Needed Estate Shoreline Design Project: Narrative Questions

1) Project Type 1 – Project Design

2) Project objectives and tasks

Objectives

Plum Point is located along Chesapeake Bay in Calvert County, MD (Figure 1). Plum Point and adjacent shorelines have gone through significant shoreline change over the years with ongoing erosion at the proposed site. The Needed Estate Citizens Association (NECA) shoreline extends from the south jetty (adjacent to the entrance inlet into Breezy Point marina) southward about 1,200 feet to approximately to the end of Bay Parkway. This project shoreline has evolved over the years from having a relatively wide beach 25 years ago to having either a narrow beach or no beach at all by 2020 resulting in extensive bulkheading and further beach width reduction.

Needed Estate (38.613451°, -76.512155°) is a community of 117 homes that is increasingly susceptible to coastal hazards including storms, flooding, and sea-level rise. Because the entire community is part of the Chesapeake Bay Critical Area, the Citizen's Association is proactive in working with homeowners to understand that all projects can impact the health of the bay. As such, NECA plans to restore beach habitat at the community beach and maintain a protective and stable shore system using a combination of:

- Four headland breakwaters;
- sand nourishment;
- dune grass plantings; and
- potentially, beneficial use dredge material from the adjacent Breezy Point Marina channel.

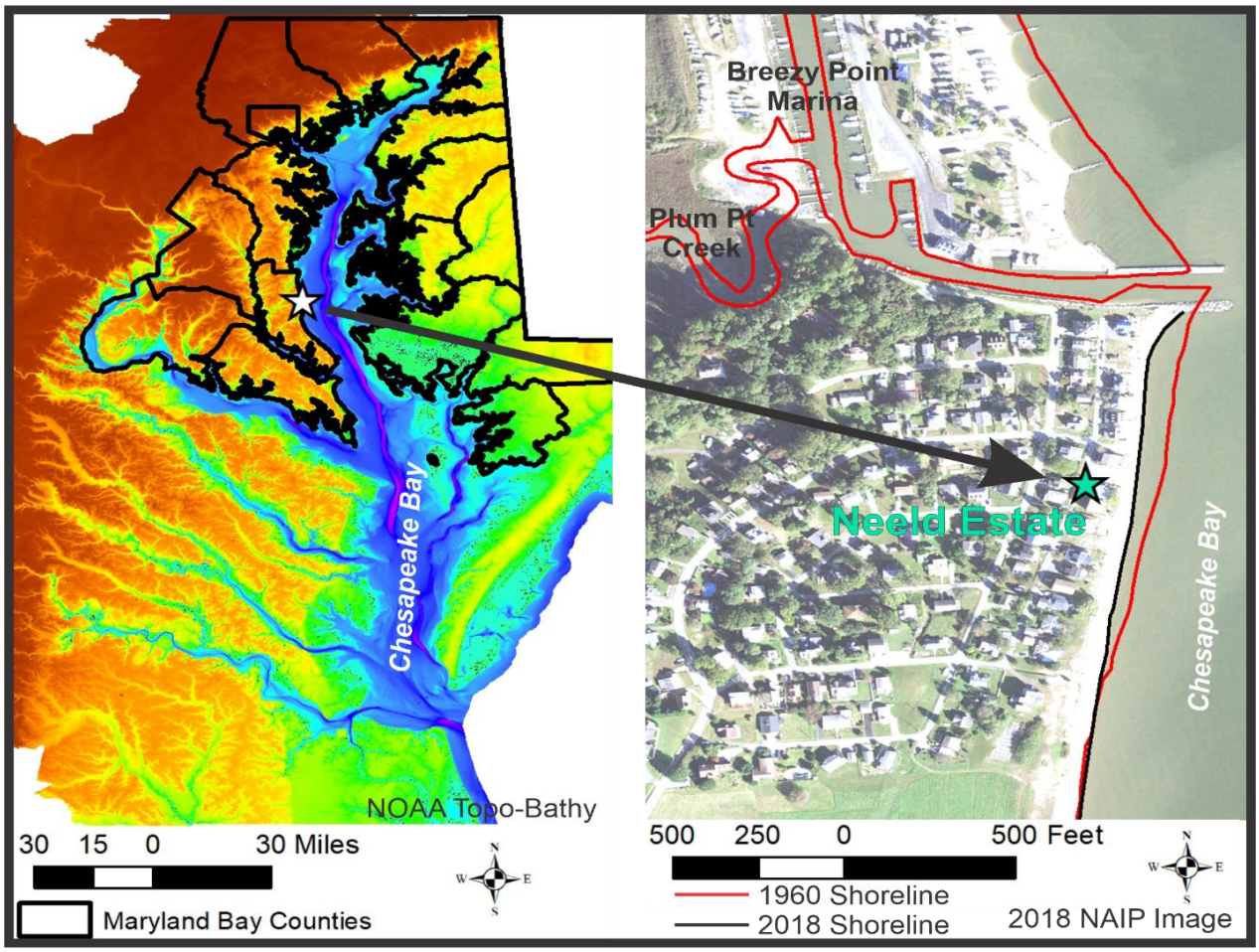

Figure 1. Location of Needed Estates shoreline management project in Calvert County, Maryland.

The plan also will address the impact of sea level rise (SLR) on the community and options to maintain coastal resiliency into the future.

Major Tasks

Task 1: Site Survey and site assessment

- Conduct a site assessment using existing online data
    - Site assessment includes physical and hydrodynamic settings that affect the shoreline now and into the future. This assessment also includes the proximity of marine resources to the site.
- Conduct an elevation survey in Maryland State Plane horizontal coordinate system with vertical control adjusted to mean low water (MLW).
- Assess nearshore stability with a combination of short cores, augers and probes

Task 2: Preliminary plan

- Prepare preliminary shoreline plan with CAD site drawings
- Conduct special NECA meeting for NECA Shoreline Committee to present plan, respond to questions and solicit feedback from community members, including but not limited to NECA Officers.

