Hashamomuck Cove
Southold, New York
Coastal Storm Risk Management

Feasibility Study

Final Integrated Feasibility Report
& Environmental Assessment
September 2019

New York State
Department of
Environmental Conservation

U.S. Army Corps of Engineers
North Atlantic Division
New York District

Hashamomuck Cove
Southold, New York

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EXECUTIVE SUMMARY

This Integrated Feasibility Report and Environmental Assessment (IFR/EA) has been produced by the US Army Corps of Engineers (USACE) in partnership with the New York State Department of Environmental Conservation (NYSDEC), the Non-Federal sponsor, for the Hashamomuck Cove, Southold, New York (Suffolk County), Coastal Storm Risk Management Feasibility Study. NYSDEC is also the Non-Federal sponsor for implementation of the recommended plan along with their partner the Town of Southold, New York.

The study area is on the North Fork of Long Island fronting Long Island Sound and includes about 1.6 miles of developed coast in the Town of Southold. County Road 48 parallels the coast and provides a primary transportation route at the northeast end of Long Island. The Hashamomuck Cove study area includes three coves that, for the purposes of this study, are called West Cove, Central Cove, and East Cove.

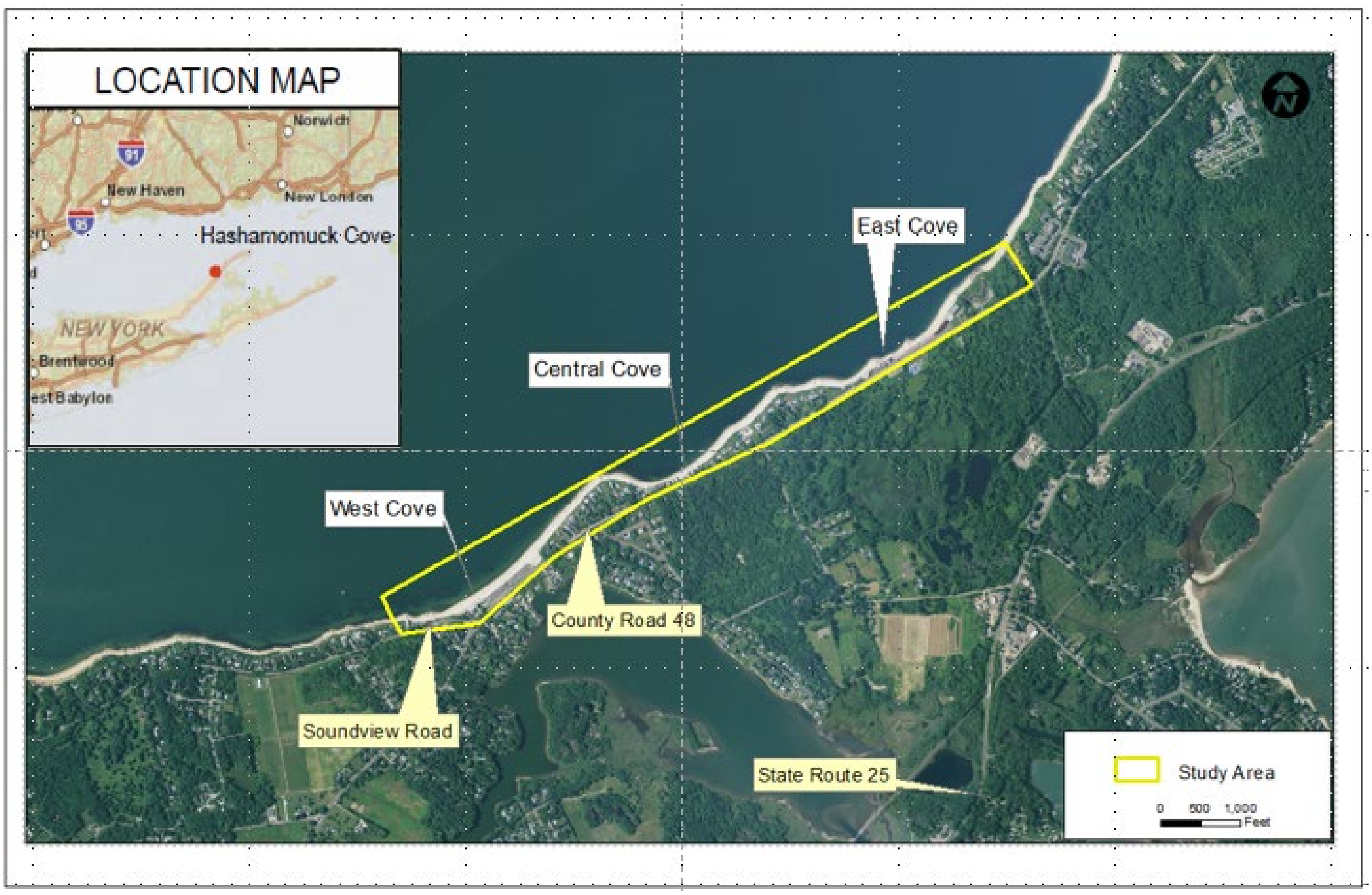

Figure ES-1. Study Area

In the study area, residential and commercial properties, the Southold Town Beach, and County Road 48 (CR-48) are vulnerable to erosion, wave attack, and inundation from coastal storms. Family residential structures are found throughout the study area and represent an economic value of more than $37 million. Commercial structures in the study area represent an additional economic value of about $8.8 million. CR-48 is one of the main roads serving outer Long Island and is an important evacuation route when State Route 25 is flooded. The closure or loss of CR-48 would result in traffic delays, loss of an evacuation route, and hamper emergency rescue operations.

The Hashamomuck Cove Study is authorized by House of Representatives, Committee on Transportation and Infrastructure, Resolution, Docket Number 2773 (May 2007):

> "Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the reports of the Chief of Engineers on the North Shore of Long Island, Suffolk County, New York, published as House Document 198, 92nd Congress, 2nd Session, as well as other related reports with a view to determine whether the modifications of the recommendations therein are advisable at the present time in the interest of navigation, streambank stabilization, flood damage reduction, floodplain management, water quality, sediment control, environmental preservation and restoration, and other related purposes in Hashamomuck Cove and tributaries."

The Hashamomuck Cove Feasibility Study is being completed with funds provided by the Disaster Relief Appropriations Act, Public Law 113-2 (P. L. 113-2). This Act provided federal funding for the completion of coastal storm risk reduction feasibility studies that were underway as of October 29-30, 2012 when Hurricane Sandy occurred. Funding provided by this appropriation allowed this study to move forward.

The study plan formulation considered a range of nonstructural and structural measures to reduce the risk of storm damage in the study area. Through an iterative planning process, potential coastal storm risk management measures were identified, screened, evaluated, and compared. Alternatives considered included nonstructural e.g. buyout of properties, hard structural e.g. new bulkheads, and soft structural e.g. beach nourishment.

Initial screening of alternatives based on the estimated magnitude of costs and benefits (damage reduction) resulted in the focused array of alternatives to carry forward for further analysis. The analysis of the focused array provided more detailed benefit and cost estimates and consideration of environmental conditions for the alternatives to identify a tentatively selected plan (TSP). The TSP identified in the 2016 draft IFR/EA was a berm-beach nourishment plan at each cove. After Public and Agency review the TSP was then optimized through refinements of the dimensions, cost, and benefits to maximize net benefits, to identify the recommended plan, or the National

Economic Development (NED) plan. The optimization analysis is discussed in the body of this report and in the Economics Appendix.

The recommended plan for coastal storm risk management at Hashamomuck Cove is a beach nourishment project, consisting of the artificial building up and/or widening of the beach by the placement of sand fill material on the shore, so that the improved beach profile reduces the risk of coastal storm damage to structures along the shorefront. Beach nourishment projects require periodic re-nourishment to replace sand lost to erosion. This requires identification of a sand source reasonably near to the site to accommodate the initial fill and re-nourishment requirements. Three upland sand sources were identified on Long Island that could be used for the project. See Figure 13 in report.

The project is approximately 8,500 feet (ft.) in length consisting of a 25 ft. wide berm placed seaward of the existing structures providing for reduced coastal storm risk in the three coves. The beach fill would be built up to elevation +6 feet North American Vertical Datum of 1988 (NAVD 88) which is estimated as the average elevation of the beach berm without erosion.

In order to ensure that the project is sustainable over the project life, the recommended plan includes the recommended volumes, and costs of the plan associated with the intermediate rate of relative sea level change (RSLC). The plan also includes monitoring of RSLC, with the recommendation that if the measured rates exceed the intermediate rate the project be reevaluated to consider the appropriate adaptation strategy.

The New York State Department of Environmental Conservation (NYSDEC) is the Non-Federal sponsor for the project and will partner with the Town of Southold to meet the Non-Federal requirements for project implementation.

PERTINENT DATA

PROJECT AREA

Hashamomuck Cove project area is in the Town of Southold, New York in Suffolk County. The project area is on the north shore of Long Island on Long Island Sound. The project area is within the study area and is the project footprint of the coastal storm risk management project.

RECOMMENDED PLAN FEATURES

Berm Length: 8,500 linear feet (ft.)
Berm Height: +6 ft. NAVD88
Foreshore Slope: Sand graded seaward on a slope of 1 Vertical to 10 Horizontal.
Berm Width: West Cove 25 ft., Central Cove 25 ft., East Cove 25 ft.
Sand Source: Trucked from upland source
Initial Placement Volume: 215,600 cubic yards (cy)
West Cove: 94,400 cy
Central Cove: 83,000 cy
East Cove: 38,200 cy
Average Re-nourishment Volume: 78,300 cy (9 times over the 50 year period of analysis)
West Cove: 37,400 cy
Central Cove: 15,700 cy
East Cove: 25,100 cy

Re-nourishment Interval: The re-nourishment interval depends on a variety of factors including storm frequency, intensity, and duration of storms. The re-nourishment costs for the Recommended Plan were estimated based on projections under the intermediate rate of RSLC, and a 5 year interval (9 events) assuming 78,300 cy per re-nourishment event for a total re-nourishment volume of about 705,000 cy.

Construction Method: Sand would be trucked to the site and be delivered to staging points with direct access to the beach. Trucks would deposit sand at appropriate locations to facilitate subsequent spreading and regrading by bulldozers or front end loaders. Initial construction is estimated to take approximately 11 months to complete. For the cost analysis, it was assumed that the construction would begin in 2022, but the construction timing is subject to future project authorization and appropriation of construction funding.

PROJECT COST

The "Project First Cost" estimate is broken out by account/cost component in Table E-1. The Project First Cost includes, real estate (01), the initial berm construction (17), planning, engineering & design (30), and construction management (31), contingencies are included. The first cost is $17,367,000. The re-nourishment cost is $46,578,000. Costs are based on October 2018 price level.

Table E-1. Recommended Plan Cost Summary
Project First Costs
(October 2018 Price Level)

Account/Cost Component	Initial Construction	Re-nourishments (9 events)
Construction Cost		
01 Lands and Damages	2,445,000	0
17 Beach	12,499,000	40,014,000
30 Planning Engineering & Design	1,409,000	3,187,000
31 Construction Management	1,014,000	3,377,000
Total	17,367,000	46,578,000
Total Project Cost 50-year Period of Federal Participation		**63,945,000**

REAL ESTATE REQUIREMENTS AND PUBLIC USE OF BEACH

The real estate cost for the project is estimated at $2,445,000. Real estate required in support of the recommended plan includes about 15 acres of land. The Non-Federal sponsor (NYSDEC) is required to obtain the real estate as outlined in the Real Estate Plan (see Appendix F). The "perpetual beach storm damage reduction easement" (USACE Standard Estate No. 26) is included in the Real Estate plan and will be the easement language used in acquiring the real estate for the beach fill areas. This easement language allows for public use of the beach.

PUBLIC ACCESS

The Non-Federal sponsor for the project (NYSDEC) is responsible for developing and implementing the public access to the beach. The public access plan provided by NYSDEC identifies locations for public access and parking (see Appendix G). The USACE policy requires public access points every ½ mile for a beach nourishment project, so that a visitor is never more than a quarter mile away from any point on the beach project.

Acquisition of public beach access points or parking areas that are necessary for compliance in cost sharing is strictly a sponsor responsibility and is not considered a project cost. Accordingly, any land cost or administrative cost incurred with the acquisition of public access points or parking areas is not considered a creditable expense towards project cost (and not included in the Real Estate plan).

ECONOMIC ANALYSIS

Annual Cost and Benefit of the Recommended Plan is provided in Table E-2. Project costs are annualized over a 50-year period of analysis at the Fiscal Year 2019 (FY19) Federal discount rate for evaluation of water resource projects (2.875%). These calculations are based on the costs and benefits developed under the intermediate rate of RSLC. The annual benefit of the project is divided by the annual cost estimate and results in an estimated Benefit-Cost Ratio (BCR) of 1.07.

Table E-2. Recommended Plan, Annual Benefit and Cost Summary
(October 2018 Price Level, FY 19 2.875 % discount rate)

Project Economic Cost	
Initial Investment Cost	
Project First Cost	$17,367,000
Interest During Construction	$207,000
Total Investment Cost	$17,574,000
Annualized Investment Cost	$667,000
Continuing Construction	
Annualized Beach Nourishment Cost	$956,000
OMRR&R (non-Federal sponsor)	
Annual Environmental Monitoring Cost	$2,000
Annual Berm Maintenance Cost	$12,000
Annual Coastal Monitoring Cost	$2,000
Total Annual Economic Cost	$1,639,000
Annual Economic Benefit	
Total Annual Benefit	$1,755,000
Net Benefit and BCR	
Annual Net Benefit	$116,000
Benefit-Cost Ratio	1.07

OMRR&R COST

The Non-Federal sponsor is responsible for the Operations, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) costs. These include the costs necessary for annual maintenance of the beach. Maintenance of the beach generally includes periodic inspections, and any activities for regrading or reshaping a beach. OMRR&R does not include bringing-in additional sand. OMRR&R costs for a beach nourishment project tend to be costs that are borne by municipal staff. This includes the annual monitoring of the project area for piping plover also referred to as environmental monitoring.

FEDERAL AND NON-FEDERAL PROJECT COST SHARING

In accordance with the cost share provisions in Section 103 of the Water Resources Development Act (WRDA) of 1986, as amended (33 U.S.C. 2213), initial construction is cost shared 65% Federal and 35% Non-Federal and continuing construction is cost shared 50% Federal and 50% Non-Federal. The Non-Federal sponsor is required to provide the necessary real estate for the project. These real estate costs are then credited toward the Non-Federal share. Table E-3 provides the cost details of the recommended plan and cost apportionment at the current price level. Table E-4 provides the cost details of the recommended plan and cost apportionment at the fully funded price level that includes cost escalation to the mid-point of construction (June 2022 for initial placement).

Table E-3. Cost Apportionment (October 2018 Price Level)

Project First Cost, October 2018 Price Level	Total	Federal Share	Non-Federal Share
		65%	35%
Initial Cost			
Beach Nourishment	$12,499,000		
Planning, Engineering & Design	$1,409,000		
Construction Management	$1,014,000		
		0%	100%
Lands and Damages	$2,445,000	$0	$2,445,000
Total	$17,367,000	$11,289,000	$6,078,000

Continuing Construction	Total	Federal Share	Non-Federal Share
		50%	50%
Beach Nourishment	$40,014,000	$20,007,000	$20,007,000
Planning, Engineering & Design	$3,187,000	$1,595,500	$1,595,500
Construction Management	$3,377,000	$1,668,500	$1,668,500
Total	$46,578,000	$23,289,000	$23,289,000

Table E-4. Cost Apportionment (Fully Funded)

Project First Cost, October 2018 Price Level	Total	Federal Share	Non-Federal Share
		65%	35%
Initial Cost			
Beach Nourishment	$13,916,000	$9,046,000	$3,127,000
Planning, Engineering & Design	$1,591,000	$1,034,000	$557,000
Construction Management	$1,163,000	$756,000	$407,000
		0%	100%
Lands and Damages	$2,682,000	$0	$2,682,000
Total	$19,352,000	$12,579,000	$6,773,000

Continuing Construction, Fully Funded	Total	Federal Share	Non-Federal Share
		50%	50%
Beach Nourishment	$101,701,000	$50,850,500	$50,850,500
Planning, Engineering & Design	$8,936,000	$4,468,000	$4,468,000
Construction Management	$12,276,000	$6,138,000	$6,138,000
Total	$122,913,000	$61,456,500	$61,456,500

ENVIRONMENTAL CONSEQUENCES

The possible environmental consequences of the Recommended Plan are considered in terms of probable environmental, social, and economic factors. Avoidance and minimization measures were incorporated in development of the project. There would be no significant impacts anticipated to fish and wildlife resources, or water quality. All impacts are anticipated to be temporary and minor in nature. No cultural resources impacts are anticipated during project implementation. The beach nourishment project may result in future use of the area by piping plover, a Federally threatened and endangered species. A shorebird management plan has been developed as part of this study and is included in Appendix A5.

The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the Non-Federal sponsor, interested Federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

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**Sections of text marked with an asterisk are applicable to the satisfaction of National Environmental Policy Act (NEPA) requirements*

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Chapter 1: Introduction

1.1 Integrated Feasibility Report and Environmental Assessment

This Integrated Feasibility Report and Environmental Assessment (IFR/EA) has been produced by the US Army Corps of Engineers (USACE) in partnership with the New York State Department of Environmental Conservation (NYSDEC), the Non-Federal sponsor, for the Hashamomuck Cove, Southold, New York (Suffolk County), Coastal Storm Risk Management Feasibility Study. This report presents the Recommended Plan for managing coastal storm risk at Hashamomuck Cove, Southold, New York (Figure 1). The Town of Southold is located in Suffolk County on the north fork of Long Island.

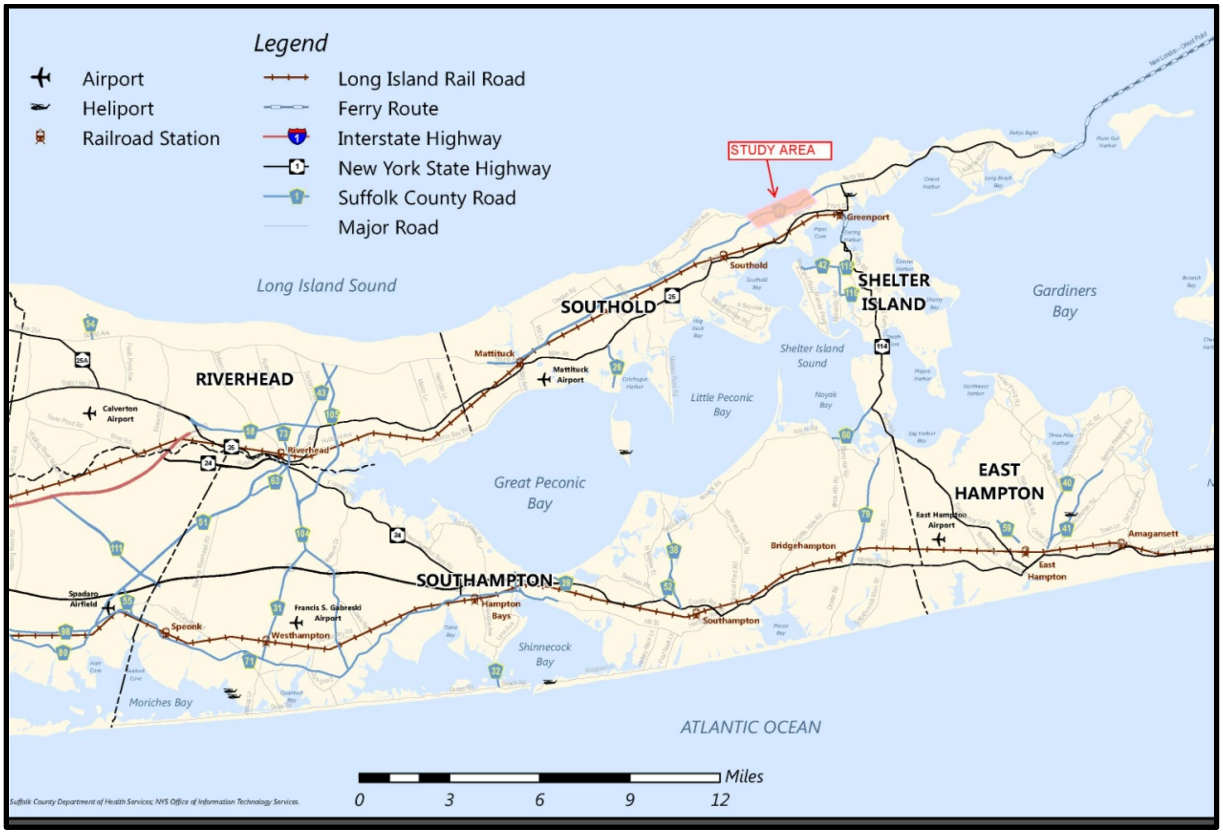

Figure 1. Hashamomuck Cove Location Map

The Federal objective of water and related land resources project planning is to contribute to national economic development (NED) consistent with managing and reducing risk to the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements (Principles and Guidelines (P&G), 1983).

Water and related land resources projects are formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective. Pursuant to this, the IFR/EA (1) summarizes the problems, needs, and opportunities for coastal storm risk management at Hashamomuck Cove; (2) presents and discusses the results of the plan formulation for coastal storm risk management of coastal resources; (3) identifies specific details of the recommended plan, including inherent risks; (4) and is issued in part to determine the extent of the Federal interest and local support for the plan.

A draft of the IFR/EA was released for concurrent public and agency technical review on August 16, 2016. USACE has evaluated and compared an array of alternatives including bulkheads, beach nourishment, and buyouts for the identification of the selected beach nourishment plan. The final recommended beach nourishment plan was based on comments from public and agency review and additional feasibility level optimization.

1.2 National Environmental Policy Act Requirements

This Integrated Feasibility Report and Environmental Assessment IFR/EA was prepared pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's (CEQ) Guidance Regarding NEPA Regulations, and USACE's Procedures for Implementing NEPA (Engineering Regulation 200-2-2).

An Environmental Assessment (EA) is a concise public document prepared by the Federal agency to determine whether the proposed action has the potential to cause significant environmental effects (40 Code of Federal Regulations (CFR) 1508.9(a)). The purposes of an EA are to:

- provide evidence and analysis sufficient to determine whether an Environmental Impact Statement (EIS) is required;
- aid a Federal agency's compliance with NEPA when no EIS is necessary; and
- facilitate preparation of an EIS when one is necessary; and serve as the basis to justify a finding of no significant impact (FONSI).

The EA must discuss:

- the need for the proposed action;
- the proposed action and alternatives;
- the probable environmental impacts of the proposed action and alternatives; and
- the agencies and persons consulted during preparation of the EA.

NEPA requires Federal agencies to integrate the environmental review into their planning and decision-making process. This integrated report is consistent with NEPA statutory requirements. The report reflects an integrated planning process, which avoids, minimizes, and mitigates adverse project effects associated with coastal storm risk management actions. Sections of the report that are required to fulfill the requirements of National Environmental Policy Act (NEPA) of 1970 are marked with an asterisk (*) in the headings.

1.3 Study Purpose Need for Action*

The purpose of the study is to determine if there is a technically feasible, economically justified and environmentally compliant recommendation for Federal participation in coastal storm risk management for Hashamomuck Cove study area in Southold, NY. The study is needed as existing shore front properties and County Road 48 are at risk from coastal storm damage due to erosion, wave effects, and inundation. Homeowners have implemented individual solutions but the area continues to experience storm damage.

1.4 Study Authority

The Hashamomuck Cove Study is authorized by House of Representatives, Committee on Transportation and Infrastructure, Resolution, Docket Number 2773 (May 2007):

> *"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the reports of the Chief of Engineers on the North Shore of Long Island, Suffolk County, New York, published as House Document 198, 92nd Congress, 2nd Session, as well as other related reports with a view to determine whether the modifications of the recommendations therein are advisable at the present time in the interest of navigation, streambank stabilization, flood damage reduction, floodplain management, water quality, sediment control, environmental preservation and restoration, and other related purposes in Hashamomuck Cove and tributaries."*

The Hashamomuck Cove Feasibility Study is being completed with funds authorized by the Disaster Relief Appropriations Act, Public Law 113-2 (P.L. 113-2). Projects authorized by this Act are subject to USACE Headquarters and North Atlantic Division Hurricane Sandy-related guidance. To date, the following guidance has been issued:

- 17 December 2013 Engineering and Construction Bulletin 2013-33, "Application of Flood Risk Reduction Standard for Sandy Rebuilding Projects."

- 9 December 2013 CECW-ZA guidance, "Disaster Relief Appropriations Act, Policy Guidance Memorandum Construction Account."
- 7 July 2013 CECW-ZA guidance, "Disaster Relief Appropriations Act, Policy Guidance Memorandum Expenses and Investigations Accounts."

1.5 Non-Federal Sponsor

The Non-Federal Sponsor for the study is the New York State Department of Environmental Conservation (NYSDEC). Based on Public Law 113-2, the feasibility study is being completed with 100% Federal funding.

1.6 Prior Studies, Reports, and Existing Water Projects

USACE initiated the Reconnaissance Phase in July 2007. The Reconnaissance Report was completed in July 2008. The report described the study area, its problems, and recommended the continuation of the study into the feasibility phase for coastal storm risk management. In December 2012, USACE and the New York State Department of Environmental Conservation executed a Feasibility Cost Sharing Agreement (FCSA). The passage of Public Law 113-2, resulted in a FCSA amendment (April 2014) to complete the study at 100% Federal cost.

Prior reports that have been prepared documenting coastal erosion and storm damages along the north shore of Long Island Sound and the Hashamomuck Cove Study Area in Southold, New York include:

- USACE, New York District, June 2008, Section 905(b) Reconnaissance Study, New York District. The report recommended a Feasibility Study that included the Hashamomuck Cove study area.
- Long Island North Shore Heritage Area Planning Commission, 2005, Long Island North Shore Heritage Area Management Plan. This report includes information on resources in the study area.
- USACE, New York District, 1995, North Shore of Long Island, New York, Storm Damage Protection and Beach Erosion Reconnaissance Study, New York District. This report further described erosion (including erosion rates) and coastal storm damage along the north shore of Long Island, including discussion of the Hashamomuck Cove area.
- New York State University, circa 1973, North Shore of Long Island Sound, Technical Report #18. Report evaluates areas along the north shore but did not include Hashamomuck Cove study area specifically.

- USACE, New York District, 1969 Survey Report of the North Shore of Long Island. This Survey Report addressed conditions along the entire north shore of Long Island, including within the study area. Erosion and coastal storm damage problems were identified, and general opportunities to address these problems for the North Shore of Long Island were discussed. No recommendations were made specific to the Hashamomuck Cove study area.

Federal Projects. The Orient Harbor coastal storm risk management revetment was constructed by USACE in the Town of Southold, New York. The project area is located along the Peconic Bay shore immediately adjacent to State Route 25, approximately 5 miles east of Hashamomuck. The project is maintained by the New York State Department of Transportation.

1.7 Study Area

The Hashamomuck Cove study area is in the Town of Southold, New York on the north fork of Long Island on Long Island Sound. The study area extends from Soundview Road near the Southold Town Beach west about 1.6 miles to Sound View Inn and includes the near shore area in Long Island Sound and County Road 48 (Figure 2). For ease in discussion in the report, the coves in the study area are being called West Cove, Central Cove, and East Cove.

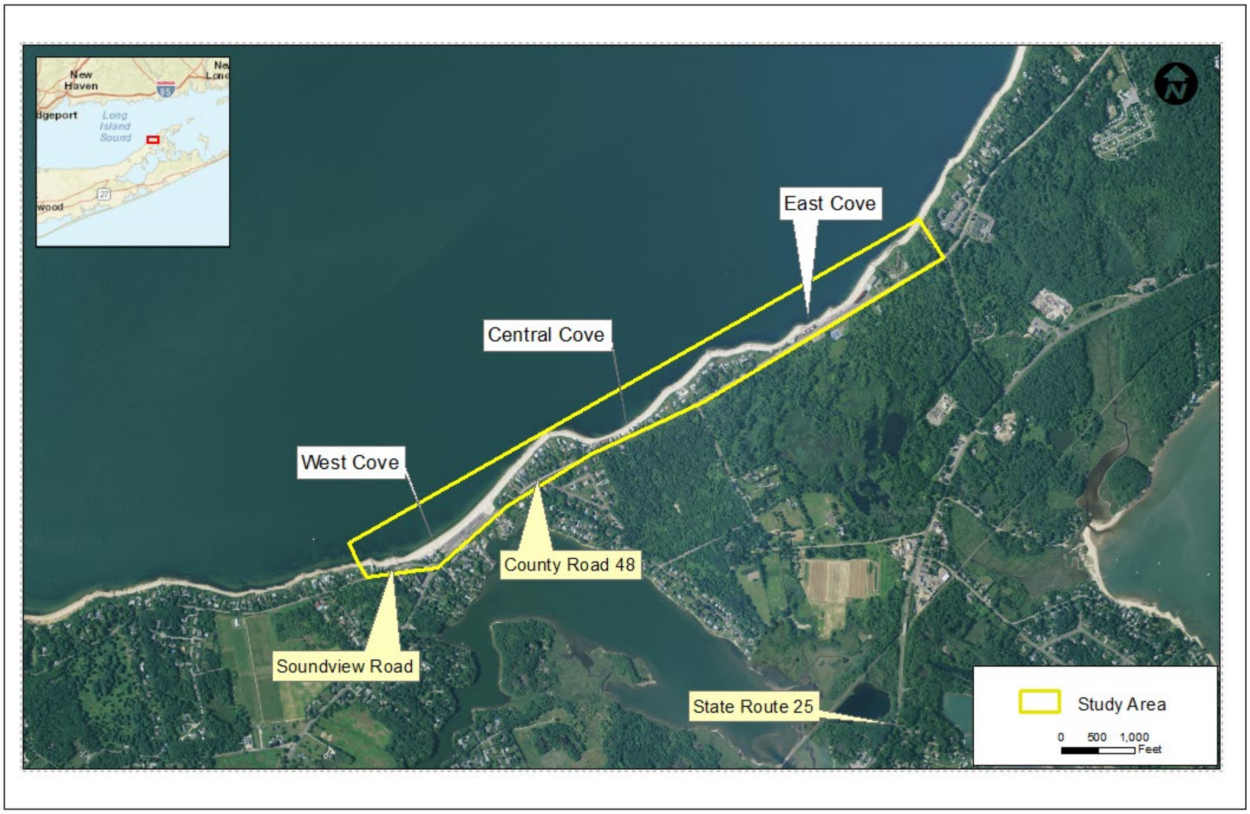

Figure 2. Study Area

The project area, which is the area in which coastal storm risk management measures are considered, is the developed coast in the Hashamomuck Cove study area. The project area is one hydraulic and economic system and contains the three component coves (West, Central, and East Coves). County Road 48 is constructed parallel to the coast immediately landward of the three coves.

