

**APPLIED COASTAL RESEARCH AND ENGINEERING, INC.**  
**TERMS AND CONDITIONS OF AGREEMENT**  
***Evaluation of Coastal Processes and Storm Impacts to Support Resilient  
Planning and Mitigation Strategies for the Vineyard Haven Harbor Shoreline***

The engagement of Applied Coastal Research and Engineering, Inc. (Applied Coastal) by the Town of Tisbury (CLIENT) is under the following terms and conditions. These terms and conditions are an integral part of the collective Agreement between CLIENT and Applied Coastal.

1. The description and fee estimate for the proposed Scope of Services is described in Attachment A and amended in Attachment B.
2. All schedules set forth in the attached Scope of Services commence upon receipt of a signed Agreement and, if requested, a retainer. All retainer amounts will be applied to the last invoice.
3. Requests for additional services and any associated fee adjustment must be authorized in writing before additional services can begin.
4. Invoices will be rendered monthly and become due upon receipt.
5. Invoice payments must be kept current for services to continue. If the CLIENT fails to pay any invoice due to APPLIED COASTAL within 45 days of the date of invoice, APPLIED COASTAL may, without waiving any other claim or right against CLIENT, suspend services under this Agreement until APPLIED COASTAL has been paid in full all amounts due APPLIED COASTAL and/or any of its Consultants and Subcontractors. Sealed plans, final documents, reports and attendance at meetings/hearings will not be provided unless payment for services is current.

If APPLIED COASTAL is performing services for the CLIENT under multiple projects, invoice payments must be kept current on all projects for services hereunder to continue. CLIENT acknowledges APPLIED COASTAL's right to suspend services and withhold plans and documents, as provided above, if payments are not current on all projects. If services are suspended for 30 days or longer, upon resuming services APPLIED COASTAL shall be entitled to reasonable expenses incurred in the interruption and resumption of its services. If services are suspended for 90 days or longer, APPLIED COASTAL shall be entitled to reasonable expenses incurred in the interruption and resumption of its services and fees for remaining services shall be equitably adjusted.

The parties agree to coordinate invoices to assure timely payment. Among other things, APPLIED COASTAL's project manager and the CLIENT will confer as often as reasonably necessary about any issues that arise involving invoicing and collections.

6. APPLIED COASTAL agrees to carry the following insurance during the term of this Agreement:
  - Workmen's Compensation and Employer's Liability Insurance in compliance with statutory limits.
  - Comprehensive General Liability Insurance including coverage with combined single limits of \$1,000,000 per occurrence and \$3,000,000 in the

- aggregate.
- Professional Liability Insurance with a limit of \$1,000,000 per claim and in the aggregate, per project.
- Automobile Liability Insurance including non-owned and hired automobiles with the combined single limit of \$1,000,000.

Certificates of Insurance will be furnished upon request. If the CLIENT requires additional insurance coverage, and it is available, CLIENT agrees to reimburse APPLIED COASTAL for such additional expense.

7. APPLIED COASTAL shall not be responsible for failure to perform or for delays in the performance of services which arise out of causes beyond the control and/or without the fault or negligence of APPLIED COASTAL.
8. APPLIED COASTAL shall, subject to and consistent with the standard of care stated in Section 10, be entitled to rely on the accuracy and completeness of data, reports, surveys, requirements and other information required to be provided by CLIENT under this Agreement.
9. APPLIED COASTAL's services will be performed on behalf of and solely for the benefit and exclusive use of CLIENT for the limited purposes set forth in the Agreement. CLIENT acknowledges that APPLIED COASTAL's services require certain decisions which are not based upon science, but rather upon judgmental considerations. CLIENT may not delegate, assign, sublet or transfer its duties or interest in this Agreement without the written consent of APPLIED COASTAL.
10. In the performance or furnishing of professional services hereunder, APPLIED COASTAL, and those it is responsible for, shall exercise the degree of skill and care customarily accepted as good professional practices and procedures by members of the same profession currently practicing under similar conditions in Massachusetts ("Standard of Care").

