Massachusetts Coastal Infrastructure
Inventory and Assessment Project
Massachusetts Department of Conservation and Recreation
Office of Waterways

Outer Cape Cod - South

Orleans
Brewster
Harwich
Chatham

July 6, 2009

Prepared for:
Massachusetts Department of Conservation and Recreation
Hingham, Massachusetts

Presented by:
Bourne Consulting Engineering
Franklin, Massachusetts

In Association With:
Applied Coastal Research & Engineering
TABLE OF CONTENTS

Section I – Coastal Hazards Infrastructure and Assessment Program

INTRODUCTION
PURPOSE
DEVELOPMENT OF MassGIS DATABASE ATTRIBUTES
DEVELOPMENT OF REPAIR / RECONSTRUCTION COSTS

Section II – Orleans

Part A – Community Findings
  • COMMUNITY DESCRIPTION
  • STRUCTURE INVENTORY
  • SUMMARY OF FINDINGS

Part B - Structure Assessment Reports

Part C - Structure Photographs

Part D - Structure Documents
  • TOWN DOCUMENT LIST
    o Document Table
  • MA DCR – DOCUMENT LIST
    o Document Table
  • MA DEP – CH 91 DOCUMENT LIST
    o Document Table
    o Copies of License Documents
  • USACE – PERMIT DOCUMENT LIST
    o Document Table
    o Copies of Permit Documents
Section III – Brewster

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Section IV – Harwich

Part A – Community Findings

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Section V – Chatham

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Section I

Coastal Hazards Infrastructure and Assessment Program

INTRODUCTION

PURPOSE

DEVELOPMENT OF MassGIS DATABASE ATTRIBUTES

DEVELOPMENT OF REPAIR / RECONSTRUCTION COSTS
Section I - Coastal Hazards Infrastructure and Assessment Program

INTRODUCTION

The Project and Client

The Commonwealth of Massachusetts has initiated a Coastal Hazards Commission (CHC) to identify the vulnerability of the state to coastal hazards. As one of five working groups working under the CHC, the 20-Yr Infrastructure Plan was to establish a prioritization for the repair of coastal structures. The focus areas of the Working Group include:

- Publicly owned infrastructure
- Infrastructure for which State is responsible
- Inventory of public hazards infrastructure
- Evaluation on conditions
- Development for a prioritization of work
- Estimation of capital and maintenance costs

The 20-Yr Infrastructure Working Group is led by Representative Frank Hynes with CZM as the lead State Agency overseeing the management of the project. The Massachusetts coastline has been broken up into 4 major regions consisting of the North Shore, Boston, South Coast, and the Cape and Islands. The South Shore (the Towns of Hull, Cohasset, Seekonk, Hingham, Plymouth, Kingston, Scituate and Duxbury) was previously evaluated by Bourne Consulting Engineering as a demonstration project in 2006.

Consultant Team

The consultant team that performed the demonstration project was led by Bourne Consulting Engineering (BCE) of Franklin, MA who was responsible for overall project management, specified areas of field assessments, and research. Assisting BCE was Applied Coastal Research and Engineering Inc. of Mashpee, MA, Childs Engineering Corporation, of Medfield, MA., and Waterfront Engineer LLC of Stratham, NH.

PURPOSE

Study Purpose

CZM seeks to identify the capacity of Massachusetts coastal structures to resist major coastal storms and prevent storm damage. In working toward this goal, CZM has initiated a program to perform an assessment of Commonwealth owned and/or maintained coastal structures. The first phase of this program was the performance of a demonstration project for coastal structures located on the South Shore. The demonstration project identified existing structures, their general conditions, ability to provide coastal protection and the probable cost for repairs. The information collected and developed has been incorporated into the MassGIS system to allow use for developing a 20 Year Coastal Infrastructure Plan.

The demonstration project served as a basis for the current statewide inventory assessment of all Commonwealth coastal structures and the needs for their maintenance and/or repair.
Goals of Study

The goals of the Massachusetts Coastal Infrastructure Inventory and Assessment Project include:

- To identify all the coastal structures the state either owns or has responsibility to maintain for the 4 regions included within the study.
- Of the structures identified, determine the structure location and characteristics, the structure condition relative to providing coastal protection and the structure importance in relation to what it is protecting.
- To the degree possible, identify the structure elevation and the FIRM mapping flood elevation and category.
- To the degree possible, identify structure owner and available documents from local, state and federal agencies.
- To establish an estimated cost to rehabilitate the coastal structures to provide the level of project established in the structure’s original design.
- Provide the information in a format compatible for incorporation into the MassGIS system.

Limit of Study

Due to the time constraints and the amount of effort necessary to collect, process and compile the information, the following are identified as limitations of the information presented:

- All property ownership was taken as presumed. No legal investigation of ownership was performed during the project. Property ownership is based on town assessor maps. Where structures were located outshore of assessor map defined property lines, it was assumed to be Town land unless other information indicated otherwise. Where structures were located outshore of Mean Low Water, property is assumed to be State owned.

- The structure ownership was based on assessor maps and research at the local, state and federal levels. Where there was indication of public work on a structure on Town land or on private property, the structure was presumed to be Town owned. Where the structure was on state property, the structure was presumed to be state owned. Where ownership of the structure was not clear but was located on private property, the structure ownership was defined as unknown.

- The study included town and state owned structures as it was assumed that most town owned structures received state funding at some level for construction and/or maintenance.
  - Structures that were determined to be private were not included.
  - Undocumented structures considered to be on private land, but having the potential to have been publicly built and/or maintained, were identified as having an “unknown ownership”.

- The prioritizing of structures was based primarily on risk to general infrastructure and density of housing. Infrastructure included was buildings. The study did not consider all infrastructure issues including:
  - No consideration on utility impacts – water, electrical, sewer, gas
  - No consideration of roadway and bridge protection
  - Evacuation routes were not considered within the investigation
  - Location of Emergency Shelters were not included in priority assessments

- Research was performed at the local, state and federal levels. The local research was limited to location and documenting available coastal structure contract drawings. Research at DCR was restricted to available historic construction plans for coastal structures at the MA-DCR Waterways office in Hingham, MA, and MA-DCR Division of Urban Parks and Recreation in
Boston, MA. No investigation of state archives was performed. Research at MA DEP Chapter 91 and USACE was limited to recorded permits and licenses found in their files. No investigation was performed at the Registry of Deeds.

DEVELOPMENT OF MassGIS DATABASE ATTRIBUTES

The specific attributes that would be incorporated into the MassGIS system were developed based on the scope of work and the goals to be achieved. The following was established to standardize the data collection and presentation and to allow total flexibility for sorting by attributes in the final GIS database. The attributes identified below were input into a MS Access database which was used to manage the data from all eight communities within a single file.

Database Attributes
- Attribute Descriptions/Definitions

Structure Number: A unique structure number was given to each coastal structure. The number was based on existing numbering systems that include the State Department of Environmental Protection community number followed by the local community assessor’s parcel numbering system. The last three digits of the number represent the structure within the parcel. Where structures extend over several parcels, the structure is referenced to a parcel that is approximately in the center of the structure. Where Town assessor’s references include letters, those are also included within the structure number. Some communities have block numbering within their numbering system and these are included. Communities without block numbering still have the block numbering included but these are illustrated as all zeros for that specific segment.

Structures that are on Town property, which would otherwise not have a parcel number, are referenced to a parcel that is in the immediate vicinity of the coastal structure.

On this basis, the following is the general numbering convention:

CCC-MMM-BBB-PPP-SSS

Where:
CCC  DEP Community Number
MMM  Community Map Number
BBB  Block Number (000 if no block numbering system)
PPP  Community Parcel Number
SSS  Structure Number

Property Ownership: All property ownership was on a “presumed” basis as no legal verification of ownership was performed. The ownership of the property was classified under four basic areas which were private ownership (Private), Town ownership (Local), Commonwealth of Massachusetts ownership (State), federal government ownership (Federal) or unknown. Property ownership was based on Town assessor’s maps. Where the location was located above Mean Low Water, and not within a defined parcel, the property ownership was presumed to be the Town unless documentation was found to indicate otherwise. Where a structure was located offshore of Mean Low Water, the property ownership was presumed to be federal.

Structure Ownership: The ownership of all structures is presumed as no verification of ownership was performed. Ownership of the structure was determined by research into historic state and federal
permits and the entity indicated on the permits as the applicant. Where no other information was found, the following was utilized:

- Structures located on private land but appearing to be significant structures were identified as owned by the Town or as “Unknown”. Unknown was used were there was a question of local or private ownership.
- Structures on Town property were assumed to be owned by the Town
- Structures that were located off-shore were presumed to be federally owned
- Structures that were identified as being privately owned were eliminated from the database

Basis of Ownership: The basis of structure ownership was provided to give rationale to the structure ownership and identified the research resource that identified the ownership or the methodology otherwise used. The responses utilized were limited to the following:

- DPW – DPW Employee Interview
- DCR - Contract Drawings
- DEP – Ch 91 License
- USACE – Permits
- Property Ownership
- Offshore Structure

Structure Owner's Name: Ownership names reflect the presumed owner of publicly owned structures. As this was for public structures only, the ownership was restricted to the community name, the state agency or the federal agency.

Earliest Structure Record: The year of the oldest document located for the structure. The information is determined from the document research performed on the structure from local, state and federal agencies. If no documents could be found than this entry is denoted as ‘Unknown’. Where documentation of the structure could be found, the date from the oldest document was utilized.

Primary Structure / Secondary Structure: Many of the coastal structures consisted of combined structures which were rated separately. It was typically found that one structure was significantly more predominant (Ex. Bulkhead/Seawall) and was therefore identified as the Primary Structure while a smaller structure might exist in front (ex. Revetment) of it. The type, height and material of each structure are identified separately. The condition of each structure was based on the Primary Structure. Where there was no secondary structure, the fields were left blank.

Structure Type: The structure type was categorized into five basic coastal structure categories which were Bulkhead/Seawall, Revetment, Coastal Beach, Coastal Dune, and Jetty/Groin.

Structure Material: The identification of the coastal structure’s material of construction was performed and represents the primary material. Stone structures consisted of both mortared and non-mortared conditions.

Structure Height: Each type of structure was categorized by its visible height in feet which was broken into four specific ranges which are:

- < 5 feet
- 5 to 10 feet
- 10 to 15 feet
- > 15 feet

Structure Condition: A preliminary assessment of the condition for each structure was performed by the field teams. This was by visual observation only and no detailed investigation was performed. The condition assessments were based on a predefined five level rating system that ranged from Rating A for Excellent Condition to Rating F for Critical Condition. A detailed listing of the conditions and their definitions can be seen in Exhibit A.
Priority Rating: In order to account for the need for protection at any one site, a five level priority rating system was established. This allowed for consideration of public infrastructure protection, density of residential housing for development of structure overall importance for coastal protection. The ratings range from Level 1 for no infrastructure or residence protection to Level 5 for critical inshore infrastructure protection and/or high density residential. The detailed listing and definitions for the priority categories can be seen in Exhibit B.

Structure Repair / Reconstruction Cost: A preliminary estimation of construction costs to maintain or repair structures was made based on the preliminary field assessment of the structures. A Repair Cost Matrix was developed based on structure type, condition, height and material and can be seen in Exhibit C. Once each structure's type, height, and material classifications were determined, the cost per foot for the structure was determined from the Repair Cost Matrix and multiplied by the length of the structure to obtain the estimated repair/restoration cost. The cost matrix repair costs include a 20 percent construction cost contingency as well as 10 percent costs for engineering and permitting.

Structure Length: The length of each structure is provided and utilized in the development of the repair/reconstruction costs. The lengths are given to the nearest foot and taken as the linear distance along the structure, as determined by the GPS location, which takes into account structure angles and curvature.

Structure Elevation: The elevation of structures was determined in feet from existing information where available. The datum used is NAVD 88 and elevations are to the nearest foot. From a previous study much of the south shore coastal structures had elevations defined based on LIDAR mapping data. Where available structure documentation with elevations was found, in areas with no LIDAR data, the information was included within the structure information. Where there was no LIDAR information or existing documentation, the item has been left blank.

LIDAR (Light Detection and Ranging) is technology that is currently being used for high-resolution topographic mapping by mounting a LIDAR sensor, integrated with Global Positioning System (GPS) and inertial measurement unit (IMU) technology, to the bottom of aircraft and measuring the pulse return rate to determine surface elevations.

FEMA Zone and Elevation: For each structure the FEMA Flood Insurance Rate Maps (FIRM) were researched for their Flood Zone designation and their Base Flood Elevation from the most recent FIRM maps for the specific Town. The elevations are provided in feet on the same datum as the FIRM maps (NGVD) with no adjustments or conversions.

Structure Comments: The engineering team provided a brief description and comment on the structure at the time of the field assessments which is provided in support of the condition rating that was given for the structure.

Pictures: At the time of the field assessments, digital photographs were taken to provide a general overview of the structure. The number of pictures was limited to a maximum of six. The first photograph for each structure is shown on the Structure Assessment Form. The list of all photographs is provided on the form.

Town Documents: Town documents represent the structure information that could be found in the Town’s DPW/Engineering Department records. Where particular records could be found, a table of document information was developed and included within the database with limited descriptions.
MA - DCR Documents: MA-DCR documents represent the structure information that could be found within DCR – Waterways office in Hingham Where particular records could be found, a table of document information was developed and included within the database with limited descriptions.

MA - DEP Chp. 91 Licenses: MA-DEP Chapter 91 license documents represent the structure information that could be found within MA-DEP Chp 91 records in Boston. Where particular records could be found, they were scanned as pdf files and attached to the structure through the GIS database information. In addition, a table of license document information was developed and included within the database with limited descriptions.

USACE Permits: USACE Permits represent the structure information that could be found within the Army Corp of Engineers regulatory office in Concord, MA. Where particular records could be found, they were scanned as pdf files and attached to the structure through the GIS database information. In addition, a table of license document information was developed and included within the database with limited descriptions.

DEVELOPMENT OF REPAIR / RECONSTRUCTION COSTS

A matrix to be used within the database has been developed to assess likely rehabilitation/repair costs to restore the coastal structures to their original design condition. No attempt was made to assess the level of exposure and associated level of protection that might be required to meet current design standards for these structures. These costs are only an estimation to bring these structures back to their original design intent based on 2006 construction costs.

The development of the cost matrix is based on the following:

Structure Condition Ratings – The condition of the coastal structures was determined in the field by the survey crew which was led by an engineer with waterfront structure assessment and design experience. The definitions of the rating criteria utilized for the assessments are presented elsewhere.

The cost implications for each rating condition are as follows:

- **A Rating** Structures not requiring any maintenance, repair or rehabilitation cost and would not be expected to experience damage if subject to a major coastal storm event

- **B Rating** Structures requiring limited or no repair and would be expected to experience only minor damage if subject to a major coastal storm event. The value of these maintenance costs is assumed to be 10 percent of the construction cost.

- **C Rating** Structures requiring moderate to significant level of repair or reconstruction and would be expected to experience significant damage if subject to a major coastal storm event. The structure is presumed to be effective under a major storm event. The value of the repair costs is assumed to be 50 percent of the construction cost.

- **D Rating** Structures requiring significant level of rehabilitation or total reconstruction and would be expected to experience significant damage or possibly fail if subject to a major coastal storm event. The value of the repair costs is assumed to be 100 percent of the construction cost.
• F Rating  Structures requiring complete reconstruction and would expect to provide little or no protection from a major coastal storm event. The value of the repair costs is assumed to be 100 percent of the construction cost plus a cost for removal/disposal of the original structure.

**Height of Structure** — Height of a structure is a major factor in the structure cost and therefore was identified as a significant factor is assessing rehabilitation/repair construction costs. The structures were broken down into four major categories which were:

- **< 5’**  Structures that were less than five feet in height
- **5’-10’**  Structures five to 10 feet in height
- **10’-15’**  Structures over 10 feet to 15 feet in height
- **> 15’**  Structures greater than 15 feet in height – assumed 20 feet typical

**Length of Structure** — Length is based on field GPS location with measurements rounded to the nearest foot.

**Bulkhead / Seawall Structures** — These structures are assumed to be constructed out of concrete, steel, stone or wood with each having its own criteria for establishing costs. For each structure type the following was assumed:

- **Concrete Seawalls** — These walls were assumed to be gravity structures with the volume of concrete used based on the bottom width being one-half of the structure height. Costs of construction were based on a per cubic yard estimate that varied from $350 to $630 per cubic yard depending on the structure height. Values for excavation and demolition of existing structure were also included.

- **Stone Seawalls** — These walls were treated the same as concrete seawalls and assumed to be gravity structures with the volume of the structure based on the bottom width being one-half of the structure height. Costs of construction were based on a per cubic yard estimate that varied from $350 to $630 per cubic yard depending on the structure height. Values for excavation and demolition of existing structure were also included.

- **Steel Bulkheads** — Steel bulkheads were presumed to be constructed with steel sheet piling. Tie back systems were presumed for structures 10 feet or greater in height. Shorter walls were assumed to have a cantilever design. The total depth of sheeting was presumed to be two times the exposed height. The cost for construction varied from $40 per square foot to $60 per square foot plus the cost of excavation and demolition.

- **Timber Bulkheads** — Timber bulkheads were presumed to be constructed with timber piles at eight foot on center, horizontal wales and vertical four inch sheathing. The unit costs for installed materials used were $1,500 per pile and $7.50 per bfn.

**Revetment Structures** — Revetment structures were presumed to be constructed of dry placed (no concrete) stone with a two on one slope and a horizontal toe and crown equal to the thickness layer established for each height condition. The total thickness of the revetment layers varied from six to ten feet with the cost of armor and under-layer stone assumed to be $50 per ton and the crushed stone base to be $15 per ton.
Groins and Jetties — Groins and jetties were assumed to be the same materials and construction as the revetment structures but would have two sides and therefore double the quantities.

Coastal Beaches — Costs for restoration of Coastal beaches presumed the placement of beach renourishment sands at a 1-on-20 slope over the existing beach conditions. The cost for deposition of sand assumed relatively close source of material and utilized $20 per cubic yard for the material installed.

Coastal Dunes — Restoration of coastal dunes assumed a cross section of renourished sand with a one-on-four slope on one side of a 25 foot width at the defined dune height. The cost for deposition of sand assumed relatively close source of material and utilized $20 per cubic yard for the material installed.

Contingency — A contingency of 20 percent was added to all costs to reflect the unknowns associated with this level of rehabilitation/repair estimating.

