

EXECUTIVE SUMMARY

1.0 Project Description

The Sconset Beach Nourishment Project (“Project”) is a large-scale nourishment project proposed to protect the Sconset shorefront, including some 75 private properties, many of them historic, Town roads and associated electrical and water utilities, portions of the Town of Nantucket’s wastewater facilities, Sankaty Head Lighthouse and the Sankaty Beach Club, all along the eastern shoreline of Nantucket Island (see Figure 1-1¹). The Applicant, Siasconset Beach Preservation Fund (SBPF), is a 501(c3) not-for-profit group that has been dedicated to protecting this portion of the Nantucket coastline for more than a decade. The SBPF’s primary mission is to protect and preserve the Sconset shoreline; this mission includes funding research and engineering studies to achieve erosion control, investigating ways to conserve natural resources for scenic and recreational enjoyment, demonstrating the effectiveness of innovative shoreline management strategies for coastal areas exposed to severe environmental conditions, and supporting efforts to inform the public about the importance of protecting valuable coastlines.

The Project will provide nourishment for approximately three miles of shoreline extending south from Sesachacha Pond, past Sankaty Head Lighthouse to Codfish Park and the village of Siasconset, and will also restore dune at Codfish Park and the Town Sewer Beds (see Figures 1-1 and 1-2). Project construction will utilize 2.6 million cubic yards (CY) of beach-compatible sediment to build a wide, high beach and dune which will protect the eroding Coastal Bank and threatened upland properties and structures. The Project’s engineered design consists of two components: (1) a design beach profile, which will be maintained post-construction to consistently provide protection against a major storm event, and (2) an advanced nourishment profile, which will extend seaward from the design beach and will erode over time.

The design beach profile will directly abut the toe of Coastal Bank and Dune and spread across the existing beach face, transitioning into the advanced nourishment profile. The design template is shown in plan view in Figures 1-7A through 1-7E, and cross-section view 1-8A through 1-8F. As depicted on Figure 1-1, the full nourishment template, on average approximately 206 feet wide, extends from Profile 98 at the North end through Profile 85 at the South end, and tapers landward at both ends. Farther south, at Profile 81, the Proponent will construct a dune seaward of the Town Sewer Beds.

The advanced nourishment profile is considered sacrificial, eroding over time in response to natural coastal processes while preventing loss of the design beach. As it erodes, the advanced nourishment profile will provide sediment to the littoral system at a rate

¹ All figures referred to in the Executive Summary (ES) are located in their respective section of the FEIR, unless they are in a stand-alone ES.

somewhat in excess of that provided naturally over the past decade. Once erosion removes the advanced nourishment material and begins encroaching into the design beach profile, the Project will not provide its intended level of protection for landward resources; at this point, the Proponent will renourish the beach. Proposed methods to monitor evolution of the nourishment template are presented in Executive Summary, Section 5.

Since the basic infrastructure of the beach dewatering systems at Codfish Park and LHS-S is currently in place, these components have been incorporated into the Project. Renovations to these units will make them operational. These beach dewatering systems are potentially valuable for extending the design life of the nourishment.

Bank stabilization is an integral component of the Project, since even with the proposed nourishment, over-steepened sections of Coastal Bank will need to be stabilized to prevent further losses and protect landward resources. To achieve this stabilization, the Proponent is constructing terraces using fabric bags and vegetation; these vegetated toe and bank face terraces will reduce the overall slope of over-steepened portions of the bank, provide wide areas for planting native bank-compatible vegetation, and protect the toe of bank during large storm events.

1.1 Public Benefits

Public benefits from the Project are substantial and multifaceted:

- Preservation of the historic Sconset shoreline and much of Sconset village, including a portion of the coast owned by the Town of Nantucket;
- Protection of Codfish Park Road, including water and electrical utilities and the only emergency access to Codfish Park;
- Protection of the Sconset sewer beds, where past erosion necessitated the abandonment of a planned expansion;
- Protection of 4-5% of the Town's tax base (i.e. based on properties located along the edge of the project shoreline);
- Creation of approximately 40 acres of new, enhanced habitat for endangered bird species;
- Protection of the historic Sconset bluff walk, a frequently-used tourist attraction; and
- Demonstration of the potential for beach nourishment as an effective shoreline management strategy to mitigate erosion and protect threatened coastal resources elsewhere on Nantucket and the Commonwealth.

2.0 Regulatory Analysis

The Project requires the regulatory permits, reviews and approvals listed in Table ES-1.

Since the DEIR Certificate was issued, the Proponent has conducted extensive outreach with public agencies, the Nantucket community and other DEIR commenters. The alternatives analysis process was one avenue through which the Proponent extensively collaborated with resource agencies to refine the Project design and evaluate feasible options. This alternatives analysis followed the U.S. Army Corps of Engineers' (USACE's) Highway Methodology; staff from fisheries agencies and other key state and federal environmental permitting agencies met and reviewed Project data and design throughout the alternatives analysis process. Since the DEIR, this process has involved an expanded alternatives analysis review of upland and marine sediment sources which are presented in Executive Summary, Sections 3 and 4.

Since the DEIR Certificate was issued, the Proponent has also engaged in numerous other consultations with regulatory officials and interested parties; these have included:

- A meeting held at the Department of Environmental Protection's Southeast Regional Office, which was attended by key DEP staff involved with Chapter 91 Waterways Permits, Water Quality Certification, and oversight of Wetlands Protection Act permitting as well as key Office of Coastal Zone Management (CZM) staff involved with issuance of the CZM Federal Consistency Certification approval;
- Natural Heritage & Endangered Species Program (NHESP) conference calls to discuss Piping Plover issues and Waterbird surveys;
- Nantucket Board of Selectmen, both collectively and individually;
- Mass Audubon staff, a property owner in the Project area;
- Nantucket Land Council staff and Board members; and
- Nantucket Land Bank staff and Board, key property owners in the Project area.

