

Thatchbed Island Erosion and Mitigation Options Study

Public Meeting
1/14/2026

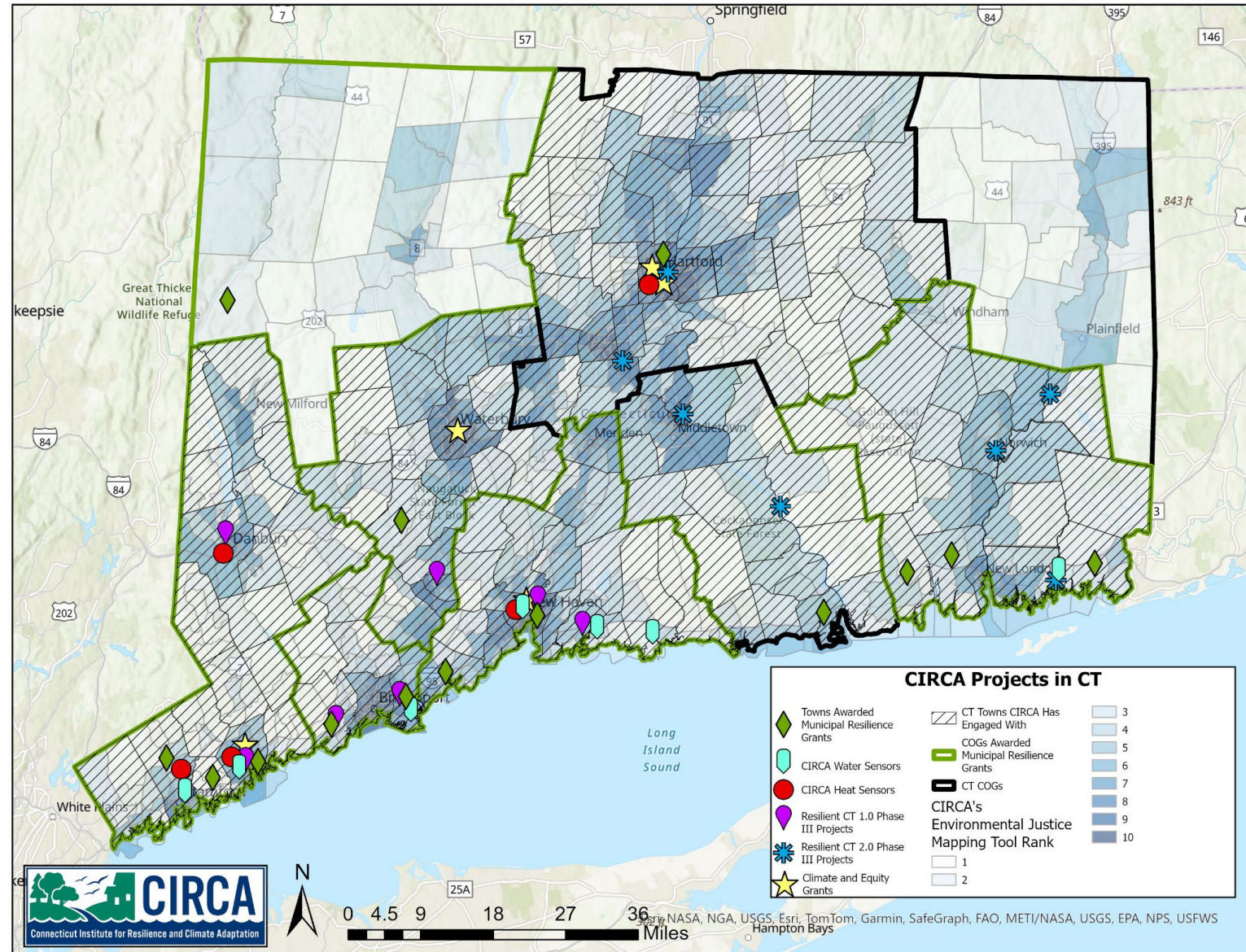
Yaprak Onat, Ph.D. PE.
Associate Director of Research, UConn CIRCA

UConn

Connecticut Institute for Resilience and Climate Adaptation (CIRCA)

CIRCA's mission is to increase the resilience and sustainability of communities vulnerable to the growing impacts of climate change on the natural, built, and human environments.