Engineering and Regulatory Approvals — A ten percent increase to the cost matrix prices was assessed to represent the engineering design and regulatory approval requirements for the restoration of these structures.
## EXHIBIT A

**Structure Condition Table – 5 Level Rating System**

<table>
<thead>
<tr>
<th>Preliminary Condition Assessment</th>
<th>Definition Based Upon Perceived Immediacy of Action and Potential to Cause Damage if Not Corrected</th>
<th>Level of Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Excellent</td>
<td>Like new condition. Structure expected to withstand major coastal storm without damage. Stable landform (beach, dune or bank). Adequate system exists to provide protection from major coastal storm</td>
<td>None</td>
</tr>
<tr>
<td>B Good</td>
<td>Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure</td>
<td>Minor</td>
</tr>
<tr>
<td>C Fair</td>
<td>Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life</td>
<td>Moderate</td>
</tr>
<tr>
<td>D Poor</td>
<td>Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.</td>
<td>Major</td>
</tr>
<tr>
<td>F Critical</td>
<td>Conditions of structure/landform may warrant emergency stabilization as failure may result in potential loss of property and/or life. Landform eroded, loss of integrity. Structure exhibits critical levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure provides little or no protection from a major coastal storm. Actions taken to totally reconstruct structure to regain full capacity. Landform stability is severely compromised, rate of erosion/material loss may be increasing, and landform does not provide adequate protection from a major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.</td>
<td>Immediate</td>
</tr>
</tbody>
</table>
EXHIBIT B

Priority Rating System - 5 Level Rating System

<table>
<thead>
<tr>
<th>Preliminary Priority Level Assessment</th>
<th>Level Based Upon Perceived Immediacy of Action and Presence of Potential Risk to Inshore Structures if Not Corrected</th>
<th>Level of Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>None No Inshore Structures or Residential Dwelling Units Present</td>
<td>Long Term Planning Considerations</td>
</tr>
<tr>
<td>II</td>
<td>Low Priority Inshore Structures Present with Limited potential for Significant Infrastructure Damage</td>
<td>Future Project Consideration</td>
</tr>
<tr>
<td>III</td>
<td>Moderate Priority Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (&lt;1 dwelling impacted / 100 feet of shoreline)</td>
<td>Consider for Active Project Improvement Listing</td>
</tr>
<tr>
<td>IV</td>
<td>High Priority High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)</td>
<td>Consider for Next Project Construction Listing</td>
</tr>
<tr>
<td>V</td>
<td>Immediate / Highest Priority Critical Inshore Structures Present with Potential for Infrastructure Damage and/or High Density Residential Dwellings Conditions of structure may warrant emergency stabilization as failure may result in potential loss of property and/or life. (&gt;10 dwellings impacted / 100 feet of shoreline)</td>
<td>Consider For Immediate Action Due to Public Safety and Welfare Issues</td>
</tr>
</tbody>
</table>
### REPAIR / REHABILITATION COSTING DATA

Cost per linear foot of structure

<table>
<thead>
<tr>
<th>STRUCTURE TYPE</th>
<th>MATERIALS</th>
<th>STRUCTURE WIDTH</th>
<th>STRUCTURE HEIGHT</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>BULKHEAD/SEAWALL</td>
<td>CONCRETE</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
<td>$84</td>
<td>$425</td>
<td>$850</td>
<td>$983</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td></td>
<td>$0</td>
<td>$132</td>
<td>$759</td>
<td>$1,518</td>
<td>$1,782</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 15 Feet</td>
<td></td>
<td>$0</td>
<td>$251</td>
<td>$1,254</td>
<td>$2,508</td>
<td>$2,970</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td></td>
<td>$0</td>
<td>$396</td>
<td>$1,980</td>
<td>$3,960</td>
<td>$4,752</td>
</tr>
<tr>
<td></td>
<td>STEEL</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
<td>$54</td>
<td>$273</td>
<td>$546</td>
<td>$680</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td></td>
<td>$0</td>
<td>$165</td>
<td>$825</td>
<td>$1,650</td>
<td>$1,848</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 15 Feet</td>
<td></td>
<td>$0</td>
<td>$251</td>
<td>$1,254</td>
<td>$2,508</td>
<td>$2,772</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td></td>
<td>$0</td>
<td>$343</td>
<td>$1,716</td>
<td>$3,432</td>
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<td></td>
<td>STONE</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
<td>$84</td>
<td>$425</td>
<td>$850</td>
<td>$983</td>
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<td>WOOD</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
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<td>$431</td>
<td>$862</td>
<td>$994</td>
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<td>$804</td>
<td>$1,608</td>
<td>$1,872</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td></td>
<td>$0</td>
<td>$202</td>
<td>$1,008</td>
<td>$2,017</td>
<td>$2,280</td>
</tr>
<tr>
<td>COASTAL BEACH</td>
<td>SAND</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
<td>$26</td>
<td>$132</td>
<td>$264</td>
<td>$264</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td></td>
<td>$0</td>
<td>$127</td>
<td>$634</td>
<td>$1,287</td>
<td>$1,287</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 15 Feet</td>
<td></td>
<td>$0</td>
<td>$224</td>
<td>$1,122</td>
<td>$2,244</td>
<td>$2,244</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td></td>
<td>$0</td>
<td>$396</td>
<td>$1,980</td>
<td>$3,960</td>
<td>$3,960</td>
</tr>
<tr>
<td>COASTAL DUNE</td>
<td>SAND</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
<td>$18</td>
<td>$93</td>
<td>$186</td>
<td>$186</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td></td>
<td>$0</td>
<td>$48</td>
<td>$236</td>
<td>$476</td>
<td>$476</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 15 Feet</td>
<td></td>
<td>$0</td>
<td>$79</td>
<td>$395</td>
<td>$790</td>
<td>$790</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td></td>
<td>$0</td>
<td>$132</td>
<td>$680</td>
<td>$1,320</td>
<td>$1,320</td>
</tr>
<tr>
<td>REVETMENT</td>
<td>STONE</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
<td>$66</td>
<td>$333</td>
<td>$664</td>
<td>$730</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td></td>
<td>$0</td>
<td>$120</td>
<td>$601</td>
<td>$1,201</td>
<td>$1,300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 15 Feet</td>
<td></td>
<td>$0</td>
<td>$157</td>
<td>$781</td>
<td>$1,696</td>
<td>$1,696</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td></td>
<td>$0</td>
<td>$247</td>
<td>$1,234</td>
<td>$2,488</td>
<td>$2,666</td>
</tr>
<tr>
<td>GROIN</td>
<td>STONE</td>
<td>Under 5 Feet</td>
<td></td>
<td>$0</td>
<td>$132</td>
<td>$684</td>
<td>$1,328</td>
<td>$1,450</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td></td>
<td>$0</td>
<td>$240</td>
<td>$1,201</td>
<td>$2,402</td>
<td>$2,600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 15 Feet</td>
<td></td>
<td>$0</td>
<td>$314</td>
<td>$1,564</td>
<td>$3,128</td>
<td>$3,322</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td></td>
<td>$0</td>
<td>$494</td>
<td>$2,468</td>
<td>$4,937</td>
<td>$5,333</td>
</tr>
</tbody>
</table>

**NOTE:** Repair / Rehabilitation Costs include 10% for engineering and regulatory approvals and 20% for construction contingency.
Section II

Orleans
Section II – Community Findings – Town of Orleans

COMMUNITY DESCRIPTION

The Town of Orleans consists of a land area of 14.14 square miles out of a total area of 21.06 square miles and had a population of 6,341 in the 2000 census. The Town is located on Cape Cod of Massachusetts and its location can be seen on this report’s cover. The estimated length of shoreline is 9 miles that are directly exposed to open ocean. The Town is protected from major coastal storms by both natural and man-made shoreline structures that require maintenance to insure the long term protection of its coastline. The man-made and publicly owned structures that protect the Town were investigated for their ability to provide adequate protection from major coastal storms. Structures have been identified as publicly owned, including coastal dunes and beaches, based on evidence of investment of public funds made to create/enhance/maintain these structures. The assessment did not include floating or pile supported structures as they are assumed not to provide any significant coastal protection from major storm event.

STRUCTURE INVENTORY

Within the Town of Orleans, there were 11 structures which had public or unknown ownership which provide significant coastal protection. The location of the structures can be seen in Sheets 1 through Sheet 8 in Section II-B of this report. The structures were categorized by their type and by their structural condition based on a preliminary field assessment. The distribution of structures by type and condition can be seen in the following table:

<table>
<thead>
<tr>
<th>Primary Structure (ft)</th>
<th>Total Structures</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
<th>Total Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead / Seawall</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>985</td>
</tr>
<tr>
<td>Revetment</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>650</td>
</tr>
<tr>
<td>Breakwater</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groin / Jetty</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>160</td>
</tr>
<tr>
<td>Coastal Dune</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>270</td>
</tr>
<tr>
<td>Coastal Beach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11</strong></td>
<td><strong>5</strong></td>
<td><strong>4</strong></td>
<td><strong>2</strong></td>
<td></td>
<td><strong>2065</strong></td>
<td></td>
</tr>
</tbody>
</table>

Within the above table, the total length of each type of structure is also provided. The structures are listed by the type which is providing the primary coastal protection. Many sites have multiple structure types at the same location (i.e. revetment in front of seawall). These secondary structures, although not identified within these tables, are included in the development of repair/rehabilitation costs.

The development of repair costs has been included by structure type and by condition. In the Town of Orleans’s case there are a total of 11 structures which would require approximately $ 2.9 million to bring all the coastal structures to “A” Rating. Most critical will be the structures in the “D” and “F” classifications as those are assumed to undergo some level of damage or failure during the next major coastal storm event. To reconstruct these structures, identified in the preliminary survey as being in poor condition, an estimated $ 2.5 million would be required to upgrade the Town’s coastal protection.
Based on the limited research within the scope of this project research, the presumed ownership of the structures was established on an initial basis and would be subject to more intense review in future tasks. Structures identified as being owned privately were excluded from further consideration. Although ownership of the land on which the structure was located was a factor, the structure ownership was treated as a separate issue from land ownership. For the Town of Orleans, the breakdown of structures by assumed ownership is as follows:

The identification of presumed ownership was not based on the investigation of legal documents but relied on property ownership and from construction and regulatory documents that were found. A more detailed investigation of legal documents and agreements would be required where structure ownership is disputed. A more detailed identification of structure type, length, condition and location can be found in Section II-B which contains Structure Assessment Reports for each individual structure found.

**SUMMARY**

The enclosed reports and associated documents reflects the Town of Orleans’s coastal structure information that will eventually be input into a state-wide GIS database and will be accessible through MassGIS. This data, when compiled state wide, will be critical in the development of both short term and long term planning for maintaining and improving Massachusetts coastal protection.

This database will also provide relatively quick access to identify available documentation for these structures as well as the ability to be updated as coastal structure improvements are made.
Section II - Orleans

Part B

Structure Assessment Reports
**Structure Assessment Form**

- **Location:** Asa's Landing
- **Date:** 10/29/2007
- **Earliest Structure Record:** Unknown
- **Estimated Reconstruction/Repair Cost:** $1,320.00

<table>
<thead>
<tr>
<th>Length: 20 Feet NAVD 88</th>
<th>Top Elevation: 10 Feet NGVD</th>
<th>FIRM Map Zone: A8</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
</table>

- **Primary Type:** Revetment
- **Primary Material:** Stone
- **Primary Height:** Under 5 Feet
- **Secondary Type:**
- **Secondary Material:**
- **Secondary Height:**

**Structure Summary:** Placed single line of stones adjacent to the town landing. The stones are on average 2 feet by 1 foot by 1 foot in size.

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Priority Rating</th>
<th>Level of Action Description</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B Good</td>
<td>I None</td>
<td>Minor</td>
<td>No Inshore Structures or Residential Dwelling Units Present</td>
</tr>
<tr>
<td>Description</td>
<td>Priority Rating</td>
<td>Level of Action Description</td>
<td>Action Description</td>
</tr>
<tr>
<td>Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.</td>
<td>None</td>
<td>Long Term Planning Considerations</td>
<td>No Inshore Structures or Residential Dwelling Units Present</td>
</tr>
</tbody>
</table>

**Structure Images:**

- [054-011-000-003-100-PH01A.JPG](attachment://054-011-000-003-100-PH01A.JPG)

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
### CZM Coastal Infrastructure Inventory and Assessment

**Structure Assessment Form**

<table>
<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Smuggler's Path</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presumed Structure Owner:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>10/29/2007</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner Name:</th>
<th>Earliest Structure Record:</th>
<th>Estimated Reconstruction/Repair Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orleans</td>
<td>1980</td>
<td>$19,919.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>V11</td>
<td>13 Feet NGVD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Feet</td>
<td>Feet NAVD 88</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Type:</th>
<th>Primary Material:</th>
<th>Primary Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revetment</td>
<td>Stone</td>
<td>Under 5 Feet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
<th>Secondary Height:</th>
</tr>
</thead>
</table>

#### Structure Summary:

The dumped stones vary in size, averaging 2 feet by 1 foot by 1 foot. The slope is 1 on 5. There is erosion inshore of the revetment. There is understone visible and unraveling at the toe. Debris, grass, and branches are scattered throughout the structure. There is a parking lot behind, beach in front and boat ramp adjacent to the revetment.

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Priority Rating</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>None</td>
<td>No Inshore Structures or Residential Dwelling Units Present</td>
</tr>
</tbody>
</table>

---

**Structure Images:**

- 054-013-000-030-100-PHO1A.JPG
- 054-013-000-030-100-PHO1B.JPG

**Structure Documents:**

- USACE: November 1
- DEP: September 1
- Proposed Timber: 054-013-000-030-100-COE1A
- Plan Accompanying: 054-013-000-030-100-LIC1A

---

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Orleans

Location: Rock Harbor Inlet
Based On Comment: 
Earliest Structure Record: 1958

Date: 10/29/2007
Estimated Reconstruction/Repair Cost: $38,400.00

Length: 160 Feet
Top Elevation: 12 Feet NGVD
FIRM Map Zone: A4
FIRM Map Elevation: 

Primary Type: Groin/ Jetty
Primary Material: Stone
Primary Height: 5 to 10 Feet

Secondary Type: 
Secondary Material: 
Secondary Height: 

Structure Summary:
The stone groin is at the mouth of Rock Harbor, adjacent to the boat ramp. The stones are approximately 2 feet by 2 feet at a 1 on 1 slope. The crest is 1 stone wide. The stones are well placed with no visible movement.

Condition Rating
B Good

Level of Action Description
Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating
I None

Action Description
No Inshore Structures or Residential Dwelling Units Present

Structure Images:
[054-016-000-038-100-P4O1A.jpg]

Structure Documents:
USACE | November 1 | Proposed Jetty | 054-016-000-038-100-COE1A
MA-DCR | June 1958 | Proposed Harbor | 054-016-000-038-100-DCR1A
MA-DCR | July 1960 | Proposed Harbor | 054-016-000-038-100-DCR1B

Prepared By: Bourne Consulting Engineering
### CZM Coastal Infrastructure Inventory and Assessment

#### Structure Assessment Form

**Property Owner:**
- Local

**Presumed Structure Owner:**
- Local

**Owner Name:**
- Orleans

**Location:**
- Rock Harbor Inlet

**Date:**
- 10/29/2007

**Based On Comment:**

**Earliest Structure Record:**
- 1934

**Estimated Reconstruction/Repair Cost:**
- $2,471,040.00

#### Structure Summary:
Steel bulkhead with steel cap. There were fender piles in front with a ramp and floats. Behind is a parking lot. There is minor corrosion at the tidal zone. There is no visible erosion or scour.

#### Condition Rating
- **Rating:** Poor
- **Level of Action:** Major
- **Description:** Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

#### Structure Images:
- [054-016-000-038-200-PHO2A.jpg](#)

#### Structure Documents:
- **USACE**
  - March 1953: Proposed Bulkhead, 054-016-000-038-200-COE2A
  - April 1954: Proposed Excavation, 054-016-000-038-200-COE2B
  - February 19: Proposed Bulkhead, 054-016-000-038-200-COE2C
  - June 1934: Proposed Timber, 054-016-000-038-200-DCR2A
  - January 195: Proposed Retaining, 054-016-000-038-200-DCR2B
  - April 1954: Proposed Harbor, 054-016-000-038-200-DCR2C
  - April 1956: Proposed Bulkhead, 054-016-000-038-200-DCR2D
  - February 19: Proposed Harbor, 054-016-000-038-200-DCR2E
  - November 1: Proposed Harbor, 054-016-000-038-200-DCR2F
- **MA-DCR**
  - August 1977: Plan Accompanying, 054-016-000-038-200-LIC2A

**Prepared By:** Bourne Consulting Engineering
**Structure Assessment Form**

<table>
<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Rock Harbor Inlet</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Presumed Structure Owner:</th>
<th>Earliest Structure Record:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Unknown</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner Name:</th>
<th>Estimated Reconstruction/Repair Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orleans</td>
<td>$180,180.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 Feet</td>
<td>Feet NAVD 88</td>
<td>A3</td>
<td>12 Feet NGVD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Type:</th>
<th>Primary Material:</th>
<th>Primary Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revetment</td>
<td>Stone</td>
<td>5 to 10 Feet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
<th>Secondary Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Structure Summary:**

The dumped stone revetment has stones that vary in size. On average, the stones are 3 feet by 2 feet by 1 foot in size. The slope is 1 on 3. There is visible stone movement. The understone is visible. Behind the revetment is a road and houses.

**Condition**

<table>
<thead>
<tr>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
</tr>
<tr>
<td>Level of Action</td>
</tr>
<tr>
<td>Description</td>
</tr>
</tbody>
</table>

**Priority**

<table>
<thead>
<tr>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
</tr>
<tr>
<td>Action</td>
</tr>
<tr>
<td>Description</td>
</tr>
</tbody>
</table>

**Structure Images:**

- 054-016-000-038-300-PHO3A.jpg
- 054-016-000-038-300-PHO3B.jpg
- 054-016-000-038-300-PHO3C.jpg

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
### Structure Assessment Form

**Property Owner:** Local  
**Presumed Structure Owner:** Local  
**Owner Name:** Orleans  
**Location:** Town Cove - Eastham Town Line  
**Based On Comment:**  
**Earliest Structure Record:** 1971  
**Estimated Reconstruction/Repair Cost:** $26,572.00  
**Date:** 10/29/2007

**Length:** 165 Feet  
**Top Elevation:** Feet NAVD 88  
**FIRM Map Zone:** A10  
**FIRM Map Elevation:** 12 Feet NGVD  
**Primary Type:** Bulkhead/ Seawall  
**Primary Material:** Wood  
**Primary Height:** 10 to 15 Feet  
**Secondary Type:**  
**Secondary Material:**  
**Secondary Height:**  
---

**Structure Summary:**
The timber bulkhead is stabilized by timber piles and wales. There is minor growth at the tidal zone. A gangway and floats come off the middle of the bulkhead. Behind is a parking lot. Adjacent is a boat ramp.

**Condition Rating**
- **Level of Action:** Minor  
- **Description:** Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

**Priority Rating**
- **Action Description:** None  
- **Long Term Planning Considerations:** No Inshore Structures or Residential Dwelling Units Present

### Structure Images:
- [054-018-000-049-100-PHO1A.JPG](#)  
- [054-018-000-049-100-PHO1B.JPG](#)  
- [054-018-000-049-100-PHO1C.JPG](#)

### Structure Documents:
- **USACE:** December 1  
  - Town of Orleans to  
  - Plan to Accompany  
  - 054-018-000-049-100-COE1A  
- **DEP:** December 1  
  - Plan to Accompany  
  - 054-018-000-049-100-LIC1A  
- **DEP:** August 1974  
  - Plan to  
  - 054-018-000-049-100-LIC1B

---

**Prepared By:** Bourne Consulting Engineering
**Structure Assessment Form**

<table>
<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Mill Pond</td>
<td>10/29/2007</td>
</tr>
</tbody>
</table>

Presumed Structure Owner: Local

Owner Name: Orleans

Based On Comment: 

Earliest Structure Record: Unknown

Estimated Reconstruction/Repair Cost: $14,969.00

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 Feet</td>
<td>Feet NAVD 88</td>
<td>A11</td>
<td>12 Feet NGVD</td>
</tr>
</tbody>
</table>

Primary Type: Revetment

Primary Material: Stone

Primary Height: Under 5 Feet

Secondary Type: 

Secondary Material: 

Secondary Height: 

Structure Summary:
The dumped stone revetment consists of stones that are approximately 2 feet by 1 foot by 1 foot in size. The stones are dumped along the boat ramp.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rating</th>
<th>Priority Rating</th>
<th>Priority Action</th>
<th>Priority Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Fair</td>
<td>None</td>
<td>Long Term Planning Considerations</td>
<td>No Inshore Structures or Residential Dwelling Units Present</td>
</tr>
</tbody>
</table>

Level of Action Moderate

Description Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Structure Images:

- [054-021-000-043-100-PHO1A.JPG](#)
- [054-021-000-043-100-PHO1B.JPG](#)

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Property Owner:
State

Presumed Structure Owner:
State

Owner Name:
MA-DCR

Location:
Namskaket - Wildflower Lane

Based On Comment:

Date:
10/29/2007

Earliest Structure Record:
2006

Estimated Reconstruction/Repair Cost:
$21,330.00

Length:
270 Feet
Top Elevation:
788 Feet NAVD 88

FIRM Map Zone:
V4
FIRM Map Elevation:
16 Feet NGVD

Primary Type:
Coastal Dune
Primary Material:
Sand

Secondary Type:

Secondary Material:

Primary Height:
10 to 15 Feet

Secondary Height:

Structure Summary:
The dunes are at a 1 on 3 slope. The high tide line comes up to the toe of the dunes. Outshore is a beach with some debris. Behind are houses.

Condition Rating
B

Level of Action Rating
Minor

Description Rating
Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating
II

Action Rating
Low Priority

Description Rating
Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
054-023-000-014-100-PHO1A.JPG
054-023-000-014-100-PHO1B.JPG
054-023-000-014-100-PHO1C.JPG

Structure Documents:
MA-DCR
April 2006
Proposed Stone
054-023-000-014-100-DCR1A

DEP
July 30, 2006
Plan and Profiles of
054-023-000-014-100-LIC1A

Prepared By: Bourne Consulting Engineering
**CZM Coastal Infrastructure Inventory and Assessment**

**Structure Assessment Form**

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<td>Revetment</td>
<td>Stone</td>
<td>Under 5 Feet</td>
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<th>Secondary Material:</th>
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**Structure Summary:**
A single line of placed stones lines the side of a boat ramp. The stones are approximately 1 foot by 1 foot by 1 foot in size. The stones have been overgrown. There is a parking area behind the revetment and a boat ramp and pier adjacent.

