April 27, 2022 Job No. 2021-0071

Secretary Kathleen Theoharides
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Sent via email: MEPA@mass.gov

Re: **ENVIRONMENTAL NOTIFICATION FORM**
Proposed Primary Dune Nourishment
Town of Hull
Town Owned Layout of Beach Ave (adjacent to 27 – 53 Beach Ave)
Hull, MA

Dear Secretary Theoharides,

On behalf of Town of Hull, we are hereby submitting an electronic copy of an Environmental Notification Form (ENF) for the above referenced project. During remote operations, we are refraining from sending physical copies to MEPA and the distribution list, except for the Massachusetts Historical Commission.

Please post this ENF Filing Notification in the next Environmental Monitor.

If you have any questions, or require any additional information, please call me at 508-495-6210 or send an email to mbuck@woodsholegroup.com.

Sincerely,

Mitchell Buck

Mitchell Buck, P.E.

MAB/beg

cc: Distribution List
Phil Lemnios, Town of Hull

Environmental Notification Form

Proposed Primary Dune Nourishment Adjacent to 27-53 Beach Avenue for the Town of Hull

April 2022

PREPARED FOR:
Secretary Kathleen Theoharides
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

PREPARED BY:
Woods Hole Group, Inc.
A CLS Company
107 Waterhouse Road
Bourne, MA 02532

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Bourne, MA 02532
Phone: 508-540-8080
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www.whgrp.com

Environmental Notification Form Contents:

Section A - Environmental Notification Form (ENF) Application

Section B - Project Description

Section C – Alternatives Analysis

Section D – Performance Standards Compliance Narrative

Section E – Review of Consistency with Coastal Zone Management (CZM) Policies

Section F - Output Report from Resilient MA Action Team (RMAT) Climate Resilience Design Standards Tool

Section G – Grain Size Analyses

- Grain Size Analysis, dated 2/19/2019
- Grain Size Analysis, dated 12/8/2021

Section H - Public Notice and ENF Distribution List

Section I– List of Required Permits & Reviews

Section J - Project Maps and Plans

- Hull USGS Map
- Printout from the EEA EJ Maps Viewer
- Plan entitled, “Proposed Dune Restoration, Town of Hull, Hull, MA Existing Conditions Plan”, dated 4/13/2022
- Plan entitled, “Proposed Dune Restoration, Town of Hull, Hull, MA Proposed Nourishment Plan”, Sheets 1-2, dated 4/22/2022

Section A

Environmental Notification Form Application

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: ———————————

MEPA Analyst: _____

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: Proposed Primary Dune Nourishment along 27-53 Beach Avenue

Street Address: Town owned layout of Beach Ave, adjacent 27-53 Beach Avenue

Municipality: Hull	Watershed: Weymouth & Weir
Universal Transverse Mercator Coordinates: 4,682,751 N, 345,969 W (meters)	Latitude: 42.281771° N Longitude: 70.868103° W
Estimated commencement date: November 15, 2022	Estimated completion date: March 30, 2023
Project Type: Dune Restoration	Status of project design: 100 %complete

Proponent: Town of Hull – Philip Lemnios		
Street Address: 253 Atlantic Ave		
Municipality: Hull	State: MA	Zip Code: 02045
Name of Contact Person: Mitchell Buck		
Firm/Agency: Woods Hole Group, Inc.	Street Address: 107 Waterhouse Rd	
Municipality: Bourne	State: MA	Zip Code: 02532
Phone:508-495-6210	Fax: 508-540-1001	E-mail: mbuck@woodsholegroup.com

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☐Yes ☒No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8)) ☐Yes ☐No
a Rollover EIR? (see 301 CMR 11.06(13)) ☐Yes ☐No
a Special Review Procedure? (see 301CMR 11.09) ☐Yes ☐No
a Waiver of mandatory EIR? (see 301 CMR 11.11) ☐Yes ☐No
a Phase I Waiver? (see 301 CMR 11.11) ☐Yes ☐No
(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF.)

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?
11.03(3)(b)(1)(a)

Which State Agency Permits will the project require?
May require a Superseding Order of Conditions

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:
Office of Coastal Zone Management Coastal Resiliency Grant in the amount of $70,055.00

Summary of Project Size & Environmental Impacts	**Existing**	**Change**	**Total**
LAND			
Total site acreage	0.48 ac		
New acres of land altered		0 ac	
Acres of impervious area	0.05 ac	-0.05 ac	0 ac
Square feet of new bordering vegetated wetlands alteration		0 ac	
Square feet of new other wetland alteration		20,922	
Acres of new non-water dependent use of tidelands or waterways		0 ac	
STRUCTURES			
Gross square footage	N/A	N/A	N/A
Number of housing units	N/A	N/A	N/A
Maximum height (feet)	N/A	N/A	N/A
TRANSPORTATION			
Vehicle trips per day	N/A	N/A	N/A
Parking spaces	N/A	N/A	N/A
WASTEWATER			
Water Use (Gallons per day)	N/A	N/A	N/A
Water withdrawal (GPD)	N/A	N/A	N/A
Wastewater generation/treatment (GPD)	N/A	N/A	N/A
Length of water mains (miles)	N/A	N/A	N/A
Length of sewer mains (miles)	N/A	N/A	N/A

Has this project been filed with MEPA before?
☐ Yes (EEA #_____) ☒No

Has any project on this site been filed with MEPA before?
☐ Yes (EEA #_____) ☒No

GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

Describe the existing conditions and land uses on the project site:
Extending approximately 800 linear ft, the primary dune parallel to 27-53 Beach Ave has been significantly altered and degraded as compared to adjacent sections of primary dune north and south. The ~400 ft northern section has eroded from coastal storms and non-permitted pedestrian paths. The southern ~400 ft section contains two man-made gaps in the primary dune that has created flood pathways resulting in further deterioration of this area. The altered primary dune proposed to be restored is approximately 828 ft long including the transitions with adjacent sections, covers an area of 20,922 square ft, and is located within the 50-ft Town-owned road layout of Beach Ave. As a result of human alteration, the primary dune is in a debilitated state, which has reduced its ability provide storm damage prevention, flood control, and habitat functions. One permitted pedestrian access path (SE 35-1380) over the primary dune exists at the intersection of Malta St and Beach Ave. A more detailed discussion of the existing conditions and land uses is provided in the Project Narrative in Section B.

Describe the proposed project and its programmatic and physical elements:
The proposed project calls for the restoration of 828 linear ft of altered primary frontal dune. The purpose of the proposed project is to restore the primary dune adjacent to 27-53 Beach Ave to a state (height and width) consistent with the existing primary dune system that runs to the north and south of the project area along Beach Ave. Currently, the altered primary dune is a flood pathway during storms, particularly at two unauthorized concrete patios that are built into the dune, that allows for flooding of this section of Beach Avenue as well as inland low-lying developed areas, deposits sand and debris in the streets, and presents a risk to Town-owned roads and utilities. This has also degraded the coastal dune resource habitat available to plants and wildlife. The proposed primary dune restoration will add approximately 20,922 cubic yards of compatible sediment to the existing primary dune match adjacent unaltered sections immediately to the north and south of the project area providing both an increased level of flood protection and damage prevention while simultaneously enhancing habitat. The restored dune will have a narrow crest at an elevation of 15-16 ft (NAVD88). Plantings of beach grass will follow final gradings of the dune for stabilization. The project also proposes to add two additional permitted pedestrian access pathways along Beach Ave to improve public access to North Nantasket Beach and deter creation of non-permitted pedestrian paths. A more detailed discussion of the proposed project is provided in the Project Narrative in Section B.

NOTE: The project description should summarize both the project's direct and indirect impacts (including construction period impacts) in terms of their magnitude, geographic extent, duration and frequency, and reversibility, as applicable. It should also discuss the infrastructure requirements of the project and the capacity of the municipal and/or regional infrastructure to sustain these requirements into the future.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:
The following alternatives were considered:

Alternative 1: No Action
Alternative 2: Dune Restoration Using 2V:H1 Slopes within Town Property
Alternative 3: Dune Restoration Consistent with NHESP Guidance
Alternative 4: Bioengineered Dune within Town Property
Alternative 5: Dune Restoration Using 3V:H1 Slopes within Town Property with Additional

Permitted Pedestrian Paths (Preferred)

A detailed assessment of the alternatives considered is provided in the alternatives analysis in Section C.

NOTE*: The purpose of the alternatives analysis is to consider what effect changing the parameters and/or siting of a project, or components thereof, will have on the environment, keeping in mind that the objective of the MEPA review process is to avoid or minimize damage to the environment to the greatest extent feasible. Examples of alternative projects include alternative site locations, alternative site uses, and alternative site configurations.*
Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:
The proposed project is designed to restore and enhance an altered coastal dune and integrate it with the existing primary dunes to the north and south. We do not believe that the proposed dune restoration will negatively impact existing natural resources or function, rather, it will restore and enhance the existing dune resource and its ability to provide storm damage prevention, flood control and habitat functions.

A more detailed discussion of the project alternatives considered is provided in Section C.

If the project is proposed to be constructed in phases, please describe each phase:
The project is not expected to be constructed in phases. Construction is anticipated for the fall of 2023. However, depending on the timing of construction of the initial dune restoration, the plantings may be delayed to comply with the Town of Hull's 2018 Beach Management Plan planting window between September 1 and March 30. Construction will follow time of year restrictions between April 1and August 31 to protect rare and endangered shorebird species.

A more detailed discussion of the construction methodology is provided in the Project Narrative in Section B.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:
Is the project within or adjacent to an Area of Critical Environmental Concern?
☐Yes (Specify_____)
☒No
if yes, does the ACEC have an approved Resource Management Plan? ___ Yes ___ No;
If yes, describe how the project complies with this plan.
_____
Will there be stormwater runoff or discharge to the designated ACEC? ___ Yes ___ No;
If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.
_____

RARE SPECIES:
Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)
☒Yes (Specify **Estimated & Priority Habitat**) ☐No

HISTORICAL /ARCHAEOLOGICAL RESOURCES:
Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?
☐Yes (Specify_____) ☒No
If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify_____) ☐No

WATER RESOURCES:
Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site? ___Yes _X_No;

if yes, identify the ORW and its location. _____

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site? ___Yes _X_No; if yes, identify the water body and pollutant(s) causing the impairment:_____.

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? ___Yes _X_No

STORMWATER MANAGEMENT:

Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations: **N/A**

MASSACHUSETTS CONTINGENCY PLAN:

Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes ___ No _X_ ; if yes, please describe the current status of the site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):_____

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes ___ No _X_; if yes, describe which portion of the site and how the project will be consistent with the AUL: _____.

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN? Yes ___ No _X__ ; if yes, please describe:_____

SOLID AND HAZARDOUS WASTE:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:____

Man-made materials and construction demolition waste will be removed from the site and be disposed of at an upland disposal facility.

(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)

Will your project disturb asbestos containing materials? Yes ___ No _X_ ; if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment:

The project Proponent will incorporate limiting idling in construction equipment to avoid and minimize Greenhouse Gas emission during the construction period.

DESIGNATED WILD AND SCENIC RIVER:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ No _X_ ; if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the “outstandingly remarkable” resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River?

Yes ___ No ___ ; if yes, specify name of river and designation: _____;
if yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River.
Yes ___ No ___ ;
if yes,describe the potential impacts to one or more of the "outstandingly remarkable" resources or stated purposes and mitigation measures proposed.

ATTACHMENTS:

1. List of all attachments to this document.
2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.
3.. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.
4 Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts.
5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).
6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).
7. List of municipal and federal permits and reviews required by the project, as applicable.
8. Printout of output report from RMAT Climate Resilience Design Standards Tool, available here.
9. Printout from the EEA EJ Maps Viewer showing the project location relative to Environmental Justice (EJ) Populations located in whole or in part within a 1-mile and 5-mile radius of the project site.

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1)
___ Yes _X_ No; if yes, specify each threshold:

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	0	0	0
Internal roadways	0	0	0
Parking and other paved areas	0.05	-0.05	0
Other altered areas	0.43	-0.43	0
Undeveloped areas	0	0.48	0.48
Total: Project Site Acreage	0.48	0	0.48

B. Has any part of the project site been in active agricultural use in the last five years?
___ Yes _X_ No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use?
___ Yes _X_ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes _X_ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction?
___ Yes _X_ No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes _X_ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No _X_; if yes, describe:

III. Consistency

A. Identify the current municipal comprehensive land use plan
Title:___**Hull Community Development Plan** _____ Date____June 2004_____

B. Describe the project's consistency with that plan with regard to:
1) economic development _____
2) adequacy of infrastructure _____
3) open space impacts _____
4) compatibility with adjacent land uses_____

See below for consistency.

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)
RPA:

Title: **MetroFuture Regional Plan** Date May 2008

D. Describe the project's consistency with that plan with regard to:
1) economic development _____
2) adequacy of infrastructure _____
3) open space impacts _____

Hull's economic goals from the Hull Community Development Plan are to promote development that is compatible with Hull's environment and historic character, have minimal impacts upon existing natural resources, and not compromise the interests of future generations. The Metropolitan Area Planning Council's (MAPC) economic goals focus on informed, inclusive and proactive planning for the region, with an emphasis on long-term perspectives. The regional plan addresses climate change as a long-term challenge to economic growth and advises cities and towns to take action to mitigate the effects of increasing global temperature and to make strategic investments to protect vulnerable areas. The Town of Hull is investing in coastal resilience for the Town by proposing to restore the vulnerable areas of this coastal dune. The proposed project will mitigate flooding and storm impacts of one of the most vulnerable sections of the coastal dune identified by the Town through their FY19 CZM Resiliency Grant for "Nature-Based Solutions for Community Resilience on North Nantasket Beach". The proposed project will not only have negligible adverse impacts upon the existing natural resources, but will also restore and enhance the degraded habitat of this section of the coastal dune. Finally, the proposed project will reduce future adverse economic impacts to the community as a result of increased protection from storm damage and flooding.

The Town of Hull mainly consists of high-density residential neighborhoods, and land available for development is very limited. The Hull Community Development Plan states "The lack of developable land essentially prevents the town from expanding its housing base." Although the proposed project does not provide a solution to limited infrastructure growth options, it will reduce the risk of flooding and storm damage in high repetitive loss areas by eliminating the flood pathway along Beach Ave, which is a current concern for the Town. It will also protect nearby roads and sidewalks that are frequently undermined and damaged during storms and periods of overwash. This is also consistent with the MAPC's position in the MetroFuture Regional Plan that more cities and towns should take action to mitigate the effects of increasing global temperatures and to prevent damage from natural disasters.

Open space is recognized as important by both the Hull Community Development Plan and the MetroFuture Regional Plan. Both plans address the importance of conserving the natural environment and its ability to provide recreational opportunities and scenic beauty. These qualities enhance the experience for visitors to the area, as well as to residents that enjoy being in a natural setting. The proposed dune restoration is in line with the goals of both planning documents as it aims to restore and enhance open space and natural habitat, including coastal beach, coastal dune, and protected species habitat.

The proposed project is not only compatible with adjacent land uses, but these adjacent areas will directly benefit from the project. The project area is adjacent to the coastal beach and will protect residential housing landward of the proposed site. The two ~60 ft long gaps in the primary dune within the project area has created a flood pathways for storms and has

resulted in repeated flooding to nearby residential areas. The proposed restoration of the coastal dune seaward of these properties will provide additional protection against storms and flooding. It should be noted that this area was identified as a top priority action from the Municipal Vulnerability Preparedness (MVP) workshop that was part of the Hull's MVP certification, and also identified in the Kleinfelder Vulnerability Assessment 2016 Report funded by CZM.

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? _X_ Yes ___ No; if yes, specify, in quantitative terms:

The proposed project will result in an alteration of 0.48 acres of estimated and priority habitat.

(NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

B. Does the project require any state permits related to **rare species or habitat**? ___ Yes _X_ No

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? _X_ Yes ___ No.

D. If you answered "No" to all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? _X_ Yes ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? _X_Yes ___No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes _X_ No; if yes, attach the letter of determination to this submission.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes _X__ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts

3. Which rare species are known to occur within the Priority or Estimated Habitat?

Shorebirds including Piping Plovers and Common Terns

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? _X_ Yes ___ No

The Town hires Mass Audubon to monitor shorebirds throughout North Nantasket Beach each season.

4. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes _X_ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

A NOI will be filed after the receipt of the MEPA Certificate

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes _X_ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? _X_ Yes ___ No; if yes, specify, in quantitative terms:

The proposed project will alter (restore) 20,922 square feet of Coastal (Primary) Dune using State grant funding.

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? _X_ Yes ___ No; if yes, specify which permit:

Order of Conditions

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? _X_ Yes ___ No; if yes, has a Notice of Intent been filed? ___ Yes _X_ No; if yes, list the date and MassDEP file number: _____; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes _X_ No.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site:

The proposed project calls for restoration of an altered coastal dune. The project proposes 20,922 square feet of permanent impacts to barrier beach and coastal dune to restore the dunes ability to provide storm damage prevention and flood control and enhance habitat. Temporary impacts from construction will be minimized since construction will take place entirely from the Beach Ave roadway.

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Land Under the Ocean		
Designated Port Areas		
Coastal Beaches		
Coastal Dunes	20,922	permanent
Barrier Beaches	20,922	permanent
Coastal Banks		
Rocky Intertidal Shores		
Salt Marshes		
Land Under Salt Ponds		
Land Containing Shellfish		
Fish Runs		
Land Subject to Coastal Storm Flowage	20,922	permanent
Inland Wetlands		
Bank (lf)		
Bordering Vegetated Wetlands		

Isolated Vegetated Wetlands	_____	_____
Land under Water	_____	_____
Isolated Land Subject to Flooding	_____	_____
Bordering Land Subject to Flooding	_____	_____
Riverfront Area	_____	_____

D. Is any part of the project:

1. proposed as a **limited project**? ___ Yes _X_ No; if yes, what is the area (in sf)?____
2. the construction or alteration of a **dam**? ___ Yes _X_ No; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? _X_ Yes ___ No
4. dredging or disposal of dredged material? ___ Yes _X_ No; if yes, describe the volume of dredged material and the proposed disposal site:
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**? ___ Yes _X_ No
6. subject to a wetlands restriction order? ___ Yes _X_ No; if yes, identify the area (in sf):
7. located in buffer zones? ___Yes _X_No; if yes, how much (in sf) _____

E. Will the project:

1. be subject to a local wetlands ordinance or bylaw? ___ Yes _X_ No
2. alter any federally-protected wetlands not regulated under state law? ___ Yes _X_ No; if yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? ___ Yes _X_ No; if yes, is there a current Chapter 91 License or Permit affecting the project site? ___ Yes ___ No; if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands:

B. Does the project require a new or modified license or permit under M.G.L.c.91? ___ Yes _X_ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current ___ Change ___ Total ___

If yes, how many square feet of solid fill or pile-supported structures (in sf)?

C. For non-water-dependent use projects, indicate the following: **N/A**

Area of filled tidelands on the site:_____

Area of filled tidelands covered by buildings:_____

For portions of site on filled tidelands, list ground floor uses and area of each use:

_____

Does the project include new non-water-dependent uses located over flowed tidelands? Yes ___ No ___

Height of building on filled tidelands_____

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes _X_ No; if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations? ___Yes

_X_ No; if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR? ___ Yes _X_ No;
(NOTE: If yes, then the project will be subject to Public Benefit Review and Determination.)

G. Does the project include dredging? ___ Yes _X_ No; if yes, answer the following questions:
What type of dredging? Improvement ___ Maintenance ___ Both ____
What is the proposed dredge volume, in cubic yards (cys) _____
What is the proposed dredge footprint ____length (ft) ___width (ft)____depth (ft);
Will dredging impact the following resource areas?
Intertidal Yes__ No__; if yes, ___ sq ft
Outstanding Resource Waters Yes__ No__; if yes, ___ sq ft
Other resource area (i.e. shellfish beds, eel grass beds) Yes__ No__; if yes __ sq ft
If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?
If no to any of the above, what information or documentation was used to support this determination?
Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.
Sediment Characterization
Existing gradation analysis results? __Yes ___No: if yes, provide results.
Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ___Yes ____No; if yes, provide results.
Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? If yes, check the appropriate option.

Beach Nourishment ___
Unconfined Ocean Disposal ___
Confined Disposal:
Confined Aquatic Disposal (CAD) ___
Confined Disposal Facility (CDF) ___
Landfill Reuse in accordance with COMM-97-001 ___
Shoreline Placement ___
Upland Material Reuse____
In-State landfill disposal____
Out-of-state landfill disposal ____
(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? _X_ Yes ___ No; if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management:

See Section E for a review of CZM Consistency

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes _X_ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Municipal or regional water supply	_____	_____	_____
Withdrawal from groundwater	_____	_____	_____
Withdrawal from surface water	_____	_____	_____
Interbasin transfer	_____	_____	_____

(NOTE: Interbasin Transfer approval will be required if the basin and community where the proposed water supply source is located is different from the basin and community where the wastewater from the source will be discharged.)

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. _____

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? _____Will the project require an increase in that withdrawal? ___Yes ___No; if yes, then how much of an increase (gpd)? _____

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	_____	_____	_____	_____
Capacity of water treatment plant (gpd)	_____	_____	_____	_____

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve:

1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking

water supply for purpose of forest harvesting activities? ___ Yes ___ No

III. Consistency

Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

	Existing	Change	Total
Discharge of sanitary wastewater	_____	_____	_____
Discharge of industrial wastewater	_____	_____	_____
TOTAL	_____	_____	_____

	Existing	Change	Total
Discharge to groundwater	_____	_____	_____
Discharge to outstanding resource water	_____	_____	_____
Discharge to surface water	_____	_____	_____
Discharge to municipal or regional wastewater facility	_____	_____	_____
TOTAL	_____	_____	_____

B. Is the existing collection system at or near its capacity? ___ Yes ___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow	Total
Wastewater treatment plant capacity (in gallons per day)	_____	_____	_____	_____

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is located.)

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (tons per day):

	Existing	Change	Total
Storage	_____	_____	_____
Treatment	_____	_____	_____
Processing	_____	_____	_____
Combustion	_____	_____	_____
Disposal	_____	_____	_____

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	_____	_____	_____
Number of vehicle trips per day	_____	_____	_____
ITE Land Use Code(s):	_____	_____	_____

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

C. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes ____ No; if yes, describe if and how will the project will participate in the TMA:

D. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes ____ No; if yes, generally describe:

E. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

III. Consistency

Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? _____
2. Cutting of living public shade trees (number)? _____
3. Elimination of stone wall (in linear feet)? _____

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)	_____	_____	_____
Length of fuel line (in miles)	_____	_____	_____
Length of transmission lines (in miles)	_____	_____	_____
Capacity of transmission lines (in kilovolts)	_____	_____	_____

B. If the project involves construction or expansion of an electric generating facility, what are:

1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter	_____	_____	_____
Carbon monoxide	_____	_____	_____
Sulfur dioxide	_____	_____	_____
Volatile organic compounds	_____	_____	_____
Oxides of nitrogen	_____	_____	_____
Lead	_____	_____	_____
Any hazardous air pollutant	_____	_____	_____
Carbon dioxide	_____	_____	_____

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	_____	_____	_____
Treatment, processing	_____	_____	_____
Combustion	_____	_____	_____
Disposal	_____	_____	_____

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	_____	_____	_____
Recycling	_____	_____	_____
Treatment	_____	_____	_____
Disposal	_____	_____	_____

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos? ___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency

Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? ___ Yes _X_ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes ____ No; if yes, attach correspondence

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X_ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes ___ No; if yes, please describe:

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X_ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

D. If you answered "No" to all parts of both questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

III. Consistency

Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

CLIMATE CHANGE ADAPTATION AND RESILIENCY SECTION

This section of the Environmental Notification Form (ENF) solicits information and disclosures related to climate change adaptation and resiliency, in accordance with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency (the "MEPA Interim Protocol"), effective October 1, 2021. The Interim Protocol builds on the analysis and recommendations of the 2018 Massachusetts Integrated State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), and incorporates the efforts of the Resilient Massachusetts Action Team (RMAT), the inter-agency steering committee responsible for implementation, monitoring, and maintenance of the SHMCAP, including the "Climate Resilience Design Standards and Guidelines" project. The RMAT team recently released the RMAT Climate Resilience Design Standards Tool, which is available here.

The MEPA Interim Protocol is intended to gather project-level data in a standardized manner that will both inform the MEPA review process and assist the RMAT team in evaluating the accuracy and effectiveness of the RMAT Climate Resilience Design Standards Tool. Once this testing process is completed, the MEPA Office anticipates developing a formal Climate Change Adaptation and Resiliency Policy through a public stakeholder process. Questions about the RMAT Climate Resilience Design Standards Tool can be directed to rmat@mass.gov.

All Proponents must complete the following section, referencing as appropriate the results of the output report generated by the RMAT Climate Resilience Design Standards Tool and attached to the ENF. In completing this section, Proponents are encouraged, but not required at this time, to utilize the recommended design standards and associated Tier 1/2/3 methodologies outlined in the RMAT Climate Resilience Design Standards Tool to analyze the project design. However, Proponents are requested to respond to a respond to a user feedback survey on the RMAT website or to provide feedback to rmat@mass.gov, which will be used by the RMAT team to further refine the tool. Proponents are also encouraged to consult general guidance and best practices as described in the RMAT Climate Resilience Design Guidelines.

Climate Change Adaptation and Resiliency Strategies

I. Has the project taken measures to adapt to climate change for all of the climate parameters analyzed in the RMAT Climate Resilience Design Standards Tool (sea level rise/storm surge, extreme precipitation (urban or riverine flooding), extreme heat)? ___Yes _X_ No

Note: Climate adaptation and resiliency strategies include actions that seek to reduce vulnerability to anticipated climate risks and improve resiliency for future climate conditions. Examples of climate adaptation and resiliency strategies include flood barriers, increased stormwater infiltration, living shorelines, elevated infrastructure, increased tree canopy, etc. Projects should address any planning priorities identified by the affected municipality through the Municipal Vulnerability Preparedness (MVP) program or other planning efforts, and should consider a flexible adaptive pathways approach, an adaptation best practice that encourages design strategies that adapt over time to respond to changing climate conditions. General guidance and best practices for designing for climate risk are described in the RMAT Climate Resilience Design Guidelines.

A. If no, explain why.

Extreme Precipitation – Urban Flooding

Roadway and stormwater redesign were not part of the proposed project scope as the goal of the Project is to restore Coastal Dune to mitigate coastal storm flood risks. The Project does not propose any increases in impervious surface area that would result in increased stormwater runoff. Existing impervious surface area in the altered dune across from 33 Malta Street and 31 Beach Ave (i.e. patios) will be removed and the altered primary dune will be restored to match elevations and form of existing natural dunes to the north and south of the Project Site. The restored dune will be planted with native beach grass species which will stabilize the dune. While the Project Site is designated at risk of Urban Flooding due to Extreme Precipitation, the proposed

project is designed to mitigate the effects of Urban Flooding from Sea Level Rise/Storm Surge which may reduce seawater inflow to drainage systems and help them retain capacity to manage rainfall stormwater during combined coastal/precipitation flooding events. The proposed project may provide some minor relief to Urban Flooding from precipitation by decreasing the amount of impervious surface area within the area.

Extreme Heat

The proposed project is located within a coastal dune between a coastal beach and an impervious roadway surface. The site is exposed to direct sunlight which heats the paved roadway. The roadway absorbs the heat and then radiates some of it back into the immediate area. The coastal beach is valued for recreational uses such as sunbathing and swimming which depend to some degree on it being hot. The proposed restoration of the coastal dune will have several limited heat mitigation co-benefits, including increased shading of the roadway by increasing the dune height, removal of two concrete patio slabs, and restoration of vegetation (native beach grass species). The sandy nature of the existing coastal dune and the beach environment does not support the addition of large trees that would provide increased shade and reduce the effects of extreme heat. The project area also does not include landside public gathering areas that could benefit from shading for people to take refuge from the hot beach. While the Project Site is designated at risk of Extreme Heat, the proposed project is designed to mitigate the effects of flooding from Sea Level Rise/Storm Surge and may provide some minor relief to the effects of extreme heat.

B. If yes, describe the measures the project will take, including identifying the planning horizon and climate data used in designing project components. If applicable, specify the return period and design storm used (e.g., 100-year, 24-hour storm).

Sea Level Rise/Storm Surge

The purpose of the proposed project is to help the Town of Hull adapt to increasing sea level rise/storm surge climate risks by mitigating future coastal flood exposure. The 2016 Hull Coastal Climate Change Vulnerability Assessment and Adaptation Study identified the community as highly vulnerable to coastal flooding and the long-term impacts of sea level rise and extreme storm surge. The study notes "Coastal flooding now causes property damage almost every year in Hull and results in the closure of vulnerable roads several times a year." One of the primary goals of the report was to identify areas of town that were vulnerable to the combined effects of sea level rise and storm surge from extreme storm events. The North Nantasket Beach coastal dune was identified as the second highest priority assets for adaptation, after only the Hull Wastewater Treatment Plant. The proposed dune restoration site is one of the locations of the primary dune identified by the report as a high risk area and proposes to implement adaptation strategies recommended in that report to mitigate sea level rise and storm surge impacts. This strategy was also rated as the highest priority in the Town's 2019 MVP Workshop. This measure will also allow for more long-term climate change adaptation strategies to be developed and implemented, including, if necessary, managed retreat.

Woods Hole Group simulated the proposed dune morphological response to storms to inform the preferred dune design alternative by optimizing the ability of the dune to provide flood protection and storm damage prevention. A narrow dune crest constructed to an elevation of 15-16 ft NAVD88 with side slopes of 3H:1V was selected as the preferred alternative since it provides an approximate 10-year level of storm protection (10% annual chance storm). While other alternatives provided further protection against storm damage, the preferred was selected as it balances human use needs and minimized impacts to private property and adjacent habitat for endangered species while maximizing practical protection in the available space. The increased flood protection offered by the restored dune meets the Target Planning Horizon of 2030 identified by the RMAT Climate Resilience Design Standards Tool.

C. Is the project contributing to regional adaptation strategies? _X_ Yes __ No; If yes, describe.

The Town of Hull is one of two communities that occupy the outer Boston Harbor peninsulas, which are important land structures that are the first line of defense from coastal storm wave energy and provide critical flood and storm damage protection to municipalities of Metro Boston. The viability of the Town of Hull is therefore critical for regional resilience to coastal climate change impacts.

One of the sub-strategies of the 2014 Metro Boston Regional Climate Change Adaptation Strategy Report is "Ecological and Habitat Restoration." The report emphasizes the importance of adaptive infrastructure in which it purports the idea that landscape is infrastructure and that designers can use these landscape components to ensure that communities become resilient to climate change. By proposing to restore the primary frontal dune, the Town is redesigning the landscape naturally so there is a continuous buffer to flooding to landward areas. The proposed restoration supports the Regional Strategies goal of ecological restoration that increases resilience to the effects of climate change. This will also enhance the coastal dune habitat itself while restoring habitat connectivity with adjacent sections of altered coastal dune to the north and south.