Executive Director: James O'Donnell





1983 Topographic map - USGS

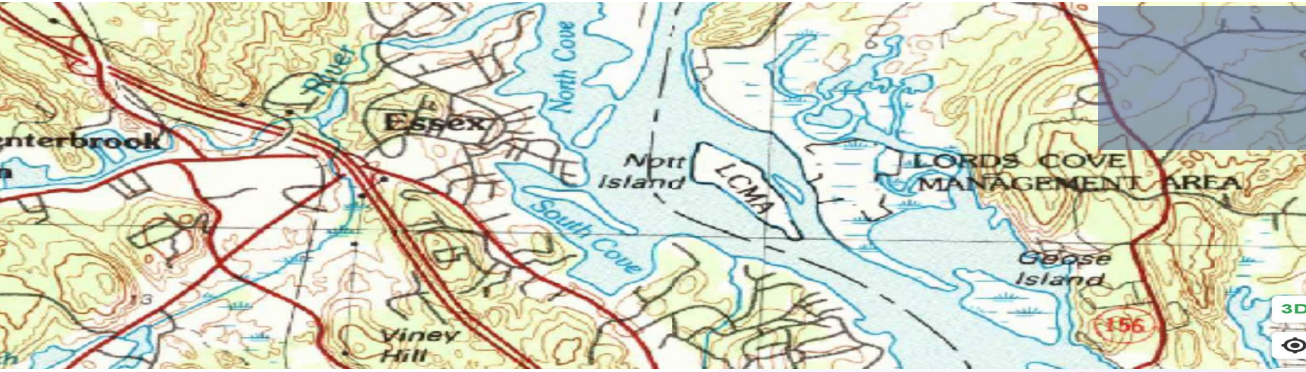
ABOUT THE PROJECT

Analyze erosion causes on Thatched Island, assess the utility of Geotube/Envirotube technology for erosion prevention, and develop design concepts for a demonstration project using dredged materials.

PROJECT STAGES

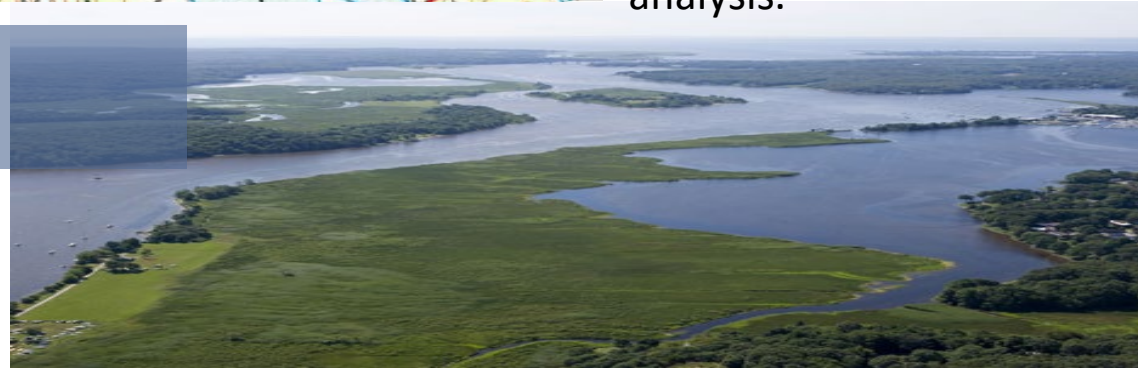
Past Impacts

Understanding the evolution of the island using historical data analysis.



Current Conditions

Understanding the current conditions that are impacting the island via fieldwork and numerical modeling.