**Condition Rating**
- **Priority Rating**: None
- **Level of Action Description**: Long Term Planning Considerations
- **Description**: No Inshore Structures or Residential Dwelling Units Present

**Structure Images:**
- 054-042-000-048-100-PHO1A.JPG
- 054-042-000-048-100-PHO1B.JPG
- 054-042-000-048-100-PHO1C.JPG

**Structure Documents:**
- DEP January 1977 Plan Accompanying 054-042-000-048-100-LIC1A

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Orleans
Structure ID: 054-076-000-016-100
Key: community-map-block-parcel-structure

Property Owner: Local

Location: Ellis's Creek

Date: 10/29/2007

Presumed Structure Owner: Local

Based On Comment:

Owner Name: Orleans

Earliest Structure Record: 1986

Estimated Reconstruction/Repair Cost: $15,200.00

Length: 100 Feet

Top Elevation: 88 Feet NAVD

FIRM Map Zone: A16

FIRM Map Elevation: 13 Feet NGVD

Primary Type: Bulkhead/Seawall

Primary Material: Wood

Primary Height: Under 5 Feet

Secondary Type: Stone

Secondary Material: Stone

Secondary Height: Under 5 Feet

Structure Summary:
The timber bulkhead is fully emerged at high tide. The cap and tops of piles are still visible. The bulkhead does not retain the water. The parking area behind the bulkhead is under water also. The bulkhead would not protect any of the houses located behind it. Boats tie off the bulkhead. The stone revetment is adjacent to the bulkhead and boat ramp. There is minor stone movement.

Condition Rating:
Level of Action Description:
Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure/landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent/limit future deterioration and extend life of structure.

Priority Rating Action Description:
III Moderate Priority Consider for Active Project Improvement Listing
Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
054-076-000-016-100-PHO1A.JPG
054-076-000-016-100-PHO1B.JPG

Structure Documents:
DEP April 1986 Plan Accompanying 054-076-000-016-100-LIC1A

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

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Structure Summary:
The dumped stone revetment is at a 1 on 3 slope. The stones are approximately 1 foot by 1 foot by 2 feet. There is stone movement and unraveling throughout. Route 28 is directly behind the revetment. There are houses adjacent to the structure and across the street.

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<td>Moderate</td>
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Structure Images:
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- 054-096-000-026-100-PHO1B.jpg
- 054-096-000-026-100-PHO1C.jpg

Structure Documents:
- MA-DCR June 1946 Proposed Shore 054-096-000-016-100-DCR1A

Prepared By: Bourne Consulting Engineering
Section II - Orleans

Part C

Structure Photographs
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Section II - Orleans

Part D

Structure Documents

TOWN DOCUMENT LIST

MA DCR - DOCUMENT LIST

MA DEP – Ch 91 DOCUMENT LIST
  • Copies of License Documents

USACE – PERMIT DOCUMENT LIST
  • Copies of Permit Documents
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**No Town Documents for the Town of Orleans**
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<td>04-020-000-000-000-001</td>
<td>004-020-000-000-000-001</td>
<td>1</td>
<td>Plan for Proposed Parking Lot at Town of Orleans, Orleans, Massachusetts</td>
<td>July 30, 2002</td>
<td>Orleans</td>
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<td>04-020-000-000-000-002</td>
<td>004-020-000-000-000-002</td>
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<td>Plan for Proposed Parking Lot at Town of Orleans, Orleans, Massachusetts</td>
<td>January 1997</td>
<td>Orleans</td>
<td>Orleans</td>
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<td>04-020-000-000-000-003</td>
<td>004-020-000-000-000-003</td>
<td>1</td>
<td>Plan for Proposed Parking Lot at Town of Orleans, Orleans, Massachusetts</td>
<td>April 1998</td>
<td>Orleans</td>
<td>Orleans</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
(1) All timber to be crosscut, wound, and salt treated.
(2) All hardware to be galvanized.
(3) Outside cross braces to be 4" x 6" timber.
(4) Fill behind wall = 120' + 4'

There is no Harbor Line in the Area of the Proposed Work.

Soundings and Elevations are in Feet and refer to Mean Low Water.
Plan to Accompany Petition of The Town of Orleans
To Construct and Maintain a Bulkhead, Rock Revetment, Fill, Pile and Timber Piers, Ramps, Pile Held Floats & Fingers, and Dredging in ROCK HARBOR, ORLEANS, MA.

NOTES:
1. PROPOSED WORK TO BE ENTIRELY ON LAND OWNED BY THE TOWN OF ORLEANS.
2. SEE ORIGINAL PETITION PLAN DATED 10 OCT. 1975 FOR ABUTTING PROPERTY OWNERS' ADDRESSES.
3. DREDGED MATERIAL (2,100 C.Y.) TO BE USED AS FILL FOR PARKING AREA.
4. ADDITIONAL APPROXIMATE OF FILL TO BE OBTAINED FROM SELECTED LAND SOURCES.

PLAN

LICENSE PLAN NO. 362
Approved by Department of Environmental Quality Engineering of Massachusetts August 19, 1977
COMMISSIONER
CHIEF ENGINEER
SECTION A-A, TYPICAL

SECTION B-B, TYPICAL

Timber Bulkhead Detail

NOTES - CONT'D

5. Elevations on this plan supersede those shown on 10 Oct. 1975 plan, to comply with DEQ requirements of 22 July 77

6. Parking area to be temporarily surfaced with coarse gravel bedding, bituminous pavement to be deferred. A maximum of two years, size of the area is in accordance with DEQ modification of 22 July 77.


8. All pilings, piers, and float timbers to be coated with non-leachant permanent preservatives.

9. All features and structures shown in red indicate the proposed work.

Rock Harbor, Orleans, MA.

08H-016-000-038-200
License Plan No. 362

Approved by Department of Environmental Quality Engineering
Notes:
Existing utilities & buildings to be relocated or removed due to the proposed bulkhead alignment.

Elevations are in feet and tenths and are based on mean low water. Minus figures represent depths below that same plane.

Original bulkhead built in 1953 & 1954 by the Division of Waterways.

Plan accompanying petition of TOWN OF ORLEANS
Proposed bulkhead landing, gangways & floats
Rock Harbor
Orleans, Mass.

FEB. 18, 1986
Sheet 1 of 2

Braman Engineering Company
Civil Engineers & Surveyors

License plan no. 1509
Approved by Department of Environmental Quality Engineer of Massachusetts

Commissioner
Division Director
Section Chief
Date

Robert A. Braman
No. 1095
Registered Professional Engineer
Civil
PLAN TO ACCOMPANY PETITION OF THE
TOWN OF ORLEANS
TO CONSTRUCT AND MAINTAIN A TIMBER
BULKHEAD, ADDITIONAL CONCRETE RAMP,
REDUCTION, FILL, AND FLOATING PIERS IN
TOWN COVE
ORLEANS, MASSACHUSETTS
PLAN TO ACCOMPANY PETITION OF THE TOWN OF ORLEANS TO CONSTRUCT AND MAINTAIN A TIMBER BULKHEAD, ADDITIONAL CONCRETE RAMP, DREDGING AND FILL IN TOWN COVE, ORLEANS, MASSACHUSETTS

LICENSE PLAN NO. 6236
APPROVED BY DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS, AUGUST 1, 1975
PLAN & PROFILES
of
PROPOSED BEACH NOURISHMENT
at
SKaket BEACH ORLEANS, MA
prepared for
TOWN of ORLEANS

Scale: As Noted      Date: JULY 30, 2004

Ryder & Wilcox, Inc.     P.E. & P.L.S
P.O. Box 439 South Orleans, MA  02652

PERMIT NO. 10245
Approved by Department of Environmental Protection
Date: MAY 03 2005
PLAN ACCOMPANYING PETITION OF THE TOWN OF ORLEANS
TO LICENSE AND MAINTAIN AN EXISTING PILE AND TIMBER DOCK, RAMP, FLOAT, AND CONCRETE BOAT RAMP IN MEETINGHOUSE RIVER, ORLEANS, MASS.

NICKERSON & BERGER, INC. ENGINEERS

LICENSE PLAN NO. 377
Approved by Department of Environmental Quality Engineer of Massachusetts JANUARY 9, 1979
COMMISSIONER
CHIEF ENGINEER
NOTES:
1. Elevations are based on the plane of mean low water. Minus figures represent depths below that plane.
2. Prop. Catch basins to have gas traps and hydro-carbon filters. Outlet at bulkhead to have a flap gate.
3. All timber piles & sheeting to be CCA treated with 2.5 pcf. All other timber to be CCA treated with 10 pcf.
4. Public use.

PLAN ACCOMPANYING PETITION OF TOWN OF ORLEANS TO CONSTRUCT TIMBER BULKHEAD IN ELI'S CREEK ORLEANS, MASS.
APRIL 7, 1986
BRAMAN ENGINEERING COMPANY
CIVIL ENGINEERS & SURVEYORS

LICENSE PLAN NO. 1534
Approved by Department of Environmental Quality Engineers of Massachusetts

COMMISSIONER
DIVISION DIRECTOR
SECTION CHIEF
<table>
<thead>
<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sheets</th>
<th>Location</th>
<th>Description</th>
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<td>054-013-000-030-109</td>
<td>054-013-000-030-100-COE1A</td>
<td>82-023</td>
<td>USACE</td>
<td>Orleans</td>
<td>November 1980</td>
<td>Proposed Timber Pier in Neusel Harbor, Orleans, Massachusetts - Application by the Town of Orleans</td>
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<td>Snow Shore Road</td>
<td>Stone Revetment</td>
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<td>054-016-000-038-100-COE1A</td>
<td>61-54</td>
<td>USACE</td>
<td>Orleans</td>
<td>November 1980</td>
<td>Proposed Jetty Extension - Rock Harbor Orleans, Massachusetts - Application by DPHW of Massachusetts - Division of Waterways</td>
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<td>Rock Harbor</td>
<td>Jetty</td>
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<td>054-016-000-038-201</td>
<td>054-016-000-038-200-COE2A</td>
<td>53-58</td>
<td>USACE</td>
<td>Orleans</td>
<td>March 1983</td>
<td>Proposed Bulkhead, Dredging and Fill In Rock Creek at Rock Harbor, Orleans, Massachusetts - DPHW of Massachusetts - Division of Waterways</td>
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<td>Bulkhead</td>
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<tr>
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<td>054-016-000-038-200-COE2B</td>
<td>54-136</td>
<td>USACE</td>
<td>Orleans</td>
<td>April 1954</td>
<td>Proposed Excavation and Bulkhead Construction - Rock Creek - Eastham and Orleans, Massachusetts - Application by the DPHW of Massachusetts - Division of Waterways</td>
<td>2</td>
<td>Rock Harbor</td>
<td>Proposed Bulkhead</td>
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<tr>
<td>054-016-000-038-201</td>
<td>054-016-000-038-200-COE2C</td>
<td>86-228</td>
<td>USACE</td>
<td>Orleans</td>
<td>February 1986</td>
<td>Proposed Bulkhead, Laying, Gargeways and Floats in Rock Harbor, Orleans, Barnstable County, Massachusetts - Application by the Town of Orleans</td>
<td>2</td>
<td>Rock Harbor</td>
<td>Steel Bulkhead</td>
</tr>
<tr>
<td>054-018-000-049-100</td>
<td>054-018-000-049-100-COE1A</td>
<td>74-206</td>
<td>USACE</td>
<td>Orleans</td>
<td>December 1973</td>
<td>Town of Orleans to Construct and Maintain a Timber Bulkhead, Additional Concrete Ramp, Dredging Fill and Floating Piers in Town Cove, Orleans, Massachusetts</td>
<td>1</td>
<td>Town Cove</td>
<td>Timber Bulkhead</td>
</tr>
</tbody>
</table>
Soundings and Elevations are in Feet and refer to Mean Low Water.
NOTE
ELEVATIONS ARE IN FEET AND TENTHS AND REFER TO PLANE OF MEAN LOW WATER. MINUS FIGURES SHOW DEPTHS BELOW THE SAME PLANE.
SIDE AND END SLOPES ARE ALL 1:5 TO 10 APPROX. EXISTING SURFACE SHOWN IN RED. LOCATION OF PROPOSED WORK IS SHOWN IN RED. LENGTH OF NEW EXTENSION APPROX. 100'; LENGTH OF RECONSTRUCTION FOR EXISTING JETTY APPROX. 50'.

PROPOSED JETTY EXTENSION ROCK HARBOR ORLEANS, MASS.
APPLICATION BY DEPARTMENT OF PUBLIC WORKS MASSACHUSETTS DIVISION 2, WATERWAYS NOVEMBER 1960

[Signature]
NOTE
ELEVATIONS ARE IN FEET AND TENTHS.
ABOVE THE PLANE OF MEAN LOW WATER.
AIRPLANE FIGURES SHOW DEPTHS BELOW
THE SAME PLANE.
WORK TO BE DONE HATCHED IN RED.

PROPOSED BULKHEAD, DREDGING & FILL
IN ROCK CREEK
AT
ROCK HARBOR
ORLEANS, MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
MARCH 1953

Everett M. Hutchins
DISTRICT WATERWAYS ENGINEER
NOTE
ELEVATIONS ARE IN FEET AND TENTHS
ABOVE THE PLANE OR MEAN LOW WATER.
MINUS Z. CURVES SHOW DEPTHS BELOW
THE SAME PLANE.
EXCAVATED MATERIAL, APPROXIMATELY
6,000 CUBIC YARDS IN EASTHAM AND
6,000 CUBIC YARDS IN ORLEANS TO BE
DEPOSITED ABOVE M.L.W. IN AREAS
CHOWN ON PLAN.
LOCATIONS OF WORK TO BE DONE ARE
CHOWN IN RED.

PROPOSED EXCAVATION
AND
BULKHEAD CONSTRUCTION
ROCK CREEK
EASTHAM & ORLEANS, MASS.
APPLICATION OF
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
APRIL 1954
SCALE SHOWN

Julia R. Keene
Hingham, Mass.

EASTHAM
Town of Eastham

EXCAVATE TO 3 FT.
BELOW M.L.W.

EXCAVATE TO 1 FT.
ABOVE M.L.W.

Disposal Area

PROPOSED BULKHEAD

ORLEANS

PLAN
SCALE: FEET
1:2000

LOCATION PLAN
SPACE: FEET
11.29.50

054-016-000-038-200

BOSTON, MASS.
NOTES:
EXISTING UTILITIES & BUILDING TO BE RELOCATED OR REMOVED DUE TO THE PROPOSED BULKHEAD ALIGNMENT
ELEVATIONS ARE IN FEET AND TENTHS AND ARE BASED ON MEAN LOW WATER. MINUS FIGURES REPRESENT DEPTHS BELOW THAT SAME PLANE.

ORIGINAL BULKHEAD BUILT IN 1953 ± 1954 BY THE DIVISION OF WATERWAYS.

PROPOSED BULKHEAD, LANDINGS, GANGWAYS & FLOATS IN ROCK HARBOR
ORLEANS, BARNSTABLE CO. MA.
APPLICATION BY TOWN OF ORLEANS
FEB. 16, 1986 SHEET 1 OF 8
BRAMAH ENGINEERING CO.
CIVIL ENGINEERS SURVEYORS
258 MAIN ST. BUZZARDS BAY, MA.
Section III

Brewster
Section III – Community Findings – Town of Brewster

COMMUNITY DESCRIPTION

The Town of Brewster consists of a land area of 23.01 square miles out of a total area of 25.48 square miles and had a population of 10,094 in the 2000 census. The Town is located on Cape Cod of Massachusetts and its location can be seen on this report’s cover. The estimated length of shoreline is 7 miles that are directly exposed to open ocean. The Town is protected from major coastal storms by both natural and man-made shoreline structures that require maintenance to insure the long term protection of its coastline. The man-made and publicly owned structures that protect the Town were investigated for their ability to provide adequate protection from major coastal storms. Structures have been identified as publicly owned, including coastal dunes and beaches, based on evidence of investment of public funds made to create/enhance/maintain these structures. The assessment did not include floating or pile supported structures as they are assumed not to provide any significant coastal protection from major storm events.

STRUCTURE INVENTORY

Within the Town of Brewster, there were 2 structures which had public or unknown ownership which provide significant coastal protection. The location of the structures can be seen on Sheet 1 in Section III-B of this report. The structures were categorized by their type and by their structural condition based on a preliminary field assessment. The distribution of structures by type and condition can be seen in the following table:

<table>
<thead>
<tr>
<th>Primary Structure (t)</th>
<th>Total Structures</th>
<th>Total Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead / Seawall</td>
<td>1</td>
<td>545</td>
</tr>
<tr>
<td>Revetment</td>
<td>1</td>
<td>275</td>
</tr>
<tr>
<td>Breakwater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groin / Jetty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal Dune</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Coastal Beach</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Within the above table, the total length of each type of structure is also provided. The structures are listed by the type which is providing the primary coastal protection. Many sites have multiple structure types at the same location (i.e. revetment in front of seawall). These secondary structures, although not identified within these tables, are included in the development of repair/rehabilitation costs.

The development of repair costs has been included by structure type and by condition. In the Town of Brewster's case there are a total of 2 structures which would require approximately $511,000 to bring all the coastal structures to “A” Rating. Most critical will be the structures in the “D” and “F” classifications as those are assumed to undergo some level of damage or failure during the next major coastal storm event of which Brewster has none.
STRUCTURE REPAIR / RECONSTRUCTION COST - Town of Brewster

<table>
<thead>
<tr>
<th>Primary Structure (1)</th>
<th>Total Structures</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead / Seawall</td>
<td>1</td>
<td></td>
<td>$181,289</td>
<td></td>
<td></td>
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<td>$181,289</td>
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<tr>
<td>Revetment</td>
<td>1</td>
<td></td>
<td></td>
<td>330,275</td>
<td></td>
<td></td>
<td>$330,275</td>
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<tr>
<td>Breakwater</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ -</td>
</tr>
<tr>
<td>Groin / Jetty</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ -</td>
</tr>
<tr>
<td>Coastal Dune</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ -</td>
</tr>
<tr>
<td>Coastal Beach</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ -</td>
</tr>
</tbody>
</table>

2 $ - $ - $ 511,564 $ - $ - $ 511,564

Based on the limited research within the scope of this project research, the presumed ownership of the structures was established on an initial basis and would be subject to more intense review in future tasks. Structures identified as being owned privately were excluded from further consideration. Although ownership of the land on which the structure was located was a factor, the structure ownership was treated as a separate issue from land ownership. For the Town of Brewster, the breakdown of structures by assumed ownership is as follows:

STRUCTURE OWNERSHIP / REPAIR COST - Town of Brewster

<table>
<thead>
<tr>
<th>Primary Structure (1)</th>
<th>Total Structures</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
<th>Total Cost</th>
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<tr>
<td>Town Owned</td>
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<td>$511,564</td>
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<td>Commonwealth of Mass.</td>
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<tr>
<td>Federal Government</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ -</td>
</tr>
<tr>
<td>Unknown Ownership</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ -</td>
</tr>
</tbody>
</table>

2 $ - $ - $ 511,564 $ - $ - $ 511,564

The identification of presumed ownership was not based on the investigation of legal documents but relied on property ownership and from construction and regulatory documents that were found. A more detailed investigation of legal documents and agreements would be required where structure ownership is disputed. A more detailed identification of structure type, length, condition and location can be found in Section III-B which contains Structure Assessment Reports for each individual structure found.

SUMMARY

The enclosed reports and associated documents reflects the Town of Brewster’s coastal structure information that will eventually be input into a state-wide GIS database and will be accessible through MassGIS. This data, when compiled state-wide, will be critical in the development of both short term and long term planning for maintaining and improving Massachusetts coastal protection.

This database will also provide relatively quick access to identify available documentation for these structures as well as the ability to be updated as coastal structure improvements are made.
Section III - Brewster

Part B

Structure Assessment Reports
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Brewster

Location: Paines Creek Beach
Earliest Structure Record: Unknown
Date: 10/2/2007
Estimated Reconstruction/Repair Cost: $181,289.00

Length: 545 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: V4
FIRM Map Elevation: 16 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: Under 5 Feet
Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is the revetment fronting the parking lot at Paines Creek Beach. There is some slumping of the crest and erosion is evident behind the structure.

Condition C
Rating Fair
Level of Action Moderate
Description Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority II
Rating Low Priority
Action Future Project Consideration
Description Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
[009-038-000-701-100-PHO1A.jpg]

Structure Documents:
USACE January 1955 Proposed Stone 009-038-000-701-100-COE1A
USACE June 1958 Proposed Stone 009-038-000-701-100-COE1B

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Brewster

Location: Paines Creek Beach
Based On Comment: 
Earliest Structure Record: 1953

Date: 10/2/2007
Estimated Reconstruction/Repair Cost: $330,275.00

Length: 275 Feet
FIRM Map Zone: V4
FIRM Map Elevation: 16 Feet NGVD
Top Elevation: 

Primary Type: Groin/ Jetty
Primary Material: Stone
Primary Height: 5 to 10 Feet

Secondary Type: 
Secondary Material: 
Secondary Height: 

Structure Summary:
These structures are the two groins at Paines Creek Beach. The side slopes and crest are in fair condition. Some loss of fill stone is evident.