Consistent with this Standard of Care, the services shall conform to applicable laws, codes, ordinances and regulations of any governmental agency having jurisdiction over the project, at the time services are rendered. APPLIED COASTAL shall perform its services as expeditiously as is consistent with the Standard of Care and with the orderly progress of the Work.

11. APPLIED COASTAL shall not be required to sign any documents, no matter by whom requested, that would result in APPLIED COASTAL's having to certify, guaranty or warrant the existence of conditions whose existence APPLIED COASTAL cannot ascertain. Any certification provided by APPLIED COASTAL shall be so provided based on APPLIED COASTAL's knowledge, information and belief subject to the preceding sentence, and shall be given in APPLIED COASTAL's professional opinion consistent with the Standard of Care. To the extent the work is not included in the Scope of Services, APPLIED COASTAL shall be compensated for any work necessary to verify project compliance with regulatory standards for purposes of such certification.

12. All documents including Drawings and Specifications (whether in hard or electronic form) prepared by APPLIED COASTAL pursuant to the Agreement are instruments of service with respect to the Project. They are not intended or represented to be suitable for reuse by the CLIENT or others on extensions of the Project or on any other Project. Any reuse by CLIENT or a third person or entity authorized by CLIENT without written verification or adaptation by APPLIED COASTAL for the specific purpose intended will be at the CLIENT's sole risk and without liability or legal exposure to APPLIED COASTAL. Any such verification or adaptation will entitle APPLIED COASTAL to additional compensation at rates to be agreed upon by APPLIED COASTAL and the third person or entity seeking to reuse said documents.

If any information hereunder is provided in electronic format, CLIENT recognizes that such plans, documents or other information recorded on or transmitted as electronic media, including CADD documents ("Electronic Documents") are subject to undetectable alteration, either intentional or unintentional, due to, among other causes, transmission, conversion, media degradation, software error, or human alteration. Accordingly, the Electronic Documents are provided to CLIENT for informational purposes only and not as record documents.


13. Any materials, reports, information, data, etc. given to or prepared or assembled by APPLIED COASTAL under this Agreement are to be kept confidential and shall not be made available to any individual or organization by APPLIED COASTAL (except agents, servants, or employees of APPLIED COASTAL) without the prior written approval of the CLIENT, except as otherwise required by law. APPLIED COASTAL shall comply with the provisions Chapter 66A of the General Laws of Massachusetts as it relates to public documents, and all other state and federal laws and regulations relating to confidentiality, security, privacy and use of confidential data.

Any materials produced in whole or in part under this Agreement shall not be subject to copyright, except by the CLIENT, in the United States or any other country. CLIENT shall have unrestricted authority to, without payment of any royalty, commission, or additional fee of any type or nature, publicly disclose, reproduce, distribute and otherwise use, and authorize others to use, in whole or in part, any reports, data or other materials prepared under this Agreement.

All data, reports, programs, software, equipment, furnishings, and any other documentation or product paid for by the CLIENT shall vest in the CLIENT at the termination of this Agreement. APPLIED COASTAL shall at all times, during or after termination of this Agreement, obtain the prior written approval of the CLIENT before making any statement bearing on the work performed or data collected under this Agreement to the press or issuing any material for publication through any medium.


14. Subject to agreement of the parties, any questions in dispute under this Agreement may be submitted to non-binding mediation. On the written notice of either party to the other of the election to submit any dispute under this Agreement to mediation, each party shall designate their representative and shall meet within ten (10) days after the service of the notice. The parties themselves shall then attempt to resolve the dispute within ten (10) days of meeting. Should the parties themselves be unable to agree on a resolution of the dispute, then the parties shall proceed with mediation in accordance with the mediation rules of the American Arbitration Association or such other rules, if any, to which the parties agree. The cost of mediation shall be borne equally by both parties.

