



FLORIDA SHORE & BEACH
PRESERVATION ASSOCIATION
A League of Cities and Counties on Beach and Coastal Issues

29th Annual National Conference on Beach Preservation Technology

ENGINEERED SHORELINE PROTECTION CASE STUDY FROM THE JERSEY SHORE

Material Selection Process, Sustainability, and Impacts from Sandy

Arthur Chew PP, PP, CME, CFM

Presented by:

Chris Timpson

TenCate Water & Environment



February 3-5, 2016
Omni Hotel
Jacksonville, FL



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Sand is an economical building material, and has predictable engineering properties.



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But sand lacks cohesion and erodes easily under the influence of current and waves.



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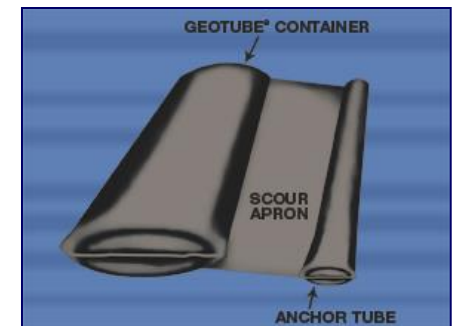
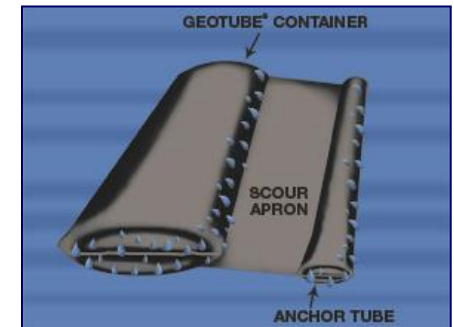
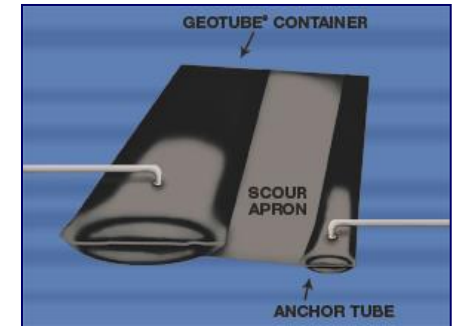
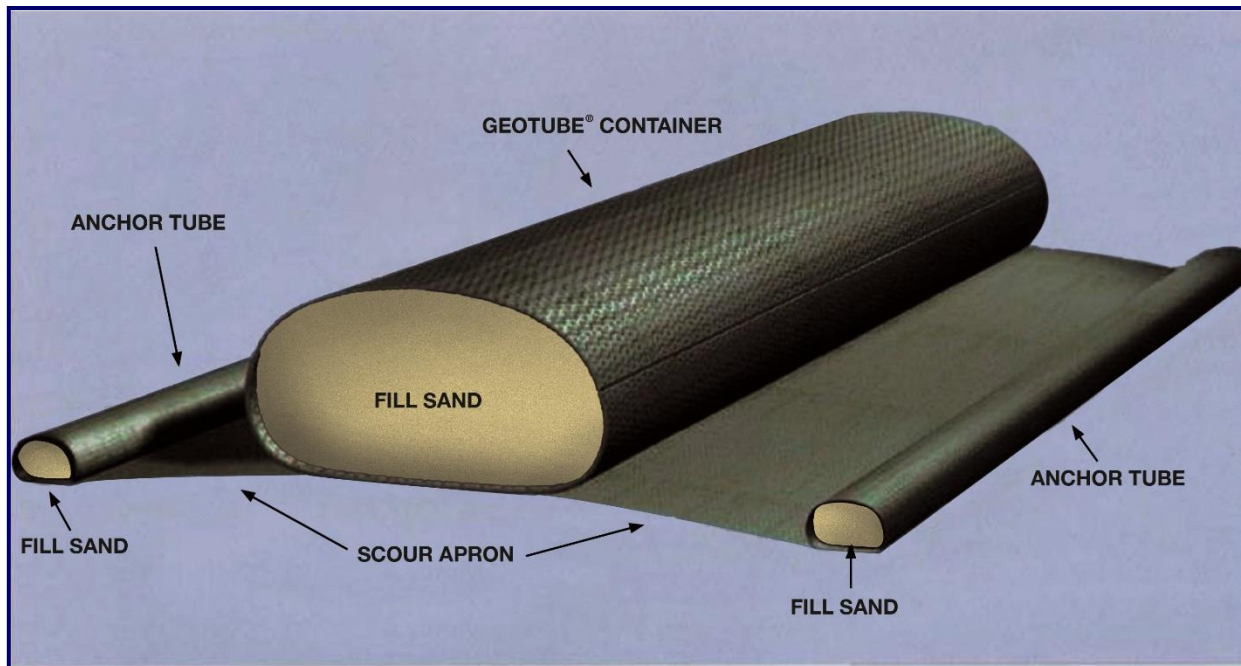
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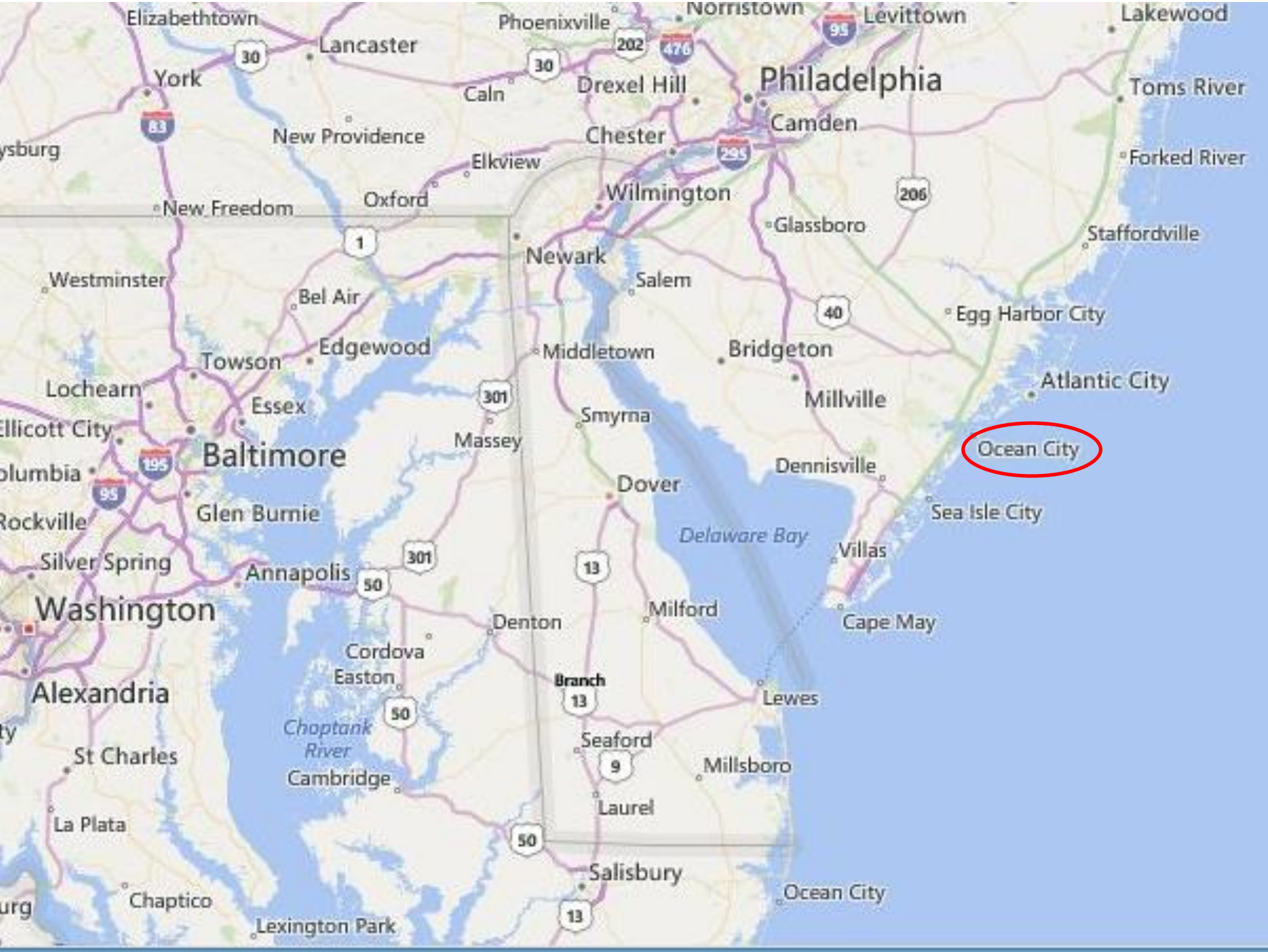


