LIVING BREAKWATERS & TOTTENVILLE SHORELINE PROTECTION PROJECT

CAC MEETING #8

PS6 Corporal Allan F. Kivlehan School

3/6/2018

NYC Parks

Governor's Office of Storm Recovery

SCAPE TEAM

SCAPE / LANDSCAPE ARCHITECTURE
OCEAN AND COASTAL CONSULTANTS
PARSONS BRINCKERHOFF
ARCADIS
SEARC ECOLOGICAL MARINE CONSULTING
NEW YORK HARBOR FOUNDATION
LOT-EK ARCHITECTURE
MFS CONSULTING ENGINEERS
PRUDENT ENGINEERING

Stantec

RACE

NEW YORK STATE OF OPPORTUNITY. DASNY

WELCOME!

Governor's Office of
Storm Recovery

COMMUNITY ADVISORY COMMITTEE

- Victoria Cerullo (Co-Chair)
- James Pistilli (Co-Chair)
- Debra Amoroso
- Phyllis Broughton
- Lauren Cosgrove
- Catherine Cramer
- Ayman Farid
- Kerry Halvorsen
- Farid Kader
- Albert Klingele
- Michael Kress
- Hui Ling Lim
- John Malizia
- Diane Mattioli
- Michele Moore
- Nicole Nigro
- Veronica Petersen
- Pamela Pettyjohn
- Anthony Reinhart
- Frank Santarpia
- Bill Shadel
- Diane Silverman

WELCOME TO NEW CAC MEMBERS

Hui Ling Lim

Farid Kader

PROJECT TEAMS

Government Partners

Governor's Office of Storm Recovery

NEW YORK STATE OF OPPORTUNITY. DASNY

NYC Parks

Environmental Review

AKRF

Hill International

Living Breakwaters (Breakwaters + Water Hub) Design Team

SCAPE / LANDSCAPE ARCHITECTURE DPC

COWI

ARCADIS

SeArc

MES

WSP PARSONS BRINCKERHOFF

PRUDENT ENGINEERING

LOT-EK

Silman

NY/NJ BAYKEEPER Protect Preserve Restore

Peer Review

TETRA TECH

Oyster Restoration

BILLION OYSTER PROJECT

Tottenville Shoreline Protection Project Design Team

Stantec

RACE

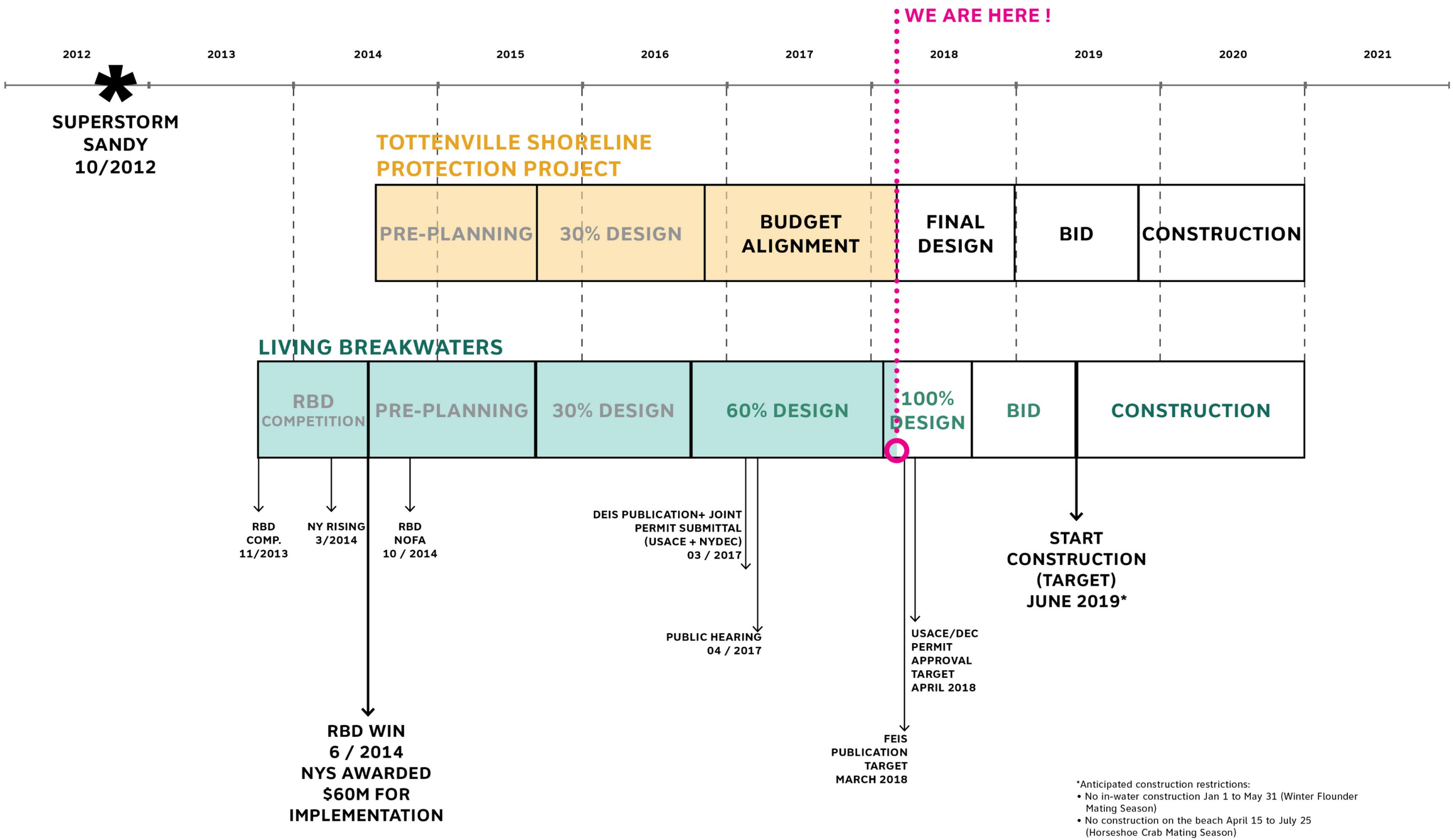
Naik GROUP

SITEWORKS

AMY S. GREENE ENVIRONMENTAL CONSULTANTS

Engineering and Land Surveying, P.C.

WHERE WE ARE IN THE PROCESS



*Anticipated construction restrictions:
- No in-water construction Jan 1 to May 31 (Winter Flounder Mating Season)
- No construction on the beach April 15 to July 25 (Horseshoe Crab Mating Season)

AGENDA

1. INTRODUCTION & MEETING OVERVIEW
2. TOTTENVILLE SHORELINE PROTECTION PROJECT UPDATE
3. LIVING BREAKWATERS PROJECT UPDATE
    - A. Living Breakwaters
    - B. Water Hub
4. EIS & PERMITTING UPDATE
5. DEP PRESENTATION

Q&A

6. CLOSING COMMENTS

#2. TOTTENVILLE SHORELINE PROTECTION PROJECT DESIGN UPDATE

Governor's Office of Storm Recovery

SINCE WE LAST MET…

- **Budget Alignment exercise completed!**
- Team has begun seepage/drainage analysis which will continue through 60% design

#3. LIVING BREAKWATERS PROJECT UPDATE

A. Breakwaters Design Update

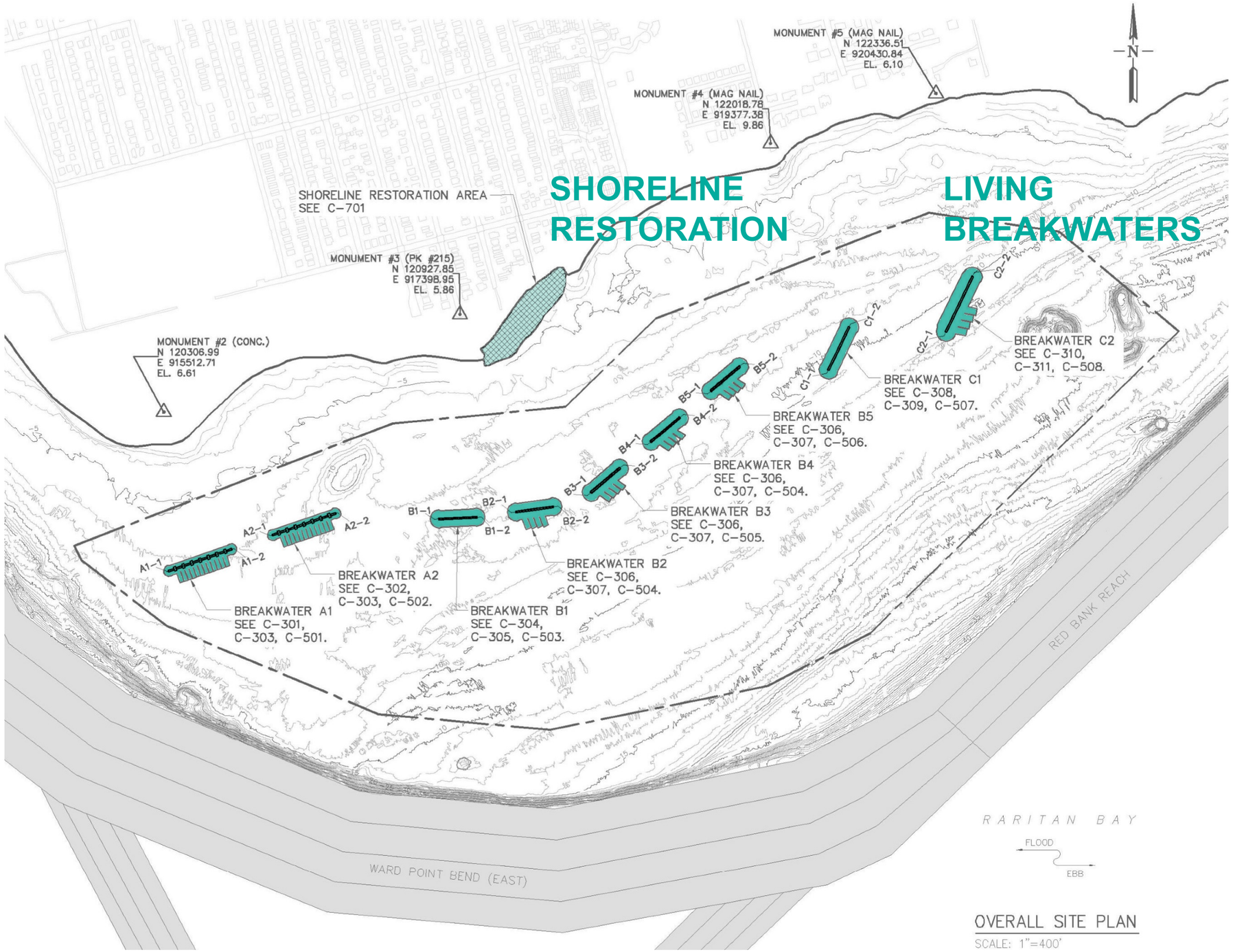
SINCE WE LAST MET…

- **60% Design completed!**
- Advanced technical documentation of the Living Breakwaters
- Evaluated breakwater performance through numerical (computer) modeling and physical modeling
- Advanced habitat design of the Living Breakwaters

LIVING BREAKWATERS DESIGN
CURRENT DESIGN

Governor's Office of Storm Recovery

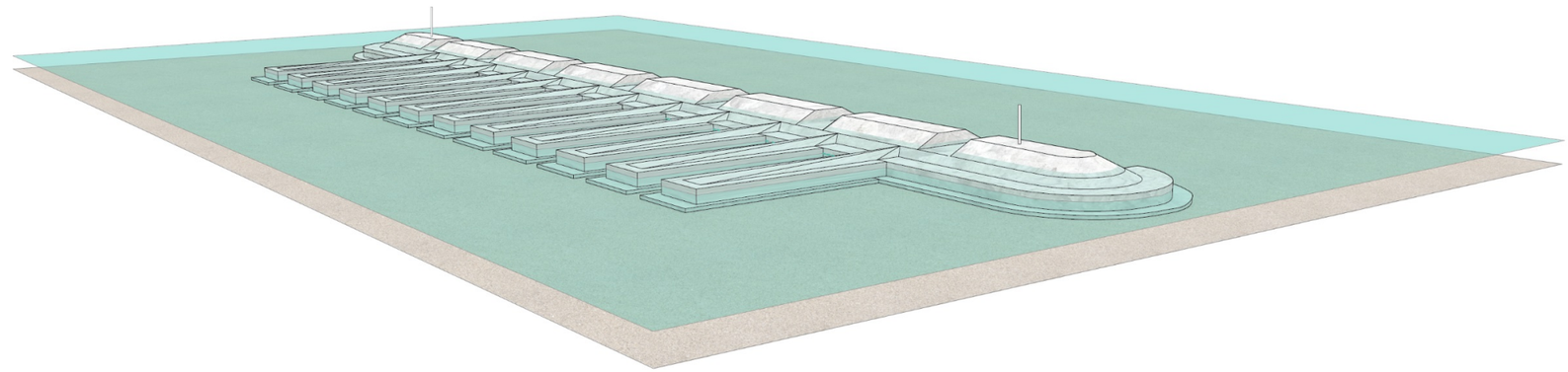
LIVING BREAKWATERS DESIGN
BREAKWATERS AT 60% DESIGN