Coastal storm damages in the project area include damages to structures and contents, land loss, and transportation infrastructure (County Road 48). Economic damages in the project are estimated using Beach-fx, a computer program developed by USACE to assist study teams with coastal storm risk assessments. For Beach-fx modeling the project area is delineated by reaches (Figure 3). Each reach is associated with a representative beach profile and man-made elements in the project area (buildings, roads, etc.) are located in these reaches.

Figure 3. Study Economic Reaches

West Cove (Reach E1-E5). West Cove is approximately 3,100 linear feet. This area includes residential properties, and the Southold Town Beach. County Road 48 is located landward of the beach and shorefront development. Private bulkheads are located in front of some of the residences.

Central Cove (Reach E6-E11). Central Cove is approximately 2,600 linear feet. This area includes residential properties and County Road 48 located landward of the beach and shorefront development (see Figure 4). Private bulkheads are located in front of some of the residences. The concave portion of the cove (Reach E8), includes homes that are in very close proximity to mean high water (within 10 feet). County Road 48 is approximately 100 ft. from mean high water in this area. Private bulkheads are located in front of some of the residences.

Figure 4. View of Central Cove

East Cove (Reach E12-E15). East Cove is approximately 2,700 linear feet. Many of the residences are also not far (100 ft. or less) from mean high water. Private bulkheads are located in front of some of the residences. Sound View Restaurant and Sound View Inn are located in Reach E14 and E15. These buildings in some locations are within 50 ft. of mean high water (Figure 5). County Route 48 is landward of the shorefront development.

Figure 5. View of Commercial Building in East Cove

Chapter 2: Existing Conditions*

Existing conditions serve as the basis for the characterization of problem identification and projection of future without project conditions. Existing conditions are described in this Chapter (coastal setting, storms and assets at risk) and in Chapter 3 (environmental resources).

2.1 Coastal Setting and Storms

Climate. Suffolk County has a moderate coastal climate with warm, humid summers and moderately cold winters. The temperature averages 51 degrees Fahrenheit (°F) annually, ranging from a low monthly average of 32°F in February to a high monthly average of 72°F in July. The average annual precipitation ranges from 40 to 45 inches and is fairly evenly distributed throughout the year.

Tides. The mean spring tide range at Hashamomuck is estimated at 4.81 feet (-2.65 to 2.16 ft. NAVD88) and the mean tide range is estimated at 4.21 feet (-2.35 to 1.86 ft. NAVD88). See Table 1.

Table 1. Estimated Tidal Datums, Hashamomuck Cove Southold, NY

Southold, NY	
Condition	Elevation in ft., NAVD88*
Mean spring high water	+2.16
Mean higher high water	+2.12
Mean high water	+1.86
NAVD88	0.00
Mean low water	-2.35
Mean lower low water	-2.61
Mean spring low water	-2.65

*North American Vertical Datum of 1988 (NAVD88)

Historical Storms. Two types of storms of primary significance along the North Shore are tropical cyclones (tropical storms and hurricanes), which typically impact the New York area in summer and fall and extratropical storms (nor'easters), which are primarily winter storms. Nor'easters are usually less intense than hurricanes but tend to have much longer durations. These storms often cause high water levels and intense wave conditions and are responsible for significant erosion and flooding throughout the coastal region of the north shore. Table 2 lists historic storms that have had impacts in the New York area.

Table 2. Historical Storms Impacting New York Area

Hurricanes Impacting New York Area		**Additional Storms Impacting New York Area**	
Date	Name	Date	Name
14 Sep 1904		03 Mar 1931	
08 Sep 1934		17 Nov 1935	
21 Sep 1938		25 Nov 1950	
14 Sep 1944		06 Nov 1953	
31 Aug 1954	Carol	11 Oct 1955	
02 Sep 1954	Edna	25 Sep 1956	
05 Oct 1954	Hazel	06 Mar 1962	
03 Aug 1955	Connie	05 Nov 1977	
12 Sep 1960	Donna	17 Jan 1978	
10 Sep 1961	Esther	06 Feb 1978	
20 Aug 1971	Doria	22 Jan 1979	
14 Jun 1972	Agnes	22 Oct 1980	
06 Aug 1976	Belle	28 Mar 1984	
27 Sep 1985	Gloria	09 Feb 1985	
19 Aug 1991	Bob	30 Oct 1991	
08 Oct 1996	Josephine	01 Jan 1992	
07 Sep 1999	Floyd	11 Dec 1992	
01 Sep 2006	Ernesto	02 Mar 1993	
28 Aug 2011	Irene	12 Mar 1993	
29-30 Oct 2012	Sandy*	28 Feb 1994	
		21 Dec 1994	
		05 Jan 1996	
		06 Oct 1996	
		02 Feb 1998	
		14 Apr 2007	
		15 Nov 2009	Nor'Ida
		13 Mar 2010	
		25 Dec 2010	
		17 Apr 2011	
		7 Nov 2012*	
		26 Dec 2012*	
		3 Oct 2015	
		23-24 Jan 2016	
		4 Jan 2018	"Bomb Cyclone"

* Hurricane Sandy affected the project area in late October, 2012, followed by two Nor'easters.
SOURCE: Beach Erosion Control and Storm Damage Reduction Feasibility North Shore Of Long Island, Asharoken, New York, Engineering Appendix, Draft March 2014, with additions by USACE staff.

Coastal Storm Climatology. Existing coastal processes at Hashamomuck Beach are driven by high energy waves and water levels generated by both tropical and extratropical storms. Based on data developed for the North Atlantic Coast Comprehensive Study (NACCS, USACE 2015), tropical storm events occur at the Hashamomuck Beach study area at a frequency of approximately once every 6.8 years. These tropical storms occur between June and November, with 74 percent of the storms occurring in the months of August and September.

Extratropical storms are a frequently occurring storm type that impacts Hashamomuck Beach with events occurring at a rate of approximately 1.2 storms per year. Extratropical storms typically occur at the project area between early fall through the spring (October through May), with most occurring in the months of November through February.

Tropical storm events are typically fast moving storms associated with elevated water levels and large waves, whereas extratropical storms are slower moving with comparatively lower water level elevations and large wave conditions. Both storm types can produce beach erosion and morphology change, as well as coastal inundation, leading to economic losses to property.

NACCS addresses the coastal areas defined by the extent of Hurricane Sandy's storm surge in the District of Columbia and the States of New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia. The Engineer Research and Development Center (ERDC) conducted rigorous regional statistical analysis and detailed high-fidelity numerical hydrodynamic modeling for the North Atlantic coastal region to quantify coastal storm wave, wind, and storm-driven water level extremes. The NACCS modeling efforts included the latest atmospheric, wave, and storm surge modeling and external statistical analysis techniques. Products from this work, incorporated into the Coastal Hazards System (CHS) database, include simulated winds, waves, and water levels for approximately 1,050 synthetic tropical events and 100 extratropical events computed at over 3 million computational locations. A smaller number -18,000 locations -save the same information at higher frequency for more convenient/concise data handling. These storm events are determined to span the range of practical storm probabilities. Data used for this study is explained in Appendix C, Coastal Engineering.

Relative Sea Level Change (RSLC). Engineer Regulation (ER) 1100-2-8162 "Incorporating Sea Level Change in Civil Works Programs" requires that future sea level rise projections be incorporated into the planning, engineering design, construction and operation of all civil works projects. Relative sea level change (RSLC) considers the effects of (1) the eustatic, or global, average of the annual increase in water surface elevation due to the global warming trend, and (2) the "regional" rate of vertical land movement (VLM) that can result from localized geological processes, including the shifting of tectonic plates, the rebounding of the Earth's crust in locations previously covered by glaciers, the compaction of sedimentary strata and the withdrawal of subsurface fluids. Regional movement varies by location, and is specific to a point on the Earth.

The mean sea level trend (low/historic rate) at Montauk, New York (NOAA 8510560) is 0.00912 ft./year based on regionally corrected mean sea level data from 1947 to 2006 (Figure 6). Over a period of 50 years (2023-2073, which is the final period of analysis) this equates to an increase of about 0.46 ft. for the low rate, 0.95 ft. for the intermediate rate, and about 2.53ft. for the high rate. Over a period of 100 years (2023-2123) this equates to an increase of about 0.91ft. for the low rate, 2.35 ft. for the intermediate rate, and about 6.92 ft. for the high rate.

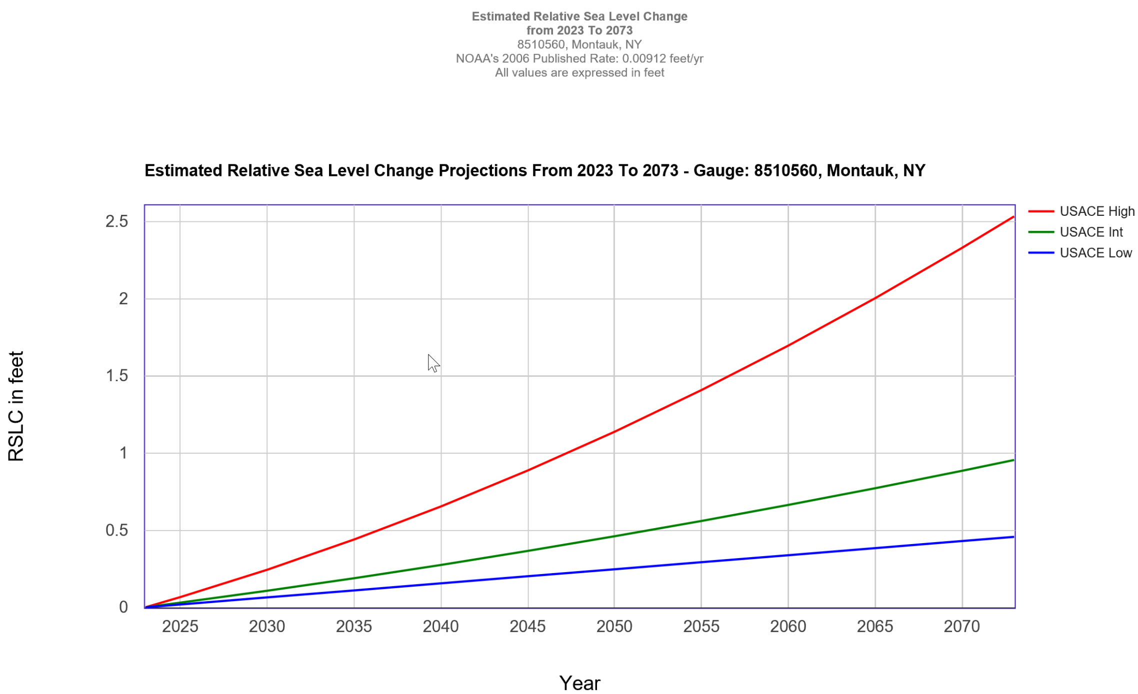

Figure 6. Mean Sea Level Change Trend

<u>Beach Erosion</u>. Coastal erosion is a shore process that reduces the width of the beach. These processes include long-shore and cross-shore sediment transport resulting from both typical and storm induced wave conditions. In some cases, the storm-induced erosion component of beach change, although devastating to development, may be short-term in nature. Following storms, the coastline tends to reshape itself into its former configuration, and some of the sand displaced from the beach is returned by wave action. The beach shape then conforms to the prevailing wave climate and littoral processes. However, over time, portions of the beach can experience permanent land loss. In developed areas, bulkheads and revetments will help to limit landward erosion but many of these structures may fail due to toe erosion and wave overtopping.

Shoreline Change. For this project area, there is no historic survey data available from which to extract the mean high water position which is typically used to determine shoreline change. As a result, the method used to calculate the rate of change was through comparison of historic aerial photography. Images were located and rectified for the project location from five time periods. Specifically, October 19, 1960, April 15, 1974, April 5, 1993, June 1, 2001, and June 10, 2010.

A shoreline baseline change rate for the project area was developed that followed the general contour of the land. Forty-five shoreline perpendicular transect locations were established as locations to calculate the shoreline change (Figure 7). From the available imagery, the wet/dry shoreline was extracted along the project length at each transect location for each time period. A least squares regression was calculated through the extracted shoreline locations for each transect to develop the initial shoreline change rates. The rates were then smoothed by creating moving averages of the four surrounding rates for each transect. Coastal Engineering Appendix D displays the calculated shoreline change rate for each transect. For the Hashamomuck Cove Study area the average shoreline change rate is -0.65 feet/year, where the minus sign indicates erosive behavior.

Figure 7. Transects for Calculation of Project Shoreline Change Rate

Federal Emergency Management Agency (FEMA) Flood Plain. FEMA flood insurance rate mapping for Southold, New York near the project area is shown in Figure 8. The Flood Insurance mapping is based on the FEMA Flood Insurance Study for Southold, Suffolk County 2009 and a portion of the mapping is included here for illustrative purposes only.

Figure 8. Flood Hazard Map

2.2 Existing Coastal Structures

USACE conducted a field visit of the study area on 4-5 August 2014 to review existing coastal structures that reduce risk against erosion along the shoreline. During the field visit, the existing coastal storm risk management structures were inventoried to determine the location, size, type, and general condition. Areas without protection were also noted and erosion conditions in these areas were documented. The data collected in August 2014 was used in conjunction with the elevation survey data collected by USACE survey team to document existing conditions for use with coastal and economic models. Figure 9a provides an illustration of example of elevations in the study area. Shoreline profiles used in the modeling are included in the Coastal Engineering Appendix.

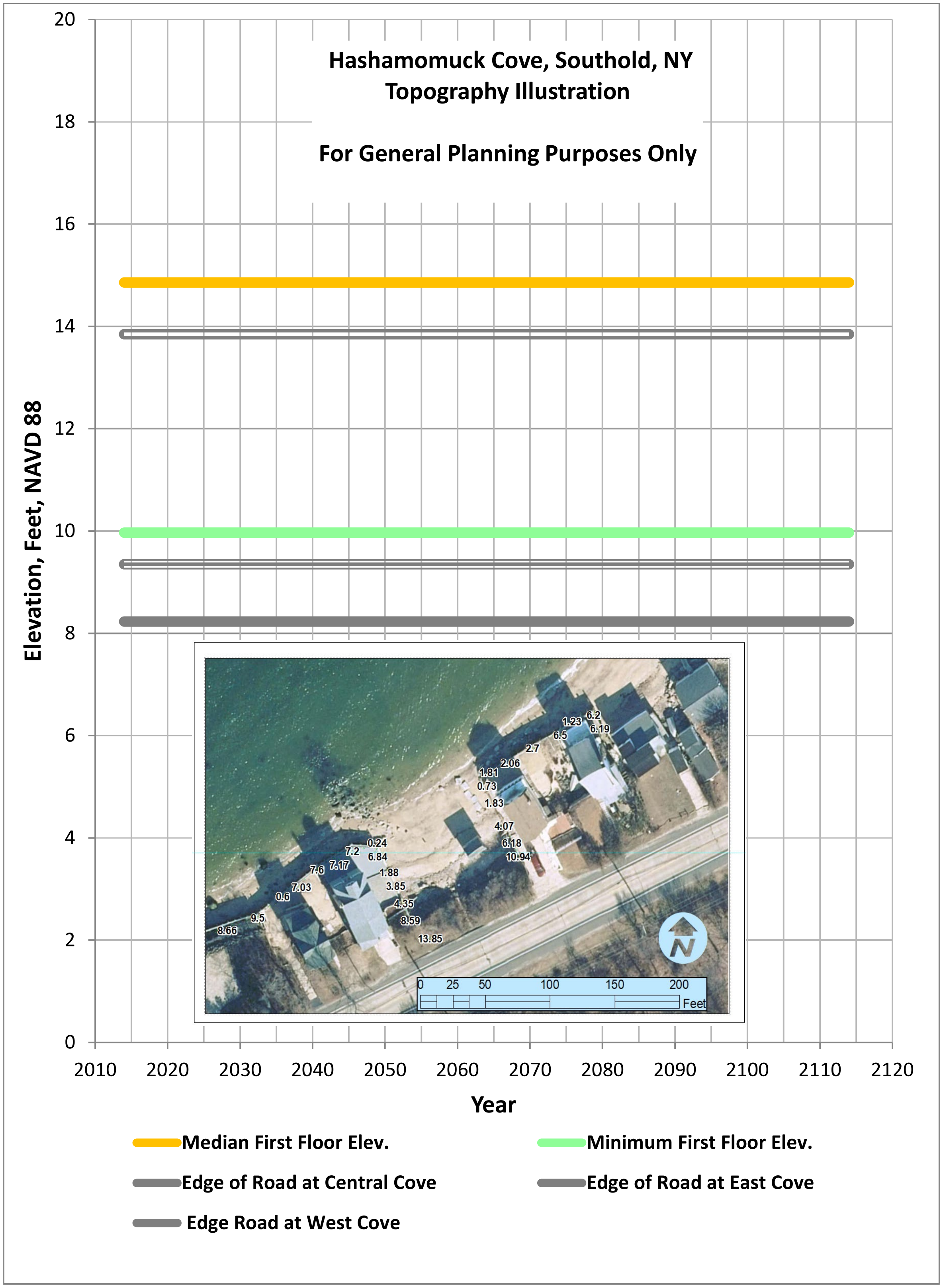

Figure 9a. Example Elevations in Study Area

The primary measure of erosion protection for the residential properties are bulkheads installed by individual owners. The bulkheads vary in height depending on the upland height. The bulkhead sheeting is constructed of various materials including pressure treated wood, fiberglass, and vinyl. The sheeting material is supported by wooden pilings. In some locations, the bulkheads include rocks at the base of the structure. There are also concrete bulkheads in some locations. The bulkheads are located along approximately 40% of the coastline in the study area. Overall, the bulkheads are generally in fair condition. In most cases, the bulkheads are contiguous and provide a continuous erosion protection measure. In some areas, there were small rock revetments installed as erosion protection. The rock revetments are located along approximately 15% of the beach front properties within the study area. Bulkheads are maintained by local property owners.

There are no coastal storm risk management features on the remainder of the beachfront properties (approximately 45%). Significant erosion was observed in several of such locations. In some areas, there are buildings (residences, hotel, and restaurant) with concrete foundations that are exposed to wave action at high tides. Portions of the restaurant and hotel buildings are raised on wooden supports.

There were also numerous groins observed during the August 2014 site visit. Conditions of the groins varied, some groins have significant gaps between the stone and are in poor condition. Some of the groins were constructed with stone while others used reinforced concrete structures such as jersey barriers or concrete filled pipes.

2.3 Access Route

County Road 48 is a primary transportation route for Suffolk County. There are two roads (County Road 48 and State Route 25) that provide access from Southold to Orient Point (north fork tip of Long Island). Both roads are heavily traveled under daily conditions. County Road 48 handles about 6,000 cars per day (annual average daily traffic) in both the east and west directions (Source: New York State Department of Transportation, Station 071118, County Road 48, count report 08/16/2012). Closure of County Road would result in rerouting of traffic onto local roads and State Route 25. County Road 48 is a critical infrastructure link for socially vulnerable populations neighboring Greenport, NY which is in top 25% of populations with high social vulnerability. County Road 48/North Road provides vital access to Southold and Greenport for three nursing homes, one hospital, and two daycare centers (Figure 9b). State Route 25 is the designated evacuation route. However, County Road 48 would also be used as an evacuation route although not officially designated as such. These routes also are important for reentry in the area. Road access is critical to allow repair, and clean-up efforts to move forward efficiently following a storm.

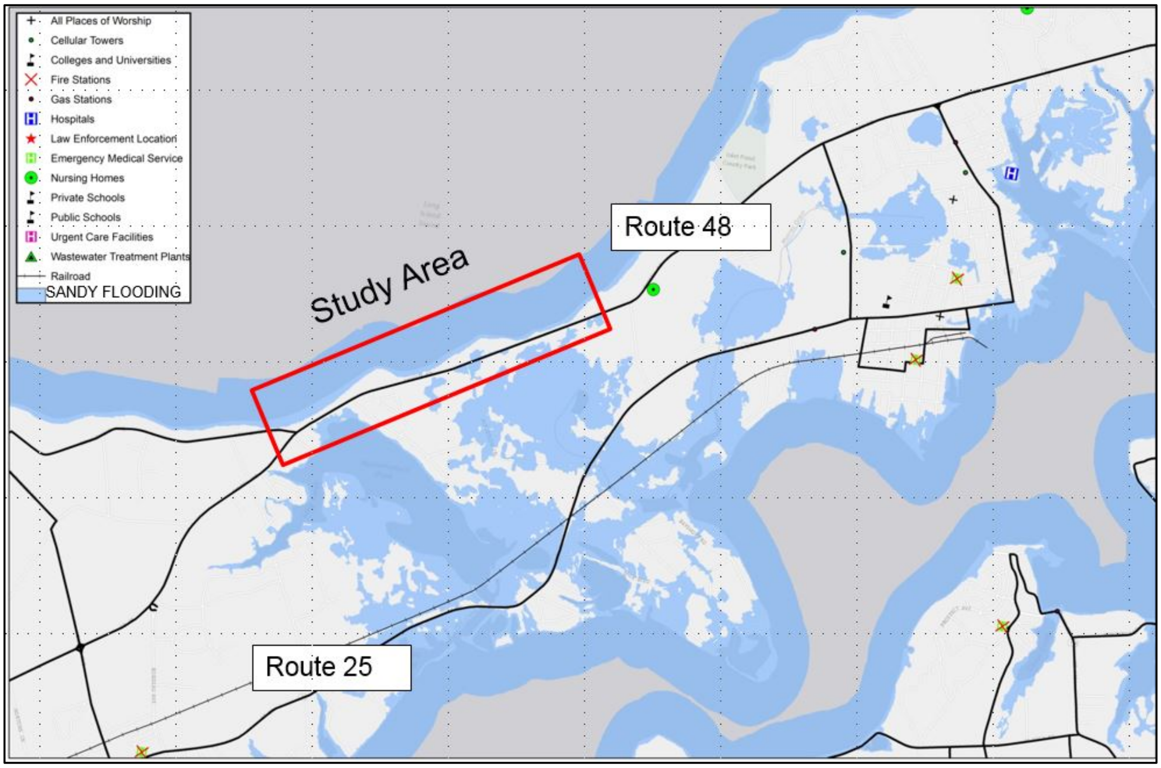

Figure 9b. Critical Infrastructure, Hurricane Sandy Flooding

Chapter 3: Existing Conditions Affected Environment*

This description of the existing environment conditions is in accordance with the requirements of National Environmental Policy Act (NEPA), and serves as the baseline for Chapter 5: Environmental Impacts and Chapter 6: Cumulative Impacts of this integrated report.

3.1 Topography, Geology, and Soils

The Town of Southold is located at the northeastern end of the North Fork of Long Island on Long Island Sound. Great Peconic Bay and Little Peconic Bay separate the Town of Southold from the South Fork of Long Island to the south. The Town of Southold has a total area of 404.5 square miles, of which, 53.7 square miles of it is land and 350.8 square miles of it (86%) is water. The town has approximately 163 linear miles of coastline (U.S. Census Bureau 2015).

Long Island was formed largely by the glacial advance and retreat of the Wisconsin Glacier that occurred approximately 21,000 years ago. As the glacier melted and receded to the north, sands, gravels, and rocks that accumulated in the glacier were deposited forming glacial moraines. The till ranges from about 5 to 50 ft. in thickness and contains many boulders. Lighter weight materials were carried away from the moraines by streams and melt-water, which created glacial outwash plains composed of primarily gravel and sand. The southern moraine, known as the Ronkonkoma, forms the main portion of Long Island. Southold is located on the northern moraine, known as the Harbor Hill moraine, and has a landscape characterized by a pronounced bluff along the shore with outwash plains in the interior and southern coastline. Most of the coastal bluffs have slopes exceeding 50 percent and are subject to extreme soil erosion from wind and wave action (Southold 2011). Gaps in the moraine, such as Hashamomuck Pond, are areas where blocks of glacial ice were partially buried and then melted after the retreat of the main ice front (Crandell 1963 in Southold 2011).

The Harbor Hill Moraine is located along the entire northern coastline of the Town of Southold, gradually decreasing in height from west to east. Topographic elevations in Southold range from sea level to 160 ft. above mean sea level (msl) in the Mattituck Hills (western portion of the town) (Southold 2011). The slope of the beach in the project area is variable (Cross Sections indicating the existing slope and the final slope under the proposed project are provided in Appendix D – Civil Engineering).

The predominant soils present within the Hashamomuck Cove project area are categorized as Beaches. There are small areas of Haven loam (2 to 6 percent), Plymouth loamy sand (3 to 8 percent slopes), Riverhead sandy loam (3 to 8 percent slopes) and Carver and Plymouth sands (15 to 35 percent slope) soils associated with the escarpments in the backshore area. These soils occur throughout Suffolk County in rolling to steep areas on moraines and on level to gently sloped areas of outwash plains. They are generally deep, well to excessively drained, medium to coarse textured soils that formed in a sandy loam, loamy or silt mantel over stratified coarse sand and gravel (NRCS 2015a). (See Section 2.1 on beach erosion.)

The Federal Farmland Protection Policy Act (FPPA) of 1981 was enacted to minimize the extent to which Federal programs contribute to the irreversible conversion of farmland to nonagricultural uses. The Act applies to farmland with soil types classified as prime, unique, or of statewide or local importance. Haven loam (2 to 6 percent slopes) and Riverhead sandy loam (3 to 8 percent) are designated as a "prime farmland" and Plymouth loamy sand (3 to 8 percent slopes) is designated as "farmland of statewide importance."

The FPPA applies only to Federal assistance and actions that would convert important farmland to nonagricultural uses. Section 658.3 Applicability and exemptions provides that "Assistance and actions related to the purchase, maintenance, renovation, or replacement of existing structures and sites converted prior to the time of an application for assistance from a Federal agency, including assistance and actions related to the construction of minor new ancillary structures (such as garages or sheds), are not subject to the Act." (7 CFR Ch. VI (1–1–03 Edition) (NRCS 2015b). The areas designated as prime farmlands, within the project area, are Haven, Plymouth, and Riverhead soils associated with the escarpment along the backshore area and are primarily located on private property. The proposed project involves beach nourishment and would not involve impacts to prime farmlands.

3.2 Water Resources

3.2.1 Regional Hydrogeology and Groundwater Resources

Long Island's groundwater reservoir consists of a sequence of unconsolidated glacial, lacustrine, deltaic, and marine deposits of clay, silt, sand, and gravel that range in age from Upper Cretaceous to Pleistocene (United States Geological Survey [USGS] 2002 in USACE 2005). Three principal aquifers underlie Long Island. They are unconsolidated deposits of Pleistocene age, referred to as the Upper Glacial Aquifer, and unconsolidated deposits of Cretaceous age, that include the Magothy Aquifer and the Lloyd Aquifer (USGS 1995 in USACE 2005). The three aquifers are bounded above by the water table and below by the crystalline bedrock surface. Laterally, usable freshwater in the aquifers is bounded by a freshwater-saltwater transition zone that surrounds Long Island (USGS 1995 in USACE 2005).

The Upper Glacial Aquifer is the primary source of fresh groundwater in the Town of Southold. This aquifer is underlain by the Magothy Aquifer which also provides public water supply to the town but only west of Mattituck Creek. East of Mattituck Inlet, the Magothy Aquifer contains saline groundwater. Below the Magothy Aquifer is a late Cretaceous age layer of clay (the

Raritan formation) and beneath that is the Lloyd Aquifer. The Lloyd Aquifer contains only saltwater within the Town of Southold (Southold 2011).

Nassau and Suffolk counties utilize an aquifer designated by the U.S. Environmental Protection (USEPA) Agency, pursuant to the Federal Safe Drinking Water Act of 1974 (Public Law 93-523), as a sole source aquifer (43 Fed. Reg 26,611 (1978)). As defined by the USEPA, a sole source aquifer supplies at least 50 percent of the drinking water for its service area and there are no reasonably available alternative drinking water sources should the aquifer become contaminated. The Suffolk County Government Office of Water Resources enforces regulations controlling 39 Community Water Supplies (CWS) and 254 Non-Community Water Supplies (NCWS) in Suffolk County. The public water suppliers serve more than 90% of Suffolk County's 1.45 million residents (Suffolk County Government 2015).

The New York State Department of Environmental Conservation (NYSDEC) Water Quality Standards are the basis for programs to protect the state waters. Standards set forth the maximum allowable levels of chemical pollutants and are used as the regulatory targets for permitting, compliance, enforcement, and monitoring and assessing the quality of the state's waters. Waters are classified for their best uses (fishing, source of drinking water, etc.) and standards (and guidance values) are set to protect those uses. Water Quality Standards are found in New York Codes, Rules and Regulations Title 6 (6 NYCRR). All fresh groundwater in New York State is Class GA. The best usage of Class GA waters is as a source of potable water supply (NYSDEC 2015).

3.2.2 Surface Water

The Long Island Sound estuary is open to the ocean at both ends (through Block Island Sound to the east and the lower Hudson River estuary to the west) and most of its fresh water input is located at the higher salinity eastern end (through the Connecticut and Thames River). Salinity at the western boundary of the Sound is from around 22 parts per thousand (ppt) in the spring to 27 ppt in the fall, increasing eastward to 30 to 31 ppt at the western end of the Sound. The project area salinity (in April) is approximately 27-28 ppt (NOAA 2003). Thermal stratification in the Sound develops in the spring and breaks down in the fall. The surface temperatures in the open Sound range from 36 to 41°F in the winter and from 68 to 77°F in late summer (Riley, 1956 in NOAA, 2003).

The project area is located within the Eastern Suffolk County Drainage Basin (NYSDEC 2015). Long Island Sound and Hashamomuck Pond, within the project area and vicinity, are designated as Class SA. There are also freshwater wetlands located south of Route 48 in the vicinity of the

East Cove portion of the study area. One unnamed pond within this large wetland complex is designated as Class C.

The best usages of Class SA waters are shellfishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish and wildlife propagation and survival. The inland tidal and freshwater portions of Mattituck Creek are designated Class SC and Class C, respectively. The best usage of Class SC and Class C waters is fishing. These waters shall be suitable for fish, shellfish and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes (NYSDEC 2015).

3.2.3 Coastal Processes

Three primary factors shape coastal zone morphology: 1) ocean factors; 2) beach characteristics; and 3) other natural physical variables. Ocean factors include waves, tidal variations, storm surges, and sea level change. Beach characteristics include beach sediment volume, composition, and grain size. Other natural variables include rainfall runoff, groundwater flow, pore pressures, and existing vegetative cover (Komar 1998 in USACE 2015a). All three factors interact in a dynamic process, which defines the coastal zone area. Anthropogenic can also play a role in shaping the coast. As shorelines retreat due to longshore currents, wave and tidal action, and storm events, artificial structures are often constructed to slow down or minimize further erosion. These structures typically modify the coastal zone to increase sediment retention within heavily utilized or populated areas (USACE 2000 in USACE 2015a). There are bulkheads and groins scattered throughout the study area, although many have not been maintained.

3.3 Vegetation

3.3.1 Upland

The beach in the proposed project area is narrow and backed by low bluffs in some areas. The area inland of the beach along County Road 48 ranges in elevation with a maximum height of about +12 ft. NAVD88. Vegetation in the project area is characterized by herbs and low shrubs. The area adjacent to the south side of the project area includes a freshwater wetland and Hashamomuck Pond.

