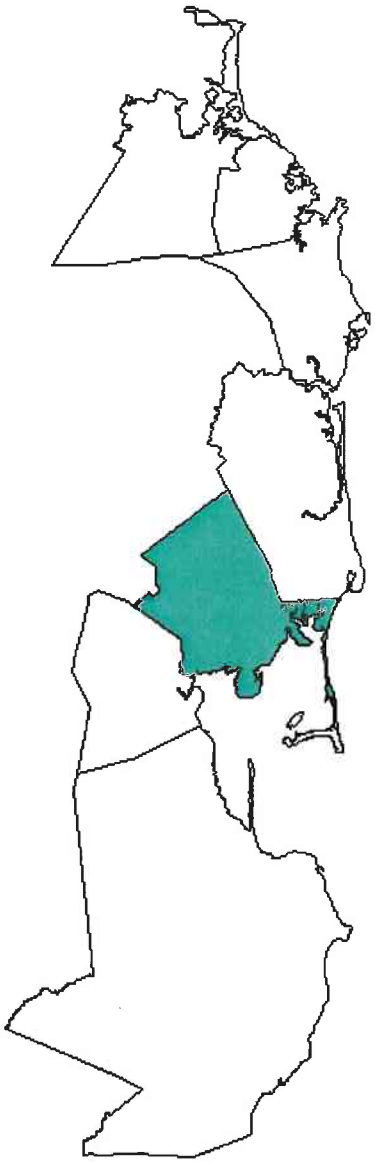
South Shore Coastal Infrastructure Inventory and Assessment Demonstration Project

Coastal Hazards Commission



Town of Duxbury

Prepared for:
Office of Coastal Zone Management
Boston, MA

February 28, 2007

Presented by:

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Franklin, Massachusetts

In Association With:

Applied Coastal Research & Engineering, Inc.
Alpha Land Surveying & Engineering Associates

BCE **Bourne Consulting Engineering**
Waterfront Engineers

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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 region included in the demonstration project was identified as the South Shore and included the eight communities of Hingham, Hull, Cohasset, Scituate, Marshfield, Duxbury, Kingston and Plymouth.

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, research and field assessments. Assisting ***BCE*** was Applied Coastal Research and Engineering, Inc. of Mashpee, MA who was responsible for field assessments and GIS data conversion. Alpha Land Surveying and Engineering of Middleboro, MA also supported the Team with field GPS survey.

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 is the performance of a demonstration project for coastal structures located on the South Shore. The demonstration project will identify existing structures, their general conditions, ability to provide coastal protection and the probable cost for repairs. The information collected and developed will be incorporated into the MassGIS system to allow use for developing a 20 Year Coastal Infrastructure Plan.

As this is a demonstration project, it will serve as the basis for development of a statewide inventory and assessment of all Commonwealth coastal structures and the needs for their maintenance and/or repair. Incorporated into this project will be the identification of issues and limitations of the investigation and

assessment to achieve the overall goals and what should be included in future investigations/assessments of coastal structures for the other regions.

Goals of Study

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

- To be used as the model to go forward for assessment of coastal structures for the remainder of the coastal regions
- To identify areas of research and/or assessment that need to be modified for future phases that were not included within the demonstration project
- Complete the study with the final report by November 15, 2006 for submission to the Coastal Hazards Commission
- To identify all the coastal structures the state either owns or has responsibility to maintain for the eight communities 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.
    - Federal structures were identified but no assessment of conditions or priority was performed.
    - 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. No investigation of state archives was performed. Research at MA DEP Chp 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-PPP-BBB-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 the state.

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: Ownerships 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 determine 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 were 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 is 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 bfm.

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

Preliminary Condition Assessment		Definition Based Upon Perceived Immediacy of Action and Potential to Cause Damage if Not Corrected	Level of Action Required
A	Excellent	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	None
B	Good	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	Minor
C	Fair	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	Moderate
D	Poor	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.	Major
F	Critical	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.	Immediate

EXHIBIT B

Priority Rating System - 5 Level Rating System

Preliminary Priority Level Assessment		Level Based Upon Perceived Immediacy of Action and Presence of Potential Risk to Inshore Structures if Not Corrected	Level of Action Required
I	None	No Inshore Structures or Residential Dwelling Units Present	Long Term Planning Considerations
II	Low Priority	Inshore Structures Present with Limited potential for Significant Infrastructure Damage	Future Project Consideration
III	Moderate Priority	Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)	Consider for Active Project Improvement Listing
IV	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)	Consider for Next Project Construction Listing
V	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. (>10 dwellings impacted / 100 feet of shoreline)	Consider For Immediate Action Due to Public Safety and Welfare Issues

CZM SOUTH SHORE COASTAL INFRASTRUCTURE INVENTORY AND ASSESMENT PROJECT

EXHIBIT C

September 14, 2006

REPAIR / REHABILITATION COSTING DATA

Cost per linear foot of structure

STRUCTURE TYPE	STRUCTURE MATERIALS	STRUCTURE HEIGHT	STRUCTURE CONDITION RATING A	B	C	D	E
BULKHEAD/ SEAWALL	CONCRETE	Under 5 Feet	$0	$84	$425	$850	$983
		5 To 10 Feet	$0	$152	$759	$1,518	$1,782
		10 To 15 Feet	$0	$251	$1,254	$2,508	$2,970
		Over 15 Feet	$0	$396	$1,980	$3,960	$4,752
	STEEL	Under 5 Feet	$0	$54	$273	$546	$680
		5 To 10 Feet	$0	$165	$825	$1,650	$1,848
		10 To 15 Feet	$0	$251	$1,254	$2,508	$2,772
		Over 15 Feet	$0	$343	$1,716	$3,432	$3,795
	STONE	Under 5 Feet	$0	$84	$425	$850	$983
		5 To 10 Feet	$0	$152	$759	$1,518	$1,782
		10 To 15 Feet	$0	$251	$1,254	$2,508	$2,970
		Over 15 Feet	$0	$396	$1,980	$3,960	$4,752
	WOOD	Under 5 Feet	$0	$86	$431	$862	$994
		5 To 10 Feet	$0	$127	$632	$1,265	$1,463
		10 To 15 Feet	$0	$161	$804	$1,608	$1,872
		Over 15 Feet	$0	$202	$1,008	$2,017	$2,380
COASTAL BEACH	SAND	Under 5 Feet	$0	$26	$132	$264	$264
		5 To 10 Feet	$0	$127	$634	$1,267	$1,267
		10 To 15 Feet	$0	$224	$1,122	$2,244	$2,244
		Over 15 Feet	$0	$396	$1,980	$3,960	$3,960
COASTAL DUNE	SAND	Under 5 Feet	$0	$18	$93	$186	$186
		5 To 10 Feet	$0	$48	$238	$476	$476
		10 To 15 Feet	$0	$79	$395	$790	$790
		Over 15 Feet	$0	$132	$660	$1,320	$1,320
REVETMENT	STONE	Under 5 Feet	$0	$66	$333	$664	$730
		5 To 10 Feet	$0	$120	$601	$1,201	$1,300
		10 To 15 Feet	$0	$157	$781	$1,564	$1,696
		Over 15 Feet	$0	$247	$1,234	$2,468	$2,666
GROIN	STONE	Under 5 Feet	$0	$157	$664	$1,328	$1,460
		5 To 10 Feet	$0	$157	$1,201	$2,402	$2,600
		10 To 15 Feet	$0	$157	$1,564	$3,128	$3,392
		Over 15 Feet	$0	$157	$2,468	$4,937	$5,333

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

Section II

Town of Duxbury

Community Findings

Section II – Community Findings – Town of Duxbury

COMMUNITY DESCRIPTION

The Town of Duxbury consists of a land area of 23.8 square miles out of a total area of 37.6 square miles and had a population of 14,248 in the 2000 census. The Town is located on the South Shore of Massachusetts and its location can be seen on this report's cover. The estimated length of shoreline that is directly exposed to open ocean waves is 4.7 miles with the remaining shoreline semi-protected by offshore structures or landforms. 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 Duxbury, there were 13 publicly owned structures identified which provide significant coastal protection. The location of the structures can be seen in Sheets 1 through Sheet 3 in Section III 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 Duxbury

Primary Structure (1)	Total Structures	Structure Condition Rating A	B	C	D	F	Total Length
Bulkhead / Seawall	11		6	4		1	4598
Revetment	2		1	1			116
Groin / Jetty							
Coastal Dune							
Coastal Beach							
	13		7	5		1	4714

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 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 Duxbury's case there are a total of 13 structures which would require approximately $2.8 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 $1.0 million would be required to upgrade the Town's coastal protection.

STRUCTURE REPAIR / RECONSTRUCTION COST - Town of Duxbury

Primary Structure (1)	Total Structures	Structure Condition Rating A	B	C	D	F	Total Cost
Bulkhead / Seawall	11		$384,049	$ 1,403,411		$ 1,024,650	$ 2,812,110
Revetment	2		$ 5,940	$ 15,616			$ 21,556
Groin / Jetty							$ -
Coastal Dune							$ -
Coastal Beach							$ -
	13	$-	$389,989	$ 1,419,027	$-	$ 1,024,650	$ 2,833,666

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 Duxbury the breakdown of structures by assumed ownership is as follows:

STRUCTURE OWNERSHIP / REPAIR COST - Town of Duxbury

Primary Structure (1)	Total Structures	Structure Condition Rating A	B	C	D	F	Total Cost
Town Owned	13		$389,989	$ 1,419,027		$ 1,024,650	$ 2,833,666
Commonwealth of Massachusetts							$ -
Federal Government Owned							$ -
Unknown Ownership							$ -
							$ -
	13	$-	$389,989	$ 1,419,027	$-	$ 1,024,650	$ 2,833,666

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 which contains Structure Assessment Reports for each individual structure found.

SUMMARY

The enclosed reports and associated documents reflects the Town of Duxbury'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

Town of Duxbury

Structure Assessment Reports

COASTAL STRUCTURE LOCATION PLAN

TOWN OF DUXBURY

SOUTH SHORE COASTAL INFRASTRUCTURE INVENTORY AND ASSESSMENT DEMONSTRATION PROJECT

AUGUST 2006

0 200

SCALE: 1" = 200'

BCE Bourne Consulting Engineering

SHEET 1 OF 3

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COASTAL STRUCTURE LOCATION PLAN

TOWN OF DUXBURY

SOUTH SHORE COASTAL INFRASTRUCTURE INVENTORY AND ASSESSMENT DEMONSTRATION PROJECT

AUGUST 2006

0 200

SCALE: 1" = 200'

BCE Bourne Consulting Engineering

SHEET 2 OF 3

File: X:\26600-\26637\Final Town Report Ortho Drawings\Duxbury Report Drawing.dwg

File: X:\26600-\26637\Final Town Report Ortho Drawings\Duxbury Report Drawing.dwg

COASTAL STRUCTURE LOCATION PLAN

TOWN OF DUXBURY

SOUTH SHORE COASTAL INFRASTRUCTURE INVENTORY
AND ASSESSMENT DEMONSTRATION PROJECT

AUGUST 2006

0 200

SCALE: 1" = 200'

BCE Bourne Consulting Engineering
184 West Central Street
Franklin, MA 02038
PH. (508) 528-8133 FAX. (508) 528-8671

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-191-505-140-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Long Point	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	1936	$24,077.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
160 Feet	Feet NAVD 88	VE	14 Feet NGVD

Primary Type:	Primary Material:	Primary Height:
Bulkhead/ Seawall	Concrete	Under 5 Feet

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

Structure Summary :

Revetment slope (100-500 lbs. stone) for 15' width in front of concrete seawall with railing (parking lot behind). Minor spalling.

Condition Rating	B Good	*Priority Rating*	I None
Level of Action	Minor	*Action*	Long Term Planning Considerations
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.	*Description*	No Inshore Structures or Residential Dwelling Units Present

Structure Images:

018-191-505-140-100-PHO1A.jpg

Structure Documents:

USACE	MAY 8 1936	PROPOSED WHARF	018-191-505-140-100-COE1A
USACE	SEP 27 193	PROPOSED ROCK	018-191-505-140-100-COE1B
USACE	NOV. 1 1938	PLAN	018-191-505-140-100-COE1C
USACE	JUL 1988	RECONSTRUCT	018-191-505-140-100-COE1D

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-191-505-140-200

Key: community-map-block-parcel-structure

Property Owner: Local

Location: Long Point

Date: 7/26/2006

Presumed Structure Owner: Local

Based On Comment: USACE - Permits

Owner Name: Duxbury

Earliest Structure Record: 1988

Estimated Reconstruction/Repair Cost: $5,940.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
90 Feet	Feet NAVD 88	VE	14 Feet NGVD

Primary Type:	Primary Material:	Primary Height:
Revetment	Concrete	Under 5 Feet

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

Asphalt boat ramp with concrete sidewalls. Some deterioration at outshore corners of concrete walls.

Condition Rating	B Good
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	I None
Action	Long Term Planning Considerations
Description	No Inshore Structures or Residential Dwelling Units Present

Structure Images:

018-191-505-140-200-PHO2A.jpg

Structure Documents:

USACE	JUL 1988	RECONSTRUCT	018-191-505-140-100-COE2A

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-200-470-053-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Howards Landing	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DEP – Ch 91 License

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	1993	$9,867.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
65 Feet	10 Feet NAVD 88	VE	16 Feet NGVD

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

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

Stone block seawall (dryset) forming filled wharf. Minor voids in wall, but no movement or rotation of stones observed. Minor fill loss noted.

Condition Rating	B Good
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	I None
Action	Long Term Planning Considerations
Description	No Inshore Structures or Residential Dwelling Units Present

Structure Images:

018-200-470-053-100-PHO1A.jpg

018-200-470-053-100-PHO1B.jpg

018-200-470-053-100-PHO1C.jpg

Structure Documents:

DEP CH.91	SEPT. 1993	PLAN	018-200-470-053-100-LIC1A

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-200-470-053-200

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Howards Landing	9/1/2006

Presumed Structure Owner:	Based On Comment:
Local	DEP - CH 91 License

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	0	$15,616.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
26 Feet	10 Feet NAVD 88	VE	16 Feet NGVD

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

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

1.) Stone block seawall (dryset) forming filld wharf. Minor voids in wall, but no movement or rotation of stones observed. Minor fill loss noted.
2.) Dumped rip rap (100 to 500 lb. stones) along south shore edge of boat ramp. Provides little protection. Not well constructed.
3.) Bituminuous pavement boat ramp. Pavement ends above mean high water and is broken and deteriorated. Sand and rock beach used to

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	I
Rating	None
Action	Long Term Planning Considerations
Description	No Inshore Structures or Residential Dwelling Units Present

Structure Images:

018-200-470-053-200-PHO2A.jpg
018-200-470-053-200-PHO2B.jpg
018-200-470-053-200-PHO2C.jpg
018-200-470-053-200-PHO2D.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-201-997-078-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Massasoit Rd.	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DPW - DPW Employee Interview

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	0	$13,601.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
161 Feet	Feet NAVD 88	VE	15 Feet NGVD

Primary Type:	Primary Material:	Primary Height:
Bulkhead/ Seawall	Stone	Under 5 Feet

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

Stone seawall with mortared joints and stairs to access beach. Steel railing is deteriorated. Some cracks and voids in mortar in joint. Appears to have concrete footing buried and is connected to private seawall on one side.

Condition Rating	B Good
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	III 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:

018-201-997-078-100-PHO1A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-210F-916-004-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	0	$112,820.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
518	9	VE	21
Feet	Feet NAVD 88		Feet NGVD

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

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

Structure Summary :

Concrete seawall in satisfactory condition with some cracking for full height of front outshore face. Some deterioration at joints. 30" wide wall with wave return face. 2' high x 6' wide revetment along face (1 ton stone)

Condition Rating	B Good
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	IV High Priority
Action	Consider for Next Project Construction Listing
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:

018-210F-916-004-100-PHO1A.jpg

018-210F-916-004-100-PHO1B.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-211-939-118-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	0	$86,001.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
1018 Feet	9 Feet NAVD 88	VE	21 Feet NGVD

Primary Type:	Primary Material:	Primary Height:
Bulkhead/ Seawall	Concrete	Under 5 Feet

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

Concrete seawall in satisfactory condition with some vertical cracks for full height of front face. 30 inch wide wall with wave return face.

Condition Rating	B Good	*Priority Rating*	IV High Priority
Level of Action	Minor	*Action*	Consider for Next Project Construction Listing
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.	*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:

018-211-939-118-100-PHO1A.jpg

018-211-939-118-100-PHO1B.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-211-939-131-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	0	$21,252.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
50 Feet	9 Feet NAVD 88	VE	21 Feet NGVD

Primary Type:	Primary Material:	Primary Height:
Bulkhead/ Seawall	Concrete	Under 5 Feet

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

Concrete seawall in fair condition with cracking and spalling. Built 30 inch wide with wave return face.

Condition Rating	C Fair	*Priority Rating*	IV High Priority
Level of Action	Moderate	*Action*	Consider for Next Project Construction Listing
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.	*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:

018-211-939-131-100-PHO1A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-212-600-901-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	1962	$519,621.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
476 Feet	9 Feet NAVD 88	VE	21 Feet NGVD

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

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

Structure Summary :

Concrete wall in fair condition. Evidence of lateral movement and slight tilt to outshore. Appeared to have failed previously and revetment (average 1 to 2 ton stone) placed along outshore face to stabalize.

Condition Rating	C	*Priority Rating*	IV
	Fair		High Priority
Level of Action	Moderate	*Action*	Consider for Next Project Construction Listing
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.	*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:

018-212-600-901-100-PHO1A.jpg
018-212-600-901-100-PHO1B.jpg
018-212-600-901-100-PHO1C.jpg

Structure Documents:

MA DPW	AUG 1962	PROPOSED	018-212-600-901-100-DCR1A
DEP CH.91	NOV. 4 1994	PLAN	018-212-600-901-100-LIC1A
DEP CH.91	JULY 02, 19	PLANS	018-212-600-901-100-LIC1B
USACE	NOV 14 199	PETITION TO	018-212-600-901-100-COE1A

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-212-901-001-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	1953	$137,683.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
907 Feet	9 Feet NAVD 88	VE	21 Feet NGVD

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

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

Concrete seawall in satisfactory condition with some minor cracking. Wall built with 30" wide cap and wave return face.

