



COLUMBUS AVENUE SEAWALL

PROJECT REVIEW - NEIGHBORHOOD SUBCOMMITTEE MEETING JULY 28, 2020

Proactive By Design.
Our Company Commitment



GZA GeoEnvironmental, Inc.



Meeting Agenda

- **Introduction**
- **Prior Columbus Ave Seawall Assessment Work**
- **GZA's Current Project Scope**
- **Project Summary/Progress To Date**
- **Anticipated Schedule**
- **Design Questions**
- **Discussion**



Columbus Avenue Seawall

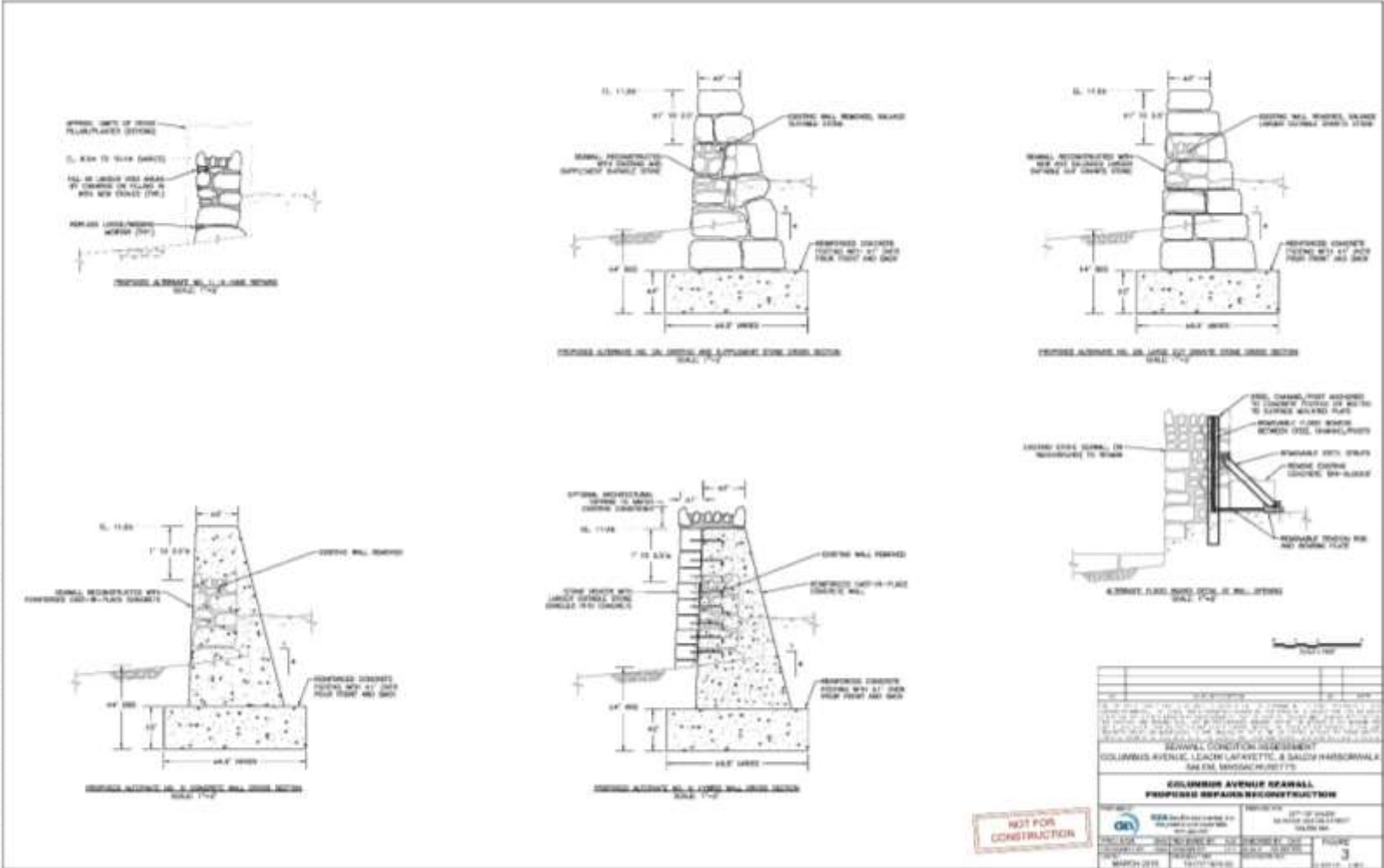
- **No Historic Information Found (pre-1938)**
- **Seawall is approximately 474 ft long**
- **Stone/Masonry Construction**
- **Elevation Varies from 10.1 to 8.5 in North American Vertical Datum 1988 (NAVD88)**
- **“B”, Good Condition, per Massachusetts Coastal Infrastructure Inventory and Assessment Project, by the Massachusetts Department of Conservation and Recreation, North Shore 2009**

Columbus Avenue Seawall

- Observed to be in overall FAIR to POOR Condition
 - Loose/missing stones,
 - Deteriorated and missing mortar/cracks