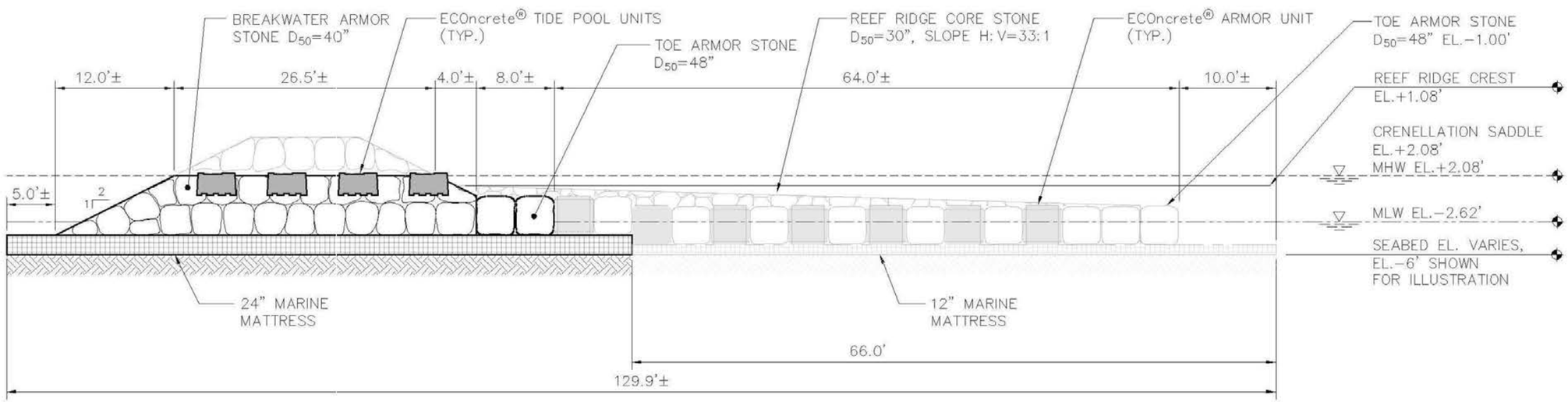


OVERALL SITE PLAN
SCALE: 1"=400'

Governor's Office of Storm Recovery

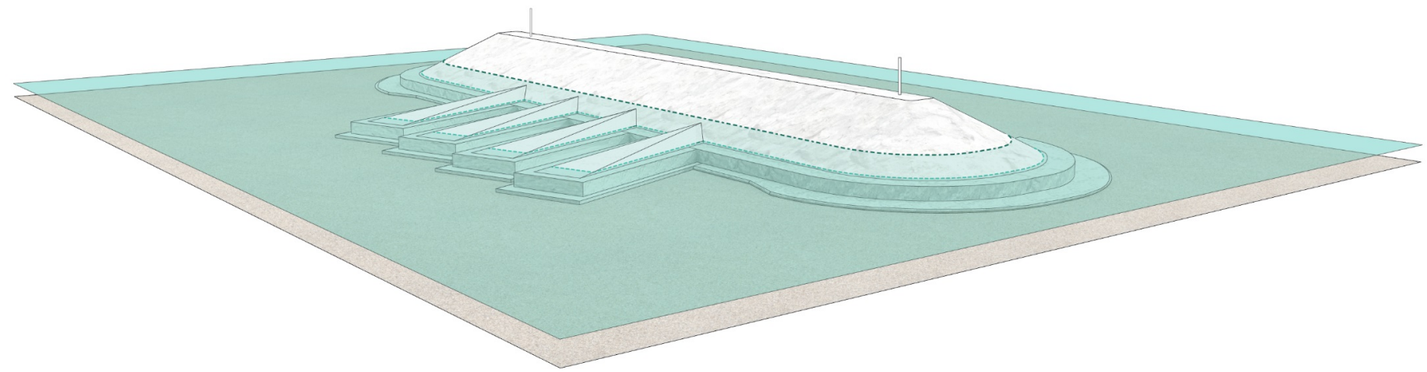
LIVING BREAKWATERS DESIGN
TYPE A BREAKWATERS

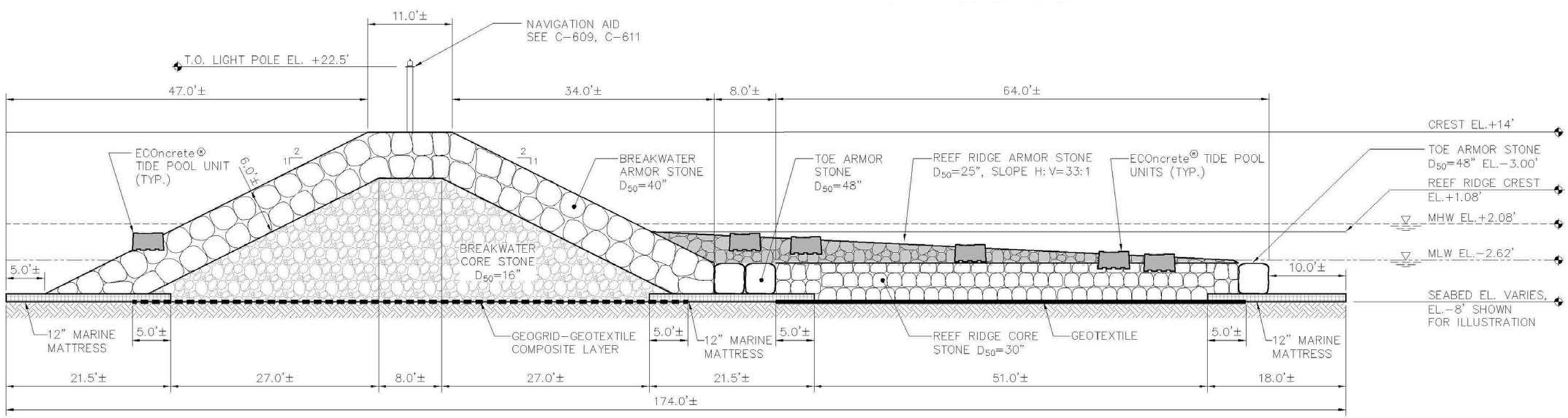




B
C-501
BREAKWATER A1 – SECTION B
SCALE: 1"=8'

LIVING BREAKWATERS DESIGN
TYPE B BREAKWATERS



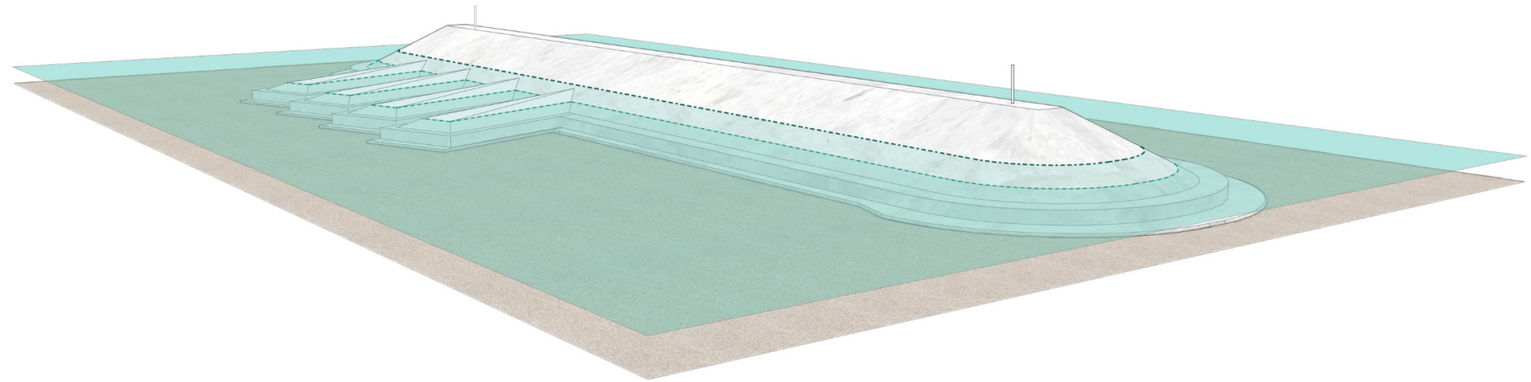


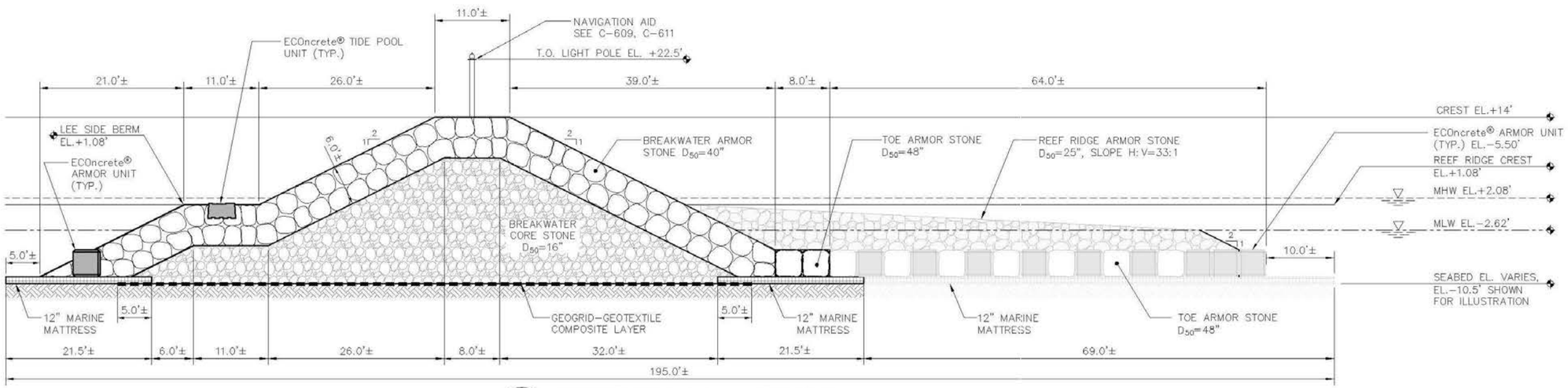
A
C-504

BREAKWATER B2, B4 – SECTION A

SCALE: 1"=8'

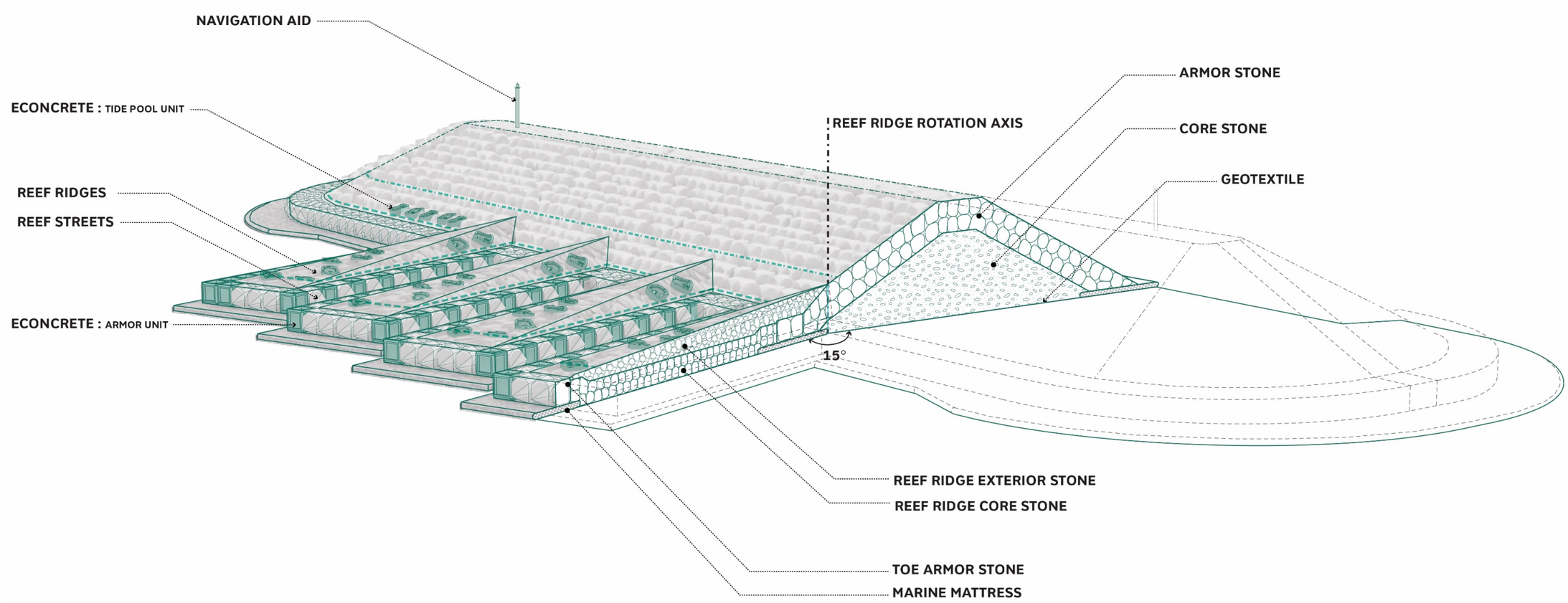
LIVING BREAKWATERS DESIGN
TYPE C BREAKWATERS

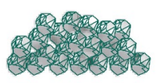




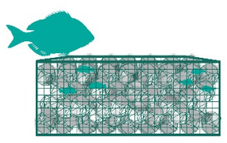
B
C-508
BREAKWATER C2 – SECTION B
SCALE: 1"=10'

LIVING BREAKWATERS DESIGN MATERIALS

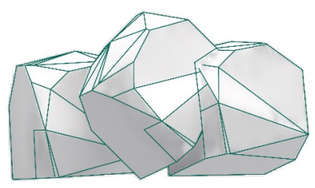




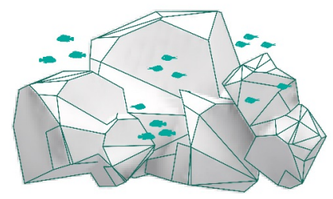
INTERNAL CORE STONE
D_{50}= 16″



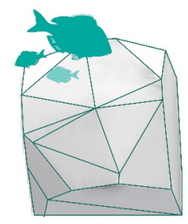
MARINE MATTRESS
HT= 12″



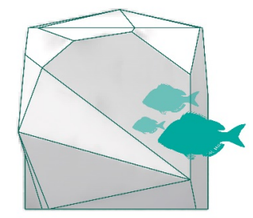
REEF RIDGE CORE STONE
Dmin= 24″ D_{50}= 30″
Dmax=36″



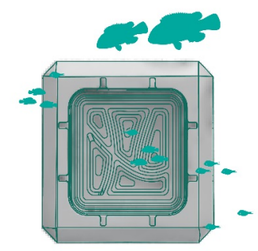
REEF RIDGE EXTERIOR STONE
D_{15}= 15″ D_{50}= 24″
D_{100}=36″



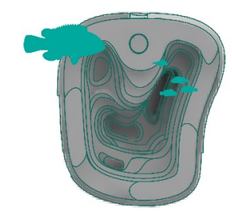
STONE ARMOR UNIT
D_{50}= 40″



STONE TOE ARMOR UNIT
D_{50}: 48″



ECOncrete® TOE ARMOR UNIT
Dimension: 48″x 48″x 48″

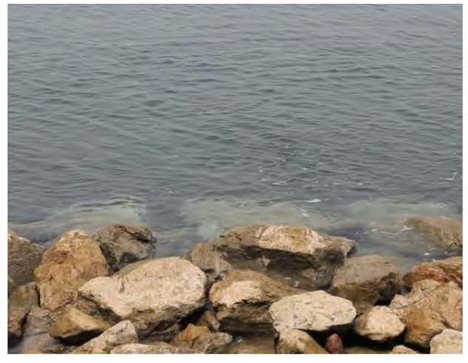


ECOncrete® TIDE POOLS
Dimension: 44″X 48″X27

LIVING BREAKWATERS DESIGN
LIVING BREAKWATER MATERIALS

ARMOR STONE

ρ ≈ 165 lb/ft3, narrow gradation: Wmin = 1.6 ton, W50 = 2.0 ton, Wmax = 2.4 ton . Armor stone is specified in weight to ensure stability. Equivalent diameters would be Dmin = 37 in, D50 = 40 in, Dmax = 43 in

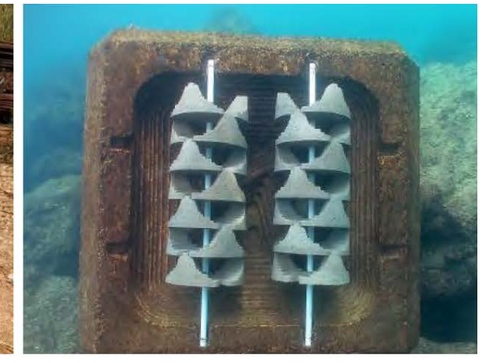


TOE ARMOR STONE

ρ ≈ 165 lb/ft3, narrow gradation: Dmin = 41 in, D50 = 48 in, Dmax = 55 in. Quarried stones alternate with ECOncrete units.