The proposed strategy meets two of the three categories of adaptation the report proposes: protect – the use of measures to shield land uses from the impacts of a rising sea and accommodate – the use of measures that adjust to the impacts of a rising sea while maintaining existing land uses. While the proposed project does not incorporate retreat, it increases the period of time for the Town and homeowners to make decisions regarding managed retreat, if necessary.

II. Has the Proponent considered alternative locations for the project in light of climate change risks? ___ Yes _X_ No

A. If no, explain why.

The location of the proposed dune restoration was identified in the 2016 Hull Coastal Climate Change Vulnerability Assessment and Adaptation Study as a flood pathway during storms. The dune in its current degraded state allows flood waters to pass through the gaps in the natural barrier resulting in flooding of low-lying developed areas to the west. Other locations along the North Nantasket primary dune have been restored to match adjacent dune elevations in an effort to close off flood pathways. The Town seeks to close off these remaining breaches in the dune to meet their goal of restoring a continuous primary frontal dune along the entirety of Beach Ave.

The footprint of the restored dune is limited to the seaward half of the unpaved portion of the 50-foot wide road corridor owned by the Town of Hull due, in part, to privately owned beach lots and endangered species habitat on seaward edge of the dune. Landward of Beach Ave is a highly developed and populated urban environment with no space to accommodate natural landward migration of the coastal dunes. The proposed dune will restore connectivity of this dune resource and habitat along this stretch of shoreline.

B. If yes, describe alternatives considered.

III. Is the project located in Land Subject to Coastal Storm Flowage (LSCSF) or Bordering Land Subject to Flooding (BLSF) as defined in the Wetlands Protection Act? __X_Yes ____No

If yes, describe how/whether proposed changes to the site's topography (including the addition of fill) will result in changes to floodwater flow paths and/or velocities that could impact adjacent properties or the functioning of the floodplain. General guidance on providing this analysis can be found in the CZM/MassDEP Coastal Wetlands Manual, available here.

The existing site topography consists of an altered primary frontal dune seaward of a developed residential area which provides diminished ability to attenuate flood waters, reduce storm-wave overwash and coastal erosion, and prevent storm damage. The proposed Project will restore 828 linear feet of altered coastal dune to a crest elevation of 15-16 ft NAVD88 and 3H:1V side slopes. The addition of nourishment to restore the coastal dune to match dune elevations to north and the south would close two existing flood pathways caused by human alterations (patios) and restore a uniform crest along its length increasing the dune's ability to provide a consistent level of storm damage prevention and flood control function. No low elevation gaps will remain along the dead-end portion of Beach Avenue. While three pedestrian access paths are proposed along this 828 ft length of primary dune, two of which are new, the paths have been designed to comply with 2018 Hull Beach Management Plan to negate the creation flood pathways. Modeling of the proposed dune design shows an increase in the current flood protection offered by the portion of the dune south of Malta St from less than a 5-year storm to upwards of a 10-year storm, while north of Malta St the flood protection exceeds a 10 year storm level. This increase in flood protection would provide flood relief to nearby residential areas and much needed sediment source to the adjacent coastal beach.

The Project would also remove existing impervious surfaces, two concrete patios, within the altered dune that causes increased velocity of storm-wave overwash, channelizes flood waters toward landward residential areas, and is prone to scouring at the seaward edge. The dune will be planted with native beach grass vegetation following construction which will stabilize the dune and slow flood waters, reduce storm-wave overwash, reduce coastal erosion, and enhance habitat.

ENVIRONMENTAL JUSTICE SECTION

I. Identifying Characteristics of EJ Populations

A. If an Environmental Justice (EJ) population has been identified as located in whole or in part within 5 miles of the project site, describe the characteristics of each EJ populations as identified in the EJ Maps Viewer (i.e., the census block group identification number and EJ characteristics of "Minority," "Minority and Income," etc.). Provide a breakdown of those EJ populations within 1 mile of the project site, and those within 5 miles of the site.

Within 5 Miles of the Project Site:

- **Block Group 1, Census Tract 9801.01 in Boston, Suffolk County, MA**
  - **EJ Characteristic: Minority (Total minority population: 61.7%)**
- **Block Group 1, Census Tract 9901.01 in Boston, Suffolk County, MA**
  - **EJ Characteristic: Minority (Total minority population: 100.0%)**
- **Block Group 1, Census Tract 4178.02 in Quincy, Norfolk County, MA**
  - **EJ Characteristics: Minority (Total minority population: 35.6%) & income (Median household income: $49,167: this is 57.3% of the MA median)**
- **Block Group 2, Census Tract 4178.02 in Quincy, Norfolk County, MA**
  - **EJ Characteristics: Minority (Total minority population: 68.3%) & income and English isolation (Households with language isolation: 27.9%)**
- **Block Group 3, Census Tract 4227, in Weymouth, Norfolk County, MA**
  - **EJ Characteristic: Minority (Total minority population: 26.6%)**
- **Block Group 2, Census Tract 4226, in Weymouth, Norfolk County, MA**
  - **EJ Characteristic: Minority (Total minority population: 26.3%)**

There are no Environmental Justice populations within 1 mile of the project site.

B. Identify all languages identified in the "Languages Spoken in Massachusetts" tab of the EJ Maps Viewer as spoken by 5 percent or more of the EJ population who also identify as not speaking English "very well." The languages should be identified for each census tract located in whole or in part within 1 mile and 5 miles of the project site, regardless of whether such census tract contains any designated EJ populations.

Within 5 Miles of the Project Site:

- **Block Group 1, Census Tract 9801.01 in Boston, Suffolk County, MA: Spanish or Spanish Creole: 6.4%**
- **Block Group 1, Census Tract 4178.02 in Quincy, Norfolk County, MA: Chinese: 25.6%**

There are no Environmental Justice populations within 1 mile of the project site.

C. If the list of languages identified under Section I.B. has been modified with approval of the EEA EJ Director, provide a list of approved languages that the project will use to provide public involvement opportunities during the course of MEPA review. If the list has been expanded by the Proponent (without input from the EEA EJ Director), provide a list of the additional languages that will be used to provide public involvement opportunities during the course of MEPA review as required by Part II of the MEPA Public Involvement Protocol for Environmental Justice Populations ("MEPA EJ Public Involvement Protocol"). If the project is exempt from Part II of the protocol, please specify.

N/A – The Project is exempt from Part II of the protocol because the Project Site does not meet the definition of a Designated Geographic Area; there are no Environmental Justice populations within 1 mile and the Project does not propose to meet or exceed MEPA review thresholds at 301 CMR 11.03(8)(a) and (b) or generate 150 or more new average daily trips of

diesel vehicle traffic over a duration of one year. The Project is not subject to 310 CMR 11.05(4)(a) and therefore is not required to undertake measures to provide public involvement opportunities for Environmental Justice Populations.

II. Potential Effects on EJ Populations

A. If an EJ population has been identified using the EJ Maps Viewer within 1 mile of the project site, describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

N/A – There are no Environmental Justice populations within 1 mile of the project site.

B. If an EJ population has been identified using the EJ Maps Viewer within 5 miles of the project site, will the project: (i) meet or exceed MEPA review thresholds under 301 CMR 11.03(8)(a)-(b) __ Yes _X_ No; or (ii) generate150 or more new average daily trips (adt) of diesel vehicle traffic, excluding public transit trips, over a duration of 1 year or more. ___ Yes _X_ No

C. If you answered "Yes" to either question in Section II.B., describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

III. Public Involvement Activities

A. Provide a description of activities conducted prior to filing to promote public involvement by EJ populations, in accordance with Part II of the MEPA EJ Public Involvement Protocol. In particular:

1. If advance notification was provided under Part II.A., attach a copy of the Environmental Justice Screening Form and provide list of CBOs/tribes contacted (with dates). Copies of email correspondence can be attached in lieu of a separate list.

2. State how CBOs and tribes were informed of ways to request a community meeting, and if any meeting was requested. If public meetings were held, describe any issues of concern that were raised at such meetings, and any steps taken (including modifications to the project design) to address such concerns.

3. If the project is exempt from Part II of the protocol, please specify.

N/A – The Project is exempt from Part II of the protocol because the Project Site does not meet the definition of a Designated Geographic Area; there are no Environmental Justice populations within 1 mile and the Project does not propose to meet or exceed MEPA review thresholds at 301 CMR 11.03(8)(a) and (b) or generate 150 or more New adt of diesel vehicle traffic over a duration of one year. The Project is not subject to 310 CMR 11.05(4)(a) and therefore is not required to undertake measures to provide public involvement opportunities for Environmental Justice Populations.

B. Provide below (or attach) a distribution list (if different from the list in Section III.A. above) of CBOs and tribes, or other individuals or entities the Proponent intends to maintain for the notice of the MEPA Site Visit and circulation of other materials and notices during the course of MEPA review.

N/A – See response above to question III.A.

C. Describe (or submit as a separate document) the Proponent's plan to maintain the same level of community engagement throughout the MEPA review process, as conducted prior to filing.

N/A – See response above to question III.A.

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name) Hull Times (Date) 4/28/22

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)
4/25/22		4/25/22	Mitchell Buck

Philip Lemnios	Mitchell Buck
Name (print or type)	Name (print or type)
Town of Hull, Town Manager	Woods Hole Group
Firm/Agency	Firm/Agency
253 Atlantic Ave	107 Waterhouse Rd
Street	Street
Hull, MA 02045	Bourne, MA 02532
Municipality/State/Zip	Municipality/State/Zip
781-925-2000	508-495-6210
Phone	Phone

Section B

Project Description

B. PROJECT DESCRIPTION

1.0 Introduction

North Nantasket Beach (NNB) begins north of the Nantasket Reservation (Phipps St) and continues for approximately 2 miles until reaching the Point Allerton headlands (Holbrook Ave). A primary Coastal Dune spans much of the length of this coastline along the eastern (seaward) boundary of the Beach Ave road corridor, which is not entirely paved. The Town of Hull (Town) manages the coastal dune system under the Town of Hull Beach Management Plan (BMP, 2018), which allows Town to clear the road, restore dune volume, install native plantings, and maintain public access.

An ~800 linear-ft section of the naturally occurring primary frontal dune, along the east side of the road corridor adjacent to 27 to 53 Beach Ave, has become degraded in comparison to adjacent sections to the north and south that maintain greater width, height, volume, and vegetation (yellow outline in Figure B-1). Within this degraded stretch of dune system are two gaps in the primary coastal dune at 31-37 Beach Ave and 33 Malta St that have been altered and maintained as unauthorized patio areas (pink outlines in Figure B-1). Each gap is approximately sixty-feet wide, stretching north to south along the primary frontal dune, and extend another 15 ft east (seaward) of the paved edge of Beach Avenue. Between the two gaps is a 220 ft stretch of dune that has diminished and become degraded over time as well as an additional 50 ft stretch of dune extending south from the gap at 27 Beach Ave. In total, this ~400 ft section of Coastal Dune between 27 Beach Ave and 33 Malta St is degraded and will be the primary focus of the restoration efforts (Figures B-2 & B-3). While the ~400 ft section of dune to the north of 33 Malta St (Figure B-4) is larger in volume and height than the southern section, in order to provide a consistent level of flood protection and habitat enhancement for the entirety of 27-53 Beach Ave the dune needs additional height and volume to enhance its resilience to coastal storms. The northern portion also contains five unpermitted pedestrian paths that have further degraded conditions of the primary dune. The total length and area of the altered, degraded dune is 828 linear-ft section and 20,922 square feet, respectively, which is located entirely within the Town-owned 50 ft wide layout for the Beach Avenue roadway.

As part of essential flood protection and mitigation planning efforts, the Town is proposing to restore and enhance the existing degraded primary frontal dune adjacent to 27 – 53 Beach Ave and integrate it with the primary frontal dunes to the north and south (project locus, Figure B-1). The project is being funded through a FY22 CZM Resiliency Grant along with Town matching funds. This project is intended to both restore degraded habitat to provide habitat connectivity as well as provide storm damage protection for inland properties. This project will also fill unauthorized footpaths, re-establish an existing authorized footpath over the dune at Malta St (SE35-1380), and create two new additional paths over the dune to help manage public access at either dead end. The size of the dune that can be constructed is limited to the unpaved portion of the Town-owned Beach Ave road layout where a degraded, altered primary dune exists. While the proposed primary dune nourishment is only providing a limited level of flood protection against a design level storm with an approximate 10-year return period (10% annual chance), it is expected to provide an increased level of flood protection and habitat enhancement over

existing conditions. The proposed work will allow the Town to close two gaps in the dune resulting from unauthorized patios that currently represent flood pathways. This project will also authorize the Town to manage and maintain this 828 ft long stretch of primary dune in the long term, consistent with other sections of the primary dune that allow for placing comptable beach sand and revegetating with native salt-tolerant plant species after storms.

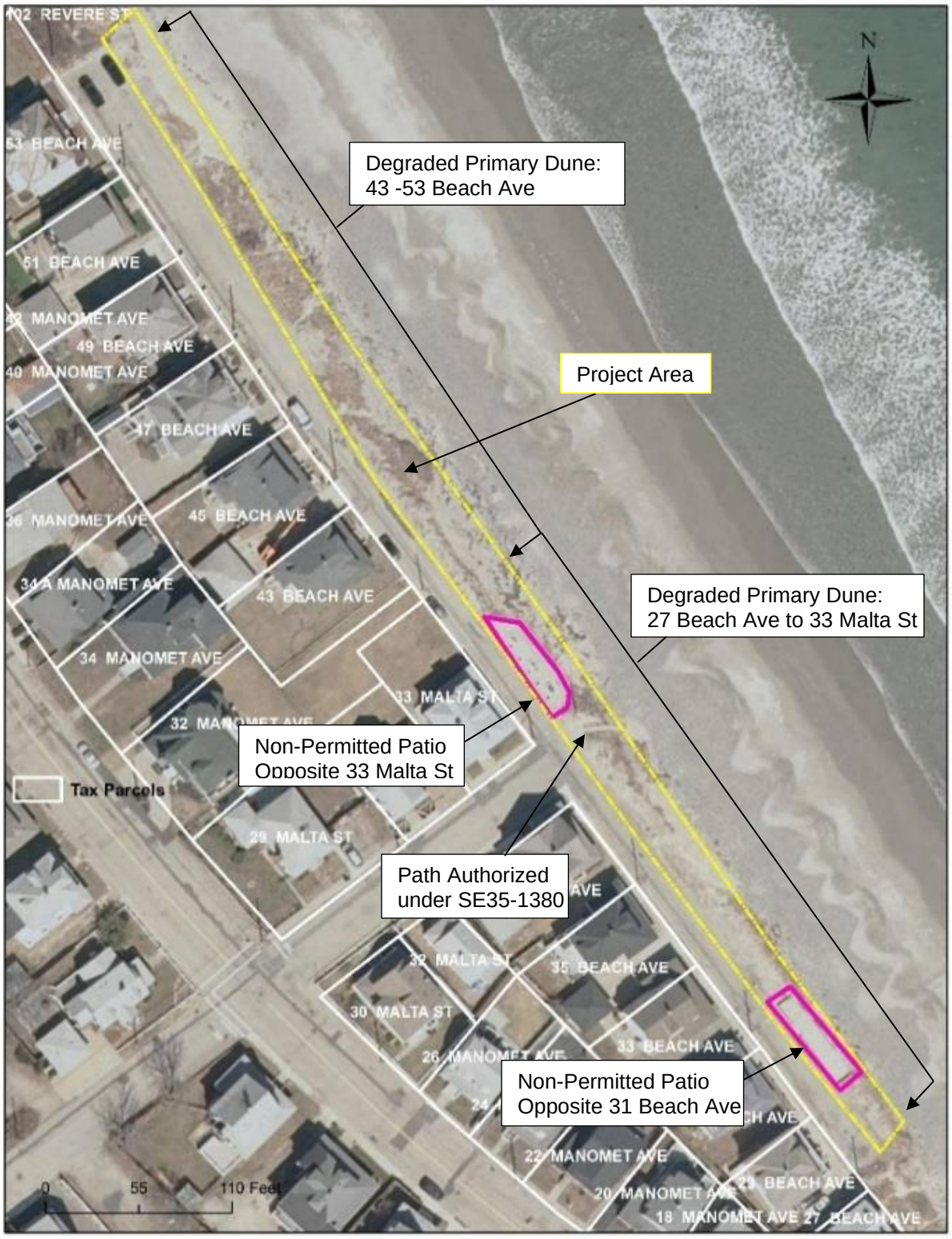


Figure B-1. **Google earth aerial showing the ~800 ft section of degraded dune area (yellow) adjacent to 27-53 Beach Ave and the two gaps in the dune at 31-37 Beach Ave and 33 Malta St (pink).**

Figure B-2. **MassGIS 2019 aerial imagery and site photos of the southern portion of the project locus at the southern extent of Beach Ave.**

Figure B-3. **MassGIS 2019 aerial imagery and site photos of the southern portion of the project locus adjacent to the intersection of Beach Ave and Malta St.**

Figure B-4. **MassGIS 2019 aerial imagery and site photos of the northern portion of the project locus at the northern extent of Beach Ave.**

2.0 Background

The Town of Hull has previously obtained Massachusetts Office of Coastal Zone Management (CZM) funded coastal resiliency grants to establish primary dune restoration priorities across NNB and advance restoration projects at several priority dune gaps and various non-permitted dune crossings from concept through design, permitting, and construction. This included restoring a 400 ft long section of degraded dune opposite 131-145 Beach Ave under SE35-1485 (Figure B-5) and a 75 ft long section of degraded dune at A St along (SE35-1549) with the establishment of an ADA compliant walkway and parking for beach access under a Fiscal Year 2021 (FY21) Grant. These actions, along with others being implemented by the Town, will bring the goal of restoring a continuous primary frontal dune to further fruition along the entirety of Beach Avenue, significantly enhance the system's coastal flooding and storm damage protection benefits, as well as providing habitat enhancement and other co-benefits.

Figure B-5. Photo of the 400 ft section of restored Primary Dune at 131-145 Beach Ave approximately 2,450 ft north of the project location.

The Town is seeking to restore the primary frontal dune at the two remaining 60 ft wide gaps in the North Nantasket Beach dune system, adjacent to 33 Malta Street and 31-37 Beach Avenue, and enhance adjacent remaining sections of degraded dune (800 ft in total). This application is being assembled as part of a subsequent CZM grant (FY22). This Environmental Notification Form (ENF) is the first application filed for the project which will initiate environmental review. Once the Massachusetts Environmental Policy Act (MEPA) review process is complete and a Certificate is received, a Notice of Intent (NOI) will be filed for the proposed project with the Hull Conservation Commission to obtain an Order of Conditions.

3.0 Project Need

The Hull peninsula is exposed to the open waters of Massachusetts Bay, Boston Harbor and Hingham Bay, and is therefore highly vulnerable to coastal flooding, long-term impacts of sea level rise, and increased storm surge. In 2016, Kleinfelder and Woods Hole Group conducted a *Coastal Climate Change Vulnerability Assessment and Adaptation Study* (CCCVA Study) for the

Town of Hull. The study found that numerous streets within the North Nantasket Beach area were at high risk for flooding in near time horizons. In 2030 (~10 year planning horizon), most of the North Nantasket Beach area was projected to have a 2-5% annual probability of flooding, with the exception of areas in the vicinity of Beach Avenue which had a 10-25% annual probability of flooding. The altered primary dune at the project locus was identified in the 2016 Kleinfelder and Woods Hole Group study as a flood pathway during storms (black circle in Figure B-6).

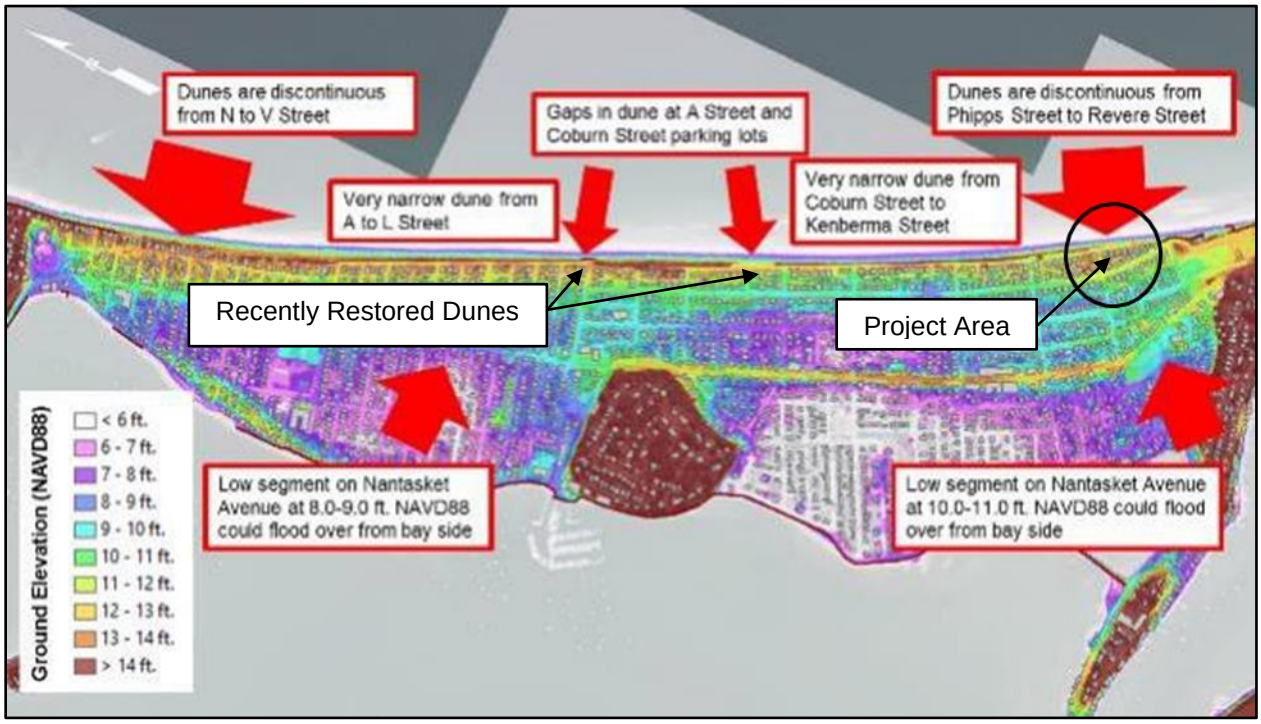


Figure B-6. Sources of flooding for high-risk areas along North Nantasket Beach with the subject property identified by the black circle.

As part of a subsequent CZM FY19 Coastal Resilience Grant-funded *Nature-Based Solutions for Community Resiliency on North Nantasket Beach* (2020) project, Woods Hole Group estimated the level of storm protection provided by each section of primary frontal dune along North Nantasket Beach, including the project area, on a volumetric basis. Volumes for each section were estimated using 2013/14 Post-Sandy LiDAR. The volume to level of storm protection relationships were developed through cross-shore sediment and flood transport modeling of representative dune transects. Based on this approach, the study indicated that the altered coastal dune system in the project area, circa 2013/14, afforded the properties landward a level of protection against the 25-year (4% annual chance) storm.

In developing the current proposed project, Woods Hole Group created a new existing conditions topographic profile using ground survey data collected by Woods Hole Group in 2021 and supplemented with aerial survey data collected by GEI in 2021. Figure B-7 compares the 2021 topography with the 2013/14 topography that was used for the 2020 level of storm protection estimate for the same transect. The comparison shows that there has been extensive erosion of

both the coastal beach and dune since 2013/14, this reduction in dune volume would equate with a much lower level of protection than estimated in the 2020 study.

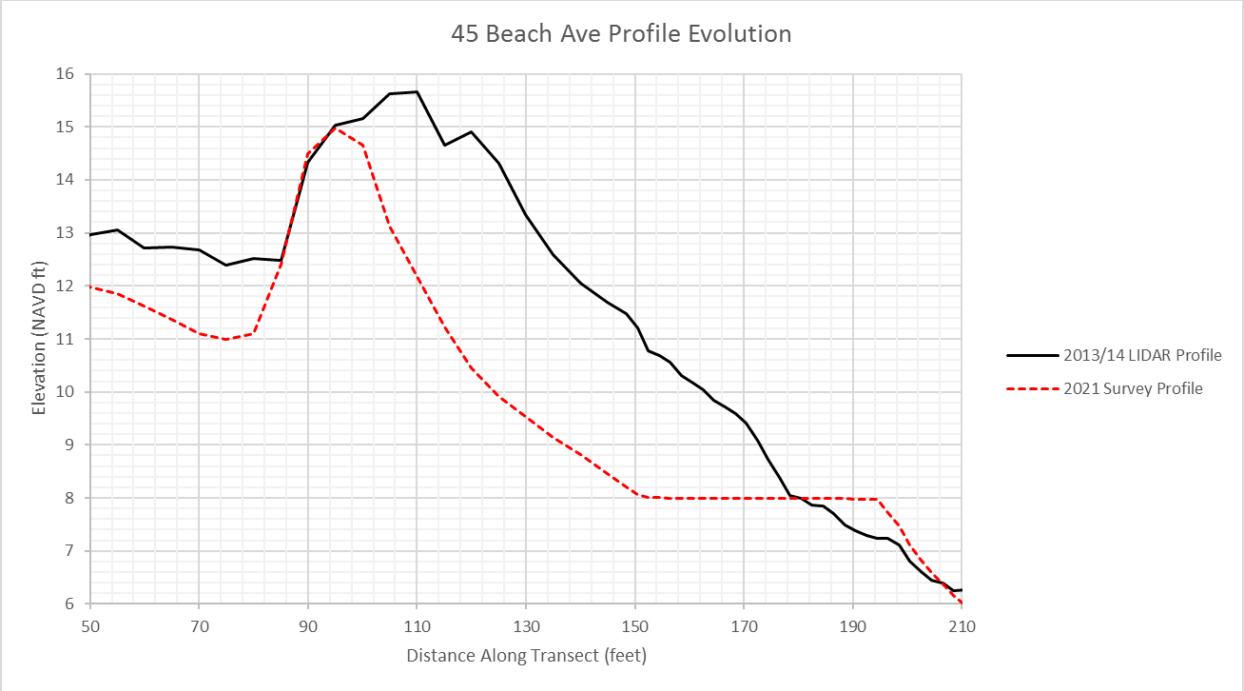


Figure B-7. Comparison of the transect at 45 Beach Ave taken from the 2020 study (2013/14 LiDAR) with the same transect extracted from recent 2021 survey data. Note significant beach and dune erosion have occurred in the last 8-9 years.

Since this 2016 CCCVA Study, the Woods Hole Group has developed and released the Massachusetts Coast Flood Risk Model (MC-FRM). MC-FRM provides comprehensive, high-resolution, probabilistic information on present coastal flood risks and how they are expected to change with future sea level rise and storm intensification for the entire Massachusetts Coast. Woods Hole Group developed the MC-FRM to incorporate a suite of return period storms ranging from the 1-year to 1,000 year (100% to 0.1% annual chance), using latest projections of water levels that integrate future rates of sea level rise for the years 2030, 2050, and 2070. Model results include the processes of wave runup and overtopping. Woods Hole Group utilized the storm modeling results from MC-FRM to develop probabilistic flood maps showing the annual-percent-chance risk of storm flooding along within the Town of Hull in both present day and 2030. Figure B-8 shows the annual percent chance risk that any given patch of ground will be inundated (i.e. wet) due to storm flooding in any given year based on the colored shading. The figures do not indicate the severity of that flooding inundation that could be very small (inches) or large (feet). They are simply intended to demonstrate the annual percent risk of where storm flooding (inundation) could occur in both present and future day. This is different from the FEMA mapping that shows both the extent and severity of flooding inundation for a single storm (1%-annual chance / 100-yr) in present day.

Under present-day conditions, the flood risk ranges from 0.5% to 5% south of Malta St, equivalent to 20 and 200 year return period storm levels, while the roadway north of Malta St remains mostly dry. This is due to the severely degraded state of the dune south of Malta St where the gap in the dune at 31-37 Beach Ave serves as a flood pathway. Under future conditions in 2030, this flood risk expands to include the dwellings abutting the landward boundary of Beach Ave as well as the roadway north of Malta St since the gap in the dune opposite of 33 Malta St now becomes a flood pathway. By 2050 and 2070, much of this area is inundated during even low probably events. The MC-FRM results indicate that 27-53 Beach Ave is at risk of storm flooding under present day conditions where the dune gaps represent flood pathways, and that by 2030 the flood risk will increase and expand to include the entire roadway.

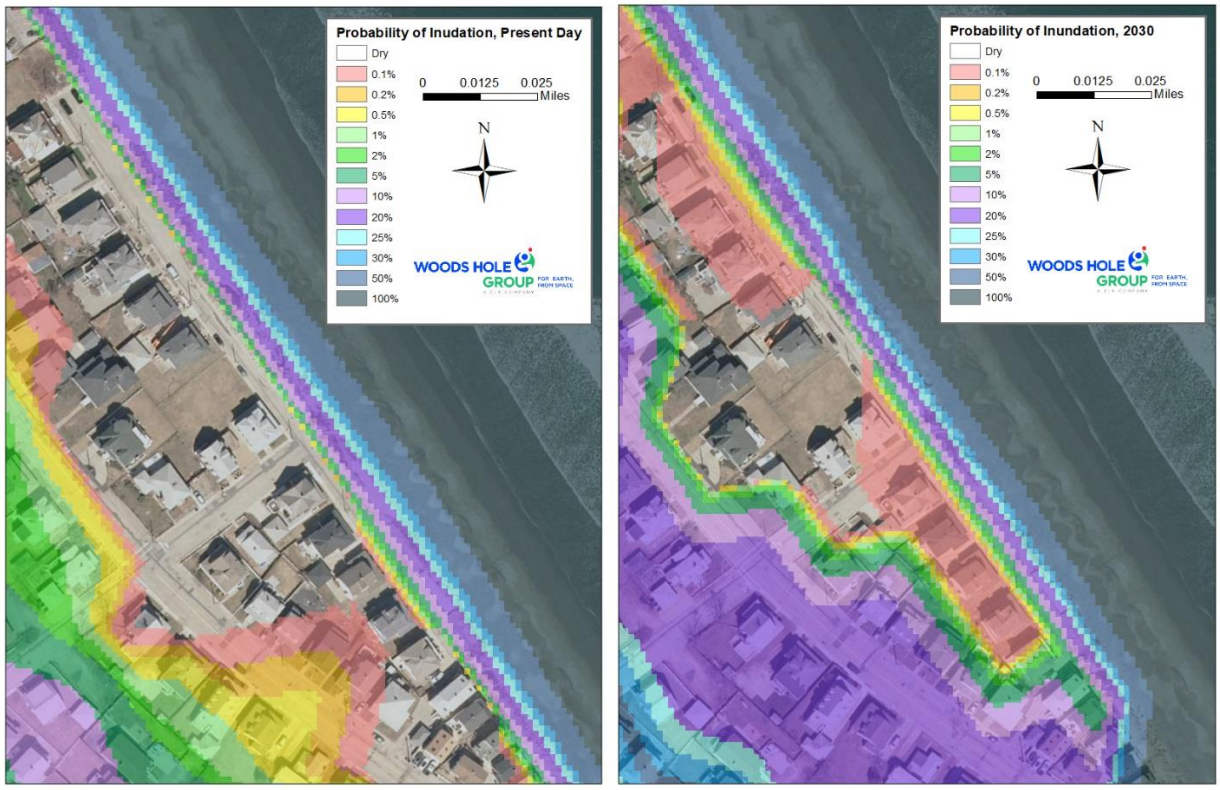


Figure B-8. Probability of inundation mapping based on the MC-FRM flooding elevations for Present Day (left) and the year 2030 (right). Under present-day conditions, the flood risk ranges from 0.5% to 5% (20 - 200 year return period storm level) south of Malta St while the roadway is largely dry north of Malta St. Under future conditions in 2030, this flood risk expands to include the dwellings and the section of roadway north of Malta St.