15. Notwithstanding any other provision of this Agreement, neither party shall be liable to the other for any special, indirect or other consequential (as defined below) damages incurred due to the fault of the other party regardless of the nature of the fault or whether it was committed by the CLIENT or APPLIED COASTAL, or their employees, sub consultants, or subcontractors. Consequential damages include, without limitation, liability for loss of use of the Project or existing property, loss of profits, loss of production or business interruption, however the same may be caused.
16. In entering into this Agreement, CLIENT has relied only upon the representations set forth in this Agreement. No verbal warranties, representations or statements shall be considered a part of this Agreement or a basis upon which the CLIENT relied in entering into this Agreement. No statements, representations, warranties or understandings, unless contained herein, exist between CLIENT and APPLIED COASTAL.
17. Nothing contained in this Agreement shall create a contractual relationship with, or a cause of action in favor of, a third party against either the CLIENT or APPLIED COASTAL. APPLIED COASTAL's services under this Agreement are being performed solely for the benefit of the CLIENT and no person or other entity shall have any claim against APPLIED COASTAL because of this Agreement. In addition, nothing herein shall be construed as creating a contractual relationship between the CLIENT and any APPLIED COASTAL employee, representative or consultant. The CLIENT agrees that in the event of a dispute regarding this Agreement or the services rendered by APPLIED COASTAL hereunder, the CLIENT shall only seek recourse against APPLIED COASTAL and waives any right to pursue a claim against APPLIED COASTAL's directors, officers or employees individually.
18. Any taxes or fees, enacted by local, state or federal government and based on gross receipts or revenues, will be invoiced to and payable by CLIENT as an additional amount due under this Agreement. The CLIENT is a tax-exempt governmental agency.
19. This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, without regard to conflict of laws principles.

  
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John S. Ramsey, Vice-President  
Applied Coastal Research and Engineering, Inc.  
766 Falmouth Road, Suite A-1  
Mashpee, MA 02649

10/09/19

\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Authorized Signatory for  
Town of Tisbury, Massachusetts

10-2-2019

\_\_\_\_\_  
Date



## **Attachment A: Scope of Services**

### **Project Approach**

To provide a more detailed quantitative assessment of both the risks and potential mitigation strategies, an evaluation of coastal processes and potential storm damage related to infrastructure in Vineyard Haven Harbor is proposed. This analysis would include an evaluation of tidal, wave, and sediment transport dynamics within the harbor system, including the Lagoon Pond shoreline in the vicinity of Beach Road. The evaluation also will incorporate a quantitative assessment of severe storms as it relates to both tidal flooding (storm surge “pathways”) and wave overtopping/damage along the district referred to as the “Harbor/Lagoon Pond/SSA Triangle”. The storm assessments will include present conditions, as well as anticipated sea-level rise over the next 30-to-50 years. The overall study area will extend along the Vineyard Haven Harbor shoreline from the breakwater protecting the inner harbor to Eastville Beach.

Ongoing efforts to address upland stormwater issues, planned for completion in the fall of 2019, will be integrated into the understanding of flooding concerns within the study area, as appropriate. The results of the quantitative coastal processes analysis (and information gathered from other Town efforts) will form the basis for developing specific mitigation strategies to address both flooding and erosion concerns within the study area. In addition, it is anticipated that results from this evaluation can be used to inform future zoning strategies to ensure long-term coastal resiliency for the Vineyard Haven Harbor region.

