North Shore of Long Island, Bayville, NY
Coastal Storm Risk Management
Feasibility Study

(AP Photo/Kathy Kmonicek)

Draft Integrated Feasibility Report
and Environmental Assessment
February 2016

New York State
Department of
Environmental Conservation

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

EXECUTIVE SUMMARY

This Study has determined that periodic coastal storms, such as tropical storms, hurricanes, and nor'easters, pose a severe threat to life and property in the Village of Bayville, Nassau County, New York (Bayville). There is an opportunity to manage coastal storm risks in Bayville. In response to these problems and opportunities, plan formulation activities considered a range of nonstructural and structural measures as documented in this draft Integrated Feasibility Report and Environmental Assessment (IFREA). Through an iterative plan formulation process, potential coastal storm risk management measures were identified, evaluated, and compared.

Alternative coastal storm risk management plans that survived the initial screening of alternatives included hard structural (floodwalls and bulkheads) and soft structural (beachfill) plans. Plans minimized environmental impacts by matching the existing ground surface (i.e. new floodwalls where the shoreline is already bulkheaded and sand-covered floodwalls (buried floodwalls) on the existing dunes). Alternative 4 was found to be the most effective and efficient of the four alternatives. Alternative 4 was found to be the alternative having the lowest construction cost while having the highest net benefits, making it the Tentatively Selected Plan (TSP).

The project spans a geographic distance of approximately 14,890 linear feet along the Long Island Sound and Oyster Bay shorelines of Bayville and ties into high ground (+13.0 feet (ft) North Atlantic Vertical Datum of 1998 (NAVD 88) to +14.0 ft NAVD88) at each end. Private property owners will be allowed continued access and will receive compensation if their existing access structures need to be removed for construction. All of the alternatives were evaluated at the two percent flood (50-year) level of performance. The exact height of the project will be determined during the optimization phase of the Study, which follows public and agency reviews of this report.

The estimated total first cost for project implementation is $64,469,000 (October 2015 Price Level), to be cost shared 65% Federal and 35% non-Federal. Annual net benefits are in the amount of $3,237,000 and the benefit cost ratio is 2.2.

The non-Federal project sponsor, New York State Department of Environmental Conservation (NYSDEC), has indicated its support for the TSP and subject to public review, and report finalization, is willing to enter into a Project Partnership Agreement (PPA) with the Federal Government for the implementation of the Recommended Plan, which will be identified in the Final Feasibility Report.

PERTINENT DATA

DESCRIPTION

The Tentatively Selected Plan (TSP) for the North Shore of Long Island, Bayville, New York coastal storm risk management (CSRM) feasibility Study provides for an alignment of elevation +13 feet (ft) North American Vertical Datum of 1988 (NAVD88) to +14 ft NAVD88, consisting of floodwalls, raised ground surfaces, and buried floodwalls, that tie into high ground at each end of the project. The exact dimensions and level of performance of the project will be determined as part of the optimization process to follow the release of this draft IFREA.

LOCATION

The Village of Bayville is located in Nassau County, NY, along the Long Island Sound and Oyster Bay.

FEATURES

The project spans a geographic distance of approximately 14,890 linear feet along the coastline of Bayville and ties into high ground (+13 ft NAVD 88 to +14 ft NAVD88) at each end. For each segment of the project, features were chosen to match the existing surroundings, *i.e.*, elevated bulkheads where the shoreline is already bulkheaded and buried floodwalls (seawalls covered with sand and a vegetation cap) on the existing dunes.

Project Feature	Length (lf)
Floodwall	11,950
Buried Floodwalls	2,940
Raised Road & Ground Surfaces	~800
Total Length	14,890

With the floodwalls and buried floodwalls in place, pumps will be required to pump storm water through the alignment and into the Bay. Three pumps have been proposed for the following locations and capacities: at Jefferson Avenue (65 cubic feet per second (cfs)), between 14th and June Avenue (48 cfs), and at the east end of 1st St. (46 cfs). The exact locations, capacities, and elevations of the pump stations will be determined as part of the optimization process.

REAL ESTATE REQUIREMENTS

The project will require temporary and permanent easements, as well as fee simple purchase for the construction of one of the three pumping stations. The estimated cost for real estate is $6,269,000.

Permanent Easements	26.0 acres
Temporary Easements	2.74 acres
Special Use Permit	0.33 acres
Total	29.08 acres

PROJECT COSTS (October 2015 price levels)

Initial Project First Cost	$ 64,469,000
Real Estate Cost	$6,269,000

ECONOMICS (October 2015 price levels)

Annual Project Cost (Discounted at 3.125% over a 50-year period)	$2,796,000
Average Annual Benefits (Discounted at 3.125% over a 50-year period)	$6,033,000
Average Annual Net Benefits	$3,237,000
Benefit Cost Ratio	2.2

COST APPORTIONMENT (October 2015 price levels)

Fully Funded Project First Cost*	$67,702,000
Federal (65%)	$44,006,000
Non-Federal (35%)	$23,696,000
Total	$67,702,000

**The Initial Project First Cost of $64,469,000 (Oct. 2015 P.L.) escalated to the midpoint of construction.*

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Chapter 1: Introduction

1.1 Study Purpose and Scope

The U.S. Army Corps of Engineers (USACE) North Atlantic Division (NAD), New York District (NAN) prepared this draft Integrated Feasibility Report and Environmental Assessment for the North Shore of Long Island, Bayville, New York, Coastal Storm Risk Management Study (Bayville Study). It includes input from the non-Federal Study partner, local governments, natural resource agencies, and the public. This report presents potential solutions to manage coastal storm risk in the Village of Bayville, Nassau County, New York (Bayville) (Figure 1). 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.

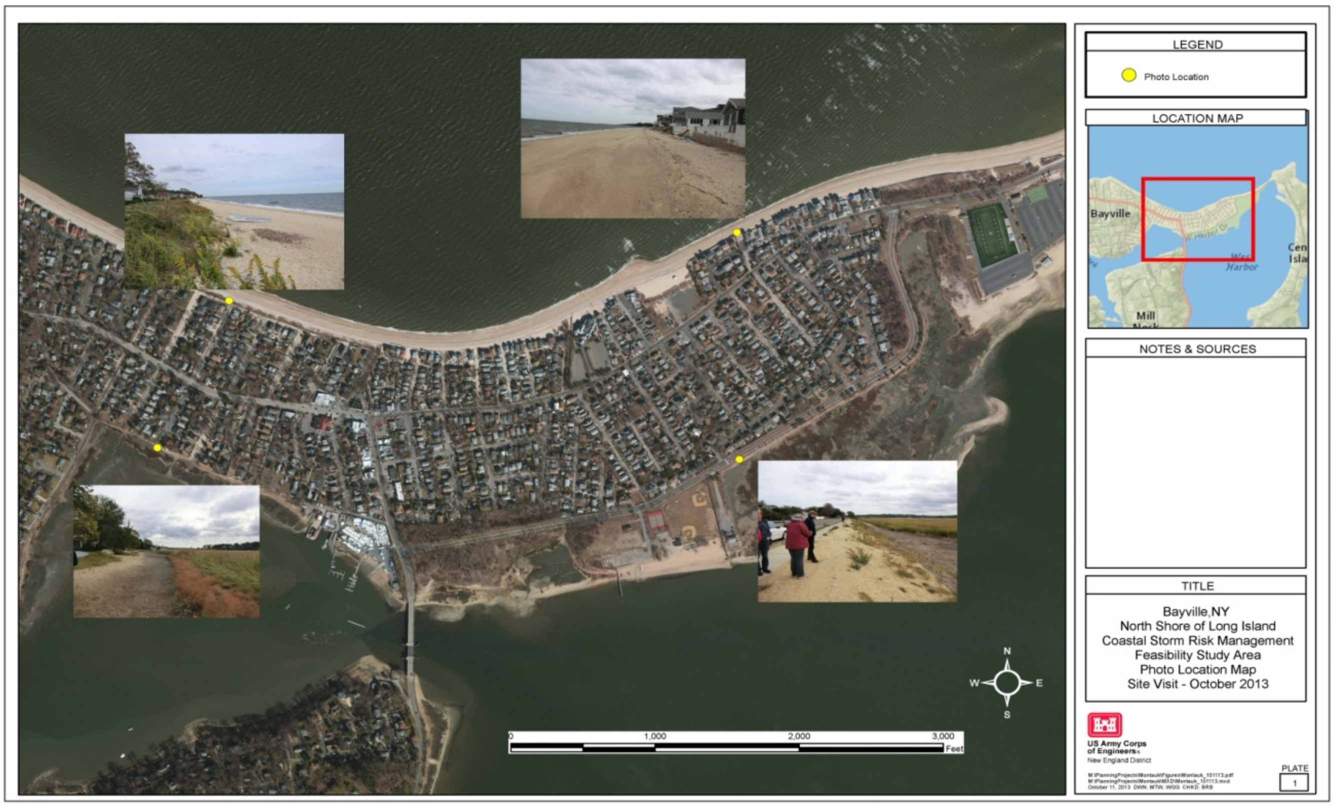

Figure 1. Bayville, Nassau County, New York

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. This feasibility report will: (1) summarize the current and potential water resource problems, needs, and opportunities for coastal storm risk management in Bayville; (2) present and discuss the results of the plan formulation for water resource management solutions; (3) identify specific details of the Tentatively Selected Plan (TSP), including inherent risks and (4) determine the extent of Federal interest and local support for the plan.

1.2 Purpose and Need for Action*

The purpose of the Study is to determine if there is an economically justified and environmentally compliant recommendation for Federal participation in coastal storm risk management for the Bayville Study area. The Study is needed due to the fact that Bayville is low-lying and is highly susceptible to the effects of coastal storms within Long Island Sound. Bayville has experienced coastal storm damage due to Hurricane Irene (2011), Tropical Storm Lee (2011), and Hurricane Sandy (2012). The majority of damage was the direct result of inundation; however, the Bayville is also susceptible to damages caused by wave attack and beach erosion as evidenced by the effects of the powerful nor'easter of December 1992.

1.3 Study Authority

The Bayville Study was authorized by a resolution of the Committee on Public Works and Transportation of the U.S. House of Representatives adopted May 13, 1993:

> *"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives that the Secretary of the Army, acting through the Chief of Engineers, is requested to review the report of the Chief of Engineers on the North Shore of Long Island, Nassau County, New York, published as House Document 198, Ninety-second Congress, Second Session, and other pertinent reports to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of beach erosion control, storm damage reduction and related purposes, on the North Shore of Long Island, New York, particularly in and adjacent to the communities."*

1.4 The Planning Process

In compliance with the USACE planning process, this draft Integrated Feasibility Report and Environmental Assessment is being released for concurrent public and agency technical review by USACE of the TSP. For the TSP, the Study team has evaluated an array of alternatives to arrive at a general description of the TSP (type of action - nonstructural treatments such as house elevations, relocations, etc. vs. floodwalls vs. road raising), with the exact details to be determined in a process called optimization. Optimization of the TSP happens after comments from public review and agency review are received and incorporated into the draft report package. Through optimization, the TSP becomes the Recommended Plan. Following final rounds of agency reviews, the Study team will prepare a Final Integrated Feasibility Report to present the Recommended Plan.

1.5 National Environmental Policy Act Requirements

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

An 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;

- 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.

1.6 Prior Studies, Reports, and Existing Water Projects

There are no existing USACE coastal storm risk management or Federal navigation projects within the Bayville Study area. Prior reports that have been prepared documenting conditions along the north shore of Long Island Sound and the Bayville Study area are:

- *New York Department of State, 2014, Village of Bayville: New York Rising Community Reconstruction Plan*. The Village of Bayville NYRCR Plan was developed in response to Hurricane Irene, Tropical Storm Lee, and Hurricane Sandy in order to assess storm damage, and identify critical issues within the community. The NYRCR Planning Committee inventoried critical assets in the community and assessed the assets' exposure to risk. On the basis of this work, the Planning Committee described recovery and resiliency needs and identified opportunities. The Planning Committee then developed a series of comprehensive reconstruction and resiliency strategies and identified projects and implementation actions to help fulfill those strategies.
- *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 Oyster Bay 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 the Bayville, NY 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.

1.7 Study Area

Bayville is a low-lying community located on the north shore of Long Island in Nassau County within the Town of Oyster Bay (Figure 1). The northern shoreline within the Study area is a fully developed, mostly private gated beachfront community. The north shore beachfront is approximately 1.5 miles facing Long Island Sound with beach widths ranging from 100 to 200 feet. The majority of the beachfront properties are built behind concrete bulkheads and the rest are behind dunes. Bayville Avenue is the only major road connecting Centre Island located to the east of Bayville. The community located between Bayville Avenue and the southern bay front is generally a low-lying residential area with a recreational beach area and a small boat launch along Oyster Bay. The terrain is largely hilly in the western portion of the village due to its position on the Harbor Hill terminal moraine. An evacuation shelter is located in this area on School Street, as is the village town hall and a church. In this western portion of Bayville, the elevations exceed 100 feet above sea level.

1.7.1 Planning Reaches

The Study area shoreline was divided into eight reaches for plan formulation, based on shoreline characteristics and orientation. From west to east, reaches 1, 2, 3, 3a, 4 and 5 follow the Long Island Sound shoreline along the northern edge of the Study area. To the south along the Oyster Bay shoreline two additional reaches were analyzed. The planning reaches are described in more detail in Chapter 3, "Plan Formulation."

1.7.2 Project Area

The project area is the area in which measures will likely be built. Because the TSP is primarily a structural plan, the project area encompasses only the portion of the study area that is within the lowest elevation areas encompassing the eastern end of Bayville.

1.8 Non-Federal Sponsor

The non-Federal Sponsor for the Study is the New York State Department of Environmental Conservation (NYSDEC). Bayville is an active participant in the Study and is a local sponsor partnering with NYSDEC per a signed agreement between Bayville and NYSDEC. The Study will be completed with funds authorized by the Disaster Relief Appropriation Act of 2013 (PL 113-2) at full Federal expense.

Chapter 2: Existing Conditions*

Existing conditions, which serve as the basis for the characterization of problem identification and projection of future without project conditions, are described in this section. Existing conditions are described through the environmental setting, the built environment, and the human environment. Details from the Hurricane and Storm Damage Reduction at Bayville, Nassau County, New York, Environmental Scoping Document (USACE New York District, 2002) helped to inform the existing conditions of this report. For an explanation of how USACE describes storms and flood levels, see Section 2.4 (Describing Storms and Flood Levels).

2.1 Existing Conditions Affected Environment

This description of the environment to be affected within existing 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 draft integrated report. The Study area encompasses beach, dune, marine, estuarine marsh, maritime scrub-shrub and marine woodland habitat as detailed in the following sections.

2.1.1 Land Use, Geology, Topography and Soils

2.1.1.1 Land Use
Bayville's terrain is largely rolling and hilly, especially in the western portion of the Village, due to its position on the Harbor Hill terminal moraine. The portion of Bayville to the east of Washington Avenue, and the extreme western end, are low-lying. Land use in Bayville is primarily residential. There are limited areas of open space, mostly in public parkland. A number of marine commercial uses are present along the southerly shoreline of Bayville, primarily in the vicinity of Bayville Bridge. A business district of commercial use buildings runs from the intersection of Ludlam Avenue and Bayville Avenue (NYSDOS 2003).

Bayville has three residents-only beaches: Mill Neck Creek, with a boat launch and dock; West Harbor Beach, with a boat launch and swimming beach on Oyster Bay Harbor; and the Sound Side Beach on the Sound. Visitors can use Centre Island Beach to the east and Charles E. Ransom Beach at the west end of the village; both are Town of Oyster Bay facilities (Fischler 2011).

Despite its close proximity to New York City and the more densely developed surrounding areas of western Long Island, much of the Oyster Bay/Cold Spring Harbor Complex watershed consists of low density residential development, recreational facilities, and open space. Bayville and the hamlets of Oyster Bay, East Norwich, and Cold Spring Harbor have areas of higher density residential development, while commercial and industrial facilities are concentrated in Oyster Bay hamlet, Bayville, and on the eastern shore of Cold Spring Harbor. Waterfront land uses include public recreational facilities and residential waterfront properties. The following lists the make-up of Bayville's land use (Cashin Associates P.C. 2002):

- 80% residential
- 10% open space
- 7% transportation
- 2% commercial
- 1% former industrial

Of the 2,651 housing units within Bayville, 2,458 units are occupied year round (U.S. Census 2010). In 2010 Bayville had a population of 6,669 and a population density of 4,400 persons per square mile. Bayville is essentially fully developed at the present time, with very limited future development potential.

2.1.1.2 Subsurface Geology
Bayville is underlain by approximately 400 ft of unconsolidated and relatively soft geologic material of Cretaceous and Pleistocene age. These deposits rest of hard, dense crystalline bedrock. The unconsolidated deposits are the main source of groundwater for Bayville and elsewhere on Long Island. At the base of the unconsolidated section is the formation known as the Lloyd Member of the Raritan Formation. The Lloyd Aquifer is on the order of 100 ft thick in Bayville and is moderately permeable. The aquifer serves as the source of public water for Bayville (NYSDOS 2003).

The principal geologic units in Bayville, from the surface downward are: glacial deposits, undifferentiated clay deposits (the Magothy formation, which generally is found in this position in the sediment column on Long Island, is not present in Bayville), and Lloyd sand member (this unit is about 100 ft thick and is moderately permeable). Studies of the geologic history of this area show that Bayville has a very complex geologic formation that is not comparable to other units on Long Island (NYSDOS 2003).

2.1.1.3 Surface Geology and Topography

The low-lying eastern end of Bayville is a relatively flat surface with generally no elevation above +12 ft North Atlantic Vertical Datum of 1988 (NAVD88) and comprised of a tombolo, which is a sandy strip of land that joins an island to the mainland. The Bayville tombolo is approximately 1.5 miles in length, between Centre Island and the more elevated Western portion of Bayville, and ranges from 1,500 to 2,000 ft in length. The more elevated area at the western end of Bayville historically has been called Oak Neck. This area is roughly circular and is slightly less than one mile in area. The highest elevation is approximately +150 feet (NAVD88) above mean sea level. The topography of this area is hilly, and has a number of overlooks and discontinuous bluffs (NYSDOS 2003).

The north shore beach facing Long Island Sound in Bayville is approximately 1.5 miles in length, with widths ranging from 100 to 200 feet. On the bayside tidal wetlands predominate in the sheltered harbor areas, particularly in Oyster Bay and along the edges of Mill Neck Creek reaching up to Mill Neck Preserve. Tidal marsh soils are made up of partially decomposed herbaceous organic material laid over glaciofluvial deposits and/or sandy marine deposits (NRCS 2013). The Oyster Bay Harbor shoreline of Bayville is bordered primarily by natural and man-made beaches. Figure 2 shows these natural shoreline features.

The surface geology of Bayville reflects the recent geologic origins and history of the area. The tombolo is mapped and characterized as a well-graded sandy deposit that was transported and deposited by long-shore currents in Long Island Sound. The Oak Neck upland was formed from unsorted materials that were pushed ahead of the advancing glacier and were left behind when the ice sheet receded.

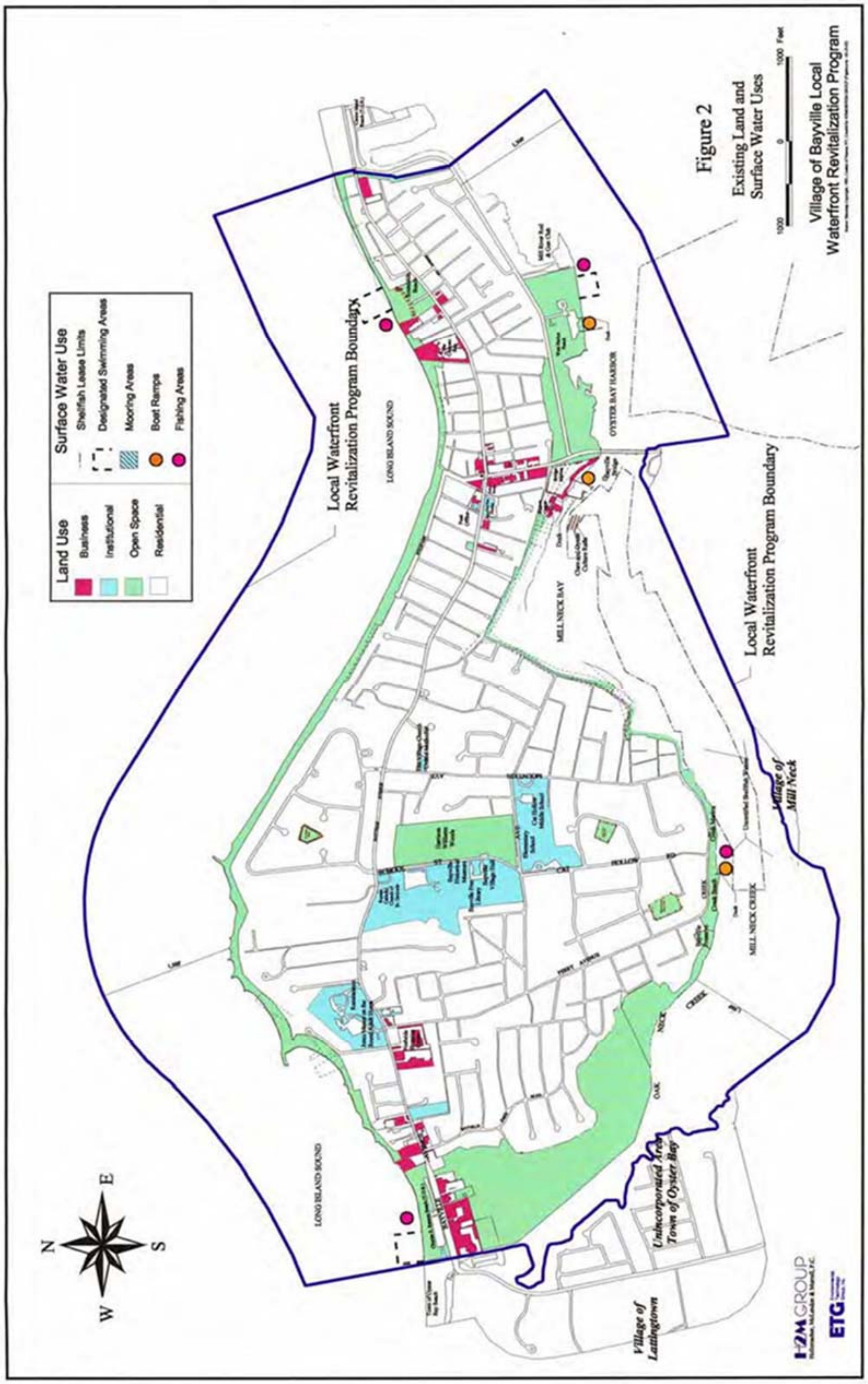

Figure 2. Land and Surface Water Use in Bayville, NY

2.1.1.4 Soils

In general, the soils in Bayville reflect the nature of the geologic deposits from which they were derived. Soils that have formed on the tombolo are generally very rapidly draining, coarse in texture, and are not very rich in organic content. Because of this poor fertility, this area does not support abundant plant life. Upland soils in the Oak Neck area (elevated western portion of Bayville) generally contain Riverhead and Plymouth soils that are well drained to excessively drained, and are rich in organic matter. These characteristics allow the soils to support an abundance of natural vegetation. The organic and tidal marsh soils present in the tidal estuary areas of Mill Neck and Oak Neck Creeks are poorly drained and dense; they are generally classified as Ipswich soils (NRCS 2013). Beach soils were formed by the beach building processes along the land-water interface.

2.1.2 Water Resources

2.1.2.1 Groundwater Resources

Groundwater occurs in two zones in Bayville. Currently, the sole source of potable water for municipal use is the Lloyd aquifer. The second zone occurs in the Glacial aquifer, but use was discontinued due to saltwater intrusion. Available information regarding water levels in Lloyd aquifer wells shows no significant trend or decline in response to pumping in recent years. Long-term monitoring shoes a net decline in the hydrostatic head of approximately ten feet since the beginning of the century (NYSDOS 2003).

2.1.2.2 Surface Water

The surface waters in the Study area are mainly salty and brackish. The water bodies in the Study area include Mill Neck Creek, Mill Neck Bay, Oak Neck Creek, Oyster Bay Harbor, and Long Island Sound. Although there are no significant freshwater bodies within Bayville, freshwater drainage from watersheds located to the south of the Study area have had significant impact in the quality of waters that surround Bayville. This drainage system includes the 479-acre Oak Neck watershed, 459-acre Factory Pond watershed, Kentruck Pond and the 2,715-acre Shu Swamp, and the Beaver Lake/Beaver Book watershed (NYSDOS 2003).

The Bayville-Centre Island watershed is 830 acres in size. It affects the water quality of Long Island Sound to the north, and Oyster Bay Harbor and its tributaries to the south. The major water quality problems for these surface waters are caused by contaminant loadings contributed by stormwater runoff, malfunctioning on-lot sanitary systems (i.e. septic systems), and other non-point pollution sources. A large portion of the watershed drains to surrounding surface waters through numerous outfalls and as overland flow. Recharge basins are used in Bayville to recharge collected stormwater back to the groundwater system. However, these recharge basins are unable to handle the large volume of stormwater during extreme rainfall events, and ultimately discharge stormwater to surface waters. Uncontrolled stormwater runoff from impervious surfaces is a significant source of potential impacts to surface waters within the harbor complex watershed, groundwater supplies, benthic habitat, and the water quality of the harbor complex itself.

Bayville is on a regulated Municipal Separate Storm Sewer System (MS4), which is a conveyance that is (1) owned by a state, city, town, village or other public entity that discharges to waters of the U.S; (2) designed or used to collect or convey stormwater; (3) not a combined sewer; and (4) not part of a Publicly Owned Treatment Works (sewage treatment plant). The NYSDEC State Pollutant Discharge Elimination System (SPDES) General Permit for MS4 requires municipalities (which includes Bayville) in the Oyster Bay/Cold Spring Harbor watershed to meet pathogen reduction targets for their regulated MS4s.

Through stormwater management programs and other planning initiatives, Bayville and other Oyster Bay/Cold Spring Harbor watershed municipalities have developed and implemented a variety of Best Management Practices (BMPs) to address stormwater quality and quantity issues associated with land development and redevelopment projects. The municipalities have also begun to address historical development and nonpoint source pollution impacts in the watershed; however, stormwater runoff continues to be a significant threat to water quality and overall health of the Oyster Bay/Cold Spring Harbor Complex and its watershed (Friends of the Bay 2011).

