FINAL

Detailed Project Report/
Environmental Assessment

Bird Island Restoration
Marion, Massachusetts



US ARMY CORPS
OF ENGINEERS
New England District

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Bird Island Restoration Project
Marion, Massachusetts

Detailed Project Report and Environmental Assessment

Section 206, Aquatic Ecosystem Restoration

July 2006

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Bird Island Restoration Project
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Executive Summary

Bird Island, in the town of Marion, Massachusetts, provides critical nesting habitat for Roseate and Common Terns. It is one of a number of islands in Buzzards Bay and Nantucket Sound that have been among the most important nesting sites in the United States for Roseate Terns and Common Terns. The northeastern population of the Roseate Tern is listed as endangered at both the federal and state levels of jurisdiction; Common Terns are listed as a Species of Special Concern in Massachusetts. Between 1920 and 1972, many tern nesting islands in Buzzards Bay were overrun by gulls, forcing the majority of the terns to Bird Island, so that Bird Island now supports critical nesting habitat for 22 percent of the Northeast population of Roseate Terns. The majority of the Northeast population of Roseate Tern is concentrated at just three sites: Great Gull Island, New York; Bird Island, Marion; and Ram Island, Mattapoisett, Massachusetts. Bird Island also supports a stone and masonry lighthouse, which is listed on the National Register of Historic Places.

Bird Island measures approximately 3 acres in size, of which 1.5 acres of the island is above the elevation of the Mean Spring High Water tide. The island is surrounded by a deteriorating revetment, which has allowed waves to erode its surface, lowering the ground elevation and changing it from sand and gravel with low herbaceous vegetation to salt marsh and salt pannes. This habitat degradation has reduced the area available for tern nesting. The limited nesting area on Bird Island forces Roseate Terns to compete with more aggressive Common Terns for nest sites.

This Detailed Project Report and Environmental Assessment, prepared under the authority of Section 206 of the Water Resources Development Act of 1996, explores options to:

- Restore the revetment at Bird Island to reduce or eliminate erosion of the nesting substrate
- Restore suitable nesting substrate and vegetation for tern nesting on Bird Island

This report considers three alternatives (including the No Action Alterative) to restore tern nesting habitat on Bird Island. The restoration project would restore Common Tern nesting habitat around the perimeter of the island to draw Common Terns out of Roseate Tern habitat, benefiting both species by increasing the carrying capacity of the island. In the future if no restoration project were conducted (known as the No Action Alternative), the island would lose at least 0.5 additional acres of suitable nesting area over the next fifty years. Under the second alternative (Alternative B), the revetment would be restored in the same general location to protect and maintain the existing 1.5 acres of suitable tern nesting habitat, and no restoration of eroded substrates would be conducted. The third alterative (Alternative C) involves stabilizing the revetment in the same general location and restoring just over one-half acre of substrate landward of the revetment. This alternative provides 2.2 acres of suitable nesting habitat. Two other alternatives, aimed at expanding the island by 1 and 2 acres respectively were eliminated from detailed evaluation in the report because of their potential impacts to aquatic habitats.

Alternative C – Revetment and Nesting Habitat Restoration is the recommended plan. Restoring the stone revetment would stabilize the shorefront and attenuate wave energy, protecting the island from all but extreme storm waves and reduce the rate of erosion of upland material. Sand from dredging the Cape Cod Canal Hog Island Channel would be placed in the eroded and scoured areas inside the revetment. This material would restore appropriate substrates for nesting terns outside the range of tidal influence. The restored nesting areas would improve and expand Common Tern nesting areas within the revetment, reducing Common Tern encroachment into the higher elevation, Roseate Tern nesting areas. The project would allow the Roseate Tern population to increase without adversely affecting the Common Tern populations. This alternative would provide a suitable substrate to increase the estimated number of nesting pairs of Roseate Terns to an estimated 1,157 and Common Terns to an estimated 2,893 nesting pairs over the 50-year life of the project. The recommended plan provides mitigation for impacts to just over one-half acre of existing salt marsh resources on the island at two offsite locations. The estimated implementation (construction and real estate) cost of Alternative C is $3,395,000.

The Massachusetts Executive Office of Environmental Affairs, represented by the Office of Coastal Zone Management and the Division of Fisheries and Wildlife is the non-federal project sponsor. The U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, National Marine Fisheries Service, and Massachusetts Division of Marine Fisheries, and Massachusetts Audubon Society have been involved in project planning.

FINDING OF NO SIGNIFICANT IMPACT

The objective of this project is to restore Bird Island to a habitat favorable for nesting Roseate Terns and Common Terns. Bird Island is located in Buzzards Bay in Marion, Massachusetts, southwest of Butler's Point at the entrance of Outer Sippican Harbor. This project is authorized under Section 204 of the Water Resources Development Act of 1992 (PL 102-980) entitled Beneficial Uses of Dredged Material, which provides authority for the Secretary of the Army to implement projects for the protection, restoration, and rehabilitation of aquatic and ecologically related habitats, including wetlands, in connection with dredging for construction, operation, or maintenance dredging of an authorized federal navigation project.

Bird Island provides critical nesting habitat for Roseate Terns (*Sterna dougallii*) and Common Terns (*S. hirundo*). The Roseate Tern is a migratory seabird with a range restricted to the immediate coast. The northeastern population of the Roseate Tern is listed as endangered at both the Federal and state levels of jurisdiction and is always found nesting with the Common Tern, which is listed as a Species of Special Concern in Massachusetts. The Roseate Tern appears to benefit from the protection provided by the more aggressive Common Tern. However, when space is limited, such as on Bird Island, the Common Tern competes for nest sites with the Roseate Tern. The gradual loss of breeding sites in the northeast and the Roseate Tern's reluctance to colonize new sites, is a serious obstacle to the recovery of the northeast population.

Much of the1.5-acre Bird Island experiences wave action and submergence during storm events because of a deteriorating stone revetment. This exposure has eroded the shoreline of the island lowering the ground elevation and changing its composition from gravel and sand to salt marsh and salt pannes, reducing the area suitable for tern nesting. Sandy/gravelly materials provide favorable tern habitat. This erosion has reduced ground elevations of the island; therefore, much of the island is washed over during winter storms, or even during wind-induced tidal surges in the summer. The purpose of the project is to restore suitable nesting substrate elevation and vegetation for tern nesting on Bird Island through the placement of dredge material from the Cape Cod Canal Hog Island Channel or other suitable dredge material site.

The alternative analysis process involved extensive coordination with federal, state and local agencies over a period of three years to assure the sensitive regulatory, policy and social issues associated with the project were fully evaluated. The initial alternative analysis included the No Action Alternative and four nesting habitat restoration alternatives be initially considered based on their capacity to meet the project goals and objectives. These alternatives include the Alternative A - No Action, Alternative B - Revetment Restoration, Alternative C - Revetment and Nesting Habitat Restoration on 3-Acre Island, Alternative D -Revetment, Nesting Habitat Restoration and Island Expansion on 4-Acre Island and Alternative E - Revetment, Nesting Habitat Restoration and Island Expansion on 5-Acre Island. Based on discussions with the interagency team and considering the quality of subtidal habitats near Bird Island during the initial evaluation, the two island expansion alternatives (Alternatives D and E) were eliminated from further consideration.

The recommended plan is Alternative C - Revetment and Nesting Habitat Restoration on 3-Acre Island based on its projected benefits compared to implementation and maintenance costs. Restoring the stone revetment would stabilize the shorefront and attenuate wave energy, protecting the island from all but extreme storm waves and reduce the rate of erosion of upland material. The restored nesting areas improve and expand Common Tern nesting areas within the revetment, reducing their encroachment into the higher elevation, vegetated Roseate Tern nesting areas. The fill, in combination with management practices, including placing bird boxes, would allow the Roseate Tern population to increase without adversely affecting the Common Tern populations. This alternative would provide a suitable substrate to increase the number of nesting pairs of Roseate Terns and Common Terns over the 50-year life of the project. The recommended plan provides mitigation at two offsite locations for unavoidable impacts to salt marsh.

To meet the proposed project goals for restoration of tern nesting habitat, Alternative C would fill 28,050 square feet (sf) (0.64 acres (ac)) of salt marsh landward of the revetment. Due to constraints with island size and surrounding intertidal habitat, on-site mitigation was determined to be infeasible. Therefore, unavoidable impacts to salt marsh landward of the revetment would be compensated off-site through the restoration/enhancement of 0.3 ac of salt marsh at Apponagansett Bay in Dartmouth and 0.5 ac of salt marsh in Little Bay in Fairhaven (for a total of 0.8 ac) or other suitable locations. Salt marsh located at the toe of the existing revetment; three areas totaling 5,300 sf or 0.1 ac would be temporarily excavated during construction and replaced at the toe of the new revetment. To minimize this temporary disruption and avoid the stock piling of the salt marsh vegetation during construction of the revetment, the toe of the revetment would be constructed in sections with salt marsh replacement made immediately upon completion of each section.

Three different alternative alignments were also considered to avoid and minimize impacts to intertidal habitat however, moving the revetment out of the intertidal area (landward) would detrimentally impact tern-nesting habitat and would not meet the goals of the project. Based on the alternative alignment analysis and modifications that were made to the revetment to limit its footprint, impacts to intertidal habitat were avoided to the maximum extent practicable. With the preferred Alternative C, there would be 8,802 sf (0.2 ac) of intertidal impacts. Some of the functions and values of the intertidal habitat will be regained, as colonization of the aquatic invertebrates will occur on the revetment to a limited degree over time. On-site mitigation of intertidal habitat was determined to be infeasible and therefore, off-site compensation of intertidal habitat would be pursued through tidal channel restoration at the Apponagansett Bay restoration site in Dartmouth to the maximum extent practicable.

No significant adverse impacts to the environment are anticipated. My determination of a Finding of No Significant Impact is based on the Environmental Assessment and the following considerations:

a) Water quality impacts will be minimized by employing standard erosion control techniques.

b) There will be 0.64 acres (ac) of impacts to salt marsh to accomplish the goals of the project. These impacts are unavoidable and will be compensated off-site through the restoration/enhancement of 0.3 ac of salt marsh at Apponagansett Bay in Dartmouth and 0.5 ac of salt marsh in Little Bay in Fairhaven (for a total of 0.8 ac) or other suitable locations.

c) There will be no significant long-term adverse impacts on the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans in the waters around Bird Island and in Buzzard's Bay Estuary. Off-site compensation of intertidal habitat impacts will be pursued through tidal channel restoration at the Apponagansett Bay restoration site in Dartmouth to the maximum extent practicable.

d) This project will have no significant adverse impact on any federal or state rare or endangered species. Existing suitable substrates and vegetation will be maintained for tern nesting during the nesting season and no construction activities will occur from April 7 to September 7 of any year to avoid impacts during the tern nesting season.

e) No archaeological or historical resources will be adversely affected by this project. Restoring the revetment has the added benefit of protecting the historic lighthouse on Bird Island, a supplemental goal of the proposed project.

f) No changes in local or regional air quality would occur with the construction and operation of the proposed project. Under 310 Code of Massachusetts Regulations (CMR), an air quality approval will not be required from the Massachusetts Department of Environmental Protection.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the Bird Island, Marion, Massachusetts Section 204 Beneficial Uses of Dredged Material Project is not a major federal action significantly affecting the quality of the human environment. Therefore, I have determined that this project is exempt from the requirement to prepare an Environmental Impact Statement.

26 July 2006

Date

Curtis L. Thalken
Colonel, Corps of Engineers
District Commander

Introduction

Background

Roseate Terns (*Sterna dougallii*) and Common Terns (*Sterna hirundo*) are among Massachusetts's most vulnerable natural resources. These migratory seabirds were once abundant in Massachusetts waters, reportedly numbering in the hundreds of thousands, but a variety of threats (particularly hunting and displacement by gulls) have resulted in much-reduced populations today. The northeastern population of the Roseate Tern is listed as endangered at both the federal and state levels of jurisdiction and is always found nesting with the Common Tern, which is listed as a Species of Special Concern in Massachusetts. The Roseate Tern appears to benefit from the protection provided by the more aggressive Common Tern.

The islands in Buzzards Bay and Nantucket Sound have been among the most important nesting sites of Common Terns and Roseate Terns in the United States. Between 1920 and 1972, many tern nesting islands within Buzzards Bay were overrun by gulls, forcing the majority of the terns to Bird Island. Bird Island is located in Buzzards Bay in the town of Marion, Massachusetts approximately 60 miles south of Boston (Figure 1). The island is situated approximately one-half mile south of Butler's Point at the entrance of Outer Sippican Harbor (Figure 2). Since 1990, two other islands in Buzzards Bay (Ram and Penikese) have been restored for terns. However, the total nesting area available to terns is still limited, especially for Roseate Terns. This increases the terns' vulnerability to potential catastrophic events, such as oil spills, predation or disease. The gradual loss of breeding sites in the northeast and the Roseate Tern's reluctance to colonize new sites are serious obstacles to the recovery of the northeast population.

Bird Island provides critical nesting habitat for Roseate Terns and Common Terns. The island is approximately 3 acres (ac) which 1.5 ac are above the Mean Spring High Water tide (4.5 feet Mean Low Water). Erosion of the island has lowered the ground elevation, changing the surface characteristics of the island from that of gravel and sand to salt marsh and salt pannes, thus reducing the available area suitable for nesting terns. When space is limited, such as on Bird Island, the Common Tern competes for nest sites with the Roseate Tern.

On Bird Island, Common Terns historically nested around the less-vegetated perimeter of the island. This area has eroded substantially since the revetment was built 160 years ago, and most of the upland perimeter (landward of the revetment) has been converted to salt marsh. This has resulted in very crowded nesting conditions on the island. Due to this loss of their habitat, Common Terns have penetrated into Roseate Tern habitat in the more-vegetated interior, where they have been able to displace Roseates. Common Terns produce fewer chicks in these less-suitable heavily vegetated areas as compared to more sparsely vegetated areas. Placement of dense clusters of artificial nesting structures (such as plywood boards, which are suitable for Roseates but not for Common Terns) has allowed Roseates to persist on the island despite Common Tern displacement and aggression. The proposed habitat restoration project at Bird Island aims to restore Common Tern nesting habitat around the perimeter of the island in order to draw Common Terns out of upland Roseate habitat. This will benefit both species by increasing

the carrying capacity of the island and increasing the productivity of the birds, which will be able to select the most suitable nesting habitat.

The Cape Cod Canal is a potential source of dredged material to be used to increase the elevation and quality of the substrate at Bird Island. The dredging sites in the Canal are approximately 2 to 6 miles (depending on the precise location within the channel) from Bird Island (Figure 3).

Figure 1. Project Location

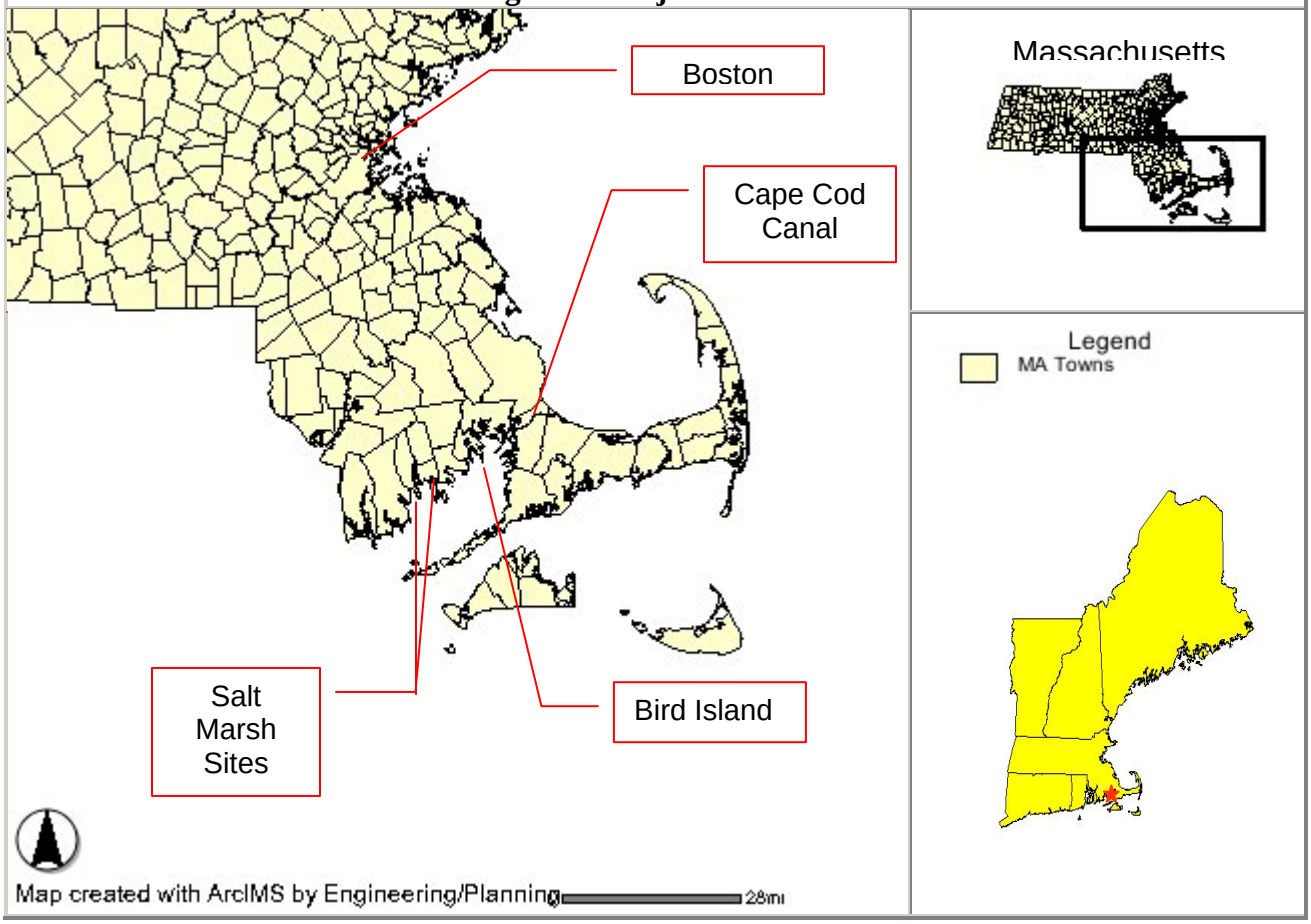
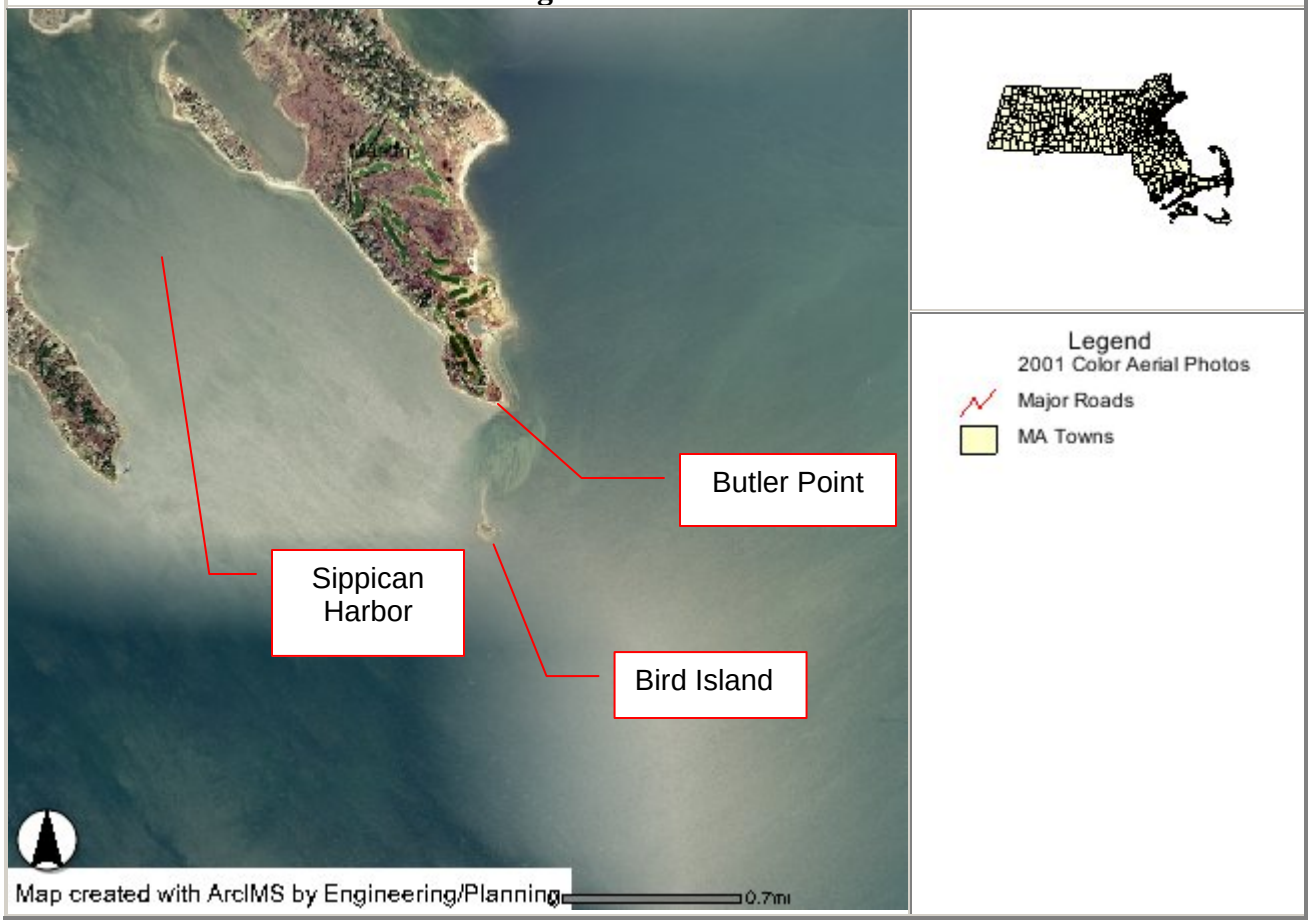


Figure 2. Bird Island



Project Authorization and Requirements

The major feature of the recommended plan is the construction of a revetment to restore and protect island nesting habitat for terns. A smaller component of the recommended plan involves placing dredged material on Bird Island to restore tern nesting substrates. Two Corps of Engineers authorities are potentially applicable to the project: the Aquatic Ecosystem Restoration Authority and the Beneficial Uses of Dredged Material Authority (see text box below). Funding under both authorities was used in executing the Feasibility phase of the project. Near the end of the feasibility phase, it became apparent that the quantity of dredged material to be used in the project and therefore the cost for the dredged material component would be small (<5,000 cubic yards); therefore, the major authority for the project is the Section 206, Aquatic Ecosystem Restoration Authority. However, dredged material from a Corps of Engineers navigation maintenance dredging project is the most cost effective source of sand for the island restoration and the Section 204 authority offers cost saving to the non-federal sponsor; therefore, that portion of the project will be subject to the Section 204 cost sharing requirements.

Corps of Engineers Ecosystem Restoration Authorities Applicable to the Bird Island Project

Section 206 of the Water Resources Development Act of 1996 (PL 104-303) entitled Aquatic Ecosystem Restoration provides authority for the Secretary of the Army to implement projects that improve the quality of the environment, are in the public interest, and are cost effective. The Aquatic Ecosystem Restoration Program requires the non-Federal sponsor to provide 35% of the study, design and implementation costs of the project, all necessary Lands, Easements, Rights of Way, Relocations, and Disposal Areas (LERRDs), and perform 100% of the operation and maintenance of the project.

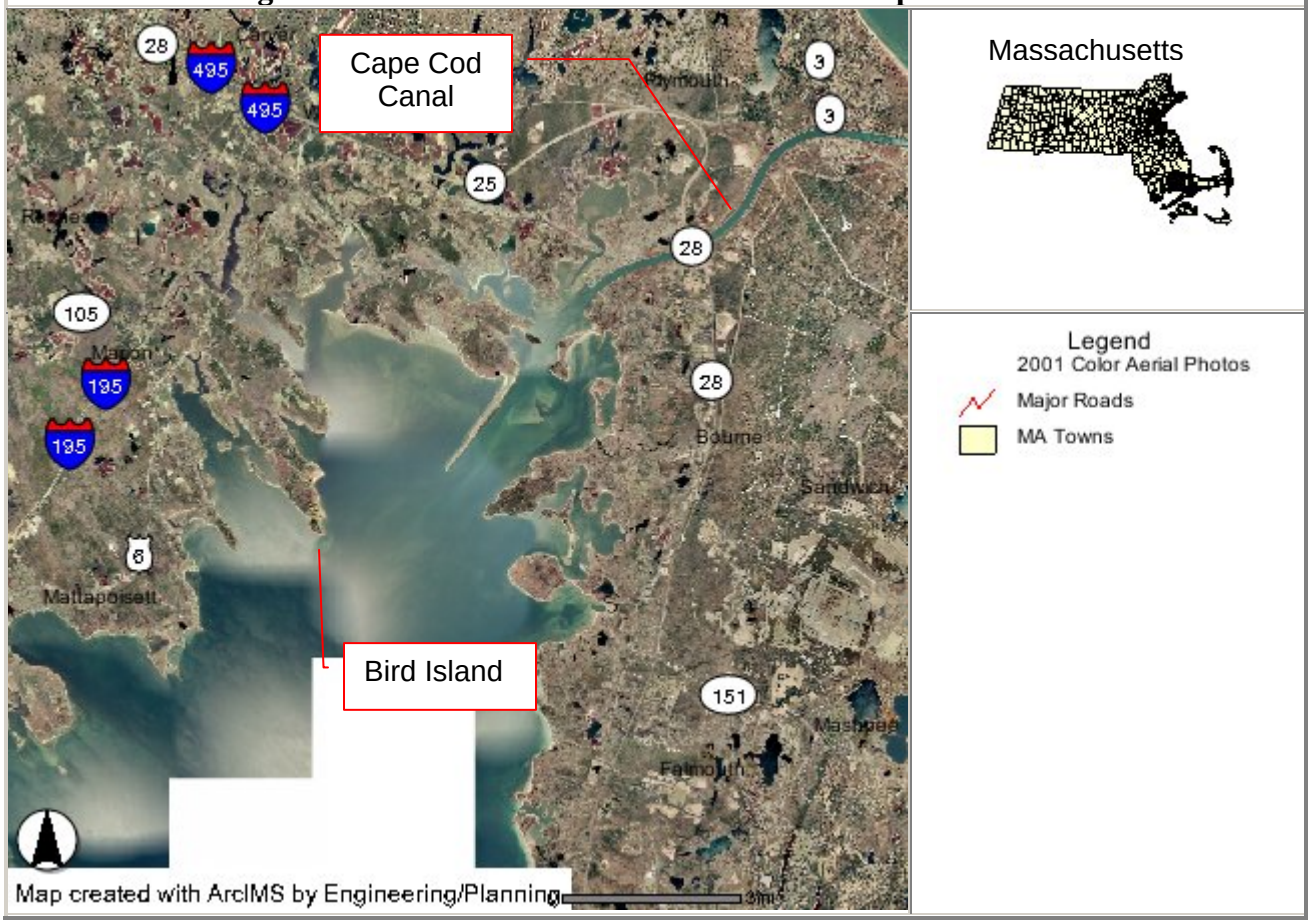
The use of dredged material in this restoration project is authorized under Section 204 of the Water Resources Development Act of 1992 (PL 102-980) entitled Beneficial Uses of Dredged Material, which provides authority for the Secretary of the Army to implement projects for the protection, restoration, and rehabilitation of aquatic and ecologically related habitats, including wetlands, in connection with dredging for construction, operation, or maintenance dredging of an authorized federal navigation project.

