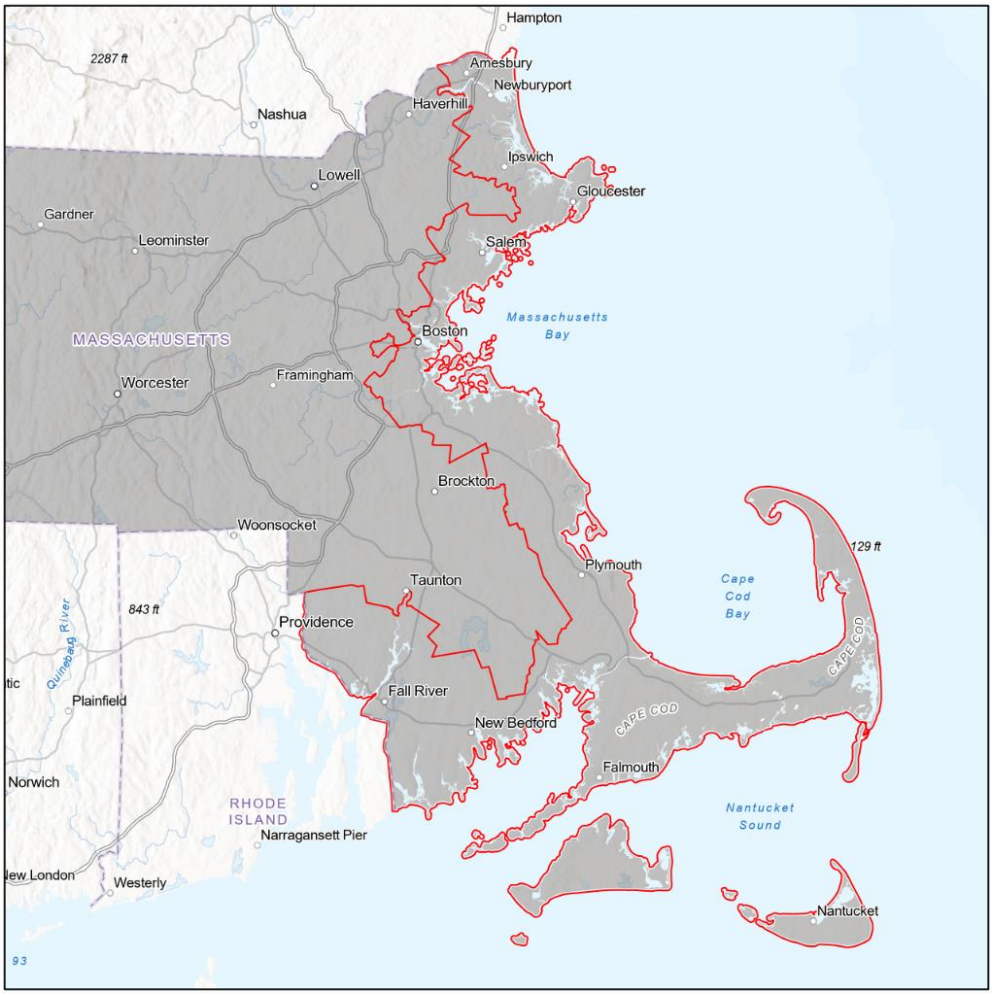

Draft Programmatic Environmental Assessment

Coastal Flood and Erosion Mitigation Projects

Commonwealth of Massachusetts

August 2022 ***– DRAFT***

U.S. Department of Homeland Security
Federal Emergency Management Agency, Region I
99 High Street, Sixth Floor
Boston, MA 02110

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ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effect
BMP	Best Management Practice
BUAR	Massachusetts Board of Underwater Archaeological Resources
CATEX	Categorical Exclusion
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resource System
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
CLOMR	Conditional Letter of Map Revision
CMR	Code of Massachusetts Regulations
DCR	Massachusetts Department of Conservation and Recreation
DMF	Massachusetts Division of Marine Fisheries
DPA	Designated Port Area
EA	Environmental Assessment
EFH	Essential Fish Habitat
EHP	Environmental Planning and Historic Preservation
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
IPaC	Information for Planning and Consultation
LOMR	Letter of Map Revision
MA CZM	Massachusetts Office of Coastal Zone Management
Mass DEP	Massachusetts Department of Environmental Protection
Mass Wildlife	Massachusetts Division of Fisheries and Wildlife
MAISWG	Massachusetts Aquatic Invasive Species Working Group
MBTA	Migratory Bird Treaty Act
MEPA	Massachusetts Environmental Policy Act
MESA	Massachusetts Endangered Species Act
MHC	Massachusetts Historical Commission
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHESP	Natural Heritage and Endangered Species Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
NRHP	National Register of Historic Places
OPA	Otherwise Protected Area
PEA	Programmatic Environmental Assessment
PA	Programmatic Agreement
RCRA	Resource Conservation and Recovery Act
SAV	Submerged aquatic vegetation
SEA	Supplemental Environmental Assessment
SHPO	State Historic Preservation Officer
TCP	Traditional Cultural Property
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Loads
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service

1.0 INTRODUCTION

The mission of the Federal Emergency Management Agency (FEMA) is helping people before, during, and after disasters. An important component of FEMA's mission is disaster resilience, which includes funding for activities that help communities reduce the future impacts of natural disasters on life and property.

The purpose of this programmatic environmental assessment (PEA) is to identify, at a programmatic level, the potential adverse and beneficial effects associated with certain coastal flood and erosion mitigation measures in the Commonwealth of Massachusetts. FEMA's experience in conducting environmental planning and historic preservation (EHP) reviews for shoreline stabilization projects, as required by the National Environmental Policy Act (NEPA), provides sufficient information to determine the likely impacts of these eligible activities on the human environment. This PEA captures and builds upon FEMA's knowledge and experience to evaluate the potential environmental effects of FEMA funding for eligible shoreline stabilization projects. The PEA also identifies specific coastal flood and erosion mitigation projects that may not require additional NEPA review and actions that would require site-specific reviews that could be tiered under this PEA. Some projects or classes of activities may continue to require project-specific NEPA compliance reviews.

FEMA prepared this PEA in accordance with NEPA, the Council on Environmental Quality (CEQ) regulations to implement NEPA (40 Code of Federal Regulations [C.F.R.] Parts 1500-1508), and agency guidance for implementing NEPA (DHS Instruction 023-01 and FEMA Instruction 108-01-1).

1.1 Process for the Use of This PEA

The CEQ regulations at 40 C.F.R. §§ 1500.4(k) and 1501.11 encourage the development of program-level NEPA environmental documents and tiering from those programmatic documents to eliminate repetitive discussions, allowing for site-specific reviews that are focused on a narrower scope specific to the subsequent action. A PEA is used to address a group of projects that are similar in scope, scale, magnitude, and the nature of the impact. In addition, CEQ regulations at 40 C.F.R. § 1501.5 allow agencies to prepare an environmental assessment (EA) on any action at any time to assist agency planning and decision-making. FEMA developed this PEA under these CEQ authorities.

For a project to qualify under this PEA, the scope of the project and the nature of impacts must be evaluated in this PEA, and a finding that the project conforms to the PEA must be documented. The compliance checklist provided in **Appendix B, Document 1** provides a framework for confirming consistency with the PEA and would be used to document compliance for the record of environmental consideration (REC) to determine if all project activities are covered under the PEA. Additional project-specific analyses may be required if the context and/or intensity of a proposed project substantively differ from those described in this PEA. All projects using this PEA will be processed under standard compliance procedures regarding other federal laws, as described in the checklist (e.g., Endangered Species Act [ESA], National Historic Preservation Act [NHPA], Coastal Zone Management Act [CZMA] and Executive Orders [EOs] for Floodplain Management, Protection of Wetlands, and Environmental Justice). FEMA reserves the right to choose to not use the PEA and prepare an individual EA for an otherwise qualifying project.

Coastal flood and erosion mitigation projects that are less complex or that affect less than a half-acre may be eligible for categorical exclusions (CATEXs) and would not require coverage under this PEA. A CATEX is a class of actions that FEMA has established through public review and comment that would not typically result in significant impacts, either individually or cumulatively. The use of a CATEX for activities that promote resilience would still require an evaluation of extraordinary circumstances and compliance with environmental and historic preservation laws and EOs. If a specific project proposal is not included in the activities described in Section 4 (the Proposed Action) and does not fall within the parameters of a CATEX, then a separate NEPA evaluation would need to be conducted.

It is expected that some coastal flood and erosion mitigation projects will be more complicated and involve larger-scale efforts than those evaluated in this PEA. If a specific action is expected to (1) create impacts not described in this PEA, (2) create impacts greater in magnitude, extent, or duration than those described in this PEA, or (3) require mitigation measures to keep impacts below significant levels that are not described in this PEA, then a supplemental environmental assessment (SEA) would be prepared to address the specific action. The SEA would be tiered from this PEA in accordance with CEQ's NEPA-implementing regulations. Actions that are determined to require a more detailed or broader environmental review may require the preparation of a stand-alone EA or other applicable NEPA process.

This PEA is intended to facilitate FEMA's compliance with EHP requirements by providing a framework to address the potential impacts of shoreline stabilization actions. FEMA coordinates and integrates, to the maximum extent possible, the review and compliance processes required by other federal laws and policies such as Section 106 of the NHPA, Section 7 of the ESA, the Eight-Step Analysis for EOs 11988 and 11990, and others into the NEPA review. This PEA provides a framework for integrating these requirements with NEPA compliance for flood and erosion mitigation projects.

This PEA does not cover actions where there are likely to be significant effects and for which it would be appropriate to develop an environmental impact statement (EIS). CEQ regulations (40 C.F.R. § 1501.3) provide guidance to determine whether the effects of an action could be significant, including the following:

- In considering whether the effects of the Proposed Action are significant, agencies will analyze the potentially affected environment and the degree of the effects of the action. Agencies should consider connected actions consistent with 40 C.F.R. § 1501.9(e)(1).
- In considering the potentially affected environment, agencies should consider, as appropriate to the specific action, the affected area (e.g., national, regional, or local) and its resources, such as listed species and designated critical habitat under the ESA or historic properties that would require review under the NHPA. Significance varies with the setting of the Proposed Action. For instance, in the case of a site-specific action, significance would usually depend only upon the effects in the local area (40 C.F.R. § 1501.3(b)(1)).
- In considering the degree of the effects, agencies should consider the following, as appropriate to the specific action (40 C.F.R. § 1501.3(b)(2)):
    - Both short- and long-term effects,
    - Both beneficial and adverse effects,
    - Effects on public health and safety, and
    - Effects that would violate federal, state, tribal, or local laws protecting the environment.

2.0 PURPOSE AND NEED

FEMA provides assistance to communities to increase disaster resilience through projects that help prevent loss of life and property and reduce disaster recovery costs. The purpose of coastal flood and erosion mitigation projects is to reduce risks associated with coastal flood and erosion hazards that affect people, structures, and infrastructure by reducing the effects of flowing water, wave action, storm surge, and sea level rise on coastal communities. These projects are needed because of repetitive and increased levels of coastal flooding and erosion due to climate change that is resulting in sea level rise and an increased frequency and intensity of storms. These changes could also result in the inundation of larger areas that would increase damage and saltwater intrusion levels (Resilient MA 2022).

3.0 PEA STUDY AREA AND BACKGROUND

The area of analysis for this PEA encompasses the coastal zone as defined by the Massachusetts Coastal Zone Management Plan and the limit of tidal influence on coastal rivers within the Commonwealth of Massachusetts (see **Appendix A, Maps 1-6**). The Massachusetts coastal zone encompasses lands and waters within an area defined by the seaward limit of the state's territorial sea, extending from the Massachusetts-New Hampshire border south to the Massachusetts-Rhode Island border, and landward to 100 feet inland of specified major roads, rail lines, other visible rights-of-way. The coastal zone includes all of Cape Cod, Nantucket, Martha's Vineyard, and the Elizabeth Islands. The coastal zone includes all islands, transitional and intertidal areas, coastal wetlands, and beaches. In isolated instances where the boundary line might exclude coastal resource areas, these resources are included in the coastal zone, although the written description follows the boundary line. Tidal rivers and adjacent uplands are included, at a minimum, to the extent of vegetation affected by measurably saline water (MA CZM 2011). For this PEA, the study area includes all landward territory within the coastal zone and seaward out to 0.25 miles from the high tide line. In addition, the study area includes tidal waters that extend inland beyond the coastal zone boundary on the Merrimack, Mystic, and Taunton rivers and includes a 0.25 mile land buffer along these tidal river areas.

This PEA only covers projects with the primary purpose of flood or erosion mitigation and connected actions that are commonly associated with coastal flood and erosion mitigation measures. FEMA assistance for coastal flood mitigation projects is generally limited to nonfederal and tribal lands in areas eligible for hazard mitigation funding.

3.1 Background

The entire Massachusetts coastline is exposed to coastal flooding and erosion from both routine tidal flooding and flooding caused by storm events. Both flood types have been increasing in frequency and intensity because of sea level rise. Flood impacts associated with tidal flooding often result in bimonthly flooding from high tides, particularly during King Tides. Higher flood levels and events from natural disturbances, such as hurricanes and Nor'easters, have also been increasing in frequency and intensity. Between 2006 and 2017 there were a total of 172 recorded coastal flood events in the Commonwealth of Massachusetts (Mass 2018). Impacts associated with severe coastal flooding include beach and dune erosion, loss of wetlands and other coastal ecosystems, saltwater intrusion into drinking and wastewater infrastructure, loss of coastal infrastructure, loss of recreation areas, and damage and loss to coastal structures that include walls, piers, bulkheads, bridges, and buildings.

3.2 State and Local Regulations

In Massachusetts, development projects and other activities that require one or more state agency actions require an environmental impact review under the Massachusetts Environmental Policy Act (MEPA) according to 301 Code of Massachusetts Regulation (CMR) 11. The MEPA review of a project is initiated through the filing of an Environmental Notification Form and identifies the MEPA review thresholds the project meets or exceeds, and any state agency actions that may be required (MEPA 2022). A Project Proponent should complete the MEPA Environmental Notification Form process prior to the NEPA review as the state process helps identify environmental resources, potential project design change requirements, and any state and federal permits needed. It is FEMA's experience that if the MEPA process is not completed prior to NEPA review, it is best to hold off on final EHP authorization until the MEPA process is complete to incorporate any design changes, project conditions, etc. Coordination with the local municipality is also recommended prior to the NEPA review process to ensure compliance with all local ordinances. Relevant laws and regulations are described in more detail in Section 5.

4.0 ALTERNATIVES

NEPA regulations state that an agency must explore and objectively evaluate all reasonable alternatives, and for alternatives that were eliminated from detailed study, briefly discuss the reasons for their elimination (40 C.F.R. 1502.14). Additionally, a No Action alternative must be included. This section describes the No Action alternative, the Proposed Action (that would provide for the purpose and need), and other alternatives that were considered but eliminated from the full analysis.

4.1 No Action Alternative

Under the No Action alternative, FEMA would not undertake or fund any action. There could be a range of possible outcomes if FEMA funding is not provided, depending on the amount of alternative funding available and priorities established by a community. Because of the broad range of communities located along the coast of Massachusetts, it is impossible to predict each community’s actions, time frame, and standards to which the work would be completed. Therefore, to provide a consistent basis for comparison to the Proposed Action, it is assumed, for the purposes of this PEA, that facilities would remain in their current state (e.g., damaged facilities would not be repaired or replaced) or local and state governments and private property owners might construct some non-FEMA funded projects that could include repairs, minor mitigation, and shoreline restoration projects that would otherwise likely not be eligible for FEMA funding. These projects would be properly engineered and permitted but may not provide the same level of protection as the Proposed Action and would not necessarily be connected or constructed in a coordinated fashion to provide protection across property boundaries or jurisdictional lines. Specific actions may take much longer to implement under the No Action alternative because of the need to gather sufficient funding for construction. The area would still be subject to flooding and erosion for the planning horizon of the PEA because of the unmitigated effects of flowing water, wave and/or wind action, tidewaters, and storm and flooding events. The No Action alternative would not result in long-term resilience or coordinated hazard mitigation.

4.2 Proposed Action

The Proposed Action includes coastal flood, erosion mitigation, and shoreline stabilization projects with up to 10 acres of ground disturbance within the study area in the Commonwealth of Massachusetts. The Proposed Action covers (1) hard engineering designs including the installation of revetments, bulkheads and seawalls, flood protection berms and levees, offshore groins, and wave attenuators along coastlines and (2) bioengineering designs including shoreline bank regrading and stabilization, beach/dune nourishment, and marsh and wetlands creation, restoration, and enhancement. Equipment staging and access routes for the Proposed Action could be excluded from the 10-acre ground disturbance area if the access and staging areas do not require any ground disturbance to prepare them for use. The Proposed Action may also include connected actions that include general repairs of coastal structures and infrastructure and may include elements, such as outfall pipes, required for the Proposed Action to function properly (Section 4.2.3). Sea level rise and projected precipitation rates should be considered when designing coastal flood and erosion mitigation projects using the latest National Oceanic and Atmospheric Administration (NOAA) sea level rise data (NOAA 2022) and design strategies within NOAA's *Adapting to Climate Change: A Planning Guide for State Coastal Managers* (NOAA 2010). Each project type is discussed in more detail below.

Several CATEXs may apply to flood mitigation and shoreline stabilization projects and a CATEX should be used for NEPA compliance when appropriate. Potentially applicable CATEXs are described in more detail in Section 4.3.2.

4.2.1 Hard Engineering Designs

Hard engineering designs use engineered structures to retain and deflect floodwaters, reduce the force of water against the shoreline, or increase shoreline resistance to erosive forces. These designs are generally more appropriate in areas of high wave energy and should be designed and evaluated carefully to avoid negative effects and degradation of the environment.

The implementation of hard engineering designs would require excavators and other heavy equipment and vehicles. In areas of steep bluffs, project materials and heavy equipment may be delivered via watercraft such as a tug and barge or surplus navy landing craft, and construction could also take place with heavy equipment on a spud barge. Hard engineering designs may or may not require in-water work. If in-water work is required, the potential for environmental impacts and project implementation methods would need to be clearly defined to assess whether those potential impacts are evaluated in this PEA.

Individual flood mitigation or shoreline stabilization projects using hard engineering techniques may span, or have impacts that span, multiple jurisdictions (i.e., local, or tribal). This PEA includes thresholds to help a Project Proponent determine whether projects may have cross-jurisdictional impacts. These thresholds have been determined through a literature review of downdrift impacts from shore-parallel hard engineering designs (e.g., seawalls, bulkheads, and revetments), shore-perpendicular hard engineering designs (e.g., groins), and breakwaters.

Coastal currents tend to carry sediments in one direction along a shoreline, which is referred to as the downdrift direction. A review of the literature found that studies of potential impacts of hard engineered techniques focused on scouring in front of shore-parallel erosion control structures and excess erosion along the adjacent shoreline to adequately design return walls. The downdrift impacts of shore-parallel structures as a function of the structure length have not been heavily studied, but some laboratory tests

have shown that the downdrift impact of a structure can be three to four times the structure length (Kraus and McDougal 1996). The downdrift impacts of shore-perpendicular structures are thought to be three to five times the structure length (Caufield 1997). Breakwaters have similar downdrift impacts as groins (Mangor et al. 2017). An SEA would be needed in cases where a jurisdictional boundary is located downdrift from the proposed project area at less than four times the length of the proposed shore-parallel structure (i.e., a seawall, bulkhead, or revetment) or less than five times the length of a proposed shore-perpendicular structure (i.e., a groin, jetty, or breakwater). In these instances, a Project Proponent would need to coordinate with the appropriate downdrift jurisdictional authorities and permitting agencies which may require the inclusion of downdrift mitigation actions.

All hard engineering methods would need to follow the requirements of the United States Army Corps of Engineers (USACE) publication *Design of Coastal Revetments, Seawalls, and Bulkheads* engineering manual (USACE 1995) and the Massachusetts Office of Coastal Zone Management (MA CZM) and Massachusetts Department of Environmental Protection (Mass DEP) publication *Applying the Massachusetts Coastal Wetlands Regulations: A Practical Manual for Conservation Commissions to Protect the Storm Damage Prevention and Flood Control Functions of Coastal Resource Areas* (2017).

4.2.1.1 Revetments

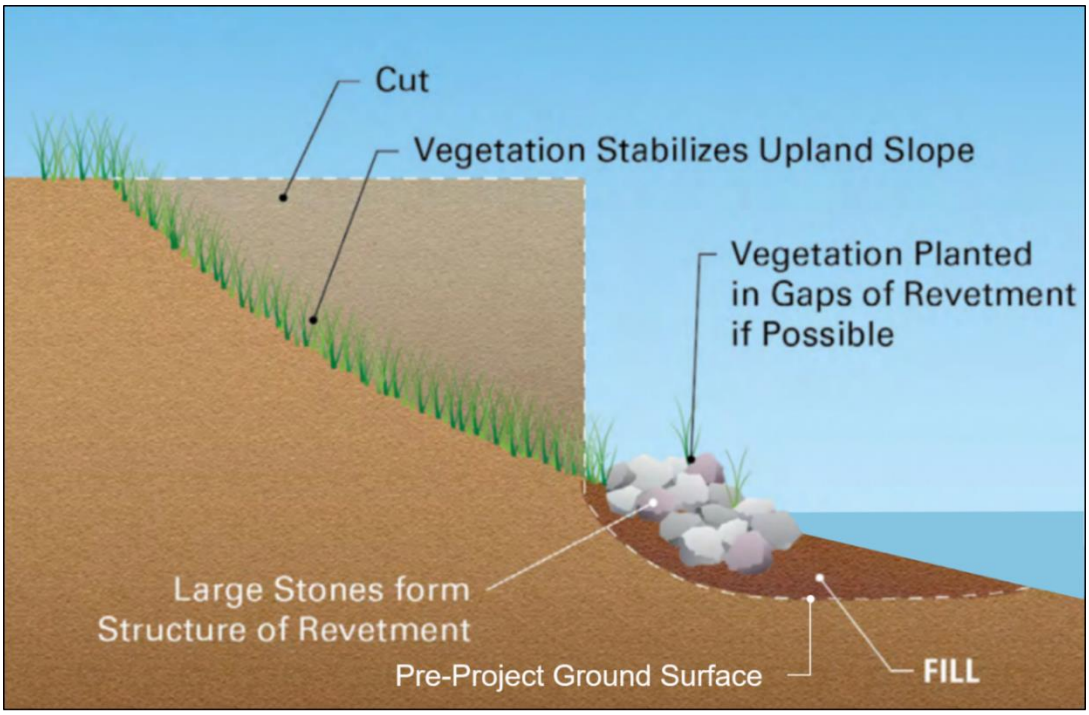
Revetments are structures that are installed to fit the slope and shape of the shoreline and are used to dissipate wave energy and provide an immediate barrier against erosion (**Figure 1**). These structures may consist of rock or riprap, concrete, cellular blocks, or other materials. A rock or riprap revetment is the installation of large rocks along a shoreline. Rocks may be angular or rounded materials sized to withstand the expected erosive forces at the site. A concrete revetment is an arrangement of concrete structures installed to fit the shape of a graded shoreline slope. Various concrete component shapes, sizes, and configurations may be used as revetments, such as stone, concrete, asphalt, or gabions (USACE 1995). Revetment installation can also include slope regrading and the installation of native vegetation on the slope above a revetment or within the spaces between the revetment rocks to increase stability and create habitat.

Revetments can provide long-term stability and long life with minimal maintenance, particularly if native or desirable vegetation is planted in spaces between revetment rocks to inhibit the growth of invasive weeds. They can be designed for high-wave-energy areas and may be flexible enough to reform if the foundation is eroded or settlement occurs. Each revetment design must consider location-specific conditions such as bank slope and stability, expected wave action, hydraulic conditions, and anticipated scour depths. Revetment toes extend into the soil to a depth that correlates with protection against toe scour from wave action. The scour depth is usually associated with the design water level (e.g., 100-year flood event), but designs may also consider long-term water level fluctuations.

Basic design elements for revetments include, but are not limited, to the following:

- Revetment materials should be selected and sized based on expected wave forces at the site.
- Revetments should extend up the bank to the elevation at which vegetation provides adequate soil stabilization. Water level range and wave height should be considered to determine the full extent of the revetment.

- The base of the revetment should be founded below the maximum scour depth or placed on non-erosive material. The potential for prolonged periods of low water should be considered because they may focus wave energy at the base of the revetment.
- Toe protection, including toe buttresses, is required to prevent displacement of the seaward edge of the revetment.



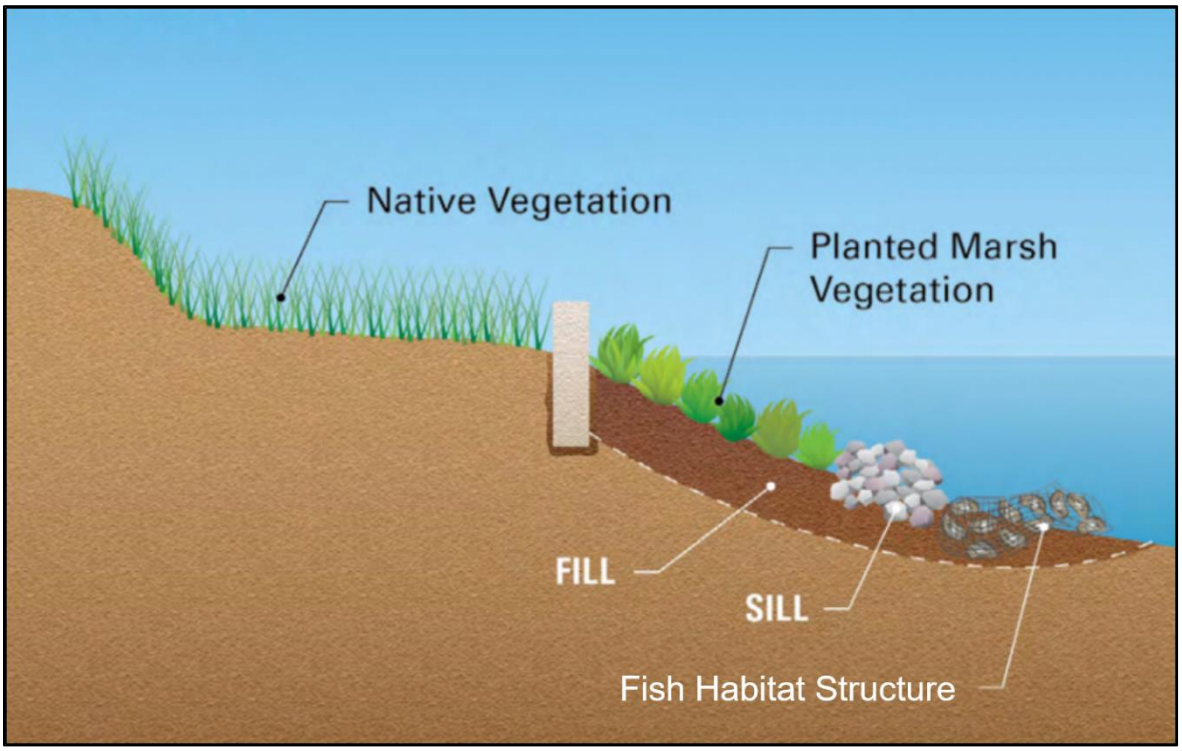
Source: FEMA 2018

Figure 1. Revetment Design Example

4.2.1.2 Bulkheads and Seawalls

Bulkheads are vertical walls constructed of concrete, steel, or aluminum sheet piling (**Figure 2**). They are commonly constructed parallel to the shoreline and are primarily designed to hold soil in place behind the bulkhead. Bulkheads may provide only minimal protection from waves but can provide robust shoreline erosion protection by acting as physical barriers between the water and ground surface as well as retaining walls for the shoreline. Bulkheads are not intended to provide flood mitigation. Bulkheads require seepage control components to balance hydrostatic loads and allow groundwater flow to the adjacent waterbody and, in high water conditions, back from the waterbody into the groundwater system. They must be designed and constructed for the range of wind-wave conditions expected to manage potential overtopping and erosion. Failure of a bulkhead can occur because of scouring at the base of the bulkhead from wave action, and the toe of the structure should be designed based on geotechnical and hydraulic conditions, including wave action and current scour. Bulkheads can be constructed along any shoreline and require moderate maintenance, depending on the construction material chosen. Sheet pile walls and concrete walls, for example, will eventually need replacement because of corrosion (USACE 1994).

Seawalls are similar structures constructed parallel to the shore but, in addition to holding soil in place, are intended to provide protection from flooding and wave action. When wave energy is reflected off the wall, erosion at the toe of the wall may increase (NPS 2019a). Bulkheads and seawalls are suitable for high-energy wave environments with appropriate engineering; although, bulkheads are not intended to provide protection from wave energy or tides. Both bulkheads and seawalls can increase erosion of shorelines adjacent to the bulkhead as wave energy travels parallel to the shoreline where it may dissipate on an unprotected segment of the shoreline. The construction of a gravel/cobble beach or placement of riprap in front of the structures may be incorporated to reduce the impacts of waves and erosion on the toe or the face of the structure. Elements such as native vegetation plantings landward of the bulkhead or installation of fish habitat structures or large woody debris offshore can be included and may reduce impacts on the ecology of the shoreline system.



Source: FEMA 2018

Figure 2. Bulkhead Design Example

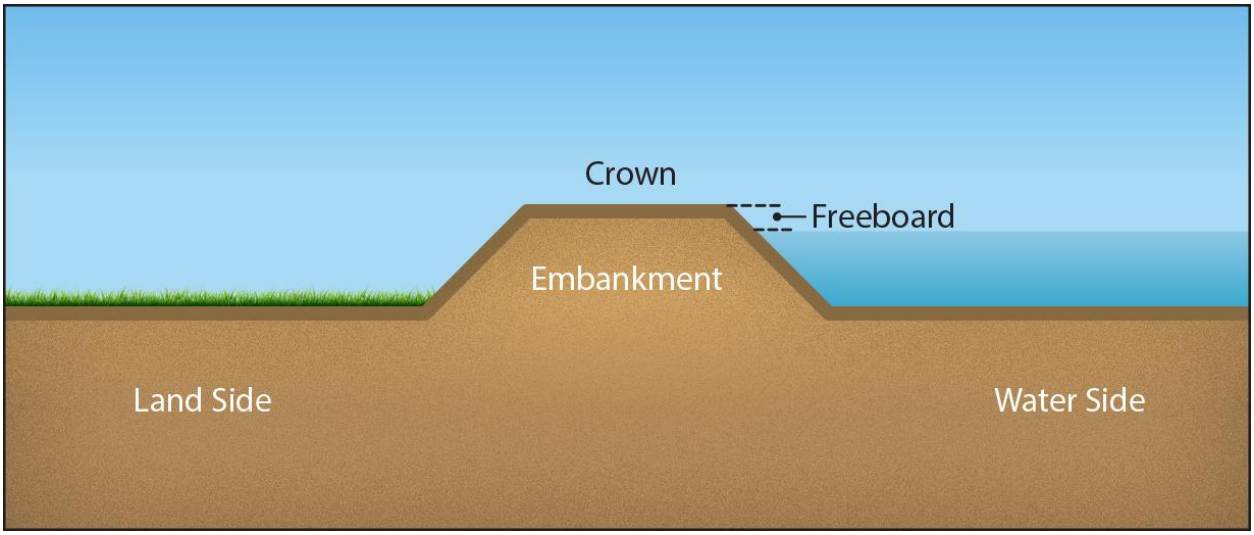
Each bulkhead and seawall must be designed based on location-specific conditions such as substrate type, expected wave action, hydraulic conditions, and existing bank stability. Geotechnical investigations and hydraulic modeling would be likely required to characterize site conditions. Site conditions will dictate the types of materials used and the structural design requirements. Structure design, including pile thickness and embedment depth, is dependent on bulkhead or seawall height and soil conditions, and structures must be designed by a liscened professional engineer.

Basic design elements for bulkheads include, but are not limited to, the following considerations:

- Toe protection to mitigate scouring,
- Seepage control to balance hydrostatic loads,
- Concrete bulkheads must be designed to resist sliding and overturning, and
- All metal components (e.g., piling, connections, anchoring) should be corrosion-resistant.

4.2.1.3 Levees/Berms

Levees run parallel to rivers and low-lying coastlines, protecting land that could be flooded during high water events. Levees are sloped on both the water and landward side, generally have a flat top, or crown, and include seepage control and drainage elements (**Figure 3**). Levees are similar to other types of embankments parallel to the shoreline except that they provide flood protection from seasonal high water and therefore are subject to water loading for short periods of only a few days or weeks per year. Levees are usually made from soil with a center core of clay or dense impermeable material. Factors considered when designing a levee include the soil profile of the area, strength of the foundation materials, slope stability, settlement, and trafficability of the levee surface. Levee designs would need to follow the requirements of the USACE "Design and Construction of Levees" manual (USACE 2000) and meet FEMA accreditation criteria as described in 44 C.F.R. Parts 65.10 and 60.3 (FEMA 2021).



Source: FEMA 2022

Figure 3. Levee Components

4.2.1.4 Groins

Groins are structures that are installed perpendicular to the shore to trap longshore transport of sediments (littoral drift) and are generally installed in groups, or groin fields (**Figure 4**). The sand trapped between groins acts as a buffer between incoming waves and the shoreline. Groins are most effective when littoral drift is transported in a single direction and has a large percentage of sand. The clay and silt fraction of the sediments are small-diameter grain sizes and generally will not fall out of suspension to form a stable protective beach feature.

Groins would be constructed to the minimum length and height necessary to maintain beach form and volume and designed with rough, as opposed to smooth, faces to maximize energy dissipation and minimize reflected wave energy. After construction, groins should be filled to entrapment capacity with sediment that has grain sizes that are compatible with the adjacent beach (MA CZM 2017).

Source: NPS 2019b

Figure 4. Groin Example

4.2.1.5 Wave Attenuators

Wave attenuators are floating or fixed structures that are designed to reduce wave energy from the exposed (seaward) side to the protected (landward) side (**Figure 5**). Floating wave attenuators can be used in areas where other engineering designs cannot, such as deep water, areas with unstable soil conditions, and areas with large water fluctuations. Wave attenuators can be moored horizontally, vertically, or both, and are installed with a portion of the attenuator remaining above the water level and a portion underwater. Wave attenuators can be designed for specific applications depending on the water type and condition, water depth, wave height, wavelength, and wave fetch distance and are available in a range of sizes, shapes, materials, and anchoring systems (IWC 2018).

Wave attenuators use a combination of weighted tops with underwater anchoring systems that reflect and dissipate waves from front and side impact. Wave attenuators reflect and dissipate incoming waves, making them smaller, less impactful, and sometimes make them dissipate completely as they pass over, under, and through the attenuator (IWC 2018).