ECONCRETE TIDE POOLS

ECONCRETE ARMOR UNITS



ECONCRETE ARMOR UNIT TREATMENTS

REEF RIDGE ARMOR

REEF RIDGE CORE STONE

ρ≈ 165 lb/ft3, narrow gradation: Dmin = 24 in, D50 = 30 in, Dmax = 36 in.

CORE STONE

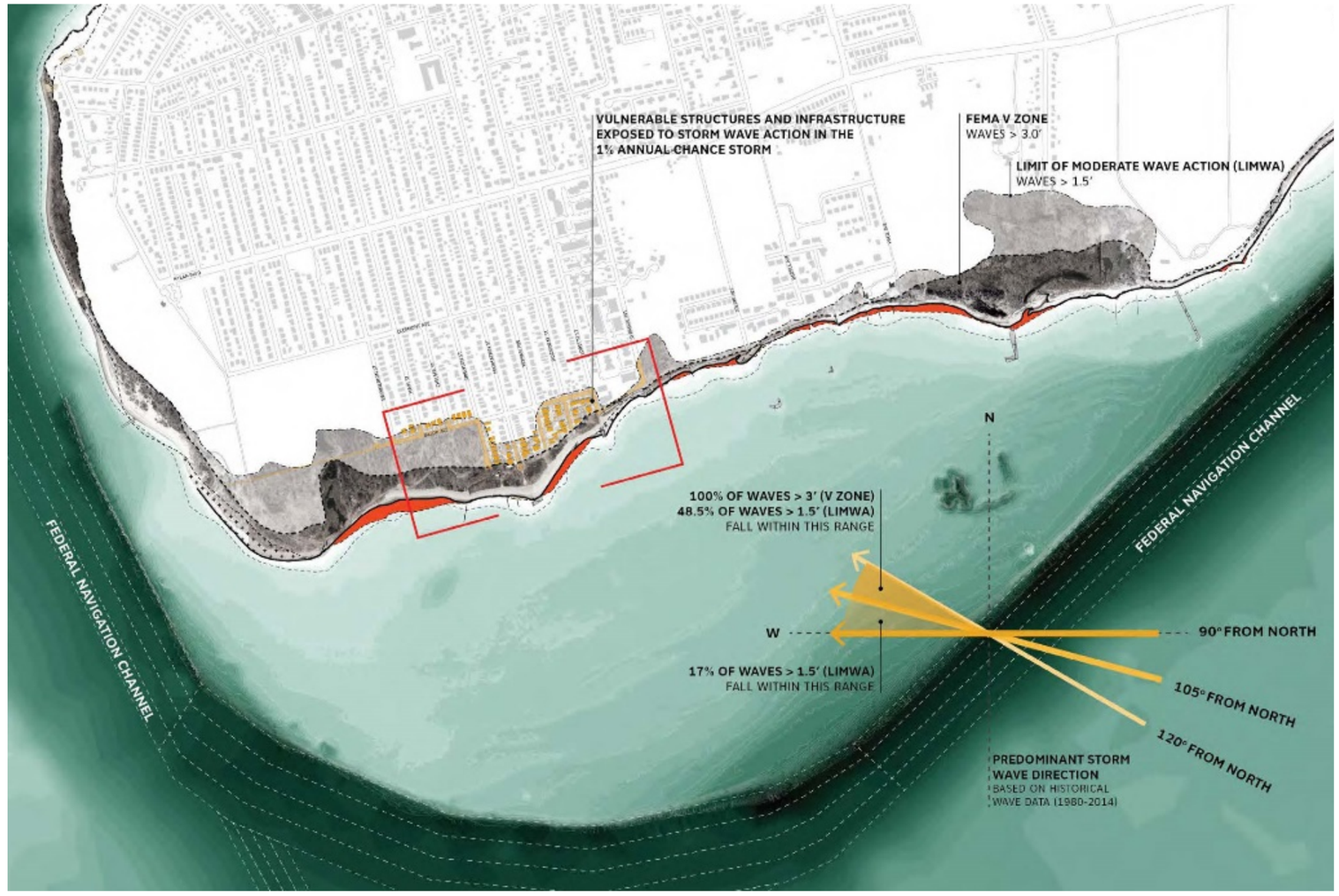
ρ ≈ 165 lb/ft3, narrow gradation: Dmin = 24 in, D50 = 30 in, Dmax = 36 in.

MARINE MATTRESS

GEOTEXTILE

LIVING BREAKWATERS DESIGN RISK REDUCTION

- **Reduce height of waves reaching the shore during storm events**
  - Large waves reach the shore during infrequent storm events
  - Largest waves come from the east and southeast
- **Reduce or reverse historic erosion trends**
  - Shoreline has experienced net erosion over the past 30 years
  - Erosion will continue of not addressed
  - Smaller, everyday waves drive erosion



LIVING BREAKWATERS DESIGN
WAVE MODELING

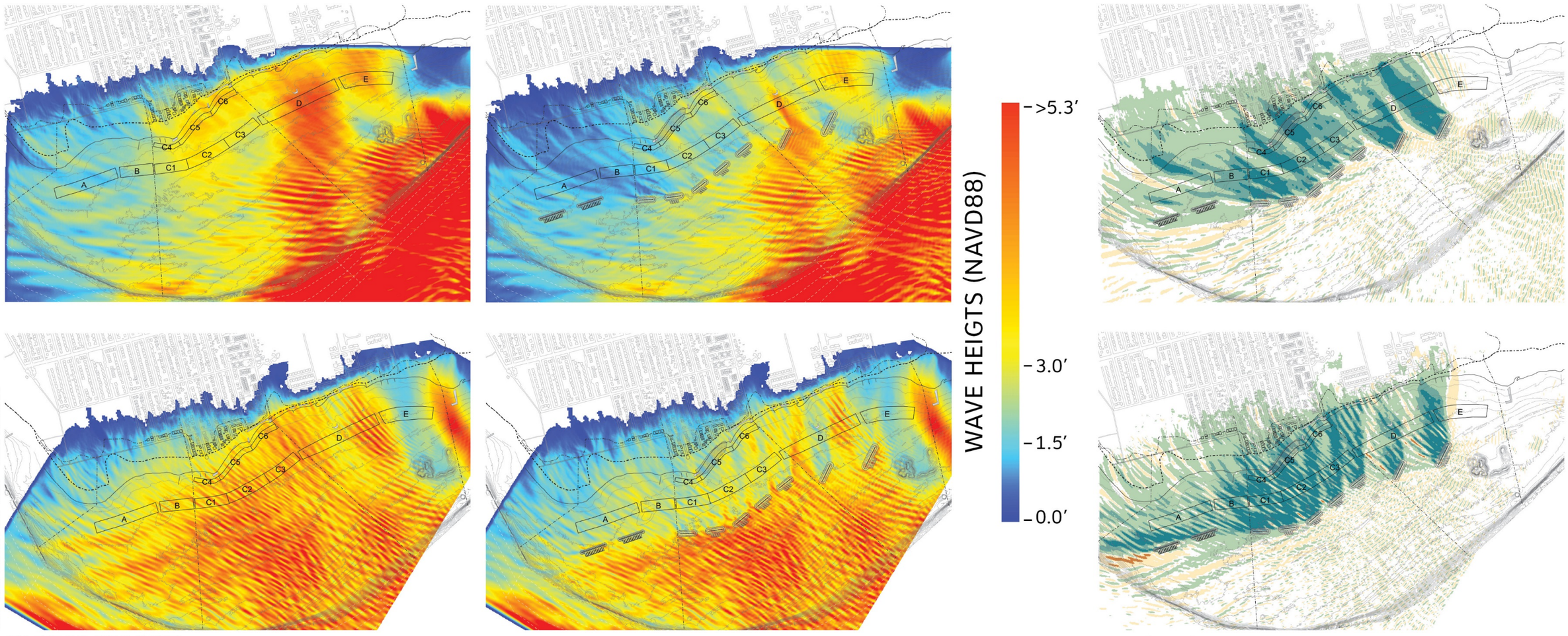
NO ACTION

WITH BREAKWATERS AT 60% DESIGN

CHANGE FROM NO ACTION SCENARIO

WAVES FROM EAST
100 Year Storm+ 30" SLR = 15.4 NAVD88

WAVES FROM EAST-SOUTHEAST
100 Year Storm+ 30" SLR = 15.4 NAVD88



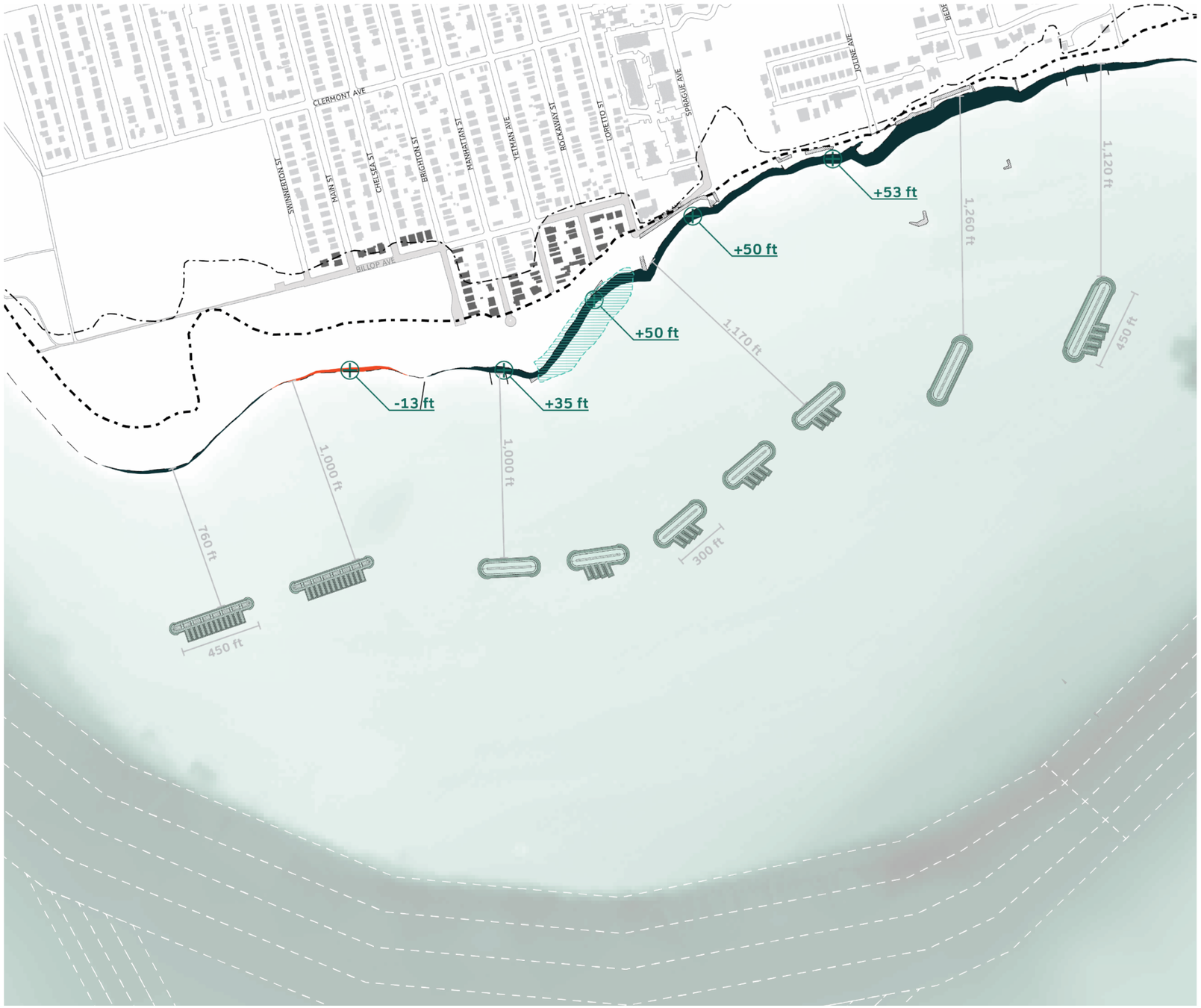
PROJECT AND SITE ELEMENTS

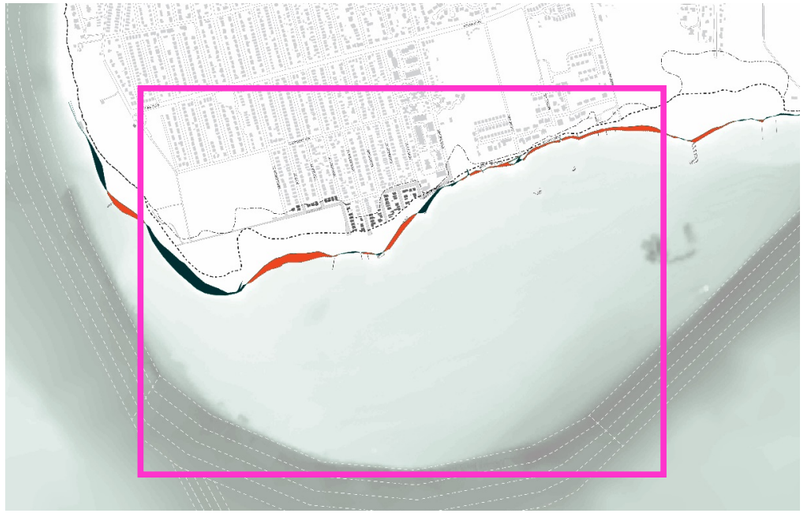
- A — Comparison Box Averages
- Shoreline Restoration
- Spring 2015 MHW (2.08 NAVD88)
- Shoreline Structures