Overall, the approach can be divided into four (4) major tasks, which are described in more detail in the “Approach” section:

1. Site-Specific Analysis of Overtopping and Coastal Flooding
2. Quantitative Analysis of Coastal Change and Sediment Transport Processes
3. Initial Engineering Analysis to Screen Potential Alternatives
4. Prioritize Shore and Flood Protection Strategies

### **Project Goals & Objectives**

The overall goal of the planning analysis is to produce a “roadmap” that the Town can utilize to proactively plan for projects that will improve the coastal resiliency of the downtown Vineyard Haven community. By basing future shore protection decisions on a quantitative analysis of coastal processes, the Town of Tisbury anticipates more cost-effective and sustainable solutions in the long-term. The proposed project is intended to meet the following goals and objectives:

- Utilize existing tidal, bathymetric, and environmental information to inform development of the baseline models needed to support the project.
- Utilize numerical tidal hydrodynamic, wave, and sediment transport models to quantitatively evaluate coastal processes along the Vineyard Haven Harbor shoreline between the breakwater protecting the inner harbor to Eastville Beach. This modeling will be performed for existing conditions, as well as anticipated sea-level rise over the next 30-to-50 years.

An initial evaluation of both long-term and short-term shoreline change is planned to provide site-specific analyses of observed sediment migration along the shoreline. The analysis will incorporate available information from any relevant beach nourishment projects placed along the shoreline, as well as other available information. It is anticipated that a shoreline survey of the observed high water line will be performed to evaluate recent changes in shoreline position. Comparison of the 2019 surveyed shoreline position with historic shorelines developed as part of this project will provide needed information for the evaluation of sediment movement in this region.

A quantitative analysis of coastal processes will be required to develop a defensible evaluation of sediment transport along the harbor shoreline that can provide the basis for development of shoreline management strategies. Three numerical models are proposed to evaluate coastal processes: a wave refraction model, a longshore sediment transport/shoreline change model, and a tidal hydrodynamic model. The wave refraction modeling is required to estimate the driving forces governing longshore transport. Since the local bathymetry and breakwater structures modify the wave directions and heights, this model will be used to determine how local changes in wave conditions modify sediment transport potential along the beach. The wave analysis will be based upon Nantucket Sound waves that control local coastal processes. The study will incorporate state-of-the-art wave refraction analysis techniques to transform the offshore waves to the shoreline for long-term sediment transport calculations. Once wave heights and directions for various conditions have been determined, a sediment transport model will be employed to estimate the annual longshore sediment transport rate along the shoreline region depicted in Figure 1. Sediment transport direction and rate are important parameters that characterize the stability of the nearshore system. In the longshore direction, a system in equilibrium will have a small net transport along the length of the shoreline due to balanced wave and current forces. The equilibrated shoreline may experience high wave energy conditions; however, there will be an overall balance in transported sediment volume in both longshore directions. Utilizing a combination of the wave model information and existing historical shoreline change data, a predictive model of longshore sediment transport will be calibrated to observed conditions. Once the shoreline change model has been calibrated, it can be utilized to simulate the longevity and migration of potential beach nourishment projects, as well as the influence of sand-trapping structures. This aspect of the modeling effort is critical for assessing the viability of potential shore protection alternatives.

Due to the low-lying nature of the Vineyard Haven Harbor shoreline, it also is anticipated that the planning evaluation will benefit from a hydrodynamic analysis of storm-induced flow. A hydrodynamic evaluation of storm surge dynamics will be developed to not only indicate water elevations, but also flow patterns through specific upland areas during severe events. The specific model will be calibrated based upon data from previous modeling efforts for Vineyard Haven Harbor and Lagoon Pond, where the model extent will allow assessment of flooding impacts along the Vineyard Haven Harbor shoreline, as well as within Lagoon Pond. Once calibrated for existing conditions, various storm surge scenarios will be evaluated, including appropriate sea-level rise scenarios for the approximate 50-year timeframe of the assessment. Within the context of ongoing coastal evolution, the influence of relative sea-level rise also will be accounted for within the analysis.

In this manner, quantitative information can inform the evaluation of engineering alternatives for appropriate time horizons.

