EXECUTIVE SUMMARY

This Feasibility Report and Environmental Assessment for the Nantasket Beach Coastal Storm Damage Reduction Project was prepared under Section 103 of the1962 River and Harbor Act, as amended, which authorizes the US Army Corps of Engineers to participate in the cost of projects and antecedent studies for reducing coastal storm damage. Study funds were also available through Public Law 113–2—January 29, 2013, which provided resources to deal with the consequences of Hurricane Sandy in the Northeast. Nantasket Beach experienced the effects of Hurricane Sandy in October 2012 in the form of high winds and a rise in water level (surge plus tide) of about 7.41 feet NAVD88 based on data recorded at the Boston Harbor NOAA station, north of Weymouth, MA. Report elevations in NGVD29 can be converted to NAVD88 by subtracting 0.814 feet. For example, a crest elevation of 10.0 feet NGVD29 is 9.2 feet in NAVD88. This report responds to a request from the Commonwealth of Massachusetts, Department of Conservation and Recreation (DCR), for a study to investigate the flooding and erosion problem at Nantasket Beach and its causes, and to present feasible solutions for reducing damage in the Nantasket Beach backshore. The study is the product of detailed investigations conducted by the New England District of the US Army Corps of Engineers in cooperation with the DCR and other state and Federal agencies.

The study area for the Nantasket Beach Coastal Storm Damage Reduction Project consists of the DCR's Nantasket Beach Reservation and the adjoining backshore area. It is located in the town of Hull, Plymouth County, Massachusetts, approximately 12 miles southeast of the city of Boston. See Figure 1. The study area is the southerly 6,800 foot long portion of an elongated spit extending along a SE-NW axis into Massachusetts Bay from the Atlantic Hill section of Hull to Point Allerton. Beginning at its southern end, the backshore is protected by an approximately 5,400-foot long sea wall, and its 1,400-foot long northerly end by a combination of sand fill and rip rap revetment and jersey barriers.

Coastal storms cause extensive damage to the publicly owned Nantasket Beach, its protective works and backshore public, commercial, and residential properties. Storm driven waves from the east are responsible for the removal of sand in front of the concrete sea wall and the consequent lowering of the beach. The sea wall footings have been exposed and undermined in some places. By December 1992, the conditions had deteriorated to such an extent that a coastal storm with an approximately 10-year recurrence interval caused the failure and weakening of about 650 feet of sea wall at its northern end. The lowering of the beach and the sea wall breach increased ocean overtopping during coastal storms and the flooding of the backshore.

DCR reconstructed the portion of the sea wall lost in the 1992 storm with a new structure called the Northern Revetment, and placed a stone revetment known as the Temporary Seawall Fortification (TSF) at the south end of the Reservation. This improved protection to those areas of Hull Shore Drive and Nantasket Avenue, the only roadway links between the mainland and portions of the town to the north. The central portion of the DCR reservation, historic seawall, and commercial properties in the backshore have no similar protection, and suffer from greater seasonal material losses and higher storm wave overtopping volumes. The portion of the town north of this area contains an estimated two-thirds of the town's land area and 80 percent of the population of approximately 10,500 persons, in addition to elementary and high schools, the Pemberton Coast Guard Station, and a number of commercial and public properties.

If a plan to reduce flooding and erosion is not implemented, the Nantasket shoreline, fronted by its older sea wall, would be vulnerable to storm damage from wave overtopping or wall failure. The DCR has invested an estimated $2M to restore the bathhouse. This investment would be at risk if a project were not undertaken to protect the sea wall. An initial screening process eliminated an offshore breakwater as a possible solution for reducing damage due to coastal storms at Nantasket Beach due to economic reasons. We identified three plans which warrant further consideration: elevating 13 structures above the 100-year floodplain, sand fill nourishment, and a stone revetment might reduce recurring storm damage and be economically feasible. Our analysis indicated that, although a plan to elevate 13 structures is feasible, a high level of residual damage to properties (about 75 percent) would remain if this plan was implemented. Two beach fill nourishment plans to protect Zone 2, the 2,200-foot middle portion of the DCR reservation, were economically feasible, however their cost exceeded what is allowed under Section 103. Two stone revetment plans to protect Zone 2 were also found to be economically feasible. A revetment plan for 10-year level of protection showed a higher benefit-to-cost ratio than a plan offering 25-year level of protection, so that is the recommended plan.