WAVE CHANGE

- -3.8' to -1.09'
- -1.09' to -0.71'
- -0.71' to -0.08'
- -0.08' to 0.08'
- 0.08' to 0.5'
- 0.5' to 1.04'

LIVING BREAKWATERS DESIGN
SHORELINE CHANGE AND SEDIMENT TRANSPORT MODELING



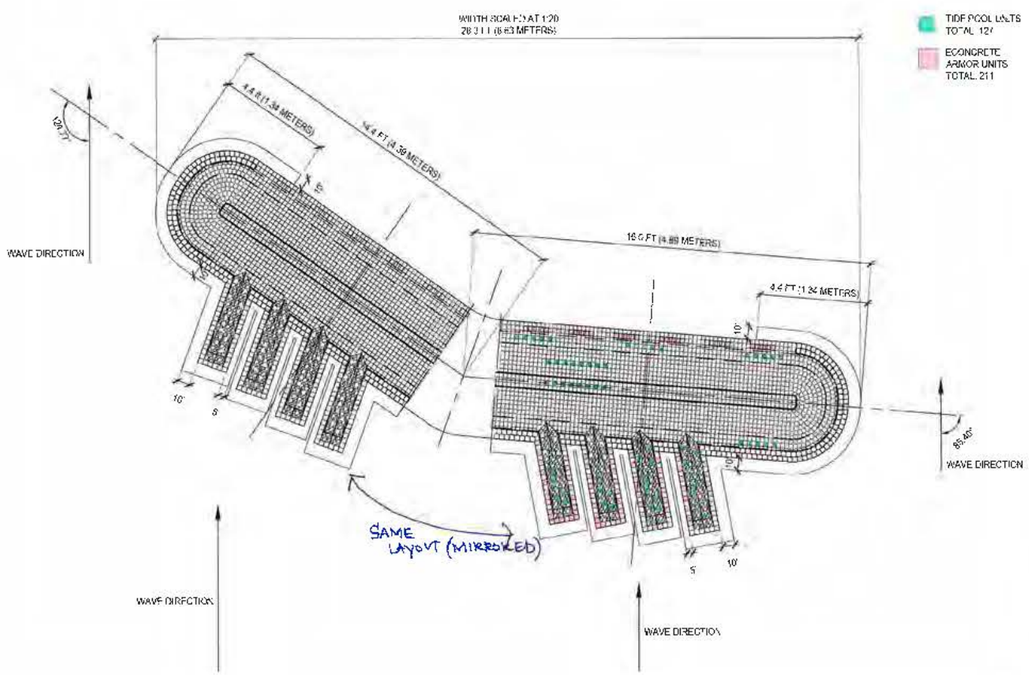


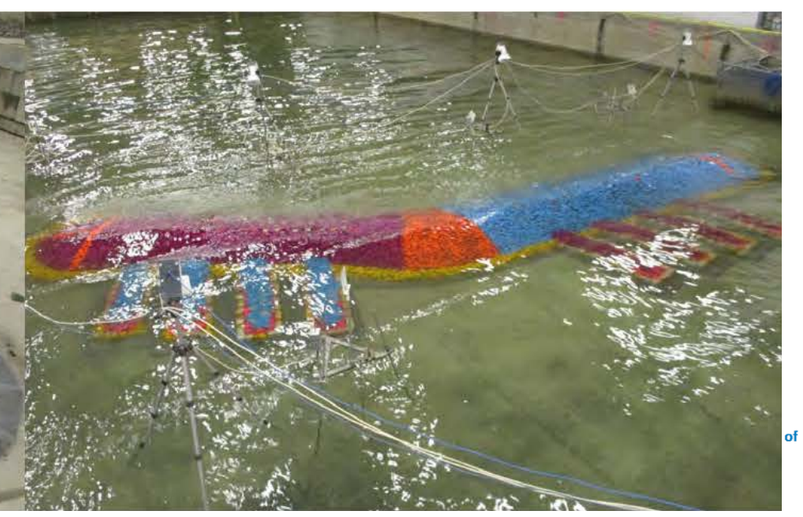
HISTORIC EROSION PATTERNS

- FEMA LIMWA
- FEMA V-ZONE
- MODELED 2035 SHORELINE
- MHW SPRING 2015
- OBSERVED BEACH GROWTH
- OBSERVED EROSION
- SHORELINE STRUCTURES
- BREAKWATER FOOTPRINT
- PROPOSED SHORELINE RESTORATION
- +53 ft ANTICIPATED ACCRETION OR EROSION

Governor's Office of Storm Recovery

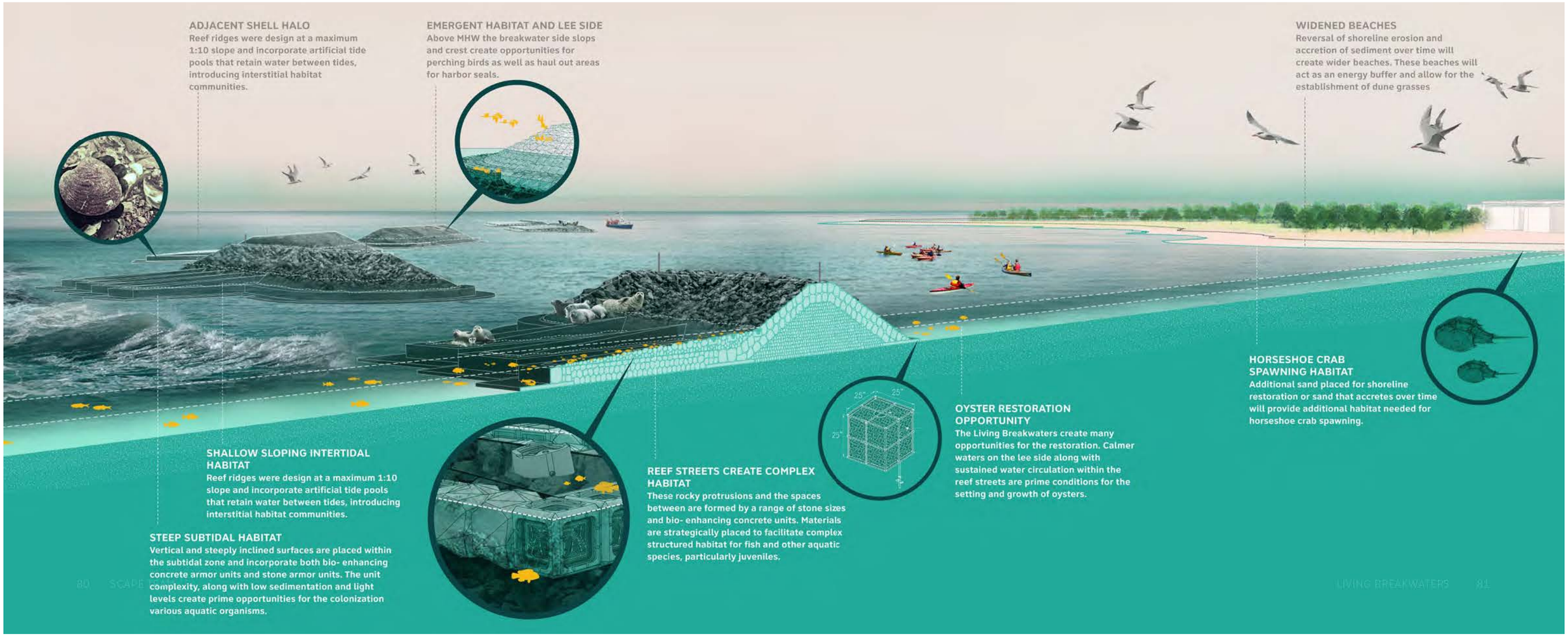
LIVING BREAKWATERS DESIGN
PHYSICAL MODELING FOR STRUCTURAL STABILITY



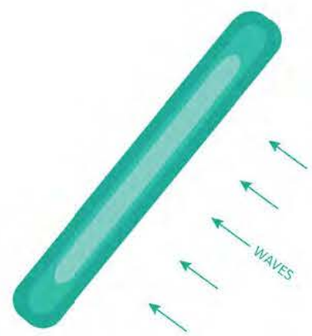


LIVING BREAKWATERS DESIGN
PHYSICAL MODELING FOR STRUCTURAL STABILITY

LIVING BREAKWATERS DESIGN
HABITAT DESIGN

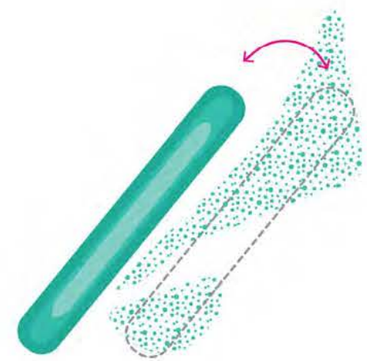


LIVING BREAKWATERS DESIGN
HABITAT DESIGN

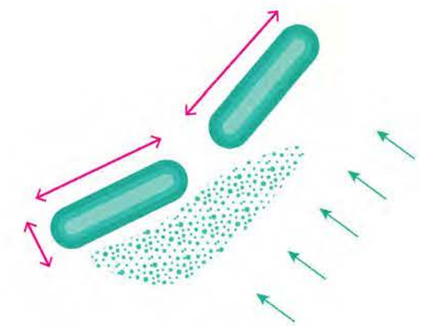


TRADITIONAL BREAKWATER DESIGN

Wave Attenuation
Erosion Control
Creation of Posous Rocky Habitat



AVOID CRITICAL HABITAT

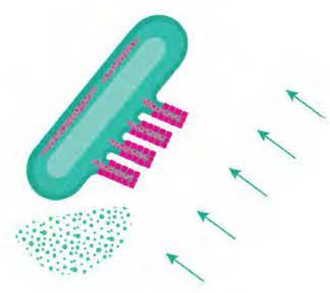


MINIMIZE FOOTPRINT

Narrower Breakwater Cross Section
Reduce Crest Elevation
Multiple Shorter Breakwaters With Gaps

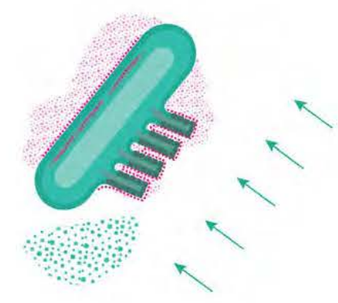
ADD REEF STREETS

Increase Macro Complexity
Increase Intertidal Habitat
Mimic Forms Found in Nature



ADD MICRO-COMPLEXITY

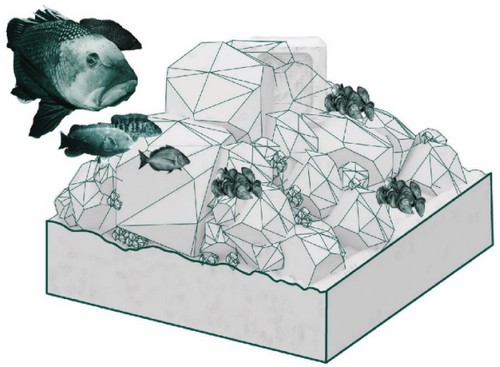
Use Bio-Enhanced Concrete Units
Increase Size Diversity of Crevices
Increase Surface Rugosity
Increase Micro Complexity



INSTALL OYSTERS

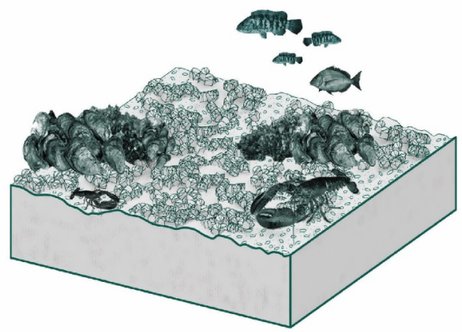
Incorporate Active Restoration Efforts to Further Enhance Habitat and Help Achieve Regional Restoration Goals

LIVING BREAKWATERS DESIGN
HABITAT DESIGN



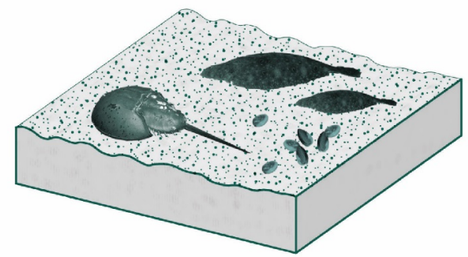
HARD BOTTOM OR HARD/ROCKY

Ranging from small cobbles to boulders that include the breakwater structures and existing rock piles. Habitats occur in emergent, intertidal, and subtidal conditions.



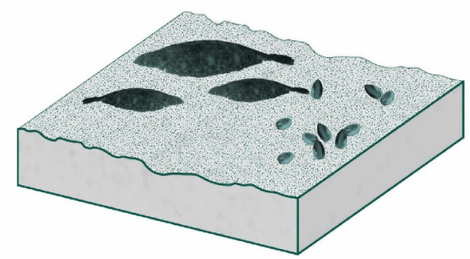
LARGE GRAIN

Substrate includes gravel, pebbles, and shells. Existing gravel and cobble conditions on site as well as shell halo generated by the breakwater over time are aligned with this habitat type. Habitats occur in intertidal and subtidal locations.



