized bottom could restore approximately 0.005 acres (240 square feet) of tidal channel underneath and immediately adjacent to the culvert and thus restore hydrology at Mill Pond if this option is selected.

Protected Areas

Protected Areas Policy #1: Preserve, restore, and enhance complexes of coastal resources of regional or statewide significance through the Areas of Critical Environmental Concern (ACEC) program.

There are no ACECs affected by the proposed action; therefore, this policy is not applicable.

Protected Areas Policy #2: Protect state and locally designated scenic rivers and state classified scenic rivers in the coastal zone.

There are no state or locally designated scenic rivers or state classified scenic rivers affected by the proposed action; therefore, this policy is not applicable.

Protected Areas Policy #3: Ensure that proposed developments in or near designated or registered historic districts or sites respect the preservation intent of the designation and that potential adverse effects are minimized.

There are no registered historic districts or sites in or near the study area for the proposed action; therefore, this policy is not applicable.

Coastal Hazards

Coastal Hazard Policy #1: Preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage, salt marshes, and land under the ocean.

As described under Habitat Policy #1, the proposed action would have temporary adverse impacts on dunes associated with construction and road widening; however, there would be beneficial impacts associated with reducing pedestrian dispersal through the dunes.

Coastal Hazard Policy #2: Ensure construction in water bodies and contiguous land areas will minimize interference with water circulation and sediment transport. Approve permits for flood or erosion control projects only when it has been determined that there will be no significant adverse effects on the project site, or adjacent or downcoast areas.

The replacement of the culvert at Mill Pond with the larger culvert could improve water circulation and sediment transfer. Additionally, all construction in that area would include compliance with all relevant federal, state, and local regulations. Otherwise, there are no flood or erosion control projects associated with the proposed action.

Coastal Hazard Policy #3: Ensure that state and federally funded public works projects proposed for locations within the coastal zone will:

- Not exacerbate existing hazards or damage natural buffers or other natural resources.
- Be reasonably safe from flood and erosion related damage.
- Not promote growth and development in hazard-prone or buffer areas, especially in velocity zones and ACECs.
- Not be used on Coastal Barrier Resource Units for new or substantial rehabilitation of structures in a manner inconsistent with the Coastal Barrier Resource/Improvement Acts.

The proposed action would not exacerbate existing hazards or significantly damage the natural buffers or other natural resources. It is reasonably safe from flood and erosion-related damage because of those natural buffers. It does not promote growth and development in hazard-prone or buffer areas, and it is not within a Coastal Barrier Resource Unit.

Port and Harbor Infrastructure

Ports Policy #1: Ensure that dredging and disposal of dredged material minimize adverse effects on water quality, physical processes, marine productivity, and public health.

The proposed action does not include dredging or disposal of dredged material; therefore, this policy does not apply.

Ports Policy #2: Obtain the widest possible public benefit from channel dredging, ensuring that designated ports and developed harbors are given highest priority in the allocation of federal and state dredging funds. Ensure that this dredging is consistent with marine environment policies.

The proposed action does not include dredging or disposal of dredged material; therefore, this policy does not apply.

Ports Policy #3: Preserve and enhance the capacity of Designated Port Areas (DPAs) to accommodate water-dependent industrial uses, and prevent the exclusion of such uses from tidelands and any other DPA lands over which a state agency exerts control by virtue of ownership, regulatory authority, or other legal jurisdiction.

The proposed action does not include dredging or disposal of dredged material; therefore, this policy does not apply.

Public Access

Public Access Policy #1: Ensure that developments proposed near existing public recreation sites minimize their adverse effects.

By providing accommodations along the road for pedestrians, including crosswalks, the proposed action would minimize the adverse impacts related to recreational users' dispersed use of the dunes.

Public Access Management Principle #1: Improve public access to coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation. Link existing coastal recreation sites to each other or to nearby coastal inland facilities via trails for bicyclists, hikers, and equestrians and via river for boaters.

The proposed action would improve public access to coastal recreation facilities, specifically Herring Cove Beach and the Province Lands Bike Trail, by constructing bicycle accommodations, which could also accommodate pedestrians. It also would alleviate automobile traffic issues related to congestion during the summer months when bicyclists and pedestrians

clog the roadway. It provides a safer link between Provincetown and Herring Cove Beach and the Province Lands Bike Trail for bicyclists and pedestrians.

Public Access Management Principle #2: Increase capacity of existing recreation areas by facilitating multiple use and by improving management, maintenance, and public support facilities. Resolve conflicting uses whenever possible through improved management rather than through exclusion of uses.

The proposed action would meet this management goal by providing a modest increase in road width to accommodate the multiple modes of transportation and installation of crosswalks and traffic calming devices. The proposed action would improve the integrity of the road.

Public Access Management Principle #3: Provide technical assistance to developers of private recreational facilities and sites that increase public access to the shoreline.

The proposed action would not provide technical assistance to developers of private recreational facilities; however, it would be implemented in such as that Provincetown officials would be able to tie into the bicycle accommodations at the national seashore boundary.

Public Access Management Principle #4: Expand existing recreation facilities and acquire and develop new public areas for coastal recreational activities. Give highest priority to expansions or new acquisitions in regions of high need or limited site availability. Assure that both transportation access and the recreational facilities are compatible with social and environmental characteristics of surrounding communities.

The proposed action would only improve existing areas for coastal recreational activities; it would not expand existing facilities or develop new areas for coastal recreational activities. The existing opportunities are plentiful.

Energy

Energy Policy #1: For coastally dependent energy facilities, consider siting in alternative coastal locations. For non-coastally dependent energy facilities, consider siting in areas outside of the coastal zone. Weigh the environmental and safety impacts of locating proposed energy facilities at alternative sites.

The proposed action is not an energy facility; therefore, this policy does not apply.

Energy Management Principle #1: Encourage energy conservation and the use of alternative sources such as solar and wind power in order to assist in meeting the energy needs for the Commonwealth.

The proposed action would encourage energy conservation by providing bicycle accommodations within the study area.

Ocean Resources

Ocean Resources Policy #1: Support the development of environmentally sustainable aquaculture, both for commercial and enhancement (public shellfish stocking) purposes. Ensure that the review process regulating aquaculture facility sites (and access routes to those areas) protects ecologically significant resources (salt marshes, dunes, beaches, barrier beaches, and salt ponds) and minimizes adverse impacts upon the coastal and marine environment.

The proposed action is not an aquaculture facility; therefore, this policy does not apply.

Ocean Resources Policy #2: Extraction of marine minerals will be considered in areas of state jurisdiction, except where prohibited by the Massachusetts Ocean Sanctuaries Act, where and when the protection of fisheries, air and marine water quality, marine resources, navigation, and recreation can be assured.

The proposed action does not include the extraction of marine minerals; therefore, this policy does not apply.

Ocean Resources Policy #3: Accommodate offshore sand and gravel mining needs in areas and in ways that will not adversely affect shoreline areas due to alteration of wave direction and dynamics, marine resources, and navigation. Mining of sand and gravel, when and where permitted, will be primarily for the purpose of beach nourishment.

The proposed action does not include offshore sand and gravel mining; therefore, this policy does not apply.

Growth Management

Growth Management Principle #1: Encourage, through technical assistance and review of publicly funded development, compatibility of proposed development with local community character and scenic resources.