Natural features in the project area are interspersed with extensive public and private shorefront properties and man-made structures (e.g., parking lots, bulkheads, revetments, seawalls, groins, etc.). In addition, Route 48, a major transportation route, runs parallel to the coastline within the project area and is being undermined in some areas due to coastal erosion. Upland vegetation within the study area is limited to maintained landscaped areas associated with residential and commercial buildings, stabilized areas landward of bulkheads, and narrow beach. These areas are dominated by grasses, herbs and shrubs such as evening primrose (*Oenothera biennis*), common milkweed (*Asclepias syriaca*), Montauk daisy (*Nipponanthemum nipponicum*) (escaped from residential gardens), catbrier (*Smilax rotundifolia*), and staghorn sumac (*Rhus typhina*). Some of the woodland trees that are commonly found in yards and along streets in the project vicinity include white oak (*Quercus alba*), red oak (*Q. rubra*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), American elm (*Ulnus americana*), yellow poplar (*Liriodendron tulipifera*) and hickory (*Carya* spp.) In the higher portions of the beach, early successional vegetation is sparsely growing including American beachgrass (*Ammophila breviligulata*), silverweed (*Potentilla anserina*), sea lavender (*Limonium nashii*), morning glory (Convolvulaceae), and seaside goldenrod (*Solidago sempervirens*). Some non-native invasive species, such as common reed (*Phragmites australis*), Japanese knotweed (*Fallopia japonica*) and honeysuckle shrubs (*Lonicera* sp.) were also observed in the project area.

3.3.2 Wetland

The project area and vicinity are characterized by a variety of habitat types and special plant communities. Pursuant to the U.S. Fish and Wildlife Service's Planning Aid Letter, dated August 13, 2015, the Service defines wetlands as transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water (USFWS 2015a). Intertidal and shallow subtidal habitats provide a variety of ecosystem functions and values, including primary production, provision of fish and shellfish habitat and nursery areas, biogeochemical cycling of nutrients, carbon sequestration, sediment trapping, and wave attenuation (Currin *et al.* 2010 in USFWS 2015a).

The U.S. Fish and Wildlife Service (USFWS) classifies wetlands according to the *Classification of Wetlands and Deepwater Habitats* (Cowardin et al., 1979) in the National Wetland Inventory. The Cowardin system is a hierarchical classification system in which wetlands are divided into systems, subsystems, classes, and subclasses. Of interest in the project area are the following wetland systems:

> Palustrine - all non-tidal wetlands dominated by trees, shrubs, and persistent emergent herbaceous plants. Five classes were used to characterize this system by the dominant form of vegetation or composition of the substrate; aquatic bed, emergent, scrub/shrub, forested and unconsolidated bottom.
>
> Estuarine - deepwater tidal habitats and adjacent tidal wetlands and is more strongly influences by land than the Marine system. There are two subsystems, subtidal and

intertidal, and ten classes used to characterize this system by the dominant form of vegetation or composition of the substrate; rock bottom, unconsolidated bottom, aquatic bed, reef, streambed, rocky shore, unconsolidated shore, emergent wetland, scrub/shrub wetland and forested wetland.

According to the USFWS National Wetland Inventory, the general project area includes subtidal and intertidal estuarine wetlands and palustrine (freshwater) emergent, forested, scrub/shrub pond wetlands. Modifiers provided for each wetland characterize water regimes or other unique features (Figure 10 USFWS National Wetland Inventory).

Within the proposed project area, the estuarine intertidal unconsolidated sandy shore (E2US2P) is narrow, ranging in width from about 20 to 100 ft. (average width for the narrowest and widest portion of each cove) and is backed by low bluffs in some areas. This beach area is composed of sand and cobbles with some scattered successional vegetation in the upper portion (above mean high water) of the beach.. The NYSDEC classifies this beach area as Coastal Shoals, Bars, and Mudflats. This zone is not vegetated and is covered by water at high tide, and is either exposed or covered by a maximum of one foot of water at low tide. The subtidal habitat is classified by the NYSDEC as the Littoral Zone; a zone of open water with a maximum depth of six ft. measured from mean low water elevation (Southold 2011).

The adjacent estuarine subtidal habitat (E1UBL) is characterized by the National Wetland Inventory as having an unconsolidated bottom. Eelgrass mapping was also conducted during a study entitled *Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York* (Tiner et al. 2003) which included the near shore area (i.e., to a depth of –15 ft. at mean low water) along the North Shore of Long Island from Southold to Orient Point. Survey methods included mapping eelgrass beds through aerial photo-interpretation and follow-up ground-truthing using visual observation and an underwater video camera where beds or bottoms were not visible from the boat. No eelgrass was observed in the Hashamomuck Cove project area during this study.

A survey was also conducted on September 21, 2015 by the U.S. Army Corps of Engineers, New England District (USACE 2015a) in the project area to document the presence or absence of eelgrass (*Zostera marina*) in the subtidal nearshore environment. Three transects paralleling the Hashamomuck Beach shoreline were established for the eelgrass survey prior to the start of field activities. Transect 1 was located 50 ft. from the shoreline, Transect 2 was located 100 ft. from the shoreline, and Transect 3 was located 200 ft. from the shoreline. Transects were traversed at low speeds by a boat operator while visual observations of the bottom were made by a marine ecologist through a viewing bucket. No eelgrass was observed in the survey area. Additionally, no eelgrass blades were observed within the beach wrack along the entire Hashamomuck Cove project area. The subtidal survey area was dominated by sandy expanses interspersed with areas of cobble and large boulders extending beyond the offshore transect. Sparse patches of various macroalgal species typical of a nearshore environment were present on both bottom types. See Appendix A2 – 2015 Sediment Sampling, Benthic Community Analysis, and Eel Grass Survey for additional information.

Freshwater wetlands are scattered throughout the Town of Southold. The largest concentration of freshwater wetlands, the Arshamomaque Preserve wetland complex, is located on the south side of County Road 48 and southeast of the Hashamomuck Cove project area (Figure 10 USFWS National Wetland Inventory). This preserve includes an old field successional community along with mixed hardwood forest, swamp cottonwood *(Populus deltoides*) and cattail (*Typha* sp.) marsh (Southold 2015). Some areas within the Arshamomaque Preserve have been designated as a Significant Natural Community by the NYSDEC. Portions of the Hashamomuck Cove project area located within 100 foot buffer zone for state-regulated freshwater wetlands and within the one half mile buffer zone of designated Significant Natural Communities.

In March of 1987, the New York State Department of State designated Hashamomuck Pond as a Significant Coastal Fish and Wildlife Habitat (New York State Department of State 2005 in USFWS 2015a). Hashamomuck Pond is located west of Conklin Point emptying through Mill Creek into Shelter Island Sound in the Town of Southold. There is moderate to high density residential development on the north and northwest sides of the pond and marina development at the mouth of Mill Creek. The southwest side of the pond remains largely undeveloped, and a large parcel on the eastern side of the pond has been preserved (New York State Department of Environmental Conservation 2002 in USACE 2015a).

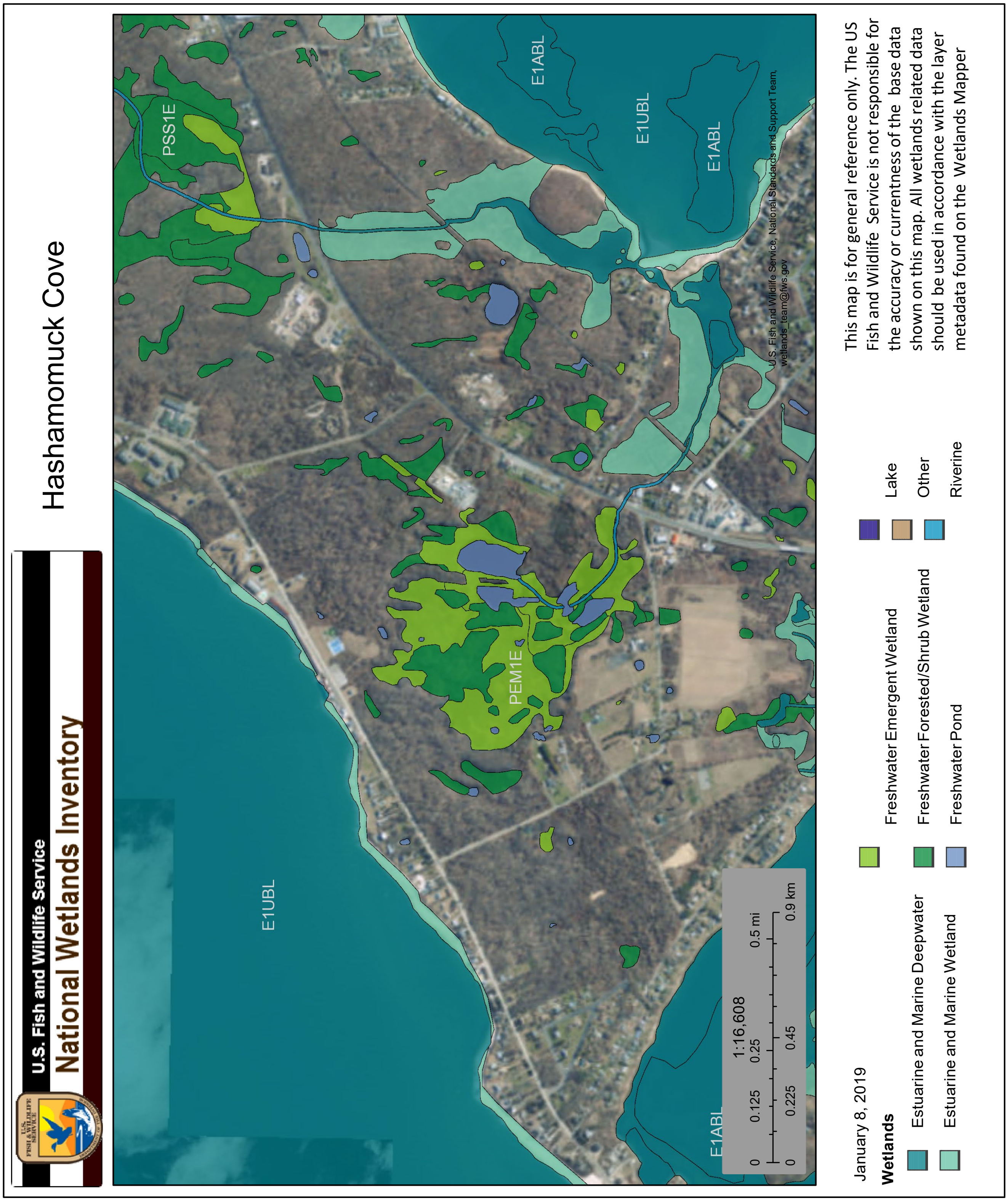

Figure 10. USFWS National Wetland Inventory

3.4 Fish and Wildlife

The marine waters in and around the Town of Southold support a variety of finfish, shellfish, and crustaceans. These marine organisms are important not only for their role as natural resources, but also because of the degree to which they support the Town's commercial and recreational fishing industry (Southold 2011).

3.4.1 Finfish

Long Island Sound and the Peconic Estuary are very important nursery and spawning habitat for coastal fish. Anadromous fish, such as shad (*Alosa sapidissima*), white perch (*Morone americana*), striped bass (*Morone saxatilis*), and Atlantic menhaden *(Brevoortia tyrannus),* spawn in Atlantic coast rivers. The young emerge from the spawning estuaries for annual migrations to coastal waters and then return as adults to spawn at their natal estuaries in the spring. Estuarine fish, such as winter flounder (*Pseudopleuronectes americanus*), blackfish or tautog (*Tautoga onitis*) and many of the principal bait fish, including Atlantic silversides (*Menidia*), striped killifish (*Fundulus majalis*), and sand lance (*Ammodytes amenicanus*), generally remain within an estuary throughout their lives. Other popular food and sport fish found in the area include bluefish (*Pomatomus saltatrix*), fluke or summer flounder (*Paralichthys dentatus*), weakfish (*Cynoscion regalis*), porgies or scup (*Stenotomus chrysops*), and sea bass (*Centropristis striata*). These species range from New England to the Carolinas and generally migrate inshore and north in the spring and summer, and offshore and south in the fall and winter. Most of these species spawn while the fish are away from New York, and young fish and adults move into our shallow coastal waters and estuaries in the spring. Others, such as weakfish, spawn as they move into our waters in the spring. Offshore fish, such as Atlantic cod (*Gadus morhua*), whiting or silver hake (*Merluccius bilinearis*), tuna (*Thunnus spp.*), haddock (*Melanogrammus aeglefinus*), and several species of shark may or may not be migratory, but generally do not enter New York State waters in large numbers (Southold 2011).

3.4.2 Shellfish

A variety of edible shellfish are found in the Southold area include hard-shelled clams or quahogs (*Mercenaria mercenaria*), soft-shelled clams or steamers (*Mya arenaria*), surf clams, (*Spisula solidissima*), oysters (*Crassostrea virginica*), bay scallops (*Argopecten irradians*), blue mussels (*Mytilus edulis*), channeled whelk (*Busycon canaliculatum*) and knobbed whelk (*Busycon caricum*) (Southold 2011). Within the Hashamomuck Cove project area, hard-shelled clam, blue mussels, and whelks are likely to found. Hard-shelled clams are found near the top of sandy or muddy sand substrates in creeks, bays and along ocean beaches and are currently the most important commercial shellfish in Southold (Southold 2011). Blue mussels are common, attaching themselves to intertidal rocks, pilings, scattered shells and other mussels and whelks are carnivorous sea snails commonly found throughout the Long Island Sound. The project area is not included as a shellfish harvest area (Map II-9) in the Town of Southold Local Revitalization Program report (Southold 2011).

3.4.3 Benthic Resources

Benthos is the complex community of plants and animals that live on or in bottom sediments of oceans, bays, streams, and wetlands. In September 2015, field studies were conducted by the U.S. Army Corps of Engineers, New England District to provide baseline information on biological resources (i.e., benthos and eelgrass) of the study area as well as document the existing physical properties (grain size) of the beach sediments in the study area (USACE 2015a).

The study area extends about 1.6 miles west from Soundview Road near the Southold Town Beach and includes three coves: Southold Town Beach Cove (West Cove), Hashamomuck Cove (Center Cove), and Pebble Beach Cove (East Cove) separated by slightly protruding headlands (USACE 2015a). Ten transects were established within the project area to collect samples for benthic community analysis and sediment grain size.

Samples were collected on September 21, 2015 at low tide. A sample for benthic community analysis and a sediment sample for grain size analysis were taken at the high-intertidal level, the mid-intertidal level, and the low-intertidal tide level along all transects with the exception of Transect 5. No high-intertidal or mid-intertidal samples were collected on Transect 5 as the area was a bulkhead with large armor stone. Organisms identified during sampling were identified to the lowest taxon possible and enumerated.

Twenty-eight cores for benthic community analysis were processed at the New England District's Environmental Laboratory. A total of fifteen different taxa were observed in the 28 samples. The following narrative provides a description of the benthic communities in the High, Mid and Low-Intertidal stations.

High-intertidal Stations - The benthic communities in the high-intertidal area were generally azoic or consisted of typical opportunistic annelid species. Six of the nine stations sampled did not have species present. In the 3 stations where species were present, they were represented by a single polychaetes species, *Capitella capitata*, which is a known opportunistic annelid. Data on the benthos collected at the high-intertidal stations are presented in Table 3a.

Mid-intertidal Stations - The benthic communities in the mid-intertidal areas were also dominated by typical opportunistic annelid species (*Capitella capitata* and *Scalibregma inflatum*) commonly found along Long Island Sound beaches. Of note at the mid-intertidal station T-10 – M (i.e., Transect 10 – mid-intertidal) blue mussels were found. These mussels were juvenile and were attached to large gravel-sized sediments. Data on the benthos collected at the mid-intertidal stations are presented in Table 3b.

Low-intertidal Stations - The low-intertidal communities were also dominated by typical opportunistic annelid species (*Capitella capitata* and oligochaetes), but also contained a varied mix of other typical sandy shore species. These species included various crustacean isopods, amphipods, and decapods as well some typical intertidal gastropods species (*Crepidula plana* and *Nassarius trivitatus*). A lone blue mussel was found at station T-4 - L (i.e., Transect 4 - low-intertidal). Data on the benthos collected at the low-intertidal stations are presented in Table 3c.

The grain size data showed that the sediments in the high-, mid-, and low-intertidal areas were predominately a mix of cobble-gravel-sand. The benthic communities in the high-intertidal area were generally azoic or consisted of typical opportunistic annelid species, while the communities in the mid-intertidal areas were dominated by typical opportunistic annelid species. The low-intertidal communities were also dominated by typical opportunistic annelid species, but also contained a varied mix of other typical sandy shore species such as isopod and decapod crustaceans and a few gastropod species.

Table 3. Benthic Invertebrates

Table 3a– High Intertidal, Data collected from the high-intertidal locations at Hashamomuck Beach Study Area on Sept. 21, 2015. No high intertidal sample was collected at Transect 5.
Numbers are per 0.003 m^{2}.

	HIGH-INTERTIDAL									
TRANSECT NUMBER	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
ANNELIDA										
POLYCHAETA										
Capitella capitata	3	*	1	*	-	*	2	*	*	*
INDIVIDUALS / SAMPLE	3	0	1	0	-	0	2	0	0	0
SPECIES / SAMPLE	1	0	1	0	-	0	1	0	0	0

Table 3b-Benthic invertebrates collected from the mid-intertidal locations at Hashamomuck Beach Study Area on Sept. 21, 2015. No mid-intertidal sample was collected at Transect 5.
Numbers are per 0.003 m^2

	MID-INTERTIDAL									
TRANSECT NUMBER	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
ANNELIDA										
POLYCHAETA										
Capitella capitata	111	*	7	*	-	17	4	*	11	*
Scalibregma inflatum	*	3	1	*	-	*	6	*	13	34
OLIGOCHAETA										
Unidentified Oligochaete sp.	10	*	*	*	-	9	*	*	1	*
MOLLUSCA										
BIVALVIA										
Mytilus edulis	*	*	*	*	*	*	*	*	*	2
GASTROPODA										
Nassarius trivitatus	*	*	1	*	-	*	*	*	*	2
INDIVIDUALS / SAMPLE	121	3	9	0	-	26	10	0	25	38
SPECIES / SAMPLE	2	1	3	0	-	2	2	0	3	3

Table 3c-Benthic Invertebrates – Low Intertidal Data collected from the low-intertidal locations at Hashamomuck Beach Study Area on Sept. 21, 2015.
Numbers are per 0.003 m^2

	LOW-INTERTIDAL									
TRANSECT NUMBER	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
ANNELIDA										
POLYCHAETA										
Capitella capitata	*	25	67	25	72	91	6	*	*	3
Exogone sp.	*	*	*	*	*	*	1	*	1	*
Leitoscoloplos robustus	*	5	19	*	*	*	*	*	*	*
Scalibregma inflatum	*	3	*	*	*	1	*	*	*	*
Streblospio benedicti	*	*	1	*	*	*	*	*	*	*
OLIGOCHAETA										
Unidentified Oligochaete sp.	*	1	3	*	27	15	10	1	*	17
ARTHROPODA										
CRUSTACEA										
ISOPODA										
Sphaeroma quadridentata	*	*	*	14	*	*	*	*	5	*
AMPHIPODA										
Unidentified Amphithoidae	*	*	*	2	*	*	*	*	*	*
CUMACEA										
Unidentified Cumacean	1	*	*	1	*	*	*	*	*	*
DECAPODA										
Pagurus longicarpus	1	*	*	*	*	*	*	1	*	*
Hemigrapsus sanguineus	*	*	*	4	*	*	*	*	*	*
MOLLUSCA										
BIVALVIA										
Mytilus edulis	*	*	*	1	*	*	*	*	*	*
GASTROPODA										
Mitrella lunata	*	1	*	*	*	*	*	2	*	*
Crepidula plana	*	*	*	*	*	*	*	5	1	*
Nassarius trivitatus	*	*	*	*	*	*	*	*	2	*
INDIVIDUALS / SAMPLE	**2**	**35**	**90**	**42**	**99**	**107**	**17**	**9**	**9**	**20**
SPECIES / SAMPLE	**2**	**5**	**4**	**6**	**2**	**3**	**3**	**4**	**4**	**2**

3.4.4 Reptiles and Amphibians

Site-specific studies or surveys describing the diversity and abundance of amphibians and reptiles within the study area are not available. No amphibians are expected to inhabit the shoreline project area because of the density of development and road infrastructure, narrow beach and lack of fresh water within the project boundaries. The common garter snake (*Thamnophis sirtalis*) is frequently found in lawns and so may be found in some residential areas within the project. The common garter snake is 16 to 30 inches in length and consumes many kinds of insects, slugs, worms and an occasional small frog or mouse (NYSDEC 2016a).

New York waters are primarily used as "nursery" waters for young sea turtles. Sea turtles arrive in New York every year in late May as water temperatures rise. By mid-November, they migrate south in search of warmer waters. Turtle species that may have the potential to occur seasonally in the offshore environment of Long Island include the Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*) green sea turtle (*Chelonia mydas*), and leatherback sea turtle (*Dermochelys coriacea*). Of these species, the leatherback is a highly pelagic fast swimming open water animal and is not expected to visit the sound. Studies of sea turtles near Long Island, NY have shown that turtles typically occur in waters with depths between 16 and 49 ft. deep and in areas where the waters are slow-moving or still (i.e., less than 2 knots) (Ruben and Morreale 1999). As such, other than transient individuals, it would be unlikely that sea turtles would be found in the nearshore waters of the project area.

All sea turtle populations are either threatened or endangered and are protected under the U.S. Endangered Species Act. Additional information about sea turtles is found in Section 4.1.2 Federal Endangered and Threatened Species.

3.4.5 Birds

No site-specific bird surveys have been conducted in the study area, however a diversity of bird species is likely to be present due to the variety of habitats in the Hashamomuck Cove project area. The most abundant species are likely to be habitat generalists that are tolerant of development such as house sparrow (*Passer domesticus), mourning dove (Zenaida macroura),* crow (*Corvus brachyrhynchos*), eastern tufted titmouse (*Parus bicolor),* northern cardinal *(Cardinalis cardinalis),* Carolina wren (*Thryothorus ludovicianus*), American robin (*Turdus migratorius*), gray catbird (*Dumetella carolinensis*), European starling (*Sturnus vulgaris*), common grackle (*Quiscalus quiscula*), and brown-headed cowbird (*Quiscalus major*). Herring gulls (*Larus argentatus*), great blackbacked gulls (*Larus marinus*), double-crested cormorants (*Phalacrocorax auritus*) and sanderlings (*Calidris alba*) have been observed resting and feeding in the study area. The closest designated Bird Conservation Area is the Peconic

River Headwaters located approximately 20 miles southwest of the project area in Brookhaven and Riverhead, NY (NYSDEC 2016d).

The primary statutory authority for *Birds of Conservation Concern (BCC) 2008* (U.S. Fish and Wildlife Service 2008) is the Fish and Wildlife Conservation Act of 1980, as amended; other authorities include the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-j), the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884, as amended), and the Migratory Bird Treaty Act (MBTA) of 1918. The USFWS provided a list of BCC birds in their letter dated 13 August 2015 that are protected under the MBTA, which prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Service (USFWS 2015a). The word "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." Unauthorized taking of birds is a violation of the MBTA. Neither the MBTA nor its implementing regulations, 50 CFR Part 21, provide for permitting of "incidental take" of migratory birds. Bald and golden eagles are afforded additional legal protection under the Bald and Golden Eagle Protection Act.

The USFWS provided a list of migratory birds in their Fish and Wildlife Coordination Act 2b Report (see Appendix A4). Many of the migratory species on the lists (e.g., warblers, thrushes and sparrows, etc.) utilize forest and shrub habitats and therefore, it would be unlikely for those species to utilize the project area for roosting or feeding due to the lack of suitable habitat. However, there are many shorebirds that may be found in the project as transient individual during migration. Some species such as the Red Knot (*Calidris canutus rufa*), a Federally threatened species, and Least Tern (*Sternula antillarum)*, a State threatened species, are discussed in Sections 3.5 and 3.6, respectively. Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds" requires federal agencies to assess impact to migratory birds as a result of project activities (USFWS 2015a).

3.4.6 Mammals

Site specific studies describing the diversity and abundance of mammals within the study area are not available. Mammals likely to inhabit the study area would be generalist tolerant of development such as raccoon (*Procyon lotor*), opossum (*Didelphis virginiana),* eastern cottontail *(Sylvilagus floridanus),* and white-tailed deer *(Odocoileus virginianus).*

Harbor seals (*Phoca vitulina*) are the most abundant seals found in New York State. Places where people view harbors seals in Suffolk County are Cupsogue Beach State Park and Montauk Point State Park located on the southern shore of Long Island. Seals are likely to be seen at these parks during the day from early winter (November) and into spring (May) (NYSDEC 2016b).

Seal haul-out locations have been documented in the Gardiners Bay area most recently in 2012. Bottlenose dolphin (*Tursiops truncatus*) are also periodically observed in the Atlantic Ocean off of Long Island (NYSDEC 2016c).

3.4.7 Invasive Species

Non-native invasive species include plants and animals that have been introduced into a new location by human activity that have the capability to flourish in the non-native environment through the lack of natural controls, the ability for prolific growth or rapid reproductive capabilities. These species can disrupt the natural ecosystem by displacing more diverse and valuable ecological communities.

Four Asian shore crabs (*Hemigrapsus sanguineus*) were identified at Station T4 in the 2015 Sediment Sampling, Benthic Community Analysis, and Eelgrass Survey. This species has been identified as invasive species in Long Island Sound. *Hemigrapsus* distribution currently extends from Maine to North Carolina where it inhabits shallow and intertidal waters with a preference for rocky- cobble bottom. There are no current methods to control its distribution. While the invasive *Hemigrapsus* is present in the project area, it does not constitute a major component of the benthic community within the project area. The dynamic nature of the sandy environment (e.g., constant movement of sand) within the project area makes it difficult for most benthic dwelling animals to inhabit, consequently making this type of habitat generally low in both species diversity and abundance.

Non-native invasive plant species observed within the project area included common reed (*Phragmites australis*), Japanese knotweed (*Fallopia japonica*) and honeysuckle shrubs (*Lonicera* sp.). These species are limited to small, isolated patches within a narrow area located between the dynamic sandy beach and the bunk heads, roads, parking lots, and/or upland lawns of adjacent homes. While these species are located in the project area, the limited amount of suitable habitat prevents the development of large monocultures typical of these species. In addition, the placement of sand will not increase the amount of suitable habitat and therefore, would not contribute to an increase in abundance.

3.5 Federal Threatened and Endangered Species

3.5.1 U.S. Fish and Wildlife Service

According to the U.S. Fish and Wildlife Service Information, Planning and Conservation System (IPaC) website, six (6) Federally protected animal or plant species have been identified as possibly being present along the coastal beach in the proposed project area; roseate tern (*Sterna dougallii dougallii)* (northeastern population), piping plover (*Charadrius melodus*), red knot

(*Calidris canutus rufa*), sandplain gerardia (*Agalinis acuta*), seabeach amaranth (*Amaranthus pumilus*) and northern long-eared bat (*Myotis septentrionalis*).

Roseate Tern - The northeastern population of the roseate tern was designated as Federally endangered on 2 November 1987. Roseate terns were once abundant but a variety of threats have resulted in much-reduced populations. According to the 1998 U.S. Fish and Wildlife Service Roseate Tern Recovery Plan – Northeastern Population, the numbers of roseate terns were severely reduced in the 1870s and 1880s by commercial hunting for the millinery trade. The total number of roseate terns was estimated to be roughly 2,000 pairs at the lowest point in about 1890 (Nisbet 1980 in USFWS 1998). Roseate tern populations increased following protection efforts but declined again to a low of 2,500 pairs in 1977 due to habitat loss and gull encroachment.

Roseate terns generally nest on sandy, gravelly, or rocky islands. As per the U.S. Fish and Wildlife Service 2010 Caribbean Roseate Tern and North Atlantic Roseate Tern (*Sterna dougallii dougallii*) 5-Year Review: Summary and Evaluation, in 2009, approximately 94% of the population of Roseate Tern pairs were concentrated at just 3 colonies: Great Gull Island, New York (NY); Bird Island, Marion, Massachusetts (MA); and Ram Island, Mattapoisett, MA (USFWS 2010). Roseate terns feed almost exclusively on small and/or juvenile fish; occasionally it includes crustaceans and insects in its diet. Its feeding habits are fairly specialized, consuming primarily sand lance. Roseate terns capture food mainly by plunge-diving (diving from heights of 1-12 meters (m) and often submerging to 50 centimeters (cm)), but also by surface-dipping and contact-dipping (MA NHESP 2007).

Piping Plover - The piping plover, a Federally threatened species, is a small species of shorebird which breeds in the northeastern Atlantic coast. Plover nest above the high tide line on coastal beaches, sand flats at the ends of sandspits and barrier islands, gently sloping fore dunes, blowout areas behind primary dunes, sparsely vegetated dunes, and wash over areas cut into or between dunes. Feeding areas include intertidal portions of ocean beaches, wash over areas, mudflats, sandflats, wrack lines, and shorelines of coastal ponds, lagoons, or salt marshes (USFWS 1996 in USFWS 2015a). Plover prey on a variety of invertebrate species such as earthworms, larval insects, amphipods, isopods, tiny crabs and shrimp, polychaete worms, and small mollusks (Sibley et al. 2001). Plover broods prefer ephemeral pools and bay tidal flats over other habitat types due to higher arthropod abundance and relatively increased availability of escape cover (Elias et al. 2000 in USACE 2015a). Breeding plover on the Atlantic Coast are generally found at accreting ends of barrier islands, along sandy peninsulas, and near coastal inlets (USFWS 1996 in USFWS 2015a). The coastline within the study area may support suitable nesting and foraging piping plover habitat (USFWS 2015a).

The State of New York Natural Heritage Program is a partnership between the NYSDEC and the State University of New York College of Environmental Science and Forestry. The Natural Heritage Program mission is the conservation of rare animals, rare plants, and natural ecosystems (refer to as "natural communities") (NYSDEC 2016f).

The Natural Heritage Program indicated in a letter dated January 13, 2016, that piping plover (also listed by New York State as endangered) nested at Hashamomuck Beach (Southold Town Beach) in 2004. The North Fork Audubon Society (NFAS) and The Nature Conservancy (TNC) initiated a monitoring program for piping plover in 1996. Monitoring protocols involve multiple visits to approximately 20 sites during the period of April 1 to August 15.

Based on a review of the most recent monitoring reports (2008-2015), no piping plover nesting has been recorded at Hashamomuck Beach in the near-term. The Town of Southold contracts annually for piping plover monitoring in the town (telecom on January 27, 2016 with John Sepenoski, Town of Southold, Office of Engineering). The North Fork Audubon Society (NFAS) completed monitoring reports from 2008 to 2011 and the Group for the East End, in partnership with NFAS, prepared the 2012 to 2015 monitoring reports. Hashamomuck Beach had a Habitat Suitability Rating of 3 throughout the years 2008-2011 which was defined as, "Suitable nesting habitat but frequent human disturbance and/or predator presence. Ample beach space above the high tide mark, but other factors diminish nesting success." However, in 2012, the Hashamomuck Beach Habitat Suitability Rating was reduced to 4, which is defined as, "Generally unsuitable habitat. Significant human disturbance and/or predators are present. Insufficient area above high tide mark for nesting and some suitable foraging habitat is present."