Source: IWC 2018

Figure 5. Wave Attenuator Example

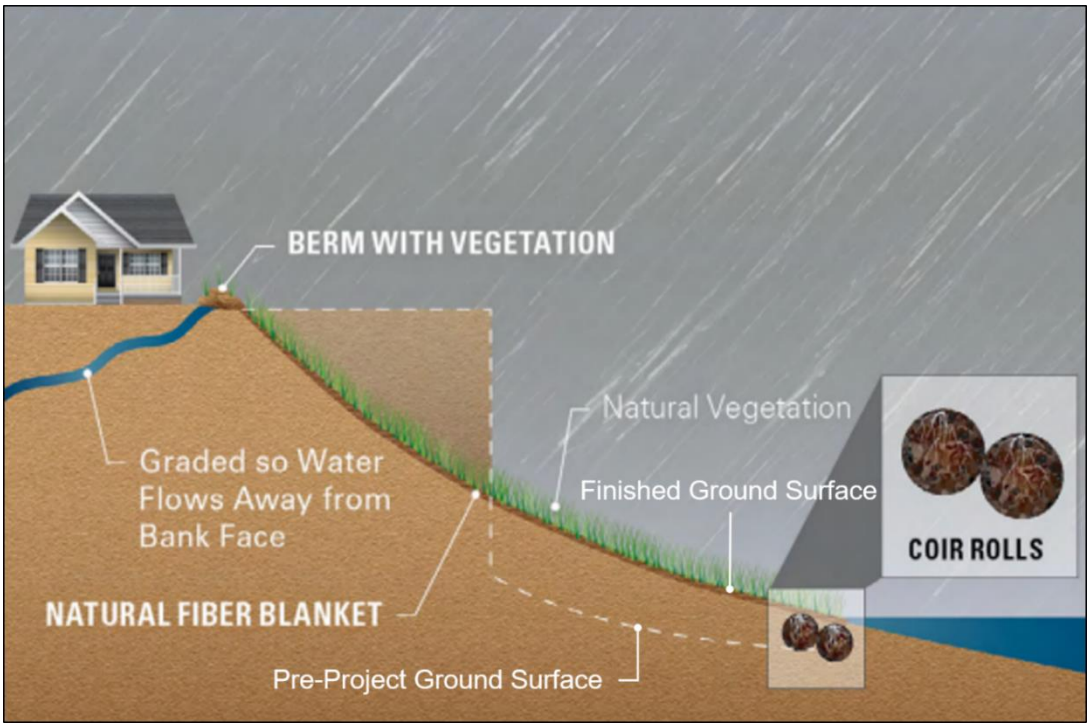
4.2.2 Bioengineering Designs

Bioengineered designs covered by this PEA are those that use native vegetation and other suitable plant species to provide flood mitigation and reduce erosion along a shoreline. Bioengineered designs alone, without engineered structural elements, may be used in areas of low to moderate wave action, but are often used together with engineered structural components in areas with greater wave action/scour potential. These designs provide a self-sustaining, low-maintenance solution for many impaired shoreline conditions. The design principles require an integrated watershed and sediment transport system-based approach. Bioengineering approaches use sound engineering practices and ecological principles to assess, design, construct, and maintain living vegetative systems that are blended into the shoreline and coastal ecosystem (FEMA 2018). Because bioengineered stabilization projects often have environmental benefits, they may be more easily approved by regulatory agencies than hard stabilization projects, which may be subject to additional regulations and conditions (described in Section 4.2.1).

The implementation of bioengineered projects may require excavators and other heavy equipment to install structural components and place sediment but would not typically require heavy equipment to plant vegetation. Exceptions may include using heavy equipment to conduct broadcast seeding and to place willow bundles on engineered slopes. In areas of steep bluffs, project materials and heavy equipment may be delivered from the waterside via watercraft such as a tug and barge or surplus Navy landing craft, and construction could take place with heavy equipment located on a spud barge. Bioengineered designs are most appropriate in low- to medium-wave-energy environments and they may or may not require in-water work. If in-water work is required, the potential for environmental impacts may be greater and project implementation methods would need to be clearly defined to assess whether potential impacts are described in this PEA. As with the hard engineering methods, bioengineering designs would need to follow the criteria within the MA CZM and Mass DEP's publication *Applying the Massachusetts Coastal Wetlands Regulations: A Practical Manual for Conservation Commissions to Protect the Storm Damage Prevention and Flood Control Functions of Coastal Resource Areas* (Richards 2017).

4.2.2.1 Bank Regrading/Stabilization

Bank regrading involves the stabilization of an unstable and over-steepened slope by grading the slope to retreat (to slope backward) the bank crest or by placing fill at the bank toe. Stabilization is achieved by diverting surface runoff from the eroding bank face by creating berms or installing drywells or French drains to encourage infiltration. Berms are often incorporated into bank regrading and stabilization projects and the berm may be vegetated to increase stability. Temporary erosion controls may be installed, including coir rolls and natural fiber blankets. Native, deep-rooted vegetation may also be planted on the bank to stabilize soils. A conceptual representation of this project type is provided in **Figure 6**.

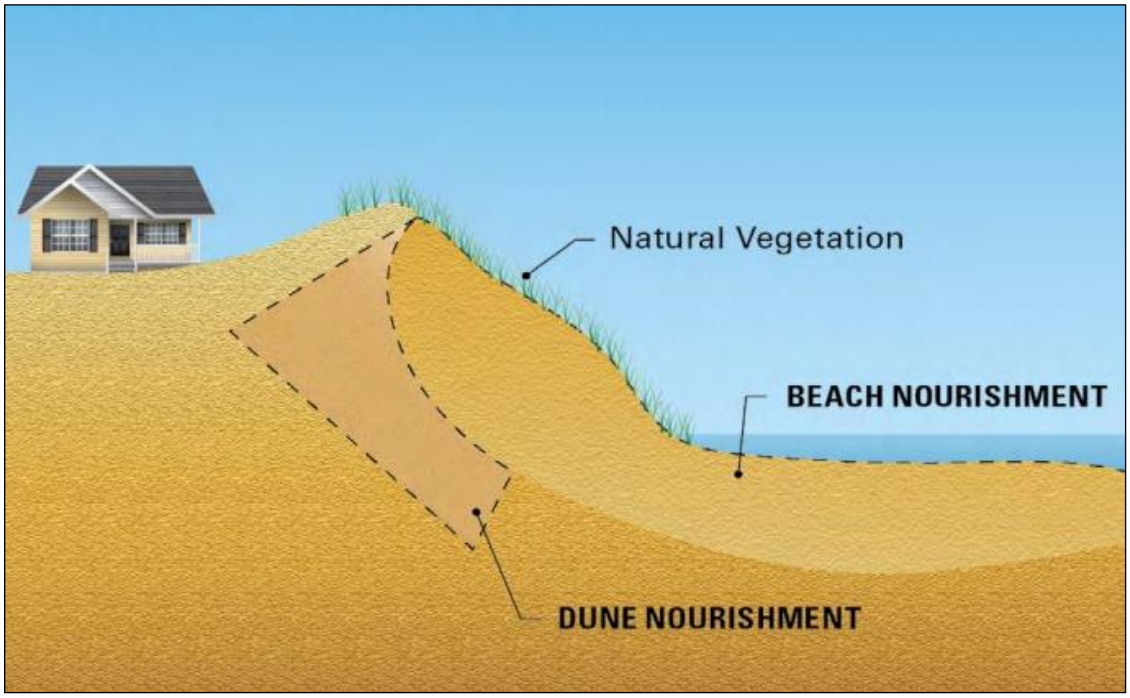


Source: FEMA 2018

Figure 6. Bank Regrading/Stabilization

4.2.2.2 Beach/Dune Restoration

Beach/dune restoration involves the placement of clean compatible sediment (based on mean grain size and material) to widen beaches, add height to dunes, and add sediment to the shoreline system. When beach restoration is used to create dunes, native deep-rooted beach grasses are often planted at the top of the dune and upper beach to trap and stabilize the sediment and filter stormwater runoff, as shown in **Figure 7** (FEMA 2018).



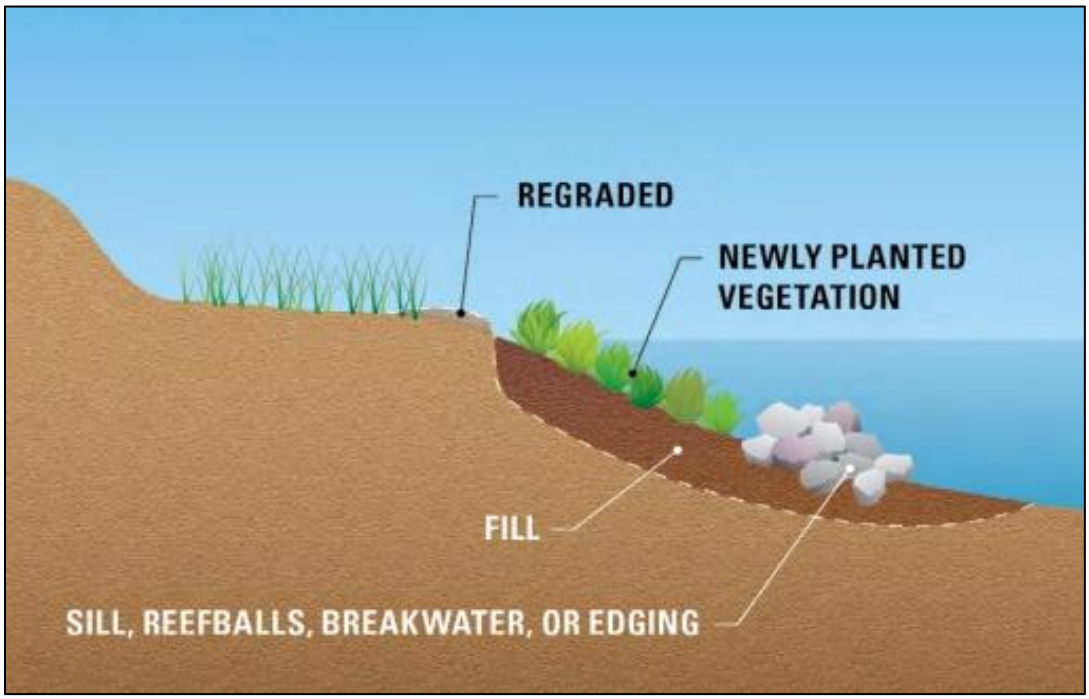
Source: FEMA 2018

Figure 7. Beach/Dune Restoration

4.2.2.3 Marsh and Wetlands Creation, Restoration, or Enhancement

Marsh and wetland creation is the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Successful creation results in a gain in aquatic resource area and functions and is contingent upon the establishment of hydric soils, wetland hydrology, and vegetation specific to wetland communities. Wetland creation is best implemented where there are other existing wetlands nearby (EPA 2016).

Restoration is the rehabilitation of a degraded wetland or the reestablishment of a destroyed marsh or wetland. Enhancement is the alteration of an existing wetland to improve its functions (USGS and EPA 2002). These approaches may include several actions, such as regrading unstable slopes or removing fill material, placing sediment that is appropriate for marsh vegetation, filling drainage channels or restoring historical channels, and planting native marsh vegetation on the future marsh platform. In low-wave-energy environments, sills may be installed parallel to the vegetated shoreline to reduce wave energy and prevent erosion. In higher-wave-energy environments, breakwaters might be installed to attenuate wave energy and allow sediments to collect. A conceptual representation of this project type is provided in **Figure 8**.



Source: FEMA 2018

Figure 8. Marsh and Wetlands Creation, Restoration, or Enhancement

Sills and breakwaters used in marsh projects should be engineered, as both are wave energy dissipation structures with important design considerations. Both types of structures would need to be designed to function for a selected design water elevation and wave height. The structures would need to be designed so that the rock weight is enough to resist expected wave uplift forces and each structure would need to have an offshore toe buried to resist scour from expected waves.

Common wetland design elements include (1) selecting a site based on location and watershed criteria (e.g., level of development, location of nearby waterbodies, existing wetland characteristics), (2) analyzing the hydraulics to determine inflows and outflows of surface waters, water levels, and the timing and duration of soil saturation, (3) determining water sources and quality (e.g., potential chemical inputs into the area), (4) augmenting or mulching soils in the project site to support the establishment of wetland vegetation, (5) selecting wetland plants appropriate to the setting and the goals of the project, (6) implementing a buffer zone around the wetland (e.g., an area of upland vegetation, a fence, sediment basin) to protect the area from disturbance and trap undesirable materials, and (7) maintaining the wetland or marsh (USGS and EPA 2002).

4.2.3 General Repairs of Coastal Structures and Infrastructure

As part of a larger shoreline project covered above, FEMA may fund the repair of damaged structures or infrastructure to pre-disaster conditions where the existing capacity and function of the structures and/or infrastructure would not change. The type of infrastructure that may be repaired includes, but is not limited to, sewers, outfalls, culverts, water lines, roadways, trails, and existing bioengineered features such as wetlands.

4.3 Alternatives Considered but Dismissed

This section describes shoreline resilience activities considered but eliminated from evaluation in the PEA because they are either ineligible activities or activities that fall within the parameters of a CATEX.

4.3.1 Activities with a Primary Purpose Not Related to Coastal Flood or Shoreline Stabilization Mitigation

Activities that do not have a primary purpose of coastal flood or shoreline erosion mitigation are not eligible for coverage under this PEA. Common examples may include activities with a primary purpose of improving stormwater management, flooding from rivers or heavy precipitation, or construction/maintenance of coastal infrastructure not associated with flood management.

4.3.2 Activities Ineligible for FEMA Funding

FEMA policies do not typically allow funding of the following types of projects; therefore, they were not retained as alternatives for consideration under this PEA.

- Projects on federally owned land and land adjacent to federal lands when the proposed project falls under the primary or specific authority of another federal agency,
- Projects not meeting exceptions under Section 6 of the Coastal Barrier Resource Act (CBRA) (16 U.S.C. § 3505) and Hazard Mitigation Assistance specific projects within the Coastal Barrier Resources System.
- Projects not associated with an eligible coastal flood mitigation project that are dependent on a contingent action to be effective and/or feasible (i.e., not a stand-alone project that solves a problem independently or constitutes a functional portion of a solution),
- Projects for maintenance activities, deferred or future, without an increase in the level of protection,
- Purchase of equipment to accomplish eligible work (e.g., excavators), and
- Activities intended solely to remedy a code violation without an increase in the level of protection.

4.3.3 Actions Covered by CATEXs

Projects that are covered by a CATEX should use the CATEX for compliance with NEPA and would not need to use this PEA. Therefore, activities that would be covered by a CATEX are not evaluated in this PEA. The following CATEXs may cover some coastal flood, erosion, and shoreline stabilization projects in the study area for this PEA.

CATEX N5 *Federal Assistance for Actions in Coastal Areas Subject to Moderate Wave Action or V Zones* provides coverage for repair, hazard mitigation, new construction, or restoration actions of less than one-half acre within the following areas: seaward of the limit of moderate wave action or areas within the V zone. Actions must be consistent with state or tribal enforceable policies or approved coastal management programs, must not be located within, or affect a Coastal Barrier Resource System unit, and must not result in man-made alterations to sand dunes or permanent removal of vegetation. Actions must follow federal requirements and local codes and meet additional criteria if there would be a substantial improvement or new construction of structures. Applicable actions include the repair and new

construction of jetties and groins, repair and elevation of structures, repair of functionally dependent facilities such as piers and bathrooms, and beach restoration projects (except projects that result in human alteration to sand dunes, such as beach nourishment).

CATEX N8 *Federal Assistance for New Construction* covers new construction and associated site preparation activities in undisturbed or undeveloped areas when the activities comprise less than one acre and follow best management practices (BMPs) to control noise, water, and air pollution. This CATEX does not apply to new construction in undisturbed or undeveloped floodplains, wetlands, or seaward of the limit of moderate wave action (or V zone when the limit of moderate wave action has not been identified). This CATEX covers a range of activities typically necessary for new construction, including field work, temporary staging, and construction equipment and vehicle use.

CATEX N12 *Federal Assistance for Planting of Indigenous Vegetation* covers the planting of native vegetation, such as planting grasses for dune and bank stabilization. No acreage limit applies to this CATEX.

4.3.4 Tide Gates

Gates that affect the conveyance of tidal flow with the ability to manipulate the ebb and flow of tidal waters, passively or actively, are not considered in this PEA. This includes all tide gates that are self-regulated, manually controlled, or passively controlled such as with flappers. Tide gates are not included because the potential magnitude of environmental impacts may exceed significance thresholds.

5.0 AFFECTED ENVIRONMENT AND POTENTIAL EFFECTS

This section describes the environment potentially affected by the alternatives, evaluates potential environmental effects, and recommends measures to avoid or reduce those effects. Effects are changes to the existing environment including ecological, aesthetic, historic, cultural, economic, social, or health conditions. Effects may also include consequences resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 C.F.R. 1508.1(g)(1)).

When possible, quantitative information is provided to establish the magnitude of potential effects; otherwise, the potential effects are evaluated qualitatively based on the criteria listed Table 5.1.

Table 5.1. Classification of Potential Effects

Effect Scale	Criteria
None/Negligible	Resource area would not be affected and there would be no effect, OR changes or benefits would either be nondetectable or, if detected, would have effects that would be slight and local. Effects would be well below regulatory standards, as applicable.
Minor	Changes to the resource would be measurable, but the changes would be small and localized. Adverse or beneficial effects would be within or below regulatory standards, as applicable. Mitigation measures would reduce any potential adverse effects.
Moderate	Changes to the resource would be measurable and have either localized or regional scale effects/benefits. Effects would be within or below regulatory standards, but historic conditions would be altered on a short-term basis. Mitigation measures would be necessary, and the measures would reduce any potential adverse effects.
Major	Changes to the resource would be readily measurable and would have substantial consequences/benefits on a local or regional level. Effects would exceed regulatory standards. Mitigation measures to offset the adverse effects would be required to reduce effects, though long-term changes to the resource would be expected.

Based on a preliminary screening of resources and the project's geographic location, **Table 5.2** identifies resources that do not require a detailed assessment and the reasons why.

Table 5.2. Resources Not Present

Resource	Reason for Elimination from EA
EO 12699: Seismic Safety	According to the United States Geologic Survey Earthquake Hazard Program, the project area is not in a seismically active area; therefore, the alternatives would not affect seismic activity or be affected by seismic hazards.

5.1 Physical Resources

5.1.1 Geology, Topography, and Soils

5.1.1.1 Existing Conditions

The study area spans six ecoregions, which are areas with a general similarity in ecosystems, including bedrock and soil types. The study area is generally low lying with elevations under 200 feet, although elevations up to 1,000 feet occur, and soils primarily consist of sand, silt, clay, and volcanic rock (EPA 2009). Additional details of the ecoregions are described in **Table 5.3**. Ecoregions are shown in **Map 7** of **Appendix A.**

Table 5.3. Coastal Ecoregions of Massachusetts

Ecoregion	Details
Gulf of Maine Coastal Lowland	Bedrock geology consists of metasedimentary rocks, intruded by several Paleozoic and Mesozoic plutonic bodies. Elevations range from sea level to 250 feet. Major soil types include extensive glacial sand, silt, and clay deposits, with a coastal pattern typified by plutonic capes and intervening sand beaches that front the region's largest salt marshes.
Gulf of Maine Coastal Plain	Bedrock geology consists of sandy till, sand, gravel, lake sand and pebbles as well as Precambrian gneiss, schist, amphibolite, and granite. Elevations range between 100 feet to 600 feet with a peak of 1,160 feet. Common soil types include coarse-loamy and sandy-skeletal, mesic Inceptisols, and Entisols.
Boston Basin	Bedrock types include marine silt and clay, sandy till, and gravel alongside Precambrian to Cambrian argillite, quartzite, conglomerate, sandstone, and siltstone. Elevations range from sea level to 370 feet. Major soil types include Entisols, Inceptisols, and Humaquepts.
Southern New England Coastal Plains and Hills	Bedrock types are mostly granites, schist, and gneiss; although, some soft marble occurs. Elevations range between 10 feet to 1000 feet. Major soil types include Inceptisols and Entisols.
Narragansett/Bristol Lowland	Bedrock types include sand, gravel, sandy till, clay, outwash, and underlying lake deposits. Pennsylvania sandstone, graywacke, shale, and conglomerate occur along with Precambrian gneiss and granite. Elevations range between sea level and 344 feet. Major soil types include Entisols, Inceptisols, and Histosols.
Cape Cod/Long Island	Geology consists of Precambrian bedrock of granite, gneiss, and schist is covered by 200 to 400 feet or more of gravel, sand, silt, and clay. Elevations are commonly less than 150 feet with a high point of 395 feet. Common soil types include Mesic Entisols that are often well-drained. Sandy and loam soils occur with a few areas of finer textured soils.

Source: EPA 2009

Some soils within the study area are protected under the Farmland Protection Policy Act (FPPA) of 1981, 7 U.S.C. §§ 4201 et seq. The law was enacted to minimize federal activities that convert prime and unique farmland and farmland of statewide or local importance to nonagricultural uses and to ensure that federal programs are compatible with local, state, and private programs and policies to protect farmland. The

FPPA does not consider areas already committed to urban uses as farmland (7 C.F.R. § 658.2[a]) and activities under Part 523.11(C) of the FPPA are not subject to its provisions. If an individual project area is located outside of an urban area, FEMA would confirm whether the area contains farmland soils by using the Natural Resource Conservation Service's (NRCS) online web soil survey. FEMA would consult with NRCS on projects that would result in the conversion of farmland soils to nonfarm uses.

5.1.1.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, implementation of non-FEMA funded projects to mitigate flooding and erosion would require the use of construction equipment, staging areas, and access roads and could increase the probability of exposing bedrock and localized soil erosion. Therefore, there would be a short-term **negligible** adverse effect on exposed bedrock from construction activity and short-term **minor** adverse effects on soils from ground disturbance. There would be **no effect** on topography in the short-term. Non-FEMA funded projects occurring on soils designated as prime or unique farmland, would result in disturbance of soils during construction and may convert farmland soils to non-farmland uses in the long term. Therefore, there would be a short-term **negligible** to **minor** adverse effect on farmland soils during construction and a long-term **minor** effect from the conversion of soils to non-farmland uses.

In the long term, non-FEMA funded projects involving alterations of bank slope, regrading, or adding rock would change the existing topography in localized areas where the project occurs and thus result in **negligible** adverse effects on topography. Non-FEMA funded projects would protect individual properties and hard engineering designs could redirect erosion downstream of the design. Thus, non-FEMA funded projects could lack coordination among communities or the appropriate scale to substantially mitigate the risk of flooding and erosion. Flooding would likely continue to erode shoreline within the study area causing instability and topographic changes but would be unlikely to alter geology. Flooding and erosion of farmland could result in reduced productivity or overall loss of farmland soils. Therefore, there would be no long-term effect on geology. The No Action alternative would have a long-term **minor** to **moderate** adverse effect on soils and topography from continued flooding and erosion, which could also include adverse effects on farmland soils.

Proposed Action

General Consequences of the Proposed Action

The Proposed Action could result in **minor** to **moderate** short-term adverse effects from construction-related ground disturbance at project sites, staging areas, and along access roads as construction activities and equipment could expose bedrock or increase the probability of localized soil erosion. The Proposed Action could alter existing topography through grading or placement of fill, depending on the type of design implemented. Ground disturbance and soil erosion may be avoided or minimized by discouraging the use of mechanized equipment in areas with steep slopes (typically greater than a 20 percent slope) or sensitive soils (e.g., soils sensitive to compaction such as clay) to the maximum extent feasible as well as using rubber tired equipment, using existing access roads, and implementing erosion control measures such as straw bales.

In the long term, the Proposed Action and connected actions would reduce the risk of flooding and erosion including associated bedrock exposure and soil instability and loss. The reduction of erosion and

soil loss would stabilize shoreline topography, which may have been altered during project implementation. Therefore, the Proposed Action and connected actions would have long-term **minor** to **moderate** beneficial effects on soils (including designated farmland soils) and topography from the stabilization of soils on the project site. If any project is found to have an adverse effect on soils protected by the FPPA after consultation with NRCS, an SEA or a separate EA would be required dependent on the adverse effect.

Project-Specific Consequences

Hard Engineering Designs

In the long term, hard engineering designs can alter sediment transport patterns, resulting in increased erosion at each end of the stabilization structure by reflecting wave energy onto adjacent unarmored shorelines and accelerating currents. This increased erosion may increase beach and bluff recession on either end of the structure but would likely have a greater effect on the downdrift side (USACE 2003; Lin and Wu 2014). The downdrift impacts of hard engineering designs can extend three to five times the length of the structure, as discussed in Section 4.2.1. Similarly, hard engineering designs can remove sand from the local sediment supply that is necessary to maintain existing beaches and bluff toes by blocking the movement of sediments from directly behind the structure to the shore (Griggs and Tait 1988; Griggs 2005). Reduced sediment supply could result in sediment starvation directly seaward and downdrift of the structure and result in the loss of shoreline sediments and beach, dune, or bank erosion in the long term. These downdrift effects could result in impacts on homes, infrastructure, habitat, and recreational opportunities. Therefore, hard engineering designs could result in **minor** to **moderate** adverse effects on soils and topography in the long term. A coastal sediment transport impact analysis would be required for any hard engineering designs. If downdrift impacts are found, an SEA may be required. If major impacts from downdrift erosion are anticipated, this PEA cannot be used and an individual EA or EIS would be required.

Bioengineering Designs

As described in Section 4.2.2, bioengineering designs would use living vegetative systems for shoreline stabilization, which maintain natural sediment transport systems. Therefore, bioengineering designs would result in a **minor** to **moderate** long-term benefit on soils by stabilizing shorelines while maintaining natural sediment transport systems. Bioengineering designs are unlikely to result in offshore or downdrift effects.

Project Conditions

- Hard engineering designs must include a coastal sediment transport impact analysis.

5.1.2 Clean Air Act

The Clean Air Act regulates air emissions from area, stationary, and mobile sources. Air quality standards have been set for lead, nitrogen dioxide, ozone, carbon monoxide, sulfur dioxide, and particulate matter to protect public health and the environment. Areas where the monitored concentration of a pollutant exceeds air quality standards are designated as nonattainment areas. Areas where all pollutants are below the standards are classified as in attainment areas.

5.1.2.1 Existing Conditions

The status of nonattainment and maintenance areas is available through the U.S. Environmental Protection Agency's (EPA) Greenbook and are updated periodically (EPA 2022b). **Table 5.4** summarizes the attainment status for counties within the study area.

Table 5.4. National Ambient Air Quality Standards Attainment by County

County	Attainment Status	County	Attainment Status
Barnstable	In Attainment	Nantucket	In Attainment
Bristol	In Attainment	Norfolk	In Attainment
Dukes	Nonattainment for 8-hour ozone	Plymouth	In Attainment
Essex	In Attainment	Suffolk	In Attainment
Middlesex	In Attainment		

Source: EPA 2022b, data is current as of December 31, 2021

5.1.2.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, construction activities for non-FEMA funded projects to mitigate flooding and erosion would result in temporary emissions from construction vehicles and equipment and an increase in particulate matter from construction activities. Each non-FEMA funded project would have a short-term **negligible** to **minor** effect on air quality. Non-FEMA funded projects would protect individual properties near the project site but would be unlikely to be coordinated across communities. Thus, the risk of flooding would not be substantially reduced. Continued flooding could result in roadway closures and detours until floodwaters recede or to perform repairs. Roadway closures and detours could result in increased emissions from vehicles, thus there could be a **minor** adverse effect on air quality from increased vehicle emissions if roadways closures and detours occur. Non-FEMA funded projects would be unlikely to become new permanent sources of emissions.

Proposed Action

General Consequences of the Proposed Action

The Proposed Action would result in temporary emissions from construction vehicles and equipment. During the construction phase, exposed soil could temporarily increase airborne particulate matter into the

project area from fugitive dust. Emissions from construction equipment could have **negligible** to **minor** temporary effects on the levels of some pollutants, including Carbon Monoxide, Volatile Organic Compounds, Nitrogen Dioxide, Ozone, and Particulate Matter. All construction equipment would be required to meet current EPA emissions standards (EPA 2016a). Actions to reduce emissions would be implemented such as minimizing engine idling and using equipment in good working condition. Depending on the extent of equipment and vehicle use, there would be short-term **negligible** to **minor** negative effects on air quality. Emissions would be expected to be below *de minimis* thresholds and would not increase levels of regulated air pollutants above *de minimis* thresholds. Projects located in nonattainment areas (i.e., Dukes County) may require a conformity analysis. Because an area's attainment status may change, each project covered by this PEA would need to be reviewed against the current attainment status of the project area and the potential to exceed *de minimis* thresholds.

In the long-term, the Proposed Action would reduce the risk of flooding and the associated need for roadway closures or detours. Thus, there would be a **minor** long-term beneficial effect from the reduced risk of increased vehicle emissions. No long-term adverse effects on air quality are anticipated because the Proposed Action would not be a source of long-term air emissions. If a project would result in a new long-term source of air pollutants, or temporary emissions would cause a moderate or greater adverse effect, then an SEA may need to be prepared.

Project-Specific Consequences

Hard Engineering Designs

No additional impacts specific to hard engineering designs are anticipated.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated.

Project Conditions

None

5.1.3 Climate Change

Climate change refers to changes in the Earth's climate caused by a general warming of the atmosphere. Its primary cause is emissions of greenhouse gases, including carbon dioxide and methane. Climate change can affect species distributions, temperature fluctuations, and weather patterns. CEQ's *Final NEPA Guidance on Consideration of Greenhouse Gas Emissions and the Effects on Climate Change* (CEQ 2016) recommends that a quantitative analysis should be done if an action would release more than 25,000 metric tons of greenhouse gases per year.

5.1.3.1 Existing Conditions

The changing climate impacts the Commonwealth of Massachusetts in numerous ways including rising temperatures, altered precipitation patterns, more intense and frequent storm events, and rising sea levels. The Commonwealth of Massachusetts has experienced a two-degree Fahrenheit increase in temperature in the last century (EPA 2016c). Between 1901 and 2020, annual precipitation in the state has increased by over 10 percent with more recorded large precipitation events (EPA 2016c; EPA 2020a). Sea levels in Massachusetts have increased by as much as 8 inches since 1950 in the Boston area, and the speed of sea level rise has accelerated over the last ten years; by 2040, projections for future sea level rise range from

0.89 feet to 1.12 feet (NOAA 2022). Increases in large precipitation events and rising sea levels has resulted in an increased potential for flooding and erosion from increases in wave height, storm surge, and floodwaters that reach further inland.

5.1.3.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, non-FEMA funded projects to mitigate flooding and erosion would result in recurring short-term **negligible** effects on the climate from construction equipment greenhouse gas emissions. Non-FEMA funded projects would not result in long-term climate effects because these projects would not be new sources of emissions. There could be a long-term **minor** to **moderate** effect on communities from increased levels of flooding and erosion due to climate-related increases in storms and sea levels. Non-FEMA funded projects would only protect individual properties or small areas within a community, leaving the remaining area susceptible to climate-related increases in flooding and erosion.

Proposed Action

General Consequences of the Proposed Action

The Proposed Action would result in temporary greenhouse gas emissions from construction vehicles and equipment. Emissions from construction equipment would be temporary and would not be expected to increase greenhouse gases to the extent that they would contribute to regional climate change. Emissions would be reduced by minimizing engine idling and using equipment in good condition. However, some large projects could involve large numbers of truck trips and long durations of heavy equipment usage. Prior to applying the PEA to a specific project, consideration should be given to whether the project may result in a level of greenhouse gas emissions that could exceed 25,000 metric tons of greenhouse gas per year. If a project is found to exceed 25,000 metric tons of greenhouse gas per year, an SEA would be required.

In the long term, the Proposed Action would result in a **minor** to **moderate** long-term beneficial effect by increasing a community's resilience to climate change effects, such as increased flooding, storm surge, and sea level rise through the construction of flooding and erosion mitigation measures. No new sources of long-term greenhouse gas emissions would occur. If a project would result in a new long-term source of air pollutants, then an SEA may need to be prepared.

Project-Specific Consequences

Hard Engineering Designs

No additional impacts specific to hard engineering designs are anticipated.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated.

Project Conditions

None.

5.2 Water Resources

5.2.1 Water Quality

The Clean Water Act (CWA) regulates the discharge of pollutants into water and is administered by USACE and the EPA. Section 404 of the CWA establishes the requirements for discharging dredged or fill materials into waters of the United States. USACE administers Massachusetts General Permits, in accordance with Section 404, for activities that occur in waters of the U.S. with minimal adverse effects. General Permits require compliance with standard project conditions including the use of appropriate soil erosion, sediment, and turbidity controls and restrictions on heavy equipment use in waters and wetlands. MA DEP administers Section 401 of the CWA and issues water quality certifications for the discharge of dredged materials, dredging, and dredged material disposal in waters of the United States. Section 402 of the CWA, the National Pollution Discharge Elimination System (NPDES), regulates both point and nonpoint pollutant sources including stormwater and stormwater runoff. Activities that involve one or more acres of ground disturbance require an NPDES Construction General Permit issued by the EPA. Work that involves the alteration of outfalls may also require an NPDES permit or a modification of an existing permit for the discharge from the pipe.

CWA Section 303(d) requires states to identify waters that do not or are not expected to meet applicable water quality standards with current pollution control technologies alone. Under Section 303(d), states must develop Total Maximum Daily Loads (TMDLs) for impaired waterbodies. A TMDL establishes the maximum amount of a pollutant or contaminant allowed in a waterbody and serves as a planning tool for restoring water quality. Projects that propose work in impaired waters may require additional review under Section 402 through the EPA.

The Safe Drinking Water Act of 1974, 42 U.S.C. § 300f et seq. (amended in 1986 and 1996), was established to protect the quality of drinking water of all above or underground resources. This act authorizes the EPA to establish water quality standards to protect drinking water and requires all owners or operators of public water systems to comply with those criteria. Section 1424(e) of the Safe Drinking Water Act of 1974 authorizes the EPA to designate an aquifer for special protection under the sole source aquifer program, if the aquifer is the sole or principal drinking water resource for an area (i.e., it supplies 50 percent or more of the drinking water in a particular area) and if its contamination would create a significant hazard to public health.

The Massachusetts Wetlands Protection Act (Massachusetts General Laws Chapter 131, Section 40) protects wetlands and the public interests they provide, including flood control, prevention of pollution and storm damage, and protection of public and private water supplies, groundwater supply, fisheries, land containing shellfish, and wildlife habitat. In addition to wetlands, the law protects other resource areas, such as 100-year floodplains, riverfront areas, and land under waterbodies, waterways, salt ponds, fish runs, and the ocean. Projects occurring in wetlands and resource areas are reviewed in accordance with state regulation (310 CMR 10.00). Should a project be determined to impact resource areas, an Order of Conditions permit must be obtained. Mass DEP oversees the administration of the law.

5.2.1.1 Existing Conditions

According to the *Massachusetts Year 2018/2020 Integrated List of Waters*, Massachusetts has approximately 2,726 square miles of coastal waters forming a series of bays, sounds, and islands. The northern Massachusetts coastline forms Ipswich Bay, south of which is the Boston Harbor. Continuing

south are Cape Cod Bay and Nantucket Sound. The Muskeget Channel and Vineyard Sound are present between the Nantucket and Dukes Islands and Buzzards Bay is to the west of the islands. Major rivers that drain into the Atlantic Ocean through the study area include the Merrimack River, Ipswich River, Charles River, and the Taunton River. In addition to major rivers, there are many smaller water systems including the Cape Cod Canal and unnamed tributaries. As discussed further in Section 5.2.3, Wetlands, the study area supports both tidal and nontidal wetlands, which are habitats sensitive to pollution and sedimentation.

There are 13 coastal drainage areas in the project area as indicated below and depicted on **Map 8** of **Appendix A**:

Table 5.5. Massachusetts Coastal Drainage Areas

Coastal Drainage Areas			
Boston Harbor	Ipswich	Narragansett Bay	South Coastal
Buzzards Bay	Islands	North Coastal	Taunton
Cape Cod	Merrimack	Parker	Ten Mile
Charles			

The *Massachusetts Year 2018/2020 Integrated List of Waters* issued by Mass DEP contains a list of waters requiring a TMDL, which is also known as the 303(d) list or Category 5 waters. According to this report, approximately 167 square miles of coastal waters in Massachusetts are listed as Category 5 waters. Common sources of impairments include, but are not limited to, fecal coliform and bacteria, excessive nutrients, algae, low levels of dissolved oxygen, and turbidity. All coastal drainage basins within the project area contain Category 5 waters.

Sole source aquifers in the study area include the Plymouth/Carver Aquifer, the Cape Cod Aquifer, Martha's Vineyard Aquifer, and Nantucket Aquifer as depicted in **Map 9** of **Appendix A** (EPA 2020b). Cape Cod and the Islands are characterized by low hills and plains covering unconsolidated sediments that form the most productive aquifers in the state.

5.2.1.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action Alternative, non-FEMA funded projects to mitigate flooding, erosion, and repair damaged facilities could require soil disturbance, dredging, placement of fill in waters of the U.S., in-water work, removal of vegetation, and runoff from construction. This could result in reductions in water quality and an increase in pollutants in already impaired waters. Thus, non-FEMA funded projects could result in **negligible** to **moderate** short-term effects on water quality. Construction-related pollutants could enter aquifers, resulting in **negligible** to **minor** effects on safe drinking water. In the long term, non-FEMA funded projects would not substantially mitigate flooding and erosion. Flooding events could overload drainage systems and outfalls causing backwater conditions, surcharging, and flow reversal. Receding floodwaters could transport debris, sediments, and contaminants such as sewage from backed up collection systems or combined overflows and petroleum-based pollutants such as motor oil. Continued erosion would result in turbidity and sedimentation and could result in the release of

contaminated soils into waters of the U.S. Therefore, the No Action alternative would have **minor** to **major** adverse effects on water quality, including the water quality of sole source aquifers, over the long term.