The proposed action would be compatible with local community character and scenic resources. The NPS has coordinated with local government officials throughout the planning process and has analyzed potential impacts on scenic resources within this EA/AoE (under the impact topic of visual resources). Moors Road is a long-established feature of the study area, and the rehabilitation of the road would not significantly alter the visual character of the study area.

Growth Management Principle #2: Ensure that state and federally funded transportation and wastewater projects primarily serve existing developed areas, assigning highest priority to projects that meet the needs of urban and community development centers.

The proposed action would improve the existing access and circulation for those visitors to and residents of Provincetown by rehabilitating Moors Road and accommodating bicyclist and pedestrian traffic.

Growth Management Principle #3: Encourage the revitalization and enhancement of existing development centers in the coastal zone through technical assistance and federal and state financial support for residential, commercial, and industrial development.

The proposed action does not include the revitalization or enhancement of an existing development center; therefore, this policy does not apply.

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APPENDIX C: PLANT SPECIES CHECKLIST

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Moors Road Rare Plant Survey - September 22-24, 2009

Cape Cod National Seashore: Species Checklist

Habitat Key: D=Dune fields and roadsides; S=salt marsh; I=interdunal swale; P=Shank Painter Pond

*Native Status Key: N=Native; I=Introduced; NI=Both (only resolvable at sub-specific taxonomic level); NA=Insufficient data

Scientific Name	Common Name	Family	Habitat(s)	Native
<i>Acer rubrum</i> L.	red maple	Aceraceae	P	N
<i>Achillea millefolium</i> L.	common yarrow	Asteraceae	D	NI
<i>Ambrosia artemisiifolia</i> L.	annual ragweed	Asteraceae	D	N
<i>Amelanchier arborea</i> (Michx. f.) Fernald	common serviceberry	Rosaceae	D	N
<i>Ammophila breviligulata</i> Fernald	American beachgrass	Poaceae	D	N
<i>Aralia nudicaulis</i> L.	wild sarsaparilla	Araliaceae	D	N
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	bearberry	Ericaceae	D	N
<i>Artemisia stelleriana</i> Besser	oldwoman	Asteraceae	D	I
<i>Asclepias syriaca</i> L.	common milkweed	Asclepiadaceae	D	N
<i>Atriplex cristata</i> Humb. & Bonpl. ex Willd.	crested saltbush	Chenopodiaceae	S	N
<i>Baccharis halimifolia</i> L.	eastern baccharis	Asteraceae	S	N
<i>Bromus tectorum</i> L.	cheatgrass	Poaceae	D	I
<i>Cakile edentula</i> (Bigelow) Hook.	American searocket	Brassicaceae	D	N
<i>Calamagrostis canadensis</i> (Michx.) P. Beauv.	bluejoint	Poaceae	S	N
<i>Carex silicea</i> Olney	beach sedge	Cyperaceae	D	N
<i>Carex swanii</i> (Fernald) Mack.	Swan's sedge	Cyperaceae	D	N
<i>Carex tosa</i> (Fernald) E.P. Bicknell	shaved sedge	Cyperaceae	D	N
<i>Centaurea stoebe</i> L. ssp. <i>micranthos</i> (Gugler) Hayek	spotted knapweed	Asteraceae	D	I
<i>Chamaedaphne calyculata</i> (L.) Moench	leatherleaf	Ericaceae	S	N
<i>Chamaesyce polygonifolia</i> (L.) Small	seaside sandmat	Euphorbiaceae	D	N
<i>Chimaphila maculata</i> (L.) Pursh	striped prince's pine	Pyrolaceae	D	N
<i>Cladium mariscoides</i> (Muhl.) Torr.	smooth sawgrass	Cyperaceae	I	N
<i>Clethra alnifolia</i> L.	coastal sweetpepperbush	Clethraceae	P	N
<i>Cyperus grayi</i> Torr.	Gray's flatsedge	Cyperaceae	D	N
<i>Cyperus lupulinus</i> (Spreng.) Marcks	Great Plains flatsedge	Cyperaceae	D	N
<i>Dactylis glomerata</i> L.	orchardgrass	Poaceae	D	I
<i>Danthonia spicata</i> (L.) P. Beauv. ex Roem. & Schult.	poverty oatgrass	Poaceae	D	N
<i>Daucus carota</i> L.	Queen Anne's lace	Apiaceae	D	I
<i>Decodon verticillatus</i> (L.) Elliot	swamp loosestrife	Lythraceae	S	N
<i>Deschampsia flexuosa</i> (L.) Trin.	wavy hairgrass	Poaceae	D	N
<i>Dianthus armeria</i> L.	Deptford pink	Caryophyllaceae	D	I
<i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark	tapered rosette grass	Poaceae	D	N
<i>Dichanthelium depauperatum</i> (Muhl.) Gould	starved panicgrass	Poaceae	D	N
<i>Digitaria ischaemum</i> (Schreb.) Schreb. ex Muhl.	smooth crabgrass	Poaceae	D	I
<i>Distichlis spicata</i> (L.) Greene	saltgrass	Poaceae	S	N
<i>Drosera intermedia</i> Hayne	spoonleaf sundew	Droseraceae	I	N
<i>Dulichium arundinaceum</i> (L.) Britton	threeway sedge	Cyperaceae	S	N
<i>Eleocharis</i> R. Br.	spikerush	Cyperaceae	I	NA
<i>Eragrostis minor</i> Host	little lovegrass	Poaceae	D	I
<i>Eragrostis spectabilis</i> (Pursh) Steud.	purple lovegrass	Poaceae	D	N
<i>Eriophorum virginicum</i> L.	tawny cottongrass	Cyperaceae	S	N
<i>Eurybia divaricata</i> (L.) G.L. Nesom	white wood aster	Asteraceae	D	N
<i>Euthamia caroliniana</i> (L.) Greene ex Porter & Britton	slender goldentop	Asteraceae	I	N
<i>Gaylussacia baccata</i> (Wangenh.) K. Koch	black huckleberry	Ericaceae	D	N
<i>Gaylussacia frondosa</i> (L.) Torr. & A. Gray ex Torr.	blue huckleberry	Ericaceae	D	N
<i>Gnaphalium uliginosum</i> L.	marsh cudweed	Asteraceae	D	I
<i>Hieracium sabaudum</i> L.	New England hawkweed	Asteraceae	D	I
<i>Hudsonia tomentosa</i> Nutt.	woolly beachheather	Cistaceae	D	N
<i>Hypericum gentianoides</i> (L.) Britton, Sterns & Poggenb.	orangegrass	Clusiaceae	D	N
<i>Hypericum punctatum</i> Lam.	spotted St. Johnswort	Clusiaceae	D	N
<i>Hypochaeris radicata</i> L.	hairy cat's ear	Asteraceae	D	I
<i>Ilex glabra</i> (L.) A. Gray	inkberry	Aquifoliaceae	I	N
<i>Ilex verticillata</i> (L.) A. Gray	common winterberry	Aquifoliaceae	D	N
<i>Ionactis linariifolius</i> (L.) Greene	flaxleaf whitetop aster	Asteraceae	D	N
<i>Juncus acuminatus</i> Michx.	tapertip rush	Juncaceae	I	N



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Habitat Key: D=Dune fields and roadsides; S=salt marsh; I=interdunal swale; P=Shank Painter Pond

