

**EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
DAM, LEVEE AND SEAWALL REPAIR AND REMOVAL**

ADMINISTRATIVE SUMMARY

PROJECT TITLE:	Design and Permitting for Long Beach Seawall	STATE ID #	#057-039-000-010B-100	
LOCATION COORDINATES:	Latitude	42° 56' 36"	Longitude	-70° 37' 07"

RESPONDING ORGANIZATION

Contact Name: David Gould, Town of Plymouth, Department of Marine & Environmental Affairs

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PROJECT CATEGORY (CHOOSE ONE):

- Category 1 - Dams and similar unregulated impoundments
- Category 2 - Seawalls, coastal flood and/or foreshore protection
- Category 3 - Inland flood control structures and levees, excluding dams and similar unregulated impoundments

FUNDS SOUGHT FROM PROGRAM

State Funds via EEA \$93,563

Anticipated Matching Funds (*cash and in-kind*) \$31,188

Sources (*Federal? State? Local?*): Local

AUTHORIZED APPLICATION SIGNATURE

Signature _____ Date _____

Print Name and Title David Gould, Director

**EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
DAM, LEVEE AND SEAWALL REPAIR AND REMOVAL:
APPLICATION FOR FUNDING – DESIGN AND PERMIT
RESPONSE PROPOSAL**

Introduction

This response to the Executive Office of Energy and Environmental Affairs (EOEEA), Request for Quotes (RFQ) is being submitted by the Town of Plymouth to perform design and environmental permitting services for the reconstruction/upgrading of approximately 900 linear feet of revetment primarily fronting the Plymouth Long Beach parking lot and Route 3A. The existing vertical concrete seawall has failed at several locations and does not provide an appropriate design for the lowered condition of the beach. The proposed seawall and revetment design will consist of providing an appropriate concrete gravity seawall to an elevation that reduces overtopping volumes during nor'easters. The fronting revetment will be designed within the existing revetment footprint, where the height of the structure will be similar to existing conditions. Areas where seawall/revetment reconstruction is planned are shown on the attached existing conditions plan (Attachment A).

This project provides improvements to storm damage protection to the properties landward of the seawall. Over the past several decades, northeast storm events have continued to cause significant damage to coastal infrastructure in Warren's Cove and the Plymouth Long Beach parking lot. Specifically, the low lying landform at the south end of Plymouth Long Beach (including the Town beach parking lot, Bert's Cove Restaurant, and Pilgrim Sands Motel) have experienced wave overtopping during severe storm events. Recently, the series of severe northeast storms over the 2012-2013 winter season (including the influence of Hurricane Sandy) caused continued lowering of the fronting beach and moderate damage to the revetment and seawall. In February 2016, a minor nor'easter caused an approximate 200-foot section of seawall to completely fail and collapse toward the ocean. This complete failure, along with several areas where repairs have been made when sections of the upper seawall have been sheared off since 2005, are indicative that the structure is beyond its serviceable life. The property directly landward of the wall is public, where the revetment and seawall protect Warren Avenue (Route 3A) directly landward of the parking lot. This roadway serves as one of the primary evacuation routes from the Pilgrim Nuclear Generating Station.

The estimated commencement date for the Project is September, 2016 with completion in April, 2017. This is a Category 2 project as failure of the wall would likely cause serious public infrastructure damage.

Part I: Project Identification and Narrative

Section A: Review of Current Conditions

The Project Area is located at the southern limit of Plymouth Long Beach in the Town of Plymouth. The shore protection consists of approximately 900 linear feet of seawall and revetment structure located on the east side of the barrier beach system along Warren Avenue (Route 3A). The location of the Project is shown on the USGS topographic map in Figure 1 and a more detailed existing conditions plan is provided in Attachment A. The beach and seawall may be accessed by the public Town along the entire length of the project area, as the entire area is Town property. The Town parking lot landward of the seawall fronts both Warren Avenue (Route 3A) and a portion of Eel River. Warren Avenue serves as one of the primary evacuation routes from the Pilgrim Nuclear Generating Station, as well as numerous other properties in the Plymouth Beach vicinity. Even moderate storms wash tons of sand, rock, and debris over the seawalls and into Eel River, blocking flow. In addition, debris washes across Warren Avenue, often causing temporary closure of the roadway. The source of most of the overwash material is the gravel and stone parking lot for Plymouth Long Beach. The earth moving equipment is often tasked, and at considerable expense, with removing tons of sand from the river. The blockage causes upstream flooding as well as damage to the river and its biota.