Corps of Engineers projects involving the disposal of dredged material associated with the maintenance of navigation projects are accomplished in the least costly manner consistent with sound engineering practice and meeting all federal environmental requirements. This constitutes the base plan for the navigation purpose. If the ecosystem restoration project is part of the base plan of the maintenance navigation project, it is a navigation cost and funded entirely by the Federal government. Where the ecosystem restoration project is not part of the base plan, the base plan serves as the reference point for measuring the costs of the ecosystem restoration project that are attributable to the environmental purpose. The non-Federal sponsor must provide 25% of the incremental cost above that of the base plan, including all lands, easements, rights of way, relocations, and disposal areas.

Purpose and Need

The killing of terns for the plume industry greatly reduced numbers in the northeast to approximately 2,000 pairs by the 1880's. Following protection, numbers rose to the 8,500 pair level in 1930. From the 1930's through the 1970's, Roseate Terns were displaced from nesting colonies by Herring Gulls (*Larus argentatus*) and Great Black-backed Gulls (*L. marinus*), and had again declined to approximately 2,500 pairs by 1979.

Figure 3. Bird Island Location Relative to the Cape Cod Canal



The following tern population demographics are based on 2005 unpublished data provided by the Massachusetts Division of Fisheries and Wildlife (MA DFW 2005). In 2005, the Northeast Roseate Tern population numbered 3,100 pairs. From 2001 to 2005, the population averaged 3,500 pairs, and has steadily declined during this time period. The majority (84%) of the population is concentrated at just three sites: Great Gull Island, New York (1,450 pairs), Bird Island, Marion (750 pairs), and Ram Island, Mattapoisett (750 pairs). Common Terns in Massachusetts numbered 15,500 pairs in 2005. From 2001 to 2005, the population averaged 15,200 pairs, and appears to be increasing in the state. The three major nesting sites (supporting 83% of the pairs) are: South Monomoy Island (8,500 pairs), Bird Island, Marion (1,900 pairs), and Ram Island, Mattapoisett (2,300 pairs) (MA DFW, 2005). Roseate and Common Tern populations in Massachusetts continue to be threatened by predators and displacement by gulls and, should established nesting colonies be disrupted, the lack of suitable (i.e., predator-free) alternative nesting sites is a serious concern. Gull control at South Monomoy and Ram Islands has resulted in thriving Common Tern colonies at these restored sites. Two other tern restoration projects (at Penikese and Muskeget Islands) are currently underway; both involve clearing gulls from small portions of the islands.

The long-term goal of Massachusetts Division of Fisheries and Wildlife (MA DFW) tern restoration and management program for Buzzards Bay is to restore Penikese Island as a major breeding site, and to maintain three large and productive colonies of both Common and Roseate Terns at Bird, Ram and Penikese Islands. In the short-and medium-term, Bird and Ram Islands are the two most important sites, because each supports about 22% of the Northeastern population of the endangered Roseate Tern. Terns of both species have displayed strong tendencies to remain at these sites despite deteriorating conditions at both. Habitat restoration at Bird Island presents an opportunity to substantially increase the Northeast population of the Roseate Tern. The restoration of Bird Island will meet short-term objectives of the Buzzards Bay management program and contribute to the long-term goals through the increased stability and productivity of both species of terns at Bird Island and in Buzzards Bay in general. In addition, the achievement of these objectives would be an important step in meeting the goals of the federal Recovery Plan for the Northeastern Population of the Roseate Tern. Restoring the revetment has the added benefit of protecting the historic lighthouse on Bird Island, a supplemental goal of the proposed project.

Problem Identification

Existing Conditions

Bird Island measures approximately 3 acres in size, of which, 1.5 acres of the island is above the elevation of the Mean Spring High Water tide. It has supported various structures including: the lighthouse, keeper's home and storage sheds, various docks and piers, and a protective stone revetment. Currently, the only remaining structures include a stone and masonry lighthouse, which is listed on the National Register of Historic Places, rubble or foundations from a few small structures (bell tower, fuel storage, and cistern) and the deteriorated stone revetment (Figure 4) surrounding the entire island except for the north side near the intertidal/subtidal spit. Elevations on the island range between 4 feet and 10 feet Mean Low Water (MLW). The base of the lighthouse is at approximate elevation 9 feet MLW. The shoreline measures approximately 1,250 feet and has a granite stone revetment along approximately 1,100 feet of shoreline. The northern end of the island is not armored and extends to an elongated, gravelly/sandy beach and intertidal/subtidal sand spit.

The deteriorated condition of the stone revetment surrounding the island has allowed tidal water to infiltrate the island, eroding the natural sandy substrate. Salt marsh has expanded in area as waves and tides have eroded the preexisting, higher elevation habitats that historically provided suitable tern nesting habitat. The habitats on the island consist of a combination of low vegetation, exposed sand, and salt marsh. The loss of nesting habitat to erosion has reduced the capacity of the island to support nesting by Roseate and Common Terns.



Figure 4. Existing Revetment, north end of Bird Island

Future Conditions Without the Project/No Action Alternative

If no action were taken to restore the island, the Roseate Tern population will continue to be at risk and impacted from overcrowding and excess competition with the Common Terns as well as flooding of nests during extreme tides and certain storms. Over time, continued exposure to erosive forces would reduce the size and quality of the habitat, reducing and eventually eliminating its capacity to support terns and further concentrating this endangered population into fewer sites. Based on the historic rate of loss of suitable nesting habitat (about 1.5 acre lost over 160 years), another 0.25 acre of tern nesting habitat would be lost over the next 25 years and 0.5 acre would be lost over the next 50 years without the project. This is likely an underestimate with an accelerated rate of erosion due to the deteriorating condition of the revetment and sea level rise.

Problems and Opportunities

Bird Island provides critical nesting habitat for about 22 percent of the northeast population of Roseate Terns, which are listed as endangered at both the federal and state levels

of jurisdiction. Roseate Terns are listed as endangered principally because of range contraction and secondarily because of declining numbers. Few suitable Common and Roseate Tern nesting sites exist in Massachusetts, and (especially in the case of the Roseate Tern) for the Northeast region as a whole. As a result, terns are highly concentrated into just a few sites. This increases their vulnerability to threats such as habitat loss, oil spills, severe predation and storm events, and disease. Therefore, it is imperative that suitable nesting sites be restored and maintained so that as many alternate sites as possible are available in order to buffer the terns in case major threats materialize. Loss of even one primary Roseate Tern nesting island could have severe consequences for this endangered population. The restoration of Bird Island presents an opportunity to substantially increase the northeast population of Roseate Terns.

Goals and Objectives

The long-term goal of Massachusetts Division of Fisheries and Wildlife (MA DFW) tern restoration and management program for Buzzards Bay is to restore Penikese Island as a major breeding site, and to maintain three large and productive colonies of both Common and Roseate Terns at Bird, Ram and Penikese Islands. In the short-and medium-term, Bird and Ram Islands are the two most important sites, because each supports about 22% of the Northeastern population of the endangered Roseate Tern. Terns of both species have displayed strong tendencies to remain at these sites despite deteriorating conditions at both. Habitat restoration at Bird Island presents an opportunity to substantially increase the Northeast population of the Roseate Tern.

The objectives of this project are to reverse the deterioration at Bird Island and to increase the island's stability in order to increase numbers and productivity of both species of terns there. This habitat restoration project is considered essential to meet the short and long-term goals of the MA DFW Buzzards Bay tern restoration program and would be an important step in meeting the goals of the federal Recovery Plan for the Northeastern population of the Roseate Tern.

The Garrett Group (TGG), LTD prepared an Environmental Impact Report (EIR) dated March 15, 2002 for a similar project being sponsored by the Massachusetts Division of Fisheries and Wildlife (MA DFW). The report, entitled Draft Environmental Impact Report New Bedford Harbor Tern Restoration Project – Roseate Tern Nesting Habitat Enhancement at Bird Island in Marion, Massachusetts (NHESP-02-NBHTR) dated September 16, 2002 (MA DFW, 2002), defined several alternatives for restoring tern habitats at Bird Island. (Throughout this report, the EIR is referred to as the 2002 EIR.) Similar goals are being adopted for this report.

The 2002 EIR stated the goal of the Bird Island Restoration Project as:

> "Increase nesting habitat at Bird Island in order to support increased numbers of roseate terns and common terns, in support of the federal recovery plan for the roseate tern, and to stabilize the shoreline to protect the lighthouse of Bird Island."

Although this project is focused primarily on protection of tern nesting habitat by reconstructing the revetment and restoring nesting substrates, the project will also serve to protect the lighthouse.

The study team established the following specific objectives for the project:

- Restore the revetment at Bird Island to reduce or eliminate erosion over the 50-year project life.
- Restore suitable nesting substrate and vegetation for tern nesting on Bird Island.

These objectives will guide project design and serve as the basis for monitoring project success.

Planning Constraints

Constraints are limits on the planning process and project alternatives. Specific planning constraints identified for the Bird Island Project are listed below:

- Maintain existing suitable substrates and vegetation for tern nesting during the nesting season.
- Restrict on-island access during the tern-nesting season (April 7 to September 7 of any year).
- Do not create crevices that could trap chicks that leave the nests.

Alternatives

Plan Formulation

The 2002 EIR defined several alternatives for restoring tern habitats at Bird Island. Preliminary screening of these alternatives by the Corps of Engineers and the interagency project team for the Section 204/206 study initially indicated that five alternatives should be considered based on their capacity to meet the project goals and objectives. These alternatives, described in detail in the sections that follow, are:

A) Alternative A - No Action. The No Action alternative is required by NEPA regulations. Based on the historic rate of erosion, the island would lose approximately 0.5 additional acres of suitable nesting area over the next fifty years.

B) Alternative B - Revetment Restoration. Under this alternative, the revetment would be restored in the same general location to protect and maintain the existing 1.5 acres of suitable tern nesting habitat, and no replacement of already eroded sediment would occur.

C) Alternative C - Revetment and Nesting Habitat Restoration on 3-Acre Island. This alternative corresponds to Alternative 3 in the 2002 EIR, which involves stabilizing

the revetment in the same general location and restoring the 0.64 acres of substrate landward of the revetment. This alternative provides 2.2 acres of suitable nesting habitat.

D) Alternative D - Revetment, Nesting Habitat Restoration and Island Expansion on 4-Acre Island. This alternative corresponds to Alternative 4 in the 2002 EIR except that material placed outside the existing revetment would be stabilized by relocating the revetment to enclose the material and the island would be expanded by 1 acre to a total size of 4 acres. This alternative provides 3.2 acres of suitable nesting habitat.

E) Alternative E - Revetment, Nesting Habitat Restoration and Island Expansion on 5-Acre Island. This alternative also corresponds to Alternative 4 in the 2002 EIR except that material placed outside the existing revetment would be stabilized by relocating the revetment to enclose the material and the island would be expanded by 2 acres to a total size of 5 acres. This alternative provides 4.2 acres of suitable nesting habitat.

To avoid confusion with the alternatives defined in the 2002 EIR, the alternatives in this report are defined by letter, rather than by number.

Recommended Plan Summary

Alternative C – Revetment and Nesting Habitat Restoration is the recommended plan based on its projected benefits compared to implementation and maintenance costs. Alternative C involves restoring the stone revetment and placing fill onto the island within the perimeter of the revetment (Figure 5). Restoring the stone revetment would stabilize the shorefront and attenuate wave energy, protecting the island from all but extreme storm waves and reduce the rate of erosion of upland material. Sand from dredging the Cape Cod Canal Hog Island Channel would be placed in the eroded and scoured areas inside the revetment. This material would restore appropriate substrates for nesting terns outside the range of tidal influence. The restored nesting areas improve and expand Common Tern nesting areas within the revetment, reducing Common Tern encroachment into the higher elevation, more vegetated Roseate Tern nesting areas. The fill, in combination with management practices, including placement of nest boxes, would allow the Roseate Tern population to increase without adversely affecting the Common Tern population. This alternative would provide a suitable substrate to increase the number of nesting pairs of Roseate Terns to an estimated 1,157 and Common Terns to an estimated 2,893 nesting pairs over the 50-year life of the project (see Table 1 Number of Nesting Pairs of Terns by Alternative). The recommended plan provides mitigation at two offsite locations for impacts to salt marsh. The estimated implementation (construction and lands, easements, rights of way, and disposal areas (LERRDs) cost of Alternative C is $3,395,000. A detailed description of this plan is provided in the following section.

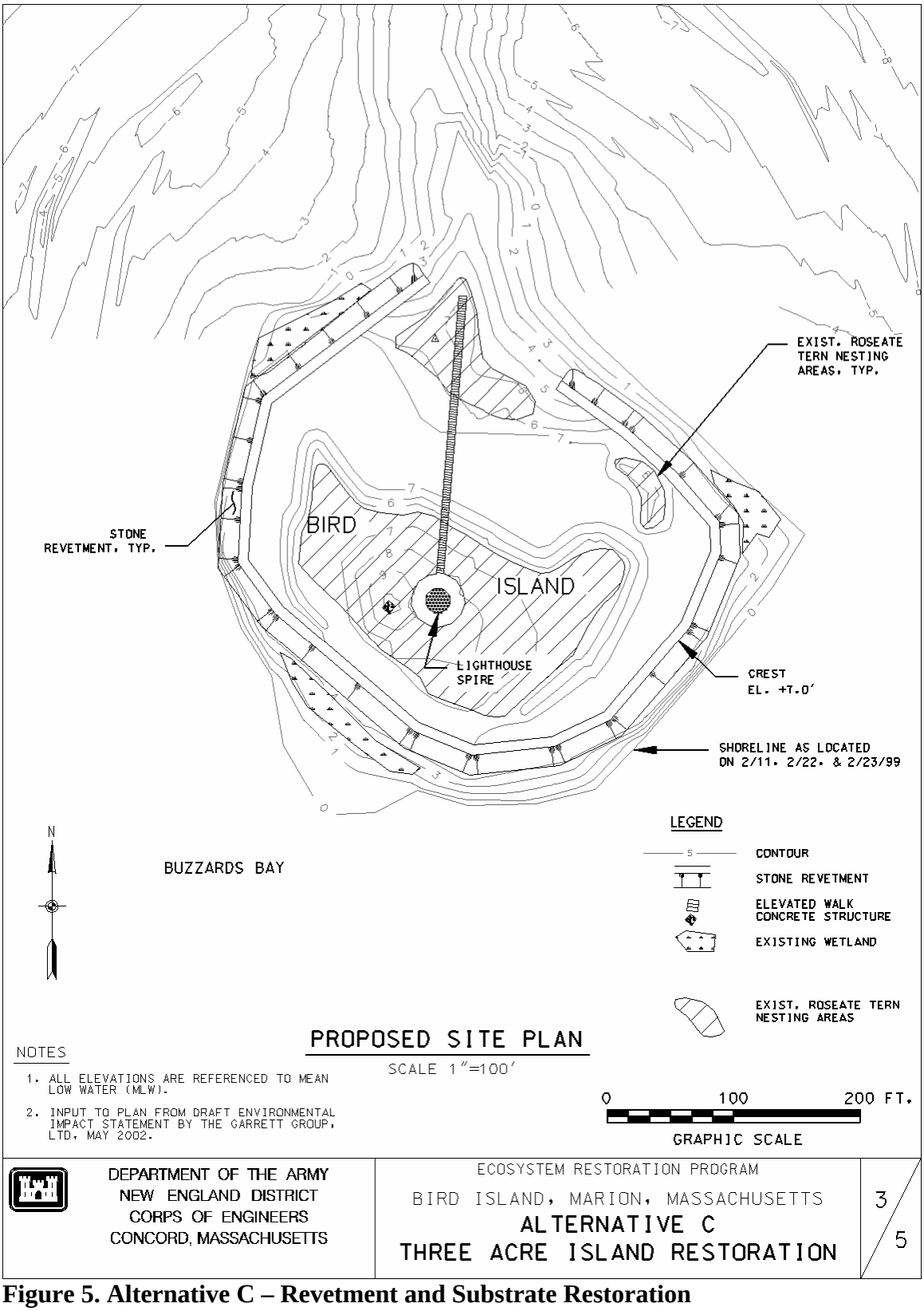


Figure 5. Alternative C – Revetment and Substrate Restoration

Descriptions of Alternatives

Alternative A – No Action

If no action were taken to restore the island, the Roseate Tern population would continue to be impacted and at additional future risk from overcrowding and excess competition as well as flooding impacts from certain storm events. Over time, continued exposure to erosive forces would further reduce the size and quality of the nesting habitat as more of the island transitions to a salt marsh and salt panne habitat, reducing and eventually eliminating its capacity to support terns and further concentrating this endangered population into fewer sites. Based on the historic rate of erosion, the island would lose approximately 0.5 additional ac of suitable nesting area over the next fifty years, reducing the total area of suitable habitat to 1.25 ac. at the mid-life of the project and 1.0 ac after fifty years. Although there would be an increase in wetland habitat, the reduction in nesting habitat equates to a reduced number of federally endangered Roseate Terns to an estimated 471 nesting pairs and a reduced number of Common Terns to an estimated 1,179 nesting pairs over the 50 years life of the project (see Table 1 Number of Nesting Pairs of Terns by Alternative). Instead of meeting the goals of the federal Recovery Plan for the Northeastern Population of the Roseate Terns, this alternative results in a continued decline in the population and its long-term viability. Figure 6 shows the island under existing conditions.

Alternative B – Revetment Restoration

Alternative B involves rebuilding the stone revetment to protect existing nesting habitats from continued erosion (Figure 7). The site historically contained substantial upland areas as well as the stone armoring that protected the habitat and lighthouse. Breakdown and deterioration of the revetment has allowed more frequent inundation of portions of the island and has increased frequency of overtopping of the stone revetment by storm waves. This has caused increased erosion of the upland tern nesting habitat. Restoring the stone revetment would stabilize the shorefront and attenuate wave energy. This would serve to protect the island under mean wave conditions and reduce the rate of erosion of upland material. Erosion of the island would continue to occur during major storm events, but at a reduced rate compared to the existing conditions. Sand would be periodically placed on the island to maintain the amount of tern nesting habitat that exists presently.

Rebuilding the revetment in combination with maintenance of the existing substrate and management practices, including placement of nest boxes, would maintain the Roseate Tern population. This alternative would provide a suitable substrate to maintain the present number of nesting Roseate Terns, 750 and 1,900 pairs of nesting Common Terns over the 50 year life of the project (see Table 1 Number of Nesting Pairs of Terns by Alternative).

This alternative would fill 8,400 sf (0.19 ac) of salt marsh landward of the revetment because the wider crest width and backslope of the new revetment would extend into lower elevation areas occupied by salt marsh. This salt marsh would be replaced at the Apponagansett Bay salt marsh restoration site described in the Mitigation Sites section of this document. Salt

marsh located at the toe of the existing revetment, three areas totaling 5,300 sf (0.12 ac), would be temporarily excavated during construction and replaced at the toe of the new revetment. This alternative also impacts 8,800 sf (0.2 ac) of intertidal habitat. Some of the functions and values of the intertidal habitat will be regained, as colonization of the aquatic invertebrates will occur on the revetment to a limited degree over time. On-site mitigation of intertidal habitat was determined to be infeasible and therefore, off-site compensation of intertidal habitat will be pursued through tidal channel restoration at the Apponagansett Bay restoration site in Dartmouth.

The estimated implementation cost of Alternative B is $3,195,000 including construction and real estate costs and the cost to replace salt marsh filled during construction.

Alternative C – Revetment and Nesting Habitat Restoration on 3-Acre Island

Alternative C involves placing fill onto the island within the perimeter of the existing stone revetment and restoring the stone revetment (Figure 5). The site historically contained substantial upland areas as well as the stone armoring that protected both the habitat and the lighthouse. Periodic inundation of the island and overtopping of the stone revetment by storm waves eroded the uplands causing the loss of tern nesting habitat. As with Alternative B, restoring the stone revetment would stabilize the shorefront and attenuate wave energy. This would serve to protect the island under mean wave conditions and reduce the rate of erosion of upland material. Erosion of the nesting would continue to occur during major storm events, but at a reduced rate compared to the existing conditions. Sand would be periodically placed on the island to maintain the restored substrate.

Fill would be placed in the eroded and scoured areas landward of the stone revetment to restore appropriate elevations and substrates for nesting terns. The objective would be to improve and expand Common Tern nesting areas along the seaward limits of the fill to encourage the Common Terns to reduce encroachment into the higher elevation, vegetated Roseate Tern nesting areas. The fill in combination with management practices, including placement of nest boxes, would allow the Roseate Tern population to be maintained and eventually increase without adversely affecting the Common Tern populations. This alternative would provide a suitable substrate to increase the number of nesting pairs of Roseate Terns to an estimated 1,157 and Common Terns to an estimated 2,893 nesting pairs over the 50-year life of the project (see Table 1 Number of Nesting Pairs of Terns by Alternative).

This alternative would fill 28,050 sf (0.64 ac) of salt marsh and salt pannes. Unavoidable impacts to salt marsh landward of the revetment would be compensated through the restoration/enhancement of 0.3 ac of salt marsh at Apponagansett Bay in Dartmouth and 0.5 ac of salt marsh in Little Bay in Fairhaven, for a total of 0.8 ac. Salt marsh located at the toe of the existing revetment, three areas totaling 5,300 sf (0.12 ac), would be temporarily excavated during construction and replaced at the toe of the new revetment. To minimize this temporary disruption, the toe of the revetment would be constructed in sections with the underlying substrate and salt marsh replacement made immediately upon completion of each section. Alternative C also impacts 8,800 sf (0.2 ac) of intertidal habitat with a stone-slope revetment and

temporarily impacts 17,390 sf (0.4 ac) of intertidal habitat during construction of the revetment buried toe. Three different alternative alignments were considered to avoid and minimize impacts to intertidal habitat (see Alternative Revetment Alignments for Alternative C); however, moving the revetment out of the intertidal area (landward) would detrimentally impact tern nesting habitat and would not meet the goals of the project. Some of the functions and values of the intertidal habitat will be regained, as colonization by benthic invertebrates will occur on cobble substrate material over the buried toe and on the revetment over time. On-site mitigation of intertidal habitat was determined to be infeasible and therefore, off-site compensation of intertidal habitat will be pursued through tidal channel restoration at the Apponagansett Bay restoration site in Dartmouth.

The estimated implementation cost of Alternative C is $3,395,000 including construction and real estate costs and the cost to replace salt marsh filled during construction.

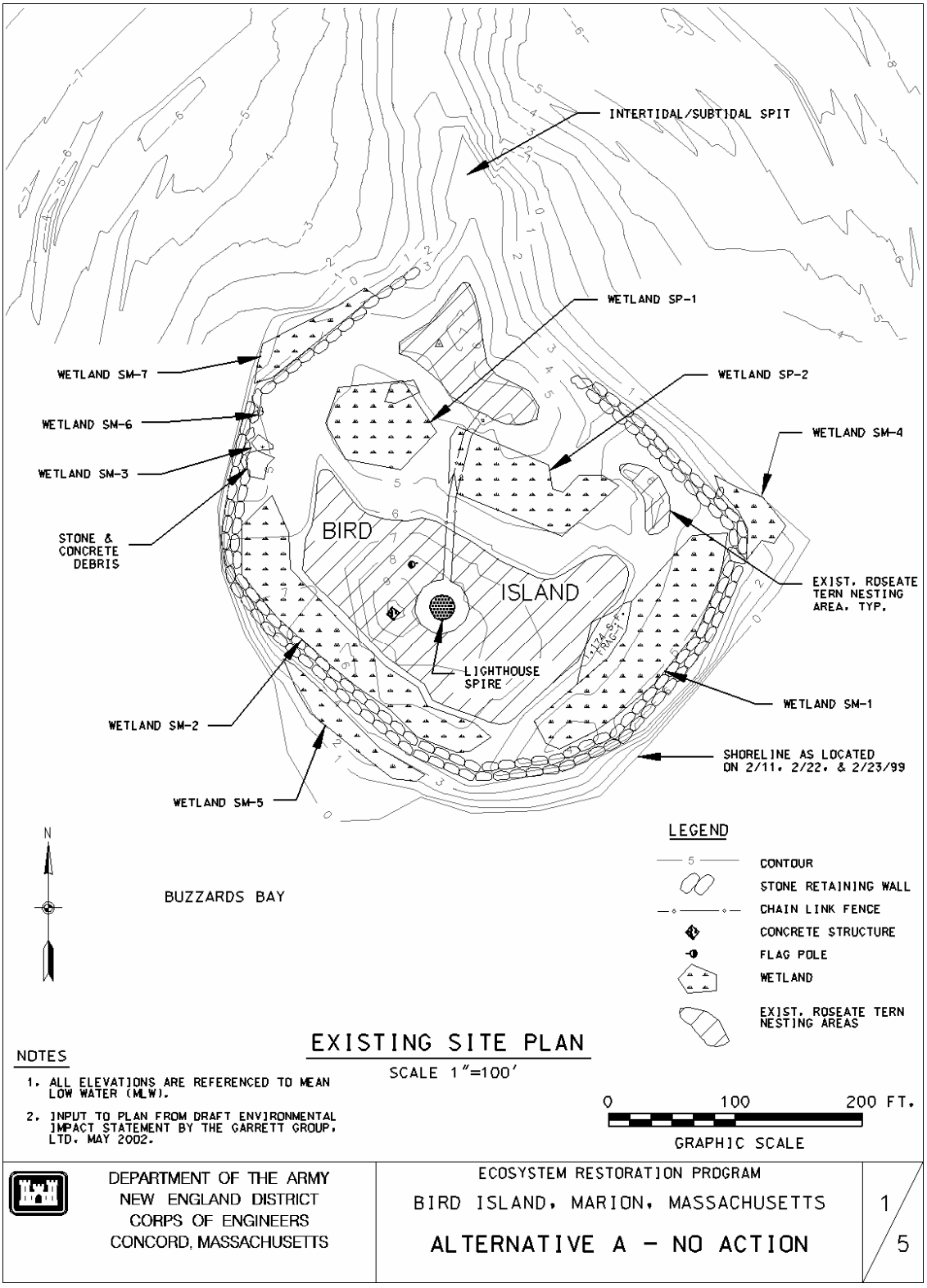


Figure 6. Alternative A – No Action

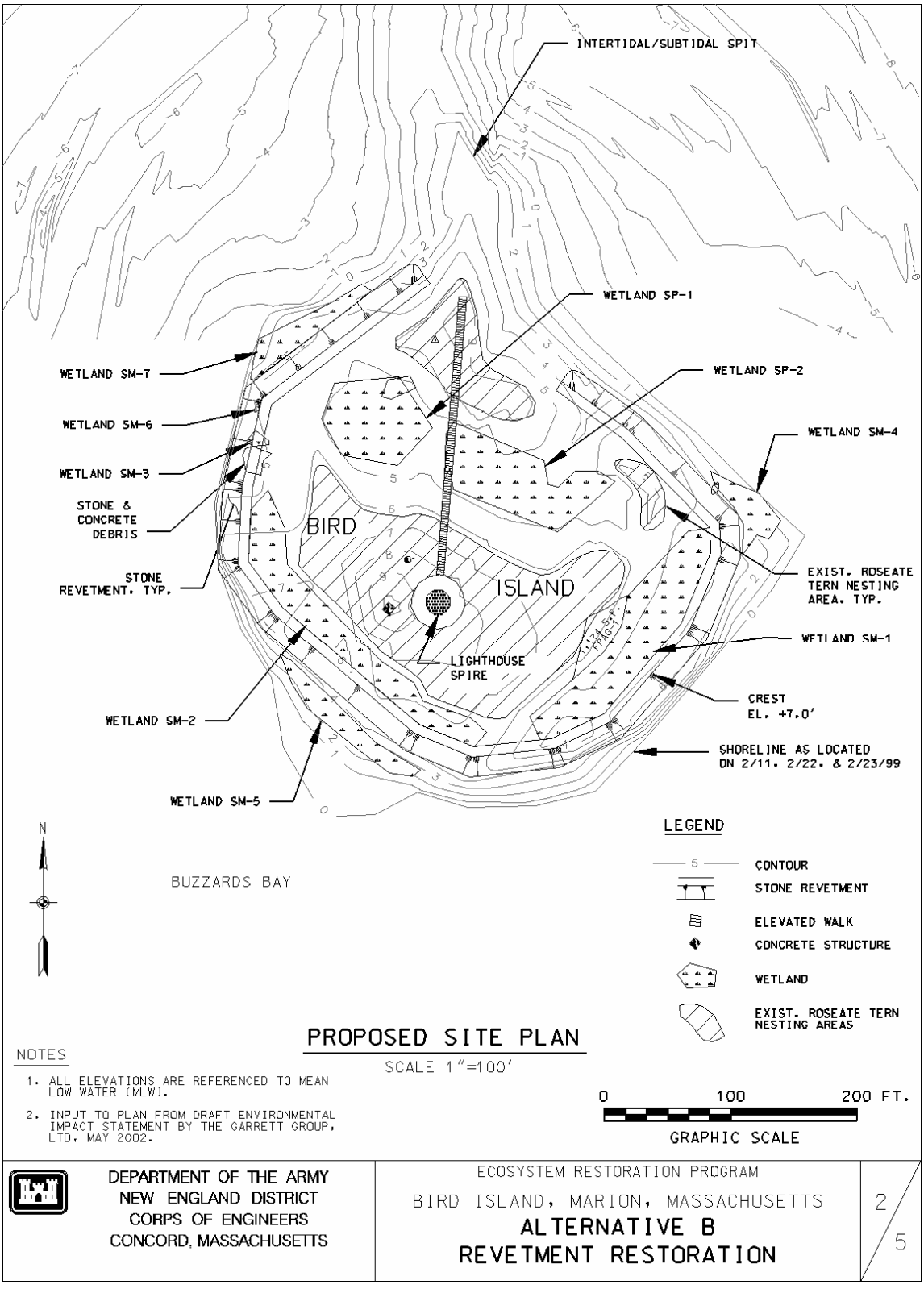


Figure 7. Alternative B – Revetment Restoration

Alternative D – Revetment, Nesting Habitat Restoration and Island Expansion on 4-Acre Island

The island would be expanded by 1 acre under Alternative D by placing sand or other fill material within and seaward of the existing stone revetment (Figure 8). As under Alternative C, sand or other suitable material would be placed on low depressions on the island to increase their elevation relative to tidal flooding and provide a suitable substrate for Common Tern nesting or for vegetation that would support Roseate Tern nesting. A new revetment would be constructed approximately 80 feet to the south of the existing revetment with the same crest elevation and design characteristics as the revetment for Alternatives B and C, but with an additional length of new revetment of approximately 550 feet.