Columbus Avenue Seawall



NOT FOR CONSTRUCTION

<p>SEAWALL CONDITION ASSESSMENT COLUMBUS AVENUE, LEACH LAFAYETTE, & SALVO HARBORWALK SALVO, OKLAHOMA</p>	
<p>COLUMBUS AVENUE SEAWALL PROPOSED REPAIRS RECONSTRUCTION</p>	
<p>DATE: MARCH 2023</p>	<p>SCALE: 1/4" = 1'-0"</p>
<p>PROJECT NO: 2023-001</p>	<p>DATE: 03/20/23</p>
<p>DESIGNED BY: [Name]</p>	<p>CHECKED BY: [Name]</p>
<p>APPROVED BY: [Name]</p>	<p>DATE: 03/20/23</p>



Columbus Avenue Seawall

Alt No.	Repair Recommendation	Wall Height	Cost Estimate
Alt No. 1	In-kind Repairs	No Change	\$90k to \$120k
Alt No. 2A	Reconstruct with Existing and Supplemental Stone	+0.9-2.5 ft	\$550k to \$700k
Alt No. 2B	Reconstruct with Large Cut Granite Stone	+0.9-2.5 ft	\$750k to \$900k
Alt No. 3	Reconstruct with Reinforced Concrete Wall	+0.9-2.5 ft	\$1.4m to \$1.7m
Alt No. 4	Reconstruct with Hybrid-Concrete and Stone Veneer Wall	+0.9-2.5 ft	\$1.5m to \$1.8m

Columbus Avenue Seawall

➤ Alt No. 2B – Reconstruct with Large Cut Granite Stone

Pros

- Medium upfront cost
- Increased flood protection
- Aesthetics- stone masonry

Cons

- Routine maintenance/upkeep
- Material availability



Columbus Avenue Seawall



- **EOEEA Dams and Seawall Grant submitted July 2019**
- **March 2018 Storm Damage Seawall Assessment Report Letter – Oct 2019**
- **Award Notice January 2020**
- **GZA's Scope of Services/Task Order March 2020**



Columbus Avenue Seawall

GZA's Scope of Services

- Task 1 – Project Review
- Task 2 – Survey/Ecological Work
- Task 3 – Design Development
- Task 4 – Permitting
- Task 5 – Final Design/Bid Documents
- Task 6 – Bid Phase Services



Columbus Avenue Seawall

GZA's Scope of Services

- Task 1 – Project Review
- **Task 2 – Survey/Ecological Work**
- Task 3 – Design Development
- Task 4 – Permitting
- Task 5 – Final Design/Bid Documents
- Task 6 – Bid Phase Services

Columbus Avenue Seawall



Living Shoreline – Marsh Enhancement Area



JUNIPER COVE - SALEM, MA
 Design Layout Concept
 Contours referenced to NAVD88 (feet)

0 25 50 75 100 Feet

Columbus Avenue Seawall



JUNIPER COVE LIVING SHORELINE RENDERING
SALEM, MA

Columbus Avenue Seawall

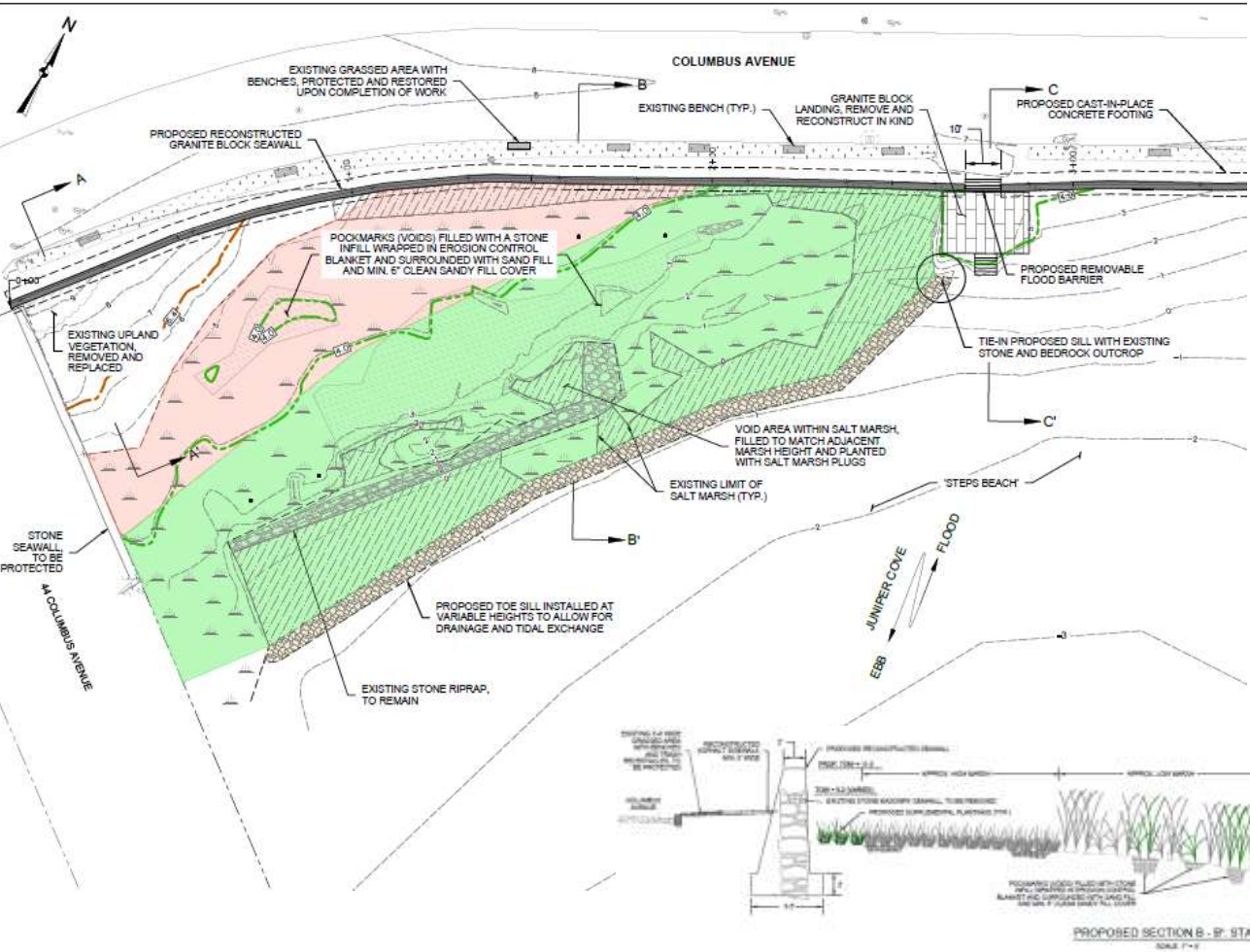
- Partly desiccated with “pockmark” voids throughout
- Erosion and undermining along seaward edge