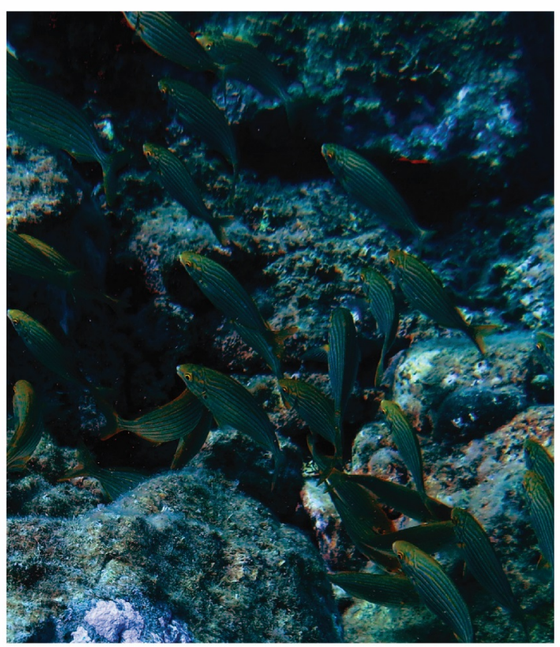
SMALL GRAIN

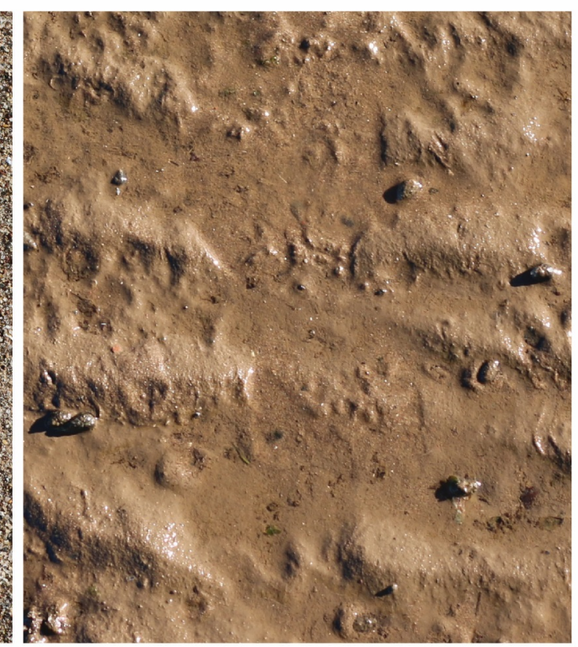
Substrate includes fine to coarse grain sand. Breakwaters will promote the accumulation of sediment along the shoreline, reducing erosion, and yielding wider beaches. Beach fill will also enhance on-shore small grain habitats.



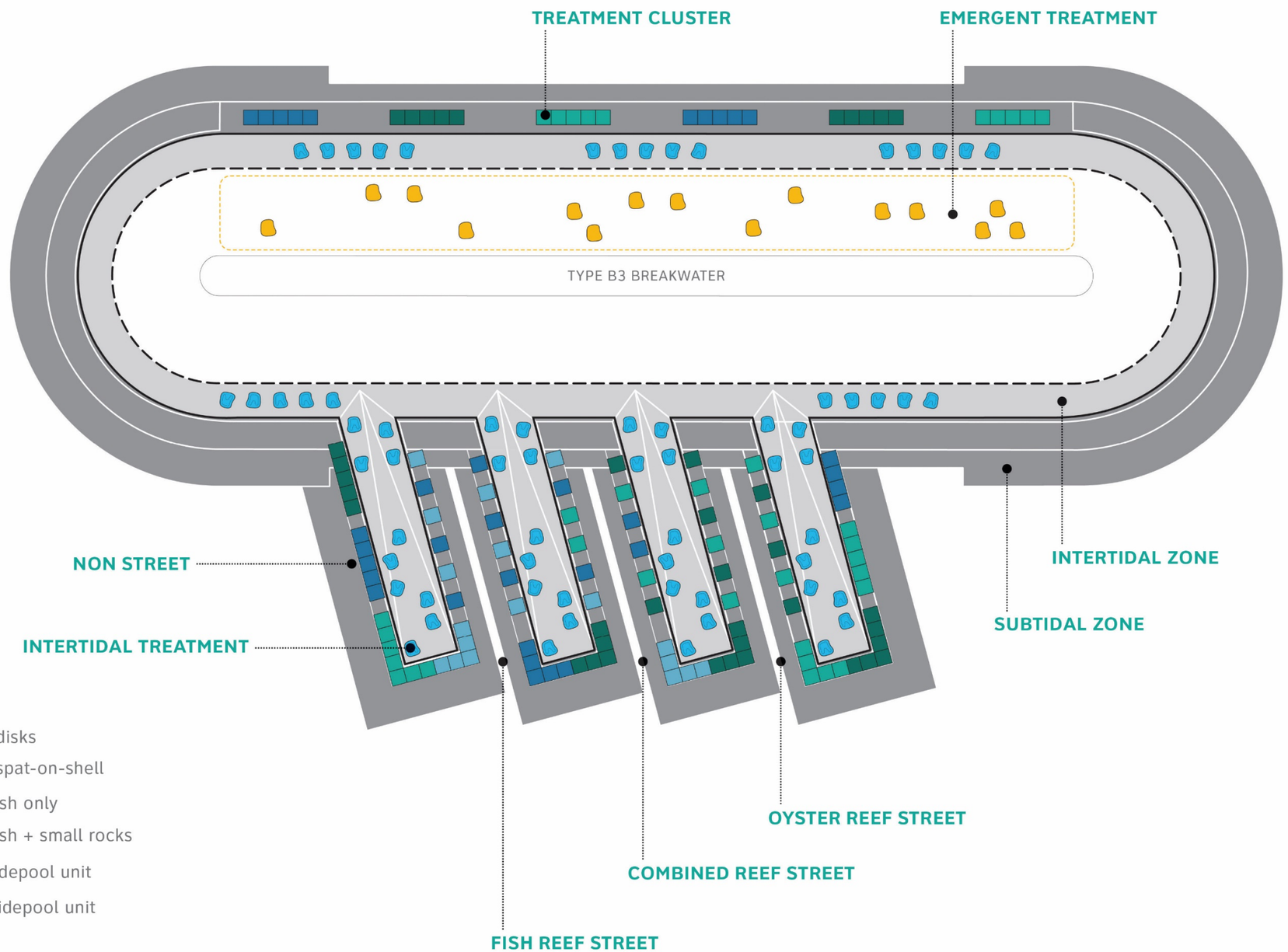
FINE GRAIN

Substrate includes silt and clay cohesive material. This habitat type is observed near the project area, but not observed in the area of breakwater construction. Fine grain habitats are not anticipated to be generated by breakwater interactions with their surroundings.





LIVING BREAKWATERS DESIGN
HABITAT DESIGN



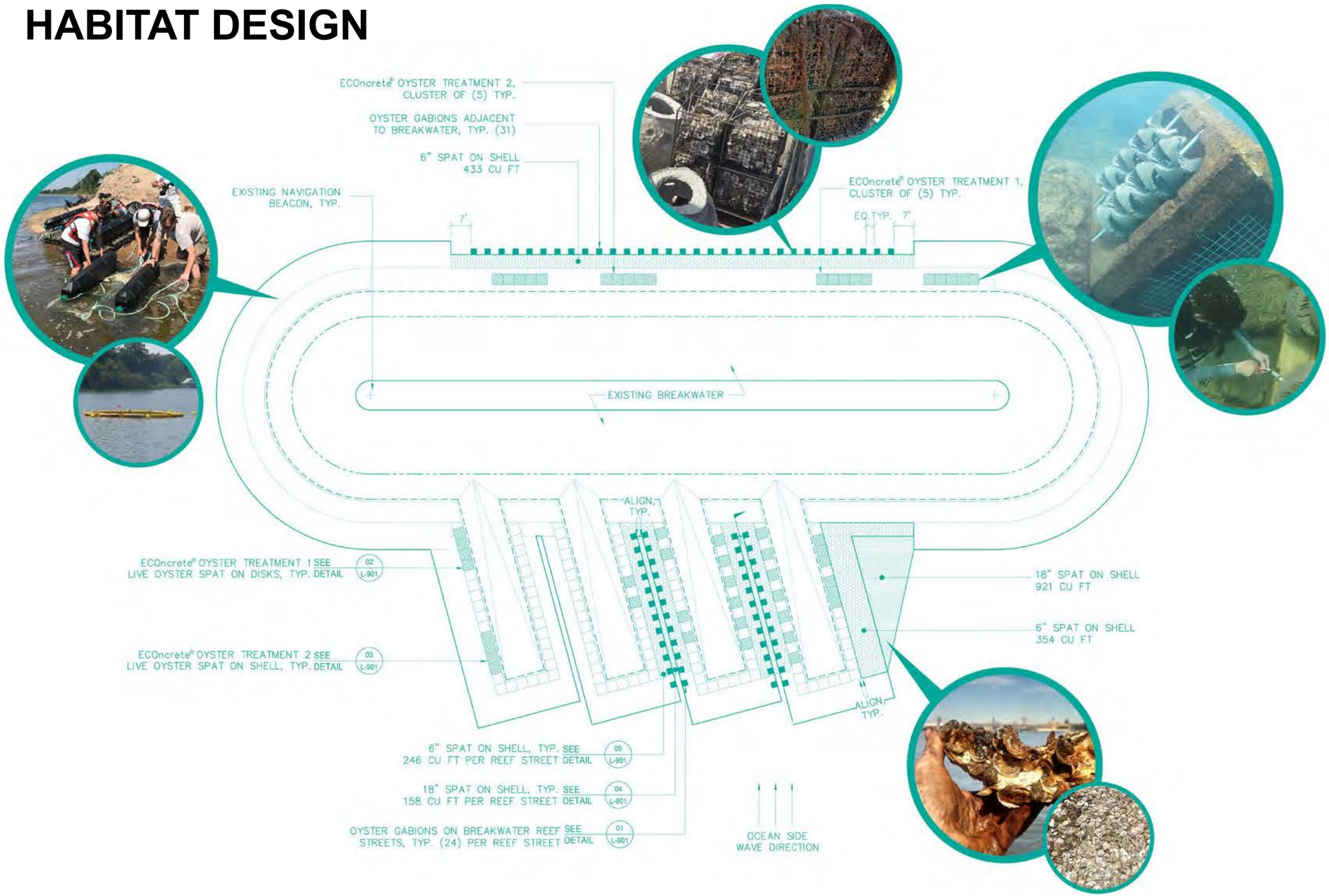
LEGEND

- Oyster treatment 1 - disks
- Oyster treatment 2 - spat-on-shell
- Fish treatment 1 - mesh only
- Fish treatment 2 - mesh + small rocks
- Intertidal treatment tidepool unit
- Emergent treatment tidepool unit

MHW
MLW

Governor's Office of Storm Recovery

LIVING BREAKWATERS DESIGN
HABITAT DESIGN



Governor's Office of Storm Recovery

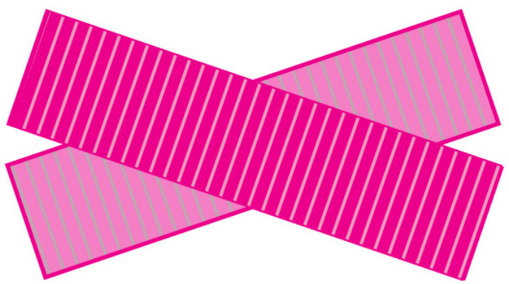
LIVING BREAKWATERS DESIGN NEXT STEPS

- Make minor refinements to breakwater design and alignment based on observations from hydrodynamic and physical modeling
- Updated permit application for the Living Breakwaters (Target Spring 2018)
- Advance breakwater design and documentation to 100% (Target Fall 2018)

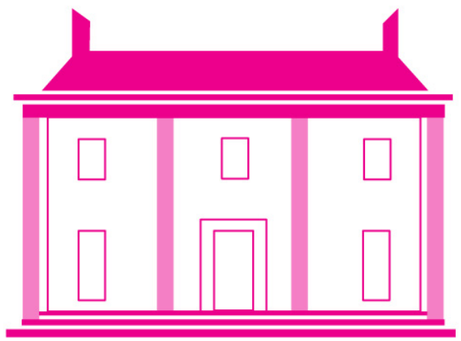
#3. LIVING BREAKWATERS PROJECT UPDATE

B. Water Hub Design Update

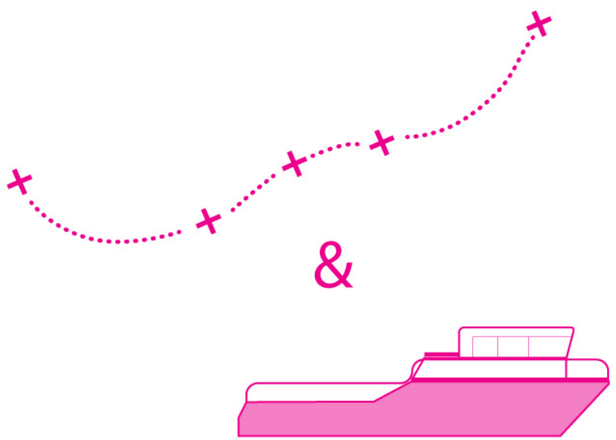
WATER HUB
EVOLUTION OF THE WATER HUB STRATEGY



New community and educational facility located at the end of Page Avenue



Retrofitting an existing historic structure in Conf. House Park for community and educational programs



Combining a floating hub for educational and community programs with interpretive shoreline elements

WATER HUB
FLOATING HUB

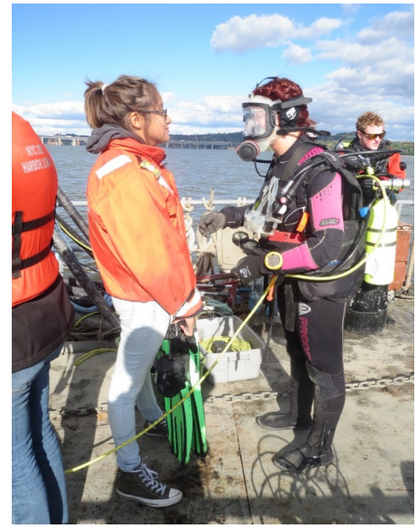
- **Boat and Features**
  - Passenger capacity of 40 or more
  - 4 foot draft
  - Classroom space
  - Exhibit space
  - Hydraulic crane
  - Open deck for oyster monitoring and scuba diving activities
  - Radar and GPS