This alternative would provide a suitable substrate to increase the number of Roseate Terns to an estimated 1,728 nesting pairs and an estimated number of Common Terns to 4,322 nesting pairs over the 50 year life of the project (see Table 1 Number of Nesting Pairs of Terns by Alternative).

This alternative would fill 28,050 sf (0.64 ac) of salt marsh, which would be compensated off-site at Apponagansett Bay and Little Bay. Some salt marsh would be temporarily excavated during construction and replaced at the toe of the new revetment. This alternative would also fill over 1 acre of intertidal and shallow subtidal habitat.

Alternative E – Revetment, Nesting Habitat Restoration and Island Expansion on 5-Acre Island

The island would be expanded by 2 acres under Alternative E by placing sand or other fill material within and seaward of the existing stone revetment (Figure 9). As under Alternative C, sand or other suitable material would be placed on low depressions on the island to increase their height relative to tidal flooding and provide a suitable substrate for Common Tern nesting or for vegetation that would support Roseate Tern nesting. A new revetment would be constructed approximately 160 feet to the south of the existing revetment with the same crest elevation and design characteristics as the revetment for Alternatives B and C, but with an additional length of new revetment of approximately 750 feet.

This alternative would provide a suitable substrate to increase the number of Roseate Terns to an estimated 2,300 nesting pairs and increase the number of Common Terns to an estimated 5,750 nesting pairs over the 50-year life of the project (see Table 1 Number of Nesting Pairs of Terns by Alternative).

This alternative would fill 28,050 sf (0.64 ac) of salt marsh, which would be compensated off-site at Apponagansett Bay and Little Bay. Some salt marsh would be temporarily excavated during construction and replaced at the toe of the new revetment. This alternative would also fill over 2 acres of intertidal and shallow subtidal habitat

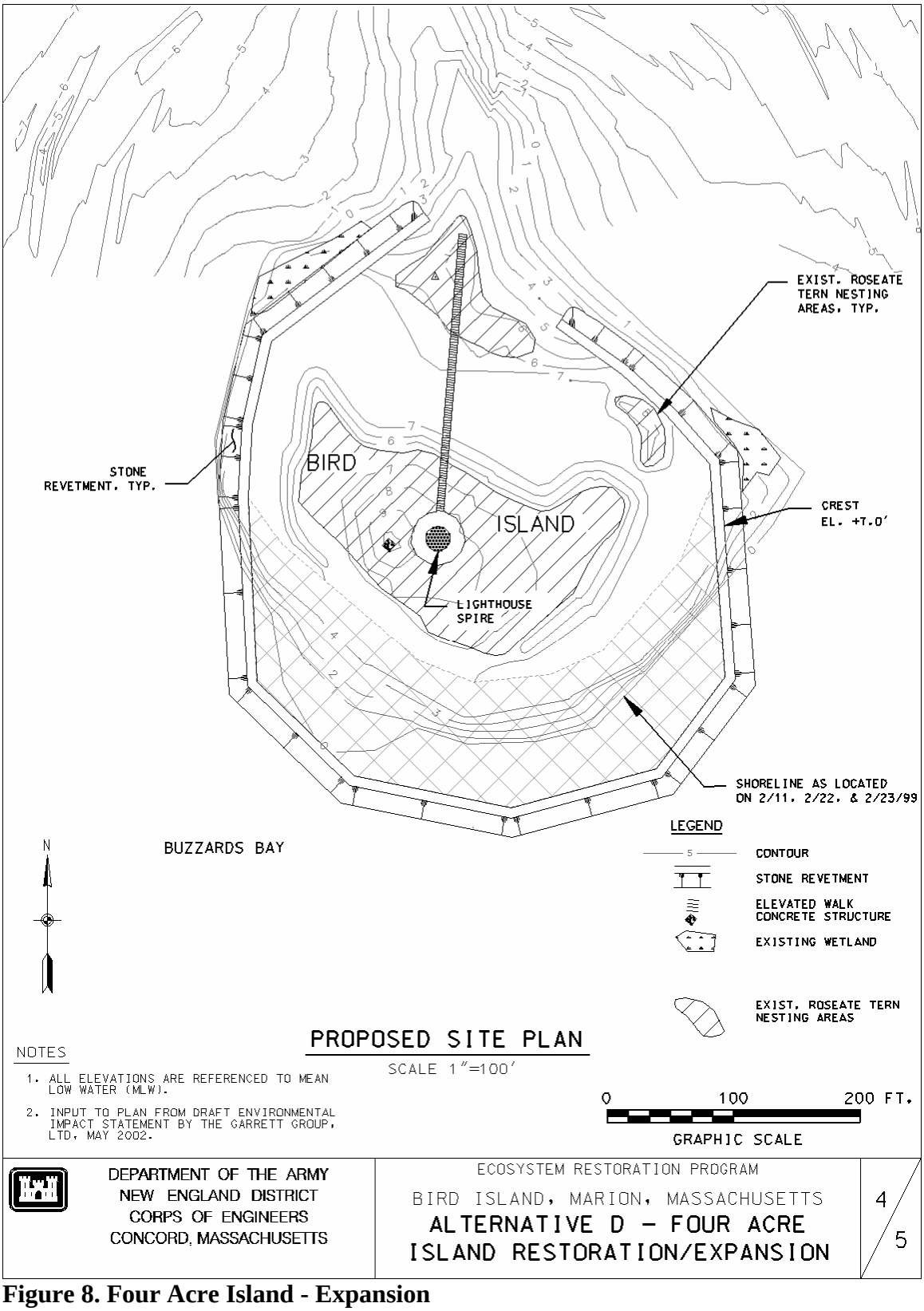


Figure 8. Four Acre Island - Expansion

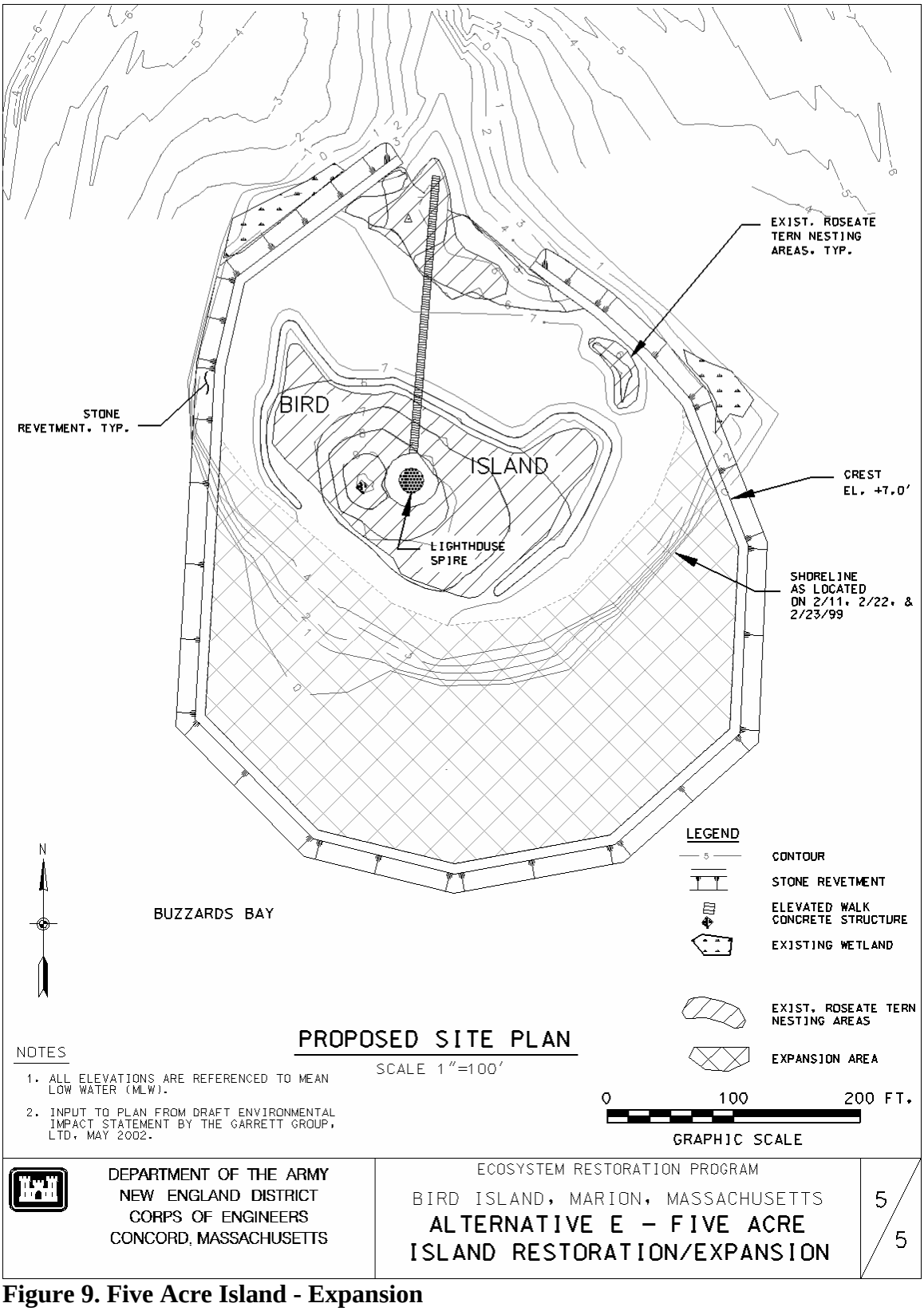


Figure 9. Five Acre Island - Expansion

Alternative Revetment Alignments for Alternative C

Three revetment Alignments were also evaluated for Alternative C to evaluate differences in impacts to intertidal habitat. The preferred Alignment, C-1 permanently replaced 8,800 sf of intertidal habitat with a stone-slope revetment and temporarily impacts 17,390 sf during construction of the revetment buried toe. By moving the revetment landward, Alignment C-2 reduced intertidal impacts to 16,215 sf of temporary impacts and Alignment C-3 eliminated impacts to intertidal habitat. However, current and potential nesting habitat was substantially reduced as the alignments were moved landward. Alignment C-2 and C-3 would result in an estimated reduction of 13,400 sf and 26,700 sf, respectively, of tern nesting habitat (based on the restored habitat conditions of Alterative C). This reduced island size could reduce the number of potential nesting terns from the optimal conditions proposed in Alternative C-1 by 600 for Alignment C-2 and 1,225 for Alignment C-3 (based on an estimated carrying capacity of 500 pairs of terns per ¼ acre). The goal of the project is to restore nesting habitat, a severely limited resource, for the Federally endangered Roseate Tern; therefore, Alignments C-2 and C-3 did not meet the goals of the project and were eliminated from further evaluation. This determination of practicable impacts was made in recognition of the site-specific environmental conditions and goals of the project.

Mitigation Analysis

To meet the proposed project goals for restoration of tern nesting habitat, Alternative C would fill 28,050 square feet (sf) (0.64 ac) of salt marsh landward of the revetment. Due to constraints with island size and surrounding intertidal habitat, avoidance and on-site mitigation was determined to be infeasible. Although the Corps of Engineers normally plans and designs ecosystem restoration projects to avoid any requirement for compensatory fish and wildlife mitigation, mitigation is proposed in this case because of the high value of the habitat directly affected by the project (salt marsh) and the extremely high value of the habitat to be restored (critical habitat for a Federally–listed endangered species). Therefore, unavoidable impacts to salt marsh landward of the revetment would be compensated off-site through the restoration/enhancement of 0.3 ac of salt marsh at Apponagansett Bay in Dartmouth and 0.5 ac of salt marsh in Little Bay in Fairhaven (for a total of 0.8 ac). Salt marsh located at the toe of the existing revetment (three areas totaling 5,300 sf or 0.1 ac) would be temporarily excavated during construction and replaced at the toe of the new revetment. To minimize this temporary disruption and avoid stockpiling of the salt marsh vegetation during construction of the revetment, the toe of the revetment would be constructed in sections with the underlying substrate and salt marsh replacement made immediately upon completion of each section.

Three different alternative alignments were considered to avoid and minimize impacts to intertidal habitat (see Alternative Revetment Alignments for Alternative C); however, moving the revetment out of the intertidal area (landward) would detrimentally impact tern nesting habitat and would not meet the goals of the project. Based on the alternative analysis and modifications to the revetment design to limit its footprint, impacts to intertidal habitat were avoided to the maximum extent practicable. There are 8,800 sf (0.2 ac) of intertidal impacts associated with the recommended plan (Alternative C). Some of the functions and values of the

intertidal habitat will be regained, as colonization of the aquatic invertebrates will occur on the revetment to a limited degree over time. On-site mitigation of intertidal habitat was determined to be infeasible and therefore, off-site compensation of intertidal habitat will be pursued through tidal channel restoration at the Apponagansett Bay restoration site in Dartmouth. The functions and values of intertidal habitat temporarily impacted by the construction of the buried revetment toe will restore naturally over time.

Mitigation Sites

Apponagansett Bay Mitigation Site

Salt marsh filled to restore tern nesting habitat at Bird Island will be compensated at Apponagansett Bay in Dartmouth, Massachusetts, 14 miles southwest of Bird Island within Buzzards Bay (Figure 10). Salt marsh would be restored at a small cove within Apponagansett Bay by removing a stone and soil filled walkway across a tidal spur on the cove and replacing it with a wooden walkway. Approximately 400 cubic yards of soil would be removed to restore elevations similar to the surrounding salt marsh (between mean tide level and mean spring high water). All of the material excavated to restore salt marsh elevations would be transported to the town composting facility approximately 1 mile from the site. The existing path would be replaced with a 4-foot wide wooden walkway 4 feet above the marsh surface. The fill removed would allow the direct restoration of 0.3 ac of salt marsh within the footprint of the path. Intertidal habitat restoration will be accomplished at this site through the restoration of the tidal channel, which will provide intertidal habitat benefits, the restoration of natural tidal flushing in Apponagansett Bay and the salt marsh north of the path, and enhance access for fish and other mobile fauna within the cove.

The estimated cost of salt marsh restoration at this site is $120,000, including real estate costs.

Little Bay Salt Marsh Restoration Site

A portion of the salt marsh filled to restore tern nesting habitat at Bird Island will be replaced at Little Bay in Fairhaven, Massachusetts, 8 miles southwest of Bird Island within Buzzards Bay (Figure 11). Salt marsh would be restored at the Little Bay site on Sconticut Neck by grading a 0.5 ac portion of the marsh presently dominated by common reed (*Phragmites australis*) to elevations that will support salt marsh vegetation (i.e. lower than mean spring high water). Approximately 670 cubic yards of soil would be removed to restore elevations matching the surrounding salt marsh. All of the material excavated to restore salt marsh elevations would be transported to one of the town composting facilities approximately 1.5 to 3 miles from the site. Reducing the elevation of the common reed marsh would increase tidal flooding increasing soil water salinity and allowing salt marsh vegetation to reestablish on the site. The estimated cost of salt marsh restoration at this site is $63,000, including real estate costs.

Figure 10. Apponagansett Bay Salt Marsh Restoration Site

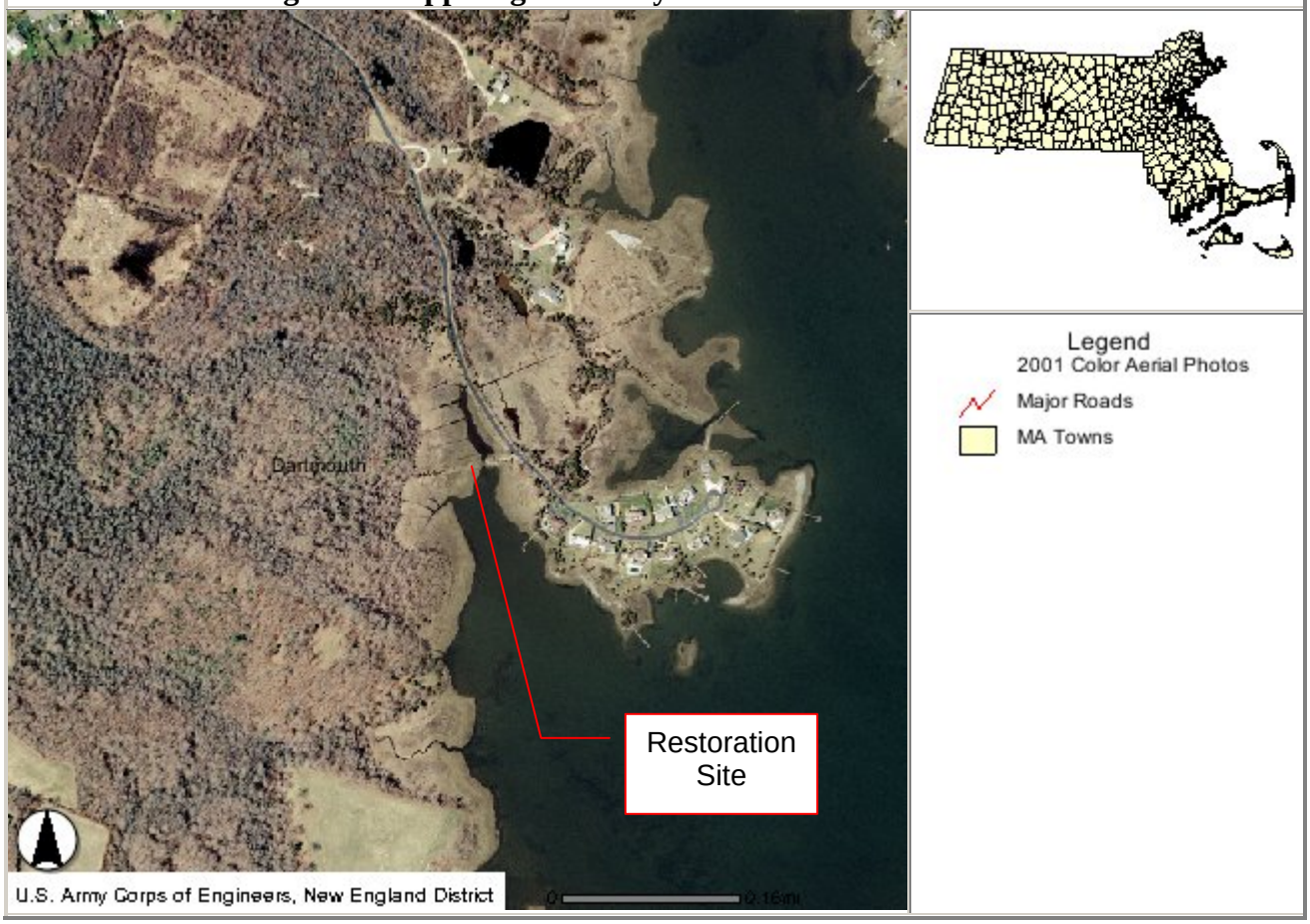


Figure 11. Little Bay Salt Marsh Restoration Site

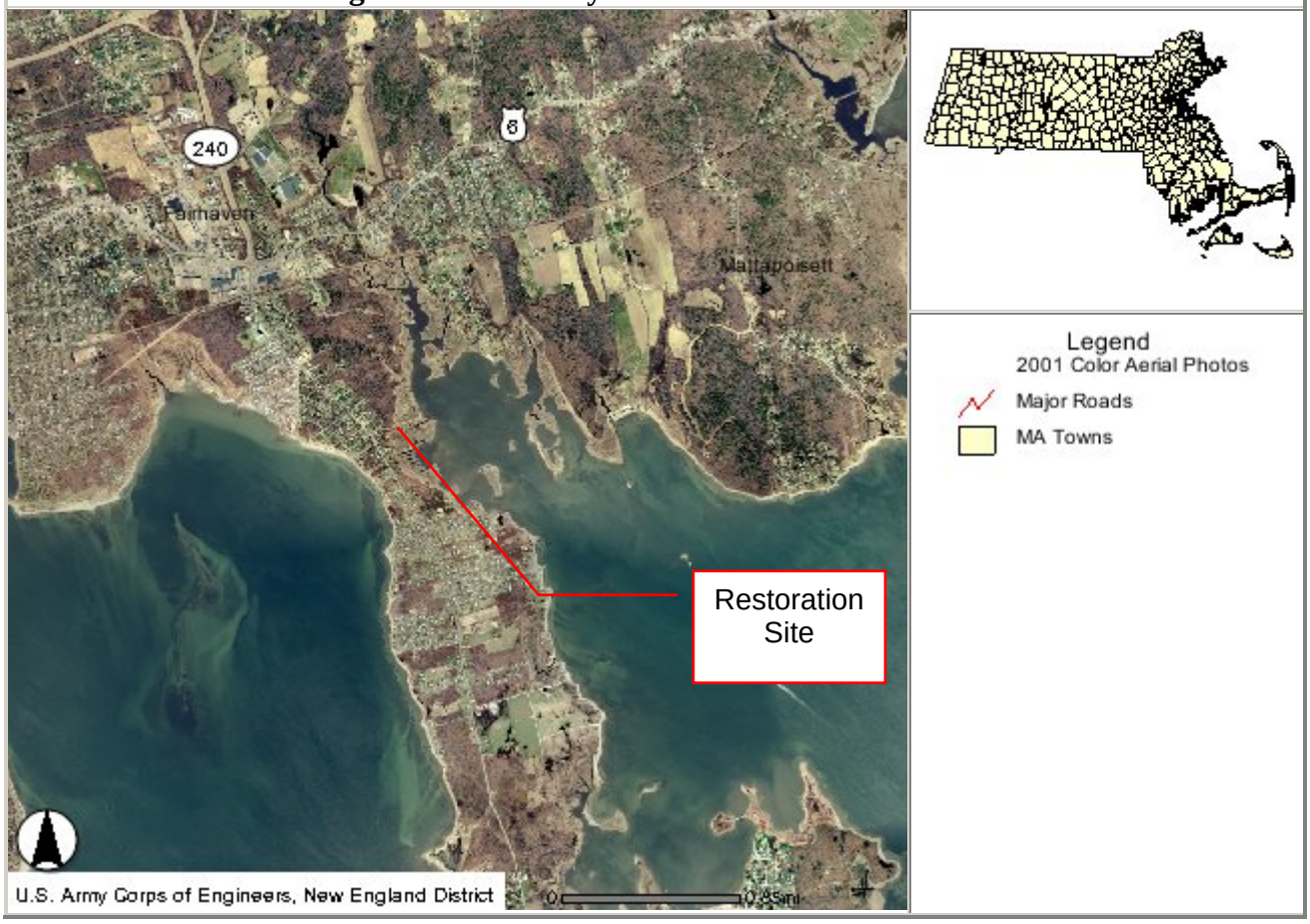


Table 1 –Number of Nesting Pairs of Terns by Alternative

Alternatives	Acres of Suitable Nesting Habitat	Number of Pairs of Nesting Roseate Terns	Number of Pairs of Nesting Common Terns
Alternative A – No Action (in 50 years – life of the project)	1.0	471	1,179
Alternative A – No Action (in 25 years, mid-project life)	1.25	614	1,536
Alternative B – Revetment Restoration	1.5	750	1,900
Alternative C – Revetment and Nesting Habitat Restoration on 3-Acre Island	2.2	1,157	2,893
Alternative D – Revetment and Nesting Habitat Restoration on 4-Acre Island (Expansion)	3.2	1,728	4,322
Alternative E – Revetment and Nesting Habitat Restoration on 5-Acre Island (Expansion)	4.2	2,300	5,750

Note: The number of nesting pairs of terns per Alternative is derived from an extrapolation of the existing conditions as represented in Alternative B (based on average tern densities on Bird Island from 2001 to 2005 provided by the Massachusetts Division of Fisheries and Wildlife (MA DFW 2005)). It is assumed that ¼ acre of suitable nesting habitat will support approximately 500 pairs of nesting terns and the ratio of Roseate Terns to Common Terns remains similar (approximately 1 pair Roseate Tern per 2.5 pairs Common Terns). No loss of habitat predicted over the 50-year project life for Alternative B-E due to periodic maintenance.

Alternative Fill Material Sources

Sources of material to be used to restore substrates at Bird Island include dredged material from the Cape Cod Canal, purchase from an operating sand and gravel provider, and an upland excavation source. The study team considered the possibility of obtaining the sand from a Corps of Engineers restoration site located in the town of Bourne (Village of Buzzards Bay), Massachusetts where the restoration project involves removing sand from a filled wetland. This site, approximately 7.5 miles from Bird Island by barge, would have had the added benefit of sharing the excavation cost among the two project, but evaluation of this option indicated that it would be much more expensive than obtaining the material from a dredging project and logistically difficult. Therefore, this option is not considered in detail in this report. The dredging and material purchase options are discussed in detail in the sections below.

Cape Cod Canal Maintenance Dredge Site

Approximately 2,700 cubic yards of sand is required to restore the substrate at Bird Island. This material can be obtained from the periodic maintenance dredging of the Cape Cod Canal. Shoaling in the Cape Cod Canal requires frequent dredging to maintain safe navigation. Because of the relatively high current velocities, the substrate within the Canal is predominantly sand and gravel, or larger material. The Corps of Engineers actively seeks opportunities to beneficially reuse dredged material and the proximity of the Cape Cod Canal to Bird Island and the quality of the material in the canal provides an excellent opportunity for beneficial reuse.