Surface water quality in Oyster Bay and Mill Neck Creek are classified as SA by the NYSDEC. SA marine water classification means that the saline surface waters are suitable for shellfishing, primary and secondary contact recreation and fishing, and fish propagation and survival. However, certain areas in these waters do not comply with SA criteria for all or part of the year. In particular, the entire area within West Neck Creek and Oak Neck Creek generally fails to satisfy the shellfish harvesting standards, and is therefore uncertified for shellfishing. A small part of Oyster Bay Harbor, just east of the Bayville Bridge, is available for seasonal harvesting between November 1 and April 30 each year. Water quality is monitored in the area by a local community organization in cooperation with NYSDEC and Nassau County. Long Island Sound waters adjacent to Bayville are open year-round for shellfishing without seasonal or conditional restrictions (NYSDOS 2003).

Water depths in Oyster Bay and Cold Spring Harbor range from 6 to 30 ft below mean low water (with depths of 30 to 60 ft between Centre Island and Cove Neck and 70 ft near Whitewood Point). The tidal range in Oyster Bay and Mill Neck Creek is approximately 7.4 feet to 8.5 feet (NYSDOS et al. 1997) which is sufficient to flush the Oyster Bay Harbor system and prevent dissolved oxygen deficiencies (NYSDOS 2003). The salinity in Oyster Bay and Cold Spring Harbor generally ranges from 15 ppt to 18.5 ppt. Temperature for Oyster Bay and Cold Spring Harbor ranges from 4.2 – 23.4°C with an average of 13.2°C (Global Sea Temperature 2015).

2.1.2.3 Wetlands

There are no designated freshwater wetlands in Bayville. However, tidal wetlands are abundant along the shoreline and a portion of the project area lies within and adjacent to tidal wetlands (salt marsh) on the Oyster Bay side. The NYSDEC-designated Significant Coastal Fish and Wildlife Habitats (SCFWH) in Mill Neck Creek consists of approximately 700 acres of open tidal waters, tidal marshes and creeks, mudflats and wooded freshwater swamps. The fish and wildlife habitat areas that are associated with Mill Neck Creek include Oak Neck Creek, Bayville Brook, and Beaver Brook.

The network of tidal creeks and salt marshes that make up much of Mill Neck Creek provide a unique and valuable habitat to a variety of species. This area is composed of a combination of high salt marsh, low salt marsh, intertidal mudflat communities and sub-tidal areas. Each of these communities is a part of the larger coastal marsh ecosystem – one transitioning to another – forming a mosaic with adjacent communities.

Many of the plants found in tidal wetlands are able to absorb deleterious chemicals, removing them from the water column. Tidal wetlands trap fine particles, thereby preventing sediment transportation into the open waters of bays and harbors. They also serve to stabilize shorelines by preventing erosion of the underlying sediments. Tidal wetlands are especially important in coastal storm events as they serve as a buffer from damaging waves and wind while helping to absorb rainfall and stormwater runoff.

2.1.3 Area Designation

The environment of the Study area, including the waters and substrate of Long Island Sound and Oyster Bay Harbor, beach habitat, tidal flats, and salt marshes; supports a diverse and valuable ecological network of fauna and flora. The project area has received recognition for its unique and high quality natural resources, and has been designated by State and Federal resource agencies as a significant resource. The New York State Department of State (NYSDOS) has designated the Oyster Bay-Cold Spring Harbor area as an "Outstanding Natural Coastal Area." Mill Neck Creek Wetlands and Oyster Bay Cove have been designated as "Significant Coastal Fish and Wildlife Habitats" under New York State Executive Law, Article 42. Bayville is bordered by the Long Island Sound, an "Estuary of National Significance" to the north and the Oyster Bay National Wildlife Refuge (OBNWR) to the south. The OBNWR is administered by the U.S. Fish and Wildlife Service (USFWS) and is part of the Long Island National Wildlife Refuge Complex. The Study area lies within the Three Harbors Significant Coastal Habitat identified by the USFWS's Northeast Coastal Areas Study (USFWS 1992). Figure 3 displays the boundaries of the OBNWR and the Study area.

Oyster Bay NWR is the largest refuge in the Long Island National Wildlife Refuge Complex. The Refuge consists of 3,209 acres of bay bottom, saltmarsh, and a small freshwater wetland. Nationally, Oyster Bay NWR is one of the few bay bottom Refuges owned and managed by the U.S. Fish and Wildlife Service. Oyster Bay is the largest refuge in the Long Island National Wildlife Refuge Complex and receives the most public use of all the refuges. Management activities include wetland restoration and protection of the natural shoreline and vegetation. Fishing (Town of Oyster Bay permits required for shellfishing), wildlife observation, photography and environmental education are approved recreational uses on the refuge (NYSDOS 2003).

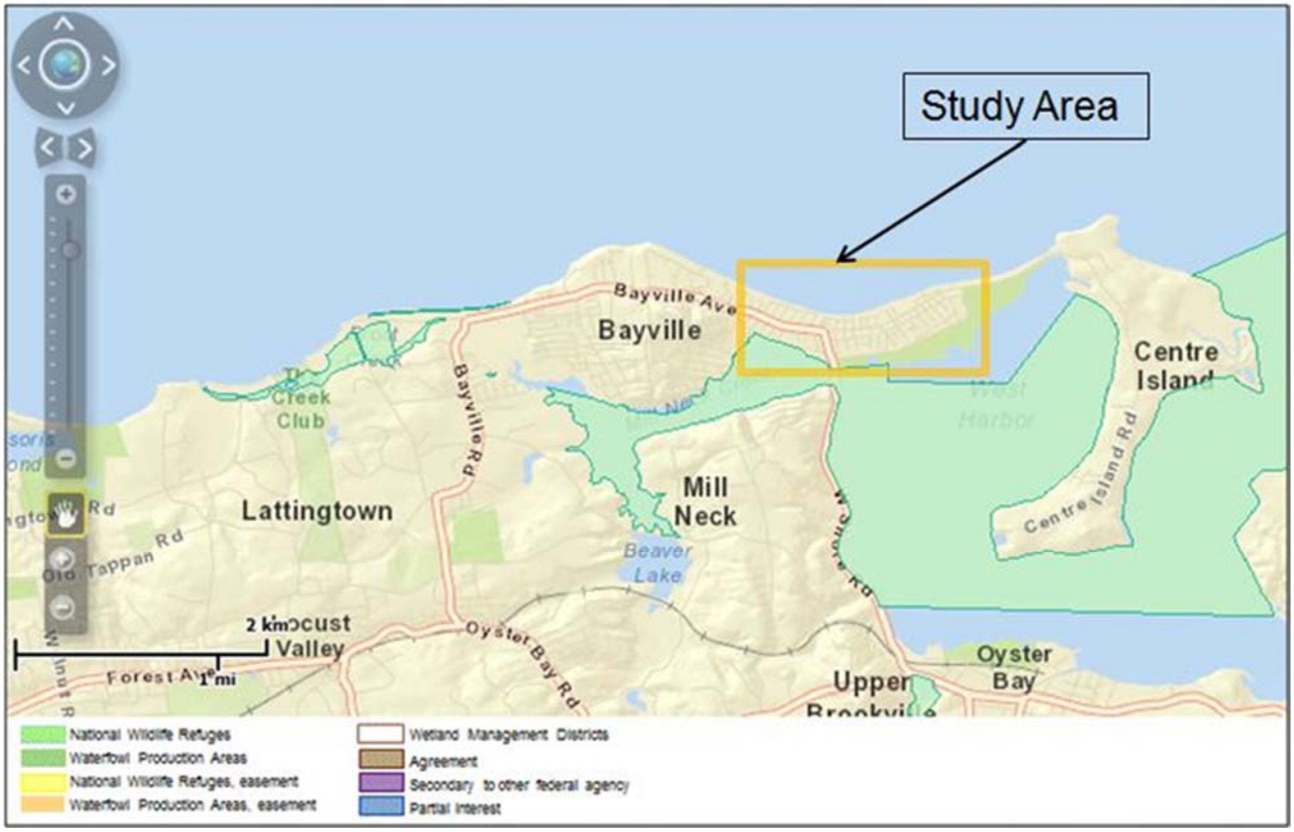

Figure 3. Oyster Bay National Wildlife Refuge and the Study Area

2.1.4 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). All three factors interact in a dynamic process, which defines the coastal zone area.

Anthropogenic influences often supplement the natural forces, and play significant roles in shaping the coastal zone. As shorelines retreat due to long shore 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 2000b). Most of Long Island was formed during the Pleistocene Age. The major topographic features of Long Island are the plateaus of the north shore, which are glacial moraines, and the sloping plains of the southern portion of the island (Gross et al 1972). The north shore harbors and bays are in locations of former valleys of the north-draining streams of Cretaceous time. Manhasset formation covered Cretaceous rocks, and later on, the area was covered by Wisconsin drift and till. On the north shore, bays and harbors alternate with peninsulas and necks that are backed in some areas by fresh cliffs or bluffs of the shore scarp. The material of the necks and bluffs has eroded over time and has been deposited as spits (e.g. West Beach on Eatons Neck), baymouth bars, and tombolos (sand bars such as Asharoken Beach which connect offshore islands to the mainland) (Davies 1972).

2.1.5 Vegetation

2.1.5.1 Upland

Bayville comprises built residential landscape, beach landscape of Bayville's coast along the Long Island Sound, and a salt marsh plant community and intertidal mudflat landscape along Bayville's bayfront with Oyster Bay, West Harbor, and Mill Neck Bay. Bayville's Long Island Sound shoreline is a sand and cobble beach with coastal vegetation patches dotting the beach. The low sand dune and beach area of the western end of the project area supports the greatest extent of coastal dune plant growth in the Study area. A New York District biologist surveyed the vegetation in this area in September 2001.[1] The following plants were observed: sea rocket (*Cakile edentula*), seaside spurge (*Chamaesyce polygonifolia*), common saltwort (*Salsola kali*), common cocklebur (*Xanthium strumarium*), bouncing bet (*Saponaria officinalis*), jimsonweed (*Datura stramonium*), seaside goldenrod (*Solidago sempervirens*), sea chickweed (*Honckenya peploides*), flatsedge (*Cyperus retrorsus*), dusty miller (*Artemisia stelleriana*), sheep sorrel (*Rumex acetosella*), halberd-leaved orach (*Atriplex patula*), wild radish (*Raphanus raphanistrum*), American beach grass (*Ammophila breviligulata*), ragweed (*Ambrosia artemisiifolia*), common evening primrose (*Oenothera biennis*), beach pea (*Lathyrus japonicus*), mugwort (*Artemisia vulgaris*), dandelion (*Taraxacum officinale*), salt spray rose (*Rosa rugosa*), Virginia creeper (*Parthenocissus quinquefolia*), black jack oak (*Quercus marilandica*), hedge bindweed (*Calystegia sepium*), field pennycress (*Thlaspi arvense*), prickly pear (*Opuntia drummondii*), and pitch pine (*Pinus rigida*). The dune, located within the Bayville Soundside Beach property, was observed to be predominantly vegetated by beach grass.

Red maple (*Acer rubrum*) swamps are common and relatively well-developed in the Study area. Upland forests range from rich deciduous slope forests of tulip poplar (*Liriodendron tulipifera*), red oak (*Quercus rubra*), and spicebush (*Lindera benzoin*) to dry morainal woodlands of chestnut oak (*Quercus prinus*) and mountain laurel (*Kalmia latifolia*) (USFWS 1992).

2.1.5.2 Tidal Wetlands

Saltmarshes are dominated by grasses and other marsh plants which are adapted to saturated soil concentrations, saltwater, and the rise and fall of the tide. In general, tidal wetlands form in low energy environments that are sheltered from direct wave action. Soil salt content ranges from approximately 18 to 30 parts per thousand (PPT) (Long Island Sound Study 2003). Tidal marshes are normally categorized into two distinct zones, the lower (intertidal) marsh, and the upper (high) marsh. In saline tidal marshes such as Bayville, the lower marsh is normally covered and exposed daily by the tide. It is predominantly vegetated by the tall form of Smooth Cordgrass (*Spartina alterniflora*). The upper marsh area is covered by water sporadically and is characterized by salt hay (*Spartina patens*), salt grass (*Distichilis spicata*), black grass (*Juncus gerardii*), and salt marsh bulrush (*Scirpus robustus*).

Saltwater cordgrass (*Spartina alterniflora*) and saltmeadow cordgrass (saltmeadow hay; *S. patens*) comprises the saltmarsh community of Bayville's border with Oyster Bay, although total acreage is not very extensive. The fringe of this estuarine marsh is vegetated by common reed (*Phragmites australis*), marsh elder (*Iva frutescens*), cattails (*Typha spp*.), and cordgrass (*Spartina spp*.). A small amount of robust emergent marsh occurs in OBNWR.

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[1] The 2001 survey was deemed adequate because the plant assemblage listed here are typical of a sandy, marine environment, and unlikely to have changed since then.

The OBNWR borders the project area and consists of 3,204 acres of bay bottom, salt marsh, and a small freshwater wetland. It is managed principally for use by migratory waterfowl and other waterbirds. The vegetation found in OBNWR is typical of saltmarsh assemblages found along the Northeast Atlantic coast. Bay bottom comprises 78% of the Refuge; unconsolidated shoreline is 3%; Saltmarsh cordgrass (*Spartina alterniflora*) fringe along the shore accounts for 5%; another 5% includes high marsh habitat with salt meadow hay and saltgrass (*S. patens/Distichlis spicata*) at the west end of the harbor; and an estuarine stream bed, approximately 9%, makes up the remainder (USFWS 2013).

2.1.6 Fish and Wildlife

2.1.6.1 Finfish

Tidal wetlands in the project area provide critical spawning and nursery habitat for a wide variety of fish species. These species, in turn, are important prey for valuable commercial and recreational fish species such as striped bass (*Morone saxatilis*), blue fish (*Pomatomus saltatrix*), and winter flounder (*Pleuronectes americanus*). Fish species found in the creeks and ditches running throughout the marsh include common mummichog (*Fundulus heteroclitus*), striped killfish (*Fundulus majalis*), sheepshead minnow (*Cyprinodon variegatus*), American eel (*Anguilla rostrata*), Atlantic silverside (*Menidia menidia*), and young-of-year winter flounder (Long Island Sound Study 2003).

The NYSDOS identifies Oyster Bay Harbor as a significant nursing and feeding habitat for striped bass, scup, summer flounder, bluefish, Atlantic silverside, menhaden, winter flounder, and blackfish during the months of April through November (NYSDOS 2005).

Oyster Bay offers fisherman shallow and deep habitat, as well as protected coves and lengths of unbroken shoreline, making it a big draw for fly fisherman looking for striped bass in spring and fall and bluefish in summer. Recreational fishing occurs from recreational boats launched at local ramps or marinas and from local beaches. Varieties of fish typically caught in the Oyster Bay Complex include striped bass, snapper, bluefish, fluke, flounder, weakfish, blackfish, and eel (NYSDOS 2003). Commercial fishing is prohibited in the OBNWR, which covers approximately 80% of Oyster Bay.

In the western end of Long Island Sound, recreational fishing for species like bluefish, weakfish, black sea bass, fluke and winter flounder takes place year-round. Striped bass are the number one game fish in the area. Striped bass enter the Sound on a spawning run in spring, which often begins as early as February, and provide fishing throughout the summer and fall with the best months being April and May.

2.1.6.2 Invertebrate and Benthic Resources

The invertebrate animal communities found among the salt marsh plants include crabs, snails, shrimp, mussels, insects, and spiders (Olmstead and Fell 1974). Fiddler crab (*Uca pugnax*), ribbed mussel (*Geukensia demissa*), mud crab (*Panopeus herbstii*), hard clam (*Mercenaria mercenaria*), periwinkle snail (*Littorina sp.*), and soft-shelled clam (*Mya arenaria*) are typical residents of the tidal flats and intertidal marsh areas of Oyster Bay. The sediment of the bay and sound support a variety of infauna and inflora, living within the sediment, and epifauna and epiflora, living on the surface of the sediment (NYSDOS et al. 1997). Coarse sands, rocks and cobble substrates support communities of bivalves, including oysters (*Crassostrea virginica*), scallops (*Argopecten irradians*) and clams; as well as sponges, bryozoans, tunicates and infaunal worms. Muddy bottoms support both filter feeding bivalves and annelid worms.

Benthos is the complex community of plants and animals that live on or in bottom sediments of oceans, bays, streams, and wetlands. Crustaceans of the benthic habitat of the bay and sound include hermit crab (*Pagurus sp*.), blue crab (*Callinectes sapidus*), lobster (*Homarus americanus*), green crab (*Carcinus maenas*), spider crab (*Libinia sp*.), Jonah crab (*Cancer borealis*), rock crab (*Cancer irroratus*), lady crab (*Ovalipes ocellatus*), and mantis shrimp (*Squilla empusa*). Other macroinvertebrates of the benthic community include horseshoe crab (*Limulus polyphemus*), gastropods, such as whelk (*Buccinum sp*.) and oyster drill (*Urosalpinx cinerea*), and polychaete worms.

The invertebrate populations of the benthos are important foraging sources for marine and estuarine fish. Invertebrates of the swash zone of the sound and those found within the abundant wrack material washed ashore on the beach areas of Bayville provide a valuable food source to shorebirds. Amphipods are important species of the wrack material consumed by shorebirds and some songbirds.

In fall 2003 and spring 2004 benthic samples were taken from Bayville beach locations by the USACE New York District.[2] Four transects were run perpendicular to the shoreline along the Long Island Sound shore beach. One transect was located near the Soundside Beach Park and the second transect was located at the end of Madison Avenue. At each transect, three replicate samplers were collected beginning at Mean Low Water (MLW) (0m) and at +1m and -1m intervals with a 7.5 cm PVC coring tube to a depth of 10-15 cm (USACE 2005).

Results showed that the fall 2003 macroinvertebrate species richness was limited to 4 phyla and 18 taxa. The spring 2004 data was found to be more diverse with 7 phyla consisting of 26 taxa. The macroinvertebrate abundance was significantly lower in the fall 2003 versus spring 2004 (679 individuals versus 1,976 individuals). In both the fall 2003 and spring 2004, annelids were the most abundant (77.4% and 72.6% respectively). Other significantly abundant phyla in fall 2003 were Mollusca (7.5%) and nematoda (6.4%; and nematoda (19.1%) for spring 2004 (USACE 2005).

2.1.6.3 Shellfish

The Oyster Bay/Cold Spring Harbor Complex provides 90% of New York's oyster harvest and 33% of New York's clam harvest. The coastal waters within the water body are a productive commercial shellfish growing area, particularly for oysters and hard clams. The Town of Oyster Bay's Bay Management Program in cooperation with the North Oyster Bay Baymen's Association has seeded 30.8 million clams since 1999 and roughly 2 million oysters since 2005 (Oyster Bay/Cold Spring Harbor Protection Committee 2015).

Oyster Bay supports the oldest and largest commercial oyster and clam farm aquaculture operation remaining on Long Island. Frank M. Flowers and Sons have been farming oysters and clams in the bay since 1887 and now cultivate more than 1,800 leased underwater acres in Oyster Bay Harbor (Novick 2014). Peak oyster season in Oyster Bay runs from September through March.

[2] The 2003/2004 samples were deemed adequate as representative of a benthic community in a disturbed, intertidal, sandy environment. A newer survey is more than likely to show the same results.

However, in recent years the oyster population in the bay has been depleted by pollution, overfishing, and damaged by coastal storms like Hurricane Sandy.

Oyster Bay Harbor is also used for the harvesting of clams and lobsters by independent commercial baymen and lobstermen. Sites on the waterfront for baymen to access the commercial fishery resource (i.e., vessel mooring areas, and facilities to load equipment and unload product) are considered to be an important component of the Bayville waterfront. Bayville contains an ample number of such sites, both private and public, for these purposes. Presently, there are several locations throughout the area from which commercial fishermen can access their vessels, including: Frank M. Flower and Sons, Inc. (oysters and clams), the Bridge Marina (lobsters and clams), Creek Beach (clams), and West Harbor Beach (clams) (NYSDOS 2003).

2.1.6.4 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 Long Island Sound shoreline project area because of the high salinity resulting from sea spray. However, the salt marsh on the Oyster Bay side likely provides habitat for several species of toad (the American toad and the Fowlers toad) and frogs in areas of higher elevation. This area of the marsh may also provide foraging habitat for common snakes, including garter and water snakes. The common snapping turtle may occupy any open water areas of the marsh as well. In addition, Northern diamondback terrapin (*Malaclemys terrapin terrapin*) are commonly found within the salt marshes and tidal creeks of the OBNWR, particularly in the Frost and Mill Neck Creek sections. The Refuge is considered to have one of the largest populations of diamondback terrapin on Long Island (USFWS 2015).

2.1.6.5 Birds

NYSDOS has singled out OBNWR as having the greatest waterfowl concentration on Long Island's north shore. More than 126 bird species have been documented at the Refuge, including 23 species of waterfowl. The Oyster Bay/Cold Spring Harbor complex serves as an important wintering area for waterfowl from November through March and also serves as a migration stop-over for several waterfowl species during the months of March-April and October-November.

NYSDOS mid-winter aerial surveys of waterfowl abundance in the OBNWR for the ten-year period 1975-1984 indicated average concentrations of nearly 1,600 birds in the bay each year (6,380 in peak year), including approximately 1,350 scaup (*Aythya sp.*) (6,230 in peak year), along with lesser numbers of mallard (*Anas platyrhyncos*), Canada goose (*Branta canadensis*), bufflehead (*Bucephala albeola*), oldsquaw (*Clangula hyemalis*), common goldeneye (*Bucephala clangula*), and red-breasted merganser (*Mergus serrator*) (NYSDOS 2005). Use of the bay by wintering waterfowl is influenced in part by the extent of ice cover so there is yearly variability on which and how many of a species will utilize the Refuge. The most common waterfowl species using the Refuge in winter include greater scaup, bufflehead, and black duck. The three species comprise approximately 85 percent of all ducks using the Refuge (USFWS 2015).

The most common waterbird on the Refuge is the double-crested cormorant. They are seen year-round on the Refuge. Cormorant numbers are highest from April through October. Great cormorants occur at a low level during the winter months. Other waterbirds which use the Refuge include common loon, red-throated loon, horned grebe, pied-billed grebe, American coot, belted kingfisher, great blue heron, black-crowned night heron, green heron, great egret, and snowy egret. Heron numbers peak in August (USFWS 2015).

Gulls are common on the Refuge. Herring gulls are the most common in winter and decline during the warmer months. Great black-backed gulls are present year-round but occur in lower numbers than herring gulls. Ring-billed gulls are more common in the winter months, but their numbers are lower than herring gulls. Laughing gulls and Bonaparte's gulls use the Refuge in summer and winter, respectively (USFWS 2015).

Certain areas of the OBNWR, like Mill Neck Creek and Frost Creek provide excellent breeding ground for black duck, clapper rail, and osprey. Least terns often forage on schools of baitfish within Oyster Bay. Terns use OBNWR from May through October. Common and least tern use are heaviest from May through August. Forster's terns are present on the Refuge in good numbers during September and October. Suitable maritime beach nesting habitat is limited within the overall habitat area; however, at least one piping plover pair was observed on the beach at Plum Point marsh on Centre Island in 2002. By mid-August 2015, one pair of nesting piping plover had been reported to have fledged four plover chicks that year. The nest location was on the eastern portion of Centre Island and not within the Study area (USFWS 2015).

The U.S. Fish and Wildlife Service maintain an updated list of Birds of Conservation Concern (BCC) under the authority of the Fish and Wildlife Coordination Act (FWCA) of 1980, as amended. The 1988 amendment to the FWCA requires the Secretary of the Interior, through the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." BCC 2008 is the most recent effort by the USFWS to carry out the proactive conservation mandate. BCC identified in the Study area are protected under the Migratory Bird Treaty Act (MBTA), which prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the USFWS. Bald and golden eagles are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). Table 1 shows the BCC list for the New England/Mid-Atlantic Coast (USFWS 2015).

Table 1. Bird Conservation Region (BCR) 30 BCC of New England/Mid-Atlantic Coast 2008 list.

Common Name	**Scientific Name**	**Status**
Red-throated Loon	*Gavia stellate*	(nb)
Pied-billed Grebe	*Podilymbus podiceps*	
Horned Grebe	*Podiceps auritus*	(nb)
American Bittern	*Botaurus lentiginosus*	
Least Bittern	*Ixobrychus exilis*	
Snowy Egret	*Egretta thula*	
Bald Eagle	*Haliaeetus leucocephalus*	(b)
Peregrine Falcon	*Falco peregrinus*	(b)
Black Rail	*Laterallus jamaicensis*	
Wilsons Plover	*Charadrius wilsonia*	
American Oystercatcher	*Haematopus palliatus*	
Solitary Sandpiper	*Tringa solitaria*	(nb)
Lesser Yellowlegs	*Tringa flavipes*	(nb)
Upland Sandpiper	*Bartramia longicauda*	
Whimbrel	*Numenius phaeopus*	(nb)
Hudsonian Godwit	*Limosa haemastica*	(nb)

Common Name	Scientific Name	Status
Marbled Godwit	*Limosa fedoa*	(nb)
Red Knot	*Calidris canutus*	(nb), (a)
Semipalmated Sandpiper	*Calidris pusilla*	(nb)
Buff-breasted Sandpiper	*Calidris subruficollis*	(nb)
Short-billed Dowitcher	*Limnodromus griseus*	(nb)
Seaside Sparrow	*Ammodramus maritimus*	(c)
Rusty Blackbird	*Euphagus carolinus*	(nb)
Purple Sandpiper	*Calidris maritima*	(nb)
Least Tern	*Sternula antillarum*	(c)
Gull-billed Tern	*Gelochelidon nilotica*	
Black Skimmer	*Rynchops niger*	
Short-Eared Owl	*Asio flammeus*	(nb)
Whip-poor-will	*Antrostomus vociferus*	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	
Loggerhead Shrike	*Lanius ludovicianus*	
Brown-headed Nuthatch	*Sitta pusilla*	
Sedge Wren	*Cistothorus platensis*	
Wood Thrush	*Hylocichla mustelina*	
Blue-winged Warbler	*Vermivora cyanoptera*	
Golden-winged Warbler	*Vermivora chrysoptera*	
Prairie Warbler	*Setophaga discolor*	
Cerulean Warbler	*Setophaga cerulea*	
Worm-eating Warbler	*Helmitheros vermivorum*	
Kentucky Warbler	*Geothlypis formosa*	
Henslow's Sparrow	*Ammodramus henslowii*	
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	
Saltmarsh Sharp-tailed Sparrow	*Ammodramus caudacutus*	

(a) indicates ESA candidate, (b) indicates ESA delisted, (c) indicates non-listed subspecies or population of Threatened or Endangered species, (nb) indicates non-breeding in this Bird Conservation Region.