Table ES-1 Permits, reviews and approvals that may be required for the Project

<i>Federal Agency</i>	<i>Permit</i>	<i>Jurisdiction/Reason for Review</i>
U.S. Army Corps of Engineers	Section 404/10 Permit	Permit for work in navigable waters or wetlands
NOAA Fisheries	Magnuson-Stevens Fishery Conservation and Management Act National Endangered Species Act Section 7 review	Review of USACE permit application for Essential Fish Habitat and endangered marine species.
U.S. Fish & Wildlife Service	National Endangered Species Act	Review of USACE permit application associated with Piping plover habitat.
<i>State Agency</i>	<i>Permit</i>	<i>Jurisdiction/Reason for Review</i>
Massachusetts Coastal Zone Management	Federal Consistency Certification 301 CMR 21.00	Projects in the coastal zone that require a federal permit.
Massachusetts Board of Underwater Archaeological Resources	312 CMR 2.00	Permit is required to uncover and/or remove underwater archaeological resources.
Department of Environmental Protection	Chapter 91 Waterways Permit M.G.L. c91 and 310 CMR 9.00	Work in Private and Commonwealth Tidelands
	Water Quality Certificate 314 CMR 9.00	Dredging and Dredged Material Disposal
	Wetlands Protection Act Order of Conditions (Town of Nantucket) 310 CMR 10.00	<ul style="list-style-type: none"> • Land Under Water • Coastal Bank • Coastal Dunes • Coastal Beach • Floodplain • 100-foot buffer zone
Natural Heritage and Endangered Species Program	MA Endangered Species Act 321 CMR 10:00	Protected Shorebirds and Waterbirds
Massachusetts Historical Commission	Chapter 254 (state) Section 106 (federal)	Projects requiring a state or federal license or permit
Division of Conservation and Recreation	Marine Sanctuaries Act	Activities in state's marine sanctuaries
<i>Local Agency</i>	<i>Permit</i>	<i>Jurisdiction/Reason for Review</i>
Nantucket Conservation Commission	Order of Conditions (see DEP, above) and Local Wetlands Bylaw Chapter 136 Wetlands	<ul style="list-style-type: none"> • Land Under Water • Coastal Bank • Coastal Dunes • Coastal Beach • Floodplain • 100-foot buffer zone
Planning Board/Municipal Clerk	Chapter 91 Waterways License	Sign-offs for zoning consistency

To demonstrate and receive a determination of Coastal Zone Management consistency, the Proponent must address water quality, habitat, protected areas, coastal hazards, ports and harbor infrastructure, public access, energy, ocean resources and growth management policies. The proposed Project complies with the policies of the Massachusetts-approved Coastal Zone Management program and will be conducted in a manner consistent with such policies.

The Chapter 91 Waterways permit application requires the Proponent to address tidelands jurisdiction, review Chapter 91 licensing history, discuss a determination of water-dependency, and demonstrate compliance with Chapter 91 regulatory standards. The Project adheres to the intents and purposes of the Waterways Regulations by proposing beach and dune nourishment to protect and preserve both public and private property and infrastructure as well as to maintain and enhance public access along the entire nearly 3 mile Project shoreline. The Project complies with applicable Waterways Regulations.

The Water Quality Certification (WQC) requires that the Project comply with new WQC regulations applicable to beach nourishment projects. These new regulations (314 CMR 9.07(6)) stipulate that beach nourishment should be conducted in accordance with Best Management Procedures for Beach Nourishment and any procedures developed by the Massachusetts Office of Coastal Zone Management. The Project is consistent with these regulations since it provides a beach that is entirely open and available for public access. Dredged material used for nourishment will be clean, beach-compatible sand, and will not be a solid waste. Dredging and filling will be conducted to maintain state water quality standards in the surface waters and protect existing uses including fishing and swimming. In conformance with state water quality goals, the Proponent has identified time-of-year restrictions to protect marine ecology of the area.

The Project complies with the state Wetlands Protection Act (WPA) performance standards and the standards contained within the Town of Nantucket's Bylaw. WPA review ensures that the Natural Heritage and Endangered Species Program (NHESP) is notified about potential impacts to rare species from projects occurring in wetland resource areas or buffer zones. Therefore, this Project is subject to review by the NHESP; the FEIR thoroughly reviews the Massachusetts Endangered Species Act in local and state contexts.

The Proponent has coordinated survey efforts with the Massachusetts Board of Underwater Archaeologists to comply with the procedural plan stipulated by the agency for the underwater archaeological investigation. The purpose of this process is to identify any sensitive archaeological resources in the Project area so they may be avoided during dredging and construction.

3.0 Alternatives Analysis of Upland Sediment Sources

The Proponent has thoroughly analyzed the feasibility of utilizing an upland location as a sediment source for nourishment material. There are no available on-island sediment sources containing the requisite volume of appropriately-sized sediment to satisfy Project objectives.

Off-island upland sediment sources that conform to grain size criteria are available; however, transporting the large volume of nourishment material required for this Project from an upland location to the receiving beach could not be accomplished within the timeframe required to successfully nourish a beach. This Project needs to be constructed in one continuous construction season to ensure success of the nourishment template. Upland sediment sources would require a minimum of 2.5 years and up to 13 years to provide the required volume of sediment to the Beach Nourishment Project and therefore are not a feasible sediment source alternative.

The Proponent has engaged in detailed analyses of various sediment transportation alternatives. These analyses have revealed that daily production rates required to achieve Project objectives would necessitate simultaneous operations at two major ports at or near their maximum daily load rate capacity which is not likely possible. In addition, transportation of upland sediment to the Project site would require safe, uninterrupted travel for five fully-loaded barges tied together in a potentially hazardous high-energy environment, which is highly unlikely. Utilizing an off-island upland sediment source would unrealistically require around-the-clock operations, ideal weather conditions, and the procurement of large numbers of relatively scarce tugs and barges.

Truck delivery options would generate unacceptable impacts at the ferry off-loading facility in Nantucket Harbor and on Nantucket's streets (approximately 130,000 truck trips required), including downtown and Sconset Village locations.

In addition, costs associated with utilizing an upland sediment source are prohibitively high, exceeding the costs of using an offshore borrow site by a factor 2.5 to 4.

Results from the upland sediment source alternatives analysis are presented in Table ES-2. It has been concluded that using an upland sediment source for the project is not feasible.