Condition C
Rating Fair
Level of Action Moderate
Description Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority II
Rating Low Priority
Action Future Project Consideration
Description Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
009-038-000-701-200-PHO2A.jpg

Structure Documents:

<table>
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<tr>
<th>USACE</th>
<th>June 1958</th>
<th>Proposed Stone</th>
<th>009-038-000-701-200-COE2A</th>
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<tbody>
<tr>
<td>MA-DCR</td>
<td>December 1</td>
<td>Proposed Shore</td>
<td>009-038-000-701-200-DCR2A</td>
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<tr>
<td>MA-DCR</td>
<td>May 1958</td>
<td>Proposed Shore</td>
<td>009-038-000-701-200-DCR2B</td>
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Prepared By: Bourne Consulting Engineering
Section III - Brewster

Part C

Structure Photographs
<table>
<thead>
<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sheets</th>
<th>Location</th>
<th>Description</th>
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<td>009-038-003-701-100-PH01A.jpg</td>
<td>Bourne Consulting Engineering</td>
<td>October 2007</td>
<td>DIGITAL IMAGE</td>
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<td>Structure Location</td>
<td>Structure Condition Photo at Time of Survey</td>
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<td>009-038-000-701-200-PH02A.jpg</td>
<td>Bourne Consulting Engineering</td>
<td>October 2007</td>
<td>DIGITAL IMAGE</td>
<td>1</td>
<td>Structure Location</td>
<td>Structure Condition Photo at Time of Survey</td>
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<td></td>
</tr>
</tbody>
</table>
Section III - Brewster

Part D

Structure Documents

TOWN DOCUMENT LIST

MA DCR - DOCUMENT LIST

MA DEP – Ch 91 DOCUMENT LIST
  - Copies of License Documents

USACE – PERMIT DOCUMENT LIST
  - Copies of Permit Documents
<table>
<thead>
<tr>
<th>Document No.</th>
<th>Contact Email</th>
<th>Municipality</th>
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<th>Title</th>
<th>Sheets</th>
<th>Location</th>
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<td>Contract/ Drawing Number</td>
<td>Entity</td>
<td>Municipality</td>
<td>Date</td>
<td>Title</td>
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<tr>
<td>009-038-000-701-200</td>
<td>009-038-000-701-200-DCR2A</td>
<td>1352</td>
<td>MA-DCR</td>
<td>Brewster</td>
<td>Dec-53</td>
<td>Proposed Shore Protection - Groin Construction - Brewster - Prepared for DPW of Massachusetts - Division of Waterways</td>
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</table>
No DEP Ch. 91 Licenses for the Town of Brewster

<table>
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<tr>
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<th>Sheets</th>
<th>Location</th>
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<td>Contract Drawing Number</td>
<td>Entity</td>
<td>Municipality</td>
<td>Date</td>
<td>Title</td>
<td>Sheets</td>
<td>Location</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>-------------------------</td>
<td>--------</td>
<td>--------------</td>
<td>-----------</td>
<td>----------------------------------------------------------------------</td>
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<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>009-038-000-701-100</td>
<td>009-038-000-701-100-C01A</td>
<td>N/A USACE Brewster</td>
<td>January 1958</td>
<td>Proposed Stone Groins and Riprap - Cape Cod Bay, Brewster, MA</td>
<td>2</td>
<td>Paines Creek Road</td>
<td>Groins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>009-038-000-701-190</td>
<td>009-038-000-701-190-C01B</td>
<td>N/A USACE Brewster</td>
<td>June 1958</td>
<td>Proposed Stone Groin and Mound Paines Creek Landing - Cape Cod Bay, Brewster, MA</td>
<td>1</td>
<td>Paines Creek Landing</td>
<td>Groin and Mound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>009-038-000-701-200</td>
<td>009-038-000-701-200-C02A</td>
<td>N/A USACE Brewster</td>
<td>June 1958</td>
<td>Proposed Stone Groin and Mound Paines Creek Landing - Cape Cod Bay, Brewster, MA</td>
<td>1</td>
<td>Paines Creek Landing</td>
<td>Groin and Mound</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTE
ELEVATIONS ARE IN FEET AND TENTHS
ABOVE PLANE OF MEAN LOW WATER,
APPROX.SURFACE EXISTING GROUND SHOWN
THUS, 
ALL RISE AND END SLOPES 1/4 TO 1.
LOCATION PROPOSED WORK SHOWN IN RED.

PROPOSED
STONE GROINS & RIPRAP
CAPE COD BAY
BREWSTER - MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS - MASSACHUSETTS
DIVISION OF WATERWAYS
JANUARY 1956

Robert W. MacDonald
NOTE

ELEVATIONS ARE IN FEET AND TENTHS AND REFER TO PLANE OF MEAN LOW WATER.
APPROX. EXISTING GROUND SHOWN THUS "THAT SIDE AND END SLOPES OF groin ARE 1:5 TO 1:9. LOCATION OF PROPOSED WORK IS SHOWN ON THIS PLAN IN RED.

PROPOSED
STONE groin AND MOUND
PAINES CREEK LANDING
CAPE COD BAY
BREWSER-MASS.
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
JUNE-1958

[Signature]
NOTE
ELEVATIONS ARE IN FEET AND TENTHS
AND REFER TO PLANE OF MEAN LOW WATER.
APPROX. EXISTING GROUND SHOWN THUS "XX")
SIDE AND END SLOPES OF GROIN ARE 1.5 TO 1.0.
LOCATION OF PROPOSED WORK IS SHOWN
ON THIS PLAN IN RED.

PROPOSED
STONE GROIN AND MOUND
PAINES CREEK LANDING
CAPE COD BAY
BREWSTER, MASS.
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERSWAYS
JUNE 1958

Robert B. Markham
Section IV

Harwich
Section IV – Community Findings – Town of Harwich

COMMUNITY DESCRIPTION

The Town of Harwich consists of a land area of 21.04 square miles out of a total area of 33.15 square miles and had a population of 12,386 in the 2000 census. The Town is located on Cape Cod of Massachusetts and its location can be seen on this report’s cover. The estimated length of shoreline is 5 miles that are directly exposed to open ocean. The Town is protected from major coastal storms by both natural and man-made shoreline structures that require maintenance to insure the long term protection of its coastline. The man-made and publicly owned structures that protect the Town were investigated for their ability to provide adequate protection from major coastal storms. Structures have been identified as publicly owned, including coastal dunes and beaches, based on evidence of investment of public funds made to create/enhance/maintain these structures. The assessment did not include floating or pile supported structures as they are assumed not to provide any significant coastal protection from major storm events.

STRUCTURE INVENTORY

Within the Town of Harwich, there were 16 structures which had public or unknown ownership which provide significant coastal protection. The location of the structures can be seen in Sheets 1 through Sheet 6 in Section IV-B of this report. The structures were categorized by their type and by their structural condition based on a preliminary field assessment. The distribution of structures by type and condition can be seen in the following table:

**STRUCTURE TYPE AND QUANTITY - Town of Harwich**

<table>
<thead>
<tr>
<th>Primary Structure (1)</th>
<th>Total Structures</th>
<th>Structure Condition Rating</th>
<th>Total Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Bulkhead / Seawall</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revetment</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakwater</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groin / Jetty</td>
<td>4</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Coastal Dune</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal Beach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>2</td>
<td>13</td>
</tr>
</tbody>
</table>

Within the above table, the total length of each type of structure is also provided. The structures are listed by the type which is providing the primary coastal protection. Many sites have multiple structure types at the same location (i.e. revetment in front of seawall). These secondary structures, although not identified within these tables, are included in the development of repair/rehabilitation costs.

The development of repair costs has been included by structure type and by condition. In the Town of Harwich’s case there are a total of 16 structures which would require approximately $3.7 million to bring all the coastal structures to “A” Rating. Most critical will be the structures in the “D” and “F” classifications as those are assumed to undergo some level of damage or failure during the next major coastal storm event. To reconstruct these structures, identified in the preliminary survey as being in poor condition, an estimated $165,000 would be required to upgrade the Town’s coastal protection.
Based on the limited research within the scope of this project research, the presumed ownership of the structures was established on an initial basis and would be subject to more intense review in future tasks. Structures identified as being owned privately were excluded from further consideration. Although ownership of the land on which the structure was located was a factor, the structure ownership was treated as a separate issue from land ownership. For the Town of Harwich, the breakdown of structures by assumed ownership is as follows:

**SUMMARY**

The enclosed reports and associated documents reflects the Town of Harwich's coastal structure information that will eventually be input into a state-wide GIS database and will be accessible through MassGIS. This data, when compiled state-wide, will be critical in the development of both short term and long term planning for maintaining and improving Massachusetts coastal protection.

This database will also provide relatively quick access to identify available documentation for these structures as well as the ability to be updated as coastal structure improvements are made.
Section IV - Harwich

Part B

Structure Assessment Reports
COASTAL STRUCTURE LOCATION PLAN

TOWN OF HARWICH
COASTAL INFRASTRUCTURE INVENTORY
AND ASSESSMENT PROJECT
NOVEMBER 2007

SCALE: 1" = 150'

ALLEN'S HARBOR
LOWER COUNTY ROAD

032-12Y1-000-58A-200
032-12Y1-000-58A-300
032-12Y1-000-68A-100
032-006-000-008-100
032-006-000-008-200
**CZM Coastal Infrastructure Inventory and Assessment**

**Structure Assessment Form**

<table>
<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Central Avenue</td>
<td>10/16/2007</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presumed Structure Owner:</th>
<th>Based On Comment:</th>
<th>Earliest Structure Record:</th>
<th>Estimated Reconstruction/Repair Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td></td>
<td>Unknown</td>
<td>$18,018.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Feet</td>
<td>Feet NAVD 88</td>
<td>V8</td>
<td>18 Feet NGVD</td>
</tr>
</tbody>
</table>

**Primary Type:** Revetment  
**Primary Material:** Stone  
**Primary Height:** 5 to 10 Feet

**Secondary Type:**  
**Secondary Material:**  
**Secondary Height:**

**Structure Summary:**
This structure is a revetment at the end of Central Avenue. The side slope is in good condition but there is some erosion evident behind the crest. There is vegetation growing from between the armor stones. The structure toe is buried.

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Priority Rating</th>
<th>Level of Action Description</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Fair</td>
<td>III Moderate Priority</td>
<td>Moderate</td>
<td>Consider for Active Project Improvement Listing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.</td>
<td></td>
</tr>
</tbody>
</table>

**Structure Images:**  
[032-006-000-00B-100-PH01A.jpg]

**Structure Documents:**  

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich

Location: Central Avenue
Based On Comment: 
Earliest Structure Record: Unknown

Date: 10/16/2007
Estimated Reconstruction/Repair Cost: $165,990.00

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 Feet</td>
<td>Feet NAVD 88</td>
<td>V8</td>
<td>18 Feet NGVD</td>
</tr>
</tbody>
</table>

Primary Type: Groin/ Jetty
Primary Material: Stone
Primary Height: Under 5 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a groin at the end of Central Avenue. It is unraveled and leaking sand. There is very little interlocking evident between adjacent armor stones.

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Priority Rating</th>
<th>Level of Action</th>
<th>Action Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Poor</td>
<td>I None</td>
<td>Major</td>
<td>Long Term Planning Considerations</td>
</tr>
<tr>
<td>Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Structure Images:
[032-006-000-00B-200-PHO2A.jpg]

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner:
Local

Presumed Structure Owner:
Local

Owner Name:
Harwich

Location:
Allens Harbor

Based On Comment:

Earliest Structure Record:
1965

Estimated Reconstruction/Repair Cost:
$104,326.00

Length:
165 Feet

Top Elevation:
Feet NAVD 88

FIRM Map Zone:
V13

FIRM Map Elevation:
Feet NGVD 13

Primary Type:
Bulkhead/ Seawall

Primary Material:
Wood

Primary Height:
5 to 10 Feet

Secondary Type:

Secondary Material:

Secondary Height:

Structure Summary:
This structure is a bulkhead at Allens Harbor. This structure fronts a parking lot for the marina and has floating dockage on the water side. The timbers on the wall front are weathered while the cap is cracked and splintered in places. No inspection below water line.

Condition
C

Rating
Fair

Level of Action
Moderate

Description
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority
III

Rating
Moderate Priority

Action
Consider for Active Project Improvement Listing

Description
Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
032-12Y1-000-58A-100-PHO1A.jpg

Structure Documents:

<table>
<thead>
<tr>
<th>Usage</th>
<th>Date</th>
<th>Document Type</th>
<th>ID</th>
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</thead>
<tbody>
<tr>
<td>USACE</td>
<td>March 1965</td>
<td>Proposed Harbor</td>
<td>032-12Y1-000-58A-100-COE1A</td>
</tr>
<tr>
<td>DEP</td>
<td>January 198</td>
<td>Plan Accompanying</td>
<td>032-12Y1-000-58A-100-LIC1A</td>
</tr>
<tr>
<td>DEP</td>
<td>November 1</td>
<td>Plans Accompanying</td>
<td>032-12Y1-000-58A-100-LIC1B</td>
</tr>
</tbody>
</table>

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich
Location: Allens Harbor
Based On Comment:
Earliest Structure Record: Unknown
Estimated Reconstruction/Repair Cost: $27,027.00

Length: 45 Feet NAVD 88
Top Elevation: 10 Feet NGVD
FIRM Map Zone: A8
FIRM Map Elevation:

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet

Secondary Type: 
Secondary Material: 
Secondary Height:

Structure Summary:
These structures are the abutments at the Lower County Road bridge over Allens Harbor (West Side). They are generally in good condition but there is some slumping in the southwest corner.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
032-12Y1-000-58A-200-PHO2A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich
Location: Allens Harbor
Based On Comment: 
Earliest Structure Record: Unknown
Estimated Reconstruction/Repair Cost: $27,027.00

Date: 10/16/2007

Length: 45 Feet
Top Elevation: 10 Feet NAVD 88
FIRM Map Zone: A8
FIRM Map Elevation: 10 Feet NGVD
Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet
Secondary Type: 
Secondary Material: 
Secondary Height: 

Structure Summary:
These structures are the abutments at the Lower County Road bridge over Allens Harbor (East Side). They are generally in good condition but there is some slumping in the southwest corner.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing

Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
[032-12Y1-000-58A-300-PHO3A.jpg]

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich

Location: Saquatucket Harbor
Based On Comment:
Earliest Structure Record: 1968
Estimated Reconstruction/Repair Cost: $398,475.00

Length: 525 Feet
Top Elevation: A10 Feet NAVD 88
FIRM Map Zone: A10
FIRM Map Elevation: 11 Feet NGVD

Primary Type: Bulkhead/Seawall
Primary Material: Concrete
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a concrete bulkhead fronting the parking lot at Saquatucket Harbor. The concrete is discolored but solid. There is a minimum of cracking and spalling evident.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing
inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
032-15T-000-003-100-PHO1A.jpg

Structure Documents:
USACE October 196 Proposed Marina 032-15T-000-003-100-COE1A
MA-DCR September 1 Proposed Marina 032-15T-000-003-100-DCR1A

Prepared By: Bourne Consulting Engineering
### CZM Coastal Infrastructure Inventory and Assessment

#### Structure Assessment Form

<table>
<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Saquatucket Harbor</td>
<td>10/16/2007</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presumed Structure Owner:</th>
<th>Earliest Structure Record:</th>
<th>Estimated Reconstruction/Repair Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>1968</td>
<td>$197,340.00</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner Name:</th>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
<th>Primary Type:</th>
<th>Primary Material:</th>
<th>Primary Height:</th>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
<th>Secondary Height:</th>
<th>Structure Summary:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harwich</td>
<td>260</td>
<td>Feet NAVD 88</td>
<td>A10</td>
<td>11 Feet NGVD</td>
<td>Bulkhead/Seawall</td>
<td>Concrete</td>
<td>5 to 10 Feet</td>
<td></td>
<td></td>
<td></td>
<td>This structure is a concrete bulkhead on the east side of Saquatucket Harbor. It is aged and discolored. There is some minor cracking and spalling evident.</td>
</tr>
</tbody>
</table>

#### Condition

<table>
<thead>
<tr>
<th>Rating</th>
<th>Priority</th>
<th>Level of Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair</td>
<td>III</td>
<td>Moderate</td>
<td>Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.</td>
</tr>
</tbody>
</table>

#### Structure Images:
- [032-15T-000-003-200-PHO2A.jpg](#)

#### Structure Documents:
- Usage: October 196, Proposed Marina: 032-15T-000-003-200-COE2A
- MA-DCR: September 1, Proposed Marina: 032-15T-000-003-200-DCR2A

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich

Location: Wychmere Harbor

Earliest Structure Record: 1961

Date: 10/16/2007

Estimated Reconstruction/Repair Cost: $116,972.00

Length: 185 Feet
Top Elevation: 11 Feet NAVD 88
FIRM Map Zone: A10
FIRM Map Elevation: 11 Feet NGVD

Primary Type: Bulkhead/ Seawall
Primary Material: Wood
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a bulkhead at the Wychmere Harbor town pier. The structure fronts a parking lot and is adjacent to town dockage. It is weathered but sound.

Condition Rating: C
Level of Action Description: Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating: III
Action Description: Moderate Priority
Consider for Active Project Improvement Listing
Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
032-15U-000-023-100-PHO1A.jpg

Structure Documents:
MA-DCR: July 1961
Proposed Harbor
DEP: September 1
Plan Accompanying
032-15U-000-023-100-DCR1A
032-15U-000-023-100-LIC1A

Prepared By: Bourne Consulting Engineering
CZN Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

**Property Owner:**
Local

**Presumed Structure Owner:**
Local

**Owner Name:**
Harwich

**Location:**
Red River Beach

**Based On Comment:**

**Earliest Structure Record:**
1953

**Estimated Reconstruction/Repair Cost:**
$285,520.00

**Length:**
430 Feet

**Top Elevation:**
88 Feet NAVD

**FIRM Map Zone:**
V13

**FIRM Map Elevation:**
15 Feet NGVD

**Primary Type:**
Groin or Jetty

**Primary Material:**
Stone

**Primary Height:**
Under 5 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:**
These structures are the groin field at Red River Beach. There are 9 groins recorded. The western 8 groins alternate in length with one short groin between 2 longer ones. There is a terminal groin at the eastern end of the field which is approximately twice the length of the longer groins. The armor stones on these structures are becoming unraveled.

**Condition Rating**
Moderate

**Level of Action Description**
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

**Priority Rating**
None

**Action Description**
No Inshore Structures or Residential Dwelling Units Present

**Structure Images:**
032-17N3-000-001-100-PHO1A.jpg

**Structure Documents:**

<table>
<thead>
<tr>
<th>Structure</th>
<th>Provenance</th>
<th>Date</th>
<th>Document Type</th>
<th>Document ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>USACE</td>
<td>July 1953</td>
<td>Proposed Beach</td>
<td>032-17N3-000-001-100-C0E1A</td>
<td></td>
</tr>
<tr>
<td>USACE</td>
<td>March 1959</td>
<td>Proposed Groins and Shore</td>
<td>032-17N3-000-001-100-C0E1B</td>
<td></td>
</tr>
<tr>
<td>MA-DCR</td>
<td>December 1</td>
<td>Proposed Shore</td>
<td>032-17N3-000-001-100-DCR1A</td>
<td></td>
</tr>
<tr>
<td>MA-DCR</td>
<td>November 1</td>
<td>Proposed Beach</td>
<td>032-17N3-000-001-100-DCR1B</td>
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Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Town: Harwich
Structure ID: 032-281-000-018-100
Key: community-map-block-parcel-structure

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich

Location: Pleasant Road Beach
Based On Comment:

Earliest Structure Record: 1947
Estimated Reconstruction/Repair Cost: $12,540.00

Length: 95 Feet
Top Elevation: 88 Feet NAVD 88
FIRM Map Zone: V13
FIRM Map Elevation: 15 Feet NGVD

Primary Type: groin/jetty
Primary Material: Stone
Primary Height: Under 5 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is the groin at Pleasant Road beach. There is some minor slumping of the armor stone evident. The beach is impounded to the crest on the updrift (west) side while the downdrift side is exposed to the toe.

Condition Rating Level of Action Description
B Good Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
I None No Inshore Structures or Residential Dwelling Units Present

Structure Images:
032-281-000-018-100-PHO1A.jpg

Structure Documents:
USACE February 19 Proposed Stone Jetty 032-281-000-018-100-COE1A
USACE March 1954 Proposed Stone 032-281-000-018-100-COE1B
MA-DCR March 1954 Proposed Shore 032-281-000-018-100-DCR1A

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich
Location: Grey Neck Road
Based On Comment: 
Earliest Structure Record: Unknown
Estimated Reconstruction/Repair Cost: $30,030.00

Length: 50 Feet NAVD 88
Top Elevation: 13 Feet NGVD
FIRM Map Zone: V13
FIRM Map Elevation: 

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet
Secondary Type: 
Secondary Material: 
Secondary Height: 

Structure Summary:
This structure is a stone revetment at the foot of the dune at Grey Neck Beach. The armor east of the stairs is slumped with erosion evident behind it. The revetment toe is buried and the dune above is vegetated.