2.1.6.6 Mammals

Site specific studies describing the diversity and abundance of mammals within the Study area are not available. Several small terrestrial mammals potentially utilize the limited landscaped habitat of the residential areas of Bayville. These species include: striped skunk *(Mephitis mephitis*), eastern cottontail (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), and raccoon (*Procyon lotor*). Raccoon, muskrat (*Ondatra zibethicus*), and red fox (*Vulpes vulpes*) potentially forage in the intertidal marsh areas. Harbor seals may be observed at OBNWR during March. Seal use of Long Island has been increasing in the past few years (USFWS 2015).

2.1.7 Federal Threatened and Endangered Species

The following species were identified by the U.S. Fish and Wildlife Service as threatened or endangered resources that may occur in the Study area:

- Piping Plover (*Charadrius melodus*) – Threatened
- Red knot (*Calidris canutus rufa*) – Threatened
- Roseate Tern (*Sterna dougallii dougallii*) – Endangered
- Northern Long-eared Bat (*Myotis septentrionalis*) – Threatened
- Sandplain Gerardia (*Agalinis acuta*) – Endangered
- Seabeach Amaranth (*Amaranthus pumilus*) – Threatened

The piping plover (threatened) is a small species of shorebird which breeds in the northeastern Atlantic coastal region. The bayside at Centre Island Town Park, which is adjacent to the Study area provides breeding habitat for the piping plovers. Plovers 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). 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). Wintering plovers on the Atlantic Coast are generally found at accreting ends of barrier islands, along sandy peninsulas, and near coastal inlets (USFWS 1996).

The red knot (threatened) is a medium-sized shorebird which breeds in the central and northwestern Canadian Arctic. In New York, red knot has been reported from several locations on Long Island (USFWS 2014). Preferred wintering and migration microhabitats are muddy or sandy coastal areas, more specifically, the mouths of bays and estuaries, unimproved tidal inlets and tidal flats (Niles et. al. 2008). The species preferentially feed in microhabitats such as creek mouths and wrack lines and is a specialized molluscivore (Piersma and van Gils 2011). Within the nonbreeding portion of the range, red knot habitat is primarily threatened by the effects of sea level rise, shoreline stabilization, and coastal development (USFWS 2014).

The roseate tern (endangered) is an exclusively marine species of seabird. In North America, the roseate tern typically breeds on small islands in two distinct geographical areas from May to July (USFWS 1998). The northeastern population of birds breeds from North Carolina to Maine and includes several locations on Long Island, mostly in the Towns of East Hampton and Southold. Post breeding adult roseate terns and offspring have been observed feeding in the northeastern Atlantic as late as August. Roseate terns feed primarily on marine fish. Studies of tern colonies in Stratton Island, Maine, indicate that adult roseate terns fed young a diet restricted to sand lance (*Ammodytes spp*.) over a one-year period (Shealer and Kress 1994).

The northern long-eared bat (threatened) is a medium-sized bat found across much of the eastern and north central United States. White Nose Syndrome is responsible for much of the species' recent population decline. Northern long-eared bat typically winters in caves and abandoned mines. There are approximately 90 hibernacula known to occur across the state (USFWS 2015). During the summer months, literature indicates northern long-eared bat prefers decaying hardwood snags for roosting (Menzel et al. 2002). However, northern long-eared bats have been observed roosting in a wide variety of tree species including softwood species. Other roosting habitat includes human made structures such as buildings, utility poles, and barns (USFWS 2015).

Federal and State designated endangered and threatened species known to use OBNWR include the bald eagle; peregrine falcon; osprey; northern harrier; least tern; and Kemp's ridley and loggerhead sea turtles. Peregrine falcons typically migrate through OBNWR during the autumn and spring. Bald eagles sporadically visit the Refuge during winter migration. Ospreys nest on the Refuge and have successfully raised young. Northern harriers are observed during spring and autumn migration at the Refuge. Atlantic loggerhead and Kemp's ridley sea turtles are known to forage in Oyster Bay; however, sightings of the turtles are rare and on those occasions, they are usually victims of an injury or cold stun (USFWS 2015).

There is no designated critical habitat for any of the listed species in the project area. Coordination with the USFWS and NMFS pursuant to Section 7 of the Endangered Species Act is on-going.

2.1.8 State Threatened and Endangered Species

The New York Department of Environmental Conservation (NYSDEC) Natural Heritage Program manages the state’s listed plant and animal species. A review of NYSDEC’s Nature Explorer data shows threatened and endangered species habitat within the Study area. Four species of plants were identified as endangered or threatened in Bayville (Table 2).

Table 2. State-listed plants in Bayville, NY.

Common Name	Scientific Name	Distribution Status	Year Last Documented	Status
Downy Lettuce	*Lactuca hirsuta*	Possible (but not Confirmed)		Endangered
Rough Rush-grass	*Sporobolus clandestinus*	Historically Confirmed	1925	Endangered
White Milkweed	*Asclepias variegata*	Historically Confirmed	1928	Endangered
Yellow Giant-hyssop	*Agastache nepetoides*	Historically Confirmed	1928	Threatened

2.1.9 Essential Fish Habitat

An Essential Fish Habitat (EFH) assessment was prepared and is included in the Environmental Appendix A. Fifteen EFH designated species are identified to potentially occur within the intertidal and nearshore subtidal zones along the Bayville shorelines, Table 3 (NMFS 2015). USACE is currently in coordination with NMFS to assess potential project impacts to EFH.

Table 3. Essential Fish Habitat for Bayville, NY.

Common Name	Scientific Name	Life Stage Found at Location
Atlantic Salmon	*Salmo salar*	Juvenile, Adult
Pollock	*Pollachius virens*	Juvenile, Adult
Windowpane Flounder	*Scopthalmus aquosus*	Eggs, Larvae, Juvenile, Adult
Winter Flounder	*Pseudopleuronectes americanus*	Eggs, Larvae, Juvenile, Adult
Red Hake	*Urophycis chuss*	Eggs, Larvae, Juvenile, Adult
King Mackerel	*Scomberomorus cavalla*	Eggs, Larvae, Juvenile, Adult
Spanish Mackerel	*Scomberomorus maculatus*	Eggs, Larvae, Juvenile, Adult
Sand Tiger Shark	*Carcharias taurus*	Larvae
Summer Flounder	*Paralichthys dentatus*	Juvenile
Cobia	*Rachycentron canadum*	Eggs, Larvae, Juvenile, Adult
Scup	*Stemotomus chrysops*	Eggs, Larvae, Juvenile, Adult
Bluefish	*Pomatomus saltatrix*	Adult, Juvenile
Atlantic Mackerel	*Scomber scombrus*	Eggs, Larvae, Juvenile, Adult
Black Sea Bass	*Centropristis striata*	Juvenile
Atlantic Sea Herring	*Clupea harengus*	Juvenile, Adult

2.1.10 Socioeconomics

A formal census update of post-Hurricane Sandy demographic information is not currently available. However, estimates from the U.S. Census Bureau (2015) show that the population of Bayville has grown slightly with an increase of roughly 80 new individuals (6,669 people in 2010 to 6,748 people estimated in 2014). Income has likely remained stable since the 2010 census (U.S. Census Bureau 2015).

2.1.10.1 Demographics

The population in Bayville decreased from 7,190 to 6,748 between 1990 and 2014. Using the 2014 U.S. Census Bureau population estimate of 6,748 people, this means that Bayville is currently 6.1% smaller than it was in 1990, the year of its peak recorded population. The 2013 median household income was $98,362, compared to $58,003 for the state of New York (U.S. Census Bureau 2015). In the official 2010 census, about 95% of Bayville's 6,669 residents identified as Caucasian/white, 0.3% identified as Black or African American, 0.4% as American Indian or Alaska Native, 1.7% as Asian, 1.4% as Hispanic or Latino, and 1.2% as some other race.

2.1.11 Environmental Justice and Protection of Children

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its program, policies, and activities on minority and low-income populations in the U.S., including Native Americans. Executive Order 13045, "Protection of Children from Environmental Health Risks and

Safety Risks," requires Federal agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children.

No adverse impacts to children, minority or low income populations are anticipated as a result of this project. Ninety-five percent of the population self-reported as white and 21.7% of the population were under 18 years old within Bayville in 2010. Approximately 5.2% of residents are below the poverty level (U.S. Census Bureau, 2015).

2.1.12 Cultural Resources

The Area of Potential Effect (APE) is the project area, as well as any buildings that may have a view of the project features. The mitigation area is a degraded wetland area. The two potential staging areas are located on existing parking lots. Based on a review of the State and National Registers and previous research and surveys as described in Sections 2.1.12.1 and 2.1.12.2 of this report, there are no architectural sites within or adjacent to the APE. There is one archaeological site, identified as a small village, with one burial, that was identified in the vicinity of the west end of the Mill Basin portion of the APE, Map research indicated some construction within the area from the nineteenth century. However, construction from this era is either gone, or the structures have been so heavily modified that they no longer possess significance.

2.1.12.1 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 in the landscape 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 the Long Island Sound about 18 miles east of Bayville 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 or traded 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.

Warm and dry climatic conditions began to yield to a cooler, moister, more modern climate with oak and chestnut vegetation about 2,000 years B.P. By 1,000 years B.P., the trade and exchange network influence had disappeared. Increasing evidence of sedentism is manifested in the expanded use of storage facilities and more permanent house structures. Increased gathering of shellfish and the harvesting of plants reflect an intensification of food procurement evidently related to population growth. The emergence of agricultural production is also related to this sedentary settlement pattern, which was maintained until European contact. Material culture of this period is distinguished by several distinctive ceramic forms and small triangular projectile points, the latter most likely indicative of bow and arrow technology.

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 York, 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 feet in length. Several Late Woodland burials were identified within the site boundaries.

Early contact between Native Americans and Europeans has been documented across Long Island. In Nassau County, near the project area, early twentieth century archaeologist A.C. Parker recorded several sites including corn fields, that were abandoned by Indians at Oyster Bay c. 1650, and two forts on Fort Neck near Oyster Bay, one a square earthen work structure, while the other was a wooden palisade. One was stormed by Europeans c. 1650 (Parker 1922). One of the forts, called Fort Massapeag, was built, occupied, and abandoned during the mid-seventeenth century. This site is a National Historic Landmark.

The Matinecock Indians sold a large tract of land south of Mill Neck near Oyster Bay to Europeans in 1653. The Native Americans continued to live there for some time after as evidenced by European trade goods recovered from the Spring Lake Village site. Closer to the Bayville project area, a Native American burial recovered from a small Matinecock village site in Bayville was carbon dated to 1555 A.D. +/-85 years.

A total of 20 previously documented pre-contact sites lie within a one mile radius of the project area, with one small village site, which contained a burial, situated at the western end of the Mill Basin portion of the APE.

2.1.12.2 Contact and Post-Contact (Historic) Period Context

According to Peter Stuyvesant, the earliest European attempts at planting a settlement on Long Island were made in 1632 by the Dutch at Oyster Bay. In 1639, Dutch possession of the lands on which the settlement had been made was formalized by purchase from the local native population.

Dutch and English claims to Long Island territory were complicated and were in conflict to each other. In general, the Dutch West India Company claimed title to Western Long Island, while the English held authority over the eastern part of the Island. Complicating matters was the fact that the Dutch company was unable to populate the areas under its control, so it accepted English settlers on its lands as long as they did not dispute the authority of the Dutch West India Company.

Eventually, squatters who recognized neither the authority of either government began to settle the area. These included Nicholas Simkins, William Smith and John Titus who settled near the site of the present day Town of Oyster Bay in the 1640s (Hammond 2003).

The formal boundary between the Dutch and the English territories was established by the Treaty of Hartford in 1650. This line, which extended north and south from the western edge of Oyster Bay, was agreed upon as the division but there was still considerable confusion as the Dutch considered the western edge of Oyster Bay to be defined by the eastern edge of Centre Island while the English considered it to be the western edge of Mill Neck.

In 1653, a group of traders from Massachusetts established the settlement that would ultimately grow to become the Town of Oyster Bay. These settlers were attracted by the natural harbor of Oyster Bay and by the fact that because Oyster Bay was claimed by both the Dutch and the English it effectively remained outside of the direct control of either government and thus offered a unique opportunity to avoid paying taxes or duties.

A purchase was made from the local native population for the town site that was expanded by a second purchase in 1658 to include the lands within the bounds of the current project area. This second purchase included the promontory Oak Neck near the westerly limits of the project area and the isthmus between Oak Neck and Centre or Hog Island known as The Pines on the east. These purchases remained as one large tract until 1674, when the lands of Oak Neck and Pine Neck were divided between 23 separate property owners. The lands of Pine Neck were identified to remain as pasture.

Throughout the remainder of the seventeenth and the start of the eighteenth century, the Town of Oyster Bay continued to grow gradually with much of the economic focus being on maritime activity. Timber harvesting for shipbuilding, salt hay farming, and the manufacture of lime from the grinding of oyster and clam shells were the major activities.

In 1754, a road was surveyed from Beaver Swamp to Centre Island. This predecessor to Bayville Avenue passed through Bayville and Mingo Springs. A map of 1778 shows the pasture lands along present day Bayville Beach. In 1837, a coastal survey map of Hog Island, later known as Centre Island, depicts forested areas near current day Bayville Beach, and Bayville Avenue is now labeled as such. In a coastal map of 1847, there are three buildings shown on the south side of Pine Neck near the mouth of Mill Neck Creek. North of the buildings was still forested, while to the south the landscape was largely open, and was probably a salt hay meadow.

By 1859, a nucleus of settlement known as Oak Neck, west of the project area, named for the geographic feature for which it was situated was renamed Bayville. This same map depicts the first buildings located within the project area.

The possibilities for income generation in shellfish harvesting were first realized in the area in the early nineteenth century. Clamming, a key source of income, continued well throughout the nineteenth century. One prominent company founded in the latter part of the nineteenth century, Frank M. Flower & Sons, is still in operation.

Another local harvest was asparagus. During the late nineteenth century, sizeable areas of Bayville were devoted to the farming of asparagus. The value of the area's suitable climate and well-drained soil was first discovered in 1825 by John Bell who is credited with the introduction of the vegetable to local cultivation. Several years later, Nicholas Godfrey, a prominent local landowner, harvested the crop on his land near present-day Bayville Park Boulevard. The vegetable could be harvested in great quantities and it became a key contributor to the area's economy. At one time, Bayville produced 11,000 bunches of asparagus daily and most of the harvest was shipped to New York City. The cultivation of asparagus gradually waned as Bayville developed as a summer resort.

Nicholas Godfrey, the successful asparagus grower, took advantage of the area's beaches and commenced a business by screening the sand and hauling it away. The entrepreneur subsequently acquired a schooner that he used for screening gravel. Similar to many of Bayville's prior industrial pursuits, sand and gravel mining were short lived While Bayville began to be recognized for its summertime recreational potential, the sand and gravel mining business gradually began to decline.

The map of 1873 shows a dock on Oyster Bay labeled "Bayville Steamboat Landing." The steamboat ran until the first bridge was constructed in the late nineteenth century. The steamboat landing serviced the boat that brought the interested buyers to look at the new subdivision of Nicholas Godfrey's Pine Island property.

The large scale residential development of Pine Island began with the 1889 subdivision and sale of Nicholas Godfrey's Pine Island property. The advertisement for the auction of land provided information about the 307 pine tree covered building plots. Each building plot consisted of two lots that could accommodate either a business or dwelling, although in some areas, the subdivision was restricted to residential construction.

Bayville did not experience rapid growth, however, until the construction of the Bayville Bridge over Mill Neck Creek, which was completed in 1898. A pier was constructed at Ferry Beach in 1920. Condemned vessels were submerged in order to form footings for the breakwater. The wharf at Ferry Beach was commonly known as Wall's Beach Dock. A ferry began service between Bayville and Greenwich, Connecticut, then another larger boat between Bayville and Rye, New York. The steamer Northport operated between New York City and Bayville, while a smaller launch was operated between the Long Island Railroad's Oyster Bay Station to Pine Island.

By the 1920s, Bayville had numerous restaurants, hotels and, boarding houses. The popularity of the automobile made the trip to Bayville much easier as a day trip or as a vacation destination. After the Second World War, the area began to lose its identity as a summer resort since many chose to reside at Bayville year round. The wharf fell into disrepair and the pavilions and restaurants on the beach closed. There are still remnants of the heyday of Bayville as a summer resort.

2.1.13 Coastal Zone Management

The State of New York administers its Federally-approved coastal zone program through the NYSDOS, Office of Planning and Development. Pursuant to the Federal Coastal Zone Management Act (CZMA), New York has defined its coastal zone boundaries and developed policies to be utilized to evaluate projects within the designated coastal zone.

As a Federally-funded project within the coastal zone of New York, the Bayville project must be reviewed by the NYSDOS for consistency with the policies of the New York State CZMA Plan. These applicable policies, along with an impact analysis and consistency determination are discussed within the environmental consequences section of this report as well as in CZM consistency review that is presented in Appendix A.

2.1.14 Floodplains

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect 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" for the following actions:

- acquiring, managing, and disposing of federal lands and facilities;
- providing federally-undertaken, financed, or assisted construction and improvements;
- conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

Bayville includes areas that have been designated by the Federal Emergency Management Agency (FEMA) as susceptible to potential flood damage. Coastal flooding due to storm surge through Long Island Sound and Oyster Bay and intense rainfall in this area can be caused by a variety of different meteorological events, such as nor'easters, tropical storms and hurricanes. Figure 4 depicts the portions of the Study area that lie within the FEMA 1 percent floodplain (100-year floodplain, i.e., Zones VE and AE).

2.1.15 Hazardous, Toxic, and Radioactive Waste

There are no wastewater treatment plants in Bayville. Presently, all sewage is handled by on-site individual subsurface sewage disposal systems. In some areas of Bayville, sanitary overflows occur during heavy rainfalls or major storms which raise the groundwater levels, especially in areas where the soils have poor permeability.

An HTRW database search was conducted in October 2015 utilizing the NYSDEC's environmental remediation databases. The Spill Incidents Database search showed that six spills were reported in the last year. All but one were residential, and two of the six are still under investigation by the NYSDEC (NYSDEC 2015a).

A search of the Environmental Site Remediation Database showed one site, the Bayville Village Cleaners as having been investigated twice, once under the State's Superfund Program and again under the Voluntary Cleanup Program. After conclusion of the State's investigation and evaluation under the Superfund Program, the action was classified as requiring no further action. The investigation under the Voluntary Cleanup Program, however, showed that repeated discharges of PCE contaminated condensate to the ground surface on the west side of the building led to the contamination of subsurface soil and groundwater. Clean up has since occurred and monitoring has concluded; the dry cleaners no longer use PCE in their dry cleaning process (NYSDEC 2015b).

According to the NYSDEC Bulk Storage Database, the Bayville Water Department has two permitted active bulk storage tanks on-site. All other previously-used bulk storage facilities have since been closed or are unregulated by the State (NYSDEC 2015c).

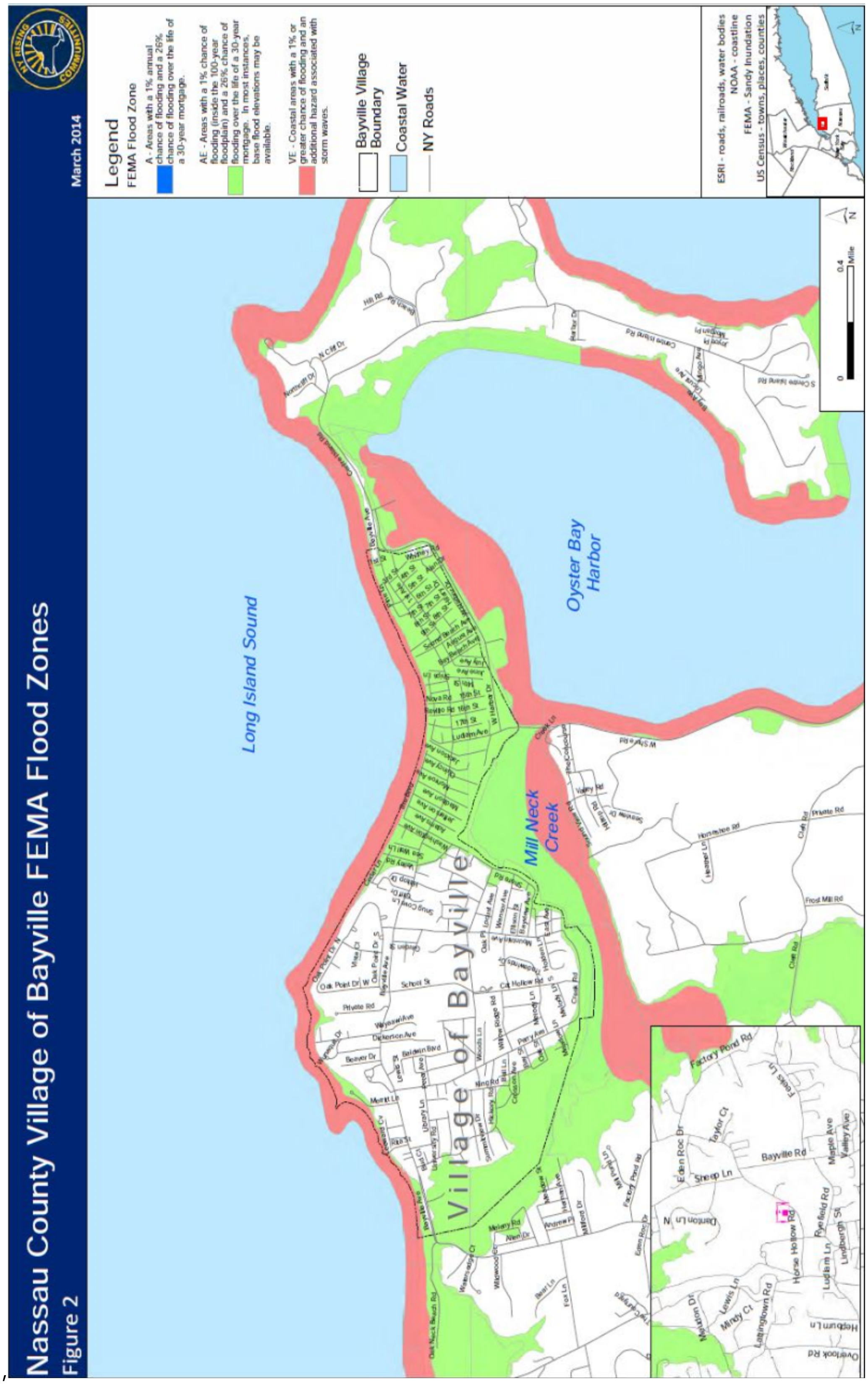

Figure 4. FEMA Flood Zones in Bayville, NY

2.1.16 Recreation and Scenic Resources

One of the most valuable natural resources available to the residents in Bayville is the scenic views of the surrounding environment. Almost all of Bayville's boundaries continuously abut surface waters- Long Island Sound to the north, and Mill Neck/Oak Neck Creek and Oyster Bay to the south. The beaches not only provide aesthetic value through its scenic views, but also recreational value with activities such as swimming, walking, and running.

The beach along the northern shore (soundside) of Bayville provides some public access, with a majority of the beaches only available to nearby residents. Residents can enjoy soundside beach on Long Island Sound which is accessible for swimming, picnicking, and fishing. At West Harbor Beach, on Oyster Bay Harbor, residents can enjoy activities and facilities such as swimming, boat launching, fishing, tennis and bocce courts, and a multi-use recreation field. Boating facilities with associated moorings and a comfort station are available to residents at Creek Beach on Mill Neck Creek. A public boat ramp is located at West Harbor Beach.

The public has access to three Town of Oyster Bay beaches within Bayville and the vicinity. Ransom Beach in Bayville on Long Island Sound is at the west end; Stehli Beach is also on the Sound, located just west of the Village line; and Centre Island Beach which has frontage on both the Sound side and on Oyster Bay Harbor lies just east of the Village line. Stehli Beach and the Centre Island beaches are in unincorporated areas of the Town of Oyster Bay (NYSDOS 2003).
Harrison Williams Woods is open to the public and provides trails for walking, running, and taking in the natural setting of the 16-acre, Bayville-owned parkland. Other Bayville-owned recreational facilities are the Community Center, where senior and teenage groups have social meetings, and where one can find basketball and volleyball courts; the ice skating rink behind the Village Hall; Bayville Commons, which is a public open space at the intersection of Ludlum Avenue and Bayville Road; and the woodlands and wetlands on the former Schmitt property which Bayville purchased in 1998 (NYSDOS 2003). Additionally, the OBNWR provides a multitude of recreational activities such as: bird watching, kayak and canoe rentals, and wildlife viewing.

2.1.17 Air Quality

In accordance with the Clean Air Act of 1977, as amended, the U.S. Environmental Protection Agency (USEPA) developed National Ambient Air Quality Standards (NAAQS) to establish the maximum allowable atmospheric concentrations of pollutants that may occur while ensuring protection of public health and welfare, and with a reasonable margin of safety.

The USEPA measures community-wide air quality based on daily measured concentrations of six criteria air pollutants; carbon monoxide, sulfur dioxide, respirable particulate matter, lead, nitrogen dioxide, and ozone. Based on these measurements of air quality, the USEPA designates attainment areas and non-attainment areas nationwide. Non-attainment areas are designated in areas where air pollution levels persistently exceed the national ambient air quality standards.

Based on the NAAQS, Nassau County is located in the New York, Northern New York, Long Island, Connecticut, nonattainment area, which is currently classified as "marginal" nonattainment for the 2008 8-hour ozone standard. The nonattainment area is part of the Ozone Transport Region. Ozone is controlled through the regulation of its precursor emissions, which include oxides of nitrogen (NOx) and volatile organic compounds (VOCs) (NYSDEC 2015d).

2.1.18 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. Although noise level measurements have not been obtained in the Study area, they can be approximated based on existing land uses. 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.