Proposed Action

General Consequences of the Proposed Action

The use of construction equipment poses a minor risk of leaks of oils, fuels, and lubricants that could impact water quality. Construction would result in vegetation removal and ground disturbance that would expose soils to elements such as wind and water that increase the risk of erosion. Eroded soils could contain contaminants that endanger water resources, cause turbidity and sedimentation, and could degrade aquatic habitats. Therefore, there would be **minor** short-term impacts on water quality because of construction. Construction-related pollutants could enter aquifers. However, surface waters from a construction area would typically infiltrate through soil before reaching aquifer waters; thus, the potential concentration of pollutants would likely be low and result in **negligible** to **minor** short-term impacts on safe drinking water.

Projects resulting in permanent long-term impacts, such as permanent adverse impacts from fill and loss of waters of the U.S., may require compensatory mitigation and an SEA would need to be prepared. In the long term, flood mitigation would reduce the risk that receding floodwaters would transport debris, sediments, and contaminants into waterbodies. Erosion mitigation would reduce the risk of sedimentation and potential release of contaminated soils into waters of the U.S. or sole source aquifers. Therefore, the Proposed Action would result in long-term **minor** to **moderate** beneficial effects on water quality.

For projects that impact waters of the U.S., coordination with USACE and the EPA would be required to determine the need for any CWA permits (see Project Conditions and Section 6). Permits would require mitigation measures consistent with USACE regulations, which may include the restoration or enhancement of surface waters and riparian areas impacted by project activities (33 C.F.R Part 320-332). Projects eligible for the Massachusetts General Permit, in accordance with USACE, would require soil erosion and sediment controls (General Condition 13), as well as restrict heavy equipment use in waters and wetlands (General Condition 16). For projects that occur in Category 5 waters, additional review of NPDES permit applications by the EPA may be needed to ensure that TMDL limits are not exceeded. An SEA would be required if the proposed project would cause or contribute to long-term impacts on water quality and/or would require compensatory mitigation under Section 404 regulations.

Project-Specific Consequences

Hard Engineering Designs

As previously discussed, short-term negligible temporary impacts would occur because of general construction activities. However, hard stabilization designs that use man-made materials (e.g., concrete or sheet pile) or that result in changes in topography (e.g., walls in contrast to the natural shoreline slopes) would have a greater potential for long-term adverse impacts. As described in Section 5.1.1, hard engineering designs may result in downdrift erosion. Eroded soils may contain contaminants or result in turbidity and sedimentation.

Revetments

Shoreline armoring (e.g., revetments, sea walls, riprap, jetties, breakwaters, groins, and piers) has the potential to cause **minor** to **moderate** long-term impacts on water quality, as it has been shown to alter sediment dynamics, accelerate shoreline erosion, and cause loss of habitat. Areas located around revetments may become subject to increased erosion because of the effects of waves breaking against the structure, accelerated currents, and reduced sediment availability within the littoral cell (a cell contains a complete cycle of sedimentation including sources, transport paths, and sinks) (USACE 2020).

Bulkheads and Seawalls

The construction of bulkheads and seawalls may result in scouring of the beach in front of the structure, especially on chronically eroded shorelines, resulting in **minor** to **moderate** impacts on water quality due to released sediment. The extent of this effect is dependent upon the width of the beach, the wave energy reaching the beach and seawall, and the sediment supply. Like revetments, seawalls must be sited and designed carefully and consider the potential for increased erosion of neighboring shorelines (USACE 2020).

Breakwaters

Breakwaters can disrupt longshore sediment transport and adversely affect downdrift beaches resulting in long-term **minor** impacts on water quality because of impacts on sediment transport. However, because breakwaters are constructed parallel to the shore, the construction of this type of structure would likely result in less of an impact than groins and jetties, as discussed below.

Groins and Jetties

Groins and jetties affect the littoral drift of sediment along the shoreline and alters the lateral movement of sediment, which may affect erosion and depositional areas, further impacting additional downdrift areas. As a result, the construction of groins and jetties may have long-term **minor** to **moderate** adverse impacts on water quality if excessive sand and sediment enter the waterway, increasing turbidity and total suspended solids.

Bioengineering Designs

Similar to hard engineering designs, bioengineering designs would also typically involve ground disturbance and in-water work. Projects would include the risk of construction-related leaks and spills or erosion of soils during construction activities. There would be **negligible** impacts on water quality in the short term as long as permit-related mitigation measures are followed. In the long term, the planting of vegetation, or enhancement and creation of marshes and wetlands, would help reduce pollutants in runoff and provide long-term **minor** to **moderate** benefits to water quality that would not occur with hard engineering designs.

Project Conditions

- Before construction begins, the Project Proponent must obtain any required CWA Section 404 and 401 permits from USACE and Mass DEP, respectively, and comply with all terms and conditions of the issued permits.
- Before construction begins, the Project Proponent must obtain any required NPDES permits for construction and discharges from the EPA and comply with all terms and conditions of the issued permit.

- Before construction begins, the Project Proponent must file a Notice of Intent with the local Conservation Commission in accordance with the Massachusetts Wetlands Protection Act.

5.2.2 Floodplains

Executive Order 11988 Floodplain Management requires federal agencies to avoid, to the extent possible, the long- and short-term effects associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. Each federal agency must provide leadership and take action to reduce the risk of flood loss; minimize the effect of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities. FEMA uses an 8-Step analysis to evaluate and document potential effects on, and mitigate effects to, floodplains in compliance with Executive Order 11988 and 44 C.F.R. Part 9. As part of this analysis, FEMA issues initial and final public notices to inform and solicit feedback from the public regarding the potential effects on floodplains and notify the public of FEMA's final decision when it has been made. The 8-step analysis is required for each individual project.

The Massachusetts Department of Conservation and Recreation Flood Hazard Management Program is the State Coordinating Office for the National Flood Insurance Program (NFIP). In Massachusetts, 341 communities participate in the NFIP (FEMA 2022b).

The Massachusetts Wetlands Protection Act protects multiple resource areas including the 100-year floodplain. Compliance with this law is discussed in Section 5.2.1.

5.2.2.1 Existing Conditions

The study area includes the Massachusetts coastal zone and extends along the tidally influenced portion of rivers. Most of the study area is (at least partially) located within the 100-year floodplain (denoted as A or AE zones), or in floodplains with additional hazards from storm-induced waves such as flooding and damage from wave action (denoted as V or VE zones). Shorelines with low relief may have wider floodplains, while areas of steep bluffs may only have the toe of the bluff within the 100-year floodplain. Portions of a flood or erosion mitigation project may be within the floodplain, while other portions may extend outside of the floodplain. Projects that are in proximity with the confluence of streams or rivers and the ocean may also be within wider floodplain areas. Staging areas associated with a construction project are more likely to be in a floodplain when the project is in an area with wider floodplains.

5.2.2.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, local and state governments and private landowners might construct some non-FEMA funded projects to reduce flooding and erosion. Although these projects would be properly engineered and permitted, they may involve ground disturbance and vegetation removal around the project site, which could degrade the condition and natural function of the floodplain. Additionally, projects may include the placement of fill within the floodplain. Fill may be placed temporarily or permanently and impacts would be localized to the project site, resulting in a **minor** adverse effect on the floodplain. In the long term, non-FEMA funded projects would not substantially mitigate flooding and erosion within the project's community because such projects would not necessarily be connected or constructed in a coordinated fashion to provide protection across property boundaries or jurisdictional

lines. Consequently, flooding and erosion would continue to impact people and structures in the floodplain. Therefore, there would be **minor** to **major** long-term adverse effects on the floodplain from the No Action alternative.

Proposed Action

General Consequences of the Proposed Action

The Proposed Action would result in **minor** short-term adverse effects from construction-related ground disturbance that could be mitigated through BMPs. In the long term, placement of fill in the floodplain could result in **minor** adverse effects by obstructing floodwaters. Changes in the floodplain would require a Letter of Map Revision (LOMR) from FEMA to officially revise the Flood Insurance Rate Map(s) (FIRM) for the affected floodplain. A Conditional Letter of Map Revision (CLOMR) from FEMA could be issued to determine whether a project would require a LOMR at the completion of the project. There would be long-term **minor** to **moderate** benefits to floodplains by reducing the risk of flooding that would impact people and infrastructure located in the floodplain, and floodplain restoration activities would benefit natural floodplain values. Coordination with the local floodplain manager would be required to obtain approval and any required permits for development in a floodplain (see Project Conditions and Section 6). If a project would have a permanent adverse effect on the floodplain, an SEA would be required.

Project-Specific Consequences

Hard Engineering Designs

Hard engineering designs would result in **minor** short-term adverse effects on floodplains from construction-related ground disturbance within the floodplain. Ground disturbance may modify flood elevations or flow patterns or introduce contaminants and sediments that would affect the natural values of the floodplain. Hard engineering designs, including revetments, sea walls, riprap, jetties, breakwaters, and groins, deflect wave energy and could result in the migration of wave energy impacts downstream or downshore. Berms and levees affect the natural function and evolution of the floodplain by constraining floodwater access to the floodplain and could result in increased floodwater volume or velocity downstream. . Permanent changes in floodplain topography and flow patterns of floodwaters could result in **negligible** to **moderate** adverse effects on flooding and floodplain functions including habitat values. Reductions in erosion would improve water quality and likely increase habitat values, thus resulting in a **minor** to **moderate** beneficial effect on floodplain functions.

Bioengineering Designs

The use of bioengineered designs would improve natural floodplain functions by using vegetation and natural slopes and features rather than creating a hard edge to the floodplain. Bioengineering designs proposed along shorelines near the confluence of a river would need to be designed to prevent the additional vegetation from creating backwater conditions and increasing flooding occurrences and severity. Many bioengineered designs could be constructed farther inland from the shoreline than hard engineering designs and would therefore have less effect on floodplains because of the setback from the water. Bioengineering designs would have similar construction-related effects as hard engineering designs, but the long-term effects would be more beneficial to natural floodplain functions.

Project Conditions

- Before construction begins, the Project Proponent must obtain approval from the local permitting official responsible for any floodplain development to demonstrate that the Proposed Action is consistent with the criteria of the NFIP (44 C.F.R. part 59 et seq.) or any more restrictive federal, state, or local floodplain management standards (44 C.F.R. 9.11(d)(6)) and comply with all terms and conditions of the issued permit.
- Before construction begins, if the proposed project may cause modification of any regulatory floodway, the effective base flood elevation, or the special flood hazard area, the Project Proponent may be required to obtain a CLOMR from FEMA, dependent on grant requirements, to demonstrate whether a revision of the FIRM Panel with a LOMR is likely (44 C.F.R. parts 65.8 and 72).
- Within six months of project completion, the Applicant must initiate with FEMA a Flood Insurance Rate Map (FIRM) change and request a Letter of [Flood] Map Revision (LOMR) in accordance with 44 C.F.R. Parts 65.3 and 9.11(d)(6). A copy of the Letter of Map Revision must be submitted to the State and FEMA for inclusion in the administrative record.

5.2.3 Wetlands

Executive Order 11990 Protection of Wetlands requires federal agencies to avoid to the extent possible the long- and short-term adverse effects associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. Each federal agency must take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities. FEMA uses an 8-Step analysis to evaluate potential effects on and mitigate effects on wetlands, in compliance with Executive Order 11990 and 44 C.F.R. Part 9.

The Massachusetts Wetlands Protection Act protects wetlands and the public interests they provide, such as flood control and pollution and storm damage prevention. Compliance with the Wetlands Protection Act is discussed in detail in Section 5.2.1.

5.2.3.1 Existing Conditions

The study area supports both marine and freshwater wetlands. Coastal shoreline projects are most likely to encounter estuarine marine wetlands that may include salt marshes and brackish wetlands. Freshwater wetlands would be found upland of the high tide line or associated with the river systems in the study area. Marine wetlands can reduce storm surge and wave heights that contribute to coastal flooding and the vegetation in wetlands may slow water movement, allow sediments to settle out of the water column, and reduce erosion. Freshwater wetlands hold floodwaters and slow flows, reducing flood impacts downstream of the wetlands and improving floodplain functions. According to the United States Fish and Wildlife Service's (USFWS) National Wetlands Inventory there are approximately 172,716 acres of wetlands within the study area, consisting of 81,047 acres of marine wetlands and 91,669 acres of freshwater wetlands (**Table 5.6**) (USFWS 2022c).

Table 5.6. Coastal Wetlands Acres

Wetland Type	Acres in Study Area	Percent of Study Area
Estuarine Marine Wetland	81,047	6.22
Freshwater Emergent	9,596	0.74
Freshwater Forested/Shrub	82,073	6.30
Total Marine Wetlands	81,047	6.22
Total Freshwater Wetlands	91,669	7.04
Total	**172,716**	**13.26**

Source: USFWS 2022c

5.2.3.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, the current impacts from erosion and accretion, which promote a loss of wetland habitat along shorelines by increasing sedimentation and destroying existing vegetation, would continue. The construction of non-FEMA funded projects to reduce flooding and erosion at individual sites may result in construction-related runoff and/or the placement of temporary or permanent fill within wetlands that would result in a **minor** to **moderate** adverse effect on wetlands in the short term or long term depending on the use of fill material. Non-FEMA funded projects could include localized wetland restoration or mitigation components to offset long-term adverse effects associated with construction impacts on wetlands. However, In the long term, non-FEMA funded projects would not substantially mitigate flooding and erosion. The unmitigated coastal erosion and storm surge-related saltwater inundation could degrade the condition and function of existing wetlands. Therefore, in the long term, there would be **minor** to **moderate** adverse effects on wetlands within the study area.

Proposed Action

General Consequences of the Proposed Action

Construction has the potential to result in short-term **minor** to **moderate** adverse effects if wetland habitats are directly disturbed or impacted by temporary or permanent fill or other construction activities, such as the use of temporary access routes or staging areas. If a project or a structure could affect wetlands, a project specific 8-step would be required. Construction activities also have the potential to impact the water quality within a wetland through increased sedimentation or pollution. BMPs focusing on the use of compatible fill materials and pollution controls and avoidance measures such as keeping equipment out of wetlands and using mats to prevent soil compaction would aid in mitigating these short-term adverse impacts.

There may be impacts beyond the project footprint if a project impacts sources of wetland hydrology or requires filling or conversion of portions of wetlands. When partially filled or converted, the remaining wetland acreage may experience declines in functions, values, and habitat quality; changes in hydrology and natural flow within the wetlands; and the spread of invasive species. This PEA presumes that projects can be designed to avoid permanent impacts on wetlands, except for marsh/wetland creation designs. For any project that could impact wetlands, a project-specific 8-step would be required which could result in

the preparation of an SEA to address additional impacts on wetlands that are not otherwise evaluated. Coordination with USACE and compliance with the Massachusetts Wetlands Protection Act would be required.

There would be long-term **minor** to **moderate** beneficial effects on wetlands under the Proposed Action by reducing flooding and erosion that increases contamination and sedimentation entering wetlands. Additionally, reduced flooding would result in less saltwater inundation of freshwater wetlands and would have a **negligible** beneficial effect in the long term. However, a proposed project could have **minor** to **moderate** adverse effects on wetlands if a project includes permanent fill in designated wetlands. Projects involving permanent fill would be considered on a case-by-case basis to determine the need to prepare an SEA.

Project-Specific Consequences

Hard Engineering Designs

In the long term, hard stabilization designs have the potential to permanently fill existing wetlands and would result in **minor** to **moderate** adverse effects. As previously noted, a project that would permanently fill wetlands would be required to perform an 8-step analysis and would be considered on a case-by-case basis to determine the need for an SEA. Hard stabilization designs have the potential to create a hard barrier that could separate existing tidal wetlands from oceanic and tidal influence. This separation could adversely affect wetland hydrology even if there is no direct fill of the wetland. In addition, if the littoral transport of shoreline sediments is interrupted by shoreline hardening or by breakwaters, jetties, or groins; erosion or accretion of shoreline sediment can occur and result in the loss of downdrift wetlands. Because a wetland permit and associated compensatory mitigation would not be required if there is no direct wetland fill, there may still be adverse impacts on wetland hydrology from hard engineering designs. The potential for these effects would be evaluated using the 8-step process for determining whether this PEA may be applied to a project. Because of these issues, the installation of hard engineering designs could result in long-term **minor** to **moderate** adverse effects on wetlands.

If the construction of hard engineering designs occurs in an area where an existing wetland is present, some wetland vegetation loss may occur. However, it is likely that these areas would have already lost substantial amounts of vegetation because of the shoreline erosion that generates the need for the project and that some vegetation could be replanted to enhance existing wetlands. Therefore, hard stabilization designs could result in long-term **minor** benefits for wetland habitats.

Bioengineering Designs

The use of native vegetation and natural materials in bioengineered designs would likely result in a **minor** to **moderate** long-term beneficial effect on wetland habitats throughout the study area. The use of sills or toe protection may have beneficial effects by reducing erosion and allowing native wetland plants to establish, which would allow the natural wetland vegetation root systems to provide erosion protection. However, there may be adverse effects if these designs fill a portion of any adjacent wetlands. Effects may range from **minor** to **moderate** beneficial effects to **minor** adverse effects.

Project Conditions

- Conditions for wetlands are tied to state and federal permitting procedures, see Section 5.2.1.

5.2.4 Wild and Scenic Rivers

The Wild and Scenic Rivers Act was enacted in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Act is notable for safeguarding the unique character of these designated wild and scenic rivers while recognizing the potential for their appropriate use and development. It encourages river management that crosses political boundaries and promotes public participation in developing goals for river protection. The outstandingly remarkable values that qualify a river for designation include scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values.

Federally designated rivers are classified as wild, scenic, or recreational. *Wild* river areas are rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines that are essentially primitive and unpolluted waters. These represent the vestiges of primitive America. *Scenic* river areas are rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but which are accessible in places by roads. *Recreational* river areas are rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

5.2.4.1 Existing Conditions

The study area encompasses approximately 16 miles of the designated Taunton River as depicted in **Map 10** of **Appendix A** (USDA 2022b). The Taunton River is free from dams and other impediments and encompasses wetlands, estuaries, and agricultural use leading to a vast amount of biodiversity within the river. As one of the most diverse and intact coastal riverine ecosystems in southern New England, it was designated for its outstanding values for agriculture, fisheries and wildlife habitat, scenic beauty, history and archaeology, and recreational opportunities. Of the 22-mile segment of the Taunton within the study area, approximately 10 miles spanning from the ocean inland are designated as *recreation*. The remaining 6 miles within the study area are designated as *scenic*. Should any rivers within the study area be designated as Wild and Scenic after the publication of this PEA, such rivers would also be covered under this PEA analysis.

5.2.4.2 Potential Effects and Proposed Mitigation

No Action Alternative

Any modification of a designated river could affect the protected values of the river. Under the No Action alternative, construction of non-FEMA funded projects could reduce the scenic value of the river by disturbing ground, removing vegetation, or obstructing views with construction equipment. Ground disturbance could release potentially contaminated sediments that adversely affect the river (see Section 5.2.1). Recreation sites located within a project area may be temporarily closed for safety during construction activities. Therefore, non-FEMA funded projects could result in short-term **minor** to **major** effects on the Taunton River, depending on the location, scale, and intensity of the activities. Alterations of the riverbank could have long-term adverse impacts on fish and wildlife through loss of vegetation and habitat. In the long term, non-FEMA funded projects would focus on individual sites and properties and would not substantially mitigate flooding and erosion for the surrounding area; therefore, flooding and erosion of the shoreline could continue. This could be viewed as a natural process on a wild and scenic designated river and thus would not represent an adverse effect. However, if the continued erosion results

in the release of potentially contaminated sediments, loss of fish and wildlife habitat, loss of recreational access, or other wild and scenic river values, the No Action alternative could result in long-term **minor** to **major** adverse effect on the Taunton.

Proposed Action

General Consequences of the Proposed Action

Construction activities have the potential to temporarily limit access to or reduce the visual appeal of a Wild and Scenic River. Depending on the duration and scale of construction activities, there could be a **minor** to **moderate** adverse short-term effect. Depending on the design of a project, access to scenic views or recreational opportunities of a Wild and Scenic River may be inhibited or enhanced in the long-term, see project specific consequences for more detail. If the Proposed Action is located within one-quarter mile of the Taunton River or any river within the study that could be designated Wild and Scenic in the future, FEMA would consult with the National Park Service (NPS) to make a formal determination of effect under Section 7 of the Wild and Scenic Rivers Act. The determination would evaluate the effects of the Proposed Action on the values that are the basis for the river's designation as a Wild and Scenic River. The consultation may include conditions that the Project Proponent would be required to meet. Depending on which values would be affected by the Proposed Action, the potential effects and BMPs would likely be similar to those described in each section pertaining to the relevant value (i.e., Section 5.2.1, Water Quality; Section 5.2.4, Fish and Wildlife; and Section 5.5 Cultural Resources).

Project-Specific Consequences

Hard Engineering Designs

Hard engineering designs may result in sediment starvation in downstream reaches that could degrade habitat in the long term by increasing erosion in those downstream areas that would affect fish and wildlife habitat hard engineering designs could constrain floodwaters, resulting in increased flood flow volumes and velocities that could result in scour downstream of the design feature. Increased erosion from sediment starvation and downstream scour could impact scenic values by degrading vegetative communities or creating barren eroded banks. Hard engineering designs such as revetments and seawalls would place fill in otherwise natural areas, which could be considered visually unappealing. Therefore, there could be **minor** adverse effects on the values of current and future designated Wild and Scenic Rivers in the study area.

Bioengineering Designs

Bioengineering designs use living vegetative systems that are blended into the natural ecosystem. These bioengineered systems would have beneficial effects on water quality and fish and wildlife habitat. These designs could be considered visually appealing, may increase the scenic value of the river, and may support some types of recreation (e.g., fishing, bird watching). Bioengineered designs would not result in sediment starvation and downstream effects and would have lower flood flow velocities and provide shelter for fish species (see Sections 5.2.2 and 5.4.2). Therefore, there could be a **minor** to **moderate** beneficial effects on the values of current and future designated Wild and Scenic Rivers in the study area.

Project Conditions

- Compliance with the terms and conditions resulting from FEMA’s consultation with NPS.

5.2.5 Navigation

This section analyzes the impacts of the alternatives on navigation in designated areas maintained by the federal government. The Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq., Ch. 425, Mar. 3, 1899; 30 Stat. 1151) protects navigable waters of the U.S.; administration of this Act has been delegated to the Coast Guard and USACE. The Coast Guard regulates activities that may affect bridges and causeways over navigable waters while USACE regulates the construction of structures and all other work within, over, or under navigable waters of the United States. USACE is also responsible for regulating the maintenance of navigation channels, generally through dredging, while the Coast Guard is responsible for the maintenance of navigational aids, such as buoys and channel markers. It is prohibited by law for projects to obstruct navigation channels or navigational aids. Projects with features extending into navigable waters must provide as-built plans to the NOAA Office of the Coast Survey to update federal navigation charts.

Section 14 of the Rivers and Harbors Act of 1899 (33 U.S.C § 408) regulates third-party obstructions or alterations to USACE civil works projects, including navigable river and harbor improvements. All such alterations in a federally authorized channel require Section 408 permission from USACE prior to starting work.

The MA CZM developed ten Designated Port Areas (DPA) to promote and protect water-dependent industrial uses. These DPAs have key features such as commercial fishing, shipping, and other vessel-related marine commercial activities and support manufacturing, processing, research, and production activities that require marine transportation or access to large volumes of water. The Massachusetts CZM reviews and approves municipal harbor plans for DPAs to balance environmental and economic needs. Specific projects located within DPAs should determine if project activities are in accordance with the municipal harbor plan.

5.2.5.1 Existing Conditions

The study area includes 30 seaports along the Massachusetts shoreline including ports, ferry terminals, shipyards, piers, and wharves as depicted in **Map 11** of **Appendix A** (Massachusetts Department of Transportation, n.d.). Seaports in the study area serve freight and passenger needs with some providing service year-round and others only seasonally. Large, deep, draft vessels that use the navigation channels include cargo freighters, tankers, large pleasure craft, and other working vessels such as ferries and tugboats. Nineteen ferry routes travel through the study area (Massachusetts Department of Transportation, n.d.). The study area encompasses all tidally influenced navigable waters subject to regulation under Section 10 in Massachusetts.

5.2.5.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, non-FEMA funded projects to reduce flooding and erosion may include the use of offshore barges. Barges would be operated close to the shore and are prohibited by law from interfering with the navigation of vessels. Non-FEMA funded projects would be unlikely to include projects that require a higher degree of engineering such as offshore breakwaters or jetties that could potentially interfere with navigation channels and would be subject to regulations and permitting in accordance with the Rivers and Harbors Action (Section 10) and Section 408 administered through

USACE. Therefore, there would be a **negligible** impact on navigation in the short term. In the long term, non-FEMA funded projects would not substantially mitigate flooding and erosion. As a result, existing bluffs, beaches, and shoreline features would continue to erode, possibly contributing sediment to navigation channels close to shore that may require additional dredging. Therefore, under the No Action alternative, there would be **negligible** to **minor** adverse effects on navigation in the long term.

Proposed Action

General Consequences of the Proposed Action

Under the Proposed Action, work may include the use of offshore barges. Much like the No Action alternative, barges would be operated close to the shore and are prohibited by law from interfering with navigation. Any projects proposing features that would extend into navigable waters must have required federal, state, and local permits and approvals prior to commencement of work, including in accordance with the Rivers and Harbors Action (Section 10) and Section 408 administered through USACE; as-built plans would need to be provided to the NOAA Office of the Coast Survey to update federal navigation charts. For any project proposing features that would extend into navigable waterways and interfere with navigation, and SEA would be prepared. In the long term, revetments, bulkheads, seawalls, levees, berms, and bioengineering designs would occur on, directly adjacent to, or parallel to the shore. Because of their proximity to the shore, projects would likely not have adverse effects on navigation in the long term. Shoreline erosion reduction measures could reduce sediment inputs into navigable waters and thus potentially reduce the need for dredging navigation channels. This benefit would likely be negligible as rivers and tributaries are a greater source of sediment inputs, but localized effects could be measurable. Breakwaters, groins, and wave attenuators, discussed further below, could extend into open waters, which could impact navigation channels.

Project-Specific Consequences

Hard Engineering Designs

Breakwaters, groins, jetties, and wave attenuators have the potential to encroach on navigation channels because of their location offshore or orientation to the shoreline. This could impact vessel movements through the area in the long term. However, construction would require a permit from USACE, which would likely condition approvals to maintain unobstructed navigation channels. As long as projects are designed and constructed in compliance with USACE permits, there would be **negligible** effect on navigation from the location of structures in the water. If a project would locate a structure in or immediately adjacent to a navigation channel as shown on navigation charts maintained by NOAA, this PEA would not apply unless the Project Proponent obtains documentation (such as a permit or letter of approval) that the project will not interfere with navigation.

Groins and jetties would have the greatest effect on the lateral movement of sediments (see Section 4.2.1), which may alter both erosion and deposition areas. An alteration of sediment movement patterns may have unintended effects on downdrift areas by creating new areas of deposition or scour that are outside of the project area or trap sediments within the project area and cause sediments to accumulate farther offshore in the project area, which could impact navigation channels that are close to the shore. Although these projects would still require USACE permits (see section 5.2.1), the potential effects are more unpredictable and permit conditions may not fully address potential impacts. Therefore, the placement of groins and jetties may have a **minor** adverse effect on navigation.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated.

Project Conditions

The following conditions would be necessary to avoid and minimize potential impacts:

- Before construction begins, the Project Proponent must obtain any required River and Harbors Act Section 10 Permit from USACE and comply with all terms and conditions of the issued permit.
- Any project proposing features that extend into navigable waters must have required USACE, MASS CZM, and local permits and approvals prior to commencement of work.
- Any projects with features extending into navigable waters must provide as-built plans to the NOAA Office of the Coast Survey to update federal navigation charts.

5.3 Coastal Resources

5.3.1 Coastal Zone Management Act

The Coastal Zone Management Act, enacted in 1972, was established to preserve, protect, develop, and, where possible, restore or enhance the resources of the nation's coastal zone. Section 307 of the Coastal Zone Management Act requires federal actions, within (or outside of, but with the potential to affect) the coastal zone, to be consistent with the enforceable policies of the state's federally approved coastal zone management program (NOAA 2020).

The Massachusetts Office of Coastal Zone Management (MA CZM) is responsible for managing the state's coastal program. The program has developed policies for the protection of coastal resources including habitat, ports and harbors, public access and recreation, and water quality as described in the *Massachusetts Coastal Management Policy Guide*. The enforceable policies most relevant to the coastal flooding and erosion control projects emphasize protecting, restoring, and enhancing natural coastal landforms and processes as a preferred method of reducing and managing coastal hazards and minimizing the effect of construction on water circulation and sediment transport, including to downcoast areas. In addition, enforceable policies ensure that coastal construction and developments promote public use and enjoyment of the water's edge.

The program includes several coastal hazard objectives including two that are relevant to coastal flooding and erosion control projects: (1) prevent, eliminate, or significantly reduce threats to public safety, property, and environmental resources resulting from hazards such as erosion, flooding, and storm damage; and (2) allow natural physical coastal processes to continue while allowing appropriately sited coastal development and economic growth and promote the use of nonstructural alternatives for shore protection, where appropriate and to the extent feasible (MA CZM 2011).

Mass DEP administers the regulatory provisions of the Massachusetts Public Waterfront Act, commonly called "Chapter 91." The program issues licenses for projects in waterways and ensures that projects meet public-access requirements (310 CMR 9.01(2)).

5.3.1.1 Existing Conditions

The Massachusetts coastal zone extends from the Massachusetts-New Hampshire border south to the Massachusetts-Rhode Island border, see Appendix A, Map 1. It includes the lands and waters within the seaward limit of the state's territorial sea to 100 feet landward of the first major land transportation route (e.g., road, rail line). Generally, the coastal zone includes all islands, transitional and intertidal areas, coastal wetlands, beaches, tidal rivers, and waters that support anadromous fish spawning in coastal towns (MA CZM 2011). The study area includes all areas landward of the coastal zone and a quarter mile seaward of the coastline.

Coastline characteristics vary along the Massachusetts shore. The southeastern coastal area encompasses Cape Code, Martha's Vineyard, and Nantucket Island and is characterized by level to rolling plains, sand dunes, beaches, and tide flats. The remaining coast is characterized by flat to irregular plains, maritime dunes, and salt marshes. The coastal area within the City of Boston and the surrounding area is highly developed with large areas of hardened shoreline (EPA 2009).

5.3.1.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, non-FEMA funded projects to reduce flooding and erosion would require construction in the coastal zone. Construction activities would result in the temporary restriction of access to the project site and **minor** short-term impacts on water quality (see Section 5.2.1). Non-FEMA funded projects would likely be a patchwork of repairs that would protect the individual structures adjacent to and near the project. Non-FEMA funded actions may not include coordination across communities or jurisdictions but would still need to be consistent with all MA CZM guidance and enforceable policies to protect coastal resources. Thus, in the long term, flooding and shoreline erosion would not be substantially mitigated. Continued flooding and erosion could create hazardous conditions by damaging coastal infrastructure, depositing debris, and spreading contaminants, such as sewage. Public access to the shoreline would be limited if floodwaters inundate and/or erosion causes damage to trails, piers, and roads along the shoreline. Thus, the No Action alternative would have a **moderate** long-term impact on coastal resources from continued flooding and erosion.

Proposed Action

General Consequences of the Proposed Action

Under the Proposed Action, construction would occur within the coastal zone. Construction activities would result in the temporary restriction of access to the project site and could result in short-term adverse effects on water quality from ground-disturbing activities (see Section 5.2.1) Water quality permits from Mass DEP and the EPA would likely require BMPs to reduce the risks of construction-related erosion and sedimentation and would be consistent with MA CZM coastal policies (see Section 5.2.1). Thus, there would be a **negligible** short-term adverse effect on coastal resources.

In the long term, the Proposed Action would reduce coastal flooding and erosion, reducing threats to public health and safety (as described in Section 5.6.5), reducing the risk of damage to coastal property, and reducing impacts on environmental resources (see Section 5.4). Specific projects under the Proposed Action would need to be consistent with all MA CZM guidance and enforceable policies to protect coastal resources.

Consultation with the MA CZM would occur through a federal consistency review for projects that would affect the coastal zone. The consistency review would identify mitigation measures necessary to avoid, minimize, and mitigate adverse effects and ensure consistency with coastal hazard objectives and enforceable policies. If a project is found to be inconsistent with MA CZM policy, the scope of work would need to be adjusted to conform to MA CZM policies. Changes to a project scope would trigger additional project specific NEPA compliance reviews. If the required scope of work changes are beyond the extent of this PEA, then an SEA may be required.

Project-Specific Consequences

Hard Engineering Designs

Hard engineering designs may alter sediment transport patterns, which can result in increased beach and bluff recession downdrift or sediment starvation directly seaward of the structure. Specific projects under the Proposed Action would need to be consistent with coastal hazard objectives and MA CZM enforceable policies that encourage natural physical coastal processes to continue and require that adverse effects on sediment transport patterns be minimized. Some hard engineering designs, such as rubble placement for a revetment, could be considered visually unappealing or could reduce public access to the site in the long term. In addition, hard engineering designs may interrupt natural coastal landforms and processes by placing a hard barrier between landside features (e.g., a coastal bank) and the water. Therefore, hard engineering designs may not be consistent with the objectives and policies of the Massachusetts Coastal Zone Program. Consultation with the MA CZM would occur through a federal consistency review for projects that would affect the coastal zone. The consistency review would identify measures to avoid, minimize, and mitigate adverse effects, ensure consistency with coastal hazard objectives and enforceable policies, and could identify the need for design changes.

Bioengineering Designs

No additional impacts specific to the construction of bioengineering designs are anticipated. Bioengineering designs include living vegetative systems that are blended into the shoreline and coastal ecosystem. This would allow natural physical coastal processes to continue as compared to hard engineering designs and may create new areas for natural processes to occur. Therefore, bioengineering designs would be consistent with the objectives and policies of the Massachusetts Coastal Zone Program.

Project Conditions

- Before construction begins, the Project Proponent must coordinate with the Massachusetts Office of Coastal Zone Management and obtain a favorable Coastal Zone Consistency Determination. The Project Proponent must comply with all terms and conditions of the issued Coastal Consistency Determination.
- Before construction begins, the Project Proponent must obtain a Mass DEP Chapter 91 Waterway License and comply with all terms and conditions of the issued permit.

5.3.2 Coastal Barrier Resources Act

The Coastal Barrier Resources Act (CBRA) of 1982, and the associated Coastal Barrier Improvement Act of 1990 encourages the conservation of biologically rich coastal barriers by restricting federal expenditures that support development within the Coastal Barrier Resources System (CBRS) and Otherwise Protected Areas (OPAs). Within designated CBRS units, no new federal expenditures or assistance can be made, including the construction of roads, infrastructure, and most projects related to shoreline stabilization. Within OPAs, only federal flood insurance is prohibited; CBRA does not restrict other types of federal expenditures or assistance within these areas (USFWS 2019a).

5.3.2.1 Existing Conditions

CBRS Units and OPAs are scattered along the Massachusetts coastline as depicted in **Map 12** in **Appendix A**. System Units and OPAs are especially concentrated along the Cape Cod, Martha's Vineyard, and Nantucket Island coastline and north near the cities of Ipswich and Newburyport. Larger System Units also occur along Duxbury, Plymouth, and Kingston Bays (USFWS 2019b).

5.3.2.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, construction activities to implement non-FEMA funded structures could be located within or adjacent to CBRAs and result in short-term effects on coastal barriers from the production of noise, ground disturbance, vegetation removal, and reduced water quality (see Section 5.1.1, Geology, Topography, and Soils, Section 5.2.1, Water Quality, Section 5.4.1, Vegetation, and Section 5.6.2, Noise). These impacts would be temporary and spatially dispersed, resulting in **negligible** short-term effects. In the long term, non-FEMA funded projects would likely lack coordination among communities and be of a size or scale to substantially mitigate the risk of flooding and erosion.

Existing bluffs, beaches, and shoreline features would continue to be inundated with floodwaters and eroded over time causing instability and degrading habitat. Therefore, there could be a **minor** to **moderate** long-term adverse effect on CBRS resources if non-FEMA funded projects are implemented within or near them.