Condition Rating
Fair
Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating
Low Priority
Future Project Consideration
Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Harwich
Location: Herring River
Based On Comment:
Earliest Structure Record: Unknown
Estimated Reconstruction/Repair Cost: $30,030.00
Date: 10/16/2007

Length: 50 Feet
Top Elevation: NAVD 88
FIRM Map Zone: V13
FIRM Map Elevation: 12 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet
Secondary Type:
Secondary Material:
Secondary Height:

Structure Summary:
These structures are the armored abutments at the Lower County Road bridge over the Herring River (West Side). The riprap is in good condition. There is some slumping at the southwest corner that has begun to undermine the bridge footing.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extends life.
Priority Rating Action Description
IV High Priority Consider for Next Project Construction Listing High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images: 032-4N3-000-00B-100-PHO1A.jpg
Structure Documents:

Prepared By: Bourne Consulting Engineering
**CZM Coastal Infrastructure Inventory and Assessment**

**Structure Assessment Form**

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<th>Date:</th>
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**Structure Summary:**
These structures are the armored abutments at the Lower County Road bridge over the Herring River (East Side). The riprap is in good condition. There is some minor slumping along the north side.

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<th>Condition Rating</th>
<th>Priority Rating</th>
<th>Level of Action Description</th>
<th>Priority Action Description</th>
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<tr>
<td>C Fair</td>
<td>IV High Priority</td>
<td>Moderate</td>
<td>Consider for Next Project Construction Listing</td>
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Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

**Structure Images:**
032-4N3-000-00B-200-PH02A.jpg

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
**CZM Coastal Infrastructure Inventory and Assessment**

**Structure Assessment Form**

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<tr>
<td>Groin Jetty</td>
<td>Stone</td>
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**Structure Summary:**

This structure is a groin at Earle Road Beach. The side slopes and crest are in good condition. The beach is impounded to the groin crest on the updrift (west) side while the groin is exposed to the toe on the downdrift side.

**Condition Rating**

- **B**
- Good

**Level of Action Description**

Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

**Priority Rating Action Description**

- **1**
- None
- Long Term Planning Considerations
- No Inshore Structures or Residential Dwelling Units Present

**Structure Images:**

- 032-5P4-000-009-100-PHO1A.jpg

**Structure Documents:**

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<th>MA-DCR</th>
<th>August 1936</th>
<th>Proposed Shore</th>
<th>032-5P4-000-009-100-DCR1A</th>
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<td>November 1</td>
<td>Proposed Shore</td>
<td>032-5P4-000-009-100-DCR1B</td>
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Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment  

Structure Assessment Form

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<th>FIRM Map Zone:</th>
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<td>V13</td>
<td>14 Feet NGVD</td>
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<td>Stone</td>
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<table>
<thead>
<tr>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
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Structure Summary:  
This structure is a stone revetment along the west bank of the entrance to Wychmere Harbor. The stones are almost stacked vertically and the revetment abuts a vertical stone wall. The armor stones are cracked and slumped in sections.

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<thead>
<tr>
<th>Condition Rating</th>
<th>Level of Action Description</th>
<th>Priority Rating</th>
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<tr>
<td>C</td>
<td>Moderate</td>
<td>Moderate Priority</td>
<td>Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (&lt;1 dwelling impacted / 100 feet of shoreline)</td>
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<td>Fair</td>
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Structure Images:
[032-8P1-000-002-100-PHO1A.jpg]

Structure Documents:
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<td>March 1956</td>
<td>MA-DCR</td>
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Prepared By: Bourne Consulting Engineering
## CZM Coastal Infrastructure Inventory and Assessment
### Structure Assessment Form

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<th>Property Owner:</th>
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<tr>
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<table>
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<tr>
<td>This structure is a stone breakwater extending past the entrance to Wychmere Harbor. It is mostly in good condition. Some sections near the bend are slumped and the crest is collapsed. Some areas show small displacement of the side slope stones from the crest.</td>
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### Condition Rating
- **Priority Rating**
  - **Level of Action Description**
  - **Description**
    - **C**
      - Fair
      - Moderate
      - Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

### Structure Images:
- 032-8P1-000-002-200-PHO2A.jpg
- 032-8P1-000-002-200-PHO2B.jpg
- 032-8P1-000-002-200-PHO2C.jpg

### Structure Documents:
- MA-DCR
  - July 1947
  - Proposed Channel 032-8P1-000-002-200-DCR2A

Prepared By: Bourne Consulting Engineering
Section IV - Harwich

Part C

Structure Photographs
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<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
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</table>
Section IV - Harwich

Part D

Structure Documents

TOWN DOCUMENT LIST

MA DCR - DOCUMENT LIST

MA DEP – Ch 91 DOCUMENT LIST

- Copies of License Documents

USACE – PERMIT DOCUMENT LIST

- Copies of Permit Documents
<table>
<thead>
<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sheets</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
</table>

No Town Documents for the Town of Harwich
<table>
<thead>
<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sections</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>032-12Y1-000-58A-100</td>
<td>032-12Y1-000-58A-100-L1C1A</td>
<td>1191</td>
<td>DEP</td>
<td>Harwich</td>
<td>January 1985</td>
<td>Plan Accompanying Petition of Town of Harwich to Construct and Maintain a Boat Launching Ramp in Allen's Harbor, Harwich, County of Barnstable, Massachusetts</td>
<td>3</td>
<td>Allen's Harbor</td>
<td>Shows Existing Bulkhead License 24353</td>
</tr>
<tr>
<td>032-12Y1-000-58A-100</td>
<td>032-12Y1-000-58A-100-L1C1B</td>
<td>2400</td>
<td>DEP</td>
<td>Harwich</td>
<td>November 1990</td>
<td>Plan Accompanying Petition of Town of Harwich - Allen's Harbor Boat Ramp Addition</td>
<td>2</td>
<td>Allen's Harbor</td>
<td>Shows Existing Bulkhead</td>
</tr>
<tr>
<td>032-15U-000-023-100</td>
<td>032-15U-000-023-100-L1C1A</td>
<td>588</td>
<td>DEP</td>
<td>Harwich</td>
<td>September 1979</td>
<td>Plan Accompanying Petition of the Town of Harwich to Construct and Maintain a Concrete Pier, Pile Heel Floats and Ramps, and Wood Mooring Piles and to Maintain Existing Bulkhead Constructed of Steel and an Existing Wood Pile Supported 1 Story Building In</td>
<td>2</td>
<td>Wychmere Harbor</td>
<td>Maintain Existing Bulkhead</td>
</tr>
</tbody>
</table>
PLAN ACCOMPANYING PETITION OF TOWN OF HARWICH TO CONSTRUCT AND MAINTAIN A BOAT LAUNCHING RAMP IN ALLENS HARBOR, HARWICH, COUNTY OF BARNSTABLE, MASS.
PLANS ACCOMPANYING PETITION OF:
TOWN OF HARWICH,
ALLENS HARBOR BOAT RAMP ADDITION.
HARWICH ENGINEERING DEPT.
SCALE: 1" = 40'

LICENSE PLAN NO. 2490
Approved by Department of Environmental Protection

COMMISSIONER
SECTION CHIEF
EXISTING BOAT RAMP (FILE NO: DF-166)
DEQ LICENSE #1191

MLW

MLWS

6'-0"

STEEL PLATE EXTENSION

2'-0"

RAMP ADDITION - CROSS SECTION
Scale: 1/2" = 1'-0"

FILL WITH CRUSHED STONE

LICENSE PLAN NO. 2490
Approved by Department of Environmental Protection
Date: NOV 30 1990
<table>
<thead>
<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sheets</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>032-12Y1-000-55A-100</td>
<td>032-12Y1-000-55A-100-COE1A</td>
<td>65-67 USACE Harwich</td>
<td>March 1965</td>
<td>Proposed Harbor Improvements Dexter and Timber Bulkhead - Allen Harbor - Harwich, Massachusetts - Application by DPW of Massachusetts - Division of Waterways</td>
<td>2</td>
<td>Allen Harbor</td>
<td>Timber Bulkhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>032-15T-000-003-100</td>
<td>032-15T-000-003-100-COE1A</td>
<td>68-352 USACE Harwich</td>
<td>October 1968</td>
<td>Proposed Marina Facility - Bulkhead, Floats, Access Ramp and Parking Area - Saquatsuck Harbor - Formerly Andrews River - Harwich, Massachusetts - Application by DPW of Massachusetts - Division of Waterways</td>
<td>2</td>
<td>Saquatsuck Harbor</td>
<td>Bulkhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>032-17N3-000-001-100</td>
<td>032-17N3-000-001-100-COE1A</td>
<td>93-146 USACE Harwich</td>
<td>July 1953</td>
<td>Proposed Beach Development - Nantucket Sound - Harwich, Massachusetts - Application by DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Deep Hole Road</td>
<td>Jetty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>032-17N3-000-001-100</td>
<td>032-17N3-000-001-100-COE1B</td>
<td>59-119 USACE Harwich</td>
<td>March 1959</td>
<td>Proposed Groins and Sand Fill - Vicinity of Red River Beach - Nantucket Sound - Harwich, Massachusetts - Application by DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Red River Beach</td>
<td>Groins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>032-2B1-000-018-100</td>
<td>032-2B1-000-018-100-COE1A</td>
<td>47-32 USACE Harwich</td>
<td>February 1947</td>
<td>Proposed Stone Jetty in Nantucket Sound - Harwich, Mass. - Application by DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Beach Road</td>
<td>Jetty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>032-2B1-000-018-100</td>
<td>032-2B1-000-018-100-COE1B</td>
<td>54-92 USACE Harwich</td>
<td>March 1944</td>
<td>Proposed Stone Groin and Sand Fill - Nantucket Sound - Harwich, Massachusetts - Application by DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Pleasant Road</td>
<td>Jetty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTE

ELEVATIONS ARE IN FEET AND TENTHS AND REFER TO PLANE OF MEAN LOW WATER. MINUS FIGURES SHOW DEPTHS BELOW THE SAME PLANE.

DREDGED MATERIAL, APPROX. 2500 C.Y. MAY IF SUITABLE FOR THE PURPOSE BE USED AS BACKFILL OTHERWISE REMOVED TO APPROVED DISPOSAL AREA.

NEW CONSTRUCTION AND MATERIALS TO BE IN ACCORDANCE WITH DEEP STANDARD PRACTICE. LOCATION PROP WORK LIMITS SHOWN IN RED.

PROPOSED HARBOR IMPROVEMENTS
DREDGING AND TIMBER BULKHEAD

ALLENS HARBOR
HARWICH MASS

APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
MARCH 1965

John A. Hammer
DEPUTY CHIEF ENGINEER WATERWAYS
**PROFILE OF BOAT RAMP**

Scale 1" = 16'

Notes:
Location of work to be done shown in Red
Elevations are in feet & tenths and refer to the plane of M.L.W. Minus figures show depths below that same plane.
All construction methods and materials to be in accordance with standard practice

Property Owners:
Easterly Abbutters ¾ William F. Downey & Julia T. Downey ¾ Rudolf Homan & Helen Kroger Homan.
Westerly Abbutters ¾ Frank H. Thompson & Marian M. Raymond & John J. Grullemans

Property lines are shown on Application dated January 1968 (Acc. No. 04630).

**SECTION A-A**
Scale 1/8" = 4' - 0"

PROPOSED MARINA FACILITY
Bulkhead, Floats, Access Ramp & Parking Area
SAQUATUCKET HARBOR
Formerly Andrews River
HARWICH MASS.

Application By
Department of Public Works of Massachusetts
DIVISION OF WATERWAYS
OCTOBER 1968
PROPOSED MARINA FACILITY
BULKHEAD, FLOATS, ACCESS RAMP & PARKING AREA

SAQUATUCKET HARBOR
Formerly Andrews River
HARWICH MASS.

Application By
Department of Public Works of Massachusetts
DIVISION OF WATERWAYS
OCTOBER 1968
PROFILE OF BOAT RAMP

Scale 1" = 15'

Notes:
Location of work to be done shown in red. Elevations are in feet and tenths and refer to the plane of M.L.W. Minus figures show depths below that plane.
All construction methods and materials to be in accordance with standard practice.

Property Owners:
Easterly Abutters % William F. Downey % Julia T. Downey % Rudolf Homan % Helen Kuiper Homan.

Westerly Abutters % Frank H. Thompson % Marion M. Raymond % John J. Grullenberg.
Property lines are shown on Application dated January 1968 (Acc. No. 04890).

SECTION A-A
Scale 1" = 1'-0"

PROPOSED MARINA FACILITY
Bulkhead, Floats, Access Ramp & Parking Area
SAQUATUCKET HARBOR
Formerly Andrews River
HARWICH MASS.

Application By
Department of Public Works of Massachusetts
DIVISION OF WATERWAYS
OCTOBER 1968
PROPOSED STONE JETTY IN
NANTUCKET SOUND
HARWICH MASS.

APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF ENGINEERS

[Signature]

[County Watershed Committee]

[Date: 032-281-000-019-100]
HARWICH
PLEASANT RD.

LOCATION PLAN
SCALE - FEET
1: 9000
SEE U.S. GEOL. SURV. HARWICH QUAD.

PROPOSED
SAND FILL
SCALE - FEET
1: 2000

GROIN PROFILE
SCALE - FEET
1' = 30' 

SECTION AA
SCALE - FEET
1' = 30' 

PROPOSED
STONE GROIN & SAND FILL
NANTUCKET SOUND
HARWICH SHORE AT PLEASANT ROAD
HARWICH - MASS.

DEPARTMENT = PUBLIC WORKS ** MASSACHUSETTS DIVISION ** WATERWAYS
MARCH 1954

DISTRICT WATERWAYS ENGINEER.
Section V

Chatham
Section V – Community Findings – Town of Chatham

COMMUNITY DESCRIPTION

The Town of Chatham consists of a land area of 16.43 square miles out of a total area of 24.33 square miles and had a population of 6,625 in the 2000 census. The Town is located on Cape Cod of Massachusetts and its location can be seen on this report’s cover. The estimated length of shoreline is 37 miles that are directly exposed to open ocean. The Town is protected from major coastal storms by both natural and man-made shoreline structures that require maintenance to insure the long term protection of its coastline. The man-made and publicly owned structures that protect the Town were investigated for their ability to provide adequate protection from major coastal storms. Structures have been identified as publicly owned, including coastal dunes and beaches, based on evidence of investment of public funds made to create/extend/maintain these structures. The assessment did not include floating or pile supported structures as they are assumed not to provide any significant coastal protection from major storm events.

STRUCTURE INVENTORY

Within the Town of Chatham, there were 23 structures which had public or unknown ownership which provide significant coastal protection. The location of the structures can be seen in Sheets 1 through Sheet 11 in Section V-B of this report. The structures were categorized by their type and by their structural condition based on a preliminary field assessment. The distribution of structures by type and condition can be seen in the following table:

<table>
<thead>
<tr>
<th>Primary Structure (1)</th>
<th>Total Structures</th>
<th>Structure Condition Rating</th>
<th>Total Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Bulkhead / Seawall</td>
<td>6</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Revetment</td>
<td>7</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Breakwater</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groin / Jetty</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Coastal Dune</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Coastal Beach</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>3</strong></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

Within the above table, the total length of each type of structure is also provided. The structures are listed by the type which is providing the primary coastal protection. Many sites have multiple structure types at the same location (i.e. revetment in front of seawall). These secondary structures, although not identified within these tables, are included in the development of repair/rehabilitation costs.

The development of repair costs has been included by structure type and by condition. In the Town of Chatham’s case there are a total of 23 structures which would require approximately $4.2 million to bring all the coastal structures to “A” Rating. Most critical will be the structures in the “D” and “F” classifications as those are assumed to undergo some level of damage or failure during the next major coastal storm event. To reconstruct these structures, identified in the preliminary survey as being in poor condition, an estimated $1.4 million would be required to upgrade the Town’s coastal protection.
STRUCTURE REPAIR / RECONSTRUCTION COST - Town of Chatham

<table>
<thead>
<tr>
<th>Primary Structure (1)</th>
<th>Total Structures</th>
<th>Structure Condition Rating</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead / Seawall</td>
<td>6</td>
<td>$36,210 $1,176,437</td>
<td>$1,212,647</td>
</tr>
<tr>
<td>Revetment</td>
<td>7</td>
<td>$83,433 $233,679 $262,264</td>
<td>$559,376</td>
</tr>
<tr>
<td>Breakwater</td>
<td></td>
<td></td>
<td>$1,363,352</td>
</tr>
<tr>
<td>Groin / Jetty</td>
<td>3</td>
<td>$252,320 $1,140,542</td>
<td>$1,393,262</td>
</tr>
<tr>
<td>Coastal Dune</td>
<td>3</td>
<td>$41,280</td>
<td>$41,280</td>
</tr>
<tr>
<td>Coastal Beach</td>
<td>4</td>
<td>$1,020,096</td>
<td>$1,020,096</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>$99,643 $2,723,812 $1,403,206</td>
<td>$4,226,681</td>
</tr>
</tbody>
</table>

Based on the limited research within the scope of this project research, the presumed ownership of the structures was established on an initial basis and would be subject to more intense review in future tasks. Structures identified as being owned privately were excluded from further consideration. Although ownership of the land on which the structure was located was a factor, the structure ownership was treated as a separate issue from land ownership. For the Town of Chatham, the breakdown of structures by assumed ownership is as follows:

STRUCTURE OWNERSHIP / REPAIR COST - Town of Chatham

<table>
<thead>
<tr>
<th>Primary Structure (1)</th>
<th>Total Structures</th>
<th>Structure Condition Rating</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town Owned</td>
<td>23</td>
<td>$99,643 $2,723,812 $1,403,206</td>
<td>$4,226,681</td>
</tr>
<tr>
<td>Commonwealth of Massachusetts</td>
<td></td>
<td></td>
<td>$-</td>
</tr>
<tr>
<td>Federal Government Owned</td>
<td></td>
<td></td>
<td>$-</td>
</tr>
<tr>
<td>Unknown Ownership</td>
<td></td>
<td></td>
<td>$-</td>
</tr>
</tbody>
</table>

The identification of presumed ownership was not based on the investigation of legal documents but relied on property ownership and from construction and regulatory documents that were found. A more detailed investigation of legal documents and agreements would be required where structure ownership is disputed. A more detailed identification of structure type, length, condition and location can be found in Section V-B which contains Structure Assessment Reports for each individual structure found.

SUMMARY

The enclosed reports and associated documents reflects the Town of Chatham’s coastal structure information that will eventually be input into a state-wide GIS database and will be accessible through MassGIS. This data, when compiled state-wide, will be critical in the development of both short term and long term planning for maintaining and improving Massachusetts coastal protection.

This database will also provide relatively quick access to identify available documentation for these structures as well as the ability to be updated as coastal structure improvements are made.
Section V - Chatham

Part B

Structure Assessment Reports
COASTAL STRUCTURE LOCATION PLAN

TOWN OF CHATHAM
COASTAL INFRASTRUCTURE INVENTORY
AND ASSESSMENT PROJECT
NOVEMBER 2007

SCALE: 1" = 150'
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local

Presumed Structure Owner: Local

Owner Name: Chatham

Location: Forest Beach

Based On Comment:

Earliest Structure Record: 1946

Estimated Reconstruction/Repair Cost: $252,320.00

Date: 8/29/2007

Length: 380 Feet

Top Elevation: Feet NAVD 88

FIRM Map Zone: V8

FIRM Map Elevation: 16 Feet NGVD

Primary Type: Groin/Jetty

Primary Material: Stone

Primary Height: Under 5 Feet

Secondary Type: 

Secondary Material: 

Secondary Height: 

Structure Summary:

This is a field of stone groins at Forest Beach. They are low profile groins with weathered armor. Some armor stones have become displaced and there is little interlocking apparent. 14 groins were noted.

Condition Rating
C Fair

Level of Action Description
Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating Action Description
II Low Priority Future Project Consideration Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:

010-03A-001-015-100-PHO1A.jpg

Structure Documents:

USACE December 1 Proposed Stone 010-03A-001-015-100-COE1A

USACE November 1 Proposed Groins and 010-03A-001-015-100-COE1B

USACE October 195 Proposed Groins and 010-03A-001-015-100-COE1C

USACE May 1960 Proposed Stone 010-03A-001-015-100-COE1D

USACE April 1965 Proposed Shore 010-03A-001-015-100-COE1E

MA-DCR August 1946 Proposed Shore 010-03A-001-015-100-DCR1A

MA-DCR May 1955 Proposed Hurricane 010-03A-001-015-100-DCR1B

MA-DCR August 1957 Proposed Shore 010-03A-001-015-100-DCR1C

MA-DCR December Proposed Shore 010-03A-001-015-100-DCR1D

MA-DCR May 1967 Proposed Shore 010-03A-001-015-100-DCR1E

Prepared By: Bourne Consulting Engineering
**Structure Assessment Form**

**Property Owner:** Local

**Presumed Structure Owner:** Local

**Owner Name:** Chatham

**Location:** Mill Creek

**Based On Comment:**

**Earliest Structure Record:** Unknown

**Estimated Reconstruction/Repair Cost:** $576,576.00

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>240 Feet</td>
<td>Feet NAVD 88</td>
<td>V13</td>
<td>15 Feet NGVD</td>
</tr>
</tbody>
</table>

**Primary Type:** Groin/Jetty

**Primary Material:** Stone

**Primary Height:** 5 to 10 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:**
This structure is the terminal groin on the west side of Mill Creek. The landward section of the structure is partially buried by the beach. Armor stones on the structure have become unraveled.