2.2 The Built Environment

The built environment is the human-made surroundings that provide the setting for human activity such as roads, homes, and businesses. It is the human-made space in which people live, work, and recreate on a day-to-day basis. Humans have greatly influenced the heavily-developed Village.

2.2.1 Access Routes

The main road through Bayville is Bayville Avenue, which leads westward through Lattingtown, Locust Valley, and Glen Cove, and eastward to Centre Island. From Bayville Avenue, one can turn south on Ludlum Avenue, travel over the Bayville Bridge to Shore Road in the Village of Mill Neck, and continue on to Oyster Bay hamlet. Both Bayville Avenue and Ludlum Avenue are Nassau County roadways. West Harbor Drive is a Town of Oyster Bay roadway. Bayville has jurisdiction over Mountain Avenue, Godfrey Avenue, Creek Road, Perry Avenue, School Street, and Merrit Lane. All other roads in Bayville are privately-owned or owned by home owners associations. During most of the year, traffic operations generally are acceptable in Bayville, since the main roadways (i.e., Bayville Avenue and Ludlum Avenue) pass entirely through, and out of, Bayville, and can readily accommodate normal flows. However, traffic congestion often occurs in the summer, especially on holiday weekends. Bayville has addressed this seasonal problem by restricting traffic into Bayville during the highest volume periods, using measures such as the institution of temporary one-way restrictions on Bayville Avenue.

Although the roadway system in Bayville generally is adequate with respect to existing traffic flows, except during certain summertime peak periods, traffic disruption often occurs as a result of the recurring flooding problems. Passenger car travel is interrupted on a regular basis along some of the roadways in low-lying areas of Bayville due to the accumulation of stormwater runoff and/or coastal waters inundating the land surface. During coastal storm events, Bayville Avenue may be used as an evacuation route for residents of both Bayville and Centre Island. During severe storm events, the depth and extent of flooding in some areas is particularly severe, creating a public safety hazard by blocking the passage of emergency vehicles.

2.3 Storm Drainage Systems

Bayville is served by a Nassau County stormwater drainage system, which serves Bayville Avenue and Ludlam Avenue. This system directs stormwater into a network of pipes that are designed to allow seepage to occur through slotted and perforated sections. As originally designed and constructed in the 1950s, this system had no outlet to Mill Neck Creek, and was designed to discharge all stormwater to the ground. An outfall from this drainage network subsequently was added at the end of Adams Avenue, which allows some of the stormwater to be directed into Mill Neck Creek. There also are a few drainage channels that have outlets in the wetlands on the south side of Bayville. A portion of the stormwater from this system is directed to County-owned recharge basins, which presently are overgrown with vegetation, thereby decreasing their storage capacity.

The existing stormwater drainage system in Bayville is not adequate to handle heavy rainfalls and, as a result, flooding occurs in certain areas, including the "president streets" area, the east and west ends of Bayville, and other low-lying areas (such as the area locally known as the "numbered streets"). Much of the system is unable to discharge during high tides, when the outfalls become submerged under coastal waters. Many of the pipes have not been properly maintained and, as a result, are clogged with accumulated sediment (NYSDOS 2003).

2.4 Describing Storms and Flood Levels

Floods are often defined according to their likelihood of occurring in any given year at a specific location. The most commonly used definition is the "100-year flood." This refers to a flood level or peak that has a 1 in 100, or 1 percent chance of being equaled or exceeded in any year (i.e., 1 percent "annual exceedance probability"). Therefore, the 100-year flood is also referred to as the "1 percent flood," or as having a "recurrence interval" or "return period" of 100 years.

A common misinterpretation is that a 100-year flood is likely to occur only once in a 100-year period. In fact, a second 100-year flood could occur a year or even a week after the first one. The term only means that that the average interval between floods greater than the 100-year flood over a very long period (say 1,000 years) will be 100 years. However, the actual interval between floods greater than this magnitude will vary considerably.

In addition, the probability of a certain flood occurring will increase for a longer period of time. For example, over the life of an average 30-year mortgage, a home located within the 100-year flood zone has a 26 percent chance of being flooded at least once. Even more significantly, a house in a 10- year flood zone is almost certain to be flooded at least once (96 percent chance) in the same 30-year mortgage cycle. The probability (P) that one or more of a certain-size flood occurring during any period will exceed a given flood threshold can be estimated as

$$P = 1 - \left[1 - \frac{1}{T}\right]^n$$

where T is the return period of a given flood (e.g., 100 years, 50 years, 25 years) and n is the number of years in the period. The probability of flooding by various return period floods in any given year and over the life of a 30-year mortgage is summarized in Table 4.

Table 4. Examples of Flooding by Various Return Periods.

Return Period (years)	Chance of flooding in any given year	Percent chance of flooding during 30-year mortgage
10	10 in 100 (10%)	96%
50	2 in 100 (2%)	46%
100	1 in 100 (1%)	26%
500	0.2 in 100 (0.2%)	6%

Because of the potential confusion, recent USACE guidance documents and policy letters recommend use of the annual exceedance probability terminology instead of the recurrence interval or return period terminology. For example, one would discuss the "1-percent-annual-exceedance-probability flood" or "1-percent-chance-exceedance flood," which may be shortened to "1 percent flood" as opposed to the "100-year flood." This report uses the short form "1 percent flood."

2.4.2 Sea Level Change and Climate Change

Sea level change (SLC) is a change in the mean level of the ocean. Relative or "local" sea level change (RSLC) is the locally observed change in sea level relative to a fixed point. It is the additive effect of global or "eustatic" sea level rise if 1.7 millimeters (mm) per year, and the subsidence or uplift rate at a fixed point. 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.

The Department of the Army Engineer Regulation ER 1100-2-8162 (31 Dec 2013) requires that future sea level rise projections must be incorporated into the planning, engineering design, construction and operation of all civil works projects. The Study team should evaluate the proposed alternatives in consideration of the "low," "intermediate," and "high" potential rates of future SLR for both "with" and "without project" conditions. This range of potential rates of SLR is based on findings by the National Research Council (NRC 1987) and the Intergovernmental Panel for Climate Change (IPCC 2007). The historic rate of future sea-level rise is determined directly from gauge data gathered in the vicinity of the Study area. Tide conditions at Port Jefferson (National Oceanic and Atmospheric Administration (NOAA) Station #8514560) best represent the conditions experienced in Bayville. A 23-year record (1992 to 2015) of tide data gathered at Port Jefferson, NY indicates a mean sea level trend (eustatic SLR + the local rate of Vertical Land Movement) of +2.44 mm/year, or 0.008 ft/year which equates to a 0.4 ft increase expected over the next 50 years (Figure 5) (USACE SLC tool 2015).

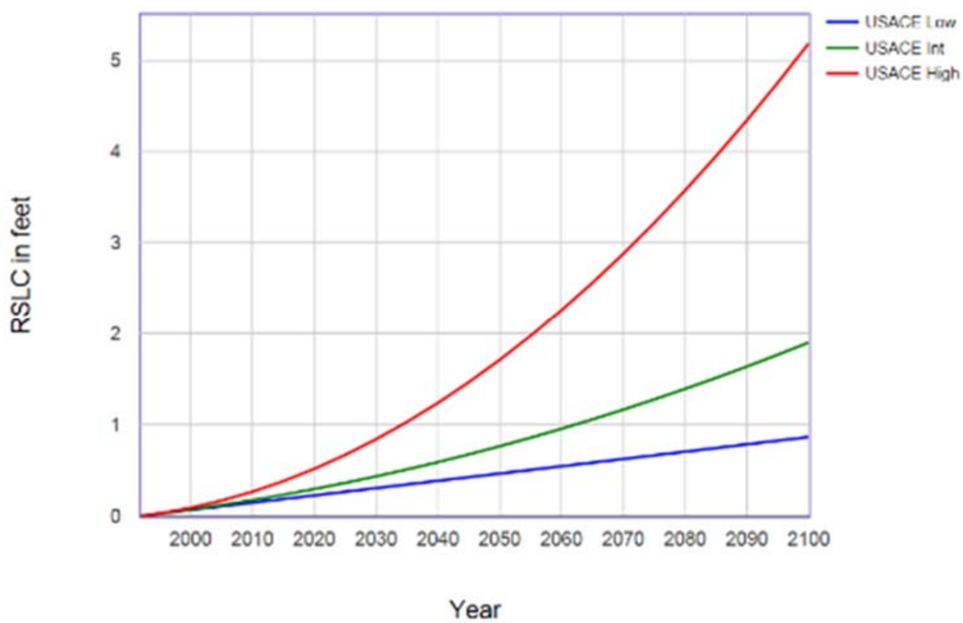

Figure 5. Estimated Relative Sea Level Change Projections 1992-2100, Port Jefferson, NY

Climate change in the Northeastern U.S. is anticipated to result in an increase in the extent and frequency of coastal flooding, a rise in the frequency of severe storms and related damages, and sea level rise of 2-6 feet over the next century (Frumhoff et al. 2007). Increases in sea level and continued coastal storms will result in more inundation of coastal areas, and subsequent increases in shoreline erosion and wetland loss. Inundation of low-lying areas will result in the potential for saltwater to infiltrate into freshwater surface waters and aquifers. Increased flooding and erosion has the potential to negatively impact transportation infrastructure and sewage and septic systems.

Coastal wetlands are vulnerable to the effects of sea-level rise, increasing water temperatures, and increased nutrients. If accretion of river-borne sediment and organic matter is unable to keep pace with the combined effects of sea-level rise and land subsidence, coastal marshes will be reduced or disappear. This will impact the ecological services provided by these areas including buffering coastal areas from waves and erosion, filtering nutrients and pollutants, providing wildlife habitat, and providing nursery areas for fisheries. Because hard-clams and oysters depend on wetland-based food chains, impacts to coastal wetlands are anticipated to impact those fisheries (Frumhoff et al. 2007).

It is difficult to predict the ways in which warming of water temperatures will influence other factors that affect marine ecosystems, including nutrient dynamics, ocean circulation, and plankton production. However, commercial fish and shellfish have water temperature thresholds that define conditions suitable for reproduction, growth, and survival. Increased water temperatures over the last decade have already led to declines in lobster landings in Long Island Sound (Fogarty et al. 2007). In addition, warmer water temperatures also appear to facilitate the spread of shellfish disease, the frequency and intensity of harmful algal blooms, and the ability of invasive species to reproduce and spread (Frumhoff et al. 2007).

Chapter 3: Plan Formulation

Through planning activities, including feasibility studies, USACE Study teams help decision-makers identify water resources problems, conceive solutions to them and compare the importance of the inevitable conflicting values inherent in any solution. The 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies (Principles and Guidelines) lay out an iterative 6-step planning process that is used for all USACE Civil Works studies, including the North Atlantic Coast Comprehensive Study (NACCS) coastal storm risk management (CSRM) framework (USACE 2015). The Study team followed this planning process, as described in this chapter, to choose a Tentatively Selected Plan.

3.1 Problem Statement

Problem definition is the detailed description of a problem. It begins with a problem statement, a simple assertion of the basic problem.

Problem statement: Bayville experiences frequent damages from flooding and waves due to coastal storms and high tides. Storm surge affects Bayville from both the north (Long Island Sound) and from the south (Oyster Bay.) The topography, coupled with an inadequate storm water drainage system, prolongs the damaging effects of coastal flooding, potentially posing a threat to the safety of residents that do not evacuate in advance of significant storms.

The primary problem encountered in the Study area is coastal flooding associated with elevated water levels. Although nuisance flooding can occur during periods of high astronomical tides or minor storms, severe flooding damage results from tropical storms, hurricanes, and nor'easters. Bayville has a history of devastating coastal storm damages. Most commonly, storm damage occurs when water inundates Bayville from the lowest elevation terrain located along the southern portion of the Study area. Additionally, as demonstrated by the nor'easter of December 1992, wave induced storm damage can also result from large coastal storms. There are several depressions in Bayville (elevation less than 6 feet) which result in standing water for long periods of time following a storm event.

During and following astronomical high tides and storm events, including Hurricane Irene and Hurricane Sandy, elevated water levels in Long Island Sound, Oyster Bay, and Mill Creek flood the Village of Bayville in the following patterns:

- Long Island Sound floods homes within a several block span of the Pine Lane area and extending south to First Avenue and Numbered Streets;
- Overflow from Mill Creek floods homes and businesses within a several block span of the Presidents Streets neighborhood and extends south to Bayville Avenue;
- Winds force Long Island Sound waters into Oyster Bay, which overflows into the West Harbor Drive area and backs up into Mill Creek and floods homes along Shore Road.

Bayville Ave/Ludlam Ave and roads in low lying areas of the Village's east end become difficult to travel and/ or become impassable due to flooding. Following Hurricane Irene, Bayville Avenue was inundated with approximately three feet of water; residents traveled using row boats, kayaks, and surf boards. Pine Lane residents used buckets to bail out yards and homes that were flooded with approximately one foot of water. During Hurricane Sandy, high winds and an astronomical high tide combined with an 11-foot storm surge to inundate Ransom/Stehli Beach in the Village's west end. Hurricane Sandy also flooded the Village's entire low-lying east end. The storm surge breached the center of an existing sand dune on the beach in the area of Pine Lane. The breach allowed the water to flow south along the paved surface of 5th Avenue, south toward Oyster Bay, and flood Bayville Ave and 1st Ave in the process. Flooding of the east end necessitated the emergency shut-down of the gas utility service and numerous businesses in this area. The inundation of Bayville Avenue made the road impassable and resulted in stalled vehicles, blocking access for emergency personnel and utility trucks. Residents once again used row boats and kayaks to navigate Bayville Avenue. The fire trucks and ambulance based out of the Village's only Firehouse on Bayville Avenue were relocated to Village Hall as a storm preparedness measure. The flooding of Bayville Avenue prevented the travel of all vehicles, including the fire trucks and ambulance, during the early morning high tide (from approximately 12am to 6am) and flooded the Firehouse's basement. The water level on Bayville Avenue decreased with the ebbing tide, but standing water remained in the areas of lowest elevation; emergency and personal use vehicles were only able to push through the standing water at approximately 6am.

The Bayville Bridge spans Oyster Bay and connects the Village of Bayville and Centre Island to the Town of Oyster Bay via West Shore Road and Ludlam Avenue. The Coast Guard requires that the Bridge be left open during storm emergencies to allow the passage of boat traffic. Hurricane Sandy's floodwaters inundated Ludlam Avenue/Bayville Bridge/West Shore Road, submerged the Bayville Bridge and rendered the bridge's electrical equipment inoperable. The bridge remained in the open position after tide waters receded and was unable to be closed to restore the ingress/egress roadway, until it reopened on April 17, 2013. According to an August 23, 2013 article published in Roads & Bridges, three days of storm surge from Hurricane Sandy resulted in the equivalent of approximately 30 years of normal erosion damage to West Shore Road. The reconstruction of West Shore Road began in December 2012 and ended in mid- June 2013. Until then residents could not enter and leave the Village via this route. The damage to the Bridge and West Shore road left the Village with only one vehicular access route for seven months following Hurricane Sandy, which diminished public safety and disrupted the local economy by delaying the re-opening of businesses and limiting tourism. The Village estimates approximately 300 homes were affected by Hurricane Sandy. Additionally, winds from Hurricane Sandy damaged trees, which created road closures due to debris and brought down electrical power lines and telephone lines. This contributed to regional and local losses of electrical power, internet, cell phone, and land-line telephone service.

3.2 Future Without Project Conditions*

The future without project condition serves as the base conditions for all the alternative analyses. The future without project conditions at Bayville within the period of analysis (2020-2070) are identified as continued flooding and wave impacts from future coastal storms. Future Without Project Conditions are organized by the environmental setting, the built environment, and the human environment.

3.2.1 Future Without Project Conditions for the Environmental Setting

In the absence of Federal action, the condition of wetlands, air quality, flora & fauna, threatened and endangered species, cultural resources, and HTRW is expected to remain consistent with current conditions. Because Bayville is so built out, there are few developmental opportunities remaining.

The predicted "low," "intermediate," and "high" rates of sea level change were calculated for Bayville for 2020 through 2070, the period of analysis (ER 1100-2-8162). Figure 5 shows the low, intermediate, and high estimates for sea level rise based on the Port Jefferson, NY gauge through the 50-yr period of analysis (2020-2070). The trend of rising sea level rise in the Study area is expected to continue into the future. The mean sea level trend in Bayville is an increase of .008 ft/yr or 0.4 ft over the next 50 years (USACE SLC tool 2015).

3.2.3 Future Without Project Conditions for the Human Environment

Post-Hurricane Sandy recovery is expected to continue in the immediate future. Local efforts will focus on stormwater drainage improvements and more rigorous enforcement of zoning and code requirements, building redundancy and resiliency into Bayville's infrastructure and services. It is unclear if the Borough has the resources to undertake all of the initiatives. The current USACE Study is complementary to these efforts.

3.2.4 Estimate of Future Without Project Damages

In the estimate of damages, the stage versus damage data was combined with stage versus frequency data using the HEC-FDA (Hydrologic Engineering Center – Flood Damage Analysis) program. The HEC-FDA program quantifies uncertainty in discharge-frequency, stage-discharge, and stage-damage functions and incorporates it into economic and performance analyses of alternatives. The process applies a procedure (Monte Carlo simulation) that computes the expected value of damage while accounting for uncertainty in the data inputs. The HEC-FDA program presents results for expected annual damages and equivalent annual damages. Under current USACE guidance, risk and uncertainty must be incorporated into coastal storm risk management studies.

The following areas of uncertainty were incorporated into the HEC-FDA program:

- stage frequency
- first floor elevation
- depreciated structure value
- content-to-structure value ratio
- other-to-structure value ratio

It is projected that the Long Island Sound region, including Bayville, will experience increased risk of coastal storm damage (flooding and wave attack) due to predicted sea level rise. The details on the evaluation of the without project damages are provided in Appendix C, Economics Appendix.

3.3 Key Uncertainties

Limitations to the quantity and quality of information result in uncertainties. The Study team dealt with three major uncertainties.

1. RSLC projections: The historic rate of relative sea level change (RSLC) was assumed for the Bayville Study. The historic rate of RSLC is 0.4 ft increase over the 50-year period of analysis (RSLC). In future years this will result in more frequent and higher stages of flooding. In the optimization of the Tentatively Selected Plan (TSP), formulation will account for how the project would perform under the intermediate and high rates of projected RSLC, consistent with the ER 1100-2-8162. Analysis of the intermediate and high rates of RSLC may affect the physical dimensions of the project, but would not affect the selection of the TSP.

2. Operations, Maintenance, Repair, Rehabilitation & Replacement (OMRR&R): The TSP includes several features (e.g. pump stations, backup generators etc.) that will require intensive operations and maintenance which will be the responsibility of Bayville. It is unclear at this point in the Study whether or not Bayville will have the resources to provide the necessary OMRR&R for some of the measures to reliably meet the objectives of managing flood risk and associated damages. The Study team focused its efforts on identifying the full costs of OMRR&R measures needed to avoid failure (personnel and equipment back-ups, pre-emptive project operation, etc), so that the true OMRR&R costs for these alternatives have informed the plan formulation.

3. Waterfront access: Waterfront access is important for the residents of Bayville. While the public is generally supportive of the features of the TSP, some have expressed concerns about how they will access the water. If necessary, the USACE and NYSDEC will host a meeting with the public to discuss public access options in early 2016.

3.4 Opportunities

Opportunities to solve problems in the Study area have been identified by the Study team. There are opportunities in Bayville to:

1. Reduce the risk of damages to existing infrastructure, residential and commercial properties caused by storm-induced flooding and wave attack from both the Long Island Sound and Oyster Bay.

2. Reduce the risk to life-safety related to coastal storm events. The greatest need in the Study area is for effective coastal storm risk management that provides acceptable levels of risk reduction from the impacts of storm inundation. Due to the low elevations of the shoreline surrounding the Study area, effective coastal storm risk management against high surge from both Long Island Sound and Oyster Bay is a necessary component of a complete coastal storm risk management plan. Many roadways providing access within the Study area are subject to frequent flooding, limiting transportation during flood events.

3.5 Federal Action

The Disaster Relief Appropriations Act of 2013, Public Law 113-2 (PL 113-2), directed USACE to address damages caused by Hurricane Sandy and to reduce future flood risk in ways that will support the long-term sustainability of communities such as Bayville. This feasibility Study was completed pursuant to this mission.

Per the 1983 Principles and Guidelines, the Federal objective of water and related land resources project planning is to "contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements." Water and related land resources project plans are formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective. Contributions to National Economic Development (NED) are increases in the net value of the national output of goods and services.

3.6 Planning Goal

A Study goal based on problems and opportunities was developed to help create and evaluate alternative plans. It is the overarching intent of the project.
Goal: Reduce the risk of flooding and associated damages caused by storm surge due to coastal storms that impact Bayville.

3.7 Planning Objectives

Plans are formulated to achieve planning objectives. Planning objectives and constraints are inexorably linked to problems and opportunities. A planning objective states the intended purposes of the planning process. It is a statement of what solutions should try to achieve.Objectives provide a clear statement of the Study purpose.

In support of the goal, the planning objectives are to:

1. *Manage the risk of damages from flooding caused by storm surge due to coastal storms that impact Bayville through 2070.*
   Measurement: estimated annual damages, as calculated by the HEC-FDA model
2. *Reduce storm-induced shoreline erosion in Bayville through 2070.*
   Measurement: estimated annual erosion, as observed
3. *Develop a resilient and sustainable risk management solution for Bayville through 2070.*
   Measurement: qualitative analysis of engineering robustness and rapidity (the speed with which functionality can be restored to a system or project after a disruption)

3.8 Planning Constraints

Constraints are restrictions that limit the extent of the planning process. They can be divided into universal constraints and Study-specific constraints. Universal planning constraints are the legal and policy constraints to be included in every planning Study. Study-specific planning constraints are statements of things unique to a specific planning Study that alternative plans should avoid. Constraints are designed to avoid undesirable changes between without- and with-plan conditions. No Study-specific Federal constraints have been identified; however several Study specific planning considerations have been identified in the following sections.

Universal planning constraints include:

General constraints:

1. The plan should meet the needs and concerns of the public within the Study area;
2. The plan should be flexible to accommodate changing economic, social and environmental patterns and changing technologies.
3. The plan should integrate with and be complementary to other related programs in the Study area.
4. The plan should be able to be implemented with respect to financial and institutional capabilities and public consensus.

Technical constraints:

1. Plans should be in compliance with USACE regulations.
2. Plans should be realistic and state-of-the-art while not relying on future research or development.

Environmental constraint:

1. Plans should avoid and minimize environmental impacts to the maximum degree practicable.
2. Plans should not adversely impact threatened or endangered species, and their habitat.
3. Plans should be compliant with all Federal environmental laws, Executive Orders, and guidance.

Regional and Social constraints:

1. All reasonable opportunities for development within the project scope should be weighed, with consideration of state and local interests.
2. The needs of other regions should be considered, and one area cannot be favored to the detriment of another.
3. Plans should maintain existing cultural resources to the maximum degree possible and produce the least possible disturbance to the community.

Institutional constraints:

1. Plans should be consistent with existing Federal, state, and local laws.
2. Plans should be locally supported and signed by local authorities in the form of a local cooperation agreement and guarantee for all items of local cooperation including possible cost sharing.
3. The plan should be fair and find overall support in the region and state.

Study specific considerations are:

- To the maximum extent practicable, project alternatives will avoid and or minimize adverse impacts to the Oyster Bay National Wildlife Refuge (part of the Long Island National Wildlife Refuge Complex) which abuts the Study area to the south.
- To the maximum extent practicable, project alternatives will minimize damages to privately owned real estate within Bayville (structures and individual parcels.)
- Coastal storm risk management alternatives are currently focused on the highly developed, low-lying portion of Bayville identified on the Study area map. Other coastal areas within Bayville and the town of Oyster Bay may be included into the Study if there is appropriate local support to include residential areas within the 100 year floodplain.
- To the maximum extent practicable, plan formulation will be consistent with New York State Department of Environmental Conservation (NYSDEC) Regulations for coastal projects. The NYSDEC is the non-Federal sponsor for the feasibility Study.

3.9 Coastal Storm Risk Management Measures

Plans are composed of measures. A measure is an activity (a *nonstructural action* that reduces flood damages without significantly altering the nature or extent of flooding) or a feature (a *structural element* that reduces the frequency of damaging levels of flood inundation) that can be implemented at a specific geographic site to address one or more planning objectives. They can be used individually or combined with other management measures to form alternative plans. Measures were developed to address problems and to capitalize upon opportunities. They were derived from a variety of sources including prior Bayville studies, the public scoping process, and the project delivery team. The following structural and nonstructural measures were considered in the Bayville, NY CSRM feasibility Study. Table 5 at the end of this section shows the results of the screening of identified measures.

Nonstructural Measures

The following sections briefly describe the objectives for, and the evaluation of, the various potential coastal storm risk management measures that were considered.

Buyout plan – This plan includes permanent evacuation of existing areas subject to erosion and/or inundation, involves the acquisition of this land and its structures, either by purchase or by exercising the powers of eminent domain. Following this action, all development in these areas is either demolished or relocated. With an anticipated high depreciated replacement cost of structures in the 2 percent floodplain (50-year), including land and relocation, this plan would appear to be prohibitively expensive and was thus dropped from consideration as a comprehensive solution. Limited buy-outs may be an effective means to enhance or supplement protection by other alternatives.

Floodplain Management and Zoning - Through proper land use regulation, floodplains can be managed to ensure that their use is compatible with the severity of a flood hazard. Several means of regulation are available, including zoning ordinances, subdivision regulations, and building and housing codes. Their purpose is to reduce losses by controlling the future use of floodplain lands, and thus would not be effective in mitigating the existing hazard for a highly developed area such as Bayville**.**

Building Elevation and Floodproofing – Flood retrofitting, by definition, is a body of techniques, including the elevation of structures, for managing and reducing damages due to floods, and requires adjustments both to structures and to building contents. It involves keeping water out of structures, as well as reducing the effects of water entry. Such adjustments can be applied by an individual or as part of a collective action, either when buildings are under construction or as part of a remodeling or retrofitting of existing structures. Floodproofing and raising building elevation, like other methods of preventing flood damages, has its limitations. It can generate a false sense of security and discourage timely evacuations. It fails to manage and reduce risk to non-building assets such as automobiles and landscaping. Indiscriminately used, it can tend to increase the uneconomical use of floodplains resulting from unregulated floodplain development. Limited floodproofing and/or house raising measures may be an effective means to enhance or supplement protection by other alternatives.