WATER HUB
FLOATING HUB

- **Existing Activities & Programs**
  - BOP's Oyster Research Station Program
    - Engage teachers and students at the waterfront and in the classroom through oyster monitoring and lesson plans
  - Host and attend community, school, and oyster monitoring events
  - Workforce development including training students over the summer months
  - Scientific oyster projects and monitoring at various locations

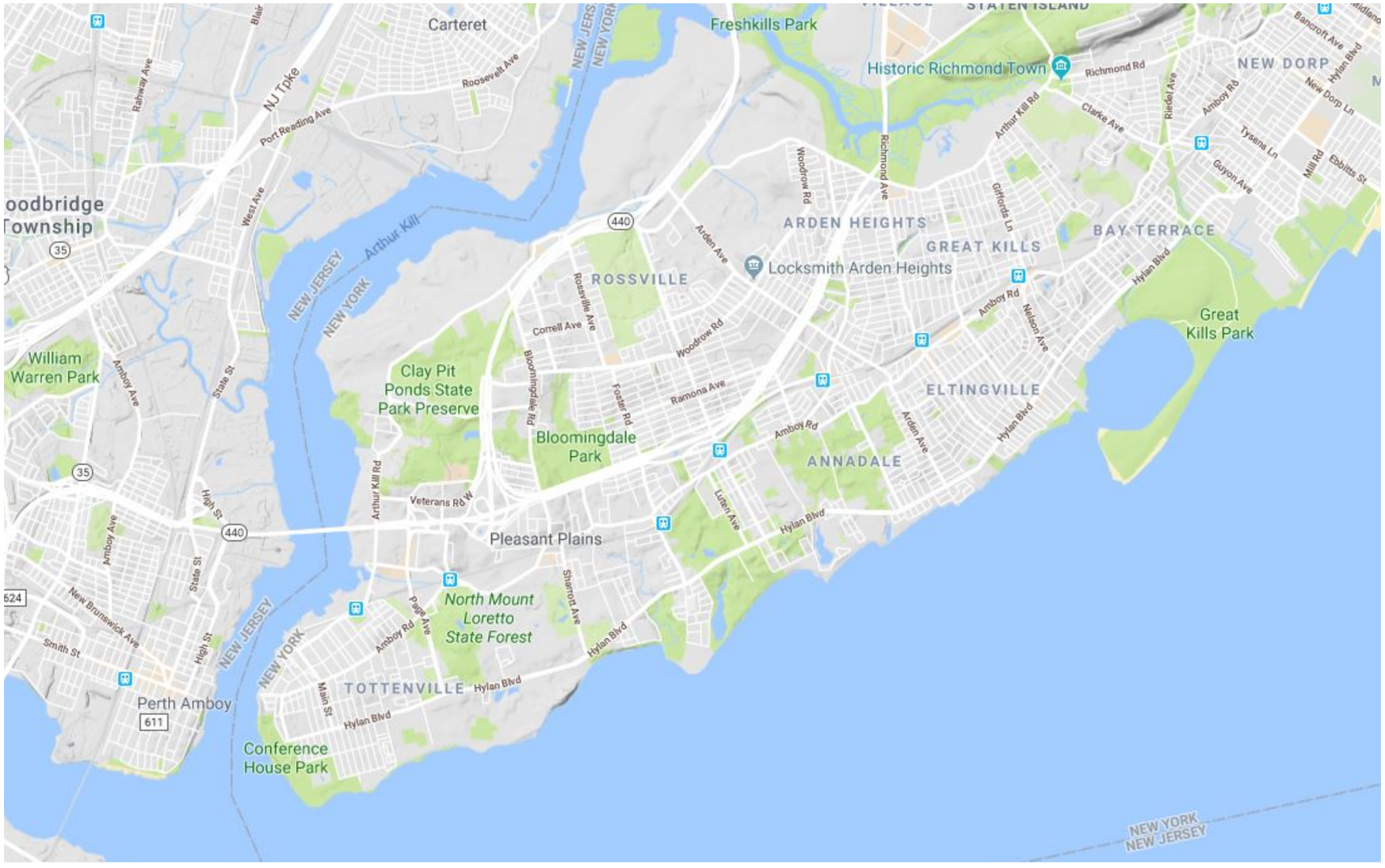
WATER HUB
FLOATING HUB

- **Proposed Activities & Programs**
  - Transport classes and volunteer groups to the breakwaters for educational and environmental monitoring purposes
  - Host community events and exhibitions aboard the vessel
  - Dockside programming that allows guests to walk through the vessel to learn about the breakwaters, climate change, and social resiliency
  - Workforce development including training students over the summer
  - Scientific oyster restoration and monitoring on the Living Breakwaters and nearby locations
    - Diving
    - Lifting heavy reef structures in and out of the water
    - Holding station in shallow water
    - Bottom imaging



WATER HUB
FLOATING HUB

- **Docking and Destinations**
  - BOP is currently researching ideal docking locations near the project location



WATER HUB
ON-SHORE FEATURES

- **Update and upgrade Conference House Park Visitors' Center exhibit to support:**
  - Guided class visits
  - Independent and self-guided learning by park visitors

WATER HUB
ON-SHORE FEATURES

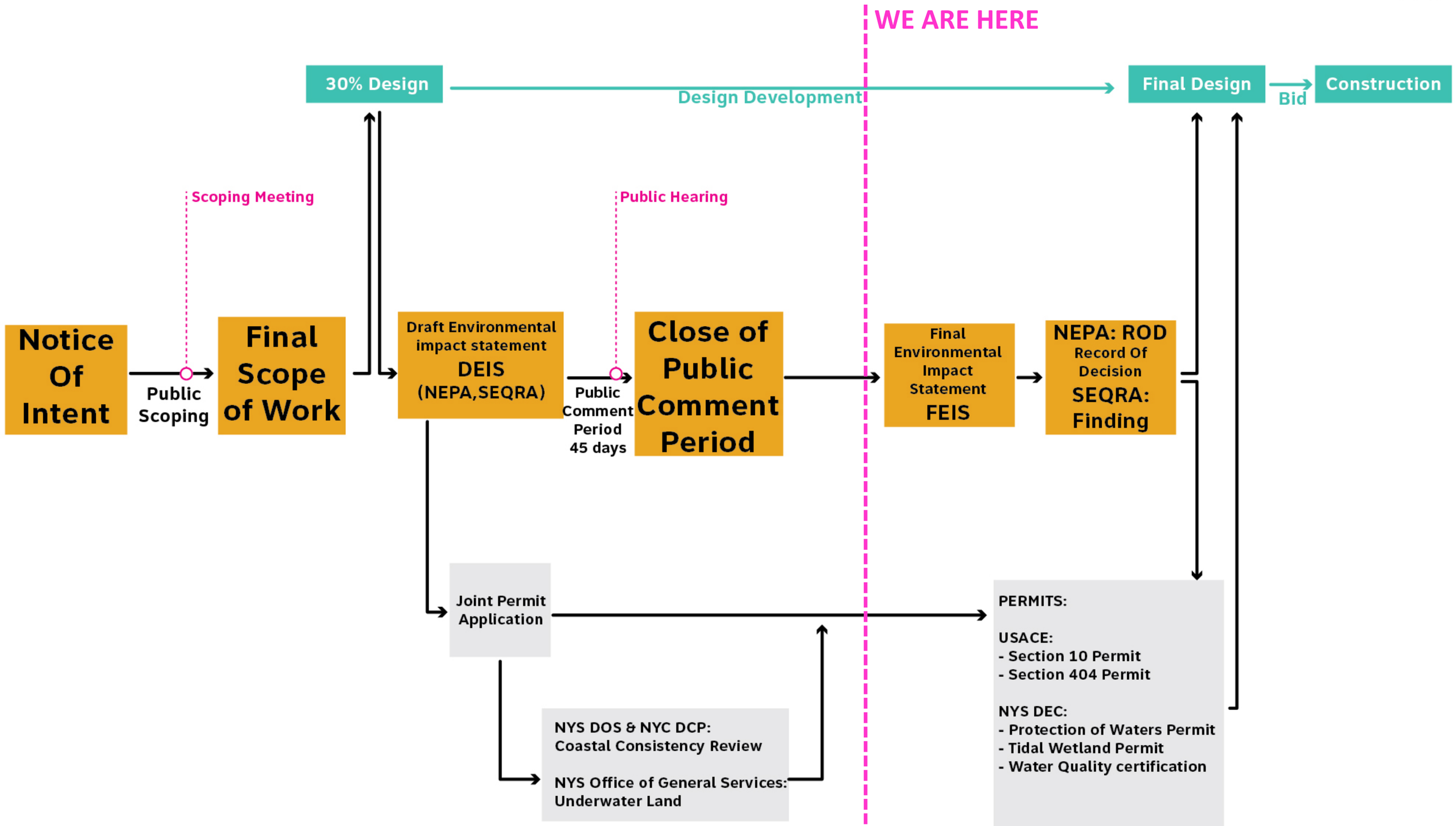
- **Shoreline markers and elements to support:**
  - Observation and self-guided learning
  - Class visits to the park
  - Neighborhood events and activities (e.g. cleanup days)
  - Monitoring of site environmental conditions

EXPANDED WATER HUB

- Science, Technology, Engineering, and Math (STEM) Curriculum Development: Investigation of NYC's Shorelines and Shallows

#4. ENVIRONMENTAL IMPACT STATEMENT AND PERMITTING UPDATE

ENVIRONMENTAL REVIEW PROCESS



ENVIRONMENTAL REVIEW PROCESS

20 FREQUENTLY ASKED QUESTIONS FORM THE COMMENTS RECEIVED ON THE EIS HAVE BEEN POSTED HERE:

https://stormrecovery.ny.gov/sites/default/files/crp/community/documents/FAQ 20 Highlight questions RTC Final.pdf