Columbus Avenue Seawall

Living Shoreline Design:

- New seaward sill
- Sand nourishment fill to raise grades and fill voids
- New and supplemental salt marsh plantings (*Spartina patens* and *Spartina alterniflora*)



Columbus Avenue Seawall

➤ Toe Sill – Coir Roll

Pros

- Natural and biodegradable material
- Promotes vegetation growth – plant directly into coir roll
- Absorbs wave energy with minimal reflection
- Easy installation

Cons

- Temporary protection (2-5 years)
- Minimal protection against waves and ice impacts
- Additional maintenance (resetting, anchoring, or replacement)



Columbus Avenue Seawall

➤ Toe Sill – Stone Sill

Pros

- Long-term protection
- Increased protection against waves and ice impacts
- Easy to moderate installation



Cons

- Less natural- hard armoring
- Possible wave reflection and scour





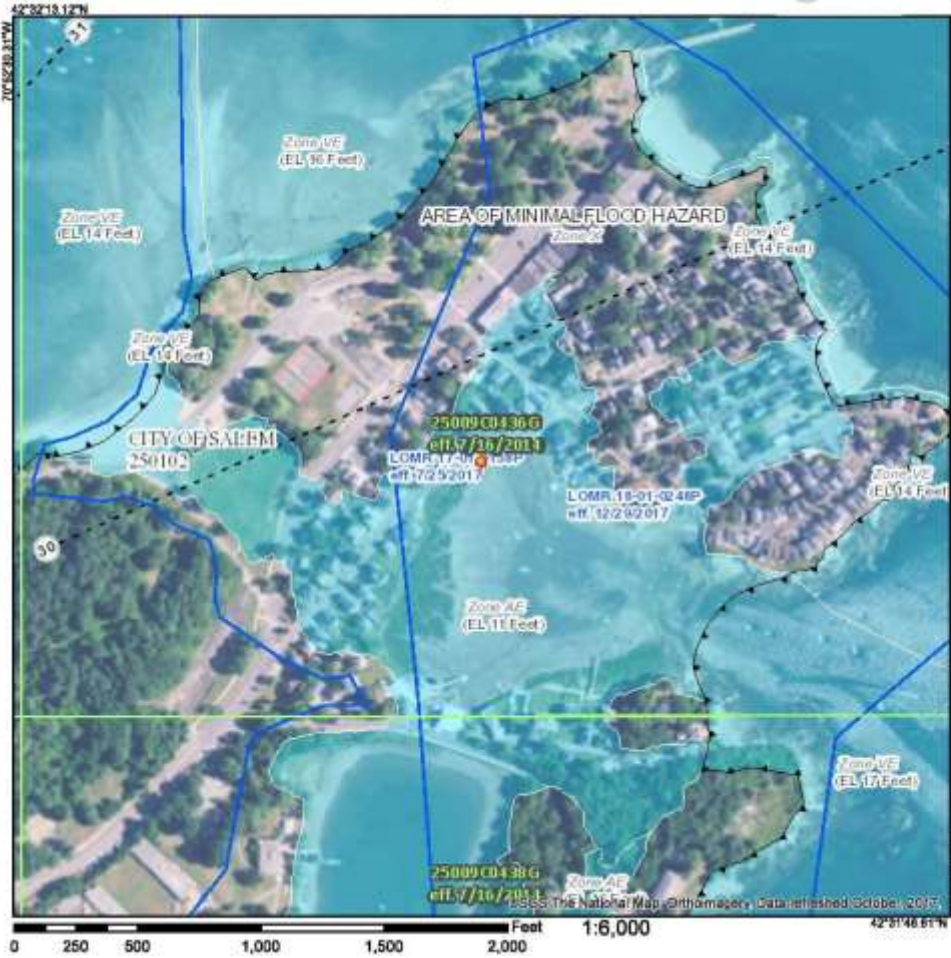
Columbus Avenue Seawall

GZA's Scope of Services

- Task 1 – Project Review
- Task 2 – Survey/Ecological Work
- **Task 3 – Design Development**
- Task 4 – Permitting
- Task 5 – Final Design/Bid Documents
- Task 6 – Bid Phase Services

Columbus Avenue Seawall

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE)
	With BFE or Depth
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile
	Future Conditions 1% Annual Chance Flood Hazard
	Area with Reduced Flood Risk due to Levees