Hurricane Evacuation Plan/Storm Warning System - The process of notifying local residents of impending hurricanes can be divided into flood forecasting, warning, and preparedness planning. Forecasting and warning is primarily a program of the National Weather Service (NWS). Preparedness planning and specific evacuation orders and warnings are local responsibilities and are not included within project cost-sharing. Evacuations and warnings are used in conjunction with built projects to minimize threats to human life and safety during storm events.

Structural Measures

The following sections briefly describe various structural protection techniques considered as elements of a comprehensive coastal storm risk management solution.

Beach Nourishment – Beach nourishment involves the placement of sand on an eroding shoreline to restore its form and to provide adequate coastal storm risk management. A beach fill typically includes a berm backed by a dune; these elements combine to manage and reduce risk and damages from erosion, wave attack and inundation to leeward areas. Beach nourishment represents a natural, generally reversible method for managing and reducing erosion, wave attack and inundation damages on the open coast. A typical beach nourishment section is shown in Figure 6. Since the project shoreline is relatively stable with just minor erosion at isolated areas, a beachfill alternative is not considered a measure which addresses the planning objectives for this Study. Additionally, due to space constraints as well as high implementation and maintenance costs, a beachfill measure was not considered a viable component of a complete plan to manage coastal storm risk within the Study area.

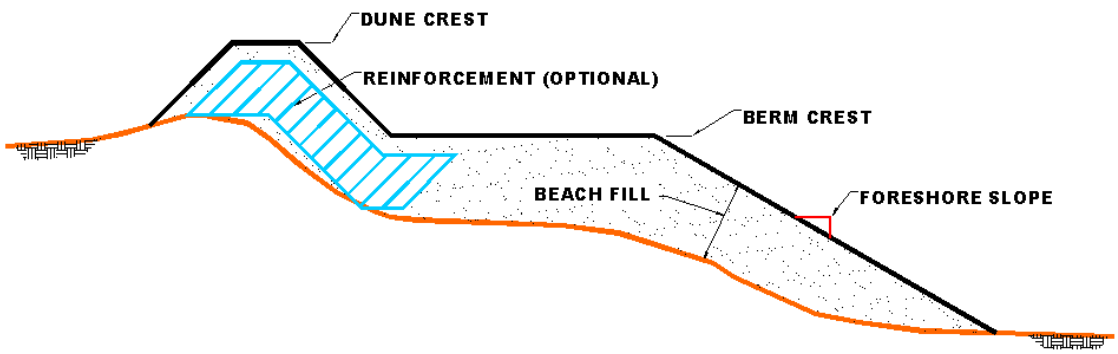

Figure 6. Typical Berm/Dune Profile

Groins – Groins are rubble mound or timber/steel sheet piles constructed perpendicular to the shoreline. By properly setting the groin length, height and space between groins, the existing and new beachfill material will be partially retained to reduce the long term erosion. However, groins are not effective in reducing offshore movement of beach material during storms. In order to retain material moving offshore, a T-groin with a shore-parallel section attached to the groin head was considered. Aesthetically, however, groins originating from the shoreline may not be as pleasing to the community as other possible solutions. Since the project shoreline is generally stable, the use of groins and T-groins, even with beachfill, is not considered a viable measure for implementation.

Offshore Breakwaters – Offshore breakwaters or artificial reefs are rock mounds constructed along the shoreline at a depth of approximately –5 ft Mean Low Water (MLW.) The submerged structures are effective at retaining beach material due to long term erosion and reducing sand movement offshore during storms. In addition, wave runup and overtopping would be reduced due to pre-breaking of storm waves. The need for beach renourishment may be reduced or eliminated due to tombolo (sand trapping) formation. This option was considered but would be prohibitively expensive and would not reduce the damages from storm surges without being supplemented with improvements along the shore. Breakwaters would not be as aesthetically pleasing as other possible solutions and could present hazards to boaters.

Buried Floodwall - Buried floodwall is similar to the dune component of beach nourishment, however, with buried rock, concrete units, geotube reinforcement or steel sheet pile inside the dune. Setting the crest of the buried floodwall above storm surge elevation would reduce the risk of inundation and wave overtopping. The buried floodwall would prevent dune breaching and limit the landward movement of shoreline after the sand cover is eroded and the buried reinforcement layer is exposed to wave action. This was considered a very viable alternative that could be well suited for this particular type of problem area.

Floodwalls and Levees – Floodwalls and levees are intended to manage and reduce risk of inundation caused by flooding due to storm surge and/or intense rainfall. These structures can be cost effective measures against coastal and riverine flooding when placed landward of direct wave exposure. Used in this manner, floodwalls and levees manage and reduce risk to interior structures. While these structures may provide a cost-effective means to reduce flooding of low-lying areas, runoff trapped behind the structure may affect the hydrology and drainage of interior areas. This may alter tidal wetlands and require additional drainage facilities. Floodwalls and levees may not be suitable for all portions of this project area, particularly in those areas where the character of the community focuses on waterfront access for fishing, boating and other such uses. The placement of such structures would involve potentially significant tradeoffs. Earthen levees were also considered for the Mill Neck Creek reach of the Study area. The type of levee considered includes steel sheetpile reinforcement installed in the center of the levee to prevent seepage through the structure. This option may be a more aesthetically pleasing option but would require a much larger footprint than a floodwall. Floodwalls usually require less of a footprint than levees which is an important consideration given the limited space that is available to construct these structures in Bayville.

Bulkheads/ Bulkhead Stabilization – Bulkhead shore stabilization measures offer both management and reduction of risk against erosion, wave attack and inundation for shorefront structures and reduce flooding of low-lying interior areas. Bulkhead may be steel, concrete, timber, vinyl or composite material completed with tie-backs and rock toe-protections. Beachfill may be added seaward to stabilize and protect the toe. Bulkhead stabilization measures help to reduce effects due to wave action, minimize overtopping floodwaters and limit landward movement of the shoreline. Their use in various portions of the project site will be considered further.

Set-back Floodwalls – This would provide management and reduction of risk against erosion, wave attack and inundation in a manner similar to the floodwall and levee alternative described previously. It would, however, be built on high ground behind waterfront structures or other features such as roadways. By being located on relatively high ground, the height of the walls above grade would be minimized. This would be particularly beneficial in areas such as Bayville, such as West Harbor Drive, where a low-elevation set-back floodwall could be placed along the center lane of the roadway.

Road Raising – Road surface pavements may be elevated to manage and reduce risk to landward properties from inundation. The raised road alternative is often less costly than a set- back floodwall, however, it requires more space. Buildings or structures seaward of the raised road would have to be floodproofed or bought out due to damages they would incur if no such action was taken. Due to the constraint of structures and utilities along the road and the available space of road shoulder, the differential elevation from road surface to adjacent ground is limited. However, certain roadways within Bayville would be suitable for surface raising and this alternative was actively considered for portions of this Study. Based on topographic maps, the best candidate for road raising is West Harbor Drive on the southeast ring along Oyster Bay, from Ludlum Avenue east to intersection of Centre Island Road. The existing elevation of this road ranges from +10 ft North Atlantic Vertical Datum of 1988 (NAVD88) to +11 ft NAVD88 and the road surface would need to be raised approximately three feet.

Interior Drainage Improvements – For the interior areas, drainage improvements such as storm sewers, catch basins and trench drains would be installed. Pump stations would also be constructed in order to drain the remaining low-lying areas from behind the perimeter structures when gravity drainage cannot be achieved.

Table 5. Measure Screening Summary.

Measure	Carried Forward	Eliminated	Reason for Consideration/Elimination
Beach Nourishment		X	Not effective in addressing problems, not applicable to site conditions.
Groins with Beach Fill		X	Not effective in addressing problems, not applicable to site conditions.
Offshore Breakwaters		X	Not effective in addressing problems, not applicable to site conditions.
Rock Reinforced Dune		X	Not Cost Effective, and greater environmental impacts than other measures
Buried Floodwalls	X		Cost Effective, meets Planning Objectives
Bulkhead / Seawalls / Floodwalls	X		Cost Effective , meets Planning Objectives
Levees	X		Cost Effective option for Mill Neck Creek Neighborhood , meets Planning Objectives
Reinforcement of Existing Bulkheads		X	Not Viable, existing walls cannot be incorporated into a Federal project (Design & Real Estate Concerns).
Set-Back Flood walls	X		Cost Effective option for West Harbor Drive
Road Raising	X		Cost Effective option for West Harbor Drive
Interior Drainage Features (pumps)	X		Necessary element for structural measures
Buy-Outs		X	Not Cost effective based upon the value of the Real Estate
Floodplain Management / Zoning		X	Not effective in addressing problems for existing structures
Building Elevation & Floodproofing	X		Cost-effective measure to address buildings that are flooded.
Evacuation Plan	X		Necessary component for all structural alternatives and nonstructural

3.10 Initial Array of Alternatives*

Measures that remained after the initial screening were considered for the initial array of alternatives.

3.10.1 Design Criteria

Design alternatives were based on a target 2 percent flood (50-year storm) design with a 50-year period of analysis. The intent was to formulate a potential comprehensive coastal storm risk management plan which is technically and economically feasible and does not have unacceptable impacts on environmental and cultural resources.

3.10.2 Development of Plan Alternatives by Reach

The shoreline in the Study area was divided into eight reaches for plan formulation, based on shoreline characteristics and orientation. From west to east, reaches 1, 2, 3, 3a, 4 and 5 follow the Long Island Sound shoreline along the northern edge of the Study area. To the south along the Oyster Bay shoreline two additional reaches were analyzed (Figure 7).

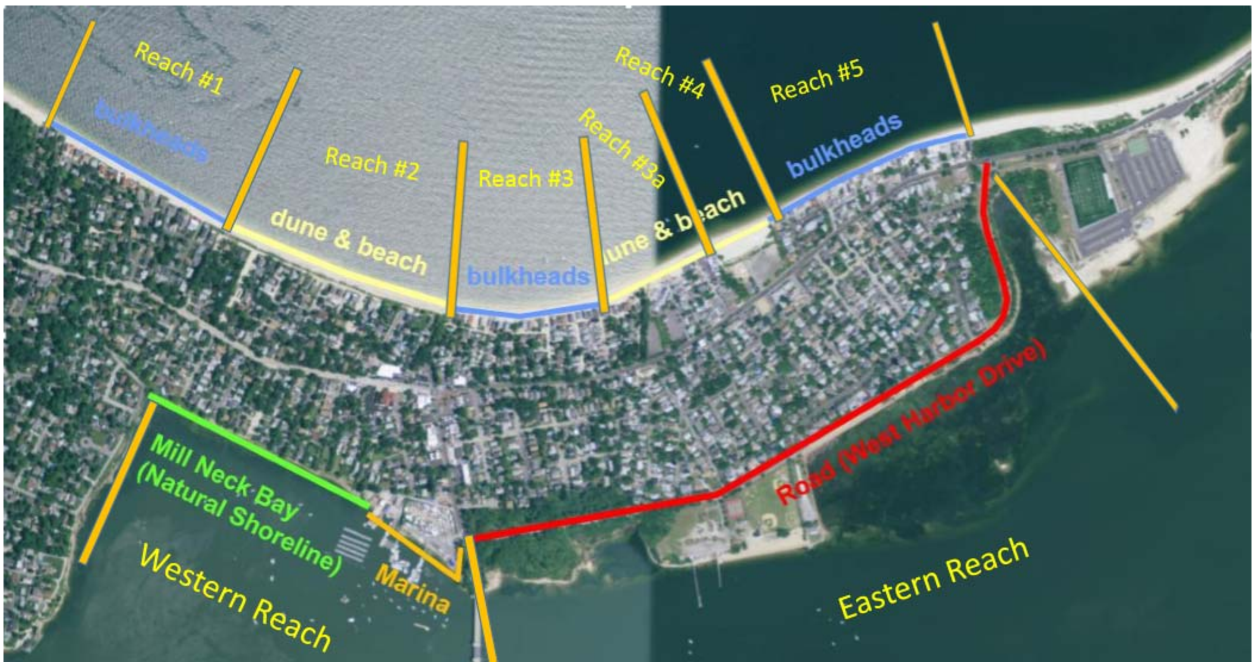

Figure 7. Reach Identification for Plan Formulation

The Long Island Sound facing shore has been considered as 6 coastal design reaches (from west to east) based on the types of existing coastal storm risk management features. In the future without project conditions more severe storm events would overtop and could cause these features to fail, exposing up to two rows of near shore structures to erosion, wave attack and storm surge inundation damages. The storm waters would continue to rapidly travel south (inland) along low lying surfaces structures and streets reaching beyond Bayville Avenue and eventually meeting storm surge from the bay side.

The existing back-bay shoreline can be considered as two coastal design reaches. The western reach is approximately 2,500 feet long from the vicinity of Saltair Lane and Shore Road easterly along Mill Neck Bay to Ludlam Avenue. This shoreline is primarily lined with residential properties with backyards sloping down to low marshlands. Some have timber bulkheads or fences where their property meets the wetlands or the tide waters of Mill Neck Bay. Many of these residences have backyards that adjoin a dirt and gravel path way that runs between the seaward limit of the backyards and the wetlands along Mill Neck Bay. The eastern 600 feet of this shore has a marina which also serves as a dockside facility for the Flowers Oyster Company. The land in these highly developed areas is low lying ranging from +5 ft NAVD88 to +7 ft NAVD88 making this area exposed to the more frequent storm surges especially from nor'easters.

The eastern back-bay reach extends along West Harbor Drive from Ludlam Avenue to near its terminus at Center Island Avenue near Center Island Beach. The average road elevation is +10.5 ft NAVD88 for most of the western 4,700 feet sloping down to +9.5 ft NAVD88 for the eastern end of the road. At these elevations, West Harbor Drive is an effective barrier to most weak to moderate storm tides (combination of storm surge and tide waters), but severe coastal storms would overtop the road surface.

Interior drainage problems from rain events also exist in Bayville. Flood damage from intense interior runoff begins as basement flooding from seepage due to high groundwater conditions. Eventually runoff exceeds the capacity of the storm water drainage facilities and collects overland running to the lowest lying areas in each drainage sub-basin. Any accompanying high tides restrict outlets and exacerbate the interior drainage problem. Although passive outlet control gates limit backflow from high tides in Oyster Bay, some leakage allowing backflow into Bayville is possible, especially if the control gates fail to close tightly. The current drainage system in Bayville involves a discontinuous network of infiltration structures including slotted pipe and leaching pits.

3.10.3 Nonstructural Plan

Floodproofing and Elevated Building. Floodproofing and/or elevation of the basement and first floor are considered for low-lying buildings for managing and reducing risk due to floods, and requires adjustments both to structures and to building contents. It involves keeping water out of structures, as well as reducing the effects of water entry. Because of the nature of Bayville's topography, it is not possible to combine structural and nonstructural measures (*ie,* raised bulkhead in Reaches 1-5 and nonstructural measures for the Oyster Bay reaches) because a structural alignment would need to span the entire length of the project area shorelines to function properly. Accordingly, the alternatives for Bayville are either nonstructural or structural, but not both.

Implementation costs for floodproofing and structure raising were calculated based on the type of improvement, incidental costs associated to the type of improvement, probability of the occurrence of the storm, storm surge stage and average footprint area of the structure. These costs were estimated as part of the planning phase for the purpose of determining project feasibility; provide means of comparing the costs in relation to the different storm stages and to approximate the costs for the proposed improvements. A contingency of 20% was included to account for uncertainties. Planning, Engineering and Design (PED), and Construction Management were assumed to be 10% and 8% respectively of the total direct (construction) costs. A total of 1,035 predominantly residential buildings within the project boundary were included in the inventory pool for analysis.

Estimated Costs

The following describes some assumptions used in the cost estimates:

- Improvements consist of three classifications:
    1. Buyout: Applies to structures which have 2.5 ft or more of flooding during 50 percent and 20 percent floods;
    2. Elevate: Applies to structures which have 2.5 ft or more of flooding during 50 percent to 10 percent floods; and

3. Flood Proofing: Applies to structures which has less than 2.5 ft of flooding during any storm.

- Flood proofing structures: $4,000 was added to account for utilities and sewer backflow valves, sump pump and other incidental costs
- Elevation Costs: $8,000 were added to account for utilities and sewer backflow valves, sump pump and other incidental costs
- Costs are based costs curves developed previously for the Passaic River Basin in New Jersey. These cost curves are shown in the *Quantities and Costs Curves for Flood Control Measures* Report [USACE, NY District-1980].
- Costs are based on an average structure foot print area of 1,500 sq ft.

The combined elevation and flood proofing with estimated costs for 10 percent and 1 percent floods are summarized in Table 6. The nonstructural economic analysis completed in 2010 indicated that nonstructural plans were not as efficient as the structural alternatives, with lower benefit to cost ratios. Updates of the nonstructural alternatives, drawing upon post-Hurricane Sandy conditions, would entail 1) increasing the cost estimate contingency from 20% to 40% to be comparable to current nonstructural projects in the New York/New Jersey region, and 2) incorporating current unit costs and construction durations, which are more conservative than the ones informing the existing 2010 price level cost estimates, and are expected to increase the nonstructural alternatives costs considerably. Therefore, as it was determined that a nonstructural analysis update would not increase the economic efficiency compared to the structural alternatives (Section 3.11). The nonstructural alternatives were screened out from the initial array of alternatives.

Table 6. Nonstructural Plan Costs (2010 Price Levels).

Nonstructural Component	**10% Floodplain**	**1% Floodplain**
Structures to be Elevated	8	134
Structures to be Floodproofed	38	405
Total Number of Structures	46	539
TOTAL FIRST COST:	**$ 6,807,000**	**$ 71,999,000**
TOTAL ANNUAL COST:	**$ 573,000**	**$ 3,674,000**

3.10.4 Long Island Sound Front Coastal Storm Risk Management Alternatives

Following the screening of measures, one coastal storm risk management alternative was developed for the Long Island Sound shoreline reaches that have existing concrete seawalls, and one alternative was developed for the rest of the shoreline reaches that have existing beach and dunes. Horizontal alignment of improvements was based on mapped physical features and field investigations. The top elevation of the structures was established at 14 ft NAVD88. The 2 percent flood (50-year) design was chosen for preliminary comparison of the various coastal storm risk management plans. The level of design will be optimized following the TSP milestone to identify the National Economic Development Plan (NED plan).

3.10.4.1 Floodwall with Rock Toe Protection

A concrete and steel sheetpile floodwall with rock toe protection would be constructed directly seaward of the existing bulkheads along the first row of waterfront buildings. The new floodwall would extend 1,450 ft from Cliff Drive to Washington Avenue in Reach 1, 1,250 ft from Sound Beach Road to Ships Lane in Reach 3, and 1,450 ft from 7th Street to West Harbor Drive in Reach 5. Rock toe protection will be placed at the seaward toe of the new floodwalls to provide scour protection.

The proposed floodwall covers Reaches 1, 3, and 5 of the Study area, approximately 4,150 ft of shoreline. The new sheet pile seaward of the existing bulkhead will have a crest elevation of +14.0 ft NAVD88. The crest elevation of the rock toe protection is at +4 ft NAVD88, composed of two layers of armor stone supported by underlayer and bedding stone. The rock toe protection will be backfilled and covered with sand. The new floodwalls would have a gravel splash apron landward of the sheetpile. The typical cross-section is shown in Figure 8. The sheetpile bulkheads would be tied into sections of raised and buried floodwall proposed for the rest of the Long Island Sound facing reaches.

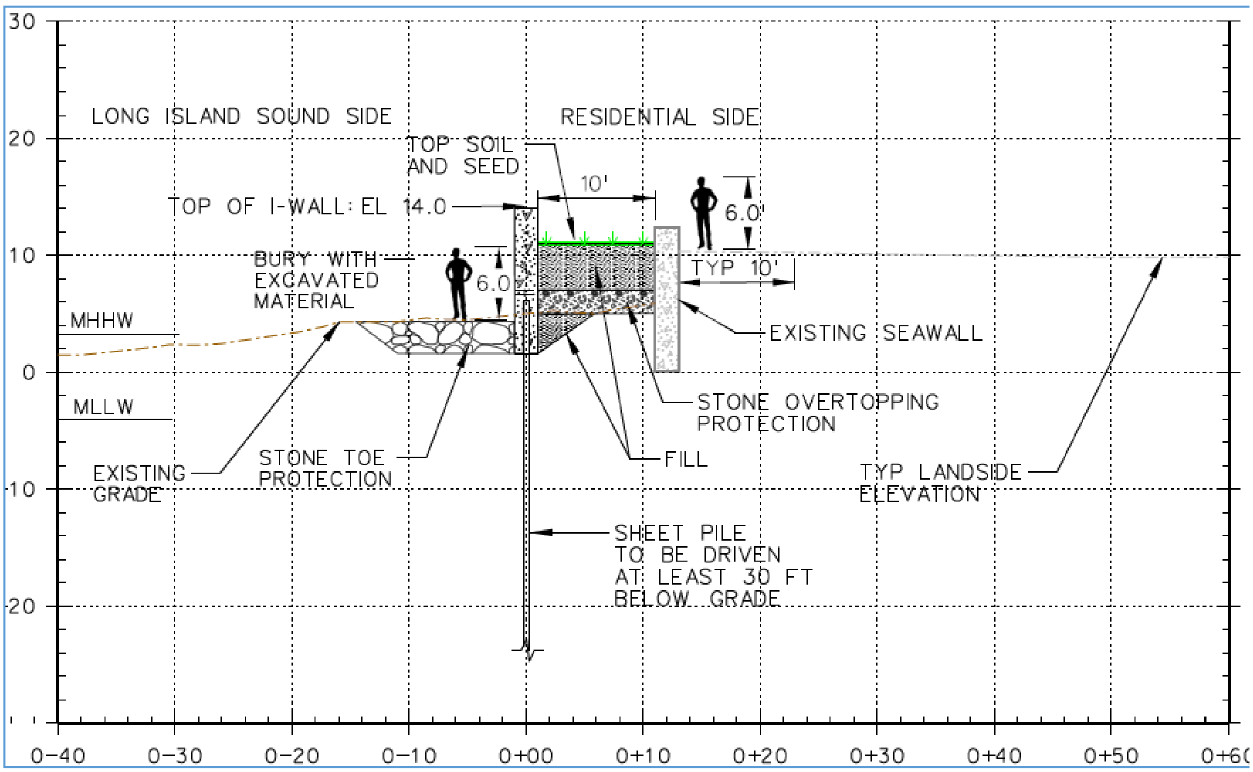

Figure 8. Typical Floodwall with Rock Toe Protection near Pine Lane Reach (elevation on y-axis shown on NAVD88)

3.10.4.2 Buried Floodwall

The 3,400 ft shoreline in Reaches 2, 3, and 3a will be reinforced with a concrete capped free-standing sheet pile wall located approximately 30 ft to 40 ft seaward of the waterfront property. The free-standing sheet pile wall would be driven to approximately –3.5 ft NAVD88 and maintain a +14.0 ft NAVD88 crest elevation. The sheet pile will be covered with sand having a 6 ft wide crest at elevation of approximately +16.0 ft NAVD88 and 1V:3H side slopes. The sand cover will be planted and equipped with timber walk-overs at strategic locations to provide for adequate public access. The sand cover is not needed for the buried floodwall to function as designed. A typical buried floodwall is shown in Figure 9. Including approximately 600 ft of tie-in at corners and ends, the total waterfront length of buried floodwall would be approximately 4,000 ft. The existing 400 ft dune behind the public beach in Reach 4 will be raised from an average height of +12.5 ft NAVD88 to +14.0 ft NAVD88 completed with buried floodwall inside the dune and beach grass planting and a timber walk-over. The advantage of this measure is full incorporation of existing features, minimal disturbance of the waterfront access and preservation of the existing waterfront view.

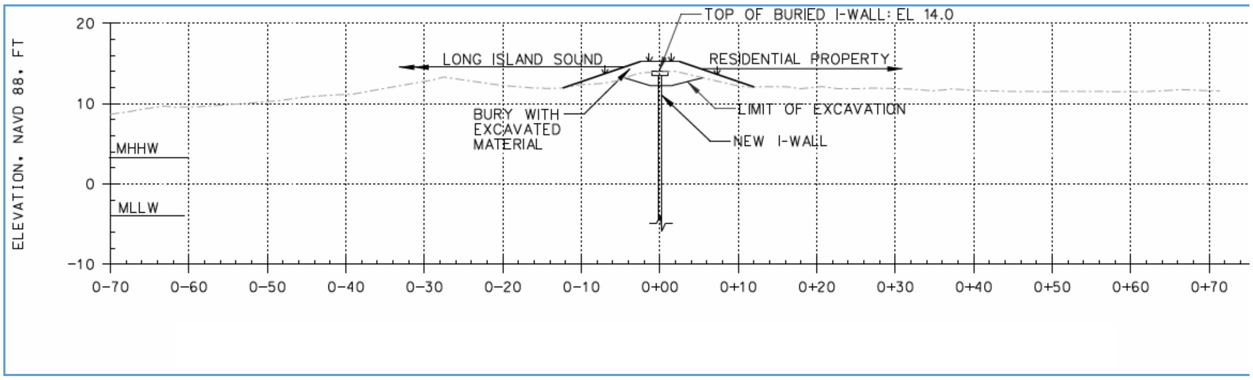

Figure 9. Typical LIS Buried Floodwall

3.10.5 Bay Side Coastal Storm Risk Management Alternatives

Four coastal storm risk management alternatives for the Oyster Bay Side area were developed utilizing coastal storm risk management features discussed in the plan formulation section. Horizontal alignment of improvements was based on physical features and field investigations. The current Bay Side design elevation has been established at +13 ft NAVD88.

3.10.5.1 Raised Road

For the eastern reach of bay waterfront, approximately 5,300 ft roadway along West Harbor Drive, would be raised to +13 ft NAVD88 from the existing average +10.5 ft NAVD88. A raised road instead of fixed floodwall may be more aesthetically appealing and would eliminate construction of expensive closure structures in this reach.

3.10.5.2 Bay Side Sheet Pile Floodwall

As shown in Figure 10, the sheet pile will be driven approximately 8 ft seaward from the existing guardrail along the eastern 5,300 ft of West Harbor Drive. The vertical sheetpile will be free-standing with a concrete pile cap at +13 ft NAVD88 elevation. The sheetpile floodwall would be stabilized with 2-layers of 200 pound armor stone on the bayside with adequate drainage provisions along the roadside. The total length of the sheet pile wall is approximately 5,300 ft including tie-ins to eastern and western ends.