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Scientific Name	Common Name	Family	Habitat(s)	Native
<i>Juncus greenei</i> Oakes & Tuck.	Greene's rush	Juncaceae	D	N
<i>Juniperus virginiana</i> L.	eastern redcedar	Cupressaceae	D	N
<i>Kalmia angustifolia</i> L.	sheep laurel	Ericaceae	S	N
<i>Lactuca serriola</i> L.	prickly lettuce	Asteraceae	D	I
<i>Lathyrus japonicus</i> Willd.	beach pea	Fabaceae	D	N
<i>Lechea maritima</i> Leggett ex Britton, Sterns & Poggenb.	beach pinweed	Cistaceae	D	N
<i>Lepidium campestre</i> (L.) W.T. Aiton	field pepperweed	Brassicaceae	D	I
<i>Limonium carolinianum</i> (Walter) Britton	lavender thrift	Plumbaginaceae	S	N
<i>Lindera benzoin</i> (L.) Blume	northern spicebush	Lauraceae	D	N
<i>Lyonia ligustrina</i> (L.) DC.	maleberry	Ericaceae	P	N
<i>Maianthemum canadense</i> Desf.	Canada mayflower	Liliaceae	D	N
<i>Maianthemum trifolium</i> (L.) Sloboda	threeleaf false lily of the valley	Liliaceae	D	N
<i>Melilotus officinalis</i> (L.) Lam.	yellow sweetclover	Fabaceae	D	I
<i>Monotropa uniflora</i> L.	Indianpipe	Monotropaceae	D	N
<i>Morella pensylvanica</i> (Mirb.) Kartesz	northern bayberry	Myricaceae	D,I	N
<i>Nuttallanthus canadensis</i> (L.) D.A. Sutton	Canada toadflax	Scrophulariaceae	D	N
<i>Nymphaea odorata</i> Aiton	American white waterlily	Nymphaeaceae	S	N
<i>Nyssa sylvatica</i> Marsh.	blackgum	Cornaceae	P	N
<i>Oenothera biennis</i> L.	common evening primrose	Onagraceae	D	N
<i>Panicum dichotomiflorum</i> Michx.	fall panicgrass	Poaceae	D	N
<i>Panicum rigidulum</i> Bosc ex Nees	redtop panicgrass	Poaceae	D	N
<i>Panicum virgatum</i> L.	switchgrass	Poaceae	D	N
<i>Parthenocissus quinquefolia</i> (L.) Planch.	Virginia creeper	Vitaceae	D	N
<i>Photinia pyrifolia</i> (Lam.) K.R. Robertson & Phipps	red chokeberry	Rosaceae	D	N
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	common reed	Poaceae	D	N
<i>Pinus nigra</i> Arnold	Austrian pine	Pinaceae	D	I
<i>Pinus rigida</i> Mill.	pitch pine	Pinaceae	S	N
<i>Plantago lanceolata</i> L.	narrowleaf plantain	Plantaginaceae	D	I
<i>Poa compressa</i> L.	Canada bluegrass	Poaceae	D	I
<i>Polygonella articulata</i> (L.) Meisn.	coastal jointweed	Polygonaceae	D	N
<i>Polypodium virginianum</i> L.	rock polypody	Polypodiaceae	D	N
<i>Prenanthes trifoliolata</i> (Cass.) Fernald	gall of the earth	Asteraceae	D	N
<i>Prunus maritima</i> Marsh.	beach plum	Rosaceae	D	N
<i>Prunus serotina</i> Ehrh.	black cherry	Rosaceae	D	N
<i>Prunus virginiana</i> L.	chokecherry	Rosaceae	D,I	N
<i>Pseudognaphalium obtusifolium</i> (L.) Hilliard & B.L. Burttt ss	rabbit-tobacco	Asteraceae	D	N
<i>Pteridium aquilinum</i> (L.) Kuhn	western brackenfern	Dennstaedtiaceae	D	N
<i>Quercus coccinea</i> Münchh.	scarlet oak	Fagaceae	D	N
<i>Quercus ilicifolia</i> Wangenh.	bear oak	Fagaceae	D	N
<i>Quercus velutina</i> Lam.	black oak	Fagaceae	D	N
<i>Raphanus raphanistrum</i> L.	wild radish	Brassicaceae	I	I
<i>Rhododendron viscosum</i> (L.) Torr.	swamp azalea	Ericaceae	D	N
<i>Rhus copallinum</i> L.	winged sumac	Anacardiaceae	D	N
<i>Rhynchospora capitellata</i> (Michx.) Vahl	brownish beaksedge	Cyperaceae	D	N
<i>Rosa carolina</i> L.	Carolina rose	Rosaceae	P	N
<i>Rosa rugosa</i> Thunb.	rugosa rose	Rosaceae	D	I
<i>Rubus allegheniensis</i> Porter	Allegheny blackberry	Rosaceae	D	N
<i>Rubus flagellaris</i> Willd.	northern dewberry	Rosaceae	I	N
<i>Rumex acetosella</i> L.	common sheep sorrel	Polygonaceae	D	I
<i>Salicornia depressa</i> Standl.	Virginia glasswort	Chenopodiaceae	D	N
<i>Salsola kali</i> L.	Russian thistle	Chenopodiaceae	I	I
<i>Saponaria officinalis</i> L.	bouncingbet	Caryophyllaceae	D	I
<i>Sarracenia purpurea</i> L.	purple pitcherplant	Sarracenaceae	D	N
<i>Sassafras albidum</i> (Nutt.) Nees	sassafras	Lauraceae	S	N
<i>Schizachyrium scoparium</i> (Michx.) Nash	little bluestem	Poaceae	D	N



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Scientific Name	Common Name	Family	Habitat(s)	Native
<i>Scirpus cyperinus</i> (L.) Kunth	woolgrass	Cyperaceae	D	N
<i>Smilax glauca</i> Walter	cat greenbrier	Smilacaceae	S	N
<i>Smilax rotundifolia</i> L.	roundleaf greenbrier	Smilacaceae	D	N
<i>Solidago bicolor</i> L.	white goldenrod	Asteraceae	I	N
<i>Solidago canadensis</i> L.	Canada goldenrod	Asteraceae	D	N
<i>Solidago odora</i> Aiton	anisescented goldenrod	Asteraceae	P	N
<i>Solidago sempervirens</i> L.	seaside goldenrod	Asteraceae	D	N
<i>Spartina alterniflora</i> Loisel.	smooth cordgrass	Poaceae	D	N
<i>Spartina patens</i> (Aiton) Muhl.	saltmeadow cordgrass	Poaceae	D	N
<i>Spergularia</i> (Pers.) J. Presl & C. Presl	sandspurry	Caryophyllaceae	D	NA
<i>Spiraea alba</i> Du Roi	white meadowsweet	Rosaceae	S	N
<i>Suaeda maritima</i> (L.) Dumort.	herbaceous seepweed	Chenopodiaceae	S	NI
<i>Toxicodendron radicans</i> (L.) Kuntze	eastern poison ivy	Anacardiaceae	D	N
<i>Triadenum virginicum</i> (L.) Raf.	Virginia marsh St. Johnswort	Clusiaceae	I	N
<i>Trifolium arvense</i> L.	rabbitfoot clover	Fabaceae	D	I
<i>Trifolium hybridum</i> L.	alsike clover	Fabaceae	S	I
<i>Typha angustifolia</i> L.	narrowleaf cattail	Typhaceae	D,I	I
<i>Vaccinium corymbosum</i> L.	highbush blueberry	Ericaceae	I	N
<i>Vaccinium macrocarpon</i> Aiton	cranberry	Ericaceae	D	N
<i>Verbascum thapsus</i> L.	common mullein	Scrophulariaceae	D	I
<i>Viburnum dentatum</i> L.	southern arrowwood	Caprifoliaceae	S	N
<i>Viola lanceolata</i> L.	bog white violet	Violaceae	P	N
<i>Xanthium strumarium</i> L.	rough cocklebur	Asteraceae	I	N

*Native status based on USDA PLANTS Database, 2009 (accessed Nov. 17, 2009). <http://plants.usda.gov>

APPENDIX D: WETLAND DELINEATION SUPPORTING INFORMATION

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VEGETATION - Use scientific names of plants.