### Task 3: Initial Engineering Analysis to Screen Potential Alternatives

Combining the results developed in Tasks 1 and 2, as well as the extent of existing coastal armoring along the Vineyard Haven Harbor shoreline, an engineering analysis of potential shore and flood protection options will be developed based upon shoreline 'reach'. Results from the sediment transport analyses will inform the viability of different shore protection strategies at meeting the long-term sustainability goals of the project. Specifically, the alternatives evaluation will assess the relative role of existing armoring, land elevation, and "sediment starvation" to overall mitigation needs. This will include an evaluation for enhancing sediment supply to provide additional coastal resiliency for appropriate areas.

Once alternatives are evaluated relative to their applicability to shoreline and flood damage protection, screening of these options will be performed to determine the most appropriate alternatives. In general, both exclusionary and discretionary criteria will be utilized to assess the applicability of different options, considering aspects of each alternative including engineering, economics, and potential environmental impacts. Once the alternatives screening process is completed, a matrix of potential shore protection options will be developed for each shoreline 'reach'.

### Task 4: Prioritize Shore and Flood Protection Strategies

Once potential shore and flood protection options, along with potential infrastructure improvement costs, have been identified for each of the shoreline reaches along the study shoreline, an assessment of vulnerability and "need" will be developed based on the overall economic parameters. While it is important to protect all vulnerable coastal properties to the extent practical, the Town realizes that developing a proactive plan for addressing coastal hazards in the most critical areas needs to be the priority.

Utilizing the coastal processes, engineering alternatives, and economics data developed from the above tasks, a prioritization scheme for shore and flood protection within the study limits will be developed. This scheme likely will include both 'hard' and 'soft' shore protection measures, based on project need within each of the reaches identified. In general, economic drivers will be critical to this prioritization process; however, coastal resiliency also will need to be addressed, as future shore protection expenditure planning will require that a sustainable outcome will be achieved based upon a 50-year planning horizon.

Finally, a critical aspect of the overall prioritization plan for shore protection is public "buy-in" regarding both the process and the findings of this planning effort. It is anticipated that several (a minimum of three) public presentations will be needed, as stakeholder input is critical to the overall process of coastal planning efforts. Two community "working sessions" are planned to initially present draft alternatives and then the final findings of the report.



**Attachment B: Scope of Services  
FY20 CZM Coastal Resilience Grant Program  
Town of Tisbury  
September 26, 2019**

**Contractor**

John Grande, Town Administrator  
Town of Tisbury  
51 Spring Street  
Tisbury, MA 02568  
508-696-4201  
[jgrande@tisburyma.gov](mailto:jgrande@tisburyma.gov)

**Project Title**

*Evaluation of Coastal Processes and Storm Impacts to Support Resilient Planning and Mitigation Strategies for the Vineyard Haven Harbor Shoreline*

**Summary**

The Town of Tisbury will develop an understanding of coastal processes (e.g., tidal, wave, and sediment transport) and storm flooding to support a detailed analysis of potential shoreline management strategies that will provide resiliency for the Vineyard Haven Harbor shoreline over the next 50 years. The harbor area represents the transportation hub for nearly all services to the island, including port facilities for the Steamship Authority, and contains one of the island's largest industrial and commercial areas. The project will provide a scientific basis for the town to proactively plan for projects that will improve the resiliency of the harbor area. The project has broad local support and advances four priority action items identified in the town's Municipal Vulnerability Preparedness plan.

**Scope, Budget and Schedule**

As described in the application to the Coastal Resilience Grant Program, the following tasks will be performed under this contract (See Pages 12 and 13).

**Reimbursement**

To receive grant funding, the applicant must have agreed to the fiscal requirements of the program by providing a statement from the authorized signatory of the organization acknowledging and accepting the following:

- Matching funds, in cash and/or in-kind, must total at least 25% of the total project cost.
- Grant funding is provided on a reimbursement basis according to the agreed upon scope of work and contract and only upon receipt of a reimbursement package as described below. Advanced payments shall not be made. No payments will be made for Massachusetts sales tax.
- Work done prior to the project start date (the date issued and signed by the Commonwealth's Department Authorized Signatory) shall NOT be reimbursed.