Proposed Action

General Consequences of the Proposed Action

Under the Proposed Action, mitigation projects would not meet the exceptions under Section 6 of the CBRA (16 U.S.C. § 3505) within designated CBRS units would not be eligible for FEMA grant funding and thus there would be no effect on System Units. FEMA would get an official property determination from USFWS for all Proposed Actions within a CBRS buffer zone to determine if the project is subject to the restrictions of CBRA.

Projects proposed in OPAs may receive FEMA grant funding. Construction activities would result in short-term **minor** adverse effects on coastal resources from the production of noise, ground disturbance, vegetation removal, and reduced water quality (see Section 5.1.1, Geology, Topography, and Soils, Section 5.2.1, Water Quality, Section 5.4.1, Vegetation, and Section 5.6.2, Noise). In the long term, the Proposed Action would reduce the risk of flooding and erosion and associated adverse effects on OPAs such as reduced water quality, soil erosion, and degraded habitat.

Project-Specific Consequences

Hard Engineering Designs

As described in Section 5.1.1, hard engineering designs may result in downdrift erosion or sediment starvation that could disrupt natural processes, degrade habitat, or result in habitat loss, which could adversely affect a nearby CBRS System unit or OPA located downdrift of a proposed project. Therefore, **minor** to **moderate** effects on coastal resources could occur. A coastal sediment transport impact analysis would be required for any hard engineering designs. If downdrift impacts are found, an SEA may be required.

Bioengineering Designs

Bioengineering designs use living vegetative systems that are blended into the shoreline and coastal ecosystems. Enhanced natural vegetative systems would result in benefits to water quality and may create, improve, or expand coastal habitat. Improved water quality would be beneficial to aquatic plants that depend on the ability for light to penetrate waters and improved coastal habitat would support animal species and ecological diversity. Therefore, there would be a **minor** to **moderate** beneficial effect from bioengineering designs located within OPAs.

Project Conditions

- A coastal sediment transport impact analysis would be required for any hard engineering designs.

5.4 Biological Resources

5.4.1 Vegetation

The Massachusetts Division of Fisheries and Wildlife's (MassWildlife) Natural Heritage and Endangered Species Program (NHESP) manages state-designated rare plants and natural communities (MassWildlife 2022) under the Massachusetts ESA (MESA) (Massachusetts General Laws, Chapter 131A). NHESP is responsible for the conservation and protection of hundreds of species that are not hunted, fished, trapped, or commercially harvested in the state, as well as the protection of the natural communities that make up their habitats.

Massachusetts General Laws, Chapter 87 protects public shade trees, or all trees within or on the boundaries of a public way. Under this law, public shade trees cannot be cut, trimmed, or removed by any person other than the tree warden or deputy, unless permission from the tree warden is granted.

As noted in Section 5.3.1, CZM is responsible for managing the state's coastal program. This includes management and protection of coastal vegetation in terrestrial, intertidal, and submerged aquatic habitats.

5.4.1.1 Existing Conditions

The EPA developed a system of ecoregions to structure and implement ecosystem management strategies across federal agencies, state agencies, and nongovernmental organizations that consist of areas that have similar characteristics, environmental conditions, ecosystem types, functions, and qualities (EPA 2022a). The study area contains six EPA-designated Level IV ecoregions, as shown in **Appendix A, Map 7** and summarized in **Table 5.7** (EPA 2022a).

Table 5.7. Ecoregions in the Study Area

Ecoregion	Area (Square Miles)	Percent of Total (%)
Gulf of Maine Coastal Lowland	312.86	18.3
Gulf of Maine Coastal Plain	3.09	0.2
Boston Basin	156.97	9.22
Southern New England Coastal Plains and Hills	61.36	3.6
Narragansett/Bristol Lowland	451.58	26.25
Cape Cod/Long Island	719.28	42.26
Total	**1,702.10**	**100.0**

Source: EPA 2022a

The Gulf of Maine Coastal Lowland ecoregion is characterized by a vegetation mosaic that includes Appalachian oak-pine forests and extensive post-settlement white and pitch pine (*Pinus strobus* and *Pinus rigida*) forests in sandy areas. Pitch pine bogs, some Atlantic white cedar (*Thuja occidentalis*) swamps, red maple (*Acer rubrum*) swamps, and *Spartina* saltmarsh also occur throughout the ecoregion.

The Gulf of Maine Coastal Plain ecoregion is made up of mesic to dry Appalachian oak-pine forests. Some hemlock (*Tsuga sp.*)-hardwood-pine forests occur, and floodplain forests include American elm (*Ulmus americana*) and silver maple (*Acer saccharinum*).

The Boston Basin ecoregion is almost entirely urban and suburban land where most and most natural vegetation has been removed. Maritime shrubland (characterized by huckleberry [*Vaccinium sp.*] and eastern redcedar [*Juniperus virginiana*]) and saltmarshes (dominant species include cordgrass [*Spartina sp.*], spike-grass [*Distichlis spicata*], and saltmarsh rush [*Juncus gerardii*]) occur along the estuaries, bays, and islands on the ecoregion's eastern edge.

The Southern New England Coastal Plains and Hills ecoregion is characterized today by a variety of dry to mesic successional oak (*Quercus sp.*) and oak-pine (*Pinus sp.*) forests.

The Narragansett/Bristol Lowland ecoregion is composed mostly of mixed forest with numerous wetlands, including cranberry bogs, and small areas of croplands and pasture. Forests in this ecoregion are oak-hickory (*Carya sp.*) and oak-pine, and saltmarshes, beach strands, and low dunes occur along the coast.

The Cape Cod/Long Island ecoregion is composed of a wide variety of vegetation communities including maritime and coastal forests and woodlands, swamps, bogs, maritime shrubland, dune woodlands, sandplain grasslands, sandplain heathlands, sand dune grasslands, beach strands, and saltmarshes. Oak-pine forests and woodlands in the ecoregion may have dense shrub layers. Common sandplains and dune species include bluestem (*Andropogon sp.*), scrub oak (*Quercus berberidifolia*), beach grass (*Ammophila sp.*), and seaside goldenrod (*Solidago sempervirens*).

The NHESP and the Nature Conservancy's Massachusetts Program developed *Biomap2*, a map-based system to identify and prioritize intact landscapes in Massachusetts that are better able to support ecological processes and disturbance regimes referred to as critical natural landscape. A critical natural

landscape is made up of large natural landscape blocks that provide habitat for a wide array of native species, support intact ecological processes, maintain connectivity among habitats, and enhance ecological resilience. According to *Biomap2* data, there are approximately 493,679 acres of critical natural landscape within the study area that includes 304,978 acres of landscape blocks, which are areas of intact predominately natural vegetation, consisting of wetlands, rivers, lakes, ponds, contiguous forest, as well as coastal habitats such as barrier beaches and salt marshes (Mass 2022a).

In coastal regions, coastal wetlands and shallow nearshore habitats support submerged aquatic vegetation (SAV), which serves as important spawning and nursery grounds for fish and many other aquatic organisms and provides important foraging habitat for birds and other species. SAV is a key component of Essential Fish Habitat (EFH) in many areas (refer to Section 5.4.5). In Massachusetts, SAV primarily includes eelgrass (*Zostera marina*) beds. Widgeon grass (*Ruppia maritima*) is also present in the upper reaches of some embayments (Mass 2020). Mass DEP periodically maps the state's SAV beds and has identified a state-wide decline in SAV coverage along the coast (Costello and Kenworthy 2011).

5.4.1.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, construction of non-FEMA funded projects to reduce flooding and erosion may result in short-term **minor** to **moderate** adverse effects on vegetation from ground disturbance and vegetation removal during construction activities. This includes potential effects to terrestrial vegetation, emergent aquatic vegetation, and SAV. Non-FEMA funded projects could include minor mitigation or shoreline restoration components that provide localized benefits to vegetation. However, in the long term, effects from ongoing terrestrial and aquatic vegetation loss and disturbance, the spread of invasive species because of largely unmitigated erosion, and inundation of terrestrial vegetation could have **minor** to **moderate** adverse effects on vegetation.

Proposed Action

General Consequences of the Proposed Action

The Proposed Action would have short-term **minor** to **moderate** adverse effects on vegetation during and directly after construction. Construction, as well as access and staging, may involve the removal of vegetation and equipment may disturb or compact soils, which can inhibit plant establishment, growth, and seed germination. Some projects would reseed or replant disturbed land with native vegetation, thus mitigating long-term effects of vegetation loss. In the long term, the mitigation of shoreline erosion could decrease vegetation loss and reduce the amount of disturbed area that invites invasive species to become established (refer to Section 5.4.3). Additionally, the Proposed Action would result in reduced flooding and saltwater inundation of vegetation, which can cause desiccation and kill or degrade vegetation communities (Cornell University Cooperative Extension 2012). Therefore, the Proposed Action would result in long-term **minor** to **moderate** beneficial effects on vegetation. If any project were to adversely affect the vegetation habitat that it would reduce population levels of native species or sufficient habitat would not remain to maintain the viability of all vegetation species, and SEA would be required.

Project-Specific Consequences

Hard Engineering Designs

Hard engineering designs would generally result in the conversion of some terrestrial and/or aquatic vegetation to hard surfaces (i.e., rock or concrete). However, project areas would likely have already lost some vegetation because of shoreline erosion or inundation by saltwater during coastal flooding. Some vegetation could be replanted in or around structures on the shore to offset vegetation loss within the project footprint. The structure would also reduce or halt the ongoing erosion or coastal flooding that could damage vegetation beyond the project footprint. Therefore, hard engineering designs could have long-term **minor** to **moderate** beneficial effects on vegetation by protecting vegetation communities from erosion and flooding.

Bioengineering Designs

Bioengineering designs would enhance, restore, or expand natural vegetation communities in addition to protecting existing communities from erosion and flooding. The enhancement, restoration, or creation of natural vegetation communities would also reduce the prevalence of or potential for invasive plant species. Therefore, bioengineering designs would have long-term **minor** to **moderate** beneficial effects on vegetation communities.

Project Conditions

- Conditions for vegetation removal would be established through other permitting and consultation processes (e.g., ESA permitting, Massachusetts Wetland Protection Act)

5.4.2 Fish and Wildlife

MassWildlife is responsible for the conservation of freshwater fish and wildlife in the Commonwealth. NHESP is responsible for the conservation and protection of hundreds of species of wildlife and fish that are not hunted, fished, trapped, or commercially harvested in the state, as well as the protection of the natural communities that make up their habitats. The Massachusetts Division of Marine Fisheries (DMF) is responsible for the management of the Commonwealth's commercial and recreational marine fisheries. The Massachusetts Department of Conservation and Recreation (DCR) administers the Areas of Critical Environmental Concern program; Areas of Critical Environmental Concern are characterized by their quality, uniqueness, and significance of their natural and cultural resources (DCR 2022).

The Bald and Golden Eagle Protection Act as amended, 16 U.S.C. § 668 et seq., provides for the protection of Bald and Golden Eagles by prohibiting the take, possession, sale, purchase, barter, transport, export, or import of any Bald or Golden Eagle, alive or dead, including any part, nest, or egg unless allowed by permit. This Act can require consultation with USFWS to ensure that proposed federal actions do not adversely affect Bald or Golden Eagles. Project activities may be required to avoid certain seasons or buffer areas around nesting eagles, and would be subject to conservation measures defined in the National Bald Eagle Management Guidelines (USFWS 2007).

The Migratory Bird Treaty Act (MBTA) provides a program for the conservation of migratory birds that fly through lands of the United States. A migratory bird is any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. Most species native to North America are covered by the MBTA. The lead federal agency for

implementing the MBTA is USFWS. The law makes it unlawful at any time, by any means, or in any manner to take any part, nest, or egg of migratory birds. "Take" is defined in regulation (50 C.F.R. 10.12) as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or any attempt to carry out these activities."

5.4.2.1 Existing Conditions

Fish and Wildlife Habitat

Each of the six EPA-designated Level IV ecoregions in the study area (**Table 5.7**) supports a characteristic diversity of fish and wildlife species and is a useful tool for describing the ecological communities that may occur within a large area such as the Massachusetts shoreline (EPA 2022a).

The Gulf of Main Coastal Lowland ecoregion includes a variety of habitat types and supports common species such as Virginia opossum (*Didelphis virginiana*), eastern gray squirrel (*Sciurus carolinensis*), and American beaver (*Castor canadensis*). The shoreline in this ecoregion contains important coastal habitats for numerous fish and wildlife species including birds such as the Sanderling (*Calidris alba*), Common Tern (*Sterna hirundo*), Least Tern (*Sternula antrillarum*), and Piping Plover (*Charadrius melodus*).

The Gulf of Maine Coastal Plain ecoregion within the study area is mostly developed and suburban land. Typical wildlife species that could be found within the study area in this ecoregion include those species that are accustomed to suburban noise and disturbance such as red squirrels (*Tamiasciurus hudsonicus*), raccoons (*Procyon lotor*), Northern Cardinals (*Cardinalis cardinalis*), and Blue Jays (*Cyanocitta cristata*).

T**he Boston Basin ecoregion** is inhabited by fish and wildlife species that are common in urbanized areas. Over 150 bird species have been documented at the Boston Nature Center and Wildlife Sanctuary and include species such as American Robin (*Turdus migratorius*), Dark-eyed Junco (*Junco hyemalis*), Cooper's Hawk (*Accipiter cooperii*), and Eastern Kingbird (*Tyrannus Tyrannus*) (Mass Audubon 2022a).

The Southern New England Coastal Plains and Hills ecoregion is comprised mostly of suburban development. However, the eastern portion of this ecoregion within the study area is made up of the Blue Hills Reservation which contains an array of diverse habitats that supports wildlife species such as copperhead snakes (*Agkistrodon contortrix*), timber rattlesnakes (*Crotalus horridus*), and Turkey Vultures (*Cathartes aura*) (Mass 2022b).

The Narragansett/Bristol Lowland ecoregion borders Buzzards Bay to the north and supports fish species such as black sea bass (*Centropristis striata*), summer flounder (*Paralichthys dentatus*), and scup (*Stenotomus chrysops*). Inland this ecoregion is fairly developed and supports species such as the eastern coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), and Wild Turkey (*Meleagris gallopavo*) (Buzzards Bay Coalition 2017).

The Cape Cod/Long Island ecoregion supports a variety of fish and wildlife species including mammals such as red fox (*Vulpes vulpes*) and grey fox (*Urocyon cinereoargenteus*) and fish species such as striped bass (*Morone saxatilis*) and bluefish (*Pomatomus saltatrix*).

According to NHESP and the Nature Conservancy's Massachusetts Program *Biomap2*, there are approximately 380,095 acres of "core habitat" within the study area. Core habitats are necessary to promote the long-term persistence of native species listed under the state ESA or listed in the State Wildlife Action Plan, as well as a wide diversity of natural communities and intact ecosystems across

Massachusetts. Core habitats include habitats for rare, vulnerable, or uncommon mammals, birds, reptiles, amphibians, fish, invertebrate, and plant species, as well as priority natural communities, high-quality wetland, vernal pool, aquatic, and coastal habitats, and intact forest ecosystems. Additionally, there are approximately 304,978 acres of "landscape blocks" that provide connectivity between habitats, support intact ecological processes, enhance resilience to disturbances, and habitats to sustain healthy populations of wide-ranging species such as bobcat (*Lynx rufus*), black bear (*Ursus americanus*), and moose (*Alces alces*) (Mass 2022a).

Bald Eagles

In Massachusetts, Bald Eagles (*Haliaeetus leucocephalus*) usually live near coastal areas, estuaries, and larger inland waters. Bald Eagles require a large amount of shoreline habitat that contains large trees for perching and nesting. Typically, Bald Eagles choose to nest near waterbodies with a good supply of moderate- to large-sized fish. During the winter, Bald Eagles have been known to use trees over 12 miles from their feeding areas for roosting at night. As of 2021, between 70 and 80 territorial pairs of Bald Eagles were identified in Massachusetts; however, not all of them were in the study area (MassWildlife 2019a). The study area is not within the known range for Golden Eagles (*Aquila chrysaetos*) (USFWS 2022a).

Migratory Birds

Over 1,000 native bird species are protected by the MBTA. The study area is located within the Atlantic Flyway. The USFWS Information for Planning and Consultation (IPaC) tool lists 58 migratory birds that are either USFWS Birds of Conservation Concern, or that warrant special attention within the study area. Examples of migratory birds that may be present within the study area include Black-billed Cuckoos (*Coccyzus erythropthalmus*), Brown Pelicans (*Pelecanus occidentalis*), and Purple Sandpipers (*Calidris maritima*) (USFWS 2022b).

Sea Turtles

Four species of sea turtles can be found in Massachusetts waters during the summer and fall. This includes the green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelis kempii*), loggerhead sea turtle (*Caretta caretta*), and leatherback sea turtle (*Dermochelys coriacea*). All four species are listed under the ESA.

5.4.2.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, construction-related disturbances, including noise, vibration, ground disturbance, vegetation removal, and in-water work could remove or degrade habitats and temporarily alter wildlife behavior, which would result in **minor** to **moderate** short-term adverse effects on fish and wildlife, including eagles, and migratory birds. Construction activities that result in behavior alterations would be short-term and temporary. However, implementation of projects without systemic coordination could result in a larger number of piecemeal projects and therefore greater frequency of disturbance associated with construction and maintenance.

In the long term, non-FEMA funded projects could include minor mitigation or shoreline restoration actions, but would not substantially mitigate coastal flooding or erosion. Ongoing impacts on habitats would continue and may include the loss of habitat for shoreline species including Bald Eagles and migratory birds and impaired water quality and sedimentation that would affect aquatic species. **Minor** to

moderate adverse effects from unmitigated coastal flooding and erosion could result in long-term impacts on fish and wildlife and their habitats.

Proposed Action

General Consequences of the Proposed Action

Construction of the Proposed Action could temporarily alter the behavior of wildlife including migratory birds, eagles, fish, and sea turtles, as a result of disturbance from construction, staging, access, and all other project-related activities. Noise, vibration, vegetation removal, ground disturbance, and in-water work all have the potential to disrupt foraging, breeding, migratory, and/or nesting behaviors and to reduce or degrade available habitats, affecting the health of species and populations. Because the activity in any one location would be limited in area (less than 10 acres) and duration, the potential negative effects would be **negligible** to **moderate** and short-term. The coordinated implementation of projects would also reduce the frequency of disturbance compared to the No Action Alternative. BMPs such as avoiding breeding or spawning seasons with construction activities or in-water work as much as is practicable would reduce potential impacts on fish and wildlife. Consideration for most fish and wildlife species would occur during state permitting processes.

Coastal flooding and erosion can degrade the quality of terrestrial habitats by altering and killing vegetation, and can also lead to reduced water quality through increased sedimentation that negatively impacts aquatic habitats. In the long term, Proposed Action projects would mitigate coastal flooding and erosion and would have **minor** benefits for wildlife species, including migratory birds, eagles, sea turtles, and fish. If any project were to adversely affect the habitat that it would reduce population levels of native species or sufficient habitat would not remain to maintain the viability of all fish and wildlife species in the project area, and SEA would be required.

Construction activities that remove vegetation during the migratory bird breeding season (April 1 to September 1) have the potential to affect migratory birds by destroying nests, eggs, and young. If vegetation removal occurs during the breeding season, the Project Proponent would be responsible for coordinating with USFWS to obtain any required authorization and provide documentation of coordination with USFWS to FEMA.

If Bald Eagle nests are identified in a project area and conservation measures defined in the USFWS National Bald Eagle Management Guidelines cannot be implemented, consultation with USFWS would be required to establish actions to protect nest sites, including appropriate buffers. Typical mitigation measures include seasonal limits on clearing activities, retention of nest trees, the establishment of buffers around nest trees, and implementation of the USFWS Bald Eagle Management Guidelines (USFWS 2007). If a take of Bald Eagles is required, the Project Proponent would be required to obtain a take permit from USFWS prior to the start of construction.

Project-Specific Consequences of the Proposed Action

Hard Engineering Designs

Hard engineering designs that alter the characteristics of the shoreline could directly degrade and destroy habitat and disrupt natural forces and tidal influences along the shoreline and in tidally influenced wetlands and backwaters. As described in Section 5.1.1, hard engineering designs may also result in downdrift erosion. Eroded soils may contain contaminants or result in sedimentation that reduces water

quality. Hard engineering designs may remove sand from the local sediment supply resulting in the degradation or loss of habitat for shoreline species and would result in a **minor** to **moderate** adverse effect on fish and wildlife in the long term that may or may not be offset by the long-term beneficial effect of slowing coastal erosion and loss of upland habitats from coastal flooding.

Projects that would require the use of pile driving equipment or offshore barges for the construction of hard engineering designs along the coast would temporarily disturb nearshore marine habitats through increased underwater noise generated during pile driving and elevated turbidity resulting from the anchoring of nearshore structures or construction barges on the sea floor. Given that expected increases in turbidity would be temporary and localized, resultant effects on sea turtles, fish, and marine mammal behavior would be **negligible**. However, underwater noise from proposed pile driving activities has the potential to result in **moderate** effects on sea turtles, fish, and marine mammal species—constituting harassment under the MMPA—if individuals were to occur in or near a project area during construction. Therefore, projects involving pile driving in or directly adjacent to marine waters would require consultation with NMFS to identify appropriate measures to minimize the effects of pile driving on marine species and to determine whether incidental take authorization from NMFS would be required prior to the commencement of pile driving activities.

Bioengineering Designs

Bioengineering designs would have **minor** to **moderate** long-term beneficial effects by restoring, enhancing, or creating natural habitats that may support a wide diversity of fish and wildlife species, including migratory birds and eagles. Installation of bioengineering designs would result in disturbances associated with vehicle and equipment traffic and construction activities (e.g., excavation). These effects would be temporary, localized, and would be expected to have **negligible** to **minor** effects on fish and wildlife.

Project Conditions

- Coordination with MassWildlife and/or DMF is required prior to construction. The state permitting processes may result in conditions or conservation measures that must be implemented to mitigate impacts on fish and wildlife.
- Coordination with NMFS is required for projects that would involve the generation of underwater noise (e.g., pile driving) in or directly adjacent to marine waters to identify appropriate measures to minimize the effects of noise on fish and sea turtles and to determine whether an incidental take authorization would be required prior to the commencement of activities.
- Coordination with Mass Fish & Wildlife is required if the project occurs within migratory bird nesting season to obtain any required authorization. The Project Proponent must provide documentation of coordination with FEMA.
- If Bald Eagle nests are identified in a project area and National Bald Eagle Management Guidelines cannot be satisfactorily implemented, consultation with USFWS would be required to establish actions to protect nest sites, including appropriate buffers. If take would occur, the Project Proponent must obtain a permit from USFWS prior to the start of construction.

5.4.3 Invasive Species

EO 13112, Invasive Species, requires federal agencies to prevent the introduction of invasive species and provide for their control to minimize the economic, ecological, and human health impacts that invasive species cause. EO 13112 defines invasive species as an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health, including noxious weed plant species and invasive animal species. Invasive species often outcompete the species that historically occurred in a particular ecosystem, altering the species composition of the plant and animal communities and their functions.

The Massachusetts Department of Agricultural Resources is the lead state agency responsible for the management of invasive plant species in accordance with state law. Invasive plant species are regulated through the Massachusetts Prohibited Plant List, which prohibits the importation, sale, and trade of 141 plants determined to be invasive in Massachusetts (Massachusetts Department of Agricultural Resources 2021).

In addition to invasive plant species, the United Stated Department of Agriculture (USDA) establishes quarantine areas for invasive animal species. The quarantine for the emerald ash borer (*Agrilus planipennis*) was rescinded in January 2021 (USDA 2022a). MA CZM works to monitor and reduce the spread of invasive marine species in coastal waters of Massachusetts through the marine invasive species program (MA CZM 2022).

5.4.3.1 Existing Conditions

The Massachusetts Invasive Plant Advisory Group has listed 36 species as invasive, 33 species as likely invasive, and 3 species as potentially invasive (MIPAG 2005). The Massachusetts Aquatic Invasive Species Working Group (MAISWG) has identified 18 species or groups of species as "high priority" based on: the severity of the problem posed to Massachusetts by the introduced species, the existing capabilities for management, and the associated costs and benefits of management (MAISWG 2002). Examples of high priority species included water chestnut (*Trapa natans*), Eurasian watermilfoil (*Myriophyllum spicatum*), common reed (*Phragmites australis*), European green crab (*Carcinus maenus*), and Asian shore crab (*Hemigraspus sanguineus*).

5.4.3.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, construction activities from non-FEMA funded projects to mitigate coastal flooding and erosion would result in short-to long-term **minor** to **moderate** adverse effects related to invasive species. This is because construction that results in loss of natural vegetation and ground disturbance may make an area more susceptible to the spread and colonization of invasive species and in-water work has the potential to spread aquatic invasive organisms from one area to another.

Non-FEMA funded projects could include minor mitigation or shoreline restoration actions that could involve invasive species removal. However, in the long term, the No Action alternative would not substantially mitigate coastal flooding or erosion within communities and ongoing erosion and shoreline degradation may support the spread of invasive species, resulting in **minor** to **moderate** adverse effects.

Proposed Action

General Consequences of the Proposed Action

Construction of the Proposed Action would temporarily disturb soils and vegetation, creating suitable conditions for the growth and spread of invasive plant species. The establishment of staging areas and access routes could also contribute to the spread of invasive plant species. Equipment used for in-water work could also spread aquatic invasive species if the equipment is not cleaned properly before entering the water and after being removed from the water. To reduce long-term adverse effects, native vegetation would be reseeded or replanted in disturbed areas to the extent practicable. The Project Proponent would be obligated to follow all conditions in any required CWA permits for in-water work, which would minimize the spread of aquatic invasive species. BMPs such as cleaning equipment used in the water (e.g., boats, trailers, boots) with high pressure hot water to remove aquatic invasive species before starting work and before moving the equipment to a new water body, draining bilges, livewells, and other water-containing devices before leaving water access points would limit the potential for in-water work to spread aquatic invasive plants and animals. The Proposed Action would have short-term **minor** to **moderate** adverse effects related to invasive species from ground disturbance and vegetation removal and in-water work.

In the long term, reduction of coastal flooding and erosion would decrease the frequency and extent of disturbance to natural vegetation communities, thereby reducing opportunities for invasives to become established. The Proposed Action would have a **minor** to **moderate** benefit related to invasive species.

Project-Specific Consequences

Hard Engineering Designs

Hard engineering designs that place hard substrates such as sheet pile, concrete, and riprap in fresh or brackish waters could promote the spread of invasive mussels including zebra and quagga mussels. These species can be spread by improperly cleaned footwear, vehicles, and construction equipment that moves from areas of infestation to new areas. Hard engineering designs also provide the hard substrates preferred by many of these invasive species and may effectively expand the available habitat for invasive species. Hard engineering designs may provide fewer opportunities to replant with native species. Many hard engineering designs result in rough and uneven surfaces that may collect soil and provide substrates for invasive species to become established in that are difficult to reach and maintain. Hard engineering designs could result in **minor** to **moderate** long-term adverse effects related to invasive species.

Bioengineering Designs

As described for hard engineering designs, construction staff and equipment involved in the implementation of bioengineering designs could spread invasive plant and wildlife species if not properly cleaned. However, bioengineering designs would have long-term **minor** to **moderate** beneficial effects related to invasive species because projects would replace existing invasive plant species with native plant species. Bioengineering designs would also be likely to use less hard substrate materials that aquatic invasive animals can use as compared to hard engineering designs.

Project Conditions

- The Project Proponent must obtain and follow all conditions of any required CWA, Chapter 91, and/or Order of Conditions permits for in-water work, which would minimize the spread of aquatic invasive species.

5.4.4 Threatened and Endangered Species

The ESA directs federal agencies to protect threatened and endangered species in consultation with the USFWS and NMFS. Section 7 of the ESA requires federal agencies to aid in the conservation of listed species and to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of listed species. The law also prohibits any action that causes a taking of any listed species of endangered fish or wildlife. "Take" under the ESA is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or any attempt to carry out these activities (50 C.F.R. 10.12). Because the ESA defines an action area as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 C.F.R. 402.02), the action area where effects on listed species may occur could be larger than the project area where project activities would occur.

5.4.4.1 Existing Conditions

As of January 2021, USFWS lists 12 federally threatened or endangered plant and animal species that may be found within the study area, as summarized in **Appendix B, Document 2**. Critical habitat has been designated for one ESA-listed species under USFWS jurisdiction, the Plymouth redbelly turtle (*Pseudemys rubriventris bangsi*), in the study area. There are approximately 3,372 acres of designated critical habitat for the Plymouth redbelly turtle within the study area, including several ponds and adjacent upland areas in eastern Plymouth County, approximately 2.1 miles from the coastline.

Based on a review of the list of federally listed marine and anadromous species in rivers, bays, estuaries, and marine waters of the Northeast and Mid-Atlantic region (NOAA Fisheries 2021), 10 species under NMFS jurisdiction were identified as having the potential to occur within the study area, as summarized in **Appendix B, Document 2.** Additionally, designated critical habitat for two species under NMFS jurisdiction, the Atlantic sturgeon (*Acipenser oxyrinchus*) and the North Atlantic right whale (*Eubalaena glacialis*), overlaps portions of the study area.

There are 173 wildlife species and 259 plant species that are protected under MESA (MassWildlife 2020b). According to *Biomap2*, there are 331,516 acres within the study area that have been identified as containing the habitats required for the long-term survival of species listed under MESA and species included in the Massachusetts State Wildlife Action Plan (MassWildlife 2011).

5.4.4.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action Alternative, non-FEMA funded projects to mitigate coastal flooding and erosion could have adverse effects on listed species and their habitats through construction activities that may cause noise, vibration, and ground disturbance or that could involve in-water work that may result in the release of sediment and pollutants to freshwater and/or nearshore marine habitats. Therefore, these non-

FEMA funded projects could result in **minor** adverse effects on ESA-listed species and/or designated critical habitat.

Under this alternative, there could be long-term **minor** to **moderate** adverse effects on ESA-listed species from loss of habitat due to unmitigated coastal flooding and erosion. Non-FEMA funded projects could include minor mitigation or localized shoreline restoration components, but ongoing coastal flooding and erosion could increase sedimentation and impair water quality resulting in impacts on aquatic species in both freshwater and nearshore marine environments. There could also be long-term **minor** to **moderate** adverse effects on ESA-listed species and/or designated critical habitat from the implementation of non-FEMA funded projects that may result in habitat loss or decreased habitat connectivity.

Proposed Action

General Consequences of the Proposed Action

The Proposed Action has the potential to result in **no effect** to **moderate** adverse effects on ESA-listed species. Should a project have the potential to affect an ESA-listed species, FEMA would prepare a biological assessment to evaluate the potential effects of the project on listed species. FEMA would then consult with USFWS and/or NMFS under ESA Section 7(a)(2) and would seek concurrence with findings of *may affect, not likely to adversely affect,* or conduct a formal consultation for findings of *may affect, likely to adversely affect.* If a proposed project is determined to *likely to adversely affect* a listed species, issuance of a biological opinion and an incidental take permit by USFWS/NMFS would be required prior to project implementation.

Coastal flooding and shoreline erosion mitigation activities could affect both terrestrial and aquatic habitats. All proposed actions would involve some construction, staging, and/or access route usage that could have the potential for short-term direct effects on listed species. Disturbances from noise, human activity, equipment and vehicle use, and loss of habitat from vegetation removal, excavation, and construction activities would all have the potential to affect listed aquatic and terrestrial species.

In the long term, projects that substantially reduce shoreline erosion and coastal flooding would have **minor** benefits on threatened and endangered species by protecting established habitats and water quality as described in Section 5.4.2.

Potential effects on federally threatened and endangered species would need to be reviewed on a project-specific basis. Projects with the potential to affect ESA-listed species would have to adhere to any required terms and conditions and conservation measures developed through consultation with USFWS and/or NMFS. If a project would be *not likely to adversely affect* listed species, then with the implementation of terms, conditions, and conservation measures developed through consultation, there would be **negligible** adverse effects. If a project would be *likely to adversely affect* a listed species, then with the implementation of terms, conditions, and conservation measures developed through consultation, there would be a **minor** to **moderate** effect on listed species. BMPs related to the protection of water quality, wetlands, vegetation, fish and wildlife habitat, and invasive species, as presented in Sections 5.2.1, 5.2.3, 5.4.1, 5.4.2, and 5.4.3 would also provide protection for habitats for ESA-listed species.

It should be noted that the Proposed Action also has the potential to affect species listed as threatened or endangered under state law. State-listed species will be considered during the state permitting process.

Implementation of any terms, conditions, or conservations measures identified during the state permitting process will be required.

Project-Specific Consequences

Hard Engineering Designs

Hard engineering designs are more likely to result in long-term effects through permanent loss and/or degradation of habitats within the project footprint and potential changes in littoral movement of sediments. As described for fish and wildlife in Section 5.4.2, potential effects could include direct degradation or destruction of habitat, disruption of natural tidal processes (e.g., sediment supply), increased downdrift erosion, and temporarily elevated underwater noise. These consequences could be more severe because of the vulnerability of populations of listed species to disturbance and habitat loss. Hard engineering designs could have long-term **minor** to **moderate** adverse effects on listed species that would be mitigated through measures identified in consultation with USFWS and/or NMFS.

Bioengineering Designs

Bioengineered designs have a greater potential for long-term beneficial effects on listed species because restoring, enhancing, or creating natural habitat areas could benefit habitats suitable for ESA-listed species. Additionally, bioengineering designs may replace nonnative or invasive species with native species that offer higher quality habitats.

Project Conditions

- As needed, implement any avoidance and minimization measures resulting from consultation or coordination with USFWS and/or NMFS in accordance with Section 7 of the ESA. The Project Proponent would be required to comply with any measures developed through the Section 7 consultation.

5.4.5 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act is the primary law governing marine fisheries management in U.S. federal waters and designates NMFS as the lead federal agency responsible for its implementation. The act fosters the long-term biological and economic sustainability of our nation's marine fisheries. One primary provision of the act is the designation of EFH for all species managed under the act. All federal agencies are required to assess the potential effects of proposed actions and alternatives on EFH; federal agencies must consult on any actions that could adversely affect EFH.

5.4.5.1 Existing Conditions

NMFS lists EFH and fisheries resources for 31 species and one shark complex in the study area in one or more of the following categories: eggs, larvae/neonate, juveniles, and adults as shown in **Table 5.8** (NOAA 2021). The study area also contains Habitat Areas of Particular Concern for the sand tiger shark (*Carcharias taurus*), juvenile Atlantic cod (*Gadus morhua*), and summer flounder (*Paralichthys dentatus*).

Table 5.8. EFH in the Study Area

Species	Eggs	Larvae/ Neonate	Juvenile	Adult
Acadian Redfish (*Sebastes fasciatus*)		X		
Albacore Tuna (*Thunnus alalunga*)			X	X
American Plaice (*Hippoglossoides platessoides*)	X	X	X	X
Atlantic Cod (*Gadus morhua*)	X	X	X	X
Atlantic Herring (*Clupea harengus*)	X	X	X	X
Atlantic Sea Scallop (*Placopecten magellanicus*)	X	X	X	X
Atlantic Wolffish (*Anarhichas lupus*)	X	X	X	X
Basking Shark (*Cetorhinus maximus*)	X	X	X	X
Bluefin Tuna (*Thunnus thynnus*)			X	X
Common Thresher Shark (*Alopias vulpinus*)	X	X	X	X
Haddock (*Melanogrammus aeglefinus*)	X	X	X	X
Little Skate (*Leucoraja erinacea*)			X	X
Monkfish (*Lophius americanus*)	X	X	X	X
Ocean Pout (*Macrozoarces americanus*)	X		X	X
Pollock (*Pollachius virens*)	X	X	X	X
Porbeagle Shark (*Lamna nasus*)	X	X	X	X
Red Hake (*Urophycis chuss*)	X	X	X	X
Sand Tiger Shark (*Carcharias taurus*)		X	X	
Sandbar Shark (*Carcharhinus plumbeus*)			X	X
Silver Hake (*Merluccius bilinearis*)	X	X	X	X
Skipjack Tuna (*Katsuwonus pelamis*)				X
Smoothhound Shark Complex (Atlantic Stock)	X	X	X	X
Thorny Skate (*Amblyraja radiata*)			X	
White Hake (*Urophycis tenuis*)	X	X	X	X
White Shark (*Carcharodon carcharias*)		X	X	X
Windowpane Flounder (*Scophthalmus aquosus*)	X	X	X	X
Winter Flounder (*Pseudopleuronectes americanus*)	X	X	X	X
Winter Skate (*Leucoraja ocellata*)			X	X
Witch Flounder (*Glyptocephalus cynoglossus*)	X	X		X
Yellowfin Tuna (*Thunnus albacares*)			X	
Yellowtail Flounder (*Limanda ferruginea*)	X	X	X	X

Source: NOAA 2021

5.4.5.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, construction of non-FEMA funded projects to reduce coastal flooding and erosion could result in short-term **minor** to **moderate** effects on EFH. Construction of hardened in-water or shoreline structures in locations where EFH is present could result in loss of or physical damage to SAV, shellfish beds, substrates, or other components of EFH. Construction-related pollutants and sediments and nutrients from ground disturbance could degrade water quality in EFH. Installation of in-water or over-water structures could shade aquatic habitats, thereby inhibiting growth of SAV, and could require installation of anchor lines or other components that physically damage SAV, emergent plants, or shellfish beds. If a project would have the potential to affect EFH and it would require a federal permit, then the federal permitting agency would have to consult with NMFS under Section 305(b) of the MSA to analyze potential adverse effects and develop measures required to conserve EFH. Projects that would not require a federal permit, authorization, or funding would not be required to consult on effects on EFH or develop conservation measures.