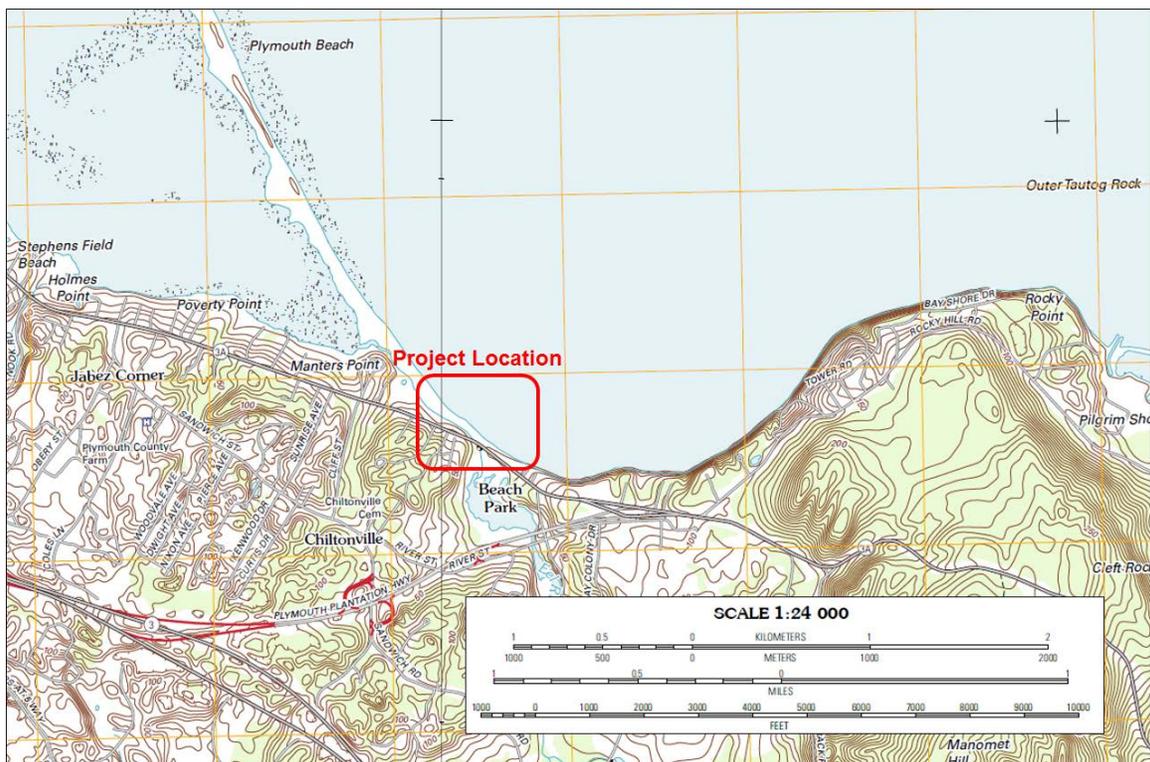


Figure 1. Project Area vicinity showing Plymouth Beach and Warren Cove (map from USGS).

The low lying landform at the south end of Plymouth Beach has experienced wave overtopping during severe storm events. Recently, the series of severe northeast storms over the 2012-2013 winter season. Damage during a Nor'easter in January 2013 is typical of problems at Plymouth Beach after storms. During this event Route 3A had to be closed due to flooding and waves overtopping the seawall washed sand and gravel into the Eel River. It took five days to dredge out the river with a large backhoe. The dredged material is typically put back on the parking lot area and used in reconstruction of the parking area. Dredging is done under emergency permits. Storm damage and the failure of an approximate 200-foot length of seawall after a February 2015 nor'easter is documented in Figures 2 and 3.



Figure 2. Failed section of seawall following a moderate nor'easter in February 2016 (view towards the south).



Figure 3. Failed section of seawall following a moderate nor'easter in February 2016 (view towards the north). Excavation equipment is shown in the background performing emergency dredging of the Eel River blockage.

From a historical perspective, in 1969, the State constructed a 1,050-foot concrete seawall running northerly from the end of the 1958 wall to the Federal stone dike at the Manters Point footbridge over Eel River at a cost of \$106,000. As stated in a 1977 Memorandum from the Engineering Division, “upon completion of the construction this [the seawall/revetment] was turned over to the Town of Plymouth to maintain.” The elevation of the top of this seawall was 20 feet above mean low water. On the bay side of this wall and 5 feet below its crest, a stone apron was built extending towards the ocean. A more complete description of the shore protection efforts on the seawall fronting the beach parking lot is shown below:

- Pre-1943: A concrete seawall was constructed some time prior to 1943, extending from the Plymouth Beach bathhouse south approximately 1,820 feet (555 meters). This seawall protected numerous private properties and was constructed either by private interests or the Commonwealth of Massachusetts, or a combination thereof.