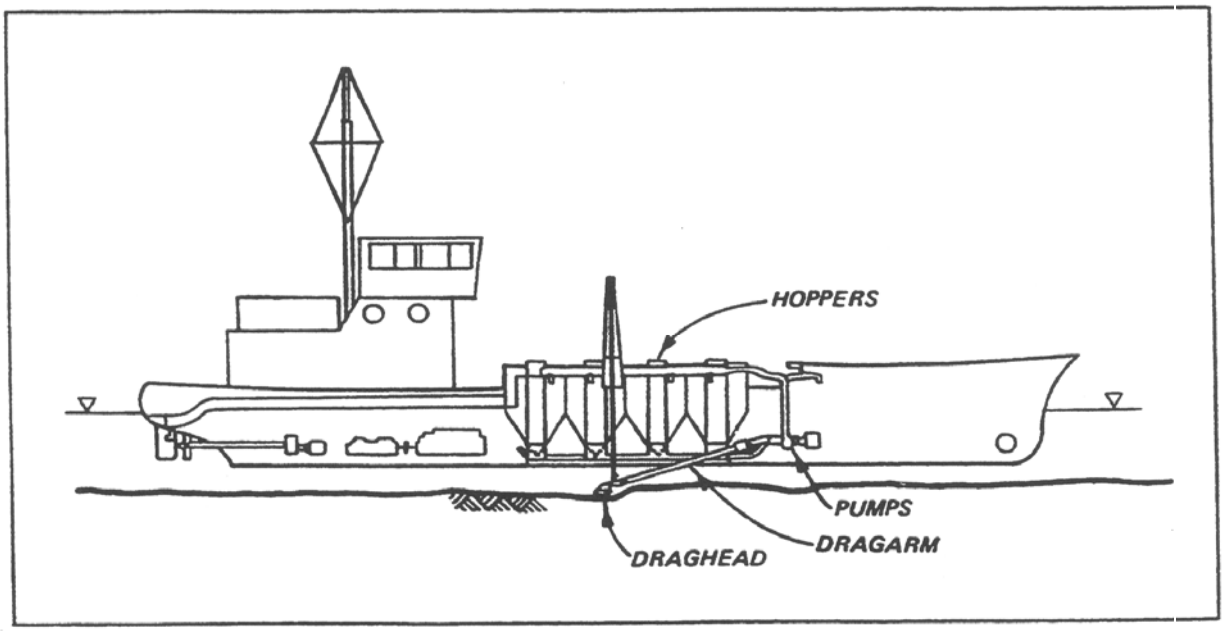
In entirety, the Cape Cod Canal measures 17.4 miles. The western end of the Canal originates at the head of Buzzards Bay in close proximity to Bird Island. The entrance from Buzzards Bay on the west side nearest to Bird Island is composed of the Cleveland Ledge Approach Channel and the Hog Island Channel, which lead to the Canal. The Cleveland Ledge Channel is located 1.6 miles from Bird Island at its closest point. The Hog Island Channel is located approximately 2 (west end) to 6 (east end) miles from Bird Island. Although the specific location of dredging at the Cape Cod Canal could change depending on the dredging needs at the time when the Bird Island Restoration Project moves to implementation, these reaches provide the least costly opportunities to provide dredged material to Bird Island.

The material used at Bird Island must be of suitable composition to support tern nesting. There are no known definitive references on the size of material for tern nesting, but suitable substrates are generally described as sand, gravel, or shell. Table 2 shows the composition of surface material at Bird Island. Sample A represents material from the Roseate Tern nesting area. Sample B was collected in a Common Tern nesting area and Sample C was collected in a beach front Common Tern area (not used for nesting). The material to be removed from the west end of the Hog Island Channel consists of medium to fine sand (see Appendix D). Of eight samples collected in this area in 1996, only one contained more than 1 percent fines (silt/clay). The composition of medium sand ranged from 6 to 76 percent. The composition of fine sand ranged from 18 to 82 percent. As shown in Table 2, this material may be compatible with material on Bird Island depending on the precise location of dredging in the Canal.

Table 2. Bird Island Grain Size Comparisons

		Bird Island Samples				Hog Island Channel Location							
	mm Size	A	B	C	EIR Sample	W	X	Y	Z	AA	BB	CC	DD
% gravel	>4.76 mm	31	4	7	11	4	4	<1	<1	<1	<1	<1	<1
% coarse sand	2.0 to 4.76 mm	7	2	31	45	1	2	3	3	2	3	2	<1
% med. sand	0.42 to 2.0 mm	39	78	60	36	76	76	50	52	18	16	17	6
% fine sand	0.074 to 0.42 mm	11	15	1	7	18	18	46	44	79	80	80	82
% fines	<0.074 mm	12	1	1	1	<1	<1	<1	1	1	1	1	12
		100	100	100	100	99	100	99	100	100	100	100	100

Material would be dredged from the Canal and transported to the Bird Island site on a hopper dredge. Hopper dredges are self-propelled crafts that include an integral suction pipe or several suction pipes, which are dragged along the channel bottom. The bottom materials are drawn through a suction head on the drag arms, passed through the suction pipe and centrifugal pump, and deposited, as a slurry, in a large onboard hopper. In the hopper, most of the sand settles out and the excess water runs overboard. After loading, the hopper dredge can cruise to a designated dumpsite, open the bottom doors, and discharge the dredged material. For the Bird Island Restoration Project, the dredged material would be pumped onto the island. Hopper dredges are able to operate in sea conditions that would severely restrict the safe operation of other types of dredges. In addition, hopper dredges present minimum interference to other vessel operations when working in busy channels and are able to efficiently transport dredged materials over short-haul distances. This type of dredge is well suited to perform maintenance dredging in the Cape Cod Canal given the strong currents and predominance of elongated shoals.



Source: McLellan et al., 1989

The disposal sites identified below have previously been used for disposal of Cape Cod Canal dredged material. They will serve as the basis for calculating the cost of the base plan using the Section 204 guidance. Cost for dredging in excess of the cost of the base plan will be shared with the non-Federal sponsor at a ratio of 75% Federal: 25% non-Federal. Although the two sites have been established in the vicinity of the Cape Cod Canal, only the Cape Cod Bay Disposal Site is currently available. Therefore, the Cape Cod Bay Disposal Site is used in the calculations in this report.

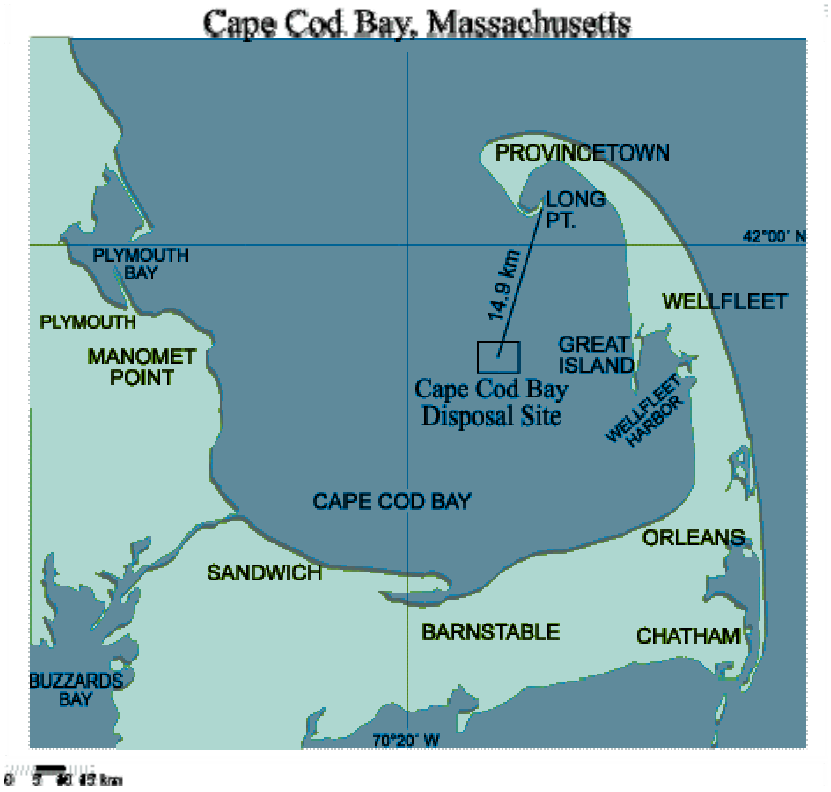
Cape Cod Bay Disposal Site -Site 1 - A circular area, one nautical mile in diameter, located about 3.6 miles northeast of Cape Cod Canal Buoy #1. The center is located at 41'-49'N, 70'-25'W (Figure 12).

Buzzards Bay Disposal Site at Cleveland East Ledge - Site 2 - This site is a rectangular area 2,000 feet long, bearing 106 degrees true and 1,400 feet wide, bearing 16 degrees true. The center of the area is a point 700 yards southeast of Cleveland East Ledge Light on bearing 304 degrees 30 minutes true. Depths in this site range from 10 to 13 meters (33 to 43 feet) (Figure 12).

The cost of transporting 2,700 cubic yards of sand from the Hog Island Channel to Bird Island is estimated at $51,000. The base plan cost of dredging and disposing of this 2,700 cubic yards of material in open water at the Cape Cod Bay Disposal Site is estimated at $6.50 per cubic yard, a total of $18,000. Therefore, the incremental cost of reusing the material at Bird Island instead of open water disposal is $33,000.

Sand Purchase for a Sand and Gravel Operation

Sand for the Bird Island Restoration Project could be purchased from a sand and gravel operation on the mainland. This option would require the material to be purchased and transported by truck to the offloading site in New Bedford, placed in a barge, then transported to Bird Island where it would be offloaded by a crane or excavator. The estimated cost of purchasing, then transporting 2,700 cubic yards of sand from an upland site to Bird Island is $73,000.



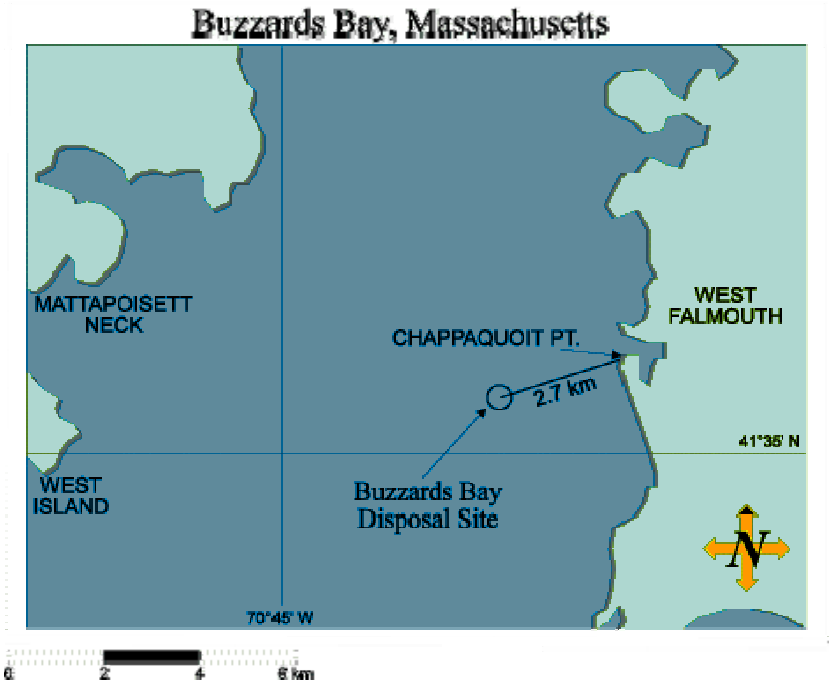


Figure 12. Locations of open water disposal sites

Comparison of Alternatives

Island Restoration Alternatives

Each of the restoration alternatives (i.e. Alternatives A, B, C, D, and E) considered in this report consists of a combination of measures formulated to combine cost effective features that minimize environmental impacts and maximize benefits, within project constraints. The study team also recognized the value of intertidal and subtidal habitats surrounding the island; therefore, the revetment is designed to minimize its footprint while achieving the project purpose.

The project team including the Corps of Engineers, the Massachusetts Division of Fisheries and Wildlife, Town of Marion, Massachusetts Office of Coastal Zone Management, Massachusetts Division of Marine Fisheries, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Environmental Protection Agency, Massachusetts Audubon Society, and others met a number of times to discuss the potential restoration alternatives. Based on these discussions and considering the quality of subtidal habitats near Bird Island and the presence of potential alternative options for tern habitat restoration, the group decided that island expansion should not be pursued at this site because of its adverse affect to valuable intertidal and subtidal cobble habitats. Therefore, the island expansion alternatives (Alternatives D and E) were removed from further consideration and are not discussed in detail in this document. This decision left three possible alternatives (including No Action) for consideration.

Appendix B contains an Incremental Analysis, which compares the incremental costs and benefits of the Bird Island restoration alternatives. The purpose of an Incremental Analysis is to display and evaluate the change in cost and benefits for the various alternatives to help decision makers select among the various plans. The information generated helps to identify the best restoration alternative.

The incremental cost associated with an alternative is the added cost for each additional unit of benefit. The benefits and cost of each alternative (including first cost, interest during construction, and projected maintenance costs[1]) and the incremental costs are summarized in Table 3. In this case, the units of benefits are additional pairs of nesting Roseate Terns. So, the analysis indicates the added cost required to obtain additional pairs of Roseate Terns when moving from a smaller alternative to the next larger alternative. Table 3 shows that the cost "to buy" the alternative that provides 136 more pairs of Roseate Terns compared to the future conditions without the project (an island eroded to a smaller size) is $3,245,600, almost $24,000 per tern pair. However, the next increment of benefit – 543 more pairs of Roseate Terns, costs only $241,200, or only $6,400 per tern pair. So it is clearly worth it to buy the next increment of benefits.

1 These are the economic costs considered in the Cost Effectiveness/Incremental Cost Analysis, rather the financial costs shown in other sections of this report.

Both Alternative B and C are cost effective. A plan is not cost effective if compared with another alternative, it provides fewer or the same number of habitat units at a higher cost. Best buy plans are a subset of cost effective plans. For each best buy plan there are no other plans that will give the same level of output at a lower incremental cost. The analysis identified Alternative C as a Best Buy plan and the National Ecosystem Restoration (NER) Plan.

Table 3. Costs and Output of Feasible Bird Island Restoration Alternatives

Alternative	Cost of Alternative (1,000's)	Incremental Cost of Alternative (1,000's)	Incremental Benefit (No. R. Tern Pairs)
Alternative A	$0	NA	NA
Alternative B	$3,245.6	$3,245.6	136
Alternative C	$3,486	$3,486.8	543

*Based on 2001 data published in the 2002 EIR that was available when the Incremental Analysis was prepared.

Sand Source Alternatives

The alternative sources of material to restore the substrate alternatives included an in-water dredging source and upland sources. The environmental effects of the in-water source (dredging the Cape Cod Canal) are negligible since the small amount of material required would be obtained from an ongoing larger scale dredging effort. The upland source is an upland quarry source in Acushnet, Massachusetts. Obtaining the material from an upland source would generate about 250 truck trips across local roads, which would be avoided with the Hog Island Channel source. In addition to having a greater potential for adverse environmental effects, the upland source is substantially more expensive than obtaining the material from dredging the Cape Cod Canal, Hog Island Channel. The costs of various sand sources and separate transportation costs are shown in Table 4. No matter where the upland source is located relative to Bird Island, the distance to barge the sand to Bird Island from the nearest suitable port (New Bedford) is greater than the barge distance from the Cape Cod Canal dredging. The nearest port facility to Bird Island capable of handling such a transfer is in New Bedford, Massachusetts, which is 15 miles from Bird Island; the Canal dredging site is only 2 to 6 miles from Bird Island.

Table 4. Cost of Alternative Sand Sources for Restoring Bird Island

Activity	Cost
Purchase 2,700 cy of sand	$54,000
Dredge and transport 2,700 cy of sand from Hog Island Channel to Bird Island	$51,000
Transport 2,700 cy of sand from Hog Island Channel to Cape Cod Bay Disposal Site	$18,000
Transport (by truck and by barge) 2,700 cy of sand from an upland site to Bird Island	$19,000

Detailed Description of the Recommended Plan

The Recommended Plan (Alternative C) involves restoring the stone revetment and placing fill onto the island within the perimeter of the new revetment (Figure 5). Restoring the stone revetment would stabilize the shorefront and attenuate wave energy, protecting the island from all but extreme storm waves, and would reduce the rate of erosion of upland material. The existing revetment would be removed and the new revetment constructed in 25-foot-long segments to protect the island during construction and allow salt marsh affected to be reestablished rapidly as the construction proceeds. Sand from dredging the Cape Cod Canal Hog Island Channel would be transported to Bird Island in a hopper dredge, then pumped onto Bird Island where dozers and other heavy equipment would distribute it onsite. Because the exact source of the material within the Canal has not been identified, the project costs include the cost of excavating and stockpiling the existing surface material at Bird Island to use to cover the new sand from the dredge site. Replacing this material would restore appropriate substrates for nesting terns outside the range of tidal influence. (Sampling prior to construction will determine whether this step is necessary based on the grain size of the available material.) Sensitive areas on the island would be delineated prior to construction to exclude heavy equipment. The restored nesting areas improve and expand Common Tern nesting areas within the revetment, reducing their encroachment into the higher elevation, vegetated Roseate Tern nesting areas. The fill, in combination with management practices, including placement of nest boxes, would allow the Roseate Tern population to increase without adversely affecting the Common Tern populations. This alternative would provide a suitable substrate to increase the number of nesting pairs of Roseate Terns to an estimated 1,157 and Common Terns to 2,893 nesting pairs over the 50-year life of the project.

The recommended plan provides mitigation at the Apponagansett and Little Bay salt marshes to balance impacts to salt marsh. The features of these sites are described in the Mitigation Sites Section (page 20).

A temporary pier, extending to –5.0 feet MLW would be installed at the north end of the island. Temporary haul roads would be constructed to move equipment around the island, but no equipment would be permitted in the Roseate Tern nesting areas.

The off island staging site located near the Marion Harbormaster's office is 0.76 miles from Bird Island by water. Materials for the project would be shipped via barge from New Bedford, as this is the best and closest facility to load stone and construction material for the project. There are at least three facilitates within Fairhaven and New Bedford that can provide this service. New Bedford Harbor is approximately 15 miles from Bird Island.

Stone Revetment Analysis

The existing and recommended revetments are 1,000 feet long around most of the perimeter of the island.

The Garrett Group, Ltd used the storm wave heights presented in Table 7 to compute revetment stone size requirements for an improved engineered revetment. The crest elevation of the improved revetment will be fixed at its current nominal elevation of 7.0 feet MLW. While extreme storm events (greater than the 5-year storm) will overtop the revetment and inundate the entire island, the improved system will be highly resistant to the erosive forces associated with the semi-diurnal mean high water tide levels coupled with the 7.0 foot wave and lower (MA DFW, 2002).

The revetment should be constructed with a gradual slope, not to exceed 1Vertical to 3 Horizontal (1V:3H) to maximize wave energy attenuation on the structure. Further steepening of the seaward slope would increase wave run-up and potential overtopping. The effects of wave overtopping of the structure can be partially mitigated by extending the width of the improved stone crest from the typical two armor stone widths (i.e. 5 ft) to at least 10.0 feet, which corresponds to four armor stone widths.

The Corps of Engineers (COE) computed the D_{50} stone size (median stone size) for waves associated with the Mean High Water, 1-year wave and the 7.0 foot design wave for various revetment side slopes using the SPM Hudson Equation. The results of this analysis are presented in Appendix E, Table 4.

The revetment has been designed to minimize the loss of island nesting habitat and intertidal resources while serving the primary purpose of protecting the island from further erosion. The revetment would have a crest width of 10 feet and a crest elevation of 7.0 feet MLW. The face would be constructed with rough random stone placement and a slope of 1V:3H. The revetment incorporates a buried toe for scour protection, due to the fact that the cobble existing on the beach is a veneer, and the silty sand underneath the cobble is vulnerable to erosion. The revetment would have a 5-foot thick armor layer composed of stone weighing from 1,700 to 2,800 lbs. The underlayer stone would be 2 feet thick and composed of stones weighing from 170 to 280 lbs. The stone bedding layer would be 1 foot thick, corresponding to twice the maximum stone bedding size of 6 inches. A nonwoven geotextile fabric would be placed between the native soil and the bedding stone material to provide separation between the two materials. The geotextile separation layer would be wrapped within the toe of the revetment to provide anchoring. An estimated 30% of the stones for the new revetment would be obtained from the existing stone revetment.

Preliminary Construction Sequence

The following initial construction sequence has been developed for project planning and design purposes:

- Mobilize at Marion staging site
- Construct pier to access Bird Island
- Construct revetment in 25 foot long segments to minimize exposure of the island to erosion

- Excavate salt marsh in 25 foot long segments in advance of the revetment construction and place the underlying substrate materials and salt marsh on the previous segment of new revetment
- Grade off-site replacement salt marsh
- Excavate and stockpile the existing substrate material from the areas to be filled on Bird Island to provide the final nesting substrate surface layer
- Dredge sand from the Cape Cod Canal and pump onto Bird Island to fill depressions
- Grade filled areas and cover with the stockpiled excavated native island material
- Plant graded areas and install nest structures
- Demobilize

Terns begin arriving at Bird Island at the end of April, and the earliest eggs now typically are laid during the second week of May. Laying may continue into mid-August. Most terns begin moving in July to staging areas in the region before starting migration a few weeks later to South America; however, terns may be present on the island until early September. To avoid impacts to terns during nesting or pre-migration, no construction work will be permitted on Bird Island between April 7th and September 7th (MA DFW, 2004a).

Implementation Schedule

Implementation of the recommendations contained in this report is subject to Corps of Engineers review, approval and funding processes, and sponsor participation, including execution of a Project Cooperation Agreement (PCA). Upon receiving project approval from the North Atlantic Division, the New England District must prepare plans and specifications prior to solicitation of bids and contract award. Construction of the project is scheduled to begin in the fall of 2007, provided all approvals and funding are obtained.

Operation and Maintenance

As non-Federal sponsor, the Massachusetts Executive Office of Environmental Affairs (EOEA) will be responsible for operation and maintenance of the completed project. Operation and maintenance would include:

- Periodic inspections of the revetment and substrate
- Relocating revetment stones shifted during storms
- Replacing substrate eroded during major storm events

The estimated maintenance cost is $210,000 over the 50-year project life, or $4,200 per year in today's dollars.

Real Estate Requirements

As non-Federal sponsor the EOEA must provide all lands, easements, rights of way and disposal areas needed to construct the project. The project will require about one acre of the

town owned land on Front Street for a staging and off- loading for accessing the island. The temporary easement for this site is valued at $9,000 for a 6-month construction term.

Additional real estate costs are associated with the salt marsh mitigation sites. Permanent easements will be required for the 0.8 acre of land required for the mitigation sites. Temporary easements will be acquired over the public streets adjacent to the mitigation sites.

Project Costs

Project costs are displayed in Table 5. The total estimated project implementation cost (i.e. excluding operation and maintenance) is $3,775,000. This includes costs for the feasibility study ($180,000), plans and specifications ($200,000), construction ($3,350,000), and LERRDs ($45,000). Operation and maintenance over the 50-year project life, consisting of replacing eroding sand surface and repositioning revetment as necessary is projected to cost $210,000.

Table 5. Cost of Major Project Features

Feature		Alternative C
Revetment Construction		2,709,000
Island Substrate Work		122,000
Salt Marsh Replacement		167,000
Real Estate		45,000
Maintenance		210,000

Financial Analysis

The non-Federal sponsor, the EOEA, has indicated its willingness to execute a Project Cooperation Agreement (PCA) for the project. EOEA has partnered with the New England District on similar, now completed, environmental restoration projects. EOEA is aware of and capable of meeting its financial obligations for the project.

Views of the Sponsor

The Commonwealth of Massachusetts, Office of Coastal Zone Management and Division of Fisheries and Wildlife, strongly supports the project and the Recommended Plan pursuant to views expressed at interagency coordination meetings and coordination letters received.

Affected Environment

General Setting

Bird Island is approximately 3.0 acres in size, 1.5 of which is above the Mean Spring High Water tide (4.5 feet Mean Low Water), with a shoreline frontage of approximately 1,250 linear feet. Existing features on the island include a deteriorating stone revetment and a stone and masonry lighthouse facility that is listed on the National Register of Historic Places. The granite stone revetment extends along approximately 1,100 linear feet of intertidal shoreline. The highest point of the island is 10.0 feet above Mean Low Water. The northern extent of the island is not armored and gradually extends to an elongated, gravelly/sandy beach and intertidal/subtidal spit.

The island provides critical nesting habitat for Roseate Terns (*Sterna dougallii*), listed as federally and state endangered, and Common Terns (*S. hirundo*), a Species of Special Concern in Massachusetts. Island resources include vegetated uplands, seven distinct areas of salt marsh ranging in size from less than 50 square feet to 9,300 square feet, two salt pannes and contiguous tidal and subtidal resources including offshore eelgrass (*Zostera marina*) beds. Tern feeding areas in the vicinity are rich in American sandlance (*Ammondytes americanus*), Atlantic herring (*Clupea harengus*), and blue-backed herring (*Alosa aestivalis*), preferred forage for terns in this area. In addition, Bird Island and contiguous areas within Buzzards Bay provide a diverse assemblage of coastal habitat types, which support a wide range of aquatic and terrestrial marine species.

Physical Environment and Site Hydrology

The Massachusetts Division of Marine Fisheries (MA DMF) conducted an underwater biological survey in July of 1999. The subtidal substrate conditions were observed to be primarily rocky from the western end of Bird Island southward toward the eastern side of the island ending approximately 150 feet south of the sand bar. A sandy bottom was observed from the northwestern end of the island continuing easterly towards the sand bar to south and east of the sand bar (MA DMF, 1999). Similar physical conditions were observed in an intertidal/subtidal survey conducted by the MA DMF during the summer of 2004 (MA DMF, 2004b).

Bird Island is exposed to the long southwest fetch of Buzzards Bay where large wave forces originate causing continuous erosion of island materials. These materials have historically been distributed to the subtidal environment to the north and northeast of the island. Bird Island is subject to intense coastal storms, most notably, hurricanes and nor'easters, which yield extreme water surface elevations and severe wind generated waves. Approximately 1.5 acres (ac) of Bird Island exists above Mean Spring High Water and is suitable for ground-nesting birds. The highest point on the island is reported to be 10.0-ft. Due to the state of disrepair of the island, much of the tern nesting area is washed over during winter storms, or even during wind-induced tidal surges in summer (MA DFW, 2002).

Historic records indicate the walls limited erosion and fill loss when in good repair. This indicates that the existing revetment elevation of 7.0 feet MLW with a revetment width of 6-8 feet provided erosion protection from daily wave action and while the larger extreme storm tides inundate the island they do not create damaging erosive wave forces since the island is inundated by the stillwater elevation during these extreme in-frequent tidal events. Since the revetment has deteriorated in various stages of disrepair over time, the island has become unprotected from frequent tidal inundation. An expanding area inside the armoring has eroded soils, sand and gravel and is now intermittently flooded by extreme high tides and supports salt marsh and salt panne resources. These areas are no longer suitable for either Roseate or Common Tern nesting habitat.

The wind and wave climate that characterize the site were detailed in Bourne Consulting Engineers report dated 2001. That report, based upon empirical wind and wave records, notes that the predominant wind direction at the site is from the southwest. The coastal processes analyzed considered the effects of winds originating between 90 and 225 degrees due to the effective restriction of the fetch lengths from other directions.

The 2002 EIR indicates that during site visits conducted by Garrett Group on March 15, April 11 and 29, 2002 which included flooding and ebbing tidal conditions, observations indicated that the salt marshes and other tidally influenced habitats inside the stone revetment are only flooded by salt water during extreme astronomic high tides, or when the island is overtopped by storm waves and tides (MA DFW, 2002).

Tides in the study area, are semi-diurnal, with two high and low waters occurring during each lunar day (approximately 24 hours and 50 minutes). Tidal flood profiles, developed by the Corps for the open ocean along the New England coastline were used to estimate tidal flood frequencies at Bird Island (see Plate 3 and Plate 4 of H&H Appendix E). Stillwater elevations at the site are summarized in Table 6.