Task 3: Pre-final Plans and Associated Products

- Conduct a pre-permit application site visit with Maryland Department of Environment (MDE) and U.S. Army Corps of Engineers.
- Evaluate site visit findings (e.g., risks) and associated design recommendations
- Prepare Joint Permit application (JPA) for submission, including the following state and federal permits
    - Maryland Department of Environment (MDE): Water Quality Certification
    - Maryland Board of Public Works (BPW): Wetlands License
    - U.S. Army Corps of Engineers (Corps): Department of the Army Permit

Task 4: Final Plans and Associated Products

- Prepare final plans
- Prepare final specifications
- Prepare construction cost estimates
- Acquire local permits, including Critical Areas and Erosion And Sediment Control
    - Calvert County SCD Erosion and Sediment Control Permit
    - Calvert County Critical Areas permit
    - Calvert County Building permit, if needed.

See Attachment A for the contractor proposal that specifies the scope of work, concept plan and other supporting figures. The final page of the attachment, Figure 10, presents the concept sketch. See Attachment B1 for a cover letter from NECA's President and Executive Officer for this grant, Attachment B2 for a letter of support from NECA's State Senator and Attachment B4 for a letter of support from the Calvert County Board of County Supervisors.

3) Project alignment

Our project will support objectives outlined in the *Breezy Point/Neeld Estate Flood Mitigation Plan* published December 2016 by Calvert County Department of Planning and Zoning. This plan identifies Neeld Estate as the **fifth most flood prone community in the county.** On 8 April 2017, Calvert County government representatives presented the plan details, including a set of recommendations in response to eight ranked flooding concerns identified by residents, at a NECA meeting. Two of the county's recommendations related to shoreline erosion and another to stormwater management. See Attachment C1 for this presentation. It is unclear if/how these specific recommendations have been prioritized relative to county-wide needs. Subsequent sections of this application provide justification regarding the pressing need for the project.

4) Demographic information about the community (Neeld Estates) served by and involved in the project

NECA's best information regarding our community's demographics is shown below. The population categories are consistent with those addressed in EPA's *Environmental Justice Screening and Mapping Tool* referenced in RFP Appendix D.