Date 09/23/09

Sampling Point: 1

Tree Stratum	(Plot size: <u> 30ft radius </u>)	Absolute % Cover	Dom. Sp?	Indicator Status				
1.	_____	_____	_____	_____	Dominance Test Worksheet: # Dominants FAC or wetter: <u> 1 </u> (A) # Dominants across all strata: <u> 1 </u> (B) % Dominants FAC or wetter: <u> 100% </u> (A/B)			
2.	_____	_____	_____	_____				
3.	_____	_____	_____	_____				
4.	_____	_____	_____	_____				
5.	_____	_____	_____	_____				
6.	_____	_____	_____	_____				
7.	_____	_____	_____	_____				
		_____ = Total Cover			Prevalence Index Worksheet: Total % Cover of: Multiply By: OBL <u> 79.5 </u> x 1 = <u> 79.5 </u> FACW _____ x 2 = _____ FAC _____ x 3 = _____ FACU _____ x 4 = _____ UPL _____ x 5 = _____ Sum: <u> 79.5 </u> (A) <u> 79.5 </u> (B) Prevalence Index = B/A = <u> 1.00 </u>			
Sapling Stratum	(Plot size: <u> 15ft radius </u>)	Absolute % Cover	Dom. Sp?	Indicator Status				
1.	_____	_____	_____	_____				
2.	_____	_____	_____	_____				
3.	_____	_____	_____	_____				
4.	_____	_____	_____	_____				
5.	_____	_____	_____	_____				
6.	_____	_____	_____	_____				
7.	_____	_____	_____	_____				
		_____ = Total Cover			Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is > 50% <input checked="" type="checkbox"/> Prevalence Index is <= 3.0 ¹ _____ Problematic Hydrophytic Vegetation ¹ (explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.			
Shrub Stratum	(Plot size: <u> 15ft radius </u>)	Absolute % Cover	Dom. Sp?	Indicator Status				
1.	_____	_____	_____	_____				
2.	_____	_____	_____	_____				
3.	_____	_____	_____	_____				
4.	_____	_____	_____	_____				
5.	_____	_____	_____	_____				
6.	_____	_____	_____	_____				
7.	_____	_____	_____	_____				
		_____ = Total Cover			Definitions of Vegetation Strata: Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH). Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH. Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height. Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height. Woody vine - All woody vines, regardless of height.			
Herb Stratum	(Plot size: <u> 5ft radius </u>)	Absolute % Cover	Dom. Sp?	Indicator Status				
1.	<u>Spartina alterniflora</u> Loisel.	63	X	OBL				
2.	<u>Suaeda maritima</u> (L.) Dumort.	10.5		OBL				
3.	<u>Limonium carolinianum</u> (Walt.) Britt.	3		OBL				
4.	<u>Salicornia depressa</u> Standl.	3		OBL				
5.	_____	_____	_____	_____				
6.	_____	_____	_____	_____				
7.	_____	_____	_____	_____				
8.	_____	_____	_____	_____				
9.	_____	_____	_____	_____				
10.	_____	_____	_____	_____				
11.	_____	_____	_____	_____				
12.	_____	_____	_____	_____				
		79.5 = Total Cover						
Woody Vines	(Plot size: <u> 30ft radius </u>)	Absolute % Cover	Dom. Sp?	Indicator Status				
1.	_____	_____	_____	_____				
2.	_____	_____	_____	_____				
3.	_____	_____	_____	_____				
4.	_____	_____	_____	_____				
5.	_____	_____	_____	_____				
		_____ = Total Cover			Hydrophytic Vegetation Present? <u> YES </u>			

Remarks:



Wetland Data Form - 1987 Corps Manual

Data Point Number: 2

Project: CACO - Moors Road
 Applicant: National Park Service
 County or City: Barnstable
 State: MA
 Investigator(s): D.A. DeBerry, Ph.D., PWS, PWD (VA); K. Kent

Date: 9/23/2009
 Wetland Classification: Emergent, tidal
 Normal Circumstances: X
 Atypical Situation (see Remarks): _____
 Problem Area (see Remarks): _____

Vegetation Parameter: [NOTE: SEE ATTACHED PAGE FOR SPECIES ABUNDANCE]

Scientific Name (dominant species only)	Common Name (dominant species only)	Stratum	IND
Spartina alterniflora Loisel.	smooth cordgrass	Herbaceous	OBL
Suaeda maritima (L.) Dumort.	herbaceous seepweed	Herbaceous	OBL

Percent of dominant plant species FAC or wetter: **100%**

Remarks: PARAMETER IS MET.

Soil Parameter:

Map Unit: <u>IPSWICH, PAWCATUCK, MATUNUCK PEATS</u>		Drainage Class: <u>VPD</u>			
Subgroup: <u>TYPIC/TERRIC SULFIHEMISTS</u>		Map type confirmed: _____			
Depth (inches)	Horizon	Matrix color	Mottle color	Mottle characteristics	Texture
0-1	O	5Y 3/2			MUCKY LOAM
1-16	Cg1	10YR 6/2			SAND

Hydric Soil Indicators:

Histosol _____	Aquic Moisture Regime _____	High Organic Content (sandy soils) <u>X</u>
Histic Epipedon _____	Reducing Conditions _____	Organic Streaking (sandy soils) <u>X</u>
Sulfidic Odor <u>X</u>	Gleyed or Low Chroma <u>X</u>	Local Hydric Soils List <u>X</u>
	Concretions _____	National Hydric Soils List <u>X</u>
		Other _____

Remarks: PARAMETER IS MET.

Hydrology Parameter:

<i>Water depths (inches):</i>	<i>Primary Indicators:</i>	<i>Secondary Indicators:</i>
Surface water: _____	Inundated: _____	Oxidized root channels: _____
Free water in pit: <u>5</u>	Saturated in upper 12 inches: _____	Water stained leaves: _____
Saturated soil: _____	Water marks: _____	Local soil survey data: _____
	Drift lines: <u>X</u>	FAC-Neutral test: <u>X</u>
	Sediment deposits: <u>X</u>	Other (describe in Remarks): <u>X</u>
	Drainage patterns in wetlands: _____	Note: Describe any recorded data in Remarks.

Remarks: PARAMETER IS MET.
CRAB BURROWS PRESENT

Wetland Determination (check all that apply):

Hydr. Vegetation: Hydric Soils: Wetland Hydrology:

Final Remarks: WETLAND AREA "B" APPROX. 25 FEET SOUTHEAST OF CULVERT; SALT MARSH
ALL PARAMETERS ARE MET.

VEGETATION - Use scientific names of plants.