Some of the issues cited in the monitoring report that diminish habitat suitability and deter nesting at Hashamomuck Beach include a lack of upper beach habitat; intimidation and predatory behaviors of a large population of gull species (herring, great black-backed and ring-billed), and the high concentration of summer visitors to the popular beach. Recommendations for improving conditions include, increased signage to educate visitors about piping plover; requiring that dogs are leashed while walking on the beach, encouraging visitors not to feed gulls (which attracts more gulls), and to remove their trash.

Increasing the width of the beach as proposed, may increase the Habitat Suitability Rating for Hashamomuck Beach and increase the potential for piping plover to nest and forage in the project area. A Shorebird Management Plan has been prepared to address this potential, see Appendix A5 for the Management Plan.

Red Knot - The red knot, was listed as a Federally threatened species on January 12, 2015. The red knot is makes one of the longest yearly migrations of any bird, traveling 15,000 km (9,300 mi) from its Arctic breeding grounds to Tierra del Fuego in southern South America. During migration, red knots concentrate in huge numbers at traditional staging grounds during migration. Delaware Bay is an important staging area during spring migration, where the knots feed on the eggs of spawning horseshoe crabs. The red knot breeds in drier tundra areas, such as sparsely vegetated hillsides. Outside of breeding season, red knot is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays (USFWS 2015d). It is unlikely that the Hashamomuck Cove project area is used by red knots as other than a transient stopover to or from their breeding grounds in the Canadian Arctic. While there is no known survey efforts being conducted within the project area for red knot, there have been no documented observations of red knot in the project area on the ebird.org website (Cornell Lab of Ornithology 2016).

Northern Long-Eared Bat - The northern long-eared bat *(Myotis septentrionalis*), a Federally threatened species, is a medium-sized bat found across much of the eastern and northcentral United States. White-nose syndrome is responsible for much of the species' recent population decline. Northern long-eared bat (NLEB) typically winters in caves and abandoned mines. There are approximately 90 hibernacula known to occur across the state (USFWS 2015b in USFWS 2015a). During the summer months, northern long-eared bats roost under loose bark, in cracks, crevices, and cavities within a variety of tree species. Other roosting habitat includes human made structures such as buildings, utility poles, and barns (USFWS 2015b in USFWS 2015a). While the forested uplands on the south side of Route 48 (Arshamomaque Preserve) in the project vicinity have the potential to support summer roosting habitat for northern long-eared bat (USFWS 2015a), there would be no bridge or culvert work (structures which can be used by roosting bats) and no trees cutting is anticipated. Additionally, there is no known occurrence of northern long-eared bat in the general project vicinity (telecom on March 29, 2016 with Terra Gulden-Dunlop, Fish and Wildlife Biologist, USFWS Long Island Field Office).

Sandplain Gerardia - The sandplain gerardia (*Agalinis acuta*) is the only Federally endangered plant species in the State of New York. The sandplain gerardia is a small annual plant that is found in coastal grassland areas on Long Island. Loss of habitat to development, and encroachment by invasive exotic competitors are the main reasons why this plant is considered to be in imminent danger of extirpation (NYSDEC 2016e). This species is very rare and the project area lacks coastal grasslands and, therefore, it is unlikely to be found in the project area.

Seabeach Amaranth - The seabeach amaranth (*Amaranthus pumilus*) is listed as a Federally threatened species. The seabeach amaranth is an annual plant with reddish stems and small, rounded leaves. This species occurs on barrier island beaches, where its primary habitat consists of overwash flats at accreting ends of islands and lower foredunes and upper strands of non-eroding beaches. It occasionally establishes small temporary populations in other habitats, including sound-side beaches, blowouts in foredunes, and sand and shell material placed as beach replenishment or dredge spoil. The species appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. These characteristics allow it to move around in the landscape as a fugitive species, occupying suitable habitat as it becomes available (USACE 2015a). Thought to be extirpated from New York State, it was found again in 1990 (NYSDEC 2016e). Construction of beach stabilization structures that stop the natural movement of sand has degraded much seabeach amaranth habitat. The plants grow close to the surface and can range in size from less than an inch to more than a foot across. Flowering and seed production usually start in July and continue until the plants die in the fall (NYSDEC 2016e). Beaches in the project area are narrow and lack the highly dynamic process needed to create seabeach amaranth habitat.

3.5.2 National Marine Fisheries Service

As designated on the National Marine Fisheries Service (NMFS) species distribution maps website,[1] the proposed project location overlaps with areas of potential distribution for Atlantic sturgeon (*Acipenser oxyrinchus*); sea turtles of the New England region including the threatened Atlantic loggerhead (*Caretta caretta)* and green sea turtle (*Chelonia mydas*) and endangered Atlantic leatherback (*Dermochelys coriacea*) and Atlantic Kemp's ridley (*Lepidochelys kempi*); as well as large Atlantic whales including the endangered humpback (*Megaptera novaeangliae*), right (*Eubalaena glacialis*), and fin (*Balaenoptera physalus*) whales.

Atlantic Sturgeon - Atlantic sturgeon, from any of the five Distinct Population Segments (DPS) (Gulf of Maine DPS is listed as threatened other four DPSs are listed as endangered), may be present in the project area. After emigration from the natal estuary, sub-adult and adult Atlantic sturgeon forage within the marine environment, typically in waters less than 50 meters depth (ASSRT 2007). Atlantic sturgeons forage for benthic invertebrates and small fish such as sand lance while making coastal migrations. In bays and harbors foraging often occurs at or near areas with submerged vegetation or shellfish resources. The project area does not provide suitable habitat for overwintering; so the presence of Atlantic sturgeon is likely limited to the warmer months. The nearest spawning rivers are the Kennebec River, Maine and the Hudson River, New York, so no eggs, larvae or juvenile Atlantic sturgeon are likely to occur in the project area.

Sea Turtles - Endangered and threatened sea turtles are seasonal or occasional visitors to the offshore environments of Long Island Sound. Sea turtles may be present from May through November; the loggerhead, Kemp's ridley, and green sea turtles are mostly juvenile and sub-adult individuals foraging in nearshore coastal waters.

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[1] http://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/maps/index.html

The most frequently seen sea turtle in NY waters, the loggerhead, has a conspicuously large, block-like head, and averages 3 ft. long and 300 pounds. Juvenile loggerheads regularly inhabit Long Island Sound and the eastern bays where they feed mainly on crustaceans and shellfish. Some adults can be found along the ocean shore and in New York Harbor (CRESLI 2016). Loggerheads feed on benthic organisms found in large bay systems and forage in the open waters in search of hard-shelled prey (crabs, crustaceans, mollusks), in addition to jellyfish, fish and eelgrass.

The most endangered and smallest of the sea turtles, the Kemp's ridley averages 20-28 inches long and 80-110 pounds. It is the second most commonly seen sea turtle in New York. The Kemp's ridley appears to prefer estuarine areas where green crabs and mussels are found. In New York, the waters off Long Island are used by immature (2-5 year-old) Kemp's ridleys.

Green sea turtles utilize Long Island's warm shallow bays and Long Island Sound to feed on crabs, crustaceans and submerged aquatic vegetation such as eel grass. They feed and may be the least likely of the turtles to be seen in the Sound due to the relative paucity of sea grasses found in the Sound. On Long Island, juvenile green turtles can be found entrapped in fishing gear during the summer and a small number suffer cold stunning each year (CRESLI 2016).

The leatherback turtle is a highly pelagic fast swimming open water animal and not an expected visitor to the Sound. Leatherbacks are commonly seen in Long Island's offshore waters during the late summer (CRESLI 2016).

Large Atlantic Whales - As depicted on NMFS Estimated Range of Large Atlantic Whales map,[2] the humpback, right, and fin whales have the potential to be transiting through the eastern most portion of Long Island Sound.

Right whales are primarily transiting the New York area on their way to more northerly feeding and concentration areas. During late winter and early spring, they begin moving north along the coast past Cape Hatteras and near the Long Island Coast. Individual have been sighted along the south shore of Long Island, Block Island Sound, Gardiners Bay and south shore inlets and bays. Humpback whale presence in the northwestern Atlantic is variable and probably a response to the changing distribution of preferred food sources. For the most part, humpbacks are in transit through the New York area from June through September on their northward migration to summering areas in the Gulf of Maine. Finback whales occupy both deep and shallow waters

[2] http://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/maps/atlanticlargewhales.pdf.pdf

and are probably the most abundant large cetacean in Atlantic coast New York waters. They are most abundant in spring and summer, but do have some presence during the winter months. Large whales are generally not encountered in Long Island Sound proper. According to the distribution of sightings reports performed between 2007 and 2011, these whale species were not observed in the project area (Waring *et al.* 2015). These whales are unlikely to occur within the project vicinity or in the shallow depths of the proposed project area.

3.6 State Threatened and Endangered Species

This section will discuss the following State protected species; the piping plover (*Charadrius melodus*), listed as State endangered and the least tern (*Sternula antillarum)*, listed as State threatened.

Piping Plover - The discussion of Piping Plover is included in Section 3.5.1 above Federal and Threatened Endangered species.

Least Tern - The least tern is the smallest American tern, measuring about 9 inches (23 cm) in length. Arriving at its nesting colony by late April to mid-May, the least tern breeds in colonies of up to 200 birds. Nests are scraped in sand, shell, or gravel, and may be sparingly lined with small shells or other debris. By late August and early September, least terns leave their northern breeding grounds to head for wintering areas. Least terns feed mostly on small fish caught by skimming the surface of the water or by making dives from the air (NYSDEC, 2016g).
Least tern colonies are monitored annually in the Hashamomuck Cove project vicinity by the North Fork Audubon Society (NFAS) and The Nature Conservancy (TNC) in conjunction with piping plover monitoring. The monitoring protocols involve multiple visits to approximately 20 sites during the period of April 1 to August 15. The number of least tern nesting colonies ranged between three (3) and seven (7) between the years of 2008-2015, with the number of nesting pairs ranging from 220 in 2009 to 49 in 2012. Hashmomuck Beach was not listed as a least tern nesting colony at any time during that 8 year period. The limited size of the beach, the high gull population, and the high number of summer visitors to Hashamomuck Beach deter nesting by least terns, similar to piping plover.

3.7 Essential Fish Habitat

The 1996 amendments to the Magnuson-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 minutes x 10 minutes square coordinates $41^0$10.0'N, 72^0 20.0'W, $41^0$00.0'N and 72^0 30.0'W. (NMFS 2016)[3]

As stated in the National Marine Fisheries Service (NMFS) source documents (NMFS 2016), fourteen (14) Federally managed fish species, one (1) shark species and two (2) skate have the potential to occur within the project area. EFH designated species are identified to potentially occur within the intertidal and nearshore subtidal zones along the Hashamomuck Cove project area shoreline. In addition, the horseshoe crab has the potential to occur in the area (NMFS, Ms. Ursula Howson - NOAA/National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office Habitat Conservation Division, March 15, 2018, teleconference on EFH.)

The species listed for the project area include Atlantic sea herring (*Clupea harengus*) (juveniles, adult), Atlantic mackerel (*Scomber scombrus*) (eggs, larvae, juveniles, adults), Atlantic salmon (*Salmo salar*) (juveniles, adults),black sea bass (*Centropristis striata*) (juveniles), bluefish (*Pomatomus saltatrix*) (juveniles, adults), cobia (*Rachycentron canadum*) (eggs, larvae, juveniles, adults), king mackerel (*Scomberomorus cavalla*) (eggs, larvae, juveniles, adults), pollock (*Pollachius virens*) (juveniles, adults), red hake (*Urophycis chuss*) (eggs, larvae, juveniles, adults), scup (*Stenotomus chrysops*) (eggs, larvae, juveniles, adults), Spanish mackerel (*Scomberomorus maculatus*) (eggs, larvae, juveniles, adults), summer flounder (*Paralichthys dentatus*) (juveniles); windowpane (*Scophthalmus aquosus*) (eggs, larvae, juveniles, adults), winter flounder (*Pseudopleuronectes americanus*) (eggs, larvae, juveniles, adults); sand tiger shark (*Carcharias taurus*) (larvae), little skate (*Leucoraja erinacea*) (juveniles, adults), winter skate (*Leucoraja ocellata*) (juveniles, adults), and horseshoe crab (*Limulus polyphemus*). Information and detailed descriptions of the life history requirements of these species was derived from the National Marine Fisheries Service (NMFS) "Guide to EFH Species Designations" and in the provided Essential Fish Habitat Assessment (Appendix A1).

3.8 Socioeconomic

The Town of Southold is one of ten towns in Suffolk County. The town contains ten individual villages. These are Cutchogue, East Marion, Fishers Island, Greenport West, Laurel, Mattituck, New Suffolk, Orient, Peconic, and Southold (Southold 2016). The following census data included the entire Town of Southold.

In 2010, the population of the Town of Southold was 21,968 which equates to 408 persons per square mile. Historic trends show a steady increase in the population of the town, which increased to 22,248 in 2014 (an increase of 1.3% since 2010).

[3] Source: http://www.greateratlantic.fisheries.noaa.gov/hcd/STATES4/ConnNYNJ.htm

The 2010 to 2014 median household income in the Town of Southold (in 2014 dollars) was $83,559 (U.S. Census 2010). In the 2010 census, about 84.8% of the Southold's residents were identified as Caucasian/White, 2.7% as Black or African American, 0.1% as American Indian, 0.8% as Asian, 0.1% Native Hawaiian and Other Pacific Islander, 1.5% as two or more races, and 10.8% Hispanic or Latino.

According to the 2010 census, there were 15,377 housing units, of which 82.5% were owner-occupied (U.S. Census 2010). In 2010, the age distribution for the Town of Southold was 4.0% persons under 5 years, 18.8% persons under 18 years, and 24.7% persons 65 years and over. Female persons represented 50.8% of the population. In 2010, 5.3% of the population of the Town of Southold met the criteria for families below poverty level (U.S. Census 2010).

In 2000, on average, roughly 55.8% of the Town of Southold's residents lived and worked in Southold. A significant portion of the remainder were employed throughout the North Fork of Long Island with some residents commuting further west on Long Island and to New York City, Connecticut, and elsewhere on a regular basis (Southold 2016).

3.9 Environmental Justice

In accordance with Executive Order 12898 (dated February 11, 1994), Federal agencies are required to identify and address the potential for disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations.

As compared to the United States, which has 14.8% of families below poverty level and a minority population of approximately 36%, the Town of Southold does not have a large low income or minority population (5.3% and 15%, respectively) (U.S. Census 2010).
The NYSDEC Office of Environmental Justice has prepared maps identifying potential Environmental Justice Areas throughout New York (NYSDEC, 2016h). The Town of Southold is not listed as an Environmental Justice Area. Potential Environmental Justice Areas are defined as 2000 U.S. Census block groups of 250 to 500 households each that had populations that met or exceeded at least one of the following statistical thresholds:

1. At least 51.1% of the population in an urban area reported themselves to be members of minority groups; or
2. At least 33.8% of the population in a rural area reported themselves to be members of minority groups; or
3. At least 23.6% of the population in an urban or rural area had household incomes below the Federal poverty level.

The proposed project involves beach nourishment and is not targeted towards minority or low income populations. The project would not involve disproportional environmental and health hazards targeted towards minority or low income populations. There are no environmental justice issues identified.

3.10 Protection of Children

Executive Order 13045 requires Federal agencies to examine proposed actions to determine whether they will have disproportionately high human health or safety risks on children. The closest schools are located approximately 1.5 miles east in Greenport and over 2 miles west in Southold and therefore, there should be no direct impact to areas with a high density of children. The Southold Town Beach (West Cove) is used by families with children during the summer months. Construction is anticipated to start in the West Cove in January (before the summer recreation season begins) and move eastward. It is anticipated that construction will be completed in West Cove before the recreation season at the public beach begins. Access to the active work areas will be controlled during beach nourishment activities.

3.11 Cultural Resources

As a Federal agency, USACE has certain responsibilities for the identification, protection, and preservation of cultural resources that may be located within the Area of Potential Effect (APE)[4] associated with a proposed project. Present statutes, regulations, and Executive Order governing the identification, protection and preservation of these resources include the National Historic Preservation Act of 1966 (NHPA), as amended; the National Environmental Policy Act of 1969; Executive Order 11593; and the regulations implementing Section 106 of the NHPA (36 CFR Part 800, Protection of Historic Properties, August 2004). Significant cultural resources include any material remains of human activity eligible for inclusion on the National Register of Historic Places (NRHP).

As established by 36 CFR Part 60, an historical property (generally a property over 50 years of age) is eligible for listing in the National Register if it possesses “integrity of location, design, setting, materials, workmanship, feeling, and association,” and it meets at least one of four criteria:

A. It is associated with events that have made a significant contribution to the broad patterns of our history; or

[4] The APE includes all areas directly impacted by activities required to construct project features. The APE also includes viewsheds and landscapes in the vicinity of the project area.

B. It is associated with the lives of persons significant in our past; or
C. It embodies the distinctive characteristics of a type, period, or method of construction, or it represents the work of a master, or it possesses high artistic values, or it represents a significant and distinguishable entity whose components may lack distinction; or
D. It has yielded, or may be likely to yield information important in prehistory or history.

Cultural resource work is coordinated with the New York Historic Preservation Office (NYHPO). The Advisory Council on Historic Preservation, Native American Tribes, other interested parties and the public are given opportunities to participate in the process.

3.11.1 Pre-Contact Period Context

Long Island was not a coastal location at the time of Paleo-Indian occupancy. A hypothetical reconstruction of the land area of the Middle Atlantic coast c. 10,000 to 12,000 years ago postulated that evidence of Paleo-Indian occupation along the northern side of Long Island would not relate directly to coastal environments, but rather to the exploitation of inland/riverine habitats. Evidence of this occupation is generally in the form of isolated fluted point sites and reflects the presence of early human groups in the region.

Paleo-Indian occupants would have co-inhabited the region with a rich fauna, such as forest mastodon, deer, small game, and possibly caribou. The proximity of a riverine habitat would have supported aquatic resources, both flora and fauna.

Dated and stratified archaic sites have been found on Long Island. The Wading River site, located in Brookhaven Township, is situated in a small valley or hollow overlooking a broad salt marsh along the Wading River. This winter habitation site produced a significant number of faunal remains within a midden consisting of shellfish (soft-shelled clam and oyster) deer, bird, and turtle. Lithic remains consisted of numerous stemmed and side-notched projectile points.

Hypothetical reconstructions of the Middle Atlantic coast between 6,000 and 8,000 years ago suggest that estuarine areas were approaching their current coastline locations, with the shoreline achieving its current location approximately 3,000 years B.P. (Before Present). Climatic conditions were warm and somewhat moister than in the preceding Boreal Phase with hemlock as the dominant vegetation species.

This time period coincides with the emergence of the Middle Archaic Period. Material culture changes during the Middle Archaic to include the appearance of ground stone tools in addition to flaked stone artifacts. There is also a shift in the dominant raw materials utilized for tools, away from cryptocrystalline rocks to rhyolite, argillite, and other rock types, which may be suggestive of increasing mobility of people and also possibly of changes in social organization.

Native American occupation sites producing cultural materials datable to the Middle Archaic are considered to be rare on Long Island. Diagnostic Early Archaic lithic artifacts associated with these sites are side-notched points (Hardaway), as well as stemmed (Stanley) points, two broad diagnostic forms that span as much as 2,000 years of occupation in the eastern United States.

Climatic changes commencing about 4,600 B.P. produced the warmest and driest conditions of the current post-glacial period, with oak and hickory becoming dominant tree species. These climatic changes appear to roughly coincide with the emergence of the archaeologically defined Late Archaic/Transitional or Terminal Archaic Period. This period is characterized by diagnostic lithic forms and an increase in the number of base camps. Late Archaic occupations have been documented across Long Island and southern New England. Sites of note include the Stony Brook site located along Long Island Sound and the Orient Sites Numbers 1 and 2, also located on the Sound at the eastern end of the island.

Orient culture burials found on Long Island are often found with carved soapstone/steatite objects quarried in Connecticut and Rhode Island and transported to Long Island. A large Late Archaic site in Northport suggests year-round habitation. The Crabmeadow site is a shell midden complex site which occupies an area roughly one square mile in size. A portion of this site contained artifacts dating to the Late Archaic such as Wading River projectile points.

The appearance of cache pits and ceramic storage vessels, a key characteristic of the successive Transitional and Early/Middle Woodland Periods, indicates a greater degree of sedentism among Native
Americans in the Middle Atlantic region. Evidence for long-distance trade and exchange is manifested in the presence of Meadowood cultural materials from western New York at habitation and other sites dating from around 3,250 to 2,500 years B.P.

Late Woodland occupation has been documented at numerous locations throughout Long Island. The majority of sites reported on from this period consist of shell mounds or middens. The entire isthmus of land on the west side of Oyster Bay/Mill Neck contained traces of shell heaps. Presumably, these traces of middens would all represent pre-contact site locations dating to the Late Archaic through Woodland Periods.

Ceramic vessel sherds found on Late Woodland sites on Long Island are similar to sherds found on Late Woodland sites in southeastern New York, northern New Jersey, and Connecticut. Surface decorations consist of cord, fabric and net impressions, as well as incised, stamped and punctuated. The Crabmeadow site in Northport produced a full range of lithic tools and a wide variety of ceramics dating to the Late Woodland Period. There were nine shell middens ranging in size from 20 to 70 ft. in length.

Early contact between Native Americans and Europeans has been documented across Long Island. The land comprising Southold was home to the Corchaug tribe of Algonquians. Their name for the area was Yennecott, meaning an extended stretch of land. The Corchaugs lived in what are now the current villages of Mattituck, Cutchogue, Aquebogue and Hashamomuck.

3.11.2 Post-Contact Period Context

Southold was the first town settled by Europeans on Long Island. The Reverend John Youngs organized a church and left New Haven with his followers in October of 1640. Title to all the land from Orient Point to the Wading River had already been bought by New Haven from the Corchaugs. The settlement slowly grew and a new church for a larger congregation was built in 1684. In 1664, the settlers severed ties with Connecticut and came under the control of the New York colony. The Town of Southold was occupied by the British during the entire Revolutionary War.

The biggest transformation of Southold came with the arrival of the railroad in 1844. The village of Greenport was chosen as the terminal. The railroad brought isolation from the rest of the state to an end. Farmers began to grow crops for market. The town began to prosper. Greenport became a small shipbuilding and whaling center. Summer visitors were attracted to the area. Boarding houses were established and hotels built in all of the small hamlets and villages. Orient had the oldest summer resort on Long Island, the hotel of a Jonathan Latham.

After the Civil War, Southold continued to grow. Greenport had a thriving fishing, scalloping and oyster industry. Six steamboats carried tourists from New York City, Connecticut, and Rhode Island to the town daily during the summer. During the early twentieth century, with the improvement of the roads, large summer estates and horse farms were constructed in the area. Religious groups built campgrounds where families could enjoy a vacation in a “moral and refined” atmosphere. The agricultural economy also continued to thrive.

The end of World War II was another turning point in the Town of Southold’s development. Relative prosperity and improved transportation combined to increase the number of second homes on eastern Long Island. People from New Jersey, New York City, Brooklyn, Nassau, and Queens Counties began spending summers on the North Fork.

The year-round population of Southold in 1940 was 12,000. Magazine articles began promoting Southold as an ideal and inexpensive place for retirement. The promotion attracted enough people to the area so that by the 1960s, Southold had the highest median age in New York State.

Long used for potato farming, large areas of Southold were redeveloped as vineyards in the late twentieth century. There is now a thriving wine making industry on this part of Long Island.

Hashamomuck was an area the Corchaug Indians had their settlements when the Europeans first came to the area in 1640. Decimated by disease and pushed out of their ancestral homelands, they were mostly gone by the early eighteenth century. The area also bears witness to the second home boom that began with the arrival of the railroad in the mid-nineteenth century and intensified with the popularity of the automobile in the twentieth century.

There is no archaeological sensitivity within the area of the proposed project. Dense residential development has destroyed upland archaeological potential. The beach has been impacted by erosion and any sites that may have been present have been washed away.

3.12 Coastal Zone Management

A project in the Hashamomuck study area is located in or could affect coastal zone resources of the State of New York. Therefore, it is necessary to analyze the project in greater detail with respect to its consistency with the State Coastal Policies of the NYS Coastal Zone Management (CZM) plan as well as the Town of Southold's, Local Waterfront Revitalization Policies (LWRP). The New York State Department of State administers the CZM plan and has established 44 coastal policies which are the basis for determining if an action is consistent with the state's program. Similarly the LWRP contains policies that must be evaluated. Each policy was reviewed in the context of the proposed project, and where an interaction occurred, a responsive statement was prepared which evaluated the plan's consistency with that policy. Pursuant to Section 307(c) of the Coastal Zone Management Act of 1972 (16 U.S.C. 1456(c), USACE District staff reviewed all the policies listed in the programs relative to the proposed project. This review is provided in Appendix A3.

3.13 Land Use and Zoning

The current land use in the project area consists of a public beach, developed residential areas with private access to the beach and commercial property (restaurant and motel). Residential areas cover the majority of the project area, including the areas abutting the beach. Current zoning in the area is low density residential.

3.14 Hazardous, Toxic, and Radioactive Waste

A search of Federal and State environmental databases was conducted for a corridor study along the shoreline (EDR 2016). The researched area was approximately one mile west, east, north, and south of the proposed shoreline. Governmental agency records were reviewed for information that would be helpful in determining the environmental status, the presence, or potential of hazardous, toxic, or radioactive waste (HTRW) contamination. Because regulated facilities may impact other properties, it was also necessary to review governmental records for the surrounding area. There were four sites on the NY Spills database near the study area and one on the LTANKS database.

- At 60125 North Road, there was a yellow greasy material floating at the water's edge in Long Sound. The spill closure date was June 20, 1997.
- At Clarks Beach, several bags of asbestos were found abandoned on the beach. The cleanup was completed in September of 1996.
- A small amount of diesel fuel was spilled as a result of a traffic accident on State Route 25. The spill was contained and the spill closure date was February 2001.
- Excavation of an underground storage tank (UST) at a residence at 57035 Route 48 identified the UST as having holes and the surrounding soil being contaminated. Corrective action was taken and the project cleanup was completed on April 5, 2011.
- The LTANKS database identified one site near the study area. A residence at 825 Clark Road had an above ground storage tank with a small leak. Cleanup and disposal was completed by the homeowner and cleanup ceased on March 2, 1995.

3.15 Aesthetic and Scenic Resources

The shoreline of Hashamomuck Cove project area includes a public beach in the West Cove portion of the project area. The Central and East Cove portions of the project area are developed with a motel, restaurant, and private homes. Unobstructed views of Long Island Sound from Route 48 are generally limited to the public beach (West Cove) portion of the project area. There is a scenic view of Hashamomuck Pond, on the south side of Route 48 opposite from the Town of Southold public beach (West Cove). In addition, the Arshamomaque Preserve wetland complex, located on the south side of Route 48 southeast of the East Cove portion of the project provides for passive recreational opportunities for residents and visitors.

3.16 Recreation

Recreational opportunities in the project area include the Southold Town beach. Other portions of the beach within the project area are privately owned. The Town of Southold contains a variety of parks under the jurisdiction of the State, county, and town that provide additional opportunities for public access to coastal resources (Southold, Town of 2011).

3.17 Air Quality

The Project area is located in the north/central part of Long Island on the Long Island Sound, in Suffolk County, which is part of the New York, Northern New Jersey, Long Island, and Connecticut ozone nonattainment area. Suffolk County has been designated with the following attainment status with respect to the National Ambient Air Quality Standards (NAAQS) for criteria pollutants: 'moderate' nonattainment area for the 2008 8-hour ozone standard and a maintenance area for the 2006 particulate matter less than 2.5 microns (PM2.5) standard (40 CFR §81.333). The county is part of the Ozone Transport Region. Oxides of nitrogen (NOx) and volatile organic compounds (VOCs) are precursors for ozone and sulfur dioxide (SO2) is a precursor pollutant for PM2.5. Suffolk County is in attainment of the NAAQS for all other criteria pollutants.

Emissions from the Project are associated with non-road construction equipment working on the site and on-road trucks moving on public roads to and from the Project site. Emissions from these two source categories are primarily generated from their diesel engines, with emissions that include NOx, VOCs, SO2, and PM2.5. Emissions from Federal Actions, such as the Proposed Project, are regulated under 40 CFR §93 Subpart B General Conformity. Fugitive dust on the worksite can potentially be generated due to trucks and equipment moving on unpaved surfaces, but can be significantly reduced through the use of best management practices relating to site work dust mitigation. Fugitive dust is made up of PM and can contain PM2.5.

3.18 Greenhouse Gases (GHGS)

In addition to the applicable regulated pollutants (Section 3.13.1), each Federal Agency project's NEPA assessments will need to consider and evaluate GHGs consistent with Council on Environmental Quality (CEQ) revised draft guidance on the consideration of GHGs emissions and the effects of climate change.[5]

3.19 Noise

Noise is defined as unwanted sound. The day-night noise level (Ldn) is widely used to describe noise levels in any given community (USEPA 1978). The unit of measurement for Ldn is the "A"-weighted decibel (dBA), which closely approximates the frequency responses of human hearing. The primary source of noise in the study area is vehicular traffic on local roadways and local construction projects that may be underway. The typical Ldn in residential areas ranges from 39 to 59 dBA (USEPA 1978). It is assumed that the existing sound levels in the study area are roughly within this range.

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[5] See https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance

Chapter 4: Plan Formulation

The 1983 Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Implementation Studies provides a 6-step planning process to be used for USACE Civil Works studies in developing and evaluation of alternatives. The USACE regulation that describes the process is the Planning Guidance Notebook; Engineering Regulation 1105-2-100 dated April 22, 2000 and subsequent revisions. The steps of a feasibility study include scoping: identification of problems and opportunities; formulation of alternatives; evaluation and comparisons of the alternatives, and selection. Iterations of the steps are conducted several times during a study and aimed at reducing uncertainty with each iteration by gathering and developing data instrumental to the decision to arrive at the recommended plan (Planning Manual Part II: Risk Informed Planning, July 2017). This is consistent with North Atlantic Coast Comprehensive Study (NACCS) coastal storm risk management framework (which is similar to the 6- step planning process).

4.1 Problem and Opportunity Statement

The problem and opportunity statements and discussion set the focus of the feasibility study. These statements are developed at the start of the study and lead to the identification of the study objectives.

Problems

- Continued Coastal Storm Erosion and Damage to Properties
- Continued Risk of Coastal Storm Damage to County Road 48
- Increased Transportation Delays

Opportunities:

- Reduce Risk to Properties and Infrastructure
- Provide More Resilient Transportation Network
- Improve Recreation

The north shore of Long Island is affected by both extra tropical storms (nor'easters) and tropical storms. In October 2012 (Hurricane Sandy), the high water mark measured by USGS (HWM-NY-SUF-614) at Goldsmiths inlet (about 5 miles west of the study area) was 7.7 ft. NAVD88. Storm driven surge and waves can cause beach and bluff erosion and flooding of low lying areas. Erosion during storms can result in loss of land, damages to homes, businesses, and roads. In the project area the erosion is most pronounced within the concave portions of the three coves.