	Population	% of Total
People of color	6	3%
Low income	18	10%
Linguistically isolated	0	0%
Less than high school education	7	4%
Under 5 years of age	5	3%
Over 64 years of age	55	30%
Other	92	50%
Total Population	183	100%

5(a) Project details

i. Living Shoreline Metrics

Length (feet) to be designed: 1,200 ft
Bank Height: 5 ft
Erosion Rate (1960-2018): -1.2 ft/yr
Drainage area treated/planned: 50 acres
Impervious acre treated: 48 acres (Site length * 0.04; based on MDE (2020))
Sediment Reduced: 371,330 lbs/yr (Protocol 1 TSS=BankHeight*ErosionRate*ShoreLength* 93.6 (lbs/cf; bulk density) * 0.551 (Sand reduction factor in MD)
N Reduced: 108 lbs/yr ((Protocol 1 TSS) * 0.00029 (lbs TN / lbs TSS))
P Reduced: 76 lbs/yr ((Protocol 1 TSS) * 0.000205 (lbs TP / lbs TSS))

ii. Cost-effectiveness & co-benefits

- The estimated cost of our design project = $34.7K.
- The estimated cost to implement the design = (linear feet designed) x ($1K to $1.3K design cost per linear foot), or $1.2M to $1.56M.
- We used design cost to compute the first two cost-effectiveness values and implementation cost (i.e., $1.56M, the high end of the range) to compute the nutrient reduction cost effectiveness value shown below.
- We assumed a 10-year period, which translates to reduction of 1,857 tons (3.713 million lbs) of sediment, 1,080 lbs of nitrogen, and 760 lbs of phosphorus into Chesapeake Bay.

Ln. Feet to be designed	$29/ft	($34.7K/1200 ft)
Drainage area treated/planned (acres)	$694/acre	($34.7K/50 acres)
Impervious acre treated	$723/acre	($34.7K/48)
N Reduction	$1,444/lb	($1.56M/1080 lbs)
P Reduction	$2,053/lb	($1.56M/760 lbs)
S Reduction	$0.42/lb	($1.56M/3.713M lbs)

These cost-effectiveness values compare favorably to the benchmarks presented as part of the RFP evaluation criteria. This finding plus the co-benefits discussed below represent a strong business case for the $34.7K investment in this project.

Many co-benefits and outcomes exist for this project including habitat enhancement, shoreline stabilization, and hazards mitigation for a section of shoreline that has a critical erosion issue impacting homes and roads. The design will consider the environmental elements (i.e. wind, water levels, fetch, etc.) impacting the site and will protect infrastructure from storms and rising sea levels. The shore stabilization strategy that will be used in this project is a living shoreline which offers multiple benefits including buffering floods, reducing erosion, storing carbon, attracting wildlife, and improving water quality by reducing Total Maximum Daily Load (TMDL) nutrient and sediment impacts to Chesapeake Bay.

Habitat enhancement: Restoring the beach and nearshore along this shoreline will provide habitat for fish and wildlife and provide spawning areas for fish and other living marine life. Areas with natural coastal habitat, such as beaches, have higher populations of fish and other living organisms important for shorebirds. The nearby marsh in Plum Point Creek is home to an abundance of wildlife including many kinds of birds that fish near our shoreline. In addition, a large population of horseshoe crabs comes to our diminishing beach in May/June to lay eggs in the sand and fertilize them. A section of the eroding shore was protected with a rock revetment and now, no beach exists along this section of shoreline. By incorporating the revetment into the project design, habitat can be increased in its vicinity. Submerged aquatic vegetation (SAV) is very limited in our section of the Bay. Breakwaters have been shown to sustain SAV populations,

particularly on high energy shorelines, by reducing the wave energy behind breakwaters. Our beach is located along the boundaries of The Plum Point Oyster Sanctuary so the breakwater structures themselves can become oyster reefs to increase the oyster population. Due to flooding and storm surge, saltwater inundation kills upland vegetation, and the flood prone areas in our neighborhood have difficulty growing vegetation where sand over-washes. Beaches also provide needed habitat for meiofauna, microscopic marine animals that live in the sediment. Meiofauna is an important trophic link in the food web by serving as food for higher trophic levels. In addition, these invertebrates facilitate biomineralization of organic matter and enhance nutrient regeneration.