Date 09/23/09

Sampling Point: 2

	Absolute % Cover	Dom. Sp?	Indicator Status	
Tree Stratum (Plot size: <u> 30ft radius </u>) 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ _____ = Total Cover				Dominance Test Worksheet: # Dominants FAC or wetter: <u> 2 </u> (A) # Dominants across all strata: <u> 2 </u> (B) % Dominants FAC or wetter: <u> 100% </u> (A/B)
Sapling Stratum (Plot size: <u> 15ft radius </u>) 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ _____ = Total Cover				
Shrub Stratum (Plot size: <u> 15ft radius </u>) 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ _____ = Total Cover				Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is > 50% <input checked="" type="checkbox"/> Prevalence Index is <= 3.0 ¹ _____ Problematic Hydrophytic Vegetation ¹ (explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
Herb Stratum (Plot size: <u> 5ft radius </u>) 1. <u>Spartina alterniflora Loisel.</u> <u> 38 </u> <u> X </u> <u> OBL </u> 2. <u>Suaeda maritima (L.) Dumort.</u> <u> 38 </u> <u> X </u> <u> OBL </u> 3. <u>Salicornia depressa Standl.</u> <u> 3 </u> _____ <u> OBL </u> 4. <u>Limonium carolinianum (Walt.) Britt.</u> <u> 3 </u> _____ <u> OBL </u> 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ 11. _____ 12. _____ _____ = Total Cover				Definitions of Vegetation Strata: Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH). Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH. Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height. Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height.
Woody Vines (Plot size: <u> 30ft radius </u>) 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ _____ = Total Cover				Woody vine - All woody vines, regardless of height. Hydrophytic Vegetation Present? <u> YES </u>

Remarks:



Wetland Data Form - 1987 Corps Manual

Data Point Number: 3

Project: CACO - Moors Road
Applicant: National Park Service
County or City: Barnstable
State: MA
Investigator(s): D.A. DeBerry, Ph.D., PWS, PWD (VA); K. Kent

Date: 9/23/2009
Wetland Classification: Non-wetland
Normal Circumstances: X
Atypical Situation (see Remarks):
Problem Area (see Remarks):

Vegetation Parameter: [NOTE: SEE ATTACHED PAGE FOR SPECIES ABUNDANCE]

Table with 4 columns: Scientific Name (dominant species only), Common Name (dominant species only), Stratum, IND. Rows include Pinus rigida, Quercus coccinea, Prunus serotina, Gaylussacia baccata, and Arctostaphylos uva-ursi.

Percent of dominant plant species FAC or wetter: 0

Remarks: PARAMETER IS NOT MET.

Soil Parameter:

Soil data table with columns: Depth (inches), Horizon, Matrix color, Mottle color, Mottle characteristics, Texture. Includes Map Unit: HOOKSAN SAND and Drainage Class: ED.

Hydric Soil Indicators: Histosol, Histic Epipedon, Sulfidic Odor, Aquic Moisture Regime, Reducing Conditions, Gleyed or Low Chroma, Concretions, High Organic Content (sandy soils), Organic Streaking (sandy soils), Local Hydric Soils List, National Hydric Soils List, Other.

Remarks: PARAMETER IS NOT MET.

Hydrology Parameter:

Hydrology data table with columns: Water depths (inches), Primary Indicators, Secondary Indicators. Includes indicators like Inundated, Saturated in upper 12 inches, Water marks, etc.

Remarks: PARAMETER IS NOT MET. DATA POINT TAKEN ABOVE WRACK LINE

Wetland Determination (check all that apply):

Hydr. Vegetation: [] Hydric Soils: [] Wetland Hydrology: []

Final Remarks: UPLANDS ON ROADSIDE/DUNE AREA NEAR WETLAND FLAG "A-12" ONE OR MORE PARAMETERS NOT MET.

VEGETATION - Use scientific names of plants.

Date 09/23/09

Sampling Point: 3

Tree Stratum	(Plot size: <u>30ft radius</u>)	Absolute % Cover	Dom. Sp?	Indicator Status																									
1.	_____	_____	_____	_____	Dominance Test Worksheet: # Dominants FAC or wetter: _____ (A) # Dominants across all strata: <u>5</u> (B) % Dominants FAC or wetter: _____ (A/B)																								
2.	_____	_____	_____	_____																									
3.	_____	_____	_____	_____																									
4.	_____	_____	_____	_____																									
5.	_____	_____	_____	_____																									
6.	_____	_____	_____	_____																									
7.	_____	_____	_____	_____																									
_____ = Total Cover					Prevalence Index Worksheet: <table style="width:100%; border-collapse: collapse;"> <tr> <td colspan="2">Total % Cover of:</td> <td>Multiply By:</td> </tr> <tr> <td>FACU- <u>6</u></td> <td>x 4.3 =</td> <td><u>25.8</u></td> </tr> <tr> <td>FACW <u>3</u></td> <td>x 2 =</td> <td><u>6</u></td> </tr> <tr> <td>FAC <u>10.5</u></td> <td>x 3 =</td> <td><u>31.5</u></td> </tr> <tr> <td>FACU <u>142.5</u></td> <td>x 4 =</td> <td><u>570</u></td> </tr> <tr> <td>UPL <u>16.5</u></td> <td>x 5 =</td> <td><u>82.5</u></td> </tr> <tr> <td>Sum: <u>178.5</u> (A)</td> <td></td> <td><u>715.8</u> (B)</td> </tr> <tr> <td colspan="2">Prevalence Index = B/A =</td> <td><u>4.01</u></td> </tr> </table>	Total % Cover of:		Multiply By:	FACU- <u>6</u>	x 4.3 =	<u>25.8</u>	FACW <u>3</u>	x 2 =	<u>6</u>	FAC <u>10.5</u>	x 3 =	<u>31.5</u>	FACU <u>142.5</u>	x 4 =	<u>570</u>	UPL <u>16.5</u>	x 5 =	<u>82.5</u>	Sum: <u>178.5</u> (A)		<u>715.8</u> (B)	Prevalence Index = B/A =		<u>4.01</u>
Total % Cover of:		Multiply By:																											
FACU- <u>6</u>	x 4.3 =	<u>25.8</u>																											
FACW <u>3</u>	x 2 =	<u>6</u>																											
FAC <u>10.5</u>	x 3 =	<u>31.5</u>																											
FACU <u>142.5</u>	x 4 =	<u>570</u>																											
UPL <u>16.5</u>	x 5 =	<u>82.5</u>																											
Sum: <u>178.5</u> (A)		<u>715.8</u> (B)																											
Prevalence Index = B/A =		<u>4.01</u>																											
Sapling Stratum (Plot size: <u>15ft radius</u>)																													
1.	<u>Pinus rigida P. Mill.</u>	<u>10.5</u>	<u>X</u>	<u>FACU</u>																									
2.	<u>Quercus coccinea Muenchh.</u>	<u>10.5</u>	<u>X</u>	<u>UPL</u>																									
3.	_____	_____	_____	_____																									
4.	_____	_____	_____	_____																									
5.	_____	_____	_____	_____																									
6.	_____	_____	_____	_____																									
7.	_____	_____	_____	_____																									
<u>21</u> = Total Cover																													
Shrub Stratum (Plot size: <u>15ft radius</u>)																													
1.	<u>Prunus serotina Ehrh.</u>	<u>63</u>	<u>X</u>	<u>FACU</u>																									
2.	<u>Gaylussacia baccata (Wangenh.) K. Koch</u>	<u>63</u>	<u>X</u>	<u>FACU</u>																									
3.	<u>Viburnum dentatum L.</u>	<u>10.5</u>	_____	<u>FAC</u>																									
4.	<u>Rhus copallinum L.</u>	<u>10.5</u>	_____	<u>NI</u>																									
5.	<u>Rosa rugosa Thunb.</u>	<u>3</u>	_____	<u>FACU-</u>																									
6.	_____	_____	_____	_____																									
7.	_____	_____	_____	_____																									
<u>150</u> = Total Cover																													
Herb Stratum (Plot size: <u>5ft radius</u>)																													
1.	<u>Arctostaphylos uva-ursi (L.) Spreng.</u>	<u>85.5</u>	<u>X</u>	<u>NI</u>																									
2.	<u>Solidago sempervirens L.</u>	<u>3</u>	_____	<u>FACW</u>																									
3.	<u>Ammophila breviligulata Fern.</u>	<u>3</u>	_____	<u>FACU-</u>																									
4.	<u>Parthenocissus quinquefolia (L.) Planch.</u>	<u>3</u>	_____	<u>FACU</u>																									
5.	<u>Achillea millefolium L.</u>	<u>3</u>	_____	<u>FACU</u>																									
6.	<u>Solidago odora Ait.</u>	<u>3</u>	_____	<u>UPL</u>																									
7.	<u>Solidago bicolor L.</u>	<u>3</u>	_____	<u>UPL</u>																									
8.	_____	_____	_____	_____																									
9.	_____	_____	_____	_____																									
10.	_____	_____	_____	_____																									
11.	_____	_____	_____	_____																									
12.	_____	_____	_____	_____																									
<u>103.5</u> = Total Cover																													
Woody Vines (Plot size: <u>30ft radius</u>)																													
1.	_____	_____	_____	_____																									
2.	_____	_____	_____	_____																									
3.	_____	_____	_____	_____																									
4.	_____	_____	_____	_____																									
5.	_____	_____	_____	_____																									
_____ = Total Cover																													
<table style="width:100%; border-collapse: collapse;"> <tr> <td colspan="5">Hydrophytic Vegetation</td> </tr> <tr> <td colspan="5">Present? <u> NO </u></td> </tr> </table>					Hydrophytic Vegetation					Present? <u> NO </u>																			
Hydrophytic Vegetation																													
Present? <u> NO </u>																													