Table ES-2 Alternatives Analysis of off-island upland sediment sources

Method	Environmental Factors	Other Considerations	Feasibility	Cost	Time Frame
Off-island Option 1					
<p>a. Barge to Nantucket Harbor</p> <p>b. Truck across island</p> <p>c. Delivery to beach over Coastal Bank</p>	<p>Unacceptable:</p> <p>Noise and traffic associated with ~130,000 truck trips would impact downtown Nantucket and resources along the route to Sconset</p>	<p>Unacceptable:</p> <ul style="list-style-type: none"> o Extensive barge traffic (3,250 trips) during busy boating season in Nantucket Harbor and approaches; o Impossible to use Town dock at required frequency for barge unloading 	<p>Not Feasible:</p> <p>Cannot be completed in a single season (would require 2-5 years of uninterrupted barge and truck trips). Factoring in downtown due to weather and wave conditions increases the time to construct to 10-13 years</p>	<p>Unacceptable:</p> <p>Currently costs are \$40/CY to transport sand to the beach at Sconset via this method for smaller projects. While the 2.6-MCY volume would lower costs, the total expenditure would be prohibitively high:</p> <p>Unit cost ~ \$36/CY Total cost ~ \$94-104 million.</p>	<p>Unacceptable</p> <p>Assumptions</p> <ul style="list-style-type: none"> o ~65 days/build season are feasible for barge travel based on wave data. o 1,000 CY barges would be used. <p>Time to construct ~ 10-13 years</p>
Off-island Option 2					
<p>a. Barge to Sconset Beach</p> <p>b. Beach barges</p> <p>c. Offload sediment via bulldozers</p>	<p>Unacceptable:</p> <ul style="list-style-type: none"> o Interruption of longshore drift with potential downdrift beach erosion impacts; o Serious safety hazards to barges and crew 	<p>Questionable:</p> <p>Would require use of small (1000-2000 cy) barges suitable only for small-scale projects; never attempted at the scale of the Beach Nourishment Project</p>	<p>Not Feasible:</p> <p>Would not meet wetlands performance standards requiring no downdrift impacts (i.e. not permissible)</p>	<p>Unacceptable:</p> <ul style="list-style-type: none"> o Price of off-island sediment ~ \$39 million; o Transportation cost would be similar to Option 1 plus building/moving temporary jetties (\$1 million per/jetty). <p>Unit cost >\$36/CY; Total Cost ≥ \$100 million</p>	<p>Unacceptable:</p> <p>Assumptions</p> <ul style="list-style-type: none"> o 10-20 barges available o Beaching barges is feasible <p>Time to construct ~ 2-4 years.</p>
Off-island Option 3					
<p>a. Barge to Sconset</p> <p>b. Offload onto offshore jack-up barge</p> <p>c. Hydraulically pump sediment to beach</p>	<p>Only temporary minimal impacts</p>	<p>Questionable feasibility:</p> <ul style="list-style-type: none"> o Requires many hard to find tugs and barges; o Highly sensitive to weather conditions; environment at Project site is hazardous due to high energy 	<p>Low Feasibility:</p> <ul style="list-style-type: none"> o Requires operation of two ports at daily maximum loading rates; o Depends on availability of hard-to-find barges and tugs; o Requires ideal weather conditions for safe, continuous travel of 4-5 loaded barges connected together 	<p>Unacceptable:</p> <p>Price of off-island sediment ~ \$39 million + transportation costs</p> <p>Unit cost ~ \$21-29/CY Total Cost ~ \$55-\$75 million</p>	<p>Unacceptable:</p> <p>Assumptions</p> <ul style="list-style-type: none"> o 2 large tugs o 6-8 large (6,000 cy) barges o offload at 2 pumpout stations o ~ 26 trips/port <p>Time to construct ~ 2.5 seasons.</p>

4.0 Alternatives Analysis of Marine Sediment Sources

The Proponent's extensive analysis of alternative sediment sources has concluded that a marine sediment source is necessary to provide nourishment material of appropriate grain size and adequate volume at a rate acceptable to satisfy the Project's engineering requirements. In light of this conclusion, a number of specific marine locations have been evaluated for their feasibility as sources for the Project's nourishment material. These locations, shown on Figures 4-1 and 6-21 include:

1. Tuckernuck Shoal,
2. Handkerchief Shoal,
3. Quidnet Rip,
4. Nantucket Shoals,
5. Great Point Shoal,
6. Sankaty Head Shelf (shallow shelf 1-2 miles offshore from Sankaty Head),
7. Bass Rip shoal,
8. Preferred Borrow Site.

Analyzing the various potential borrow sites for this Project first involved reviewing the existing datasets and then applying exclusionary criteria to the site-specific information to eliminate unacceptable areas from further consideration. This incremental process is intended to methodically evaluate each potential borrow site using comparable criteria.

Exclusionary criteria are critical components in the evaluation of potential offshore borrow sites. Borrow material used for nourishment projects must have specific characteristics to adequately satisfy Project objectives. When an analysis indicates that a potential sediment source does not satisfy any of these critical criteria, it is necessarily excluded from further consideration. These criteria include:

1. Grain size compatibility with the native beach;
2. Geomorphology indicating potentially-adequate sand supply;
3. Minimal or nonexistent impacts to adjacent shorelines from wave or current modifications;
4. Minimized environmental impacts, including fisheries;
5. Lack of interference with archaeological resources; and
6. Feasibility for construction and dredging requirements.

These criteria are considered to varying degrees in this analysis inasmuch as they relate to the process by which potential sand sources were excluded from further consideration (see

Table ES-3). Accepting or excluding a particular potential borrow site depends on the site-specific parameters relative to the various criteria being evaluated.

Grain size compatibility, sediment volume and fishermen input were all key factors in excluding potential borrow sites for this Project. The proposed borrow site for the Project meets all the outlined criteria for an optimum sediment source. Sediment at this site is similarly coarse to the native beach, contains little silt and clay, and exhibits a significant gravel component, which is an ideal scenario. Furthermore, this material is available in sufficient volume to supply both the initial nourishment and the planned subsequent renourishment. In addition, the site is only occasionally used by commercial fishermen.

To fully utilize the beach-compatible material at the borrow site, two distinct but adjacent areas will be excavated. Wave modeling studies consistently indicate the excavations will not meaningfully alter waves or sediment transport, and will not create any adverse effects along the coastline. In addition to the favorable physical characteristics, the borrow area is sufficiently close to shore to accommodate excavation by either hopper or hydraulic dredge, allowing the Proponent to evaluate a greater number of potential contractors and maximize bidding competition. It will be feasible for the excavated material to be pumped onto the beach directly from the dredge via an underwater pipeline.

The seafloor at the proposed borrow site is 30-60 feet below MLW, and both excavation areas are within three miles of the Sconset shoreline. Excavation areas are landward and entirely distinct of Bass Rip shoal or any other shoal. These shoals, which will remain unaffected by the Project, contain vast expanses of sediment; the combined size of both excavation areas is roughly equivalent to 0.1% of the entire shoal structure east of Nantucket, or roughly 2% of the portion of the shoal structure nearest to shore. These shoal areas are all seaward (east of) the borrow site. Sophisticated mathematical modeling indicates that in a 50-year storm, any wave height increase resulting from borrow site excavations would occur more than 2.5 miles offshore and would not result in any on-shore impacts (see Figures 5-16 and 5-17). The modeling is commonly used as a reliable method to design beach nourishment projects worldwide reflecting the technology's valuable predictive quality and low degree of error.

The proposed borrow site has been selected for its optimal sand and environmental characteristics, including elimination of any risk that the borrow site might cause increased wave energy to impact the shoreline. To ensure that the dredging operation conforms to the permitted plan, the dredge location and physical parameters of the dredged material will be closely monitored by various regulatory agencies through regular reporting and observation.