Condition Rating	B Good	*Priority Rating*	IV High Priority
Level of Action	Minor	*Action*	Consider for Next Project Construction Listing
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.	*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:

018-212-901-001-100-PHO1A.jpg

018-212-901-001-100-PHO1B.jpg

Structure Documents:

MA DPW	SEPT. 1953	PROPOSED	018-212-901-001-100-DCR1A

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-212-901-060-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR – Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	0	$1,024,650.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
345 Feet	0 Feet NAVD 88	VE	21 Feet NGVD

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

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

Historic DCR documents indicate bulkhead construction at location. No evidence of bulkhead found. Currently, cobble beach with dune (approximately 10 feet high) inshore. Erosion of material landward of historic bulkhead line. Temporary stabablization to prevent fill loss at ends of adjacent structures.

Condition Rating	F
Level of Action	Critical
Description	Immediate
	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.

Priority Rating	IV
Action	High Priority
Description	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:

018-212-901-060-100-PHO1A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-212-901-064-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	1946	$268,686.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
354 Feet	9 Feet NAVD 88	VE	21 Feet NGVD

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

Secondary Type:	Secondary Material:	Secondary Height:

Structure Summary :

First 50' is precast concrete seawall in fair condition with horizontal joint at mid-height. Concrete cracking and spalling near wall top and apex of curve. Remainder of structure is condition "B" with minor cracking (construction similar to adjacent structures)

Condition Rating	C Fair	*Priority Rating*	IV High Priority
Level of Action	Moderate	*Action*	Consider for Next Project Construction Listing
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.	*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:

018-212-901-064-100-PHO1A.jpg

018-212-901-064-100-PHO1B.jpg

Structure Documents:

MA DPW	NOV 1946	PROPOSED	018-212-901-064-100-DCR1A

Prepared By: Bourne Consulting Engineering

CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Duxbury

Structure ID: 018-212-901-073-100

Key: community-map-block-parcel-structure

Property Owner:	Location:	Date:
Local	Duxbury Beach	7/26/2006

Presumed Structure Owner:	Based On Comment:
Local	DCR - Contract Drawings

Owner Name:	Earliest Structure Record:	Estimated Reconstruction/Repair Cost:
Duxbury	1946	$593,852.00

Length:	Top Elevation:	FIRM Map Zone:	FIRM Map Elevation:
544 Feet	9 Feet NAVD 88	VE	21 Feet NGVD

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

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

Structure Summary :

Concrete seawall with 30" cap and wave return face. Revetment is 3' to 4' high x 6' to 8' wide with stone size 1 ton to 2 ton. Horz. Movement of about 3 wall sections (40'ea = 120' total) Horzontal cracking at wall mid-Height

Condition Rating	C
Level of Action	Fair
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	IV
Action	High Priority
Description	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:

018-212-901-073-100-PHO1A.jpg

018-212-901-073-100-PHO1B.jpg

Structure Documents:

MA DPW	NOV 1946	PROPOSED	018-212-901-073-100-DCR1A
DEP CH.91	JULY 02, 19	PLANS	018-212-901-073-100-LIC1A

Prepared By: Bourne Consulting Engineering

Section IV

Town of Duxbury

Structure Photographs

TOWN: DUXBURY
SOURCE: BCE - FIELD PHOTOGRAPHS
LOCATION: Bourne Consulting Engineering
DATE OF RESEARCH: AUGUST 2006

Structure No	Digital Image No	Contract/ Drawing Number	Entity	Municipality	Date	Title	Sheets	Location	Description
018-191-505-140-100	018-191-505-140-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-191-505-140-200	018-191-505-140-200-PHO2A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-200-470-053-100	018-200-470-053-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-200-470-053-100	018-200-470-053-100-PHO1B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-200-470-053-100	018-200-470-053-100-PHO1C.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-200-470-053-200	018-200-470-053-200-PHO2A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-200-470-053-200	018-200-470-053-200-PHO2B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-200-470-053-200	018-200-470-053-200-PHO2C.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-200-470-053-200	018-200-470-053-200-PHO2D.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-201-997-078-100	018-201-997-078-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-210F-916-004-100	018-210F-916-004-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-210F-916-004-100	018-210F-916-004-100-PHO1B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-211-939-118-100	018-211-939-118-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-211-939-118-100	018-211-939-118-100-PHO1B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-211-939-131-100	018-211-939-131-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-212-600-901-100	018-212-600-901-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-212-600-901-100	018-212-600-901-100-PHO1B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-212-600-901-100	018-212-600-901-100-PHO1C.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
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018-212-901-001-100	018-212-901-001-100-PHO1B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-212-901-064-100	018-212-901-064-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
018-212-901-064-100	018-212-901-064-100-PHO1B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey

TOWN: DUXBURY
SOURCE: BCE - FIELD PHOTOGRAPHS
LOCATION: Bourne Consulting Engineering
DATE OF RESEARCH: AUGUST 2006

018-212-901-060-100	018-212-901-060-100-PHO1A.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey
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018-212-901-073-100	018-212-901-073-100-PHO1B.jpg		Bourne Consulting Engineering	DUXBURY	August 2006	DIGITAL IMAGE	1	Structure Location	Structure Condtion Photo at Time of Survey

018-211-939-118-100-PHO1B.jpg

018-191-505-140-200-PHO2A.jpg

018-200-470-053-100-PHO1A.JPG

018-200-470-053-100-PHO1B.JPG

018-200-470-053-100-PHO1C.JPG

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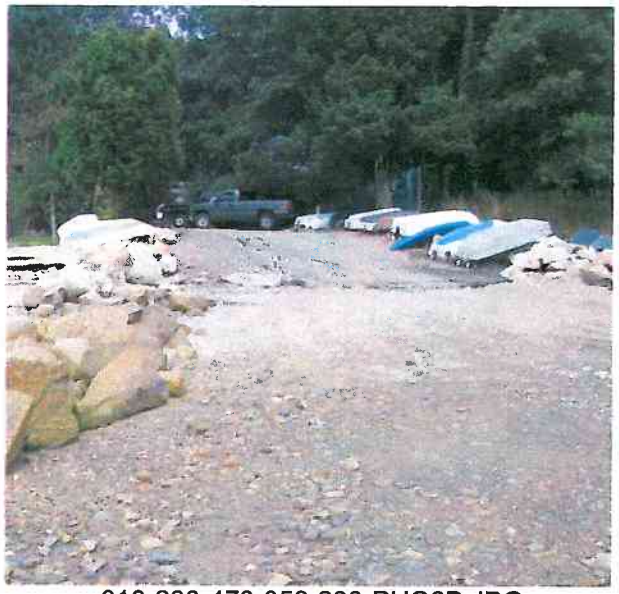

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018-200-470-053-200-PHO2D.JPG

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018-191-505-140-100-PHO1A.jpg


018-211-939-118-100-PHO1A.jpg


018-212-901-073-100-PHO1B.jpg


018-211-939-131-100-PHO1A.jpg


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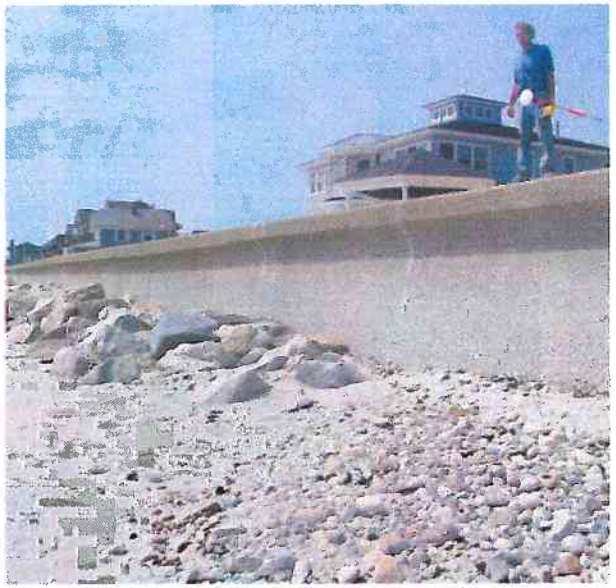
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018-212-901-001-100-PHO1B.jpg

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018-212-901-064-100-PHO1A.jpg

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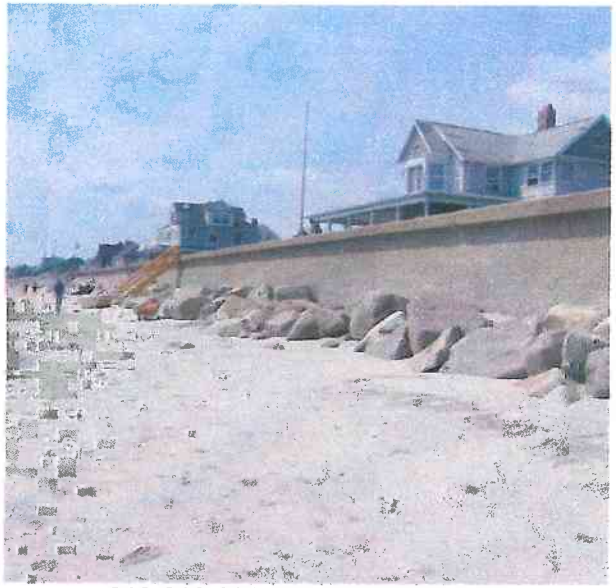

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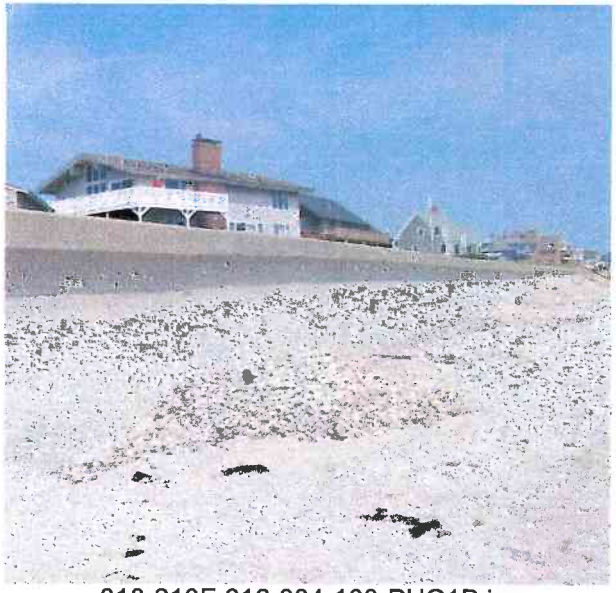


018-210F-916-004-100-PHO1B.jpg

Section V

Town of Duxbury

Structure Research

TOWN DOCUMENT LIST

MA DCR - DOCUMENT LIST

MA DEP – Chp 91 DOCUMENT LIST

- Copies of License Documents

USACE – PERMIT DOCUMENT LIST

- Copies of Permit Documents

TOWN: DUXBURY
SOURCE: TOWN OF DUXBURY
LOCATION: DUXBURY, MA
DATE OF RESEARCH: AUGUST 2006

NO DRAWINGS AVAILABLE AT THE TOWN

BCE Structure No	Document No	Contract/ Drawing Number	Entity	Municipality	Date	Title	Sheets	Location	Description

TOWN: DUXBURY
SOURCE: MA-DCR - OFFICE OF WATERWAYS
LOCATION: MA-DCR - OFFICE OF WATERWAYS, HINGHAM, MA
DATE OF RESEARCH: AUGUST 2006

BCE Structure No	Document No	Contract/ Drawing Number	Entity	Municipality	Date	Title	Sheets	Location	Description
018-212-600-901-100	018-212-600-901-100-DCR1A	2357	MA DPW	DUXBURY	AUG 1962	PROPOSED CONCRETE SEAWALL, VICINITY OF GURNET ROAD	1	DUXBURY BEACH	FROM CONTRACT 1339 SOUTH 300 FEET
018-212-901-001-100	018-212-901-001-100-DCR1A	1339	MA DPW	DUXBURY	SEPT. 1953	PROPOSED CONCRETE RETAINING WALL, DUXBURY BEACH	3	DUXBURY BEACH	FROM CONTRACT 960 SOUTH 1800 FEET
018-212-901-064-100	018-212-901-064-100-DCR1A	960	MA DPW	DUXBURY	NOV 1946	PROPOSED CONCRETE RETAINING WALL, DUXBURY BEACH	2	DUXBURY BEACH	FROM MARSHFIELD TOWN LINE SOUTHERLY 1500 FEET
018-212-901-073-100	018-212-901-073-100-DCR1A	960	MA DPW	DUXBURY	NOV 1946	PROPOSED CONCRETE RETAINING WALL, DUXBURY BEACH	2	DUXBURY BEACH	FROM MARSHFIELD TOWN LINE SOUTHERLY 1500 FEET

TOWN: DUXBURY
SOURCE: MA-DEP CHAPTER 91 LICENSE
LOCATION: MA-DEP MAIN OFFICE, BOSTON, MA
DATE OF RESEARCH: AUGUST 2006

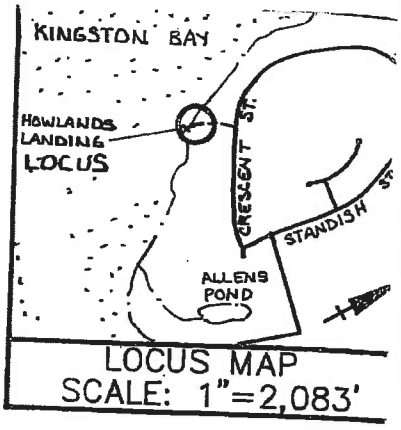
Structure No	Document No	Contract/ Drawing Number	Entity	Municipality	Date	Title	Sheets	Location	Description
018-200-470-053-100	018-200-470-053-100-LIC1A	5083	DEP CH.91	DUXBURY	SEPT. 1993	PLAN ACCOMPANYING PETITION OF: THE TOWN OF DUXBURY DEPT. OF PUBLIC WORKS 878 TREMONT STREET, DUXBURY, MA 02332	1	HOWLAND LANDING, CRESCENT STREET, NEAR MYLES STANDISH MONUMENT STATE PARK	REPAIR BOAT LANDING GROINS
018-022-470-053-200	018-200-470-053-200-LIC2A	5083	DEP CH.91	DUXBURY	SEPT. 1993	PLAN ACCOMPANYING PETITION OF: THE TOWN OF DUXBURY DEPT. OF PUBLIC WORKS 878 TREMONT STREET, DUXBURY, MA 02332	1	HOWLAND LANDING, CRESCENT STREET, NEAR MYLES STANDISH MONUMENT STATE PARK	REPAIR BOAT LANDING GROINS
018-212-600-901-100	018-212-600-901-100-LIC1A	4235	DEP CH.91	DUXBURY	NOV. 4 1994	PLAN ACCOMPANYING THE PETITION OF: THE TOWN OF DUXBURY TO REPAIR AND MAINTAIN AN EXISTING SEAWALL AND NEW REVETMENT	3	BETWEEN 123 GURNET ROAD AND 435 CANTON AVE	REPAIR SEAWALL AND CONSTRUCT REVETMENT
018-212-600-901-100	018-212-600-901-100-LIC1B	6664	DEP CH.91	DUXBURY	JULY 02, 1997	PLANS ACCOMPANYING PETITION OF: THE TOWN OF DUXBURY FOR PLACING STONE PROTECTION ALONG EXISTING SEAWALL	5	GURNET ROAD AND BAY AVENUE	STONE PROTECTION FOR SEAWALL
018-212-901-073-100	018-212-901-073-100-LIC1A	6664	DEP CH.91	DUXBURY	JULY 02, 1997	PLANS ACCOMPANYING PETITION OF: THE TOWN OF DUXBURY FOR PLACING STONE PROTECTION ALONG EXISTING SEAWALL	5	GURNET ROAD AND BAY AVENUE	STONE PROTECTION FOR SEAWALL

018-200-420-053-100
018-022-470-053-200

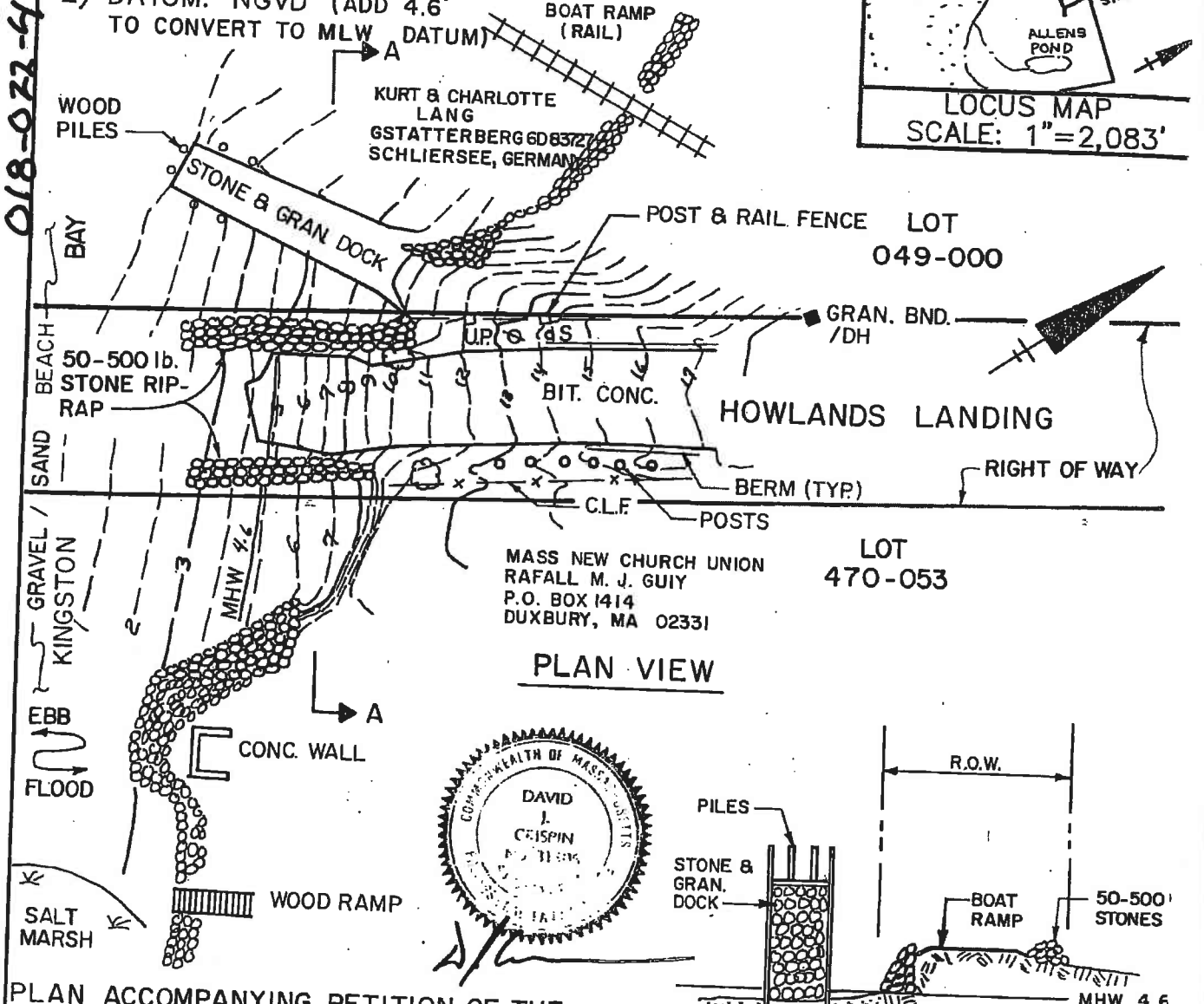
NOTES:

1) EXISTING CONTOURS BASED ON FIELD SURVEY JULY 1993. LOT LINES ARE COMPILED AND DO NOT REPRESENT A PROPERTY LINE SURVEY BY THIS OFFICE.