- 1958-1969: The Commonwealth of Massachusetts completed a concrete seawall with stone apron in the vicinity of the Town Beach, extending from the Plymouth Beach bathhouse to the Federal stone dike at the Manters Point footbridge over the Eel River. Sometime between 1951 and 1965 a single groin was constructed in front of Bert's Restaurant. During the Fall of 1969, two stone groins 180 feet (55 meters) long and spaced 460 feet (140 meters) apart were constructed on Plymouth Beach, to the north of the pre-existing groin at Bert's Restaurant.
- 1972-1978: Two additional groins were installed on Plymouth Beach to the north of the pre-existing groins. The addition of these two groins made a total of five groins between Bert's Restaurant and the Manters Point footbridge over the Eel River.

Although much of the 900-foot seawall section that is the subject of this proposal has remained intact, numerous repairs to both the fronting revetment and seawall have been required over the past 10 years, including re-casting portions of the wall that have sheared off (see Figure 4), placement of flowable fill and revetment construction to prevent wall undermining/failure (see Figure 5), and emergency placement of boulders against failed sections of the seawall to prevent collapse.

The 2007 "South Shore Coastal Infrastructure Inventory and Assessment Demonstration Project" by Bourne Consulting Engineers identified the wall as #057-039-000-010B-100 and gave it a Condition C (Fair) rating. The report assigned a Priority II (Low) rating stating "inshore structures present with limited potential for significant infrastructure damage". An excerpt from the report is included as Attachment B. Based on more recent failures of the structure, it is clear that the condition should be degraded to an F, as demonstrated in Figures 2 and 3. In addition, the inventory tends to focus upon infrastructure immediately landward of the coastal structure without assessing the wider flood plain influence of the structure. Along this portion of Plymouth Long Beach, structural failure of the seawall could lead to complete blockage of Eel Rver (and the associated upstream flooding), as well as increased flood damage to Warren Avenue (Route 3A), which is a critical evacuation route.

The overall goal for a redesigned seawall is to provide appropriate longevity of the combined seawall and revetment over the next 50 years. The design will evaluate increased structure height necessary to achieve long-term coastal resiliency goals.



Figure 4. Failed section of seawall following a moderate nor'easter in early 2011 showing area that had been sheared off from the top of the seawall. This portion of seawall had the cap re-cast in late 2011, as part of emergency repairs.



Figure 5. Undermining of seawall as beach erosion causes lowering of the seaward beach profile and exposing the foundation. This undermining required emergency repairs in 2009.

Section B: Environmental Concerns

As mentioned, Warren Avenue serves as a primary evacuation route from the Pilgrim Nuclear Generating Station. In addition, emergency response time to the Plymouth homes south of this overwash area is substantially increased when the road is impassable due to flooding.

At present, the low elevation fronting beach is a sand/gravel/cobble material that is completely submerged at high tide. Groins constructed along the shoreline prevent alongshore movement of littoral sediments. The long-term effect of this highly armored shoreline has been a loss of sediment supply to the beach; however, the existence of the seawall is critical to sustaining upland infrastructure. A separate project through the MCZM Coastal Resilience Grant Program is evaluating the enhancement of shore protection through placement of a cobble berm; however, reconstruction of the seawall will still be required. When combined with the cobble berm project, the proposed

seawall improvements and cobble berm will increase storm damage protection and re-establish the depleted littoral drift.

The proposed seawall and revetment reconstruction will occur within the same footprint as the existing structures; therefore, the environmental concerns are limited. There are no endangered species mapped within the project limits. The proposed project is not anticipated to adversely impact ecological health of this high-energy coastal beach system. In addition, a reduction in wave overtopping will prevent storm-induced blockage of Eel River, an anadromous fish passage. Therefore, the project will provide an overall ecological benefit to the barrier beach system by providing long-term protection to the Eel River habitat.

Section C: Project Plan

Due to the condition of the seawall and the demonstrated structural failures over the past decade, it is clear that the structure has exceeded its serviceable life. Emergency work in 2009 was performed to prevent undermining of the seawall. In 2011, the Town of Plymouth performed emergency repairs to the upper half of the seawall and reconstructed the revetment along an approximate 100-foot section near the southern limits of the proposed project. However, based on more recent failures, the structural integrity of the seawall along this entire ±900-foot section is compromised and requires replacement.