Fisheries resources at the borrow site are similar to or lower in recreational and/or commercial value than at alternative offshore sites. Avian populations at the borrow site are not unique, and since ample foraging habitat of comparable quality is located nearby, Project activities will not meaningfully impact these populations.

Archaeological resources are also comparable between alternative offshore borrow sites. The specific archaeology at the proposed borrow site will be studied in-depth prior to Project implementation; this study will be performed in conjunction with the Massachusetts Board of Underwater Archaeological Resources.

In summary, the only marine sediment source alternative that was not excluded in the analysis of key exclusionary criteria was the preferred borrow site. All other alternatives were excluded by one or more of these criteria.

Table ES-3 Key Exclusionary Criteria of Potential Borrow Areas

Area of Analysis	Sediment Grain Size	Distance to Receiving Beach (nautical miles)	Fishing	Exclusionary Criteria
1. Tuckernuck Shoal	0.44	15	Charter - Regular	Excluded: <ul style="list-style-type: none"> • Grain Size Too Fine • Distance too great to Nourishment Area
2. Handkerchief Shoal	0.35	13	Charter - Heavy	Excluded: <ul style="list-style-type: none"> • Grain Size Too Fine • Distance too great to Nourishment Area • Heavy Charter Fishing
3. Quidnet Rip	NA	2-3	Charter and Commercial - Heavy	Excluded: <ul style="list-style-type: none"> • Heavy Charter and Commercial Fishing
4. Nantucket Shoals	0.67	4-10	Commercial - Regular	Excluded: <ul style="list-style-type: none"> • Distance too great to Nourishment Area
5. Great Point Shoal	0.44	4-7	Charter - Heavy	Excluded: <ul style="list-style-type: none"> • Grain Size Too Fine • Distance too great to Nourishment Area • Heavy Charter Fishing
6. Sankaty Head Shelf	0.58	1-2	Commercial - Occasional	Excluded: <ul style="list-style-type: none"> • Grain Size Too Fine
7. Bass Rip Shoal	0.72	2-3 ⁺	Commercial - Occasional	Excluded: <ul style="list-style-type: none"> • Grain Size Too Fine • Active recreational and commercial fisheries value
8. Selected Borrow Site	0.86	<3	Commercial - Occasional	No Exclusions

5.0 Physical Characteristics and Modeling

The coastal system in the Project area is composed of a high, eroding bluff that tapers down in elevation to a Coastal Dune north and south of Sankaty Bluff. The beach fronting the dune and Coastal Bank is steep, narrow, and primarily comprised of medium-to-coarse sands. Vegetated dunes exist at the toe of bank on the northern fringe and southern third of the Project area, but persistent erosion has cut into the dunes along most of Sconset Beach. The beach consists of a sand berm that transitions to gravel at the shoreline. A mix of sand, gravel, and cobble is found throughout the surf zone. Cross-shore sediment transitions back to a sandy bottom near the toe of the submerged profile, and the offshore profile is characterized by sandy shoals with large patches of cobble and isolated higher-relief boulder areas.

The Sankaty bluff is comprised of poorly-sorted, stratified glacial sediments. The existing cross-shore sediment profile has resulted from long-term sorting of glacial sediments by waves and currents; these sediments have eroded from the Coastal Bank. Predominant mechanisms for sediment transport in the Project area are the wave-generated longshore currents. During high-water events and storm tides, waves overtop the narrow beach and undermine the toe of bank; undercutting of the toe causes upper portions of the bank to collapse, introducing poorly-sorted glacial sediments onto the beach and nearshore.

By natural sorting, fine particles are winnowed out and transported offshore by both longshore and cross-shore currents. The sand and gravel fraction of the glacial sediments remain on the beach and in the nearshore area where they are reworked by waves. Heavier components (gravel) are deposited in the high-energy swash and surf zones while sand fractions are either left on the beach berm or carried to deeper water to settle near the toe of the profile.

5.1 *Project Area Sediment Characterization*

The Proponent collected 248 sediment samples from the bank, beach, dune, breaking zone, and offshore profile for grain size analyses. The samples were located along 36 transects spaced at 500-foot intervals beginning just south of the Town Sewer beds and extending north almost to Sesachacha Pond. All sediment samples were collected within four inches of the surface and were analyzed using a series of 0.25 phi and 0.5 phi increment sieves (-4.25 through 4.0 phi). Silt and clay-sized particles finer than 4.0 phi were collected in the pan and weighed.

Composite results for all 248 samples (weighted by elevation) indicate a mean grain size of 0.86 mm with an average silt content of 2.8%. However, mean grain size changes across the beach profile.

Overall, sediment is finest-grained on the Coastal Bank and becomes progressively coarser toward the breaking zone, where the sediment is classified as gravel but becomes finer from

the -12-foot contour to the -24-foot contour. Grain size distribution across the beach cross-section will vary through the year as the profile changes between winter and summer. However, sampling across the entire cross-shore profile allowed the Proponent to capture the seasonal variability in the elevation of various grain sizes.

The Proponent has characterized sediment within the preferred offshore borrow site through a series of investigations which included nine vibracores, fifty-three nautical miles of seismic reflection profiles, sidescan sonar imagery, magnetometer data, and fathometer readings. Sediment at the offshore borrow site is compatible with the native beach sediment in terms of grain size, sorting, and percent silt content. The composite mean grain size for both excavation areas is 0.86 mm with an average silt content of 1.05%; average grain size is identical to the composite native beach grain size and slightly coarser than the composite dry beach grain size. Silt content at the borrow site is lower than the composite native beach silt content (2.8%) and slightly higher than the composite dry beach silt content (0.3%).

5.2 Offshore Oceanic Conditions

Data provided by NOAA tide station 8449130 (located in Nantucket harbor) and a 1200-KHz Acoustic Doppler Current Profiler (ADCP) offshore from Sconset beach show that in the Project area the tidal range is 1.3 feet and is predominantly a mixed semi-diurnal tide. Data from the ADCP also suggest that tide propagation is lateral (longshore), with the flood tide running south to north ($\sim 360^\circ$) and the ebb tide running north to south (175°). Typical currents flow from 2.5-4.3 feet per second, with ebb tides sometimes flowing more rapidly (4.3 ft/sec) than flood tides (3.0 ft/sec) (especially during ebb-dominated spring tides). At the ADCP location where water is 24 feet deep, there is no direct correlation between current strength and wave height.