Since the stone revetment plan for protecting 2,200 feet of sea wall (Zone 2) is economically feasible, maximizes coastal storm damage reduction benefits (annual benefits minus annual costs), and meets pertinent environmental and cultural resources criteria, it is the National Economic Development (NED) Plan and therefore qualifies for further Federal participation. The NED Plan calls for construction of a stone revetment approximately 2,200 feet long in front of the sea wall with an 8.25 foot wide crest at elevation 10 feet NGVD and a lV:3H slope to the existing beach.

The Section 103 authority, under which this present study was conducted, provides for Federal participation of 65 percent of first costs, including construction, contingencies, Engineering and Design (E&D), and Construction Management (CM) up to $5M in Federal costs, including the Federal share of reconnaissance and feasibility studies, which amount to $869,194.48. The project first cost of $6,353,300 would be cost shared. A projected annual maintenance cost of $1,100 per year during the 50-year life of the project would be a non-Federal responsibility.

The project was economically justified at the 2013 Price Level with an annual net benefit of $812,300 and a Benefit to Cost Ratio (BCR) of 4.09. Project costs were updated to the January 2014 price level using the FY14 Federal interest rate of 3.5 percent and the Civil Works Construction Cost Index for Breakwaters and Seawalls (EGM 1110-2-1304, 31 March 2014). The economic cost of the project in 2014, including interest during 4 months of construction, amounts to $6,382,200. Annual Cost over the 50-year project life is $273,200 with Net Benefits of $827,000. The resulting BCR of 3.03 supports the recommended project.

At the start of second quarter FY15, the TPCS spreadsheet was updated to reflect the current schedule. The program year price level was adjusted from 2014Q2 to 2015Q1 which increased the project first cost from $6,463,000 to $6,499,000. The Midpoint of Design was also updated from 2015Q2 to 2015Q3 and the Midpoint of Construction was updated from 2016Q1 to 2016Q2 which then increased the total project cost from $6,595,000 to $6,631,000. The resulting Federal Cost is $4,310,000 and the Non-Federal Cost is $2,321,000.

The New England District Engineer recommends construction of 2,200 foot long stone revetment project in front of the sea wall in Zone 2. We found the project to be technically (engineering) and economically feasible, and environmentally and culturally acceptable, for reducing storm damage due to flooding and erosion in the Nantasket Beach backshore. The DCR intends to repair and rehabilitate the seawall in front of where the recommended Federal project would be built.

NANTASKET BEACH DCR RESERVATION
HULL, MASSACHUSETTS

Coastal Storm Damage Reduction Report

Storm waves attack Nantasket Beach on October 29, 2012

Photo source: http://www.flickr.com/photos/jeffcutler/8135566996/in/photostream/

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December 2014

ABBREVIATIONS

ARA	Abbreviated Risk Analysis
BCR	Benefit-Cost Ratio
CENAE	Corps of Engineers, New England District
CM	Construction Management
cfs	cubic feet per second
cy	cubic yards
E&D	Engineering and Design
EOEA	Executive Office of Environmental Affairs
FCSA	Feasibility Cost Sharing Agreement
ft	feet (foot)
FY	Fiscal Year
GPM	gallons per minute
H	Horizontal
HRA	Hull Redevelopment Authority
LERRD	Lands, Easements, Rights-of-Way, Relocation, Disposal
LF	Linear Feet
MHW	Mean High Water
MLW	Mean Low Water
NED	National Economic Development
NGVD	National Geodetic Vertical Datum
RC	Reinforced Concrete
S&A	Construction Management
SF	Square Feet
SY	Square Yard
TPCS	Total Project Cost Summary
V	Vertical

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