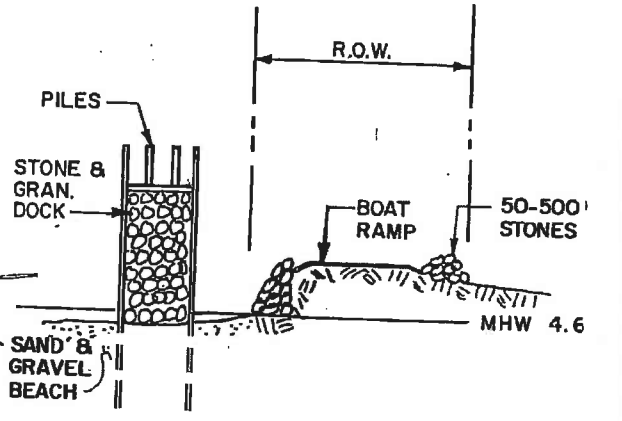
2) DATUM: NGVD (ADD 4.6' TO CONVERT TO MLW DATUM)



LOCUS MAP
SCALE: 1"=2,083'



PLAN VIEW



CROSS SECTION A-A

SCALE: 1" = 40' HORIZ.
1" = 8' VERT.

PLAN ACCOMPANYING PETITION OF THE TOWN OF DUXBURY DEPT. OF PUBLIC WORKS 878 TREMONT STREET, DUXBURY, MA 02332 FOR MAINTENANCE & REPAIR OF A BOAT LANDING (HOWLAND'S LANDING) AND GROINS IN KINGSTON BAY, DUXBURY, MA

SCALE: 1"= 40'

0 20 40 80 FEET

PREPARED BY:
THE BSC GROUP, INC.
293 WASHINGTON STREET
NORWELL, MA
02061

SEPT. 1993

SHEET 1 OF 1

LICENSE PLAN NO. 5083

Approved by Department of Environmental Protection of Massachusetts

COMMISSIONER

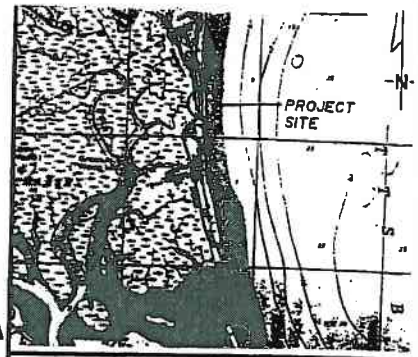
DIVISION DIRECTOR

SECTION CHIEF

MAY 1 4 1996

4 5169.00

018-212-600-901-100



LOCUS MAP

N

SEAWALL CONSTRUCTION MPDW CONTRACT 960 NOV. 1946

N/F ROGER C. TOUGAS PO BOX 213 GREEN HARBOR, MA

N/F BARRY & MARY WOODS 435 CANTON AVE MILTON, MA

N/F GEORGE STEPTOE 143 GURNET RD

N/F WILLIAM STEVENSON 137 GURNET RD

N/F SUSAN D'ARPINO 123 GURNET RD

MLW 80'±

MHW

MASSACHUSETTS BAY

LIMIT OF NEW STONE (300± LF)

LIMIT OF EXISTING STONE 215± LF

15' WAY

GURNET ROAD

20.5 22.6 20.3 22.4 22.1 19.8 21.9 19.0 7.8 11.7 21.7 21.6 17.1 15.6 22.3 21.5 22.3 8.6 11.1 22.3 21.9 22.4 19.5 20.7 22.4 22.4

COMMONWEALTH OF MASSACHUSETTS
DAVID B. VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER

NOTES:

1. DATUM MLW=0.0; MHW=9.2; HIGH WATER LEVEL (HWL)=10.7. SPOT ELEVATIONS BY NVA 2/94.
2. LOCATIONS & SIZES OF BUILDINGS ARE APPROXIMATE, BASED ON SCALING OF PRIOR DRAWINGS.
3. 100 YR FLOODPLAIN AT ELEV 22.0 MLW.
4. VOLUME OF STONE TO BE PLACED BELOW MHW = 350 C.Y. (SEE SHEET 3 OF 3).

SITE PLAN

SCALE: 1" = 60'

0' 30' 60'

SHEET 1 OF 3

PLAN ACCOMPANYING THE PETITION OF THE TOWN OF DUXBURY TO REPAIR AND MAINTAIN AN EXISTING SEAWALL AND NEW REVETMENT AT GURNET ROAD, DUXBURY, MA

LICENSE PLAN NO. 4235

Approved by Department of Environmental Protection of Massachusetts

Thomas B. Powers COMMISSIONER

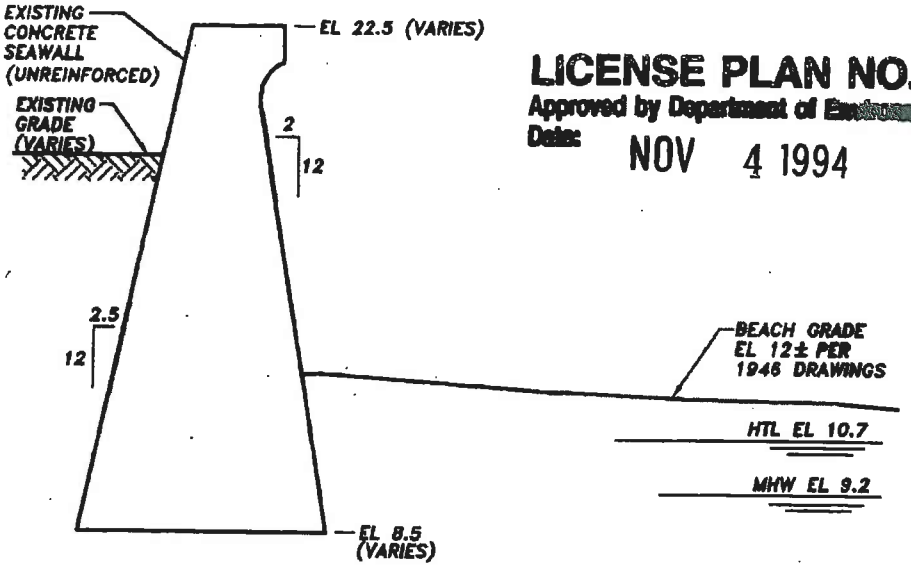
DIVISION DIRECTOR

SECTION CHIEF

NOV 4 1994 DATE

NUCCI VINE ASSOCIATES, INC.

LICENSE PLAN NO. 4235
Approved by Department of Environmental Protection
Date: NOV 4 1994

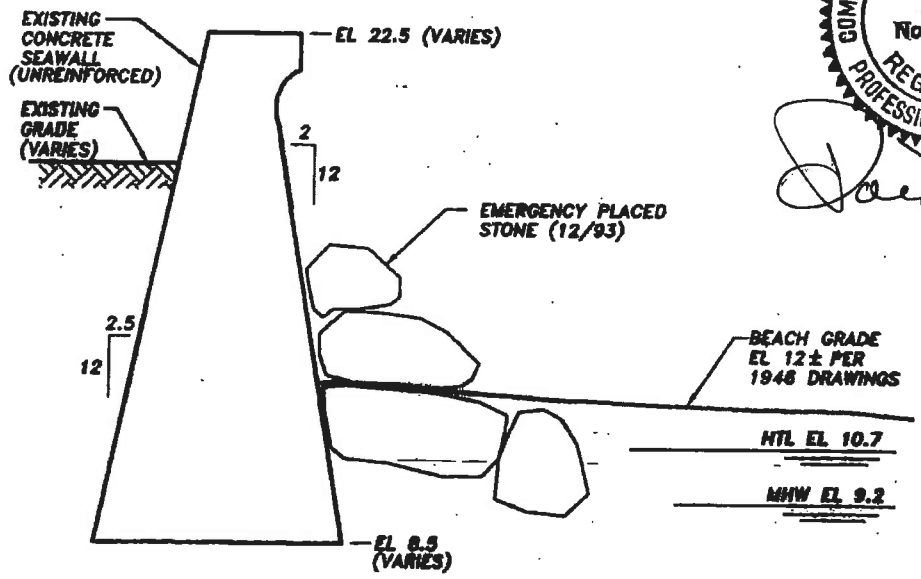


TYPICAL EXISTING SECTION A–A

SCALE: 1" = 5'

0 5'

COMMONWEALTH OF MASSACHUSETTS
DAVID B. MINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER



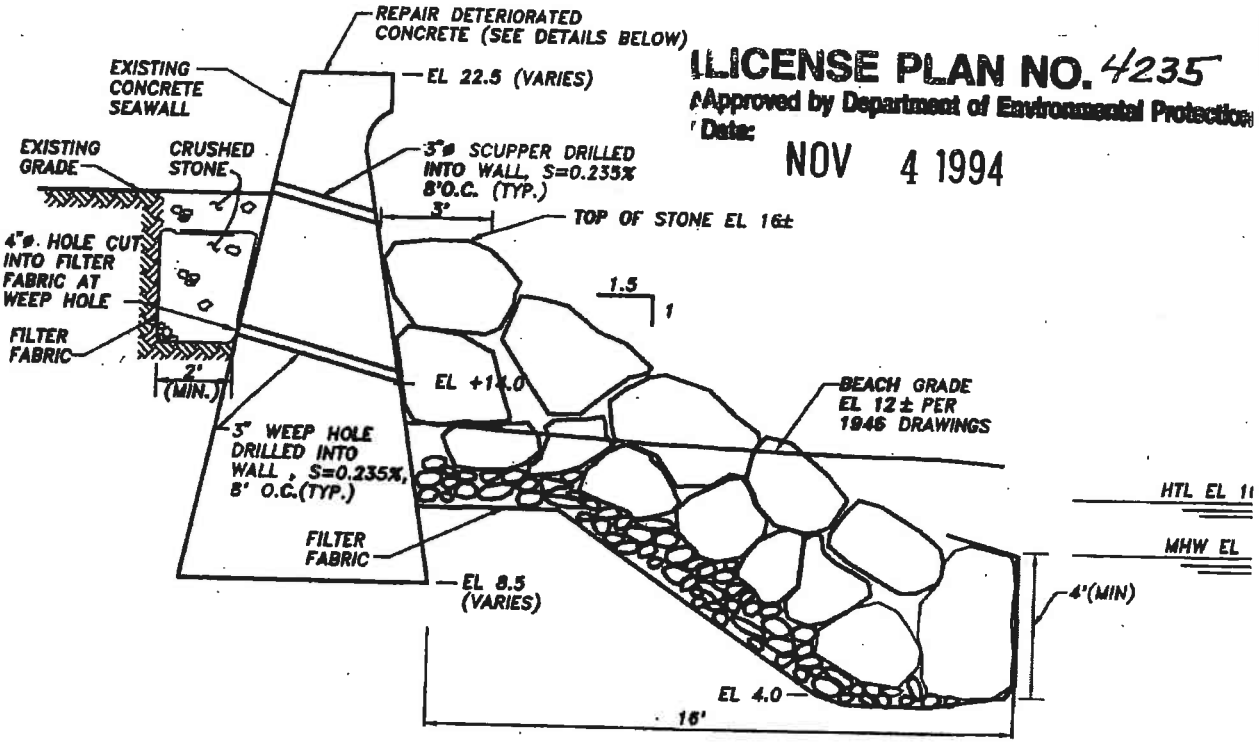
TYPICAL EXISTING SECTION B–B

SCALE: 1" = 5'

0 5'

AUGUST 10, 1994

LICENSE PLAN NO. 4235
Approved by Department of Environmental Protection
Date: NOV 4 1994

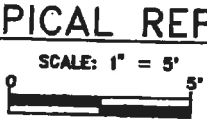


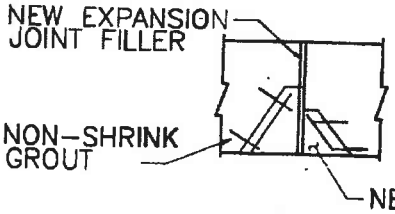
COMMONWEALTH OF MASSACHUSETTS
DAVID B. VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER

Dave B. Vine

TYPICAL REPAIR

SCALE: 1" = 5'

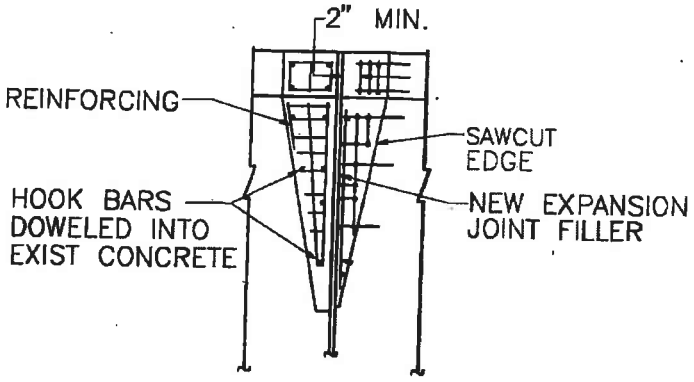




PLAN

REPAIRED WALL CAP

SCALE: 1" = 4'

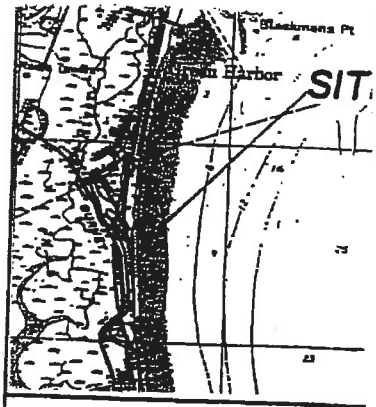


PROFILE

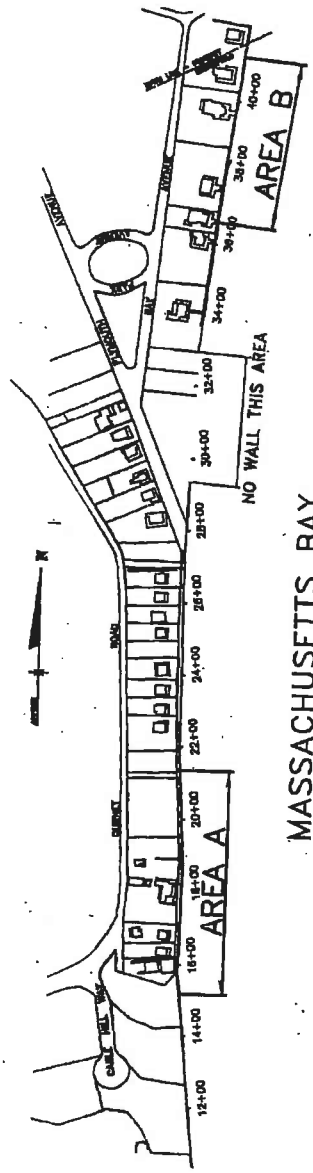
REPAIRED WALL CAP

SCALE: 1" = 4'

018-212-600-901-100
018-212-701-073-700



LOCUS MAP



MASSACHUSETTS BAY
ATLANTIC OCEAN

NOTES:
1. DATUM MLW=0.0; MHW=9.2; HTL=10.7
2. 100 YR.FLOOD PLAIN AT ELEV. 23.5
3. VOLUME OF STONE TO BE PLACED
   BELOW MHW=600 CY;
   BELOW HTL=840 CY

LOCATION PLAN

COMMONWEALTH OF MASSACHUSETTS
DAVID B. VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER

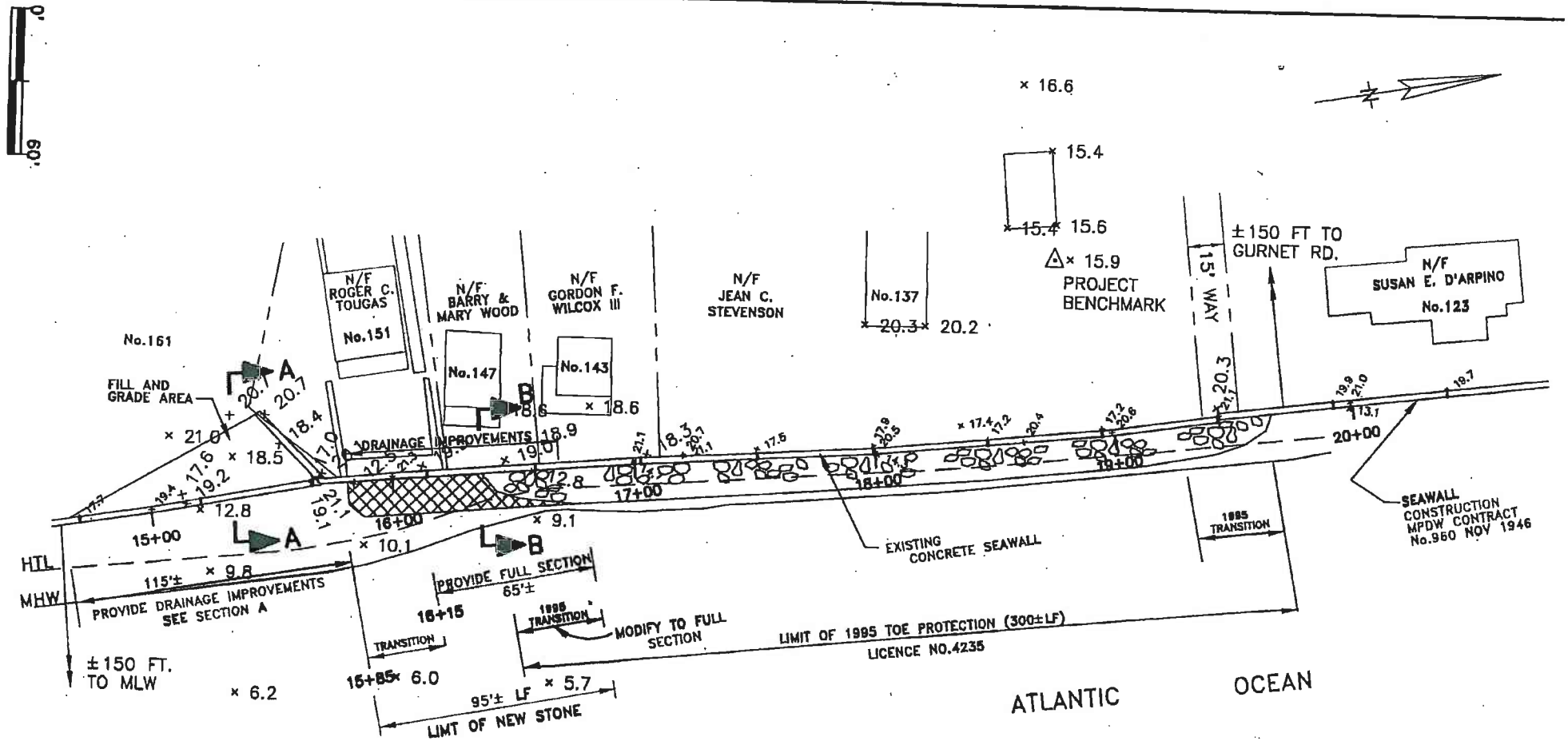
0' 500'