Infrastructure Protection: The system will protect upland infrastructure and improve coastal community resiliency by buffering storm waves and reducing flooding. Creating a high, wide beach will prevent breaking waves along the shoreline which cause overwash and flooding of roads. Only one road exists in the neighborhood to enter and exit, so coming and going from our homes can be impossible when it floods. As many cars must be moved to higher ground, this creates issues if health and safety emergencies occur. The flooding is not just a problem for the waterfront homes, but it is a community problem. Many low-lying properties flood from shoreline overwash. In the north end of the community, the waterfront homes are higher than the properties behind them. Shoreline overwash flood waters become landlocked in these low areas with no way to return to the bay. This project also will prevent the spread of sewage contaminated water through the community when our neighborhood floods. Every homeowner has their own well and septic many of which have aging septic systems and drain fields. Creating a stable beach will increase property values and thereby tax revenue. Homes in a beach community with no beach and that are increasingly vulnerable to storm damage and flooding will lose property value. Increasingly, Neeld Estates have been impacted by storms and floods due to climate impact and global sea level rise. Flooding is now a more common event than ever; it no longer takes a hurricane or a Nor'Easter to do major damage. The streets have flooded at least 3 times in the last 6 years. In October 2021, we had an unusually high tide along with a strong SE onshore wind, accompanied by 4 to 5-foot waves, all causing waves to crash onto the yards of beach front homes. Water poured into the streets, flooding homes and property which were low lying. With the waves came a large movement of sand which had to be replaced in some areas and removed from areas where there was an abundant accumulation. Another painstakingly major cleanup job for many of our neighbors. Calvert County provided three dumpsters over a period of three weeks to allow homeowners to clean out their flooded properties.

Shoreline Resiliency: Properly designed and constructed breakwater systems have been shown to provide superior shore protection and will recreate habitat along the shoreline that has been eroded over the last 25 years. The living shoreline, with grasses and vegetation above and below water, will absorb and reduce wave energy and also help reduce landward impacts from rising water due to global sea rise. The gapped offshore structures allow for tidal exchange and access by fauna. These structures will outperform a hardened shoreline by designing/creating breakwaters and a living shoreline. Ten waterfront properties at the north end of our neighborhood have with bulkheads. Waves crash against the bulkheads creating wave reflection producing more shoreline erosion where the beach is not protected. Five more homes, south of the bulkhead, have placed sandbag protection. We anticipate that the erosion will continue to travel from north to south. Not including the cost of the breakwater construction, a living shoreline is more cost effective than a hardened shoreline. This is a long-term solution as the breakwaters are designed to last 50 years will only periodic maintenance.

Social benefits: Many social benefits will result from this project. It will educate our homeowners about how to protect the Bay and provide a demonstration area for the community to be active in planting and maintaining native wetland plants. It also will show the community the benefits of having a natural shoreline as compared to a hardened shoreline. Recreational use of the community beach is high for both leisure activities, such as swimming, sunbathing, and dog walking, and holding community events. The benefits of living near the water has been shown to increase physical activity, lower psychological distress, and have better overall health and well-being. Creating safe access will maximize well-being benefits for residents particularly at a time when the coronavirus has increased stress as well as physical and mental health challenges. NECA is very active within the community and is committed to providing learning experiences. It created a Shoreline Committee to examine options to preserve and restore the shoreline of NECA. The Shoreline Committee has become a team of dedicated community members. We, as a committee, have learned about solutions that will have the highest probability of obtaining our goal as naturally as we can with the use of breakwaters and a living shoreline. It's been a constant learning experience with much more to come!

iii. Current site conditions

The range of items identified in the RFP (e.g., utilities, infrastructure, tree canopy and wetlands) are not present at the project site, hence will not be impacted

iv. Project and site selection

Neeld Estate, a residential community on the Chesapeake Bay composed of 117 homes, has been subject to significant community shoreline reductions due to severe storm-driven shoreline reductions and rising bay level. In 1993, the community had a 400 to 800-foot-wide beach that supported a wide range of individual homeowner and community activities/gatherings, including but not limited to the summer months. In 2010, nine homes at the northern end of the community were forced to install a bulkhead; in 2020, five additional homes had to place one-ton sandbags along the shoreline to protect their homes. In just over the past year, bay front homes have lost 9 to 12 additional feet of property due to severe storm shoreline erosion and rising bay level. In short, what once was a thriving shoreline and source of tremendous joy and pride for residents of all ages across the community is now a constant stressful reminder of the need for NECA to act with thoughtful urgency to mitigate the risk of future erosion, flooding and related property damage. See Attachment C2 for pictures of the impact of the last three events, including the powerful October 2021 storm surge (largest since Hurricane Isabel), that damaged the community's shoreline (and homes) and become the latest call to action for our community!