	Area with Flood Risk due to Levees
OTHER AREAS	Area of Minimal Flood Hazard
	Effective LOMs
	Area of Undetermined Flood Hazard
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	Cross Sections with 1% Annual Chance Water Surface Elevation
	Coastal Transect
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

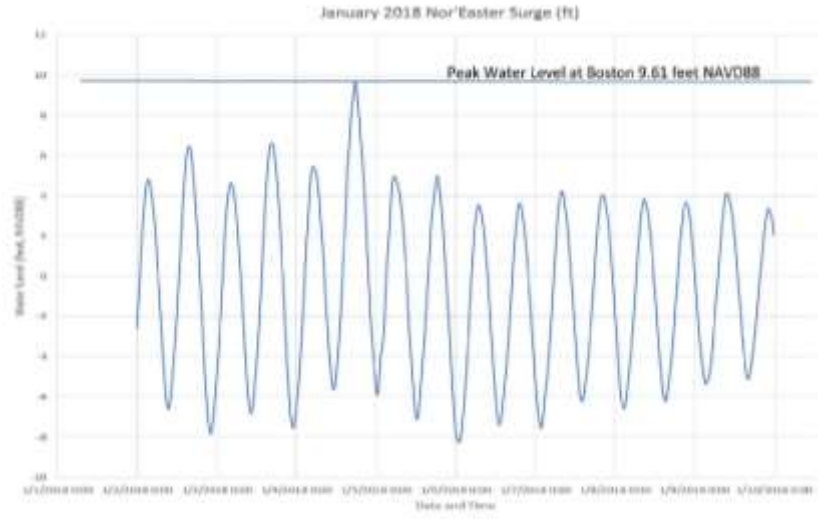
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/31/2019 at 12:12:21 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legends, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Columbus Avenue Seawall

January 2018





Columbus Avenue Seawall

COASTAL MODELING – INTENT

1. Wave heights in the Cove/at the Columbus Ave seawall
2. Wave effect/wave run-up at NE end of seawall
3. Wave overtopping at seawall
4. Effects of Breakwater



Columbus Avenue Seawall

COASTAL MODELING – PARAMETERS

Return Period	FEMA		USACE ³					
	Stillwater Elevation ¹ (ft, NAVD88)	Base Flood Elevation ² (ft, NAVD88)	Stillwater Elevation (ft, NAVD88)			Wave Height (ft)		
			#10709	#10710	#69	#10709	#10710	#69
1-year			6.1	6.1	6.1	8.7	7.0	9.7
2-year			6.7	6.7	6.7	12.8	9.8	13.8
5-year			7.3	7.4	7.3	14.4	11.3	15.3
10-year	8.4		7.7	7.8	7.7	15.0	11.8	15.8
50-year	9.4		8.7	8.7	8.6	15.6	12.6	16.4
100-year	10.0	11	9.1	9.1	9.0	15.8	12.8	16.5
500-year	11.4		9.9	9.9	9.8	15.9	13.2	16.7