**Condition Rating**
- **Level of Action Description:** Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

**Priority Rating**
- **Priority Action Description:** Inshore Structures Present with Limited potential for Significant Infrastructure Damage

**Structure Images:**
- 010-048-004-004-100-PHO1A.jpg

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
Structure Assessment Form

Property Owner: Local

Presumed Structure Owner: Local

Owner Name: Chatham

Location: Mill Creek

Based On Comment:

Earliest Structure Record: Unknown

Estimated Reconstruction/Repair Cost: $564,366.00

Length: 425 Feet

Top Elevation: Feet NAVD 88

FIRM Map Zone: V13

FIRM Map Elevation: 15 Feet NGVD

Primary Type: groin/jetty

Primary Material: stone

Primary Height: under 5 feet

Secondary Type: 

Secondary Material: 

Secondary Height: 

Structure Summary:
This structure is a stone jetty on the east side of Mill Creek. The section nearest the shoreline is unraveled and mostly submerged. The armor on the unraveled portion near the shoreline is being flanked. The outer section is also unraveled but sits higher in the water.

Condition Rating
D Poor

Level of Action Description
Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm.

Priority Rating
II Low Priority

Action Description
Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
010-048-055-005-100-PH01A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham

Location: Cockle Cove
Based On Comment:

Earliest Structure Record: 1955
Estimated Reconstruction/Repair Cost: $506,880.00

Length: 800 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: V13
FIRM Map Elevation: Feet NGVD 16

Primary Type: Coastal Beach
Primary Material: Sand
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is the Cockle Cove beach nourishment. The beach is in good condition, showing no erosive hot spots or other issues. A typical beach profile is evident. The backing dune shows a small scarp at the toe.

Condition Rating
C Fair
Level of Action Description
Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating
Low Priority
Action Description
Future Project Consideration
Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
010-05B-000-14A-100-PHO1A.jpg

Structure Documents:
MA-DCR May 1955 Proposed Hurricane 010-05B-000-14A-100-DCR1A
DEP January 7, 2 Cockle Cove Beach 010-05B-000-14A-100-LIC1A

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham
Location: Barn Hill Road
Date: 8/29/2007
Based On Comment:

Earliest Structure Record: 1986
Estimated Reconstruction/Repair Cost: $156,750.00

Length: 190 Feet
Top Elevation: A7 Feet NAVD 88
FIRM Map Zone: A7
FIRM Map Elevation: 8 Feet NGVD

Primary Type: Bulkhead/ Seawall
Primary Material: Steel
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a bulkhead at Barn Hill Road boat ramp. It is a steel sheetpile with timber caps. Both components show aging.

Condition Rating
C
Fair

Level of Action Description
Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating
II
Low Priority

Action Description
Future Project Consideration
Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
010-09B-031-014-100-PH01A.jpg

Structure Documents:

<table>
<thead>
<tr>
<th>Usage</th>
<th>November 1</th>
<th>To Construct</th>
<th>010-09B-031-014-100-COE1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEP</td>
<td>November 1</td>
<td>Plan Accompanying</td>
<td>010-09B-031-014-100-LIC1A</td>
</tr>
<tr>
<td>DEP</td>
<td>January 26, Construct a Bulkhead</td>
<td>010-09B-031-014-100-LIC1B</td>
<td></td>
</tr>
</tbody>
</table>

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham
Location: Barn Hill Road
Based On Comment: 
Earliest Structure Record: Unknown

Date: 8/29/2007
Estimated Reconstruction/Repair Cost: $10,811.00

Length: 90 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: A7
FIRM Map Elevation: 8 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet
Secondary Type: 
Secondary Material: 
Secondary Height: 

Structure Summary:
The structure is a riprap slope adjacent to the Barn Hill boat ramp. The stone is weathered but solid. The side slopes are in good condition. Vegetation is growing out along cap and between stones.

Condition Rating
Level of Action Description
B Good Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
II Low Priority
Future Project Consideration
Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
Structure Documents:
010-09B-031-014-200-PHC2A.jpg
DEP January 26, Accompanying 010-09B-031-014-200-LIC2A

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham
Location: Ryder Cove Road
Based On Comment:
Earliest Structure Record: 1986
Estimated Reconstruction/Repair Cost: $96,466.00
Date: 8/29/2007

Length: 120 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: A9
FIRM Map Elevation: I

Primary Type: Bulkhead/Seawall
Primary Material: Wood
Primary Height: 10 to 15 Feet

Secondary Type: 
Secondary Material: 
Secondary Height: 

Structure Summary:
This structure is a timber bulkhead located at the end of Ryder Cove Road. The bulkhead is solid but weathered with some cracking at the crest.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings ( <1 dwelling impacted / 100 feet of shoreline)

Structure Images:
010-11J-006-006-100-PHO1A.jpg

Structure Documents:
USACE November 1 To Construct 010-11J-006-006-100-COE1A
DEP November 1 Plan Accompanying 010-11J-006-006-100-LIC1A

Prepared By: Bourne Consulting Engineering
## CZM Coastal Infrastructure Inventory and Assessment

### Structure Assessment Form

**Property Owner:** Local

**Presumed Structure Owner:** Local

**Owner Name:** Chatham

**Location:** Champlain Road

**Based On Comment:**

**Earliest Structure Record:** Unknown

**Estimated Reconstruction/Repair Cost:** $36,210.00

**Date:** 8/29/2007

### Dimensions

- **Length:** 170 Feet NAVD 88
- **Top Elevation:** 13 Feet NGVD
- **FIRM Map Zone:** V12
- **FIRM Map Elevation:** 13 Feet NGVD

### Primary Details

- **Primary Type:** Bulkhead/Seawall
- **Primary Material:** Steel
- **Primary Height:** 5 to 10 Feet

### Secondary Details

- **Secondary Type:** Coastal Dune
- **Secondary Material:** Sand
- **Secondary Height:** 5 to 10 Feet

### Structure Summary:

This structure is a sheetpile at the bend in Champlain Road that is fronted by earth/dune. The cap of the sheetpile is visible while the rest of the wall is buried in the bank and covered in vegetation. There are fiber rolls at the base that are becoming exposed.

### Condition Rating

- **Description:** Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landfill is present. Structure / landfill adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

### Priority Rating

- **Action Description:** High Value inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

### Structure Images:

- 010-12A-005-009-100-PH01A.jpg

### Structure Documents:
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner:
Local

Presumed Structure Owner:
Local

Owner Name:
Chatham

Location:
Stage Harbor Road

Based On Comment:

Earliest Structure Record:
1992

Date:
6/29/2007

Estimated Reconstruction/Repair Cost:
$183,361.00

Length: 290 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: V12
FIRM Map Elevation: 12 Feet NGVD

Primary Type: Bulkhead/ Sea Wall
Primary Material: Wood
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a timber bulkhead fronting a parking lot for a boat ramp. The structure is solid but weathered. The cap of the wall is loose in sections.

Condition Rating
C

Level of Action Description
Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating
III
Moderate Priority

Action Description
Consider for Active Project Improvement Listing
Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (≤1 dwelling impacted / 100 feet of shoreline)

Structure Images:
[010-13A-002-024-100-PHO1A.jpg]

Structure Documents:
DEP October 1999 Plan Accompanying
DEP September 1 Plan Accompanying

Prepared By: Bourne Consulting Engineering
**Structure Assessment Form**

**Property Owner:** Local  
**Location:** Strong Island Road  
**Date:** 8/29/2007  
**Estimated Reconstruction/Repair Cost:** $11,900.00

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<tbody>
<tr>
<td>50 Feet</td>
<td>Feet NAVD 88</td>
<td>V16</td>
<td>14 Feet NGVD</td>
</tr>
</tbody>
</table>

**Primary Type:** Coastal Dune  
**Primary Material:** Sand  
**Primary Height:** 5 to 10 Feet

**Secondary Type:**  
**Secondary Material:**  
**Secondary Height:**

**Structure Summary:**
This structure is a nourishment located at the end of Strong Island Road. The dune is fronting a small parking lot and functioning well. There is no evidence of the fiber roll reported beneath the dune.

**Condition Rating**  
**Level of Action Description**
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storms with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

**Priority Rating**
Consider for Active Project Improvement Listing

**Action Description**
Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

**Structure Images:**  
010-13M-046-01A-100-PH01A.jpg

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham

Location: Bridge Street
Based On Comment:

Earliest Structure Record: Unknown
Estimated Reconstruction/Repair Cost: $27,027.00

Length: 45 Feet
Top Elevation: NAVD 88 Feet
FIRM Map Zone: A9
FIRM Map Elevation: 10 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is the armored abutment on the east side of the Bridge Street bridge. There are some displaced stones but they are generally in good condition.

Condition Rating
C Fair
Level of Action Description
Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images: 010-14A-11A-093-100-PHO1A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Town: Chatham
Structure ID: 010-14A-11A-093-200
Key: community-map-block-parcel-structure

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham
Location: Bridge Street
Based On Comment:
Earliest Structure Record: Unknown
Estimated Reconstruction/Repair Cost: $27,027.00
Date: 8/29/2007

Length: 45 Feet
Top Elevation: 88 Feet NAVD 88
FIRM Map Zone: A9
FIRM Map Elevation: 10 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet
Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
These structures are the armored abutments on the west side of the Bridge Street bridge. There are some displaced armor stones but they are generally in good condition.

Condition Rating
C Fair

Priority Rating
Level of Action Description
Moderate

III
Consider for Active Project Improvement Listing
Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images: 010-14A-11A-083-200-PHO02A.jpg
Structure Documents:

Prepared By: Bourne Consulting Engineering
## CZM Coastal Infrastructure Inventory and Assessment

### Structure Assessment Form

**Property Owner:**
- Local

**Presumed Structure Owner:**
- Local

**Owner Name:**
- Chatham

**Location:**
- Oyster Pond

**Date:**
- 8/29/2007

**Based On Comment:**

**Earliest Structure Record:**
- Unknown

**Estimated Reconstruction/Repair Cost:**
- $164,736.00

**Length:**
- 260 Feet

**Top Elevation:**
- 8 Feet NAVD 88

**FIRM Map Zone:**
- A7

**FIRM Map Elevation:**
- 8 Feet NGVD

**Primary Type:**
- Coastal Beach

**Primary Material:**
- Sand

**Primary Height:**
- 5 to 10 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:**
This structure is a beach fill located at the east end of Oyster Pond on the west side of Stage Harbor Road. The beach is in good condition but the elevation is somewhat low. A typical beach profile is evident.

**Condition Rating**
- C
  - Fair

**Level of Action Description**
- Moderate
  - Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

**Priority Rating Action Description**
- III
  - Moderate Priority
  - Consider for Active Project Improvement Listing
  - Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings ( <1 dwelling impacted / 100 feet of shoreline)

### Structure Images:
- [010-14D-000-0C1-100-PHO1A.jpg](010-14D-000-0C1-100-PHO1A.jpg)

### Structure Documents:

---

**Prepared By:**
- Bourne Consulting Engineering
**Structure Assessment Form**

**Property Owner:** Local  
**Presumed Structure Owner:** Local  
**Owner Name:** Chatham  
**Location:** Cotchpinicut Road  
**Based On Comment:**  
**Earliest Structure Record:** Unknown  
**Date:** 8/29/2007  
**Estimated Reconstruction/Repair Cost:** $5,580.00

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<tr>
<td>60 Feet</td>
<td>14 Feet NGVD</td>
<td>V13</td>
<td>14 Feet NGVD</td>
</tr>
</tbody>
</table>

**Primary Type:** Coastal Dune  
**Primary Material:** Sand  
**Primary Height:** Under 5 Feet  
**Secondary Type:**  
**Secondary Material:**  
**Secondary Height:**  

**Structure Summary:**
This structure is a nourishment located at the end of Cotchpinicut Road. The dune elevation is becoming depleted. The beach is showing a typical profile shape.

**Condition Rating**  
**Level of Action Description**  
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

**Priority Rating**  
**Action Description**  
II  
Low Priority  
Future Project Consideration  
Inshore Structures Present with Limited potential for Significant Infrastructure Damage

**Structure Images:**  
010-15K-018-D11-100-PHO1A.jpg

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham
Location: Claffin Landing
Date: 8/29/2007
Estimated Reconstruction/Repair Cost: $126,720.00

Length: 200 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: V13
FIRM Map Elevation: 13 Feet NGVD
Primary Type: Coastal Beach
Primary Material: Sand
Primary Height: 5 to 10 Feet
Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a nourishment at Claffin Landing. The beach and dune elevation are somewhat depressed. There is no beach grass on dune area. A typical beach profile is evident.

Condition Rating: C
Level of Action Description: Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating: II
Action Description: Low Priority
Future Project Consideration: Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
010-16E-013-OF2-100-PHO1A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham
Location: Town Fish Pier
Based On Comment: 
Earliest Structure Record: 1965
Estimated Reconstruction/Repair Cost: $161,330.00

Length: 485 Feet NAVD 88
Top Elevation: Feet NAVD 88
FIRM Map Zone: A9
FIRM Map Elevation: 12 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: Under 5 Feet
Secondary Type: Secondary Material: 
Secondary Height:

Structure Summary:
This structure is a stone revetment running north of the Fish Pier. The crest and sideslopes are level. The toe is starting to become unraveled at the southern end. Some armor stones have become displaced.

Condition Rating
C Fair
Level of Action Description
Moderate

Priority Rating Action Description
IV High Priority Consider for Next Project Construction Listing
High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
010-16F-15B-0A9-100-PHO1A.jpg

Structure Documents:
MA-DCR August 1965 Proposed Shore
010-16F-15B-0A9-100-DCR1A

Prepared By: Bourne Consulting Engineering
Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham
Location: Town Fish Pier
Based On Comment:
Earliest Structure Record: 1967
Estimated Reconstruction/Repair Cost: $451,440.00

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<th>Length:</th>
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<td>360 Feet</td>
<td>Feet NAVD 88</td>
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<td></td>
<td>V13 Feet NGVD</td>
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<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
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</thead>
<tbody>
<tr>
<td>V13</td>
<td>13</td>
</tr>
</tbody>
</table>

Primary Type: Bulkhead/Seawall
Primary Material: Steel
Primary Height: 10 to 15 Feet
Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a bulkhead fronting the Fish Pier. The bulkhead is a steel sheetpile with concrete cap and fronted by timber whaling. It was installed in 1998.

Condition Rating:
Fair

Level of Action Description:
Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Priority Rating</th>
<th>Level of Action Description</th>
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<tbody>
<tr>
<td>Fair</td>
<td>High Priority</td>
<td>Consider for Next Project Construction Listing</td>
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Structure Images:
- [010-16F-PIER-005-100-PHO1A.jpg](#)

Structure Documents:
- Proposed Bulkhead, Plan Accompanying [010-16F-PIER-005-100-COE1A](#)
- Plan Accompanying [010-16F-PIER-005-100-LIC1A](#)
- Plan Accompanying [010-16F-PIER-005-100-LIC1B](#)
- Plan Accompanying [010-16F-PIER-005-100-LIC1C](#)
- Plan Accompanying [010-16F-PIER-005-100-LIC1D](#)
- Plan Accompanying [010-16F-PIER-005-100-LIC1E](#)

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

<table>
<thead>
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<th>Property Owner:</th>
<th>Location:</th>
<th>Date:</th>
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<tr>
<td>Local</td>
<td>Town Fish Pier</td>
<td>8/29/2007</td>
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Presumed Structure Owner:

Based On Comment:

Owner Name:

Earliest Structure Record:

Estimated Reconstruction/Repair Cost:

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<tr>
<td>230</td>
<td>Feet</td>
<td>Feet NAVD 88</td>
<td>Feet NGVD</td>
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<thead>
<tr>
<th>Primary Type:</th>
<th>Primary Material:</th>
<th>Primary Height:</th>
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<tbody>
<tr>
<td>Bulkhead/Seawall</td>
<td>Concrete</td>
<td>10 to 15 Feet</td>
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</table>

<table>
<thead>
<tr>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
<th>Secondary Height:</th>
</tr>
</thead>
</table>

Structure Summary:

This structure is a bulkhead south of the Fish Pier. There has been repair to the sheetpile and anchors and new tiebacks. The bulkhead was repaired in 1999-2000.

Condition Rating | Priority Rating | Level of Action Description | Action Description |
<table>
<thead>
<tr>
<th></th>
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<tr>
<td>C</td>
<td>IV</td>
<td>Moderate</td>
<td>High Priority</td>
</tr>
<tr>
<td>Fair</td>
<td>Consider for Next Project Construction Listing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.</td>
<td></td>
<td></td>
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<tr>
<td>High Value inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)</td>
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Structure Images:

010-16F-PIER-005-230-PHO2A.jpg

Structure Documents:

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<tr>
<th>USACE</th>
<th>November 1</th>
<th>To Build and Maintain</th>
<th>010-16F-PIER-005-200-COE2A</th>
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<tr>
<td></td>
<td>July 1956</td>
<td>Proposed Riprap,</td>
<td>010-16F-PIER-005-200-COE2B</td>
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<tr>
<td>USACE</td>
<td>January 197</td>
<td>To Install a Sheet</td>
<td>010-16F-PIER-005-200-COE2C</td>
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<td></td>
<td>April 1979</td>
<td>Plan Accompanying</td>
<td>010-16F-PIER-005-200-LIC2A</td>
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<td>DEP</td>
<td>October 26,</td>
<td>Plan Accompanying</td>
<td>010-16F-PIER-005-200-LIC2B</td>
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<td>DEP</td>
<td>October 1, 1</td>
<td>Plan Accompanying</td>
<td>010-16F-PIER-005-200-LIC2C</td>
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<td>DEP</td>
<td>September 2</td>
<td>Plan Accompanying</td>
<td>010-16F-PIER-005-200-LIC2D</td>
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Prepared By: Bourne Consulting Engineering
# CZM Coastal Infrastructure Inventory and Assessment

## Structure Assessment Form

**Property Owner:** Local  

**Presumed Structure Owner:** Local

**Owner Name:** Chatham  

**Location:** Town Fish Pier  

**Date:** 8/29/2007  

**Based On Comment:**

**Earliest Structure Record:** 1956  

**Estimated Reconstruction/Repair Cost:** $18,295.00

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<tr>
<td>55 Feet</td>
<td>Feet NAVD 88</td>
<td>V13</td>
<td>13 Feet NGVD</td>
</tr>
</tbody>
</table>

**Primary Type:** Revetment  

**Primary Material:** Stone  

**Primary Height:** Under 5 Feet  

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:** This structure is a stone revetment at the south end of the Fish Pier. It is composed of dumped armor stone which lies along the south side of the bulkhead. There is no appreciable interlocking between stones.

**Condition Rating**  

**Level of Action Description**  

Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

**Priority Rating Action Description**  

III  

Moderate Priority  

Consider for Active Project Improvement Listing  

Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

---

**Structure Images:**  

- [010-16F-PIER-005-300-PHO3A.jpg]

**Structure Documents:**  

- USACE  
  - July 1956  
- DEP  
  - October 1
- Proposed Riprap, Accompanying
  - 010-16F-PIER-005-300-COE3A  
  - 010-16F-PIER-005-300-LIC3A

---

**Prepared By:** Bourne Consulting Engineering
**Structure Assessment Form**

**Property Owner:** Local

**Location:** Chatham Light

**Date:** 8/29/2007

**Presumed Structure Owner:** Local

**Based On Comment:**

**Owner Name:** Chatham

**Earliest Structure Record:** 1991

**Estimated Reconstruction/Repair Cost:** $262,264.00

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<td>395 Feet</td>
<td>15 Feet NAVD 88</td>
<td>V13</td>
<td>15 Feet NGVD</td>
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</tbody>
</table>

**Primary Type:** Revetment

**Primary Material:** Stone

**Primary Height:** Under 5 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:**
This structure is a revetment fronting the parking lot at the Chatham Lighthouse. There is a moderate dune in front of the majority of the structure. The dune fronting and backing the revetment is heavily vegetated with beach grass. The armor stone in the center section is mostly unraveled.