Wave statistics generated for the Project areas were based on 1980-1999 hindcast wave data provided by USACE Wave Information Studies (WIS). Data were obtained from WIS Station 73 (41.25 N, 69.67 W), which is located approximately 15 miles east of the Project area in water approximately 89 feet deep. Average wave height at this station is 4.2 feet with a period of 5.1 seconds and a direction of 208° (SSE), with largest waves occurring during the winter months. Approximately half of the waves propagate from the offshore-direction band, 0° - 180° . Within this band, average wave height is 4.4 feet with a period of 5.5 seconds and a direction of 107° (ESE).

5.3 Onshore Oceanic Conditions

Wave statistics generated for the Project areas were based on 1980-1999 hindcast wave data provided by USACE Wave Information Studies (WIS). Data were obtained from WIS Station 73 (41.25 N, 69.67 W), which is located approximately 15 miles east of the Project area in water approximately 89 feet deep. The largest onshore storm waves typically occur between October and March and exhibit maximum wave heights of 20.0-26.2 feet. With

the exception of tropical storm events, the largest onshore waves typically occur in December and January, when maximum heights are 24.3 and 26.2 feet, respectively, and average 6.3 feet. The smallest onshore waves occur in July and August, with average heights of 2.5 and 2.8 feet, respectively, and typically achieve a maximum of 15.4 feet. Under normal conditions, the largest and longest waves typically come from the northeast.

5.4 Storm Surge

Storm surge is defined as the rise of the sea surface above its astronomical tide level due to meteorological storm forces and is known as the storm stage. The increased elevation is attributable to a variety of factors including waves, wind shear stress, and atmospheric pressure. Accurately estimating storm-stage water levels is essential for developing an appropriate beach fill design that will withstand adverse coastal conditions.

The 50-year storm stage at Sconset Beach was calculated using FEMA Flood Insurance Study reports. These studies provide still-water flood levels for 10, 50, 100, and 500-year storms as elevations measured above the High Tide Line (HTL); HTL for the eastern side of Nantucket Island is 3.0 feet above MLW. Therefore, HTL elevation can be added to FEMA still-water levels to calculate storm-stage elevation. Using this calculation, storm stage is 4.8 feet HTL (10-year storm), 9.2 feet HTL (50-year storm), 10.2 feet HTL (100-year storm), and 12.5 feet HTL (500-year storm).

The Proponent engineered the final Project design using FEMA elevations since they provide a conservative (higher) estimate of storm stage than the highest water levels observed by NOAA (7.7 feet MLW, recorded on October 30, 1991 in Nantucket Harbor).

5.5 Sea Level Change

Relative sea level rise (RSLR) is the apparent change in sea level as compared to a fixed vertical datum. RSLR consists of two independent components: eustatic sea level change and subsidence/rebound. Eustatic sea level change is defined as the global change in oceanic water level relative to a fixed vertical datum (e.g. North American Vertical Datum of 1988). Subsidence and rebound are defined as local changes in land elevation relative to a fixed vertical datum (NRC, 1987).

In 2005, NOAA calculated a mean sea level trend based on monthly data from 1965-1999 (NOAA, 2005). NOAA station 8449130, located in Nantucket harbor, calculated a mean sea level rise of 3 mm/year (0.0098 feet/yr) with a standard error of 0.32 mm/year (0.001 feet/yr).

NOAA's estimate of the annual rate of sea level rise is more conservative (larger) than the other commonly-used estimate, which is the National Research Council (NRC) annual rate of 2.3 mm/yr. Data used in the NOAA study is more recent (up to 1999), and the data collection station is much closer to the Project area. Therefore, the NOAA estimate of 3 mm/year (0.0098 feet/year) was used during development of the Project design.

5.6 *Depth of Closure*

Depth of closure is defined as “the most landward depth seaward of which there is no significant change in bottom elevation and no significant net transport between the nearshore and offshore for a given or characteristic time period” (Kraus, Larson and Wise, 1998). The depth of closure is typically estimated by either comparing historic profiles and observing where the profiles close (i.e. pinch out and have no elevation difference) or using empirical equations, such as those developed by Hallermeier (1978) or Birkemeier (1985).

Project engineers determined that the depth of closure is -26 feet MLW during the development of the final Project design.

5.7 *Wave Modeling*

The Proponent used an advanced 2D/3D integrated model known as Delft3D (WL | Delft, 2005) to evaluate potential impacts of dredging at the preferred borrow site. Delft3D consists of several modules that simulate physical processes such as wave transformation, hydrodynamics, sediment transport, erosion, scour, and deposition. The model can efficiently simulate processes driven by a combination of waves, tides, winds, and density gradients, and can predict sediment transport and bathymetric change using advanced transport formulations that account for bedload and suspended load transport. Waves in Delft3D are simulated using SWAN (Simulating Waves Nearshore), an advanced wave transformation model that incorporates most wave transformation processes including breaking, shoaling, refraction, diffraction, and bottom friction. Tides and tidal currents are simulated using Delft3DFLOW.

Engineers use the Delft3D package to investigate the performance of beach fill and erosion control structures as well as physical impacts of offshore borrow site dredging (Hartog, 2006; Benedet *et al.*, 2006; Benedet *et al.*, *in press*; CPE, 2006). The model can simulate relevant coastal processes over short-term periods (i.e. days or individual storms) or long-term periods (i.e. seasons and years).

There are no shoreline impacts associated with offshore dredging for any of the different wave scenarios. For the average wave, average storm, 20-year storm, and 50-year storm conditions, the largest change in wave height resulting from borrow site excavation was on the order of a few inches and the maximum deflection was only a few degrees; these changes were all constrained within a few miles of the study area, and did not propagate to the shore in any of the models.

Since the borrow site excavation caused no changes in the nearshore wave climate, there also were no changes to existing nearshore currents.

5.8 Sediment Transport

Sediment transport was determined using sophisticated models (Delft3D-Mor (morphology), Delft3D-Wave (SWAN), and Delft3D-Flow to calculate sediment transport and seabed elevation changes). Sediment transport was simulated using TRANPOR199 model for a 48-hour period related to 20- and 50-year storm conditions and for a one-year period to assess annual conditions. Sediment transport at the borrow site is very low during the annual conditions (generally less than 5 cy/ft). Model results suggest that the amount of sediment transport that occurs over an entire average year is of similar order of magnitude to the amount of sediment transport that occurs over 48 hours during a storm with a return period of 50 years. Sediment transport reaches maximum values of approximately 78 cy/ft during the 20 year storm and 83.6 cy/ft during the 50 year storm. The impacts of dredging on sediment transport during these storm events are confined to the offshore area and do not affect adjacent beaches. Sediment transport increase within the excavation areas indicates mild borrow area infilling during major storms. During the 48 hours simulation, infilling rates between 0.2 and 0.8 cy/ft are observed for the 20-year storm event, and 0.2 to 1.2 cy/ft for the 50-year storm event. During the annual simulation, that used the schematized wave climate, changes in sediment transport due to borrow site dredging were generally less than 1 cy/ft. No changes were observed on the beaches in or adjacent to the project area.