Non-FEMA funded projects could include minor shoreline restoration components that could provide localized benefits to EFH. However, in the long term, non-FEMA funded projects would not substantially mitigate coastal flooding or erosion, which could have **minor** adverse effects on EFH from ongoing erosion and sedimentation resulting in degradation of water quality in EFH habitat. Also, alterations of substrates (e.g., through armoring) could adversely affect the establishment of SAV or shellfish beds, which are important components of EFH.

Proposed Action

General Consequences of the Proposed Action

Under the Proposed Action, there is the potential for construction activities, both on land or in-water, to have short-term **minor** to **moderate** adverse effects on EFH with compliance with the MSA. Potential adverse effects include physical damage or loss of EFH, localized water quality impacts, and reduction in habitats providing safe passage, forage, and/or cover and shelter. Projects that would be constructed within or near EFH would need to be reviewed on a project-specific basis. If a project would have the potential to affect EFH, FEMA would consult with NMFS under Section 305(b) of the MSA to analyze adverse effects and develop measures required to conserve EFH. BMPs related to the protection of water quality, wetlands, vegetation, fish and wildlife habitat, and invasive species, as presented in Sections 5.2.1, 5.2.3, 5.4.1, 5.4.2, and 5.4.3 could also reduce potential effects on EFH. With the implementation of those measures, projects would have **minor** to **moderate** adverse effects on EFH.

In the long term, substantial coastal flooding and erosion would be reduced resulting in a reduction in contaminants, nutrients, and sediments entering EFH. Therefore, there could generally be **minor** beneficial effects on EFH.

Project-Specific Consequences

Hard Engineering Designs

Hard engineering designs that use treated wood could result in **minor** to **moderate** adverse effects on EFH. Wood treated with creosote, polycyclic aromatic hydrocarbons, metals, or other preservatives can leach pollutants into the water that could contaminate the water and sediments nearby (Kahler et al. 2000).

Revetments

Construction of revetments that places riprap, concrete, cellular blocks, or other materials in the water or below the high tide line where EFH is present would result in long-term, **minor** to **moderate** adverse effects associated with the loss of EFH in those locations. Through consultation under the MSA, compensatory mitigation measures may be developed and would be required to be implemented to minimize the adverse effects. Construction activities would result in short-term **minor** to **moderate** adverse effects on EFH by creating turbidity in the immediate environment. Additionally, shoreline armoring has the potential to affect water quality in EFH by altering sediment dynamics, accelerating shoreline erosion, and causing a loss of habitat in areas located around revetments. Revetments may lead to increased erosion at the toe of the structure or in adjacent areas from waves breaking against the structure. Revetments can disrupt longshore sediment transport and adversely affect downdrift shorelines. These impacts on wave and sediment dynamics would have long-term **minor** to **moderate** adverse effects on EFH (USACE 2020).

Bulkheads and Seawalls

The construction of bulkheads and seawalls may result in long-term **minor** to **moderate** adverse effects on EFH from the same mechanisms as revetments and because mobilized sediments would impact water quality in EFH as discussed in Section 5.2.1.

Breakwaters

Breakwaters can disrupt longshore sediment transport and adversely affect downdrift shorelines resulting in long-term **minor** effects to water quality in EFH due to impacts on sediment transport. In addition, breakwaters permanently remove EFH within the project footprint.

Groins and Jetties

The construction of groins and jetties may have long-term **minor** to **moderate** adverse effects on EFH from an increase in turbidity and total suspended solids from the alteration of littoral drift of sediment along the shoreline. Groins and jetties also permanently remove EFH within the project footprint.

Bioengineering Designs

In the long term, the restoration, enhancement, or creation of marshes and wetlands, and planting of native vegetation would help reduce pollutant runoff and would increase habitats that constitute EFH, such as SAV. Therefore, bioengineered designs would provide long-term **minor** to **moderate** benefits to EFH that would not occur with hard engineering designs.

Project Conditions

- The Project Proponent must comply with all required measures from the FEMA consultation with NMFS under Section 305(b) of the MSA.

5.5 Cultural Resources

FEMA must consider the potential effects of its actions upon cultural resources prior to engaging in any project. Cultural resources are defined as prehistoric and historic sites, structures, districts, buildings, objects, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. There are several laws a federal agency must consider when working with and identifying cultural resources. FEMA will meet this obligation through its compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended and implemented by 36 C.F.R. Part 800. The NHPA defines a historic property as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register." Eligibility criteria for listing a property on the National Register of Historic Places (NRHP) are found at 36 C.F.R. Part 60.

FEMA Region 1 has established an NHPA Programmatic Agreement for the review of projects in Massachusetts. The *Prototype Programmatic Agreement Among FEMA, the Massachusetts SHPO, the Stockbridge-Munsee Community, and the Massachusetts Emergency Management Agency* was executed on December 12, 2018. The programmatic approach is used to stipulate roles and responsibilities, exempt certain Undertakings from Section 106 review, establish protocols for consultation, facilitate identification and evaluation of historic properties, and streamline the assessment and resolution of adverse effects to historic properties.

Cultural resources determined to be potentially significant and eligible for the NRHP under the NHPA are subject to a higher level of review and federal agencies must consider the potential effects of their projects on those resources and consider steps to avoid, minimize, or mitigate those effects. To be considered significant, a cultural resource must meet one or more of the criteria established by the NPS that would make that resource eligible for inclusion in the NRHP. The term "eligible for inclusion in the NRHP" includes all properties that meet the NRHP listing criteria, which are specified in the Department of Interior regulations Title 36, Part 60.4 and NRHP Bulletin 15 (1997). Specific guidance for evaluating historic vessels and shipwrecks for NRHP eligibility is provided in NPS Bulletin 20 (1992). Specific guidance for evaluating archaeological properties for NRHP eligibility is provided in NPS Bulleting 36 (2000). Properties and sites that have not been evaluated at the time of the undertaking may be considered potentially eligible for inclusion in the NRHP and, as such, are afforded the same regulatory consideration as nominated properties.

Under Section 101(d)(6)(A) of the NHPA, properties of traditional religious and cultural significance to Indian tribes may be deemed eligible for listing on the NRHP. In addition to the NHPA, the Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001–3013, establishes the rights of Native American lineal descendants, Indian tribes, and Native Hawaiian Organizations for the treatment, repatriation, and disposition of Native American human remains, funerary objects, sacred objects, and other Traditional Cultural Property. The Advisory Council on Historic Preservation (ACHP) is an independent federal agency established by the NHPA. ACHP's mission focuses on the preservation of cultural resources and the development of federal policy related to historic preservation. The NHPA established state historic preservation officers (SHPOs) in each state and territory and Tribal Historic Preservation Officers (THPOs) for federally recognized Native American tribes. The two federally recognized Native American tribes in Massachusetts are the Wampanoag Tribe of Gay Head (Aquinnah) and the Mashpee Wampanoag Tribe. Other federally recognized tribes in neighboring states with cultural

ties to land in Massachusetts include the Stockbridge-Munsee Community, the Delaware Tribe of Indians, the Mohegan Tribe of Indians, the Narragansett Indian Tribe, and the Mashantucket Tribal Nation. In addition, there are six state-recognized tribes including the Chappaquiddick Tribe of the Wampanoag Indian Nation, the Chaubunagungamaug Band of the Nipmuck Nation, the Herring Pond Wampanoag Tribe, the Nipmuc Nation (Hassanamisco Band), the Pocasset Wampanoag Tribe, and the Seaconke Wampanoag Tribe.

In addition to federal laws, there are several state laws and regulations that protect historic resources including burials (Massachusetts Unmarked Burial Laws [Chapter 38, Section 6; Chapter 9, Section 26A and 27C; and Chapter 7, Section 38A; as amended]) and underwater archaeological resources (Massachusetts General Law Ch. 6, s. 179-180, and Ch. 91, s. 63).

5.5.1 Identification of Area of Potential Effects, Cultural Resources, and Consultation Process

Area of Potential Effects

Pursuant to 36 C.F.R. 800.4(a)(1), the Area of Potential Effects (APE) is defined as the geographic area(s) within which the undertaking may directly or indirectly affect cultural resources. Within the APE, effects to cultural resources are evaluated prior to the undertaking for both Standing Structures (aboveground resources) and Archaeology (belowground resources). The APE for this undertaking consists of all areas of ground disturbance, including staging and access areas not on hardened surfaces, and any locations from which permanent alterations will be visible. Areas that are currently underwater are also included.

Cultural Resources

The Massachusetts Historical Commission (MHC) maintains a database of historic properties in the state: the Massachusetts Cultural Resource Information System, which is regularly updated. FEMA uses this and other federal databases (e.g., the National Register of Historic Places National Resources Information Service [NRHP NRIS] database), historical aerial images and historic maps, and written histories of the project area to identify known and potential eligible resources that may be affected by a project. For underwater resources, a review of the Massachusetts Board of Underwater Archaeological Resources (BUAR) database of submerged cultural resources in state waters would also be conducted.

Identification level surveys may be required by the Massachusetts SHPO, State Archaeologist, or BUAR for any given project identified in this PEA that does not fall under the FEMA Region 1 PA Second Tier Allowances. For archaeological surveys, both agencies require submission of a permit application with a research design and will issue permits for cultural resource surveys to individuals who meet the Secretary of the Interior's Historic Preservation Professional Qualifications Standards (NPS 1997) in their respective disciplines. BUAR Special Use Permits are also required for addressing unanticipated discoveries and conducting any mitigation activities in state waters.

Consultation

FEMA initiates Section 106 consultation on individual projects with the Massachusetts SHPO through submission of an initiation of consultation letter with a detailed description of the undertaking, the proposed direct and indirect APE, a list of interested or consulting parties, and the results of background research. FEMA also identifies and consults with interested or consulting parties including federal and state-recognized Indian tribes with cultural ties to the project area, historic or archaeological groups, historic park managers, and local historic district commissions. Local or regional historic preservation and

planning organizations and agencies that FEMA may consult with on a given project within the study area are identified in the Massachusetts State Historic Preservation Plan, 2018-2022 (MHC 2018).

5.5.1.1 Historic (Standing) Structures Existing Conditions

The Massachusetts coastal zone contains a diverse range of historic structures that spans the period of initial development of the English Colonies in the seventeenth century through the mid-twentieth century. Individual coastal and nearshore structures and historic districts reflect broad themes in the history of the Commonwealth. Historic thematic contexts include social and economic development, maritime industries including fisheries, whaling and boat building, commerce and trade, immigration and cultural identity, African American and Native American history, religion and education, colonial and national military history, transportation systems, art, and recreation over the course of nearly 400 years.

The SHPO's website indicates that the Inventory of Historic (Standing) and Archaeological Assets of the Commonwealth consists of 216,000 historic and archaeological site records (MHC 2022). As of December 2021, there are 4,440 historic properties eligible for, or listed on, the NRHP in the Commonwealth of Massachusetts. Most of the historic properties are aboveground buildings (3,154), districts (956), or structures (135) (NPS 2021). Of these historic properties, 28 districts, 140 buildings, and 15 structures are designated National Historic Landmarks. Within the eight counties that include in whole or in part the Massachusetts coastal zone (Barnstable, Bristol, Dukes, Essex, Nantucket, Norfolk, Plymouth, and Suffolk), there are 1,410 historic properties concentrated primarily within the Boston metropolitan area. Among the National Historic Landmarks is the entirety of Nantucket Island, Tuckernuck, and Muskeget.

Historic properties along the Massachusetts shoreline are otherwise concentrated in districts that correspond with historic and contemporary population centers or are dispersed individual historic properties between coastal cities and towns. Historic aids to navigation are one type of individual resource widely dispersed throughout the harbors, bays, channels, inlets, and islands that comprise the study area. The MHC completed regional reconnaissance surveys for the Boston area (MHC 1982a), Southeast Massachusetts (MHC 1982b), and the Cape Cod and Islands (MHC 1986) regions that present historic thematic contexts useful in the identification and evaluation of cultural resources in these regions. Contexts were developed to characterize historic patterns and changes within seven chronological periods including the Contact Period (1500-1620), Plantation Period (1620-1692), Colonial Period (1692-1775), Federal Period (1775-1830), Early and Late Industrial Periods (1830-1870 and 1870-1915), and the Early Modern Period (1915-1940). Many of the historic districts within the study area span several of these periods and illustrate the evolution of the state’s social and economic history, particularly in cases where early maritime or industrial structures were adapted to recreational, residential, or other specialized use. One example of this trend is the Rocky Neck Historic District in Gloucester (1829-1967 period of significance), a late eighteenth century fishing community that evolved in the late nineteenth century into a summer resort and artist community. Coastal defensive resources also can span several periods, such as Fort Independence in Boston Harbor, an early colonial fortification reconstructed several times during various periods in American military history. Other resource types such as Revere Beach Reservation, part of the Metropolitan Park System, are significant cultural landscapes that represent the late nineteenth and early twentieth century development of summer oceanfront recreational places. The Dune Shacks of Peaked Hill Bars Historic District in Provincetown is another example of the unique twentieth-century cultural landscapes along the Massachusetts shoreline.

Submerged vessels are classified as structures if they occur in the archaeological record as a mostly intact hull made up of interdependent and interrelated parts in a definite pattern of organization (NPS 1992). The BUAR database includes approximately 3,000 vessel casualties in Massachusetts waters, with approximately 2,300 identified wrecks concentrated in nearshore coastal waters adjacent to Boston, Chatham, Gloucester, Marblehead, Provincetown, Nantucket, Rockport, and Scituate (Robinson 2008). The distribution of shipwrecks in state waters is depicted on a sensitivity map in the Massachusetts Executive Office of Energy and Environmental Affairs, Office of Coastal Zone Management 2015 Ocean Management Plan (Volume 2, Figure 26). Analyses of the BUAR database used to develop the map concluded that the most common shipwreck type in Massachusetts waters are wooden-hulled schooners dating from the second half of the nineteenth century, carrying fuel oil, coal, clay, lime, stone, lumber, or fish destined for a Massachusetts port until either being stranded, burned, or foundered in foul weather (Robinson 2008).

There are three Traditional Cultural Properties (TCP) within the study area that are significant to Wampanoag people who live in Massachusetts, all of which may contain submerged or terrestrial historic structures (see Section 5.5.1.3).

5.5.1.2 Archaeological Resources Existing Conditions

Historic archaeological resources within the study area correspond with thematic contexts represented by standing structures, districts, and landmarks throughout the coastal zone, in towns, cities, and rural settings. The state’s inventory of cultural resources along the coast is vast and includes industrial, domestic, commercial, military, ceremonial, recreational, maritime, and transportation related archaeological sites spanning the Contact Period through the twentieth century. Submerged vessels that appear as broken or scattered sections of a structure with localized deposition of apparel, armament, cargo, and other artifacts, or other remains, widely separated with little or no continuity, are considered archaeological sites (versus structures).

The earliest archaeological sites associated with indigenous Native American groups in Massachusetts date to between 10,000 and 13,000 years ago during the early Holocene Paleo-Indian migration into the coastal Northeast region. During this time, Nantucket, Martha's Vineyard, and Cape Cod were part of a contiguous land mass. Archaeological remains throughout the coastal zone illustrate a chronology of Native American land use that began soon after coastal deglaciation and continues today. As in other parts of coastal southern New England, climatic fluctuations, sea level rise, and resulting ecological changes have influenced the capacity for human adaptation and settlement on this landscape since the Paleo-Indian Period. Inundation of the coastal plain caused the formation of Nantucket, Vineyard, and Block Island sounds during the Early/Middle Archaic Period, as early as 8,000 years ago. Sea level rise during the early to mid-Holocene would have inundated archaeological sites that formed on exposed landforms. In recent years, scientific investigations driven by renewable energy initiatives in state and federal waters off the coast of Massachusetts have documented submerged cultural landscapes.

Archaeological site types associated with pre-Contact period Native American activity include villages, base and temporary camps, cremation burials, ossuaries, and interments, shell middens, fish weirs and fords, lithic quarries and workshops, rock shelters, resource procurement sites, trails, and isolated finds. Native American sites dating to the Contact Period have been identified but are relatively uncommon in portions of the mainland Massachusetts coast because of the early devastation of Wampanoag people from exposure to European diseases through trade and exchange. Historic Native American sites can

include residential domestic households, Christian Indian reservations, meeting houses, gardens, and planting fields, fishing, and whaling camps, submerged traditional vessels, cultural landscapes, trails, fords, and fish weirs. There are three TCPs within the study area that are significant to the Wampanoag people, all of which may contain submerged or terrestrial archaeological resources (see Section 5.5.1.3).

5.5.1.3 Traditional Cultural Properties Existing Conditions

Three TCPs have been identified by Wampanoag Indian Tribes in Massachusetts. In 2010, Nantucket Sound was determined eligible for listing in the NRHP as a TCP and as a historic and archaeological property that has yielded and has the potential to yield important information about the Native American exploration and settlement of Cape Cod and the Islands. The Vineyard Sound and Moshup's Bridge TCP was identified by the Aquinnah and Mashpee Wampanoag Tribes during consultations associated with a proposed renewable energy project under the authority of the Bureau of Ocean Energy Management. This project also resulted in the 2019 identification of multiple locations on Chappaquiddick Island that the state-recognized Chappaquiddick Wampanoag Tribe consider traditional cultural places based on their members' current and past cultural practices. Included are buildings, landscapes, and natural resources.

5.5.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, there would be no FEMA action; therefore, there would be no effect on cultural resources from FEMA-funded grant activities. Non-FEMA funded shoreline stabilization projects implemented by communities would have the potential to damage, destroy, or expose historic properties along the shoreline through construction and excavation activities. However, most of these projects would require USACE permits and approvals, as well as state review by the BUAR and the Executive Office of Energy and Environmental Affairs, in accordance with the Massachusetts Environmental Policy Act. In these cases, BUAR and the Massachusetts SHPO would review the projects for potential impacts to cultural resources. Under the No Action alternative, sea level rise in combination with coastal erosion and flooding during storm events would continue to adversely affect cultural resources along the Massachusetts shoreline and in the nearshore submerged environment. Cultural resources that could be at risk include historic standing structures, historic districts, monuments, piers and wharves, historic transportation infrastructure, aids to navigation, military sites, shipwrecks, and terrestrial and submerged archaeological sites.

Historic structures along the Massachusetts shoreline could become undermined by erosion, as shoreline embankments recede. Buried piers, wharves, and building foundations, along with their structures, could erode out of embankments into the ocean, and shipwrecks can deteriorate as their individual elements disperse. Pre-Contact period and historic archaeological sites also would continue to erode from exposed shoreline embankments.

The No Action alternative would result in **minor** to **major** adverse effects to historic properties over the long term from non-FEMA funded projects and continued exposure to coastal flood and erosion risks.

Proposed Action

General Consequences of the Proposed Action

Unless an activity is identified in the FEMA Region 1 Programmatic Agreement Tier Two Allowances, a project-specific consultation with the SHPO or THPO would be necessary for all shoreline stabilization activities covered by the Proposed Action. FEMA would conduct an individual Section 106 consultation for each project application in accordance with the NHPA before the grant award. In addition to the research required to identify previously documented cultural resources within the APE, archaeological reconnaissance and intensive surveys or architectural assessments may be needed to determine whether previously undocumented resources are present. Nearshore marine archaeological reconnaissance surveys may also be required. If resources are potentially present, then FEMA would determine whether the resource could be affected and consult with the SHPO or THPO, as appropriate, and other potentially interested parties on potential effects and required avoidance or mitigation measures. Through Section 106 consultation with the SHPO and THPO and the application of project-specific mitigation measures developed through the consultation process, potential effects to above and below ground cultural resources would be minimized to the extent feasible, or mitigated through appropriate treatment plans. Project-specific mitigation measures depend on the specific resource type that is adversely affected and its context. Measures may include revising project design plans to avoid or minimize adverse effects, conducting detailed documentation of structures, conducting archaeological data recovery, or alternative mitigation measures such as public media or educational programs, among other things. Inadvertent discovery protocols may also be appropriate as a mitigation measure to any projects that propose ground-disturbing activities regardless of how minor the disturbance may appear.

Project-Specific Consequences

Hard Engineering Designs

Installation of hard engineering designs requires the use of heavy machinery and therefore has the potential to impact the terrestrial or submerged APE through excavation and regrading, driving piles, use of large and heavy materials such as concrete blocks, and anchoring of nearshore structures or construction barges on the sea floor. Even if grading is limited, the weight of certain structures could have an adverse effect on fragile archaeological sites, such as unmarked human burials. Given the nature of the materials used, potential height, overall dimensions, and the surface visibility of hard engineering designs, adverse effects to aboveground historic properties within a given structure's viewshed are possible. Offshore breakwaters and wave attenuators could also result in the preservation of submerged shoreline historic resources including shipwrecks, by reducing the natural erosional effects to a particular resource caused by the movement of seawater and sediment during storm events.

Bioengineering Designs

Individual bioengineering design projects may require the use of heavy machinery or in-water work and may be combined with hard engineering designs. Of these designs, beach/dune restoration that involves the placement of clean compatible sediment on a shoreline system and installation of native plantings may be excluded from Section 106 consultations under the FEMA Region 1 Programmatic Agreement Second Tier Programmatic Allowances (FEMA 2008). Regrading of shoreline embankments and wetland creation or enhancement has the potential to impact terrestrial archaeological sites but is unlikely to have an

adverse effect on standing structures within a given project viewshed because of the use of context sensitive plantings.

Project Conditions:

- In the event of the discovery of archaeological deposits (e.g., Native American pottery, stone tools, shell, old house foundations, old bottles), the Project Proponent and their contractor must immediately stop all work in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the finds. The Project Proponent and their contractor must secure all archaeological discoveries and restrict access to discovery sites. The Project Proponent must immediately report the archaeological discovery to MEMA and FEMA; FEMA will determine the next steps.
- In the event of the discovery of human remains, the Project Proponent and their contractor must immediately stop all work in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the finds. The Project Proponent and their contractor must secure all human remains discoveries and restrict access to discovery sites. The Project Proponent and their contractor must follow the provisions of applicable state laws or any amendments or supplanting laws and regulations. Violation of state law will jeopardize FEMA funding for the project. The Project Proponent must inform the Office of the Chief Medical Examiner, the State Archaeologist, MEMA, and FEMA. FEMA will consult with the SHPO and Tribes, if remains are of tribal origin. Work in sensitive areas may not resume until consultation is completed and appropriate measures have been taken to ensure that the project is compliant with the NHPA.
- All borrow or fill material must come from pre-existing stockpiles, material reclaimed from maintained roadside ditches (provided the designed width or depth of the ditch is not increased), or commercially procured material from a pre-existing source. For any FEMA-funded project requiring the use of a noncommercial source or a commercial source that was not permitted to operate prior to commencement of the project (e.g., a new pit, agricultural fields, road rights-of-way) in whole or in part, regardless of cost, the Project Proponent must notify FEMA and MEMA prior to extracting material. FEMA must review the source for compliance with all applicable federal EHP laws and EOs prior to the Project Proponent or their contractor commencing borrow extraction. Consultation and regulatory permitting may be required. Noncompliance with this requirement may jeopardize receipt of federal funding. Documentation of borrow sources used is required at closeout.

5.6 Socioeconomic Resources

5.6.1 Land Use and Planning

Chapter 41, Section 81D of Massachusetts state law requires that local governments engage in long-term land-use planning. Land use planning is implemented to provide a basis for decision-making regarding long-term physical development and may include setbacks for structures located on coastal property. Effects of proposed flood mitigation and shoreline stabilization projects are evaluated based on their consistency with adopted local land-use policies and regulations.

5.6.1.1 Existing Conditions

The study area encompasses large areas of open space, wildlife refuges, and preservation areas interspersed with low density residential developments and small commercial centers. A small percentage (2 percent) of land in the study area is used for agriculture (Massachusetts Bureau of Geographic Information 2019). The greater Boston area is an exception, which is predominately urban with mixed use developments and very little open land remaining. Numerous public beaches and recreation sites are also present along the coast and represent a one percent of land base in the study area. See **Table 5.9** for a breakdown of land uses within the study area and **Map 13** in **Appendix A.**

Table 5.9. Land Uses within Study Area

Land Use	Percentage of Study Area
Agricultural	2%
Forest	1%
Developed	38%
Recreation	1%
Open Land	19%
Other	39%

Source: Massachusetts Bureau of Geographic Information 2019

5.6.1.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, non-FEMA funded projects would likely be placed near existing structures and facilities (to provide protection for those existing uses) and would be unlikely to promote development or alter land use in the short or long term. In the long term, non-FEMA funded would protect individual properties and likely not be coordinated across communities or jurisdictions, thus projects would not substantially mitigate coastal flooding or reduce erosion throughout a community. Continued flooding and erosion could cause damage to roadways and require detours or closures that limit access to land, or displace residences and businesses near the shore. Erosion could result in a permanent loss of habitat and reduced access to recreational opportunities along the shoreline. Local governments may implement setbacks from the shoreline or other land-use regulations to protect public safety. If communities within the project area have developed long-term plans and policies, such as comprehensive or master plans, it is unlikely that continued shoreline erosion and degradation would be consistent with the land-use goals in those documents. Thus, the No Action alternative could have long-term **minor** to **moderate** adverse effects on land use within shoreline communities.

Proposed Action

General Consequences of the Proposed Action

Under the Proposed Action, construction activity could reduce access to the shoreline at the project site, or to adjacent land uses from the staging of equipment. Construction activity could require roadway detours or closures that temporarily reduce access to adjacent land uses. Thus, there could be **minor** short-term adverse effects on land use from construction activity. Structures may be installed, or natural

habitats may be expanded (e.g., seawall installation or wetland creation), which may alter the land use of the project site; however, adjacent, and surrounding land uses would be unlikely to be substantially altered. Communities may choose the appropriate method of shoreline protection depending on whether the specific project area community prioritizes green space or development along the shoreline as described in adopted local land use plans. In the long term, coastal flooding and erosion mitigation projects would likely reduce the risk of damage to nearshore structures and facilities, thus supporting existing land uses. Additional setbacks or changes in land-use plans and zoning intended to protect residents and infrastructure would not be affected by the proposed action. Implementation of long-term land-use plans would be more successful because of the increased certainty about shoreline risks as the shoreline is stabilized and flooding impacts reduced. Implementation of the Proposed Action would be in accordance with the *Massachusetts Coastal Management Policy Guide*, which includes the maintenance of public access to shorelines (Section 5.3.1), and with local land use plans that implement the statewide policies. Therefore, there would be long-term **minor** to **moderate** benefits on land use from implementation of the Proposed Action when consistent with current land-use plans. If the proposed design or the proposed location are not consistent with existing land-use policies and plans, or if the land-use plans would require updating, then there could be an adverse impact on land use then the project would likely not move forward and would not be covered by this PEA. If the project area community has not implemented a long-term planning document, such as a comprehensive plan, the Proposed Action may not be designed with future land-use development goals in mind, resulting in **minor** adverse effects on land use and zoning in the long term.

Project-Specific Consequences

Hard Engineering Designs

In the long term, hard engineering designs may result in downdrift erosion or sediment starvation. Downdrift erosion can result in a loss of land downdrift from the project area, which could require revised land-use policies (e.g., zoning and setbacks) for public safety. If hard engineering designs are constructed behind beaches or recreational areas, sediment starvation may result in a loss of recreational areas. Revetments, bulkheads, and seawalls have the potential to adversely affect shoreline access by placing hard materials along the shore or by creating vertical walls or steep slopes and may result in inconsistencies with local land-use policies and plans. Reduced access may be mitigated through the addition of access routes. Thus, implementation of hard engineering designs may have long-term **minor** to **moderate** adverse effects on land use because of land loss and sediment starvation, dependent on the location and type of measure implemented. A coastal sediment transport impact analysis would be required for any hard engineering designs. If a specific project would result in effects such that a community would need to revise its land-use plan, then the project would likely not move forward and would not be covered by this PEA.

Bioengineering Designs

Bioengineering designs create and/or maintain living vegetative systems that could enhance existing green space (e.g., habitat restoration) and potentially increase recreational opportunities (e.g., widening, or stabilizing beaches). These designs could result in a long-term **minor** beneficial effect on land use.

Project Conditions

- None

5.6.2 Noise

The EPA developed federal noise emission standards in accordance with the Noise Control Act of 1972. The EPA identified major sources of noise and determined appropriate noise levels for activities that would infringe on public health and welfare in accordance with the law. The EPA identifies a 24-hour exposure level of 70 decibels as the level of environmental noise that would prevent any measurable hearing loss over a lifetime (EPA 1974). Noise levels of 55 decibels outdoors and 45 decibels indoors are identified as "preventing activity interference and annoyance" (EPA 1974). Areas of frequent human use that would benefit from lowered noise levels are identified as sensitive receptors. Typical sensitive receptors include residences, schools, churches, hospitals, nursing homes, and libraries. Additionally, the Federal Highway Administration (FHWA) established noise levels and ranges for construction equipment (FHWA 2006) and the Occupational Safety and Health Administration established thresholds for occupational noise exposure to protect the health and safety of workers (29 C.F.R. 1926.52). Local noise ordinances may apply to specific project areas. Proposed coastal flood mitigation and erosion control projects would need to be consistent with local noise ordinances.

5.6.2.1 Existing Conditions

The following noise-sensitive environments occur within the study area and may occur within or adjacent to individual project areas.

- National and state parks, wildlife refuges, and preserves are generally located in remote areas away from infrastructure and development thus existing noise levels are frequently low. Ambient noise levels for national and state parks can be as low as 10 A-weighted decibels (dBA) (NPS 2016).
- Community parks are more likely than national and state parks to be located near developed areas. Thus, background noise levels may be higher than national or state parks.
- Residential areas generally have lower average noise levels than other developed land uses; usually between 50 and 60 dBA (Federal Railroad Administration 2016).
- Specific land uses such as libraries, hospitals, and schools that require more quiet environments would be considered noise-sensitive receptors when they are close to a proposed project area.

5.6.2.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, short-term noise impacts would result from equipment used for non-FEMA funded projects. These impacts would be temporary and localized, and activities would likely follow local noise ordinance requirements, resulting in a **minor** adverse effect in the short term. In the long term, construction to repair damaged infrastructure and structures may occur within unprotected communities, resulting in recurring **minor** noise impacts from equipment use. Therefore, the No Action alternative would result in **minor** long-term adverse effects.

Proposed Action

General Consequences of the Proposed Action

Construction activity, access routes, and staging of equipment may occur in close proximity to sensitive noise receptors. Construction activities and the use of heavy equipment for the Proposed Action would result in short-term, temporary increases in ambient noise levels in the project area. Projects would need to conform to local noise ordinances regulating work hours and days to minimize potential impacts on surrounding areas. In areas of steep bluffs, project materials and heavy equipment may be delivered from the water. Construction could also take place with heavy equipment located on a spud barge. Since sound travels farther across water before attenuating, construction activities based on the water may produce noise impacts farther from the project site than expected for land-based activities. Minor traffic noise would also be produced by construction vehicles and trucks arriving and departing from the project area. Projects that occur in urban areas or near transportation infrastructure are likely to have higher existing noise levels and thus, have a **negligible to minor** short-term effect related to noise. Projects that occur in residential or rural areas where existing noise levels are low may result in **minor to moderate** short-term impacts. No long-term impacts from noise are anticipated from the Proposed Action because the project types would not be a source of long-term noise.

Project-Specific Consequences

Hard Engineering Designs

The construction of bulkheads and seawalls may require the placement of sheet piles or other piles with pile driving equipment. Noise from an impact hammer can travel long distances, even over land because of the concussive force required to drive piles. Thus, the use of pile driving equipment may result in a **moderate** short-term impact depending on the proximity to sensitive receptors and duration of pile driving. All construction activities would be required to conform with federal, state, and local noise regulations. If pile driving is proposed, an SEA may be required if the potential impact on the natural and human environment would be more than moderate.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated

Project Conditions

- All construction activities must conform to federal, state, and local noise regulations.

5.6.3 Transportation

5.6.3.1 Existing Conditions

A variety of transportation infrastructure exists within the study area supporting water, land, and air travel. Interstates in the project area include I-90, I-93, and I-95 and other major highways include Route 3, Route 6, Route 1, and Route 128 as well as the Essex Coastal Scenic Byway and Old King's Highway Scenic Byway. Roads with lower functional classifications (e.g., arterials) are most common in the study area and more likely to be in individual project areas along shorelines than interstates. Arterial roads may be the primary roads supporting automobile and bus service for shoreline communities and may also serve other forms of transportation, such as ferry service. Freight and commuter rail lines are present in the study area. Freight rail operators include Mass Coastal, CSX, and Pan Am and commuter rails include

Amtrak and the Massachusetts Bay Transportation Authority. Airports and heliports serve commercial and general aviation purposes as well as private uses within the study area. These airports are generally small, and many serve island communities and/or provide emergency services except for Boston Logan International Airport. **Table 5.10** summarizes the transportation infrastructure in the study area. Ports, marinas, ferry terminals, and boat docks present in the study area are discussed in Section 5.2.5, Navigation.

Table 5.10. Transportation Infrastructure within Study Area

State	Number of Commercial Ports	Miles of Interstates	Miles of Railroads	Freight Rail Yards	Number of Airports
Massachusetts	12	90	206	4	19

Source: Mass 2019

5.6.3.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action Alternative, communities may implement non-FEMA funded projects to mitigate coastal flooding and erosion risk. These projects may require roadway closures or detours during construction activities, to access a project site, or to stage equipment. Non-FEMA funded projects would have a **negligible** to **minor** short-term impact on transportation if roadway closures or detours occur during construction. In the long term, traffic diversions may be required because of inundation or damage to transportation corridors. Closures of roads that support transit service and serve ferry terminals, marinas, or airports and heliports would have additional impacts on transportation service and access. Island communities that rely on ferry service, marinas, or heliports and airports for access to the mainland, emergency services, and commodities may experience **major** impacts if this infrastructure is damaged or closed (see Section 5.2.5). Railroad infrastructure damaged by coastal flooding or erosion could halt the movement of goods and passengers while repairs are occurring or result in permanent closure of infrastructure if damage is significant. Depending on the extent of damage and the importance of infrastructure to the community, the No Action alternative could have a **minor** to **major** long-term impact on traffic and transportation.

Proposed Action

General Consequences of the Proposed Action

During construction, the Proposed Action could result in temporary increases in traffic as materials and equipment are mobilized to project sites. Temporary road closures may be required during construction for access to the project site or staging of equipment. BMPs, such as detours or the use of jersey barriers for safety, could be implemented during construction to mitigate impacts on traffic and transportation and any local regulations would need to be followed. Therefore, there would be a **minor** short-term adverse effect on traffic and transportation. It is unlikely that a project would adversely affect rail lines. In the long term, the Proposed Action would reduce the risk of coastal flooding and erosion and associated closures and damage to roadway, railway, port, and airport infrastructure. Therefore, there would be a

minor to **major** long-term beneficial effect on traffic and transportation. If a proposed project would cause a long-term adverse effect on transportation resources, an SEA would be required.