#5. DEPARTMENT OF ENVIRONMENTAL PROTECTION PRESETATION

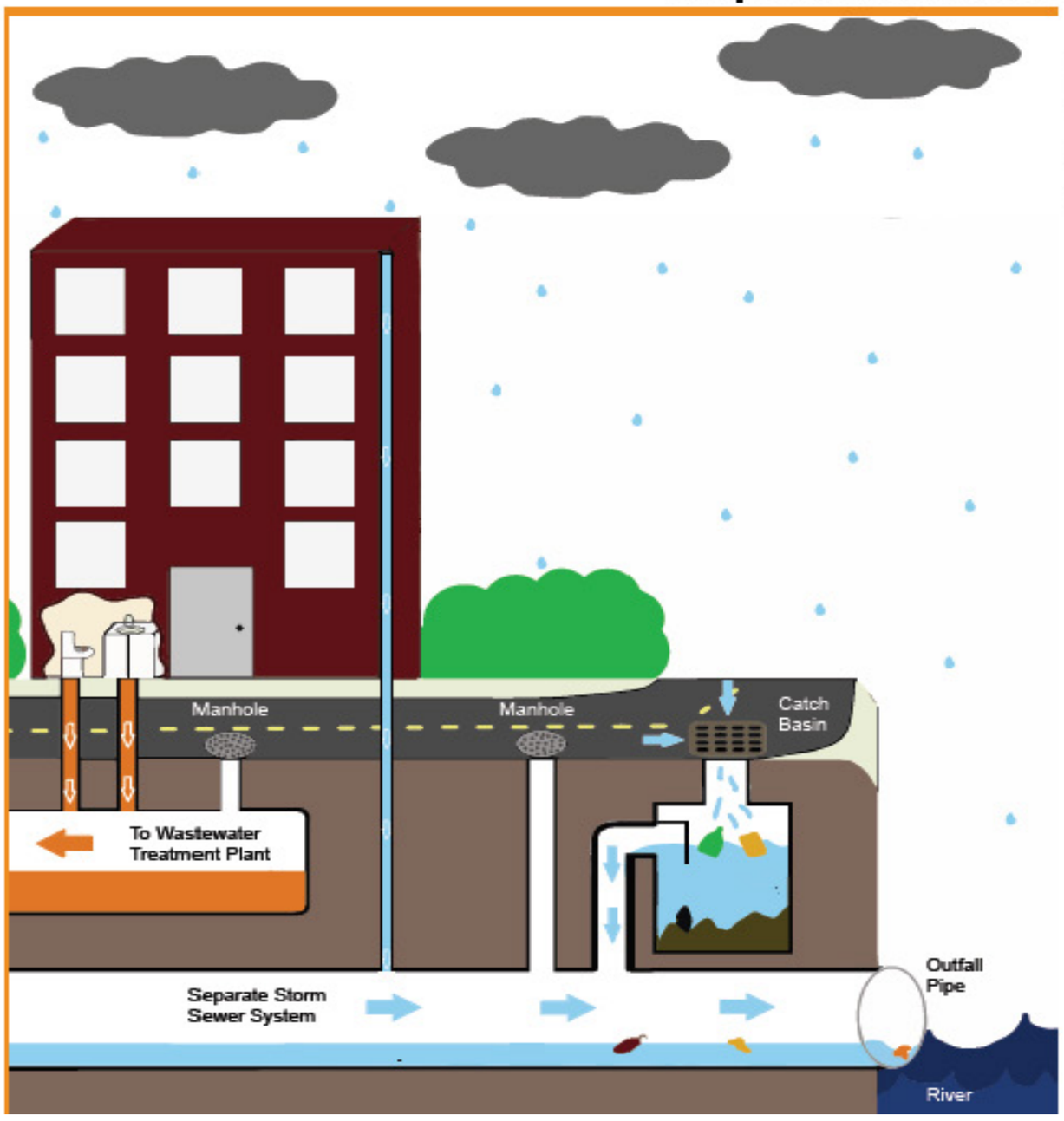
Tottenville Beach Storm Sewer Outfall

March 6th 2018

Bureau of Water and Sewer Operations

Environmental Protection

Separate Storm Sewer System

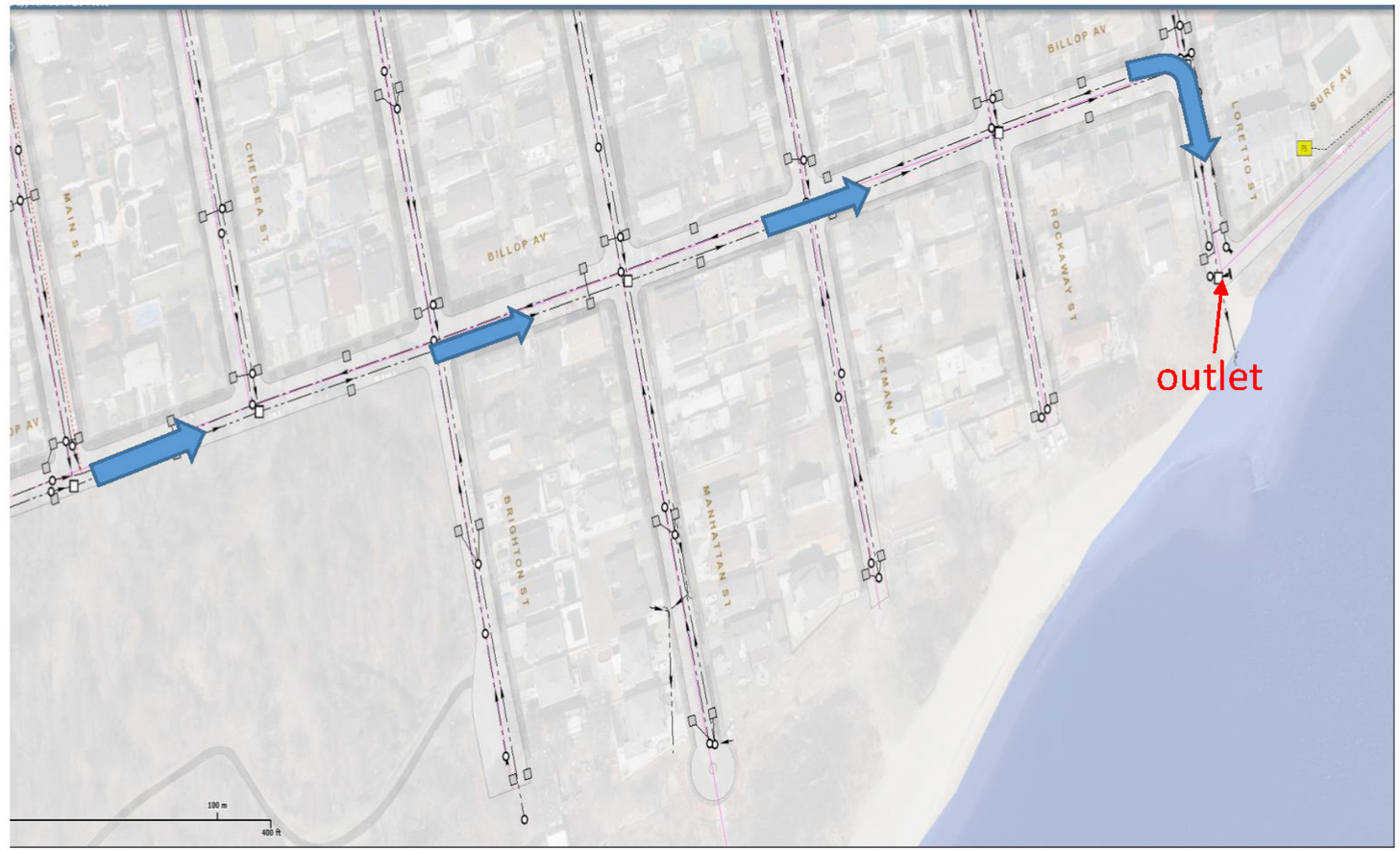


Separate Storm Sewer System

Carries storm water from the streets to a separate storm water collection sewer and discharges directly into the local waterbodies.

LORETTO STREET OUTFALL

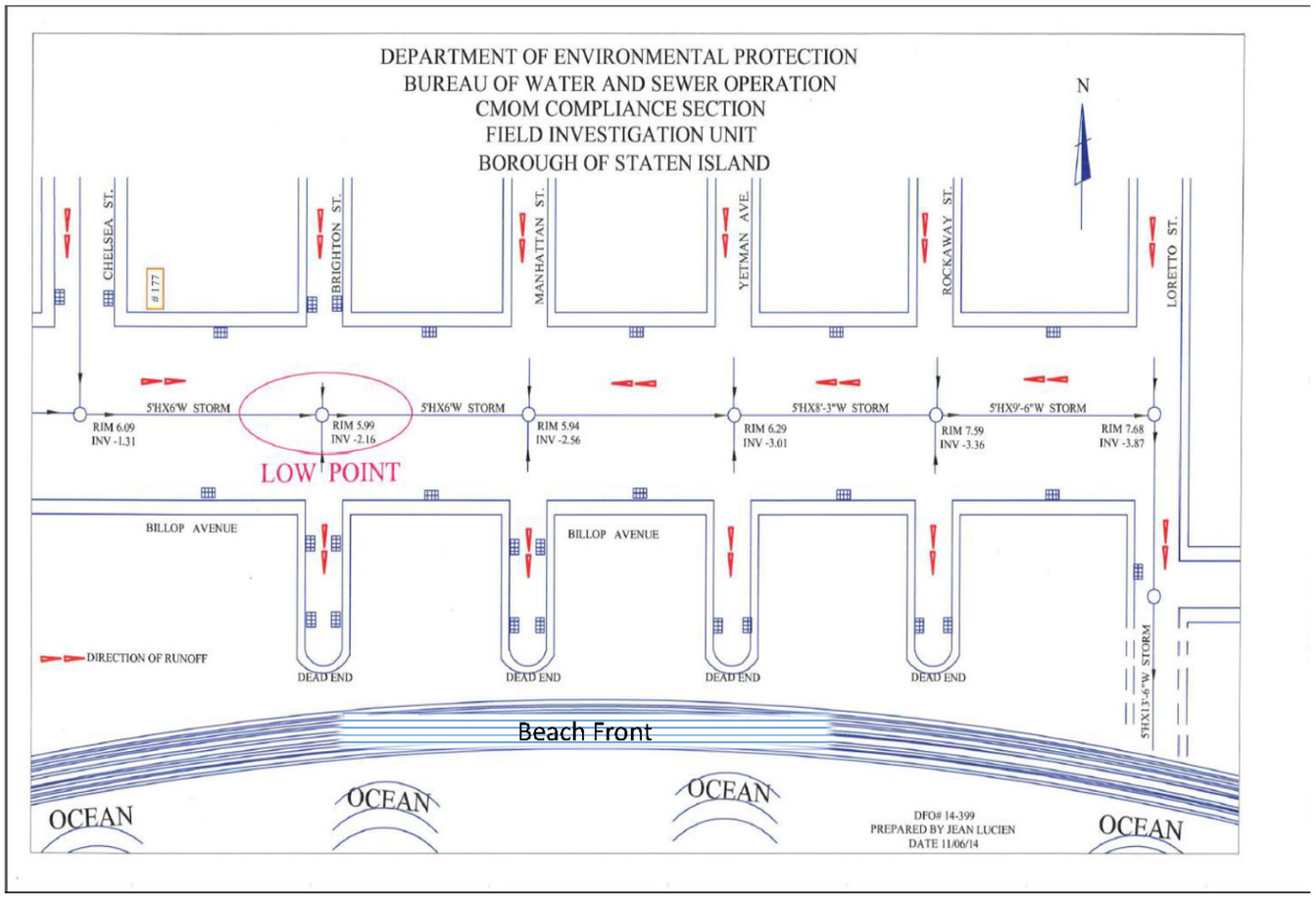
- The outfall is located on the beach area at the end Loretto street and received storm water flow from a trunk sewer running west to east on Billop Street which serves the surrounding streets.
- The outlet is 5ft H x 13.5ft W



COMMUNITY IMPACTS

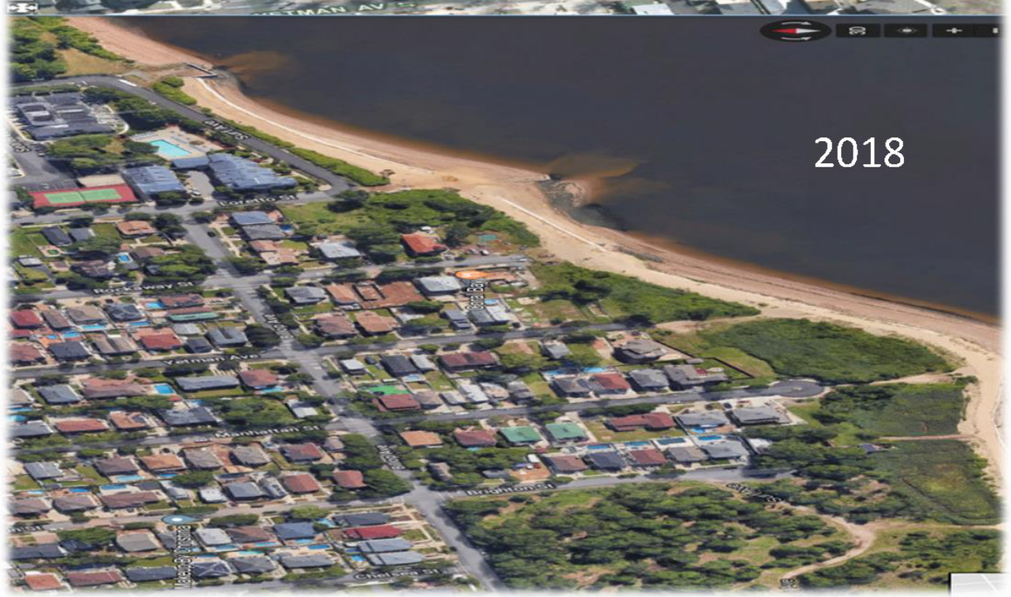
- Residents report street flooding during some heavy rain events, post Hurricane Sandy
- Sand infiltration into the mouth of the outlet is more frequent

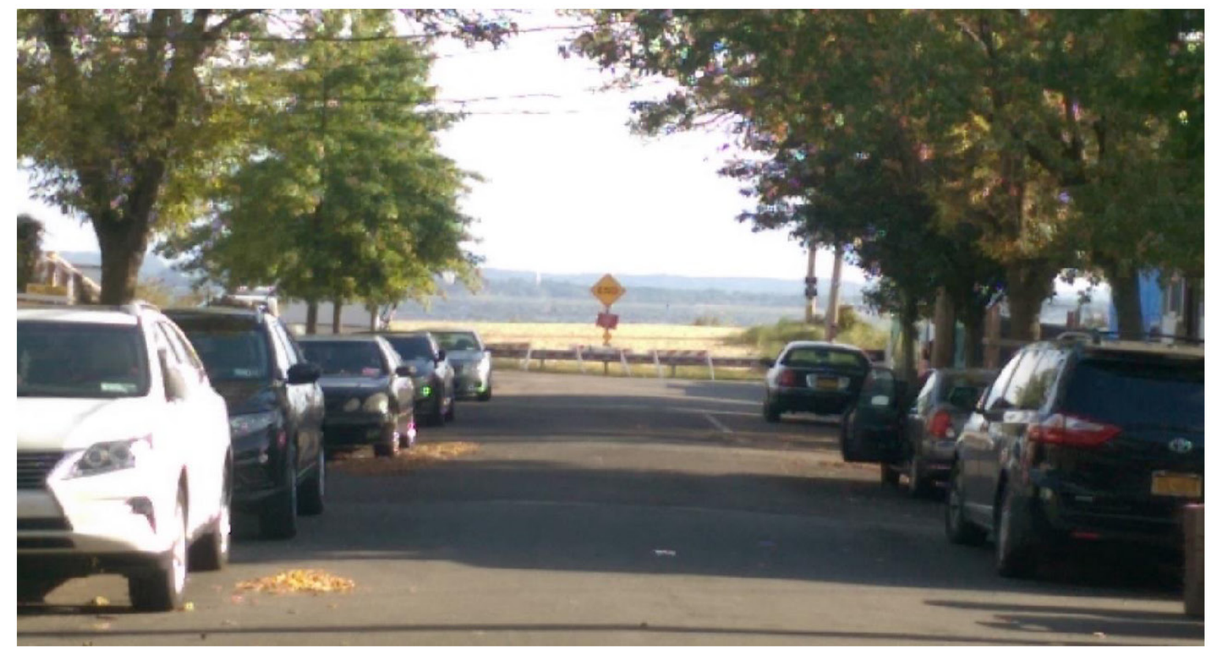
Field Investigations/Observations



- Post Hurricane Sandy – DEP investigated trunk sewer along Billop Ave and cleaned outlet during low tide which was infiltrated with Sand. Sand was observed 12”-24” high inside the outlet
- Analyzing & understanding changes in the shoreline
- Climate Change/Sea Level Rise
- Land Development and impact to natural drainage areas
- Correlation data between high tide and rainfall occurrences

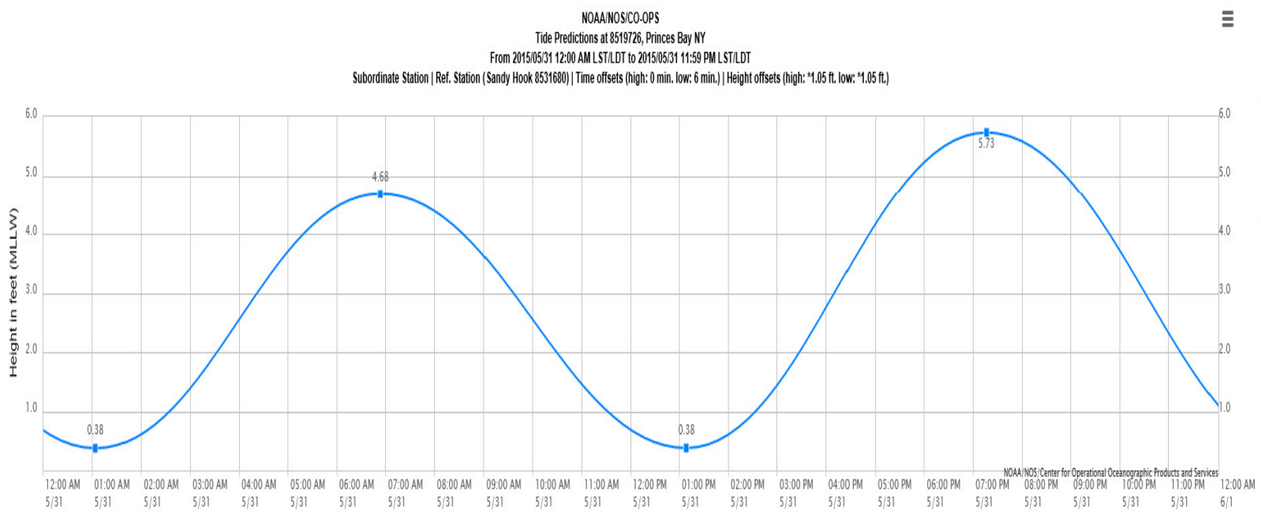
Field Investigations/Observations (continued)