Remarks: _____



Wetland Data Form - 1987 Corps Manual

Data Point Number: 4

Project: CACO - Moors Road
 Applicant: National Park Service
 County or City: Barnstable
 State: MA
 Investigator(s): D.A. DeBerry, Ph.D., PWS, PWD (VA); K. Kent

Date: 9/23/2009
 Wetland Classification: Emergent, tidal
 Normal Circumstances: X
 Atypical Situation (see Remarks): _____
 Problem Area (see Remarks): _____

Vegetation Parameter: [NOTE: SEE ATTACHED PAGE FOR SPECIES ABUNDANCE]

Scientific Name (dominant species only)	Common Name (dominant species only)	Stratum	IND
Spartina patens (Ait.) Muhl.	saltmeadow cordgrass	Herbaceous	FACW+
Suaeda maritima (L.) Dumort.	herbaceous seepweed	Herbaceous	OBL

Percent of dominant plant species FAC or wetter: **100%**

Remarks: **PARAMETER IS MET.**

Soil Parameter:

Map Unit: <u>WATER, SALINE</u>				Drainage Class: _____	
Subgroup: _____				Map type confirmed: _____	
Depth (inches)	Horizon	Matrix color	Mottle color	Mottle characteristics	Texture
0-2	O	10YR 3/2			MUCKY LOAM
2-5	Cg1	10YR 5/2			SAND
5-16	Cg2	10YR 3/1			SAND

Hydric Soil Indicators:	Aquic Moisture Regime _____	High Organic Content (sandy soils) <u>X</u>
Histosol _____	Reducing Conditions _____	Organic Streaking (sandy soils) <u>X</u>
Histic Epipedon _____	Gleyed or Low Chroma <u>X</u>	Local Hydric Soils List <u>X</u>
Sulfidic Odor <u>X</u>	Concretions _____	National Hydric Soils List <u>X</u>
		Other _____

Remarks: **PARAMETER IS MET.**

Hydrology Parameter:

<i>Water depths (inches):</i>		<i>Primary Indicators:</i>		<i>Secondary Indicators:</i>	
Surface water: _____		Inundated: _____		Oxidized root channels: _____	
Free water in pit: <u>6</u>		Saturated in upper 12 inches: _____		Water stained leaves: _____	
Saturated soil: _____		Water marks: _____		Local soil survey data: _____	
		Drift lines: <u>X</u>		FAC-Neutral test: <u>X</u>	
		Sediment deposits: <u>X</u>		Other (describe in Remarks): <u>X</u>	
		Drainage patterns in wetlands: _____		Note: Describe any recorded data in Remarks.	

Remarks: **PARAMETER IS MET.**
CRAB BURROWS

Wetland Determination (check all that apply):

Hydr. Vegetation: <input checked="" type="checkbox"/>	Hydric Soils: <input checked="" type="checkbox"/>	Wetland Hydrology: <input checked="" type="checkbox"/>
---	---	--

Final Remarks: **WETLAND AREA "A" NORTHWEST OF CULVERT (NEAR FLAG "A-13"); SALT MARSH**
ALL PARAMETERS ARE MET.

VEGETATION - Use scientific names of plants.

Date 09/23/09

Sampling Point: 4

Tree Stratum	(Plot size: <u>30ft radius</u>)	Absolute % Cover	Dom. Sp?	Indicator Status	
1.	_____	_____	_____	_____	Dominance Test Worksheet: # Dominants FAC or wetter: <u>2</u> (A) # Dominants across all strata: <u>2</u> (B) % Dominants FAC or wetter: <u>100%</u> (A/B)
2.	_____	_____	_____	_____	
3.	_____	_____	_____	_____	
4.	_____	_____	_____	_____	
5.	_____	_____	_____	_____	
6.	_____	_____	_____	_____	
7.	_____	_____	_____	_____	
_____ = Total Cover					Prevalence Index Worksheet: Total % Cover of: Multiply By: OBL <u>54.5</u> x 1 = <u>54.5</u> FACW+ <u>85.5</u> x 1.7 = <u>145.35</u> FAC _____ x 3 = _____ FACU _____ x 4 = _____ UPL _____ x 5 = _____ Sum: <u>140</u> (A) <u>199.85</u> (B) Prevalence Index = B/A = <u>1.43</u>
Sapling Stratum	(Plot size: <u>15ft radius</u>)	Absolute % Cover	Dom. Sp?	Indicator Status	
1.	_____	_____	_____	_____	
2.	_____	_____	_____	_____	
3.	_____	_____	_____	_____	
4.	_____	_____	_____	_____	
5.	_____	_____	_____	_____	
6.	_____	_____	_____	_____	
7.	_____	_____	_____	_____	
_____ = Total Cover					
Shrub Stratum	(Plot size: <u>15ft radius</u>)	Absolute % Cover	Dom. Sp?	Indicator Status	
1.	_____	_____	_____	_____	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is > 50% <input checked="" type="checkbox"/> Prevalence Index is <= 3.0 ¹ _____ Problematic Hydrophytic Vegetation ¹ (explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2.	_____	_____	_____	_____	
3.	_____	_____	_____	_____	
4.	_____	_____	_____	_____	
5.	_____	_____	_____	_____	
6.	_____	_____	_____	_____	
7.	_____	_____	_____	_____	
_____ = Total Cover					
Herb Stratum	(Plot size: <u>5ft radius</u>)	Absolute % Cover	Dom. Sp?	Indicator Status	
1.	<u>Spartina patens (Ait.) Muhl.</u>	<u>85.5</u>	<u>X</u>	<u>FACW+</u>	Definitions of Vegetation Strata: Tree - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and 3in (7.6cm) or larger in diameter at breast height (DBH). Sapling - Woody plants, excluding woody vines, approximately 20ft (6m) or more in height and less than 3in (7.6cm) DBH. Shrub - Woody plants, excluding woody vines, approximately 3 to 20ft (1 to 6m) in height. Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3ft (1m) in height. Woody vine - All woody vines, regardless of height.
2.	<u>Spartina alterniflora Loisel.</u>	<u>38</u>	<u>X</u>	<u>OBL</u>	
3.	<u>Suaeda maritima (L.) Dumort.</u>	<u>10.5</u>		<u>OBL</u>	
4.	<u>Limonium carolinianum (Walt.) Britt.</u>	<u>3</u>		<u>OBL</u>	
5.	<u>Salicornia depressa Standl.</u>	<u>3</u>		<u>OBL</u>	
6.	_____	_____	_____	_____	
7.	_____	_____	_____	_____	
8.	_____	_____	_____	_____	
9.	_____	_____	_____	_____	
10.	_____	_____	_____	_____	
11.	_____	_____	_____	_____	
12.	_____	_____	_____	_____	
<u>140</u> = Total Cover					
Woody Vines	(Plot size: <u>30ft radius</u>)	Absolute % Cover	Dom. Sp?	Indicator Status	
1.	_____	_____	_____	_____	Hydrophytic Vegetation Present? <u> YES </u>
2.	_____	_____	_____	_____	
3.	_____	_____	_____	_____	
4.	_____	_____	_____	_____	
5.	_____	_____	_____	_____	
_____ = Total Cover					