For example, in December 2010, a winter storm cut into the cliff along the Sound View Road and eroded much of the parking area at the Southold Town Beach (Figure 11). County Road 48, which runs along the shoreline, is in danger of being undermined in several locations.

Figure 12 shows County Road 48 and adjacent properties in the October 2015 storm. The closure of County Road 48 would result in traffic delays, unavailability of an evacuation route, and hamper emergency rescue operations.

Figure 11. December 2010 Storm

Figure 12. October 2015 Storm

4.2 Planning Goals/Objectives

The project goal is to provide coastal storm risk management for the Hashamomuck Cove Study Area. Plans are formulated to achieve **planning objectives.** Planning objectives and constraints are generated from the problems and opportunity statements. A planning objective asserts the intended purposes of the planning process and is a statement of what solutions should try to achieve.

Goal

- Provide Coastal Storm Risk Management for the Study Area

Planning Objectives

- Reduce Coastal Storm Damage to Shorefront Properties
- Reduce Coastal Storm Damage to Roadways

4.3 Planning Constraints

Constraints are restrictions that limit the extent of the planning process. They can be divided into **general constraints** and **study-specific constraints**. General planning constraints are the technical, legal, and policy constraints to be included in every planning study that are recognized in the development of alternatives, but not explicitly used to eliminate alternatives in the screening process. Study-specific planning constraints are statements identified in particular for the Hashamomuck study that are used to specifically screen alternatives.

General Constraints

- Plans should be formulated and evaluated in compliance with USACE regulations and NEPA.
- Plans should avoid and minimize environmental impacts to the maximum degree practicable.
- Plans should not adversely impact threatened or endangered species or their habitat.
- Plans should be compliant with all Federal environmental laws, Executive Orders, and guidance.
- Plans should represent sound, safe, and acceptable engineering solutions.

Study Specific Constraints

- The narrow beach, existing structures, and bordering freshwater wetlands limits the land area for relocation of vulnerable structures and the roadway.

4.4 Future Without Project Condition

The forecast of the future without-project condition reflects the conditions expected during the period of analysis and includes consideration of sea level rise. The future without project condition at Hashamomuck Cove within the period of analysis (2019-2069) is identified as continued damages to shoreline properties, structures, and roads from future storm events. This will result in continued maintenance and reconstruction of private armoring (bulkheads) and repairs to houses and roads following storm events.

Because the coastline of the study area is almost entirely developed, there is little opportunity for new expansion. The total value of the existing residential and commercial inventory in the study area is estimated to be $46 million. There are a few vacant parcels, which are among the most severely eroded properties as they are unprotected by bulkheads.

Without the project, existing bulkheads, homes, and businesses would continue to be at risk of damage due to coastal storms. County Road 48 would be in danger of being undermined in several locations. The closure or loss of County Road 48 would result in traffic delays and loss of an evacuation route. The evacuation routes are County Road 48 and State Route 25. Both are two lane highways (one traffic lane in each direction.). These roads carry traffic in the community of Southold, New York. In the event that County Road 48 became impassable, traffic would be detoured to State Route 25. As the capacity of State Route 25 is limited to one lane in each direction, there would likely be traffic delays and these delays would likely impact future storm related evacuation to emergency shelters and emergency rescue operations. USACE assisted New York State in developing an evacuation plan, including a Hurricane Evacuation Study for Suffolk County in 2009, the data from which was used by Suffolk County to develop a County-wide evacuation plan. No storm warning system is in place.

4.5 Beach-fx - Estimate of Future With and Without Project Damages

The Hashamomuck Cove Coastal Storm Risk Management feasibility study used Beach-fx for estimating project damages and costs over the 50-year period of analysis (life cycle). Beach-fx was developed by USACE Engineering Research and Development Center (ERDC) in Vicksburg, Mississippi. Beach-fx is an event-driven model that uses a monte-carlo iterative simulation framework to estimate damages and associated costs based on storm probabilities, tidal cycle, tidal phase, structure valuation, damage functions, beach morphology and profile storm driven change, and other factors. Coastal modeling to provide the storm response/event database for input to Beach-fx was performed using SBEACH software (Storm-induced BEAch CHange Model). This model simulates cross-shore beach, berm, and dune erosion produced by storm waves and water levels for each storm event modeled. Uncertainty regarding the number and intensity of future storms in the area is handled through the Beach-fx monte-carlo

simulation, whereby each lifecycle (iteration) randomly selects a suite of storms that may occur in the project area over a given lifecycle (iteration). The Coastal Appendix Section 3.2 discusses the development of the plausible 672 storm events used for the Hashamomuck model.
The evaluation phase of the study used Beach-fx Version 1.1, Kernel 2.0.0.4. The model was used without Planform Rates as a simplifying assumption to move the modeling work forward to identify the Tentatively Selected Plan (TSP). The optimization phase included Beach-fx model updates and incorporated planform rates. At the time of optimization phase, the most accurate update of Beach-fx was Version 1.1 Kernel 2.0.0.9.4. Many of the updates occurring between the two Kernel versions, that of the evaluation phase and that of the optimization phase, were the result of improvements made for subsequent Beach-fx projects.

For the Hashamomuck study, the geometry of the coastline is three "pocket coves". Typically, the shoreline being modeled under Beach-fx is a long, straight beach area, or a single pocket cove. Breaking up the study area into the three coves in Beach-fx provided a practical way to model the geometry of the project area.

4.6 Key Data Uncertainties

Limitations to the quantity and quality of information result in study uncertainties. Two uncertainties in gathering of data for the Hashamomuck Cove feasibility study are:

Sea Level Change (SLC). The rate of SLC in future years is not known, but there are several projections of what may occur. This uncertainty is addressed by considering the three rates of rise: low (historic), intermediate, and high per USACE guidance in ER 1100-2-8162. The SLC approach taken in this study was to consider a single scenario to identify the TSP, where low rate of SLC was used. During optimization, all three curves were considered, and the intermediate rate was selected when reporting on the cost and performance of the recommended plan.

Calibration Data for the Beach-fx model. There is no historic detailed shoreline survey data to determine shoreline erosion rates. Instead, the Beach-fx model calibration was based on long-term erosion rates established from analysis of aerial photographs from 1960, 1974, 1993, 2001, and 2010. The approach is practical when sequential years of shoreline profile data are not available.

4.7 Management Measures – Screening of Candidate Measures

Strategies to address coastal storm risk include accommodation, retreat, and no action (USACE 2015). To enact these strategies, nonstructural measures (actions to reduce flood damages without significantly altering the nature or extent of flooding) and structural measures (physical modifications designed to reduce the frequency of damaging levels of flood inundation) may be implemented. Examples of accommodation include the elevation of structures at risk (nonstructural) or the construction of seawalls, bulkheads, revetments, breakwaters, groins, etc., (hard structures). Beach nourishment is also a structural measure, but it is considered a soft structural measure. Retreat measures consist of moving at-risk structures back from the shoreline and/or property buy-outs (nonstructural).

In the 1950s and 1960s, USACE favored hard structures to reduce risk against erosion. The armoring measures are excellent for reducing risk to property, however, the hard structures can result in increased erosion in front and on the sides of the armor. Also, armoring prevents the natural processes of sand migration. Groins are similar in that they hold sand on one side of the structure (up-drift), but lose sand on the other side (down-drift). Since the 1970s, soft and nonstructural measures have been considered more often for risk management projects.

Measures to reduce coastal storm damages considered for this project are discussed in this section. The measures can be used individually or combined with other management measures to form alternative plans. The list of measures considered was derived from a variety of sources including prior studies, State agency and town staff informal input, and the study team's experience. All measures were screened for their capability to meet objectives, be feasible economically, be constructible, and avoid constraints to be included in the Initial Alternatives Array.

4.7.1 Nonstructural Measures

Elevate Buildings. This measure would raise the elevations of the buildings and is generally used to reduce the risk of inundation damages to buildings and building contents. While elevating the structure reduces risk to the damages from coastal storm inundation, it does not address the risk of shorefront erosion during storms. Thus, this is an incomplete solution as the shoreline would continue to erode eventually undermining the structures. In addition, homes in the area rely on on-site septic systems and continued land erosion would in time impact the functioning of the private septic systems. This measure was not retained for the Initial Alternatives Array.

Buyouts. This measure may be applicable for some of the properties within the study area. This alternative is environmentally beneficial in that it does not alter the natural processes of sand movement. There would continue to be a loss of shorefront land under this measure. Also, this measure is relatively high cost and homeowners may not be amenable to buyouts. This measure was retained for the Initial Alternatives Array.

Relocations. Relocations were not considered a viable measure as the amount of buildable land along the shoreline is limited and cost for land is very expensive. This measure was not retained for the Initial Alternatives Array.

4.7.2 Structural Measures

Beach Nourishment. This measure consists of the artificial building up and/or widening of the beach by the placement of sand fill material on the shore. A beach nourishment project typically includes a beach berm to reduce erosion, wave impact, and inundation damages to landward areas. Beach nourishment represents a near natural method for reducing damages. Public access requirements are applicable as part of a beach nourishment project. Beach nourishment projects require periodic re-nourishment to replace sand lost to erosion. This measure was retained for the Initial Alternatives Array.

Beach Nourishment with Dune. This measure is similar to beach nourishment, except that a dune is also constructed in conjunction with the beach fill. This measure has the same benefits as the sand beach nourishment measure, plus the added benefit of better risk reduction behind the dune. In addition, the dune can provide a source of sand for the beach. A combination of dune and berm would require more initial sand placement and re-nourishment than a stand-alone berm. This measure was retained for the Initial Alternatives Array.

Beach Nourishment with Reinforced Dune. This measure is also similar to beach nourishment, except the dune is reinforced with a hard structure. This measure is more expensive due to the hardened core, but the hardened core is designed to withstand successive storms. The hardened core is covered by sand to create a dune. This measure would also require beach re-nourishment to replenish the dune and berm. This measure was retained for the Initial Alternatives Array.

Bulkhead. A bulkhead is a sheeting material driven into the ground creating, a physical barrier between the water and the land. The sheeting material can be metal, pressure treated wood, or fiberglass. The sheeting is supported by pilings. Often there are rocks on the seaward side of the structure to protect the bulkhead against wave action. This measure would consist of the installation of a new bulkhead to protect the land behind the bulkhead. Bulkheads provide protection of land behind the bulkhead. An advantage of a new bulkhead is that it does not require much land area to implement.

The disadvantages of a bulkhead are that it is not natural looking, requires periodic maintenance, and reduces availability of sand. As the property lines for many of the shorefront properties extend to the historic mean high water, the new bulkhead(s) would need to be installed within the inter-tidal zone. Compensatory mitigation would be required due to the inter-tidal impacts.

Many of the existing properties (approximately 40%) within the study area are protected by bulkheads. This measure was retained for the Initial Alternatives Array.

Revetment. A revetment consists of stone, concrete, etc. placed on an embankment to protect the slope from erosion. There are several small private rock revetments existing in the study area at some of the shorefront homes (approximately 15% of properties). Revetments function to reduce wave energy and do not require much maintenance if designed and installed properly. One of the major disadvantages of a revetment is it takes up a substantial amount of space, thereby limiting beach area. Similar to bulkheads, they promote erosion in front and adjacent to the structure and restrict sand flow. Compensatory mitigation would be required for any new revetments due to the inter-tidal impacts in the project area. Intertidal impacts would be significant due to the eroded conditions in the project area constructing a revetment would require placing sand below the mean high water line. This measure provides similar benefits as a bulkhead but requires additional land area and impacts more inter-tidal zone. Due to the already narrow beach at the project area, current building in some cases near the high water line, significant inter-tidal environmental impacts, and high for cost for stone, this measure was not retained for the initial alternatives array.

Stone Toe to Protect Existing Bulkheads. In areas where private bulkheads currently exist, a stone toe could be added to reduce scour and undermining of the bulkhead. Most of the existing bulkheads do not have toe protection. The stone toe would reduce scour at the base of the bulkhead. This measure was retained for the Initial Alternatives Array.

Improve Existing Groins. Groins are stone, timber, or geotextile structures which extend perpendicular from the shore into the body of water. Their function is to hold or stabilize sand by trapping the littoral drift of sand. Groins are effective in holding sand on the up-drift side of the structure, but often create a reduction in sand on the down-drift side of the groin. Regulatory agencies have expressed their reluctance to implement hard structures, especially below mean high water. Furthermore, Southold officials have expressed legal concerns with groins as in the past Southold was sued by residents due to perceived loss of property (beach area) resulting from the implementation of groins. This measure was not retained for the Initial Alternatives Array.

Off-Shore Structure. Off-shore structures interrupt the movement of waves to the shore, thereby reducing the energy of wave impact on the shore. They are constructed of rock and are very expensive to install. In addition, environmental regulatory agencies will not support an off-shore structure. This measure was not retained for the Initial Alternatives Array.

4.7.3 Sand Source Discussion

Both upland and offshore borrow sources were considered as sand sources for the proposed beach fill alternatives. A concern with upland sources is the distance from the placement site and the trucking costs for transport and delivery. Cost Engineering at NAN was able to locate three quarries on Long Island that could provide suitable sand and in sufficient quality needed for the project. These sites are located 15 to 25 miles from the project area. See Figure 13.

There are no existing off-shore borrow pits near the site. The closest off-shore borrow pit would be in the Atlantic Ocean about 25 miles from the site. For this option, material would be dredged from the Atlantic Ocean borrow site, transported by barge to site, and pumped from the barge to the placement site. This option was determined to be more expensive than the trucked sand option.

Another option would be development of a new sand borrow site in Long Island Sound closer to the project. A source of sand from an engineering view point was identified in Long Island Sound off the coast of Southold, NY (see Alpine Ocean Seismic Survey, Inc. dated 24 April 1998). The identified site is 3 to 4 miles west of the Hashamomuck Town Beach in Southold, NY in water depths of approximately 50 feet. From a construction point of view, hydraulic dredging of the sand would be used to deliver the sand directly to the beach using a suction dredge and booster pumps. Costs for development and use of a new borrow site would include: site investigation and permitting; mobilization, operation and labor costs for a hydraulic dredge; land side equipment costs, operation cost, and labor costs; and monitoring and potential mitigation costs. These items would make the cost of developing and use of a new borrow site more expensive than the truck sand option. In addition, dredging within Long Island Sound is extremely controversial and New York State Agencies have opposed development of sand sources in the Sound in the past and it is highly unlikely that an offshore sand source would be permitted for the Hashamomuck project.

Based on the information described above trucking of sand to site was selected as the most cost effective and feasible sand source option for the project.

Figure 13. Potential Sand Sources

Management measures retained in the Initial Alternatives Array were screened for inclusion in the Final Alternatives Array based on the degree to which the alternative to meet the project objectives and minimize or avoid project constraints. Specifically, measures were further evaluated based on the ability of the measure to reduce storm induced damages, be cost effective, be efficient, and minimize environmental impacts. Also considered were property ownership and State and Local environmental agencies input regarding solutions. See Table 4 for screening results.

Table 4. Screening of Initial Alternatives

Alternative	Risk Reduction Shorefront Properties	Risk Reduction to County Road 48	Likely NED Benefit	ROM COST LOW < $10M MED $10-$20M HIGH >$20M	Environment Compliance Concerns	Carried Forward
No Action	NO	NO	NONE	Not Applicable	NONE	Yes
Buyouts	SOME	NO	MED	HIGH	LOW	Yes
Beach Nourishment	YES	YES	HIGH	LOW	HIGH. Sand Placement Below Mean High Water.	Yes
Beach Nourishment with Dune	YES	YES	HIGH	MED	HIGH. Sand Placement Below Mean High Water.	Yes
Beach Nourishment with Reinforced Dune	YES	YES	HIGH	HIGH	HIGH. Sand Placement Below Mean High Water.	Not Cost Effective
Bulkhead	YES	YES	MED	MED	HIGH. Bulkhead Below Mean High Water: Compensatory Mitigation Required	Yes
Toe Protection at Existing Bulkheads	SOME	LOW	LOW	LOW	HIGH. Stone Placement Below Mean High Water: Mitigation Required	No. Limited Risk Reduction Low NED Benefits. High Environ-mental Impact.

4.8 Focused Array of Alternative Plans

The Focused Array of Alternative Plans for the study area were developed from the alternatives identified to be carried forward in Table 4. An alternative plan is a set of one or more management measures functioning together to address one or more planning objectives. Five general alternatives were selected for further evaluation.

- No Action: Without Project Condition
- Beach Nourishment varying Beach Berm widths: Various berm widths were evaluated
- Beach Nourishment with Dune: Various dune widths and heights were evaluated
- Bulkhead: Variations on lengths and location were evaluated
- Buyout: Variations on the number of properties bought out were evaluated

The alternatives developed for the evaluation phase were:

Alt.	Description
1	Without Project
2B	Berm (all reaches 50 ft. wide)
2A	Berm (all reaches 25 ft. wide)
2C	Berm (width varies)
3	Dune and Berm
4A	New Bulkhead full length of study area
4B	New Bulkhead at road
5	Buyouts of properties in high damage areas

Alternative 1: No Action Plan (Without Project)

Under this Alternative, no Federal action would be taken to protect the properties and roads within the three coves. Failure to take action would result in further damage to residential property, homes, commercial property, the beach parking lot, the beach, utilities, and County Road 48. This plan fails to meet USACE study objectives or needs for the majority of the project area.

Alternative 2A, 2B, 2C: Beach Nourishment (Berm)

Under this alternative, beach nourishment would be placed along the shoreline at each cove. This alternative is expected to be successful in reducing damages to existing erosion control measures, building structures, and roads.

The berm crest height was set at +6 ft. NAVD88. Three variations on berm width are presented in the report. Alternative 2A consisted of a 25ft. wide berm. Alternative 2B consisted of a 50 ft. berm. Alternative 2C (Variable) consisted of a 75 ft. berm in the area of the highest historic shoreline change rate and/or damages, tapering to a 25 ft. berm. For the initial analysis, it was assumed that the existing groins at end point of the fill would help to prevent excessive lateral movement of sand. Periodic beach re-nourishment will be required as the beach berm is a sacrificial feature.

The beach nourishment alternative will likely provide relatively high NED benefits at a relatively low implementation cost. The cost of this alternative is driven by the cost and availability of suitable sand for beach fill.

Alternative 3: Beach Nourishment (Berm and Dune)

Under this Alternative, a dune would be constructed in addition to the beach nourishment berm. Alternative 3 is similar to Alternative 2 in that it will be effective in reducing risk to these properties, the existing erosion control armor, and the road.

The berm width for all model runs for this Alternative was assumed to be 50 feet. For the West Cove, a dune top width of 10 ft. was assumed. For both the Central and East Cove, a dune top width of 5 ft. was assumed. It was assumed that the dune would be sloped at 3V:1H. The dune elevation was assumed to be +12 ft. NAVD88 for the West Cove, variable from +9 to +12 ft. NAVD88 for the Central Cove (depending on the Reach), and +11 ft. NAVD88 for the East Cove. The dune elevations were designed to reduce risk of overtopping of the existing bulkheads.

Alternative 3 is anticipated to provide relatively high NED benefits and a medium implementation cost driven by the cost and availability of suitable sand for beach fill.

Alternative 4A and 4B: Bulkhead Installation

Under this alternative (4A), a new bulkhead would be constructed to manage and reduce risk to all of the properties within the study area. The bulkhead would be constructed in front of the existing erosion protection measures (where they exist). The bulkhead would be approximately 8,500 linear feet. It was assumed that the bulkhead would be driven 20 ft. deep with 10 ft. above grade, which is consistent with standard USACE engineering practices (one third of structure above grade). It was assumed that the sheeting would be steel sheeting due to the proposed installation depth, and the observed cobbles, both of which would hinder the installation of fiberglass or vinyl sheeting. The toe of the bulkhead would be lined from scour by two layers of toe protection (1-2 ton stones) to reduce risk from scour. It was assumed that the sheeting could be installed at a rate of 100 ft. per day. The final crest elevation for the bulkhead will be +10.5

ft. NAVD88, matching the 1 percent tidal flood elevation. The bulkhead will require timber stair walkovers to maintain waterfront access at six locations.

While the new bulkhead would be effective in protecting the properties and road in this area, there are concerns about the feasibility of implementing this alternative due to regulatory concerns regarding constructing hard structures within the inter-tidal zone. Compensatory Mitigation would be required for the bulkhead due to filling behind the bulkhead structure with sand. The bulkhead alternative for the entire project area (Alternative 4A) was run on the Beach-fx model to evaluate the reduction in damages in comparison to the Without Project Condition.

Alternative 4B was a variation of this alternative in that the bulkhead was only constructed in areas where the road was vulnerable to damage. The bulkhead would be installed immediately adjacent to the road. The bulkhead would be driven flush with the existing grade to allow access to existing property seaward of the bulkhead.

This alternative would require utility relocation for existing services to the affected homes. For the West Cove, the bulkhead would be installed in Reach E3 (approximately 1,500 linear ft.). At Central Cove, the bulkhead would be installed in Reach E8 (approximately 500 linear ft.). At East Cove, the bulkhead would be installed in Reach E13-E15 (approximately 1,500 linear ft.). This variation would not protect the existing properties, nor prevent erosion up to the bulkhead. This alternative was also run on the Beach-fx model to evaluate the reduction in damages in comparison to the Without Project Condition.

Alternative 5: Property Buyouts

Under this Alternative, properties at high risk of damage were evaluated for removal from the coastal hazard area. Tax assessment information was provided by the Southold Tax Assessors office, which was used to conduct an initial screening of potential buyout properties. USACE appraised the properties by valuing a universe of properties (eighty parcels) as of 16 November 2015 based on recent sales data within the Southold, New York area. The sales data were converted into general units of comparison (price per dwelling unit land and building merged) that established a range of supportable values from the market. The unadjusted units of comparison were applied to the actual property specific data supplied to the appraiser to estimate the market values. The property values were determined based on an assumption of non-impairment. In other words, the properties were appraised assuming the values are not affected by the potential for damage due to coastal storms.

Based on this appraisal process, residential properties in West Cove, Central Cove, and East Cove were considered for buy-out. In addition, the East Cove also includes commercial properties that were considered. The appraisal process for the commercial properties is more uncertain due to the lack of suitable comparable properties. As a result, a contingency factor of 30% was added to the appraisal of these properties. A demolition cost of $100,000 was added to the appraisal cost for each residential property, and a demolition cost of $500,000 was added to the appraisal cost for each commercial property.

This Alternative would not reduce coastal storm risk to the Town Beach or County Road 48. In addition, it is uncertain if the property owners would be willing to participate in this alternative. Figure 14 illustrates the areas modeled (candidate areas are shaded).

Figure 14. Alternative 5

4.9 Completeness, Effectiveness, Efficiency, and Acceptability of Alternative Plans

Completeness, effectiveness, efficiency, and acceptability are the four evaluation criteria specified in the Council for Environmental Quality Principles and Guidelines (Paragraph 1.6.2(c)) in the evaluation and screening of alternative plans. Alternatives considered in any planning study should meet minimum subjective standards of these criteria to qualify for further consideration and comparison with other plans.

> **Completeness** is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.
> **Effectiveness** is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.
> **Efficiency** is the extent to which an alternative plan is a cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment.
> **Acceptability** is the workability and viability of an alternative plan with respect to acceptance by State and local entities, tribes, and the public and compatibility with existing laws, regulations, and public policies.

The alternatives identified were evaluated against the P&G criteria with available information (see Table 5). It was determined to carry the seven alternatives and no action alternative forward to the cost and benefit analysis to identify the project that reasonably maximizes net economic benefits consistent with protecting the Nation's environment, i.e. the NED plan.

Table 5. Principles and Guidelines Criteria

Alternative	Completeness (includes all actions need to realize plan effects)	Effectiveness (alleviates problems and realizes opportunities)	Efficiency (cost effective)	Acceptability (compatible with existing laws regulations and public policy)
ALT 1, No Action	No	No	NA	NA
ALT 2A, 25 ft. berm width	Yes	Yes	Yes	Yes
ALT 2B, 50 ft. berm width	Yes	Yes	Yes	Yes
ALT 2C, varying berm width	Yes	Yes	Yes	Yes
ALT 3, Berm and Dune	Yes	Yes	Likely high cost due to additional sand requirements for dune	Yes
ALT 4A Bulkheads (all)	Yes	Yes	Likely higher cost to construct bulkhead seaward of properties	Construction in intertidal zone, State policy restricts structures in the intertidal zone
ALT 4B Bulkheads (Road)	Yes	Yes, some risk reduction	Likely higher cost	Yes
Alt 5 Buy-outs	Yes	Yes, some risk reduction	Likely higher cost	Yes

4.10 Project Cost for Alternatives

The costs for alternatives were estimated in order to compare alternatives and calculate the benefit to cost ratio (BCR) and net benefits for each alternative.

Alternative 2A, 2B, 2C and 3

The costs for the beach nourishment alternatives were based on an estimated cost of $48/cy in 2016. It was assumed that the beach fill would be obtained from an upland source. This cost for the alternatives analysis in 2016 included trucking, placement, planning engineering and design, and construction management. Estimated real estate cost, and contingencies were also included. Contingency percentage was estimated for the alternatives using the abbreviated cost risk methodology at 18.5%. The Beach-fx model provided the sand quantities and the annualized sand placement costs for the alternatives.

Alternative 4A and 4B

Bulkhead alternatives costs were estimated using a conceptual design to determine material and quantities and include planning engineering and design and construction management. A contingency of 21.5% was added to the bulkhead costs. Contingency percentages were estimated for the alternatives using the abbreviated cost risk methodology. For Alternative 4A, a portion of the bulkhead alignment would impact the intertidal area and a compensatory mitigation cost was also added to these estimates. Real Estate Costs were estimated for the alternatives and include the permanent easement cost, incidental costs, and contingencies.

Alternative 5

The cost of Property Buyouts (Alternative 5), was estimated based on evaluated real estate cost. The costs for this alternative also includes a demolition cost of $100,000 for residential property and $500,000 for commercial properties. The costs for the alternatives are presented in Table 6. This analysis was conducted in FY16.

Note: Information presented on alternatives comparison in this section was conducted in 2016 at the October 2015 price level and fiscal year 2016 discount rate. In Section 4.15, the optimization phase, the price level and discount rate are updated to October 2018 and the current fiscal year, respectively.

Table 6. Estimated Alternatives Costs, Present Value
(October 2015 price level, FY16 3.125 % discount rate)

Alt.	Description	Cove	Sand Placement (48$/cy)	Contingency ($)	Mitigation ($)	Real Estate ($)	Estimated Cost ($)
2A	Berm (25' Wide)	West	2,293,100	424,200	na	1,032,100	3,749,400
2A	Berm (25' Wide)	Central	2,381,900	440,700	na	808,900	3,631,400
2A	Berm (25' Wide)	East	4,025,400	744,700	na	429,900	5,200,000
TOTAL			**8,700,400**	**1,609,600**		**2,270,900**	**12,580,800**
2B	Berm (50' Wide)	West	6,091,100	1,126,900	na	1,032,100	8,250,100
2B	Berm (50' Wide)	Central	5,336,800	987,300	na	808,900	7,134,000
2B	Berm (50' Wide)	East	7,028,000	1,300,200	na	429,900	8,758,100
TOTAL			**18,455,900**	**3,414,400**		**2,270,900**	**24,142,200**
2C	Berm (25'/75' Wide)	West	3,023,000	559,300	na	1,032,100	4,614,400
2C	Berm (25'/75' Wide)	Central	3,052,600	564,700	na	809,900	4,427,200
2C	Berm (25'/75' Wide)	East	6,965,000	1,288,500	na	429,900	8,683,400
TOTAL			**13,040,600**	**2,412,500**		**2,271,900**	**17,724,900**
3	Berm with Dune	West	6,039,100	1,117,200	na	1,032,100	8,188,400
3	Berm with Dune	Central	4,761,500	880,900	na	809,900	6,452,200
3	Berm with Dune	East	6,658,200	1,231,800	na	429,900	8,319,800
TOTAL			**17,458,800**	**3,229,900**		**2,271,800**	**22,960,400**
Alt.	**Description**	**Cove**	**Bulkhead ($)**	**Contingency ($)**	**Mitigation ($50/sq. ft.)**	**Real Estate ($)**	**Estimated Cost ($)**
4A	Bulk-heads (All)	West	11,644,700	2,504,000	200,000	1,032,100	15,380,800
4A	Bulk-heads (All)	Central	10,257,400	2,205,500	350,000	809,900	13,622,700
4A	Bulk-heads (All)	East	10,444,600	2,245,300	650,000	429,900	13,769,700
TOTAL			**32,346,700**	**6,954,800**	**1,200,000**	**2,271,900**	**42,773,200**
4B	Bulk-heads (Road)	West	3,726,900	782,600	na	329,700	4,839,200
4B		Central	1,782,700	374,400	na	54,400	2,211,500
4B		East	5,348,500	1,123,200	na	193,800	6,665,500
TOTAL			**10,858,100**	**2,280,200**	**-**	**577,900**	**13,716,200**
Alt.	**Description**	**Cove**	**Demolition ($)**	**Contingency ($)**	**Mitigation ($)**	**Real Estate ($)**	**Estimated Cost ($)**
5	Buy-outs (6 properti	West	600,000	na	na	8,659,200	9,259,200
5	Buy-outs (15 propert	Central	1,500,000	na	na	30,947,900	32,447,900
5	Buy-outs (8 properti	East	1,600,000	na	na	16,112,200	17,712,200
TOTAL			**3,700,000**	**-**	**-**	**55,719,300**	**59,419,200**

4.11 Economic Evaluation and Comparison

Damage Estimates by Alternative. The alternatives were evaluated using the Beach-fx model. Model output of damages was used to calculate the reduction in damages achieved by an alternative. A 50-year period of analysis (2019-2069) was analyzed and the FY16 discount rate of 3.125% was used to calculate present value (PV) of the damages, which was the rate in effect at that time. The calculation of benefits, Present Value (PV) of reduction in damages for each alternative are presented in Table 7. Details of the analysis are provided in the Economics Appendix Section 2.2.

Damages refer to economic losses for the properties and roadways situated along the coastline being exposed to wave attack, inundation, and erosion damages. Structure damages refer to damages to building, roads, and parking lots. Content damages refer to the material items housed within the aforementioned structures that are potentially subject to damage. Armor damages refers to the cost of repairing existing armor (bulkheads) at the properties.