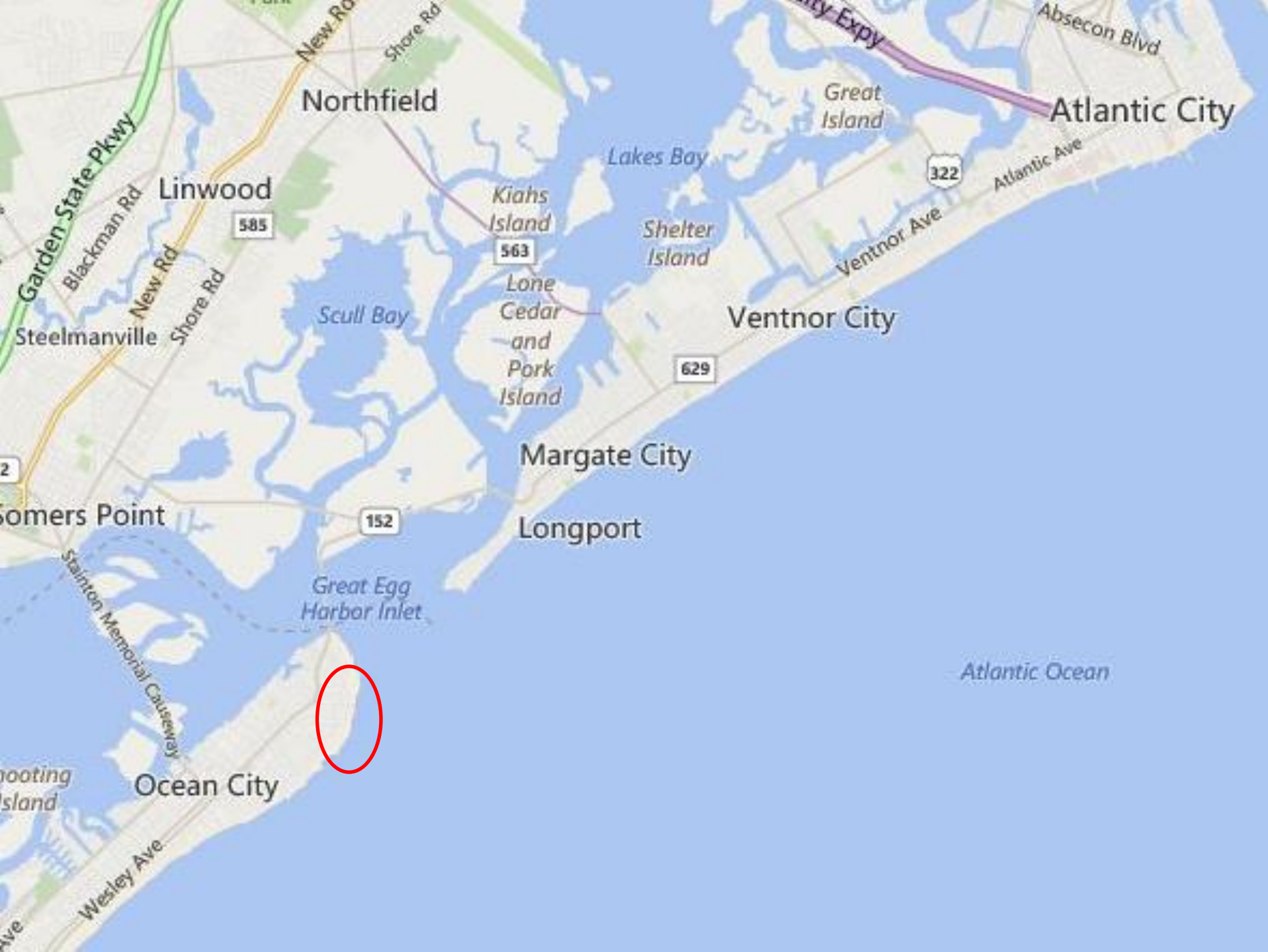
Geosynthetics can encapsulate sand to form containment structures to protect against erosion, build waterfront structures, and reclaim land.