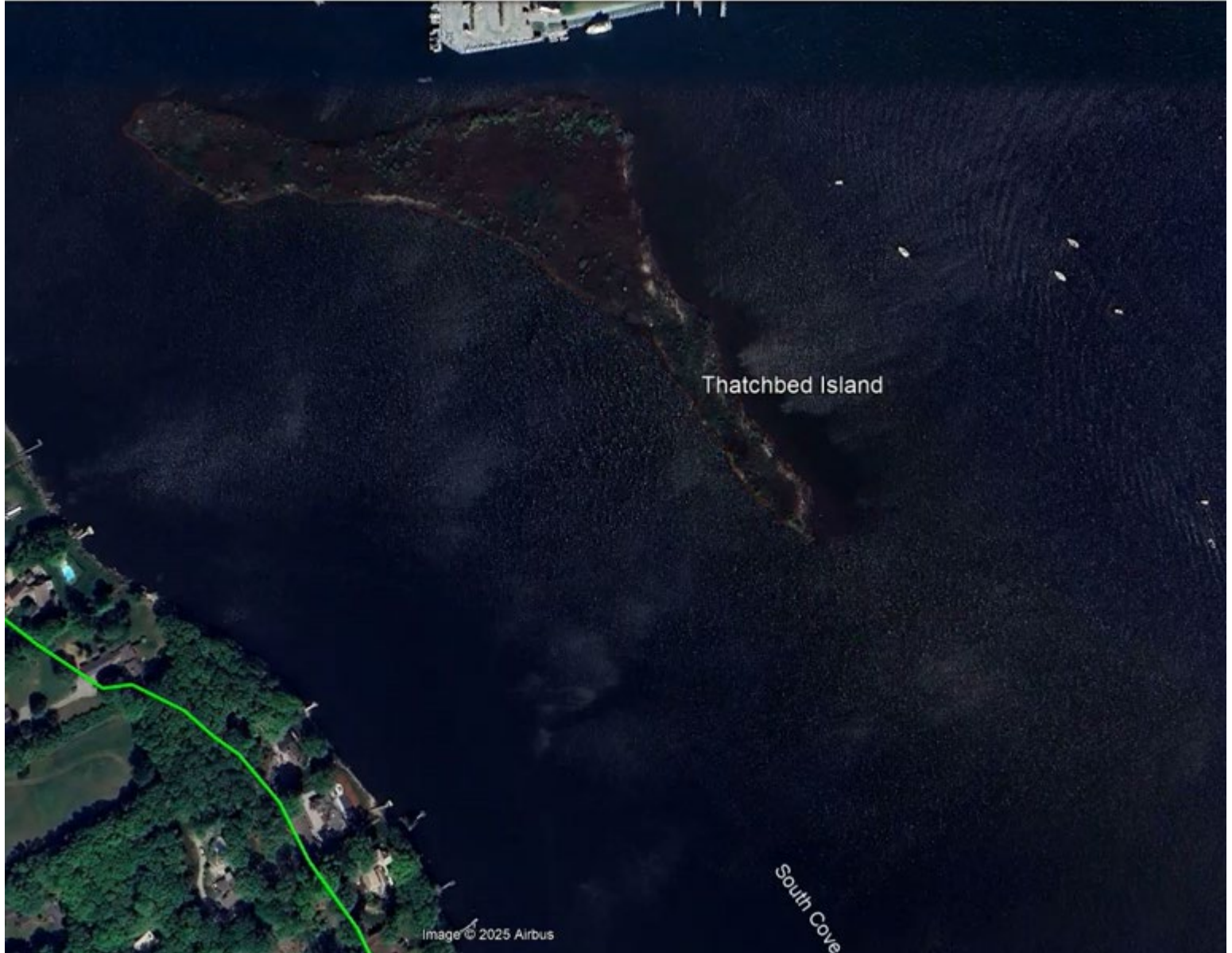
Scenario Development

Considering the current conditions, scenario development is based on the adaptation options with geotubes.



Change to Thatchbed Island, 1991-present

Digital Shoreline Analysis System (DSAS)