NOVEMBER 199

SHEET 1 OF 5

PLANS ACCOMPANYING
PETITION OF TOWN OF DUXBURY
FOR PLACING STONE PROTECTION
ALONG EXISTING SEAWALL
IN MASSACHUSETTS BAY
DUXBURY, MASSACHUSETTS

LICENSE PLAN NO. 6664
Approved by Department of Environmental Protection
of Massachusetts
Elizabeth A. Kouloheras
David B. Shunka
JUL 02 1997



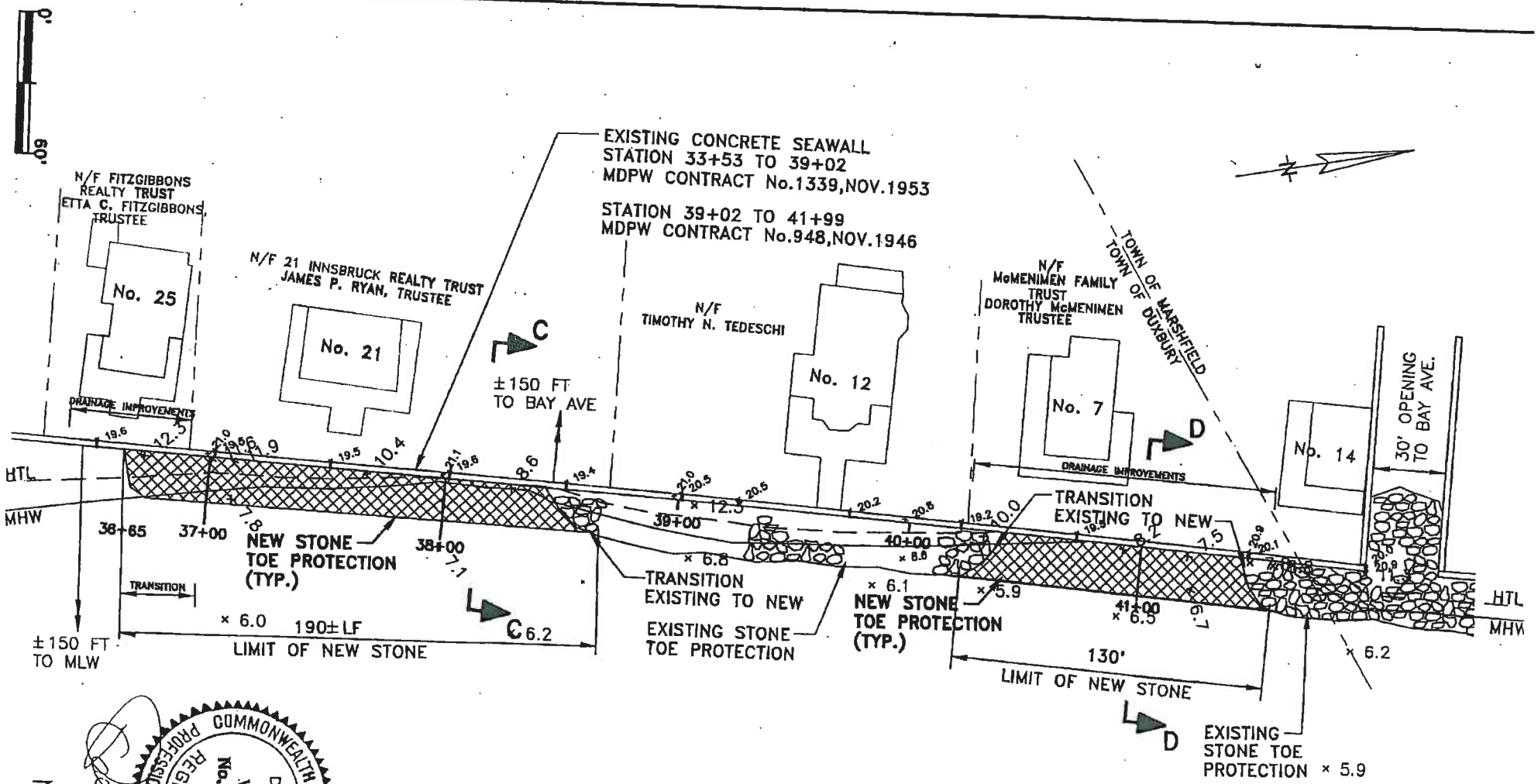
AREA A – SITE PLAN

LICENSE PLAN NO. 6664
Approved by Department of Environmental Protection
Date: JUL 02 1997

COMMONWEALTH OF MASSACHUSETTS
REGISTERED PROFESSIONAL ENGINEER
DAVID B. VINE
No. 29301

NOVEMBER 1996

SHEET 2 OF 5



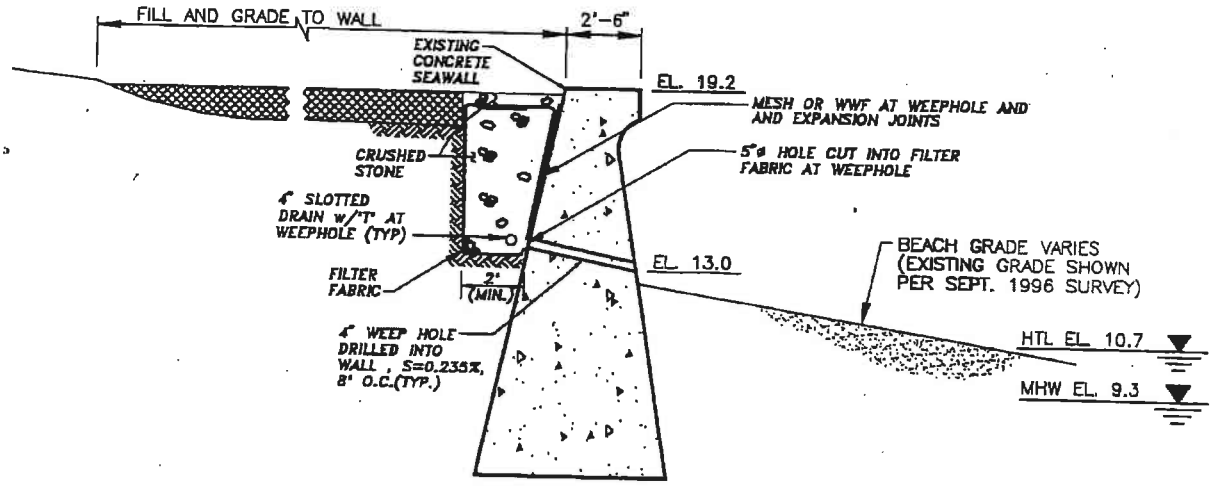
COMMONWEALTH OF MASSACHUSETTS
DAVID B VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER

LICENSE PLAN NO. 6664
Approved by Department of Environmental Protection
Date: JUL 02 1997

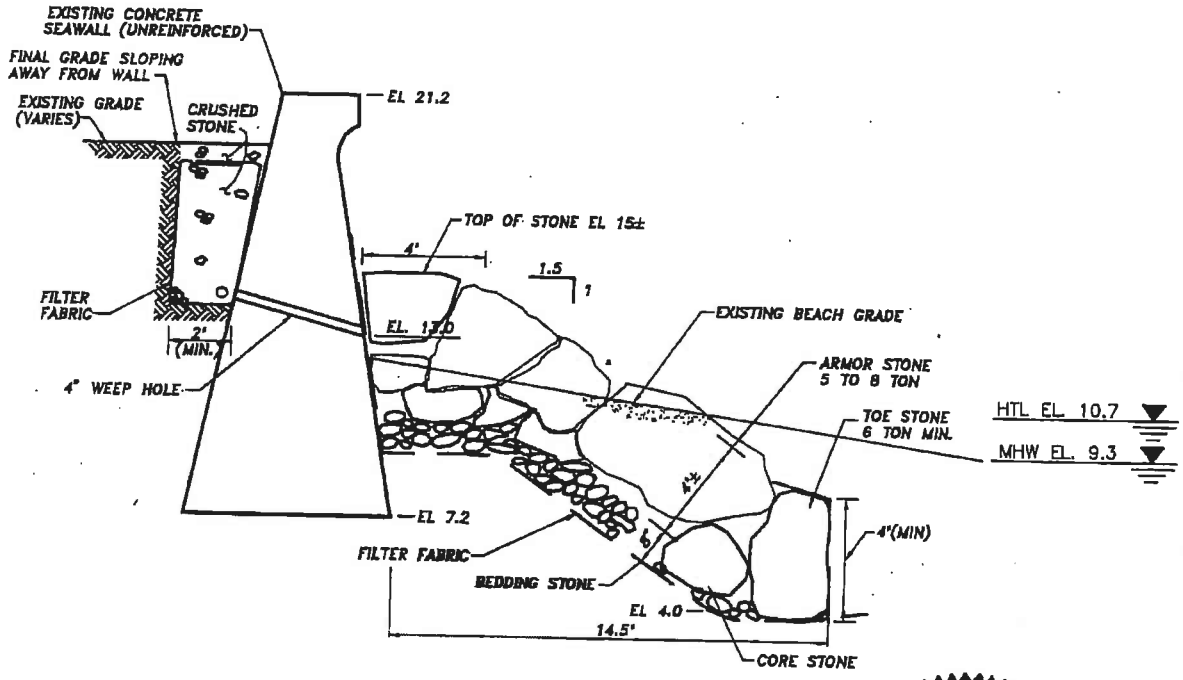
AREA B – SITE PLAN

NOVEMBER 1996

SHEET 3 OF 5



SECTION A



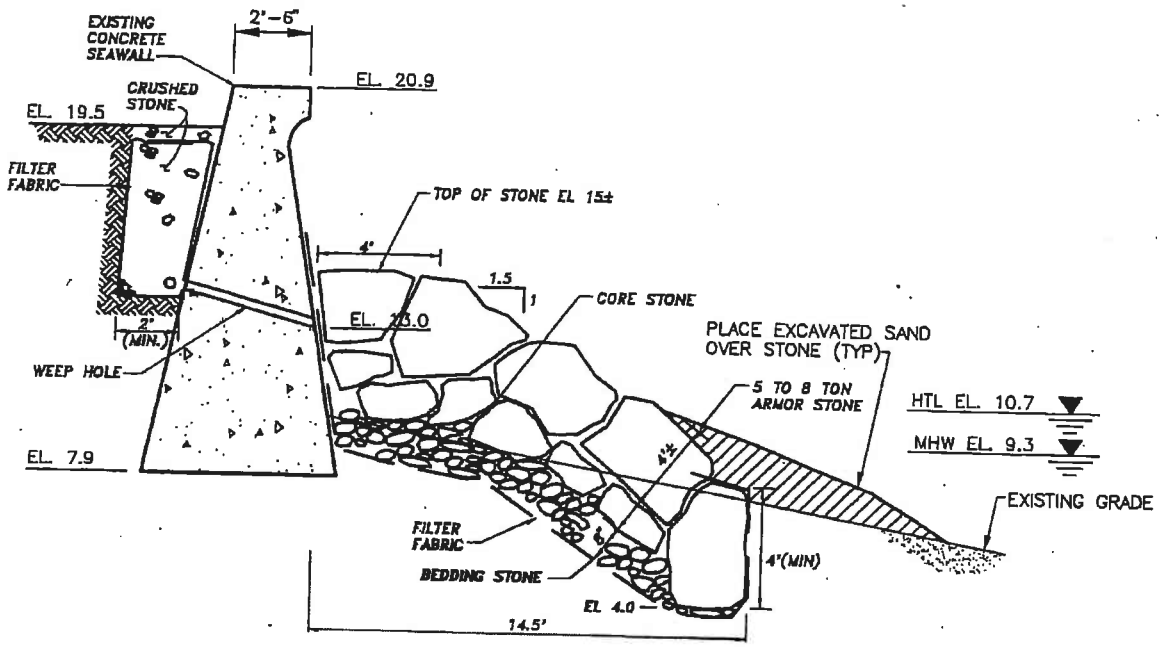
SECTION B

LICENSE PLAN NO. 6664
Approved by Department of Environmental Protection
Date: JUL 02 1997

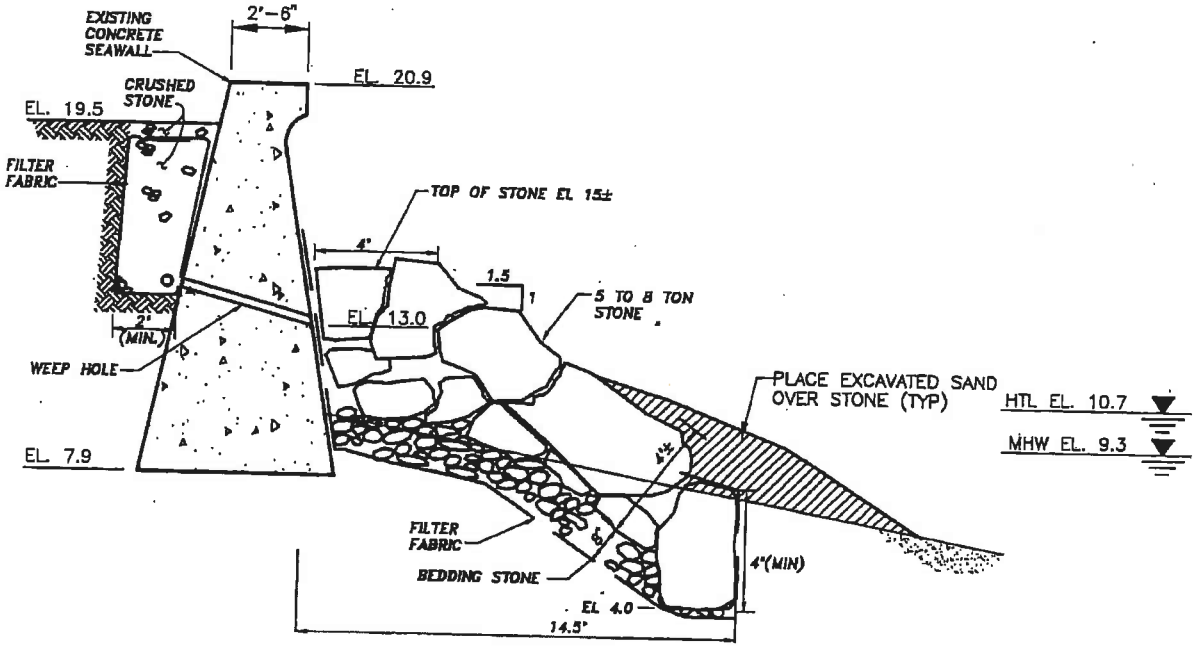
COMMONWEALTH OF MASSACHUSETTS
DAVID B. VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER

0' 6'

NOVEMBER 199



SECTION C



SECTION D

LICENSE PLAN NO. 6664
Approved by Department of Environmental Protection
Date: JUL 02 1997

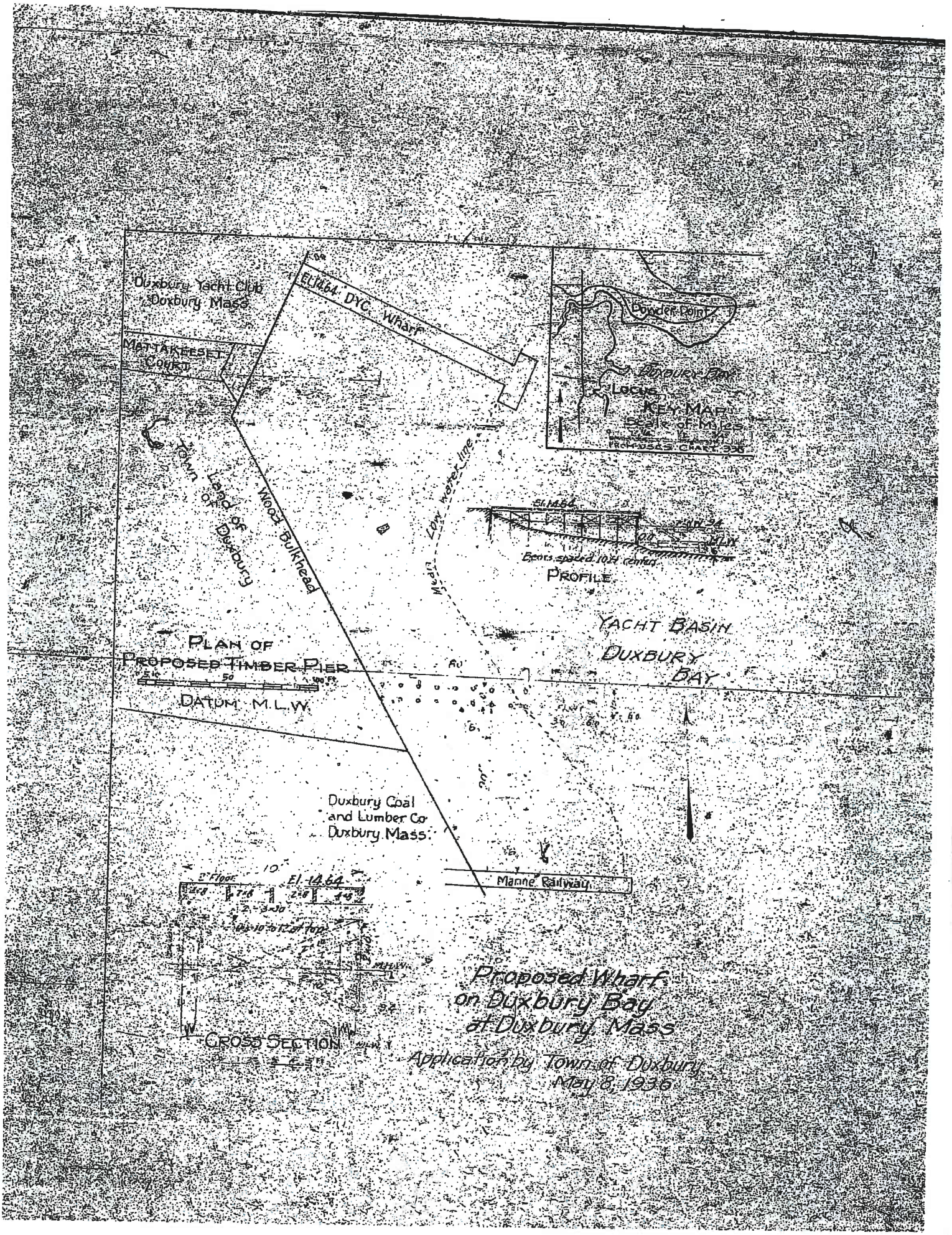
COMMONWEALTH OF MASSACHUSETTS
DAVID B. VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER

0" 6"

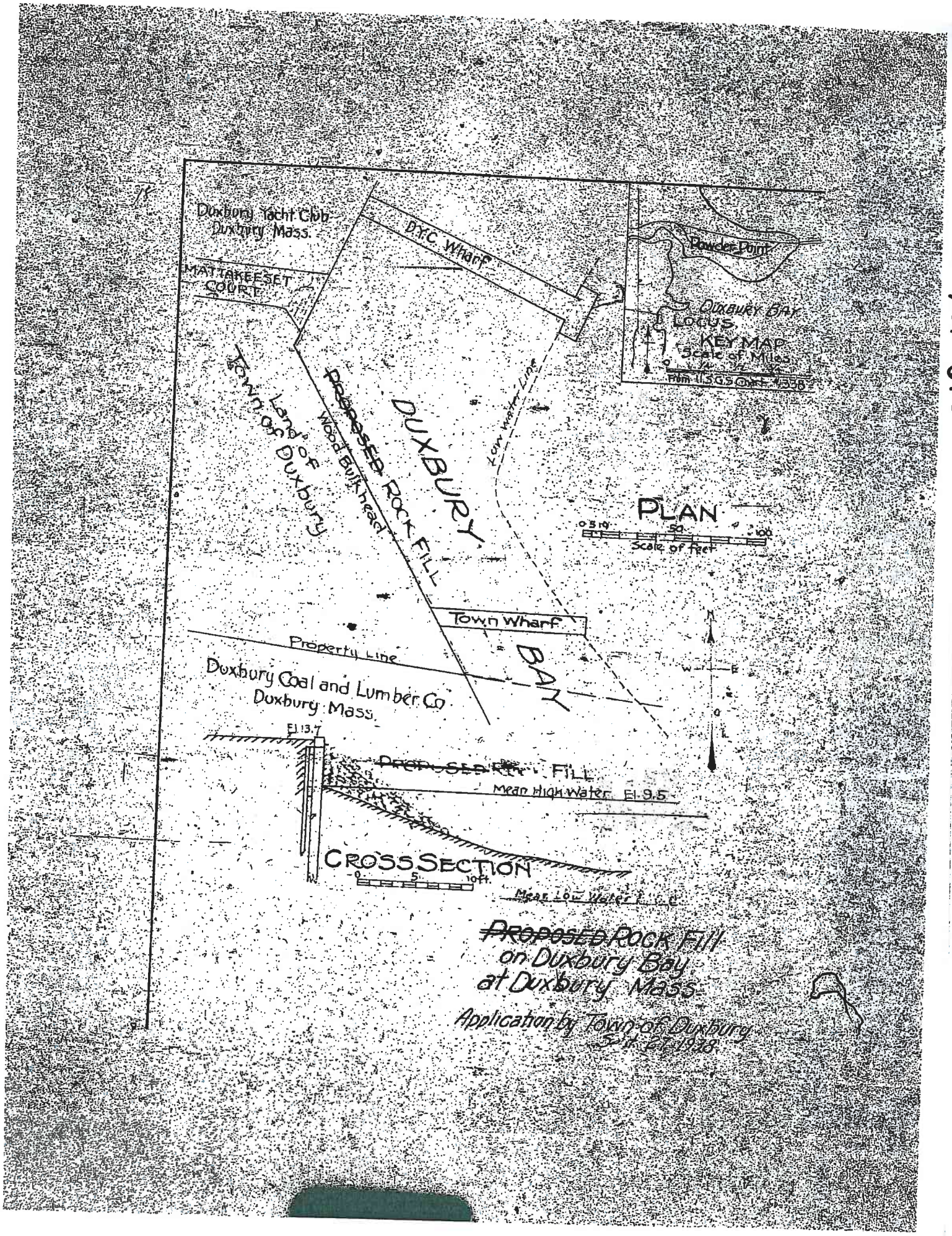
NOVEMBER 199(
SHEET 5 OF 5

TOWN: DUXBURY
SOURCE: U.S. - ARMY CORPS OF ENGINEERS
LOCATION: U.S.A.C.E. - NEW ENGLAND DISTRICT, CONCORD, MA
DATE OF RESEARCH: AUGUST 2006

BCE Structure No	Document No	Permit/ Drawing Number	Entity	Municipality	Date	Title	Sheets	Location	Description
018-191-505-140-100	018-191-505-140-100-COE1A		USACE	DUXBURY	MAY 8 1936	PROPOSED WHARF ON DUXBURY BAY AT DUXBURY, MASS	1	END OF MATTAKEESETT COURT	PROPOSED WHARF
018-191-505-140-100	018-191-505-140-100-COE1B		USACE	DUXBURY	SEPT. 27 1938	PROPOSED ROCK FILL ON DUXBURY BAY AT DUXBURY, MASS	1	END OF MATTAKEESETT COURT	PROPOSED ROCK FILL IN FRONT OF WOODEN BULKHEAD
018-191-505-140-100	018-191-505-140-100-COE1C		USACE	DUXBURY	NOV. 1 1938	PLAN ACCOMPANYING PETITION OF TOWN OF DUXBURY TO MAKE ROCK FILL, DUXBURY BAY, DUXBURY 1928	1	END OF MATTAKEESETT COURT	PROPOSED ROCK FILL IN FRONT OF WOODEN BULKHEAD
018-191-505-140-100	018-191-505-140-100-COE1D	MA-DUXB-881357-R-88	USACE	DUXBURY	JULY 1988	RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIP RAP IN DUXBURY	7	END OF MATTAKEESETT COURT	RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIP RAP
018-191-505-140-200	018-191-505-140-100-COE2A	MA-DUXB-881357-R-88	USACE	DUXBURY	JULY 1988	RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIP RAP IN DUXBURY	7	END OF MATTAKEESETT COURT	RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIP RAP
018-212-600-901-100	018-212-600-901-100-COE1A	CENAE-R-199303146	USACE	DUXBURY	NOV. 14 1994	PETITION TO REPAIR AND MAINTAIN AN EXISTING SEAWALL AND REVETMENT GURNET ROAD	3	GURNET ROAD	REPAIR AND MAINTAIN AN EXISTING SEAWALL AND REVETMENT
181-212-901-073-100	018-212-600-901-100-COE1B	CENAE-OD-R 199602456	USACE	DUXBURY	NOV. 1996	PLANS ACCOMPANYING PETITION FOR THE TOWN OF DUXBURY PLACING STONE PROTECTION ALONG AN EXISTING SEAWALL IN DUXBURY	6	GURNET ROAD NORTH OF CABLE HILL WAY	PLACING STONE PROTECTION ALONG AN EXISTING SEAWALL
181-212-901-073-100	181-212-901-073-100-COE1A	CENAE-OD-R 199602456	USACE	DUXBURY	NOV. 1996	PLANS ACCOMPANYING PETITION FOR THE TOWN OF DUXBURY PLACING STONE PROTECTION ALONG AN EXISTING SEAWALL IN DUXBURY	6	GURNET ROAD NORTH OF CABLE HILL WAY	PLACING STONE PROTECTION ALONG AN EXISTING SEAWALL



018-191-505-140-100



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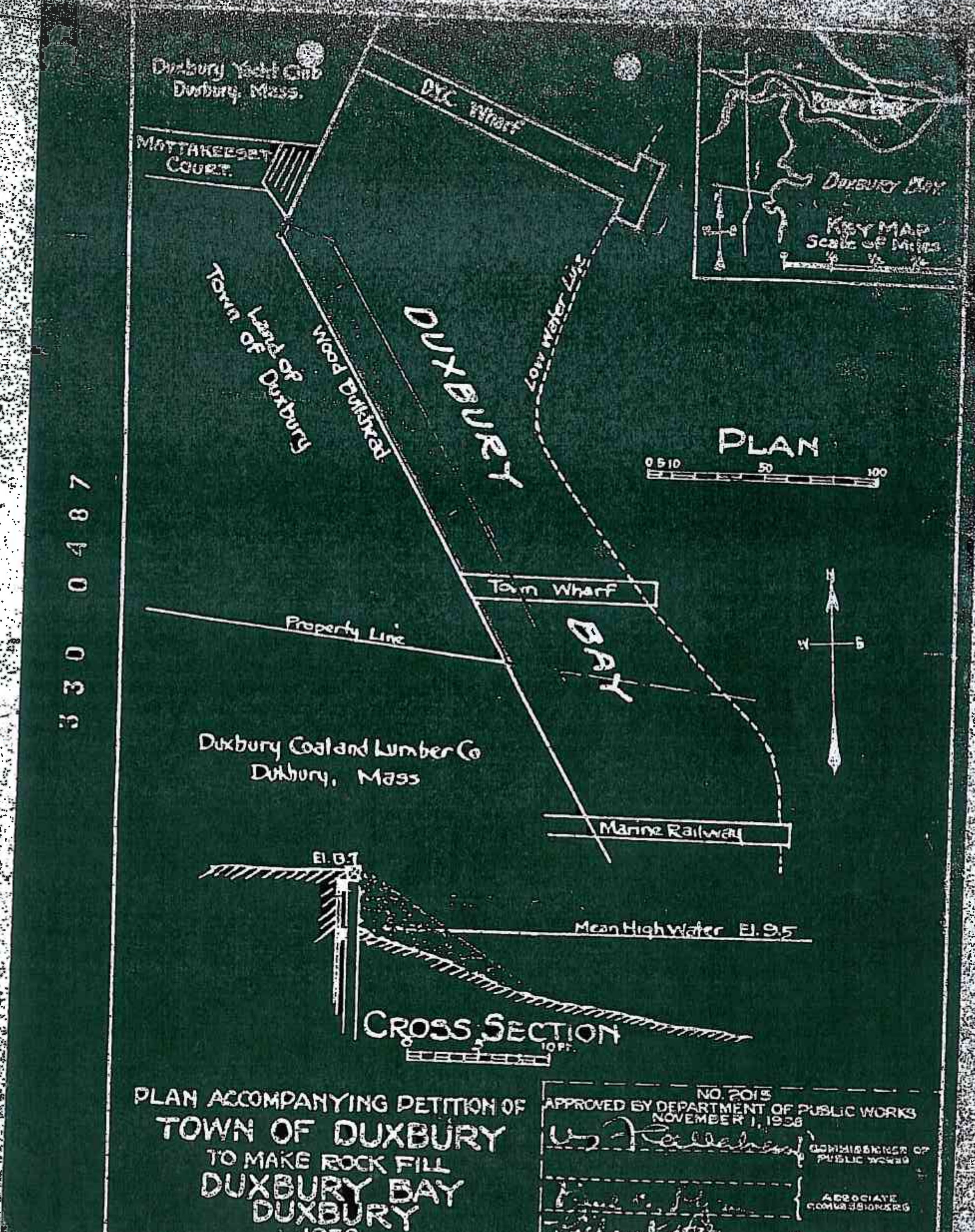

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USACE PERMIT
NAN-DUXB-881357-
-R-88

018-191-505-140-200
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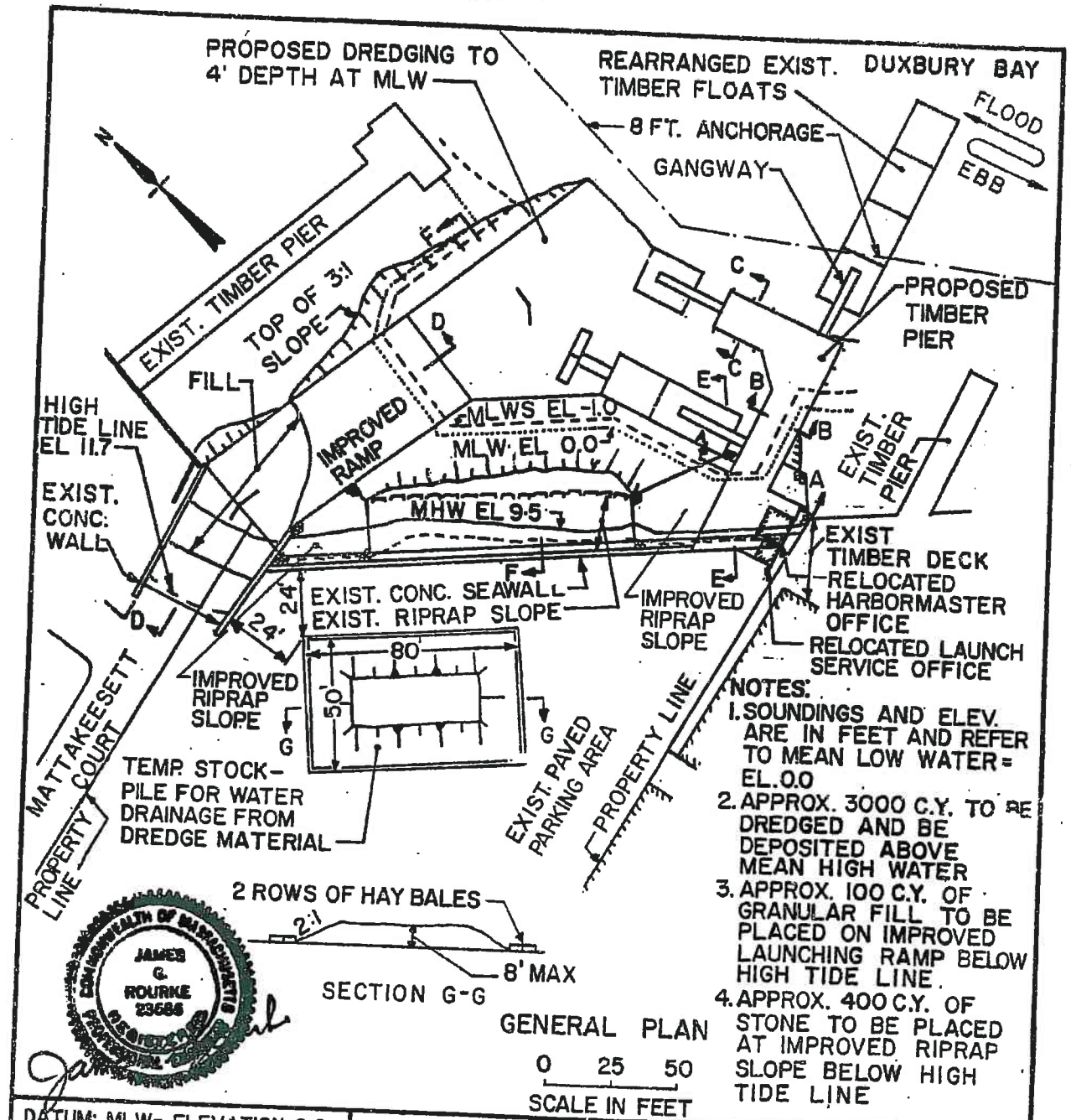


NOTES:
1. SOUNDINGS AND ELEV. ARE IN FEET AND REFER TO MEAN LOW WATER = EL. 0.0
2. APPROX. 3000 C.Y. TO BE DREDGED AND BE DEPOSITED ABOVE MEAN HIGH WATER
3. APPROX. 100 C.Y. OF GRANULAR FILL TO BE PLACED ON IMPROVED LAUNCHING RAMP BELOW HIGH TIDE LINE.
4. APPROX. 400 C.Y. OF STONE TO BE PLACED AT IMPROVED RIPRAP SLOPE BELOW HIGH TIDE LINE