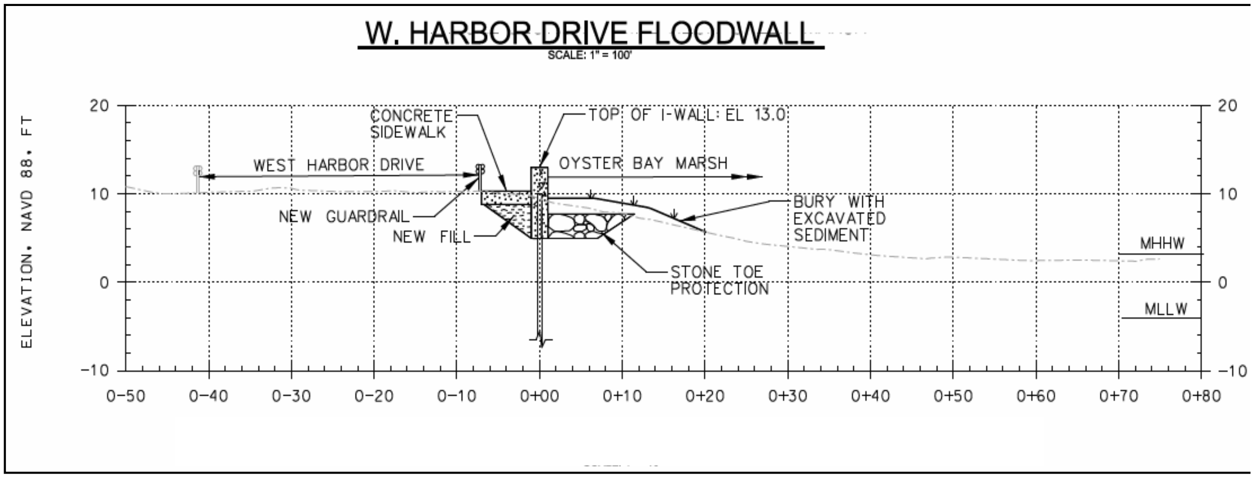

Figure 10. Typical Bay Side Sheet Pile Floodwall

3.10.5.3 Bay Side Buried Floodwall

The western 2,800 ft of low-lying bayside property would be lined by a floodwall buried by sand and located seaward of the existing bulkhead line (Figure 11). The sand cover will be 10 ft wide and +13 ft NAVD88 at crest with 1V:2H side slopes to mimic the existing dunes along the shorefront. A sheet pile cut-off wall would be driven along the centerline with a crest elevation at +13 ft NAVD88. The sheet pile would function both as a groundwater cut-off and to reduce risk from inundation. The toe of the sand cover will be above Mean High Water to minimize wetland impacts.

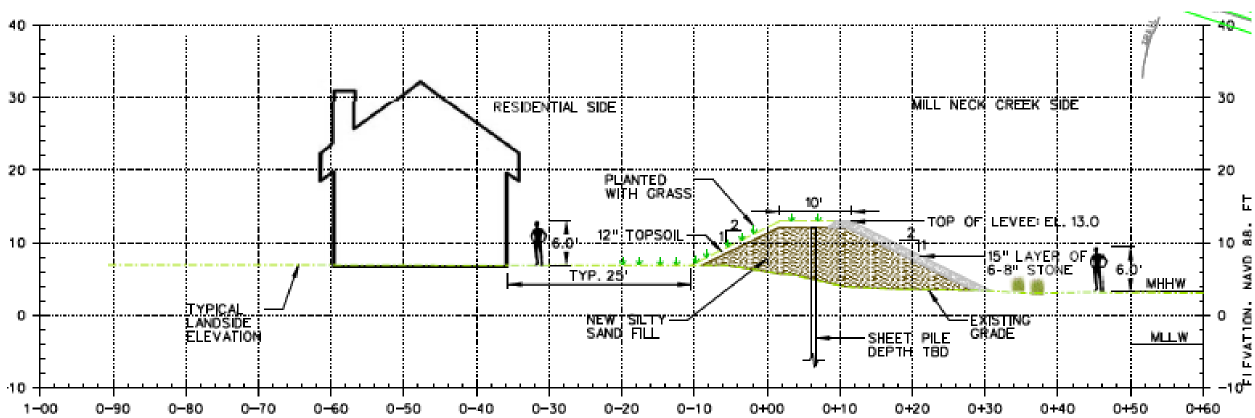

Figure 11. Typical Bay Side Buried Floodwall (elevations shown in NAVD88)

3.10.5.4 Sheet Pile Set-Back Floodwall

For the eastern reach of bay waterfront along West Harbor Drive, approximately 5,300 ft of set-back floodwall would be constructed to +13 ft NAVD88, or approximately 3.0 ft above the existing average grade elevation (Figure 12). The set-back floodwall would be located in the median of West Harbor Drive and have an average height of 3 feet above the existing grade. Additionally, the road would be tapered and raised to elevation +13 ft NAVD88 at three intersections along West Harbor Drive and cross-over interchanges would be constructed. These interchanges would minimize disruption to local traffic patterns and allow safe access to the bay-side waterfront for automobiles, bicyclists and pedestrians. This alternative also avoids and minimizes disruption to the salt marsh which abuts this reach to the south.

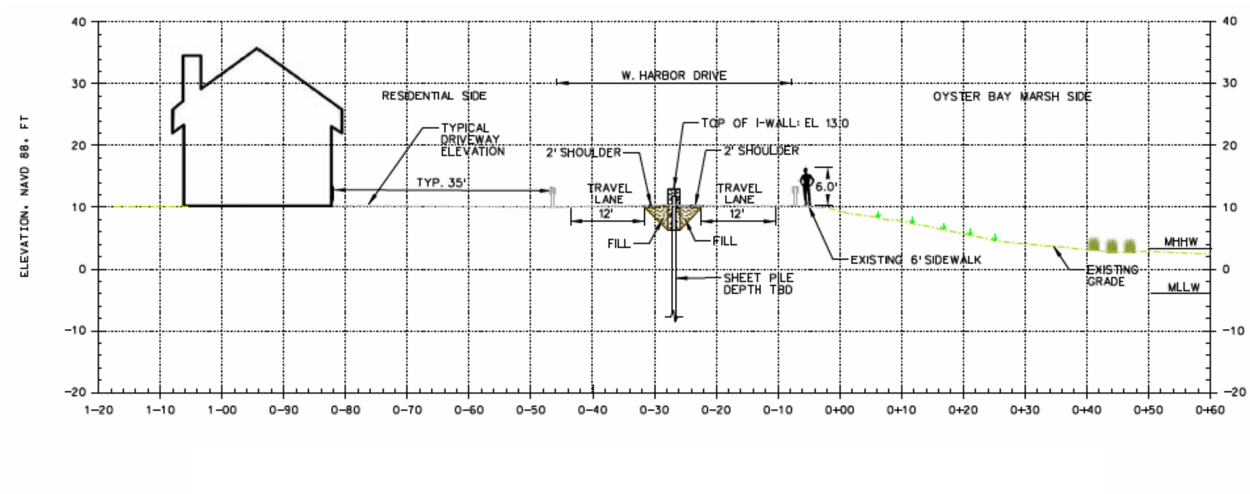

Figure 12. Typical Sheet Pile Set-back Floodwall (along West Harbor Drive)

3.11 Final Array of Alternative Plans*

The project alternatives described in Table 7 for the various reaches in the Study Area were then combined to create comprehensive alternatives for both the Long Island Sound and Oyster Bay reaches of the Study area. Four structural plan alternatives for Bayville were developed. These four structural plans provide coastal storm risk management on the Long Island Sound and along the Bay Side. For each design cross-section, elevations were selected to ensure that overtopping would be within allowable limits and to ensure reliable structural performance. Because the alternatives use different structure types and construction methods, these elevations were established for the individual alternatives and thus will vary. The alternatives all provide the equivalent level of coastal storm risk management to the 2 percent flood.

Table 7. Measure Applicability by Study Reach.

Reach	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Long Island Sound				
Seawall Reaches	Floodwall	Floodwall	Floodwall	Floodwall
Bulkhead Seawall	Buried Floodwall	Buried Floodwall	Buried Floodwall	Buried Floodwall
Bayside				
West Harbor Drive	Steel Sheetpile Floodwall	Road Raising	Road Raising	Set-back Floodwall
Mill Neck Bay Reach	Steel Sheetpile Floodwall	Sheetpile Reinforced Levee	Steel Sheetpile Floodwall	Steel Sheetpile Floodwall

3.11.1 Alternative 1

Long Island Sound side of Bayville: The alignment consists of 3,850 linear feet of seawall combined with 2,940 linear feet of buried floodwall (Figure 13 and Table 7). For initial analysis the top elevation of the structure has been established at elevation +14 ft NAVD88 (2 percent flood with wave setup.

Oyster Bay (south) side of Bayville: The alignment consists of 8,100 linear feet of floodwall. For initial analysis the top elevation of the structure has been established at elevation +13 ft NAVD88 (2 percent flood without wave setup[3]).

Drainage features: With the floodwalls and buried floodwalls in place, pump stations will be required to pump storm water through the alignment and into the Bay. Pump stations were designed with consideration of the USACE policy concerning minimum facility. Three pump stations with a combined capacity of 159 cubic feet per second (cfs) have been sized to handle the large volume of storm water expected within the Study area. All three pump stations will be co-located with an emergency natural gas powered auxiliary power generator. The first pump on Jefferson Avenue will be sized to pump 65 cubic feet per second (cfs) The second pump will be located between 14th and June Avenue and will be sized to handle a 48 cfs flow. The third pump station is located at the east end of 1st street and will be sized to handle a 46 cfs flow. New drainage lines will be constructed to efficiently deliver storm water to the pump stations and to prevent making the interior drainage problem worse than it currently is once the perimeter alignment is constructed.

Sizing and interior drainage will be refined during optimization following the Alternatives Decision Milestone (ADM). Based on preliminary designs, the costs were estimated to be $70,846,000, including minimum interior drainage facilities. Cost details are provided in Table 8.

[3] Wave setup is considered to be an insignificant design factor for the Bay Side based on available information, this assumption will be confirmed during optimization for the TSP.

Figure 13. Alternative 1 (Floodwall at Mill Neck Creek and W. Harbor Drive)

3.11.2 Alternative 2

Long Island Sound side of Bayville: The alignment consists of 3,850 linear feet of seawall combined with 2,940 linear feet of buried floodwall (Figure 14 and Table 7). For initial analysis the top elevation of the structure has been established at elevation +14 ft NAVD88 (2 percent flood with wave setup.)

Oyster Bay (south) side of Bayville: The alignment consists of 2,800 linear feet of earthen levee (shown in green in Figure 14) adjoining the Mill Neck Creek neighborhood and 5,300 linear feet of West Harbor Drive (shown in white) elevated to the design height with all adjoining private driveways and intersections tied in. For initial analysis the top elevation of structures has been established at elevation +13 ft NAVD88 (2 percent flood without wave setup, considered to be an insignificant design factor for the Bay Side.)

Drainage features: With the floodwalls and buried floodwalls in place, pump stations will be required to pump storm water through the alignment and into the Bay. Pump stations were designed with consideration of the USACE policy concerning minimum facility. Three pump stations with a combined capacity of 159 cfs have been sized to handle to large the volume of storm water expected within the Study area. All three pump stations will be co-located with an emergency natural gas powered auxiliary power generator. The first pump on Jefferson Avenue will be sized to pump 65 cubic feet per second (cfs) The second pump will be located between 14th and June Avenue and will be sized to handle a 48 cfs flow. The third pump station is located at the east end of 1st street and will be sized to handle a 46 cfs flow. New drainage lines will be constructed to efficiently deliver storm water to the pump stations and to prevent making the interior drainage problem worse than it currently is once the perimeter alignment is constructed.

Sizing and interior drainage will be refined during optimization following the ADM. Based on preliminary designs completed in 2015, the costs were estimated to be $67,739,000, including minimum interior drainage facilities. Cost details are provided in Table 8.

Figure 14. Alternative 2 (Earthen Levee at Mill Neck Creek and Elevating W. Harbor Drive)

3.11.3 Alternative 3

Long Island Sound side of Bayville: The alignment consists of 3,850 linear feet of seawall combined with 2,940 linear feet of buried floodwall (Figure 15 and Table 7). For initial analysis the top elevation of the structure has been established at elevation +14 ft NAVD88 (2 percent flood with wave setup.)

Oyster Bay (south) side of Bayville: The alignment consists of 2,800 linear feet of I-wall type concrete floodwall (shown in red in Figure 15) adjoining the Mill Neck Creek neighborhood. Additionally, 5,300 linear feet of West Harbor Drive (shown in white) is elevated to the design height with all adjoining private driveways and intersections tied in. For initial analysis the top elevation of the structure has been established at elevation +13 ft NAVD88 (2 percent flood without wave setup, considered to be an insignificant design factor for the Bay Side.)

Drainage features: With the floodwalls and buried floodwall in place, pump stations will be required to pump storm water through the alignment and into the Bay. Pump stations were designed with consideration of the USACE policy concerning minimum facility. Three pump stations with a combined capacity of 159 cfs have been sized to handle to large volume of storm water expected within the Study area. All three pump stations will be co-located with an emergency natural gas powered auxiliary power generator. The first pump on Jefferson Avenue will be sized to pump 65 cubic feet per second (cfs) The second pump will be located between 14th and June Avenue and will be sized to handle a 48 cfs flow. The third pump station is located at the east end of 1st street and will be sized to handle a 46 cfs flow. New drainage lines will be constructed to efficiently deliver storm water to the pump stations and to prevent making the interior drainage problem worse than it currently is once the perimeter alignment is constructed.

Sizing and interior drainage will be refined during optimization following the ADM. Based on preliminary designs completed in 2015, the costs were estimated to be $65,256,000, including minimum interior drainage facilities. Cost details are provided in Table 8.

Figure 15. Alternative 3 (Elevating West Harbor Drive)

3.11.4 Alternative 4

Long Island Sound side of Bayville: The alignment consists of 3,850 linear feet of seawall combined with 2,940 linear feet of buried floodwall (Figure 16 and Table 7). For initial analysis the top elevation of the structure has been established at elevation +14 ft NAVD88 (2 percent flood with wave setup.)

Oyster Bay (south) side of Bayville: The alignment consists of 2,800 linear feet of floodwall (shown in red in Figure 16) adjoining the Mill Neck Creek neighborhood. Additionally, a 5,300 linear foot set-back floodwall will be built down the center lane of West Harbor Drive (shown in white) to the established design height. Traffic cross-overs (raised road) will be constructed at two intersections to reduce traffic impacts to local residents. For initial analysis the top elevation of the structure has been established at elevation +13 ft NAVD88 (2 percent flood without wave setup, considered to be an insignificant design factor for the Bay Side.)

Drainage features: With the floodwalls and buried floodwall in place, pump stations will be required to pump storm water through the alignment and into the Bay. Pump stations were designed with consideration of the USACE policy concerning minimum facility. Three pump stations with a combined capacity of 159 cfs have been sized to handle the large volume of storm water expected within the Study area. The first pump on Jefferson Avenue will be sized to pump 65 cubic feet per second (cfs) The second pump will be located between 14th and June Avenue and will be sized to handle a 48 cfs flow. The third pump station is located at the east end of 1st street and will be sized to handle a 46 cfs flow. All three pump stations will be co-located with an emergency natural gas powered auxiliary power generator. New drainage lines will be constructed to efficiently deliver storm water to the pump stations and to prevent making the interior drainage problem worse than it currently is once the perimeter alignment is constructed.

Sizing and interior drainage will be refined during optimization following the ADM. Based on preliminary designs completed in 2015, the costs were estimated to be $64,469,000, including minimum interior drainage facilities. Cost details are provided in Table 8 .

Figure 16. Alternative 4 (Set-Back Floodwall on West Harbor Drive)

3.12 The Federal Objective

Per the 1983 Principles and Guidelines, the Federal objective of water and related land resources project planning is to "contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements." Table 8 shows the estimated cost for construction of each alternative.

Table 8. First Cost and Annual Cost Summary of Alternatives 1 to 4.

Annual Cost of Alternatives 1 to 4 October 2015 Price Levels FY16 Discount Rate 3.125%				
	Alternative #1	Alternative #2	Alternative #3	Alternative #4
Total First Cost	**$70,846,000**	**$67,739,000**	**$65,256,000**	**$64,469,000**
Interest During Construction	$1,627,000	$1,556,000	$1,499,000	$1,481,000
Annualized Total Investment Cost	$2,889,000	$2,763,000	$2,662,000	$2,630,000
Annual OMRR&R Cost	$166,000	$166,000	$166,000	$166,000
Total Annual Cost:	**$3,055,000**	**$2,929,000**	**$2,828,000**	**$2,796,000**

3.12.1 Principles and Guidelines Criteria, 1983

The 1983 Principles and Guidelines require that plans are formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability.

- **Completeness** is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. For the Bayville Study, an alternative had to provide coastal storm risk management along the entire length of the alignment (14,890 linear feet) to be considered complete. Any "holes in the fence" would threaten the success of the entire project.
- **Effectiveness** is the extent to which the alternative plans contribute to achieve the planning objectives. Effectiveness of the alternatives was measured by the reduced damages in the with-project condition against a 2 percent flood (50-year event). Alternatives that have a benefit cost ratio (BCR) lower than one will be eliminated from consideration.
- **Efficiency** is the extent to which an alternative plan is the most cost effective means of achieving the objectives. Efficiency will be measured through a comparison of BCRs and reduced damages. Plans that provide the same level of performance, but at higher cost, will be eliminated from consideration.

- **Acceptability** is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies. The alternatives were formulated to be in accord with applicable laws and regulations.

It is necessary to know the preliminary benefits and costs of the alternatives in order to assess their effectiveness and efficiency. Accordingly, the annual costs and benefits for the final array of alternative plans are presented in Table 9.

Table 9. Annual Costs and Annual Benefits for Final Array of Alternatives.

Summary of Estimated Costs and Benefits	Alternative	Annual Cost	Annual Benefits	Annual Net Benefits	BCR
Price Level: October 2015. FY16 Discount Rate: 3.125%.	Alternative 1	$3,055,000	$6,033,000	$2,978,000	**2.0**
	Alternative 2	$2,929,000	$6,033,000	$3,104,000	**2.1**
	Alternative 3	$2,828,000	$6,033,000	$3,205,000	**2.1**
	Alternative 4	$2,796,000	$6,033,000	$3,237,000	**2.2**

Chapter 4: Tentatively Selected Plan*

This section of the report describes the Tentatively Selected Plan (TSP). The TSP will be optimized after agency and public reviews for the optimal project height, which may be up to +14 ft North Atlantic Vertical Datum of 1988 (NAVD88), height is limited by elevation of tie-offs.

4.1 Proposed Action/Plan Components

Based on having the highest average annual net benefits ($3,237,000), Alternative 4 is the TSP. This alternative consists of approximately 14,890 linear ft of raised ground surfaces, floodwalls, and buried floodwalls (Table 7). The project spans a geographic distance of approximately 2.8 miles along the shoreline of Bayville and ties into high ground (+13 ft NAVD88 to +14 ft NAVD88) at each end. For each segment of the project, features were chosen to match the existing surroundings, i.e. floodwalls where the shoreline is already bulkheaded and buried floodwalls consisting of sand-covered floodwalls adjacent to existing dunes. The final length and heights will be determined during project optimization.

Major features of the TSP include:

- Long Island Sound side of Bayville: The alignment consists of 3,850 linear feet of I-wall type concrete floodwall combined with 2,940 linear feet of buried floodwall. For initial analysis the top elevation of the structure has been established at elevation +14 ft NAVD88 (2 percent flood with wave setup.)

- Oyster Bay (south) side of Bayville: The alignment consists of 2,800 linear feet of I-wall type concrete floodwall (shown in red in Figure 17) adjoining the Mill Neck Creek neighborhood. Additionally, a 5,300 linear foot set-back floodwall will be built down the center lane of West Harbor Drive (shown in red) to the established design height. Traffic cross-overs (raised road) will be constructed at two intersections (shown in white) to reduce traffic impacts to local residents. For initial analysis the top elevation of the structure has been established at elevation +13 ft NAVD88 (2 percent flood without wave setup, considered to be an insignificant design factor for the Bay Side.)

- Drainage features: With the floodwalls and buried floodwalls in place, pumps will be required to pump storm water through the alignment and into the Bay. Pumps were designed with consideration of the USACE policy concerning minimum facility. Three pumps have been sized to handle the large volume of storm water expected within the Study area. The first pump on Jefferson Avenue will be sized to pump 65 cubic feet per second (cfs) The second pump will be located between 14th and June Avenue and will be sized to handle a 48 cfs flow. The third pump station is located at the east end of 1st street and will be sized to handle a 46 cfs flow. All three pumps will be co-located with an emergency natural gas powered auxiliary power generator. New drainage lines will be constructed to efficiently deliver storm water to the pumps and to prevent making the interior drainage problem worse than it currently is once the perimeter alignment is constructed.

- Real Estate (Figure 18): Since the vast majority of Bayville is privately owned, construction of the TSP will require the Bayville (local partner) to acquire approximately 31 acres of land (either in fee or easements). In general, the perimeter floodwall will require a 30 ft - 60 ft wide easement in order to operate, maintain, repair, replace and rehabilitate the project.

Figure 17. Overview of the Tentatively Selected Plan (Alternative 4)

Figure 18. Real Estate Requirements for the Tentatively Selected Plan

4.2 Benefits of the Plan

Benefits were calculated as the difference in damages in without and with project conditions. Benefits were then amortized over a 50-year period to identify equivalent annual benefits using October 2015 price levels and the FY16 discount rate of 3.125%. The without project annual damages are $7,049,000. As the alternatives were developed to the 2 percent flood (50-year) level of performance, the residual flood damages were from properties and infrastructure outside of the 2 percent floodplain. During optimization, the Study team will find the optimal height of the project to maximize the average annual net benefits, which may lead to decrease in the residual damages identified at this time. Further details on the economic evaluation are provided in Appendix C - Economics.

4.3 Cost Estimate

A summary of the costs of the Bayville TSP is presented in Table 10.

Table 10: Total Firsts Costs for Bayville (October 2015 P.L.)

Account/Feature	Amount
01 – Lands and Damages	$6,629,000
11 – Levees & Floodwalls	$38,085,000
02 – Relocations	$2,288,000
13 – Pumping Plant	$10,118,000
18 – Environmental Mitigation	$1,089,000
30 – Planning, Engineering, & Design	$3,186,000
31 – Construction Management	$2,254,000
Total	**$64,469,000**

The initial project first cost is $64,469,000 (October 2015 P.L.) and the fully funded cost is $67,702,000, assuming price escalation through construction. These costs include construction, lands and damages, design, supervision and associated administration costs. The material costs were based on a combination of MII database, RSMeans, quotes, and some historical information. Equipment rates were obtained from region 1, and Davis Bacon Wage Rates for Nassau County, NY were utilized for labor costs. The contingencies were developed using Abbreviated Risk Analysis program (ARA). The summary of the results of this risk analysis, and more detail on the cost estimate, can be viewed in the Cost Appendix.

4.4 Operations, Maintenance, Repair, Replacement, & Rehabilitation Considerations

Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) actions will be substantial for the TSP primarily due to the features associated with the interior drainage such as pumping stations and emergency backup generators. The estimated annual OMRR&R cost is currently $166,000.

4.5 Interior Drainage and Minimum Facilities

Three pump stations, with a total capacity of 159 cfs, have been identified for the three interior drainage areas of Bayville. Interior drainage and minimum facilities will be refined during optimization. There have also been local plans for interior drainage work that might reduce the required capacity, but the status of this local project is still being coordinated with the New York Rising Program. More information regarding interior drainage and minimum facilities may be found in Appendix B: Engineering.

4.6 Risk and Uncertainty Analysis

Per USACE guidance, risk and uncertainty must be incorporated into flood risk management studies. The following areas of uncertainty were incorporated into the HEC-FDA program:

- stage frequency
- first floor elevation
- depreciated structure value
- content-to-structure value ratio
- other-to-structure value ratio

The HEC-FDA program allows uncertainty in stage-frequency to be calculated using equivalent record length, for which USACE Engineering Manual, EM 1110-2-1619, Table 4-5, was consulted. For the Bayville HEC-FDA models, an equivalent record length of 50 years was assumed. A first floor standard deviation of 0.6 ft was selected based on recommendations in the USACE Engineering Manual, EM 1110-2-1619, Table 6-5, and the 2-foot contour intervals provided in the project topographic mapping.

The analysis recognizes that estimates of depreciated structure value based on windshield inventories contain inherent uncertainty. Structure values are assumed to have a coefficient of variation of 10%. Engineering Manual EM 1110-2-1619 suggests that in lieu of better site-specific information, content-structure value ratios based on large samples of Flood Insurance Administration (FIA) claims records can be used (Table 6-4 in Engineering Manual EM 1110-2-1619). Within Passaic River Basin (PRB) depth-damage functions (utilized for this Study), a coefficient variation of 25% was applied to the content-to-structure value ratio. Because the PRB depth-damage functions present other damage as a percent of structure value, the other-to-structure value ratio was estimated to have a coefficient of variation of 10%. The Institute for Water Resources (IWR) depth-damage functions incorporate a 10% coefficient of variation into simulations of content values. IWR depth-damage functions do not estimate other-to-structure damages.

4.7 Economic, Environmental, and Other Social Effects

Four accounts have been established to facilitate evaluation of alternative plans:

1. National Economic Development (NED) – changes in the economic value of the national output of goods and services
2. Environmental Quality (EQ) – non-monetary effects on significant natural and cultural resources
3. Regional Economic Development (RED) – changes in the distribution of regional economic activity that result from each alternative plan
4. Other Social Effects (OSE) – effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts.

The Bayville TSP contributes to National Economic Development by reducing damages from future coastal storm and flood events. In addition to reducing property damage, implementation of the TSP would serve to keep critical facilities, such as police and emergency services, operational during storm events by reducing the intensity and frequency of flooding. It would also reduce flooding on evacuation routes, access routes for emergency vehicles, and the local roads that feed into these major roads. It neither contributes nor detracts from the RED account. As identified in the Environmental Assessment, there would be minimal environmental impacts because of the highly developed nature of the project area and the relatively tight footprint of the project.