Project-Specific Consequences

Hard Engineering Designs

In the long term, hard engineering designs may result in downdrift erosion or sediment starvation, which could result in detours during repairs or permanent closure from this off-site erosion. A coastal sediment transport impact analysis would be required for any hard engineering designs. If a project was found to have adverse effects on transportation due to downdrift erosion, the project would likely not move forward and would not be covered by this PEA. Thus, implementation of these projects would have no long-term adverse effect on transportation infrastructure located downdrift of project sites.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated.

Project Conditions

- Project Proponent must develop and implement a maintenance of traffic plan that identifies detours and methods to accommodate traffic.

5.6.4 Public Services and Utilities

5.6.4.1 Existing Conditions

Utility infrastructure in the study area may include natural gas and electricity infrastructure, telecommunications including internet, potable water, wastewater, and stormwater utilities. Electrical infrastructure may be located above or below ground while water infrastructure and gas lines are typically located below ground. The Massachusetts Department of Public Utilities is the oversight body for electric power, natural gas, and water utilities in the state. Natural gas available to the study area's mainland is provided by the National Grid and Eversource Energy. Natural gas for island communities is provided by local or municipal suppliers (e.g., Nantucket Energy). Electricity and telecommunications are often provided to communities by private suppliers including National Grid, Nantucket Electric Company, Massachusetts Electric, NSTAR Electric, and through municipal providers. Water and wastewater facilities are generally managed, owned, and operated at the local level. The Massachusetts Water Resources Authority as well as the Boston Water and Sewer Commission provide water, wastewater, and stormwater facilities for the greater Boston area. Rural project areas are often serviced by private wells and septic systems instead of public water and sewer systems.

Public facilities such as schools, parks, as well as beaches and other recreational opportunities exist within the study area and may be in the vicinity of some project areas. Federal civil works projects in the study area include harbors and their protective structures and navigation features such as locks, dredged material facilities, and shore protection projects. If any proposed action has the potential to affect a federal civil works project, a USACE Section 408 review is necessary under 33 U.S.C § 408. Approval under the Section 408 process is required for any project that may occupy, alter, or otherwise use a federal civil works project. The purpose of 33 U.S.C § 408 is to ensure that these federal projects continue to provide their intended benefits to the public. The NEPA requirements for Section 408 reviews are

typically completed as part of USACE's regulatory permit process or, if entirely above the ordinary high water mark, by USACE civil works environmental staff.

5.6.4.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action Alternative, non-FEMA funded projects may result in the disruption of public services and utilities. However, disruptions would be temporary and localized. Thus, there could be **minor** impacts on public services and utilities if disruptions occur. Coastal flooding and shoreline erosion would not be substantially mitigated under the No Action alternative, putting utilities both overhead and underground at higher risk of damage or failure. This could result in power outages, the loss of water and sewer services, loss of heating and cooling, and loss of telecommunication services. If utility infrastructure is damaged because of coastal flooding or shoreline erosion, outages could be extensive and long term while work occurs to repair or replace the lost facilities. Flooding and shoreline erosion would also threaten public facilities near the shoreline, which could lead to closures and loss of service that impact the operation of schools, businesses, commercial entities, residences, and recreational areas. Therefore, under the No Action alternative, there would be long-term **minor** to **moderate** impacts on public services and utilities from continued shoreline erosion.

Proposed Action

General Consequences of the Proposed Action

During the construction of Proposed Actions, utilities may be temporarily shut off and temporary road closures and detours may be required (see Section 5.6.3). If a utility shutdown is required, BMPs could be used to mitigate impact such as scheduling utility closures at times of least adverse effect. Thus, there may be a **negligible** to **minor** short-term impacts on utilities and services from temporary loss of services. In the long term, the Proposed Action would reduce the risk of coastal flooding and erosion and associated damage or loss of utility infrastructure. Therefore, the Proposed Action would result in a **minor** long-term beneficial effect on public services and utilities. If a proposed project caused a long-term adverse effect on utilities, including a permanent loss or major rerouting of utilities, then an SEA would be required.

Project-Specific Consequences

Hard Engineering Designs

In the long term, hard engineering designs have the potential to cause downdrift erosion and sediment starvation in off-site areas. Downdrift erosion may damage utility infrastructure if erosion occurs in new areas or accelerates in the downdrift area. A coastal sediment transport impact analysis would be required for any hard engineering designs. If a project would result in adverse effects from downdrift erosion, the project would likely not move forward and would not be covered by this PEA. Thus, there would be no long-term impact on public services and utilities.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated.

Project Conditions

- If utilities need to be temporarily shut off during construction, the Project Proponent must follow local ordinances regarding shutdown procedures and notification.
- Utilities that are abandoned in place must be decommissioned to state and local standards.

5.6.5 Public Health and Safety

5.6.5.1 Existing Conditions

Public safety services include law enforcement agencies, fire departments, and emergency services. Police, fire, and emergency medical services are available at the state level through the Massachusetts State Police, the Department of Fire Services, and the Massachusetts Emergency Management Agency. In addition, police, fire, and emergency medical services are provided at the local level for most areas within the study area. Emergency response time standards frequently exist in contractual obligations between communities and emergency service organizations. As a result, there may be variations in the standards between one community and another. Most emergency response teams use roads and sometimes air transportation to reach affected people and communities. The Massachusetts Department of Public Health and Mass DEP provides statewide services for health, including considerations for air quality. At the local level, medical facilities and hospitals provide for emergency and nonemergency medical needs.

5.6.5.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, construction of non-FEMA funded projects to mitigate coastal flooding and erosion could result in construction-related emissions and pollution that affect air quality (see Section 5.1.2), which could have a negative effect on human health. However, these potential impacts would be temporary and localized. Non-FEMA funded projects could require roadway closures that result in increased emergency response times or reduced access to hospitals; however, if required, detours would need to be provided (see Section 5.6.3). Therefore, there would be a **negligible** short-term impact on public health and safety. Non-FEMA funded projects would not substantially mitigate coastal flooding and erosion within a community over the long term, which could result in recurring damage leading to interruptions of service or require repairs that involve construction activities and closures of roads and services. Interruptions of service may include disruption of power or wastewater for extended periods with the potential for severe consequences on public health and safety. Recurring construction for repairs would result in the release of pollutants and emissions or necessitate roadway closures and detours (Section 5.1.2, Air Quality, Section 5.2.1, Water Quality, and Section 5.6.3, Transportation). Recurring construction activities could expose people to health hazards and increase emergency response times during the work. Therefore, there would be a **minor** to **moderate** long-term adverse effect on public health and safety.

Proposed Action

General Consequences of the Proposed Action

As with the No Action Alternative, construction of the Proposed Action would also result in construction-related emissions and pollution that affect air quality. However, these impacts would be temporary, spatially dispersed, and could be mitigated by using BMPs (see Section 5.1.2**)**. Road closures may be

needed during construction activities, to access a project site, or for the staging of equipment, which could result in increased emergency response times or reduced access to hospitals; however, detours would need to be provided. Thus, there would be a **negligible** short-term impact on public health and safety. In the long term, the Proposed Action would reduce the risk of coastal flooding and erosion and associated public health and safety concerns from damage and extended outages or closures such as the rerouting of emergency vehicles, backup of combined sewer systems, and other health hazards associated with coastal flooding. Thus, there would be a long-term **minor** to **moderate** beneficial effect from reduced risk of coastal flooding and erosion. If the proposed project would have long-term adverse effects on public health and safety, such as a permanent source of emissions or permanent reduction of air quality, an SEA would be required.

Project-Specific Consequences

Hard Engineering Designs

Downdrift erosion from hard engineering measures could result in damage to infrastructure including roadways, power lines, water, and wastewater infrastructure outside of the project area. A coastal sediment transport impact analysis would be required for any hard engineering designs. If a project could result in adverse effects on public health and safety due to downdrift erosion, the project would likely not move forward and would not be covered by this PEA. Thus, there would be no long-term effect on public health and safety.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated.

Project Conditions

- Project Proponent must develop and implement a maintenance of traffic plan that identifies detours and methods to accommodate emergency response vehicles during construction (see Section 5.6.3).

5.6.6 Environmental Justice

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions on minority or low-income populations to the greatest extent practicable and permitted by law. CEQ defines the term minority as persons from any of the following groups: Black, Asian or Pacific Islander, American Indian or Alaskan Native, and Hispanic (CEQ 1997). Low-income or poverty populations are defined using the statistical poverty threshold from the U.S. Census Bureau, which is based on income and family size. CEQ considers a census tract to be minority or low-income when at least 50 percent or more of its residents are minority, 25 percent or more of its residents are low-income, or when the population in the census tract has a meaningfully greater number of minority and low-income persons when compared to larger geographic areas such as a county or state (CEQ 1997). “Meaningfully greater” is typically defined as at least 10 percent greater than the next larger surrounding geopolitical unit.

The State of Massachusetts also considers those with limited English proficiency during an environmental justice analysis. Environmental justice populations are defined by the State of Massachusetts as those that meet any of the following criteria:

- Block group whose annual median household income is equal to or less than 65 percent of the statewide median ($81,215 in 2018) (low income)
- 25 percent or more of the residents identify as a race other than white (minority)
- 25 percent or more of households have no one over the age of 14 who speaks English only or very well (limited English proficiency)

5.6.6.1 Existing Conditions

A summary of the minority, low-income, and limited English proficiency populations within the counties encompassed by the project area and Massachusetts is shown in **Table 5.11.** Specific project areas may have much higher percentages of minority, low-income, or limited English proficiency persons representing environmental justice populations in or near a project. For each proposed project, the demographic characteristics of the adjacent populations would need to be investigated and the potential for disproportionately high and adverse impacts would need to be evaluated.

Table 5.11. Minority, Low-Income, and Limited English Proficiency

Geography	Percent Minority Population (%)	Percent Low-Income Population (%)	Percent Limited English Proficiency (%)
Barnstable County	11	19	2
Bristol County	19	26	5
Dukes County	14	23	2
Essex County	30	23	7
Middlesex County	28	16	6
Nantucket County	15	19	2
Norfolk County	25	14	5
Plymouth County	19	17	3
Suffolk County	55	34	13
Massachusetts	**30**	**33**	**9**

Source: EPA 2019

5.6.6.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, there would be no FEMA-funded action; therefore, there would not be any disproportionately high and adverse human health or environmental effects on minority or low-income populations resulting from a federal action. Implementation of non-FEMA funded projects may cause **minor** short-term adverse effects on these populations from construction-related activity including noise, traffic, and air quality impacts (see Section 5.6.2, Section 5.6.3, and Section 5.1.2). These projects

could result in a disproportionate impact on environmental justice populations located within or adjacent to the project site, particularly if located in counties with higher concentrations of environmental justice populations, such as Suffolk County. In the long term, populations would continue to be at risk of coastal flooding and erosion hazards and associated impacts on transportation, public services, and public health because non-FEMA funded projects would likely only mitigate risks for individual properties. Environmental justice populations would be unlikely to have the same capacity to protect themselves or recover from coastal flood or erosion events as compared to other populations. Therefore, disproportionately high, and adverse impacts could occur.

Proposed Action

General Consequences of the Proposed Action

Project locations would be selected based on the risk of structure and infrastructure damage from coastal flooding or shoreline erosion rather than on demographic characteristics. There could be **minor** short-term impacts on these populations from construction-related activity including noise, traffic, and air quality impacts, particularly if located in counties with higher concentrations of environmental justice populations, such as Suffolk County. An individual project analysis for the presence of minority and low-income populations and the potential for adverse impacts on these populations would be conducted. If a project would have a moderate or greater effect that would cause a disproportionately high and adverse effect on minority and low-income populations, mitigation would be required. FEMA would complete an SEA to evaluate the effect on environmental justice populations, provide additional opportunities for public input, and determine mitigation measures. If the adverse impact cannot be mitigated, the project would not be covered under this PEA and an EIS would likely be required. In the long term, the Proposed Action would reduce the risk of coastal flooding and shoreline erosion which would benefit residents regardless of their race, income level, or language proficiency. There would be no long-term adverse effects related to traffic, noise, or air quality from the Proposed Action (see Section 5.6.3, Section 5.6.2, and Section 5.1.2). The Proposed Action would not be expected to have disproportionately high and adverse effects on minority and low-income populations.

Project-Specific Consequences

Hard Engineering Designs

Some hard engineering designs have the potential to affect people who live and work farther away from the project area than other methods. For example, the construction of bulkheads and seawalls with a pile driver could result in greater noise impacts than other infrastructure installation methods because of the magnitude of the sound and the distance it can travel, as described in Section 5.6.2. Also, over the long term, hard engineering designs may result in downdrift erosion, as discussed in Section 5.6.1, affecting areas off-site from the proposed project. Therefore, a review of specific projects will need to consider the area that could be affected and include these potentially nonadjacent areas when determining whether an environmental justice population is present. If an environmental justice population is present, then FEMA would determine whether a disproportionately high and adverse impact could occur. If there could be a disproportionately high and adverse impacts on an environmental justice population, targeted outreach with that community would occur, mitigation measures would be identified, and an SEA would be prepared. If adverse impacts to environmental justice populations could not be mitigated, the project would not be covered under this PEA or an SEA.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated. Bioengineered designs would enhance greenspace and potentially public access and recreational opportunities, as described in Section 5.7.1. These potential additional benefits would be applicable to all populations within and near a project area, including environmental justice populations.

Project Conditions

None.

5.6.7 Hazardous Materials

Hazardous materials and wastes are regulated under a variety of federal and state laws, including the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act, the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act. Evaluations of hazardous substances and wastes must consider whether any hazardous material would be generated by the proposed activity and/or already exists at or in the general vicinity of the site (40 C.F.R. 312.10). If hazardous materials are discovered, they must be handled by properly permitted entities per statutes listed in 310 CMR 30.000.

5.6.7.1 Existing Conditions

Table 5.12 provides information about the number of Superfund Sites, brownfield sites, toxic release inventory sites, and RCRA sites located within the study area. Users of this PEA should confirm whether hazardous sites are present in or near their proposed project area with databases provided by government agencies, such as the EPA's Envirofacts database.

Table 5.12. Superfund, Brownfield, TRI, and RCRA Sites in the Project Area

State	State Regulatory Agency	National Priorities List (Superfund Program)	Brownfield Sites	Toxic Release Inventory Sites	Active RCRA Sites
Massachusetts	Massachusetts Department of Environmental Protection	11	323	384	8,412

Source: EPA 2022c

5.6.7.2 Potential Effects and Proposed Mitigation

No Action Alternative

Under the No Action alternative, implementation of non-FEMA funded projects would involve the use of construction equipment that could be a source of oil, fuel, and lubricant leaks. During construction, potentially hazardous materials could be used (e.g., potentially contaminated fill that could impact the environment. Therefore, there could be short-term **negligible** to **minor** impacts from equipment use and the potential for oil, fuel, and lubricant leaks and the use of hazardous materials. In the long term, coastal flooding and erosion would not be substantially mitigated within a community. Continued flooding and

erosion would threaten hazardous materials sites near the shore and within the flood prone areas and could expose contaminated soils. Any contaminated materials within these areas could be carried into the ocean by receding floodwaters or become exposed as erosion occurs, risking soil and water contamination. Therefore, under this alternative, there could be a **minor** to **moderate** long-term impact related to hazardous materials contamination.

Proposed Action

General Consequences of the Proposed Action

During construction, the Proposed Action would involve the use of construction equipment, and there would be a minor risk of leaks of oils, fuels, and lubricants from the use of such equipment. The Proposed Action may involve placement of fill either from the project site or from an external source. The Project Proponent would need to identify the source of any fill material and confirm that it is not contaminated. Therefore, the Proposed Action would not add hazardous materials or chemicals to a project site.

There would also be a potential for construction to expose contaminated materials by the excavation and removal of soil and construction debris from a project area. If hazardous materials (or evidence thereof) are discovered during the implementation of the project, the Project Proponent must handle, manage, and dispose of petroleum products, hazardous materials, and/or toxic waste in accordance with the requirements and to the satisfaction of the governing local, state, and federal regulations.

With the implementation of BMPs including the use of equipment in good condition, the Proposed Action would have **negligible** to **minor** short-term adverse effects related to hazardous materials contamination. The Proposed Action would not cause long-term adverse impacts through the addition of hazardous facilities, operations, or chemicals to the project area or increase the risk of hazardous materials-related impacts on the environment. The Proposed Action would have long-term beneficial effects by protecting hazardous sites from erosion along the shoreline and in flood prone areas. If a Phase I or II environmental site assessment indicates that contamination exceeding reporting levels is present and further action is warranted an SEA would be required.

Project-Specific Consequences

Hard Engineering Designs

Excavation for hard engineering designs is usually deeper than bioengineering designs, which could result in a greater potential for exposure of contaminated soils during the implementation of hard engineering designs. Downdrift erosion from hard engineering designs could degrade, expose, or threaten hazardous materials sites located along the shore. Therefore, implementation of hard engineering designs could have a long-term **minor** adverse effect on hazardous material sites.

Bioengineering Designs

No additional impacts specific to bioengineering designs are anticipated. Planting of vegetation and restoration, enhancement, or creation of living systems would enhance filtration of pollutants and contaminants, as described in Section 5.2.1. Therefore, bioengineering designs would result in a **negligible** to **minor** beneficial effect on hazardous materials sites from the additional filtration of pollutants and contaminants.

Project Conditions

- If hazardous materials (or evidence thereof) are discovered during the implementation of the project, the Project Proponent must handle, manage, and dispose of petroleum products, hazardous materials, and/or toxic waste in accordance with the requirements and to the satisfaction of the governing local, state, and federal regulations.
- During construction, the Project Proponent and/or their Contractor must notify MassDEP for any sudden release or spill of any chemical (either oil or a hazardous material), that exceeds the threshold for a Reportable Quantity (RQ). The Massachusetts cleanup regulations (310 CMR 40.1600) require that "Reportable Quantities" (or RQs) of spills and other sudden releases be reported to MassDEP so that assessment and the cleanup process can begin. The Massachusetts Oil and Hazardous Materials List (MOHML) provides the levels that trigger notification to MassDEP. Copies of documentation to and from MassDEP must be forwarded to the State and FEMA for inclusion in the administrative record.

5.7 Cumulative Effects

This PEA considers the overall cumulative effect of the Proposed Action and other actions that are related in terms of time or proximity. Cumulative effects represent the “effect on the environment which results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time” (87 Federal Register 23453). In the context of evaluating the scope of a proposed action, direct, indirect, and cumulative effects must be considered.

Through this PEA, FEMA evaluates the potential environmental consequences of providing grant funding for future coastal flood and erosion mitigation measures on the Massachusetts coast. These activities are described in Section 4 and include hard engineering and bioengineering designs to reduce flooding and erosion along a shoreline, as well as certain connected actions.

Because the Proposed Action would result from future grant assistance, the specific locations of the actions are unknown at the time of this assessment. Individual projects resulting from the Proposed Action could result in cumulative impacts depending on what other past or present actions have been, or will be, undertaken near an individual project area. Individual projects proposed for coverage under this PEA are not anticipated to cause significant impacts, even when combined with other actions. Projects that could result in significant impacts can generally be reduced below the level of significance by implementing the BMPs and mitigation measures described throughout Section 5. An SEA will be completed for any project that is anticipated to result in impacts that cannot be addressed by mitigation measures discussed in Section 6, Permits Conditions and SEA Thresholds.

5.7.1 Potential Cumulative Effects

Soils and Topography

Implementation of a FEMA-funded Proposed Action project along with other coastal flood and erosion mitigation projects could create a more effective mitigation system. A group of hard engineering designs would reduce soil erosion from storm and wave action and would also cumulatively increase the potential

of adverse downdrift effects from multiple project locations. Implementation of bioengineered designs along with other similar designs, could cumulatively reduce soil erosion without downdrift effects.

Water Resources

If coastal flood and erosion mitigation projects are combined, a longer length of shoreline would be protected. The combined projects would reduce pollution and sediments from entering the ocean by providing either a hard edge that retains upland soils or a naturally vegetated area for natural filtering and infiltration, resulting in a cumulative benefit on coastal water quality. The larger length of protection would reduce inland flooding by coastal waters, further reducing floodplain damage and potential saltwater inundation to freshwater resources, including wetlands.

Coastal Resources

When a coastal flood and erosion mitigation project would be combined with the other mitigation and restoration projects along the coast, there is a higher potential to meet the objectives of the state's coastal management program by reducing erosion and flooding on coastal resources. Combined bioengineering designs would further conserve natural resources and enhance public access to the coast.

Biological Resources

Multiple coastal flood and erosion mitigation projects could create larger flood control barriers along the coast. This could potentially cause the local and increased adverse effect on the local migration of coastal ESA species and migratory birds. This could have a long-term moderate adverse effect as it could further reduce the amount of suitable habitat for these species.

Combined bioengineering designs could create larger interconnected natural areas of higher quality habitat. Extended natural areas would provide additional habitat and habitat connectivity that would allow for greater movement of terrestrial and aquatic species through the area. Larger habitat areas provide enhanced habitat benefits that are greater than the sum of the parts. The cumulative effect would provide a moderate beneficial effect on the biological environment.

Implementation of a FEMA-funded project along with other coastal flood and erosion mitigation measures would remove and replace existing invasive vegetation with native trees and grasses in accordance with state regulations described in Section 5.4.3. Removal and replacement of invasive plant species with native species would provide a cumulative benefit to terrestrial and aquatic habitats.

6.0 PROJECT CONDITIONS AND SEA THRESHOLDS

The Project Proponent is responsible for obtaining all required federal, state, and local permits that may be required for their individual projects covered under this PEA. The following list contains general conditions that all projects would need to undertake to be compliant with federal regulations. Failure to comply with grant conditions may jeopardize federal funds.

- A coastal sediment transport impact analysis would be required for all hard engineering designs.
- Before construction begins, the Project Proponent must obtain any required Clean Water Act Section 404 and 401 permits from USACE and Mass DEP, respectively, and comply with all terms and conditions of the issued permits.
- Before construction begins, the Project Proponent must obtain any required Clean Water Act Section 402 NPDES permits from the EPA and comply with all terms and conditions of the issued permit.
- Before construction begins, the Project Proponent must obtain any required River and Harbors Act Section 10 Permit from USACE and comply with all terms and conditions of the issued permit.
- Before construction begins, the Project Proponent must obtain a Mass DEP Chapter 91 Waterway License and comply with all terms and conditions of the issued permit.
- Before construction begins, the Project Proponent must file a Notice of Intent with the local Conservation Commission in accordance with the Massachusetts Wetlands Protection Act.
- Before construction begins, the Project Proponent must obtain approval from the local permitting official responsible for any floodplain development to demonstrate that the Proposed Action is consistent with the criteria of the NFIP (44 C.F.R. part 59 et seq.) or any more restrictive federal, state, or local floodplain management standards (44 C.F.R. 9.11(d)(6)) and comply with all terms and conditions of the issued permit.
- Projects must comply with the terms and conditions resulting from FEMA's consultation with on Wild and Scenic Rivers, if required.
- Any project with features extending into navigation channels must provide as-built plans to the NOAA Office of the Coast Survey to update federal navigation charts.
- Compliance with all terms and conditions from any MA CZM consistency determination must be followed.
- Coordination with Mass Wildlife is required if the proposed project occurs within migratory bird nesting season to obtain any required authorization. The Project Proponent must provide documentation of coordination to FEMA.
- If Bald Eagle nests are identified in a project area, FEMA consultation with USFWS would be required if the National Bald Eagle Management Guidelines could not be implemented through project special conditions to establish actions required to protect nest sites, including appropriate buffers.

- As needed, implement any avoidance and minimization measures resulting from FEMA's consultation or coordination with USFWS and/or NMFS in accordance with Section 7 of the ESA. The Project Proponent would be required to comply with any measures developed through the Section 7 consultation.
- The Project Proponent must comply with all required measures resulting from FEMA's consultation with NMFS under Section 305(b) of the MSA to conserve EFH.
- In the event of the discovery of archaeological deposits (e.g., Native American pottery, stone tools, shell, old house foundations, old bottles), the Project Proponent and their contractor must immediately stop all work in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the finds. The Project Proponent and their contractor must secure all archaeological discoveries and restrict access to discovery sites. The Project Proponent must immediately report the archaeological discovery to MEMA and FEMA; FEMA will determine the next steps.
- In the event of the discovery of human remains, the Project Proponent and their contractor must immediately stop all work in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the finds. The Project Proponent and their contractor must secure all human remains discoveries and restrict access to discovery sites. The Project Proponent and their contractor must follow the provisions of applicable state laws or any amendments or supplanting laws and regulations. Violation of state law will jeopardize FEMA funding for this project. The Project Proponent must inform the Massachusetts State Police, the Office of the Chief Medical Examiner, the State Archaeologist, MEMA, and FEMA. FEMA will consult with the SHPO and Tribes, if remains are of tribal origin. Work in sensitive areas may not resume until consultation is completed and appropriate measures have been taken to ensure that the project is compliant with the NHPA.
- All fill material must come from pre-existing stockpiles or commercially procured material from a pre-existing source. Documentation of borrow sources used is required at closeout.
- Construction activities must conform to local noise ordinances.
- If the project includes traffic impacts, the Project Proponent must develop and implement a maintenance of traffic plan that identifies detours and methods to accommodate traffic.
- If utilities need to be temporarily shut off during construction, the Project Proponent must follow local ordinances regarding shutdown procedures and notification.
- Utilities that are abandoned in place must be decommissioned to state and local standards.
- If hazardous materials (or evidence thereof) are discovered during the implementation of the project, the Project Proponent must handle, manage, and dispose of petroleum products, hazardous materials, and/or toxic waste in accordance with the requirements and to the satisfaction of the governing local, state, and federal regulations.
- During construction, the Project Proponent and/or their Contractor must notify MassDEP for any sudden release or spill of any chemical (either oil or a hazardous material), that exceeds the threshold for a Reportable Quantity (RQ). The Massachusetts cleanup regulations (310 CMR

40.1600) require that "Reportable Quantities" (or RQs) of spills and other sudden releases be reported to MassDEP so that assessment and the cleanup process can begin. The Massachusetts Oil and Hazardous Materials List (MOHML) provides the levels that trigger notification to MassDEP. Copies of documentation to and from MassDEP must be forwarded to the State and FEMA for inclusion in the administrative record.

6.1 SEA Thresholds

Table 6.1 establishes the criteria for determining whether a proposed project may be covered under the Finding of No Significant Impact (FONSI) for this PEA or through a tiered SEA that requires extra coordination, consultation, or mitigation measures not discussed in this PEA. In these situations, an SEA would be prepared, focusing on the resources where the evaluation is needed. If a project is consistent with the scope and potential impacts described and would apply the BMPs and mitigation measures proposed in this PEA, then no further NEPA documentation would be required. If a proposed project would extend beyond the study area or its impacts are not fully described in this PEA, an SEA may need to be prepared. Note that a project must still result in a FONSI if an SEA is prepared; if a project would have significant impacts even with additional mitigation measures, then an EIS may be required. The thresholds described in Table 6.1 are presented as guidelines. The level of NEPA documentation prepared for a specific project (e.g., PEA, SEA, EA, or EIS) is determined by FEMA during project review and is at the agency's discretion. FEMA may require the preparation of an SEA or an EA for projects that may appear to be covered by this PEA.

Table 6.1. SEA Thresholds

Area of Evaluation	Project Covered by This PEA	Tiered SEA Required
NEPA	Projects are less than 10 acres in ground disturbance	Project greater than 10 acres of ground disturbance
Geology, Topography, and Soils	Negligible to moderate impacts on soils or topography. Or Mitigation measures are used to reduce potential impacts to a minor level.	The proposed project would cause downdrift erosion that crosses jurisdictional boundaries. Or The proposed project would have an adverse effect on soils protected by the FPPA after consultation with NRCS.

Area of Evaluation	Project Covered by This PEA	Tiered SEA Required
Clean Air Act	Emissions in nonattainment and maintenance areas would be temporary and less than exceedance levels. Or Emissions in attainment areas would be temporary and not cause air quality to go out of attainment for any National Ambient Air Quality Standards. Or Mitigation measures are used to reduce potential impacts below the level described above.	The proposed project would result in new long-term source(s) of air emissions. Or Temporary emissions would exceed *de minimus* thresholds causing a moderate or greater adverse effect on air quality
Climate Change	Greenhouse gas emissions would be temporary and less than exceedance levels (25,000 metric tons per year). Or Mitigation measures are used to reduce potential impacts below the level described above.	The proposed project would result in over 25,000 metric tons of greenhouse gas emissions per year.
Water Quality	Negligible or minor impacts on water quality and would not exceed water quality standards or criteria. Or Mitigation measures are used to reduce potential impacts to a moderate level.	The proposed project would cause or contribute to long-term impacts on water quality. Or The proposed project would require compensatory mitigation under federal Section 404 regulations.
Floodplains	The proposed project is not located in or does not adversely affect floodplains. Or Project is for floodplain restoration that has a beneficial impact on the floodplain Or Mitigation measures are used to reduce potential temporary impacts to a minor or moderate level.	The proposed project would have a permanent adverse impact on a floodplain that requires the development of mitigation measures not included in the PEA.

Area of Evaluation	Project Covered by This PEA	Tiered SEA Required
Wetlands	The proposed project is not located in or does not adversely affect wetlands. Or Mitigation measures are used to reduce potential temporary impacts to a minor or moderate level.	The proposed project would require fill within a wetland. Or The 8-step process shows an adverse effect on wetlands that cannot be mitigated without agency coordination.
Wild and Scenic Rivers	None or minor impact on a wild and scenic river resulting from water quality or water resources impact, visual impacts, vegetation, fish, or wildlife habitat impacts. Impacts can be mitigated through requirements provided through coordination with NPS or other managing agency Or If the project is within one-quarter mile of a wild and scenic river, concurrence from the National Park Service that the project would not adversely affect the wild and scenic river values is required.	N/A — project would not go forward without concurrence from the managing federal agency.
Navigation	None to moderate adverse effects on navigation; And Corps permit approval for breakwaters, groins, or jetties has been obtained.	Projects other than breakwaters, groins, or jetties that have long-term impacts on navigation. Or A structure is placed in or immediately adjacent to a navigation channel that would interfere with navigation.
Coastal Resources	The proposed project is located or partially located in the coastal zone and minimizes adverse effects because mitigation measures are used to reduce impacts to a minor or moderate level. Concurrence that project is consistent with state coastal zone management plan is required. And Project is not located within a CBRS/OPA zone, or would not have an adverse effect on OPAs if constructed within one.	The proposed project would be found to be inconsistent with MA CZM policies. Or Would adversely affect a CBRS and/or OPA zone.

Area of Evaluation	Project Covered by This PEA	Tiered SEA Required
Vegetation	Negligible to moderate short-term impacts on native species, their habitats, or the natural processes sustaining them. Population levels of native species would not be affected. Sufficient habitat would remain functional to maintain the viability of all species. And Any vegetation planting would be done with native vegetation.	If any project were to adversely affect vegetation or habitats such that it would reduce population levels of native species or sufficient habitat would not remain to maintain the viability of all vegetation species in the project area.
Fish and Wildlife	Negligible to moderate short-term impacts on native species, their habitats, or the natural processes sustaining them. Population levels of native species would not be affected. Sufficient habitat would remain functional to maintain the viability of all species. Or Project work occurs outside the buffer for Bald Eagle nesting grounds or the implementation of adequate recommendations from the National Bald Eagle Management Guidelines.	If any project were to adversely affect the habitat that it would reduce population levels of native species or sufficient habitat would not remain to maintain the viability of all fish and wildlife species in the project area.
Invasive Species	The proposed project does not cause the spread of invasive species Or The proposed project removes invasive species.	None
Threatened and Endangered Species	FEMA can make a *"No Effect"* determination. Or FEMA can make a *"Not Likely to Adversely Affect"* determination along with concurrence from USFWS and/or NMFS. Or Mitigation measures, including conservation measures provided by USFWS or NMFS, are used to reduce potential impacts to a minor level or to a level where the project is not likely to adversely affect listed species.	The proposed project falls under a *"likely to adversely affect"* determination and USFWS or NMFS issues a biological opinion and incidental take permit for the project.

Area of Evaluation	Project Covered by This PEA	Tiered SEA Required
Essential Fish Habitat	Project is outside EFH. Or Project can implement and comply with all conservation recommendations resulting from a FEMA consultation with NMFS under Section 305(b) of the MSA.	None
Cultural Resources	No historic properties affected. Or FEMA can make a determination of *"No Adverse Effect*" with concurrence from the SHPO and/or THPO as appropriate.	FEMA makes an *Adverse Effect* determination that is resolved through a memorandum of understanding with the SHPO, THPO, or other consulting parties or through the programmatic agreement.
Land Use and Planning	Proposed project causes no adverse impact on existing land uses or zoning within a shoreline community. There may be long-term benefits.	None
Noise	Noise levels would not exceed typical noise levels expected from equipment or vehicles and would comply with local noise ordinances. Noise generated by construction would be temporary or short-term in nature. There would be negligible to moderate short-term effects depending on proximity to sensitive noise receptors. Or Mitigation measures are used to reduce potential impacts below the levels described above.	The proposed project would generate a new long-term source of noise. If the proposed project requires pile driving, an SEA may be required if the potential impacts on the natural and human environment would be more than moderate.
Transportation	Proposed project would have only negligible or minor impacts on traffic and transportation. Or Mitigation measures are used to reduce potential impacts to a minor level.	The proposed project would cause a long-term adverse effect on transportation resources.

Area of Evaluation	Project Covered by This PEA	Tiered SEA Required
Public Services and Utilities	The proposed project would have only negligible or minor impacts on public services and utilities. Or Mitigation measures are used to reduce potential impacts to a minor level.	The proposed project would cause a long-term adverse effect on utilities, including a permanent loss or major rerouting of utilities.
Public Health and Safety	The proposed project would have only negligible or minor impacts on public health and safety. Or Mitigation measures are used to reduce potential impacts to a minor level.	The proposed project would have long-term adverse effect on public health and safety, such as a permanent source of emissions or a permanent reduction of water quality.
Environmental Justice	There would not be any disproportionately high and adverse environmental or health effects on low-income and/or minority populations. Or Mitigation measures are used to reduce potential impacts to a negligible level or result in proportionate impacts across all populations.	The proposed project would have a moderate or greater effect that requires outreach and coordination with minority and/or low-income populations to resolve potential adverse impacts.
Hazardous Materials	Hazardous or toxic materials or wastes would be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. There would be no short- or long-term adverse impacts on public safety. Or Mitigation measures would reduce potential impacts such that there would be no short- or long-term adverse impacts on public health and safety.	Phase I or II environmental site assessment indicates that contamination exceeding reporting levels is present *and* further action is warranted.

Area of Evaluation	Project Covered by This PEA	Tiered SEA Required
Cumulative Impacts	No past, present or future actions are near the project area. Or Proposed project in connection with past, present, or future actions would have only negligible or minor cumulative impacts. Or Mitigation measures are used to reduce the potential cumulative impacts to a minor level.	None

7.0 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

7.1 Notice of Intent and Scoping

NEPA, its implementing regulations, and FEMA procedures stress the importance of engagement with partner agencies, applicants, and the public to the extent practicable while preparing an EA. FEMA published a Notice of Intent (NOI) to initiate scoping and solicit input on the proposed PEA from other federal and state agencies, tribes, and the public. Because of the large geographic area covered, the NOI was published in multiple locations on multiple dates (**Table 7.1**). The comment period to solicit input on the scope of the analysis was held open for 30 days following the latest publication date. Scoping closed on April 6, 2022. Agencies, tribes, and interested persons were requested to comment on the purpose and need of the Proposed Action, alternatives, potential environmental impacts, and measures to reduce those impacts. A scoping meeting was also held on March 28, 2022, with state agencies that included MEMA, MEPA Office, state Flood Hazards Management Program, and MA CZM.

7.1.1 NOI Distribution

To solicit input on the project and its potential effects, FEMA published a NOI to prepare a PEA in the papers listed in **Table 7.1** and distributed a scoping document to the agencies listed below on March 7, 2022.