Max Erosion: 825.23 ft
Max Accretion: 14.93 ft

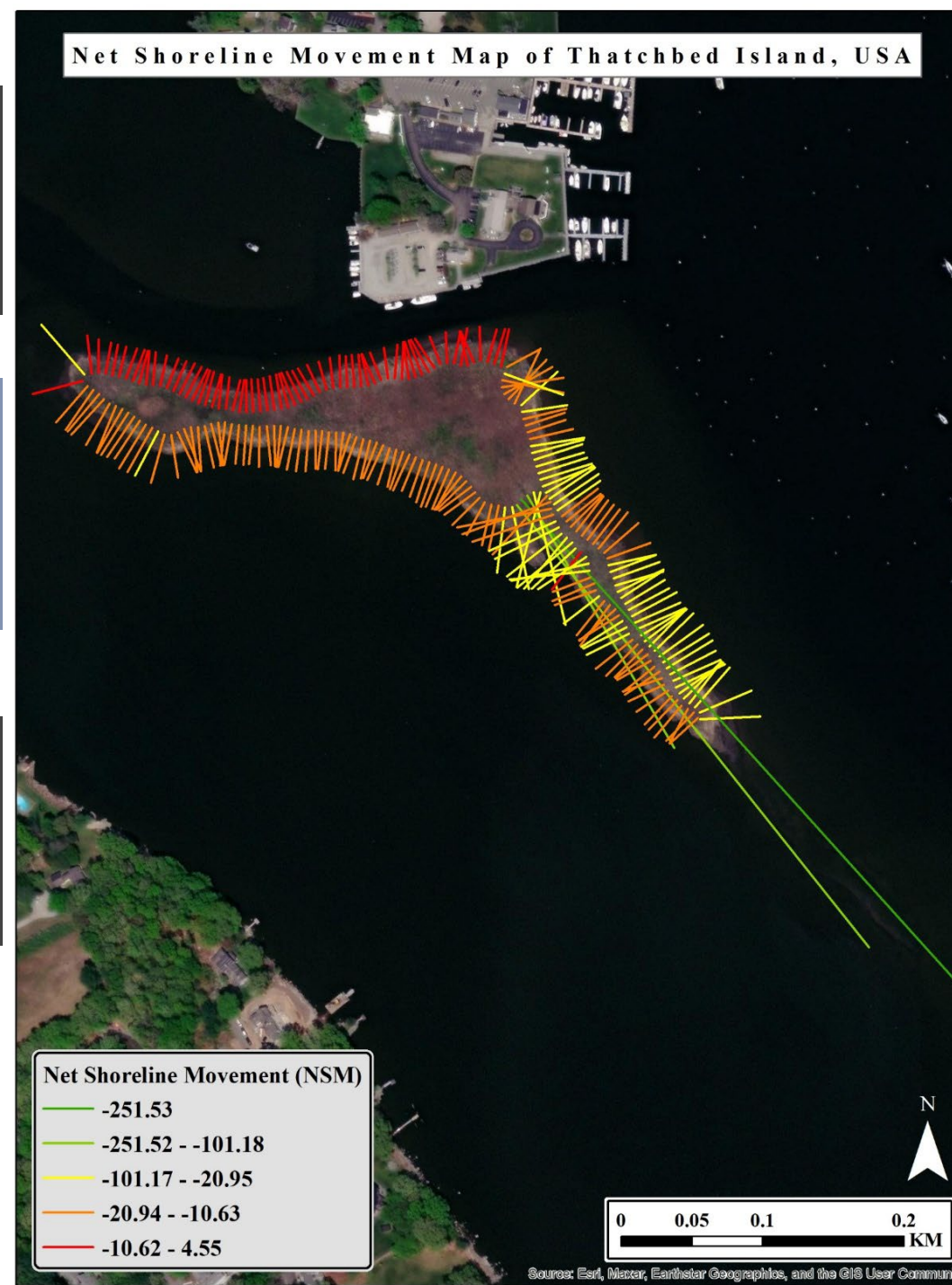
Net Shoreline Movement

82.35%

Erosion over total 238
transects

-1.77 ft/yr

Average Rate of Change



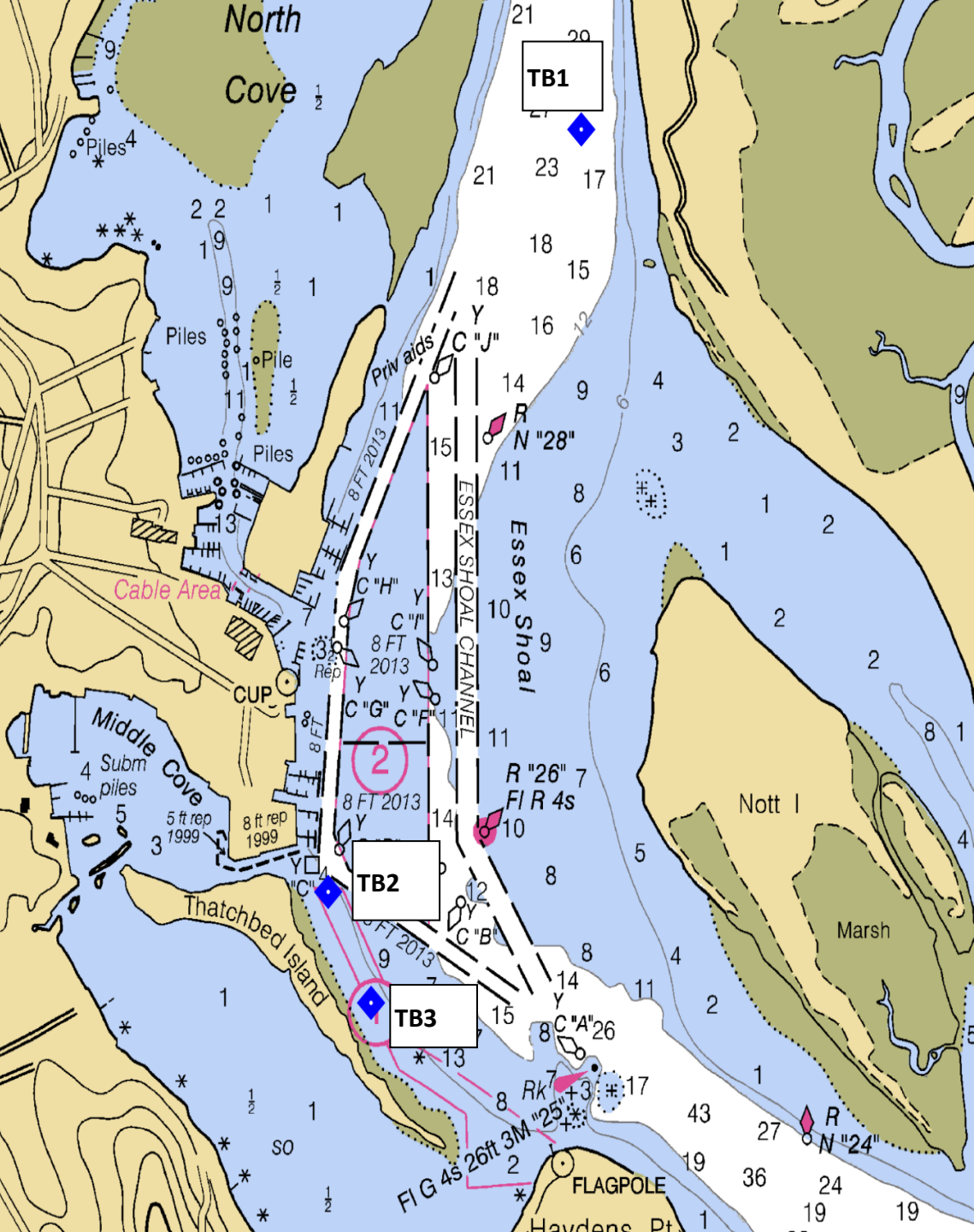
TimeFrame

Quality Assurance Project Plan (QAPP) approval in Sept 2024

Nov – Dec 2024
April – July 2025

Key Activities

- Deployment of ADCPs and turbidity sensors
- Water and sediment sample collection
- Data analysis and model calibration