Typical Design:







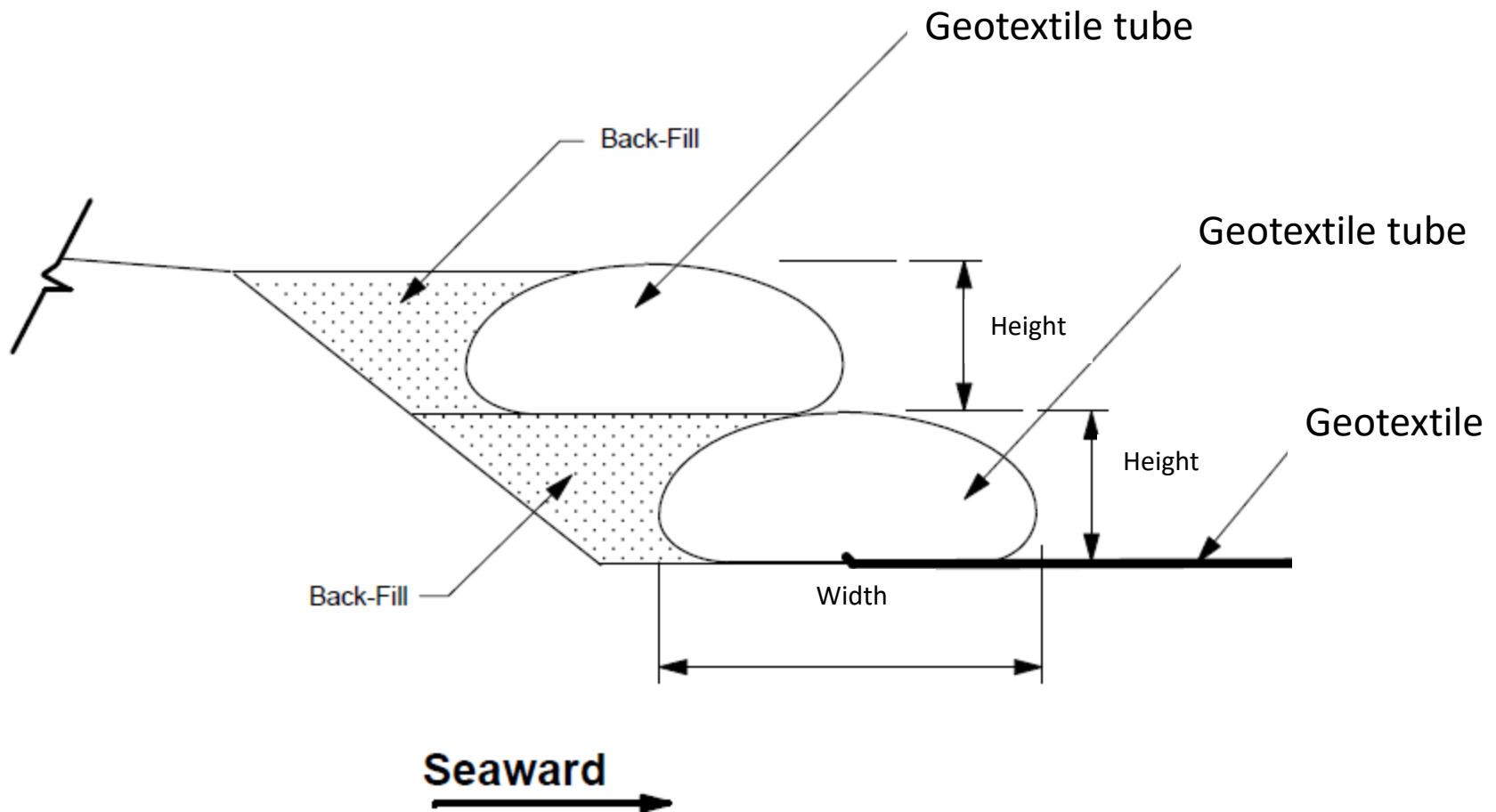


Background

- Previous geotextile tube installation in 2006.
- A series of five storms caused severe shoreline erosion August – November in 2009.
- Storms eroded almost all of dunes on Waverly Beach and undermined a section of East Atlantic Blvd.



11/15/2009



Possible cross-section of previous installation







10/19/2009



Time of Action

- As a temporary measure, the Public Works Dept placed harvested sand along the former dune line of Waverly Beach to hold back high tides from entering East Atlantic Boulevard.
- Failure to add more permanent protection in a timely fashion may result in the loss of the road as well as the utilities within the road. This cost could be significant depending on the extent of the erosion, as well as utilities being lost.
- An analysis of possible solutions was conducted.