v. Upstream land use and restoration activity considerations

Not applicable to our project

vi. Alternatives analysis

• Location:

The Neeld Estate shoreline represents the sole project location considered due to persistent shoreline erosion and movement of sand (littoral drift). This site has been impacted by coastal hazards with increasing frequency. Storms in 2015, 2018, and 2021 flooded the roads of the community. In addition, a tornado caused significant damage to homes on the Estate in 2020. In addition, NECA (www.neeldestate.com/) is active within the community providing access to environmental information as well as creating community get-togethers that can be used for education about the project and habitat needs that will improve Chesapeake Bay.

• Technique:

The project will implement a combination of the following restoration techniques:

- headland breakwaters;
- sand nourishment;
- dune grass plantings; and
- potentially, dredge material from the adjacent Breezy Point Marina channel.

Headland breakwater systems have been shown to provide long term shore protection using stable pocket beach technology. Many of these systems have been installed over the years, many over 30 and some over 40 years old giving testament to long-term durability (VIMS, Shoreline Studies Program, Breakwater Database 2020). They not only provide a strong sustainable beach system that withstands severe storm events but also provide beach and dune habitat. These Bay coast habitats have been significantly reduced over time due to shoreline hardening and channel dredging. A stable dune requires a stable beach. Estuarine beaches/dune systems serve as habitat for a wide variety of plants. Dune vegetation is characterized by its ability to withstand extremes in the natural environment. Vigorous vegetation both on the dune crest and leeward side of the dune can stabilize the sand substrate and provide attractive habitats for some shore-dwelling animals. This includes various bird which utilize the area for roosts and nesting. Dunes also support a wide variety of small mammals and reptiles (VMRC 1993).

We based our selection decision on lessons-learned, data, etc. from other similar restoration projects. Over the years, it has been found that breakwater length should be 2 to 2.5 times the design wave length and that the use of coarser sand for nourishment should be used (Hardaway and Gunn 2010). Wider gaps between breakwater units are more appropriate for a unidirectional wind wave climate whereas smaller gaps maybe needed in a more bimodal or omni-direction wind wave climate where beach sands can shift from one side of the embayment to the other.

Other techniques (e.g., bulkheads, rip rap and sandbags) were considered, but each of these shoreline hardening measures do not provide habitat or recreation benefits that the breakwater living shoreline project will. Other techniques will not provide long-term shore protection or coastal resiliency. They also prevent beach sands, even with beach nourishment alone, from residing alongshore for long especially during storm events primarily dune-to- wave reflection off the structures.

• **Minimization of adverse effects:**
Yes, we are willing to consider alternative design techniques that will minimize adverse impacts.

References cited in this section

- Hardaway, Jr. C.S. and J.R. Gunn, 2010. Design and performance of headland bays in Chesapeake Bay, USA. Coastal Engineering, 2010, CENG-02381. Elsevier. 10 pages.
- Hardaway, C.S. and Gunn, J.R., 1991. "Headland Breakwaters in the Chesapeake Bay." *Civil Engineering, October 1991*, ASCE, 64-66.
- U.S. Army Corps of Engineers, 2014. Procedures to Evaluate Sea Level Change: Impacts, Responses and Adaptation. Technical Letter No. 1100-2-1. Department of the Army, U.S. Army Corps of Engineers, Washington DC. 2-314-1000
- VMRC, 1993. Coastal Primary Sand Dunes/Beaches Guidelines. Virginia Marine Resource Commission 2600 Washington Ave, Newport News, VA 23607. Developed pursuant to Chapter 14 of Title 28.2, Code of Virginia
- VIMS Shoreline Studies Breakwater Database 2020, https://www.vims.edu/research/departments/physical/programs/ssp/shoreline_management/breakwaters/index.php

vii. Restoration site images, sketch, etc.
See Attachment A for these visuals (Figures 1-10) and supporting descriptive narrative. It should be noted that the land affected by the project is residential in nature.

viii. Preparatory efforts with regulatory agencies
We expect to apply for a number of Federal, state and county permits, including the six permits identified in our response to question 2. We also plan to conduct a pre-application site visit with the Corps and MDE, as indicated in question 2 response. See Attachment B3 for an email from a representative from Calvert County Zoning and Planning with a commitment to facilitate permitting.

ix. Project property ownership
This project will be performed solely on property owned by NECA.