- No funds will be granted for work performed after **June 30, 2020**. Requests for reimbursement will NOT be accepted after **July 31, 2020**.

Once tasks are completed and deliverables have been submitted to, reviewed and approved by CZM, the contractor may submit a reimbursement package containing the following items:

1. A letter (on city or town letterhead) from the contractor with the contractor's authorized signatory requesting reimbursement.
2. All invoices requesting payment, including those from subcontractors. Invoices must itemize costs consistent with the agreed upon scope of work. Invoices must demonstrate sufficient information for CZM to determine that the services were performed and/or products were received, and that the invoiced items meet all contractual performance requirements.
3. A detailed breakdown of the required match for the project. For in-kind services, include sufficient details to demonstrate the total amounts of match contributed, and as appropriate, a list of personnel, hours worked, hourly rate, etc.

**Reimbursement packages should be submitted according to the above schedule, and reflect work performed according to the schedule of deliverables included in the project budget.** Reimbursement is generally made within 45 days subsequent to approval of a reimbursement package.

CZM will retain a minimum of ten percent (10%) of the total maximum obligation of funds until all contract provisions are satisfied and final reports and other products are delivered and accepted.

### **Progress Reporting**

To help CZM stay current on work being conducted over the course of the project, it is expected that the Contractor will submit **monthly** progress reports describing:

- Significant activities that have occurred to show progress toward deliverables
- Whether a change in schedule or scope of work is anticipated
- Whether costs are anticipated to be overrun or underrun
- If additional assistance from CZM or partners is needed

At the conclusion of the project, the Contractor will submit a final Summary Report (See Case Study template provided).

| FY20 Coastal Resilience Grant Scope Template   |  |                      |                   |          |         |          |
|--|--|----------------------|-------------------|----------|---------|----------|
| Project Task Description   | Deliverables   | Deliverable Due Date | Invoice Due Date  | Grant    | Match   | Total    |
| Task 1: Site -Specific Analysis of Overtopping and Coastal Flooding  |  |                      |                   |          |         |          |
| Sub-task 1.1 - Kick-Off Meeting  | Sign In Sheet and Meeting Notes                            | October 15, 2019     | November 15, 2019 | \$2,964  | \$970   | \$3,934  |
| Sub-task 1.2 – Site Specific Analysis of Overtopping and Coastal Flooding: Evaluate existing coastal flooding and storm surge risk for the project area, and future flooding with sea level rise projections for the next 10, 25, and 50 years.      | Technical Memorandum                                       | February 28, 2020    | March 30, 2020    | \$10,950 | \$3,650 | \$14,600 |
| Total Task 1 Cost  |  |                      |                   | \$13,914 | \$4,620 | \$18,534 |
|  |  |                      |                   |          |         |          |
| Task 2: Quantitative Analysis of Coastal Change and Sediment Transport Processes   |  |                      |                   |          |         |          |
| Sub-task 2.1 Shoreline Change Analysis: Evaluate long and short term shoreline change, incorporating available information from beach nourishment projects, to provide site specific analyses of observed sediment migration.                        | Analysis included into Technical Memorandum (Sub-task 2.2) |                      |                   | \$8,424  | \$3,140 | \$11,564 |
| Sub-task 2.2 - Longshore Sediment Transport Model: Determine wave directions and heights and employ sediment transport model to estimate annual longshore sediment transport rate along the study shoreline. Calibrate model to observed conditions. | Analysis included into Technical Memorandum (Sub-task 2.2) |                      |                   | \$22,200 | \$7,400 | \$29,600 |
| Sub-task 2.2 - Hydrodynamic and Storm Surge Model: Conduct analysis of storm-induced flow to indicate water elevations and flow patterns through specific upland   | Technical Memorandum                                       | March 31, 2020       | April 30, 2020    | \$18,195 | \$6,065 | \$24,260 |





## **Case Study Template**

**Municipality:**

**Project Title:**

**Grant Award: \$**

**Match: \$**

### **Community Overview:**

Provide a general description of your community as a brief introduction to the project.