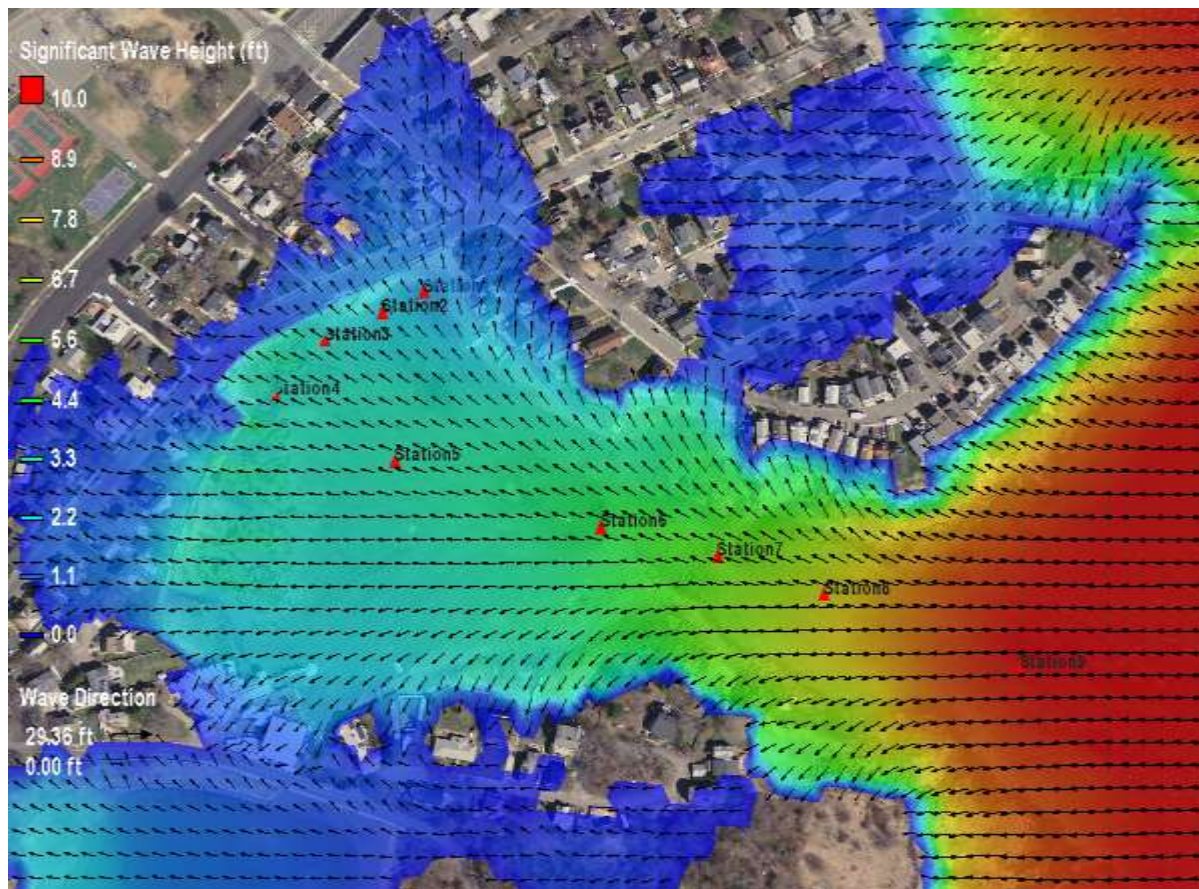
Analysis	Wind Speed (mph) Statistics			
	10-year	50-year	100-year	500-year
ASCE 7-16	61	75	80	--
GZA Statistical Analysis	56	68	74	87

Time	Water Level ² (ft, NAVD88)	Storm Type
1/4/2018	9.7	Nor'Easter
2/7/1978	9.6	Nor'Easter
3/2/2018	9.1	Nor'Easter
1/2/1987	8.7	Nor'Easter
10/30/1991	8.6	Nor'Easter
1/25/1979	8.5	Nor'Easter
12/12/1992	8.5	Nor'Easter
12/29/1959	8.5	Nor'Easter
2/19/1972	8.4	Nor'Easter
1/3/2014	8.3	Nor'Easter

Scenario 1 – Due East/Scenario 2 - NE

Columbus Avenue Seawall

COASTAL MODELING – WAVE HEIGHTS SCENERIO 1



Columbus Avenue Seawall

COASTAL MODELING – WAVE HEIGHTS SCENERIO 1



	Stations	Scenario 1	Scenario 2
SWAN Model Output ⁴ of Significant Wave Height (ft)	Output Station 1	1.6	1.2
	Output Station 2	2.3	1.8
	Output Station 3	2.7	2.3
	Output Station 4	2.9	3.2
	Output Station 5	3.1	3.2
	Output Station 6	4.4	4.2
	Output Station 7	6.0	5.8
	Output Station 8	7.4	7.1
	Output Station 9	10.0	9.6
	Output Station 10	1.4	1.2
	Output Station 11	2.2	1.7
	Output Station 12	2.6	2.2
	Output Station 13	2.0	1.8

Columbus Avenue Seawall

COASTAL MODELING – WAVE HEIGHT/WAVE RUNUP





Columbus Avenue Seawall

COASTAL MODELING – WAVE HEIGHT/WAVE RUNUP

Output Station ¹	Wall Height (ft, NAVD88)	Bed Condition		Stillwater Condition			Wave Condition				Wave Runup ²		Overtopping Flowrate ²
		Sand Removal	Bed Level ¹ (ft, NAVD88)	Stillwater Elevation (ft, NAVD88)	Water Depth (ft)	Freeboard (ft)	Significant Wave Height ¹ (ft)	Peak Wave Period ² (s)	Wave Crest Elevation ³ (ft, NAVD88)	Wave Breaking?	Wave Runup on Seawall (ft)	Wave Runup Height (ft, NAVD88)	per linear foot (gallon/min)
Northeast Corner	11	No Sand Removal	7	10	3	1	1.4	11.1	11.0	No	2.7	12.7	41
		After Sand Removal	4	10	6	1	1.1	11.1	10.8	No	2.1	12.1	17
	12	No Sand Removal	7	10	3	2	1.4	11.1	11.0	No	2.7	12.7	6
		After Sand Removal	4	10	6	2	1.1	11.1	10.8	No	2.1	12.1	2
Station 11	11	N/A	2.7	10	7.3	1	2.2	11.1	11.5	No	4.2	14.2	157
	12	N/A	2.7	10	7.3	2	2.2	11.1	11.5	No	4.2	14.2	48
Station 12	11	N/A	3.6	10	6.4	1	2.6	11.1	11.8	No	5.0	15.0	243
	12	N/A	3.6	10	6.4	2	2.6	11.1	11.8	No	5.0	15.0	89
Station 13	11	N/A	8.3	10	1.7	1	2.0	11.1	11.4	Yes	3.9	13.9	121
	12	N/A	8.3	10	1.7	2	2.0	11.1	11.4	Yes	3.9	13.9	33