- EPA, Region 1
- HUD, Region 1
- NMFS, Habitat and Ecosystem Services Division
- NMFS, Protected Resources Division
- USACE, New England District
- USFWS, New England Field Office
- National Park Service, Wild and Scenic Rivers

- MA Office of Coastal Zone Management
- MA Division of Fisheries and Wildlife
- MA Natural Heritage & Endangered Species Program
- MA Waterways Regulation Program
- MA Emergency Management Agency
- MA DCR, State Floodplain Coordinator
- MA Department of Environmental Protection
- MA State Historic Preservation Office
- MA Environmental Policy Act Office

Table 7.1. Notice of Intent Publication

Newspaper	Date NOI Published (2022)
Cape Cod Times	Sunday — April 3
Taunton Daily Gazette	Friday — April 8
Boston Herald	Sunday — April 3
Marblehead Reporter	Monday — April 4
Herald Citizen	Thursday — April 7
The Daily News of Newburyport	Monday — April 4
Patriot Ledger	Saturday — April 2
Gloucester Daily Times	Monday — April 4
Salem News	Monday — April 4

Following the distribution of the NOI, FEMA received a correspondence from Fort Point Associates requesting to be informed of future notices about the Draft PEA. FEMA responded that they would keep them informed of all future postings.

7.1.2 Scoping Comments

Following the distribution of the scoping document, FEMA received correspondence from EPA offering recommendations to refine the scope of analysis for the PEA. This included:

- Use best available data for storm surge and precipitation changes in combination with sea level rise data.
- Use specific accounting of Environmental Justice community outreach for each project covered under the PEA.
- Use the wide variety of tools available to support the analysis of environmental justice issues including EPA's EJ Screen, Center of Disease Control's Tracking Network, EPA's Health Impact Assessment Resource and Tool Compilation, EPA's Air Now portal.

- Supported inclusion of tribal coordination and encouraged FEMA to engage with tribal representatives early in the PEA development process.
- Recommended that FEMA consider hosting periodic update meetings for interested local, state, and federal parties as work progresses on the PEA.

7.2 Comments on the Draft PEA

Substantive comments received during the public review period will be addressed in the final PEA. The public is invited to submit written comments by sending an email to david.robbins@fema.dhs.gov and eric.kuns@fema.dhs.gov or mailing FEMA Region 1, 99 High Street Boston, MA 02110 Attn: Regional Environmental Officer. If no substantive comments are received from public or agency reviewers, the draft PEA and FONSI will be adopted as final.

7.3 Preparation of SEAs

In addition to the circulation of the Draft PEA, any SEAs that are tiered off the PEA would go through an appropriate level of public review before FEMA makes a NEPA compliance determination. When an action evaluated in an SEA could result in impacts on the environment beyond those described in this PEA and require mitigation in addition to that included in this document, or has the potential for public controversy, FEMA would circulate the SEA for public and agency review and comment. For these types of activities, FEMA could prepare a separate findings document (i.e., a FONSI or a NOI to prepare an EIS).

FEMA would comply with the public notification process required for compliance with EO 11988 and 11990 and 40 C.F.R. Part 9, when applicable for an action.

8.0 LIST OF PREPARERS

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2C%20parks%20and%20gardens.&text=They%20may%20also%20be%20found,pollen%20resources%2C%20and%20overwintering%20habitat.

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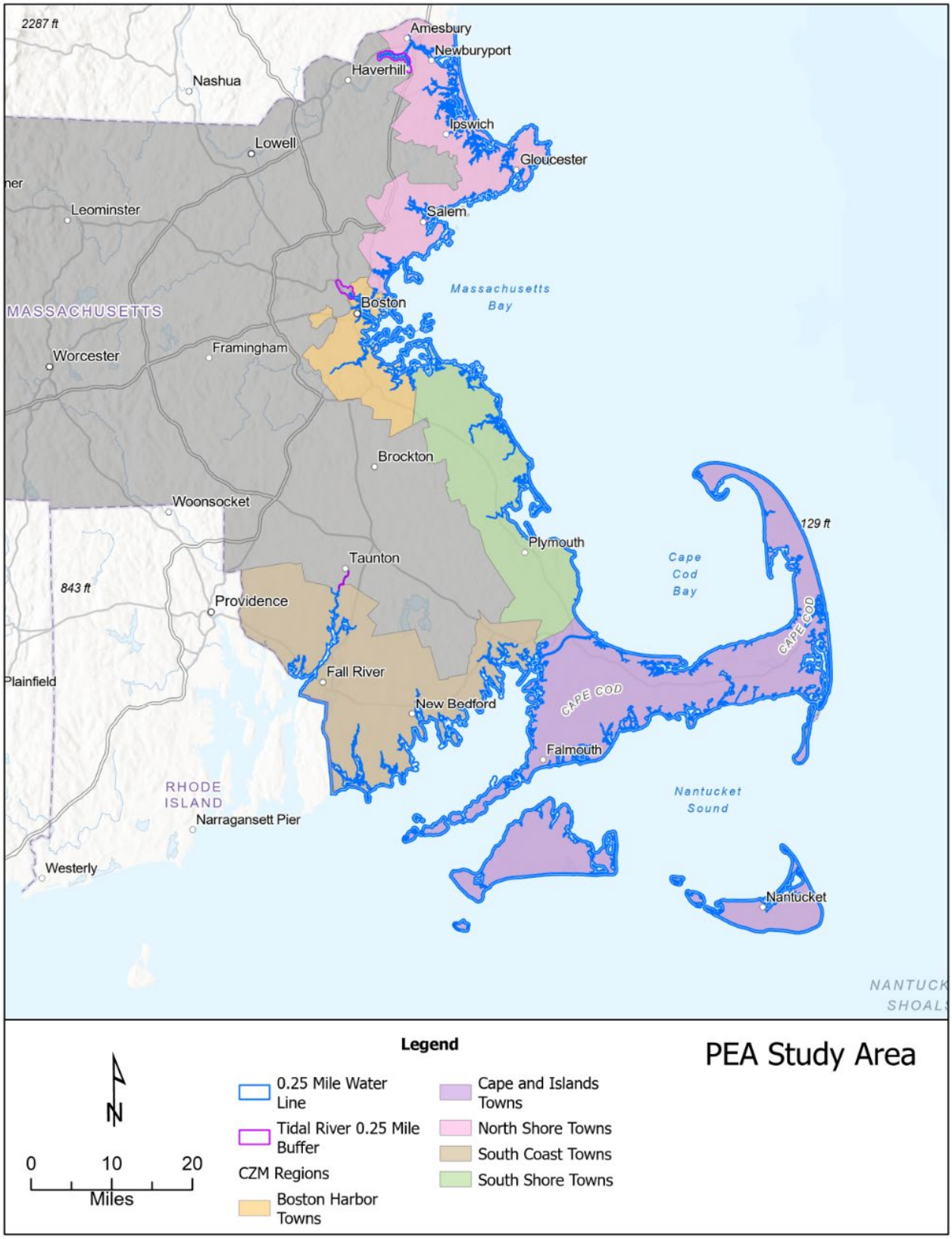
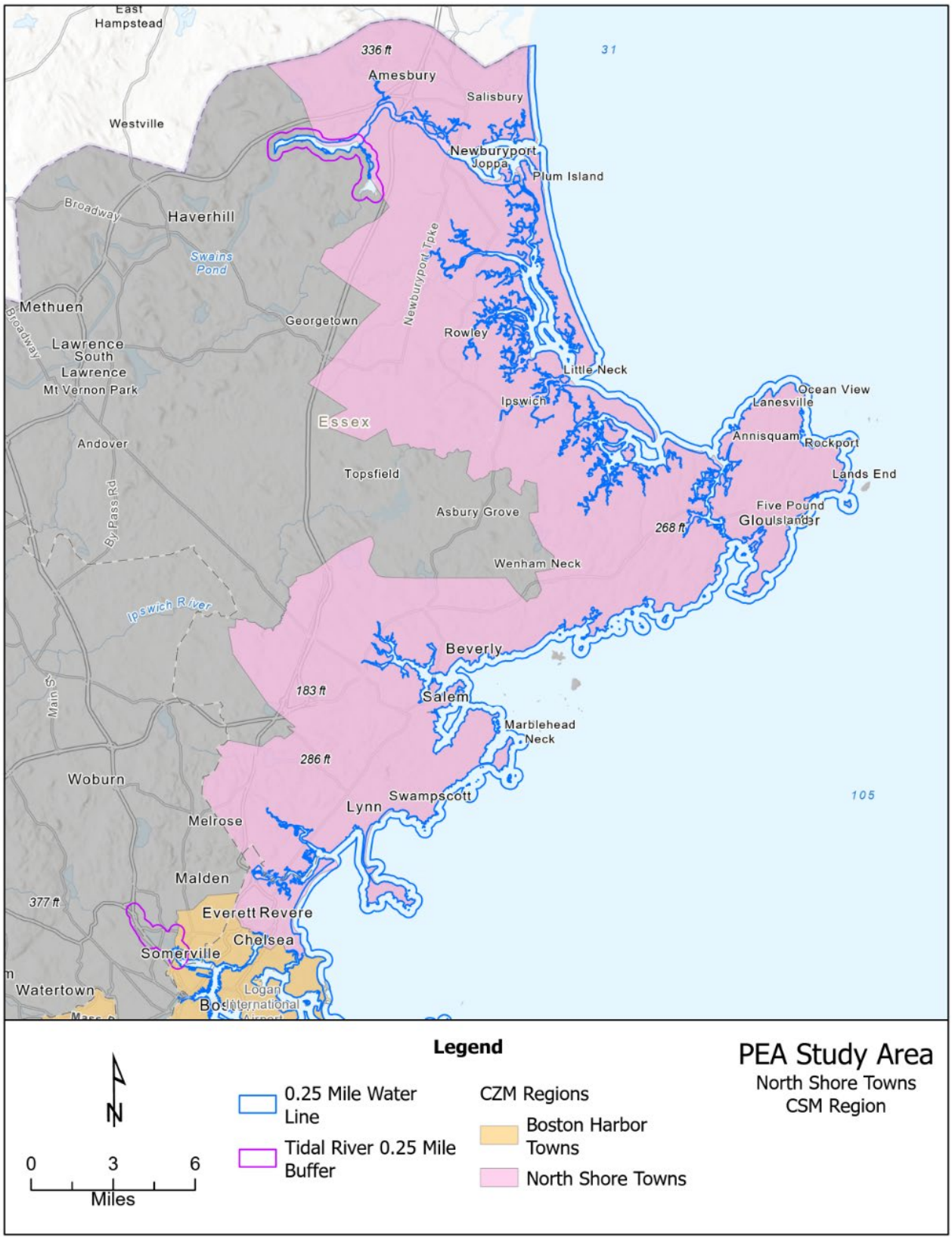
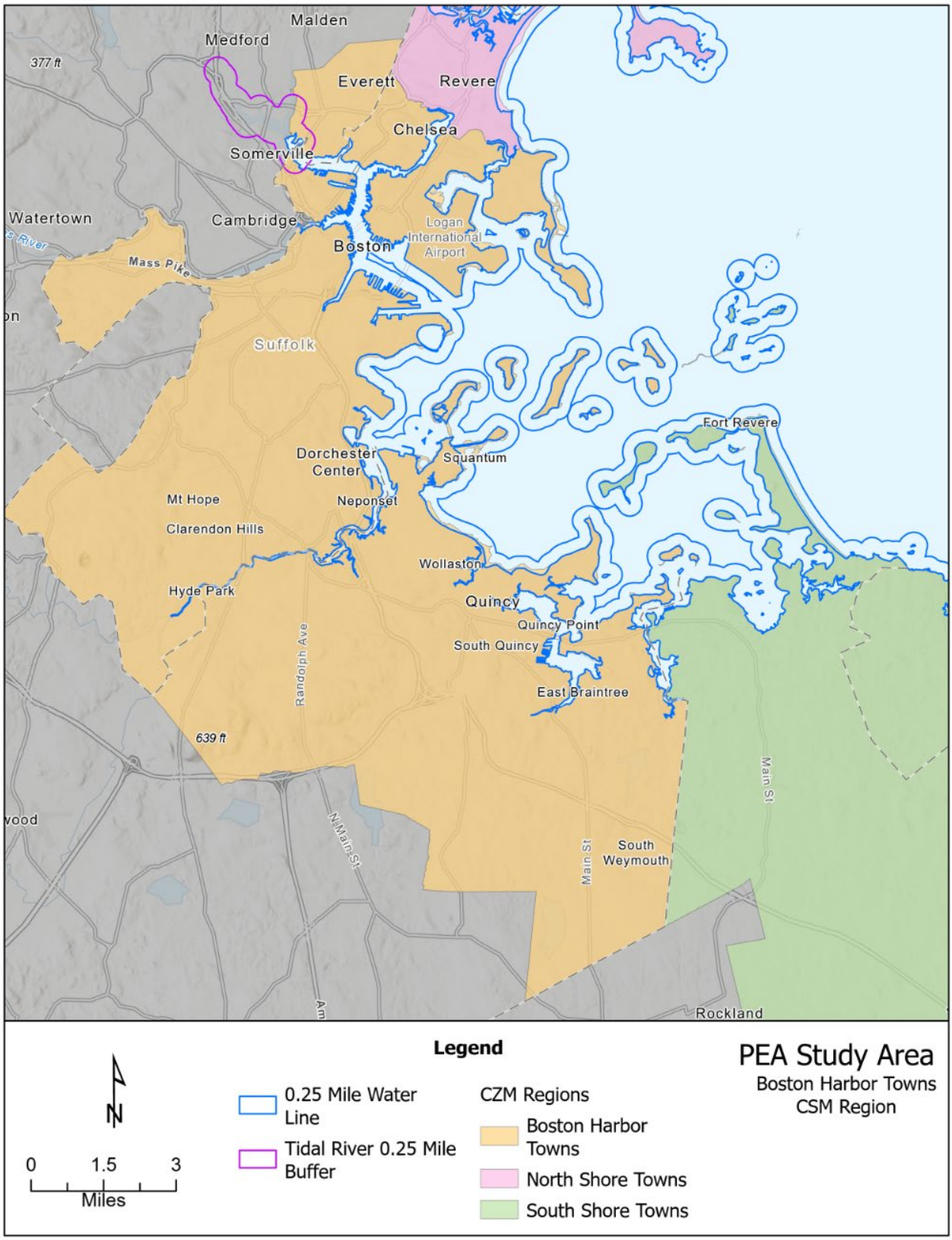
Appendix A Maps



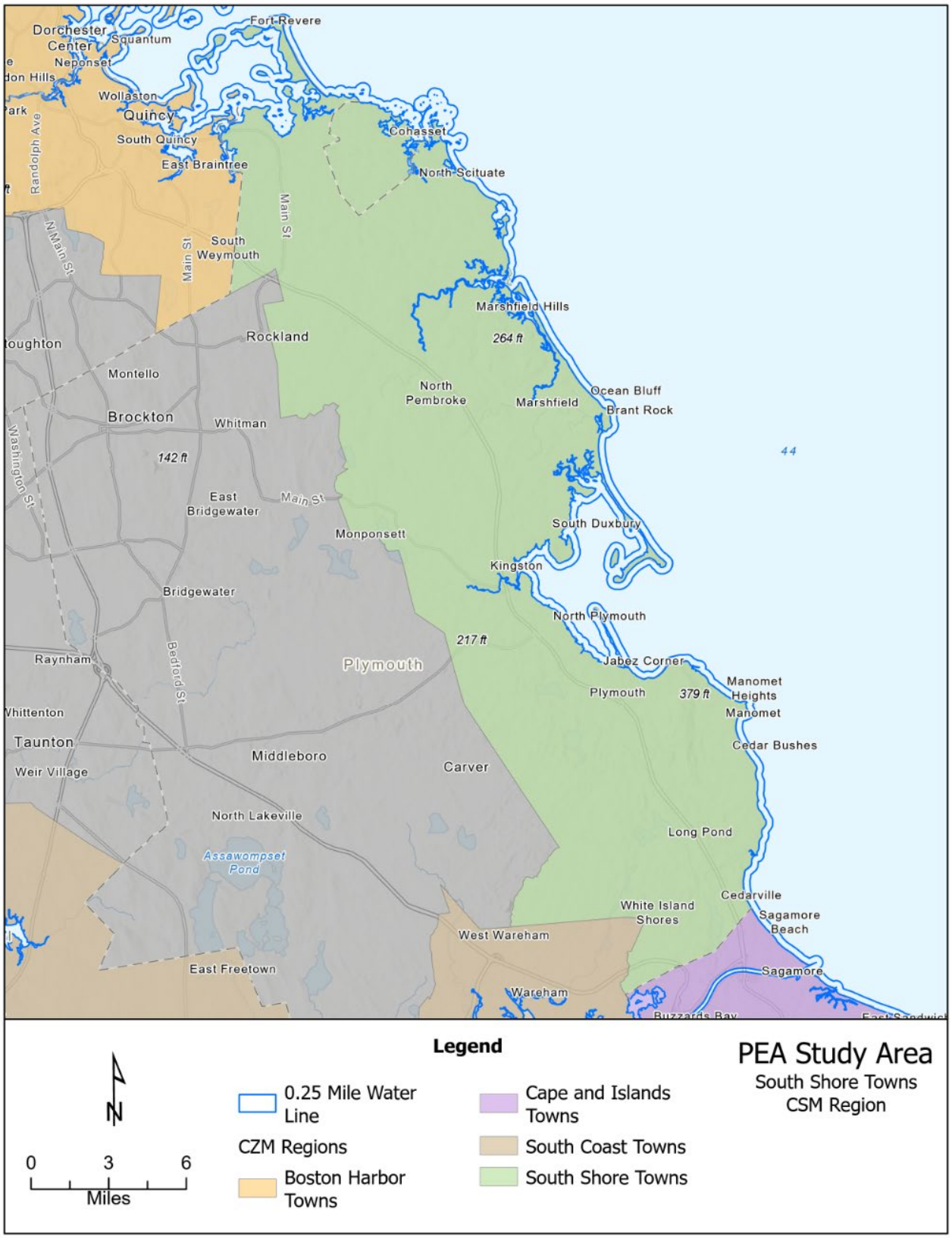
Map 1: Programmatic Environmental Assessment (PEA) Study Area