It is anticipated that the updated design will be based on the 100-year storm conditions. In addition, sea-level rise will be accounted for by assuming an increase in tide elevation of 2 feet over the next 50 years (i.e. the planned serviceable life of the new structure). Wave analyses will be performed to optimize both the vertical wall height, as well as the fronting revetment height. As described above, a concurrent effort to provide a cobble berm fronting the seawall also is planned; however, reconstruction of the seawall will still be required to ensure long-term sustainability of the landform. The approximate areas where the reconstructed revetment and seawall are required is shown on the attached existing conditions plan (Attachment A).

The proposed seawall and revetment will be designed to structurally withstand the 100-year storm wave condition. In addition, the rough-faced configuration of the proposed revetment repairs will reduce wave overtopping volumes. Wave overtopping runoff and debris that flows onto Warren Avenue and across the parking lot into the Eel River channel is expected to be modestly reduced by proposed design.

To a limited extent, sea level rise projections will be accounted for in the proposed design. Specifically, armor stone size will be established based on future depth-limited wave conditions. However, due to the relatively low-lying nature of the historic barrier beach, the structure will not eliminate storm wave overtopping either under existing or future storm conditions.

The required environmental regulatory permits for the proposed seawall/revetment reconstruction effort are shown in Table 1. Chapter 91 public access is provided along the entire length of the project, as the structure fronts Town-owned land.

Table 1: Required environmental regulatory permits for reconstruction/upgrading of approximately 900 linear feet of revetment and seawall fronting the Plymouth Long Beach Parking Lot and Route 3A	
1	Notice of Intent under the MA Wetlands Protection Act (state DEP and local)
2	Chapter 91 License (eroded beach causes structure to fall below MHW)
3	U.S. Army Corps 404 Permit (Category I)

Part II: Proponent Qualifications

The Project proponent is the Town of Plymouth, in Plymouth County, Massachusetts. The Town was officially incorporated in 1620.

The primary contact for the project will be David Gould, Director of the Department of Marine and Environmental Affairs. The secondary contact will be Kerin McCall, Environmental Technician. Copies of the resumes for these key personnel are attached.

Engineering and design of this project will be performed by Applied Coastal Research and Engineering, Inc. (Applied Coastal) in association with Sullivan Engineering (survey) and CLE Engineering (structural/geotechnical design). Resumes for the primary Applied Coastal engineers (John Ramsey, P.E. and Sean Kelley, P.E.) are provide in Attachment D.

Part III: Project Schedule and Cost Estimates

The estimated commencement date for the Project is October 2016 with completion of environmental permitting in June 2017. It is anticipated that the design would be completed by January 2017, allowing approximately 5 months for the environmental permitting effort. The total requested EOEEA Grant Funding is \$93,563, with Town Match totaling an additional \$31,188 (25% of the total project cost). A detailed cost estimate is provided in Attachment C.

Part IV: Ongoing Operations and Maintenance Plans

Because the coastal structure in the Project Area plays such an important role by protecting both upland property and critical infrastructure, the Town of Plymouth is committed to ongoing care and maintenance of the Plymouth Long Beach revetment/seawall. The Town has been proactively maintaining this structure since 1969.

As part of the project, the Town and Applied Coastal will develop an operations and maintenance plan for the structure that will include a routine inspection component. The engineering inspection process will utilize a methodology consistent with the Massachusetts South Shore Coastal Infrastructure Inventory and Assessment Demonstration Project as Applied Coastal was one of the collaborators with Bourne Consulting Engineers on this project.

LIST OF ATTACHMENTS

Attachment A: Project Existing Condition Plans

See attached permitting plans by Applied Coastal and Sullivan Engineering.

Attachment B: Planning Report(s) used as project basis

See attached excerpts from Bourne Engineering.

Attachment C: Detailed Cost Estimate

See attached cost estimate.

Attachment D: Resumes

Resume of David Gould, Kerin McCall, John Ramsey, and Sean Kelley

**Seawall at Plymouth Long Beach Fronting Parking Lot and Route 3A
 Cost Estimate for Design and Permitting Services**

Item No.	Item	Total
1	Design Analysis and Optimization	\$19,000
2	SPT Borings (11 @ \$3,250 each)	\$35,750
3	Structural Design Analysis/Cross-Section Drawings	\$15,000
4	Site Plans and Typical Cross-Sections (Permit Format)	\$14,000
5	Environmental Permitting	\$41,000
		\$124,750

Total Design/Permitting Cost	\$124,750
Design/Permitting Cost (Town)	\$31,188
EEA Grant	\$93,563
Percent Town Funding	25%