COMMONWEALTH OF MASSACHUSETTS — JAMES G. ROURKE 23686 — REGISTERED PROFESSIONAL ENGINEER

DATUM: MLW= ELEVATION 0.0
PROPERTY DESCRIPTION
LOT NUMBER: 505-140
DUXBURY TAX MAP NO. 190

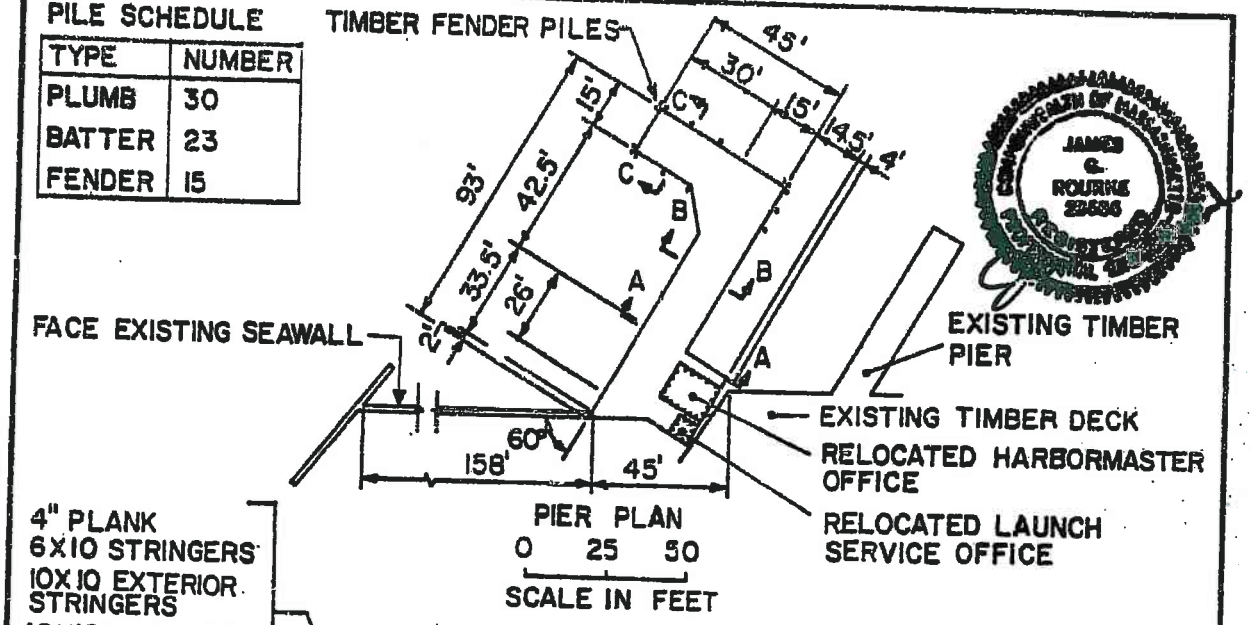
GENERAL PLAN

TOWN OF DUXBURY
TOWN HALL
878 TREMONT STREET
DUXBURY, MA 02332

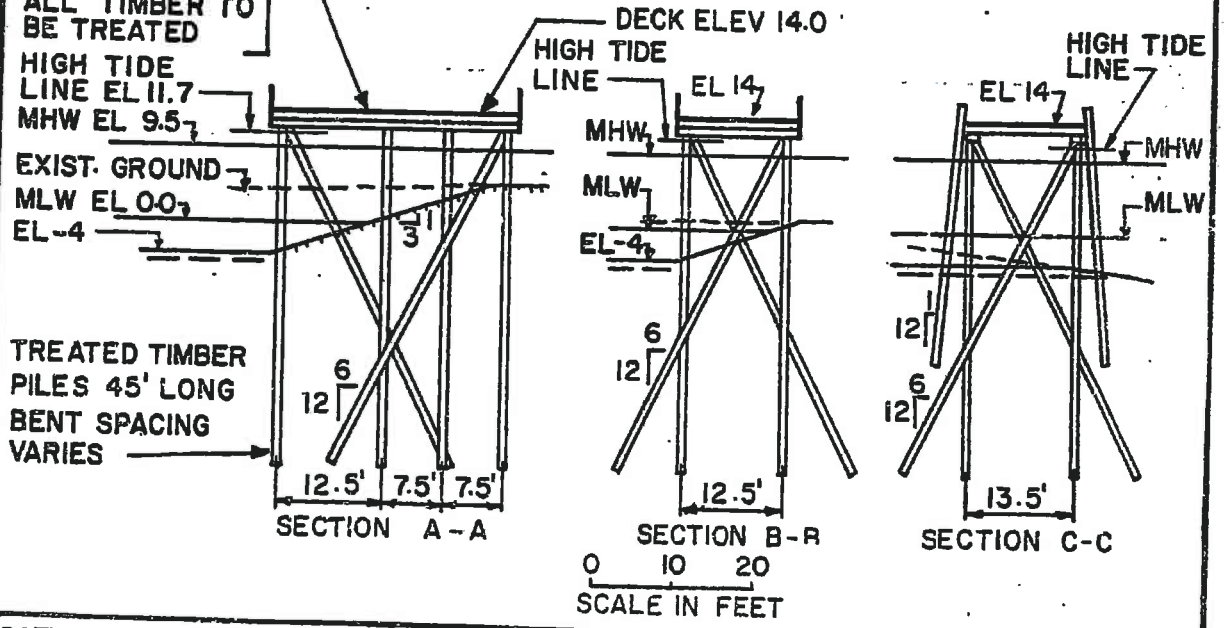
PROPOSED: RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIPRAP IN DUXBURY BAY. STATE: MA
COUNTY OF PLYMOUTH
APPLICATION BY:
TOWN OF DUXBURY
DATE: JULY 1988
SHEET 1 OF 5 (REV. 9-27-88)

FAY, SPOFFORD & THORNDIKE, INC., LEXINGTON, MA.

PILE SCHEDULE	
TYPE	NUMBER
PLUMB	30
BATTER	23
FENDER	15



4" PLANK
6X10 STRINGERS
10X10 EXTERIOR STRINGERS
12X12 PILE CAPS
ALL TIMBER TO BE TREATED

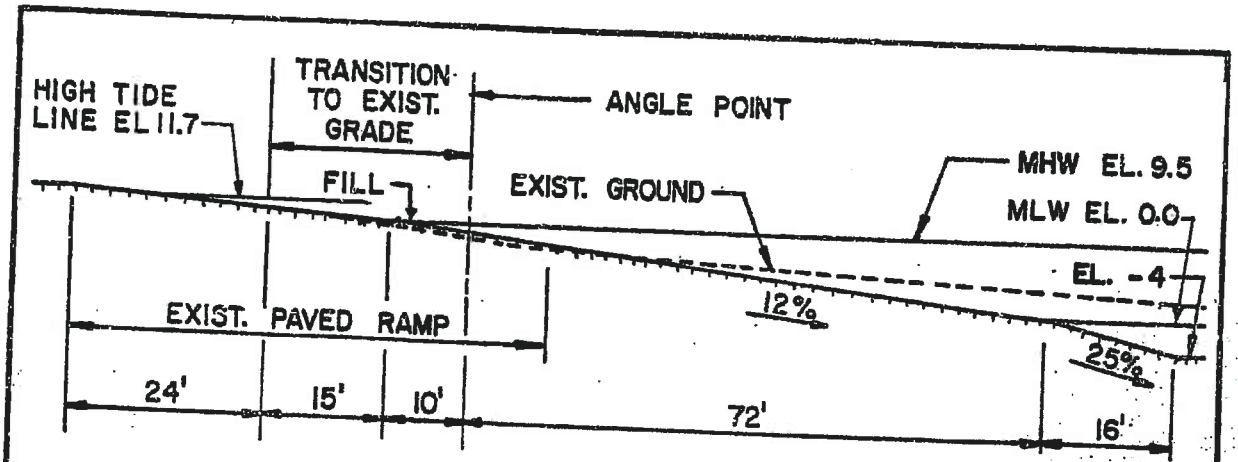


DATUM: MLW= ELEVATION 0.0
PROPERTY DESCRIPTION
LOT NUMBER: 505-140
DUXBURY TAX MAP NO. 190

PIER PLAN & SECTIONS

TOWN OF DUXBURY
TOWN HALL
878 TREMONT STREET
DUXBURY, MA 02332

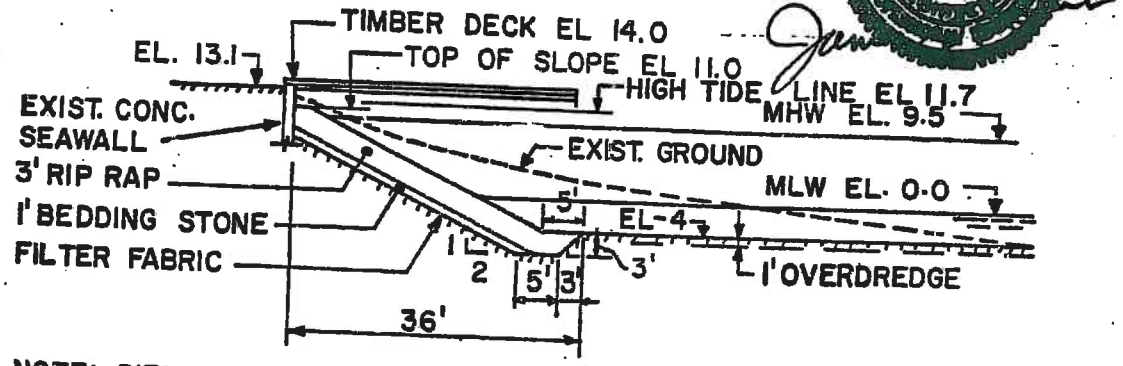
PROPOSED: RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIPRAP IN DUXBURY BAY. STATE: MA
COUNTY OF PLYMOUTH
APPLICATION BY:
TOWN OF DUXBURY
DATE: JULY 1988
SHEET 2 OF 5 (REV. 9-27-88)



SECTION D-D AT ℄ RAMP

0 10 20

SCALE IN FEET



NOTE: PIER DETAIL AND FLOAT NOT SHOWN SEE SHEET 2 OF 5

SECTION E-E

0 10 20

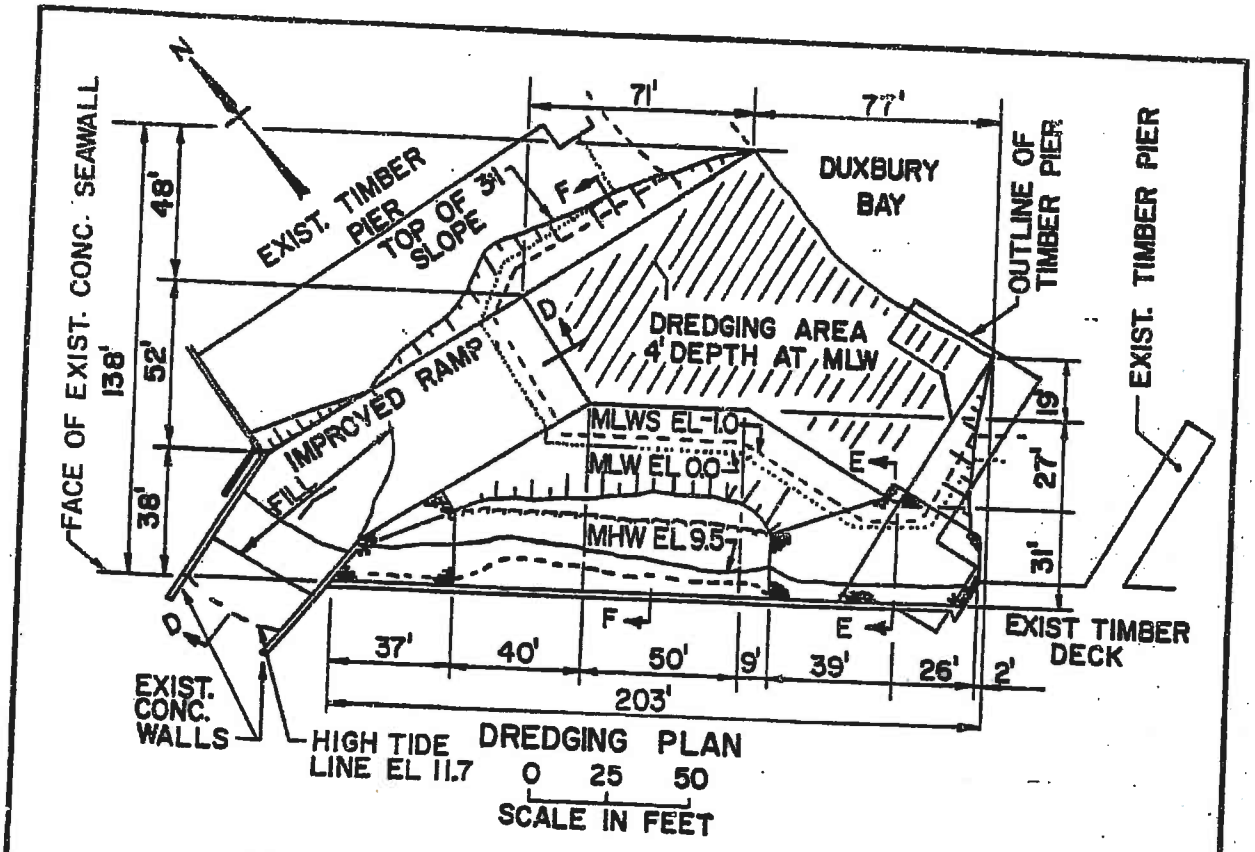
SCALE IN FEET

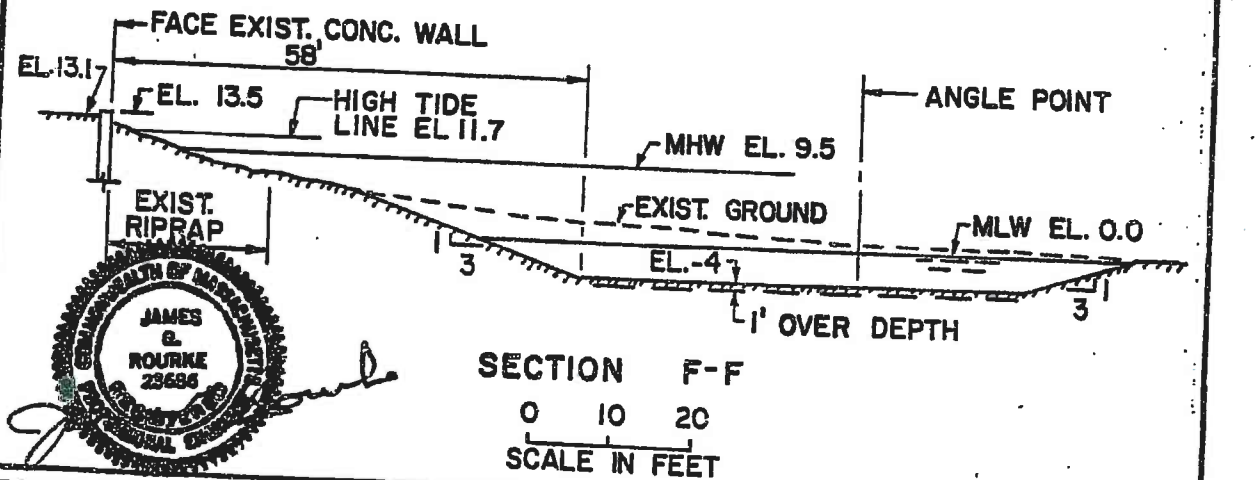
DATUM: MLW= ELEVATION 0.0
PROPERTY DESCRIPTION
LOT NUMBER: 505-140
DUXBURY TAX MAP NO. 190

SECTIONS

TOWN OF DUXBURY
TOWN HALL
878 TREMONT STREET
DUXBURY, MA 02332

PROPOSED: RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIPRAP IN DUXBURY BAY. STATE: MA
COUNTY OF PLYMOUTH
APPLICATION BY:
TOWN OF DUXBURY
DATE: JULY 1988
SHEET 3 OF 5 (REV-9-27-88)





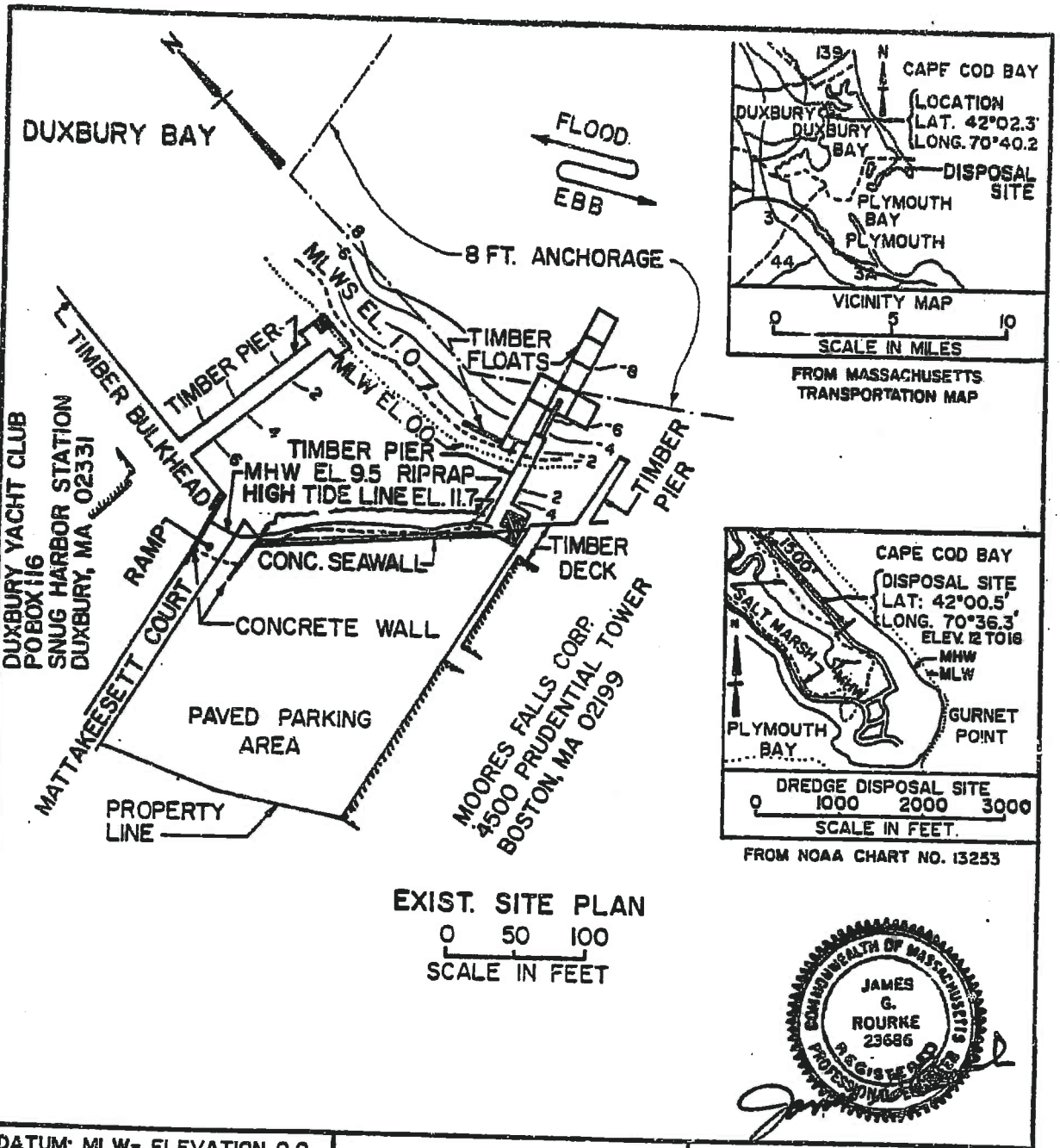
JAMES O. ROURKE 23686

DATUM: MLW= ELEVATION 0.0
PROPERTY DESCRIPTION
LOT NUMBER: 505-140
DUXBURY TAX MAP NO. 190

DREDGING PLAN & SECTION

TOWN OF DUXBURY
TOWN HALL
878 TREMONT STREET
DUXBURY, MA 02332

PROPOSED: RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIPRAP IN DUXBURY BAY. STATE: MA
COUNTY OF PLYMOUTH
APPLICATION BY:
TOWN OF DUXBURY
DATE: JULY 1988



COMMONWEALTH OF MASSACHUSETTS
JAMES G. ROURKE 23686
REGISTERED PROFESSIONAL ENGINEER

DATUM: MLW= ELEVATION 0.0
PROPERTY DESCRIPTION
LOT NUMBER: 505-140
DUXBURY TAX MAP NO. 190

EXISTING SITE PLAN

TOWN OF DUXBURY
TOWN HALL
878 TREMONT STREET
DUXBURY, MA 02332

PROPOSED: RECONSTRUCT EXISTING TIMBER PIER, DREDGE, FILL AND RIPRAP IN DUXBURY BAY. STATE: MA
COUNTY OF PLYMOUTH
APPLICATION BY:
TOWN OF DUXBURY
DATE: JULY 1988
SHEET 5 OF 5 (REV. 9-27-88)

FAY, SPOFFORD & THORNDIKE, INC., LEXINGTON, MA.