Once flood waters pass through the two gaps (patios) in the primary dunes at the project locus, indicated by the black circle in Figure B-6, they flood more landward low-lying developed areas to the west. As shown in Figure B-8 above, the flood pathway at the project locus allows storm surge to inundate and become impounded in an approximate 6 by 2 block area bound by Revere

St, Nantasket Ave., Phipps Ave, and Manomet Ave. Once flood waters reach the more low-lying areas, it is slow to drain causing additional problems long after the storm has passed. Figures B-9 and B-10 show flooding just west of these areas during two the March 2018 storms.

The residential dwellings and Town infrastructure within the Town of Hull has experienced significant damage due to storm surge and coastal flooding over the years. In Hull, a total of 243 unmitigated repetitive loss properties have been identified by the National Flood Insurance Program (NFIP) through August 2018. The NFIP defines a repetitive loss property as any property for which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. There were 769 repetitive loss claims in Hull between 1978 and March 2018, totaling $8,776,511 in damages. The developed area adjacent to the project area experiences frequent flooding due to overwash and storm surge from coastal storms, especially in the areas associated with hardened structures located in the footprint of the Primary Frontal Dune (i.e., two significant concrete patios) (one of which is shown in Figure B-9). Much of the flood waters travel across Beach Avenue to the lower-lying areas along Manomet and Samoset Aves (Figure 10). Using a conservative estimate of flooding impact to an area of approximately 0.04 square miles (Figure B-11), there are 23 repetitive loss properties identified that received nearly $2.5 million (adjusted for 2020 inflation) from the period of 1978-2020 under the National Flood Insurance Program (NFIP). With predicted increases in sea level rise and frequency of extreme coastal storms, flood insurance claims and repetitive loss properties in Hull's low lying, flood prone areas will continue to rise.

Figure B-9. Photograph following the October 27th, 2021 Nor'easter showing overwash and sand deposition in the roadway adjacent to the dune gap (patio) at 31 Beach Ave.

Figure B-10. Photograph of flooding along 1 Harvey Place a downhill area adjacent to the project locus.

Figure B-11. Areas of concentrated repetitive loss (2+ claims) properties and National Flood Insurance Claims, 1978-2020.

4.0 Existing Environment

Woods Hole Group conducted field investigations to establish existing conditions on October 29th and December 1st, 2021. The tasks performed included a topographic site survey using a survey grade Real Time Kinematic Global Positioning System (RTK GPS) and a Leica Robotic Total Station and rod conducted by a Professional Engineer & Land Surveyor, a coastal resource area delineation conducted by a Professional Wetland Scientist (PWS), and shallow subsurface sediment investigation. In addition, an aerial survey of NNB was performed by GEI Consultants on October 11 and 12, 2021, and the topographic data derived was used to supplement the collected Woods Hole Group survey data. The results of the field investigations were used to develop the existing conditions plan and the dune restoration design plans that are detailed in this section.

4.1 Barrier Beach System

The project site is located within a state designated Barrier Beach that includes the majority of the low-lying Hull Peninsula between the Massachusetts Bay and Hull Bay shorelines. A barrier beach is defined as: *"a narrow low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system. A barrier beach may be joined to the mainland at one or both ends (310 CMR 10.29 (2))."*

The greater barrier beach system is further subdivided into the Coastal Beach and Coastal Dune subcategories in the vicinity of the project site, 27-53 Beach Ave. Barrier Beach – Coastal Beach is mapped between Mean Low Water and seaward toe of the primary dune based on the coastal resource delineation, however, the project will not have any direct impacts to this resource since no work will take place here. Barrier Beach - Coastal Dune is mapped from the seaward toe of the primary dune landward to the opposite Hull Bay shoreline. A rendition of the barrier beach delineation is shown in Figure B-12 where Barrier Beach – Coastal Beach is mapped seaward of the primary dune delineated by Woods Hole Group and Barrier Beach – Coastal Dune extends landward of the coastal beach. The portion of the barrier beach shaded green, representing the primary dune where the project will take place, is comprised solely of coastal dunes that will be discussed in the next section. No material will be placed on the coastal beach and all work will take place from the road so there will be no temporary or direct impacts to Coastal Beach.

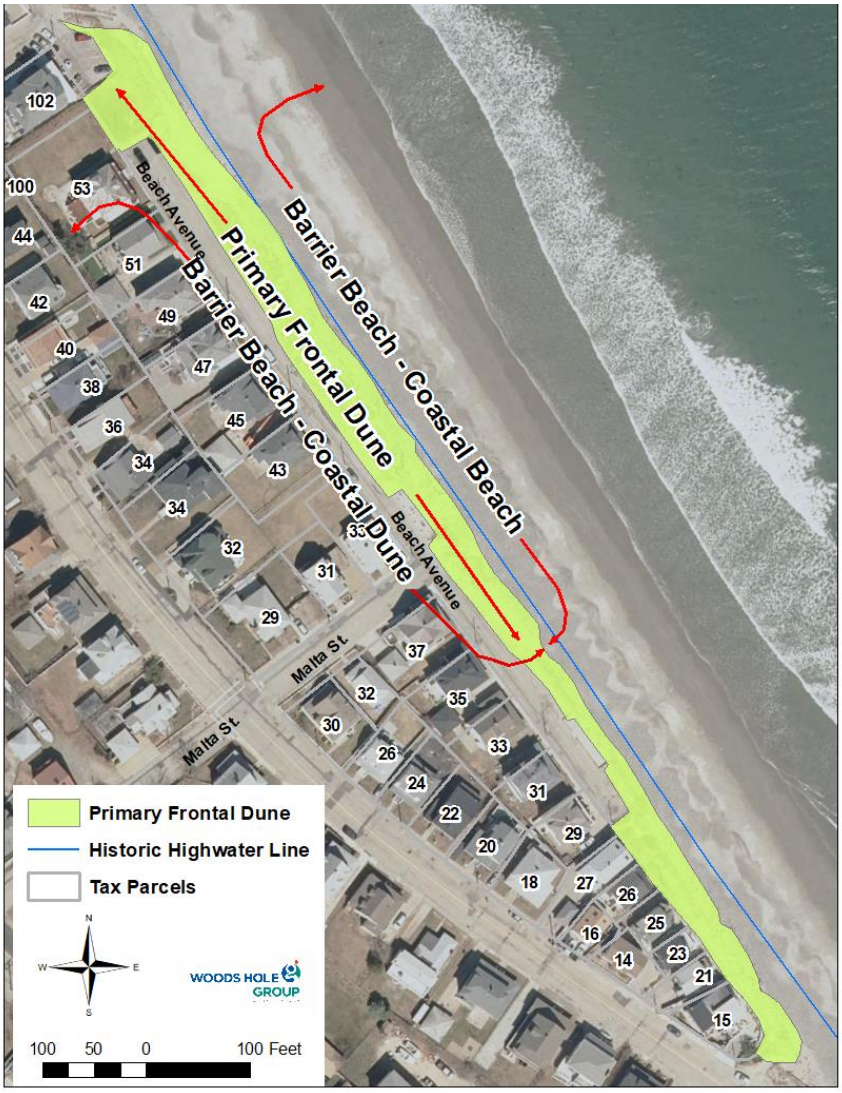


Figure B-12. Map of coastal resources delineated by a Woods Hole Group PWS on October 29, 2021.

4.2 Coastal Dune

Barrier Beach – Coastal Dune is mapped by the State from the coastal beach boundary on Massachusetts Bay shoreline landward to the Hull Bay shoreline. The coastal dune itself is composed of primary and secondary dunes. The project locus has been delineated in a Primary Dune within the coastal dune resource area and is therefore protected under the Wetlands Protection Act (WPA) 310 CMR 10.28. The area meets the definition for a coastal dune in that it is (i) a naturally occurring mound of sediment that is part of a larger natural ridge shaped landform, (ii) landward of the coastal beach, and (iii) composed of fine-grained sediment deposited by wind action (Figures B-13 – B-16). The altered and degraded primary dune area is part of a larger ridge shaped landform that currently stretches from the beach to Manomet Ave and extends north to Beach Ave near S St. and south to the area of the DCR's Nantasket Beach

just below Phipps St (Figure B-13). Even though the primary dune is altered and degraded it still performs critical dune functions such as flood control and damage prevention and providing habitat and a source of sediment to the coastal beach. If not for the human alteration to accommodate the patios and footpaths, the site would be similar in size and configuration to the primary dunes to the north and south (Figure B-16). The project locus for the primary dune is also designated as a Primary Frontal Dune (PFD) as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panels #25023C0036J and #25023C0038J (effective 1/24/2018) (see Section 4.4 Land Subject to Coastal Storm Flowage below).

Landward of the primary dune exists an altered and degraded secondary dune system that extends west to the Hull Bay shoreline. The function of the secondary dune system appears to be limited since the land is highly altered and developed with roads, buildings, and infrastructure. According to the document *Applying The Massachusetts Coastal Wetlands Regulations* prepared jointly by Coastal Zone Management (CZM) and DEP (2017), even if historic wetland resource areas are severely degraded and are not clearly evident, they are in fact still present if they are providing even a limited function. In this case, the area provides a limited degree of flood control and storm damage prevention, and, therefore the barrier beach - coastal dune resource was delineated. However, the project footprint for the dune restoration will take place solely within the primary dune itself.

Despite the altered nature of the landform, it continues to serve the important storm damage protection and flood control functions of a primary coastal dune. In terms of function the following items must be considered:

- The WPA indicates that all coastal dunes on barrier beaches, and the coastal dune closest to the beach also known as the primary frontal dune or primary dune, are per se significant to storm damage protection and flood control.

- Because dunes on barrier beaches and the coastal dune closest to the beach are singled out as intrinsically important to storm damage prevention and flood control, they warrant greater scrutiny (finding in the matter of Stephen D. Peabody Trustee, Docket No. 2002-053, Final Decision, January 25, 2006, affirmed by Essex Superior Court sub nom Peabody v. Department of Environmental Protection, ESCV 2006-00299, September 21, 2007, and affirmed in Massachusetts Appeals Court November 8, 2012).

- The primary coastal dune resource at the site has been altered and therefore some of the typical functions of a coastal dune that allow it to serve the interests of storm damage prevention and flood control have been diminished. These include dune volume, dune form, and vegetative cover.

- Despite the altered nature of the primary dune at the site, it continues to provide some functions that allow it to serve the interests of storm damage prevention and flood control. These include dissipation of wave energy during storms across the area of the

dune, supply of sediment to the beach during storms, ability to shift and change form both landward and laterally as a result of storm activity and wind-blown (aeolian) transport.

Figure B-13. View north of gap in the primary dune adjacent 33 Malta Street, showing altered dunes to the north.

Figure B-14. View of degraded primary dune extending between the gaps adjacent to 33 Malta Street and 31 Beach Ave.

Figure B-15. Southern end of altered primary dune adjacent to 31 Beach Avenue where the landform transitions into natural primary dune at the southern end of Beach Avenue.

Figure B-16. Altered primary dune adjacent 53 Beach Ave, showing naturally occurring dunes to the north.

4.3 Priority and Estimated Habitats of Rare Wildlife

According to the Massachusetts Natural Heritage & Endangered Species Program (NHESP), the project locus is located within priority and estimated habitats of rare wildlife and rare species. Two protected species, Piping Plover (*Charadrius melodus*) and Common Tern (*Sterna hirundo*), have been found within the project area. The Piping Plover is listed as "Threatened" on both the State and Federal level pursuant to U.S. Endangered Species Act (ESA, 50 CFR 17.11). The Common Tern is listed as a species of "Special Concern" in Massachusetts. Both species are protected under the Massachusetts Endangered Species Act and its implementing regulation (321 CMR 10.00), as well as the Wetlands Protection Act and its implementing regulation (310 CMR 10.37).

The coastal beach east of the altered primary dune has been used historically by shorebirds for nesting. The Town contracts with Mass Audubon to monitor shorebird habitat along the entire beach and follows established protocols for protection of these habitat areas. Figure B-17 shows that the proposed project footprint (black outline) is within NHESP mapped habitat (green hatching) which extends from the edge of the Beach Ave roadway seaward extending into the primary coastal dune and coastal beach resource areas.

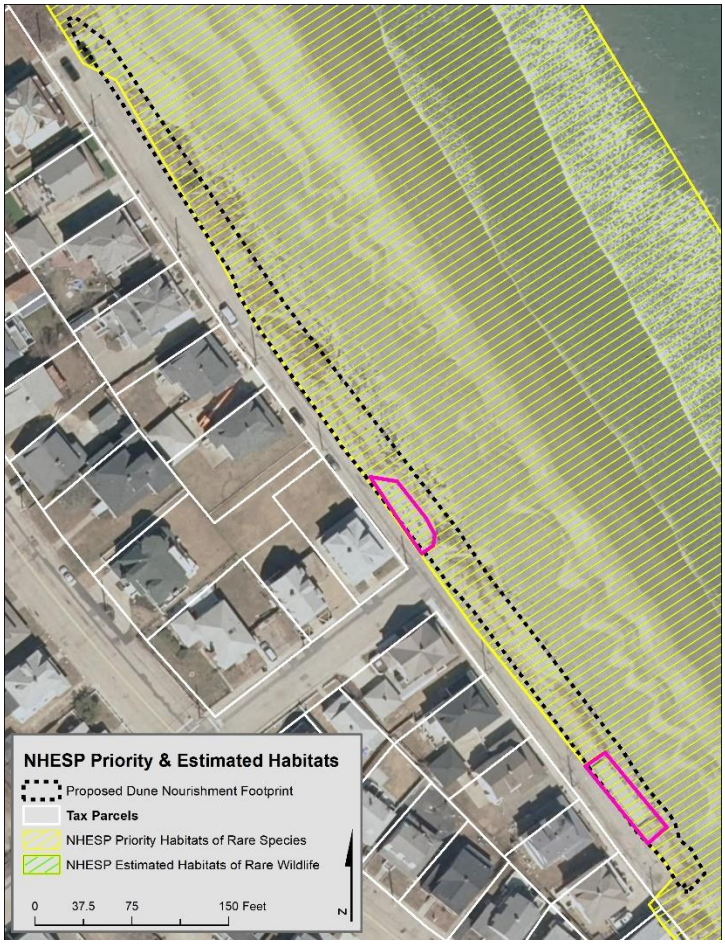


Figure B-17. NHESP mapped Estimated Habitat of Rare Wildlife as of August 2021

4.4 Land Subject to Coastal Storm Flowage

Land Subject to Coastal Storm Flowage (LSCSF) is land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record, or storm of record, whichever is greater, and can be found from the FEMA Firm Panels #25023C0036J and #25023C0038J (effective 1/24/2018). The FIRM for the Town of Hull shown in Figure B-18 indicates that the entire project area is mapped in a "VE Zone" where the "VE" designation indicates an area that is flooded and has additional wave velocity during the 100-year storm with wave heights of at least 3-feet. The number after the "VE" designation on Figure B-18 refers to the Base Flood Elevation (BFE) in feet above the NAVD88 datum, which is the water elevation during the 100-year storm event resulting from the combination of storm surge, wave setup, and wave height and runup above the storm surge elevation. For the project site, the VE(14) designation indicates that there is 1% annual risk of flooding and wave action to 14 feet NAVD88, and, therefore, the entire project area is classified as Land Subject to Coastal Storm Flowage. Landward of the dune the flood zone transitions to an AE(12) flood zone where "AE" refers to an area of lesser but still significant wave energy less than 3 feet to a BFE of 12 feet NAVD88. The FEMA FIRM also shows the project locus to be within the Primary Frontal Dune along the seaward edge of the Beach Ave road. As such, the entire project is classified as land subject to coastal

storm flowage, however, there are no wetlands performance standards for this resource area at this time.

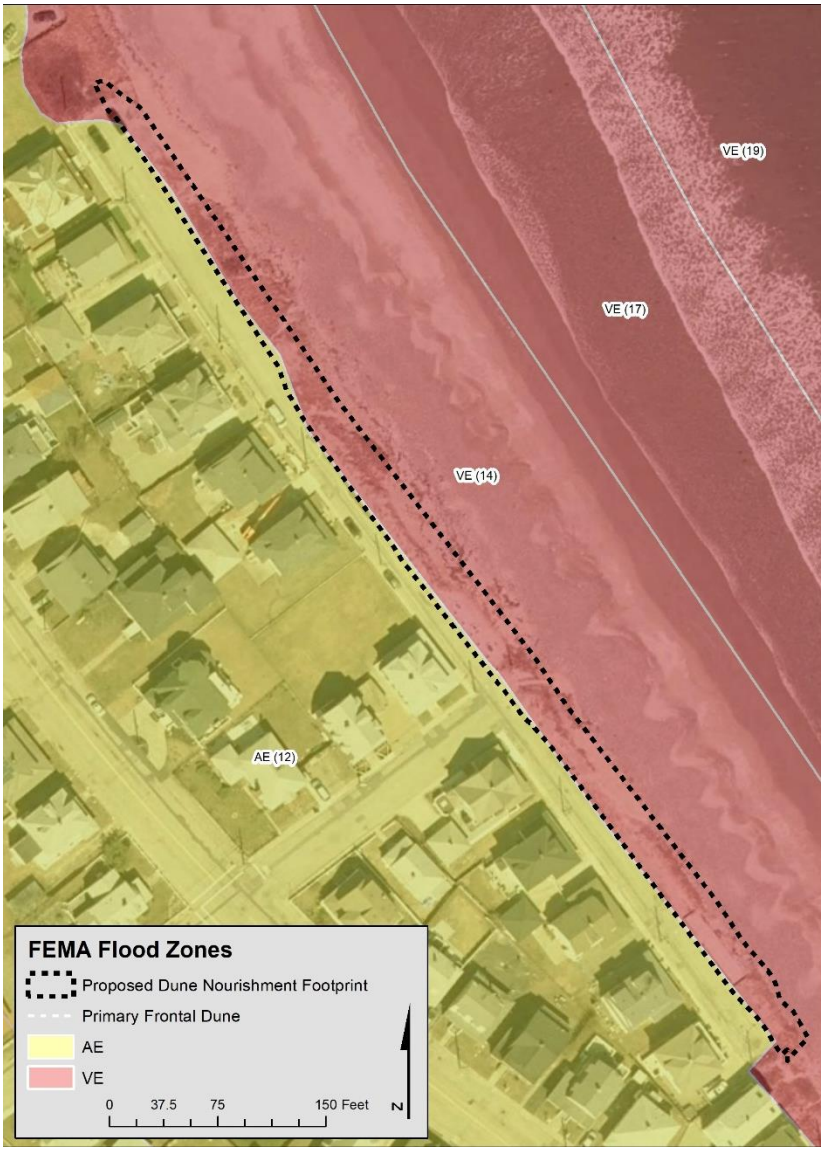


Figure B-18. Effective FEMA flood zones and BFEs for the project area.

4.5 Man-made Infrastructure

The site contains multiple man-made structures within the project locus. Seven concrete bollards and three raised stone circular fire pits reside within the 60 foot wide dune gap adjacent to 33 Malta Street that is constructed over a hard foundation (Figure B-19). Within the southern opening in the dune adjacent to 31 Beach Avenue, a 600 square foot concrete patio area is embedded within the dune gap. Abutting the concrete patio are low-lying concrete knee walls parallel to Beach Ave and the along southern edge of the patio area (Figure B-20). Both gaps allow for recreational use and foot traffic to access the beach.

Figure B-19. View of concrete posts and raised stone circles.

Figure B-20. Photo of embedded concrete patio area and abutting low-lying concrete walls.

4.6 Sediment Characterization

Two sets of sediment grain size data are available to characterize the native sediments for the project locus, and the lab results can be found in Section G. First, a series of surface grab samples (GS-18, GS-19, & GS-20) were collected from the coastal beach under a previous project with the

Town on February 11, 2019. For the current project, two (2) sediment samples were collected from the primary frontal dune north and east of the dune gaps at 33 Malta St, at the northern end of the project locus, and two (2) additional samples were collected from the dune north and east of the dune gap at 31 Beach Ave, at the south end of the locus (Figure B-21). The locations of the cores are also shown on the Existing Conditions Plan and labeled with the Plan ID. These samples were collected as shallow borings using a hand auger to a depth of 2 ft, and then a sample was collected from each boring were as a composite sample of that borehole material.

Both sets of samples were sent to a qualified laboratory, GeoTesting Express, to undergo grain size analyses and the results are shown in Table B-1. The samples were all relatively uniform, being comprised of fine to medium-grain sand with a median diameter, D_{50}, ranging between 0.22 and 0.33 mm, except for sample HULL-NE-102921 that was an outlier consisting of coarser grain sand (0.74 mm). The sediments were consistent with sand found on the adjacent dunes and there was no evidence of an underlying hardened layer such as rock, cobble, asphalt or concrete.

Table B-1. Sediment sample grain size analysis results from the Coastal Beach (02/11/2019) and Coastal Dune (10/29/2021).

Sample	Plan ID	Location	Type	D_{50} (mm)	% Gravel	% Sand	% Silt
GS-18	NA	High tide beach	Surface	0.2297	0.1	99.6	0.3
GS-19	NA	Intertidal beach	Surface	0.2425	0.0	99.1	0.9
GS-20	NA	High tide beach	Surface	0.2361	0.0	99.8	0.2
Median Grain Size Coastal Beach Samples				**0.2361**			
HULL-NE-102921	North Core #2	Dune at 33 Malta St	Shallow Boring composite	0.7418	37.7	61.6	0.7
HULL-NN-102921	North Core #1	Dune at 33 Malta St	Shallow Boring composite	0.3382	20.8	78.8	0.4
HULL-SE-102921	South Core #2	Dune at 31 Beach Ave	Shallow Boring composite	0.2287	23.7	76.0	0.3
HULL-SN-102921	South Core #1	Dune at 31 Beach Ave	Shallow Boring composite	0.2610	26.4	73.2	0.4
Median Grain Size Coastal Dune Samples				**0.3924**			
Overall Median Grain Size				**0.3254**			

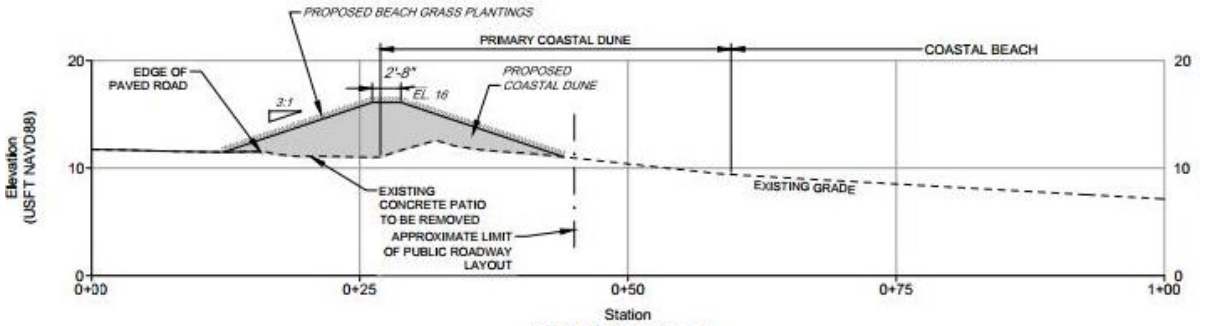
Figure B-21. Sediment sample locations.

5.0 Proposed Project

The purpose of this project is to restore the degraded and altered primary coastal dune that is seaward of road opposite of 27 – 53 Beach Ave, as shown on the attached permit plans and details (See Section J). The total length of the proposed dune restoration project is 828 linear-feet, which includes the transitions on either end with the existing adjacent dune. The project width will extend from the seaward edge of pavement for Beach Avenue to the eastern boundary of the Beach Ave road corridor. The proposed footprint is approximately 20,922 square feet and approximately 830 cubic yards of dune compatible sand will be placed in the project footprint. The sand selected for the project will be analyzed to ensure that it is compatible with the existing dune sediment, in both size and color. To provide the town with the flexibility to identify suitable sources, it is proposed that a grain size compatibility analysis will be conducted on the selected source, and submitted to the Hull Conservation Commission, or their designee, for approval prior to restoration. The proposed dune is only expected to provide a limited level of flood protection

during small to moderate coastal storms, but it is expected to provide a modest increased level of flood protection and habitat enhancement over existing conditions. It will also allow the Town to manage the resource here consistent with the rest of the NNB coastal dune system.

During placement, the dune sand will be graded to the widths, slopes and elevations indicated on the plans shown in Section J and the four (4) cross-sections shown below in Figure B-22. The dune crest will be restored to match adjacent sections of vegetated dune, with a crest elevation of 15-16 ft NAVD88 and the side slopes of 3H:1V. Following final grading, the dunes will be planted with Cape American beach grass (*Ammophila breviligulata*) and the beach access paths will be established.



TRANSECT A

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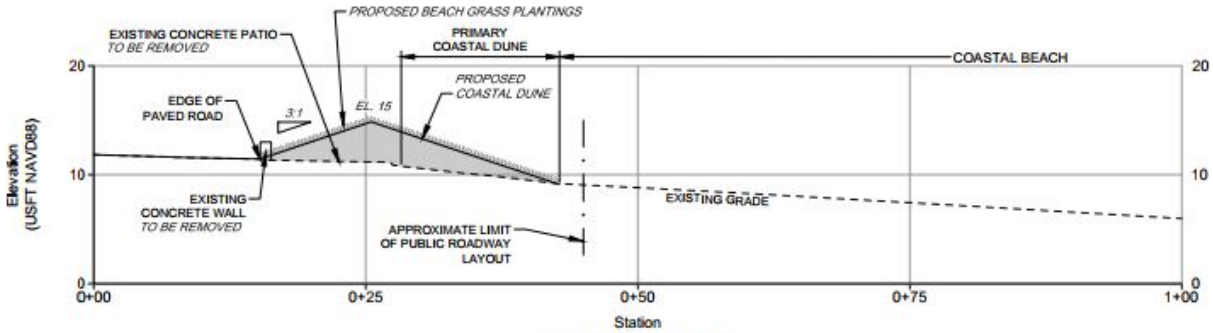

TRANSECT B

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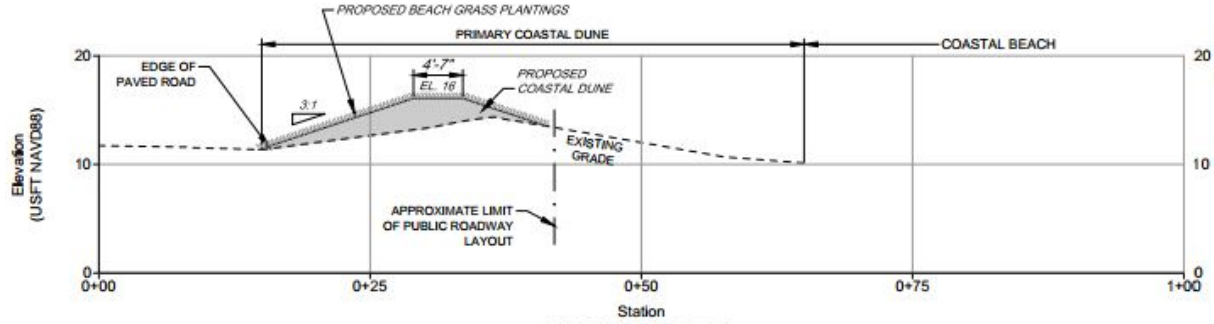

TRANSECT C

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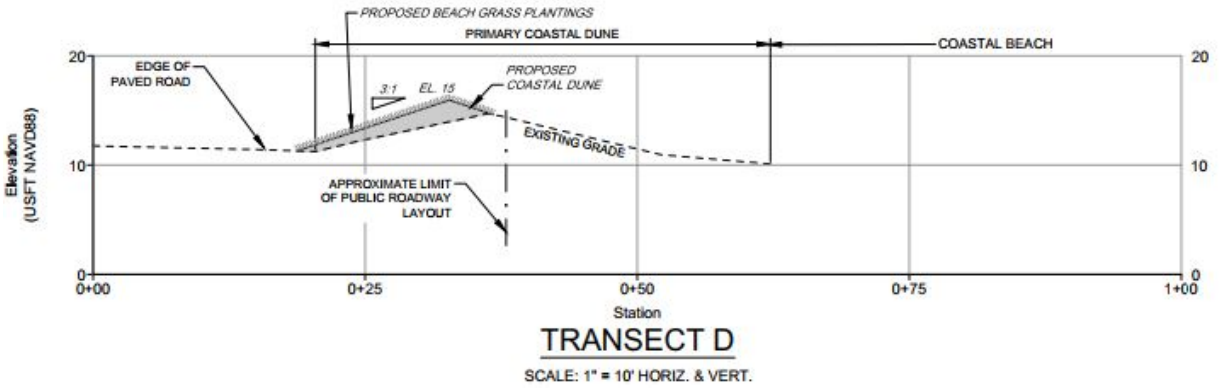


Figure B-22. Engineering design at Transects A (33 Malta St), B (31-37 Beach Ave), C (45 Beach Ave), and D (51 Beach Ave) for the proposed dune restoration along 27-53 Beach Ave (location of Transects shown on the engineering plans in Section I).

This proposed restored dune will be similar to the previously restored coastal dune at 131-145 Beach Ave in 2020 in terms of the cross-sectional profile slopes (3H:1V), heights (15-16 ft NAVD), and widths at shown in Table B-2. However, the crest width and volume will be smaller for this proposed project due to site constraints even though the proposed project is twice as long. At 131-145 Beach Ave, the dune restoration simply matched and tied into adjacent sections of dune north and south to re-establish a straight, uniform dune. At 27-53 Beach Ave, the dune is only being restored along the seaward half of the Beach Ave road corridor (18-31 ft) to match adjacent widths and elevations at either end to the extent possible.

Table B-2. Comparison of the design specifications of the current dune restoration project at 27-53 Beach Ave to 131-145 Beach Ave (SE35-1485) constructed in 2020.