The model simulations suggest that the seabed around the borrow area is stable or slightly accretional. The small gains in sediment transport over the borrow site shown in the sediment transport simulations translate to minor elevation changes at the borrow site. The simulations do not show direct linkage between beach erosion and deposition patterns and seabed elevation changes around the borrow site.

The borrow site can be expected to infill more beyond the time periods simulated (40 hours for extreme storm and one year simulations), as shoals migrate and reform over the long term, and is expected to also infill by adjustment of steep dredging side slopes (slumping), which is a process not included in the model. Such infill has no material impact on wave dynamics outside of the immediate borrow site area and therefore no material impact on conclusions based on model simulations.

5.9 Monitoring of Nourishment Area

5.9.1 Physical Processes

Monitoring of the beach and offshore zone is proposed, and necessary, to assess the performance of the beach nourishment project. Pre-construction and immediate post-construction surveys can be compared to annual post-construction surveys to determine shoreline position and overall beach volumetric changes. The surveys will provide a database which will be evaluated by coastal engineers to determine when beach renourishment should occur. After project construction, sediment will

be transported out of the beach nourishment project construction template by waves and currents, resulting in both longshore and offshore sediment movement. As the volume of the nourished beach diminishes over time, the adjacent beaches will prosper as sediment is transported to those beaches by wind and wave activity. Beach and hydrographic surveys conducted on standardized beach profile lines will provide the data to determine the extent of movement of the sediment in the littoral transport system.

5.9.1.1 Survey Methodology

The established profile lines (line numbers 85 through 98) within the beach nourishment project limits will be surveyed; additional profiles will be added where needed to maintain a spacing of 500 to 1000-feet between profile lines. This will establish a more conventional survey grid during future monitoring events planned for pre-construction, immediately post-construction, six months post-construction, and annually post-construction. Additionally, profiles within approximately one mile to either side of the project area will be surveyed to determine the indirect effect of beach fill placement. The lines will be surveyed along the same azimuths as previously surveyed (with new profiles added as needed to maintain a spacing of 500 to 1000-feet between profile lines), which is approximately perpendicular to the shoreline position. The profiles will be surveyed from a point landward of the fill to an offshore depth of -30 feet (MLW). The beach portion of survey lines will be surveyed from a point landward of fill placement to as far into the water as safety allows, but far enough into the water to allow overlap of the bathymetric portion of the survey. A level and rod method will be used to conduct the beach (land) portion of the survey.

The bathymetric survey, which will be conducted using a fathometer using the same profile lines as the beach survey, will have an accuracy range of depths from 0.8 to 2000 feet, well within the range of survey limits for the Sconset Beach Nourishment Project. A state of the art (Hypack Max) system will be used as the navigation system, providing pre-plotted profile lines on an on-board computer. The system provides real time survey vessel position on the profile line, boat speed, quality of fix and line bearing among other survey information. All data is recorded in the computer hard disc and transferred daily to a USB memory stick to preserve the information. Sounding data will be recorded continuously along each profile line at approximate intervals of 2 feet providing a detailed record of the profile line. The bathymetric profile lines will overlap the beach profile lines and extend offshore beyond the depth of closure or approximately to a depth of -30 feet (MLW).

5.9.1.2 Frequency/Duration

A survey is proposed immediately post-construction to document the condition of the newly nourished beach. In addition, a six-month post construction survey is

proposed to allow monitoring of the adjustment of the nourished beach to the equilibrium condition. It is anticipated that about a year will be required to achieve complete or near complete equilibration of the project beach. Following the six month post-construction survey, annual monitoring of approximately 5 miles of the Sconset coastline is proposed for the project. Annual surveys will be conducted during the summer months to facilitate data collection. Highly comprehensive annual surveys will be sufficient to monitor the movement of the beach nourishment fill and provide data to the design engineers which can be used to track project performance, schedule for project renourishment and determine the effects of the project as related to the adjacent beaches.

5.9.1.3 Beach Nourishment Maintenance Triggers

Beach nourishment projects, as a general rule, do not erode in a uniform manner. Rather, areas of accelerated erosion occur which are commonly referred to as "hot spots". It is the hot spot area(s) which dictate when renourishment will occur because it is in those areas that the advanced nourishment fill will first be lost, exposing the protective design beach to erosion. If the design beach erodes, it is no longer capable of providing protection from the design storm event. Erosion of the design fill is to be avoided. The beach will be monitored on an annual basis, with data collection to occur each summer following project construction. Through comparison of the survey data, the coastal engineers will be able to evaluate the rate of beach volume loss and identify those areas which are most likely to be the segments of the project driving the renourishment schedule. Two years lead time is required to prepare for renourishment of the beach including: time for completion of all regulatory and engineering/geotechnical elements of the renourishment project, borrow area delineation, design, preparation of plans and specifications, bidding the project to capable dredge contractors, contractor selection, as well as time to allow the contractor to prepare and mobilize to the project site.

Construction of the full renourishment project should be planned to occur when no more than 90% of the advanced nourishment has been eroded over a continuous 1000 feet long segment of the project area. Allowing for a buffer of 10% of the advanced nourishment remaining will account for an unexpected storm event occurring before renourishment is constructed. In the event that no distinct hot spot develops, renourishment should occur when 80% or more of the advanced nourishment project-wide has been lost. Based on the monitoring data collected each year, the engineers will be able to evaluate the data and determine when it is expected that the 90% loss criteria will occur for the 1000 feet long hot spot, or 80% for project-wide advanced nourishment loss.

It is also possible (but not likely) that a limited site specific advanced nourishment loss could occur in a segment of beach less than 1,000 feet in length. These types of losses are usually associated with secondary factors such as structures, or unique

rock features on the coastline which interrupt sediment movement. Nevertheless, in the event of an isolated beach loss, it may be feasible to avoid a complete beach renourishment project by moving fill from those areas of the beach nourishment project which still have significant advanced nourishment fill available to those areas of the beach where isolated beach loss has occurred. Just as there can be segments of the beach which have hot spots, area(s) of less than the average advanced nourishment loss rate can exist and may provide the extra sediment needed to alleviate the small isolated area of erosion, perhaps delaying the renourishment cycle by at least a year. Short of having an area of surplus advanced nourishment, barging and trucking small amounts of fill may be feasible, particularly when considering the reduced impacts associated with delaying renourishment by at least one year. It is proposed that the criteria for addressing an isolated area be similar to that for the segments of 1000 continuous feet in length or longer, that is the loss of 90% of the advanced nourishment. Unlike a full beach renourishment project however, only a one year lead time should be needed to address the regulatory and engineering requirements to mechanically move sand which is already on the beach, or to import sand to the eroded site.