Wave Heights

The predominant direction of approach for severe storm waves ranges from the southwest to southeast. The height and periods for storm related waves originating over these southerly fetches generally depend on wind speed and duration, water depth, and fetch distance. Most waves impacting Bird Island originate within Buzzards Bay. Waves provide the primary driving forces governing erosion and the observed accretion/erosion of the Bird Island shoreline.

The length and average depth of the fetch for each of the eight directional bins were determined using a nautical chart of Nantucket Sound. Significant wave height (Hs) and wave period for three wind conditions are shown in Table 7 (Bourne *et al*. 2001).

As waves propagate into shallower water near shore, the height of the shoaling waves will change, and they will gradually change direction to conform to the bathymetry in that area.

Wave modeling predicts the major effects of average wave conditions on the island and provides the basis for determining trends in sediment transport direction (Bourne *et al*. 2001).

Table 6. Estimated Tide Levels At Bird Island Estimated from Corps of Engineers Tidal Flood Profiles, New England Coastline, September 1988

STORM EVENT	STILLWATER TIDE LEVEL AND REPORT DATUM (ft MLW)
100-year Frequency Flood Event	15.7
50-year Frequency Flood Event	13.6
10-year Frequency Flood Event	9.4
1-yr Frequency Flood Event	5.5
Mean Spring High Water (MSHW)	4.5
Mean High Water (MHW)	4.1
Mean Tide Level (MTL)	2.1
National Geodetic Vertical Datum (NGVD)	1.4
Mean Low Water (MLW)	0.0

Table 7. Average Wind And Wave Height Data (Buzzards Bay long-term averaged wind data split into three southerly directional bins, with estimated fetch length and average depth, used to compute significant wave heights (Hs) and periods of offshore waves approaching Bird Island)

Directional Bin	Wind Direction (Degrees)	Mean Wind Speed (mph)	Fetch (mile)	Average Depth of Fetch (feet)	Computed Hs Wave Height (feet)	Computed Wave Period (sec)
1	146-168	17.7	15.9	40	5.6	2.9
2	169-191	15.7	10.8	35	4.1	2.5
3	192-214	15.2	8.7	30	3.1	2.2

Waves approaching Bird Island from the south refract toward the island as they propagate across shallow water. This wave refraction process focuses wave energy along the southern facing shoreline. In addition, the relatively steep (relative to shoreline) wave angle along both the east and west shorelines also allows rapid erosion of any beach compatible fill material placed seaward of the stone revetment. This mean wave conditions at the site, based upon typical wind conditions over the fetch to the south of Bird Island, generated offshore average monthly significant wave heights (H_s) of 3.1 to 5.6 feet (Bourne *et al*. 2001).

The Garrett Group, Ltd evaluated storm related waves in the preparation of the 2002 EIR. The results of these storm wave analyses are summarized in Table 8. Storm waves originating in

deep water from any direction approaching Bird Island, will be transformed by refraction and shoaling as they approach the island. The relatively shallow depths along the toe of the revetment structure will cause the larger incident waves (e.g. 100-yr, 50-yr and 10-yr storm waves) to break prior to impacting the structure. Wave conditions are depth limited. Their quantification is required to determine the proper rehabilitation scheme for the revetment structure (MA DFW, 2002).

The ACOE reviewed the Garrett analysis and data and conducted a cursory wave height analysis that determined a wave height of 6.7 feet, which correlates to the 10-yr storm wave, has been determined the design wave to determine revetment stone size and revetment design width to minimize impacts to the island during frequent high tide levels and ensure stability of the revetment for the 50-year project life. Storm waves greater than the 10-yr wave break prior to impacting the structure.

The crest elevation of the improved revetment will be fixed at its current nominal elevation of 7.0 feet MLW. While extreme storm events will overtop the revetment and inundate the entire island, these extreme tides and associated waves do not create erosive forces since the island will be inundated by the stillwater. These extreme tidal events typically occur in the fall and winter months when the nesting terns are vacant from the island reducing the risk of devastating the nests. The bird nesting season is between April and July. The improved system will be highly resistant to the erosive forces associated for the semi-diurnal mean high water tide levels coupled with the 7.0 foot wave and lower (Garrett et al 2002).

Table 8. Non-Broken Deepwater Significant Storm Wave Conditions At Bird Island

Fetch	100-yr storm		50-yr storm		10-yr storm	
	Hs (ft)	T (sec)	Hs (ft)	T (sec)	Hs (ft)	T (sec)
SW	12.5	6.3	10.3	6.0	6.7	5.0
South	10.7	5.7	9.2	5.4	5.6	4.5
SE	9.7	5.3	8.4	5.0	5.1	4.2

Water Quality

The water quality classification for Sippican Harbor is Class SA. Class SA waters are designated as excellent habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation (314 CMR 4.00 Massachusetts Surface Water Quality Standards). These waters have excellent aesthetic value. The area is also open for shellfish harvesting. Surrounding water quality and salinity are dominated by consistent marine influences and large volume dilution. The cold, oxygen-laden and nutrient rich waters characteristic of the Sippican Harbor support a productive marine ecosystem composed of a diverse array of habitat types and biological resources.

Biological Resources

Over the last few years, the Massachusetts Division of Fisheries and Wildlife (MA DFW) proposed and managed a project to restore Bird Island for nesting Roseate and Common Terns. The baseline biological data collected for this project is contained within the 2002 EIR. Due to the similarity in habitat restoration goals of the MA DFW project and the Corps project and the biological information was reasonably current, the 2002 EIR data describing the existing conditions at Bird Island was used almost exclusively in the development of the Affected Environment, Biological Resources section of this report.

Island Habitat

More than half of Bird Island is covered by dense vegetation consisting of Hedge Bindweed (*Calystegia sepium*), Smartweed (*Polygonum* spp.), Mustard (*Brassica* spp.), Dock (*Rumex* spp.), Lambs Quarters (*Chenopodium* spp.), Seaside Goldenrod (*Solidago sempervirens*), Beach Pea (*Lathyrus japonica*), and Sea Rocket (*Cakile edentula*) during the tern nesting season. This is the preferred on-site habitat for Roseate Terns, but is unsuitable for Common Terns, which prefer open sandy areas with scattered vegetation with approximately 25 - 30% cover. Less than half of Bird Island is currently suitable for Common Terns, and this area is being reduced by erosion during winter storms. Common Terns are increasingly crowding into the remaining open areas and are infiltrating into the more vegetated areas preferred by Roseate Terns. Nesting in the latter is far less successful for Common Terns; however, they displace the Roseate Terns into smaller core areas.

Salt Marsh and Salt Panne

Salt marshes are generally considered one of the most important and productive types of ecosystems. A valuable component of the marine and estuarine food web, salt marshes typically support large numbers of marine invertebrates, shellfish, finfish and shorebirds for feeding and nursery/nesting habitat. Salt marshes produce large amounts of organic matter, which is exported as detritus or dissolved organics as the resource is submerged and exposed by the daily semi-diurnal tides. Salt marsh vegetation buffers the effects of storm generated energy, acts as a sediment trap and provides other water quality benefits through the removal of excessive nutrients and pollution.

Salt marshes are divided into two general types based on the frequency of tidal flooding: low marsh and high marsh. Low marsh or regularly flooded salt marsh extends to roughly the level of mean high water and is therefore flooded twice a day in New England. High marsh extends from the inland limit of low marsh to the level of the highest lunar tides (Lefor,1987). The low marsh vegetation in New England is typically dominated by salt marsh cordgrass (*Spartina alterniflora*) while the high marsh is typically dominated by salt hay grass (*Spartina patens*). Salt marshes typically support a number of other species, most notably spike grass (*Distichlis spicata*), which often make up a large portion of the high marsh. Salt pannes are

shallow depressions in the marsh surface that contain surface water, either temporarily or permanently, and do not support marsh vegetation.

Typically, tidal marsh development begins with the post-glacial submergence of land or the concurrent rise in sea level or both. The deposition and accumulation of sediments in embayments protected from the direct force of the sea gradually aggrades to eventually support the substrate and nutrient needs of salt marsh plants. The salt marsh resources on Bird Island however, are the result of historic anthropogenic activities and natural erosive processes, and over time have developed into jurisdictional wetland resources. The deterioration of circa 1843 armoring has resulted in the on-going and dynamic erosion of the island. Observations indicate that the patches of salt marsh/salt panne located on Bird Island are isolated areas and only have hydrologic/hydraulic communication with the surrounding Buzzards Bay during storm events, when the island is overtopped by storm waves and tides, or during wind driven or extreme high tides. These low areas are unsuitable for nesting habitat for the terns.

Bird Island salt marsh and salt panne resource areas were delineated and characterized by The Garrett Group (TGG), Ltd on March 15, 2002 for the 2002 EIR. The following wetland delineation methodology and wetland descriptions were extracted from this report. In summary,

> "wetland resources were delineated at the vegetative boundary between the observed halophytes and the salt-tolerant upslope invasive thicket, much of the latter being the preferred nesting habitat for the Roseate Terns. Random soil borings were conducted within the delineated resources and yielded limited information or observational conditions that indicated hydric soils. The lack of on-site hydric soils indicates that the hydrology is sporadic and probably occurs only during extreme tidal conditions" (MA DFW, 2002).

Interagency coordination with regard to the wetland delineation was accomplished during the preparation of the 2002 EIR. There was general interagency concurrence that the resource delineation is accurate (verbal comments from the Massachusetts Department of Environmental Protection (MA DEP) to MA DFW and TGG on April 29, 2002 and U.S Army Corps of Engineers correspondence dated May 24, 2002). See Appendix H- Salt Marsh and Salt Panne Resources for detailed descriptions of individual salt marsh and salt panne resource areas on Bird Island and Figure 6 - No Action plan for the location of each resource area.

According to the wetland delineation, Bird Island currently supports approximately 23,150 square feet (sf) (0.53 ac) of salt marsh resource, of which 17,850 sf (0.41 ac) exist landward of the stone revetment and 5,300 sf (0.12 ac) exist seaward of the stone revetment; 10,200 sf (0.23 ac) of salt pannes, all landward of the stone revetment; and 500 sf (0.009 ac) of tide pools within the salt marsh resource landward of the stone revetment. In total, the surface area of island resources under the federal and state jurisdictions landward of the stone revetment are 28,050 sf (0.64 ac) with an additional 5,300 sf (0.12 ac) seaward of the revetment. A functions and values analysis using a modified Army Corps of Engineers methodology was prepared for wetland resources identified on Bird Island as part of the preparation of the 2002 EIR. Of the 0.64 ac of saltmarsh/salt panne resource area, 0.44 ac have been shown to provide limited functional significance. The most notable characteristics that limit wetland function on the island are the

lack of direct and/or frequent hydrologic interaction (i.e. permanent or intermittent flooding) with Buzzards Bay and the isolated patches of vegetation are too small to provide independent functions and values.

Eelgrass

Eelgrass (*Zostera marina*) is a vital component of the aquatic food web and provides habitat to a wide variety of marine organisms. Due to its vulnerability to shoreline development and human related disturbances, projects involving alterations to eelgrass meadows are subject to stringent regulatory protection under federal and state laws. Eelgrass beds are classified as Special Aquatic Sites (Vegetated Shallows) under the Clean Water Act, Section 404(b)(1) Guidelines. Eelgrass has been documented to grow in the nearshore subtidal environment in Sippican Harbor and around Bird Island (Costa, 1999, MA DMF, 1999 and MA DMF, 2004).

In 1999, the Division of Marine Fisheries (MA DMF) conducted an underwater biological survey to identify eelgrass concentrations and other biological resources around Bird Island (MA DMF, 1999). The results of that survey showed eelgrass, in varying densities, and a sandy bottom from the northwestern end of the island continuing easterly toward the sand bar. The area immediately southeast of the sand bar also consisted of eelgrass/or sandy bottom. To provide current information concerning the nearshore biological community, MA DMF conducted an additional survey in the summer of 2004. Numerous patches of eelgrass were again observed around the island, which became increasingly dense with the approach to the north (MA DMF, 2004). See Appendix I – Intertidal and Subtidal Surveys for more detailed information concerning the MA DMF 1999 and 2004 biological survey.

Eelgrass beds are highly productive components of the marine/estuarine environment. It is a grass-like flowering plant that propagates both by vegetative growth (spreading rhizomes), and by seed germination. Primarily a perennial plant, eelgrass may grow as an annual in areas of high scour, freezing and other stressful conditions (EPA, 2003). Eelgrass characteristics are as follows; a high rate of leaf growth; the leaves of which support large numbers of ephiphytes, which are grazed extensively upon and may be of comparable biomass to the leaves themselves; leaves which produce large quantities of organic material (detritus) for export and shoots that retard or slow currents which enhance sediment stability and increase the accumulation of organic and inorganic material; roots that bind sediment, reduce erosion and preserve sediment microflora; plants and detritus production that influence nutrient cycling between sediments and overlying waters which stabilize intertidal and subtidal habitat, thereby decreasing shoreline erosion and cycle essential nutrients (Thayer, *et al*., 1984). Eelgrass blades die in the fall however, the roots and rhizomes remain dormant through the winter. The diversity of organisms and overall abundance of both species and individuals is higher in eelgrass meadows than in adjacent unvegetated areas (Thayer, *et al*., 1984; Heck, *et al*., 1989; Hughes, *et al*., 2000). Eelgrass can successfully dominate areas that have sediments ranging from soft mud to coarse sand with average salinities of 10 to 30 parts per thousand (ppt) (Thayer, *et al*., 1984). Light availability is a primary factor limiting both depth and upstream estuary penetration of eelgrass within its temperature and salinity ranges (Thayer, *et al.*, 1984).

Eelgrass beds in the Cape Cod area play a nursery role for several commercially important fish species, although the nursery function is less obvious than in previously studied mid-Atlantic eelgrass meadows (Heck, *et al.* 1989). There is evidence that the Cape Cod eelgrass meadows serve as nurseries for white hake (*Urophycis tenuis*) and winter flounder (*Pseudopleuronectes americanus*). The threespine stickleback (*Gasterosteus aculeatus*), fourspine stickleback (*Apeltes quadracus*), mummichog (*Fundulus heteroclitus*), winter flounder, northern pipefish (*Syngnathus fuscus*), grubby (*Myoxocephalus aenaeus*) and white hake make up approximately 99% of the fish species collected in the daytime eelgrass samples (Heck, *et al*., 1989). Approximately 97% of the nighttime fish samples collected from the eelgrass include the threespine stickleback, fourspine stickleback, northern pipefish, winter flounder, grubby, Atlantic silverside (*Menidia menidia*), and cunner (*Tautogolabrus adsperus*) (Heck, *et al*., 1989). Although no known studies of secondary productivity have been conducted on the eelgrass meadow of Sippican Harbor and around Bird Island, it can be assumed that many of the above species would also inhabit these areas. Finfish observed around Bird Island in the 2004 biological survey included striped bass, tautog, and cunner (MA DMF, 2004).

Shellfish, Shrimp, Lobsters, and Crabs

The 2004 Mass GIS Shellfish Suitability Areas layer identifies areas representing habitats suitable for ten species of shellfish along the coast of Massachusetts. The ten species are American Oyster (*Crassostrea virginica*), Bay Scallop (*Argopecten irradians*) Blue Mussel (*Mytilus edulis*), European Oyster (*Ostrea edulis*), Ocean Quahog (*Arctica islandica*), Quahog (*Merceneria mercenaria*), Razor Clam (*Siliqua costata*), Sea Scallop (*Placopecten magellanicus*), Soft-shelled clam (*Mya arenaria*), and Clam Surf Clam (*Spisula solidissima*). The intertidal and subtidal areas in the immediate project vicinity around Bird Island were not listed as a suitability area for the species listed above. These maps are not field verified and therefore, should be used only as guides for potential habitats.

The Massachusetts Division of Marine Fisheries (MA DMF) conducted an underwater biological survey in July 1999 in the area around Bird Island. Twenty-two one-foot-square (ft^2) sites where selected for study based upon site characteristics which identified the potential for shellfish habitat. No quahogs, soft-shelled clams, oysters, or bay scallops were harvested at any of the twenty two sites and only one quahog was observed as the divers traversed from site to site. The only shellfish observed were slipper snails (*Crepidula* sp.). Divers also noted poor quahog habitat between sample sites (MA DMF, 1999). An additional survey was conducted in August 2004 by the MA DMF to provide current observations of the near shore biological community around Bird Island (MA DMF, 2004). In the 2004 survey, good quality shellfish and fisheries habitat was found throughout the area with varying densities and sizes of quahogs observed around the island. (See Appendix I – Intertidal and Subtidal Surveys for detailed information on the biological surveys conducted in 1999 and 2004 by the MA DMF.)

Appendix J provides a comprehensive list of fisheries resources, including 49 species expected to occur in the Buzzards Bay Estuary. Nine invertebrate species considered common to highly abundant have been listed on Table 9, five of which are shellfish with four species of *Arthropoda.* Additional life history information provided for these species includes distribution

within the seawater regime, vertical distribution within the entire water column, and benthic residential and breeding habitats Invertebrate species listed as demersal and benthic species, those typically distributed at or near the bottom would be likely to be found in the immediate project area around Bird Island (with the exception of the pelagic bay scallop).

Finfish

Appendix J provides a comprehensive list of fisheries resources, including 49 species expected to occur in the Buzzards Bay Estuary. Twenty-nine of those fish species considered common to highly abundant are listed on Table 10. Additional information provided for these species includes distribution within the seawater regime, vertical distribution within the entire water column, and benthic residential and breeding habits. Fish species more likely to be found in the immediate project area around Bird Island include fourteen demersal or benthic fish species that are typically distributed at or near the bottom and those species where eggs are laid on, or settle to the bottom. The eleven pelagic species would be encountered in more open waters. .

TABLE 9: INVERTEBRATE SHORT-LISTED SPECIES LIST AT THE PROPOSED PROJECT AREA

COMMON NAME	FISHERY TYPE	VERTICAL DISTRIBUTION	EGG DISTRIBUTION
Blue Mussel	Invertebrate-Shellfish	benthic attached	buoyant pelagic
Bay Scallop	Invertebrate-Shellfish	benthic/pelagic	buoyant pelagic
American Oyster	Invertebrate-Shellfish	benthic attached	buoyant pelagic
Northern Quahaug	Invertebrate-Shellfish	benthic burrower	buoyant pelagic
Softshell Clam	Invertebrate-Shellfish	benthic burrower	buoyant pelagic
Daggerblade Grass Shrimp	Invertebrate-Arthropod-Bait	demersal	ovoviviporous-attached
Sevenspine Bay Shrimp	Invertebrate-Arthropod-Bait	demersal	ovoviviporous-attached
American Lobster	Invertebrate-Arthropod	benthic	ovoviviporous-attached
Blue Crab	Invertebrate-Arthropod	benthic	ovoviviporous-attached

Source: Massachusetts Division of Fisheries and Wildlife (MA DFW) Draft Environmental Impact Report (EIR) dated September 16, 2002.

TABLE 10: FINFISH SHORT-LISTED SPECIES LIST AT THE PROPOSED PROJECT AREA

Source: Massachusetts Division of Fisheries and Wildlife (MA DFW) Draft Environmental Impact Report (EIR) dated September 16, 2002.

COMMON NAME	FISHERY TYPE	VERTICAL DISTRIBUTION	EGG DISTRIBUTION
Skates spp.	Cartilaginous Fish	benthic	ovoviviporous-attached
American Eel	Bony Fish	pelagic	catadromous
Blueback Herring	Bony Fish	pelagic	anadromous
Alewife	Bony Fish	pelagic	anadromous
American Menhaden	Bony Fish	pelagic	spawns at sea
Atlantic Herring	Bony Fish	pelagic	benthic-attached
Bay Anchovy	Bony Fish-Baitfish	demersal	demersal
Rainbow Smelt	Bony Fish-Baitfish	demersal	sandy beaches
Atlantic Cod	Bony Fish	demersal	pelagic-buoyant
Atlantic Tomcod	Bony Fish	demersal	demersal
Red Hake	Bony Fish	demersal	demersal
Oyster Toadfish	Bony Fish	demersal	demersal
Killifish	Bony Fish-Baitfish	pelagic	sinking, non-buoyant
Silversides	Bony Fish-Baitfish	pelagic	benthic, sandy bottom
Northern Pipefish	Bony Fish-Baitfish	demersal/grasses	benthic grasses
Northern Searobin	Bony Fish	demersal	buoyant
Striped Bass	Bony Fish	pelagic	anadromous/non-buoyant
Black Sea Bass	Bony Fish	demersal	buoyant
Scup	Bony Fish	demersal	buoyant
Bluefish	Bony Fish	pelagic	buoyant
Weakfish	Bony Fish	pelagic	buoyant
Tautog	Bony Fish	demersal	buoyant
Cunner	Bony Fish	demersal	buoyant
American Sand Lance	Bony Fish-Baitfish	benthic	benthic/sandy bottom
Atlantic Mackerel	Bony Fish	pelagic	buoyant
Butterfish	Bony Fish	demersal	buoyant
Summer Flounder	Bony Flatfish	benthic	buoyant
Windowpane Flounder	Bony Flatfish	benthic	buoyant
Winter Flounder	Bony Flatfish	benthic	buoyant

Avifauna

Bird Island provides critical nesting habitat for the Roseate Tern, listed as Endangered at the federal and state level, and Common Tern, listed as a state Species of Special Concern. Due to their protected species designations, Bird Island is rigorously managed for the benefit of terns, to the exclusion of other species during nesting season. Roseate and Common Terns prefer sites that are secure from predators and therefore, the clearing of gulls from the island is an essential part of the current and future tern management program. Gull control at South Monomoy and Ram Islands has resulted in thriving tern colonies at these restored sites. Due to the tern's protected species designation, further discussion and detailed descriptions of Roseate and Common Tern life history and habitat requirements will be included in the next section, entitled Endangered and Threatened Species.

During migration and wintering, Bird Island may provide resting and feeding habitat to other shorebirds such as American Black Duck (*Anas rubripes*), Greater Scaup (*Aythya marila*), Common Goldeneye (*Bucephala clangula*), and Atlantic Brant (*Branta bernicla*) as well as avian predators such as Herring Gulls (*Larus argentatus*), Great Black-backed Gulls (*L. marinus*), Black-Crowned Night-Heron (*Nycticorax nycticorax*) and Great Horned Owl (*Bubo virginianus*).

Endangered and Threatened Species

The U.S. Fish and Wildlife Service (USFWS) provided a letter of comment pursuant to the Endangered Species Act dated 21 May 2004 (see Appendix A – Correspondence/Public Notice). At present, the only federally-listed species on Bird Island is the federally-endangered Roseate Tern (*Sterna dougallii*). As Roseate Terns always nest in mixed colonies with Common Terns (*Sterna hirundo*), management for Roseate Terns involves both tern species. The Endangered Species Act of 1973 defines a "federally endangered species" as a species that is in danger of extinction throughout all or a significant portion of its range. Bird Island provides critical nesting habitat for Roseate Terns and the 21 May 2004 letter from the USFWS provided conceptual support for the Bird Island restoration project and initiation of informal Section 7 (of the Endangered Species Act) consultation (USFWS, 2004).

The Massachusetts Natural Heritage & Endangered Species Program (MA NHESP) provided a letter dated 3 June 2004 for information regarding state-protected rare species in the project vicinity (see Appendix A- Correspondence/Public Notice). Both the Roseate Tern, listed as State Endangered, and the Common Tern, listed as a Species of Special Concern are found in the project vicinity (MA NHESP, 2004a). A State Endangered designation is defined as "any reproductively viable native species, which has been documented by biological research and inventory to be in danger of extirpation from the Commonwealth." A designation of "Species of Special Concern" identifies "native species which have been documented by biological research or inventory to have suffered a decline that could threaten the species if allowed to continue unchecked, or which occur in such small numbers or with such restricted distribution or specialized habitat requirements that they could easily become threatened within Massachusetts." (MA NHESP 2004b).

In Massachusetts, the Roseate Tern generally nests on sandy, gravelly, or rocky islands. Roseate Terns have very specialized habitat requirements; however, are always found nesting in close association with the Common Tern. Roseate Terns, being less aggressive than Common Tern, seem to rely on the Common Terns aggressive tendencies to protect their own nests. Roseate Terns usually place their nests under cover in dense vegetation, such as Seaside Goldenrod *(Solidago sempervirens)* or Beach Pea *(Lathyrus maritima)*, or under boulders or other structures (e.g. nestboxes or wooden boards). Roseate Terns appear to enjoy the security of crevices and structural backing to their nesting sites. Nest boxes are used as a management tool to increase optimal nest sites for Roseate Terns on Bird Island. Common Terns tend to nest in open sandy areas with limited vegetation with 20-30% vegetative cover, which provides shelter for chicks (Nisbet, 2002). Although Common Terns sometimes (e.g., in parts of Bird and Ram Islands) attempt to nest in areas with continuous cover of vegetation, these areas are unsuitable for them and they are often unsuccessful in raising young. When they nest in such areas, they compete for space with Roseate Terns, which prefer vegetated habitats and can nest successfully there, and may be adversely affecting Roseate Terns at these sites

Common and Roseate Terns feed primarily on a variety of juvenile fish. The Common Tern frequently includes crustaceans and insects as an addition to its diet. It often feeds in bays, tidal inlets, or between islands, and may forage as far as 20 km from the breeding colony. The Roseate Tern feeds heavily on American Sand Lance (*Ammodytes americanus*). It forages in highly specialized situations over shallow sandbars, shoals, inlets or schools of predatory fish, which drive smaller prey to the surface. In Massachusetts, it is known to forage up to 30 km from the breeding colony.

In Buzzards Bay, terns start arriving in at the nesting islands in late-April. Common Terns usually begin laying eggs the second week of May, and Roseates begin a few days later. Peak egg-laying takes place from mid-May to mid-June, but eggs may be laid into mid-August. Incubation lasts about three weeks, and after three to four weeks chicks can fly. Fledglings of both species are dependent on their parents for at least several weeks post-fledging. Most terns begin moving in July to pre-migration staging areas in the region (especially on Cape Cod) where they feed and roost before starting migration a few weeks later. By early September, essentially all terns have departed the nesting islands for the pre-migration staging areas. By mid-September, most have departed the staging areas for the wintering grounds (principally in South America), but some linger at staging areas until mid-October.

The National Marine Fisheries Service (NMFS) provided information on jurisdictional resources in the vicinity of the proposed project in a letter dated 29 March 2004 (see Appendix A – Correspondence/Public Notice) (NMFS, 2004a). Several threatened and endangered species are seasonally present in Massachusetts waters including three species of endangered whales and three species of federally threatened or endangered sea turtles. Although federally endangered North Atlantic Right Whales (*Eubalaena glacialis*), Humpback Whales (*Megaptera novaeangliae*), and Fin Whales (*Balaenoptera physalus*) are found in Massachusetts waters, they are not considered residents of the Buzzards Bay area and therefore, it is unlikely that any of these whale species would be present in the proposed project area (NMFS, 2004a).

The sea turtles in northeastern waters are typically juveniles with the most abundant being the federally-threatened Loggerhead (*Caretta caretta*) followed by the federally endangered Kemp's Ridley (*Lepidochelys kempi*). These species may be present in Massachusetts waters from June through October. The federally endangered Leatherback Sea Turtles (*Dermochelys coriacea*) are located in New England waters during the warmer months as well. Green Sea Turtles (*Chelonia mydas*) may also occur sporadically in Massachusetts but those instances would be rare. Loggerheads and Leatherback sea turtles have been documented in Buzzards Bay in recent years and may be present in the project vicinity (NMFS, 2004a).