Project	Crest Elevation (Ft NAVD88)	Crest Width (Ft)	Side Slopes	Footprint Width (Ft)	Footprint Length (Lf)	Total Volume (Cy)
131-145 Beach Ave	16	8	3H:1V	29	400	1,210
27-53 Beach Ave	15 - 16	1 – 4.5	3H:1V	18-31	828	830

Woods Hole Group conducted cross-shore dune profile storm response modeling to confirm the design specifications, which is discussed further in Section C. When complete, the proposed project will provide a level protection against the 10-year (10% annual chance) storm for the properties adjacent to 27 - 53 Beach Ave by removing the flow pathways and limiting storm surge flooding and overtopping. While this is a lower level of protection than typically desired for a restored dune, the Town is constrained to construct the dune within the unpaved section of the narrow 50-ft Beach Ave road corridor that it owns. This prevents a dune with shallower slopes and greater elevation, crest width, and volume from being constructed. Nonetheless, the proposed dune restoration will increase the coastal resiliency for the area by providing increasing flood protection and enhancing habitat. Removing the patios areas constructed in the dune beach will remove flood pathways and manmade structures from the coastal dune resource. Unauthorized footpaths through the dune will be closed and public access will be established over the dune at three footpath crossings. The restored dune will also serve as a source of

nourishment for the Coastal Beach resource. It is expected that the restored dune will gain volume and elevation overtime as it traps sediment transport from waves and wind (aeolian) processes.

An permitted pedestrian access path (SE35-1380) already exists over the dune at the Malta St intersection and is maintained by the Town. This path will be re-established over the restored dune after construction. Two additional permitted pedestrian access paths are proposed over the dune at either end of Beach Ave at 31 and 47 Beach Ave, and is shown for reference in the attached plans in Section I. The intention of these new paths is to close a series of unauthorized paths through the dune that degrade the resource and direct foot traffic through authorized paths that can be maintained by the Town and comply with the 2018 BMP to minimize impacts from foot traffic to the primary dune. The location of the paths were choosen to minmize interference with the general locations nesting shorebirds. The paths are designed to be 48 inches wide, 43 feet long, and oriented southeasterly to reduce impacts from northeast storm events, which conforms with the specifications in the 2018 BMP. The path boundaries shall be marked with sand fencing or equivalent in an effort to contain foot traffic within each path. The pedestrian access paths will be managed as the Town manages other permitted pedestrian access paths under the 2018 BMP.

Annual maintenance of the proposed dune will include both sand nourishment between September 1 and March 30 to maintain crest height and width and replace plantings and fencing, as needed, and in accordance with the 2018 BMP. The proposed design is not expected to be a long-term solution without the addition of a beach nourishment component tot the project design since the entire coastal dune along Beach Ave is susceptible to erosion during coastal storms and there is a limited sand supply. Performance of the dune during storms is discussed separately in the Alternatives Analysis Section C, but it is anticipated to provide a level of flood protection against the 10-yr (10% annual chance) storm event.

6.0 Construction Methodology

The proposed dune restoration will be constructed completely within the approximate 18- to 30-foot-wide project footprint located seaward of and adjacent to the paved portion of Beach Avenue, and is completely contained within the Town-owned road layout of Beach Avenue and Coastal Dune resource. Construction access will be directly from Malta St and Beach Avenue, which will provide access along the full length of the project; no work will occur from the coastal beach. The footprint will be staked at the beginning of the project to delineate the limit of work. Prior to construction, existing manmade structures and debris will be removed, including the concrete pads, concrete bollards, concrete separator walls, and firepits, and disposed of at an offsite location.

Approximately 830 cubic yards of compatible sand will be trucked to the site and placed within the 20,922 square foot project footprint. It is anticipated that the source of sand for the project will come from an upland (e.g. quarry) sources, which will be reviewed by the Hull Conservation Commission prior to construction. Therefore, a sediment grain-size analysis will be performed

on the imported material to ensure sediment compatibility with the existing dune. In addition, the color of the sand will be compared to ensure that it is not significantly different than the existing dune. All information regarding sediment compatibility will be presented to the Conservation Commission for review prior to construction.

The nourishment sand will be placed directly in the project footprint from the road, and then a front end loader and backhoe will be used to grade the sand to the proper elevations (15-16 ft NAVD88) and slopes (3H:1V) as indicated on engineering drawings. Once the final grading has been completed, then the beach access paths at Malta St (SE-1380) and 31 and 47 Beach Ave will be established over the dune by delineating the boundaries with sand fencing. The beach access paths will be 48-inch wide and cross over the top of the dune at an angle to the southeast, in accordance with the 2018 Town of Hull Beach Management Plan (BMP). The restoration plantings will include Cape American Beach Grass that will be planted 2-3 culms per hole, 7-9 inches deep, and 18 inches on-center in staggered rows as shown in the plans in Section J (except within the beach access paths themselves). This planting plan complies with the 2018 Town of Hull North Nantasket Beach Management Plan (2018 BMP).

Construction is anticiapted to take place between between November 15 and March 30th to comply with the 2018 Hull Beach Management Plan (BMP) and Time of Year restrictions for nesting shorebirds, and is expected to commence in Fall 2023. Construction of the proposed project is expected to take approximately 1-2 weeks although the plantings may be delayed to just ahead of the spring growing season. It is anticiapted that the Town of Hull will construct the entire project, including the plantings, using imported sand with Town labor and equipment, just as was done for 131-145 Beach Ave and A St. No construction debris or excess materials will be left onsite, and all disturbed areas will be restored to their pre-construction condition or better. Annual mainteance of the proposed dune will include sand nourishment to maintain crest height and width as well as replacing plantings and fencing, as needed.

7.0 Dune Maintenance

Through consultation with Town's Floodplains Manager, the Hull Department of Public Works after significant storm events will restore the dune to its pre-storm condition by using comptable beach sand and revegetating with beach grass and other native salt-tolerant plant species. Dune maintenance will occur between September and March to avoid potential impacts to protected shorebird habitat on the adjacent coastal beach.

8.0 WPA Certificate of Compliance

Following completion of construction, and sufficient time to establish vegetation, a Certificate of Compliance (COC) will be requested from the Hull Conservation Commission. The request for the COC will require the following compliance materials:

- A registered Professional Land Surveyor to conduct a post-construction as-built survey and draft an as-built topographic plan to confirm the conformance of the constructed project with the design plans.

- A registered Professional Engineer to provide a written statement attesting to that the project is substantially in compliance with the permits and plans. Differences and deviations will be noted.
- A qualified Wetland Scientist to prepare a statement attesting to the project's complaince with state and local wetland regulations.

Section C

Alternatives Analysis

C. ALTERNATIVES ANALYSIS

Conceptual dune restoration designs were identified and then evaluated in the context of an alternatives analysis to determine the optimum design alternative for restoration of the primary dune resources adjacent to 27 – 53 Beach Ave. The goal of the analysis was to identify viable alternatives for restoring the coastal dune along this 828 linear-ft long stretch, to restore the primary dune at two ~60 linear-ft concrete patios, remove and restore five non-permitted pedestrian paths, and add two additional permitted pedestrian paths over the primary dune in order to minimize impacts associated with coastal flooding during storms and enhance both the resource and restore habitat connectivity.

In all, a total of five (5) alternatives were evaluated as part of this analysis including:

- Alternative 1 – No Action
- Alternative 2 – Dune Restoration Using 2:1 Slopes within Town Property
- Alternative 3 – Dune Restoration Consistent with NHESP Guidance
- Alternative 4 – Bioengineered Dune within Town Property
- Alternative 5 – Dune Restoration Using 3H:1V Slopes within Town Property and Establishing Additional Pedestrian Access Paths (Preferred Alternative)

The design of the cross-section for each of the alternatives was developed at four transects established along the 828 ft project length as shown in Figure C-1, which is referenced throughout this section. The Transects are labeled B-B, A-A, C-C, and D-D from south to north (or right to left) in Figure C-1. Transects A-A and B-B were the original transects established at the two patios and Transects C-C and D-D were added later to represent the northern extension of the project. At each transect, the existing dune and beach profile was constructed using topography based on the Woods Hole Group 2021 topographic survey data (Transects B-B & A-A) or the GEI 2021 aerial survey data (Transects C-C & D-D). These existing profiles then became the basis for the creation of each alternative design. Each of these alternatives are described, evaluated, and vetted in the following section to determine the preferred alternative for the primary dune restoration adjacent to 27-53 Beach Avenue.

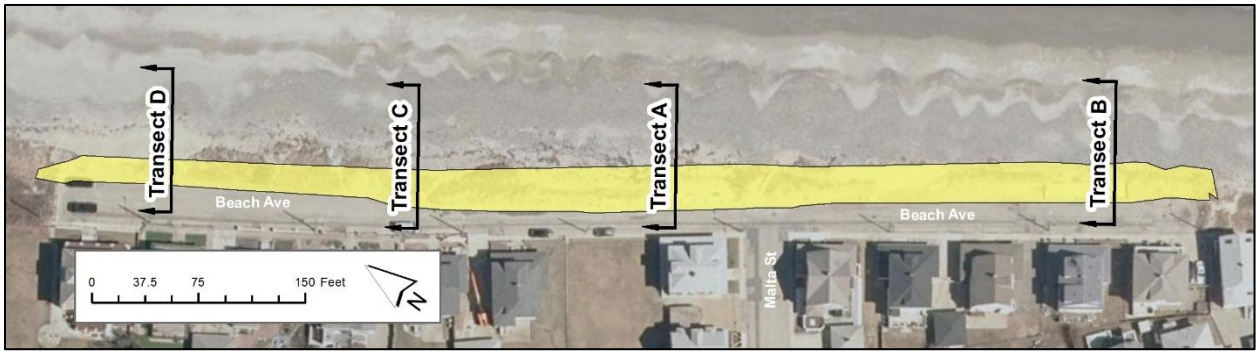


Figure C-1. MassGIS 2019 aerial imagery displaying the four (4) dune alternative transect (cross-section) locations.

Alternative 1 – No Action

The "No Action" Alternative is one where the dunes adjacent to 27-53 Beach Avenue would receive no dune restoration and no additional permitted pedestrian paths would be created. This is not desirable by the Town as the benefits of the coastal dunes to habitat and storm protection would not be realized. The primary coastal dune along Beach Avenue, in its entirety, provides coastal dune habitat and offers storm damage protection for hundreds of residences as well as infrastructure landward of the dune. The two ~60 ft wide gaps in the primary dune adjacent to 31-37 Beach Avenue and 33 Malta Street create flood pathways that result in an increased risk of flooding, not only for the residents and infrastructure along Beach Avenue, but also for more landward/inland residents.

The No Action Alternative would not include the addition of permitted pathways to allow for controlled pedestrian access over the dune. Currently, one permitted pedestrian pathway (SE35-1380) exists at the intersection of Malta Street and Beach Ave, but this pathway would continue to provide limited public access to the beach. The non-permitted dune crossings exist in the northern portion of the altered primary dune and the two gaps in the primary dune at the patios in the southern portion would remain in place and continue to be altered with continued use of the non-permitted paths over time.

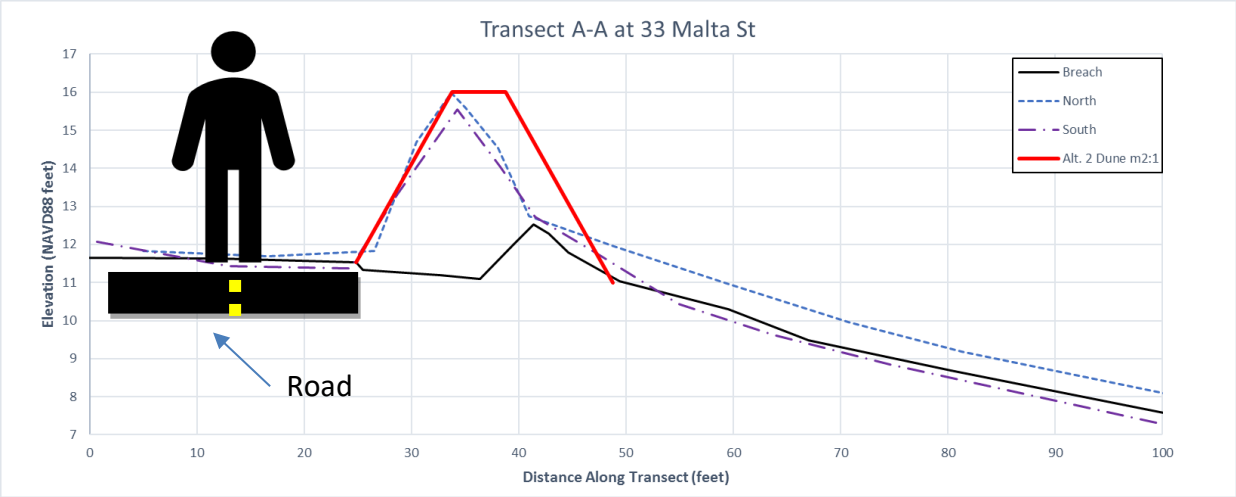
Implementation of Alternative 1 will not provide an opportunity to enhance the habitat or improve resiliency of the primary dune system along Beach Avenue, leaving the neighborhood vulnerable to coastal storms, and increasingly so due to climate change. The two gaps in the primary dune and non-permitted pedestrian paths would likely be continued to be maintained artificially and used by the local residents, ensuring that the dune does not have a chance to naturally restore itself. This is not an acceptable alternative, and, therefore, Alternative 1 has been omitted from further consideration.

Alternative 2 – Dune Restoration Using 2H:1V Slopes within Town Property

The goal of Alternative 2 was to maximize the volume of sediment (sand) that could be placed in a dune template confined to the portion of the Beach Ave road corridor available for construction (~25 ft). Maximizing the dune volume would increase both its height and width thereby increasing the coastal resilience of the resource and level of protection it affords property owners and infrastructure against storm flooding. Abutting both dead ends of Beach Ave, properties #27 and #53, the primary dune encompasses the entire 50-ft wide Beach Ave road corridor and achieves a crest elevation of 16 ft-NAVD and slopes of 2-3H:1V. Extending parallel and seaward of the Beach Ave roadway between the two dead-ends, the 828 ft long existing primary coastal dune is degraded and only occupies approximately half of the 50-ft wide road corridor. Here, slopes and crest elevations of the degraded dune vary from 2.5H:1V and 15-16 ft-NAVD adjacent to the Malta St dune gap and 3H:1V and 12-14 ft-NAVD adjacent to the southern dune gap. Within the gaps themselves, the primary dune is extremely degraded with little volume or elevation due to the concrete patios that have been constructed without authorization.

In an attempt to match the adjacent, more robust sections of primary dune, a 2H:1V slope dune was found to be feasible to achieve a crest elevation of 16 ft-NAVD and match existing adjacent grades. The overall height of a 16 ft-NAVD dune crest above the road is approximately 5 feet, roughly chest to shoulder height on an average person. This was also the design elevation and height for the crest of the restored dune at 131-145 Beach Ave (SE13-1485), which was also planted with native coastal vegetation plantings. The proposed dune configuration is shown in Figure C-2 as a solid red line relative to the existing topography that is shown as a solid black line. The adjacent, unaltered sections of dune just north and south are shown as well for reference as dashed blue and purple lines, respectively. The vertical axis represents elevation (in feet relative to the ft-NAVD vertical datum), while the horizontal axis represents the cross-shore distance along the profile in feet. Note that the vertical axis is exaggerated relative to the horizontal axis. This alternative would significantly increase the volume of the dune profile, which would likely increase its coastal resiliency and storm protection.

Based on a pre-filing consultation with NHESP and CZM, Alternative 2 was not favorable because a 2H:1V slope would have an angle of 50° that exceeds the maximum angle of repose for sand of approximately 34°. Building to this angle could lead to an unstable slope condition where sand may fall outside of the template either into the roadway or onto the privately owned beach lots and shorebird (piping plover) nesting habitat on the coastal beach. This alternative may also require more maintenance from the Town DPW department to clear the road of slumped sand and replace plantings. To avoid possible concerns with the stability of the restored dune that could impact to abutters and shorebirds and result in increased maintenance costs for the Town, Alternative 2 has been removed from further consideration.



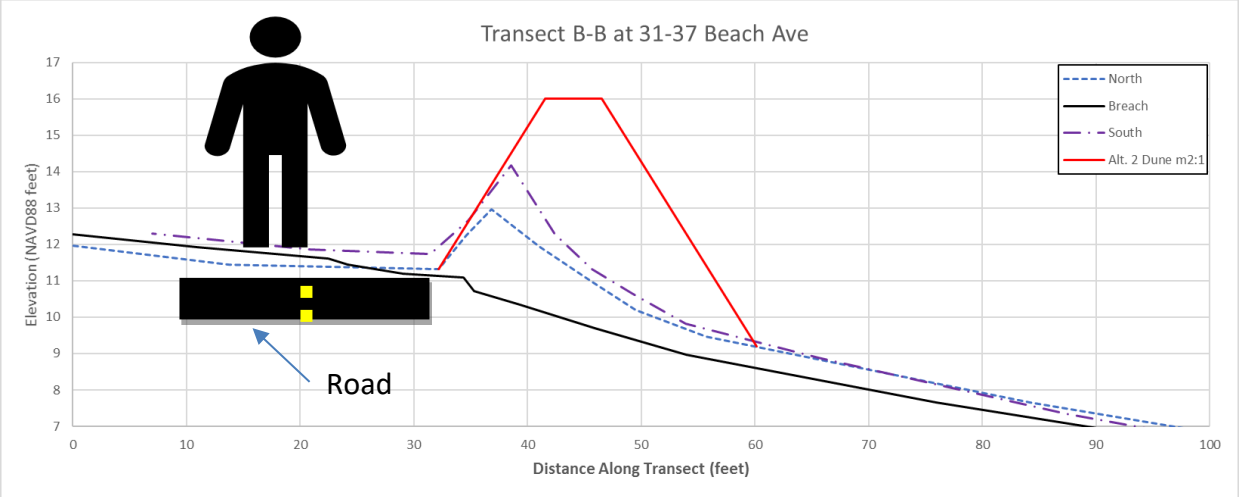


Figure C-2. Alternative 2: Constructing a 2H:1V side slope dune (red) to elevation 16 ft-NAVD in comparison to adjacent unaltered sections at Transect A-A (Top) and B-B (Bottom).

Alternative 3 – Dune Restoration Consistent with NHESP Guidance

Alternative 3 consists of restoring the dune within the Town-owned Beach Avenue road layout and extending the seaward face of the dune outside the road layout onto the coastal beach and privately owned beach lots. As a result of locating the restored dune on coastal beach resource in mapped NHESP Estimated & Priority Habitat, the portion of the dune on the coastal beach would be required to have a very gentle slope in order to not adversely impact this habitat. Guidance from NHESP promotes gentle slopes within areas of mapped NHESP Estimated & Priority Habitat where shorebird nesting and foraging occurs. A 10H:1V seaward dune slope is considered to be gentle enough to minimize impacts to habitat for critical species. While this is ideal slopes for protected shorebirds, it would result in the conversion of habitat from coastal beach to coastal dune and would extend outside the Town owned roadway into privately owned beach properties.

The Alternative 3 dune would have a narrow crest at elevation 15 ft-NAVD with a 3H:1V backslope that has an angle of 33° that is approximately equivalent to the natural angle of repose of sand (34°). This configuration would be constructed for the entire 828 ft length of primary dune that is being restored. The proposed dune configuration is shown in Figure C-3 as a solid red line relative to the existing topography that is shown as a solid black line. The vertical axis represents elevation in feet relative to the NAVD vertical datum, while the horizontal axis represents the cross-shore distance along the profile in feet. The adjacent, unaltered sections of primary dune just north and south are shown as well for reference as dashed blue and purple lines, respectively. Note that the vertical axis is exaggerated relative to the horizontal axis. This alternative would significantly increase the cross-shore volume of the dune profile, which would likely increase its coastal resiliency and storm protection.

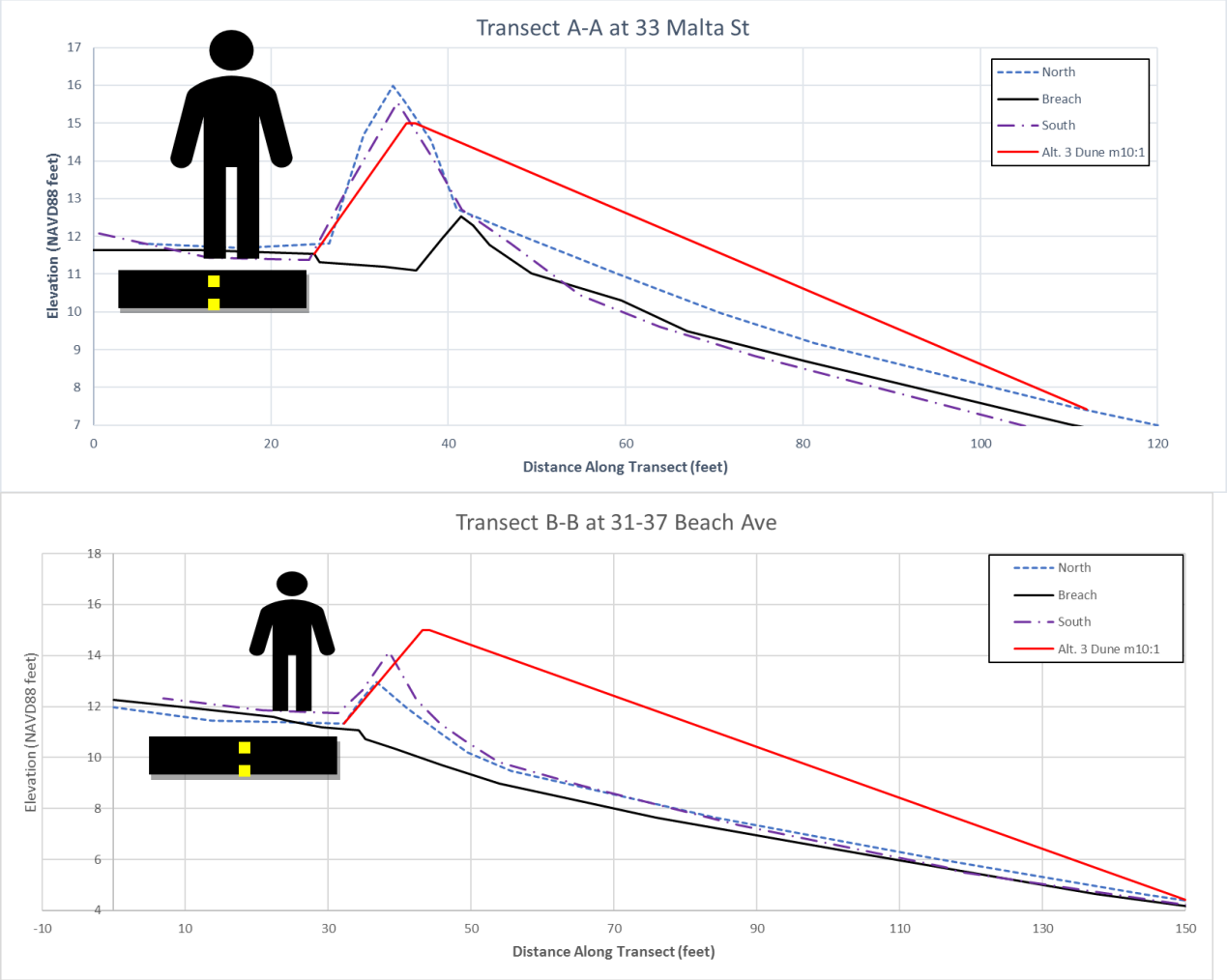


Figure C-3. Alternative 3: Constructing a dune with a 3:1 backslope and 10:1 foreshore slope (red) to elevation 15 ft-NAVD in comparison to adjacent unaltered sections at Transect A-A (Top) and B-B (Bottom).

There are several issues associated with constructing Alternative 3. The first is that the seaward face of the dune would extend seaward a 100 ft or more onto the coastal beach and be below the High Tide Line (HTL) of 6.93 ft-NAVD at Transect B-B, that would make it more susceptible to erosion during normal tides and small storms. Second, extending the dune profile 100 ft or more onto the coastal beach would result in a "bump out" of the existing coastal dune resource area, creating an inconsistency in the location of the seaward toe of dune relative to adjacent coastal dune resources. The adjacent primary dunes are natural features that have been sculpted and formed by ongoing coastal processes. Construction of a dune further seaward would be out of equilibrium with the natural beach and dune system, thereby placing the project at greater risk of storm damage and erosion. Additionally, the dune returns on either end would be angled to tie it into the adjacent dunes, which would result in increased wave refraction and reflection that could exacerbate erosion at the ends the project. Also, a significant volume of sand would be needed to fill the sand template, which would be very costly to import and may require the Town

hiring a professional contractor to construct. Because the dune restoration would extend below the HTL at Transect B-B, this would require filing for a General Permit with the U.S. Army Corps of Engineers (USACE) at great expense to the Town. Lastly, there are a number of privately owned beach lots that abut the seaward boundary of the Beach Ave road corridor where the restoration would occur, and Town funds cannot be used to enhance private property in this way.

While implementation of Alternative 3 would enhance shorebird habitat and improve resiliency of the coastal dune system along Beach Avenue, the bump out of the seaward face of the 10H:1V dune face would make it inconsistent with the adjacent existing primary dune and therefore, more prone to erosion and scarping. Compounded with the fact that the dune seaward face would be constructed on privately owned beach lots and coastal beach resource within NHESP Priority & Estimated Habitat, and require an additional permit filing with USACE, Alternative 3 has been omitted from further consideration.

Alternative 4 – Bioengineered Dune within Town Property

Alternative 4 is a bioengineered dune constructed within the Town-owned road layout using shallower, more stable slopes than Alternative 2 (2H:1V slopes) while compensating for the reduced dune volume by installing a biodegradable core in an effort to enhance the primary dune's coastal resiliency. This biodegradable core would be constructed using a coir envelope, which is a fabric weaved from coconut fiber that is then stitched together into an elongated sandbag and filled with dune compatible sand. The core envelope would have a diameter of 3 ft, which would be buried 1 ft below grade in the center of the dune and then staked in place. Sand cover would be placed over the dune and graded using shallower 3H:1V slopes, which has an angle of 33° that is approximately equivalent to the natural angle of repose of sand, approximately 34°. Finally, plantings would be installed using native, salt tolerant species. This design would be constructed along the entire 828 ft length of degraded primary dune. Alternative 4 has a reduced crest width, <1 ft, and elevation, 15-16 ft-NAVD, compared to Alternative 2, and the purpose of the biodegradable core is that it would likely be more resilient to wind, wave, or tidal action.

The proposed dune configuration is shown in Figure C-4 as a solid red line relative to the existing topography that is shown as a solid black line. The 3 ft diameter coir envelope is indicated as a brown hatched circle. The vertical axis represents elevation (in feet relative to the NAVD vertical datum), while the horizontal axis represents the cross-shore distance along the profile in feet. The adjacent, unaltered sections of primary dune to the north and south are shown as well for reference as dashed blue and purple lines, respectively. Note that the vertical axis is exaggerated relative to the horizontal axis. Alternative 4 would be constructed entirely within both the Coastal Dune resource area and Town-owned road layout).

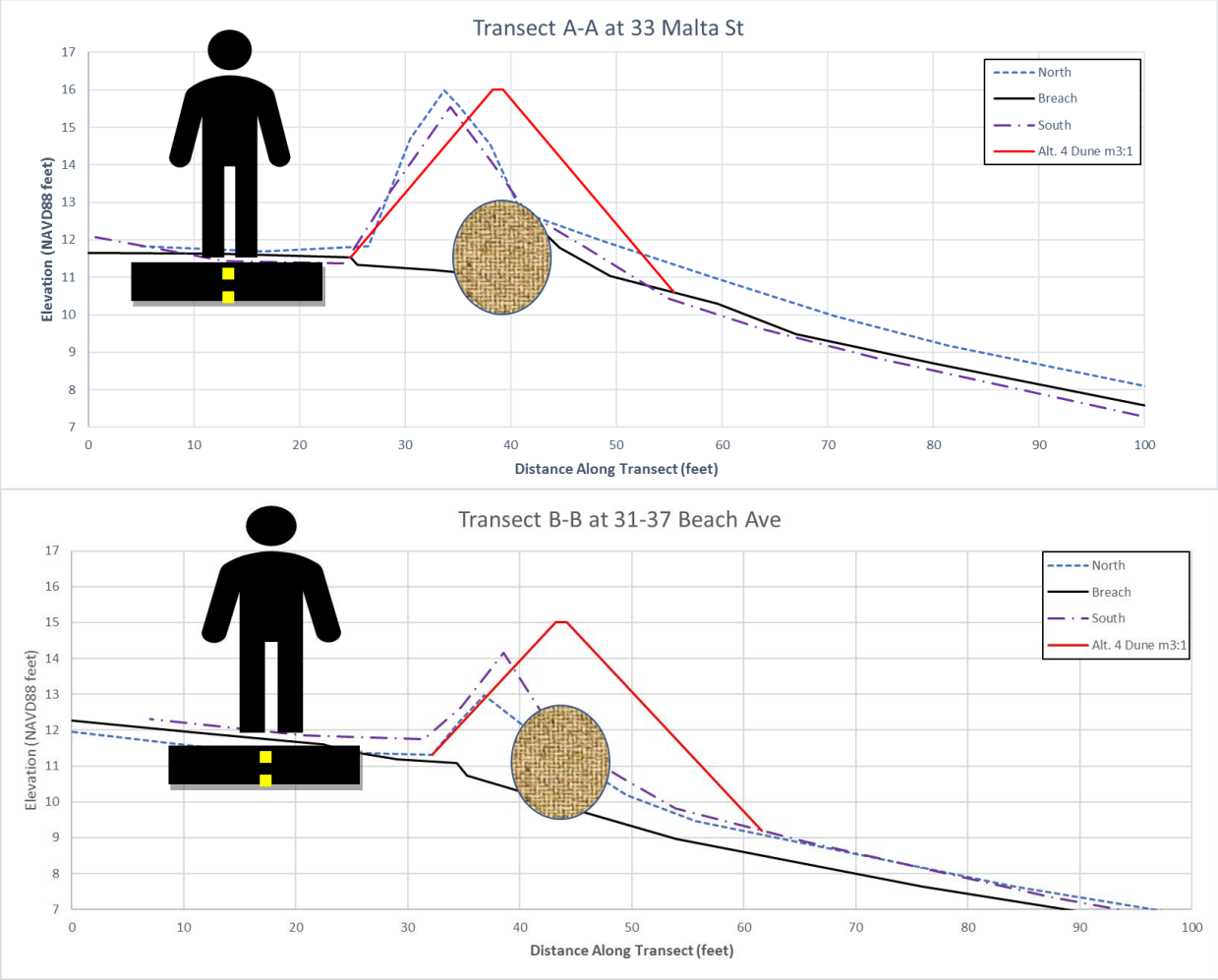


Figure C-4. Alternative 4: Constructing a 3H:1V side slope dune (red) to elevation 15 ft-NAVD with a bioengineered core in comparison to adjacent unaltered sections at Transect A-A (Top) and B-B (Bottom).