5.10 Monitoring of Offshore Borrow Area

5.10.1 Physical Processes

Based on modeling results, infilling will occur primarily due to the influence of storms. Sediment will slump into the borrow areas, changing the depth of water. The pre-excavation borrow area survey can be compared to the post-construction surveys to determine the extent of infilling.

5.10.1.1 Borrow Area Bathymetric Surveys

Bathymetric surveys will be conducted of the borrow area on an annual basis in conjunction with the beach and hydrographic surveys. Similar to the bathymetric survey of the coastline, a fathometer will be used and will be conducted on pre-plotted surveys lines at 100 feet intervals across the borrow areas. The lines will extend at least 100 feet to either side of the borrow areas. Data will be recorded at 2 feet intervals on each track line over the borrow areas to provide a detailed record of the borrow area bathymetry, and the data necessary to evaluate the volumetric changes in the borrow areas.

5.10.1.2 Frequency/Duration

Similar to the beach surveys, the borrow areas surveys are proposed to occur annually, during the summer months. Unlike the beach surveys, a six month post construction survey is not proposed. A six month survey was proposed to monitor the beach fill movement during the equilibration process, which does not apply to the borrow areas. Annual surveys will provide sufficient data to monitor infilling of the borrow areas.

6.0 Marine Fisheries

Extensive sampling of fisheries and other marine resources has been undertaken over a year long program between November 2005 and November 2006. The information has been essential for evaluating the existing fisheries species and habitats and the potential impacts of the proposed project on those resources (Figures 6-1 and 6-2). The data suggest that the borrow site is inhabited by species typically found in ocean environments of southern New England, including a number of seasonal migrants that are of particular interest to recreational sportfish fishermen (Figures 6-4, 6-5, 6-9, 6-10 and 6-13). In addition, portions of the borrow site closest to Bass Rip have some populations of surfclam that may be sought by a relatively small group of commercial surfclam dredging fishermen (Figure 6-20). Detailed information was also collected on the nearshore subtidal environment which revealed a productive benthic habitat comprised of cobble and sand with marine vegetation attached to the cobble (Figure 6-21). Remote surveys conducted with side-scan sonar showed the cobble habitat to extend at least 10,000 feet offshore and occupy an area of 2,082 acres. Dive surveys in the nearshore enabled the scientists to ground-truth the extent of coverage in the area to be impacted by the nourishment project, as well as to describe that habitat in greater detail (Figure 6-24 and 6-25).

Impacts to fisheries from the project are related to the mining of sand at the borrow site and the placement of sand along the beach. Borrow site impacts will primarily be temporary in nature as the post-construction sandy habitat will be the same as presently exists. Impacts will result from the loss of functions and values associated with the benthic communities that are removed during construction. These impacts will last for approximately one to three years, after which the habitat will have recovered. Figure 6-26 shows the location of the borrow site within the Nantucket Shoals illustrating the very small size of proposed disturbance (0.01%) compared to the extent of the larger habitat. The removal of surfclam resources that could otherwise be harvested will also result in an impact.

Impacts from beach nourishment will be related to the unavoidable conversion of existing cobble habitat to a sandy habitat. The extent of this impact will be approximately 10 acres of cobble/sand habitat, of which 3 acres (28%) is hard cobble substrate and 7 acres is sand. An additional area offshore from the fill area will be impacted after construction when some of the sand is carried seaward and subsequently eroded in future years. This impact is

associated with the covering and uncovering of cobble which presently occurs along the nearshore.

Commercial and recreational fishing activities may also be impacted during the construction period in specific areas where construction activities occur. Specifically, commercial and recreational fishing activities will be excluded from the borrow site area during sediment mining, and at the beach site where sediment is being placed. A sediment plume extending approximately 2,000 feet down the beach may cause fish to move away from those areas. In addition, bottom fishing activity along a narrow corridor between the borrow site and the beach nourishment site may be slightly affected as a pipeline will be present on the seabed with hydraulic dredging. Due to the smooth surface of the pipe, fishermen ought to be able to trawl wirelines over the pipeline except in the immediate areas of cables to buoys which will be set out at 1,000 foot intervals to mark the location of the pipeline. Bolts do protrude from the pipe where sections are fastened together which could snag bottom nets, however, this activity generally does not occur in this area due to the amount of boulders that make bottom trawling challenging.

7.0 Shorebirds and Marine Waterbirds

Avian resources within the Project area include shorebirds in the beach nourishment area and waterbirds at the offshore borrow site.

7.1 Shorebirds

Two species of protected shorebirds occur within the outer edges of the Project area: Piping Plovers (a state and federally-listed “threatened” species) and Least Terns (a state-listed species of “Special Concern”). While the majority of the Project area has not been used as nesting habitat, primarily because it contains a narrow beach frequently overwashed by storms, two historic nesting areas are present at the northern and southern ends of the Project. These include the Sesachacha Pond nesting area (at and beyond the extreme northern end of the nourishment template) and the Low Beach nesting area (seaward of the proposed dune at the Town Sewer Beds). Approximately 90% of the total nourishment template falls *outside* of these historic nesting areas. The Proponent will avoid impacting nesting shorebirds by prohibiting construction activities during the nesting season within the historic nesting areas.

Protected shorebirds are expected to benefit from the Project due to expanded and enhanced habitat area. While much of the existing Project shoreline contains beach which is too narrow for suitable nesting habitat, the completed nourishment Project will provide approximately 50 acres of significantly wider, higher beach that will be available to shorebirds for nesting and feeding. The nourished beach will be managed in accordance with local, state, and federal guidelines to further enhance its suitability for nesting shorebirds. The proposed shorebird management plan stipulates frequent monitoring and

includes provisions to protect nests and nesting habitat; these provisions include symbolic fencing, warning signs, and seasonal vehicular restrictions.

7.2 Waterbirds

Waters around Nantucket support one of the largest wintering populations of waterbirds in the Northeast; the preferred borrow site represents a small, typical portion of this abundant waterbird habitat. Existing data (including aerial and boat surveys conducted by the Proponent) indicate that the following species are present at the borrow site, with peak populations present between early December and February: diving sea ducks (Common Eider, Long-tailed Duck, Black Scoter, Surf Scoter and White-winged Scoter), gulls (Bonaparte's Gull, Herring Gull, Iceland Gull, Lesser Black-backed Gull, Great Black-backed Gull, and Black-legged Kittiwake), Razorbill, Northern Gannet, and Common Loon (Massachusetts state-listed as a species of special concern). The Proponent will conduct six additional boat surveys during winter 2006-2007 to refine the characterization of waterbird populations at the borrow site.