Sea turtles are graceful, passive marine reptiles. From the moment a hatchling reaches the ocean, a male sea turtle may spend its entire life at sea. Females only come to shore to nest where they face perilous odds as recreational and beachfront development threatens historic nesting areas. Declining populations are also attributed to over-harvesting for human food, fish bait and turtle products as well as pollution from discarded trash, boat traffic, pollution or light, which can disorient hatchings to move inland rather than to the ocean. The traditional defense of laying a large number of eggs cannot compensate for the demise caused by human related disturbances and harvesting. In order to assure federal actions do not further impact these species, Section 7 (a) of the Endangered Species Act of 1973, as amended, requires that federal agencies consult with, and with the assistance of the Secretary, insure that any federal discretionary action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species.

As previously cited, the NMFS lists four species of sea turtles that may be present in the project area during the months of June through October. The federally threatened Loggerhead Turtles average approximately 250 pounds in weight with a reddish-brown carapace. This turtle is found in a variety of habitats ranging from continental shelves, to bays and estuaries and is found circumglobally. The Atlantic population ranges from Newfoundland to Argentina with nesting occurring during the summer primarily along the east coast of Florida. It is assumed that they utilized the sargassum drifting community (floating brown algae) during the early pelagic life stage and then migrate as subadults to shallower coastal water where they forage on bottom dwelling invertebrates. Coastal development, increased use of nesting beaches, pollution and commercial fishing has contributed to the population decline of this species. Shrimp trawling and commercial fishing play a significant role in this decline. Dredging operations can also affect Loggerhead Turtles through incidental take (documented with hopper dredges) and by modifying foraging areas and degrading water quality (NMFS, 2004b).

The federally endangered Leatherback is the largest of the living sea turtles, growing up to 6.5 feet and weighing 1,400 pounds. They prefer jellyfish as their primary food, and seem to follow jellyfish migratory patterns, but will also eat fish, mollusks, squid, sea urchin and other marine creatures. Although Leatherbacks are adept in their ability to survive in cold water due to a layer of insulation under their skin, they require warm tropical or subtropical beaches to incubate their eggs. Nesting season is from February to July at sites located from Georgia to the Virgin Islands. Only a few of the 100 to 150 eggs laid by the female will grow to adulthood and breed. The recovery plan for the Leatherback Turtle indicates that nesting trends appears stable

in the United States, however the population is still under threat from incidental take in commercial fishing and pollution (NMFS, 2004c).

The status of the federally endangered Kemp's Ridley turtle has remained unchanged since being listed in 1970. This is the smallest of the sea turtles weighing approximately 75 to 100 pounds. Kemp's Ridley turtles feed on sargassum and associated infauna found in the Gulf of Mexico during the pelagic life stages and is largely a crab-eater in nearshore areas. Nearly the entire population of Kemp's Ridley turtles nest along the northeastern coast of Mexico. Juveniles are encountered in bays and estuaries in Louisiana and other gulf states and as far north as Cape Cod, Massachusetts. The decline of this species is attributed to a variety of human disturbances as previously mentioned however, shrimp trawling in Mexico and the United States has contributed to a great degree through high levels of incidental take. Dredging operations can also affect Kemp's Ridley turtles through incidental take (documented with hopper dredges) and by modifying foraging areas and degrading water quality (NMFS, 2004d).

In the southeastern United States, Green Turtles are found from Texas to Massachusetts with primary nesting sites located along the east coast of Florida, U.S Virgin Island and Puerto Rico. The breeding population off of Florida and the Pacific coast of Mexico are listed as endangered while all others are threatened. Population estimates and trends are difficult to confirm but it is generally felt that the population of Green Turtles has remained unchanged since it was listed in 1978. The recovery of the Green Turtle has been hindered by the anthropomorphic influences as described for other sea turtles, with special emphasis on harvesting for food or turtle products and the incidental take associated with shrimp trawling (NMFS, 2004e).

Essential Fish Habitat

Bird Island The 1996 amendments to the Magnunson-Stevens Fishery Conservation Management Act strengthen the ability of the National Marine Fisheries Service and the New England Fishery Management Council to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat" and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The project area Essential Fish Habitat (EFH) Designation is included within the 10' x 10' square coordinates $41^0$50.0'North, 70^0 40.0'East, $41^0$40.0'South and 70^0 50.0'West. This area includes "Atlantic Ocean water within the square within Buzzards Bay affecting the following: south of Wareham, Massachusetts, from the west half of Great Neck west to Hiller Cove as well as affecting the far end of Stony Point Dike." (NMFS, 2004f).

The 10' x10' square which encompasses the project area is designated as EFH for several marine species for various life stages including Atlantic cod, *Gadus morhua* (eggs, larvae, juveniles and adults); haddock, *Melanogrammus aeglefinus* (eggs, larvae); winter flounder, *Pleuronectes americanus*, (eggs, larvae, juveniles and adults); yellowtail flounder, *P. ferruginea* (juveniles and adults); windowpane flounder, *Scopthalmus aquosus* (eggs, larvae, juveniles and

adults); American plaice, *Hippoglossoides platessoides* (juveniles and adults); Atlantic sea herring, *Clupea harengus* (juveniles and adults); bluefish, *Pomatomus saltatrix* (juveniles and adults); long finned squid, *Loligo pealei* (juveniles and adults); short finned squid, *Illex illecebrosus* (juveniles and adults); Atlantic mackerel, *Scomber scombrus* (eggs, larvae, juveniles and adults); summer flounder, *Paralicthys dentatus* (adults); scup, *Stenotomus chrysops* (eggs, larvae, juveniles and adults); black sea bass, *Centropristus striata* (eggs, larvae, juveniles and adults); sand shark, *Charcharinus plumbeus* (adults), and bluefin tuna, *Thunnus thynnus* (juveniles and adults) (NMFS, 2004b). Information and detailed descriptions of the life history requirements of these species was derived from the NMFS "Guide to EFH Species Designations" located at http://www.nero.nmfs.gov/ro/doc/list.htm and provided in Appendix C – Essential Fish Habitat.

The essential fish habitats of concern include the waters, salt marsh, eelgrass and mudflat resources of the near project area, which are necessary for fish spawning, breeding, feeding, or growth to maturity. Salt marshes, eelgrass beds, and intertidal/subtidal areas are extremely valuable habitats for marine fish and shellfish for many reasons. Salt marshes export organic matter (detritus) which enriches coastal waters and serves as a microbial food source in estuarine and near shore marine ecosystems. Salt marshes also harbor several species of minnows such as mummichog (*Fundulus heteroclitus*) and Atlantic silversides (*Menidia menidia*), which are food sources to larger fish and serve as nurseries/refuges for young fish and important commercial species such as winter flounder. Eelgrass beds are highly productive components for forage and nursery habitat in the marine environment. Intertidal/subtidal areas typically support diverse biotic assemblages of shellfish and marine invertebrates, which also serve as a food resource for a variety of migratory finfish. An EFH assessment on the potential effects of the proposed project on designated species and their habitat, the salt marsh, eelgrass and intertidal/subtidal areas on and around Bird Island and in the vicinity, is presented in the Environmental Effects section of this document entitled Essential Fish Habitat (Appendix C).

Cape Cod Canal Maintenance Dredge Site The material to be removed from the west end of the Hog Island Channel consists of medium to fine sand. Of eight samples collected in this area in 1996, only one contained more than 1 percent fines (silt/clay). The composition of medium sand ranged from 6 to 76 percent. The composition of fine sand ranged from18 to 82 percent. Further analysis will be made to determine the suitability of dredged material for use as nesting habitat substrate. In addition, an evaluation of scheduled maintenance dredging at the Canal is necessary to determine compatibility with the timing of the Bird Island Restoration Project. The EA for the proposed dredge site will describe project compliance with the NEPA and appropriate federal and state environmental regulations, laws and executive orders including compliance with the Magnunson-Stevens Fishery Conservation Management Act (an EFH review).

Historic and Archaeological Resources

Prehistoric Context

In 1997 and 1998, the Public Archaeology Laboratory, Inc. (PAL) of Rhode Island conducted a reconnaissance archaeological survey of the town of Marion. Prior to this survey, 23 prehistoric archaeological sites had been recorded in Marion, of which only one had been the subject of scholarly investigation. The remaining sites were recorded by vocational archaeologists under the auspices of the Massachusetts Archaeological Society, mostly during the 1940's, and many were amassed by local collectors from Marion sites. PAL's survey resulted in the identification of 11 additional prehistoric sites, primarily as a result of study of museum and private artifact collections and the assistance of local informants (PAL 1998:25).

A majority of the sites are located on the harbor margins or adjacent to the seacoast where historical settlement of the town was concentrated. Prehistoric settlement and activity areas may have been concentrated near the shoreline. However, tributary streams, inland ponds, wetlands, and the Sippican River provided diverse resources that were likely also exploited by Marion's indigenous inhabitants (PAL 1998:25).

The earliest Native American sites in New England, dating from the **PaleoIndian Period (12,000 – 10,000 Years Before Present (BP**), are rare and usually represented small bands of mobile hunters and gatherers that ranged over great distances. It is likely that many PaleoIndian sites were inundated when rising sea levels covered much of the continental shelf in Buzzards Bay. No sites of the PaleoIndian Period have been recorded in Marion, although one fluted projectile point from the Clark collection was apparently recovered from the shoreline.

The **Archaic Period**, ranging in time from **10,000 – 3,000 BP** and categorized as Early, Middle, and Late Periods, represented changing climates in New England and an increase in areas of settlement. Early Period sites are rare; however, by the time of the Late Archaic Period (5,000 – 3,000 BP), sites are more numerous and indicate greater populations and a more diversified exploitation of resources. Middle Archaic (7,500 –5,000 BP) projectile points from Marion have been identified by PAL in the Clark collection. Sites of the Late Archaic are numerous in Marion and have been identified in a variety of areas. Extensive occupations are evident between the head of Sippican Harbor and the Sippican River indicating a pattern of marsh/wetland periphery occupation.

The **Woodland Period (3,600 – 450 BP)** is also represented in the town of Marion and is characterized as a continued adaptation to various ecological niches as well as the development of complex mortuary ritual in burials, the incorporation of early ceramic vessels with the use of steatite or soapstone, and the development of horticulture. Coastal resources became significant to indigenous populations during this time. The Transitional Archaic Period (3,600 – 2,500 BP), which comprised this shift to the adaptive technologies of the Woodland Period, is well represented in Marion and vicinity with diagnostic Orient, Susquehanna and Atlantic projectile points. A steatite bowl was reported from Ram Island in Sippican Harbor. No unequivocal Early Woodland sites have been identified in Marion; however archaeological evidence for the

Middle Woodland is more common and is marked by increased sedentism, larger populations, greater social complexity, and evidence for regional trade. Clark's Point and Stewart's Island are examples of sites from this period. Lastly, the Late Woodland Period (1,000 – 450 BP) is represented by large, complex village sites and frequently, shell midden sites. Numerous Late Woodland sites are recorded for Marion ranging from harbor margins and promontories to inland flats and wetlands (PAL 1998:25,28-31).

Historic Context

Extensive European settlement in Marion did not begin until early in the Colonial Period, impacting the existing Native occupations along the coast. In the late 18th and early 19th Century, primary settlement areas in Marion included the Old Landing, the Lower Village, and at Happy Alley (Rochester and County Roads). The primary economic activity was centered at the salt works in Sippican Lower Village and along the Weweantic River, the shipyards in Sippican Harbor, as well as the whaling industry. Some farming occurred in the northern portion of town. In the mid 19th Century, whaling declined prior to the Civil War. During the latter half of the 19th Century, Elizabeth Taber contributed to civic improvements in Marion, with the shift of wealth to the south from the Old Landing to the Lower Village. This movement was also dependent upon the popularization of the town as a summer resort by individuals such as Grover Cleveland and writers including Richard Gilder, Henry James, Richard Harding Davis, and Dana Gibson. Late 19th and early 20th Century development occurred at Great Neck, Converse Point, and in the Lower Village along Water Street. The community's economic base during this time was dependent on the summer resort industry together with some cranberry production and farming in the north. Although some summer residences have been converted to year-round use, many remain as summer homes only. The Tabor Academy, a private boarding school in the Lower Village, is the main source of income to the town during the winter months (MHC 1981:1).

Bird Island has approximately 1,250 feet of shoreline and a granite revetment, associated with the Bird Island Light Station that was constructed in the mid-1800's. The Bird Island Light Station was established in 1819 and is listed on the National Register of Historic Places. The light was originally 25 feet high, 18 feet in diameter, with 3-foot thick stonewalls and a 12-foot iron lantern at the top. The adjacent keeper's house was 20 feet by 34 feet with two fireplaces, a porch, a well/cistern, a covered walk to the light, and an upstairs gable with a view of the light. The house was constructed of rubble masonry resting on the ground surface with no cellar hole and a soapstone roof. Until 1837, Bird Island Lighthouse was the sole lighthouse in Buzzards Bay.

The original stone house was replaced by a larger 28-foot by 31-foot story-and-a-half dwelling between 1889 and 1890. Other island structures included a cow barn (1895), a protective pyramidal bell tower and one thousand pound fog bell (1902), a boat house with a marine railway between the two wharves for launching and retrieving boats, a small oil house for the lantern, and the seawall dating from 1843. Following the hurricane of 1938, all that remained on the island was the foundation of the keeper's house, the ruins of the oil building, the

tumbled stone from one wharf, and the light tower. In 1966, the town of Marion acquired Bird Island and restoration of the lighthouse began during the 1970's.

A reconnaissance archaeological survey of Marion conducted by the Public Archaeology Laboratory, Inc. in 1998 included the Bird Island Light Station. It noted that 19th Century archaeological resources associated with the lighthouse could still be intact on Bird Island; consequently, the site was assigned a high archaeological sensitivity. However, recent site visits have confirmed that the only evidence consists of stone and concrete rubble piles that may be either the remains of former structures or debris from the stone revetment. The revetment itself has been rebuilt several times including 1863, 1867, 1868, and 1869. Currently, the deteriorated revetment surrounds the entire island except for the north side. Restoration of the lighthouse itself was completed in 1997.

Environmental Consequences

General Setting

The goal of the Bird Island Restoration Project is to increase nesting habitat on Bird Island in order to support increased numbers of Roseate Terns and Common Terns, in support of the Massachusetts Division of Fisheries and Wildlife (MA DFW) tern restoration and management program for Buzzards Bay and the federal Roseate Tern Recovery Plan, Northeastern Population. Erosion of the island over time has lowered the ground elevation and changed the characteristics of the island from that of gravel and sand to salt marsh and salt pannes, and reduced the available area, which is suitable for nesting terns. The gradual loss of breeding sites in the northeast and the Roseate Tern's reluctance to colonize new sites, is a serious obstacle to the recovery of the northeast population. To restore nesting habitat, the Corps proposes to fill 0.64 acres of salt marsh/salt panne on the island, which will increase available nesting habitat from 1.5 acres to approximately 2.2 acres. This project will also prevent the anticipated loss of 0.5 acres of nesting habitat over the 50-life of the project. Habitat restoration around the perimeter of the island should draw Common Terns out of the more densely vegetated upland Roseate habitat. This will benefit both species by increasing the carrying capacity of the island and increasing the productivity of the birds, which will be able to select the most suitable nesting habitat.

Restoring the stone revetment will stabilize the shoreline and attenuate wave energy. This would serve to protect the island under average wave conditions, reducing the rate of erosion of upland material (nesting habitat). Restoring the revetment has the added benefit of protecting the historic lighthouse on Bird Island, a supplemental goal of the proposed project.

Physical Environment

Large wave energy is the primary physical force governing erosion of upland materials and the observed accretion of the shoreline to the north and northeast of the Bird Island. The factors contributing to the intensity of wave energy affecting Bird Island are fixed physical influences. Bird Island will continue to be subject to periodic coastal storms, which yield

extreme water surface elevations and severe wind generated waves. Wind generated waves often originate in the long southwest fetch of Buzzards Bay. The timing and duration of storm events in the northeast are unpredictable and the intensity of wave height and energy can be further compounded when combined with extreme high tides in the study area. Therefore, the attenuation of wave energy and consequent reduction in erosion on Bird Island will be accomplished through design features of the revetment.

The revetment design features includes a seaward facing 1V:3H slope, a rough and porous seaward revetment surface (crevasses between the rocks) and the revetment will also have a wide flat top 10 ft. in width. The relatively shallow depths along the toe of the revetment structure will cause the larger incident waves (e.g. 100-yr, 50-yr and 10-yr storm waves) to break prior to impacting the structure. Water and energy will be absorbed during wave run-up through roughness and crevasses in the seaward rock face and the 10 ft. wide flat revetment top will further reduce erosive forces during storm events when the revetment is overtopped. The proposed project will also raise elevations considerably (1 to 2 feet) over the high tide elevation, which will reduce inundation events in those areas and will continue to provide habitat benefits to nesting terns through the project life. However, due to the periodic overtopping of the island during storm events, erosion is expected to continue, albeit at a slower pace and therefore, some maintenance will be required to maintain optimal nesting habitat function.

Erosion has contributed to the historic loss of suitable nesting habitat on Bird Island by approximately 1.5 acres over 160 years. Based on this rate of habitat loss, under the No Action Plan (Alternative A), it is estimated that approximately 0. 5 acres of suitable nesting habitat would be further lost over the next 50 years (the life of the project) which equates to the loss of 1000 pairs of nesting terns. The restored revetment, as provided in Alternative B, includes design features to attenuate wave energy and reduce erosion on the island. No further loss of nesting habitat is predicted over the project life with Alterative B, the restoration of the revetment. However, Alternative C (the preferred alternative) provides not only, the restoration of the revetment but also, grade increases on the island to increase suitable nesting habitat for terns, a goal of the project. Due to periodic overtopping of the island, periodic island nourishment may be required (estimated to be approximately once every ten years on average) to continue to optimize nesting habitat opportunities for terns on Bird Island.

The rocky subtidal substrate observed at the western end of Bird Island seaward of the circa 1843 armoring is expected to remain the same. The physical influences and energy forces which created the existing conditions seaward of the revetment will not be modified over the long-term. Conversely, the sand bar and subtidal areas located to the north and northeast of the island, which have been historically receiving eroded island sediments, will receive a reduced rate of sediment over the long-term and therefore, the configuration of these areas may change over time. Benthic fauna and fisheries resources inhabit the intertidal/subtidal areas and the sand bar is used by avifauna for feeding and resting outside of the spring and summer tern nesting season. However, the short and long-term effects to biological resources inhabiting these areas are expected to be limited. The sediment eroded from Bird Island is a small contribution to the dynamic marine sediment transport processes ongoing in Sippican Harbor and Buzzards Bay. This dynamic process is exhibited seasonally through notable changes in the sand bar

configuration on Bird Island in the summer versus the winter season. A reduction in the rate of erosion on Bird Island will be integrated into the sediment transport process over the long term enabling biological resources adequate time to adapt to post-project conditions.

Water Quality

Appropriate erosion and sediment controls will be implemented during construction activities on Bird Island. Therefore, the cold, oxygen-laden and nutrient rich waters surrounding Bird Island and characteristic of the Sippican Harbor will not be significantly impacted by the proposed project. These waters are classified by MA DEP as Class SA waters and will remain classified as SA with the project in place. These waters will continue to support a productive marine ecosystem composed of a diverse array of habitat types and biological resources.

A temporary stockpile area will be established in the area of the existing salt pannes. This facility will incorporate an area approximately 60-ft x 100-ft and will be enclosed by a temporary silt fence and hay bale containment structure. The area will serve as a temporary storage area for the stone used to restore the revetment. The facility will also be used as a storage pile area, storing up to approximately 1,000 cubic yards (cy) of sand during the filling and grading of the upland areas.

Erosion and sedimentation controls, consisting of temporary silt fence and hay bale containment, will be established around the stockpile area. The silt fence will be 3-ft high and the fence toe will be anchored in a 6-in deep backfilled trench along its entire length. Wood support posts will be fixed to the fencing at 5-ft intervals. Hay bales, placed along the downgradient face of the fencing will be staked into the ground with two (2) stakes. The erosion and sedimentation controls will be maintained on a daily basis. Prior to the initiation of work activities each day, the site supervisor or his designate will complete a visual survey of the sediment control infrastructure. Any deficiencies in the fencing or hay bale elements will be corrected prior to the initiation of any site work.

The construction equipment will require periodic fueling. Any fuel stored on the island will have secondary containment to prevent fuel from spilling on the island during construction. The pier facility will maintain a containment boom on-site for use should an inadvertent fuel spill occur during any transfer operation. In addition, the site operator will enter into an agreement with an authorized spill control contractor to maintain a 24-hour emergency on-call service in the case of any spill, to assure rapid response and immediate containment and clean-up of any fuel spill.

Biological Resources

Island Habitat

The proposed project habitat restoration goal is to increase suitable nesting habitat for terns. Restored elevation in eroded areas will provide nesting habitat primarily for Common Terns so they will occupy these new areas and relieve the current pressure on displaced Roseate

Terns from their preferred nesting habitat. Filling low-lying areas, which currently support salt marsh and salt panne resources, will increase the area of open substrate and vegetation suitable for Common Tern nesting by approximately 0.7 acres. The proposed activity will not affect the existing densely vegetated areas, which currently are preferred by, and support Roseate Terns. The proposed filling and rehabilitation of the stone revetment will also enhance island stabilization and provide further protection to the existing and restored historical lighthouse structure.

An evaluation of the environmental impacts of each Alternative was undertaken to assist in the determination of the preferred alternative. As shown on Table 11, Alternative C provides the most suitable nesting habitat for terns, 0.95 acres more than Alternative A (at the mid-life of the project), the No Action Plan and 0.7 acres more than the Alternative B, Revetment Restoration. This increase in suitable nesting habitat equates to the increased numbers of nesting tern pairs shown in the table.

Table 11 – Number of Nesting Pairs of Roseate and Common Terns per Alternative

Alternatives	Acres of Suitable Nesting Habitat on Island	Number of Nesting Pairs of Roseate Terns	Number of Nesting Pairs of Common Terns	Total Number of Nesting Terns
Alternative A No Action (in 25 years, mid-project life)	1.25	614	1,536	2,150
Alternative B Revetment Restoration	1.5	750	1,900	2,650
Alternative C Revetment and Nesting Habitat Restoration	2.2	1,157	2,893	4,050

Note: The number of nesting pairs of terns per Alternative is derived from an extrapolation of the existing conditions as represented in Alternative B (based on average tern densities on Bird Island from 2001 to 2005 provided by the Massachusetts Division of Fisheries and Wildlife (MA DFW 2005)). It is assumed that ¼ acre of suitable nesting habitat will support approximately 500 pairs of nesting terns and the ratio of Roseate Terns to Common Terns remains similar (approximately 1 pair Roseate Tern per 2.5 pairs Common Terns).
No loss of habitat predicted over the 50-year project life for Alternative B and C due to periodic maintenance.

Three revetment Alignments were also evaluated for Alternative C in consideration of impacts to intertidal habitat. The preferred Alignment, C-1 permanently replaced 8,802 sf (0.2 ac) of intertidal habitat with a stone-slope revetment and temporarily impacted 17,387 sf (0.4 ac) during construction of the revetment buried toe. By moving the revetment landward, Alignment C-2 reduced intertidal impacts to 16,214 sf (0.37 ac) temporary impacts and Alignment C-3 eliminated impacts to intertidal habitat. However, Roseate Tern nesting habitat was significantly affected as the Alignments were moved landward. Alignment C-2 and C-3 would result in an estimated reduction of 13,927 sf (0.31 ac) and 26,700 sf (0.61 ac), respectively, of island nesting habitat when compared to optimal conditions provided by Alignment C-1 (see Table 12). The reduced availability of nesting habitat equates to an estimated loss of Roseate and Common nesting terns pairs from Bird Island by 600 nesting pairs for Alignment C-2 and 1,200 nesting pairs for C-3 and therefore, Alignments C-2 and C-3 did not meet the goals of the project and were eliminated from further evaluation.

Table 12 –Impact to Intertidal Habitat and Tern Nesting Habitat per Alternative C Alignments

Alternative C Revetment and Nesting Habitat Restoration	Permanent Impact to Intertidal Habitat (square feet)	Temporary Impact to Intertidal Habitat (square feet)	Permanent Impact to Tern Nesting Habitat (square feet)
Alignment C-1	8,802	17,387	0
Alignment C-2	0	16,214	13,927
Alignment C-3	0	0	26,700

Salt Marsh and Salt Panne

Bird Island currently supports approximately 0.64 ac (27,878 sf) of wetland resource area under the federal and state jurisdictions landward of the stone revetment and 0.12 ac (5,300 sf) seaward of the revetment. The salt marsh resources on Bird Island are the result of historic anthropogenic activities and natural erosive processes, and over time have developed into jurisdictional wetland resources. Observations indicate that the patches of salt marsh/salt panne located on Bird Island are isolated areas and only have hydrologic/hydraulic connection with the surrounding Buzzards Bay waters during extreme high tides, wind driven tides, or on rare occasions, when the island is overtopped by storm waves and tides.

Three revetment Alignments were also evaluated for Alternative C in consideration of temporary impacts to salt marsh seaward of the revetment. The landward wetland resources (0.64 ac) will be filled under all Alternative C Alignments. The three salt marsh areas (5,300 sf) located seaward of the revetment are composed of monoculture stands of salt marsh cordgrass and will be temporarily impacted by the revetment construction. To avoid or minimize

temporary impacts to salt marsh areas seaward of the revetment, a more landward alignment is necessary which reduces impacts to approximately 3,700 sf in Alternative Alignment C-2 and there will be no temporary impacts in Alternative Alignment C-3. However, moving the revetment landward will permanently reduce the amount of nesting habitat available to terns by 13,927 sf for Alignment C-2 and 27,700 sf for Alignment C-3 (see Table 13). The reduced availability of nesting habitat equates to an estimated loss of Roseate and Common nesting tern pairs from Bird Island by 600 for Alignment C-2 and 1,200 nesting pairs for C-3 and therefore, these Alignments did not meet the goals of the project and were eliminated from further evaluation.

The proposed revetment will be placed in an alignment similar to the existing revetment; however, the proposed revetment has a somewhat different configuration - a sloped seaward face and a buried toe. These design features were considered critical to the revetment's long-term resilience to physical forces and will also function to reduce the rate of island erosion through wave attenuation. As a result, there will be 5,300 sf (0.12 ac) of temporary impacts to salt marsh seaward of the revetment when the buried toe of the revetment is constructed. To minimize the impact and maintain protection to the island, the toe of the revetment will be excavated and built in 25 foot sections. Affected salt marsh seaward of the revetment will be lifted as an intact unit or divided into several large pieces and set aside and underlying substrate materials will be used to fill the adjacent completed section. Substrate materials will be placed on top of the buried toe to a thickness of one (1) foot and the salt marsh cordgrass will be replaced at a similar elevation. Salt marsh cordgrass grows successfully in a wide range of substrate conditions and propagates easily through vegetative divisions. Considering the hardy growth characteristics of salt marsh cordgrass, no long-term impacts are anticipated as a result of this temporary disturbance of salt marsh seaward of the revetment. No further compensation was determined to be necessary.

With regard to impacts to salt marsh/salt panne habitat landward of the revetment, a functions and values analysis was prepared for wetland resources identified on Bird Island as part of the preparation of the 2002 EIR. Of the 0.64 ac of salt marsh/salt panne resource area landward of the revetment, 0.44 ac have been shown to provide limited functional significance. The most notable characteristics that limit wetland function on the island are the lack of direct and/or frequent hydrology (permanent or intermittent) to Buzzards Bay and the isolated patches of vegetation are too small to provide independent functions and values.

Although limited function for some of the island wetlands was established during the functions and values assessment, salt marshes are generally considered one of the most important and productive of ecosystems. During the extensive alternative analysis, wetland impacts were determined to be unavoidable in the accomplishment of habitat restoration goals of the project. A proposal to compensate "unavoidable" wetland impacts through the on-site and in-kind restoration, the federally preferred type of mitigation, was not feasible due to constraints with the size of the island and high value surrounding intertidal habitat, which disallowed the relocation of the wetlands to the periphery of the island. Therefore, off-site mitigation is proposed at sites located within the towns of Dartmouth and Fairhaven.