Alternative 4, as proposed, is substandard for several reasons. First, there are sections of dune with more crest elevation and width, especially north of Malta St, where installation of the coir envelope would require excavation of the existing dune in order to establish the coir envelope to a uniform depth of burial. This would result in a significant, permanent impact and disturbance to the both resource and habitat in order to construct an artificial bioengineered dune that could result in further destabilization and degradation to the primary dune in the future. While the coir envelope would be staked in place to provide stability, this method of anchoring would not provide stability during extreme storms. Coir material is buoyant when inundated and combined with direct wave attack could lead to damage and displacement, resulting in failure and contributing to storm debris. Any exposed coir envelopes would need to be covered with sand following the storm otherwise they would be vulnerable to deterioration from the sun's UV rays and exposure to the elements, as well as deteriorate the natural dune aesthetics. This would result in poorer performance and higher and more frequent maintenance costs than other alternatives. The dune design for Alternative 4 would not meet the definition of a primary frontal

dune under the Wetlands Protection Act as the fixed bioengineered core prevents the landform migrating landward or laterally in response to wind, waves, or tides. The fixed position of the bioengineered core prevents the dune from providing the same functions as a dune restored solely with artificial fill.

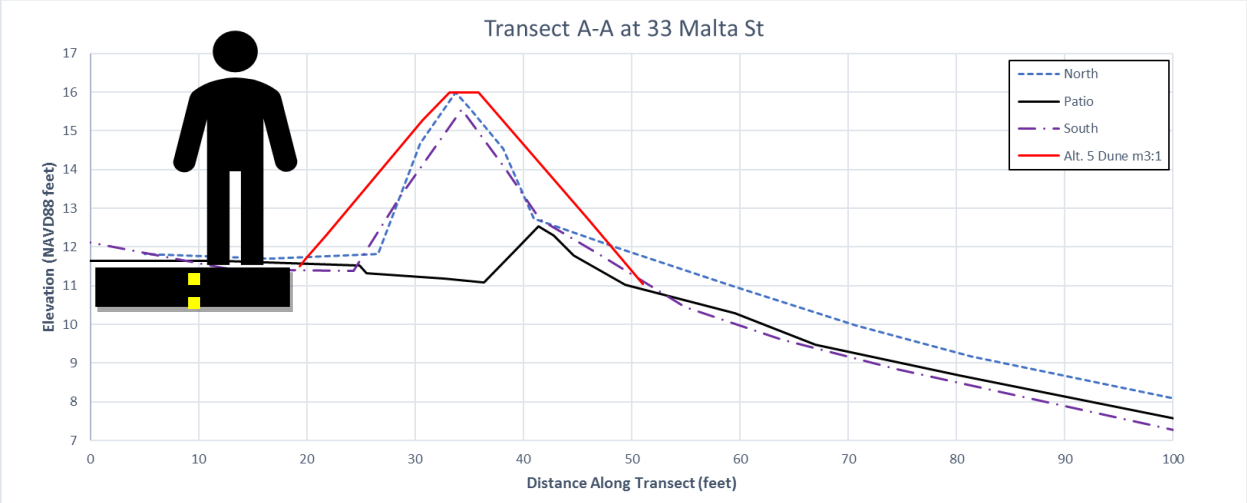
In the long term, the dune will be eroded by forces of waves and tides and the sand cover on top of the coir envelope will naturally migrate landward due to wind-blown (aeolian) and overwash transport onto the Beach Avenue roadway. This will expose the coir envelopes and require frequent maintenance to ensure the protective sand cover is in place. Coir envelopes typically biodegrade after 3-5 years, or less due to storm damage, meaning the project would require additional maintenance and have to be entirely rebuilt every few years. Considering that the costs associated with constructing a dune with a coir envelope array are significantly higher than constructing a sand dune, approximately 6-8 times, this would place a large financial and resource burden on the Town. Additionally, construction of the coir envelopes would require that the Town hire a skilled contractor to install the bioengineered core, which would present further costs to the Town. Therefore, Alternative 4 was eliminated from consideration because the Town may not be able to fund the construction and maintenance of this expensive and short-lived alternative that could have significant construction impacts the primary dune.

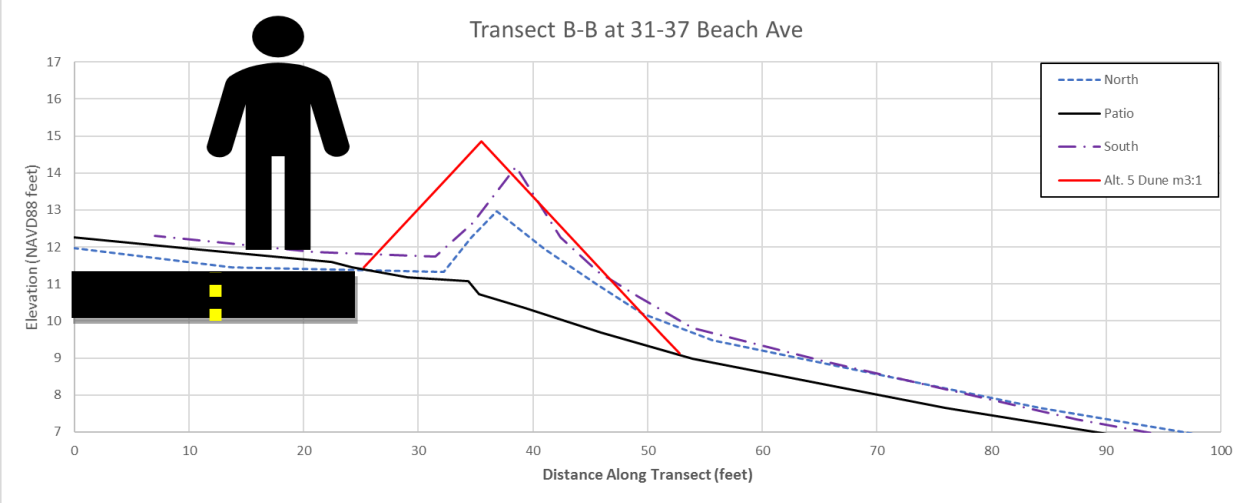
Alternative 5 – Dune Restoration Using 3H:1V Slopes within Town Property and Establishing Additional Pedestrian Access Paths (Preferred Alternative)

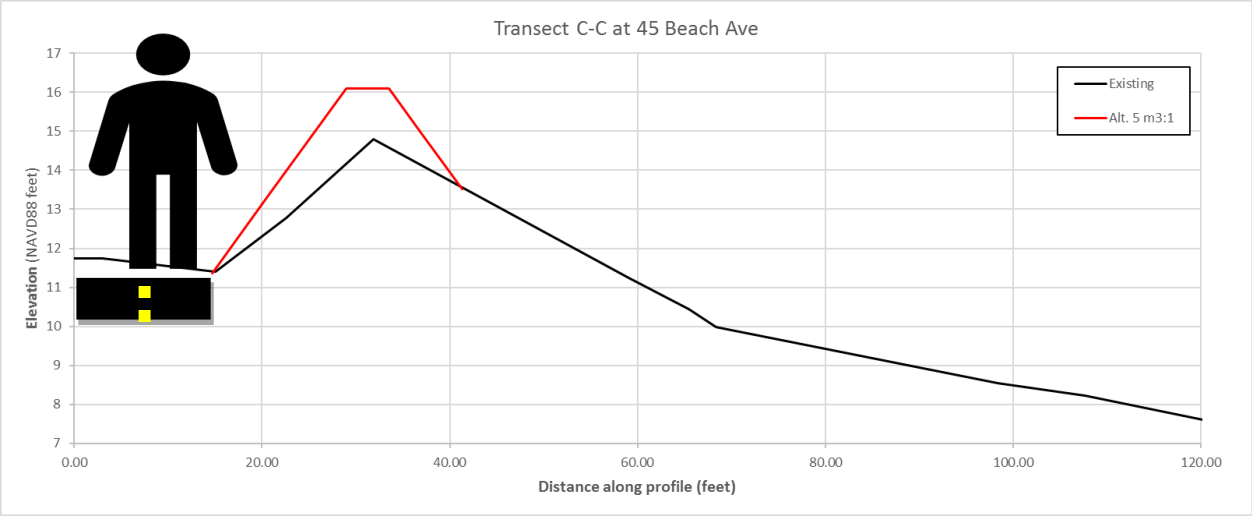
Alternative 5, the Preferred Alternative, consists of restoring the primary dune within the Town-owned Beach Avenue road layout to match the adjacent primary dune sections to the north and south, to the maximum possible extent, in terms of profile, elevation, and slopes. The 828 ft long primary dune adjacent to 27-53 Beach Ave has existing slopes and crest elevations ranging from 2.5H:1V and 15-16 ft-NAVD adjacent to the gap in the primary dune at 33 Malta St and 3H:1V and 13-14 ft-NAVD adjacent dune gap at 31-37 Beach Ave. The profile for the restored primary dune cross section would consist of a dune constructed with a narrow crest to an elevation of 15-16 ft-NAVD and 3H:1V side slopes (both faces). The 3H:1V slopes have an angle of 33° that is approximately equivalent to the natural angle of repose of sand at 34°, which was recommended during the Pre-Filing Consultation with NHESP and CZM since it would provide stability for the nourishment. Alternative 5 represents the largest stable dune that can be constructed in terms of elevation, height, volume, and width to avoid potential adverse impacts to private property and coastal beach that is endangered shorebird habitat.

The proposed dune cross-sections are shown in Figure C-5 for Transects A-A, B-B, C-C, and D-D as a solid red line relative to the existing topography that is shown as a solid black line; note that the Transects are labeled B-B, A-A, C-C and D-D from south to north (See Figure C-1 above). The vertical axis represents elevation (in feet relative to the NAVD88 vertical datum), while the horizontal axis represents the cross-shore distance along the profile in feet. The adjacent sections of dune just north and south of each patio (gaps) are also shown for A-A and B-B for reference as dashed blue and purple lines, respectively. Note that the vertical axis is exaggerated relative to the horizontal axis. At the Transects near either dead end of Beach Ave, Transect B-B to the south

and D-D to the north, there is less width to construct the dune due to private property constraints resulting in a narrower dune crest with less elevation than the middle Transects. The dune crest for the middle Transects A-A and C-C are able to achieve a crest width of 2.7 and 4.5 feet, respectively, at a design elevation of 16 ft-NAVD to match adjacent sections.







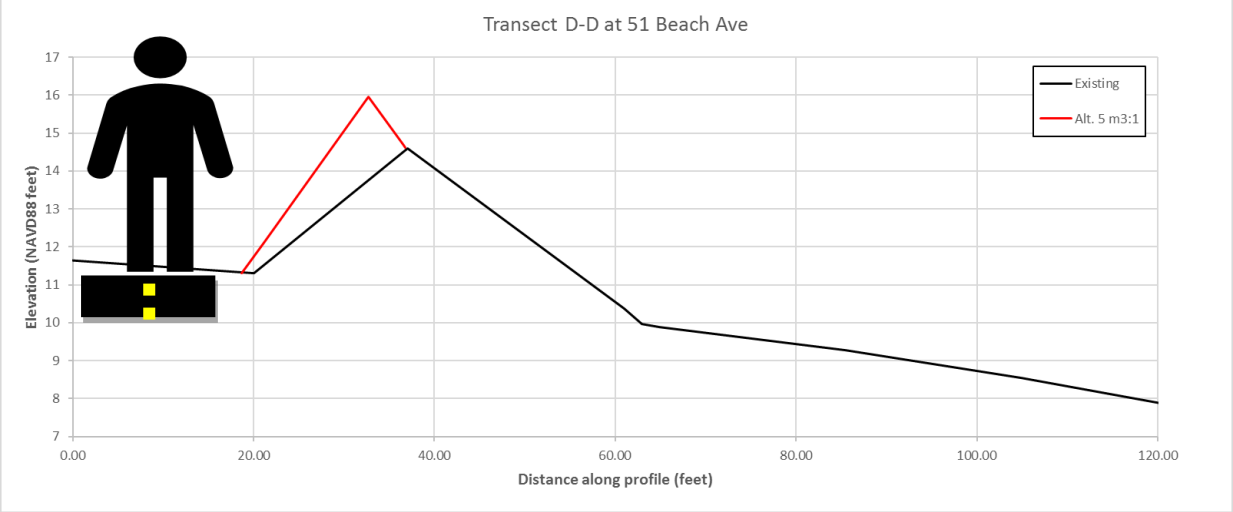
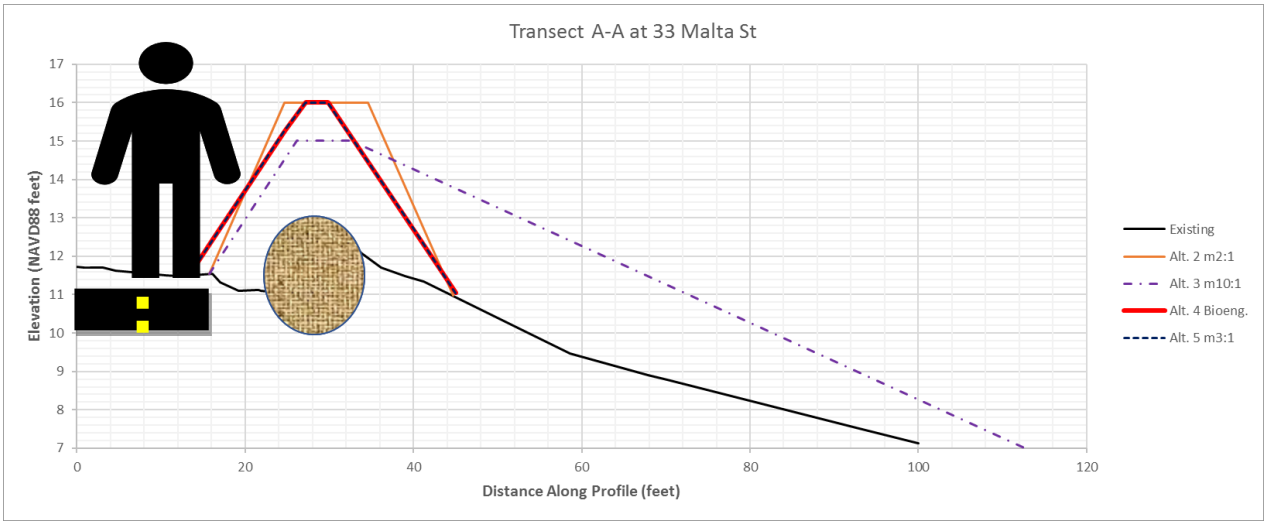


Figure C-5. Alternative 5: Constructing a 3H:1V side slope dune (red) to elevation 15 - 16 ft-NAVD88 in comparison to adjacent unaltered sections at Transect A-A (Top) and B-B (Bottom).

A comparison of Alternative 5, the Preferred Alternative, with Alternatives 1-4 is provided in Table C-1 and Figure C-6 (Transects A-A and B-B only), and note that Alternatives 4 and 5 are overlapping since they have the same dune configuration. Alternative 5 is the only primary dune design alternative proposed that produces a stable dune that can be constructed for a reasonable cost within the Town owned Beach Ave road layout. The characteristics of the previously restored primary dune at 131-145 Beach Ave in 2020 are also shown in Table C-1, for reference. Overall, the proposed Preferred Alternative and restored dune at 131-145 Beach Ave are similar. The main difference between them is that the crest of the proposed Preferred Alternative is narrower and at a slightly lower elevation in certain locations (south of Malta St).

Table C-1. Alternatives Comparison Matrix to the Preferred Alternative #5.

Alt.	Name	Crest width	Crest Elev.	Side Slopes	Bottom Width	Stable (Y/N)	Relative Construction Costs
		ft	ft-NAVD	h:v	ft		
1	No Action	0-1	11-13	2.5-3:1	0	No	Low
2	Max Dune	6.4 -10	15-16	2:1	29	No	Medium
3	Expanded Dune	<1	16	3:1 & 10:1	87-118	No	High
4	Bioengineered Dune	<1	15-16	3:1	29	No	High
5	Preferred Alt. A-A	<1	16	3:1	27.5	Yes	Medium
	Preferred Alt. B-B	2.7	14.9		31.7		
	Preferred Alt. C-C	4.5	16		26.6		
	Preferred Alt. D-D	<1	16		18.0		
NA	131-145 Beach Ave (SE35-1485)	8	16	3:1	29	Yes	Medium



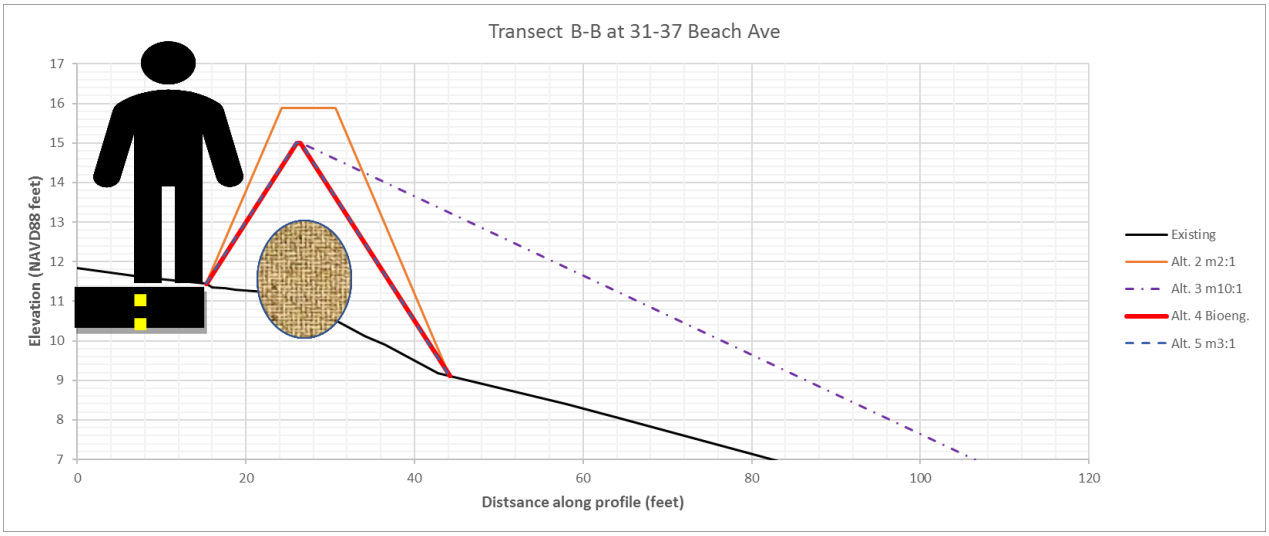


Figure C-6. Comparison of Alternatives 1, 2, 3, 4, & 5 for Transects A-A (Top) and B-B (Bottom).

Construction of Alternative 5 would result in an approximately 18 to 31-foot-wide primary dune restoration project along 828 linear feet of coastline with the restoration tapering into the abutting primary dunes at each end. The width of the dune is constrained by the private property boundaries especially at Transect D-D north of Malta St. The proposed project footprint of the dune restoration would be 20,922 square feet (0.48 acres) and would require approximately 830 cubic yards of sand to complete. The dune fill would consist of clean dune-compatible sediment with a mean diameter (D_{50}), of 0.3 mm (medium grain sand) or greater to match existing material. Alternative 5 could be constructed using Town labor and equipment as was done for the dune restorations at 131-145 Beach Ave and A St. Once the sand has been placed and graded, the dune would be planted with Cape American Beach Grass to increase its resiliency and enhance habitat. The existing permitted pedestrian path at Malta St intersection would be maintained, and two additional permitted pedestrian paths would be constructed over the primary dune north and south of the existing Malta St access path. The new paths would be maintained by the Town and will offset for the closure of existing non-permitted paths and reduce the incentive for new non-permitted paths to be created.

The performance of Alternative 5 during significant storm events was evaluated using the computer model SBEACH, which is an empirically based numerical model for simulating two-dimensional cross-shore beach change. The model was initially formulated using data from prototype-scale laboratory experiments and further developed and verified based on field measurements (Larson, Kraus, & Byrnes, 1990)[1]. The model predicts the time-dependent evolution of beach and dune profiles for specified water levels and wave conditions. In addition to beach elevation data, the model requires a time series of wave heights, wave periods and

[1] Larson, M., N. Kraus, and M. Byrnes. 1990. SBEACH: Numerical Model for Simulating Storm-Induced Beach Change. Report 2. Numerical Formulation and Model Tests. 120 pp.

water levels as forcing inputs. The specific storm information required by SBEACH is a time history of total water level (tide plus surge), as well as wind, wave height and period.

Storm information for the project was developed using several sources. Return period storm surge stillwater elevations for the 5-year, 10-year, and 25-year return period storm events (i.e., 20%, 10%, and 4% annual chance of occurrence, respectively) in present day were obtained from the MC-FRM model discussed previously in Section B and are shown in Table C-2. Wave height and periods associated with these storm return periods were obtained from the November 4, 2016 effective FEMA Flood Insurance Study (FIS) for Plymouth County. A summary of the storm surge and wave conditions simulated using SBEACH is shown in Table C-2. Due to the extent of inundation and damage caused during the March 2018 Nor'easter, the water levels, wave heights and periods for this storm, taken from NOAA Stations as discussed in the NOI filed for 131-145 Beach (SE35-1485), are also shown for reference in Table C-2. As can be seen from Table C-2, the March 1-3, 2018 Nor'easter was approximately equivalent to a 25-year event.

Table C-2. SBEACH input data for return period storm events and the March 2018 storm.

Storm Event	Storm Surge Elevation (ft)	Wave Height [H_{mo} (ft)]	Peak Wave Period [T_p (sec)]
March 2018	9.2	26.8	16.0
5-Year	7.3	20.8	9.7
10-Year	7.7	23.0	10.2
25-Year	9.3	26.0	10.8

The initial SBEACH profile was adjusted to reflect the proposed Alternative 5 dune design conditions. The performance of Alternative 5 during the 5-year, 10-year, and 25-year storm event was evaluated using SBEACH, and the results for Transects A-A, B-B, C-C, and D-D are shown in Figures C-7 through C-10, respectively. The vertical axes represent elevation (in feet relative to the NAVD88 vertical datum), while the horizontal axes represent the cross-shore distance along the profile in feet. Note that the vertical axes are exaggerated scale relative to the horizontal axes. The solid black lines show the existing topography within the altered dune. The orange lines show the proposed dune restoration with 3H:1V slopes and a crest rising to 15-16 ft-NAVD88. The dashed green, red, and gray lines show the final eroded profiles for the 5, 10, and 25-year storm simulations, respectively and the dashed blue lines represent their respective still water elevation (SWL) during each respective storm. A summary of the results is provided below:

- The 5-year storm causes modest erosion to the proposed dune at Transects A-A, C-C, and D-D as shown by the post-storm profiles (dashed green lines) in Figures C-7, C-9, and C-10; however, the eroded dune is still able to provide flood protection at each location. While the narrower and lower proposed dune at Transect B-B (southern patio) is heavily eroded, the remaining eroded dune profile still provides a level of flood protection during 5-year storm as shown in C-8.
- The 10-year post-storm profile, shown as dashed red lines in Figures C-7, C-9, and C-10, completely erodes the proposed dune at Transect B-B south of Malta St (Figure C-8).

While Transects A-A, C-C, and D-D suffer significant erosion, their eroded profile remains intact enough to still provide a level of flood protection during the 10-year storm.

- The 25-year storm completely erodes the proposed dune at Transect A-A, B-B, and C-C where the eroded profiles are shown as dashed gray lines (Figures C-7, C-9, and C-10). The eroded profile is not shown for Transect B-B in Figure C-8 since the dune is no longer intact after the 10-year storm. It should be noted again that the 25-year storm was the design level storm protection estimate for this area based on FY19 Study using 2013/14 topography, however, this level of protection has diminished due to progression erosion over the last 8-9 years.

Generally, north of Malta St the proposed primary dune provides storm protection above the 10-year storm but less than the 25-year storm while south of Malta St the primary dune provides protection for less than a 10-year storm but greater than a 5-year storm, meaning that the combined protection level is likely in the 10-year design level range. This is the same level of protection that was afforded by the dune constructed at 131-145 Beach Ave. Note that Alternatives 2 and 3 were simulated using SBEACH but results are not shown since they were already eliminated for the reasons described above. SBEACH results for Alternatives 2 and 3 would show improved resilience, compared to Alternative 5, due to greater height and volume.

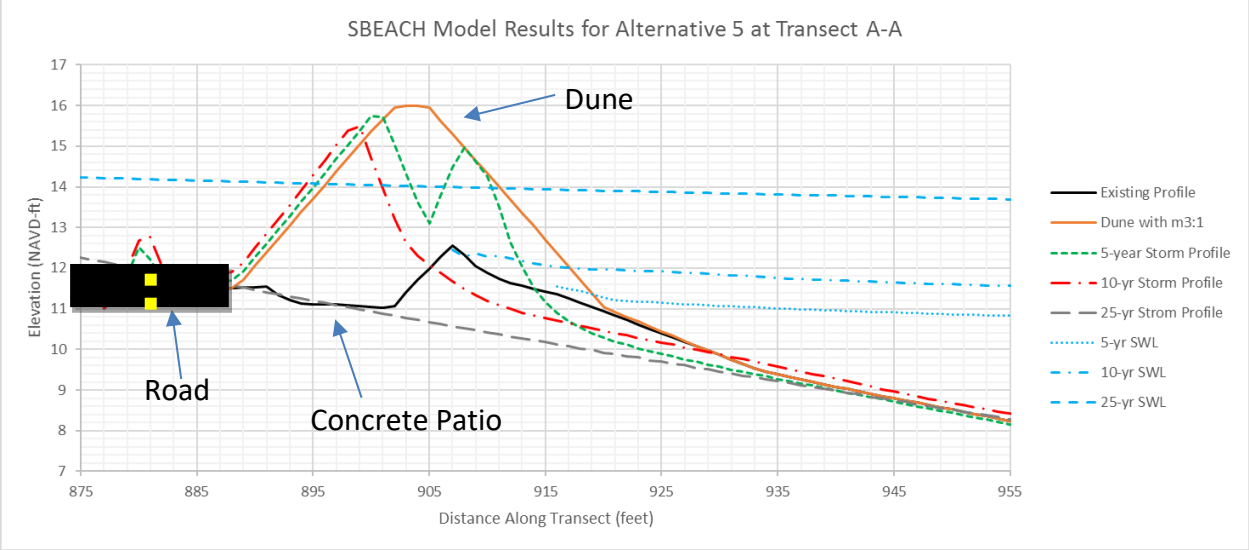


Figure C-7. SBEACH model results for the Alternative 5 at Transect A-A (33 Malta St) simulated for the 5-year, 10-year, and 25-year return period storm events. Erosion of the dune during the 25-year storm allows for flooding landward of the primary dune.

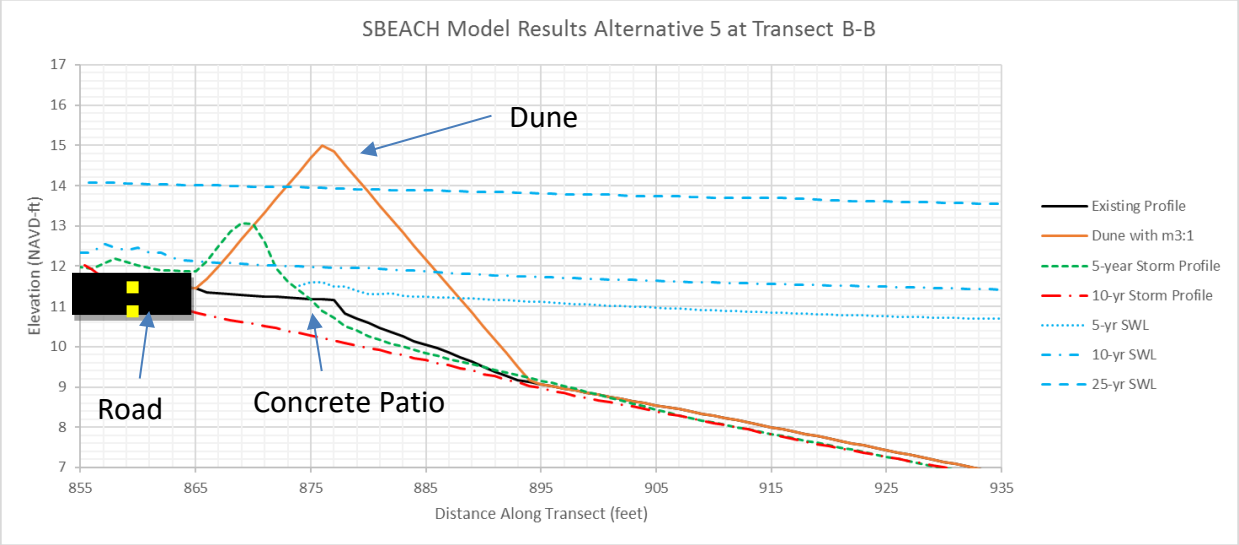


Figure C-8. **SBEACH model results for the Alternative 5 at Transect B-B (31 Beach Ave) simulated for the 5-year, 10-year, and 25-year return period storm events. Erosion of the dune during the 10-year storm allows for flooding landward of the primary dune (25-year storm profile not shown since dune is already removed).**

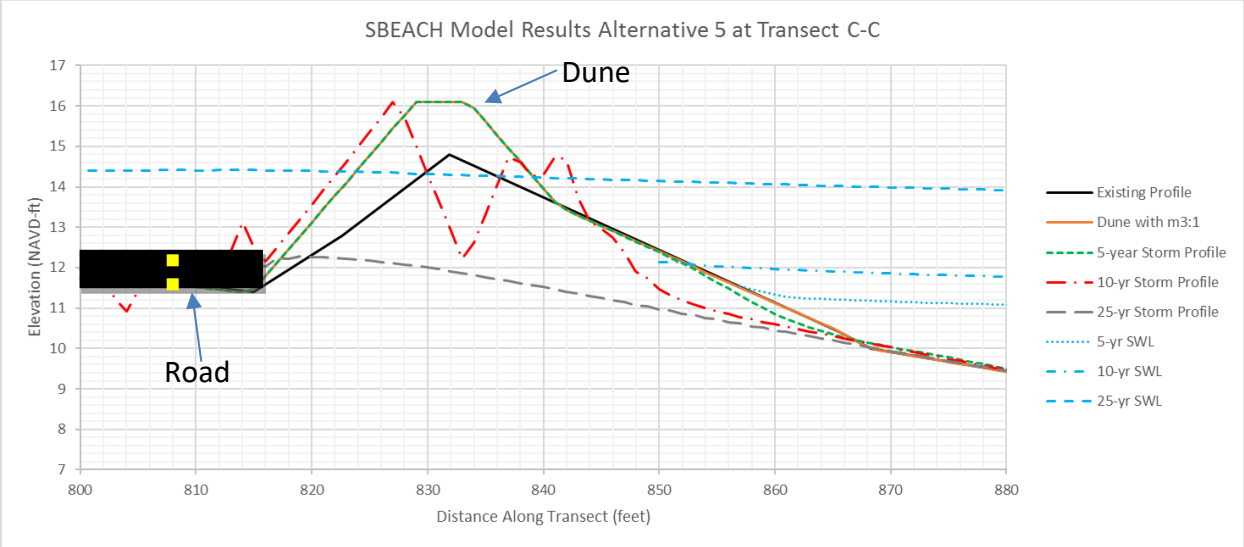


Figure C-9. **SBEACH model results for the Alternative 5 at Transect C-C (45 Beach Ave) simulated for the 5-year, 10-year, and 25-year return period storm events. Erosion of the dune during the 25-year storm allows for flooding landward of the primary dune.**

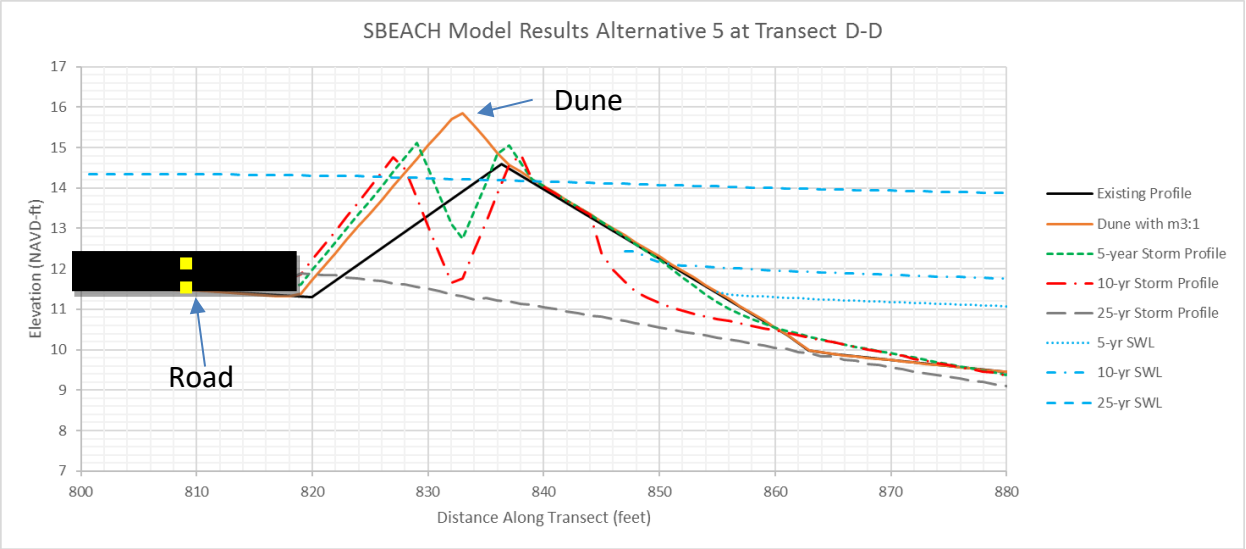


Figure C-10. SBEACH model results for the Alternative 5 at Transect D-D (51 Beach Ave) simulated for the 5-year, 10-year, and 25-year return period storm events. Erosion of the dune during the 25-year storm allows for flooding landward of the primary dune.