**Condition Rating**

**Level of Action Description**
Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

<table>
<thead>
<tr>
<th>Priority Rating</th>
<th>Action Description</th>
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<tr>
<td>IV High Priority</td>
<td>Consider for Next Project Construction Listing</td>
</tr>
<tr>
<td>High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)</td>
<td></td>
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</tbody>
</table>

**Structure Images:**
- 010-178-000-075-100-PHO1A.jpg

**Structure Documents:**
- [USAGE][November 1]
- [DEP][November 1]
- Plan and Details of 010-178-000-075-100-COE1A
- Plan Accompanying 010-178-000-075-100-LIC1A

**Prepared By:** Bourne Consulting Engineering
## CZM Coastal Infrastructure Inventory and Assessment
### Structure Assessment Form

**Property Owner:**
- Local

**Presumed Structure Owner:**
- Local

**Owner Name:**
- Chatham

**Location:**
- Andrew Harding Lane

**Date:**
- 8/29/2007

**Earliest Structure Record:**
- Unknown

**Estimated Reconstruction/Repair Cost:**
- $221,760.00

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<tr>
<th>Length</th>
<th>Top Elevation</th>
<th>FIRM Map Zone</th>
<th>FIRM Map Elevation</th>
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<tr>
<td>350 Feet</td>
<td>15 Feet NAVD 88</td>
<td>V13</td>
<td>15 Feet NGVD</td>
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</table>

**Primary Type:**
- Coastal Beach

**Primary Material:**
- Sand

**Primary Height:**
- 5 to 10 Feet

**Secondary Type:**
- Secondary Material:

**Secondary Height:**

**Structure Summary:**
This structure is a beach nourishment at the end of Andrew Harding Lane. The beach and dune are in good condition. There is a small scarp at the toe of the dune. A normal beach profile has developed.

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Level of Action Description</th>
<th>Priority Rating</th>
<th>Action Description</th>
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<tbody>
<tr>
<td>C</td>
<td>Moderate</td>
<td>III</td>
<td>Consider for Active Project Improvement Listing</td>
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**Structure Images:**
- 010-17C-010-027-100-PHO1A.jpg

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Chatham

Location: Andrew Harding Beach
Date: 8/29/2007

Based On Comment:

Earliest Structure Record: Unknown
Estimated Reconstruction/Repair Cost: $52,622.00

Length: 335 Feet
Top Elevation: 15 Feet NGVD
FIRM Map Zone: V:3
FIRM Map Elevation: 15

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a stone revetment from the end of Holway Street south to Andrew Harding Beach. The crest and side slope are in good shape. There is some shifting of armor at the face and loss of crest elevation.

Condition Rating
B Good

Level of Action Description
Minor
Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
IV High Priority Consider for Next Project Construction Listing
High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
010-17C-034-018-100-PH01A.jpg

Structure Documents:
DEP January 26, Plan to Accompany 010-17C-034-018-100-LIC1A

Prepared By: Bourne Consulting Engineering
CZM Coastal Infrastructure Inventory and Assessment

**Structure Assessment Form**

**Property Owner:** Local

**Location:** Scatteree Beach

**Date:** 8/29/2007

**Presumed Structure Owner:** Local

**Based On Comment:**

**Owner Name:** Chatham

**Earliest Structure Record:** Unknown

**Estimated Reconstruction/Repair Cost:** $23,800.00

**Length:** 100 Feet

**Top Elevation:** Feet NAVD 88

**FIRM Map Zone:** V13

**FIRM Map Elevation:** 14 Feet NGVD

**Primary Type:** Coastal Dune

**Primary Material:** Sand

**Primary Height:** 5 to 10 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:** This structure is a nourishment located at Scatteree Beach. The dune is in good condition. There is no evidence of the Jersey Barriers that are reported beneath the dune. The beach is showing a standard profile shape.

**Condition Rating**

C - Fair

**Priority Rating**

III - Moderate Priority

**Level of Action Description**

Moderate - Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

**Description**

Consider for Active Project Improvement Listing

Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

**Structure Images:**

[010-173-002-011-100-PHO1A.jpg]

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
Section V - Chatham

Part C

Structure Photographs
<table>
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<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sheets</th>
<th>Location</th>
<th>Description</th>
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Section V - Chatham

Part D

Structure Documents

TOWN DOCUMENT LIST

MA DCR - DOCUMENT LIST

MA DEP – Ch 91 DOCUMENT LIST
  • Copies of License Documents

USACE – PERMIT DOCUMENT LIST
  • Copies of Permit Documents
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<th>BCE Structure No</th>
<th>Document No</th>
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<th>Entity</th>
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<td>010-03A-001-015-100-DCR1A</td>
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<td>Chatham</td>
<td>Aug-46</td>
<td>Proposed Shore Protection - Forest Beach - Chatham - Prepared for the DPW of Massachusetts - Division of Waterways</td>
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<td>Forest Beach</td>
<td>Groins</td>
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<td>MA-DCR</td>
<td>Chatham</td>
<td>May-55</td>
<td>Proposed Hurricane Repairs Beach Restoration - Forest Beach Road and Cockle Cove - Chatham - Prepared for the DPW of Massachusetts - Division of Waterways</td>
<td>2</td>
<td>Forest Beach Road and Cockle Cove</td>
<td>Beach Restoration</td>
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<td>MA-DCR</td>
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<td>Aug-57</td>
<td>Proposed Shore Protection - Groin Construction and Sand Fill - Pleasant Street - Chatham, Massachusetts - Prepared for the DPW of Massachusetts - Division of Waterways</td>
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<td>Proposed Shore Protection - Groin Construction - Vicinity of Forest Beach Road and Morris Island Road - Chatham, Massachusetts</td>
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<td>Stone Groins</td>
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<td>Proposed Shore Protection - Stone Mounds, Groin, and Sand Fill - Morris Isle Bridge and Red River Beach - Prepared for the DPW of Massachusetts - Division of Waterways</td>
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<td>Plan Accompanying Petition of Town of Chatham to Construct Concrete Boat Ramp, Timber Bulkhead, Floats and to Dredge at Oyster Pond River &amp; Chatham, Massachusetts</td>
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<td>Timber Bulkhead</td>
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<td>Construct a Bulkhead with Boat Ramp and Parking Area at Oyster Pond River</td>
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<td>Plan Accompanying Petition of Town of Chatham to Construct Concrete Boat Ramp, Timber Bulkhead, Floats, Gargery and Dredge in Ryder's Cove - Chatham, Massachusetts</td>
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<td>Plan Accompanying Petition of Town of Chatham to License and Maintain Concrete Launching Ramp and Floats - Stage Harbor - Chatham, Barnstable County, Massachusetts</td>
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<td>Plan Accompanying Petition of Town of Chatham to Construct a Timber Bulkhead at Stage Harbor, Chatham, MA</td>
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<td>Stage Harbor</td>
<td>Bulkhead</td>
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<td>April 1979</td>
<td>Plan Accompanying Petition of Town of Chatham to Install a Sheet Steel Bulkhead and to Dredge in Lydia's Cove - Chatham, Massachusetts</td>
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<td>Fish Pier</td>
<td>Steel Bulkhead</td>
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<td>October 1989</td>
<td>Plan Accompanying Petition of Town of Chatham to Install Pilings and Maintenance Dredge in Lydia's Cove Cove - Chatham, Barnstable, MA</td>
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<td>Chatham Fish Pier</td>
<td>Pilings to Reinforce Bulkhead</td>
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<td>5300</td>
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<td>Chatham</td>
<td>January 1996</td>
<td>Plan Accompanying Petition of Town of Chatham to Construct a Bulkhead and Timber Groin, Excavate a Basin and Fill in Lydia's Cove, Chatham</td>
<td>1</td>
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<td>Plan Accompanying Petition of Town of Chatham to Replace Existing Dredge, Install New Sheet Piling and Screw Anchors, Extend North Bulkhead 120 LF, Install Two Finger Piers and a Floating Dock and Dredge 1620 CY of Sediments from Lydia's Cove</td>
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<td>Chatham Fish Pier</td>
<td>Extend Existing Bulkhead</td>
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<td>DEP</td>
<td>Chatham</td>
<td>April 1945</td>
<td>Plan Accompanying Petition of Town of Chatham, MA to Build a Fish Pier and Fish Packing Building at Lydia's Cove, Chatham, MA</td>
<td>1</td>
<td>Fish Pier</td>
<td>Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-200</td>
<td>010-16F-PIER-005-200-LIC2A</td>
<td>560</td>
<td>DEP</td>
<td>Chatham</td>
<td>April 1979</td>
<td>Plan Accompanying Petition of Town of Chatham to Install a Sheet Steel Bulkhead and to Dredge in Lydia's Cove - Chatham, Massachusetts</td>
<td>2</td>
<td>Fish Pier</td>
<td>Steel Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-200</td>
<td>010-16F-PIER-005-200-LIC2B</td>
<td>2078</td>
<td>DEP</td>
<td>Chatham</td>
<td>October 26, 1989</td>
<td>Plan Accompanying Petition of Town of Chatham to Install Pilings and Maintenance Dredge in Lydia's Cove Cove</td>
<td>2</td>
<td>Lydia's Cove</td>
<td>Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-200</td>
<td>010-16F-PIER-005-200-LIC2C</td>
<td>3886</td>
<td>DEP</td>
<td>Chatham</td>
<td>October 1, 1996</td>
<td>Plan Accompanying Petition of Town of Chatham to Build and Maintain a Timber Bulkhead, RipRap, Dredge, and Fill Sold in Lydia's Cove</td>
<td>3</td>
<td>Lydia's Cove</td>
<td>Timber Bulkhead and Riprap</td>
</tr>
<tr>
<td>010-16F-PIER-005-200</td>
<td>010-16F-PIER-005-200-LIC2D</td>
<td>3171</td>
<td>DEP</td>
<td>Chatham</td>
<td>September 20, 1949</td>
<td>Plan Accompanying Petition of Town of Chatham to Build and Maintain a Timber Bulkhead and Fill Sold in Lydia's Cove</td>
<td>1</td>
<td>Lydia's Cove</td>
<td>Timber Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-300</td>
<td>010-16F-PIER-005-300-LIC3A</td>
<td>3886</td>
<td>DEP</td>
<td>Chatham</td>
<td>October 1, 1996</td>
<td>Accompanying Petition of Town of Chatham to Build and Maintain a Timber Bulkhead, RipRap, Dredge and Fill Sold in Aunt Lydia's Cove at Chatham</td>
<td>3</td>
<td>Aunt Lydia's Cove</td>
<td>Bulkhead</td>
</tr>
<tr>
<td>010-17B-003-075-100</td>
<td>010-17B-003-075-100-LIC1A</td>
<td>5976</td>
<td>DEP</td>
<td>Chatham</td>
<td>November 1996</td>
<td>Plan Accompanying Petition of Town of Chatham to Reconstruct and Maintain a Rock Revetment at Chatham Harbor - Chatham, Barnstable County, Massachusetts</td>
<td>2</td>
<td>Main Street</td>
<td>Revetment</td>
</tr>
<tr>
<td>010-17C-004-018-100</td>
<td>010-17C-004-018-100-LIC1A</td>
<td>11818</td>
<td>DEP</td>
<td>Chatham</td>
<td>January 26, 2007</td>
<td>Plan to Accompany Petition of Town of Chatham to Construct and Maintain a Rock Revetment in Chatham Harbor, Chatham, Mass in the County of Barnstable</td>
<td>3</td>
<td>Chatham Harbor/Holiday Street</td>
<td>Rock Revetment</td>
</tr>
</tbody>
</table>
TYPICAL FILL CROSS SECTION

PERMIT NO. 9448
Approved by Department of Environmental Protection
Date: SEP 27 2002

100 YR FLOOD 16 NGVD 0.0
HTL 5.5 MLW -1.7
MHW 2.1

TITLE: PROPOSED BEACH NOURISHMENT SECTION

PURPOSE: BEACH NOURISHMENT

APPLICATION BY: TOWN OF CHATHAM

IN: CHATHAM
AT: COCKLE COVE
COUNTY: BARNSTABLE
STATE: MA

DATE: 01/07/02
NOTES:
ELEVATIONS ARE IN FEET AND TENTHS ABOVE THE PLANE OF MEAN LOW WATER. MINUS FIGURES INDICATE DEPTHS BELOW THAT SAME PLANE.

PLAN ACCOMPANYING PETITION OF TOWN OF CHATHAM TO CONSTRUCT CONCRETE BOAT RAMP, TIMBER BULKHEAD, PLACE FLOATS AND TO DREDGE IN OYSTER POND RIVER CHATHAM, MASS.
NOV. 18, 1986

BRAMAN ENGINEERING COMPANY CIVIL ENGINEERS & SURVEYORS 258 MAIN ST, BUZZARDS BAY, MA.

LICENSE PLAN NO. 1614
Approved by Department of Environmental Quality Engineering of Massachusetts

COMMISSIONER
DIVISION DIRECTOR
SECTION CHIEF
DATE
BULKHEAD SECTION
SCALE: 1" = 6'

RAMP SECTION
NOT TO SCALE

FLOAT SECTION
SCALE: 3/8" = 1'0"

LICENSE PLAN NO. 1614
Approved by Department of Environmental Quality Engineering
Date: April 28, 1987

TOWN OF CHATHAM NOV. 18, 1986 SHEET 2 OF 2
Proposed Sand Fill
Piezometric Tumous
Concrete Launching Ramp

License No. 4578

Proposed Areas to be
Excavated to El-3.0
Excavation Material to be
Used for Fill

Datum MLW = 0.0

Plan
Scale in Feet
0
0.0
100
150

Typical Section
Scale in Feet

Longitudinal Section
Scale in Feet

Companying Petition of
Town of Chatham
Structural Bulkhead with
Intermittent Filling Area
at Yeter Pond River

License Plan No. 5018
Approved by
January 26, 1966
ELEVATIONS ARE IN FEET AND TENTHS ABOVE THE PLANE OF MEAN LOW WATER. MINUS FIGURES INDICATE DEPTHS BELOW THAT SAME PLANE.

2. 350 CU YDS TO BE DREDGED, 100 CU YDS TO BE USED FOR FILL BEHIND PROPOSED BULKHEAD. REMAINDER OF DREDGED MATERIAL TO BE TAKEN TO AN IN-LAND DISPOSAL SITE.

PLAN ACCOMPANYING PETITION OF TOWN OF CHATHAM TO CONSTRUCT CONCRETE RAMP, TIMBER BULKHEAD, PLACE FLOAT, GANGWAY AND DREDGE IN RYDER'S COVE CHATHAM, MASS.

BRAMAN ENGINEERING COMPANY
CIVIL ENGINEERS & SURVEYORS
250 MAIN ST, BUZZARDS BAY, MA.

NOV. 24, 1986

SHEET 1 OF 2

LICENSE PLAN No. 1615

COMMISSIONER
DIVISION DIRECTOR
SECTION CHIEF

APPROVED
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
OF MASSACHUSETTS

April 28, 1987

R. T. BRAMAN
PROFESSIONAL ENGR. CIVIL
EXISTING TIMBER BULKHEAD

PROPOSED 8" REIN. CONC. PAD EL 6.5

OCTOBER 1, 1992

TOP EO RAMP EL 6.5

63.3'

4.0'

PROPOSED FLOAT RAMP

REMOVE UPPER WALE & SHEETING TO FACILITATE FLOAT ACCESS

PROPOSED 4" X 14" TIMBER FLOAT

PROPOSED T&G TIMBER SHEETING

PROPOSED 4" GRAVEL BASE

PROPOSED 8" REIN. CONC. RAMP

CEM

TOE OF RAMP EL -3.0

DREDGE AREA

14.0'

67' ±

TOP OF PILES EL 10.5

HW EL 4.5 HTL EL 5.0

MLW EL 3.0

PROPOSED DREDGING TO EL -3.0 MLW, 170 C.Y.

PROPOSED SCOUR PROTECTION, 16'X28.8' OF GEOWEB FILLED WITH CRUSHED STONE

12'

10'

6'

4'

-15%

APPROX.

EXIST. GRADE

12'

6'

4'

30'

25'

25'

30'

30'

TOWN OF CHATHAM

BOAT RAMP PROFILE

SCALE: 1" = 10'

LICENS PLAN NO. 3328

Approved by Department of Environmental Protection

Date: MAY 21 1993
NOTES:
ELEVATIONS ARE SHOWN IN FEET AND TENTHS BASED ON THE PLANE OF MEAN LOW WATER. TIMBER PILES SHALL BE CCA TREATED @ 2.5 PCF. ALL TIMBER SHALL BE CCA TREATED @ 1.0 PCF. ALL HARDWARE SHALL BE GALVANIZED. FLOOD ZONE V12 EL 12 MSL.

FILL PLACED BELOW HTL = 200 CY±
FILL PLACED BELOW MHW = 185 CY±

PUBLIC USE FACILITY

NORTHERLY ABUTTER:
LEWIS & FAITH A. HORTON
8 LOWELL RD. WELLESLEY, MA 02181

WESTERLY ABUTTER:
DAVID C. ELDRIDGE ESTATE
C/O ERNESTINE M. ELDRIDGE
411 STAGE HARBOR RD. CHATHAM, MA 02633

PREDICTED MEAN HIGH WATER EL = 3.9,
OBSERVED HIGH WATER EL = 4.5 DUE TO DIFFERING TIDAL CONDITIONS AT LOCUS.
TOWN OF CHATHAM
APRIL 7, 1988

LICENSE PLAN NO. 2042
Approved by Department of Environmental Protection
Date: SEP 08, 1989

TYPICAL BULKHEAD ELEVATION
SCALE: 1" = 2.0'

TOP OF PILE EL. 10.0
LEAD OR FIBERGLASS PILE CAP

TOP OF SHEETING 7.8
3/4" Ø BOLTS COUNTERSUNK
8" x 8" WALERS
TIE ROD EL. 5.1
HTL EL. 4.8
MHW EL. 3.9
APPR. EXIST. GR. 2.5
TIMBER FENDER PILES, 25' LONG

BULKHEAD SECTION
SCALE: 1" = 5'

3/8" Ø DYWIDAG THREADBAR ANCHOR
GRADE 137 EPOXY COATED
4" x 6" INBOARD
TIE ROD 3.0
R. 8" x 8" x 1"
3" T & G TIMBER SHEETING, 10'
TIMBER ANCHOR PILES @ 5:1 BATTER, 15' LONG

DYWIDAG THREADBARS @ 10' O.C.
100' OF TIMBER BLKHD
BASELINE "C"
BLKHD RETURN
TIE TO EXIST. RETUR
EXIST. BULKHEAD
SINGLE ANCHOR PILES 10' O.C.

SURVEY
STA. 0'-0"
STA. 1'-0"
STA. 1'-2"

TIMBER PILE
1/2" Ø BOLTS

48" WALE

5.0' WALE

DYWIDAG THREADBAR

30' FINISH GRADE
Elevations are in feet & tenths above the plane of mean low water minus figures indicate depths below that same plane.

2. Bench mark: Top of catch basin frame - EL 7.3 G M.L.W.

3. All fender piles & wales to be C.C.A. pressure treated to 2.5 lb/c.f.

4. All anchor piles, deadmen, caplogs & spacers to be C.C.A. pressure treated to 0.6 lb/c.f.

5. Excavated material to be disposed of at town disposal area located on Sam Ryder Road 3/4 miles from site.

Plan accompanying petition of Town of Chatham to install a sheet steel bulkhead, and to dredge in Aunt Lydia's Cove, Chatham, Mass.

January 23, 1979 - Sheet 1 of 2

Robert A. Braman
Civil Engineer & Surveyor
TREATED PLYWOOD SHALL BE PLACED BEHIND ANY PERFORATION IN BULKHEAD AND SECURED.

LIMIT OF EXCAVATION

3/4" TREATED PLYWOOD

TIE ROD

3/4" TREATED PLYWOOD

ELEVATION OF TIE ROD TO BE VERIFIED BY CONTRACTOR

APPROX. HTL = 4.5

APPROX. MLW = -3.0

APPROX. LOW WATER

APPROX. EXIST. GRADE

REPAIR DETAIL

SCALE 1/8" = 1'-0"

EXIST. TIMBER PILE RAISED AND RESET AFTER PILE IS RAISED

RODS TO BE REMOVED AND RESET AFTER PILE IS RAISED

APPROX. HTL = 4.5

APPROX. MLW = -3.0

APPROX. NOTE:

SIDE SLOPE AT BULKHEAD AT 3:1

SIDE SLOPE AT DREDGE LIMIT EL. = -7.0

TYPICAL DREDGE SECTION

SCALE 1/8" = 1'-0"

TOWN OF CHATHAM

APRIL 4, 1988

SHEET 2 OF 2

LICENSE PLAN NO. 2078

Approved by Department of Environmental Protection

Date: OCT 26, 1989

Robert A. Braman

No. 15293

PROFESSIONAL ENGINEER

Commonwealth of Massachusetts

Robert A. Braman
DEPARTMENT OF PUBLIC WORKS

TOWN OF CHATHAM
CONSTRUCT A BULKHEAD AND TIMBER PILE, EXCAVATE A BASIN, AND FILL IN AUNT LYDIAS COVE

OCTOBER 10, 1967

F. ROWLEY & ASSOCIATES, WEST Wareham, Mass.

LICENSE PLAN NO. 5330
APPROVED BY DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
JANUARY 3, 1968
COMMISSIONER, DEPT. OF PUBLIC WORKS
ASSOCIATE COMMISSIONERS

AN ACCOMPANYING PETITION OF TOWN OF CHATHAM

LOCATION PLAN
Traced from U.S.G.S. Chatham, Mass. Scale 1"=2000

TYPICAL SECTION
SCALE 1"=10

Note: Elevations are in feet and refer to the place of Mean Low Water. Minus figures are depths below that plane.