Many potential impacts to wintering waterbirds at the offshore borrow site will be avoided by conducting dredging outside the winter months when the site is most heavily utilized by waterbirds. Dredging may temporarily impact foraging habitat by removing bottom-dwelling food sources and increasing elevation to the seafloor; however, benthic organisms are expected to recolonize within 1-3 years and considerable variation in seafloor elevation occurs naturally in this dynamic offshore environment, such that some infilling of the borrow site is expected. Any potential short-term impacts to birds utilizing the offshore borrow site will not be substantial due to the abundance of suitable feeding areas off the coast of Nantucket. The area of the borrow site (195 acres) is relatively small and represents less than 0.08% of the available habitat having water depths of 60 feet or less within 6 miles of Nantucket. Foraging waterbirds will have ample alternate areas to forage.

8.0 Historical and Archaeological Resources

An offshore archaeological reconnaissance survey was requested by the Massachusetts Historical Commission (MHC) and Massachusetts Board of Underwater Archaeological Resources (MBUAR). If appropriate, a technical report and avoidance plan will be prepared and submitted to the MHC, MBUAR, USACE, and consulting parties in compliance with Section 106 of the National Historic Preservation Act and State Register Review. Following submission of these materials, the Proponent will consult with the participating agencies to resolve any potential adverse effects to archaeological resources identified in the reconnaissance survey.

9.0 Mitigation / Section 61 Findings

The Proponent has evaluated the potential impacts of sand mining and beach nourishment along the Sconset shoreline. Accordingly, the Project includes a comprehensive mitigation

plan that will avoid construction-period impacts to the extent practicable, mitigate for unavoidable impacts, and monitor habitat recovery to ensure that these effects have been accurately assessed. This section describes the elements of the mitigation and monitoring program.

9.1 Time of Year Restrictions

The Project must be constructed in one continuous construction season to ensure success of the nourishment template. Given the active Nantucket environment, the only time feasible for construction is between June and October. An advantage of this construction schedule is that Project activities will not occur during late winter and early spring, when winter flounder spawn. Data collection efforts have evaluated the nature of onshore-offshore lobster migrations, and suggest that the Project area does not serve a critical function in this process. The Project area is not an anadromous/catadromous fish run. Therefore, prescribed time of year restrictions on in-water construction activities are not necessary for the protection of critical spawning habitat for fisheries.

9.2 Shellfish Harvest and Relay

The Proponent undertook a surfclam survey in August 2006. While inclement weather limited the ability to accurately ascertain the surfclam population, the information was useful for confirming presence and absence of surfclams. The information showed that surfclams may be found along the lower edge of Bass Rip but most of the borrow site is not suitable for surfclam. That said, the Proponent has agreed to undertake a pre-construction harvesting effort to remove legal-size surfclams to be brought to market, and to relay smaller sized surfclams from the sand mining area to adjacent suitable habitats on Bass Rip. This harvest will be undertaken just prior to construction activity when the clams are active to aid their transplantation to the relayed locations.

9.3 Cobble Habitat Mitigation

The Project will result in the unavoidable conversion of 10 acres of cobble habitat including 3 acres of hard surface to a sandy habitat. Additional impacts will be sustained over about half of the equilibrium footprint which covers an additional 50 acres. The Proponent has prepared an effective means to mitigate the loss of functions and values associated with this habitat and, at the same time, enhance recreational fishing opportunities for local fishermen. The mitigation concept, developed with consultation from fishermen on Nantucket and Cape Cod, aims to produce a net benefit in fisheries habitat functions and values by replicating the amount of hard surface impacted while designing an artificial reef with a more diverse habitat than presently exists off of Nantucket. A key part of the mitigation package is the implementation of a rigorous post-construction monitoring program to verify the extent of impacts and document the successful creation of fisheries habitat. The data generated by this effort will be useful for planning additional artificial reef projects in Massachusetts waters.

The Proponent will procure approximately 28,000 clean concrete railroad ties from the MBTA for use as an artificial reef at three sites recommended by fishermen on Nantucket (see Figure 9-1). Two of the locations are near the entrance to Nantucket Harbor; the third is at Squam Head just north of the project area. The total area of the mitigation will be 58.9 acres.

The railroad ties were manufactured by a Massachusetts-based company in 2003 and shipped to the MBTA Readville Rail Yard. They are comprised of concrete with eight ¼-inch steel cables inside to provide structural stability. When the MBTA tested the ties for replacement of standard wooden ties, they failed because they were too rigid. Now the MBTA is seeking to remove the railroad ties from the Readville Rail Yard before the property is sold to a private developer. The Proponent sees the availability of the railroad ties as an unusual opportunity to provide ecologically beneficial mitigation while providing for the reuse of concrete material that would otherwise be disposed of as waste at a landfill.

The Proponent proposes to ship the railroad ties by rail from the Readville Rail Yard in Boston to Fall River. From Fall River, they will be taken by barge to Nantucket. The ties will be deployed from the barge in a somewhat random fashion to create a “pick-up sticks” type arrangement. However the number of ties deployed and areal extent of deployment will be closely planned and implemented. A mitigation plan will be prepared, in close collaboration with local fishermen and resource agencies, that shows the specific locations of deployment, and number of ties deployed in each area. Based on these numbers, high relief habitats, low relief habitats and sandy areas will be created. The foreman overseeing the deployment of the ties will work closely with local fishermen consultants to ensure that the mitigation is implemented as proposed.

9.4 Monitoring Habitat Impacts and Recovery

Extensive monitoring has been undertaken and is proposed to characterize existing physical characteristics, marine fisheries, and shorebirds and marine waterbirds. This monitoring has occurred and is proposed at the borrow site and at the nourishment site. Subsequent to the beach nourishment event, this monitoring will be replicated to inform an analysis of impacts, and, in future years, document habitat recovery. This will be accomplished at the borrow site by collecting benthic samples in the area of the borrow site and in nearby reference areas and collecting information on benthic species diversity and abundance. In the nearshore, the analysis will focus on physical indicators of impact – namely the extent of cobble habitat coverage and the changes in areal coverage from equilibrium to renourishment. Shorebirds will continue to be monitored in conjunction with the beach manager from the Town of Nantucket. This effort will also be coordinated with Mass Audubon’s shorebird manager. Surveys of marine waterbirds in the vicinity of the borrow site will be conducted for two-three years post-mining; results will be compared to pre-construction surveys.