The Preferred Alternative would take place entirely within the existing primary coastal dune resource area, and provide enhancement of its function, value, and interests. The project footprint would also be located entirely within the Town-owned Beach Avenue road layout, and therefore could be directly funded and constructed by the Town as no portion would be constructed on private property. While the dune footprint lies withing NHESP Priority & Estimated Habitat, there would be no habitat conversion, only resource (coastal dune) restoration. Additionally, CZM offered their support for this preferred alternative with a 3H:1V slope over the Alternative 2 that had a steeper 2H:1V slope during the Pre-Filing Consultation with NHESP and CZM.

Alternative 5 includes establishing and maintaining public access over the primary dune to the coastal beach in a controlled manner that minimizes impacts to resources (i.e. coastal dune) and disturbances to both vegetation (i.e. dune grass) and nesting shorebirds (i.e. piping plovers). Currently there is a permitted pedestrian access path over the primary dune at the intersection of Malta Street and Beach Ave (SE35-1380), however, at least five non-permitted paths have been established north of Malta St and the patio south of Malta St also provides non-permitted pedestrian access there. The Town is concerned that these non-permitted paths will be re-established after the primary dune has been restored if only one location for permitted pedestrian access exists along its 800 ft length. These non-permitted paths could further alter and degrade the restored dune and its vegetation while also creating disturbances to nesting shorebird habitat. In an effort to mitigate the non-permitted pedestrian paths from re-establishing, two additional permitted pedestrian access paths are proposed at 31 and 47 Beach Ave to control foot traffic while providing additional public access north and south of Malta St. These locations were selected to provide access at both the northern and southern ends of Beach

Avenue, away from the existing permitted pedestrian access path at Malta St, and to avoid conflicts with known nesting areas for shorebirds, in consultation with the Town of Hull who contracts Mass Audubon to monitor Piping Plover populations. Both the existing and two proposed permitted pedestrian access paths will comply with the 2018 Hull BMP. These permitted paths will be constructed with a 4 ft width over the dune at an angle to the southeast, to minimize impacts from Nor'easters. The paths will be delineated by sand fencing to contain the foot traffic, and filled by the Town during the off-season to mitigate flood pathways. The two proposed permitted pedestrian paths will be managed by the Town in the same way as the permitted pedestrian path at Malta St and other permitted pedestrian access paths along the entire NNB primary dune.

The project would require ongoing maintenance involving the maintenance of new permitted pedestrian paths (including filling and grading with sand during winter storm season) and placement of additional nourishment material and re-planting beach grass in order to provide long-term benefits. The Town has demonstrated its ability and commitment to carrying out these types of maintenance activities through implementation of its approved beach management plan for the entire North Nantasket Beach primary frontal dune system. While there is the potential for dune sediment overwash and rollover into the road, the Town already conducts road maintenance and cleanup for the ~2 mile stretch of existing dune along Beach Avenue so the proposed dune would simply be included in that management program. The proposed dune restoration would stabilize and strengthen the primary coastal dune system as a whole along Beach Avenue by eliminating the vulnerable gaps in the primary dune, improving habitat and habitat connectivity, flood control, and storm damage protection. The Preferred Alternative provides clear and tangible property, cost, safety, environmental benefits over all other alternatives considered, and will not result in any adverse impacts to the resource areas.

Section D

Performance Standards Compliance Narrative

D. PERFORMANCE STANDARDS COMPLIANCE NARRATIVE

The project will have impacts on the following Wetland Resources:

- Coastal Dune
- Barrier Beach – Coastal Dune
- Estimated Habitats of Rare Wildlife (for coastal wetlands)
- Land Subject to Coastal Storm Flowage (no current performance standards)

Excerpts from 310 CMR 10.28 – Coastal Dune

(2) Definition. Coastal Dune means any natural hill, mound or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash. Coastal dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control.

WHEN A COASTAL DUNE IS DETERMINED TO BE SIGNIFICANT TO STORM DAMAGE PREVENTION, FLOOD CONTROL OR THE PROTECTION OF WILDLIFE HABITAT, 310 CMR 10.28(3) through (6) SHALL APPLY:

(3) Any alteration of, or structure on, a coastal dune or within 100 feet of a coastal dune shall not have an adverse effect on the coastal dune by:

(a) affecting the ability of waves to remove sand from the dune;
(b) disturbing the vegetative cover so as to destabilize the dune;
(c) causing any modification of the dune form that would increase the potential for storm or flood damage;
(d) interfering with the landward or lateral movement of the dune;
(e) causing removal of sand from the dune artificially; or
(f) interfering with mapped or otherwise identified bird nesting habitat.

An altered primary (frontal) dune exists seaward of and adjacent to 27-53 Beach Ave that is significant to storm damage prevention and flood control despite its degraded state. The purpose of the proposed project is to enhance the primary dune function, within the coastal dune resource, by increasing the volume, height, and crest width thereby restoring habitat connectivity with adjacent sections of primary dune. The proposed project is expected to have a positive impact on the degraded primary frontal dune within the coastal dune resource area because it will supply a much needed sediment source to the dune system and the adjacent beach. The project will restore the degraded primary dune form to be similar to areas to the north and south, improving the ability of the primary dunes to provide storm damage prevention and flood control to surrounding areas. Therefore, the project will not result in a removal of sand from the dune but rather will add sediment to the coastal resources. The project will not take away the ability of waves to remove sediment from the dune since only

sand is being placed. The project will not interfere with the natural landward movement of the dune. The project will establish a vegetative cover on the primary dune to stabilize and enhance the dune and its vegetative cover. Three pedestrian access paths, one previously authorized and two additional, will be established over the dune, but they will conform with the 2018 Hull Beach Management Plan so as to not cause adverse impacts to the coastal dune resource.

The project footprint is located within a coastal dune that is mapped as bird habitat for Piping Plovers and Common Terns. The project will not adversely impact this habitat as the project proposes no conversion of existing habitat. The proposed restoration is expected to enhance the habitat and resource area over time by restoring the dunes which will nourish the beach over time where the birds are nesting. The proposed 3H:1V slopes dune nourishment design was chosen after consultation with NHESP and CZM to minimize impacts associated with steep side slopes adjacent to coastal beach.

(4) Notwithstanding the provisions of 310 CMR 10.28(3), when a building already exists upon a coastal dune, a project accessory to the existing building may be permitted, provided that such work, using the best commercially available measures, minimizes the adverse effect on the coastal dune caused by the impacts listed in 310 CMR 10.28(3)(b) through 10.28(3)(e). Such an accessory project may include, but is not limited to, a small shed or a small parking area for residences. It shall not include coastal engineering structures.

No new building, structure, or parking is being proposed as part of this work, which will remove structures such as patios and fences and restore coastal dune habitat in its place.

(5) The following projects may be permitted, provided that they adhere to the provisions of 310 CMR 10.28(3):

(a) pedestrian walkways, designed to minimize the disturbance to the vegetative cover and traditional bird nesting habitat;

(b) fencing and other devices designed to increase dune development; and

(c) plantings compatible with the natural vegetative cover.

A permitted pedestrian access path (SE 35-1380) crosses over the dune at the Malta St intersection, which will be re-established after restoration has occurred by installing new sand fencing. Two additional pedestrian access paths will be installed at either dead end of Beach Ave in conformance with the Hull Beach Management Plan (2018), which specifies a 48 inch width angled to the southeast marked with fencing for path design. The entire primary dune will be planted with native, salt tolerant Cape American beach grass, except for within the access paths themselves, that is presently growing in the primary dune.

(6) Notwithstanding the provisions of Sections 10.28(3) through (5), no project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.37.

The footprint of the proposed project is located in coastal dune mapped as (primary and estimated) habitat. The coastal dune is immediately adjacent to coastal beach areas that are also mapped as habitat. The proposed project will not encroach upon coastal beach habitat. Sand placed in the dune will act as a source of sediment to the bird habitat during storms as material is eroded from the dune and transported to the coastal beach. The 3H:V1 slope nourishment design for the dune was seen as favorable in a pre-filing consultation with NHESP since it does not encroach on the mapped Coastal Beach and includes gentler side slopes than steeper alternatives considered. The two unauthorized patios and many footpaths will be restored to coastal dune, and in their place three pedestrian access paths will established to control foot traffic to areas that minimize impacts to nesting shorebirds.

Excerpts from 310 CMR 10.29 - Barrier Beach

(2) Definition. Barrier Beach means a narrow low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system. A barrier beach may be joined to the mainland at one or both ends.

(3) When a Barrier Beach is Determined to be Significant to Storm Damage Prevention, Flood Control, Marine Fisheries or Protection of Wildlife Habitat. 310 CMR 10.27(3) through 10.27(6)(coastal beaches) and 10.28(3) through 10.28(5) (coastal dunes) shall apply to the coastal beaches and to all coastal dunes which make up a barrier beach.

Barrier Beach encompasses the low-lying areas of the Hull peninsula between the MLW shorelines on Massachusetts Bay and Hull Bay. The project footprint exists within the coastal dune portion of the greater barrier beach system that is discussed in detail above in 10.28 Coastal Dune. The project will not encroach on the seaward barrier beach – coastal beach resource.

(4) Notwithstanding the provisions of 310 CMR 10.29(3), no project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.37.

See discussion above in 10.28(3)(f), and 10.28(6).

Executive Order 181 – Barrier Beaches

Executive Order No. 181 identifies barrier beaches as an important resource. The executive order specifies the following policies:

1. Barrier beaches shall be given priority status for self-help and other state and federal acquisition programs and this priority status shall be incorporated into the Statewide Outdoor Comprehensive Recreation Plan. The highest priority for disaster assistance funds shall go towards relocating willing sellers from storm damaged barrier beach areas.

2. State funds and federal grants for construction projects shall not be used to encourage growth and development in hazard prone barrier beach areas.

3. For state-owned barrier beach property, management plans shall be prepared which are consistent with state wetland policy and shall be submitted to the Secretary of Environmental Affairs for public review under the provisions of the Massachusetts Environmental Policy Act.

4. At a minimum, no development shall be permitted in the velocity zones or primary dune areas of barrier beaches identified by the Department of Environmental Quality Engineering.

5. Coastal engineering structures shall only be used on barrier beaches to maintain navigation channels at inlets and then only if mechanisms are employed to ensure that downdrift beaches are adequately supplied with sediment.

6. Dredge material of a compatible grain size shall be used for barrier beach nourishment, if economically feasible.

7. The Coastal Zone Management Office shall coordinate state agency management policy for barrier beach areas.

The proposed project is consistent with the Executive Order as part of the management of barrier beaches. The project is being funded by MA CZM Grant to restore a degraded coastal dune resource within the barrier beach system using compatible sediment from an upland source and native, salt tolerant plantings. No structures are being proposed and existing manmade features are being removed to enhance the barrier beach - coastal dune resource and function.

310 CMR 10.37 - Estimated Habitats of Rare Wildlife (Endangered Species)

See discussion above. in 10.28(3)(f), and 10.28(6)

Section E

Review of Consistency w/ CZM Policies

E. Review of Consistency with CZM Policies (as of October 2011)

The Proponent's proposed coastal dune restoration project complies with the enforceable program policies of the Massachusetts approved coastal management program and will be conducted in a manner consistent with such policies.

The proposed project complies with the following Coastal Zone Management policies:

COASTAL HAZARDS

COASTAL HAZARD POLICY #1 - Preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage, salt marshes, and land under the ocean.

> **The project is designed to restore and enhance the altered primary dune along 27-53 Beach Ave and integrate it with the existing coastal dunes to the north and south. As such, the project will increase the ability of the coastal dune to provide the critical functions of storm damage protection and flood control.**

COASTAL HAZARD POLICY #2 - Ensure construction in water bodies and contiguous land areas will minimize interference with water circulation and sediment transport. Flood or erosion control projects must demonstrate no significant adverse effects on the project site or adjacent or downcoast areas.

> **The project is located above both the mean high water and high tide lines and therefore is not in an area subject to water circulation due to regular daily tides. As the proposed project is located in an area subject to wave action and potential inundation during a storm event, the dune will erode naturally and not inhibit water circulation or sediment transport. The project will provide enhanced flood protection against coastal storms for landward properties and there are no developed areas seaward that would be adversely impacted. The project would restore a continuous primary dune along 27-53 Beach Ave that will match the adjacent existing dune to the north and south and provide a similar level of flood protection that these abutting properties already receive. The primary dune will be restored following storms using material of a grain size compatible with native material. As such, there will be no adverse effects to adjacent areas if the placed sediment is transported during a storm event.**

COASTAL HAZARD POLICY #3 - Ensure that state and federally funded public works projects proposed for location within the coastal zone will:

- Not exacerbate existing hazards or damage natural buffers or other natural resources.

- Be reasonably safe from flood and erosion-related damage.
- Not promote growth and development in hazard-prone or buffer areas, especially in velocity zones and ACECs.
- Not be used on Coastal Barrier Resource Units for new or substantial reconstruction of structures in a manner inconsistent with the Coastal Barrier Resource/Improvement Acts.

This project is being funded by the Massachusetts Office of Coastal Zone Management under FY22 Coastal Resiliency Grant. This project will restore dune resource and enhance the function of this natural buffer. The project is located well above both the mean high water and mean high tide lines and therefore is not in an area subject to inundation and erosion during regular daily tides. During small to moderate storms, the primary dune will partially erode and fulfill its function by providing an enhanced natural buffer against flooding and damage prevention while providing nourishment to the coastal beach. The Town will maintain the primary dune with nourishment and plantings on an annual or as needed basis to ensure its long-term viability. Therefore, the project will not exacerbate storm flooding or damage and be relatively stable during normal tides.

The project will not encourage development in the velocity zone since the area landward is already highly developed and no development exists seaward on the coastal beach where this project will not provide flood protection anyways. In fact, it will remove manmade features, such as two concrete patios, constructed in the primary dune that act as flood pathways. Closing these flood pathways will serve to increase flood protection and damage prevention for landward areas. The project is not located in an ACEC or on a Coastal Barrier Resource Unit.

COASTAL HAZARD POLICY #4 - Prioritize acquisition of hazardous coastal areas that have high conservation and/or recreation values and relocation of structures out of coastal high hazard areas, giving due consideration to the effects of coastal hazards at the location to the use and manageability of the area.

Not Applicable (NA) – This project does not involve land acquisition or structure relocation.

ENERGY

ENERGY POLICY #1 - For coastally dependent energy facilities, access siting in alternative coastal locations. For non-coastally dependent energy facilities, assess siting in areas outside of the coastal zone. Weigh the environmental and safety impacts of locating proposed energy facilities at alternative sites.

NA – This project does not involve energy facilities.

ENERGY POLICY #2 - Encourage energy conservation and the use of alternative sources such as solar and wind power in order to assist in meeting the energy needs of the Commonwealth.

NA – This project does not involve energy facilities.

GROWTH MANAGEMENT

GROWTH MANAGEMENT POLICY #1 - Encourage sustainable development that is consistent with state, regional, and local plans and supports the quality and character of the community.

NA – This project does not involve community development.

GROWTH MANAGEMENT POLICY #2 - Ensure that state and federally funded infrastructure projects in the coastal zone primarily serve existing developed areas, assigning highest priority to projects that meet the needs of urban and community development centers.

NA – This project does not include any infrastructure.

GROWTH MANAGEMENT POLICY #3 - Encourage the revitalization and enhancement of existing development centers in the coastal zone through technical assistance and financial support for residential, commercial and industrial development.

NA – This project does not involve community development centers.

HABITAT

HABITAT POLICY #1 - Protect coastal, estuaries, and marine habitats - including salt marshes, shellfish beds, submerged aquatic vegetation, dunes, beaches, barrier beaches, banks, salt ponds, eelgrass beds, tidal flats, rocky shores, bays, sounds, and other ocean habitats – and coastal freshwater streams, ponds, and wetlands to preserve critical wildlife habitat and other important functions and services including nutrient and sediment attenuation, wave and storm damage protection, and landform movement and processes.

The project will have positive impact on the barrier beach, coastal beach and dune resources since it will enhance the resiliency and habitat value of the altered coastal dune, provide habitat connectivity with adjacent unaltered sections, improve its ability to provide wave and storm damage protection, remove anthropogenic features, and provide an additional sediment source to the coastal beach. The project will not impact the ability of wind, waves, and tides to add or remove sediment from the primary dune. The restoration of dune elevation and width combined with native plantings will stabilize the dune an allow for the dune to potentially add volume naturally over time.

HABITAT POLICY #2 – Advance the restoration of degraded or former habitats in coastal and marine areas.

The proposed project is intended to restore primary dune that been degraded anthropogenically by the current uses of Beach Avenue, which include the installation of two non-permitted concrete patio slabs within the primary dune and several non-permitted pedestrian paths in the northern section of the primary dune. The proposed restored dune will have a narrow dune crest with an elevation ranging from 15-16 ft (NAVD88) to match adjacent primary dune sections to the north and south. The footprint has been designed to be built within the Town owned Beach Avenue road layout and within the boundaries of existing coastal dune resource area. No work will be conducted on privately owned beach lots or within the coastal beach that is shorebird habitat.

OCEAN RESOURCES

OCEAN RESOURCES POLICY #1 - Support the development of sustainable aquaculture, both for commercial and enhancement (public shellfish stocking) purposes. Ensure that the review process regulating aquaculture facility sites (and access routes to those areas) protects significant ecological resources (salt marshes, dunes, beaches, barrier beaches, and salt ponds) and minimizes adverse effects on the coastal and marine environment and other water-dependent uses.

NA – This project does not involve aquaculture.

OCEAN RESOURCES POLICY #2 – Except where such activity is prohibited by the Ocean Sanctuaries Act, the Mass. Ocean Management Plan, or other applicable provision of law, the extraction of oil, natural gas, or marine minerals (other than sand and gravel) in or affecting the coastal zone must protect marine resources, marine water quality, fisheries and navigational, recreational and other uses.

NA – This project does not involve oil, gas or mineral extraction.

OCEAN RESOURCES POLICY #3 - Accommodate offshore sand and gravel extraction needs in areas and in ways that will not adversely affect marine resources, navigation, or shoreline areas due to alteration of wave direction and dynamics. Extraction of sand and gravel, when and where permitted, will be primarily for the purpose of beach nourishment or shoreline stabilization.

NA – The proposed project is solely for dune restoration and does not involve offshore sand or gravel extraction. The Proponent will identify an upland sediment source that will be submitted for approval by the Hull Conservation Commission prior to construction.

PORTS AND HARBORS

PORTS AND HARBORS POLICY #1 - Ensure that dredging and disposal of dredged material minimize adverse effects on water quality, physical processes, marine productivity and public health and take full advantage of opportunities for beneficial re-use.

NA – This project does involve dredging or the disposal of dredged material.

PORTS AND HARBORS POLICY #2 - Obtain the widest possible public benefit from channel dredging and ensure that Designated Ports Areas and developed harbors are given highest priority in the allocation resources.

NA – This project does not involve channel dredging and the sediment will be from an approved upland source.

PORTS AND HARBORS POLICY #3 - Preserve and enhance the capacity of Designated Port Areas (DPAs) to accommodate water-dependent industrial uses and prevent the exclusion of such uses from tidelands and any other DPA lands over which an EEA agency exerts control by virtue of ownership or other legal authority.

NA – This project is not located within or near a Designated Port Area.

PORTS AND HARBORS POLICY #4 – For development on tidelands and other coastal waterways, preserve and enhance the immediate waterfront for vessel-related activities that require sufficient space and suitable facilities along the water's edge for operational purposes.

NA – This project does not involve development on tidelands or coastal waterways.

PORTS AND HARBORS POLICY #5 - Encourage, through technical and financial assistance, expansion of water dependent uses in Designated Port Areas and developed harbors, re-development of urban waterfronts, and expansion of physical and visual access.

NA – This project is not located within or near a Designated Port Area or urban waterfront.

PROTECTED AREAS

PROTECTED AREAS POLICY #1 - Preserve, restore, and enhance coastal Areas of Critical Environmental Concern, which are complexes of natural and cultural resources of regional or statewide significance.

NA – This project is not located in an Area of Critical Environmental Concern.

PROTECTED AREAS POLICY #2 - Protect state designated scenic rivers in the coastal zone.

NA – This project is not located in a designated scenic river.

PROTECTED AREAS POLICY #3 - Ensure that proposed developments in or near designated or registered historic places respect the preservation intent of the designation and that potential adverse effects are minimized.

NA – This project is not located in or near a registered historic place.

PUBLIC ACCESS

PUBLIC ACCESS POLICY #1 - Ensure that development (both water-dependent or nonwater-dependent) of coastal sites subject to state waterways regulation will promote general public use and enjoyment of the water's edge, to an extent commensurate with the Commonwealth's interests in flowed and filled tidelands under the Public Trust Doctrine.

NA – The project is not located in flowed or filled tidelands.

PUBLIC ACCESS POLICY #2 - Improve public access to existing coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation and trail links (land or water-based) to other nearby facilities. Increase capacity of existing recreation area by facilitating multiple use and by improving management, maintenance, and public support facilities. Ensure that the adverse impacts of developments proposed near existing public access and recreation sites are minimized.

Public access to the beach currently exists at the intersection of Malta Street and Beach Avenue approved by the Conservation Commission under DEP File No. SE 35-1380. The proposed project will not interfere with this permitted pedestrian path that will be maintained and enhanced with additional nourishment. Two additional permitted pedestrian paths are proposed over the restored primary dune at each dead end of Beach Avenue (adjacent 27 & 53 Beach Ave). These two permitted pedestrian paths will improve public access to North Nantasket Beach, while addressing the adverse impacts resulting from at least five unpermitted paths north of 33 Malta St and the two patios that serve as unpermitted beach access to the south. The proposed permitted pedestrian paths will be constructed to similar to current practices (snow fence boundaries and path orientation to the southeast) in compliance with the 2018 Town of Hull Beach Management Plan.

PUBLIC ACCESS POLICY #3 - Expand existing recreation facilities and acquire and develop new public areas for coastal recreational activities, giving highest priority to regions of high need or limited site availability. Provide technical assistance to developers of both public and private recreation facilities and sites that increase public access to the shoreline to ensure that both

transportation access and the recreational facilities are compatible with social and environmental characteristics of surrounding communities.

While this project does not expand recreation facilities, it would provide two additional permitted pedestrian access paths that will enhance public access to the coastal beach.

WATER QUALITY

WATER QUALITY POLICY #1 - Ensure that point-source discharges and withdrawals in or affecting the coastal zone do not compromise water quality standards and protect designated uses and other interests.

NA – The project does not involve any point-source discharges or withdrawals.

WATER QUALITY POLICY #2 – Ensure the implementation of nonpoint source pollution controls to promote the attainment of water quality standards and protect designated uses and other interests.

Dune nourishment will utilize only natural materials and will not adversely affect nonpoint source pollution control.

WATER QUALITY POLICY #3 - Ensure that subsurface waste discharges conform to applicable standards, including the siting, construction, and maintenance requirements for on-site wastewater disposal systems, water quality standards, established Total Maximum Daily Load limits, and prohibitions on facilities in high-hazard areas.

NA – The project does not involve a subsurface waste discharge.

Section F

Output Report from RMAT Climate Resilience Design Standards Tool

RMAT Climate Resilience Design Standards Tool Project Report

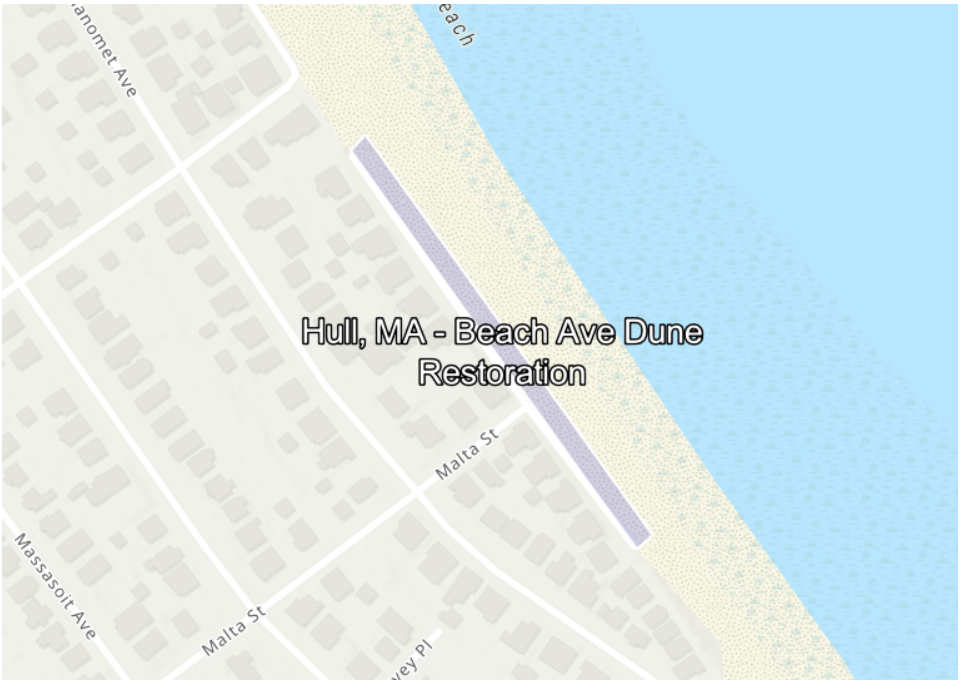
Hull, MA - Beach Ave Dune Restoration
Date Created: 12/3/2021 10:27:59 AM Created By: nbrahim Download

Project Summary

Link to Project

Estimated Construction Cost: $30000.00
End of Life Year: 2024
Project within mapped Environmental Justice population: No

Ecosystem Benefits	Scores
Project Score	High
Exposure	**Scores**
Sea Level Rise/Storm Surge	High Exposure
Extreme Precipitation - Urban Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Not Exposed
Extreme Heat	High Exposure



Asset Summary

Number of Assets: 1

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Urban Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Degraded coastal dune	—— Natural Resource project assets do not receive a preliminary climate risk rating. ——			

Project Outputs

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Degraded coastal dune	2030				Tier 1
Extreme Precipitation					
Degraded coastal dune	2030				Tier 1
Extreme Heat					
Degraded coastal dune	2030		50th		Tier 1

Scoring Rationale - Exposure

Sea Level Rise/Storm Surge

This project received a "High Exposure" because of the following:

- Exposed to the 1% annual coastal flood event as early as 2030
- Historic coastal flooding at project site
- Located within the 0.1% annual coastal flood event within the project's useful life

Extreme Precipitation - Urban Flooding

This project received a "High Exposure" because of the following:

- Existing impervious area of the project site is greater than 50%
- No historic flooding at project site
- No increase to impervious area

- Maximum annual daily rainfall is within 6 to 10 inches within the overall project's useful life

Extreme Precipitation - Riverine Flooding

This project received a "Not Exposed" because of the following:

- No historic riverine flooding at project site
- The project is not within a mapped FEMA floodplain [outside of the Massachusetts Coast Flood Risk Model (MC-FRM)]
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- Existing impervious area of the project site is greater than 50%
- 10 to 30 day increase in days over 90 deg. F within project's useful life
- Located within 100 ft of existing water body
- No increase to the impervious area of the project site
- No tree removal

Scoring Rationale - Asset Risk Scoring

Asset - Degraded coastal dune
Primary asset criticality factors influencing risk ratings for this asset:

No score available

Project Design Standards Output

Asset: Degraded coastal dune — Natural Resources

Sea Level Rise/Storm Surge

Target Planning Horizon: 2030
Intermediate Planning Horizon: Not Applicable

Applicable Design Criteria

Tiered Methodology: Tier 1 (Link)

Tidal Benchmarks: No
Stillwater Elevation: Yes
Design Flood Elevation (DFE): Yes
Wave Heights: Yes
Duration of Flooding: No
Design Flood Velocity: Yes
Wave Forces: Yes
Scour or Erosion: Yes

Extreme Precipitation

Target Planning Horizon: 2030

Applicable Design Criteria

Total Precipitation Depth for 24-hour Design Storms: No
Peak Intensity for 24-hour Design Storms: No
Riverine Peak Discharge: No
Riverine Peak Flood Elevation: No
Duration of Flooding for Design Storm: No
Flood Pathways: No

Extreme Heat

Target Planning Horizon: 2030
Percentile: 50th Percentile

Applicable Design Criteria

Annual/Summer/Winter Average Temperature: No
Heat Index: No
Days Per Year With Max Temperature > 95°F: No
Days Per Year With Max Temperature > 90°F: No
Days Per Year With Max Temperature < 32°F: No
Number of Heat Waves Per Year: No
Average Heat Wave Duration (Days): No
Cooling Degree Days (Base = 65°F): No
Heating Degree Days (Base = 65°F): No
Growing Degree Days: No

Project Inputs

Core Project Information

Name:	Hull, MA - Beach Ave Dune Restoration
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2024
Location of Project:	Hull
Estimated Capital Cost:	$30,000
Who is the Submitting Entity?	City/Town Hull Chris Krahforst (ckrahforst@town.hull.ma.us)
Is this project identified as a priority project in the Municipal Vulnerability Preparedness (MVP) plan or the local or regional Hazard Mitigation Plan (HMP)?	Yes
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Permitting
Is climate resiliency a core objective of this project?	Yes
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	MEPA ENF
Project Submission Comments:	

Project Ecosystem Benefits

Factors Influencing Output

- ✓ This is an ecological restoration project
- ✓ Project provides flood protection through nature-based solutions
- ✓ Project reduces storm damage
- ✓ Project filters stormwater using green infrastructure
- ✓ Project improves water quality
- ✓ Project enables carbon sequestration
- ✓ Project protects fisheries, wildlife, and plant habitat
- ✓ Project provides oxygen production
- ✓ Project improves air quality
- ✓ Project provides cultural resources/education

Factors to Improve Output

- ✓ Incorporate vegetation that provides pollinator habitat
- ✓ Identify opportunities to remediate existing sources of pollution
- ✓ Provide opportunities for passive and/or active recreation through open space
- ✓ Identify opportunities to prevent pollutants from impacting ecosystems

Is the primary purpose of this project ecological restoration?