Existing Bulkhead License No. 2747, dated April 12, 1945.
PLAN ACCOMPANYING PETITION OF:
TOWN OF CHATHAM TO REPLACE EXISTING TIERODS,
INSTALL NEW SHEET PILING AND SCREW ANCHORS,
EXTEND NORTH BULKHEAD 120 LF., INSTALL
TWO (2) FINGER PIERs AND A FLOATING
DOCK, AND DREDGE 1625 CY. OF SEDIMENT
FROM AUNT LYDIA'S COVE.
CHATHAM, MASSACHUSETTS
SECTION A-A
TYPICAL SECTION
AT U.S.C.G. EXTENSION
SECTION E-E
TYPICAL SECTION
NEW STEEL BULKHEAD

NEW AZ8.6 STEEL SHEETPILING
TIP EL. -22

LICENSE PLAN NO. 7281
Approved by Department of Environmental Protection
Date: AFR 4/29/1977
SECTION F-F
TYPICAL SECTION
ANCHORED BULKHEAD WITH REPLACEMENT OF EXISTING TIERODS

TO MEET EXISTING GRADE

LIMIT OF EXCAVATION EL. 0.5

REMOVE AND REPLACE EXISTING BITUMINOUS AND CONCRETE DECK
2-1/2" BIT. CONC.

REMOVE EXISTING 1-1/4" TIE ROD AND INSTALL NEW 2" TIE ROD

4X6 CONTINUOUS TIMBER DEADMAN REPAIR AS DIRECTED

EXISTING 2.27 STEEL SHEETING TO EL. -17.5 26'-0" LONG TO REMAIN

REMOVE EXISTING 12X12 WALE AND REPLACE WITH NEW

MATERIAL TO BE DREDGED

DREDGE EL -7 OVERDREDGE -8

30'-0" LONG PILE 6'-0" O.C. TO REMAIN

CURB, TOP WALE AND FENDER PILES TO REMAIN

CONCRETE DECK

EL. 14.2

EL. 11.2

MLW 0.0

MLW 5.0

EL. 7.7

EL. 1.2

License Plan No. 7281
Approved by Department of Environmental Protection

JULY 1997 SHEET 8 OF 8
PLAN ACCOMPANYING PETITION OF TOWN OF CHATHAM, MASS., TO BUILD A FISH PIER AND FISH PACKING BUILDINGS AT AUNT LYDIA'S COVE, CHATHAM, MASS., MAR 15, 1945.

NO. 2747
APPROVED BY DEPARTMENT OF PUBLIC WORKS APRIL 12, 1945.

RAYMOND W. COHEN
COMMISSIONER OF PUBLIC WORKS

GEORGE W. KIMBALL
ASSOCIATE COMMISSIONERS

WALTER R. KELLY
DIRECTOR, DIVISION OF WATERFRONT
1. Elevations are in feet & tenths above the plane of mean low water. Minus figures indicate depths below that same plane.
2. Bench mark: top of catch basin frame - EL 736 MLW.
3. All fender piles & wales to be CCA. Pressure treated to 2.5 lb/cf.
4. All anchor piles, deadmen, caplogs & spacers to be CCA. Pressure treated to 0.6 lb/cf.
5. Excavated material to be disposed of at town disposal area located on Sam Rymer road 3/4 miles from site.

AUNT LYDIA'S COVE

LICENSE # 386C

FISH PACKING BLDG.

EXISTING FUEL TANK COVERS

GRASS ISLAND

EXISTING GASOLINE PUMP

EXISTING HYDRANT

BIT. CONC. PARKING AREA

PROPOSED 21' LEAF PIER
2 PILES 22' LONG

PROPOSED BULKHEAD LIC. 31711

DREDGE TO 50' MLW

PROPOSED ANCHOR SYSTEM

PLAN

SCALE: 1" = 40'

WILLIAM M. FRANCES NICKERSON JR.
BOX 351 OLD HARBOR CHATHAM, MASS.
02633

PLANNING ACCOMPANYING PETITION OF TOWN OF CHATHAM TO INSTALL A SHEET STEEL BULKHEAD AND TO DREDGE IN AUNT LYDIA'S COVE CHATHAM, MASS.

JANUARY 23, 1979 SHEET 1 OF 2

ROBERT A. BRAMAN
CIVIL ENGINEER & SURVEYOR

LICENSE PLAN NO. 560

Approved by Department of Environmental Quality Engineering
of Massachusetts APRIL 15, 1977

CHIEF ENGINEER
TREATED PLYWOOD SHALL BE PLACED BEHIND ANY PERFORATION IN BULKHEAD AND SECURED.

REPAIR DETAIL
SCALE 1/8" = 1'-0"

DREDGE SECTION AT BULKHEAD
SCALE 1/8" = 1'-0"

ELEVATION OF CATWALK
SCALE 1/8" = 1'-0"

TYPICAL DREDGE SECTION
SCALE 1/8" = 1'-0"

LICENSE PLAN NO. 2078
Approved by Department of Environmental Protection
Date: OCT 26 1989

TOWN OF CHATHAM APRIL 4, 1988 SHEET 2 OF 2
Accompanying Petition of Town of Chatham
To Approve and Maintain a Timber
Deposit of Rip-Rap, Edge and Solid Fill in
Mound Lydia's Cove at Chatham

License Plan No 3886
Approved - October 1, 1956
NOTE: 

Plan and details shown show the island of Mt. W. Minus. 

Scale feet shown elevations above the 

Main Range of tide. 

50' Proposed work shown in red. 

TYPICAL SECTION 

PLAN ACCOMPANYING PETITION OF 
TOWN OF CHATHAM 
BUILD AND MAINTAIN A TIMBER BULKHEAD \ AND FILL SOLID IN 
AUNT LYDIA'S COVE 
AT 
CHATHAM 
SCALE AS SHOWN 1949 

PLAN DETAIL 

APPROVED BY DEPARTMENT OF PUBLIC WORKS 
SEPTEMBER 20, 1949 

[Signature] 

[Signature] 

[Signature]
PLAN
SCALE 1" = 60'

PLAN ACCOMPANYING PETITION OF
TOWN OF CHATHAM
TO RECONSTRUCT & MAINTAIN A
ROCK REVESTMENT
AT CHATHAM HARBOR, CHATHAM,
BARNSTABLE COUNTY, MASSACHUSETTS

COASTAL ENGINEERING CO., INC., ORLEANS, MA.

SLC 3 2F 2 SHEETS
LICENSE PLAN NO. # 5356

Approved by Department of Environmental Protection

DIVISION DIRECTOR
PROGRAM CHIEF

NOV 06 1996 DATE
TYPICAL SECTION

SCALE: 1" = 20'

LICENSE PLAN NO. 5976
Approved by Department of Environmental Protection
Date: NOV 06 1996

(Handwritten text and diagram not legible)
PLAN TO ACCOMPANY PETITION OF TOWN OF CHATHAM TO CONSTRUCT & MAINTAIN A ROCK REVETMENT IN CHATHAM HARBOR, CHATHAM, MASS IN THE COUNTY OF BARNSTABLE
COASTAL ENGINEERING CO., INC. ORLEANS, MASS.

LICENSE PLAN NO. 11618
Approved by Department of Environmental Protection of Massachusetts JAN 26, 1977
Mitch Ficek
TOWN OF CHATHAM
COASTAL ENGINEERING CO., INC.

GUARD RAIL (BY OTHERS)

TOP APRON 6" TO 8" STONE TO DEPTH OF 18" MIN.

EXISTING REVETMENT END OF HOLWAY ST.

FILL AS REQUIRED

TOP OF REVETMENT ELEV. = 15.5'

4 TON AVG. ARMOUR STONE

9"-12" LAYER BEDDING STONE

MHW = 5.0'

5 - 6 TON TOE STONE

ELEV. = -3.5' MLW

TYPICAL DETAIL

SCALE: 1" = 5' HORZ & VERT.
<table>
<thead>
<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sheets</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>010-03A-001-015-100</td>
<td>010-03A-001-015-100-COE1A</td>
<td>47-2</td>
<td>USACE</td>
<td>Chatham</td>
<td>December 1946</td>
<td>Proposed Stone Jetty in Nantucket Sound - Chatham, Massachusetts - Application by the DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Forest Beach</td>
<td>Groins</td>
</tr>
<tr>
<td>010-03A-001-015-100</td>
<td>010-03A-001-015-100-COE1B</td>
<td>57-346</td>
<td>USACE</td>
<td>Chatham</td>
<td>November 1957</td>
<td>Proposed Gravel and Sand Fill - Nantucket Sound - Pleasant Street Beach - Chatham, Massachusetts</td>
<td>1</td>
<td>Forest Beach</td>
<td>Groins</td>
</tr>
<tr>
<td>010-03A-001-015-100</td>
<td>010-03A-001-015-100-COE1C</td>
<td>59-2</td>
<td>USACE</td>
<td>Chatham</td>
<td>October 1958</td>
<td>Proposed Gravel and Sand Fill - Forest Beach Road - Nantucket Sound - Chatham, Massachusetts - Application by the DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Forest Beach</td>
<td>Groins</td>
</tr>
<tr>
<td>010-03A-001-015-100</td>
<td>010-03A-001-015-100-COE1D</td>
<td>60-221</td>
<td>USACE</td>
<td>Chatham</td>
<td>May 1960</td>
<td>Proposed Gravel and Sand Fill - Vicinity of Forest Beach Road - Nantucket Sound - Chatham, Massachusetts - Application by the DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Forest Beach</td>
<td>Groins</td>
</tr>
<tr>
<td>010-03A-001-015-100</td>
<td>010-03A-001-015-100-COE1E</td>
<td>66-141</td>
<td>USACE</td>
<td>Chatham</td>
<td>April 1965</td>
<td>Proposed Shore Protection - Gravel and Ravelment - Forest Beach - Chatham, Massachusetts - Application by the DPW of Massachusetts - Division of Waterways</td>
<td>1</td>
<td>Forest Beach</td>
<td>Groins</td>
</tr>
<tr>
<td>010-08B-031-014-100</td>
<td>010-08B-031-014-100-COE1A</td>
<td>87-217</td>
<td>USACE</td>
<td>Chatham</td>
<td>November 1996</td>
<td>To Construct Concrete Boat Ramp, Timber Bulkhead, Place Floats and to Deedge In Oyster Pond River - Chatham, Barnstable County, Massachusetts</td>
<td>2</td>
<td>Barn Hill Road</td>
<td>Replace Steel Bulkhead</td>
</tr>
<tr>
<td>010-11J-006-006-100</td>
<td>010-11J-006-006-100-COE1A</td>
<td>87-218</td>
<td>USACE</td>
<td>Chatham</td>
<td>November 1996</td>
<td>To Construct Concrete Ramp, Timber Bulkhead, Place Float, Gangway and Dredge in Ryder's Cove - Chatham, Barnstable County, Massachusetts</td>
<td>2</td>
<td>Ryder's Cove Road</td>
<td>Timber Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-100</td>
<td>010-16F-PIER-005-100-COE1A</td>
<td>68-34</td>
<td>USACE</td>
<td>Chatham</td>
<td>October 1967</td>
<td>Proposed Bulkhead, Groin, Excavation and Fill In Aunt Lydia Cove at Chatham, County of Barnstable, Massachusetts</td>
<td>1</td>
<td>Reh Pier</td>
<td>Timber Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-200</td>
<td>010-16F-PIER-005-200-COE2A</td>
<td>49-201</td>
<td>USACE</td>
<td>Chatham</td>
<td>November 1967</td>
<td>To Build and Maintain a Timber Bulkhead and Fill Sold In Aunt Lydia's Cove at Chatham, County of Barnstable, Massachusetts</td>
<td>1</td>
<td>Reh Pier</td>
<td>Timber Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-200</td>
<td>010-16F-PIER-005-200-COE2B</td>
<td>56-260</td>
<td>USACE</td>
<td>Chatham</td>
<td>July 1967</td>
<td>Proposed Pile, Timrre Bulkhead, Dredge and Fill Sold In Aunt Lydia's Cove - Chatham, Massachusetts</td>
<td>4</td>
<td>Reh Pier</td>
<td>Riprap and Timber Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-200</td>
<td>010-16F-PIER-005-200-COE2C</td>
<td>75-176</td>
<td>USACE</td>
<td>Chatham</td>
<td>January 1979</td>
<td>To Install a Sheet Steel Bulkhead and to Deedge In Aunt Lydia's Cove - Chatham, Barnstable County, Massachusetts</td>
<td>2</td>
<td>Reh Pier</td>
<td>Steel Bulkhead</td>
</tr>
<tr>
<td>010-16F-PIER-005-300</td>
<td>010-16F-PIER-005-300-COE3A</td>
<td>56-260</td>
<td>USACE</td>
<td>Chatham</td>
<td>July 1966</td>
<td>Proposed Pile, Timber Bulkhead, Dredge and Fill Sold In Aunt Lydia's Cove - Chatham, Massachusetts</td>
<td>4</td>
<td>Reh Pier</td>
<td>Riprap and Timber Bulkhead</td>
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<tr>
<td>010-178-000-075-100</td>
<td>010-178-000-075-100-COE1A</td>
<td>19912052</td>
<td>USACE</td>
<td>Chatham</td>
<td>November 1991</td>
<td>Plan and Details of Proposed Rock Revetment - Town of Chatham Lighthouse Beach - Shore Front Protection</td>
<td>3</td>
<td>Lighthouse Beach</td>
<td>Revetment</td>
</tr>
</tbody>
</table>
NOTE:
ELEVATIONS ARE IN FEET AND TENTHS ABOVE THE PLANE OF MEAN LOW WATER.
MINUS FIGURES SHOW DEPTH BELOW THIS PLANE. PROPOSED JETTIES ARE SHOWN IN RED.

PROPOSED STONE JETTIES IN NANTUCKET SOUND
CHATHAM, MASS.
APPLICATION BY DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS.

ARCH D Dpwd
signature
NOTE
Elevations are in feet and tenths and refer to plane of mean low water. Minus figures show depths below the same plane.
Approx. existing ground shown thsly. Exisitng groins to be removed and stone used in new groins.
Sides and end slopes for groins 1.5 to 1.
Location of proposed work shown in red. Spaces between larger stones in groins to be filled with stone chips.

PROPOSED GROINS AND SAND FILL
NANTUCKET SOUND
PLEASANT ST. BEACH—CHATHAM, MASS.

APPLICTION BY
DEPARTMENT OF PUBLIC WORKS—MASSACHUSETTS
DIVISION OF WATERWAYS

NOVEMBER 1957

Robert F. MacKennon
CHIEF, WATERWAYS ENGINEER,
NOTE

ELEVATIONS ARE IN FEET AND TENTHS
AND REFER TO PLANE OF MEAN LOW
WATER. MINUS FIGURES SHOWN BELOW
THE SAME PLANS.

APPROX. EXISTING GROINS THUS
ALL SIDES AND 45 DEGREES FOR GROINS
ARE 1.5 TO 1.0
A SECTION OF PROPOSED WORK SHOWN
IN RED.

PROPOSED
GROINS AND SAND FILL
FOREST BEACH ROAD
NANTUCKET SOUND
CHATHAM - MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
OCTOBER 1958

Robert D. MacKenzie
CHIEF WATERWAYS ENGINEER
ACC 02208
NOTE
ELEVATIONS ARE IN FEET AND TENTHS
ABOVE PLANE OF MEAN LOW WATER.
MINUS FIGURES SHOW DEPTHS BELOW
THE SAME PLANE.
APPROX. EXISTING GROUND THUS:
ALL SLOPE AND END SLOPES FOR GROINS
ARE 1.5 TO 1.0.
LOCATION OF PROPOSED WORK IS
SHOWN IN RED.

PROPOSED
STONE GROINS-SAND FILL
VICINITY OF FOREST BEACH RD.
NANTUCKET SOUND
CHATHAM, MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
MAY 1960

Robert C. Gunther
Chief Waterways Engineer
GENERAL NOTES:
Elevations are in feet & tenths & refer to the plane of mean low water, minus figures denote depths below that plane
Date of survey January 1965
Refer to transit books 873 & 996

NANTUCKET SOUND
LOCATION PLAN
YARDS
U.S.C.G.S. CHART 257

PROPOSED SHORE PROTECTION
STONE GROINS & REVETMENT
FOREST BEACH
CHATHAM MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
APRIL 1965
TO CONSTRUCT CONCRETE BOAT RAMP, TIMBER BULKHEAD, PLACE FLOATS AND TO DREDGE IN OYSTER POND RIVER
CHATHAM, BARNSTABLE CO., MA.
APPLICATION BY TOWN OF CHATHAM

NOV. 18, 1930

BRAMAN ENGINEERING CO.
CIVIL ENGINEERS & SURVEYORS
258 MAIN ST., BUIZARDS BAY, MA.
BULKHEAD SECTION
SCALE: 1" = 8'

RAMP SECTION
NOT TO SCALE

FLOAT SECTION
SCALE: 1/8" = 1'-0"
NOTES:

1. Elevations are in feet and tenths above the plane of mean low water. Minus figures indicate depths below that same plane.

2. 350 cu. yds to be dredged, 100 cu. yds to be used for fill behind proposed bulkhead. Remainder of dredged material to be taken to an in-land disposal site. (50 cu. yds, 1/2 of dredged material to be placed below H.T.L.)

3. 47 cu. yds, 1/2 of gravel to be placed below H.T.L.

...27 cu. yds, 1/2 of concrete to be placed below H.T.L.

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TO CONSTRUCT CONCRETE RAMP, TIMBER BULKHEAD, PLACE FLOAT, GANGWAY AND DREDGE IN RYDER'S COVE. CHATHAM, BARNSTABLE CO., MA.
APPLICATION BY TOWN OF CHATHAM

NOV. 24, 1986

Sheet 1 of 2

BRAUMAN ENGINEERING CO.
CIVIL ENGINEERS & SURVEYORS
258 MAIN ST. BUZZARDS BAY, MA.
BULKHEAD SECTION
SCALE: 1" = 6'

RAMP SECTION
SCALE: 1" = 5'

TYPICAL FLOAT SECTION
SCALE: 1/8" = 1'

TOWN OF CHATHAM  NOV. 24, 1986  SHEET 2 OF 2
PLAN
SCALE 1"=40'

PROPOSED BULKHEAD, GRDN. EXCAVATION & FILL IN AUNT LYDIAS COVE AT CHATHAM
COUNTY OF DANEASTABLE, MASS.
APPLICATION BY TOWN OF CHATHAM
OCTOBER 10, 1967

TO BUILD AND MAINTAIN A TIMBER BULKHEAD AND FILL SOLID IN
AUNT LYDIA'S COVE
CHATHAM MASS
APPLICATION BY
TOWN OF CHATHAM
SCALE AS SHOWN
1949
PROPOSED RIP-RAP, TIMBER BULKHEAD, DREDGE AND FILL SOLID IN AUNT LYDIA'S COVE, CHATHAM, MASS
APPLICATION BY TOWN OF CHATHAM
SCALE AS SHOWN
TYPICAL SECTION

ELEVATION

CORNER DETAIL

PROPOSED RIP-RAP, TIMBER BULKHEAD, DREDGE AND FILL SOLID IN AUNT LYDIA'S COVE CHATHAM MASS APPLICATION BY TOWN OF CHATHAM
PROPOSED RIP-RAP, TIMBER BULKHEAD, DREDGE AND FILL SOLID IN AUNT LYDIA'S COVE CHATHAM MASS
APPLICATION BY TOWN OF CHATHAM
SECTION "A-A"

SECTION "B-B"

TOWN OF CHATHAM
JANUARY 23, 1979
SHEET 2 OF 2
PROPOSED RIP-RAP TIMBER BULKHEAD, DREDGE AND FILL SOLID IN AUNT LYDIA'S COVE
CHATHAM MASS
APPLICATION BY TOWN OF CHATHAM
SCALE AS SHOWN
PROPOSED RIP-RAP, TIMBER BULKHEAD, DREDGE AND FILL SOLID IN AUNT LYDIA'S COVE CHATHAM MASS APPLICATION BY TOWN OF CHATHAM
PROPOSED RIP-RAP, TIMBER BULKHEAD,
DREDGE AND FILL SOLID IN
AUNT LYDIA'S COVE
CHATHAM MASS
APPLICATION BY
TOWN OF CHATHAM
Typical Detail

\[ MS = 0.5 \times \frac{\text{Pile Dia.}}{\text{Pile Dia.}} \times \frac{\text{Pile Dia.}}{\text{Pile Dia.}} \times \frac{\text{Pile Dia.}}{\text{Pile Dia.}} \]

\[ M_{100} = 3.3 \times \text{No.} \times \frac{\text{No.}}{\text{No.}} \times \frac{\text{No.}}{\text{No.}} \]

\[ A_{100} = 3.8 \times \text{No.} \times \frac{\text{No.}}{\text{No.}} \times \frac{\text{No.}}{\text{No.}} \]