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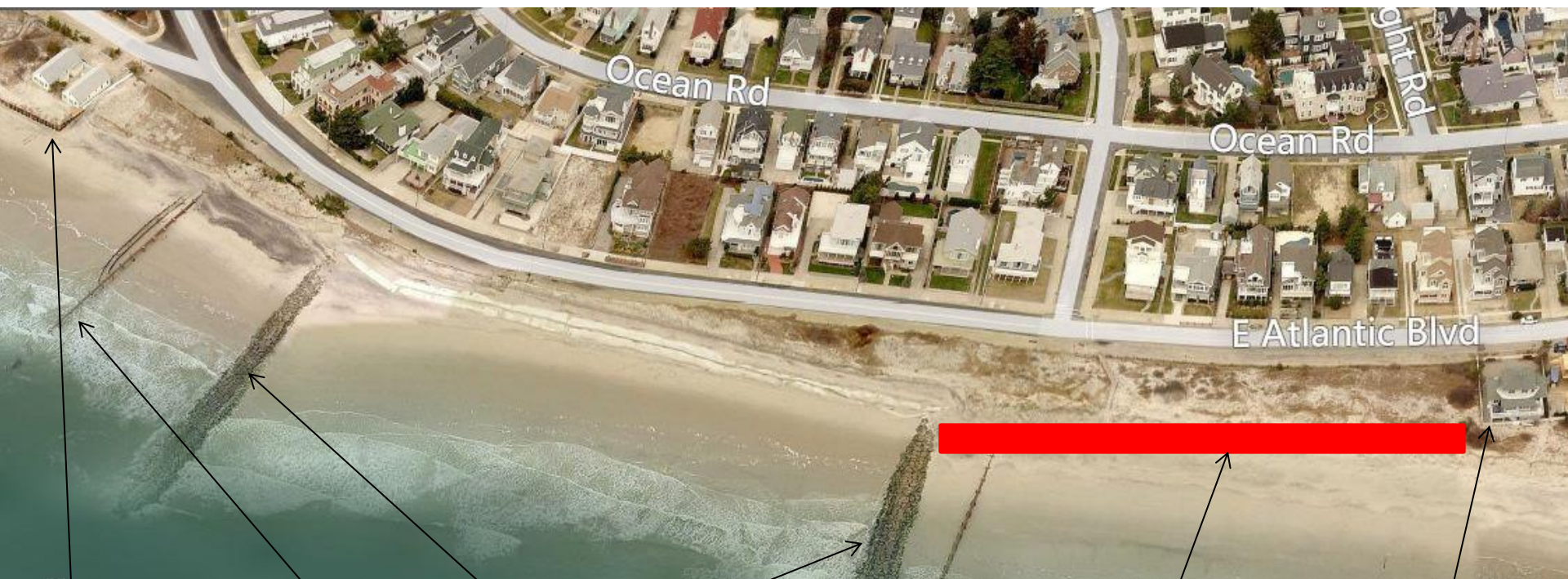
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	<u>Geosynthetic Containment Tubes</u>	<u>Steel Bulkhead</u>	<u>Gabions</u>	<u>Stone Revetment</u>
Cost	\$667/LF	\$2,000/LF	\$333/LF	\$3,500/LF
Life	25 years	50 years	25 years	100+ years
Permits	No additional permit needed	Lengthy process unlikely to obtain	May not be viewed favorably	May not be viewed favorably
Pros	Cost effective, low carbon footprint, community familiar	Longer term solution	Quick and easy to install	Most permanent option, proven effective, community familiar
Cons	Could be damaged, public skeptical, lack of sand on beach may be an issue	Large carbon footprint, costly, permitting, scour of beach at tow of bulkhead	Cages will deteriorate in water, damaged cages = stones all over the beach, public not familiar	Expensive, large carbon footprint



Recommendation

- Install geotextile tubes on Waverly Beach.
- Most cost effective and timeliest solution considering that the tubes could be installed as part of the upcoming beach fill.
- Use existing beach and dune maintenance permit.
- For all future beach fill projects, the City would have an on site inspector present whenever mechanical equipment is utilized on the beach.
- In addition, the beach rake would not be utilized on this beach as to eliminate any other possible damage to tubes.



Southern Limit
Timber Bulkhead

Rock Groins

Stormwater
Outfall Pipes

Existing Stone Revetment

Northern Limit
Steel Bulkhead



01/29/2010

GT 1000M TAN GEOTUBE UNITS

34' IN CIRCUMFERENCE. 4' OF SAND PLACED OVER THE GEOSYNTHETIC CONTAINMENT UNITS.