### **Description of Climate Impact:**

Address the community's current and potential future vulnerability to climate change impacts. What are the specific threats to the project area/site and reasons for applying to the grant program?

### **Project Goals:**

What were the specific goals of the project?

### **Approach and Result:**

How did the project team implement the project? Describe the methodology or your approach to achieve the project goals. Describe, and quantify (where possible) project results (e.g. square footage of habitat restored or created). Provide web links, if available, to your project deliverables.

### **Lessons Learned:**

What lessons were learned as a result of the project? Focus on both technical matter of the project and process-oriented lessons learned.

### **Partners and Other Support:**

Include a list of all project partners and describe their role in supporting/assisting in the project.

### **Project Photos:**

In your electronic submission of this report, please attach (as .jpg) a few representative photos of the project. Photos cannot show persons who can be easily identified, and avoid inclusion of any copyrighted, trademarked, or branded logos in the images.



- Perform a screening analysis of various engineering and/or management alternatives that can be used to improve sustainability of the Vineyard Haven shoreline between the breakwater protecting the inner harbor to Eastville Beach.
- Develop recommended alternatives for potential shore protection and flood management options, where evaluation criteria will be focused on both long-term sustainability, as well as overall protection of the coastal environment.
- Promote transferability of the project through development of a clear concise summary report that demonstrates the steps taken to support the alternatives evaluations and derive a recommended shoreline management approach.

### **Project Tasks**

The following Tasks are proposed to accomplish these planning goals:

#### Task 1: Site-Specific Analysis of Overtopping and Coastal Flooding

An evaluation of the existing storm surge risk for the project area will be performed, specifically for the dominant nor'easters. At the base level, it is important to understand how frequently these types of storms can be expected and how frequently damage may occur at the present sea-level conditions. To accomplish this task, Applied Coastal will evaluate existing LiDAR data to determine the combined influence of "stillwater" coastal flood levels combined with the influence of wave set-up within the subject area. The assessment of flood levels will be based on available historical tide data for both Nantucket and Woods Hole augmented with local information (e.g. tide data available for Vineyard Haven Harbor and Lagoon Pond), as well as more recent modeling efforts by the U.S. Army Corps of Engineers. Once existing coastal flooding conditions are established, likely sea-level rise scenarios for the next 10, 25, and 50 years will be developed from the best available data and projections. Information used to develop these scenarios will be based on the most defensible scientific information available including (a) historical relative sea-level trends for southeastern Massachusetts, as well as longer-term records from the region (likely New York City and Boston), and (b) assessments utilized as the basis for the International Panel on Climate Change (IPCC) and information contained within the Massachusetts Climate Change Clearinghouse. Once the most likely sea-level rise scenarios have been developed, an evaluation of relative flood risk determined for each area of a specific land elevation will indicate the increase in flooding frequency associated with each timeframe.

#### Task 2: Quantitative Analysis of Coastal Change and Sediment Transport Processes

The glacially-derived Vineyard Haven Harbor shoreline, between the breakwater protecting the inner harbor to Eastville Beach, consists of a man-modified shoreline of relatively narrow coastal beaches and coastal armoring, where port facilities have been developed to service island needs. In addition, major offshore coastal engineering structures anchor the two ends of the study area (the inner harbor and Eastville Beach breakwaters), where the overall wave climate and associated sediment transport dynamics are governed by the influence of these structures. Understanding the geologic nature of the beach/shoreline system, as well as the strong anthropogenic influences, allows determination of the limits of the local "littoral system". In this manner, determinations can be made regarding potential future sources of natural littoral sediments (i.e. beach nourishment) to the Vineyard Haven Harbor shoreline. This evaluation also will include how anthropogenic changes may have altered the natural sediment transport processes and the influence of sea-level rise upon the long-term stability of the harbor coastline.