DEPARTMENT OF THE ARMY PERMIT

Permittee Town of Duxbury, Thomas J. Groux, Town Mgr., Town Hall, 878 Tremont Street, Duxbury, Massachusetts 02232

Permit No. MA-DUXB-881357-R-88 JAN 9 1989

Issuing Office NEW ENGLAND DIVISION

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:

To reconstruct and maintain a town pier and launch ramp in Duxbury Bay at Mattakeesett Court, Duxbury, Massachusetts as shown in the attached plans entitled "Reconstruct Existing Timber Pier, Dredge, Fill and Riprap in Duxbury Bay, State: Ma, County of Plymouth," in 5 sheets, dated "July 1988", revised "9/27/88". The Project includes the following work.

1. The demolition and disposal of the existing timber pier and construction of a 14.5' wide, 93'X45' L-shaped treated timber pile supported pier, including temporary removal and replacement of two existing buildings onto the new pier.

PROJECT DESCRIPTION IS CONTINUED ON PAGE 4

Project Location:

Duxbury Harbor, Duxbury, Ma

Permit Conditions:

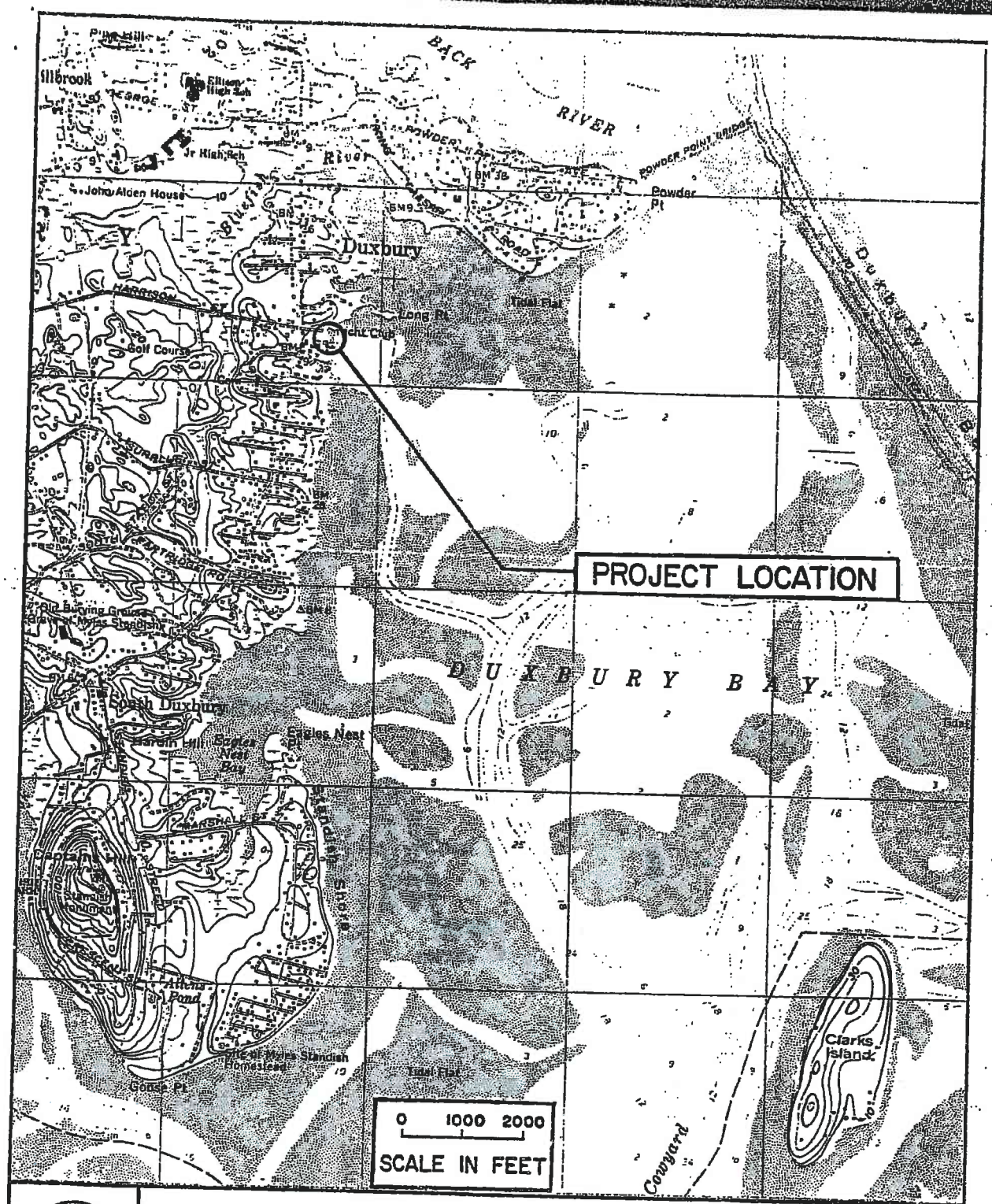
General Conditions:

1. The time limit for completing the work authorized ends on December 31, 1991. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

018-191-505-140-100/-200



LOCATION MAP

TOWN PIER AT MATTAKEESETT COURT
DUXBURY, MASSACHUSETTS

FAY, SPOFFORD & THORNDIKE, INC., ENGINEERS, LEXINGTON, MASS.

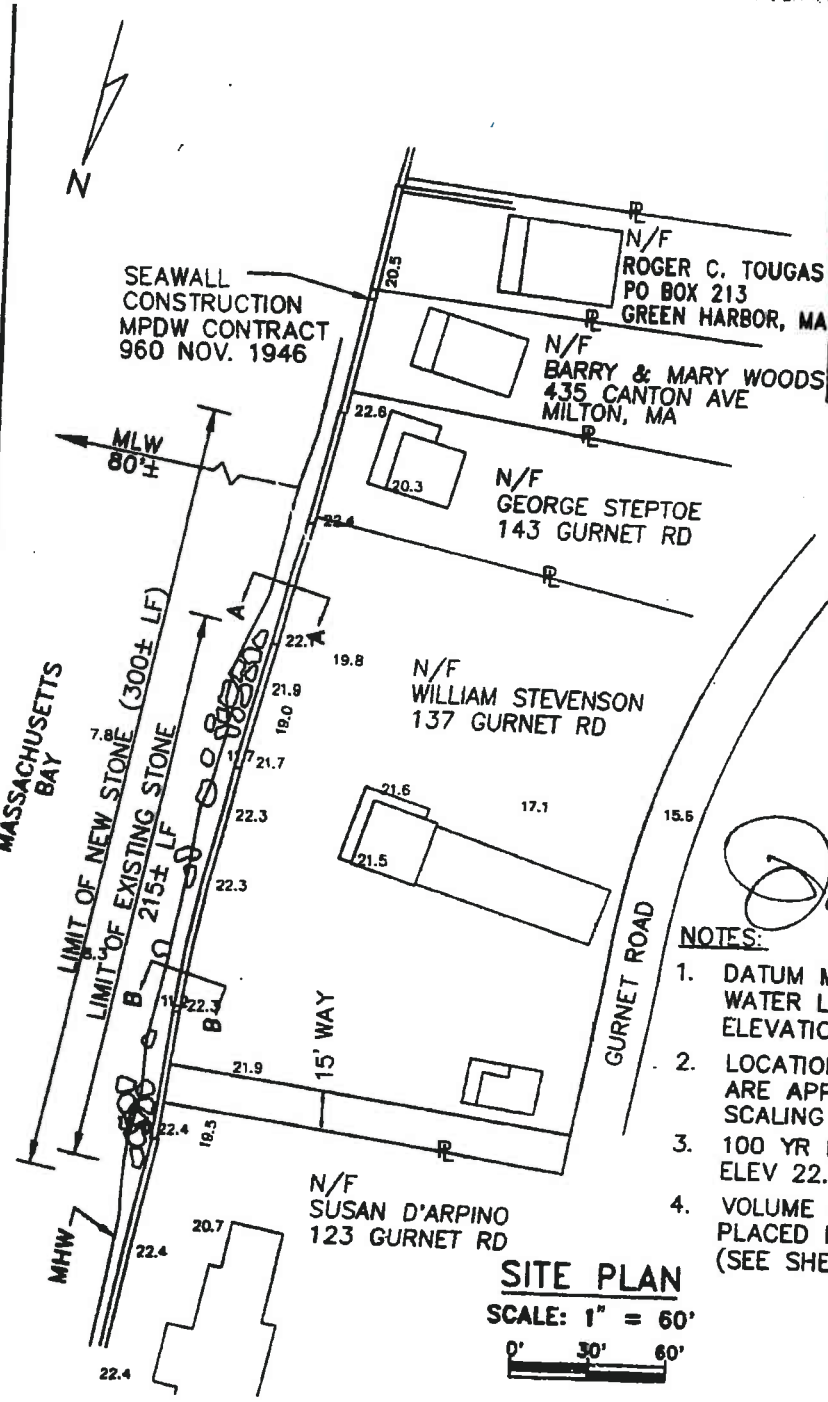
2/2

000009

018-212-600-901

USACE
19930314G

LOCUS MAP



SITE PLAN
SCALE: 1" = 60'
0' 30' 60'

COMMONWEALTH OF MASSACHUSETTS
DAVID B. VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER

NOTES:

1. DATUM MLW=0.0; MHW=9.2; HIGH WATER LEVEL (HWL)=10.7. SPOT ELEVATIONS BY NVA 2/94.
2. LOCATIONS & SIZES OF BUILDINGS ARE APPROXIMATE, BASED ON SCALING OF PRIOR DRAWINGS.
3. 100 YR FLOODPLAIN AT ELEV 22.0 MLW.
4. VOLUME OF STONE TO BE PLACED BELOW MHW = 350 C.Y. (SEE SHEET 3 OF 3).

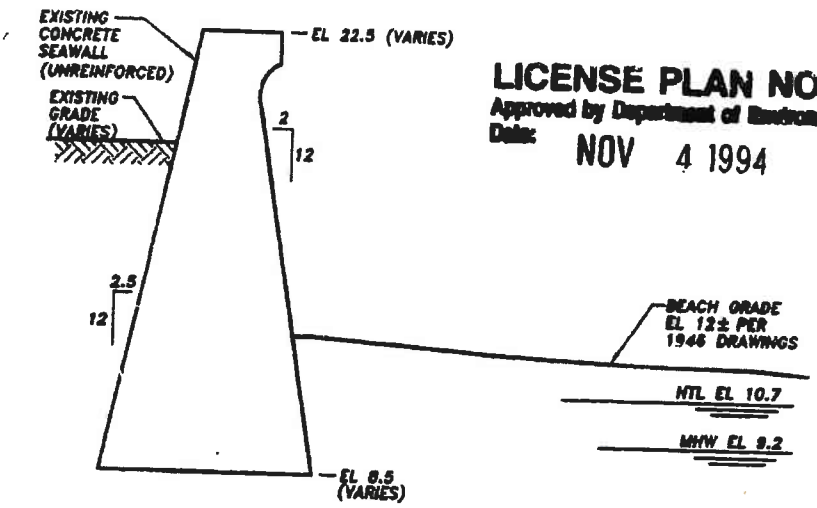
SHEET 1 OF 3

PLAN ACCOMPANYING THE PETITION OF THE TOWN OF DUXBURY TO REPAIR AND MAINTAIN AN EXISTING SEAWALL AND NEW REVETMENT AT GURNET ROAD, DUXBURY, MA

LICENSE PLAN NO. 4235
Approved by Department of Environmental Protection of Massachusetts

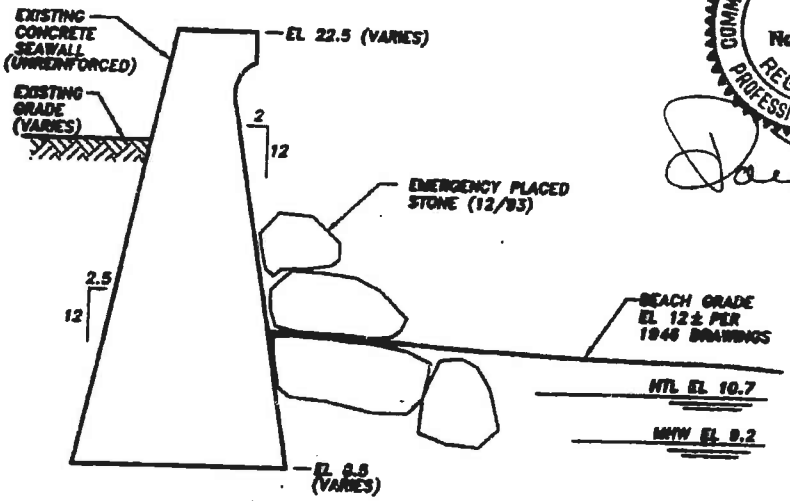
COMMISSIONER
DIVISION DIRECTOR
SECTION CHIEF
NOV 4 1994
DATE

NUCCI VINE ASSOCIATES, INC.



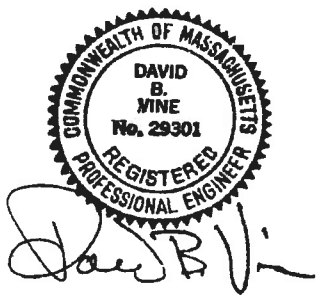
TYPICAL EXISTING
SECTION A–A

SCALE: 1" = 5'



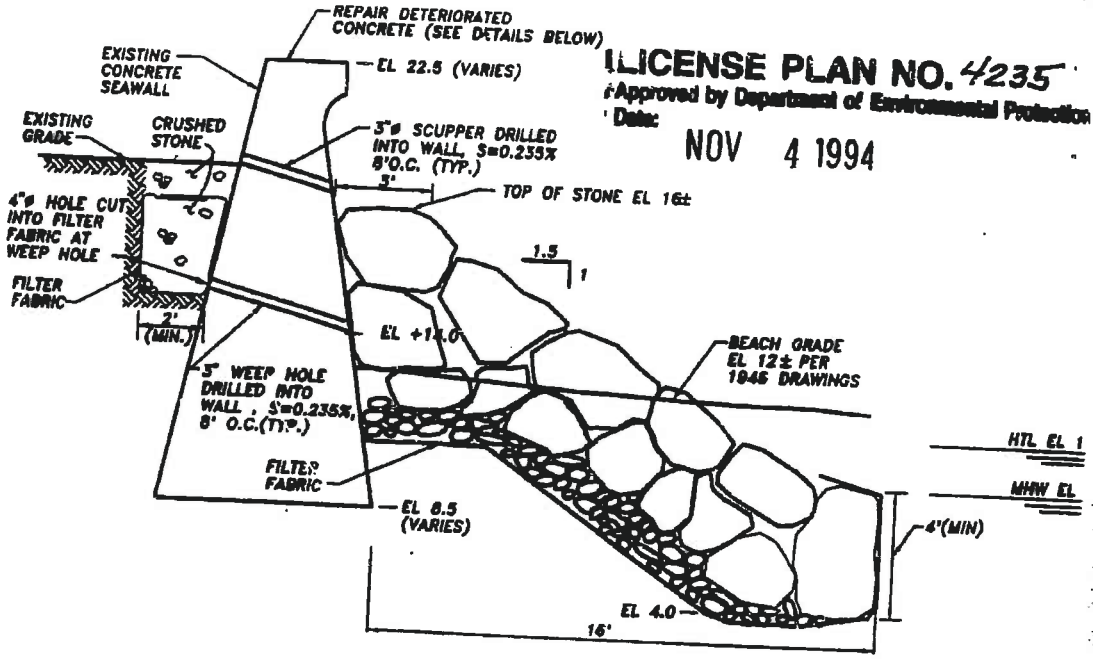
TYPICAL EXISTING
SECTION B–B

SCALE: 1" = 5'



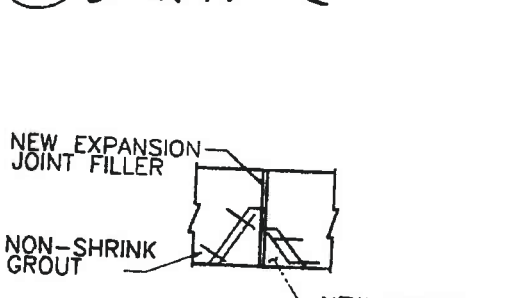
AUGUST 10, 1994

LICENSE PLAN NO. 4235
Approved by Department of Environmental Protection
Date: NOV 4 1994

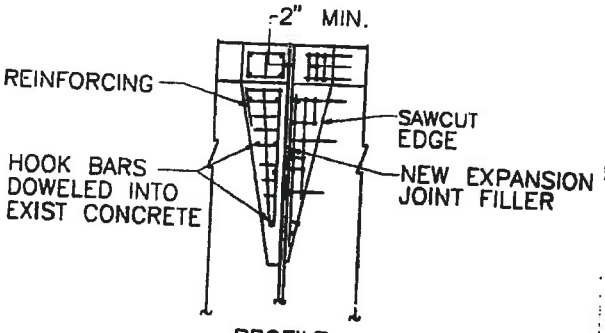


TYPICAL REPAIR
SCALE: 1" = 5'

COMMONWEALTH OF MASSACHUSETTS
DAVID B. VINE
No. 29301
REGISTERED PROFESSIONAL ENGINEER



PLAN
REPAIRED WALL CAP
SCALE: 1" = 4'



PROFILE
REPAIRED WALL CAP
SCALE: 1" = 4'