GT 1000M TAN SHROUD
ATTACHED TO FRONT AND TOP
OF SEAWARD GEOTUBE UNITS
OR APPROVED EQUAL

EL. 8.75 NAVD

4'C - ANCHORING TUBE

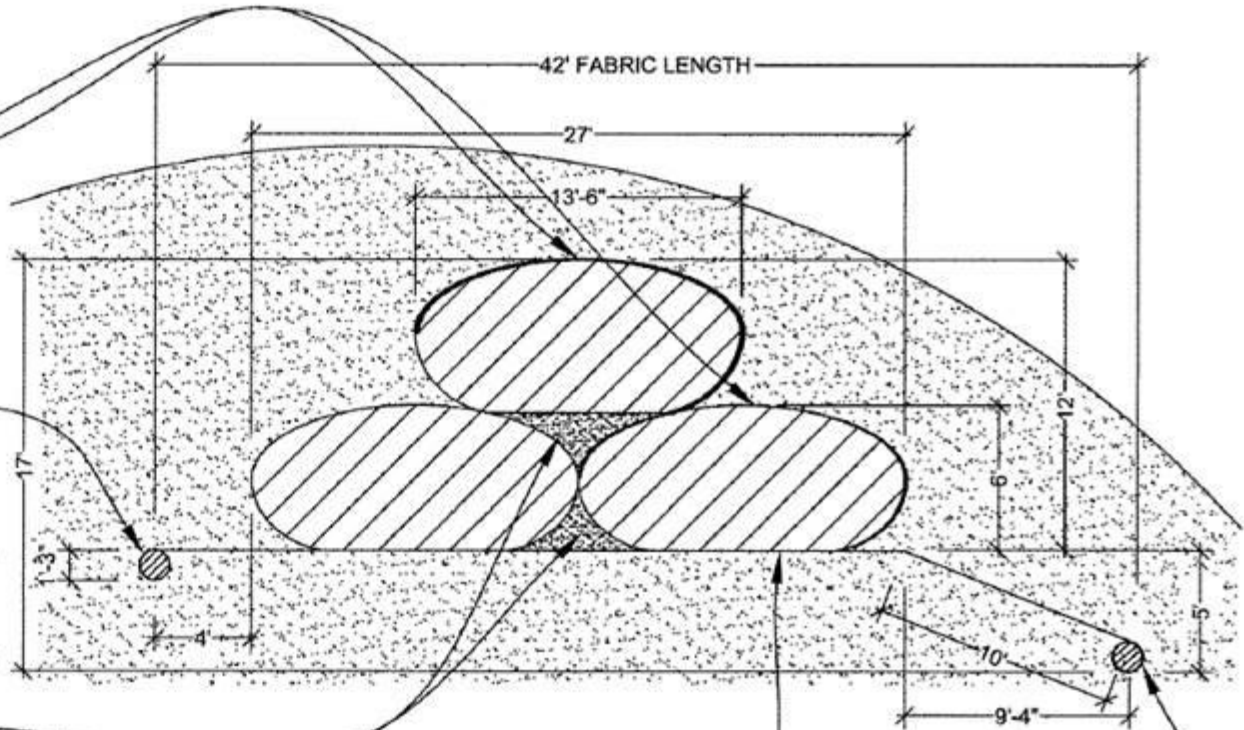
EL. -3.25 NAVD

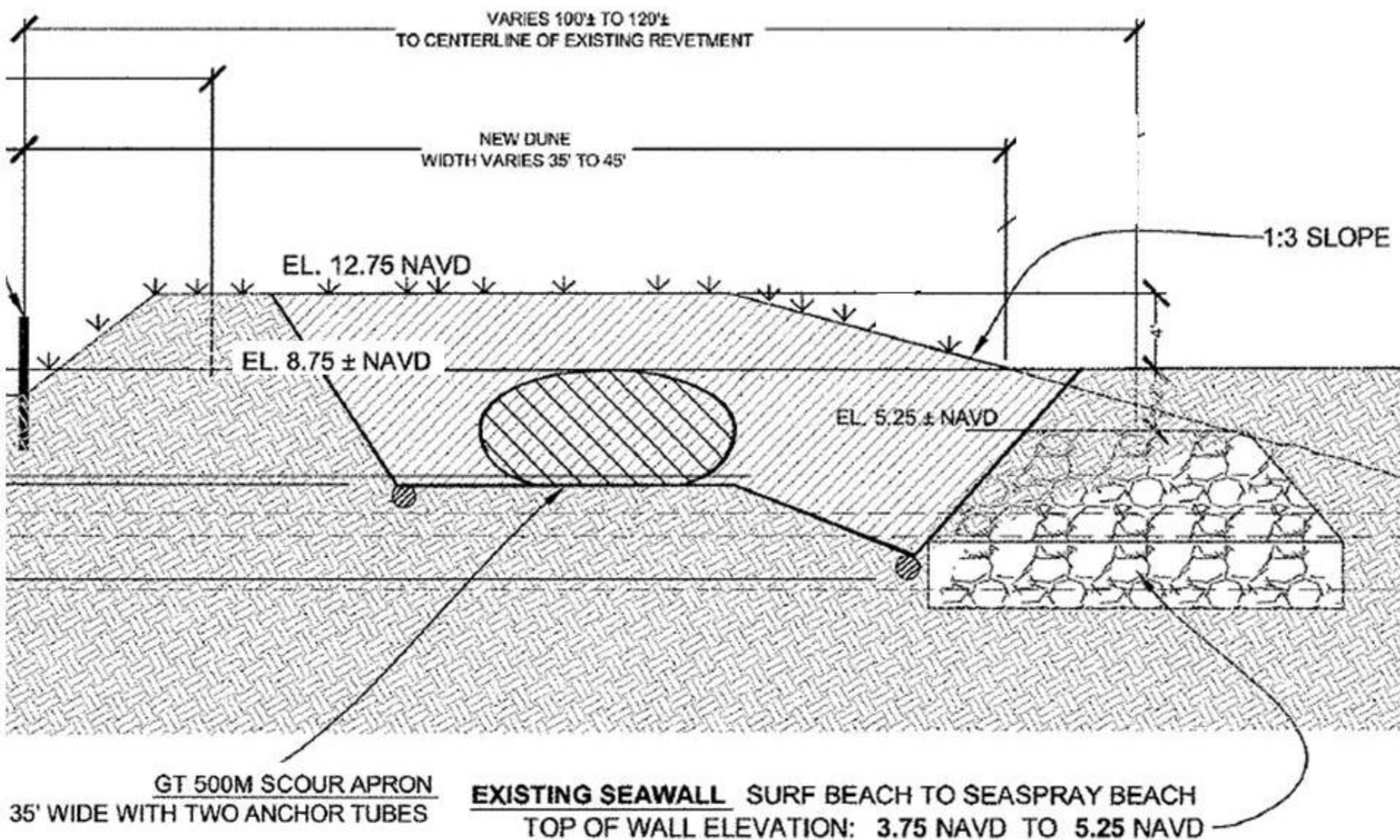
EL. -8.25 NAVD

FILL VOID BETWEEN TUBES