Columbus Avenue Seawall

COASTAL MODELING – BREAKWATER EFFECTS



Columbus Avenue Seawall

COASTAL MODELING – BREAKWATER EFFECTS

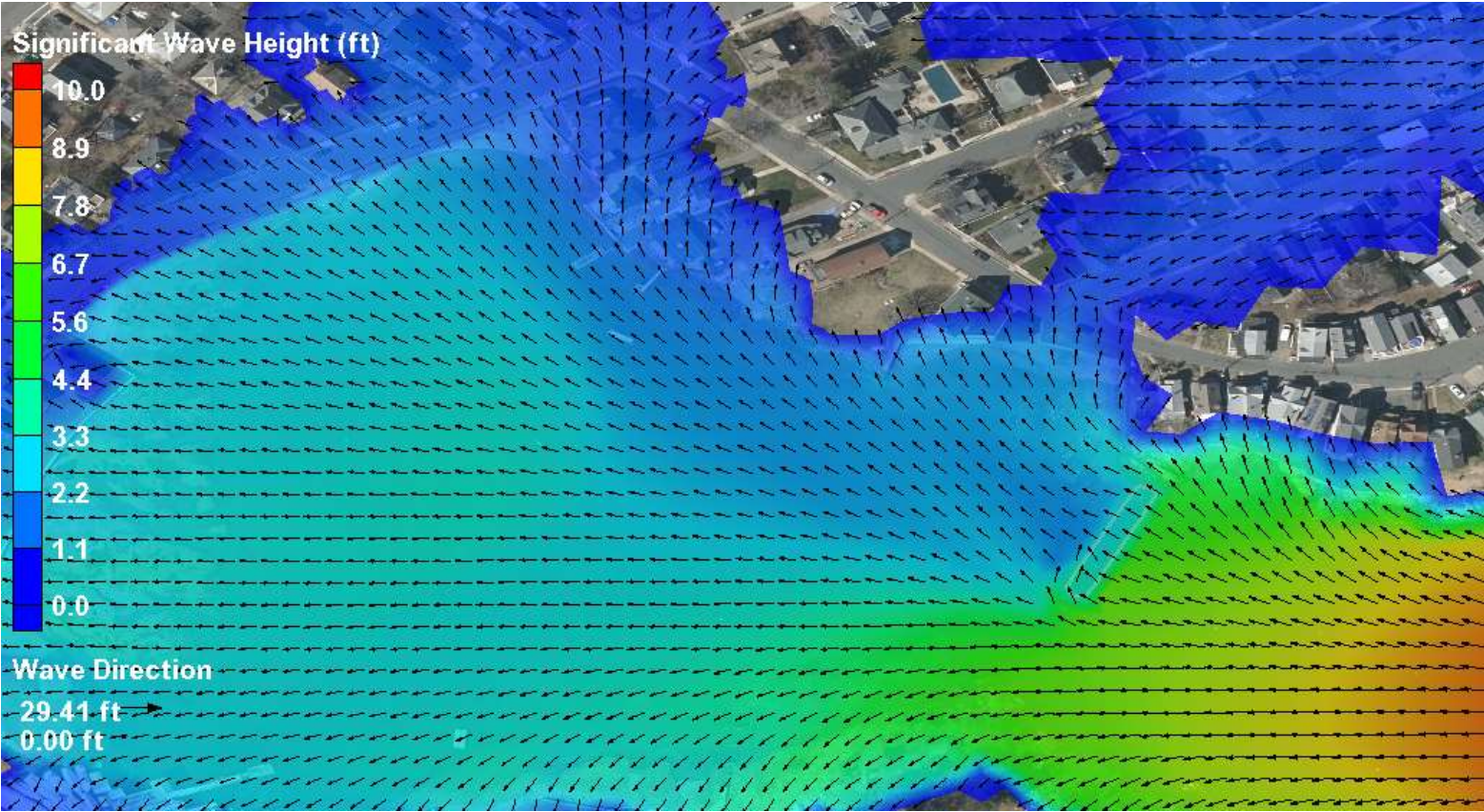


Figure 8. Revetment height: El. 8' – Scenario 1



Columbus Avenue Seawall

COASTAL MODELING – BREAKWATER EFFECTS

Output Stations	Revetment Height based on LiDAR		Revetment Height El. 0'		Revetment Height El. 5'		Revetment Height El. 8'		Revetment Height El. 10'	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
	#1	1.6	1.2	1.7	1.3	1.7	1.1	1.5	0.7	1.4
#2	2.3	1.8	2.3	1.9	2.3	1.6	2.1	0.9	2.0	0.8
#3	2.7	2.3	2.7	2.4	2.5	2.0	2.1	1.1	2.1	1.1
#4	2.9	3.2	2.9	3.1	2.5	2.8	2.3	1.7	2.3	1.9
#5	3.1	3.2	3.1	3.2	2.6	2.6	2.7	1.9	2.8	2.1
#6	4.4	4.2	4.2	4.0	3.3	3.2	2.2	2.0	2.6	2.4
#7	6.0	5.8	6.2	6.0	6.7	6.4	3.0	3.0	N/A	N/A
#8	7.4	7.1	7.4	7.1	7.4	7.1	7.4	7.1	7.4	7.1
#9	10.0	9.6	10.0	9.6	10.0	9.6	10.0	9.6	10.0	9.6
#10	1.4	1.2	1.5	1.3	1.4	1.2	1.0	0.7	0.8	0.6
#11	2.2	1.7	2.3	1.8	2.2	1.6	1.8	0.8	1.7	0.7
#12	2.6	2.2	2.6	2.3	2.4	1.9	1.9	0.9	1.8	0.8
#13	2.0	1.8	1.9	1.8	1.6	1.5	1.3	1.2	1.4	1.3