Compensation for the loss of wetland function and value as a result of the filling of 0.64 ac of salt marsh/salt panne resources on Bird Island will be accomplished through the restoration/enhancement of 0.3 acres of salt marsh at Apponagansett Bay in Dartmouth and 0.5 acres of salt marsh in Little Bay in Fairhaven (for a total of 0.8 acres). Salt marsh located at the toe of the existing revetment, three areas totaling 5,300 sf or 0.12 acres, would be temporarily excavated during construction and replaced at the toe of the new revetment. The plan complies with the Federal "No Net Loss" policy.

Table 13 – Impact to Salt Marsh and Tern Nesting Habitat per Alternative C Alignments

Alternative C Revetment and Nesting Habitat Restoration	Permanent Impact to Salt marsh Landward of the Revetment (square feet)	Temporary Impact to Salt Marsh Seaward of the Revetment (square feet)	Permanent Impact to Tern Nesting Habitat (square feet)
Alignment C-1	27,878 sf (0.64 ac)	5,300 sf	0
Alignment C-2	27,878 sf (0.64 ac)	3,700 sf	13,927
Alignment C-3	27,878 sf (0.64 ac)	0	26,700

Eelgrass

Avoidance of eelgrass beds, a highly productive habitat, was an important consideration in the selection of the proposed project design. No direct physical construction impacts to eelgrass beds were identified in the environmental evaluation of Alternative A, the No Action plan, Alternative B, the Revetment Restoration or Alternative C, the Revetment and Nesting Habitat Restoration. Sediment erosion control features will be included in the project design to control turbidity and sedimentation; factors that may limit light penetration and smother plants.

There are some indirect short-term impacts associated with the construction of project infrastructure. A temporary floating dock structure (approximately 3,900 sf) will be installed for the purpose of off-loading construction materials and personnel. This dock structure has the potential to limit light penetration (to shade underlying substrates) to varying degrees during the day depending on the angle of the sun. Eelgrass blades die in the fall with the roots and rhizomes remaining dormant through the winter. The docking facilities will be installed during the late fall to early spring season to avoid construction activities during tern nesting season, a timeframe which coincides with a period of die-back and dormancy for eelgrass. Eelgrass is tolerant to natural levels of light fluctuation, as found seasonally with a reduced number of daylight hours in the New England winter, and daily/weekly reductions in light penetration associated with cloudy and turbid conditions during weather related storm events. A temporal

reduction in the amount of light (as a result of shading by the dock) during the dormancy period is not expected to significantly effect eelgrass beds surrounding Bird Island over the long-term. When the project is complete, the pier will be removed and any disturbance in the intertidal and subtidal areas should be restored through vegetative propagation.

Shellfish, Shrimp, Lobsters, and Crabs

No impacts to intertidal habitat were realized under the No Action plan; however, tern nesting habitat would continue to deteriorate on the island. The restoration of the revetment, a component of both Alternative B and C, would temporarily impact approximately 17,390 sf (0.4 ac) of intertidal cobble habitat and permanently impact approximately 8,800 sf (0.2 ac) of intertidal cobble habitat in the area of revetment footprint. Avoidance and minimization of impacts to intertidal habitat was an important consideration in the selection of the recommended alternative (Alternative C). Modification to the revetment design to limit its footprint avoided impacts to intertidal habitat to the maximum extent practicable.

Of the nine invertebrate species considered common in the Buzzard's Bay estuary (as listed on Table 9), the Northern Quahaug was the only species noted in the nearshore biological survey (MA DMF, 2004) although good quality shellfish habitat was noted throughout the area. Impacts will be limited to the linear area of the sloped revetment, which is generally not optimal habitat for the Northern Quahaug or other species associated with sandy or muddy substrates. There may be some impacts to sessile species associated with cobble substrates and hard structures such as blue mussel. The revetment toe will be constructed in 25 foot intervals with the cobble substrate from the section under construction used as fill for the section just completed. The buried toe and intertidal revetment face should repopulate with similar species through natural recruitment. Mobile species that may be in the area such as Shrimp, Lobster and Crab would avoid areas of disturbance during construction.

Additional temporary impacts to the intertidal area may be realized through the construction of a temporary floating dock structure (approximately 3,900 sf) installed for the purpose of off-loading construction materials and personnel. The dock will be in place during a period of low biological activity and therefore, impacts are expected to be minimal. When the project is complete, the structure will be removed and any disturbance in the intertidal and subtidal areas should be restored and repopulated through natural recruitment of benthic organisms.

Fisheries

Typical environmental concerns relative to fisheries resources in the project area during construction activities include: temporary loss of existing benthic habitat, increased suspended solids, and sedimentation. No impacts to fisheries resources will be realized under the No Action plan. The restoration of the revetment (Alternative B and C) will disturb approximately17,390 sf (0.4 ac) of intertidal benthic resources during the construction of the revetment buried toe, however this area is expected to recover rapidly through natural recruitment. The revetment footprint will also displace approximately 8,800 sf (0.2 ac) of

intertidal cobble habitat. Some of the functions and values of the intertidal habitat will be regained, as colonization of the aquatic invertebrates will occur on the revetment to a limited degree over time. The restoration of the tidal channel at Apponagansett Bay will provide intertidal habitat benefits, the restoration of natural tidal flushing and enhance access for fish and other mobile fauna within the cove.

Eelgrass beds will not be significantly impacted by the restoration of the revetment.

To minimize long-term intertidal impacts, a buried toe was incorporated into the revetment design. The existing cobble bed material from the section under construction will be used as backfill for the section just completed. Benthic organisms inhabiting the excavation site would be destroyed during the construction; however, benthic invertebrates should recolonize the layer of material over the buried toe through natural recruitment within a few months. Any temporary loss of fish foraging area would be localized and short-lived. Additional temporary effects to the intertidal area may also be realized through the construction of a temporary floating dock structure (approximately 3,900 sf) installed for the purpose of off-loading construction materials and personnel. This dock structure may impact the intertidal substrates over most of its length during low tidal cycles; however, impacts are expected to be minimal. When the project is complete, the structure will be removed and any disturbance in the intertidal and subtidal areas should be restored and repopulated through natural recruitment of benthic organisms and vegetative propagation. Therefore, the impact to fisheries through the temporary loss of foraging habitat is expected to be minimal.

Appropriate erosion and sediment controls will be implemented during construction activities on Bird Island. Materials used to fill eroded area on Bird Island are coarse grained which will minimize water quality impacts and estuarine dependent fish are fairly tolerant of minimal suspended sediment concentrations. As well, fish are sufficiently mobile to avoid the area during construction and will typically return to areas of disturbance following the cessation of activity.

Construction activities must occur outside of the tern nesting season, from April 7th to September 7th to avoid impacts to tern nesting activities and during staging (preparation for migration). Most of this timeframe coincides with a period of reduced biological activity. Collectively, for the variety of fish identified in the Buzzards Bay area, spawning occurs throughout the fall, winter and spring and therefore, spawning activities cannot be entirely avoided. Fisheries impacts have been minimized through revetment design features and the use of sediment erosion control practices and therefore, no further limits to the timing of construction are recommended.

Avifauna

During the non-nesting and winter seasons, Bird Island provides resting and feeding habitat to shorebirds, waterfowl and other water birds. Typical environmental concerns relative to avifaunal resources in the project area during construction activities include the temporary loss of existing benthic forage resources and human related disruptions (noise, barge traffic, etc.).

Impacts to avifauna utilizing Bird Island during the fall and winter are not expected to be significant as the Buzzards Bay estuary is large and sufficiently rich in foraging grounds to support a wintering avifauna temporarily displaced from Bird Island. As well, birds will avoid the area during construction and will typically return to areas of disturbance following the cessation of activity. Due to the tern's protected species designation, a further discussion of the environmental effect of the proposed project on terns will be included in the next section, entitled Endangered and Threatened Species.

Endangered and Threatened Species

At present, Bird Island provides nesting habitat to the federal and state listed endangered Roseate Tern and the Common Tern, a designated state listed Species of Special Concern. The objective is to improve and expand Common Tern nesting areas on Bird Island to encourage the Common Terns to reduce encroachment into the higher elevation, vegetated Roseate Tern nesting areas. This will allow the Roseate Tern population to be maintained and eventually increase without adversely affecting the Common Tern populations. This alternative would provide a suitable substrate to increase the number of nesting pairs of Roseate Terns to 1,100 and Common Terns to 2,787 nesting pairs over the 50-year life of the project. The gradual loss of breeding sites in the northeast and the Roseate Tern's reluctance to colonize new sites, is a serious obstacle to the recovery of the northeast population and therefore, Alternative A is not acceptable. Alternative C – Revetment and Nesting Habitat Restoration, provides 0.95 acres of nesting habitat more than Alternative A, the and 0.7 acres more than the Alternative B, Revetment Restoration. This increase in suitable nesting habitat equates to increased numbers of nesting tern pairs, as shown on Table 11, which meets the short and long-term goals of the MA DFW Buzzards Bay management program and supports the goals of the Federal Recovery Plan for the Northeastern Population of the federally endangered Roseate Tern.

Several issues associated with the protection of existing Roseate Tern nesting habitat and nesting birds during construction required consideration and detailed planning in the timing and implementation of the project. To assure that proposed construction activities will not affect the existing densely vegetated areas, which currently are preferred by, and support Roseate Terns, these areas will be fully delineated with protective fencing before construction begins and avoided during all phases of construction. Crevices in the top of the revetment and exposed interior surface will be filled with smaller rocks as much as possible; however, smaller rocks may become dislodged over time during storm events and lost. To enable Massachusetts Natural Heritage and Endangered Species Program (MA NHESP) tern monitors to respond quickly to crevices that may appear in the structure, a stock pile of small rocks will be established on the island when materials are brought to the site during construction. The quantity and placement of these materials will be coordinated with the MA NHESP during the development of project Plans and Specifications. In addition, , installation of a low-level barrier fence (i.e. silt fence) may be erected by the MA NHESP as a seasonal management feature along the interior periphery of the revetment to prevent small chicks from wandering onto the revetment and becoming trapped in crevices. Predator and vegetation management at the site and the installation of nesting structures will also be continued as habitat management technique to maximize nesting success for terns. Plans and Specifications will provide measures, which prohibit the introduction of

non-indigenous species to Bird Island. For example, barges and all materials brought to Bird Island will be inspected and shown to be free of rats and other rodents, snakes, ants or other species capable of preying on tern eggs and chicks (USFWS 2006b). Plant material handling specification will provide measures to prevent the introduction of non-native invasive plant species.

Roseate Terns are very sensitive to disturbance during their nesting season. Roseate and Common Terns are found in the Northeast from approximately late April to September during which time they nest, raise young, fledge and prepare for migration. To avoid impacts or disruption of terns on Bird Island, no construction activities will be scheduled on the island from April 7th to September 7th in any year (MA DFW, 2004 and USFWS 2006b). In addition, without prior approval from the Massachusetts Natural Heritage and Endangered Species Program, Bird Island may not be visited for the purposes of project planning, design, construction or monitoring during the time of year when terns are present (generally April 7th to September 7th) (USFWS 2006b). The U.S. Fish and Wildlife Service (USFWS) provided concurrence, pursuant to the Endangered Species Act dated 13 February 2006, that Alternative C is likely to have only beneficial effects on the Roseate Tern and therefore, no formal consultation pursuant to Section 7 of the Endangered Species Act is required. Recommendations provided in the letter have been incorporated into the provisions of this document (USFWS 2006b).

Other protected species identified as seasonally present in Massachusetts waters by the National Marine Fisheries Service include three species of endangered whales and three species of federally threatened or endangered sea turtles. Although federally endangered North Atlantic Right Whales, Humpback Whales, and Fin Whales are found in Massachusetts waters, they are not considered residents of the Buzzards Bay area and therefore, it is unlikely that any of these whale species would be impacted by this project or present in the proposed project area (NMFS, 2004a). A variety of sea turtles are also listed as being found in northeastern waters including the federally-threatened Loggerhead, followed by the federally endangered Kemp's Ridley, the federally endangered Leatherback Sea Turtles and Green Sea Turtles.

The sea turtles in northeastern waters are typically juveniles found during the warmer months of June through October. Green Sea Turtles may also occur sporadically in Massachusetts but those instances would be rare. Loggerheads and Leatherback sea turtles have been documented in Buzzards Bay in recent years and may be present in the project vicinity (NMFS, 2004a). The environmental protection features of the project, sediment erosion control practices and construction scheduling during the time of year when biological activity is low and sea turtles would be less likely to be in the project area should minimize potential impacts to federally-listed turtles. As well, turtles are mobile and would be expected to avoid the area during construction. Boat operators and construction workers will be instructed on recognizing and avoiding protected sea turtles and other marine mammals prior to start of project construction.

The National Marine Fisheries Service, in a letter dated March 6, 2006 concurred with a determination that there will be no impacts to protected species as a result from the proposed project (NMFS, 2006a). A separate Environmental Assessment (EA) will be prepared to present

information on the environmental features of the dredging site and to review dredging methodology to determine the potential impacts of the proposed maintenance dredging at the Cape Cod Canal Site or other proposed dredging site on sea turtles and other identified protected species.

Essential Fish Habitat

A detailed evaluation of the impacts on the life history requirements of Essential Fish Habitat species is provided in Appendix C. Environmentally sound engineering and erosion control practices adequately protect those species listed under the Magnuson-Stevens Fisheries Conservation Act for EFH in the project area**.** No significant impacts to EFH species are anticipated. Many different types of habitats have a bearing on the quality of EFH, those areas which are necessary to fish for spawning, breeding, feeding, or growth to maturity. The essential fish habitat concerns for the project area are primarily the waters, salt marsh, intertidal and subtidal resources, and eelgrass and benthic resources of the near project area. Impacts to essential fish habitat in the project area were avoided or minimized to the maximum extent practicable through the planning and design process as described in the Environmental Assessment. Mitigation provided to compensate for permanent impacts to intertidal, subtidal and salt marsh habitats, as discussed in the preceding paragraphs, will provide comparable habitat benefits to the Buzzard's Bay estuarine environment and will adequately compensate impacts to foraging or nursery areas for EFH species. The inclusion of mitigation is consistent with Essential Fish Habitat Conservation Recommendations provided in a letter from the National Marine Fisheries Service, dated 16 February 2006 (NMFS, 2006b). In addition, further coordination will be conducted with federal and state resource agencies during preparation of Plans and Specifications to assure adequate compensation to protected species.

Cape Cod Canal Maintenance Dredge Site A separate EA will be prepared to present information on the environmental features of the dredging site and to review dredging methodology to determine the potential impacts of the proposed maintenance dredging at the Cape Cod Canal.

Historic and Archaeological Resources

This project was previously coordinated with both the Massachusetts State Historic Preservation Officer (Massachusetts Historical Commission) and the Wampanoag Tribe of Gay Head (Aquinnah) in 2001 and 2002. At that time, a finding of no adverse effect upon significant cultural resources was confirmed. Ms. Ramona Peters of the Wampanoag Tribe provided a short report of her findings including that of a bone found during a site visit. The bone was examined and found to be from a marine mammal. The Tribe had no concerns with the project as was proposed at that time. With the exception of no action, each of the alternatives would serve to protect the Bird Island Lighthouse and the island itself from further erosion by rebuilding the existing stone revetment. Although the revetment dates from the mid-19th Century, due to storm damage and erosional processes, it has been modified and both repaired and rebuilt several times. The project, if built, will serve to adequately restore the existing revetment and protect the lighthouse while also creating tern habitat on the island.

The wetland mitigation sites at Apponagansett Bay in Dartmouth and Little Bay in Fairhaven are both located within areas of archaeological sensitivity. At Apponagansett Bay, a multicomponent pre-Contact and Contact Period archaeological site (19-BR-508) is located on the peninsula near the northwest corner of Apponagansett Bay. This site is located directly east of the proposed wetland mitigation work. Artifact finds have been reported by residents and the area has long been known as a Native American activity area and habitation site for pre-Contact and Contact Period peoples in Dartmouth. The surrounding area may contain intact archaeological deposits associated with these activities. However, as the proposed mitigation consists of the removal of fill material from a former salt marsh and replacement with an elevated walkway, archaeological resources should not be at risk. The mitigation area is situated to the west of 19-BR-508, on the opposite side of the peninsula. Currently the filled area serves as an access way and trail network through adjoining lands.

The Little Bay salt marsh restoration site at Sconticut Neck in Fairhaven is surrounded by archaeological sites to its north and south along a narrow portion east of Sconticut Neck Road. University of Massachusetts Archaeological Services conducted a reconnaissance survey for a Little Bay Multi-Use Trail in 2003. Several Pre-Contact Period sites were identified north of the proposed restoration site at this time including 19-BR-348 and 19-BR-587. However, as the proposed salt marsh restoration consists of the removal of road construction debris and fill from years of dumping, impacts to significant cultural resources are not expected. Excavation will be confined to previously filled and disturbed contexts.

In sum, the Bird Island Aquatic Habitat Restoration project in Marion and subsequent wetland mitigation at salt marsh restoration sites on Apponagansett Bay in Dartmouth and Little Bay at Sconticut Neck in Fairhaven will have no adverse effects upon structures or sites of historic, architectural, or archaeological significance as defined by the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR 800. The Massachusetts State Historic Preservation Officer and Board of Underwater Archaeological Resources concurred with this determination in a letter dated 4 October 2005.

Compliance Issues

Environmental Justice

The proposed project site was not selected based on the social or economic make-up of the neighboring landowners or the watershed community, but rather based on the environmental benefits of restoring nesting habitat to the federally endangered Roseate Tern. The benefits of this project will be realized by neighboring residents equally, regardless of their race or income. As a result, no disproportionate impacts on environmental justice populations, in accordance with Executive Order #12989, dated February 11, 1994 (*Environmental Justice in Minority Populations*), are expected.

Protection of Children

No significant adverse impacts to children, minority or low-income populations are anticipated. The environmental effects of this project are occurring on and around a coastal island.

Clean Air Act Conformity

Corps of Engineers guidance on air quality compliance is summarized in Appendix C of the Corps Planning Guidance Notebook (ER1105-2-100, Appendix C, Section C-7, pg. C-47). Section 176 (c) of the Clean Air Act (CAA) requires that Federal agencies assure that their activities are in conformance with Federally-approved CAA state implementation plans for geographic areas designated as non-attainment and maintenance areas under the CAA. The U.S. Environmental Protection Agency (EPA) General Conformity Rule to implement Section 176 (c) is found at 40 CFR Part 193.

Ambient air quality is protected by federal and state regulations. The EPA has developed National Ambient Air Quality Standards (NAAQS) for certain air pollutants, with the NAAQS setting concentration limits that determine the attainment status for each criteria pollutant. The State of Massachusetts is designated as attainment or non-attainment with respect to the NAAQS for six criteria air pollutants: particulate matter no greater than 10 micrometers in diameter (PM_{10}); sulfur dioxide (SO_2); ozone (O_3); nitrogen dioxide (NO_2); carbon monoxide (CO); and lead (Pb). Ozone (O_3) is the only pollutant for which Massachusetts monitors indicate violations of the standards (MA DEP, 2003).

Section 176c of the Clean Air Act (CAA) requires that Federal agencies assure that their activities are in conformity with state plans for non-attainment areas. The Corps must evaluate and determine if the proposed action will generate air pollution emissions that aggravate a non-attainment problem or jeopardize the maintenance status of the area for ozone.

The project is located in Plymouth County, Marion, Massachusetts. Plymouth County is considered to be a non-attainment area for ozone, receiving a “moderate” classification under the new 8-hour ozone air quality classification. The General Conformity thresholds for ozone in a moderate non-attainment area have an emission rate threshold of 50 tons per year (tons/year) of VOC (volatile organic compounds) and 100 tons/year of NO_x (nitrogen oxides) (U.S. Army Environmental Center, 2002) (40 CFR 51.853, 7-1-03).

Construction of the proposed project would cause temporary reduction in local ambient air quality because of fugitive dust and emissions generated by construction equipment and placement of fill on the island. The extent of dust generated would depend on the level of construction activity and on sand composition and dryness. The use of proper dust suppression techniques should minimize nuisance airborne particulates. Construction activities on Bird Island are not expected to affect residents along the neighboring coastline.

Construction would require the use of marine vessels and nonroad construction equipment. The State of Massachusetts does not have testing requirements for some non-road construction vehicle emissions (including all "tracked" vehicles, articulated loaders/haulers, backhoes, bulldozers, cranes, excavators, loaders, mobile hydraulic platform lifters and motor graders), but has adopted federal rules that establish emissions standards for nonroad heavy duty diesel engines (40 Code of Federal Regulations (CFR) 89), nonroad gasoline engines (40 CFR 90) and marine engines (40 CFR 91). By requiring the Corps Contractor to comply with applicable Federal and state and Federal emissions requirements for construction vehicles, the Bird Island Restoration Project will conform to the requirements of the Massachusetts State Implementation Plan (SIP). Therefore, the proposed Corps activity will not worsen an existing NAAQS violation, cause a new NAAQS violation, delay the SIP attainment schedule of the NAAQS, or otherwise contradict SIP requirements for the State of Massachusetts. Other unregulated emissions meets the *de minimus* requirement established by the EPA's General Conformity Rule in that total direct and indirect emissions caused by the operation of the federal action are less than *de minimus* levels established in the rule.

To conduct a general conformity review and emission inventory for the proposed habitat restoration project, a list of construction equipment was identified using the project construction cost estimate. The first column of the emissions calculations table provides a summary equipment list (see Appendix K – Emissions Estimates). The New England District prepared calculations of the worst-case project specific emissions of NO_x and VOCs to determine whether project emissions would be under the General Conformity Trigger Levels. Because of the small scale of the project, several simplifying assumptions were applied in performing the calculations to prepare a worst-case analysis. The actual emissions would most likely be much lower, but in no case above the calculated values. For instance, the load factor is the average percentage of rated horsepower used during a source's operational profile. To simplify the calculations, we used a worst-case estimate of 1.0, or 100 percent, for all equipment. We used 12 hours per day as worst-case hours of operation for most equipment. We used the total construction duration minus non-work days (i.e. weekends and holidays) to estimate days of operation, rather than the specific days of operation for each piece of equipment. Based on these calculations, the worst-case NO_x emissions were 23.49 tons and the worst-case VOC emissions were 3.32 tons. In both cases, the total construction emissions were below the General Conformity Trigger Levels. General Conformity under the Clean Air Act, Section 176 has been evaluated for the project according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project because the total direct and indirect emissions from the project are below the conformity threshold values established at 40 CFR 93.153 (b) for ozone (NO_x and VOCs) in a moderate attainment area. These calculations are presented in Appendix K – Emissions Estimates and a Record of Non Applicability for Clean Air Act Conformity (RONA) is included at the end of this Environmental Assessment.

The determination of whether or not a project is regionally significant is if its emissions exceed 10% of the state's total emissions budget for the criteria pollutants (40 CFR 93.153 (i)). Table IV – 1 of the 2002 Eastern Massachusetts Supplement to the July 1998 Ozone Attainment State Implementation Plan Submittal (MA DEP, 2002), lists the total emissions inventories for emissions sources in the state for various years, and predicts estimated inventories for 2007.

These inventories are calculated as tons per summer day (tpsd) and show that for mobile sources alone, total values of 243.328 tpsd of NO_x and 117.118 tpsd of VOCs are predicted for 2007. As noted, the emissions for the Bird Island Habitat Restoration Project are estimated to be 23.49 and 3.32 tons for both NO_x and VOCs respectively. These values show that *in less than one day*, mobile sources alone within the area of Eastern Massachusetts would exceed the yearly estimated emissions for both NO_x and VOCs for the proposed Bird Island Habitat Restoration Project. Therefore the estimated emissions for the proposed project are below 10% of the total emissions inventory for the Commonwealth of Massachusetts. The Army activity does not reach the threshold levels established by the EPA rule, and is not regionally significant, and therefore the conformity rule is inapplicable here. Supporting emissions calculation are provide in Appendix K – Emissions Estimates and a record of Non-Applicability for the Bird Island Habitat Restoration Project is provided at the end of this Environmental Assessment. No changes in local or regional air quality would occur with the construction and operation of the proposed project. Under 310 Code of Massachusetts Regulations (CMR), an air quality approval will not be required from the MA DEP.

Cumulative Impacts

Cumulative impacts are those resulting from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions.

The project affects three habitat types: island tern nesting habitat, salt marsh, and rocky intertidal habitat. The effect of the project on tern nesting habitat is positive – it increases the area of habitat available for tern nesting. In the historical context, significant areas of tern nesting habitat have been lost concentrating the terns into smaller and smaller nesting areas away from human disturbance (i.e. on islands). The cumulative loss of critical tern nesting habitat over time drove the tern population to such low levels that the Roseate Tern was placed on the Endangered Species list. This restoration project will replace a portion of the historic tern nesting capacity. Any additional similar tern nesting habitat restoration projects will contribute to an incremental restoration of tern nesting habitat leading to a cumulative restoration of lost tern nesting resources over time.

The proposed project involves placing fill onto the island within the perimeter of the existing stone revetment filling 28,050 sf (0.64 ac) of salt marsh similar to the historical configuration of the island. In addition, the revetment will be restored along the alignment of the circa 1843 revetment minimizing the placement of fill in the intertidal zone as much as practicable. Salt marsh and intertidal habitat will be restored/enhanced at two off-site locations in Dartmouth and Fairhaven, to compensate wetland values within the general vicinity. The salt marsh filled to restore the island formed when the prior island substrate eroded exposing elevations suitable for colonization by salt marsh plants. Although salt marsh in general has been lost throughout the Buzzards Bay area, the salt marsh impacted by this project had developed recently, so its loss to the site would not affect the long term habitat pattern of the area. The project will not contribute to cumulative loss of salt marsh over time because the area of salt marsh lost is being replaced at off-site locations in Buzzards Bay as compensation. The project will convert loose cobble intertidal habitat to large stone revetment. There are similar no

reasonably foreseeable projects that would, in combination with the proposed project, have significant cumulative effects on intertidal cobble habitats.

Sustainable Design and Development

The concept of sustainable development has surfaced recently as an important consideration in the implementation of Corps water resources development projects. Economic prosperity, social well being and environmental quality, the three fundamental sustainable development principles, are integrated into the planning process to foster the "smart growth" vision of the future. The U.S. Army Corps of Engineers Districts are required to begin incorporating sustainable design and development (SDD) principles into the design, development, and construction of Corps projects in accordance with Executive Order 13123 and other applicable laws and Executive Orders.

The Sustainable Design and Development Principals are as follows:

- Meets the needs of the present without compromising the quality of life of future generations.
- Maintains economic growth while producing an absolute minimum of pollution, repairing environmental damages of the past, producing less waste, and extending opportunities to life in a pleasant and healthy environment.
- Meets human needs by maintaining a balance between development, social equality, ecology, and economics.
- Demands systematic considerations of environmental impact, energy use, natural resources, economy, and quality of life.
- Has optimal benefit only when addressed at the inception of a project, and throughout the entire life cycle of a project -- from concept to planning, to programming, design, construction, and ownership.

The proposed project is authorized under Section 206 of the Water Resources Development Act of 1996 (PL 104-303), which provides authority to develop aquatic ecosystem restoration and protection projects, and Section 204 of the Water Resources Development Act of 1992 (PL 102-980), which provides authority for the protection and restoration of aquatic and ecologically related habitats in connection with dredging for construction, operation, or maintenance dredging of an authorized Federal navigation project. The project provides a restoration of nesting habitat on Bird Island in support of the federal recovery plan for the northern population of Roseate Tern. The restoration of the island revetment has the added benefit of protecting a masonry lighthouse, which is listed on the National Register of Historic Places. The restoration of the habitat needs of a federally endangered species and protection of a nationally recognized lighthouse for future generations is consistent with the Sustainable Development Principles.