WITH BEACH SAND

GT 500M SCOUR APRON
42' WIDE WITH TWO ANCHOR TUBES
OR APPROVED EQUAL

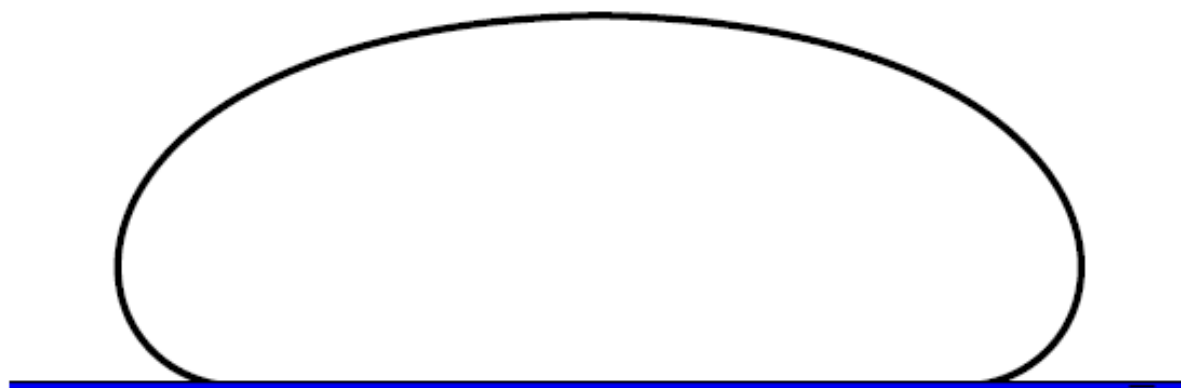
4'C - ANCHORING TUBE





Geotube® Simulator

Cross Section



11/1/10

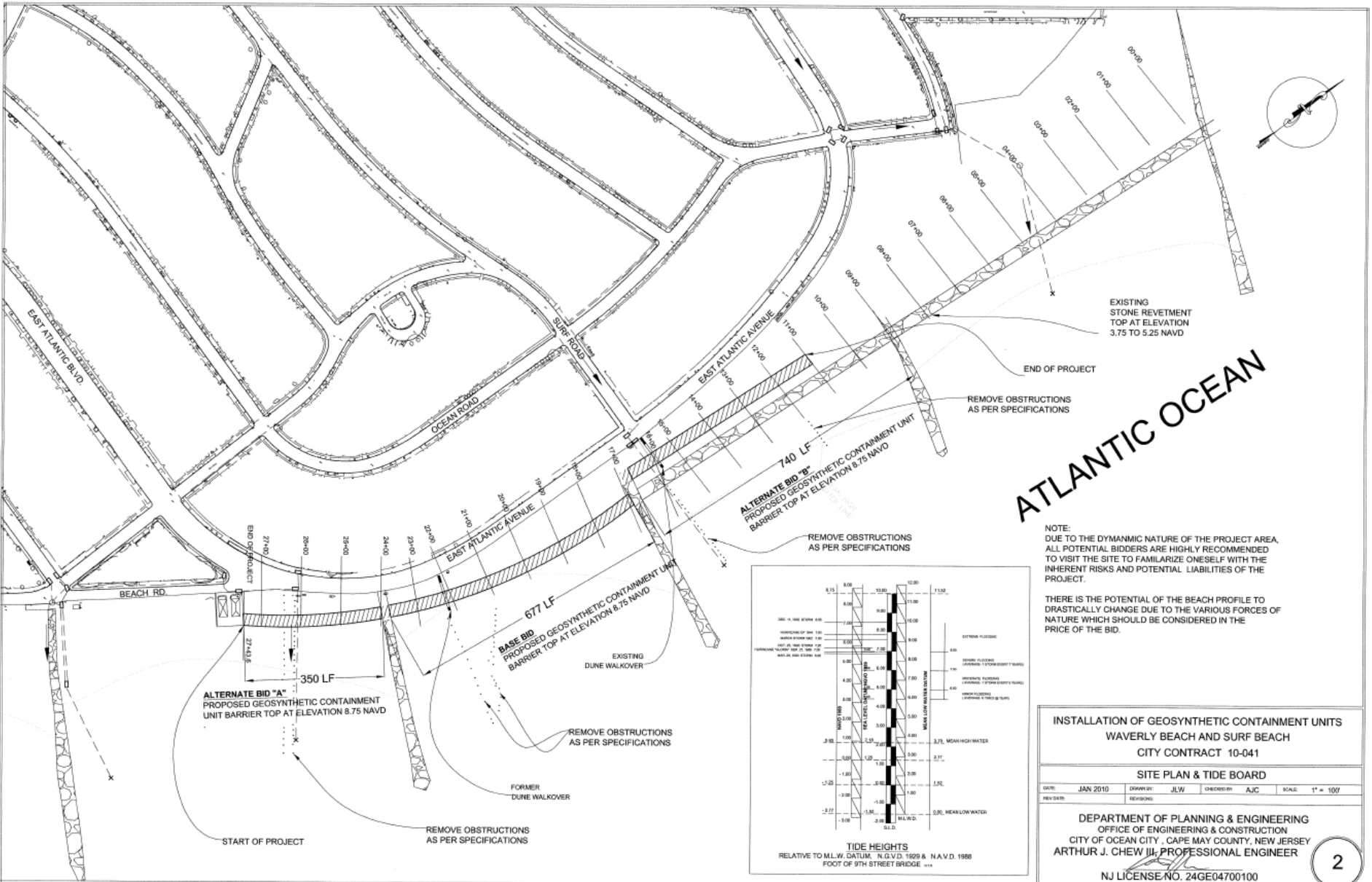
Project:

Ocean City, NJ

Units:	English	
Water Level:	Fully Emerged	
Geotube® Height (H) =	6	ft
Geotube® Circumference (C) =	34	ft
Relative Density of Fill Material =	2	sg
Geotube® Fabric Type:	GT1000	
Geotube® Fabric Type:	Rigid Mechanical	

Circumferential Tensile Force (T) =	117.13	lb/in.
Geotube® Base Contact Width (B) =	10.39	ft
Geotube® Filled Width (W) =	13.94	ft
Geotube® Cross Section Area (A) =	70.87	sq ft
Geotube® Volume Per Unit of Length (V) =	2.62	cu yd/ft
FS of Circumferential Failure =	4.3	FS
Axial Direction FS (AFS) =	13.0	FS
FS of Fill Port Failure =	9.1	FS

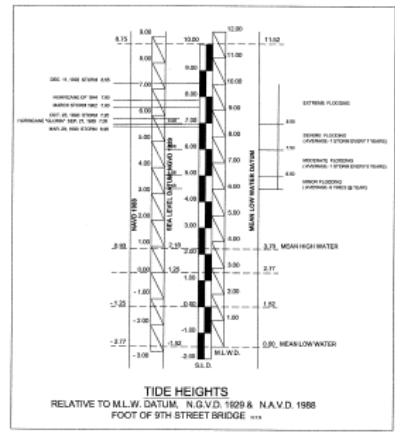
The equations used in the Geotube® Simulator are based on the paper "Two-dimensional analysis of geosynthetic tubes" by R. H. Plaut and S. Suherman, Acta Mechanica, Volume 129, 1998, pages 207-218, and on further research by Professor Raymond H. Plaut. The software was developed by Benjamin Z. Dymond. The work was performed at Virginia Tech.



ATLANTIC OCEAN

NOTE:
DUE TO THE DYNAMIC NATURE OF THE PROJECT AREA,
ALL POTENTIAL BIDDERS ARE HIGHLY RECOMMENDED
TO VISIT THE SITE TO FAMILIARIZE ONESELF WITH THE
INHERENT RISKS AND POTENTIAL LIABILITIES OF THE
PROJECT.

THERE IS THE POTENTIAL OF THE BEACH PROFILE TO
DRASTICALLY CHANGE DUE TO THE VARIOUS FORCES OF
NATURE WHICH SHOULD BE CONSIDERED IN THE
PRICE OF THE BID.