Yes

Project Benefits

Provides flood protection through nature-based solutions	Yes
Reduces storm damage	Yes
Recharges groundwater	No
Protects public water supply	No
Filters stormwater using green infrastructure	Yes
Improves water quality	Yes
Promotes decarbonization	No
Enables carbon sequestration	Yes
Provides oxygen production	Yes
Improves air quality	Yes
Prevents pollution	Maybe
Remediates existing sources of pollution	Maybe
Protects fisheries, wildlife, and plant habitat	Yes
Protects land containing shellfish	No
Provides pollinator habitat	Maybe

Provides recreation	Maybe
Provides cultural resources/education	Yes
Project Climate Exposure	
Is the primary purpose of this project ecological restoration?	Yes
Does the project site have a history of coastal flooding?	Yes
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	Unsure
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	No
Are existing trees being removed as part of the proposed project?	No
Project Assets	

Asset: Degraded coastal dune
Asset Type: Coastal Resource Area
Asset Sub-Type: Coastal dune
Construction Type: Restoration or enhancement
Construction Year: 2023
Useful Life: 1

Report Comments

N/A

Section G

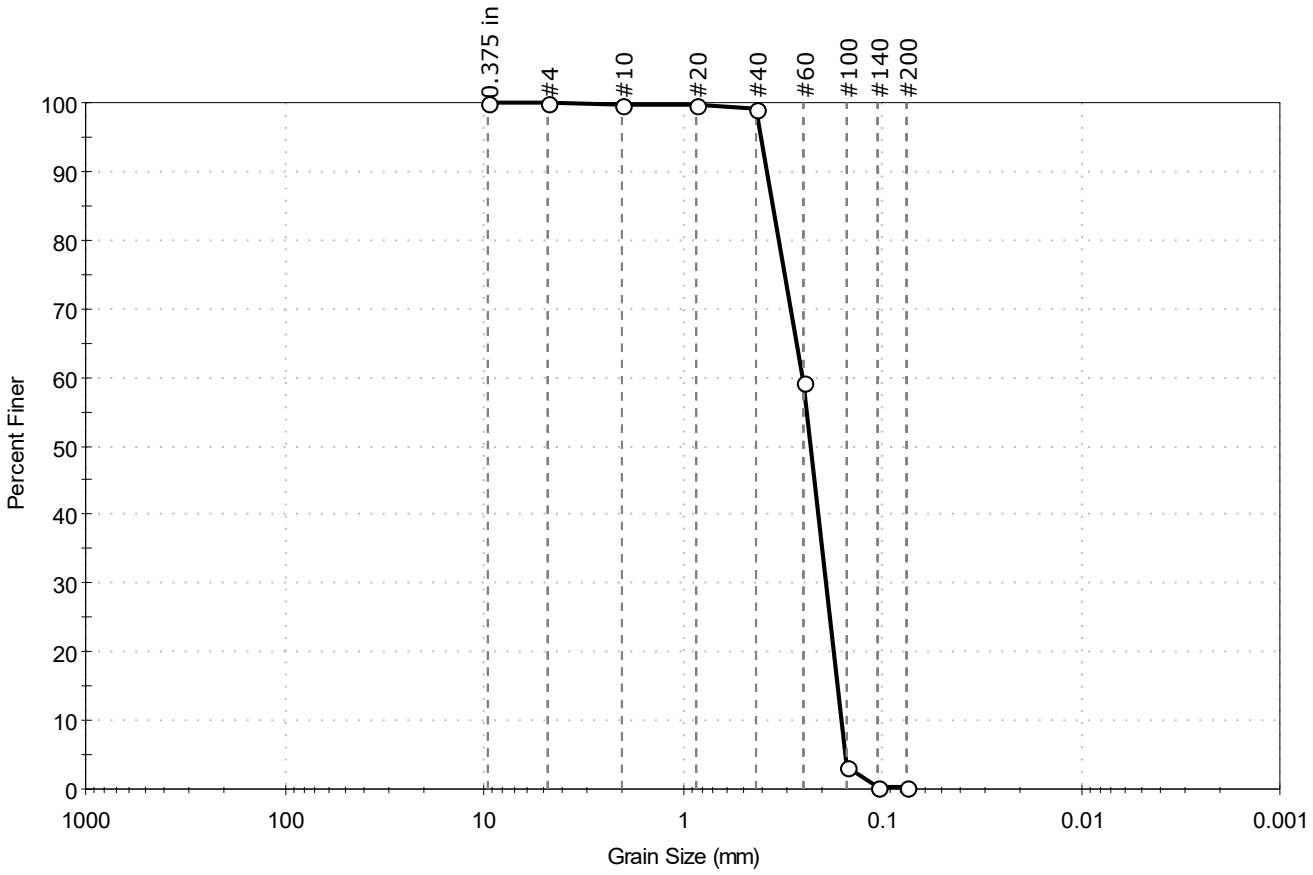
Grain Size Analyses

Grain Size Data for:

Grain Size Analysis, dated 02/19/2019

Client:	Woods Hole Group				
Project:	Nantasket_021119				
Location:	Hull, MA			Project No:	GTX-309547
Boring ID:	---	Sample Type:	bag	Tested By:	GA
Sample ID:	GS-18	Test Date:	02/19/19	Checked By:	jsc
Depth :	Surface	Test Id:	493593		
Test Comment:	---				
Visual Description:	Moist, gray sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.1	99.6	0.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	59		
#100	0.15	3		
#140	0.11	0		
#200	0.075	0.3		

Coefficients

D_{85} = 0.3525 mm	D_{30} = 0.1913 mm
D_{60} = 0.2524 mm	D_{15} = 0.1668 mm
D_{50} = 0.2297 mm	D_{10} = 0.1594 mm
C_u = 1.583	C_c = 0.910

Classification

ASTM Poorly graded SAND (SP)

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---

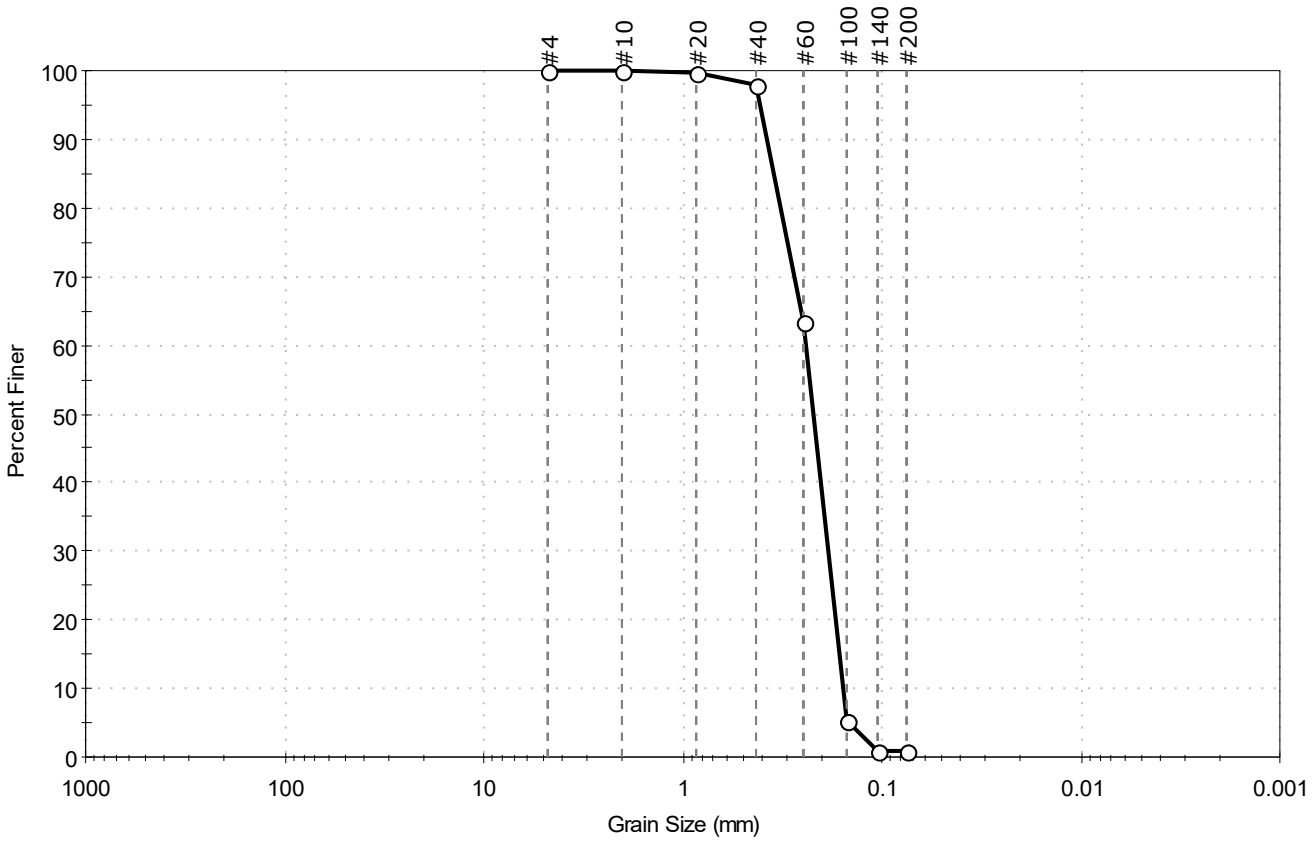
Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	Woods Hole Group				
Project:	Nantasket_021119				
Location:	Hull, MA			Project No:	GTX-309547
Boring ID:	---	Sample Type:	bag	Tested By:	GA
Sample ID:	GS-19	Test Date:	02/19/19	Checked By:	jsc
Depth :	Surface	Test Id:	493594		

Test Comment: ---
Visual Description: Moist, gray sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	99.1	0.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	98		
#60	0.25	63		
#100	0.15	5		
#140	0.11	1		
#200	0.075	0.9		

Coefficients

D_{85} = 0.3482 mm	D_{30} = 0.1864 mm
D_{60} = 0.2425 mm	D_{15} = 0.1635 mm
D_{50} = 0.2222 mm	D_{10} = 0.1564 mm
C_u = 1.551	C_c = 0.916

Classification

ASTM Poorly graded SAND (SP)

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---

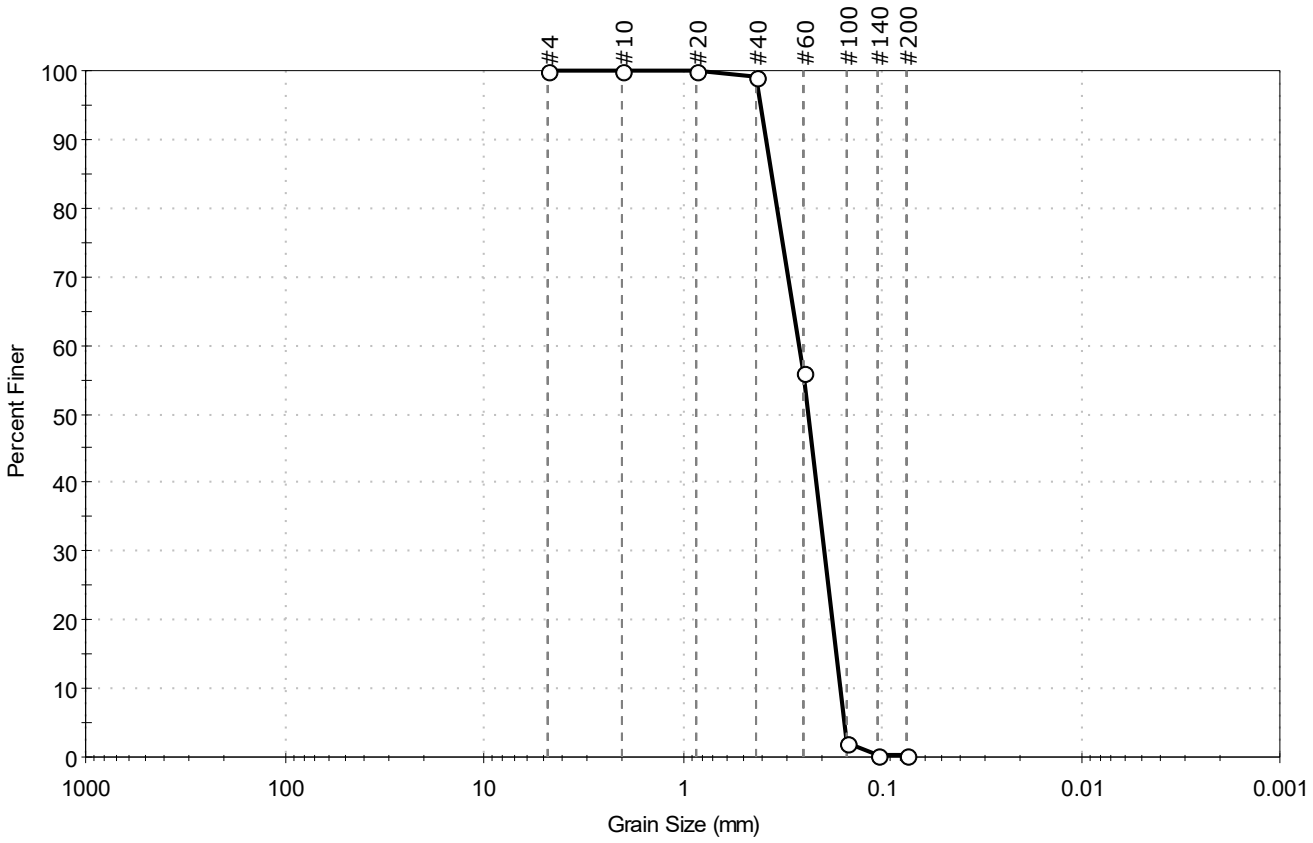
Sand/Gravel Hardness : ---

GeoTesting EXPRESS

Client:	Woods Hole Group				
Project:	Nantasket_021119				
Location:	Hull, MA			Project No:	GTX-309547
Boring ID:	---	Sample Type:	bag	Tested By:	GA
Sample ID:	GS-20	Test Date:	02/19/19	Checked By:	jsc
Depth :	Surface	Test Id:	493595		

Test Comment: ---
Visual Description: Moist, gray sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	99.8	0.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	56		
#100	0.15	2		
#140	0.11	0		
#200	0.075	0.2		

Coefficients

D_{85} = 0.3568 mm D_{30} = 0.1954 mm
D_{60} = 0.2624 mm D_{15} = 0.1695 mm
D_{50} = 0.2361 mm D_{10} = 0.1617 mm
C_u = 1.623 C_c = 0.900

Classification

ASTM Poorly graded SAND (SP)

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

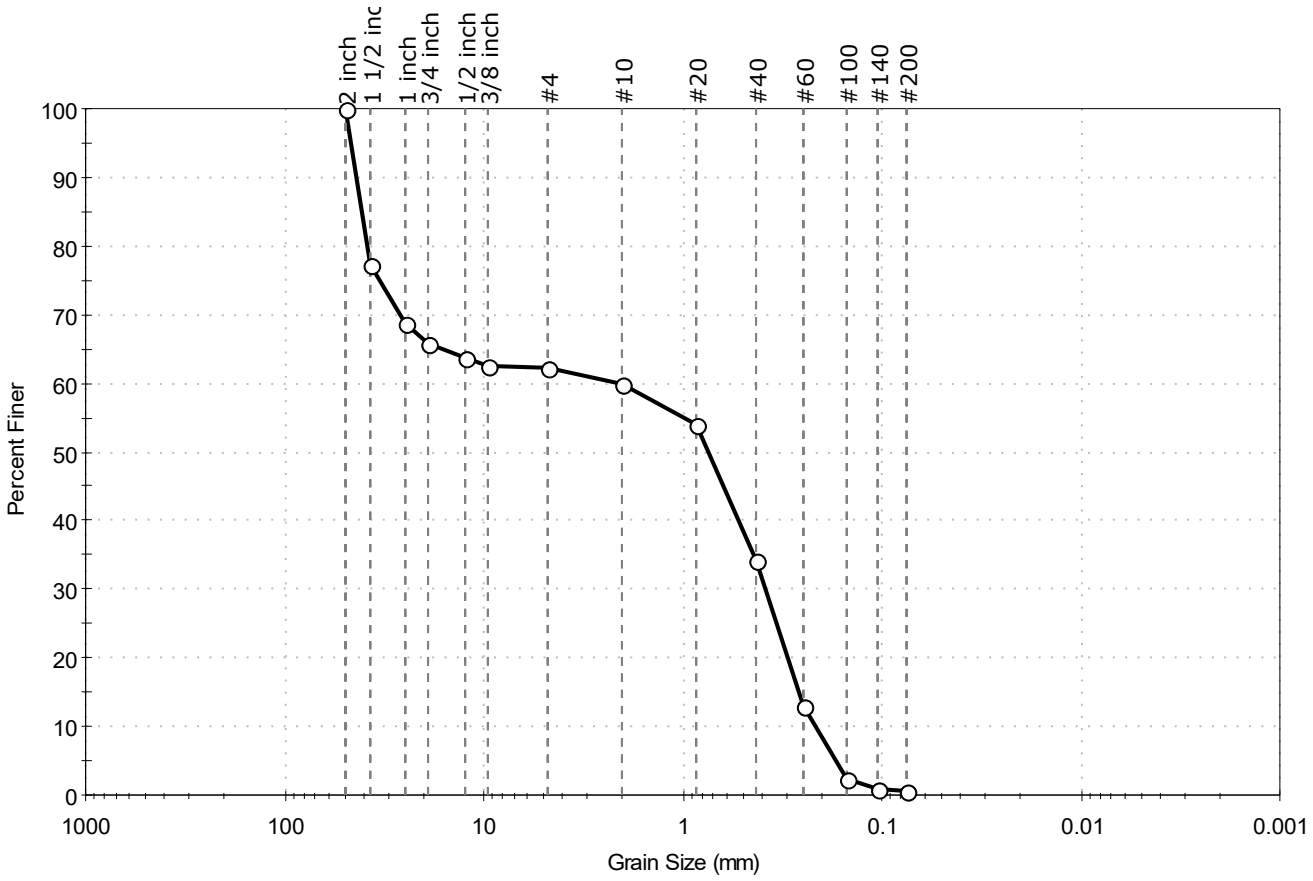
Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---

Grain Size Data for:

Grain Size Analysis, dated 12/09/2021

Client:	Woods Hole Group				
Project:	Nantasket Dune				
Location:	Hull, MA			Project No:	GTX-314668
Boring ID:	10/29/2021	Sample Type:	bag	Tested By:	ckg
Sample ID:	HULL-NE-102921	Test Date:	12/08/21	Checked By:	bfs
Depth :	---	Test Id:	643239		
Test Comment:	---				
Visual Description:	Moist, gray sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	37.7	61.6	0.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 inch	50.00	100		
1 1/2 inch	37.50	77		
1 inch	25.00	69		
3/4 inch	19.00	66		
1/2 inch	12.50	64		
3/8 inch	9.50	63		
#4	4.75	62		
#10	2.00	60		
#20	0.85	54		
#40	0.42	34		
#60	0.25	13		
#100	0.15	2		
#140	0.11	1		
#200	0.075	0.7		

Coefficients

D_{85} = 41.3765 mm D_{30} = 0.3821 mm

D_{60} = 2.0836 mm D_{15} = 0.2624 mm

D_{50} = 0.7418 mm D_{10} = 0.2163 mm

C_u = 9.633 C_c = 0.324

Classification

ASTM Poorly graded SAND with Gravel (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

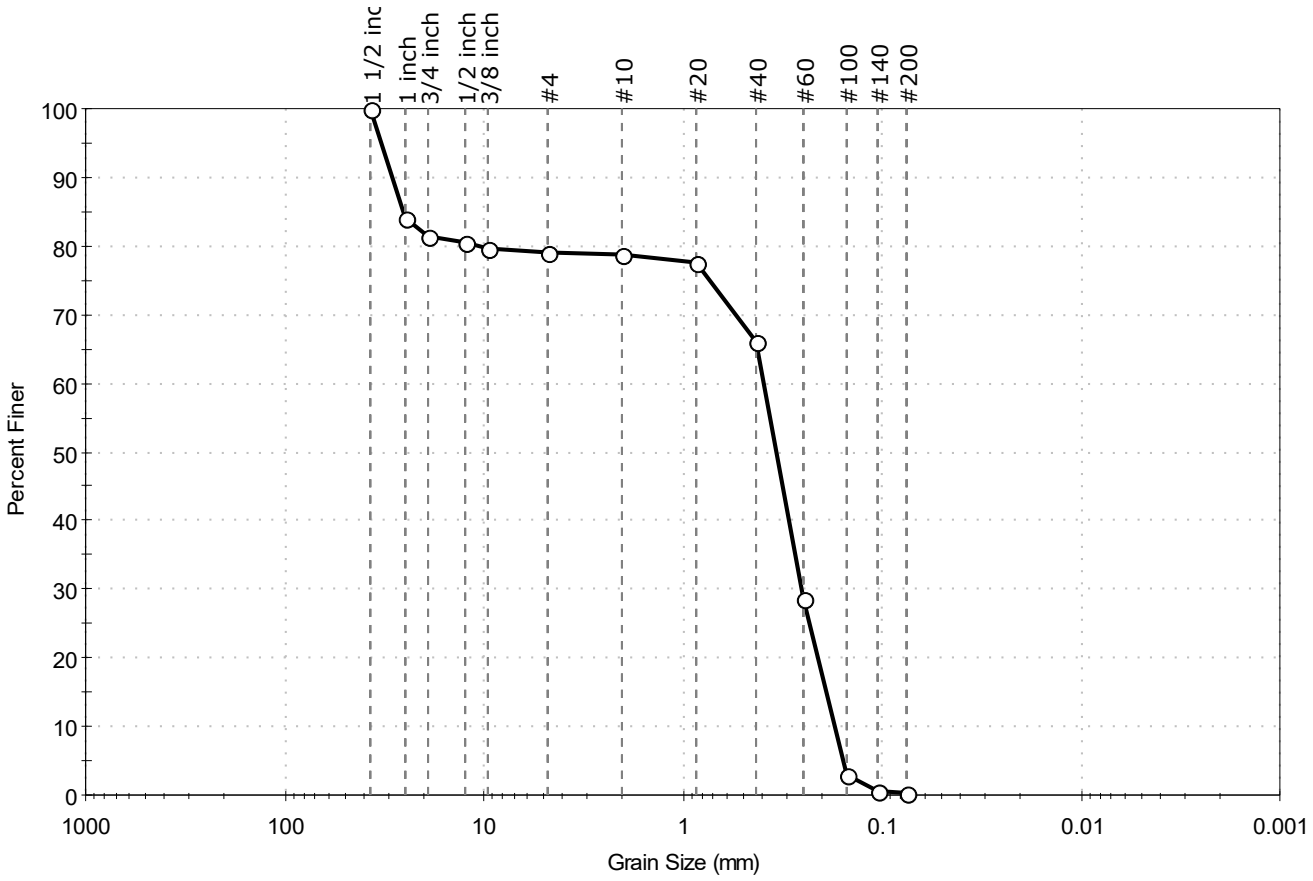
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	Woods Hole Group				
Project:	Nantasket Dune				
Location:	Hull, MA			Project No:	GTX-314668
Boring ID:	10/29/2021	Sample Type:	bag	Tested By:	ckg
Sample ID:	HULL-NN-102921	Test Date:	12/08/21	Checked By:	bfs
Depth :	---	Test Id:	643240		
Test Comment:	---				
Visual Description:	Moist, dark gray sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	20.8	78.8	0.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 1/2 inch	37.50	100		
1 inch	25.00	84		
3/4 inch	19.00	82		
1/2 inch	12.50	81		
3/8 inch	9.50	80		
#4	4.75	79		
#10	2.00	79		
#20	0.85	78		
#40	0.42	66		
#60	0.25	29		
#100	0.15	3		
#140	0.11	1		
#200	0.075	0.4		

Coefficients

D_{85} = 25.6546 mm D_{30} = 0.2552 mm
D_{60} = 0.3894 mm D_{15} = 0.1907 mm
D_{50} = 0.3382 mm D_{10} = 0.1725 mm
C_u = 2.257 C_c = 0.970

Classification

ASTM Poorly graded SAND with Gravel (SP)

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

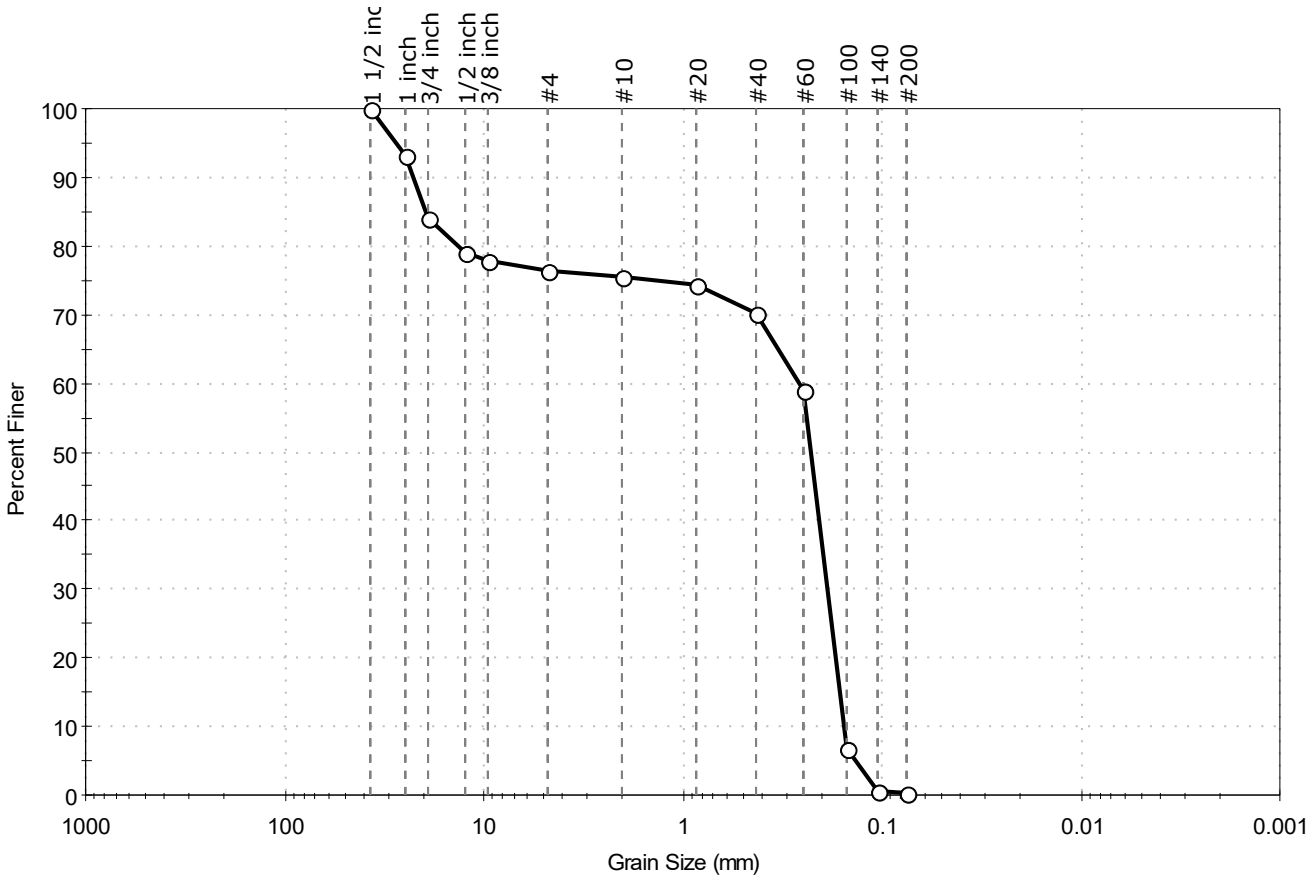
Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	Woods Hole Group				
Project:	Nantasket Dune				
Location:	Hull, MA			Project No:	GTX-314668
Boring ID:	10/29/2021	Sample Type:	bag	Tested By:	ckg
Sample ID:	HULL-SE-102921	Test Date:	12/08/21	Checked By:	bfs
Depth :	---	Test Id:	643241		
Test Comment:	---				
Visual Description:	Moist, dark gray sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	23.7	76.0	0.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 1/2 inch	37.50	100		
1 inch	25.00	93		
3/4 inch	19.00	84		
1/2 inch	12.50	79		
3/8 inch	9.50	78		
#4	4.75	76		
#10	2.00	76		
#20	0.85	74		
#40	0.42	70		
#60	0.25	59		
#100	0.15	7		
#140	0.11	1		
#200	0.075	0.3		