Remarks:

Representative Photographs: September 23, 2009



Photograph 1:
Wetland Area A
taken from Moors
Road, northwest
view. Note the
interspersed of
wetland habitat
types, including
vegetated and
non-vegetated
components.
(D.A. DeBerry:
9-23-09)

Photograph 2:
Wetland Area B
taken from Moors
Road, southeast
view. Sandy
overwash zones
are much more
prevalent on the
downstream side
of the Moors
Road culvert
(D.A. DeBerry:
9-23-09)





Photograph 3:
Area C near the
Provincetown
border, southwest
view. (D.A.
DeBerry:
9-23-09)



Wetland Function-Value Evaluation Form

Total area of wetland (>1.0 within corridor) acres Human made? NO Is wetland part of a wildlife corridor? NO or a habitat island? NO

Adjacent land use ROADWAY, NATURAL AREAS, OUTDOOR REC Distance to nearest roadway or other development ADJACENT (RT. 6)

Dominant wetland systems present (Cowardin) E2US3P, E2EM1P (from NWI) Contiguous undeveloped buffer zone present? NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? INTERTIDAL

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list or document)

Wetland I.D. AREA A

Latitude: 42, 2, 25.2 Longitude: 70, 12, 11.8

Prepared By: AC/DD Date: 10/15/2009

Wetland Impact:
Type: Area:

Evaluation based on:
Office: X Field: X

Corps manual wetland delineation completed? YES

Function/Value	Occurrence		Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
	Y	N			
Groundwater Recharge/Discharge		X	4, 5, 7, 9,10,15		INTERTIDAL POSITION AND SALINE INPUTS; NO Fx PROVIDED
Floodflow Alteration		X	2,3,5,6,7,8,13,14,15,16		LOW RUNOFF OR STORAGE CAP., TIDAL FLUCTUATIONS REDUCE Fx, CONSTRICTED OUTLET INCREASE Fx
Fish and Shellfish Habitat (Marine)	X		1,2,4		Fx PRESENT BUT REDUCED BY LOW VEG AND UNDEFINED WATERCOURSE; ESS. FISH HAB. NOT KNOWN
Sediment/Toxicant Retention	X		2,8,11,12,13,14		NO SED/TOX SOURCES IN WATERSHED; LOW VEG DENSITY/DIVERSITY; IMPOUNDING PRESENT;
Nutrient Removal	X		1,2,5,6,12,13,14		Fx CAPABILITY DECREASE BY LOW NUTRIENT AVAIL., LOW VEG COVER
Production Export	X		1,3,4,6,13		REGULAR FLUSHING; LOW PRODUCTION, MODERATE EXPORT; DECREASED BY LOW VEG/AQUATIC DIVERSITY
Sediment/Shoreline Stabilization	X		5, 7, 10, 13	X	NO STEP FROM CHANNEL TO WETLAND; EMERG VEG PROTECTS OW FRINGE AND UPLAND SHORE
Wildlife Habitat	X		3,4,5,7,8,11,12,17,18	X	LOW VEG DENSITY/DIVERSITY BUT MARSH/OPEN WATER HABITAT INCREASES Fx
Recreation	X		1,2,4,5,6,7,8,11,12	X	
Educational/Scientific Value	X		2,4,5,6,10,12,16		POOR OFF-ROAD PARKING; ROADWAY HAZARDS; SUITABLE ACCESSIBILIY TO OTHER COMMUNITIES
Uniqueness/Heritage	X		3,5,11,12,13,14,16,19,28		
Visual Quality/Aesthetics	X		1,2,5,6,7,9,12	X	Fx MAY DECREASE BY AESTHETICS, HAZARDS TO VIEWING FROM RT. 6
Endangered Species Habitat		X	NONE KNOWN		NONE DOCUMENTED IN 2009 RTE SURVEYS

Notes:
EMERGENT, INTERTIDAL SALT MARSH WETLAND COMPOSED OF SPARTINA, SUAEDA, LIMONIUM, AND SALICORNIA SPECIES
TIDAL INPUTS RETAINED BY RT. 6 CULVERT CONSTRICTION AND ROADWAY IMPOUNDING; OPEN WATER FETCH SEMI-PERSISTANT
WETLAND LOCATED ON U.S. DOI-NPS LAND (CAPE COD NATIONAL SEASHORE)
MOST PARAMETERS ASSESSED IN CONTEXT OF THE ENTIRE WETLAND SYSTEM NORTH OF RT. 6 (NOT JUST WETLAND AREA WITHIN THE ROADWAY STUDY CORRIDOR)

ASSESSMENT BASED ON FIELD INFORMATION COLLECTED BY D.A. DEBERRY AND KRISTIN KENT, SEPTEMBER 2009

*Refer to back up list of numbered considerations.