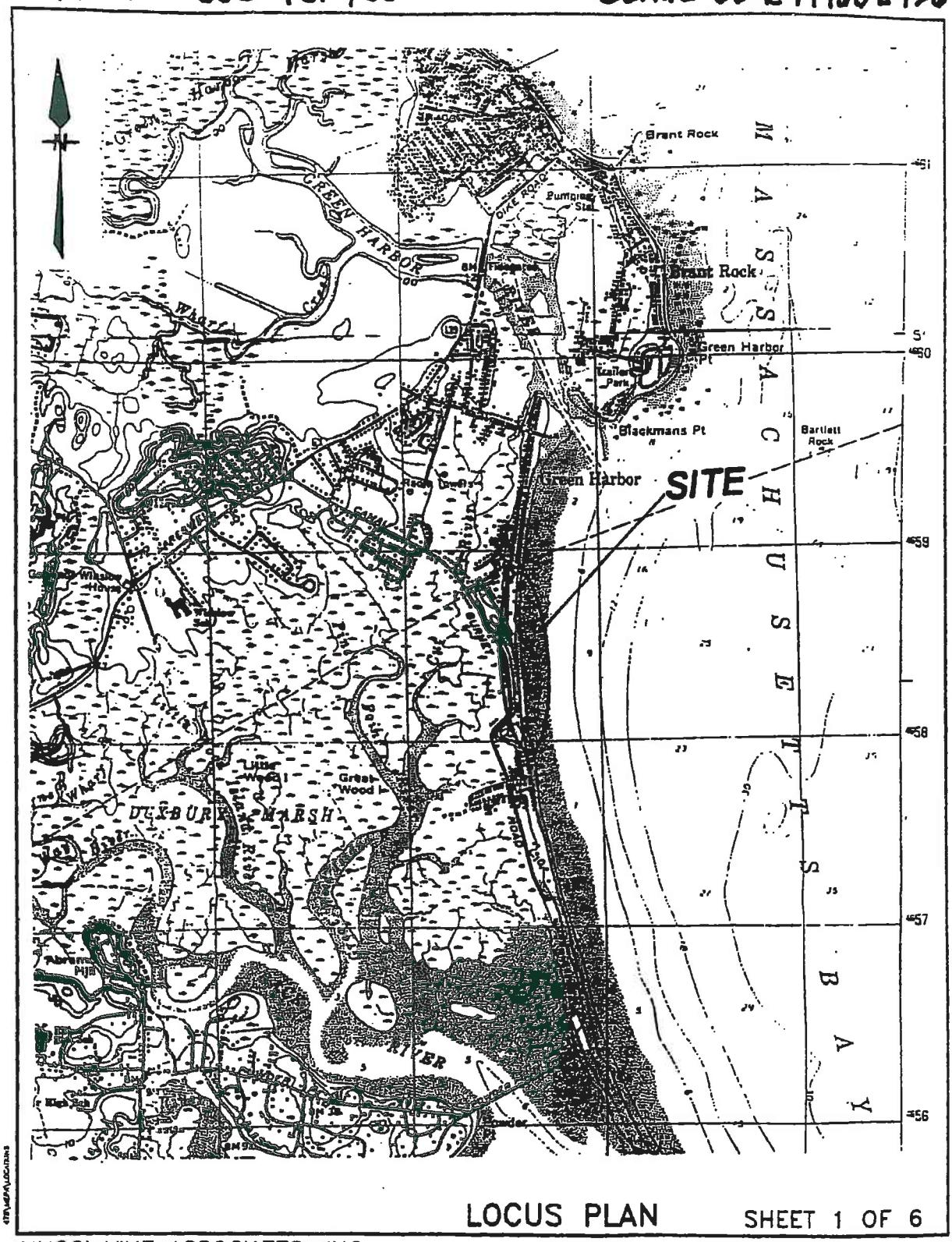
NUCCI VINE ASSOCIATES, INC.

AUGUST 10, 19

SHEET 3 OF 3

~~018-212-901-073-100~~
018-212-600-901-100

USACE#
CENAE-OD-R-199602456



LOCUS PLAN SHEET 1 OF 6

NUCCI VINE ASSOCIATES, INC.

NOTES:
1. DATUM MLW=0.0; MHW=9.2; HTL=10.7
2. 100 YR.FLOOD PLAIN AT ELEV. 23.5
3. VOLUME OF STONE TO BE PLACED BELOW MHW=600 CY; BELOW HTL=840 CY

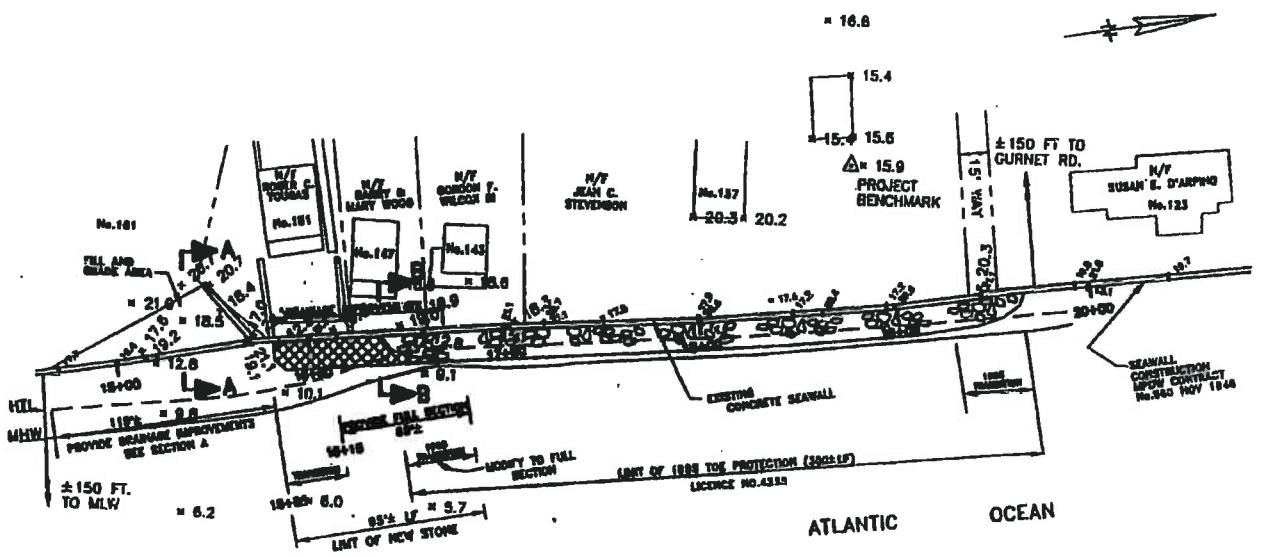
PLANS ACCOMPANYING
PETITION OF TOWN OF DUXBURY
FOR PLACING STONE PROTECTION
ALONG EXISTING SEAWALL
IN MASSACHUSETTS BAY
DUXBURY, MASSACHUSETTS

LOCATION PLAN

NOVEMBER 1996
SHEET 2 OF 6

NUCCI VINE ASSOCIATES, INC.

NUCCI VINE ASSOCIATES, INC.

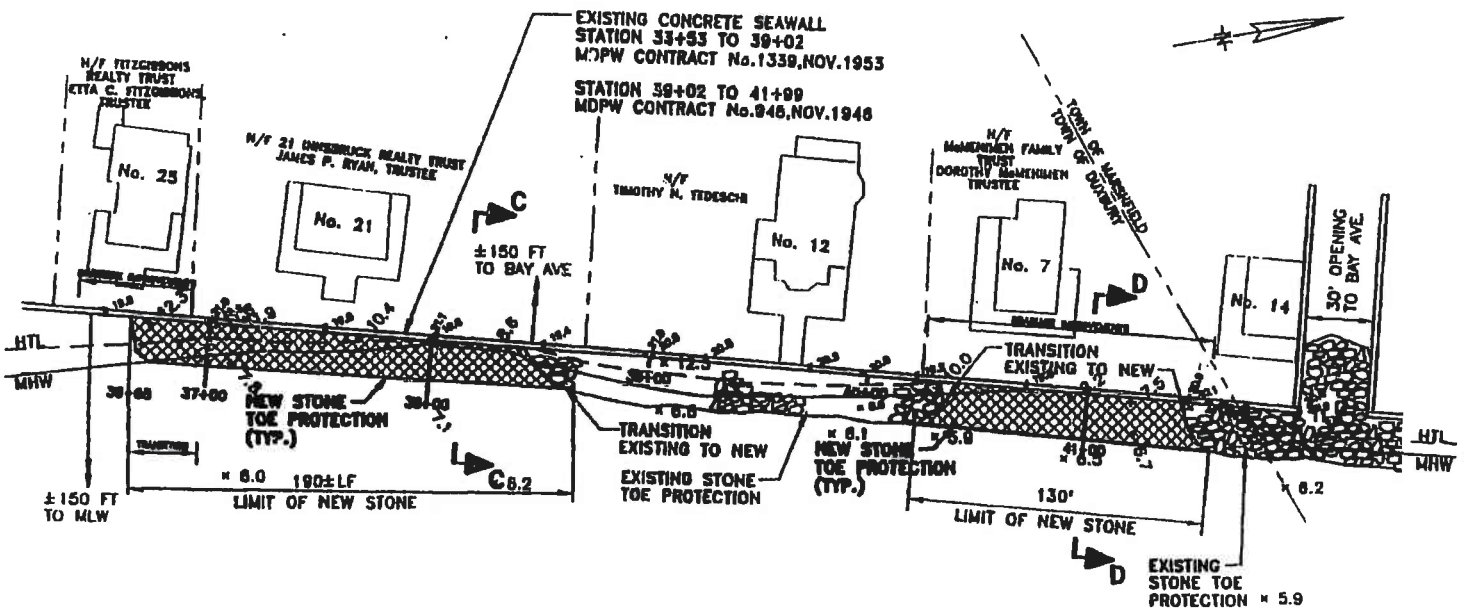


AREA A – SITE PLAN

SITE PLAN

NOVEMBER 1996
SHEET 3 OF 6

S\MEPA\AREA-A-B

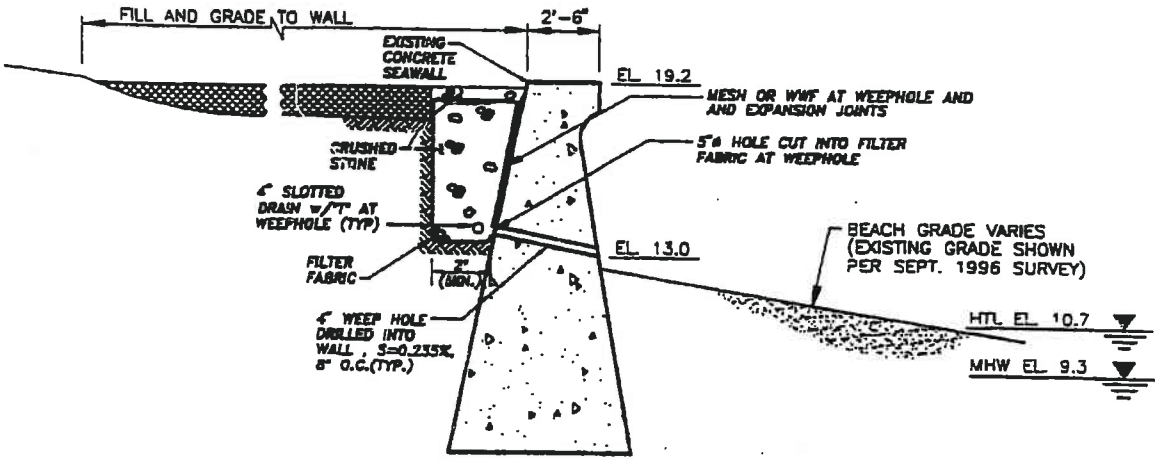


AREA B – SITE PLAN

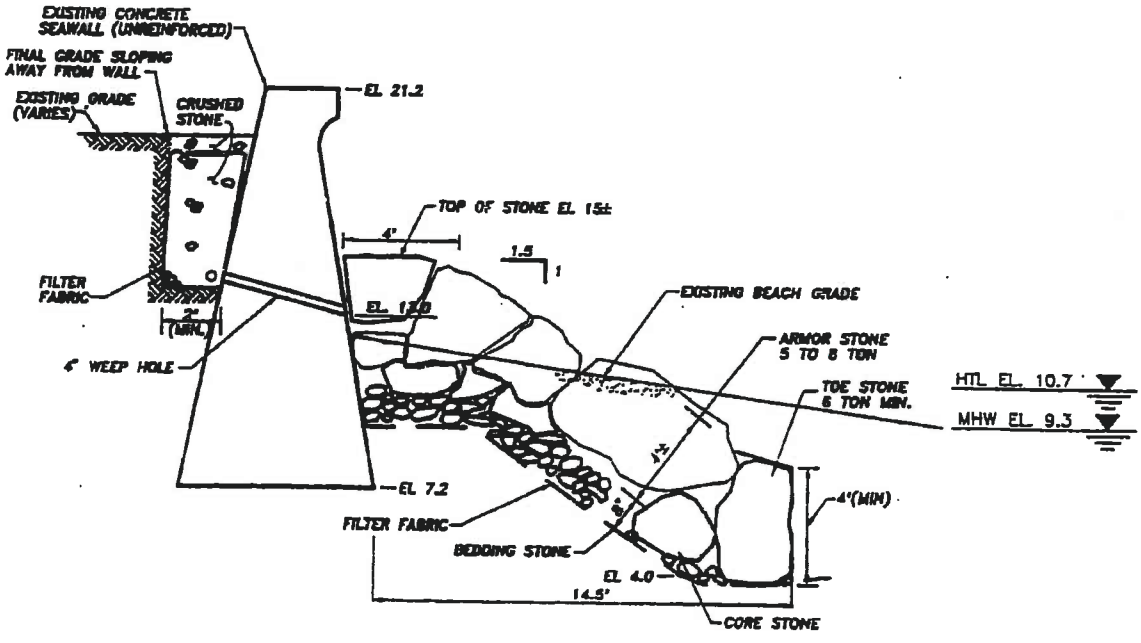
0'
80'

SITE PLAN

NOVEMBER 1996
SHEET 4 OF 6



SECTION A

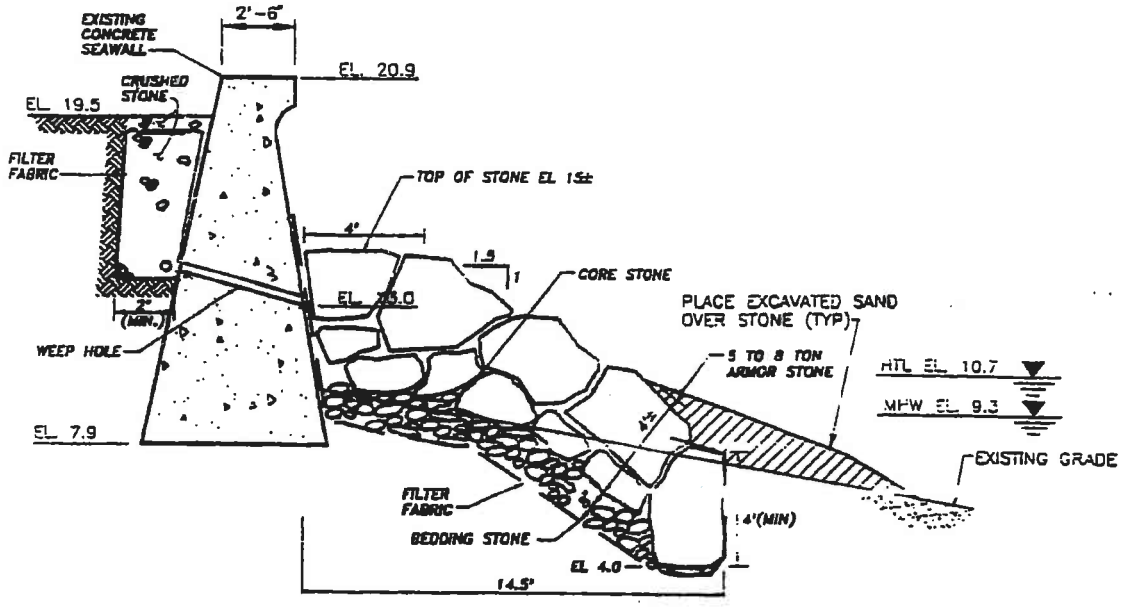


SECTION B

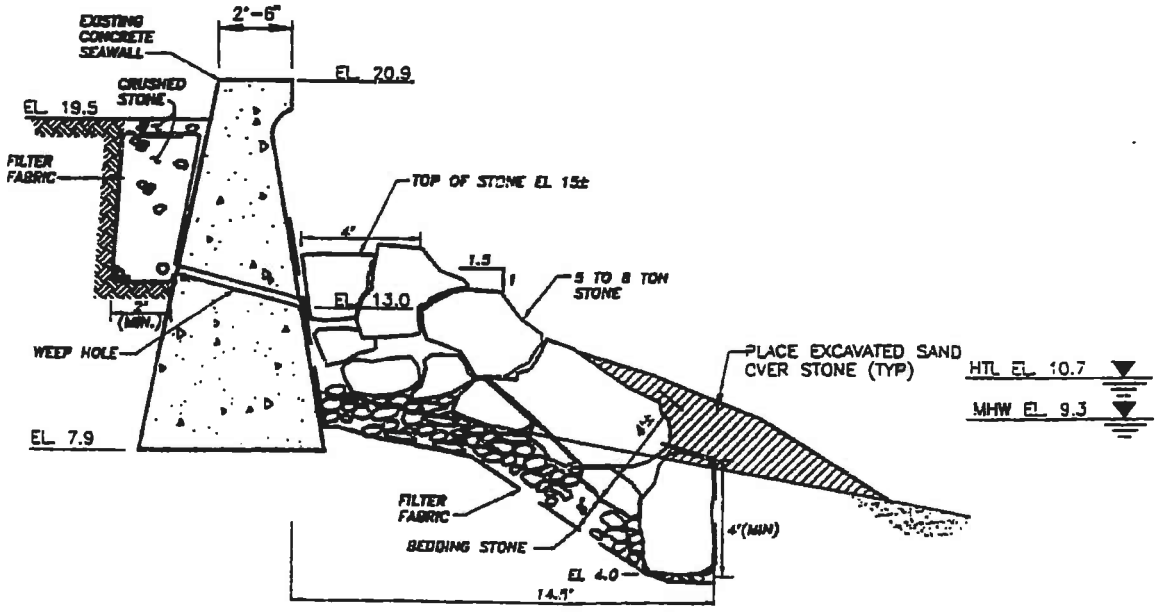
0' 6'

SECTIONS

NOVEMBER 1996
SHEET 5 OF 6



SECTION C



SECTION D

0' 6'

SECTIONS

NOVEMBER 1996
SHEET 6 OF 6

NUCCI VINE ASSOCIATES, INC.