Coefficients

D_{85} = 19.5157 mm D_{30} = 0.1881 mm

D_{60} = 0.2605 mm D_{15} = 0.1625 mm

D_{50} = 0.2287 mm D_{10} = 0.1548 mm

C_u = 1.683 C_c = 0.877

Classification

ASTM Poorly graded SAND with Gravel (SP)

AASHTO Fine Sand (A-3 (1))

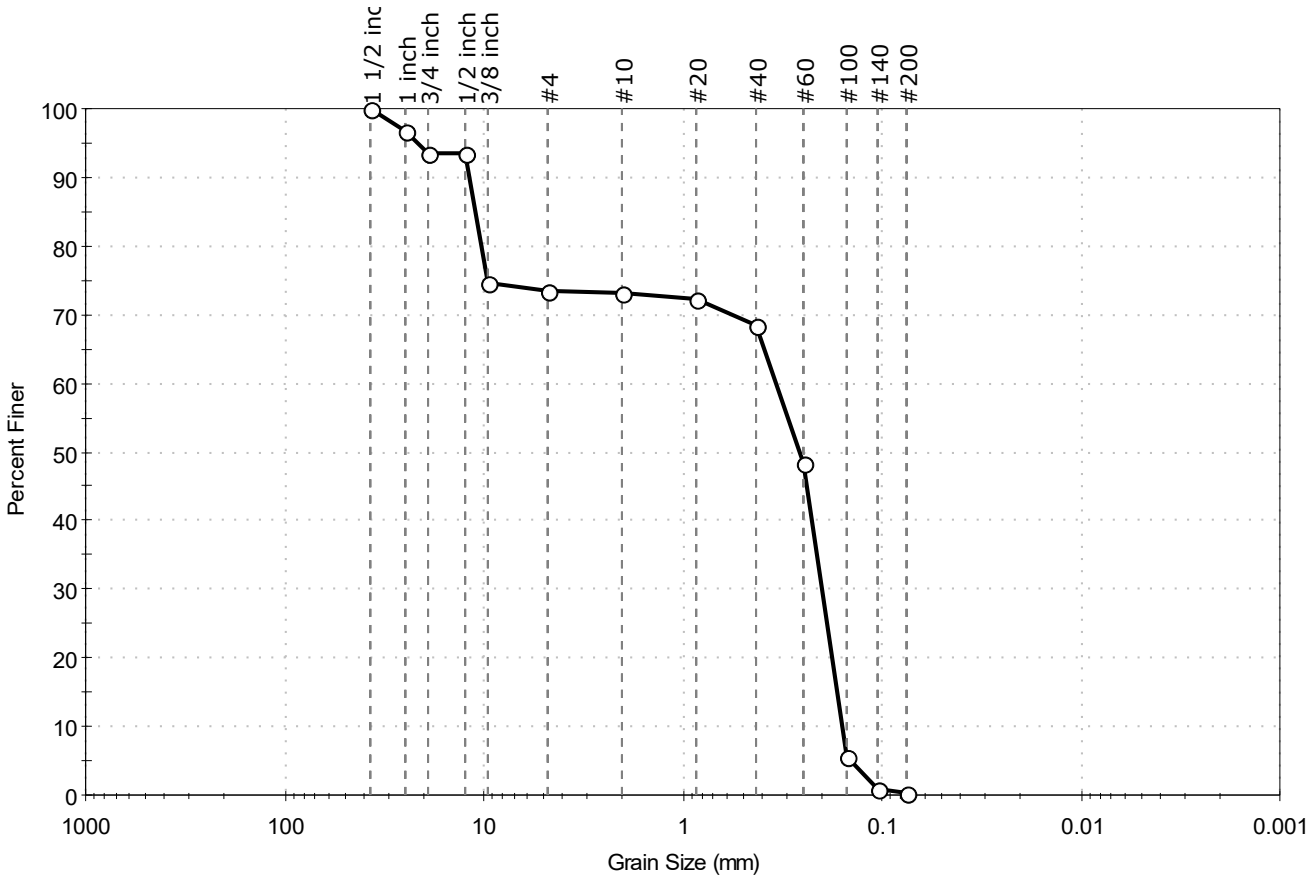
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Woods Hole Group				
Project:	Nantasket Dune				
Location:	Hull, MA			Project No:	GTX-314668
Boring ID:	10/29/2021	Sample Type:	bag	Tested By:	ckg
Sample ID:	HULL-SN-102921	Test Date:	12/09/21	Checked By:	bfs
Depth :	---	Test Id:	643242		
Test Comment:	---				
Visual Description:	Moist, brownish gray sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	26.4	73.2	0.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 1/2 inch	37.50	100		
1 inch	25.00	97		
3/4 inch	19.00	94		
1/2 inch	12.50	94		
3/8 inch	9.50	75		
#4	4.75	74		
#10	2.00	73		
#20	0.85	72		
#40	0.42	68		
#60	0.25	48		
#100	0.15	6		
#140	0.11	1		
#200	0.075	0.4		

Coefficients

D_{85} = 11.0318 mm	D_{30} = 0.2007 mm
D_{60} = 0.3404 mm	D_{15} = 0.1677 mm
D_{50} = 0.2610 mm	D_{10} = 0.1579 mm
C_u = 2.156	C_c = 0.749

Classification

ASTM Poorly graded SAND with Gravel (SP)

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Section H

Public Notice and EENF Distribution List

PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

PROJECT: Proposed Coastal Dune Restoration

LOCATION: Road Layout of Beach Ave, adjacent 27-53 Beach Ave, Hull, MA

PROPONENT: Town of Hull

The undersigned is submitting an Environmental Notification Form ("ENF") to the Secretary of Energy and Environmental Affairs on or before May 2, 2022.

This will initiate review of the above project pursuant to the Massachusetts Environmental Policy Act ("MEPA", M.G.L. c. 30, s.s. 61-62I). Copies of the ENF may be obtained from:

Town of Hull, Proponents
c/o Woods Hole Group, Inc.
A CLS Group Company
Attn: Kalinda Roberts
107 Waterhouse Road, Bourne, MA 02532
(508) 495-6273
email: kroberts@woodsholegroup.com

An electronic copy of the ENF is also being sent to the Hull Conservation Commission and Planning Board, where it may be inspected if the Town Hall is open to the public.

The Secretary of Energy and Environmental Affairs will publish notice of the ENF in the Environmental Monitor, will receive public comments on the project for twenty (20) days, and will then decide, within ten (10) days if an environmental Impact Report is needed. A site visit and consultation session on the project may also be scheduled. All persons wishing to comment on the project, or to be notified of a site visit or consultation session, should write to the Secretary of Energy and Environmental Affairs, 100 Cambridge Street, Suite 900, Boston, MA 02114, Attention: MEPA Office, referencing the above project.

By the Town of Hull (Proponent)

Dept. Of Environmental Protection
Commissioner's Office
One Winter Street
Boston, MA 02108
helena.boccadoro@mass.gov

DEP/Southeast Regional Office
Attn: MEPA Coordinator
20 Riverside Drive
Lakeville, MA 02347
george.zoto@mass.gov
jonathan.hobill@mass.gov

MA DOT – District #5
Attn: MEPA Coordinator
Box 111, 1000 County Street
Taunton, MA 02780
barbara.lachance@dot.state.ma.us

Town of Hull
Board of Health
253 Atlantic Ave
Hull, MA 02045
ebarone@town.hull.ma.us

Town of Hull
Board of Selectmen
253 Atlantic Ave
Hull, MA 02045
lwest@town.hull.ma.us

Coastal Zone Management
Attn: Project Review Coordinator
251 Causeway St., Suite 800
Boston, MA 02114
robert.boeri@mass.gov
patrice.bordonaro@mass.gov

Natural Heritage & Endangered Species Program
Division of Fisheries & Wildlife
Attn: Environmental Reviewer
1 Rabbit Hill Road
Westborough, MA 01581
melany.cheeseman@mass.gov
emily.holt@mass.gov

Massachusetts Historic Commission
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Mass. Department of Transportation
Public/Private Development Unit
10 Park Plaza, Suite 4150
Boston, MA 02116
MassDOTPPDU@dot.state.ma.us

Metropolitan Area Planning Council
60 Temple Place/6th floor
Boston, MA 02111
mpillsbury@mapc.org
afelix@mapc.org

Town of Hull
Planning Board
253 Atlantic Ave
Hull, MA 02045
cdilorio@town.hull.ma.us
sclarren@town.hull.ma.us

Town of Hull
Conservation Commission
253 Atlantic Ave
Hull, MA 02045
ckrahforst@town.hull.ma.us

Division of Marine Fisheries
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
DMF.EnvReview-North@state.ma.us

EEA Environmental Justice Director
100 Cambridge Street, Suite 900
Boston, MA 02144
MEPA-EJ@mass.gov

Section I

List of Required Permits & Reviews

I. LIST OF REQUIRED PERMITS & REVIEWS

Issuing Agency	Application	Application or File No.	Permit Name
Executive Office of Energy and Environmental Affairs (EEA)	Environmental Notification Form (ENF)	TBD	Certificate of the Secretary of EEA for ENF
Hull Conservation Commission	Notice of Intent	TBD	Order of Conditions

Section J

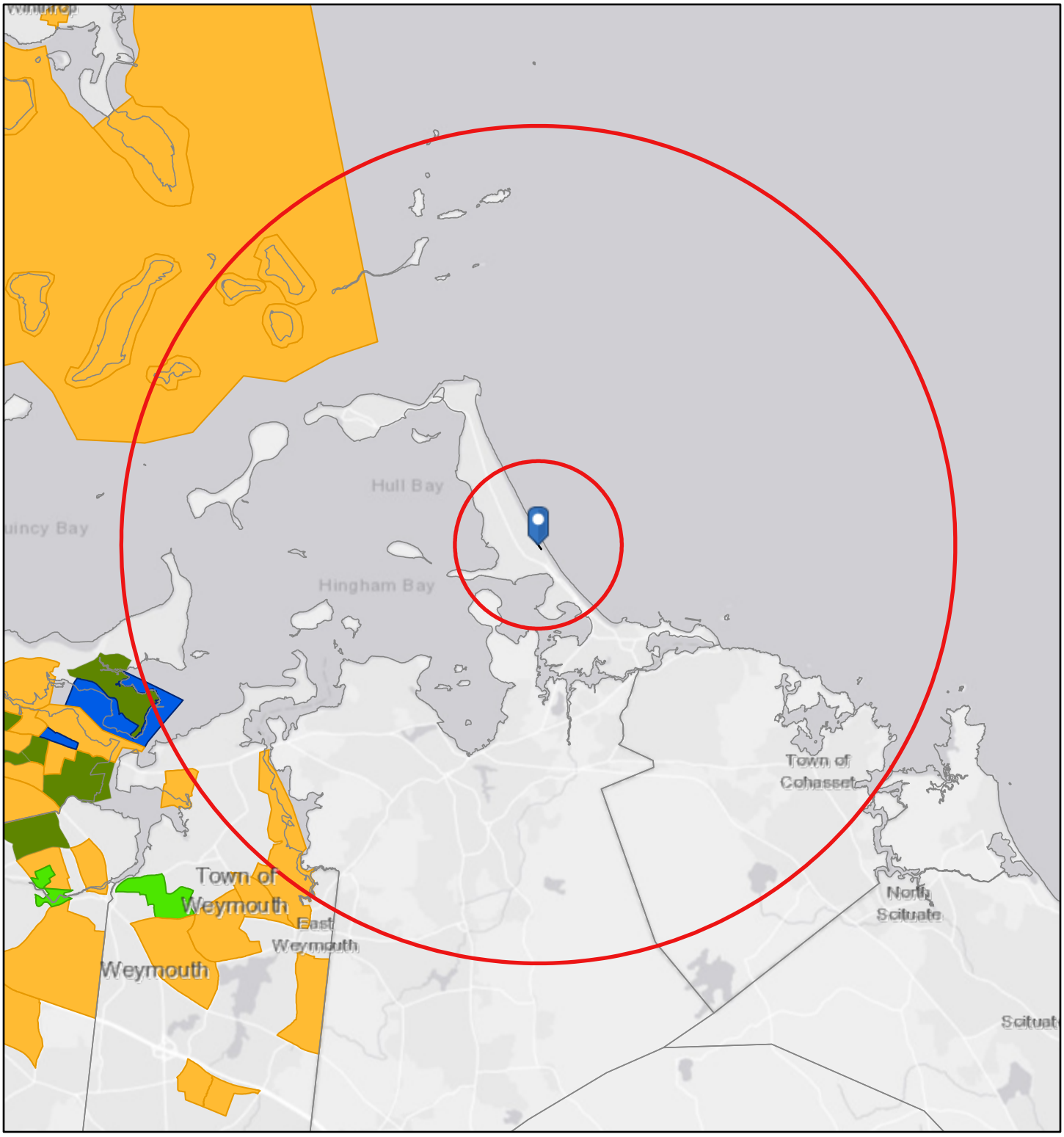
Project Maps and Plans

WOODS HOLE GROUP
A CLS COMPANY

107 Waterhouse Road
Bourne, MA 02532

Town of Hull
Coastal Dune Restoration
Town-owned layout of Beach Ave
Hull, MA
USGS Hull Quadrangle, Map Scale 1:24,000

2020 Environmental Justice Populations



4/18/2022, 12:24:33 PM

1:144,448

WHG_Proposed Dune_4-13-2022

Override 1

0 0.75 1.5 3 mi

0 1.5 3 6 km

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

MA Executive Office of Energy and Environmental Affairs

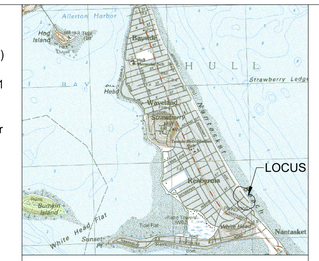
MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS | Esri, HERE, NPS | EEA GIS |

Legend

- Existing 10' Contour
- Existing 2' Contour
- Existing Spot Elevation
- Mean High Water
- High Tide line
- FEMA Flood Zone Boundary
- NHESP Priority Habitat Boundary
- Grain Size Sample Location

Notes:

1. Elevations shown are based on the North American Vertical Datum (NAVD88) in US Survey Feet units.
2. Topography was performed by Woods Hole Group on Oct. 29 & Dec. 1, 2021 with additional topographic information supplied by GEI Consultants who conducted an aerial survey on October 11 & 12, 2021.
3. Beach access path at the Malta Street intersection previously permitted under SE35-1380. Other unauthorized footpaths are also shown.
4. Mean Low Water Elevation is approximately -4.95 feet NAVD88.
5. Mean High Water Elevation is approximately +4.05 feet NAVD88.
6. High Tide Line Elevation is approximately +6.92 feet NAVD88.
7. Sediment samples collected on October 29th, 2021 and a grain size analysis determined the median grain size to be 0.39 mm.
8. 2018 Aerial orthophotograph provided by USACE.

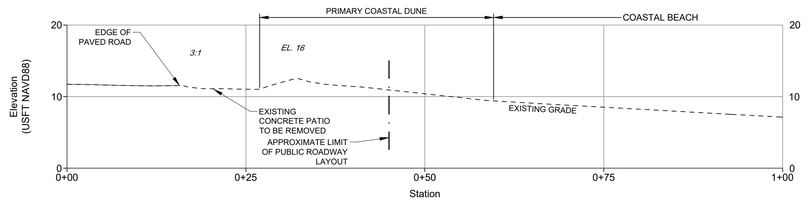


Location Map Not to Scale

Graphic Scale

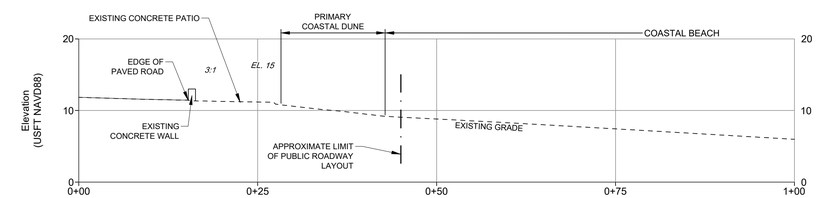
40 20 0 40 120

1" = 40'



TRANSECT A

SCALE: 1" = 10' HORIZ. & VERT.



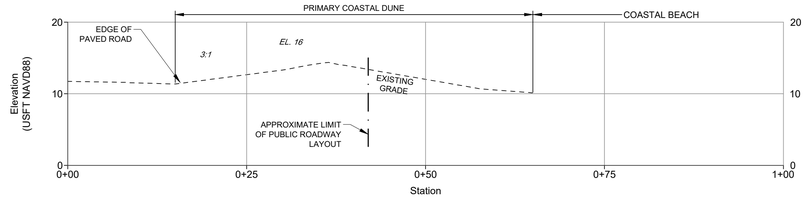
TRANSECT B

SCALE: 1" = 10' HORIZ. & VERT.

Graphic Scale

10 5 0 10 30

1" = 10'



TRANSECT C

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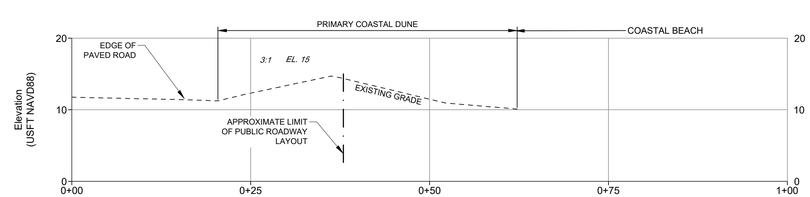


TRANSECT D

SCALE: 1" = 10' HORIZ. & VERT.

WOODS HOLE GROUP
A CLS COMPANY
107 WATERHOUSE ROAD, BOURNE, MA 02532
TELEPHONE: (508) 540-8080 FAX: (508) 540-1001

Revisions	Date
1.	
2.	
3.	
4.	
5.	
6.	
7.	

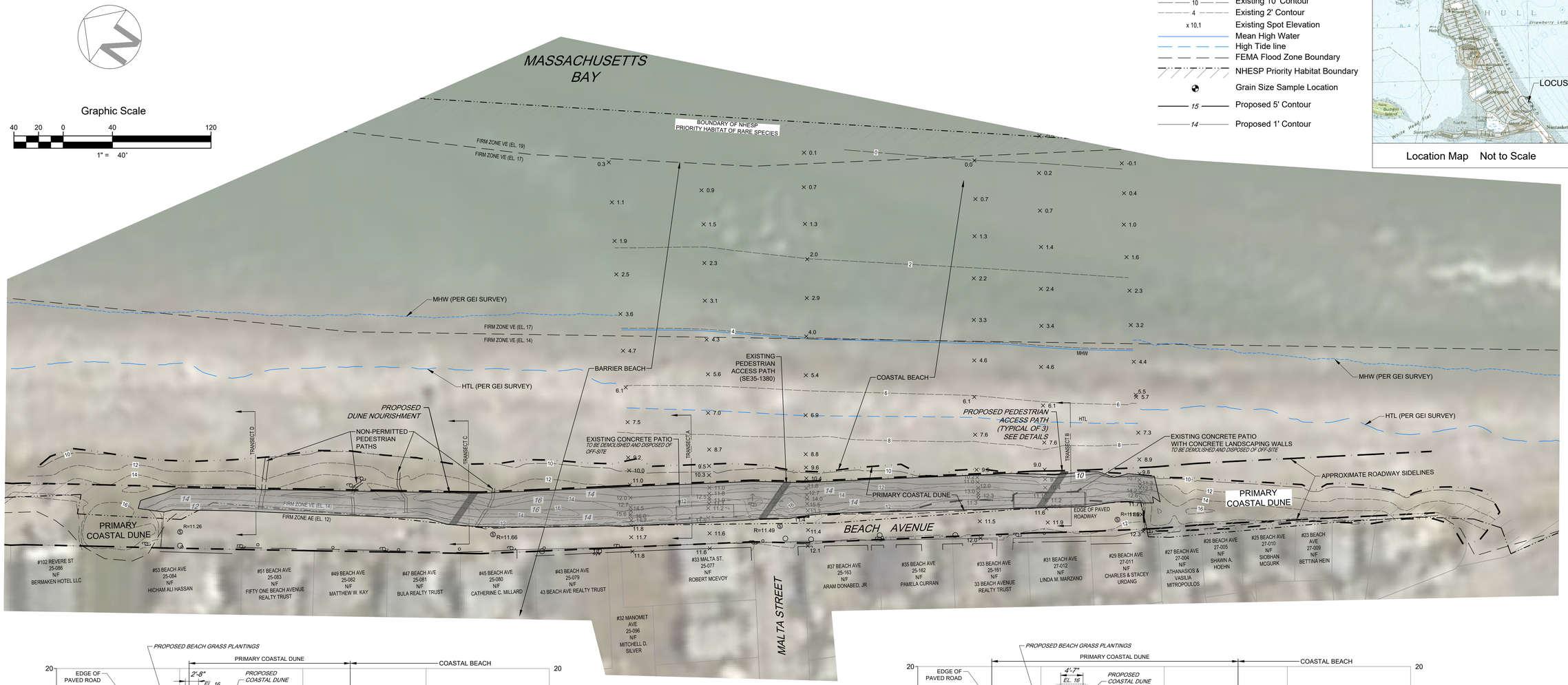
Surveyed By:

WOODS HOLE GROUP
A CLS COMPANY
107 WATERHOUSE ROAD
BOURNE, MA 02532

Title:

PROPOSED DUNE RESTORATION
TOWN OF HULL
HULL, MA
EXISTING CONDITIONS PLAN

Project Number:	21-0071
Dwg File:	21-0071_SP
Scale:	1" = 40'
Date:	APR. 13, 2022
Approved:	
Drawn:	JRK



Graphic Scale

40 20 0 40 120

1" = 40'

Legend

- Existing 10' Contour
- Existing 2' Contour
- x 10.1 Existing Spot Elevation
- Mean High Water
- High Tide line
- FEMA Flood Zone Boundary
- NHESP Priority Habitat Boundary
- Grain Size Sample Location
- Proposed 5' Contour
- Proposed 1' Contour

Location Map Not to Scale

WOODS HOLE GROUP
A CLS COMPANY
107 WATERHOUSE ROAD, BOURNE, MA 02532
TELEPHONE: (508) 540-8080 FAX: (508) 540-1001

	Date
1.	
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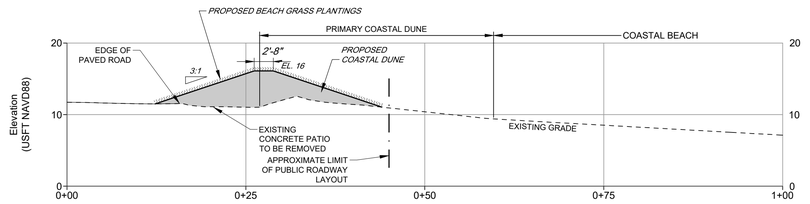
7.	

Revisions

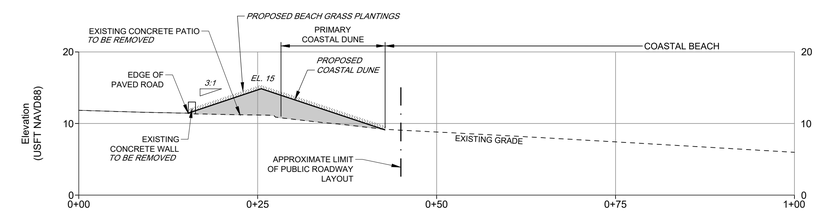
Surveyed By:

WOODS HOLE GROUP
A CLS COMPANY
107 WATERHOUSE ROAD
BOURNE, MA 02532



TRANSECT A

SCALE: 1" = 10' HORIZ. & VERT.



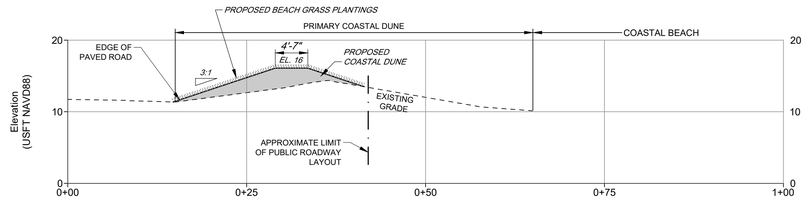
TRANSECT B

SCALE: 1" = 10' HORIZ. & VERT.

Graphic Scale

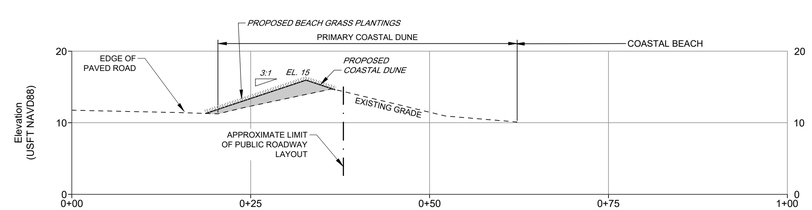
10 5 0 10 30

1" = 10'



TRANSECT C

SCALE: 1" = 10' HORIZ. & VERT.



TRANSECT D

SCALE: 1" = 10' HORIZ. & VERT.

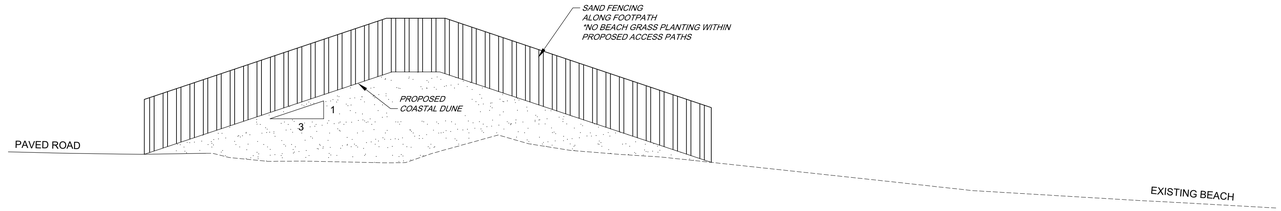
Title:

PROPOSED DUNE RESTORATION
TOWN OF HULL
HULL, MA
PROPOSED NOURISHMENT PLAN

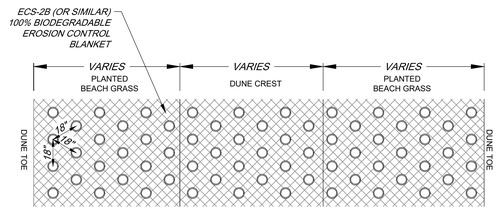
Project Number:	21-0071
Dwg File:	21-0071_SP
Scale:	1" = 40'
Date:	APR. 22, 2022
Approved:	
Drawn:	JRK

Notes:

1. Elevations shown are based on the North American Vertical Datum (NAVD88) in US Survey Feet units.
2. Topography was performed by Woods Hole Group on Oct. 29 & Dec. 1, 2021 with additional topographic information supplied by GEI Consultants who conducted an aerial survey on October 11 & 12, 2021.
3. Beach access path at the Malta Street intersection previously permitted under SE35-1380. Other non-permitted footpaths are also shown.
4. Mean Low Water Elevation is approximately -4.95 feet NAVD88.
5. Mean High Water Elevation is approximately +4.05 feet NAVD88.
6. High Tide Line Elevation is approximately +6.92 feet NAVD88.
7. Sediment samples collected on October 29th, 2021 and a grain size analysis determined the median grain size to be 0.39 mm.
8. 2018 Aerial orthophotograph provided by USACE.
9. The dune nourishment project presented herein is intended to provide limited protection from storm damage and wave overtopping.
10. The length of the proposed dune restoration project is 828 feet and the proposed footprint is approximately 20,922 square feet (0.5 acres).
11. Prior to construction, existing manmade structures will be removed including the concrete patios, concrete posts, firepits, and concrete separator walls.
12. Approximately 830 cubic yards of beach compatible sand will be placed in the project footprint. Sand will be analyzed to ensure that it matches the existing grain size (~0.39 mm) and color found in the adjacent sections of dune.
13. The dune crest will be restored to match adjacent sections of vegetated dune as close to elevation 16 feet NAVD88 that the proposed 3H:1V side slopes will allow.
14. Construction access will be from Malta St and Beach Avenue, which will provide access along the full length of the project. Imported material will be placed directly within the footprint or adjacent to it in the roadway. All work to place material will occur from Beach Ave and no work will occur on the Coastal Beach.
15. Work shall be performed in accordance with local and state permits as required.
16. Following final grading of the dune nourishment, the entire new dune area other than the three (3) permitted pedestrian access paths shall be planted with Cape American Beach Grass as bare root culms with 2-3 culms per hole and 18" on-center as shown on the detail.
17. Three (3) four foot (4') wide pedestrian access pathways shall be placed over the dune in the areas of the proposed dune restoration shown on the plan. The paths shall be oriented southeasterly to reduce impacts from Nor'easter storm events. The path boundaries shall be marked with snow fencing or equivalent.
18. The proposed dune shall require annual maintenance at least annually or as needed after storms. Maintenance will include both sand nourishment to maintain crest height and width as well as plantings and fencing, as needed.
19. The proposed design is only expected to provide a limited level of flood protection during small to moderate coastal storms, and will require regular maintenance, as described in Note #18, over the long term in order to maintain these protections.
20. The Project footprint is located within a state designated barrier beach resource area that encompasses the majority of the low-lying Hull peninsula. Barrier beach consists of coastal beach, extending from mean low water to the seaward toe of the primary dune, and coastal dune extending landward to the Hull Bay shoreline. The Project footprint is within the primary coastal dune adjacent to #27 thru #53 Beach Ave, though the coastal dune resource area extends landward of this footprint.



PP PROPOSED PEDESTRIAN PATH - TYPICAL CROSS SECTION
SCALE: 1" = 4'



LEGEND:
CAPE AMERICAN BEACH GRASS

NOTES:
1. PLANTS AND ROOTS MUST BE KEPT MOIST BEFORE AND DURING PLANTING.
2. PLANT 2-3 CULMS PER HOLE, APPROXIMATELY 7" - 9" DEEP.
3. COMPACT THE SAND FIRMLY AROUND THE PLANS.

BG BEACH GRASS PLANTING - TYPICAL DETAIL
SCALE: 1" = 4'

Graphic Scale

4 2 0 4 12

1" = 4'

WOODS HOLE GROUP
A CLS COMPANY
107 WATERHOUSE ROAD, BOURNE, MA 02532
TELEPHONE: (508) 540-8080 FAX: (508) 540-1001

	Revisions	Date
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3.		
4.		
5.		
6.		
7.		

Surveyed By:
WOODS HOLE GROUP
A CLS COMPANY
107 WATERHOUSE ROAD
BOURNE, MA 02532

Title:
PROPOSED DUNE RESTORATION
TOWN OF HULL
HULL, MA
NOTES & DETAILS

Project Number: 21-0071
Dwg File: 21-0071_SP
Scale: 1" = 40'
Date: APR. 22, 2022
Approved:
Drawn: JRK