Wetland Function-Value Evaluation Form

Total area of wetland (>0.5 within corridor) acres Human made? NO Is wetland part of a wildlife corridor? NO or a habitat island? NO

Adjacent land use ROADWAY, NATURAL AREAS, OUTDOOR REC Distance to nearest roadway or other development ADJACENT (RT. 6)

Dominant wetland systems present (Cowardin) E2US2P, E2EM5P (FROM NWI) Contiguous undeveloped buffer zone present? NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? INTERTIDAL

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list or document)

Wetland I.D. AREA B

Latitude: 42, 2, 24 Longitude: 70, 12, 12

Prepared By: AC/DD Date: 10/15/2009

Wetland Impact:
Type: _____ Area: _____

Evaluation based on:
Office: X Field: X

Corps manual wetland delineation completed? YES

Function/Value	Occurrence		Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
	Y	N			
Groundwater Recharge/Discharge		X	4,5,7,15		INTERTIDAL POSITION AND SALINE INPUTS; NO Fx PROVIDED
Floodflow Alteration		X	3,5,6,7,9,13,14,16		NO FUNCTIONAL CAPACITY INCREASE DUE TO DAILY TIDAL FLUCTUATIONS
Fish and Shellfish Habitat (Marine)	X		1,2,4	X	Fx PRESENT AS NURSERY; ESS. FISH HABITAT UNKNOWN; VEG FOR COVER, DEFINED CHANNELS PRESENT
Sediment/Toxicant Retention	X		3,7,8,11,13,14,15		FUNCTIONAL CAPACITY LIMITED BY LOW VEG BIOMASS AND TIDAL FLUCTUATIONS; LOW SOURCE QUANTITIES
Nutrient Removal	X		1,5,6,9,12		LOW SOURCE QUANTITY; LOW VEG DIV/ABUNDANCE; DIFFUSE WATER FLOWS;
Production Export	X		1,3,4,6,10,13		FUNC. CAPACITY LIMITED BY TIDAL FLUCTUATIONS; LOW VEG DIV/ABUND; MODERATE PRODUCTION/EXPORT
Sediment/Shoreline Stabilization	X		5,7,13	X	ENERGY DISSIPATION BY MARSH; SPARSE VEG ON UPLAND EDGE
Wildlife Habitat	X		1,3,4,5,6,7,8,9,11,16,18	X	VEG/AQUATIC DIVERSITY INCREASED (VEG DIV/ABUND. LOW); LIKELY IMPORTANT WATERFOWL MIGR. HABITAT
Recreation	X		1,2,4,5,6,7,8,11,12	X	
Educational/Scientific Value	X		2,4,5,6,10,12,16		POOR OFF-ROAD PARKING; ROADWAY HAZARDS; SUITABLE ACCESS TO OTHER COMMUNITIES
Uniqueness/Heritage	X		3,5,11,12,13,14,16,19,28		
Visual Quality/Aesthetics	X		1,2,5,6,7,9,12	X	Fx MAY DECREASE BY AESTHETICS, HAZARDS TO VIEWING FROM RT. 6
Endangered Species Habitat		X	NONE KNOWN		NONE DOCUMENTED IN 2009 RTE SURVEYS

Notes:
EMERGENT, INTERTIDAL SALT MARSH WETLAND COMPOSED OF SPARTINA, SUAEDA, LIMONIUM, AND SALICORNIA SPECIES
TIDAL FLUCTUATIONS CONSTRICTED THROUGH RT. 6 CULVERTS BUT HYDROLOGY NOT IMPOUNDED (CONTRAST TO AREA A)
WETLAND LOCATED ON U.S. DOI-NPS LAND (CAPE COD NATIONAL SEASHORE)
MOST PARAMETERS ASSESSED IN CONTEXT OF THE ENTIRE APPROX. 5ac. WETLAND SYSTEM SOUTH OF RT. 6 (NOT JUST WETLAND AREA WITHIN THE ROADWAY STUDY CORRIDOR)

ASSESSMENT BASED ON FIELD INFORMATION COLLECTED BY D.A. DEBERRY AND KRISTIN KENT, SEPTEMBER 2009

*Refer to back up list of numbered considerations.





Wetland Function-Value Evaluation Form

Total area of wetland (>0.5 within corridor) acres Human made? NO Is wetland part of a wildlife corridor? NO or a habitat island? NO

Adjacent land use ROADWAY, NATURAL AREAS, PROVINCETOWN Distance to nearest roadway or other development ADJACENT (RT. 6)

Dominant wetland systems present (Cowardin) E2EM1P (FROM NWI) Contiguous undeveloped buffer zone present? NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? INTERTIDAL

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list or document)

Wetland I.D. AREA C

Latitude: 42, 2, 22 Longitude: 70, 12, 5

Prepared By: AC/DD Date: 10/15/2009

Wetland Impact:
Type: Area:

Evaluation based on:
Office: X Field: X

Corps manual wetland delineation completed? YES

Function/Value	Occurrence		Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
	Y	N			
Groundwater Recharge/Discharge		X	4,5,7,15		INTERTIDAL POSITION AND SALINE INPUTS; NO Fx PROVIDED
Floodflow Alteration		X	3,5,6,7,9,13,14,16,18		MINIMAL FUNCTIONAL CAPACITY INCREASE DUE TO DAILY TIDAL FLUCTUATIONS
Fish and Shellfish Habitat (Marine)	X		1,2,4	X	TIDAL FLAT CONTRIBUTES TO NURSERY HABITAT; ESS. FISH HABITAT UNKNOWN;
Sediment/Toxicant Retention	X		3,7,8,11,13,14,15		FUNCTIONAL CAPACITY LIMITED BY LOW VEG BIOMASS AND TIDAL FLUCTUATIONS; LOW SOURCE QUANTITIES
Nutrient Removal	X		1,5,6,9,12		LOW SOURCE QUANTITY; LOW VEG DIV/ABUNDANCE; DIFFUSE WATER FLOWS;
Production Export	X		1,3,4,6,7,10,13		FUNC. CAPACITY LIMITED BY TIDAL FLUSHING LOW VEG DIV/MOD DENSITY
Sediment/Shoreline Stabilization	X		5,7,12,13	X	ENERGY DISSIPATION BY MARSH; SPARSE VEG ON UPLAND EDGE
Wildlife Habitat	X		1,3,6,7,8,11,13,18	X	LOW VEG/AQUATIC DIVERSITY; ADJACENT DEVELOPMENT; LIKELY WATERFOWL MIGR. HABITAT
Recreation	X		1,2,5,6,7,12		VALUE LIMITED BY ADJACENT DEVELOPMENT; UNSAFE ACCESS; DISTANCE TO FISHING/BOATING
Educational/Scientific Value	X		2,4,5,6,10,12,16		POOR OFF-ROAD PARKING; ROADWAY HAZARDS; SUITABLE ACCESS TO OTHER COMMUNITIES
Uniqueness/Heritage	X		2,5,8,12,13,14,16,17,19,28		
Visual Quality/Aesthetics	X		1,2,5,6,7,9,12	X	Fx MAY DECREASE BY AESTHETICS, HAZARDS TO VIEWING FROM RT. 6 AND PRESENCE OF NEARBY DEVELOPMENT
Endangered Species Habitat		X	NONE KNOWN		NONE DOCUMENTED IN 2009 RTE SURVEYS

Notes:
EMERGENT, INTERTIDAL SALT MARSH WETLAND COMPOSED OF SPARTINA, SUAEDA, LIMONIUM, AND SALICORNIA SPECIES
TIDAL FLUCTUATIONS CONSTRICTED THROUGH RT. 6 CULVERTS BUT HYDROLOGY NOT IMPOUNDED (CONTRAST TO AREA A)
WETLAND LOCATED ON U.S. DOI-NPS LAND (CAPE COD NATIONAL SEASHORE) BUT PROXIMAL TO PROVINCETOWN RESIDENTIAL DEVELOPMENT
MOST PARAMETERS ASSESSED IN CONTEXT OF THE OVERALL WETLAND SYSTEM SOUTH OF RT. 6 (NOT RESTRICTED TO THE WETLAND AREA WITHIN THE ROADWAY STUDY CORRIDOR)

ASSESSMENT BASED ON FIELD INFORMATION COLLECTED BY D.A. DEBERRY AND KRISTIN KENT, SEPTEMBER 2009

*Refer to back up list of numbered considerations.





As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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