Table 7. Alternatives Present Value Damages and Reduction Benefit
(October 2015 price level, FY16 3.125 % discount rate)

Initial Phase Damages: Alt. 1 - Without Project

DAMAGES	Alt 1 - WOP			
	West	Central	East	Total
Structure Damages	$4,518,600	$4,844,100	$4,471,700	**$13,834,400**
Content Damages	$1,480,300	$3,136,900	$1,407,100	**$6,024,300**
Armor Damages	$5,453,400	$3,972,000	$2,498,400	**$11,923,800**
TOTAL DAMAGES	**$11,452,300**	**$11,953,000**	**$8,377,200**	**$31,782,500**

Initial Phase Damages: Alt 2A - 25-ft Berm

DAMAGES	Alt 2A - 25 foot Berm			
	West	Central	East	Total
Structure Damages	$942,600	$2,863,200	$2,386,700	**$6,192,500**
Content Damages	$357,000	$2,462,300	$886,300	**$3,705,600**
Armor Damages	$800,200	$2,459,100	$779,700	**$4,039,000**
TOTAL DAMAGES	**$2,099,800**	**$7,784,600**	**$4,052,700**	**$13,937,100**

Initial Phase Damages: Alt 2B - 50-ft Berm

DAMAGES	Alt 2B - 50 Foot Berm			
	West	Central	East	Total
Structure Damages	$897,700	$1,839,600	$2,450,600	**$5,187,900**
Content Damages	$352,900	$2,894,300	$914,500	**$4,161,700**
Armor Damages	$830,700	$2,494,000	$1,038,300	**$4,363,000**
TOTAL DAMAGES	**$2,081,300**	**$7,227,900**	**$4,403,400**	**$13,712,600**

Initial Phase Damages: Alt 2C - Variable Berm Width

DAMAGES	Alt. 2C - Variable Berm Width			
	West	Central	East	Total
Structure Damages	$1,304,500	$2,599,600	$2,323,400	**$6,227,500**
Content Damages	$373,700	$2,304,200	$895,400	**$3,573,300**
Armor Damages	$908,100	$980,600	$2,595,600	**$4,484,300**
TOTAL DAMAGES	**$2,586,300**	**$5,884,400**	**$5,814,400**	**$14,285,100**

Initial Phase Damages: Alt. 3 - Berm + Dune

DAMAGES	Alt 3 - 50 Foot Berm + 5 Foot Dune			
	West	Central	East	Total
Structure Damages	$425,800	$1,389,900	$1,928,800	**$3,744,500**
Content Damages	$163,700	$1,866,600	$748,600	**$2,778,900**
Armor Damages	$783,800	$1,832,900	$791,100	**$3,407,800**
TOTAL DAMAGES	**$1,373,300**	**$5,089,400**	**$3,468,500**	**$9,931,200**

Initial Phase Damages: Alt. 4A - Bulkhead

DAMAGES	Alt 4A - Bulkhead			
	West	Central	East	Total
Structure Damages	$699,300	$695,600	$1,071,300	**$2,466,200**
Content Damages	$164,200	$1,659,400	$426,100	**$2,249,700**
Armor Damages	$0	$0	$0	**$0**
TOTAL DAMAGES	**$863,500**	**$2,355,000**	**$1,497,400**	**$4,715,900**

Initial Phase Damages: Alt. 4B - Road Bulkhead

DAMAGES	Alt 4B - Road Bulkhead			
	West	Central	East	Total
Structure Damages	$4,118,800	$4,365,300	$3,066,600	**$11,550,700**
Content Damages	$1,480,300	$3,136,900	$1,407,100	**$6,024,300**
Armor Damages	$5,453,400	$3,972,000	$2,498,400	**$11,923,800**
TOTAL DAMAGES	**$11,052,500**	**$11,474,200**	**$6,972,100**	**$29,498,800**

Initial Phase Damages: Alt. 5 – Buyout

DAMAGES	Alt 5 - Buyout			
	West	Central	East	Total
Structure Damages	$3,722,500	$2,472,300	$1,564,700	**$7,759,500**
Content Damages	$1,171,800	$2,010,800	$186,800	**$3,369,400**
Armor Damages	$5,453,400	$3,972,000	$2,498,400	**$11,923,800**
TOTAL DAMAGES	**$10,347,700**	**$8,455,100**	**$4,249,900**	**$23,052,700**

4.11.1 Alternatives Benefits Cost Summary Comparison.

Based on the evaluation and comparison of alternatives benefits and costs, the project that reasonably maximizes the net economic benefits (i.e. highest net annual benefits) consistent with protecting the Nation's environment is the 25-ft Berm beach nourishment project. See Table 8.

Table 8. Evaluation Phase Benefit and Cost Summary, (October 2015 price level, FY16 3.125% discount rate)

ANALYSIS	Alt. 1	Alt. 2A	Alt. 2B	Alt. 2C	Alt. 3
	WOP	25-ft Berm	50-ft Berm	Variable Berm	Berm and Dune
Total Damages	$31,782,500	$13,937,100	$13,712,600	$14,285,100	$9,931,200
Total Benefits[1]	$0	$17,845,400	$18,069,900	$17,497,400	$21,851,300
Total Costs[2]	$0	$12,646,700	$24,262,000	$17,934,200	$23,080,500
Total Net Benefits	$0	$5,198,700	($6,192,100)	($436,800)	($1,229,200)
Average Annual Damages	$1,264,700	$554,600	$545,700	$568,400	$395,200
Average Annual Benefits	$0	$710,100	$719,100	$696,300	$869,500
Average Annual Costs	$0	$503,200	$965,500	$713,700	$918,400
Average Annual Net Benefits	**$0**	**$206,900**	($246,400)	($17,400)	($48,900)
Benefit Cost Ratio	**-**	**1.41**	**0.78**	**0.98**	**0.95**

ANALYSIS	Alt. 4A	Alt. 4B	Alt. 5
	Bulkhead	Road Bulkhead	Buyouts
Total Damages	$4,715,900	$29,498,800	$23,052,700
Total Benefits[1]	$27,066,600	$2,283,700	$8,729,800
Total Costs[2]	$42,996,700	$13,787,800	$59,729,600
Total Net Benefits	($15,930,100)	($11,504,100)	$59,729,600
Average Annual Damages	$187,700	$1,173,800	$917,300
Average Annual Benefits	$1,077,100	$90,900	$347,400
Average Annual Costs	$1,711,000	$548,700	$2,376,800
Average Annual Net Benefits	($633,900)	($457,800)	($2,029,400)
Benefit Cost Ratio	**0.63**	**0.17**	**0.15**

[1] Includes damage reduction benefits only. Recreation, traffic delay, reduction in vehicle operation costs, and other benefits are only included in the Optimization Phase.

[2] The Initial Phase cost estimates were derived using a $48 per cubic yard cost for sand placement, and the Beach-fx output for placement quantity, and include contingency, mobilization, real estate, and other costs. IDC is an economic cost that has been added to the project Total Cost for each alternative. IDC is the Interest during construction (IDC). This is the amount of interest the project construction cost would earn were it invested from the beginning of construction until the accumulation of benefits begins.

4.12 Environmental

Of the alternatives evaluated, only the Bulkhead alternative (4A) involved permanent environmental impacts in the intertidal area and thus would require compensatory mitigation. Short-term impacts are expected with the beach nourishment alternatives (2A, 2B, and 3A); turbidity impacts are limited to the construction timeframe and it is anticipated that the benthic community will recover within one year (Wilber and Clarke, 1998 and USACE, 2014). The berm and dune alternatives would have short-term impacts to intertidal areas. The short-term impact to intertidal and subtidal habitats would increase with alternatives 2B and 3A because more sand is needed to build a wider beach or dune. The buyout alternative (5) would result in removal of structures from the coastal area and, although there would be temporary construction impacts, the area would become part of the natural coastal environment once manmade structures were removed.

4.13 Other Social Effects Benefits and Regional Economic Development

In the Other Social Effects (OSE) category, the benefit of the alternatives is to reduce safety and health risks that occur during and after storms. Reducing damages to CR 48 due to coastal storms has the benefit of safeguarding evacuation and emergency access routes and aiding in recovery after a storm event. All the alternatives except for the Buyout Alternative (5) provide risk reduction for CR48.

The Regional Economic Development Account (RED) reflects changes in the distribution of regional economic activity that result from each alternative plan. The alternatives are not anticipated to have a significant impact on this account. They neither contribute to nor detract from the RED account.

4.14 Identification of Tentatively Selected Plan

Based on the evaluation and comparison of alternatives benefits and costs (Table 8), the project that reasonably maximizes the net economic benefits (i.e. highest net annual benefits) while protecting the Nation's environment is the 25-ft Berm beach nourishment project (the NED plan).

Analysis of the 25-ft berm in the initial phase of the study indicated that there may be some additional advantage to providing for a wider berm in Central Cove. As a result, the Public Review Draft of the IFR/EA proposed a 25-foot berm for East Cove, a 25 foot berm for Central Cove with a bump out to 75-foot in the middle of the cove, and a 25 foot berm for East Cove as the Tentatively Selected Plan (TSP). Variations on the berm size were carried forward to the optimizations phase of the project to refine the plan.

4.15 Optimization Phase

Following Public and Agency Review of the Draft IFR/EA the optimization phase of the feasibility analysis was conducted. In this phase variations of berm width for the selected beach nourishment plan with the updated Beach-fx model were evaluated (See Section 5 in the Economics Appendix for discussion of model refinements and updates).

The Optimization Phase incorporated the systems approach on a more dynamic level through the use of planform rates, which considered the interaction of sand placement in each of the three coves. This analysis confirmed that the three coves act as an interconnected hydraulic, and economic system, and that the plans are appropriately formulated on a systems approach.

The three coves act as a coastal system and are interconnected. Given the current eroded condition, it is difficult to detect the transport between coves, but it is more evident when evaluating the project alternatives. The littoral drift of sand, primarily caused by waves hitting the coast obliquely, is from the west to east in the project area. On the west side of the existing small groin-like structures at the convex points (shoreline "spits"), accretion of sediment is shown where erosion is shown on its east side. The influence of existing rock structures on the littoral transport is limited as these structures are in poor condition and their impact will be further reduced as the project extends the existing shoreline seaward. From Table 12 in the Coastal Appendix, which evaluates various with-project conditions, it has been demonstrated that if one cove is excluded from a nourishment plan, an overall increase in renourishment volumes for the system is to be expected (compare Plan 9 to Plan 8 in the Coastal Appendix). It is therefore reasonable to formulate the project as one coastal system when analyzing project cost and benefits because of the interconnectedness of the coves.

As part of the optimization phase the following changes were also incorporated. The price levels and discount rate were adjusted to current conditions, and the period of analysis adjusted to 2023-2073 since the schedule for construction would begin in 2022. Additionally, an expanded assessment of relative sea level change (RSLC) rates were applied in the study analysis based on the NOAA 2017 rate at the Montauk, NY tide gauge. Based upon recent trends analysis the recommended plan is based upon the intermediate rates of RSLC, with the identification of an appropriate adaptation response should gauge records show an increase over the intermediate rate of change. This analysis is reported in Chapter 5 using the sensitivity analysis provided in Section 5.7.3.

In regard to benefit estimation, the optimization phase included the evaluation of the following benefit categories in order to select the recommended plan.

Traffic delays. Delays experienced due to CR 48 road damage and detours following a coastal storm i.e. the dollar value of the time and vehicle costs saved by preventing a detour away from CR48 in the project area. See Section 3.4.2.1 in Economics Appendix.
Recreation Benefit. Under all with-project scenarios, the beach berm will be extended and maintained providing an enhanced recreation experience to local beach goers. The largest increase in recreation value will be in the West Cove where the town beach is located. See Figure 15 and Section 3.6.3 in Economics Appendix.

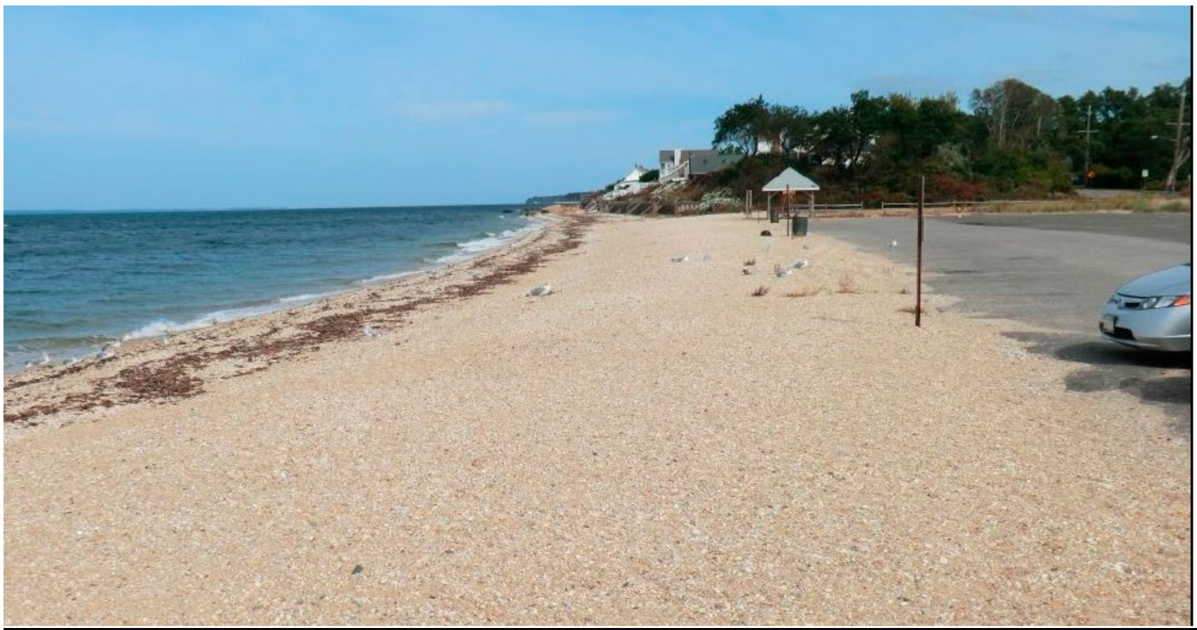

Figure 15. Town Beach

Land Loss. Land loss is due to the landward march of the shoreline over the 50-year study period. The extent of land loss in each area of the project is discussed in Section 3.6.2 of the Economics Appendix. The economic value of the reduction in land loss was calculated for the project area. See Section 3.6.2 of the Economics Appendix.

Optimization Results. Analysis of several beach berm widths resulted in the 25-ft. berm (Alt. 2A) and the 50-ft. berm (Alt 2B) identified as having the highest, and nearly equal net benefits. To further distinguish between the two berm widths more detail cost engineering was performed. Based on the cost analysis the Project Cost for the 25-ft. berm is $17,367,000 for the initial placement and $46,578,000 for 5-year periodic re-nourishment (October 2018 price level). Project Cost for the 50-foot berm is $43,094,000 for the initial placement and $65,310,000 for 5-year periodic re-nourishment (October 2018 price level).

Benefits of the project include damage reduction, traffic delay reduction, reduction of land loss, and recreation benefits. The recreation benefit represents a relatively small percentage of the overall benefits ($3.7 Million total benefit) and do not exceed 50 percent of the storm damage reduction benefits.

The annualized project economic cost for each plan was calculated including the project cost, interest during construction, and OMRR&R costs. Annualized project economic cost with the annualized benefits for each plan are provided in Table 9. The additional analysis confirmed the NED plan i.e. plan with the highest net benefits is the 25-ft. berm beach nourishment project and is the recommended plan. The plan is technically feasible, environmentally acceptable, and addresses project objectives.

Table 9. Optimization Phase, Cost Engineering Results, Benefit Cost Summary
October 2018 price level and FY19 discount rate 2.875%

Alt.	Sum of PV Damage	Sum of PV Benefit*	*Annual Benefit	Annual Cost	Annual Net Benefit	Benefit-Cost Ratio
1 (WOP)	99,449,000					
2A: 25-ft. Berm	59,452,000	45,494,000	1,726,000	$1,450,000	276,000	1.2
2B: 50-ft. Berm	35,970,000	68,978,000	2,618,000	$3,002,000	-384,000	0.87

*Benefits shown include damage reduction, traffic delay reduction, reduction of land loss, and recreation benefits. The Sum of the PV benefit includes $3.7 million in recreation benefits.

Chapter 5: Recommended Plan

The Recommended plan is approximately 8,500 feet (ft.) in length consisting of a 25 ft. wide berm placed seaward of the existing structures providing for reduced coastal storm risk in the three coves. The recommended plan is illustrated in Plans C101, 102, and 103 at the end of this chapter. The recommended plan meets the 1983 Principles and Guidelines Criteria of completeness, effectiveness, efficiency, and acceptability. The plan includes all necessary components to obtain the objectives (complete), is the plan with the largest net benefits (efficient), the plan makes a significant contribution to the planning objectives to reduce coastal storm damages to shorefront development and roadways (effective) and is acceptable as beach nourishment (sand placement) represents a near natural, reversible soft solution for reducing damages on the open coast that is adaptable to rising sea level.

Please note, the project quantities, costs and benefits reported below are based upon the intermediate rate of relative sea level change, using the analysis described in Section 5.7.3.

5.1 Recommended Plan Features

PERTINENT DATA

Berm Length: 8,500 linear feet (ft.)
Berm Height: +6 ft. NAVD88
Foreshore Slope: Sand graded seaward on a slope of 1 Vertical to 10 Horizontal.
Berm Width: West Cove 25 ft., Central Cove 25 ft., East Cove 25 ft.
Sand Source: Trucked from upland source
Initial Placement Volume: 215,600 cubic yards (cy)

- West Cove: 94,400 cy
- Central Cove: 83,000 cy
- East Cove: 38,200 cy

Average Re-nourishment Volume: 78,300 cy (9 times over the 50 year period of analysis)

- West Cove: 30,700 cy
- Central Cove: 12,900 cy
- East Cove: 20,600 cy

Re-nourishment Interval: The re-nourishment interval depends on a variety of factors including storm frequency, intensity, and duration of storms. The re-nourishment costs for the Recommended Plan were estimated based on a 5 year interval (9 events) assuming 78,300 cy per re-nourishment event for a total re-nourishment volume of about 705,00 cy.

Construction Method: Sand would be trucked to the site and be delivered to staging points with direct access to the beach at appropriate locations to facilitate subsequent spreading and regrading by bulldozers or front end loaders. Initial construction is estimated to take approximately 11 months to complete.

Sea Level Rise Adaptation: As described in Section 5.7, the recommended plan includes monitoring of the RSLC at Montauk, NY, and has identified a trigger point, when project reevaluation would be undertaken to identify the most appropriate adaptation measure. This trigger includes consideration of the time necessary to conduct and implement the results of the reevaluation. Based upon the current analysis, this reevaluation could occur between 2037 and 2067.

5.2 Recommended Plan Project Cost Estimate

The "Project First Cost" estimate is broken out by cost component in Table 10. The Project First Cost includes the initial berm construction, real estate, planning engineering & design (PED), and construction management (CM), contingencies are included. The initial construction Project First Cost is estimated at $17,367,000 (October 2018 price level). The "Total Nourishment Cost" includes the Project First Cost plus Continuing Construction and is estimated at $63,945,000 (October 2018 price level).

Table 10. Recommended Plan Cost Summary
Project First Costs, (October 2018 Price Level)

Account/Cost Component	Initial Construction	Re-nourishments (9 events)
Construction Cost		
01 Lands and Damages	2,445,000	0
17 Beach	12,499,000	40,014,000
30 Planning Engineering & Design	1,409,000	3,187,000
31 Construction Management	1,014,000	3,377,000
Total	17,367,000	46,578,000
Total Project Cost 50-year Period of Federal Participation		**63,945,000**

5.3 Real Estate Requirements

The real estate cost for the project is estimated at $2,445,000. Real estate requirements, in support of the recommended plan, include approximately 15 acres of land. The Non-Federal sponsor (NYSDEC) is required to obtain the real estate as outlined in the Real Estate Plan for the project (see Appendix F). The "perpetual beach storm damage reduction easement" (USACE Standard Estate No. 26) is included in the Real Estate plan and will be the easement language used in acquiring the real estate for the beach fill areas. This easement language allows for public use of the easement.

5.4 OMRR&R Cost

Operations, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) costs are the costs necessary for annual maintenance of the beach. Maintenance of the beach generally includes periodic inspections, and any activities for regrading or reshaping a beach.

OMRR&R does not include bringing-in additional sand. OMRR&R costs for a beach nourishment project tend to be costs that are accomplished locally with municipal staff and equipment. The estimated annual berm maintenance cost are estimated at $12,000/year. The environmental monitoring cost of $2,000/year described in the next section is added to the OMRR&R line item in cost estimates to show that this environmental monitoring is and will be conducted by the non-Federal sponsor.

5.5 Environmental and Coastal Monitoring Cost

The annual environmental monitoring is expected to be a continuation of the monitoring that is currently conducted by the Town of Southold. Annualized environmental monitoring costs for piping plover are estimated at $2,000/year.

Coastal monitoring will be conducted to measure project performance, improve the understanding of the physical processes at work and their interaction with project performance, and plan the timing and volumetric requirements of renourishment and any other required maintenance measures. The scope of this monitoring will be to review available satellite and LIDAR data and information provided by local officials. Surveys will be conducted as an integral part of preparing the plans and specifications (P&S) for renourishment operations that are estimated to be conducted every 5 years. Annualized coastal monitoring costs are estimated at $2,000/year.

There is a one-time monitoring project cost of $400,000 for piping plover and horseshoe crab monitoring during construction. This monitoring is from March – August, every day during sand placement on the beach. This monitoring will be conducted by the District or its Contractor.

5.6 Recommended Plan Economic Analysis

Using the benefits categories described in Section 4.15, itemized benefits are shown in Table 11. These are presented for both the low and intermediate rate of RSLC.

Table 11. Recommended Plan, Itemized Annual Benefit Summary

Alt 2A, 25-ft. Berm Low RSLR	Total Benefits	Average Annual Benefits	% of Benefits
Damage Reduction Benefits	$39,997,000	$1,517,800	88%
Delay - Travel Time Savings Benefits	$472,000	$17,900	1%
Delay - Vehicle Miles Traveled Benefits	$273,000	$10,400	1%
Reduction in Land Loss Benefits	$1,026,000	$38,900	2%
Recreation Benefits	$3,725,000	$141,400	8%
TOTAL	$45,493,000	$1,726,400	100%

%

Alt 2A, 25-ft. Berm Intermediate RSLR	Total Benefits	Average Annual Benefits	% of Benefits
Damage Reduction Benefits	$40,962,000	$1,554,400	89%
Delay - Travel Time Savings Benefits	$328,000	$12,400	1%
Delay - Vehicle Miles Traveled Benefits	$191,000	$7,200	0.4%
Reduction in Land Loss Benefits	$1,038,000	$39,400	2%
Recreation Benefits	$3,725,000	$141,400	8%
TOTAL	$46,244,000	$1,754,800	100%

October 2018 price level, FY19 discount rate 2.875%

Annual Costs and Benefits of the Recommended Plan are provided in Table 12 for the intermediate rate of RSLC. Project costs are annualized over a 50-year period of analysis at the FY19 Federal discount rate for evaluation of water resource projects (2.875%). The annual benefit of the project is divided by the annual cost estimate and results in an estimated Benefit-Cost Ratio (BCR) of 1.07.

Table 12. Recommended Plan, Annual Benefit and Cost Summary
(October 2018 Price Level, FY 19 2.875 % discount rate)

Project Economic Cost	
Initial Investment Cost	
Project First Cost	$17,367,000
Interest During Construction	$207,000
Total Investment Cost	$17,574,000
Annualized Investment Cost	$667,000
Continuing Construction	
Annualized Beach Nourishment Cost	$956,000
Annual Coastal Monitoring Cost	$2,000
OMRR&R (non-Federal sponsor)	
Annual Environmental Monitoring Cost	$2,000
Annual Berm Maintenance Cost	$12,000
Total Annual Economic Cost	$1,639,000
Annual Economic Benefit	
Total Annual Benefit	$1,755,000
Net Benefit and BCR	
Annual Net Benefit	$116,000
Benefit-Cost Ratio	1.07

Figure 16. West Cove, Plan C101

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Figure 17. Central Cove, Plan C102

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Figure 18. East Cove, Plan C103

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5.7 Evaluation of Risk and Uncertainty

5.7.1 Economic Analysis

Risk and uncertainty has been explicitly factored into the economic analysis of this project. A statistical risk based model, Beach-fx, was used in this study to formulate and evaluate the project in a life-cycle approach. Beach-fx integrates the coastal engineering and economic analyses and incorporates uncertainty in both physical parameters and coastal storms in the economic benefits calculations.

5.7.2 Economic Damages - Residual Risks

The recommended plan would greatly reduce, but not completely eliminate, the risk from future storm damages in the area. The annualized residual structure damage for all three coves is estimated at $2.3 million (see Economics Appendix Section 3.6.1). The residual risk estimated is based on damages to shorefront structures evaluated in this report. Structures would also continue to be subject to damage from coastal storm winds and windblown debris. There are no damages currently nor expected in the future to the structures in the study area from inundation from the backside due to the project area's topography.

5.7.3 Risk and Uncertainty in Sea Level Rise Assumptions

The recommended plan benefits and costs presented in this report assume the intermediate rate of sea level change (SLC) or about 0.95 ft. over 50 years. A sensitivity analysis on the economic damages of the recommended plan was performed using the historic (0.5 ft. increase over 50 years) and the high sea level rise rates (~2.5 ft increase over 50 years). A full discussion of the accelerated sea level rise rates and how they were calculated for the project area is contained in the Coastal Engineering Appendix Section 2.6 and Analysis of Damages is included in the Economics Appendix Section 3.5.6.

Table 12. Sea Level Rise Sensitivity

	Without Project Damages	With Project Damages	Benefit
Historical	$99,449,000	$59,452,000	$39,997,000
Intermediate Rate	$105,045,000	$64,083,000	$40,962,000
High Rate	$110,385,000	$63,095,000	$47,290,000

Table 12 shows a comparison of with and without project damages under the various scenarios. As project damages increase with accelerated sea level rise rates the benefits provided by the project also increase.

The beach nourishment project is naturally adaptable to sea level rise with the leeway that allows for an increase in the quantity of sand to adjust for an accelerated (or less than expected) rise scenario. Estimated sand quantities for the three rates of rise are provided below.

Table 13. Sand Quantities, Sensitivity to SLC

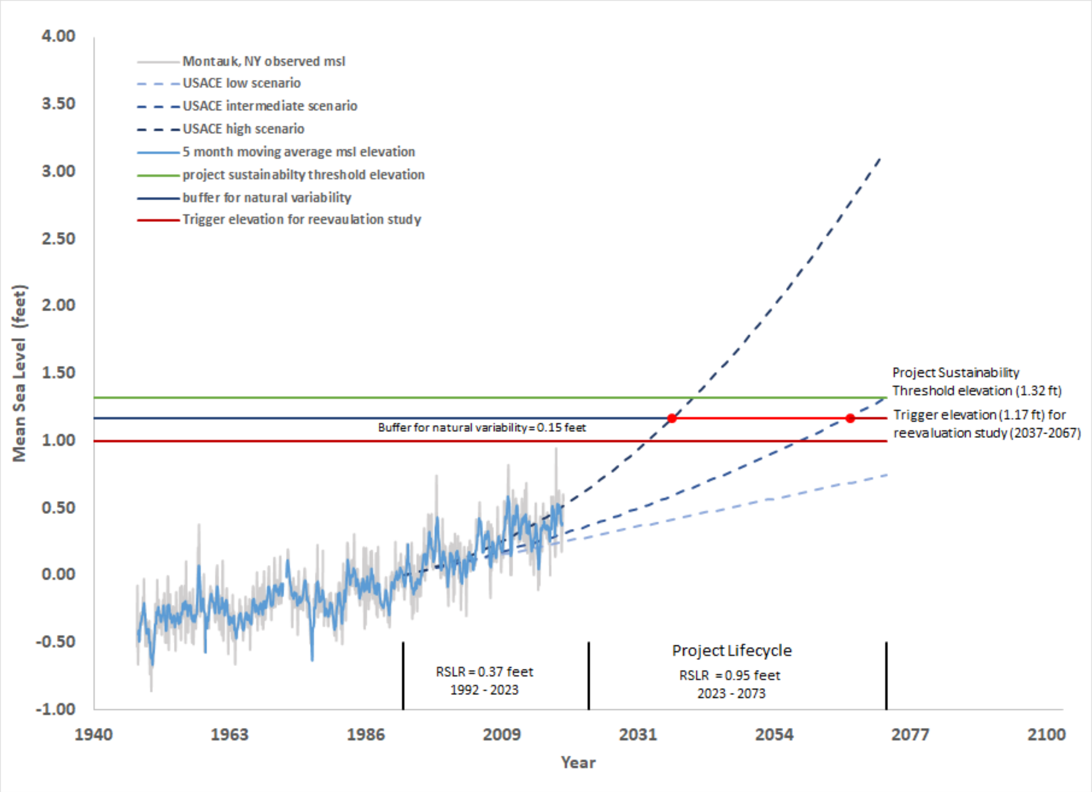
	Initial Placement Quantity (cy)	Re-nourishment Quantity per Event (9 events), cy
Historical	215,600	64,200
Intermediate Rate	220,000	78,300
High Rate	234,500	125,900

Project construction includes topographic and bathymetric surveys of the placement area before and following construction.

A current assessment of relative sea level rise (RSLR) rates used in the study analysis based on the NOAA 2017 rate at the Montauk, NY tide gauge shows an increase to 0.0107 feet/year, over the 2006 rate of 0.00912 feet/year, an increase of 20 percent. Since the project estimates are based upon the intermediate rate of RSLC, using the best current information from the tide gauge record, the project will likely need to undergo a reevaluation study before the 50 year lifecycle ends to account for greater than estimate rate of RSLC. Based on current data the reanalysis will occur between 2037 and 2067 based on the intermediate and high projections used in the study. Measured water-level information (best available) provides an assessment of the state of sea-level change rates and will help determine if reassessment of the project is needed before the project lifecycle ends in the year 2073. Damage reduction estimates assume future Federal and Non-Federal funding and sand nourishment volumes are available for the project.

A trigger elevation of 1.17 foot mean sea level based on the five month moving average mean sea level for the Montauk, NY NOAA tide gauge has been established to provide the lead time necessary for a reevaluation study. The 1.17 foot elevation includes a 0.15 foot buffer for natural variability and is based on the 90 percentile five month moving average interannual variability record at the Montauk tide gauge. The criteria to trigger the reevaluation study is 6 sequential months of the 5 month moving monthly average of mean sea level elevations above 1.17 feet at the Montauk, NY NOAA tide gauge. A graphic showing the trigger is shown in Figure 19.

Figure 19. Project Sustainability analysis under SLC Scenarios



The project sustainability elevation is based on the optimized Beach FX sand volume quantity developed using the intermediate SLC scenario for the Montauk, NY NOAA tide gauge assuming 0.95 feet of RSLR over the project life cycle. This amount of RSLR over the project lifecycle is equivalent to 1.32 feet of mean sea level rise assuming gauge zero in 1992, the midpoint of the current national tidal datum epoch (NTDE) (1983-2001). The trigger elevation of 1.17 foot msl includes a buffer based on the 90 confidence interval of the 5 month moving average interannual variability. The reduced value was set to provide a lead time of no less than 5 years or one renourishment interval for a reevaluation study.

The table below presents the annualized benefits and costs for the 3 SLC scenarios. Due to increased sand requirements under the higher rates of SLC, the project BCR decreases. This is an identified risk that the BCR maybe lower if the rate of RSLC increases at greater than the intermediate rate used. This risk will be managed by tracking the project during continuing construction to verify benefits continue to support the re-nourishment cost.