6) Future of this project

a) Factors affecting long-term value and ensuring long-term value is maximized
It is during significant storms, hurricanes and northeast storms, that headland breakwater systems are designed for and are tested over time. Typically, these systems are designed for the 50 or 100-year storms. During storms, impacts usually include some sand and vegetation loss. Adding sand and replanting are typical maintenance items. The rock, if designed and installed properly, remains intact over the long haul.

b) Addressing climate change impacts
The tide range at Plum Point is 1.4 feet. According to FEMA (2014), the storm surge levels for the 10, 50, and 100-year storms are 4.1, 4.5, and 4.7 feet (respectively) above mean low water (MLW). For planning purposes, we will use the 100-year water level. Also, according to MD DNR, a 1.3-foot rise in sea level by 2050 can be expected. This is best addressed through an adaptive management protocol as developed by the USACE 2014 where the addition of rock and/or sand to raise the crest elevation of the structure maybe required after 20 to 25 years due to sea-level rise.

c) Ongoing financial resource requirements
Not applicable to our project

d) Maintenance responsibility post-implementation
The NECA Shoreline Committee will assume this responsibility and establish a network of volunteers to maintain any shoreline that is created or protected as a result of the project.

7) Organization experience completing similar projects
NECA doesn't have previous experience, but the contractor (Coastline Design, P.C.) we will likely select to develop the plan financed by this grant does. See Attachment D1 for details regarding relevant projects performed by the contractor.

8) Existing or pending permit that applies to the project

Recently, NECA applied for a Wetland License Permit (#21-WL-0698) to replenish the Neeld Estate beach with dredge material from Breezy Point Marina just to the north of our project site. No decision has been made yet. Since we believe that dredging will be an insignificant aspect of the design solution, we can state with confidence that this permit does not put us at odds with CBT policy and procedures.

9) Project implementation

a) Implementation funding approach/source

We plan to apply for a grant to finance the construction phase. Despite the fact that our project is located in a low priority area, MD DNR Chief of Shoreline Conservation, Bhaskaran Submaranian, indicated that our project is a good candidate for an Outcome 3 grant via the Chesapeake and Atlantic Coastal Bays Trust Fund.

b) Construction project leadership and partnership

Construction project leadership will be in the hands of a member of the NECA Shoreline Committee, who will be assisted by the same contractor who will develop the plan financed with the CBT grant. This contractor will be responsible for performing two major tasks – construction management (including bid package and weekly project inspection) and an as-built survey and report. Additionally, based on a July 2021 meeting with Jackie Takas, Watershed Restoration Specialist for University of Maryland Extension/Sea Grant Program, we envision a partnership with her as well.

c) Local community awareness and engagement

NECA (www.neeldestate.com/) is very active within the community providing access to environmental information as well as creating community get-togethers that can be used for education about the project and habitat needs that will improve Chesapeake Bay. The shoreline issues have been discussed via email, Facebook, the NECA web site and at every NECA community meeting since Oct 2020, when the Shoreline Committee was established.

d) Agricultural land requirements

This is not applicable to our project

10) Impact of no grant funding

We will continue seeking funds and the project will be delayed

11) Scope of Work, Qualifications, and Cost Estimates

See Attachment A for a proposal from Coastal Design, P.C. that includes a scope of work, a summary-level cost estimate, a schedule and supporting visuals, including the design concept sketch (Figure 10).

See Attachment D for Coastal Design, P.C. qualifications. Attachment D1 presents details regarding past relevant projects performed by the contractor. Attachment D2 (the last page of Attachment D) details the experience and credentials of Mr. Scott Hardaway, President of Coastal Design, P.C., who will lead performance of their work.

See the budget tab for a detailed estimate of Coastal Design, P.C. project hours and costs. Subsequent to notification of a grant award, NECA will solicit and evaluate three competing bids. In light of the fact that NECA has established a relationship with and vetted a proposal from Coastline Design P.C. and the firm has tremendous relevant expertise, there is a high probability that we will contract for their services.