INSTALLATION OF GEOSYNTHETIC CONTAINMENT UNITS
WAVERLY BEACH AND SURF BEACH
CITY CONTRACT 10-041

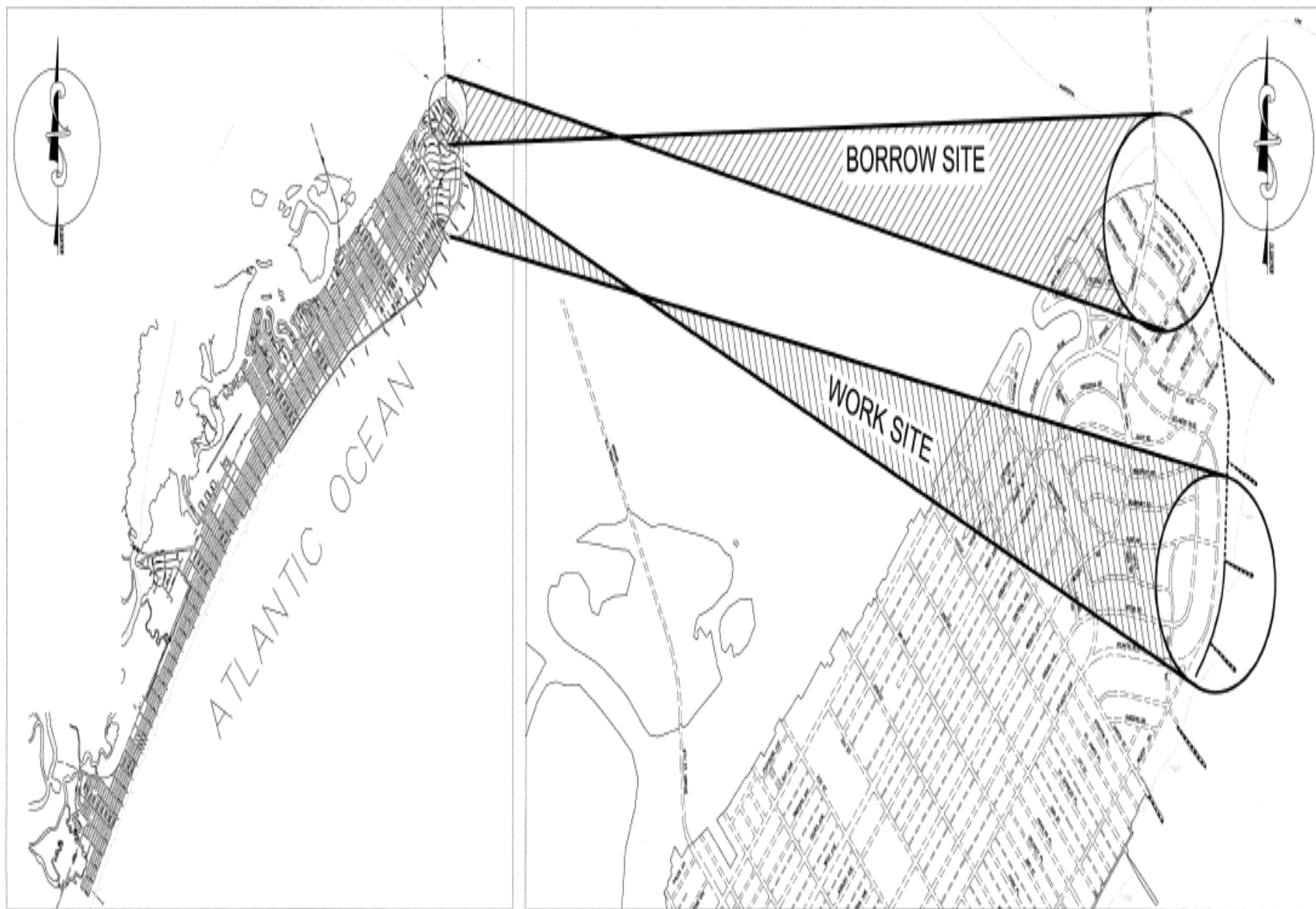
SITE PLAN & TIDE BOARD

DATE: JAN 2010	DRAWN BY: J.L.W.	CHECKED BY: A.J.C.	SCALE: 1" = 100'
REV DATE:	REVISIONS:		

DEPARTMENT OF PLANNING & ENGINEERING
OFFICE OF ENGINEERING & CONSTRUCTION
CITY OF OCEAN CITY, CAPE MAY COUNTY, NEW JERSEY
ARTHUR J. CHEW III, PROFESSIONAL ENGINEER

NJ LICENSE NO. 24GE04700100

2

















E Atlantic Blvd









Utility Pole



Utility Pole

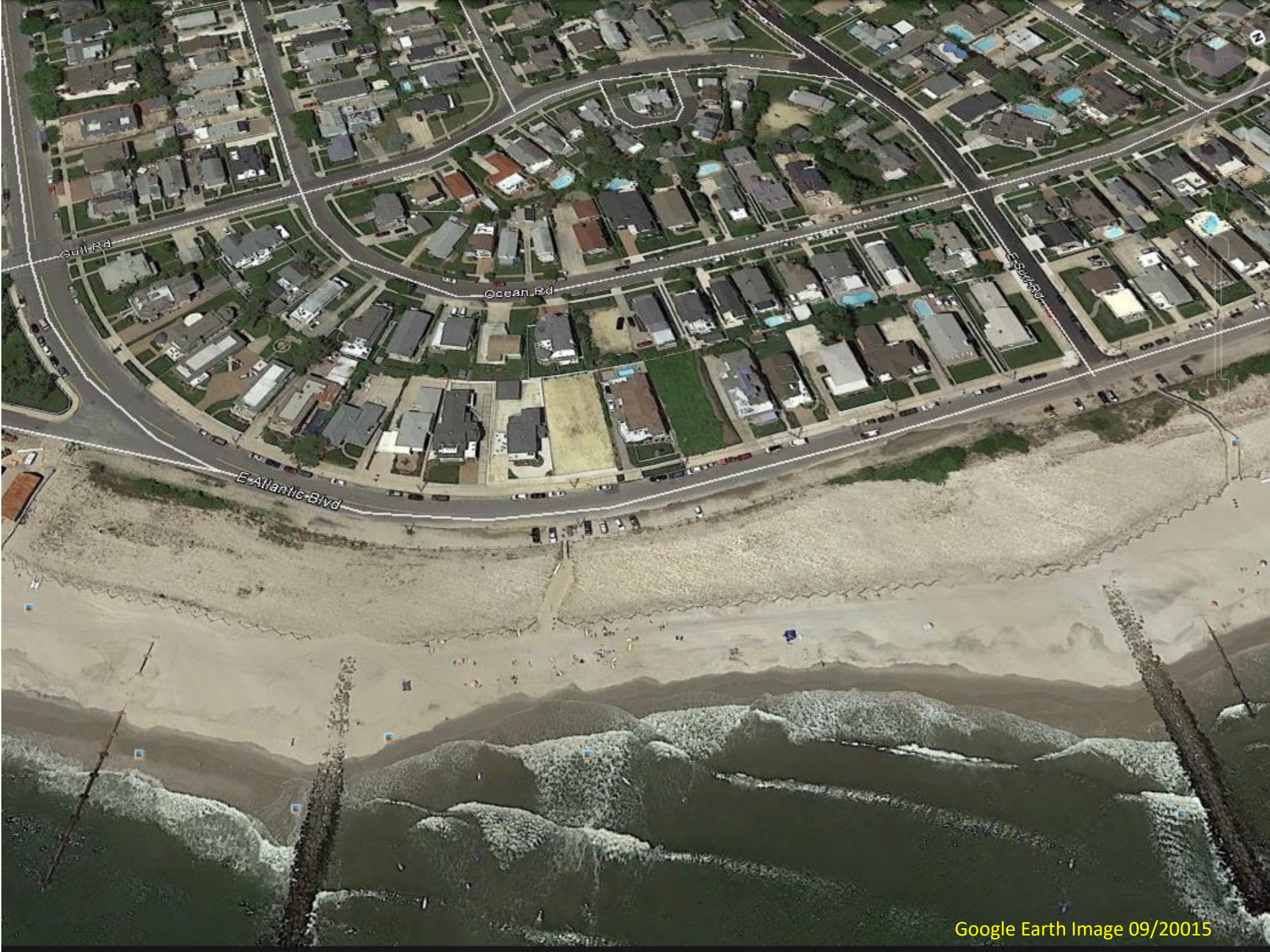


11/15/2009





Video courtesy of Park Ridge Patch





Summary

- Properly designed dune structure using 1,767 LF of tubes installed Dec 2010 – Jan 2011.
- Previous design failed during 10-year storm event.
- Super Storm Sandy hit NJ shore October 2012 and tubes performed well during 100-year storm event.



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Questions Are Welcome.

Thank you for your interest.

Special THANKS to Ocean City, NJ Public Works Dept

Presented by:

Chris Timpson

Technical Services Mgr

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706-693-1833



materials that make a difference