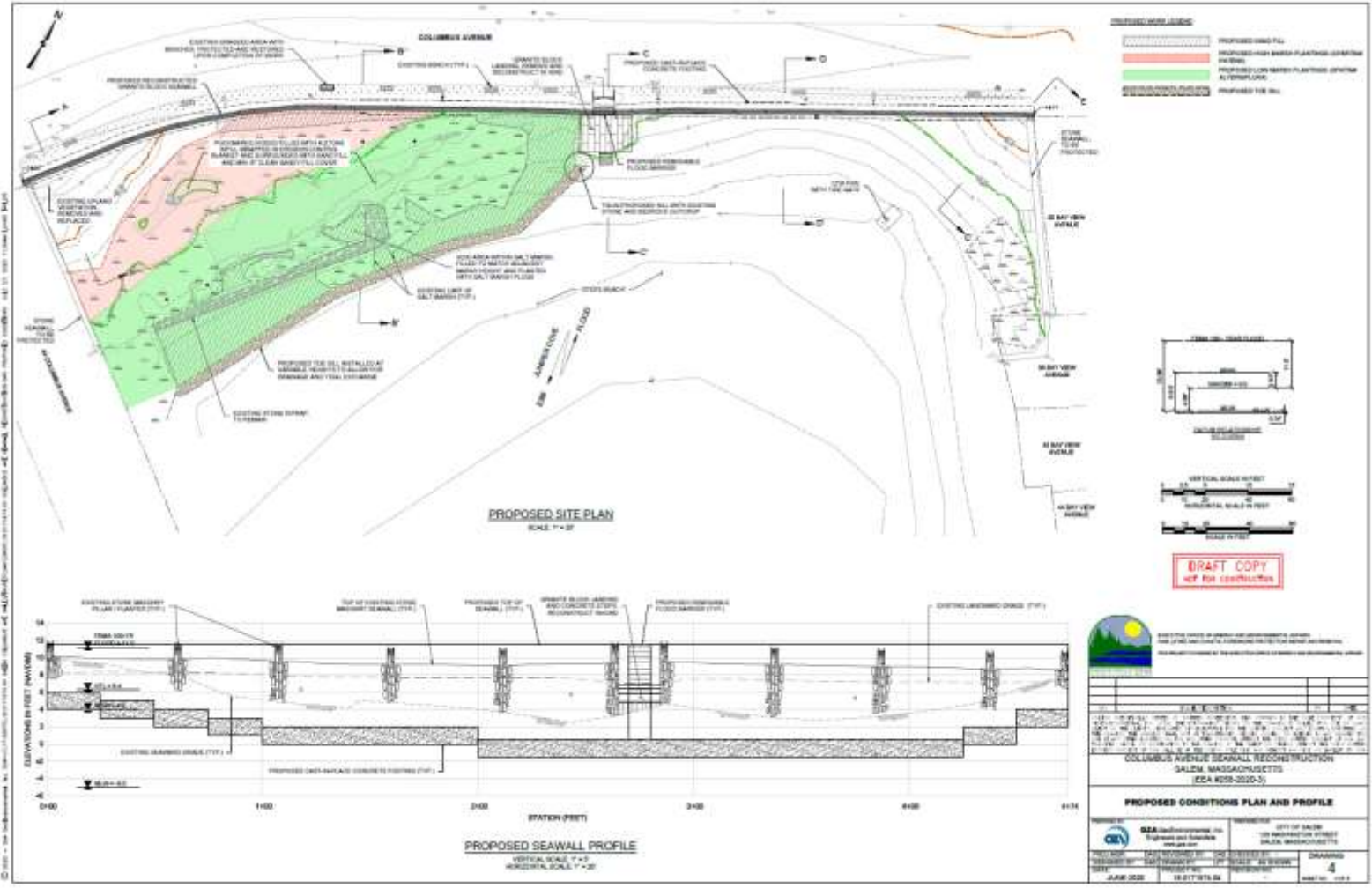


Columbus Avenue Seawall

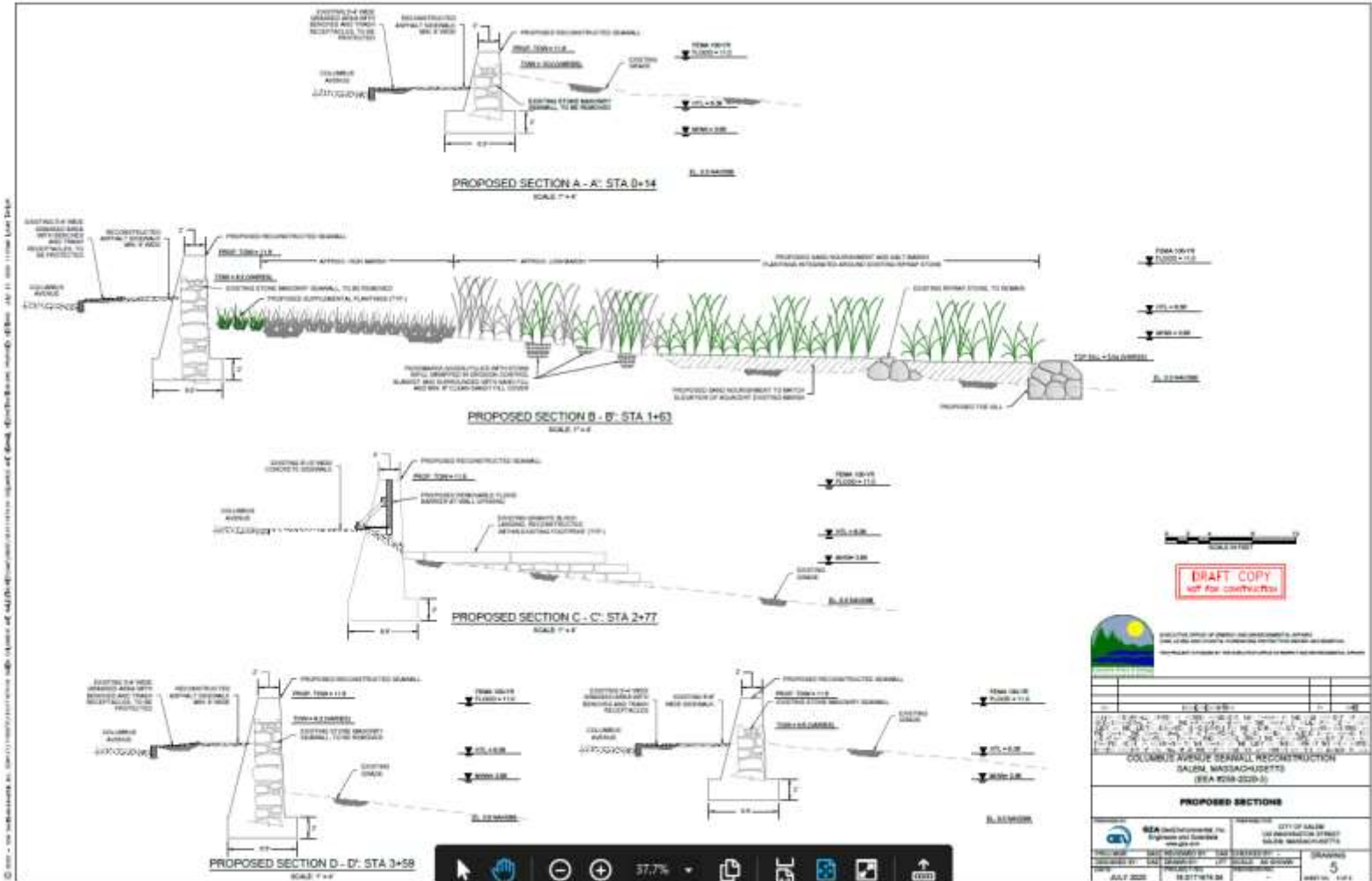
COASTAL MODELING – SUMMARY

1. Wave heights at seawall generally range from 2' to 2.4' except at the NE corner at 1.5'.
2. Additional wave runup contributing to wall overtopping at NE corner with sand build-up, however $\leq 0.5'$.
3. Overtopping of seawall at El. 11 and 12 due to wave runup.
4. Existing breakwater only minimally attenuates incoming waves.

Columbus Avenue Seawall



Columbus Avenue Seawall



© 2025 by SEA Environmental, Inc. All rights reserved. No part of this document may be reproduced without the prior written consent of SEA Environmental, Inc.





In Closing...

- **ANTICIPATED SCHEDULE**
- **REVIEW WITH THE CITY**
- **PERMITTING/CONSTRUCTION IMPLICATIONS**
- **IDENTIFY FUNDING OPPORTUNITIES**



Questions/Discussion