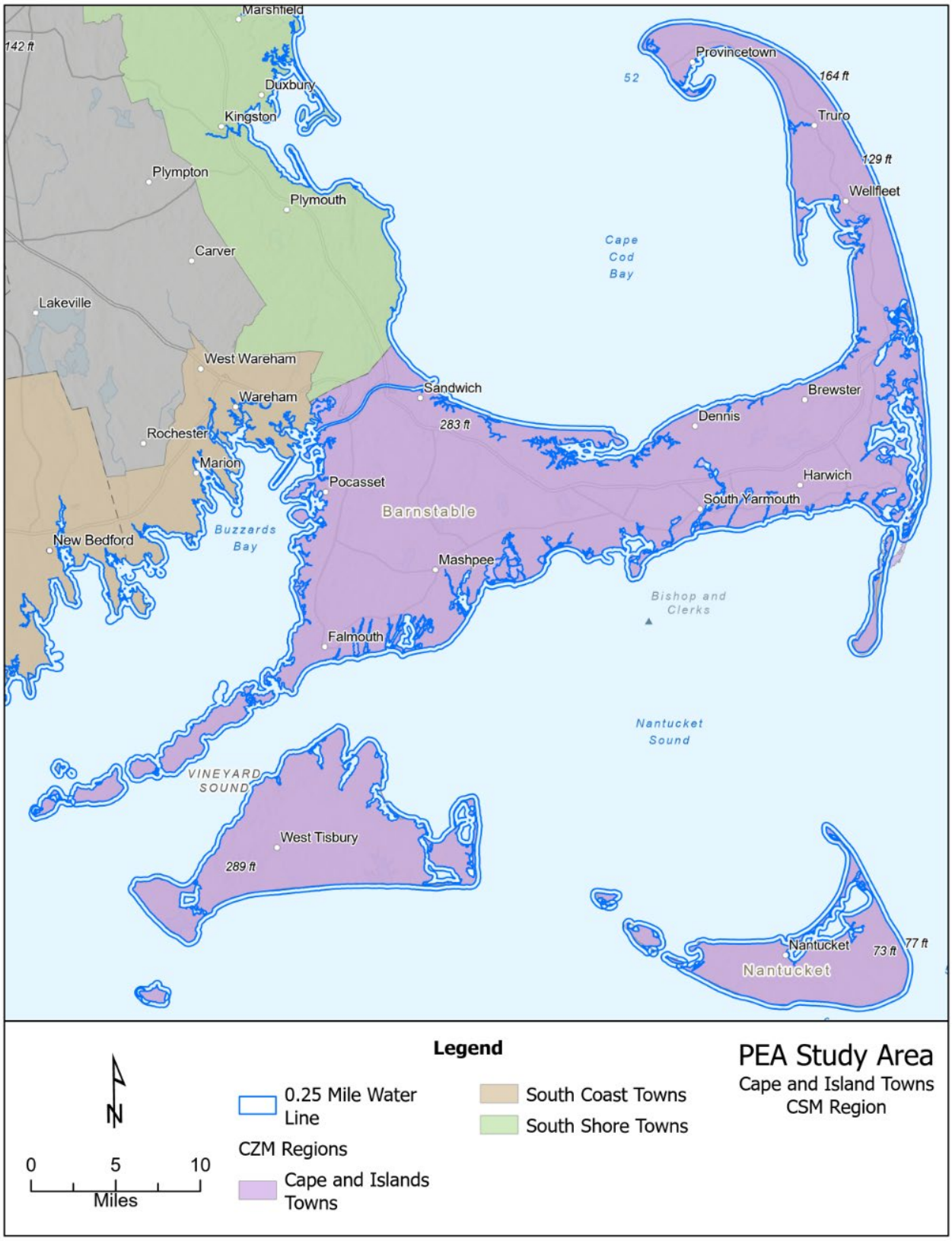
Map 2: North Shore Study Area



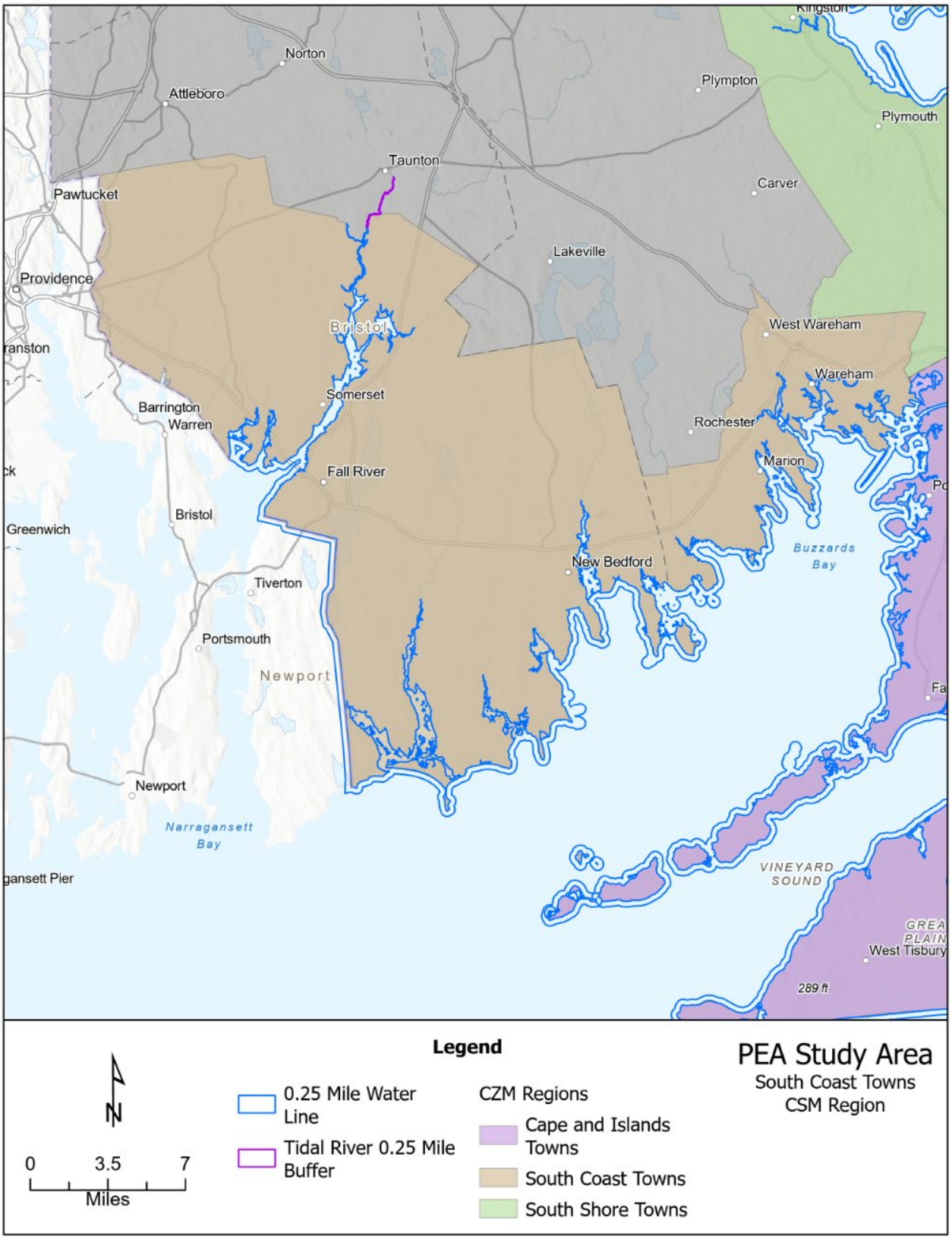
Map 3: Boston Harbor Study Area



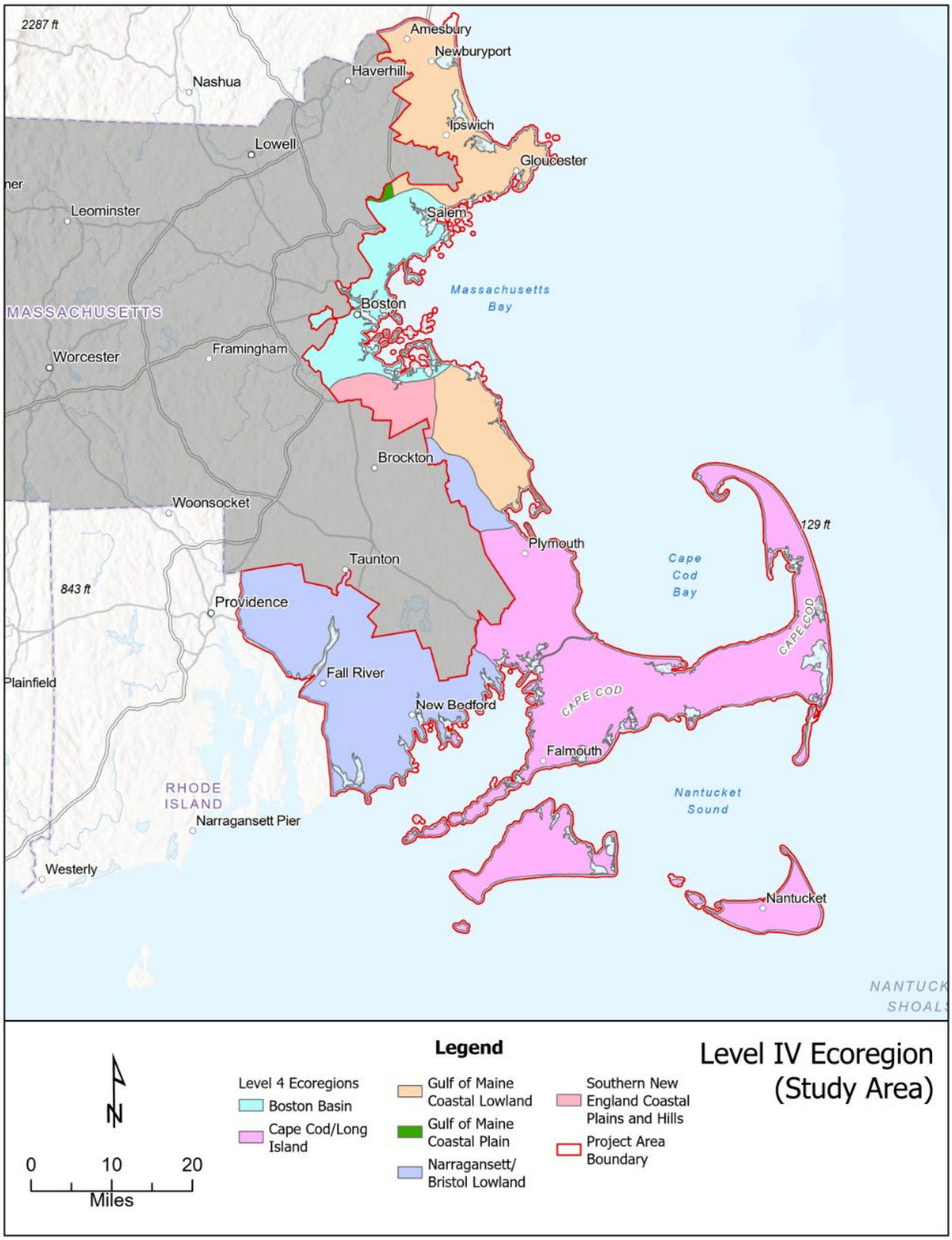
Map 4: South Shore Study Area



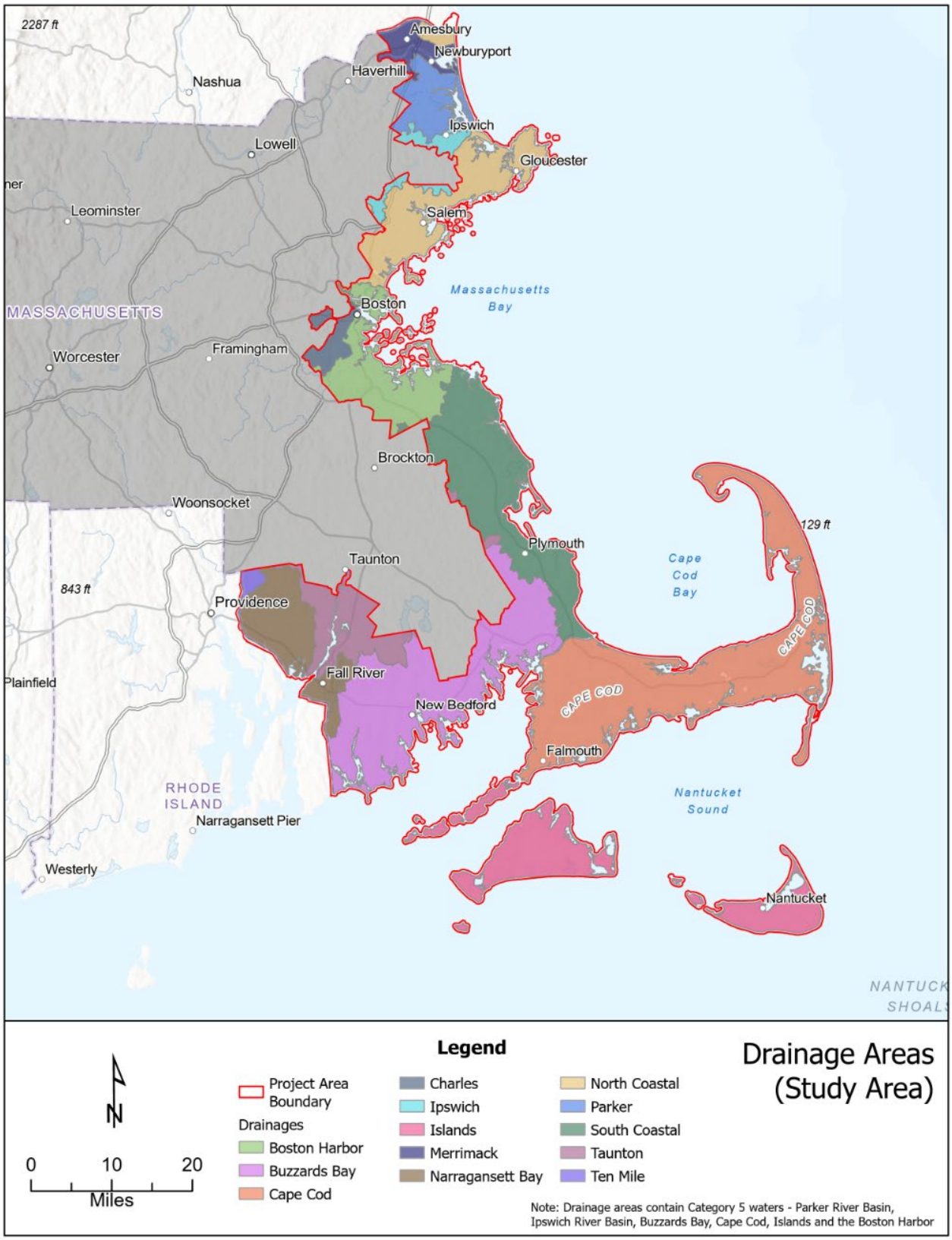
Map 5: Cape and Islands Study Area



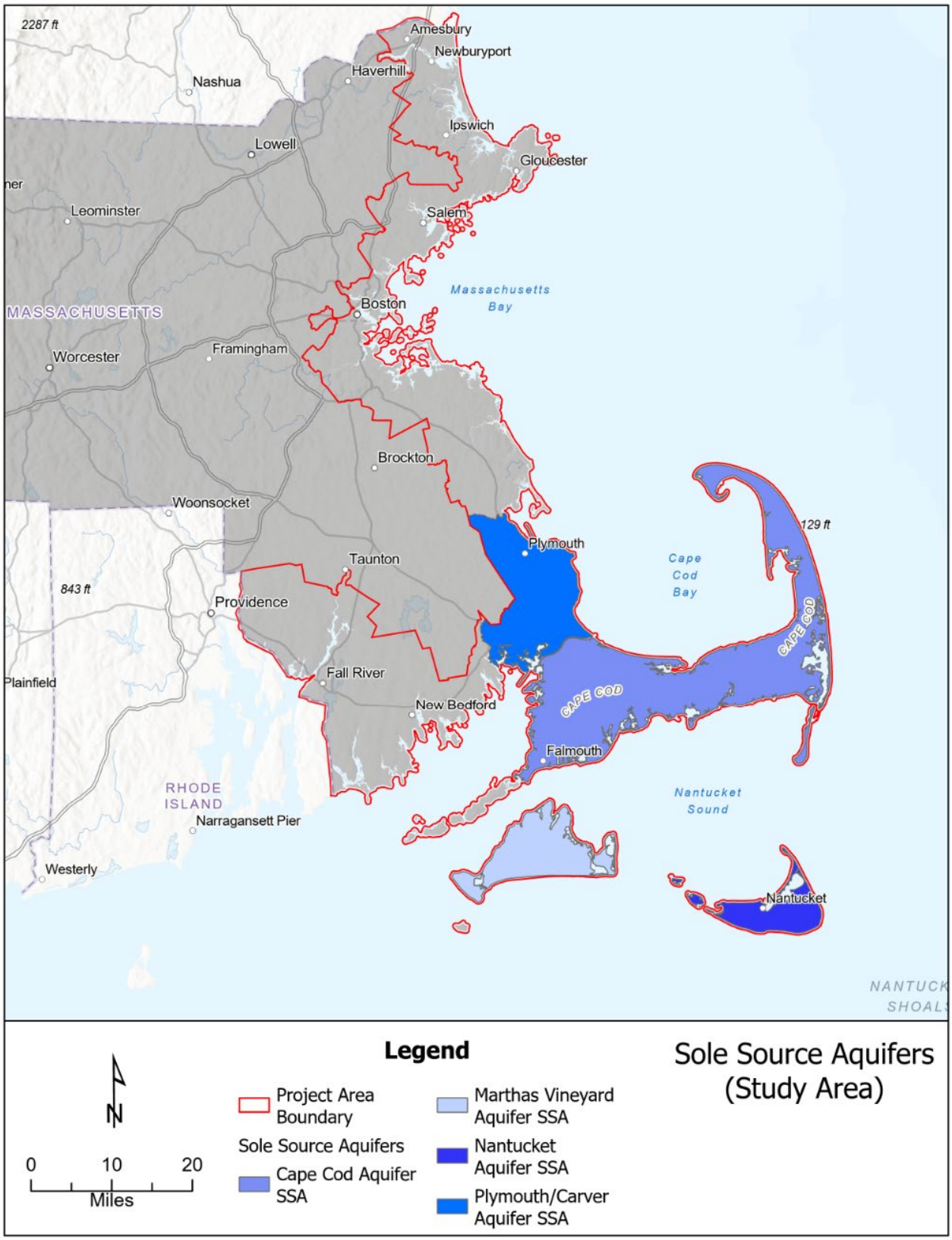
Map 6: South Coast Study Area



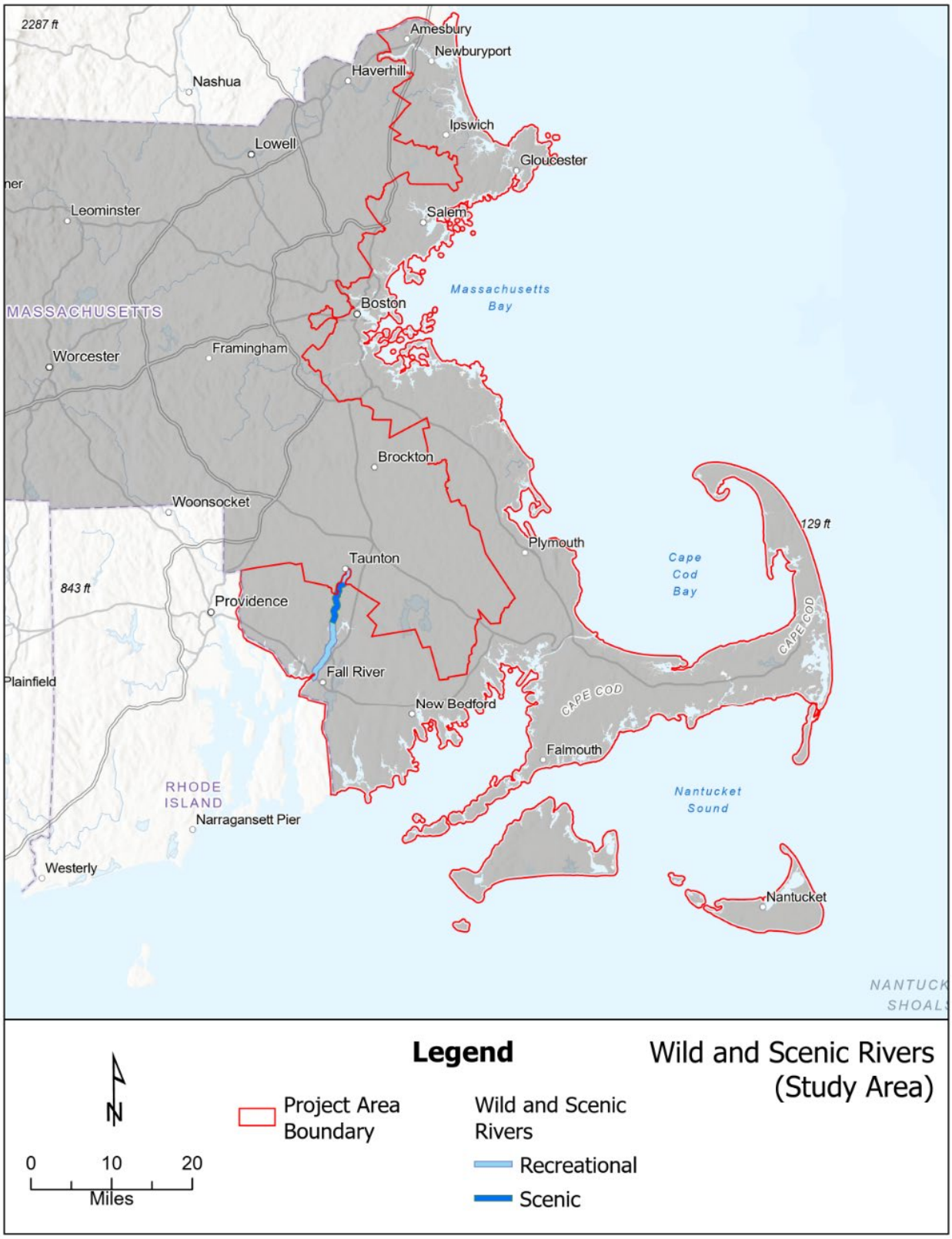
Map 7: Study Area Ecoregions



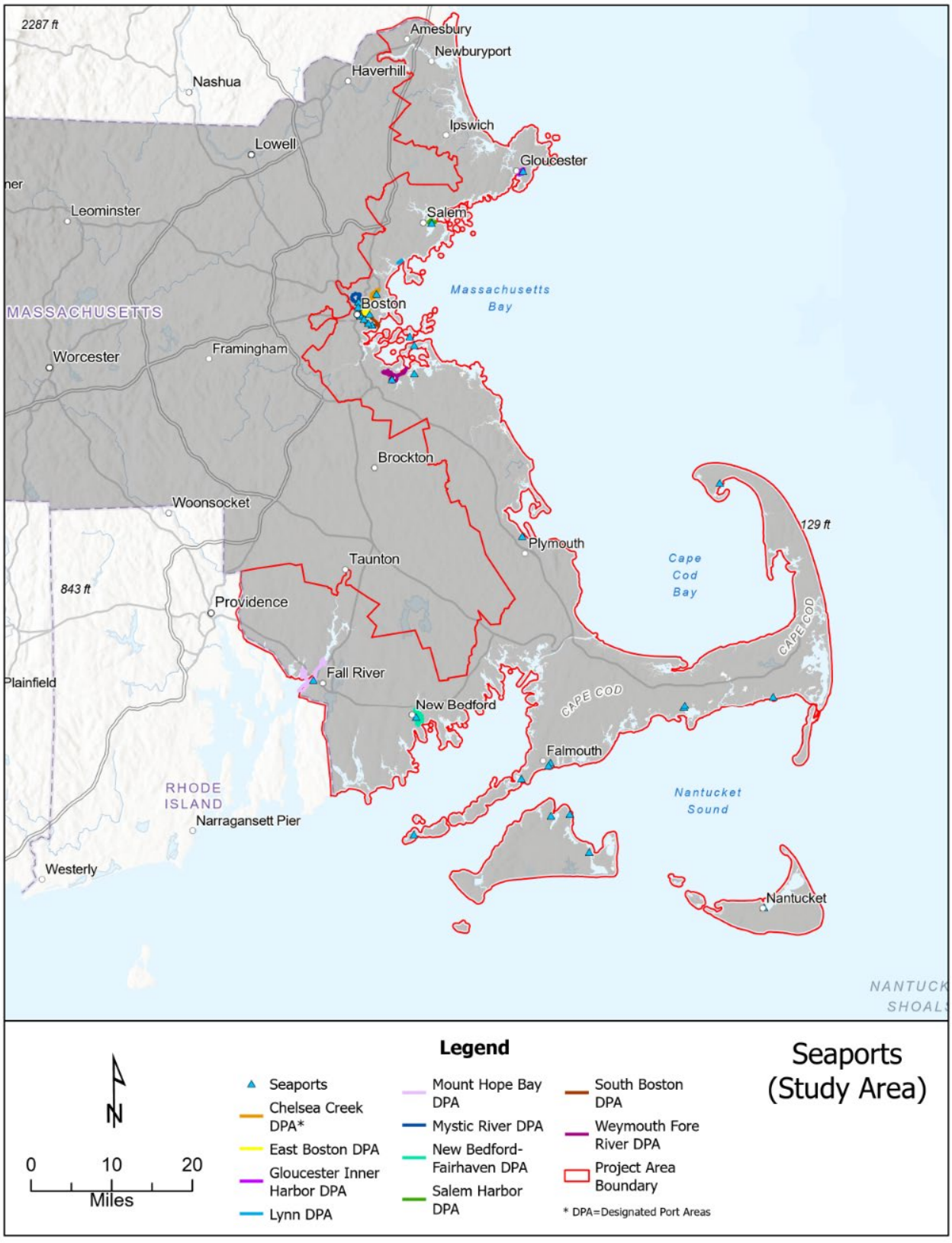
Map 8: Drainage Areas



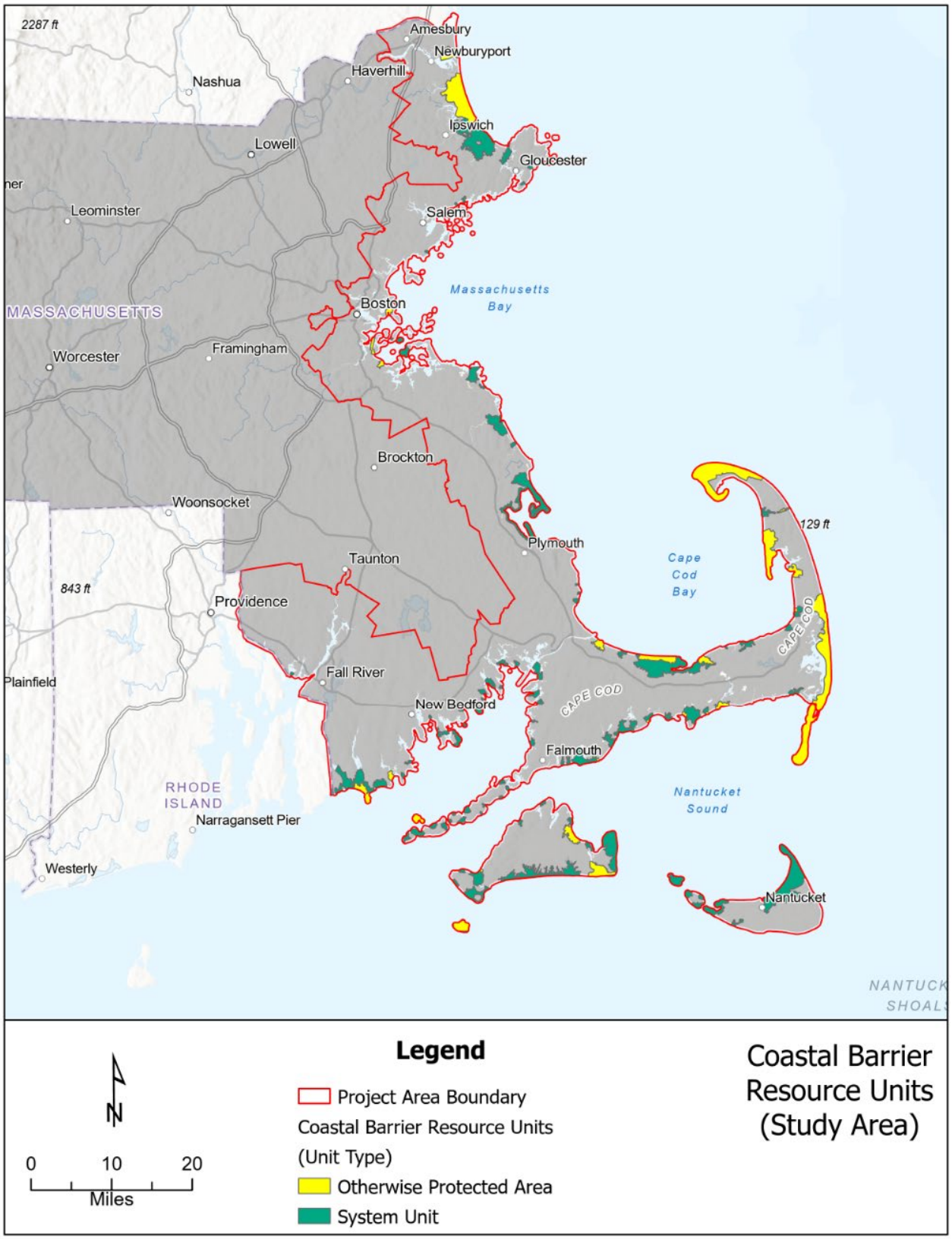
Map 9: Sole Source Aquifers



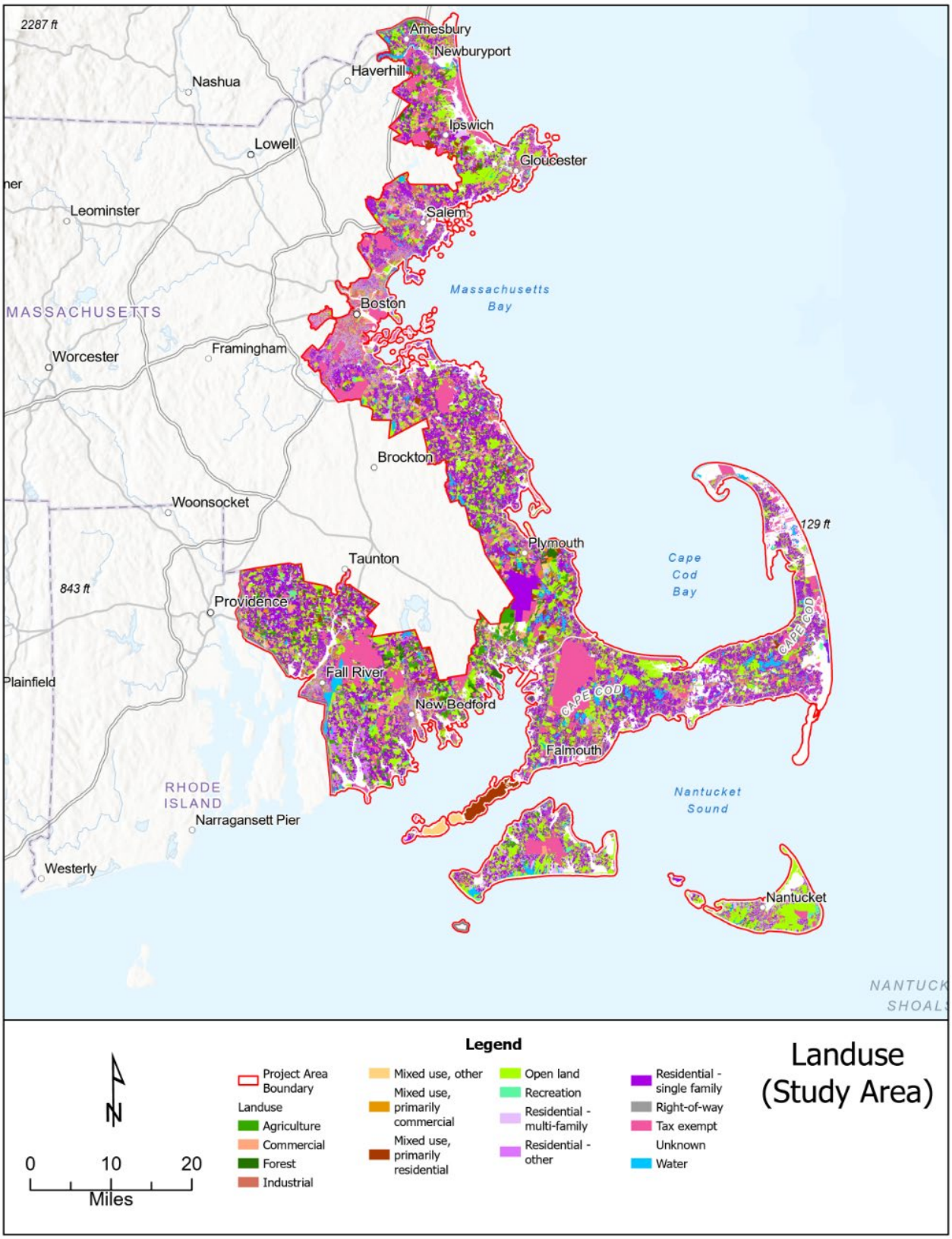
Map 10: Wild and Scenic Rivers



Map 11 Seaports in the Study Area



Map 12: Coastal Barrier Resource Units



Map 13: Land Use

Appendix B Documents

Appendix B, Document 1

Compliance Checklist

I. Project Information

Coastal Flood and Erosion Mitigation Projects in Massachusetts	Date:
Assessment under the Coastal Flood and Erosion Mitigation Projects Programmatic Environmental Assessment (PEA) and Finding of No Significant Impact (FONSI) ***This form is designed to help FEMA review each project to determine if it should be covered by this PEA or whether another level of evaluation would be more suitable, including an SEA, a stand-alone EA, or an environmental impact statement. Project Proponents may also complete this form and submit to FEMA using the address at the end of this checklist.***	
Disaster Description and Date:	
Project Name and Project Number:	
Name and Contact Information of Person Completing this Form:	

Describe Purpose and Need for Action:

Action(s) Proposed:

Hard Engineering Designs

- ☐ Revetments
- ☐ Bulkheads and Seawalls
- ☐ Levees/Berms
- ☐ Groins
- ☐ Wave Attenuators

Bioengineering Measures

- ☐ Bank Regrading/Stabilization
- ☐ Beach/Dune Restoration
- ☐ Marsh and Wetlands Creation, Restoration, or Enhancement

Other proposed activities not included above:

Describe the No Action Alternative:

Describe the Proposed Action:

Describe Public/Agency Involvement to Date (if any):

List Required Permits, Approvals, or Authorizations and Status of Each:

II. Analysis of Environmental Consequences

For each resource, confirm that the potential effects of the proposed project are described in the PEA and that mitigation measures described in the PEA will be applied to the project. Review the Additional Impacts Questionnaire (Section III) and document any additional impacts and proposed mitigation for those additional impacts. Determine whether the combination of potential effects described in the PEA and any additional impacts would result in significant impacts after mitigation measures are applied. Review the thresholds found in Table 6.1 of the PEA and determine whether the PEA would apply. If there are additional impacts related to a particular resource, a Supplemental EA (SEA) may still need to be prepared even if the PEA thresholds are not exceeded. An SEA may focus on only the resource(s) with the additional impacts.

Resource	**Document Project Effects and Mitigation that Conform with PEA**	**Document Additional Impacts** ***See Section III. Additional Impact Questionnaire***	**Describe Mitigation for Additional Effects and/or Results of Consultations (if Applicable)**	**Would Mitigation and/or Consultation Reduce Effects to a Less than Significant Level? (Yes/No)**	**Does PEA Coverage Apply? (Yes/No)**
Geology, Topography, and Soils					
Air Quality					
Climate Change					
Water Quality					
Floodplains					
Wetlands					
Wild and Scenic Rivers					
Navigation					

Resource	Document Project Effects and Mitigation that Conform with PEA	Document Additional Impacts **See Section III. Additional Impact Questionnaire*	Describe Mitigation for Additional Effects and/or Results of Consultations (if Applicable)	Would Mitigation and/or Consultation Reduce Effects to a Less than Significant Level? (Yes/No)	Does PEA Coverage Apply? (Yes/No)
Coastal Zone Management Act					
Coastal Barrier Resource Act					
Vegetation					
Fish and Wildlife					
Invasive Species					
Threatened and Endangered Species					
Essential Fish Habitat					
Cultural Resources					
Land Use and Zoning					
Noise					
Traffic and Transportation					
Public services and Utilities					

Resource	Document Project Effects and Mitigation that Conform with PEA	Document Additional Impacts **See Section III. Additional Impact Questionnaire*	Describe Mitigation for Additional Effects and/or Results of Consultations (if Applicable)	Would Mitigation and/or Consultation Reduce Effects to a Less than Significant Level? (Yes/No)	Does PEA Coverage Apply? (Yes/No)
Public Health and Safety					
Environmental Justice					
Hazardous Materials					

III. Additional Potential Effects Questionnaire

Additional effects may include 1) exceedance of thresholds described in this questionnaire and/or 2) effects not covered by the PEA and don't exceed thresholds. The questions below are designed to help identify any potential additional effects. If the answer to a given question is 'Yes', additional impacts may occur and should be described in an attachment and summarized in Section II.

If additional impacts not fully described in the PEA may occur, then an SEA, an EA, or an EIS might need to be prepared. An SEA may be a brief document focusing on only the specific additional impact(s) identified.

Geology, Topography, and Soils

Would the proposed project impact a shoreline with exposed bedrock?

Would the proposed project have an adverse effect on soils protected by the Farmland Policy Protection Act?

Would the proposed project cause downdrift erosion or deposition of sediments across jurisdictional boundaries?[1]

Air Quality

Would the proposed project result in new long-term source(s) of air emissions?

Is the proposed project in a nonattainment or maintenance area using the latest EPA Greenbook status?

Would the proposed project involve many truck trips or a long duration of heavy equipment operation?

If yes to both, a determination on whether the proposed project would exceed *de minimis* thresholds should be performed.[2]

Climate

Would the proposed project result in new long-term source(s) of greenhouse gas emissions?

Would the project release more than 25,000 metric tons of greenhouse gases per year?[3]

Water Quality

Would the proposed project cause or contribute to long-term impacts on water quality?

Would the proposed project impact water quality in such a way that TMDLs would be exceeded?

Would the proposed project require compensatory mitigation under Clean Water Act Section 404

[1] Cross-jurisdictional impacts from downdrift erosion may occur in cases where a jurisdictional boundary is located downstream from the proposed project area at a distance of less than four times the length of the proposed shore-parallel structure (if a seawall, bulkhead, or revetment) or five times the length of a proposed shore-perpendicular structure (if a groin, jetty, or breakwater).

[2] The prescribed *de minimis* annual rates are less than 50 tons of volatile organic compounds (VOCs), 100 tons of nitrogen oxides (NOX) (O3 precursors), and 100 tons of PM2.5, SO2, or NOX (PM2.5 and precursors).

[3] For example, a project that would involve many truck trips or a long duration of heavy equipment operation may approach air emissions thresholds.

regulations?

Is the proposed project over any designated sole source aquifer?

If yes, what potential effects to the aquifer would occur from the project?

Floodplains

Would the proposed project adversely affect floodplains as determined through the 8-step process?

If yes, would state and federal regulatory agencies likely require compensatory mitigation for those adverse effects? Would the proposed project adversely impact floodplain outside of the project area?

Wetlands

Would the proposed project adversely affect wetlands as determined through the 8-step process?

If yes, would state and federal regulatory agencies likely require compensatory mitigation for those adverse effects?

Would the proposed protect indirectly impact wetlands through the separation of tidal wetlands from oceanic and tidal influence?

Would the proposed project result in the loss of downdrift wetlands?

Wild and Scenic Rivers

Would the proposed project have a potential effect on water quality or water resources, visual and scenic resources, and/or vegetation, fish, and wildlife habitats within a Wild and Scenic Rivers area?.

Navigation thresholds

Would the proposed project have long-term impacts on navigation other than those associated with breakwaters, groins, or jetties?[4]

Would a structure be placed in or immediately adjacent to a navigation channel that could interfere with navigation?

Coastal Resources

Would the proposed project have a permanent adverse effect on coastal resources inconsistent with MA CZM policies?

Would the proposed project have an adverse effect on Coastal Barrier Resource Systems or Otherwise Protected Areas?

Vegetation

Would the proposed project have an adverse effect such that it would reduce populations levels of native species or sufficient habitat would not remain to maintain the viability of all vegetation species in the project area?

[4] A project may have additional adverse effects on navigation if project activities or structures would obstruct navigation channels or navigational aids, even in the short term.

Fish and Wildlife

Would the proposed project have an adverse effect such that it would reduce populations levels of native species or sufficient habitat would not remain to maintain the viability of all fish and wildlife species in the project area?

Would the proposed project affect Bald Eagle nesting areas or winter roosts?

Would vegetation be removed during the migratory bird nesting/breeding season?

Threatened and Endangered Species

Would the determination of effect under Section 7 of the Endangered Species Act be "may affect, likely to adversely affect?"

Cultural Resources

Has FEMA made, or is it expected to make, an Adverse Effect determination that would be resolved through state-specific Programmatic Agreement Treatment Measures or a memorandum of understanding with the SHPO, THPO, or other consulting parties?

Land Use and Zoning

Is the proposed project or location inconsistent with existing land use policies and plans?

Would the project result in effects such that a community would need to revise its land use plan (e.g., revise the zoning to increase setbacks to account for downdrift erosion)?

Noise

Would the proposed project generate new long-term source(s) of noise?

Would the proposed project require pile driving?

If yes, are the piles being driven with an impact or vibratory hammer; and would the noise impacts be more than moderate after mitigation measures are employed?

Traffic and Transportation

Would the proposed project have long-term impact(s) on traffic and transportation?

Public Services and Utilities

Would the proposed project have long-term impact(s) on public services and utilities, including a permanent loss or major rerouting of utilities?

Public Health and Safety

Would the proposed project have long-term adverse effects on public health and safety, such as a permanent source of emissions or permanent reduction of water quality?

Environmental Justice

Is there an environmental justice population in or adjacent to the proposed project area and would there be adverse impacts on those populations such that outreach and coordination to resolve potential adverse impacts would be required?

Hazardous Materials

Would the proposed project involve the release of hazardous materials?

Has a phase I or II environmental site assessment indicated that contamination exceeding reporting levels is present in or near the project area and further action is warranted?

For Project Proponents completing this checklist: Upon completion, submit this checklist and all attachments to FEMA EHP.

Appendix B, Document 2

ESA Species Massachusetts

Common Name	Scientific Name	Federal Status/ Responsible Agency	Critical Habitat in Study Area	Preferred Habitat
Blue Whale	*Balaenoptera borealis*	Endangered/ NMFS	No	Blue whales generally migrate seasonally between summer feeding grounds and winter breeding grounds; however, distribution and movement varies with location. In general, distribution is driven largely by food availability—they occur in waters where krill are concentrated. Off the U.S. Northeast and Mid-Atlantic coasts, they are most common during the summer and fall feeding seasons and typically leave by early winter. Although they are rare in continental shelf waters, blue whales are occasionally seen off of Cape Cod (MassWildlife 2015e).
Humpback Whale	*Megaptera novaeangliae*	Endangered/ NMFS	No	In the North Atlantic, two populations of humpback whales feed during spring, summer, and fall throughout a range that extends across the Atlantic Ocean from the Gulf of Maine to Norway. Humpback whale feeding grounds are generally in cold, productive waters, and humpbacks can be found feeding in the Massachusetts area from spring through fall. (MassWildlife 2019e)..
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered/ NMFS	Yes (Gulf of Maine)	North Atlantic right whales primarily occur in Atlantic coastal waters on the continental shelf, although they also are known to travel far offshore, over deep water. Right whales migrate seasonally. In the spring, summer, and into fall, many of these whales can be found feeding in waters off of New England. (MassWildlife 2019f).

Common Name	Scientific Name	Federal Status/ Responsible Agency	Critical Habitat in Study Area	Preferred Habitat
Northern Long-eared Bat	*Myotis septentroinalis*	Threatened/ USFWS	No	In the warmer months, colonies of Northern Long-eared Bats may be found roosting and foraging in forested areas. Preferred roosts are in clustered stands of large trees, especially in live or dead hardwoods with large, tall cavities. These bats are found in other tree roosts as well, and occasionally in human-made structures. Northern Long-eared bats forage under the forest canopy in structurally complex habitats, often above small ponds, vernal pools or streams, along gravel paths or roads, and at the forest edge. The bats are widespread in Massachusetts and have been found in 11 of 14 counties. In winter, Northern Long-eared Bats hibernate in natural caves and abandoned mines, preferring habitats where the humidity is so high that water droplets sometimes cover their fur. Winter hibernacula (hibernation sites) have been reported in Berkshire, Franklin, Hampden, Middlesex, and Worcester counties (MassWildlife 2019c).
Piping Plover	*Charadrius melodus*	Threatened/ USFWS	No	Atlantic coast piping plover nesting habitat includes sandy beaches above the high-tide line, sand flats at the end of sand spits, gently sloping foredunes, and unvegetated "blow-outs" and wash over areas created by wind and wave action between or behind coastal dunes. Piping plovers may also nest where suitable sandy, dredged material has been deposited. Nests are simple scrapes (shallow depressions) in the sand or in mixtures of sand, gravel, cobble, and shells. Nests are placed on open sand or in patches of sparse to **moderate**ly dense beach grass and other dune vegetation. Piping plovers depend on natural processes of beach erosion and accretion through wind and wave action to maintain this suitable nesting habitat. (MassWildlife 2019d).

Common Name	Scientific Name	Federal Status/ Responsible Agency	Critical Habitat in Study Area	Preferred Habitat
Red Knot	*Calidris canutus rufa*	Threatened/ USFWS	No	During migration and wintering periods, Red Knots use sandy beaches and intertidal areas in Massachusetts and feed on a variety of bivalves and crustaceans. It is uncertain if spring migrants in Massachusetts seek out and feed on horseshoe crab eggs, as occurs with the continentally significant concentrations of Red Knots along Delaware Bay beaches in southern New Jersey and eastern Delaware in May. During periods of high tide, when the intertidal zone is not exposed, knots can be found roosting in groups higher on the beach. Habitat used on the wintering grounds is similar to that during migration (MassWildlife 2020c).
Roseate Tern	*Sterna Dougallii Dougallii*	Endangered/ USFWS	No	In Massachusetts, the Roseate Tern generally nests on sandy, gravelly, or rocky islands and, less commonly, in small numbers at the ends of long barrier beaches. Compared to the common Tern, it selects nests sites with denser vegetation, such as seaside goldenrod and beach pea, which is also used for cover by chicks. Large boulders are used for cover at other locations in the northeast. it feeds in highly specialized situations over shallow sandbars, shoals, inlets or schools of predatory fish, which drive smaller prey to the surface. The Roseate is known to forage up to 30 km from the breeding colony (MassWildlife 2015b).
Green Sea Turtle North Atlantic Distinct Population Segment (DPS)	*Chelonia mydas*	Threatened/ NMFS	No	Green sea turtles occur along the northwest Atlantic coast from Massachusetts south to Florida and throughout the Gulf of Mexico and the Caribbean Sea. They generally inhabit shallow waters, including lagoons, inlets, bays, and estuaries where they forage on seagrass beds (MassWildlife 2019g).

Common Name	Scientific Name	Federal Status/ Responsible Agency	Critical Habitat in Study Area	Preferred Habitat
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered/ NMFS	No	Kemp's ridleys are distributed throughout the Gulf of Mexico and U.S. Atlantic seaboard, from Florida to New England. Kemp's ridleys primarily occupy neritic habitats in the Gulf of Mexico that include muddy or sandy bottoms where their preferred prey—spider crabs, shrimps, snails, and sea stars—are found. Nearly all Kemp's Ridley sea turtles seen in Massachusetts are small, 2- and 3-year-old juveniles that have washed ashore on a 50-mile stretch of coast along the south and east shores of Cape Cod Bay, from Barnstable to Provincetown, during November and December when the water temperatures drop (MassWildlife 2019h).
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered/ NMFS	No	Leatherbacks occupy U.S. waters in the Northwest Atlantic, West Pacific, and East Pacific. Within the United States, the majority of nesting occurs in Florida, Puerto Rico, and the U.S. Virgin Islands. In the greater Atlantic region, juveniles and adults inhabit offshore oceanic or coastal neritic areas where they forage primarily on jellyfish (NOAA Fisheries 2021).
Loggerhead Sea Turtle Northwest Atlantic DPS	*Caretta caretta*	Threatened/ NMFS	No	In the Atlantic, the loggerhead turtle's range extends from Newfoundland to Argentina. On the U.S. Atlantic Coast, Loggerheads nest on open beaches from North Carolina to the west coast of Florida. They make extensive migrations from their nesting beaches to foraging areas on the continental shelf. Juveniles and adults in coastal waters eat mostly bottom-dwelling invertebrates (MassWildlife 2019i).

Common Name	Scientific Name	Federal Status/ Responsible Agency	Critical Habitat in Study Area	Preferred Habitat
Plymouth Redbelly Turtle	*Pseudemys rubriventris bangsi*	Endangered/ USFWS	Yes	Redbelly turtles in Massachusetts are only known from ponds within Plymouth County and eastern Bristol County. The population distribution of the Redbelly turtle is from the coastal plain of New Jersey south to North Carolina and inland to West Virginia. In Massachusetts, the Redbelly turtle is a denizen of freshwater ponds of varying sizes and depths with an abundance of aquatic vegetation. Further south, this turtle usually inhabits river systems. Sandy soil on land surrounding the pond or river is required for nesting (MassWildlife 2016b).
Atlantic Sturgeon Gulf of Maine Distinct Population Segment (DPS)	*Acipenser oxyrinchus*	Threatened/ NMFS	Yes (Merrimack River)	The Gulf of Maine DPS historically spawned in the Penobscot, Kennebec, Androscoggin, Sheepscot, and Merrimack rivers. However, of these rivers, there was evidence of current spawning only in the Kennebec River when the DPS was listed in 2012. The Atlantic sturgeon is an anadromous fish that is reliant upon freshwater for spawning and embryo and larval rearing habitat, and brackish and marine waters for growth and development of the juveniles as well as sustenance of adults. In freshwater, Atlantic sturgeon use fast-flowing, rocky areas in rivers to spawn. In the marine environment Atlantic sturgeon use estuarine and nearshore habitats for foraging (MassWildlife).
Atlantic Sturgeon New York Bight DPS	*Acipenser oxyrinchus*	Endangered/ NMFS	No	The New York Bight DPS historically spawned in the Connecticut, Delaware, Hudson, Housatonic, and Taunton Rivers. However, at the time of the DPS' listing (2012), there was evidence of current spawning only in the Hudson River and in the Delaware River. The New York Bight DPS of Atlantic sturgeon has the same basic life history characteristics and habitat requirements as the Gulf of Maine DPS.

Common Name	Scientific Name	Federal Status/ Responsible Agency	Critical Habitat in Study Area	Preferred Habitat
Shortnose Sturgeon	*Acipenser brevirostru*	Endangered/ NMFS	No	Shortnose sturgeon live in rivers and coastal waters from Canada to Florida. They hatch in the freshwater of rivers and spend most of their time in the estuaries of these rivers. Unlike Atlantic sturgeon, shortnose sturgeon tend to spend relatively little time in the ocean. When they do enter marine waters, they generally stay close to shore. In the spring, adults move far upstream and away from saltwater to spawn. After spawning, the adults move rapidly back downstream to the estuaries, where they feed, rest, and spend most of their time. In Massachusetts, populations are largely riverine, although estuaries and coastal areas are used during the winter months.
American burying beetle	*Nicrophorus americanus*	Threatened/ USFWS	No	American burying beetles prefer open oak-hickory savanna forested areas with well-developed, deep sandy soils, with little shrub cover. They will also breed successfully in grasslands (MassWildlife 2015a).
Monarch Butterfly	*Danaus plexippus*	Candidate/ USFWS	No	Open meadows, fields, and wetland edges especially areas with milkweed. On migration virtually anywhere with concentrations noted along ridge lines, river valleys, and coast lines (Mass Audubon 2022b).
Northeastern Beach Tiger Beetle	*Habroscelimorpha dorsalis dorsalis*	Threatened/ USFWS	No	The Northeastern Beach Tiger Beetle is a coastal species that inhabits large, exposed ocean beaches with fine sand particles and a low intensity of human disturbance. In Massachusetts, high-quality habitat consists of wide beaches with a well-developed and dynamic dune system; typically the dominant vegetation of the upper beach and dunes is American beachgrass (Ammophila breviligulata). Inhabited beaches are relatively pristine and undisturbed by human activity, with little or no off-road vehicle traffic (MassWildlife 2019b).

Common Name	Scientific Name	Federal Status/ Responsible Agency	Critical Habitat in Study Area	Preferred Habitat
Rusty Patched Bumble Bee	*Bombus affinis*	Endangered/ USFWS	No	Rusty patched bumble bees are habitat generalists but are typically found in areas that contain natural and semi-natural upland grassland, shrubland, woodlands, and forests. They may also be found in urban or suburban areas that contain nesting habitat, nectar and pollen resources, and overwintering habitat. In the spring they are often found in and near woodland habitats (USFWS 2019c).
American Chaffseed	*Schwalbea americana*	Endangered/ USFWS	No	In Massachusetts, American chaffseed is found in sandplain grasslands, an open, sunny plant community often dominated by little bluestem grass (Schizachyrium scoparium). These are more common on Cape Cod and the islands on glacial outwash plains of sandy, nutrient-poor soil (MassWildlife 2020a).
Sandplain Gerardia	*Agalinis acuta*	Endangered/ USFWS	No	Sandplain gerardia grows in dry, sandy soils of grasslands and roadsides; in pine/oak scrub openings, usually where there is considerable growth of lichens and scattered patches of bare soil; and in sandy plains. Both poor soils and habitat disturbance may create the open, relatively competition-free areas required by Sandplain gerardia. Habitats in Massachusetts are dry grasslands, including cemeteries with native species maintained by mowing (MassWildlife 2015c).
Small Whorled Pogonia	*Isotria medeoloides*	Threatened/ USFWS	No	In Massachusetts, small whorled pagonia is found on slightly sloping, previously logged forest land made up of extremely acidic and granitic soils. Like other sites known to support this orchid, the Massachusetts sites are composed of seasonally moist areas above a fragipan. Light conditions are usually filtered rather than shaded or open (MassWildlife 2015d).