	Average Annual Benefits	Average Annual Cost*	Net Benefits	BCR
Historical	$1,726,000	$1,450,300	$275,700	1.1
Intermediate Rate	$1,755,000	$1,639,000	$114,300	1.07
High Rate	$1,999,000	$2,238,500	-$239,500	0.9

*Project costs are annualized over a 50-year period of analysis at the FY19 Federal discount rate for evaluation of water resource projects (2.875%).

5.7.4 Susceptibility of Project Area to SLC

To understand the susceptibility of SLC on the project area in the without project condition, the roadways in each Cove are considered relative to both mean spring high water elevation (MSHW) and 10% Annual Exceedance Probability (AEP) event or "10-year storm event". The MSHW elevation was selected to illustrate non-storm high water level conditions. The 10% AEP was selected as the recurrence level to examine if more frequent flooding would probably exceed community acceptable risk levels.

From an elevation point of view, the West Cove is most vulnerable with an edge of road elevation of about 8 feet NAVD88 compared to East Cove (9.3 Feet NAVD88) and Central Cove (13.8 Feet NAVD88). First floor elevations in shore front development range from 10 to 25 feet with a median value of 15 feet NAVD88. The lowest first floor is near the level of the road in West Cove.

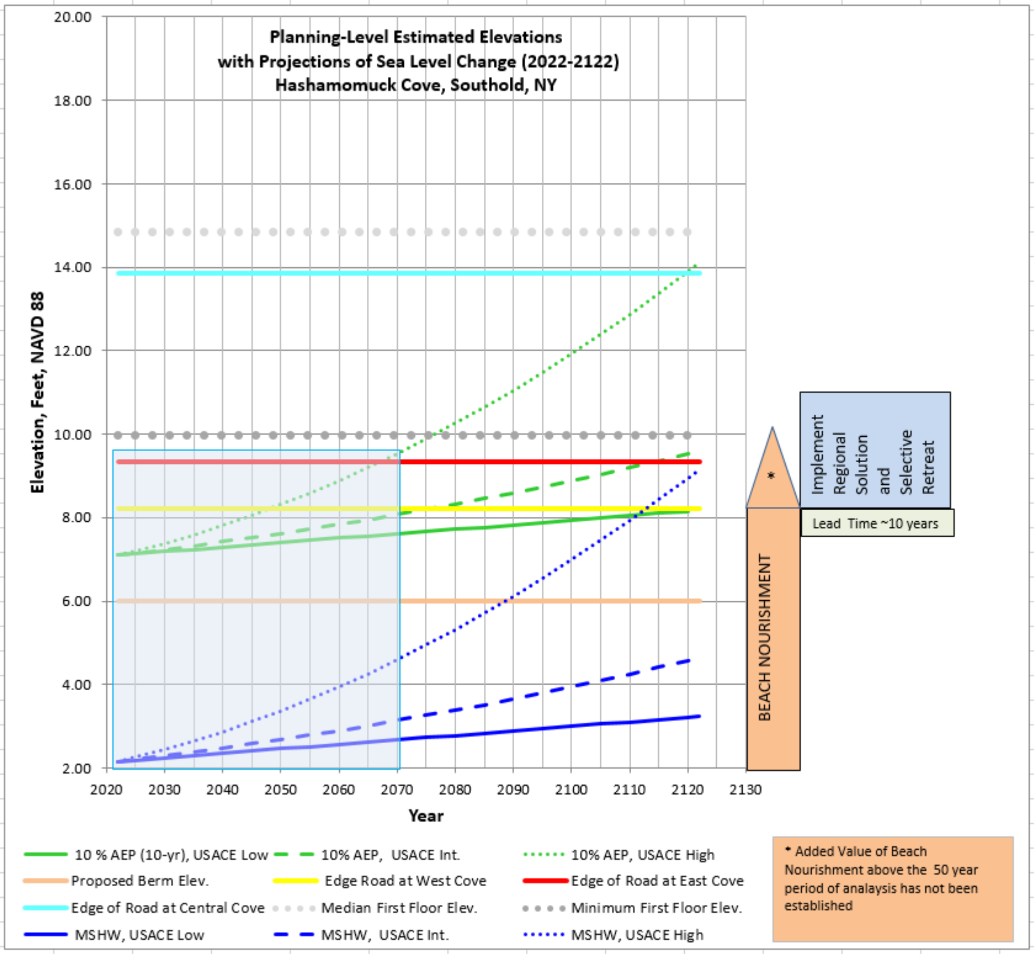
Review of the information on MSHW elevations with SLC provided in Figure 19 indicates that by 2070 County Road in West Cove remains above MSHW elevation by about 5.3, 4.9, and 3.5 feet for the low, intermediate, and high SLC scenarios, respectively. Looking out over the 100 year planning horizon, the road remains above the MSHW elevation by about 4.8 and 3.4 feet for the low and intermediate scenarios. By the year 2122, the high SLC scenario, shows the MSHW will be above County Road in West Cove by about 1.12 feet.

Review of the information on the 10% AEP storm event with SLC provided in Figure 19 indicates that by the year 2070, the difference between County Road in West Cove and the flood elevation is about 0.4, 0.0 and -1.5 feet for the low, intermediate, and high SLC scenarios, respectively. Looking out over 100 year planning horizon, the difference becomes -0.1, -1.6, and -6.1 feet.

The area is at risk from coastal storms under current conditions and SLC will exacerbate the situation. Without action, as the beach continues to erode due to coastal storms, less beach would be available to protect against storm damages such as waves and inundation. Therefore, implementing the beach nourishment project can provide risk reduction now and over the 50-

year project life. As sea level rises, the proposed beach nourishment project can be adapted by adding more sand to maintain the beach. As described in the prior section, if the RSLC tracks higher than the intermediate rate of rise, a reevaluation would be conducted to identify the appropriate adaptation response.

Figure 19A. Planning-Level Estimated Elevations with Projections of Sea Level Change (2022-2122) Hashamomuck Cove, Southold, NY



5.7.5 Risk and Uncertainty in Project Costs

In order to account for uncertainties in the final project costs, which could result from a variety of factors, all costs include an appropriate contingency on top of the actual estimated cost. The contingencies are based on a Cost Schedule Risk Assessment (CSRA), which is included in Appendix E2 and provides a detailed analysis of the many items that could impact project cost such as the trucking schedule, material availability, and weather delays. See Appendix E2 CSRA for the full analysis and contingencies applied to the project.

5.8 Emergency Response

County Road 48 provides access and egress to both the north and south sections of the north fork of Long Island. County Road 48 is the main road serving the North Fork of Long Island. Reducing the risk to its integrity will increase the efficiency of emergency response teams in the area. When a life-threatening situation occurs, timely emergency care is a key factor that affects the chances of survival. When critical facilities such as fire departments, hospitals, and other emergency medical services providers are delayed due to a flood event, there may be a cost in lives. In the event that County Road 48 is impassable due to erosion or wave damages, traffic can likely be diverted to State Road 25. Depending on the location of the road damage, and the origin of the emergency response service, the detour can delay response by 4 to 13 minutes. The shorter the response time for emergency service professionals, the better chance of a successful outcome.

5.9 Community Social Resiliency

The Suffolk County Water Authority has indicated that there are main water lines running under or near both State Road 25 and County Road 48. The main lines are 24" and 12" respectively. In addition to impeding emergency response, in the event that the road is both damaged by erosion (which may cause damage to the water lines), and flooded, the stranded residents would have limited access to clean water. According to the National Grid, there are approximately 1,000 customers east of the project area that rely on gas lines below County Road 48. Repairing a break within the gas line, and relighting the homes could take approximately 1-2 weeks. The project contributes to local storm resiliency by reducing the damage to the local roadway. By increasing the probability that County Road 48 remains intact following a storm event, the project is also increasing the probability of a faster recovery, as it would allow utility repair teams, debris removal, and home repair services to safely and efficiently access areas east of the project.

Chapter 6: Environmental Impacts*

6.1 Topography, Geology, and Soils

No-Action Alternative: Under the No-Action alternative, topography may change due to continued soil erosion as a result of storm events and flooding. Average annual land loss from erosion is estimated to be 0.06 acres for the West Cove, 0.05 acres for the Central Cove and 0.02 acres for the East Cove. The geology of the project area will not change under the no action alternative.

Proposed Action: The existing slope of the beach in the project area is variable (see Cross Sections in Appendix D – Civil Engineering). The topography (beach profile and elevation) will change with project implementation. The beach fill will be built up to elevation +6 ft. NAVD88. The beach profile will be initially wider and higher than existing conditions but will be subject to continued erosion requiring periodic re-nourishment to maintain project effectiveness. Future re-nourishment requirements will be influenced by future storms that impact the area and future sea level rise. Beach nourishment (sand placement) represents a near natural, reversible soft solution for reducing damages on the open coast.

From a beach management perspective, only areas that demonstrate significant erosion would be re-nourished. Historically, the area at the concave portions of the three coves have demonstrated the greatest degree of erosion. The beach berm will be evaluated periodically, and when a sufficient amount of berm loss is observed, a re-nourishment event would be scheduled. It should be noted that there would also be operational considerations of a minimum quantity required to trigger placement of additional sand at the project. It does not make economic sense to mobilize equipment for sand placement for small quantities of sand.

Based on the discussion, it is assumed that an average re-nourishment rate of once every five years for sand placement for the purposes of assessing environmental impacts of the project.

Soil erosion (landward of the beach) may also continue to occur depending on intensity of storm events over the period of analysis) however, in general, the wider and higher sand berm is expected to have a protective effect. The short and long-term changes to topography and soil are not considered significant as the project is located within a dynamic coastal environment. No impacts will occur to the geology with the implementation of the proposed action.

6.2 Water Resources

6.2.1 Regional Hydrogeology and Groundwater Resources

No Action Alternative: The no action alternative will have no effect on hydrogeology and groundwater, as natural processes will continue.

Proposed Action: The implementation of the proposed action will have neither short nor long-term impacts to regional hydrology and groundwater resources.

6.2.2 Surface Water

No Action Alternative: The no action alternative will allow the natural flood processes to continue.

Proposed Action: During construction of the proposed action, there will be minor short-term impacts to the surface water with an increase in suspended sediments in the water. This will be localized to the immediate area and will dissipate quickly. There will be no long-term impacts to surface water.

A Section 404(b)(1) Clean Water Act (CWA) Evaluation is located in Appendix A7. The Evaluation presents a review of compliance with the CWA and a finding of compliance with Section 404(b)(1) guidelines. A Section 401 Water Quality Certificate will be obtained from the State of New York prior to the start of construction; all permit requirements will be addressed and/or implemented.

6.2.3 Coastal Processes

No Action Alternative: The no action alternative will have neither short nor long-term impacts to coastal processes.

Proposed Action: The project would not change the rate of erosion or sediment transport in the project area. However, the proposed action will reduce the influence of the existing coastal processes on the land-based structures. In particular, the tentatively selected plan will provide coastal storm risk management to residences and roads as beach nourishment will diminish the impact of erosion.

6.3 Vegetation

6.3.1 Upland

No Action Alternative: The no action alternative may have minor impacts to upland vegetation as continued erosion may destroy vegetation which has become established above the Mean High Water elevation on the beach/bluff and ornamental vegetation and lawns associated with private residences in the project area.

Proposed action: The upper beach zone represent terrestrial communities in the project area. Implementation of the proposed action will have periodic short-term impacts to beach vegetation growing above the Mean High Water elevation, which is limited to approximately 0.5 acres of sparsely growing native early successional vegetation and non-native invasive species. The amount of beach vegetation in the project area is currently very limited, due to the existing highly erosive condition. If the beach elevation is below the design height, this vegetation will be buried with project implementation and periodic beach re-nourishment estimated to be approximately once every 5 years, depending on sea level rise rates (see Section 6.1 for additional discussion on re-nourishment). The present high beach early successional vegetation community generally consists of herbaceous species that are adapted to a dynamic environment (flooding, erosion and deposition). These impacts are anticipated to be minor and short-term relative to the natural and human disturbance which already exist in the beachfill areas. Avian communities could be temporarily displaced by construction equipment along the beach. However, construction will be short-term and minor and is not expected to interfere with nesting, breeding, or migration of any avian species. Terrestrial reptiles, amphibians, and mammals may be temporarily disturbed but will not be adversely impacted by any aspect of the project. Re-colonization of the high beach community is expected to occur in approximately 2 years and therefore these short-term impacts are not considered to be significant. Over the long-term, it is possible that there will a greater amount of upland vegetation because of the existing wider beach. During renourishment, it is likely that if beachgrass is present, it will be at the design berm height, and would not be buried by the renourishment operation.

Project activities (e.g., beach renourishment) increase the suitability of the area for nesting piping plovers. Therefore, the primary purpose of replanting is to enhance the habitat for piping plover. The environment along the seaward face of the berm is dynamic (e.g., movement of sand seasonally, during storm events, etc.) and does not support the establishment of vegetation over the long-term as observed by existing conditions. Also, plovers utilize the seaward face of the berm for foraging – USFWS suggests the seaward face of the berm remain unvegetated. The upland portion of the berm will be planted with native vegetation (30 – 40% cover with vegetation optimal for piping plover).

6.3.2 Wetlands

No Action Alternative: Under the no action alternative, the majority of freshwater wetlands associated with the Arshamomaque Preserve wetland complex (located on the south side of Road 48) and two small palustrine wetlands (located north of Road 48), will continue to be inundated by flood waters during extreme flood events (Figure 10 USFWS Wetland Inventory). These freshwater wetlands are located too far landward to be impacted under the no action alternative.

With regard to coastal wetlands, under the no action alternative, average annual land loss from erosion is estimated to be 0.06 acres for the West Cove, 0.05 acres for the Central Cove and 0.02 acres for the East Cove. Over the 50-year period of analysis, this average annual land loss equates to approximately 3 acres for the West Cove, 2.5 acres for the Central Cove and 1 acre for the East Cove for a total of 6.5 acres over the 50-year period of analysis. It is difficult to quantify the change in the amount of wetland habitat (intertidal and subtidal habitat) over the period of analysis due to a high level of uncertainty of future events (e.g., storm events, effects of bulkheads on coastal processes, slope of beach, elevation of beach, etc.). However, for general purposes, it is assumed that the amount of intertidal habitat will remain similar to existing conditions and the amount of subtidal habitat will increase as the mean high water line migrates gradually landward due to continued erosion (e.g., upland transitions to intertidal habitat and intertidal habitat transitions to subtidal habitat).

<u>Proposed Action</u>: There will be no short or long-term direct impacts to freshwater wetlands located in the project vicinity due to the proposed action. Freshwater wetlands located to the north and south of Road 48 will continue to be inundated by flood waters in extreme storm events. Freshwater wetlands in the project vicinity are located too far inland to be affected by project activities over the 50-year period of analysis (see Figure 10 USFWS Wetland Inventory).

Under the proposed action plan, the initial placement of sand and periodic re-nourishment activities will result in the burial of benthic resources in intertidal and subtidal habitat. As part of coordination under the Fish and Wildlife Act with NMFS, USACE will be implementing best management practices of placing sand on the beach above the spring high tide line and moving the material to the intertidal zone during low tide, where feasible, to minimize intertidal impacts. These impacts are expected to be short-term as benthic resources would begin to recolonize immediately following the completion of each construction reach (Wilber and Clarke, 1998). There will be no long-term impacts to the benthic resources since quantity and diversity of benthic resources are expected to return to planning levels (USACE, 2014). See Section 6.4.3 for additional discussion on impacts to benthic resources.

The total area of sand fill (footprint of the berm) for the initial construction of the project was estimated to be 11.2 acres for intertidal habitat and 10.3 acres for subtidal habitat (see Table 14). Under the proposed project, initially, the Mean High Water line will migrate seaward, transitioning intertidal habitat to beach (above Mean High Water) and subtidal habitat to intertidal habitat. However, erosion and coastal processes will continue to change and re-shape the beach over time, requiring sand re-nourishment activities to be conducted on a periodic basis to maintain project functionality. In general, it is expected that the amount of intertidal habitat will remain similar to existing conditions while subtidal habitat in the project will be reduced, the amount of which will vary over time depending on future conditions (e.g., slope of the beach, amount of erosion, etc.). This reduction in subtidal habitat is not considered significant in comparison to the quantity of similar habitat in the surrounding area. Therefore, no significant short or long-term impacts on the amount of coastal wetland habitat is anticipated.

Table 14. Area of Intertidal and Subtidal Habitat Disturbance

	Intertidal	Subtidal
West Cove (square-ft.)	164,000	69,000
Central Cove (square-ft.)	149,000	172,000
East Cove (square-ft.)	175,000	210,000
Total (square-ft.)	**488,000**	**451,000**
Total (acres)	**11.2**	**10.3**

6.4 Fish and Wildlife

No Action Alternative: The no action alternative may have long term minor effects on intertidal and nearshore benthics due to siltation from erosion and input of fine sediments which may influence the types of benthic organisms and have indirect impactson fish and wildlife.

6.4.1 Finfish

The proposed action is expected to have an indirect, short-term impact on fish species in the immediate construction area. Motile species would likely avoid burial during the construction by relocating outside of the area. However, the potential for some fish mortality does exist. Demersal fishes that may reside just offshore of the construction footprint (*e.g.*, winter flounder, windowpane flounder, summer flounder, etc.) would be temporarily displaced until appropriate invertebrate species return to the area. Resident fish are expected to feed in surrounding areas, and therefore be relatively unaffected by temporary, localized, reductions in available benthic food sources (USACE, 2000).

There will be no long-term adverse impacts on fish.

6.4.2 Shellfish

The proposed action is expected to have a direct, short-term, impact on shellfish. Sessile shellfish that are present in the immediate construction area such as blue mussel are likely to be buried. Two juvenile blue mussels were found attached to cobbles at one mid-intertidal station and a lone blue mussel was also found at one low-intertidal station (USACE 2015). However, no shellfish with significant commercial or recreational importance were identified. Certain crustacean species which are highly mobile and wary such as blue claw (*Callinectes sapidus*) have a good chance of avoiding the study area during construction and therefore would not be impacted. Upon construction completion, any shellfish that moved can return (Wilber and Clarke 1998).

There will be no long-term impacts on shellfish.

6.4.3 Benthic Resources

The implementation of the proposed action is expected to have a direct, short-term impact on benthic resources. However, the high-intertidal area was generally azoic or consisted of typical opportunistic annelid species, while the communities in the mid-intertidal areas were dominated by typical opportunistic annelid species. The low-intertidal communities were also dominated by typical opportunistic annelid species, but also contained a varied mix of other typical sandy shore species such as isopod and decapod crustaceans and a few gastropod species.

Benthic organisms living in the sediments of the beach or the nearshore areas may be impacted during the placement process by being buried by the addition of sand. Resettling of suspended sediments may indirectly impact any benthic organisms in adjacent areas. Benthic organisms inhabiting intertidal and surf zone areas are well adapted to and tolerant of considerable changes in their environment (Naqvi and Pullen, 1982). Mobile organisms living on the surface sediments would be displaced. Benthic organisms would begin to recolonize immediately following the completion of each construction reach, and populations are expected to revert to planning levels within approximately one year (Wilber and Clarke, 1998). Diversity and abundance is expected to be similar to preconstruction conditions because the new substrate will be of similar grain size to the existing conditions.

Construction is estimated to take approximately one year. Portions of the beach constructed prior to the spring would benefit from recruitment of benthic organisms to intertidal and adjacent subtidal habitats from neighboring habitats and, consequently, recovery would be quicker. Although there will be some variability of the rate of recovery due to the timing of completion of each reach, a temporal reduction in abundance of the benthic community is not likely to significantly affect the quality of the habitat in Long Island Sound in the nearshore zone because common bottom-feeding species like winter flounder, summer flounder, windowpane flounder, and scup are opportunistic predators and will switch from less abundant to more abundant species.

Impacts related to re-nourishment cycles, estimated to be approximately once every 5 years will be similar to those resulting from the initial fill but to lesser degree. It is anticipated that sand will be trucked to the project site from an upland sand source. The re-nourishment requires smaller volumes of sand than the initial fill (see Section 5.1 for beach nourishment volumes). Thus, a smaller zone of the intertidal and littoral benthos will be affected. Sand re-nourishment would not occur in areas of the project that are already at or above the design template, or only minimally disturbed. There will be no long-term impacts on benthic resources, as they are expected to return to preconstruction levels (USACE 2014b).

6.5 Reptiles and Amphibians

No Action Alternative: The no action alternative will have neither short nor long term impacts on reptiles and amphibians.

Proposed Action: The implementation of the proposed action is expected to have neither short nor long-term impacts on reptiles and amphibians. As stated in section 3.4.4, there are low numbers, if any, reptiles and amphibians in the construction area. Any reptiles in the bay would be able to move and avoid construction.

6.6 Birds

No Action Alternative: The no action alternative will have neither short nor long-term impacts on birds.

Proposed Action: The most abundant species in the project area are likely to be habitat generalists that are tolerant of development. The closest designated Bird Conservation Area is the Peconic River Headwaters, located approximately 20 miles southwest of the project area in Brookhaven and Riverhead, NY (NYSDEC 2016d). Birds that currently use the area may experience indirect short-term impacts. Increased noise and heavy machine activity could cause their displacement or disruption in foraging within the immediate vicinity of the construction. Avian species are highly mobile and are expected to avoid the construction area and return after completion of the construction. There will be no long-term impacts on bird species. See Sections 6.8 and 6.9 for additional information regarding Federal and State listed bird species, respectively.

The USFWS provided a list of migratory birds in their Fish and Wildlife Coordination Act 2b Report (see Appendix A4). Several species of shorebirds may be found in the project area as transient individuals during migration. However, avian species are highly mobile and there is an abundance of suitable habitat nearby. Migratory birds are expected to avoid the construction area and return after completion of the construction.

6.7 Mammals

No Action Alternative: The no action alternative will have neither short nor long-term impacts on mammals.

Proposed Action: Mammals in the construction area may experience short-term impacts during construction activities. During construction, heavy machinery activity and increased noise levels may indirectly cause displacement of individuals near construction activities. Mammals are mobile species and will move to avoid the construction areas, thus minimizing the impacts of construction activities on them. Most mammals inhabiting the study area are accustomed to human activities and would likely return after completion of construction. It is anticipated that any raccoon, eastern cottontail, opossum or white tail deer in the area would return to areas after construction. There will be no long-term impacts on upland mammals.

The project area is not a documented haul out site for harbor seals and it is unlikely that bottlenose dolphin would be found in the near shore waters of the project area. Therefore, no short or long term-term impacts to seals or dolphins are anticipated.

6.8 Invasive Species

No Action Alternative: The no action alternative will have neither short not long-term impacts on invasive species.

Proposed Action: Four Asian shore crabs, an invasive species in Long Island Sound, were identified within the project area. The dynamic nature of the sandy environment (e.g., constant movement of sand) are limiting conditions for most benthic dwelling animals to inhabit, consequently making this type of habitat generally low in both species diversity and abundance. The placement of sand within the project area in the future is not expected to increase preferred habitat for the Asian shore crab and should not contributed to a change in its abundance. In addition, the amount of suitable habitat is limited for common reed, Japanese knotweed and honeysuckle shrubs (invasive species observed within the project area). These plants were observed in isolated patches within the highly disturbed bank. The placement of sand will not increase the amount of suitable habitat for these plants and will not contribute to an increase in abundance.

6.9 Federal Threatened and Endangered Species

No Action Alternative: The no action alternative will have neither short nor long-term impacts on federally threatened and endangered species.

Proposed Action: There are six (6) Federally protected animal or plant species under the jurisdiction of the USFWS that have been identified as possibly being present along the coastal beach in the proposed project area: roseate tern (*Sterna dougallii dougallii)* (northeastern population), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), sandplain gerardia (*Agalinis acuta*), seabeach amaranth (*Amaranthus pumilus*), and northern long-eared bat (*Myotis septentrionalis*). In addition, the proposed project location overlaps with areas of potential distribution for eight (8) Federally protected animal species under the jurisdiction of the NMFS: Atlantic sturgeon (*Acipenser oxyrinchus*); sea turtles of the New England region, including the threatened Atlantic loggerhead (*Caretta caretta)* and green sea turtle (*Chelonia mydas*) and endangered Atlantic leatherback (*Dermochelys coriacea*) and Atlantic Kemp's ridley (*Lepidochelys kempi*); as well as large Atlantic whales including the endangered humpback (*Megaptera novaeangliae*), right (*Eubalaena glacialis*), and fin (*Balaenoptera physalus*) whales. Coordination with USFWS is in Appendix H1.

The last record of piping plover on Southold Beach was in 2004. In its current condition, the beach is unsuitable for nesting piping plover. Beach widening may increase the suitability of the habitat for nesting and foraging piping plover (beneficial effect). None of the other Federally-listed species outlined in this section have been documented as being in the project area.

Affect Determination

May Affect but Is Not Likely to Adversely Affect

Roseate Terns. The project area does not support suitable breeding habitat for roseate terns. While the off-shore waters of the Hashamomuck Cove project area may be used by roseate terns for transient foraging, the project area has not been document as a significant foraging area for roseate terns and, therefore, project activities may affect but are not likely to adversely affect this species because the effects to roseate terns are expected to be insignificant or discountable.

Piping Plover. The last record of nesting piping plover on Southold Beach was in 2004. This is most likely due to significant human disturbance insufficient area above high tide mark for nesting.

After the initial sand placement, continued erosion will require beach re-nourishment estimated to be approximately once every 5 years. Re-nourishment would not occur in areas of the project that are already at or above the design template, or only minimally disturbed. While there will be will be a temporary loss of benthic organisms with implementation of the proposed project, foraging piping plover would have an abundance of similar habitat to use in nearby areas. Benthic resources would begin to recolonize immediately following the completion of each construction reach, and populations are expected to revert to planning levels within one year (Wilber and Clarke, 1998). Diversity and abundance of benthic species after recovery is expected to be similar to preconstruction conditions because the new substrate will be of similar grain size to the existing conditions.

The proposed project may improve habitat and encourage nesting and foraging for piping plover due to beach widening. In light of this possibility, USACE worked collaboratively with the USFWS, the NYSDEC and the Town of Southold to prepare a shorebird management plan for the Hashamomuck Cove project area. This plan will expand annual monitoring to include the Central and East Cove (in addition to Hashamomuck Beach [West Cove] which is already monitored annually). Also, due to the potential for piping plover to use the widened beach after initial beach nourishment, the management plan will require that re-nourishment activities be restricted during the piping plover nesting window (April 1 to August 31) in any year. Other recommendations provided in the Management Plan include, but are not limited to, signage to educate visitors about piping plover vulnerability and life history, actions to deter gull feeding, and dog leashing requirements (see Appendix A5, Shorebird Management Plan).

In summary, beach widening may increase the suitability of the habitat for nesting and foraging piping plover (beneficial effect). To assure the protection of piping plover that may utilize the habitat after project implementation, a shorebird management plan was prepared. Therefore, the proposed project may affect but is not likely to adversely affect this species because the effects to piping plover are expected to be insignificant or discountable.

Red Knot. The red knot, a federally threatened species, makes one of the longest yearly migrations of any bird to its Arctic breeding grounds. During migration, red knots concentrate in huge numbers at traditional staging grounds during migration. It is unlikely that the Hashamomuck Cove project area is used by red knots as other than a transient stopover to or from their breeding grounds. Given the lack of suitable foraging and roosting habitat and the limited known occurrences of red knot roosting and foraging habitat, the proposed project may affect but is not likely to adversely affect red knot or critical habitats because the effects to red knot are expected to be insignificant or discountable.

Sea Turtles. Studies of sea turtles near Long Island, NY have shown that the species typically occur in waters with depths between 16 and 49 ft. and in areas where the waters are slow-moving or still (i.e., current of less than 2 knots) (Ruben and Morreale 1999).

In the event that a loggerhead or Kemp's ridley sea turtle would forage close to shore during placement of sand, there is little probability that direct contact impacts would arise from construction methods including equipment utilized to place sand, and/or the potential from burial with sand during placement would occur. It is possible that a sea turtle may encounter a zone of increased turbidity along the shore during placement, especially if surf conditions were rough. Direct impacts from increased turbidity (or noise) may cause turtles to move away from the area but this disturbance behavior would be considered an insignificant impact. Sea turtles are not expected to forage in the shallow waters where fill sand will bury the intertidal and nearshore littoral benthos and so the project would contribute to a loss of foraging habitat. Therefore, project activities may affect but are not likely to adversely affect endangered and threatened sea turtles because the effects to sea turtle species are expected to be insignificant or discountable.

Atlantic Sturgeon. Atlantic sturgeon spawning and early life stages occur in major tidally influenced freshwater rivers. No spawning or early life stages of Atlantic sturgeon occur in the action area as the environment is completely saline. The project area does not provide suitable habitat for overwintering; so the presence of Atlantic sturgeon is likely limited to the warmer months (April – November). The project area does not provide highly productive foraging habitat preferred by Atlantic sturgeon and therefore, the occurrence of sub-adult and adult Atlantic sturgeon would probably be transient. Sturgeon are tolerant of turbid conditions (in rivers) and would likely move out of the area of disturbance. Therefore, the impact of beach nourishment activities on sturgeon are insignificant.

No Effect

Northern Long-Eared Bat. The forested uplands adjacent to the project vicinity may support summer roosting habitat for northern long-eared bat (USFWS 2015a). However, there will be no bridge or culvert work (structures which can be used by roosting bats) and no tree cutting is anticipated as part of the project action. Additionally, there is no known occurrence of northern long-eared bat in the project area (telecom on March 29, 2016 with Terra Gulden-Dunlop, Fish and Wildlife Biologist, USFWS Long Island Field Office). Therefore, there will be no effect on the northern long-eared bat as a result of the Hashamomuck Cove project.

Sandplain Gerardia. The sandplain is very rare and the project area lacks coastal grasslands and therefore, sandplain gerardia is unlikely to be found in the project area. Therefore, there will be no effect on the sandplain gerardia as a result of project activities.

Seabeach Amaranth. The seabeach amaranth, appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. Beaches in the project area are not suitable for the establishment of seabeach amaranth and therefore, there will be no effect on the seabeach amaranth as a result of project activities.

Large Atlantic Whales. Humpback, right, and fin whales are unlikely to occur within the project vicinity or in the shallow depths of the proposed project area and therefore, project activities should have no effect on any endangered whale species.

6.10 State Threatened and Endangered Species

No Action Alternative: There will be no short-or long-term impacts to endangered piping plover and State threatened least tern under the no action alternative.

Proposed Action: No least tern nesting colonies have been identified in the project area during annual monitoring. Increasing the width of the beach as proposed, may have a beneficial effect on piping plover by increasing the suitability of the area for nesting. The USACE coordinated with the USFWS, NYSDEC, and the Town of Southold to prepare a Shorebird Management Plan to assure the protection of piping plover in the project area (see Section 6.5 for additional information on the environmental consequences of the proposed action on piping plover and a general description of the Shorebird Management Plan).