Tide & Rain Data Correlation, May 31, 2015

NOAA tide prediction for Princes Bay on 5/31/15



Rain Data for JFK Airport on 5/31/15

Hourly Weather History & Observations

Time (EDT)	Temp.	Wind Dir	Wind Speed	Gust Speed	Precip	Events	Conditions
3:51 PM	73.0 °F	South	18.4 mph	29.9 mph	N/A		Mostly Cloudy
4:51 PM	71.1 °F	SSE	18.4 mph	-	N/A	Thunderstorm	Thunderstorm
5:04 PM	71.6 °F	SSE	18.4 mph	25.3 mph	N/A	Thunderstorm	Thunderstorm
5:23 PM	69.8 °F	Variable	3.5 mph	-	N/A	Thunderstorm	Thunderstorm
5:51 PM	73.0 °F	Variable	3.5 mph	-	0.00 in	Rain , Thunderstorm	Light Thunderstorms and Rain
6:51 PM	73.0 °F	ENE	8.1 mph	-	0.01 in	Rain , Thunderstorm	Light Thunderstorms and Rain
7:51 PM	72.0 °F	ESE	4.6 mph	-	0.00 in	Rain , Thunderstorm	Light Thunderstorms and Rain
8:19 PM	71.6 °F	SE	10.4 mph	-	0.01 in		Overcast
8:46 PM	69.8 °F	SE	9.2 mph	-	0.01 in		Overcast
8:51 PM	70.0 °F	SE	10.4 mph	-	0.01 in		Overcast
9:51 PM	70.0 °F	ESE	9.2 mph	-	N/A		Overcast
10:51 PM	72.0 °F	ESE	10.4 mph	-	0.00 in	Rain	Light Rain
11:51 PM	64.9 °F	East	19.6 mph	26.5 mph	0.00 in		Overcast

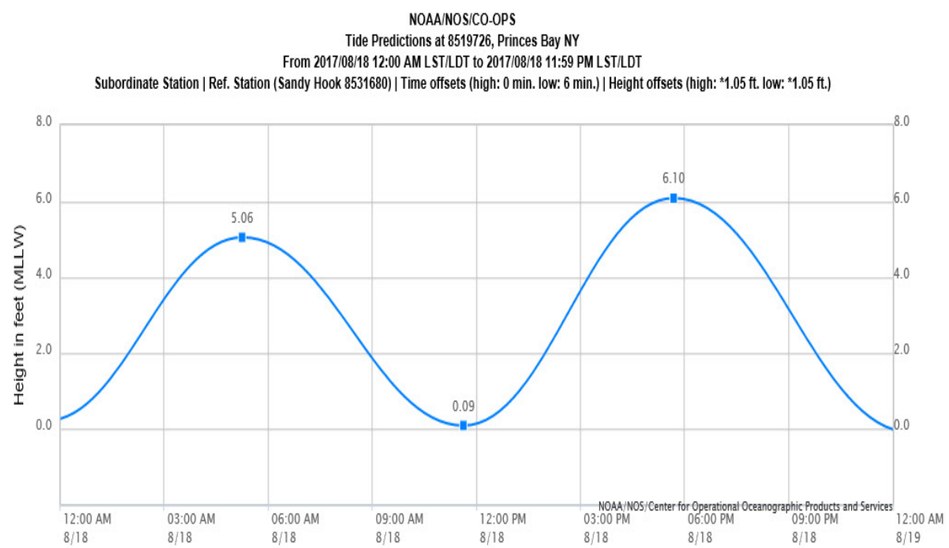
Recorded high tides were:

- 4.68 ft. (MLLW) at 6:53am
- 5.73 ft.(MLLW) at 7:16pm

Rain & thunderstorms were recorded between 4:51pm to 10:51pm. High winds recorded between 3:51 pm to 5pm

Tide & Rain Data Correlation, August 18, 2017

NOAA tide prediction for Princes Bay on 8/18/17



Rain Data for JFK Airport on 8/18/17

Hourly Weather History & Observations

Time (EDT)	Temp.	Dew Pt.	Wind Speed	Gust Speed	Pressure	Conditions	Condition
12:51 AM	76.9 °F	66F	2.7 mph	-	n/a		Cloudy
1:51 AM	76.9 °F	66F	16.0 mph	-	n/a		Cloudy
2:51 AM	76.9 °F	Calm	11.5 mph	-	n/a		Cloudy
3:51 AM	76.9 °F	Calm	11.5 mph	-	n/a		Cloudy
4:51 AM	76.9 °F	Calm	11.5 mph	-	n/a		Cloudy
5:51 AM	76.9 °F	Calm	11.5 mph	-	n/a		Cloudy
6:51 AM	76.9 °F	Calm	11.5 mph	-	n/a		Mostly Cloudy
7:51 AM	76.9 °F	Calm	12.7 mph	-	n/a		Cloudy
7:55 AM	76.9 °F	Calm	15.0 mph	-	0.00 in	Rain	Light Rain
7:55 AM	76.9 °F	Calm	15.0 mph	-	0.00 in	Rain	Light Rain
8:51 AM	76.9 °F	Calm	16.1 mph	25.3 mph	0.01 in		Cloudy
8:55 AM	76.9 °F	66F	17.3 mph	-	0.00 in	Rain, Thunderstorm	Light Thunderstorm and Rain
9:55 AM	76.9 °F	66F	11.5 mph	-	0.00 in	Rain, Thunderstorm	Heavy Thunderstorm and Rain
9:51 AM	76.9 °F	70.0F	11.5 mph	26.7 mph	0.10 in	Rain, Thunderstorm	Light Thunderstorm and Rain
10:55 AM	76.9 °F	69F	16.0 mph	-	0.07 in	Rain, Thunderstorm	Light Rain
10:51 AM	76.9 °F	69F	8.1 mph	-	0.00 in	Rain	Light Rain
10:51 AM	77.0 °F	69F	16.0 mph	-	0.00 in		Cloudy
11:55 AM	77.0 °F	Calm	11.5 mph	-	n/a		Cloudy
11:51 AM	76.1 °F	Calm	9.2 mph	-	n/a		Cloudy
12:51 PM	76.0 °F	Calm	11.5 mph	-	n/a		Cloudy
12:51 PM	76.1 °F	Calm	15.0 mph	-	n/a		Cloudy
1:00 PM	77.0 °F	Calm	12.7 mph	-	n/a		Cloudy
1:56 PM	76.1 °F	Calm	17.3 mph	-	n/a		Cloudy
1:51 PM	76.0 °F	Calm	17.3 mph	-	n/a		Cloudy
2:00 PM	77.0 °F	Calm	11.5 mph	-	n/a		Cloudy
2:51 PM	77.0 °F	Calm	15.0 mph	-	n/a		Cloudy
2:51 PM	76.0 °F	Calm	17.3 mph	-	0.00 in		Cloudy
3:51 PM	76.1 °F	Calm	15.0 mph	25.3 mph	n/a		Cloudy
3:51 PM	76.1 °F	Calm	17.3 mph	26.7 mph	n/a		Cloudy
3:56 PM	77.0 °F	Calm	16.1 mph	-	n/a		Cloudy
4:51 PM	77.0 °F	Calm	16.1 mph	24.1 mph	n/a		Cloudy
4:56 PM	77.0 °F	Calm	16.1 mph	25.3 mph	n/a		Mostly Cloudy
5:51 PM	77.0 °F	Calm	14.6 mph	-	n/a		Mostly Cloudy
7:51 PM	77.0 °F	Calm	15.0 mph	-	n/a	Thunderstorm	Cloudy
7:56 PM	76.9 °F	Calm	16.1 mph	-	0.00 in	Rain, Thunderstorm	Light Thunderstorm and Rain
7:51 PM	76.0 °F	69F	12.7 mph	-	0.01 in	Rain, Thunderstorm	Light Thunderstorm and Rain
8:56 PM	75.0 °F	69F	11.5 mph	-	0.00 in	Rain	Light Rain
8:51 PM	75.0 °F	69F	9.2 mph	-	0.00 in		Mostly Cloudy
9:51 PM	75.0 °F	69F	12.7 mph	-	n/a		Mostly Cloudy
10:51 PM	75.0 °F	69F	16.0 mph	-	n/a		Mostly Cloudy
11:51 PM	76.9 °F	70.0F	11.5 mph	-	n/a		Cloudy

Recorded high tides were:

- 5.06 ft. (MLLW) at 5:15am
- 6.10 ft. (MLLW) at 5:40pm

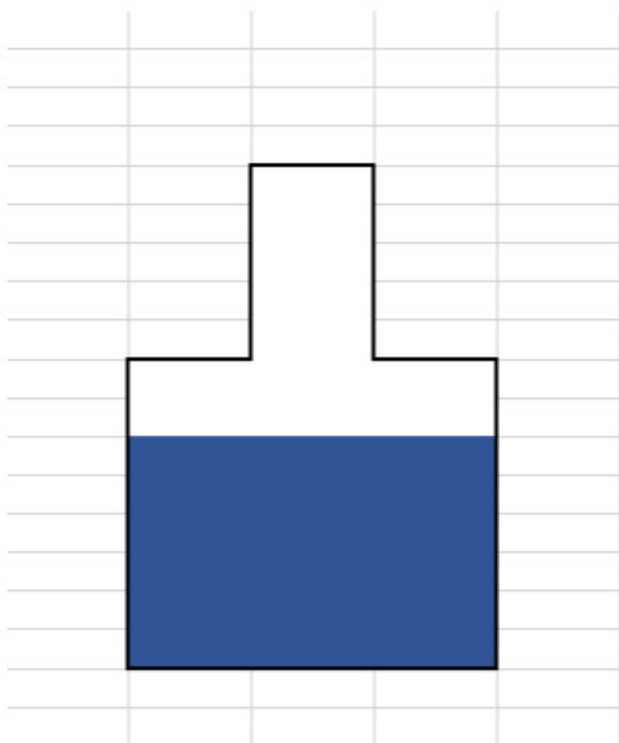
Rain & thunderstorms were recorded between 7:51am to 10:27am.

Correlation between outfall height and recorded highest tides

- <u>Datums/Relative Elevations</u>
  - The height of the sewer is 5 feet throughout. This photo was taken at the intersection of Billop Av & Chelsea St
  - Highest recorded tide on 7/15/14 was 6.34 ft (MLLW) at 11:16pm (This implies that storm sewer conveyed ~4 feet of flow)
  - Highest recorded tide on 5/31/15 was 5.73 ft (MLLW). at 7:16pm (This implies that deep sewer conveyed ~ 3.3 feet of flow)
  - **Storm and/or tide surges /high wind gusts can elevate the tide level beyond what is predicted by NOAA**

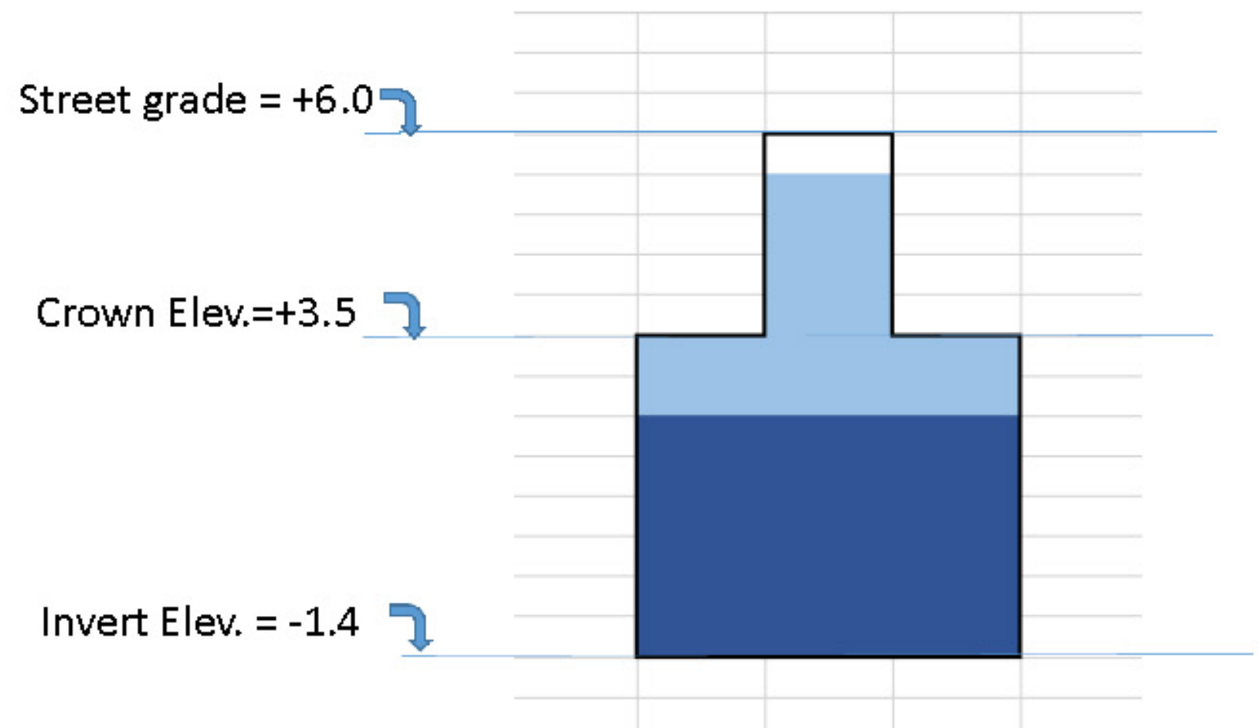
How tide can impact flow depth

Depth of flow in sewer due to tide



Depth of flow in sewer due to tide + rain

(Sample elevations taken at Chelsea St & Billop Av)



Actions Taken

- DEP engineers explored possible design solutions such as filter fabric, Gabian wall (sand barrier wall), not proven effective
- Regular monitoring of the outfall and cleaning and when an impending storm is approaching
- Tracking 311 data and working directly with local residents on flooding occurrences.
- Continuing to work with GOSR/NY Rising to understand the impact of the outfalls due to upcoming shoreline project

Questions

Questions?

#6. CLOSING COMMENTS

THANK YOU!