As for the OSE account, this project will affect the community's water views or water access along some portions of the alignment. The height of the project above the existing ground surfaces ranges from two to ten feet. Waterfront access will be maintained in the form of timber walkovers or earthen ramps.

4.8 Plan Costs and Benefits

The benefits of implementing coastal storm risk management measures represent flood damages avoided by the project. Benefits were calculated as the difference in damages before and after project implementation. Benefits were then amortized over a 50-year period of analysis to identify equivalent average annual benefits using October 2015 price levels and the FY16 discount rate of 3.125%. Table 11 provides a summary of the annual costs and benefits of the plan.

Table 11. Performance of Bayville Tentatively Selected Plan (Oct. 2015 P.L.)

Annual Project Cost (Discounted at 3.125% over a 50-year period)	$2,796,000
Average Annual Benefits (Discounted at 3.125% over a 50-year period)	$6,033,000
Average Annual Net Benefits	$3,237,000
Benefit Cost Ratio	2.2

4.9 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 summarized in Table 12.

Table 12. Bayville Study Compliance with E.O. 11988

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 of Engineers guidance, including The no action alternative, as well as nonstructural measures such as retreat, demolition and land acquisition.
If the action must be in the flood plain, advise the general public in the affected area and obtain their views and comments.	The draft Integrated Feasibility Report and Environmental Assessment was released to public review in January 2016, and public hearings have been held throughout the Study.
Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial flood plain values. Where 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.	The anticipated impacts associated with the Selected Plan are summarized in Chapters 4 and 5 of this report. The project would not alter or 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 the project area frontage is 100% 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 and the project has minimal mitigation. Chapter 3 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 draft Integrated Feasibility Report and Environmental Assessment was released to public review in January 2016, and public hearings have been held throughout the Study.
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.

Chapter 5: Environmental Impacts*

The following sections detail the environmental impacts analysis which evaluated the No Action Alternative as well as the Proposed Action which is the Tentatively Selected Plan as described in Chapter 4.

5.1 Topography, Geology, and Soils

No Action Alternative: Under the No-Action alternative, topography may change due to soil erosion and degradation from wave run up and overtopping. Geology will not change and soils will erode during flooding with no action.

Proposed Action: Topography along the Bayville shoreline would be permanently impacted by the installation of new floodwalls and buried floodwalls. Floodwalls will be raised to +14 ft North Atlantic Vertical Datum of 1988 (NAVD88), the 2 percent flood with wave setup on the Long Island Sound side and to +13 ft NAVD88 on the bayside. Along the beaches, sand fill will be placed behind the raised bulkhead to improve the aesthetics. The sand fill covering of the buried floodwalls will be 5 ft wide at the crest with 1V:3H side slopes to tie into the surrounding area. The buried floodwalls will be planted with native vegetation to help reduce risk against erosion. The buried floodwalls will be constructed using sand on site, if additional sand is required, grain size of new sand will be similar in nature to existing sand.

The construction of the floodwalls (total combined length is 3,850 linear feet) on the Long Island Sound will displace existing sand resources. Sand that is in front of the floodwalls, specifically in areas where the beach is narrow and exposed to frequent wave activity, will erode more quickly during storm and high tide events due to wave reflection. Approximately 10 feet of rip rap (measured out from the bulkhead toward the Sound) will be placed in front of the floodwalls. The rip rap will be buried under sand after construction, but sand is expected to erode due to high tides and wave refraction caused by reflection, and coastal storms, permanently exposing the rip rap beneath. Net transport of sand along coast and offshore will be accentuated. Sand that is behind the floodwalls will be stabilized with the proposed action, as floodwaters eroding the soils will be reduced. The dynamic coastal processes that presently influence the soils on the beach will continue, such that the beach elevations and width will continue to fluctuate as they have in the past.

5.2 Water Resources

5.2.1 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.

5.2.2 Surface Water

No Action Alternative: The no action alternative will allow natural flood processes to continue and will allow seawater to impact and flood Bayville.

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 construction areas and will dissipate quickly on the Long Island Sound side due to the sandy, coarse nature of the sediment. Additionally, the implementation of best management practices (BMP) such as silt fencing during construction will minimize the impacts. Stone will be used for fill in the construction of the outfalls and outfall channels on the Oyster Bay Side, which will not contribute significantly to turbidity. Higher levels of suspended sediments will be present during construction, but the impacts will be temporary, only being realized during periods of high tide due to the project's location in the upper zone of the salt marsh.

Drainage features that will be included in the project will impact storm water flows. With the floodwalls and buried floodwalls in place, pump stations will be required to pump storm water through the alignment and into the Bay. Pump stations were designed with consideration of the USACE policy (EM 1110-2-1413) concerning minimum facility. Three pump stations with a combined capacity of 159 cubic feet per second (cfs) were sized to handle the large volume of storm water expected during storm events within the Study area. The first pump on Jefferson Avenue will be sized to pump 65 cubic feet per second (cfs) The second pump will be located between 14th and June Avenue and will be sized to handle a 48 cfs flow. The third pump station is located at the east end of 1st street and will be sized to handle a 46 cfs flow. All three pump stations will be co-located with an emergency natural gas power auxiliary power generator in case of power failure to ensure operation. New drainage lines will be constructed to efficiently deliver storm water to the pump stations. Sizing and interior drainage features will be refined during optimization following the Agency Decision Milestone.

Surface water quality is not expected to be altered as a result of the proposed project. Setting tanks (10,000 gallon rectangular tanks) at each pump station, and catch basins within the conveyance storm sewers have been designed in the stormwater drainage plans. These measures will provide settling time for stormwater during periods of low and mid flow. Suspended sediments will settle out in the tanks/catch basins and will not flow into the surface water or salt marsh via the outfalls. Additionally, oil separators in the settling tanks will remove oil and grease and other floatables from stormwater; therefore, water quality will not be negatively impacted as a result of the proposed project.

A Section 404(b)(1) Clean Water Act (CWA) Evaluation is included as Appendix A to this Environmental Assessment. The Evaluation presents a review of compliance with the CWA and a finding of compliance with Section 404(b)(1) guidelines. A 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.

5.2.3 Tidal Influences

No Action Alternative: The no action alternative will have no impacts to tidal influences.

Proposed Action: Implementation of the proposed action will have neither short nor long-term impacts to tidal influences, as most of the shoreline impacted by tides (Long Island Sound side) is currently bulkheaded. Four outfalls with approximately 5 foot by 200 foot outfall channels will be constructed on the bayside to aid drainage. These outfalls will be sited within the upper marsh and will have no impact on tidal influences.

5.2.4 Coastal Processes

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

Proposed Action: Project construction will change the nature and rate of, existing coastal processes. The proposed action will greatly reduce the influence of the existing coastal processes (flooding and erosion) on land-based structures. The plan will provide long-term coastal storm risk management to residences, roads, and other structures and properties in Bayville.

5.3 Vegetation

5.3.1 Upland

No Action Alternative: The no action alternative will have minor short term impacts to upland vegetation as flooding may destroy ornamental vegetation, lawns, and existing saltmarsh vegetation.

Proposed action: Implementation of the proposed action will have localized long-term impacts to upland vegetation at the site of the three pump stations as vegetation will be removed for construction.

Long term impacts will also be realized at the sites of the four proposed outfalls in vegetated salt marsh and its associated upland borders. Rock will be placed in the outfall areas, taking place of the existing salt marsh vegetation at the four sites. See Table 13 for the expected environmental impacts to upland, salt marsh, and their associated vegetation.

On the Long Island Sound side, there will be positive long-term impacts as the buried floodwalls floodwalls will be covered with sand and planted with native grasses, increasing the amount of vegetation along the beach areas. Approximately 0.43 acres of dune grass will be planted.

Table 13. Environmental Impacts to Existing Resources.

Bayville, NY project feature	Existing Resource	Future Condition/ Resource	Sq Ft	Acres
Mill Neck Creek / Oyster Bay Reach (South Side)				
1) Drainage Area A gravity outfall	*Phragmites* marsh, upland border, salt marsh	Rock	4,021	0.09
2) Drainage Area A outfall	Salt marsh, upland border	Rock	1,850	0.04
3) Drainage Area B outfall	Upland border, *Phragmites* marsh, salt marsh	Rock	2,268	0.05
4) Drainage Area C outfall	Salt marsh, upland border	Rock	2,268	0.05
Outfall Channels (5' x 200') x 4	Salt marsh	Tidal creek	4,000	0.09
Total Permanent			**14,407**	**0.33**
Long Island Sound Reach (North side)				
Pine Lane Reach* (1700 linear feet)	Upper intertidal beach - no vegetation	Dune grass	**18,700**	**0.43**
*the floodwall is planned to be located 10 feet off the existing bulkhead. The area behind the new wall will be backfilled with a sand cap and dune grass				
5 foot wide temporary impact (F to G)			8,540	0.2

5.3.2 Tidal Wetlands

No Action Alternative: Under the no action alternative, wetlands may decrease with the rise in sea level permanently flooding the existing salt marshes in Bayville. Additionally, flooding will continue to overwash existing wetlands, damaging vegetation and organisms inhabiting the area.

Proposed Action: Salt marsh is common in undeveloped portions of the Study area. Intertidal and shallow subtidal habitats, such as those found within the project area, provide a variety of ecosystem services including primary production, fish and shellfish habitat and nursery areas, biogeochemical cycling of nutrients, carbon sequestration, sediment trapping, and wave attenuation (Currin *et al.*, 2010).

Construction of the floodwalls on the Oyster Bay/Mill Neck Bay Side could affect the quality and abundance of wetland resources by accelerating erosion rates due to wave deflection off of the vertical structure and altering natural flood disturbance regime frequencies and intensities. Loss of wetlands and wetland soils could result in a reduced capacity for local water quality maintenance. Likewise, the installation of pump stations and the establishment of outfall structures may adversely affect wetland habitats within the project area. Adverse effects to salt marsh obligate plants, especially halophytes, and salt marsh dependent wildlife including species of invertebrates, fishes, amphibians and reptiles, and bird species may occur as freshwater is introduced into the salt marsh's naturally saline aquatic system.

The current stormwater drainage system in Bayville is insufficient to handle the large volume of storm water that is common during severe coastal storms. This means that much of the storm water is not captured and flows go unchecked into the salt marsh. By constructing outfalls and pump stations, storm water runoff will be controlled and will have a more localized (point source) impact on the overall salt marsh habitat as freshwater runoff will be restricted to those areas in and around the outfall and outfall channels. Sporadic impacts to local salinity gradients will be realized due to this change; however, freshwater from stormwater is not expected to have a significant impact to the salt marsh or surrounding biota as it will rapidly mix with salt water.

Approximately 0.33 acres of permanent impacts to vegetated salt marsh will occur as a result of the construction of four outfalls and their associated outfall channels (5' x 200') on the Oyster Bay Side of the project area (Table 13). Level stone fill will be placed in those outfalls and outfall channels. Early coordination with the U.S. Fish and Wildlife Service (USFWS) has provided USACE a potential plan for mitigation of the 0.33 acres of impacted wetlands, but is subject to approval and further coordination with the USFWS and Oyster Bay National Wildlife Refuge (OBNWR).

5.3.2.1 Potential Mitigation

The proposed, potential mitigation site is located on a parcel in the 84-acre Frost Creek designated unit of the OBNWR approximately 1.5 miles west of the Study area. The unit begins just east of Peacock Point, north of The Creek Club golf course and Fox Lane, and west of Bayville Road. The northernmost boundary of the unit includes a portion of and continues along the shoreline of the Long Island Sound. A small (approximately 0.35 acres) disconnected parcel of the unit is situated between Michael F. Road and Walton Avenue within the census-designated hamlet of Locust Valley, NY. This parcel was identified by the USFWS as a potential area for mitigation through the eradication of the non-native common reed (*Phragmites australis*).

Salt marsh habitat dominates the Frost Creek unit. Meandering creek channels transect the primary salt marsh and allow inlet and outlet of tidal flows. The vast majority of vegetative cover is composed of North Atlantic low salt marsh. The most common plant species of this classification if smooth cordgrass (*Spartina alterniflora*). Smooth cordgrass provides cover for waterfowl, wading birds, shorebirds, and muskrats, as well as habitat for commercially important shellfish and fish (Webb et al., 1985). Smooth cordgrass also stabilizes shorelines against erosion and filter heavy metals and toxic materials from the water column (Kiesling et al., 1988). Salt shrub, and forest consisting of black locust (*Robinia pseudoacacia*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and American ash (*Fraxinus americana*), is also found within the unit. Other vegetation cover types include reed grass marsh dominated by common reed (*Phragmites australis*) and turf grass.

Common reed is a warm-season, rhizomatous, stoloniferous perennial grass species. While the species is native to the U.S., Saltonstall identified a non-native halophyte, likely introduced from Europe in the late 1700s that is responsible for a recent widespread North American invasion (Saltonstall, 2002). Today, in much of Northern Atlantic states, including New York, it is considered a noxious weed. Common reed reduces native biodiversity in salt marsh plant communities by establishing robust colonies in disturbed habitat patches. The rhizomatic regeneration characteristic of the species reproductive cycle compromises management and eradication efforts.

Within the Frost Creek unit, stands of common reed can be found along the southern boundary and within the small disjunct parcel to the south and east of the primary unit. Removal of common reed from these areas would greatly benefit the salt marsh community by allowing native plants to recolonize invaded patches. Native plant recolonization of restoration sites will in turn provide an opportunity for reestablishment of a diverse and abundant assemblage of native invertebrate, fish, amphibian, reptile, bird, and mammal species.

Factors which affect successful restoration and revegetation include: elevation of the site in relation to tidal regime, slope, exposure to wave action, soil chemical and physical characteristics, nutrient supply, and salinity (Broome et al., 1988). Studies have reported that removal or reduction of existing tidal flow restriction factors can result in significant improvements to native halophyte communities (Roman et al., 1984). In addition, vegetation structure changes within a salt marsh system have been attributed to decreases in marsh elevation. In existing salt marsh areas, salt marsh obligate species decline in lower elevation habitats. However, salt marsh vegetation communities may reestablish successfully at higher elevations (Sinicrope et al., 1990).

Development of a multi-faceted management plan that defines specific control measures may reduce time and cost related resource expenditures associated with remedial activity implementation. With that in mind, several methods for removing and controlling common reed grass in salt marsh habitats have been explored and are detailed below:

-Improving water quality within the salt marsh by removing adjacent sources of pollution. This could be accomplished by:

1. Installation of water quality filtration systems between the marsh and source of pollution.
2. Relocation, retrofitting, or other modifications to pollution sources to reduce impacts to the marsh habitat.

-Restoring historic marsh elevations by:

1. Determining the influence of elevation on the site's native and non-native species.
2. Identifying areas within the site that could benefit from increased or decreased elevation.
3. Determining the most appropriate method to achieve higher or lower elevation (i.e., active management measures like using dredged material to fill low areas or passive procedure such as allowing natural processes to fill lower areas).

- Restoring marsh tidal flooding regimes by:

1. Installing self-regulating tidal floodgate structures.
2. Removing non-critical tidal flood restriction structures.
3. Increasing the size of culverts and installing additional culverts.
4. Eliminating artificially created marsh drainage ditches.

- Mechanical removal, chemical application, and native planting:

1. Mechanical removal of common reed can be achieved with machine or hand tools.
2. After removal of above ground common reed vegetation, application of herbicide to neutralize the plant's rhizome mass.
3. Install native salt marsh species in areas that have been treated for common reed.

Coordination with the USFWS and the OBNWR is on-going to determine the best plan using one or a combination of the above measures for mitigation of the impacted 0.33 acres of salt marsh. A mitigation and subsequent monitoring plan will be added to this Draft Integrated Feasibility Report and Environmental Assessment once those measures have been identified.

5.3.2.2 Sea Level Change Effects on Tidal Wetlands

Sea level rise is expected to increase by 0.4 feet over the next 50 years in Bayville (NOAA 2015). Salt marshes have the ability to respond quickly to sea-level rise as long as sedimentation and internal biomass production processes keep pace and as long as the entire marsh can move to higher shore levels or further inland (Wolff et al. 1993). Infrastructure and coastal storm risk management measures such as floodwalls constrain the natural migration of wetlands in response to sea level rise.

Construction of the 2,800 linear foot concrete floodwall along Mill Neck Bay in the Mill Neck Creek neighborhood may impede the migration of salt marsh as sea level rises. However, land behind the proposed floodwall is fully developed with residential homes, lawns, and roads bordering the salt marsh; therefore natural migration landward by the salt marsh will be impeded by the existing land use.

5.4 Fish and Wildlife

5.4.1 Finfish

No Action Alternative: The FWOP will see continued recreational and commercial fishing that will affect finfish species and habitat. Loss of wetlands may also occur in the FWOP as a result of infilling from washover, specifically in the western portion of the project area. If realized, this loss of wetlands will impact finfish nursery habitat and forage areas. In addition, the no action alternative will continue to allow floodwater and untreated overland runoff to carry fine sediments and contaminants into the wetlands and Oyster Bay. This would negatively impact water quality and temporarily impact finfish in the project area.

Proposed Action: On the Oyster Bay Side the construction of outfalls and outfall channels in 0.33 acres of saltmarsh will minimize the foraging and nursery habitat for finfish utilizing the area. The proposed action is also expected to have short term and long term impacts on fish species in limited areas of construction on the shore of Long Island Sound. The entire length the combined construction of the buried floodwalls and floodwalls is approximately 6,790 feet. The average width of the beach where construction will take place is 150 feet; however, in some areas the mean higher high water level comes right up to the existing bulkheads, particularly along the Pine Lane Reach which is roughly 1,700 linear feet long. Impacts to finfish associated with construction include the burial of benthic food resources and forage area, as well as direct impacts from an increase in turbidity while construction is underway during periods of high tide.

Motile species would likely avoid burial during the construction of the floodwalls 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, windowpane, and summer flounder) would be temporarily displaced until benthos repopulate the area. Repopulation is expected to take one to three months. Resident fish are expected to feed in surrounding areas, and be relatively unaffected by temporary, localized, reductions in available benthic food sources (USACE, 2000a). Increased levels of turbidity in the water column may cause visual impairment or respiratory stress to species in the project area. These impacts are expected to be localized and short term in duration due to the coarse, sandy nature of the material that is in the area.

In areas such as the Pine Lane Reach where the tide will regularly meet the newly constructed floodwall, wave refraction is expected to erode existing sand, exposing a cobble beach. This will change the benthic community and species abundance in that area and will cause fish species adapted to sandy bottoms to relocate. This impact will affect about a quarter (2,500 LF) of the total project area on the Long Island Sound side. Motile species will be able to adjacent sandy areas. Temporary and permanent loss of benthic prey species and the shift in composition will impact, but not significantly affect, EFH for any designated species utilizing the project area. Bottom feeders are opportunistic and will relocate to nearby undisturbed areas for foraging. Therefore, no more than minimal impacts are expected to occur on finfish resources.

5.4.2 Benthic Resources

No Action Alternative: The FWOP may result in loss of wetlands due to infilling from washover on the Oyster Bay Side of the project area. This loss would impact benthic resources by burial and the restriction of their habitat. In addition, water quality will continue to be impacted as floodwaters containing fine-grained sediments and contaminants flows unchecked into the marsh and bay.

Proposed Action: Burial of benthic infauna and some epifauna will occur in the intertidal zone on the Long Island Sound beach and in the vegetated salt marsh on Oyster Bay when the buried floodwalls, floodwalls, outfalls, and outfall channels are built. On Oyster Bay, infauna and epifauna in the project footprint will be covered with stone fill for the construction of the four outfalls and associated outfall channels (5' x 200'). Benthic resources in those areas will be killed if they are unable to move from the construction area; however, the stones of the outfalls and channels are expected to be recolonized by other species such as crabs and isopods.

On the Long Island Sound beach, sand will be placed on the buried floodwalls and behind floodwalls. The sand in and along the dunes is expected to recolonize within one to three months, but the benthic community structure (species composition and abundance) will be changed in that time; it will take approximately one year for the community structure to fully recover to pre-construction conditions (Wilber and Clarke, 1998). In areas where floodwalls will be built (total combined length is 3,850 linear feet) and the tide will regularly meet the newly constructed floodwalls, wave reflection is expected to erode existing sand over time, exposing the buried rip rap beneath. Approximately 10 feet of rip rap (measured out from the bulkhead) will be placed in front of the floodwalls. The rip rap will be buried with sand after construction, but sand is expected to erode from high tides and coastal storms. This will change the benthic community and species abundance in that area. Species adapted to cobble habitat such as crabs will thrive, while those suited only for sandy substrates will move to adjacent areas.

A temporary impact to benthos from increased turbidity is expected to be localized to the immediate construction area and short term in duration. The coarse, sandy nature of the sediment to be used on the Long Island Sound buried floodwalls will cause only temporary turbidity as this material is expected to settle rapidly from the water column. Stones used in construction of the outfalls and outfall channels will contribute only a slight increase in turbidity during placement. Work will not be conducted during periods of high tide when these areas are most at risk of impacts from turbidity. Therefore, only minimal impacts to benthic resources are anticipated.

5.4.3 Shellfish

No Action Alternative: The no action alternative will short and long term impacts on commercial shellfish such as oysters, clams, and lobsters. As stated in Section 5.4.2, loss of wetlands on Oyster Bay from infilling due to washover would cause habitat loss and the potential for burial. Additionally, water quality would continue to be impacted from unchecked runoff of contaminant-carrying, fine sediments.

Proposed Action: The proposed action is not expected to have any direct impacts on commercial shellfish. There are no commercial shellfish resources present in the construction areas, however oysters and clams are harvested in Mill Neck Creek and Oyster Bay which are adjacent to the project area. Construction of the outfalls and outfall channels will cause slight increases in turbidity as stone is placed in the salt marsh along Oyster Bay. The construction will take place in the high marsh zone and will be done outside of periods of high tide; therefore, water quality impacts from turbidity are not expected to be significant.

Protecting water quality was addressed by various means in the proposed project. Substantial measures are taken to reduce total suspended solids (TSS), adsorbed pathogens, and floating oils in the rainfall runoff that outlets into the bay (the Hydrology and Hydraulics Appendix addresses these measures in greater detail). Runoff of floodwaters will be captured by off-line catch basins which will allow for physical settling of particles in the sump of each catch basin. At the downstream ends of the storm sewer lines, but upstream of the pumping stations, hydraulic residence time (the length of time that the runoff sits in a vessel) is considerably lengthened by several measures. Low flows are separated from higher storm flows by use of a weir in both flow diversion structures; the water quality tanks are each of 10,000 gallon tank capacity, are longitudinal, use alternating "on" pump switches, and have at least two compartments. These increased residence times substantially increase the settling of particles and their adsorbed pathogens out for the flow stream. Flow of stormwater into the outfalls and outfall channels creates a point source of freshwater into the marsh, but freshwater is not expected to affect salinity or impact shellfish resources as the freshwater will mix rapidly with salt water within the salt marsh. Therefore, no short or long term impacts to commercial shellfish (oysters, clams, and lobsters) are anticipated as a result of the project as proposed.

5.4.4 Reptiles and Amphibians

No Action Alternative: The no action alternative will have short and long term impacts on reptiles and amphibians as continual flooding from storm events will cause mortality to individuals present in the Study area that cannot seek refuge from high flood waters. Reptiles and amphibians may experience habitat loss, forcing them to relocate out of the Study area. Local, resident reptiles and amphibians will also continue to be susceptible to mortality due to vehicle strikes.

Proposed Action: The implementation of the proposed action is expected to have short term impacts on reptiles and amphibians as a result of heavy equipment operation adjacent to their habitat. Additionally, vehicle and equipment movement at or within these sites will increase the potential for contact injury or mortality. Diamond back terrapin females may be particularly vulnerable during nesting times. Although there will be an increase in potential, direct adverse impacts, they will be temporary.

5.4.5 Birds

No Action Alternative: The no action alternative will have short and long-term impacts on birds. Floodwaters covering areas where birds typically forage such as in the saltmarsh on the Oyster Bay Side will not be able to access those areas for food resources. Additionally, nesting habitat will be impacted by prolonged flooding events.

Proposed Action: 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. The project area provides habitat for tree, shrub, and/or ground nesting migratory birds during a portion of the year. In order to comply with the Migratory Bird Treaty Act, vegetation clearing will take place outside of the avian breeding season (February 1 through August 31). If vegetation clearing must take place within the breeding season, a qualified biologist will conduct nesting bird surveys prior to disturbances.

If nests are identified, a non-disturbance buffer will be implemented. Loss of 0.33 acres of saltmarsh will be an indirect long-term impact to birds that forage in or seek refuge in the wetland.

5.4.6 Mammals

No Action Alternative: The no action alternative will have short and long-term impacts on mammals as continual flooding will force animals from their natural habitats and cause them to relocate.

Proposed Action: Mammals in the construction area may have 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 should be able to avoid the construction areas, thereby minimizing their impacts. Most mammals inhabiting the Study area are accustomed to human activities and would likely return after completion of construction. It is anticipated that any muskrat, raccoon, striped skunk, gray squirrel, and opossum in the area would return to areas after construction. An indirect long-term impact from the loss of 0.33 acres of vegetated saltmarsh will occur as a result of the project.

5.5 Federal Threatened and Endangered Species

No Action Alternative: The no action alternative will have short and long-term impacts on Federal threatened and endangered species as continual flooding will decrease habitat quality and quantity for Threatened and Endangered (T&E) species over time.

Proposed Action: The portion of the Long Island Sound shoreline within the Study area supports a limited amount of piping plover foraging habitat. Project related activities near these areas could affect nesting and foraging behaviors of plovers during breeding/nesting season which starts in early to mid-March and runs through the end of August. Additionally, hardened coastal structures could adversely modify existing suitable foraging habitat characteristics of the shoreline (e.g., off and on site substrate erosion, flooding, and beach nourishment regimes). Plovers 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). Studies of shoreline armoring on the Washington coast have revealed that hardened coastal structures can reduce invertebrate fauna diversity (Morley et al. 2012).

Further, the beach habitat along Long Island Sound may provide limited foraging habitat for red knot. Construction activities (e.g., equipment operation and transportation, material movement, and staging areas) and structural improvements to the shoreline (e.g., floodwalls and buried floodwalls) could negatively affect the species habitat during and after project implementation particularly during their fall (late July through November) and spring (mid-May through early June) migration periods. No roseate tern habitat exists within the project area.