Increasing the width of the beach as proposed may attract least terns to the project area. However, because least terns nest in colonies, it is expected that the size of the beach would still be a significant deterrent and limiting factor for a large least tern nesting colony. Least terns feed mostly on small fish caught by skimming the surface of the water or by making dives from the air (NYSDEC, 2016g). Therefore, beach widening will not have a beneficial or detrimental effect on least tern foraging.

6.11 Essential Fish Habitat

No Action Alternative: The no action alternative will have neither short nor long-term impacts on essential fish habitat.

Proposed Action: The proposed action is expected to have an indirect, short-term impact on food availability for benthic-feeding EFH designated species in the construction area. The beach nourishment project may cause mortality of benthic infaunal organisms in the placement area. However, resident fish are expected to feed in surrounding areas, and therefore be relatively unaffected by temporary, localized, reductions in available benthic food sources (USACE 2004). If winter flounder spawning does occur around the project area, there is the potential for adverse impacts to eggs and newly settled juveniles due to burial at the project site. These potential impacts are not expected to be significant.

Horseshoe Crab. Based on the recent sampling and monitoring results cited in the previous paragraph, it is unlikely that horseshoe crabs will be present during the Hashamomuck Cove project initial beach nourishment due to sub-optimal habitat conditions in the project area. However, to assure that there will be no direct impact to horseshoe crab, the USACE will provide a horseshoe crab monitor during the initial placement of sand to relocate any horseshoe crabs found to another location outside of the project area. In the years following the initial placement of sand, the beach will be wider and therefore, more suitable for horseshoe crab spawning. As such, due to this increased likelihood of horseshoe crab presence in the project area in subsequent years, the USACE will incorporate a no-construction window during crab spawning season (April 15 to July 15, of any year) during future re-nourishment events.

A detailed EFH assessment is provided in environmental Appendix A1. The assessment indicates that implementation of the proposed action will have minimal short-term effects on EFH species, their habitat, and no long-term impacts.

6.12 Socioeconomics

No Action Alternative: The no action alternative may have short- or long-term impacts on socioeconomics. Continued erosion may permanently impact existing businesses, homes and County Road 48, which runs along the shoreline and is in danger of being undermined in several locations. In addition, the continued loss of beach may curtail recreational use of the currently popular Hashamomuck Town Beach in the future. These potential impacts may equate to a reduced number of visitors patronizing local businesses during the summer season. Households and businesses may not rebuild and leave empty lots or unrepaired homes. The closure or loss of County Road 48 would result in traffic delays, loss of an evacuation route, and hamper emergency rescue operations.

Proposed Action: The implementation of the proposed action may have positive short- and long-term socioeconomic impacts. Maintaining existing buildings, the usefulness of County Road 48 as a transportation route, and the suitability of the Southold Town Beach as an attractive coastal destination should have positive socioeconomic impacts over the period of analysis. In the construction phase of the project, the introduction of construction workers into the community should result in their purchasing of supplies and food which may contribute to a minor, indirect temporary economic benefit to the local economy. Access to the beaches would be temporarily impeded during the construction period, but long term the project would increase public access to beaches in the project area. The implementation of the plan is expected to have a direct positive impact on housing and structures due to a reduction in future storm damage to existing properties, and the subsequent reduction in costs to repair such damages. Residential property values may increase in the project area due to the added coastal storm risk management of storm damages.

6.13 Environmental Justice

As stated in Section 3.9, the Town of Southold is not considered an Environmental Justice Area according to the NYSDEC Office of Environmental Justice (NYSDEC, 2016h.)

No Action Alternative: The no action alternative will have neither short nor long-term impacts to an Environmental Justice Area.

Proposed Action: The implementation of the proposed action will have no short-or long-term impacts on an Environmental Justice Area.

6.14 Protection of Children

No Action Alternative: The no action alternative will have neither short nor long-term impacts on the protection of children.

Proposed Action: Executive Order 13045 requires Federal agencies to examine proposed actions to determine whether they will have disproportionately high human health or safety risks on children. There are no schools close to the project area and therefore, no direct impact to areas of high density of children will occur. Access for the general public will be prohibited during construction to prevent unauthorized personnel from entering the work area (including children). In addition, there will be a temporary increase in truck traffic transporting materials to and from the site. These trucks will be limited to public roadways.

6.15 Cultural Resources

No Action Alternative: The no action alternative will have neither short nor long-term impacts on cultural resources.

Proposed Action: The Area of Potential Effect for the TSP is the area defined in Figures 16 through 18. The APE is just those areas that will be impacted by sand placement. The proposed action will have no effect on historic properties. There are no historic properties in the project area. The proposed project involves placing sand on a beach which has been disturbed by wave action and erosion. Placement of sand should also have no effect on any historic architectural properties in the vicinity of the West, Central or East Coves because they are already in a coastal setting. This proposed action was coordinated with the New York State Historic Preservation Office who concurred with this no effect determination.

6.16 Coastal Zone Management

No Action Alternative: The no action alternative will have neither short nor long-term impacts in terms of Coastal Zone Management policies.

Proposed action: In conformance with 15 CFR Part 903 subpart C and enforceable policies of New York's Coastal Zone Management Program, USACE has determined that the proposed action is consistent to the maximum extent practicable with the relevant enforceable policies of the New York State Coastal Management Program, in this instance the Town of Southold Local Waterfront Revitalization Program policies (see Appendix A3).

6.17 Land Use and Zoning

No Action Alternative: The no action alternative may have short- and long-term impacts as erosion, storm damage and flooding will continue and possibly necessitate changes in land use as property is destroyed and land lost.

Proposed Action: Implementation of the proposed action will have no negative short- or long-term impacts to land use and zoning. The implementation of the proposed coastal storm risk management measures is not expected to significantly induce future development in the adjacent residential areas, because most, if not all, of the developable areas are developed.

6.18 Hazardous, Toxic, and Radioactive Waste

No Action Alternative: The no action alternative will have neither short nor long-term impacts from HTRW.

Proposed Action: There will be neither short nor long-term impacts from HTRW. There were five HTRW sites located within the study area, all of which were addressed as stated in Section 3.13. Therefore, no short or long-term impacts will occur from implementation of the proposed action.

6.19 Aesthetic and Scenic Resources

No Action Alternative: The no action alternative may have negative short- and long-term impacts as beaches will continue to erode, causing damage to the scenic resources present in Southold.

Proposed Action: Implementation of the proposed action will have negative short-term impacts to aesthetics and scenic resources. Construction equipment and vehicles which are generally not considered visually appealing will be on the beach during the implementation of the plan. Long-term impacts of the proposed action will be positive impacts. The view shed at several locations along County Road 48 towards Long Island Sound may be improved for the general public that finds a wide sandy beach visually appealing.

6.20 Recreation

No Action Alternative: The no action alternative may have negative short-and long-term impacts because the beaches and businesses that provide recreation or recreational services may be impacted by continued erosion and may be inaccessible during and after storm events until repairs are complete. The narrow width of the beach may limit the recreational carrying capacity of the public beach (e.g., adverse effects due to crowding).

Proposed Action: Implementation of the proposed action will have negative short-term impacts to recreation because beaches will be temporarily inaccessible during construction. Long-term impacts will be positive since beach will be nourished and there will be expanded public use in adjacent coves.

6.21 Air Quality

The proposed action will produce temporarily localized emission increases from the diesel powered construction equipment working onsite. The localized emission increases from the diesel powered equipment will last only during the project's construction period and then end when the project is over, thus any potential impacts will be temporary in nature.

The project described above has been evaluated for Section 176 of the Clean Air Act. Project related emissions associated with the federal action were estimated to evaluate the applicability of General Conformity regulations (40CFR§93 Subpart B). The requirements of this rule do not apply because all of the emissions associated with the project will be from land-based mobile sources such as earth-moving equipment and on-road trucks, and the State of New York has determined that the land-based mobile sources used for coastal projects of this type are included in the State's existing SIP and therefore do not fall under the General Conformity rules. Further, the total direct and indirect emissions from this project are less than the 100 tons trigger levels for NOx, PM2.5, CO, and SO2 and less than 50 tons for VOCs for each project year (40CFR§93.153(b)(1) & (2)) and for the project as a whole. The estimated total NOx emissions for the project are 9.0 tons. Emissions of VOC, PM2.5, CO, and SO2 are also all well below the applicable trigger levels.

6.22 Greenhouse Gases (GHGS)

The primary GHG emitted by diesel-fueled engines is CO2. The project is estimated to generate a total of 658 metric tons of CO2, which is equivalent to 139 passenger vehicles annual CO2 emissions.[6] The GHG emissions associated with the project are temporary and insignificant compared to over 1.1 million registered passenger vehicles in Suffolk County.[7] The project is significantly below the CEQ evaluation level of 25,000 metric tons per calendar year.

6.23 Noise

No Action Alternative: Under the no action alternative there may be negative short-term impacts from noise due to construction activities associated with storm damage repairs.

Proposed action: With implementation of the proposed action, there would be negative short-term impacts from noise due to use of construction equipment. There will be no long-term impacts.

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[6] EPA Greenhouse Gas Equivalent Calculator, www2.epa.gov/energy/greenhouse-gas-equivalencies-calculator, accessed October 7, 2015

[7] NYS Department of Motor Vehicles, NYS Vehicle Registrations on File – 2014, *dmv.ny.gov/statistic/2014ReginForce-Web.pdf*, accessed October 7, 2015

Chapter 7: Cumulative Impacts*

The Council on Environmental Quality defines "cumulative impact" as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or Non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The following section describes past, present and future Federal and local projects in the Southold area and near vicinity which represents prior work that was conducted in the study area.

There are no existing USACE coastal storm risk management projects (CSRM) within the Hashamomuck Cove Study Area in Southold, New York. USACE currently has one other CSRM project under study on the north shore of Long Island located approximately 50 miles west of Southold at Asharoken Beach. If these projects are constructed, then the Asharoken project would have no measurable influence on the Hashamomuck project due to the distance between the two areas.

Orient Harbor Revetment. The Orient Harbor coastal storm risk management revetment was constructed by USACE in the Town of Southold, New York. The project area is located along the Peconic Bay shore immediately adjacent to State Route 25, approximately 5 miles east of Hashamomuck. The project is maintained by the New York State Department of Transportation.

Bulkheads and Groins. There are a number of existing bulkheads and groins located within the Study Area. They were built mainly for the purpose of shoreline erosion management. The bulkheads are located along approximately 40% of the coastline in the study area. In some areas, there were small rock revetments installed as erosion protection. The rock revetments are located along approximately 15% of the beach front properties within the study area.

Southold Town Beach. A blizzard on December 26, 2010 caused damages at the Southold Town Beach. In 2011, 6,400 cy of sand material acquired from a dredging project at the Cross Sound Ferry Terminal in Orient was transported to Southold Town Beach, placed on the beach, and graded by the Town of Southold. (Periodic redistribution and grading of littoral drift (which forms at the Low Water Line) has occurred at Southold Town Beach since 2011 (approximately once a year).

Periodic Beach Re-nourishment Activities. Future cumulative activities include the potential Hashamomuck Cove beach re-nourishment discussed in Section 6.

A number of bulkheads, groins, and rock revetments located in the project area that were constructed in the past have permanently altered coastal habitat. With initial placement of sand under the TSP, the Mean High Water line seaward will be moved seaward. However, the project area will still be subject to continued erosion and storm events which will require periodic beach re-nourishment activities in the future. The changes to intertidal and subtidal habitat are not considered to be cumulatively significant due to the area's dynamic and changing environment.

The previous construction of groins permanently displaced sand and cobble habitats with rock, thereby modifying the benthic community from infauna to sessile type fauna. No additional permanent cumulative impacts to the benthic community are anticipated with implementation of the proposed project. There are potential short-term negative impacts to the benthic communities resulting from the initial sand placement and subsequent beach re-nourishment activities. However, these impacts are not cumulatively significant when added to past measures because the intertidal and subtidal benthic communities are expected to recolonize with similar species within a few months and be at planning densities within a year (Wilber and Clarke, 1998).

There are no anticipated cumulative impacts to fish and wildlife, or Federal and/or State threatened and endangered species. This project will be coordinated with the appropriate State and Federal agencies to ensure no significant impacts occur.

Socioeconomics of the area would benefit from the construction of the project as proposed. Specifically, construction would have a positive benefit by reducing costs resulting from storm and water damage.

Chapter 8: Coordination & Compliance with Environmental Requirements*

8.1 Compliance Summary

Table 15. Summary of Primary Federal Laws and Regulations Applicable to the Proposed Project

Item	Citation	Compliance
Clean Air Act	42 U.S.C. §§ 7401 et seq.	In compliance November 1, 2018. See RONA Appendix A7.
Clean Water Act	33 U.S.C. 1251 et seq.	USACE will obtain a Water Quality Certificate to comply with the Clean Water Act (Section 401) during the design phase of the project. NYSDEC provided a conditional likely to comply with CWA Section 401 (Water Quality Certification) in their Letter dated March 18, 2019 (see Appendix H2).
Coastal Zone Management Act	16 U.S.C. §§ 1451-1464 NY Executive Law §§ 91, 913, Article 42	A CZM Determination was prepared and is located in Appendix A3. NYDOS concurrence was obtained November 29, 2018.
Endangered Species Act of 1973	16 U.S.C. 1531 et seq.	Not likely to affect letter provided by USFWS on June 25, 2019.
Environmental Justice in Minority and Low Income Populations	Executive Order 12898	USACE performed an analysis and has determined that a disproportionate negative impact on minority or low-income groups in the community is not anticipated; a full evaluation of Environmental Justice issues is not required.
The Federal Farmland Protection Policy Act of 1981	P.L. 97-98, Sec. 1539-1549; 7 U.S.C. 4201, et seq.	The proposed project involves beach nourishment and would not involve impacts to prime farmlands.
Fish and Wildlife Coordination Act	16 U.S.C. 661 *et seq*.	Final FWCAR provided April 2019 (Appendix A4).
Magnuson-Stevens Act Fishery Conservation and Management Act	16 U.S.C. 1855(b)(2)	The EFH Assessment is located in Appendix A1. NMFS correspondence (November 15, 2018) is included in Appendix H1.
National Environmental Policy Act of 1969	42 U.S.C. 432 *et seq*.	The circulation of the Draft EA (August/ September 2016) fulfilled requirements of this act.
National Historic Preservation Act of 1966	16 U.S.C. 470 et seq.	New York SHPO has determined that no historic properties will be affected by the project. Letter in Appendix H1.
Protection of Wetlands	Executive Order 11990	The proposed project does not impact freshwater wetlands.

Protection of Children from Environmental Health Risks and Safety Risks	Executive Order 13045	Implementation of this project will reduce environmental health risks. Circulation of this report for public and agency review fulfilled the requirements of this order.

8.2 Compliance with Executive Order (EO) 11988

Executive Order 11988 requires that Federal agencies avoid, to the extent possible, adverse impacts associated with the occupancy and modification of flood plains and to avoid support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities."

The Water Resources Council Floodplain Management Guidelines for implementation of EO 11988, as referenced in ER 1165-2-26, requires an eight-step process that agencies should carry out as part of their decision-making on projects that have potential impacts to, or are within the floodplain. The eight steps and project-specific responses to them are:

EO 11988 Step	Project-Specific Response
Determine if a proposed action is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year).	The proposed action is within the base floodplain. However, the project is designed to reduce damages to existing infrastructure located landward of the proposed project.
If the action is in the base flood plain, identify and evaluate practicable alternatives to the action or to location of the action in the base flood plain.	Practicable measures and alternatives were formulated and evaluated against USACE guidance, including nonstructural measures such as buy-outs (land acquisition and demolition of structures).
If the action must be in the flood plain, advise the general public in the affected area and obtain their views and comments.	The final determination that no practicable alternatives exist to locating the action in the floodplain was advised to the general public through the release of the Draft Integrated Feasibility Report and Environmental Assessment in August 2016.
Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial flood plain values. Where	The anticipated impacts associated with the Selected Plan are summarized in Chapter 6 of this report. The project would not alter or

EO 11988 Step	Project-Specific Response
actions proposed to be located outside the base flood plain will affect the base flood plain, impacts resulting from these actions should also be identified.	impact the natural or beneficial flood plain values.
If the action is likely to induce development in the base flood plain, determine if a practicable non-flood plain alternative for the development exists.	The project will not encourage development in the floodplain because all properties available for development have been developed. The project provides benefits solely for existing development.
As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impacts of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial flood plain values. This should include reevaluation of the "no action" alternative.	The project would not induce development in the flood plain. Chapter 4 of this report summarizes the alternative identification, screening and selection process. The "no action" alternative was included in the plan formulation phase.
If the final determination is made that no practicable alternative exists to locating the action in the flood plain, advise the general public in the affected area of the findings.	The Final Integrated Feasibility Report and Environmental Assessment will document the final determination.
Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the Executive Order.	The Recommended Plan is the most responsive to all of the study objectives and the most consistent with the executive order.

8.3 List of Environmental Assessment Report Preparers

Individual	Responsibility
Judith Johnson	Biologist; NEPA
Matthew Voisine	Biologist, NEPA
Kate Atwood	Archeologist: NEPA, SEC. 106
Jenine Gallo	Biologist: Clean Air Act, NEPA
Mary Brandreth	Biologist: DQC review

Chapter 9: Plan Implementation

The implementation process would carry a plan that is recommended through planning engineering and design (PED), including development of plans and specifications, and construction. Funding by the Federal Government to support these activities would have to meet the requirements of Public Law 113-2 or traditional civil works budgeting criteria.

9.1 Consistency with Public Law 113-2

This final feasibility report has been prepared in accordance with the Disaster Relief Appropriations Act, Public Law 113-2. Specifically, this section of the report addresses:

- the specific requirements necessary to demonstrate that the project is technically feasible, economically justified and environmentally complaint;
- the specific requirements necessary to demonstrate resiliency, sustainability and consistency with the North Atlantic Coast Comprehensive Study (NACCS); and
- the costs and cost-sharing to support a Project Partnership Agreement (PPA).

Economics Justification and Environmental Compliance. The prior sections of this report demonstrate that the recommended Plan is technically feasible. It also identifies the plan to be economically justified. The Environmental Assessment has been prepared to meet the requirements of NEPA and demonstrate that the plan is compliant with environmental laws, regulations, and policies and has effectively addressed any environmental concerns of resource and regulatory agencies.

Resiliency and Consistency with the NACCS. The North Atlantic Coast Comprehensive Study (NACCS) was released in January 2015 and provides a risk management framework designed to help local communities better understand changing flood risks associated with climate change and to provide tools to help those communities better prepare for future flood risks. In particular, it encourages planning for resilient coastal communities that incorporate, wherever possible, coastal landscape systems that take into account future sea level and climate change scenarios (USACE, 2015).

The process used to identify the recommended plan was a risk management approach that included evaluation of the benefits and costs of an array of alternative solutions both structural and non-structural and took into account storm data, climate change, and rising sea levels consistent with NACCS. The beach nourishment alternative represents a solution that is adaptable to changing conditions and provides a solution that can be adapted through planned beach re-nourishment.

Recognizing the federal government's commitment to ensure no inducement of development in the floodplain, pursuant to Executive Order (E.O.) 11988, this project will identify in the PPA the need for the non-federal sponsor to develop a Floodplain Management Plan, and a requirement for the sponsor to certify that measures are in place to ensure the project does not induce development within the floodplain. Compliance with E.O. 11988 is further documented in Chapter 8. The non-Federal sponsor, NYSDEC, is to prepare a Floodplain Management Plan designed to reduce the impacts of future flood events in the project area within one year of signing a PPA and to implement the plan not later than one year after completion of construction of the project.

9.2 Cost Sharing and Non-Federal Sponsor Responsibilities

In accordance with the cost share provisions in Section 103 of the Water Resources Development Act (WRDA) of 1986, as amended (33 U.S.C. 2213), initial construction is cost shared 65% Federal and 35% Non-Federal and continuing construction is cost shared 50% Federal and 50% Non-Federal.

The Non-Federal sponsor is required to provide the necessary real estate for the project. These real estate costs are then credited toward the Non-Federal share. Real Estate Plan Appendix F details the real estate to be acquired for the beach nourishment project i.e. Perpetual Beach Storm Damage Reduction Easements.

Table 16 provides the details of the recommended plan cost apportionment at the current price level. Table 17 provides details of the recommended plan cost apportionment at the fully funded project cost that includes cost escalation to the mid-point of construction (June 2022 for initial placement).

Table 16. Cost Apportionment (October 2018 Price Level)

Project First Cost, October 2018 Price Level	Total	Federal Share	Non-Federal Share
		65%	35%
Initial Cost			
Beach Nourishment	$12,499,000		
Planning, Engineering & Design	$1,409,000		
Construction Management	$1,014,000		
		0%	100%
Lands and Damages	$2,445,000	$0	$2,445,000
Total	$17,367,000	$11,289,000	$6,078,000

Continuing Construction	Total	Federal Share	Non-Federal Share
		50%	50%
Beach Nourishment	$40,014,000	$20,007,000	$20,007,000
Planning, Engineering & Design	$3,187,000	$1,595,500	$1,595,500
Construction Management	$3,377,000	$1,668,500	$1,668,500
Total	$46,578,000	$23,289,000	$23,289,000

Table 17. Cost Apportionment (Fully Funded)

Project First Cost, October 2018 Price Level	Total	Federal Share	Non-Federal Share
		65%	35%
Initial Cost			
Beach Nourishment	$13,916,000	$9,046,000	$3,127,000
Planning, Engineering & Design	$1,591,000	$1,034,000	$557,000
Construction Management	$1,163,000	$756,000	$407,000
		0%	100%
Lands and Damages	$2,682,000	$0	$2,682,000
Total	$19,352,000	$12,579,000	$6,773,000

Continuing Construction, Fully Funded	Total	Federal Share	Non-Federal Share
		50%	50%
Beach Nourishment	$101,701,000	$50,850,500	$50,850,500
Planning, Engineering & Design	$8,936,000	$4,468,000	$4,468,000
Construction Management	$12,276,000	$6,138,000	$6,138,000
Total	$122,913,000	$61,456,500	$61,456,500

9.3 Design and Construction Considerations

Planning, Engineering and Design. Since the Hashamomuck Cove Coastal Storm Risk Management Feasibility Study was funded under Public Law 113-2 response to Hurricane Sandy, there may be funding under the same appropriation to initiate the Planning, Engineering, and Design (PED) phase for this project upon successful completion of a Chief's Report. A Design Agreement (DA) could then be executed between USACE and NYSDEC. PED is cost shared 65% Federal and 35% Non-Federal. Construction of the project will occur after Congress has authorized the project and provided sufficient funds through the normal budgeting process.

Schedule. The estimated schedule for plan implementation was developed for planning and cost estimating purpose. See Appendix E, Cost Engineering for the proposed construction schedule. The project consists of the initial placement of 216,000 CY (94,400 CY in the West Cove, 83,000 CY in the Central Cove and 38,200 CY in the East Cove) of beachfill via trucking for the construction of 25-feet berm. The construction duration for the initial beach nourishment project is estimated at 11 months based on trucking schedule of 5 weekday work days. Environmental windows are not required for initial construction. Re-nourishment is considered continuing construction and is estimated to occur every 5-years (9-events) following initial construction. As the project is anticipated to improve the existing beach habitat, environmental windows for piping plover and horseshoe crab would be implemented for future re-nourishment events.

Table 18. Implementation Schedule

Hashamomuck Cove, Southold, NY, CSRM Project Estimated Schedule	
Calendar Year	Item
2019	Final Feasibility Report to HQ
2019	Chief of Engineers Signs Report
2020	Prepare Plans and Specifications
2021	Construction Contract Award
2022	Construction Complete
2022	Fiscal Construction Contract Close-Out

9.4 Non-Federal Sponsor Support

The Non-Federal sponsors support for the recommended plan was confirmed through letters of support from NYSDEC dated March 18, 2019 and from the Town of Southold dated July 12, 2018 (See Appendix H2).

9.5 Public Use and Access

USACE beach nourishment projects require public use and access[8] be provided in order for the project to meet the requirement for Federal cost-sharing. The USACE policy requires public access points every ½ mile for a beach nourishment project, so that a visitor is never more than a quarter mile away from any point on the beach project. Public use by visitors is allowed on the beach where sand replenishment by the USACE takes place. The Non-Federal sponsor for the project (NYSDEC) is responsible for and will provide the public access to the site (See Appendix G).

[8] Public access to the project area is required by USACE public access requirements, which are identified in ER 1165-2-130, and based upon U.S.C. 426e(d).

The NYSDEC public access plan (Figure 20):

- Establishes access points that are open to all on equal terms
- Provides public access points every one half mile, so that a visitor is never more than a quarter mile away from an access point within the project area.
- Established designated parking areas consistent with expected use

The plan for public access and public use is shown below.

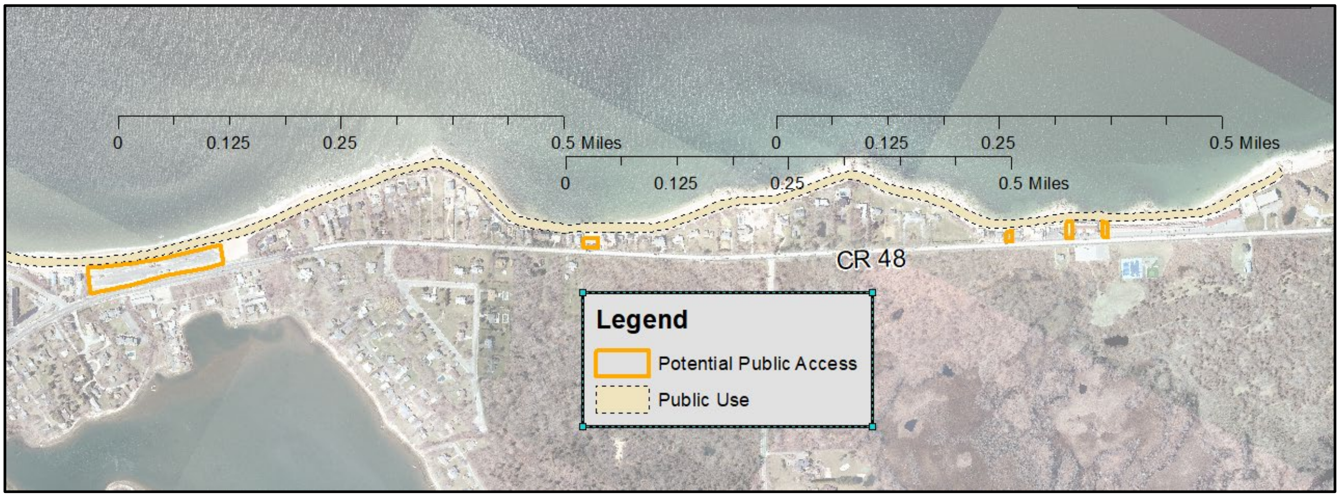

Figure 20. Public Access Plan

Public access is consistent with the New York State's Coastal Management Program, as refined in the Town of Southold Local Waterfront Revitalization Program. Policy 9 provides for public access to, and recreational use of, coastal waters, public lands (land held by a government entity), and public resources of the Town of Southold. Its subsections include:

9.1	Promote appropriate and adequate physical public access and recreation to coastal resources.
9.2	Protect and provide public visual access to coastal lands and waters from public sites and transportation routes where physically practical.
9.3	Preserve the public interest in and use of lands and waters held in public trust by the State and the Town of Southold.
9.4	Assure public access to public trust lands and navigable waters.
9.5	Provide access and recreation that is compatible with natural resource values.

Chapter 10: Local Cooperation Requirements

The Non-Federal Sponsor supports the recommendations presented in this report and agree that they intend to execute a Project Partnership Agreement (PPA) for the recommended plan. See letter of support dated March 18, 2019 included in Appendix.

Federal implementation of the recommended plan would be subject to the Non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

a. Provide a minimum of 35 percent of initial project costs assigned to coastal and storm damage reduction, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits. In addition, 50 percent of periodic nourishment costs assigned to coastal and storm damage reduction, plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do provide public benefits, and as further defined below:

(1) Provide, during design, 35 percent of design costs allocated to coastal and storm damage reduction in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

(2) Provide all lands, easements, rights-of-way, including suitable borrow areas, and perform or assure performance of all relocations, including utility relocations, as determined by the Federal government to be necessary for the initial construction, periodic nourishment or operation and maintenance of the project;

(3) Provide, during construction, any additional amounts necessary to make its total contribution equal to 35 percent of initial project costs assigned to coastal and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

c. Inform affected interests, at least yearly, of the extent of protection afforded by the flood risk management features; participate in and comply with applicable federal floodplain management and flood insurance programs, comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 US.C. 701b-12); and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the flood risk management features;

d. Operate, maintain, repair, replace, and rehabilitate the completed project, or function portion of the project, at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal government;

e. For so long as the project remains authorized, ensure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based;

f. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

g. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Federal government;

h. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

i. Hold and save the United States free from all damages arising from the initial construction, periodic nourishment, operation, maintenance, repair, replacement, and rehabilitation of the project, except for damages due to the fault or negligence of the United States or its contractors;

j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

k. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal government determines to be necessary for the initial construction, periodic nourishment, operation and maintenance of the project;

l. Assume, as between the Federal government and the Non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way required for the initial construction, periodic nourishment, or operation and maintenance of the project;

m. Agree, as between the Federal government and the Non-Federal sponsor, that the Non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA;

n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the WRDA 86, Public Law 99-662, as amended, (33 U.S.C. 2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the Non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. 4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

p. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army”; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)); and

q. Not use funds from other Federal programs, including any Non-Federal contribution required as a matching share therefore, to meet any of the Non-Federal sponsor's obligations for the project unless the Federal agency providing the funds verifies in writing that such funds are authorized to be used to carry out the project.

r. Comply with requirements of Appendix A5 Shorebird Management Plan and provide monitoring yearly after completion of the project.

Chapter 11: Recommendations

11.1 Overview

In making the following recommendations, I have given consideration to all significant aspects of this study as well as the overall public interest in coastal storm risk management within the Hashamomuck Cove Study Area. The aspects considered include engineering feasibility, economic effects, environmental impacts, social concerns, and compatibility of the project with the policies, desires, and capabilities of the local government, State, federal government, and other interested parties.

11.2 Recommendation

A number of alternatives have been examined as part of the study and a National Economic Development Plan has been identified and considered. In accordance with current Planning Guidance and the guidance outlined in P.L. 113-2, the NED plan described in this report is acceptable to the non-federal partner, agencies, and stakeholders as a Coastal Storm Risk Management Project.

I make this recommendation based on findings that the selected plan constitutes engineering feasibility, economic justification, and environmental acceptability. This recommended project, which is subject to modifications by the ASA (CW), has a project first cost of $17,367,000 for initial construction, and a first cost of $46,578,000 for continuing construction (cumulative renourishment) at October 2018 price levels; and for purposes of the PPA, a fully funded cost of $19,352,000 and an estimated fully funded continuing construction (cumulative renourishment) cost of $122,913,000. My recommendation is subject to the non-federal interests agreeing to execute and comply with the terms of a Project Partnership Agreement following approval of this report.

The recommendations contained herein reflect the information available at this time and current USACE policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and/or implementation funding.

Thomas D. Asbery
Colonel, U.S. Army
District Engineer

Chapter 12: References

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