This EA was prepared to comply with Council of Environmental Quality and USACE regulations for implementing NEPA. NEPA requires the federal government to consider the environmental effects of a proposed action and solicit comment during the planning process from

interested agencies, groups and the general public. The Section 204 and 206 Programs also require the preparation of an incremental analysis, which provides information used in the selection of the least costly and environmentally sound alternative. These processes assure that the environmental effect of a proposed action, with regard to the balance of development, social equality, ecology and economics, consistent with the established Sustainable Design and Development Principals, were considered in the development of this project and will be realized throughout the entire life cycle of the project.

Coordination

A coordinated site inspection was conducted on 5 May 2004 with federal, state and local agencies with interest or jurisdiction in the proposed project. Additional meetings were held on several occasions to coordinate project plan formulation and consider agency comments and concerns. On June 2, 2006, a Public Notice of the proposed project was released to inform federal, state and local agencies and the interested public. Four comment letters or e-mails were received during the Public Notice 30-day comment period. Coordination letters were mailed to the following agencies (see Appendix A for letters of response and a copy of the Public Notice):

Federal

U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
U.S. National Marine Fisheries Service

State

Massachusetts Executive Office of Environmental Affairs
- Massachusetts Coastal Zone Management
- Massachusetts Environmental Policy Act Unit

Massachusetts Department of Environmental Protection
- Operations and Programs - Northeast Regional Office
- Bureau of Resource Protection - Wetlands and Waterways Program

Massachusetts Department of Environmental Management
- Division of Resource Conservation
  - Bureau of Engineering - Office of Waterways
  - Bureau of Resource Protection - Office of Water Resources

Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement
- Division of Fisheries and Wildlife
  - Natural Heritage & Endangered Species Program
- Division of Marine Fisheries

Massachusetts Historic Preservation Office

Massachusetts Audubon Society

Massachusetts Board of Underwater Archaeological Resources

Tribal Governments

Wampanoag Tribe of Gay Head (Aquinnah)

Local

Town of Marion
Town of Dartmouth
Town of Fairhaven

Permit Requirements

Federal

The Army Corps of Engineers will request a Water Quality Certification (WQC) from the Massachusetts Department of Environmental Protection pursuant to Section 401 of the Clean Water Act since the project proposes to discharge or place fill in jurisdictional wetlands or waters of the United States, or the Commonwealth. Information contained within the Environmental Assessment establishes that the proposed action will not adversely affect or degrade the existing SA surface water quality associated with the adjacent surface waters to project area as defined in 314 CMR 4.00.

The Army Corps of Engineers will prepare a Coastal Zone Management Consistency Determination and request the Massachusetts Coastal Zone Management (MCZM) office concurrence with that determination. The evaluation of the project must show that the project is consistent with the enforceable policies of the state's Coastal Management Plan. The project will be undertaken in a manner that is consistent to the maximum extent practicable with the all applicable MCZM Management Program Policies. MCZM has played an active role in the planning and development of this project.

The Army Corps of Engineers is required to substantially comply with the requirements of Section 404 of the Clean Water Act for projects that include the placement of fill or dredged material, or any excavation in waters of the United States, including wetlands. This project complies with the substantive requirements of Section 404 of the Clean Water Act as provided in the Section 404(b)(1) Evaluation included in this report.

Local Sponsor – Executive Office of Environmental Affairs

Massachusetts Environmental Policy Act (MEPA) - Division of Fisheries and Wildlife (MA DFW) Draft Environmental Impact Report (EIR) dated September 16, 2002 (MA DFW, 2002), was prepared under the Massachusetts Environmental Policy Act (MEPA) regulatory guidelines. The local sponsor will provide supplemental information to the MEPA office pursuant to the proposed federal project in the completion of this regulatory requirement.

Wetland Protection Act - A Notice of Intent (NOI) will be submitted to the local Conservation Commission (ConCom) pursuant to the Massachusetts Wetland Protection Act (WPA) (310 CMR 10.00) requesting approval and an Order of Conditions for the proposed project. Based on the proposed activity's impact on salt marsh resources, the ConCom is expected to deny the project because the project fails to meet the performance standards associated with salt marsh resources contained in the regulations.

The local sponsor will request a variance from WPA and Final Order of Conditions for impacts to salt marsh through the Commissioner of the Massachusetts Department of Environmental Protection. The variance is required since the project proposes to impact through the placement of fill up to 28,050 sf of salt marsh landward of the revetment and 8,802 sf of intertidal cobble habitat seaward of the revetment. As stated in the WPA, (310 CMR 10 .32 [3]),*"A proposed project in a salt marsh, on lands within 100 ft of a salt marsh, or in a body of water adjacent to a salt marsh shall not destroy any portion of the salt marsh and shall not have an adverse effect on the productivity of the salt marsh..."*. Given the nature of the project and the variance provisions presented in the WPA (310 CMR 10.05 [10][b]), it appears that a variance from the WPA would be appropriate in this case. Issuance of the variance is required prior to all other wetland related permits.

State Waterways Program – The Massachusetts Division of Fisheries and Wildlife coordinated extensively with federal and state agencies during its pursuance of a project similar to the proposed Section 204/206 project. It was determined during that process, through existing documentation, registry review, and discussions with the MADEP-SERO - Waterways Program, that the stone revetment built along most of Bird Island's perimeter is not a licensed structure. In addition, any maintenance to the revetment is an activity not requiring a new Waterways License or Permit as defined in 310 CMR 9.05 (3)(c), since the maintenance of the revetment is a continued public service project, in which the structure has not been altered or been subject to a change in use subsequent to January 1, 1984. If the revetment were rebuilt within its original footprint, the project would not require a new Chapter 91 license. Since the new revetment will have a much larger footprint the project will require a new Chapter 91 license.

State Water Quality Certification – The project will require a 401 Water Quality Certification for fill and excavation in waters or wetlands.

State Conservation Permit -Under the requirements of MGL c. 131A (3) and 321 CMR 10.04, it must be demonstrated to the Commissioner of the Commonwealth Department of Fisheries and Wildlife that the project is the only viable project design, and that it will avoid

impacts to a state-protected rare species or substantiate a claim to an insignificant impact. This demonstration will take the form of a letter request with specific technical support information that will include: Existing and Future Site Conditions, Impact Analysis, and a Conservation Plan.

It is not feasible to relocate salt marsh and salt panne resources while meeting the goals of the project. There is no landward area available due to the small size of the island and there are substantial environmental and regulatory constraints to filling intertidal habitat to the benefit of salt marsh habitat. Therefore, the loss of salt marsh and salt panne habitat on-site is considered unavoidable. Replacement of salt marsh habitat will be undertaken off-site through restoration opportunities in Dartmouth and Fairhaven, Massachusetts.

Conclusions and Recommendations

Conclusions

Alternative C, which includes rebuilding the revetment surrounding Bird Island and restoring the substrate and elevation of the island, is the most beneficial and cost effective habitat restoration for Bird Island. This plan will substantially increase the capacity of Bird Island to support endangered Roseate Terns, as well as Common Terns.

Recommendation

I recommend that the New England District and Massachusetts Executive Office of Environmental Affairs secure the necessary Federal and non-Federal funds to implement the recommended plan. The restoration plan is consistent with current administration policy and, if implemented, will provide measurable environmental benefits.

26 July 2006
Date

Curtis L. Thalken
Colonel, Corps of Engineers
District Commander

Compliance Table

COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

Federal Statutes

1. Archaeological Resources Protection Act of 1979, as amended, 16 USC 470 et seq.

Compliance: Issuance of a permit from the Federal land manager to excavate or remove archaeological resources located on public or Indian lands signifies compliance.

2. Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: Project will be coordinated with the State Historic Preservation officer. Impacts to archaeological resources will be mitigated.

3. American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.

Compliance: Must ensure access by Native Americans to sacred sites, possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

4. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Public notice of the availability of this report to the Environmental Protection Agency is required for compliance pursuant to Sections 176c and 309 of the Clean Air Act.

5. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: A Section 404(b)(1) Evaluation and Compliance Review will been incorporated into the project report. An application shall be filed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.

6. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.

Compliance: A CZM consistency determination shall be provided to the State for review and concurrence that the proposed project is consistent with the approved State CZM program.

7. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) will determine formal consultation requirements pursuant to Section 7 of the Endangered Species Act.

8. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Not applicable, the report is not being submitted to Congress.

9. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Public notice of availability to the project report to the National Park Service (NPS) and Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

10. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the FWS, NMFS, and State fish and wildlife agencies signifies compliance with the Fish and Wildlife Coordination Act.

11. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Public notice of the availability of this report to the National Park Service (NPS) and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

12. Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.

Compliance: Disposal of dredged material as fill material is evaluated under the 404(b)(1) guidelines pursuant to the Clean Water Act.

13. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the State Historic Preservation Office signifies compliance.

14. Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3000-3013, 18 U.S.C. 1170

Compliance: Regulations implementing NAGPRA will be followed if discovery of human remains and/or funerary items occur during implementation of this project.

15. National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.

Compliance: Preparation of an Environmental Assessment signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact is issued.

16. Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: No requirements for projects or programs authorized by Congress. The proposed project is being conducted pursuant to the Congressionally-approved authority.

17. Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.

Compliance: Not applicable, this project is does not involve the construction of flood control structures for the purpose of preventing flood damages. Floodplain impacts associated with this project are the result of the restoration of nesting habitat for the Federally endangered Roseate Tern.

18. Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.

Compliance: Not applicable, the project does not involve impacts to a designated Wild and Scenic River.

19. Magnuson-Stevens Act, as amended, 16 U.S.C. 1801 et seq.

Compliance: Coordination with the National Marine Fisheries Service and preparation of an Essential Fish Habitat (EFH) Assessment signifies compliance with the EFH provisions of the Magnuson-Stevens Act.

20. Marine Mammal Protection Act of 1972, as amended, 16 U.S.C. 1361-142h et seq.

Compliance: Boat operators and construction workers associated with the proposed project will be instructed to avoid harassment of marine mammals prior to start of project construction.

Executive Orders

1. Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971

Compliance: Coordination with the State Historic Preservation Officer signifies compliance.

2. Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979.

Compliance: Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2).

3. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Public notice of the availability if this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

4. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not applicable to projects located within the United States.

5. Executive Order 12898, Environmental Justice, 11 February 1994.

Compliance: Not applicable, the project is not expected to have a significant impact on minority or low-income population, or any other population in the United States.

6. Executive 13007, Accommodation of Sacred Sites, 24 May 1996

Compliance: Not applicable, the project is not located on Federal lands.

7. Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, 21 April 1997.

Compliance: Not applicable, the project will not create a disproportionate environmental health or safety risk for children.

8. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.

Compliance: Consultation with Indian Tribal Governments, where applicable, and consistent with executive memoranda, DoD Indian policy, and USACE Tribal Policy Principles signifies compliance.

Executive Memorandum

Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: Not applicable, the project does not involve or impact prime or unique agricultural lands.

White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.

Compliance: Consultation with Federally Recognized Indian Tribes, where appropriate, signifies compliance.

References

Binzen, Timothy, Suzanne G. Cherau, and Kerrylynn Boire. 1998. Marion Community-Wide Reconnaissance Archaeological Survey, Marion, Massachusetts. Submitted by the Public Archaeology Laboratory, Inc. (PAL). Submitted to the Sippican Historical Society, Marion, Massachusetts and the MHC, Boston, Massachusetts. PAL Report Number 881, October 1998.

Bourne Consulting Engineers. 2001. Bird Island Restoration Project. In association with ENSR and ACRE. October 2001. pgs 25 w/att.

Costa, J. E. 1999. Eelgrass (*Zostera marina*) Distribution around Bird Island and Sippican Harbor. Buzzards Bay Project Technical Report. June 9, 1999.

Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31, Washington.

Environmental Protection Agency (EPA). 2003. Long Island Sound Habitat Restoration Initiative. Habitat Restoration Manual. Section 3: Submerged Aquatic Vegetation. EPA Long Island Sound Office, Stamford, CT. November 2003

Foulis, David. 2000. Interagency Assistance, Bird Island Salt Marsh Delineation, Marion, MA. Memorandum. MADEP-SERO circuit Rider. 9-11-00.

Gordon, Edward W. 1998. Marion, Massachusetts Comprehensive Cultural Resources Survey Report. On behalf of the Sippican Historical Society (Marion) and the Massachusetts Historical Commission (Boston).

Heck, K. L., K. W. Able, M. P. Fahay, and C. T. Rowan. 1989. Fishes and Decapod Crustaceans of Cape Cod Eelgrass Meadows: Species Composition, Seasonal Abundance Patterns and Comparison with Unvegetated Substrates. Estuaries 12:59-65.

Hughes, J., L. Deegan, J. Wyda, M. Weaver and A. Wright. 2000. Loss of Eelgrass Habitat and Effects on Fish Communities of Southeastern Massachusetts. Southern New England Chapter, American Fisheries Society, 2000 Summer Meeting, Programs and Abstracts.

LaSalle, M.W, Clarke, D.G., Homziak, J., Lunz, J.D., and Fredette, T.J. 1991. A Framework for Assessing the Need for Seasonal Restrictions on Dredging and Disposal Operations. Tech. Rep. D-91-1, US Army Engineer Waterways Exp. Stn., Vicksburg,MS. pp 74.

Lefor, M.W., W.C. Kennard and D.L. Civco. 1987. Relationship of salt marsh plant distributions to tidal levels in Connecticut. Environmental Management 11:1:61-68.

Massachusetts Department of Environmental Protection (MA DEP), Division of Planning and Evaluation. 2003. Commonwealth of Massachusetts 2003 Air Quality Report. Air Assessment Branch, Wall Experiment Station, 37 Shattuck Street, Lawrence, MA 01843.

Massachusetts Department of Environmental Protection, Divison of Air Quality (MA DEP). 2002. http://www.mass.gov/dep/bwp/daqc/daqcpubs.htm#sip

Massachusetts Division of Fisheries and Wildlife (MA DFW). 2005. The average number of Roseate Tern and Common Tern Numbers between 2001 and 2005. MA DFW Unpublished Data.

Massachusetts Division of Fisheries and Wildlife (MA DFW). 2002. Draft Environmental Impact Report New Bedford Harbor Tern Restoration Project – Roseate Tern Nesting Habitat Enhancement at Bird Island in Marion, Massachusetts (NHESP-02-BHTR), EOEA File No. 12490. Prepared by The Garrett Group, LTD., Plymouth, MA.

Massachusetts Division of Fisheries and Wildlife (MA DFW). 2004. Telephone coordination with Carolyn Mostello, Massachusetts Division of Fisheries and Wildlife concerning construction scheduling to avoid tern impacts. December 5, 2004.

Massachusetts Division of Marine Fisheries (MA DMF). 1999. Letter dated July 26, 1999 from the Massachusetts Division of Marine Fisheries to Charles Bradley, Town of Marion, Massachusetts, concerning a biological survey conducted by MA DMF around Bird Island on July 21, 1999.

Massachusetts Division of Marine Fisheries (MA DMF). 2004. Survey data provided by Vincent Malkoski, Senior Marine Fisheries Biologist/Diving Safety Officer concerning a biological survey conducted by MA DMF around Bird Island in August 2004.

Massachusetts Geographic Information System (GIS). 2004. *Shellfish Suitability Areas - June 2004.* http://www.mass.gov/mgis/shlfshsuit.htm

Massachusetts Historical Commission (MHC). 2005. Concurrence letter from the Massachusetts Historical Commission dated 5 October 2005. Boston, Massachusetts.

Massachusetts Historical Commission (MHC). 1981. MHC Reconnaissance Survey Report: Marion. Unpublished manuscript, MHC, Boston, Massachusetts.

Massachusetts Natural Heritage and Endangered Species Program (MA NHESP). 2004a. Letter dated 3 June 2004 from the Natural Heritage Program, Division of Fisheries and Wildlife concerning State rare species in the project vicinity.

Massachusetts Natural Heritage and Endangered Species Program (MA NHESP). 2004b. Rare Plants and Animals. http://www.mass.gov/dfwele/dfw/nhesp/nhspecies.htm

National Marine Fisheries Service (NMFS). 2006a. Comment letter dated 6 March 2006 pursuant to the Endangered Species Act from the National Marine Fisheries Service, Northeast Region, Gloucester, MA.

National Marine Fisheries Service (NMFS). 2006b. Essential Fish Habitat Recommendations letter dated 16 February 2006 from the National Marine Fisheries Service, Northeast Region, Gloucester, MA.

National Marine Fisheries Service (NMFS). 2004a. Planning Aid Letter dated 29 March 2004 from the National Marine Fisheries Service, Northeast Region, Gloucester, MA.

National Marine Fisheries Service (NMFS). 2004b. Loggerhead Sea Turtles (*Caretta caretta*). Office of Protected Species. National Marine Fisheries Service, Northeast Regional Office. http://www.nmfs.noaa.gov/prot_res/species/turtles/loggerhead.html

National Marine Fisheries Service (NMFS). 2004c. Leatherback Sea Turtle (*Dermochelys coriacea*). Office of Protected Species. National Marine Fisheries Service, Northeast Regional Office. http://www.nmfs.noaa.gov/prot_res/species/turtles/leatherback.html

National Marine Fisheries Service (NMFS). 2004d. Kemp's Ridley Turtle (*Lepidochelys kempii*). Office of Protected Species. National Marine Fisheries Service, Northeast Regional Office. http://www.nmfs.noaa.gov/prot_res/species/turtles/kemps.html

National Marine Fisheries Service (NMFS). 2004e. Green Sea Turtle (*Chelonia mydas*). Office of Protected Species. National Marine Fisheries Service, Northeast Regional Office. http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html

National Marine Fisheries Service (NMFS). 2004f. Summary of Essential Fish Habitat (EFH) Designations. National Marine Fisheries Service, Northeast Regional Office. http://www.nero.noaa.gov/ro/STATES/CapecodtoHN/41407040.html
Scott, W.B., and M.G. Scott. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 731p.

NFIP. 1992. FIRM - Map, Community Panel 255213 0008E. Marion, MA, dated 07-15-02.

Nisbet, I. C. T. (2002). Common Tern (*Sterna hirundo*). *In* The Birds of North America, No. 618 (A. Poole and F. Gill, eds.). Birds of North America, Inc., Philadelphia, PA.

Stone et al. 1994. Distribution and Abundance of Fishes and Invertebrates in Mid-Atlantic Estuaries. ELMR Rep 12 NOAA/NOS Strategic Environmental Assessments Division, Silver Springs, MD, pgs 280.

Thayer, G.W., W.J. Kenworthy, and M.S. Fonseca. 1984. The Ecology of Eelgrass Meadows of the Atlantic Coast: A Community Profile. U.S. Fish Wildl. Serv. FWS/OBS-84/02. 147 pp. Reprinted September 1985.

U.S. Army Environmental Center. 2002. Technical Guide for Compliance with the General Conformity Rule. Prepared by Lisa M Polyak, U.S. Army Center for Health Promotion and Preventative Medicine, Directorate of Environmental Health Engineering, Air Quality

Surveillance Program, and Lawrence L Webber, U.S. Army Environmental Center, Environmental Quality Division, Compliance Branch

U.S Army Corps of Engineers (USACOE). 1995. The Highway Method Workbook Supplement – Wetland Functions and Values: A Descriptive Approach. NEDEP-360-1-30a. pp.32

U.S. Army Corps of Engineers (USACOE) Shore Protection Manual (SPM), 1984.
Bold, H.C. and M.J. Wynne. 197868.

U.S. Fish and Wildlife Service (USFWS). 2006a. Email dated 14 March 2006 pursuant to the Fish and Wildlife Coordination Act from the U.S. Fish and Wildlife Service, New England Field Office, Concord, NH.

U.S. Fish and Wildlife Service (USFWS). 2006b. Letter dated 13 February 2006 pursuant to the Endangered Species Act from the U.S. Fish and Wildlife Service, New England Field Office, Concord, NH.

U. S. Fish and Wildlife Service (USFWS). 2004. Letter of comment pursuant to the Endangered Species Act and the Fish and Wildlife Coordination Act dated 21 May 2004 from the U.S. Fish and Wildlife Service, New England Field Office, Concord, NH.

U. S. Fish and Wildlife Service (USFWS). 1998. Roseate Tern Recovery Plan – Northeast Population. First Update. Northeast Region U.S. Fish and Wildlife Service, Hadley, MA.

Clean Water Act 404 (b)(1) Evaluation

CLEAN WATER ACT: SECTION 404 (b) (1) EVALUATION
SECTION 206 – AQUATIC ECOSYSTEM RESTORATION
BIRD ISLAND, MARION, MASSACHUSETTS

NEW ENGLAND DISTRICT
U.S. ARMY CORPS OF ENGINEERS, CONCORD, MA

PROJECT: Bird Island Restoration Project, Marion, Massachusetts

PROJECT MANAGER: Lawrence Oliver PHONE (978) 318-8347

FORM COMPLETED BY: Judith Johnson PHONE (978) 318-8138

PROJECT DESCRIPTION: The proposed project involves the restoration of Bird Island to a habitat favorable for nesting Roseate Terns and Common Terns. Bird Island currently supports 22% of the North American population of Roseate Terns, endangered at both the Federal and State levels of jurisdiction. Much of Bird Island experiences wave action and submergence during storm events. Exposure to wave action, in part to a deteriorating stone revetment, has eroded the shoreline of the island lowering the ground elevation and changing its composition from gravel and sand to salt marsh and salt pannes, reducing the area suitable for tern nesting. Continued exposure to erosive forces will reduce the size and quality of the habitat, reducing and eventually eliminating the capacity of Bird Island to support colony-nesting Roseate and the Common Tern.

The proposed project involves replacing the existing deteriorating stone revetment along the island periphery and placing fill onto the island within the perimeter of the revetment to elevate the substrate above spring high water. Revetment restoration will stabilize the shorefront and attenuate wave energy, protecting the island from all but extreme storm waves and reduce the rate of erosion of upland material. To achieve these project goals, 28,050 square feet (sf) or 0.64 acres (ac) of salt marsh/salt panne will be filled and 8,802 sf or 0.2 ac of intertidal cobble habitat, which will be compensated to the maximum extent practicable off-site through the restoration/enhancement of salt marsh at Apponagansett Bay in Dartmouth and Little Bay in Fairhaven. Salt marsh along the exterior portion of the revetment will be temporarily excavated to allow for the construction of the buried revetment toe and then replaced at the toe of the new revetment. The new revetment will also protect a historic stone and masonry lighthouse that is listed on the National Register of Historic Places and is maintained by the Bird Island Preservation Society.

Sand from dredging of the Cape Cod Canal Hog Island Channel (or from another source) will be placed in the eroded and scoured areas inside the revetment. This material will restore appropriate substrates for nesting terns outside the range of tidal influence. A separate Environmental Assessment (EA) will be prepared to present information on the environmental features of the dredging site and to

review dredging methodology to determine the potential impacts of the proposed maintenance dredging at the Cape Cod Canal Site or other proposed dredging site.

CLEAN WATER ACT
Evaluation of Section 404(b)(1) Guidelines

1. Review of Compliance (Section 230.10(a)-(d)).

a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose;

__X__ YES ___ NO

b. The activity does not appear to:
   1) violate applicable state water quality standards or effluent standards prohibited under Section 307of the CWA;
   2) jeopardize the existence of Federally listed threatened and endangered species or their critical habitat; and
   3) violate requirements of any Federally designated marine sanctuary,

__X__ YES ___ NO

c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values;

__X__ YES ___ NO

d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

__X__ YES ___ NO

2. Technical Evaluation Factors (Subparts C-F).

	N/A	Not Signif-icant	Signif-icant
a. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C).			
1) Substrate.		X	
2) Suspended particulates/turbidity.		X	
3) Water.		X	
4) Current patterns and water circulation		X	
5) Normal water fluctuations.		X	
6) Salinity gradients.		X	
b. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D).			
1) Threatened and endangered species. (Positive effects)			X
2) Fish, crustaceans, mollusks and other aquatic organisms in the food web.		X	
3) Other wildlife.		X	
c. Potential Impacts on Special Aquatic Sites (Subpart E).			
1) Sanctuaries and refuges.		X	
2) Wetlands.		X	
3) Mud flats.		X	
4) Vegetated shallows.		X	
5) Coral reefs.	X		
6) Riffle and pool complexes.	X		
d. Potential Effects on Human Use Characteristics (Subpart F).			
1) Municipal and private water supplies.	X		
2) Recreational and Commercial fisheries.		X	
3) Water-related recreation.		X	
4) Aesthetics.		X	
5) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves.		X	

3. Evaluation and Testing (Subpart G).

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Only those appropriate are checked.)

1) Physical characteristics..... __X__
2) Hydrography in relation to known or anticipated sources of contaminants..... __X__
3) Results from previous testing of the material or similar material in the vicinity of the project..... __X__
4) Known, significant sources of persistent pesticides from land runoff or percolation..... _____
5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA)..... _____
6) Public records of significant introduction of contaminants from industries, municipalities, or other sources..... _____
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities..... _____
8) Other sources (specify)..... _____

List appropriate references. See 2005 Environmental Assessment for the Bird Island Section 206 Aquatic Ecosystem Restoration Project

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria.

__X__YES _____NO

4. Disposal Site Delineation (Section 230.11(f)).

a. The following factors, as appropriate, have been considered in evaluating the disposal site.

1) Depth of water at disposal site..... __X__
2) Current velocity, direction, and variability at disposal site..... __X__
3) Degree of turbulence..... _____
4) Water column stratification..... _____
5) Discharge vessel speed and direction..... _____
6) Rate of discharge..... _____
7) Dredged material characteristics (constituents, amount, and type of material, settling velocities)..... __X__

8) Number of discharges per unit of time..... _____
9) Other factors affecting rates and patterns of mixing (specify)..... _____

List appropriate references. See 2005 Environmental Assessment for the Bird Island Section 206 Aquatic Ecosystem Restoration Project

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or mixing zone are acceptable.

_X_ YES ___ NO

5. Actions To Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.

_X_ YES ___ NO

6. Factual Determination (Section 230.11).

A review of appropriate information as identified in items 2 - 5 above indicates that there is minimal potential for short or long term environmental effects of the proposed discharge as related to:

a. Physical substrate (review sections 2a, 3, 4, and 5 above). _X_ YES ___ NO

b. Water circulation, fluctuation and salinity (review sections 2a, 3, 4, and 5). _X_ YES ___ NO

c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5). _X_ YES ___ NO

d. Contaminant availability (review sections 2a, 3, and 4). _X_ YES ___ NO

e. Aquatic ecosystem structure, function and organisms(review sections 2b and c, 3, and 5). _X_ YES ___ NO

f. Proposed disposal site (review sections 2, 4, and 5). c, 3, and 5). _X_ YES ___ NO

g. Cumulative effects on the aquatic ecosystem. _X_ YES ___ NO

h. Secondary effects on the aquatic ecosystem. _X_YES ___ NO

7. Findings of Compliance.

The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines.

26 July 2006

Date

Curtis L. Thalken
COL, EN
Commanding

RECORD OF NON-APPLICABILITY (RONA)

GENERAL CONFORMITY - RECORD OF NON-APPLICABILITY

Project/Action Name: ***Bird Island Restoration Project***

Project/Action Point of Contact: *Larry Oliver, USACE Project Manager*
Phone: 978-318-8347

Begin Date: *0 9-01-2007* End Date: *01-01-2008*

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project/action because:

Total direct and indirect emission from this project/action have been estimated at less than 100 tons for Ozone, and are below the conformity threshold value established at 40 CFR 93.153(b) of 100 tons/year of Ozone;

AND

The project/action is not considered regionally significant under 40 CFR 93.153(i).

Supporting documentation and emissions estimates are:

(X) SEE APPENDIX K OF THE DPR/EA FOR EMISSIONS ESTIMATES
(X) APPEAR IN THE NEPA DOCUMENTATION (Clean Air Act Conformity Section)
( ) OTHER

Date: 7/13/06 Signed:

Joseph B. Mackay, Chief
Environmental Resources Section