Suitable summer (April 15 – October 31) roosting and maternity habitat may be present for northern long-eared bats within the feasibility Study area. During the coordinated site visit in August 2015, the USFWS identified undeveloped hardwood and conifer stands, and shrub and grassland habitat where the pump stations would be located. During project implementation, construction activities such as tree clearing and equipment transportation may have the potential to affect individual roosting bats. In order to verify the extent of habitat for northern long-eared bats, a bat habitat assessment will be performed within the Study area prior to the Agency Decision Milestone.

In Oyster Bay, two species of sea turtle (Kemp's ridley and loggerhead) are known, on occasion, to reside from summer through fall. Atlantic sturgeon may also inhabit the bay year round. Project implementation will not likely impact these species as construction will all be land-based. Avoidance, minimization, and mitigation (if required) measures will be discussed for all of the above species with the USFWS during Section 7 ESA consultation and coordination of the project.

5.6 State Threatened and Endangered Species

No Action Alternative: The no action alternative will have neither short nor long-term impacts on state threatened and endangered species as there are no records of their occurrence in the Study area.

Proposed Action: Consultation is on-going with the NYSDEC's Natural Heritage Program to determine the species present in the Study area. If species are identified within the Study area, then this section will be expanded to determine the impacts of the proposed action on the sensitive resource and plans for avoidance, minimization, or mitigation, if required, will be explored.

5.7 Essential Fish Habitat

No Action Alternative: The no action alternative may have short and long-term impacts on Essential Fish Habitat. The potential loss of wetlands from infilling due to washover could limit foraging and nursery habitat. Water quality will continue to be impacted in the FWOP as flow from floodwaters runs off into the marsh and bay, bringing with it fine-grained sediments and contaminants. These impacts will affect EFH-designated fish species as well as benthic food resources.

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 construction of the buried floodwalls/floodwalls along approximately 6,790 linear feet of beach may cause mortality of benthic infaunal organisms. Recolonization adjacent to the buried floodwalls is expected to occur in one to three months. During recovery, 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).

The loss of 0.33 acres of vegetated salt marsh will impact benthic food resources and nursery habitat for EFH-designated species on the Oyster Bay Side of the project area. However, fish will be able to locate food resources outside of the limited construction area.

A detailed EFH assessment is provided in environmental Appendix A. The assessment indicates that implementation of the proposed action will have short-term, minimal effects to EFH species, their habitat, and no long-term impacts. This EA and the EFH worksheet will be submitted to NMFS during coordination and updates will be made to this section as needed.

5.8 Socioeconomics

No Action Alternative: The no action alternative may have short- or long-term impacts on socioeconomics as continued flooding may deter businesses and industry from developing or rebuilding in the area. With a lack of industry and businesses, the community will have to travel farther for goods, and services. Households may not rebuild and leave empty lots or unrepaired homes.

Proposed Action: The implementation of the proposed action should have positive short- and long-term socioeconomic impacts to existing business in the Bayville area because of the reduction of future storm damages and improved accessibility to businesses during storm events. There may also be a minor, indirect economic benefit on the local economy during initial construction. The introduction of construction workers should result in their purchasing of supplies and food during the initial construction phase and the additional phases. Public and private access to the beaches would be temporarily impeded during the construction period. 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 associated costs to repair such damages. An indirect benefit to residential property values in Bayville is expected as an increase in housing prices may be realized due to the added coastal storm risk management of storm damages.

5.9 Environmental Justice

No Action Alternative: The no action alternative will have neither short nor long-term impacts to environmental justice communities.

Proposed Action: The implementation of the proposed action will have no short-or long-term impacts to environmental justice communities. As stated in section 2.1.10, Bayville is not considered an environmental justice community.

5.10 Cultural Resources

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

Proposed Action: A review of the New York State Museum site files indicates a prehistoric site, consisting of a small village with a burial, was located at the western end of the Mill Basin portion of the project area. Prior to and during construction, field investigations may be required to determine if the site remains within the project area. Coordination and consultation with the New York State Historic Preservation Office, the Shinnecock Indian Nation, and the Unkechaug Indian Nation, a state-recognized tribe is ongoing and will result in the preparation of a Programmatic Agreement. There are no buildings or structures within the project area are listed on or determined eligible for the National Register of Historic Places. It is assumed that the proposed mitigation site, located within the OWBNR, will have been previously investigated and no historic properties have been identified. No other adverse effects are anticipated. Consultation with the New York State Historic Preservation Office is ongoing.

5.11 Coastal Zone Management

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

Proposed action: In conformance with the established policies of New York's Coastal Zone Management Program (CZM), USACE has determined that the proposed action is consistent with New York's Coastal Policies. For further information, see Appendix A. Coordination with the New York Department of State, Office of Planning and Development on the USACE's consistency determination is on-going. This section will be updated once coordination is complete.

5.12 Floodplains

No Action Alternative: The no action alternative will have negative short and long term impacts to the floodplains of Bayville. Flooding will continue eroding soils, damaging property, roads, and infrastructure.

Proposed Action: Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect 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 floodplains in carrying out its responsibilities."

The construction of the proposed action will result in a direct, long-term benefit to the community of Bayville. The construction of the setback floodwall, improvements to the stormwater system, floodwalls/ buried floodwalls along the LIS will result in both short-and long-term reductions of flood loss while improving safety to human life, health, and welfare.

With the proposed project, sheet flow from runoff will no longer flow directly into the marshy floodplains along Oyster Bay. Substantial measures are taken with the project to reduce total suspended solids (TSS), adsorbed pathogens, and floating oils in the rainfall runoff that outlets into the marsh. The proposed catch basins are off-line, allowing for physical settling of particles in the sump of each catch basin. At the downstream ends of the storm sewer lines, but upstream of the pumping stations, hydraulic residence time is considerably lengthened by several measures. Low flows are separated from higher storm flows by use of a weir in both flow diversion structures; the water quality tanks are each of 10,000-gallon tank capacity, are longitudinal, use alternating "on" pump switches, and have at least two compartments. These increased residence times substantially increase the settling of particles and their adsorbed pathogens out of the flow stream resulting in improved water quality for the floodplain.

5.13 Land Use and Zoning

No Action Alternative: The no action alternative may have short- and long-term impacts as flooding will continue and possibly necessitate changes in land use zoning 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 resulting increase in coastal storm risk management is not expected to significantly induce future development in the adjacent residential areas, because most, if not all, of the developable areas are developed.

5.14 Hazardous, Toxic, and Radioactive Waste

No Action Alternative: Short term impacts from the release of household materials such as fuel oil, asbestos, and sewage would continue during flood-causing storms with the no action alternative.

Proposed Action: Various hazardous materials (i.e. fuel and lubricants, hydraulic fluid, and solvents) for machine use will be stored at the construction sites. There is a potential for spillage as well as equipment failure resulting in the release of these materials. The project will require a Standard Operating Procedure and Hazardous Material Management Plan as oversight (Best Management Practices) to decrease the potential for any project-related short-term HTRW impacts.

5.15 Aesthetic and Scenic Resources

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

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 in Bayville during the implementation of the plan. Long-term impacts of the proposed action will have negative and positive impacts. The view shed toward the water on both the bayside and Long Island Sound side will be altered, as the new floodwall and buried floodwalls will block views. Along much of the shoreline on the sound side, floodwalls and dunes already exist so this plan will only affect the areas in which the proposed bulkhead/buried floodwalls have higher elevations than the existing or there is no existing coastal storm risk management. The sand covering the buried floodwalls will be planted with dune vegetation which will add aesthetic value.

5.16 Recreation

No Action Alternative: The no action alternative may have negative short-and long-term impacts as beaches, access to docks, and businesses that provide recreation will continue to flood and be inaccessible during and after those events until repairs are complete.

Proposed Action: Implementation of the proposed action will have negative short-term impacts to recreation as beaches will be temporarily inaccessible during construction of the floodwalls and buried floodwalls on the Long Island Sound side. Traffic access to West Harbor Beach Memorial Park on the bayside will be affected during construction of the floodwall on West Harbor Drive. However, there will be no long-term impacts as turning lanes and pedestrian crossovers into the Park are included as a part of the proposed project.

5.17 Air Quality

No Action Alternative: The no action alternative may have negative short-term impacts to air quality as construction may occur more often due to repairs to property from continued floods. No long-term impacts are expected under the no action alternative.

Proposed action: Based on a preliminary, qualitative assessment of the estimated construction schedule (24 months), it is anticipated that this project will be within the de minimis levels in any one construction year. See Appendix A for the draft Record of Non-Applicability and supporting documentation. Coordination with the U.S. Environmental Protection Agency on this project's impacts as they apply to the Clean Air Act are on-going.

5.18 Noise

No Action Alternative: The no action alternative may have negative short-term impacts to noise as construction may occur more often due to the repairs of property damaged from continued floods. However, no long-term impacts are anticipated.

Proposed action: Implementation of the proposed action will have minor negative short-term impacts to noise as construction vehicles and actions will increase the noise levels temporarily up to 100 dBa. Long-term impacts may be positive as construction and repair noise from necessary repairs due to flood damages will be reduced.

Chapter 6: 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.

USACE currently has one other CSRM project in Study on the north shore of Long Island at Asharoken located approximately 20 miles from the Bayville Study area. Due to the distance, type, and relative size of each project, it is not anticipated that either project will have any measurable influence on the other.

The proposed project will have positive and negative cumulative impacts to upland vegetation. Though some upland vegetation will be permanently removed for the construction of the three pump stations, all temporary impacts to vegetation caused by construction (i.e., staging areas, equipment access paths) will be mitigated by the replanting of native vegetation in those areas. There will be a permanent cumulative loss of 0.33 acres of salt marsh in the project area. In accordance with the USACE policy of "no net loss," all wetland impacts will be mitigated resulting in the creation or restoration of similar wetlands in the same general area as the impacts.

There are potential negative cumulative impacts to the benthic communities resulting from the combination of this project as well as other USACE projects nearby and any other non-USACE dredging or other construction projects. Intertidal and subtidal benthic communities are expected to recolonize within a few months after construction of all activities. Following this type of disturbance, the species composition of the reestablished community might be different than the pre-construction composition, thereby affecting foraging by fish and other aquatic organisms.

There are no anticipated cumulative impacts to fish and wildlife, or Federal and/or State threatened and endangered species. This project, as well as all others in the region, have been or will be coordinated with the appropriate State and Federal agencies to ensure no significant impacts occur. The timing of construction for the proposed project will avoid sensitive life stage windows of any Threatened and Endangered species, or fish and wildlife in the project area. Socioeconomics of the area may benefit from the construction of the project as proposed. Specifically, construction will have a positive benefit to all income populations of Bayville by reducing costs resulting from storm and water damage as well as costs incurred from temporary relocation during and after storm events.

The implementation of this project would result in a negative cumulative effect to parts of the viewshed in and along the Long Island Sound and Oyster Bay shorelines. The local community is in support of the project and understands and accepts the impacts in exchange for coastal storm risk management.

The following projects, described in the Bayville Local Waterfront Revitalization Program (2003), represent prior work that was conducted in the Study area:

- The Soundside Beach erosion control project on Long Island Sound was performed in Bayville. This included the planting of beach grasses to reduce erosion and the construction of an artificial sand dune. The work was completed with the assistance of grant funding provided by the NYS Department of State.
- Another beach stabilization project was carried out in Bayville, on the Long Island Sound beaches along The Boulevard, in the "President Street" areas. This involved the planting of beach grasses.
- The Mill Neck Creek shoreline stabilization project was performed in Bayville and was a beach replenishment effort conducted at the foot of Washington Avenue, to repair coastal erosion damage that had occurred in this area.

Chapter 7: Coordination & Compliance with Environmental Requirements*

Table 14. Summary of Primary Federal Laws and Regulations Applicable to the Proposed Project

Legislative Title U.S. Code/Other		Compliance
Clean Air Act	42 U.S.C. §§ 7401 7671g	On-going, Appendix A
Clean Water Act	33 U.S.C. §§ 1251 et seq.	USACE produced an evaluation complying with the Clean Water Act in Appendix A.
Coastal Zone Management Act	16 U.S.C. §§ 1451-1464 N.J.A.C. 7:7 and N.J.A.C. 7:7E	A CZM Determination was prepared and is located in Appendix A.
Endangered Species Act of 1973	16 U.S.C. §§ 1531 et seq.	USACE is currently in Section 7 ESA coordination with the USFWS. Updated coordination will be located in Appendix A.
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.
Fish and Wildlife Coordination Act	16 U.S.C. § 661 et seq.	On-going

Legislative Title U.S. Code/Other		**Compliance**
Magnuson-Stevens Act Fishery Conservation and Management Act	Section 305(b)(2) 1996 Amendments	EFH Assessment was prepared and submitted to NOAA-Fisheries as part of the Draft HSLRR/EA review. The EFH Assessment is located in Appendix A.
National Environmental Policy Act of 1969	42 U.S.C. §§ 4321-4347	The circulation of the Draft EA fulfills requirements of this act.
National Historic Preservation Act of 1966	16 U.S.C. §§ 470 et seq.	On-going. Correspondence and draft PA included in Appendix A.
Executive Order 11990, Protection of Wetlands	24-May-77	Circulation of this report for public and agency review fulfills the requirements of this order.
Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks	21-Apr-97	Implementation of this project will reduce environmental health risks. Circulation of this report for public and agency review fulfills the requirements of this order.

Chapter 8: Plan Implementation

As non-Federal sponsor, the New York State Department of Environmental Conservation must sign a Project Partnership Agreement (PPA) that will carry the project through the Preconstruction Engineering and Design (PED) phase to project construction. This process is described in more detail in Section 8.4. A Project Management Plan (PMP) will be prepared to identify tasks, responsibilities, and financial requirements of the Federal Government and the non-Federal partner during PED and construction. A project schedule has been estimated to serve as the basis of the cost estimate based on reasonable assumptions for the detailed design and construction schedules. It will be refined as more data are available in subsequent phases of the project.

8.1 Institutional Requirements

NYSDEC has indicated its intent to implement this project through a strong record of involvement and coordination in the Feasibility Study. A fully coordinated PPA package, which will include the non-Federal partner's financing plan, will be prepared subsequent to the approval of the feasibility phase to initiate design and construction. It will be based on the recommendations of the feasibility Study. NYSDEC has agreed to comply with all applicable Federal laws and policies and other requirements that include, but are not limited to:

a. Provide all lands, easements, rights-of-way, and relocations and disposal/borrow areas (LERRD) uncontaminated with hazardous and toxic wastes.
b. Provide an additional cash contribution if the value of LERRD contributions toward total project costs is less than 35 percent, so that the total share equals 35 percent.
c. Provide all improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the project. Such improvements may include, but are not necessarily limited to, retaining dikes, waste-weirs, floodwalls, embankments, monitoring features, stilling basins, and dewatering pumps and pipes.
d. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, including mitigation features, at no cost to the Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and any specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.
e. Provide of the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal project partner, now or hereafter, owns or controls for access to the Project for the purpose of inspection, and, if necessary after failure to perform by the non-Federal project partner, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall operate to relieve the non-Federal project partner of responsibility to meet the non-Federal project partner's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance.
f. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the Project and any Project-related betterments, except for damages due to the fault or negligence of the United States or its contractors.
g. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project 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 Codes of Federal regulations (CFR) Section 33.20.
h. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law (P.L.) 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the construction, operation, and maintenance of the Project. However, for lands that the Federal Government determines to be subject to the navigational servitude, only the Federal Government shall perform such investigations unless the Federal Government; provides the non-Federal project partner with prior specific written direction, in which case the non-Federal project partner shall perform such investigations in accordance with such written direction.
i. Assume complete financial responsibility, as between the Federal Government and the non-Federal project partner for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the Project.

j. As between the Federal Government and the non-Federal project partner, the non-Federal project partner shall be considered the operator of the project for the purpose of CERCLA liability. 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.
k. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1790, Public Law 91-646, as amended by Title IV of the Surface Transportation and Unifom1 Relocation Assistance Act of 1987 (Public Law 100-17),and the Unifom1 Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the construction, operation, and maintenance of the Project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.
l. 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, as well as Army regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."
m. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement.
n. Participate in and comply with applicable Federal flood plain management and flood insurance programs and comply with the requirements in Section 402 of the Water Resources Development Act of 1986, as amended.
o. Not less than once each year inform affected interests of the extent of risk management afforded by the Project.
p. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with the coastal storm risk management provided by the project.
q. Provide, during construction, any additional funds needed to cover the non-Federal share of PED costs.
r. Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the non-Federal project partner owns or controls for access to the project for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing or rehabilitating the project.
s. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal project partner has entered into a written agreement to furnish its required cooperation for the project or separable element.
t. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the ecosystem restoration, hinder its operation and maintenance, or interfere with its proper function, such as any new development on project lands or the addition of facilities which would degrade the benefits of the project.
u. Perform, or cause to be performed, 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 necessary for the construction, operation, and maintenance of the project; except that the non-Federal partner shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

v. Participate in and comply with applicable Federal floodplain management and flood insurance programs.
w. Do not use Federal funds to meet the non-Federal partner's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

In an effort to keep the non-Federal project sponsor involved and the local partner informed, meetings were held throughout the feasibility phase. Coordination efforts will continue, including coordination of this Study with other State and Federal agencies. It is currently anticipated that a public meeting will be held upon release of the draft IFREA for public review and approval of this feasibility Study.

8.2 Financial Analysis

For purposes of executing the PPA, NYSDEC has a dedicated source of funding for coastal storm risk management projects and has indicated its intent to enter into a PPA at the conclusion of the Study. The Letter of Support from NYSDEC will be requested following the Public and Agency review period and will be included in Appendix F: Pertinent Correspondence Appendix of the final Integrated Feasibility Report.

8.3 Real Estate Requirements

The total lands and easements required in support of the project is approximately 31 acres; 28 acres required in permanent easements, 3 acres required in temporary easements, and less than one acre of fee simple purchase for the construction of a pumping station. The project impacts approximately 154 parcels, affecting approximately 130+ private owners and 4 public owners (approximately 154 parcels). In some instances, more than one estate is required to be obtained over the lands of an owner.

Access to the Bayville Beach on Long Island Sound will be provided as a project feature on publicly owned land either in the form of an earthen ramp or timber stair walkover. Private property owners will be allowed continued access and will receive compensation if their existing access needs to be removed for construction. The compensation estimate is the amount that the Federal government has estimated to build either a timber stair walkover or an earthen ramp, similar to the type identified for the public property, as part of the real estate easements.

The appraisal cost estimate was completed by the New York District Corps of Engineers in January 2016. The total estimated real estate costs are $6,629,000, of which $5,666,000 are counted as lands, easements, rights-of-way, relocations, and disposal (LERRD). Publicly owned lands within the project impact area are not valued, or acquisition costs are nominal, and not considered in the cost estimate. It is to be noted that the real estate cost estimate may need to be adjusted to account for the riparian rights in the project. This will be done during optimization of the plan.

8.4 Preconstruction Engineering and Design

Because Bayville has been included as a project under Study as part of the PL 113-2 response to Hurricane Sandy, Preconstruction Engineering and Design (PED) could be cost shared under a Project Partnership Agreement (PPA) (which typically only covers construction), if there are sufficient PL 113-2 funds to complete initial construction of the project. A separate Design Agreement (DA) for PED is not required unless PL 113-2 funds are insufficient to complete initial construction of a project. It is anticipated that completion of the Bayville feasibility Study will be followed by PPA execution, once the Assistant Secretary to the Army (Civil Works) (ASA (CW)) provides notification to the Committee on Appropriations of the U.S. House of Representatives and the Senate.

For the Bayville project, PED costs are estimated at $2,000,000 (Oct. 2015 P.L.), to be cost-shared 65% Federal and 35% non-Federal. The approximate duration for PED is 15 months, from 2017 to 2018, for tasks including detailed field surveys and geotechnical data collection, and construction contract award.

8.5 Construction Schedule

The project assumes a construction period of approximately 24 months, from 2018 to 2020 which will be further refined during plan optimization.

8.6 Cost Sharing and Non-Federal Sponsor Responsibilities

The details behind the initial project first cost of implementing the Tentatively Selected Plan (TSP) are shown in Table 15. The Federal share is 65 percent of the initial project first cost. The Federal Government will design the project, prepare detailed plans and specifications and construct the project, exclusive of those items specifically required of non-Federal interests. The non-Federal share of the estimated initial project first cost of the proposed project is 35 percent. The non-Federal share includes real estate costs in the estimated amount of $6,629,000, of which $5,666,000 is counted as lands, easements, rights-of-way, relocations, and disposals (LERRD). The LERRD is are credited against the non-Federal share, reducing the non-Federal cash contribution to $18,030,000.

Table 15. Cost Apportionment (Oct. 2015 Price Level)

Fully Funded Project First Cost for PPA	
Federal (65%)	$44,006,000
Non-Federal (35%)	$23,696,000
Total	$67,702,000

8.7 Views of the Non-Federal Sponsor and Other Agencies

Investigations of the proposed action has received support from the non-Federal project sponsor, NYSDEC and the affected local partner, Bayville. This support is expressed through the Letter of Support which will be requested following the Public and Agency review period. Through project planning and National Environmental Policy Act (NEPA) scoping in 2003 and in 2014 a variety of other Federal agencies have been involved in this investigation and support the project goals.

8.8 Consistency with Public Law 113-2

This draft Integrated Feasibility Report and Environmental Assessment has been prepared in accordance with the Disaster Relief Appropriations Act of 2013, Public Law 113-2. Specifically, this section of the report addresses:

1. The specific requirements necessary to demonstrate that the project is economically justified, technically feasible, and environmentally acceptable, and
2. The specific requirements necessary to demonstrate resiliency, sustainability, and consistency with the North Atlantic Coast Comprehensive Study (NACCS).

8.8.1 Economics Justification, Technical Feasibility and Environmental Compliance

The prior sections of this report demonstrate how the TSP manages coastal storm risk. It also identifies the TSP to be economically justified for the authorized period of Federal participation. The draft Environmental Assessment has been prepared to meet the requirements of NEPA and demonstrate that the TSP is compliant with environmental laws, regulations, and policies and has effectively addressed any environmental concerns of resource and regulatory agencies.

8.8.2 Resiliency, Sustainability, and Consistency with the NACCS

This section describes how the Bayville feasibility Study is consistent with the findings and recommendations of the North Atlantic Coast Comprehensive Study (NACCS). Resiliency is defined as the ability to adapt to changing conditions and withstand, and rapidly recover from disruption due to emergencies. Sustainability is defined as the ability to continue (in existence or a certain state, or in force or intensity), without interruption or diminution.

The (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 incorporates wherever possible sustainable coastal landscape systems that takes into account, future sea level and climate change scenarios (USACE, 2015).

The process used to identify the TSP used the NACCS Risk Management framework that included evaluating alternative solutions and also considering future sea level change and climate change. A local OMRR&R plan will be put in place with periodic USACE inspections to sustain a continuous level of risk management for the period of analysis.

The Bayville TSP is a resilient, sustainable, and a robust solution. It consists of floodwalls (I-walls, set back, and buried) and raised roadways. The exact dimensions of the Bayville TSP will be identified during optimization. Optimization will take into account project performance under intermediate and high rates of sea level change, in accord with ETL 1100-2-1 (dated 30 Jun 2014). The ability of the structures to adapt to higher rates of sea level change by increasing the height of the project without increasing the project footprint (which would increase the environmental mitigation required), will be evaluated during optimization.

8.9 Major Conclusions and Findings

This Study has determined that periodic coastal storms, including tropical storms, hurricanes, and nor'easters pose a severe threat to life and property in Bayville, Nassau County, New York. There is potential to manage coastal storm risks in Bayville. In response to these problems and opportunities, plan formulation activities considered a range of nonstructural and structural measures. Through an iterative plan formulation process, potential coastal storm risk management measures were identified, evaluated, and compared.

Alternative coastal storm risk management plans that survived the initial screening of alternatives included structural measures such as floodwalls, and buried floodwalls. Plans minimized environmental impacts by matching the existing ground surface (i.e. floodwalls where the shoreline is already bulkheaded and sand-covered floodwalls (buried floodwalls) on the existing dunes). Alternative 4 was found to be the most effective and efficient of the four alternatives, having the lowest construction cost while having the highest net benefits, making it the TSP.

The project spans a geographic distance of approximately 14,890 linear feet along the Long Island Sound and Oyster Bay shorelines of Bayville and ties into high ground (+13.0 ft NAVD 88 to +14.0 ft NAVD88) at each end. Private property owners will be allowed continued access and will receive compensation if their existing access needs to be removed for construction. All of the alternatives were evaluated at the 2 percent flood (50-year) level of performance. The exact height of the project will be determined during the optimization phase of the Study, which follows public comments and reviews of the draft Integrated Feasibility Report and Environmental Assessment.

Chapter 9: Recommendations

In making the following recommendations, I have given consideration to all significant aspects in the overall public interest, including environmental, social and economic effects, engineering feasibility and compatibility of the project with the policies, desires and capabilities of the State of New York and other non-Federal interests.

I recommend that the selected plan for coastal storm risk management at Bayville, New York, as fully detailed in this draft Integrated Feasibility Report and Environmental Assessment, be authorized for construction as a Federal project, subject to such modifications as may be prescribed by the Chief of Engineers. These recommendations are made with the provisions that local interests will:

a. Provide to the United States all necessary lands, easements, rights-of-way, relocations, and suitable borrow and/or disposal areas deemed necessary by the United States for initial construction and subsequent maintenance of the project.

b. Hold and save the United States free from claims for damages that may result from construction and subsequent maintenance, operation, and public use of the project, except damages due to the fault or negligence of the United States or its contractors.

c. Contribute the local share of non-Federal costs for initial construction and operation and maintenance over the 50 year period of analysis of the project, as required to serve the intended purposes. This plan consists of 14,890 linear feet of raised floodwalls, raised ground surfaces, buried floodwalls drainage features and three pump stations at a total first cost of $64,469,000 (October 2015 price levels) and a fully funded cost of $67,702,000. Under current guidelines, the project will be cost shared on a 65% Federal and 35% non-Federal basis.

d. Upon completion of each project feature, acquire, rehabilitate, repair, replace, operate and maintain easements for public access to areas created or enhanced by the project. The cost of the operation and maintenance of these easements will be the responsibility of the non-Federal sponsor.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of highest review levels within the Executive Branch. Consequently, the recommendations may be modified (by the Chief of Engineers) before they are transmitted to the Congress as proposals for authorization and implementing funding. However, prior to transmittal to Congress, the partner, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

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Chapter 10: References*

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