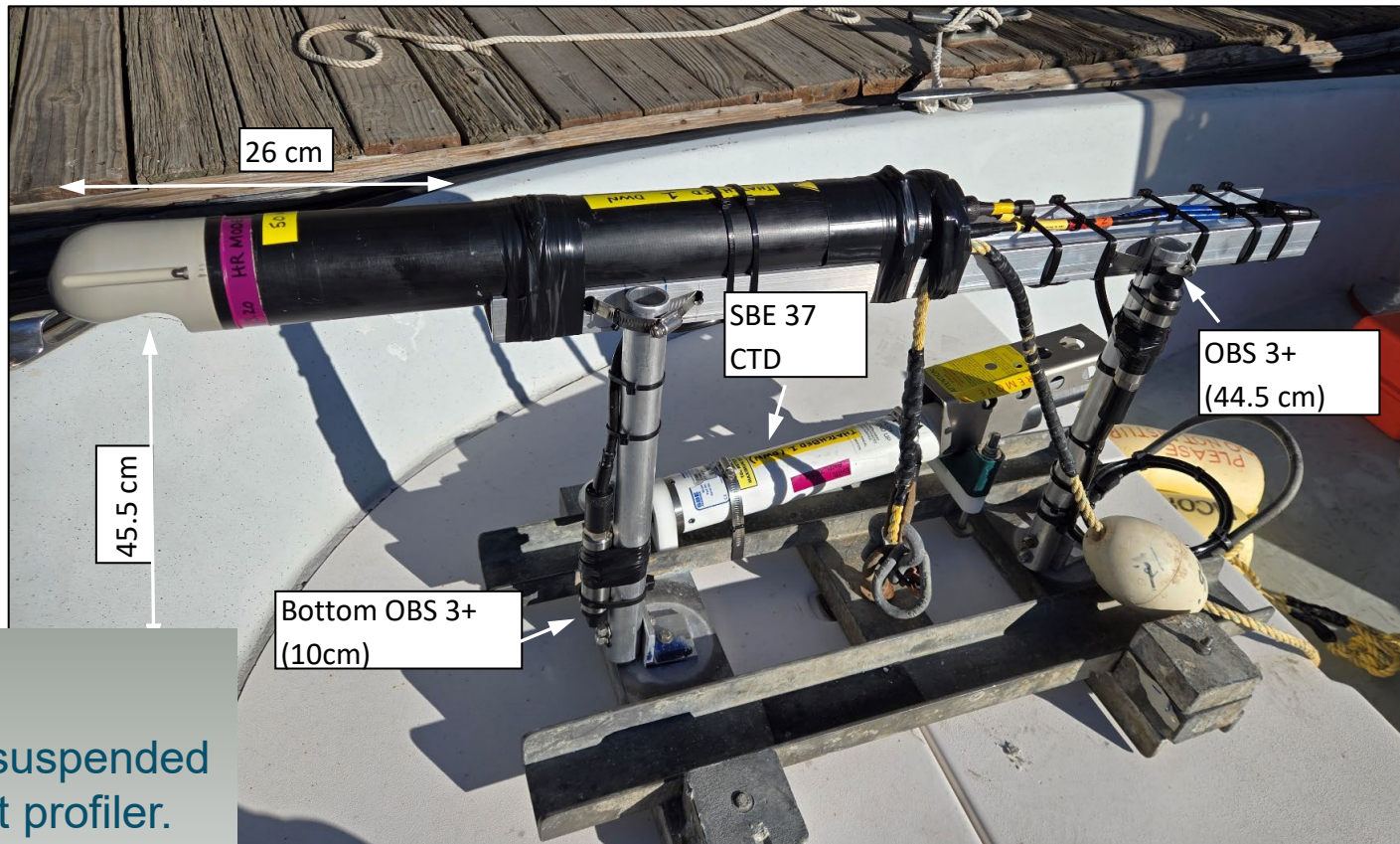


Deployed Equipment



Upward looking Aquadopp on sled frame mount

Each site has two frames.
Downward looking frame: Characterize suspended sediment load, and an Aquadopp current profiler.
Upward looking frame: Provide water column current velocities



Downward-looking Aquadopp on customized sled frame mount

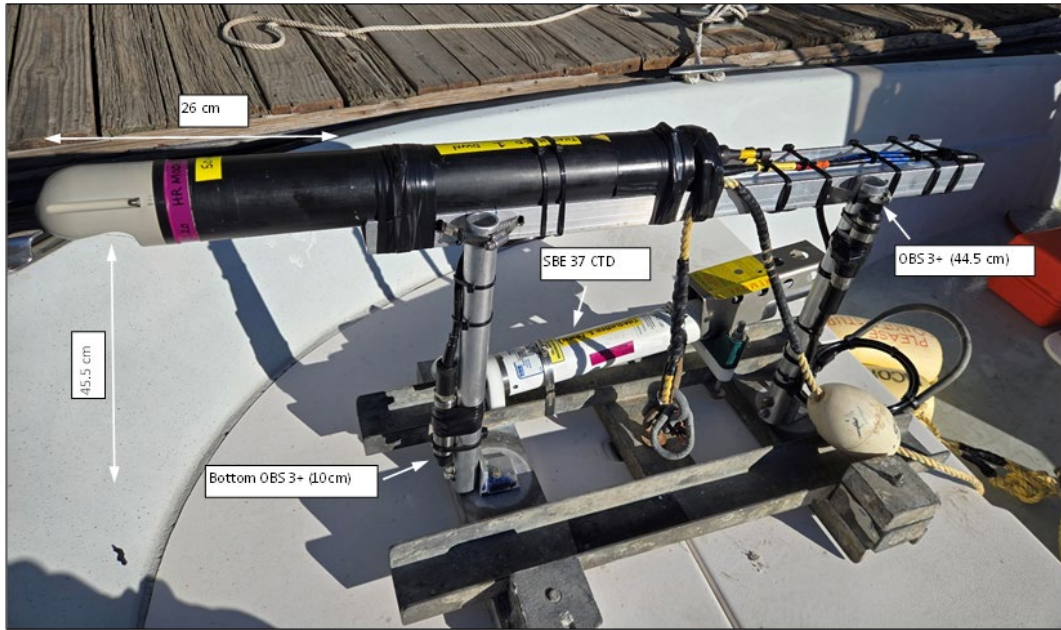


Figure 1. Downward looking Aquadopp on customized sledframe mount for characterizing near-bed turbulence shear.

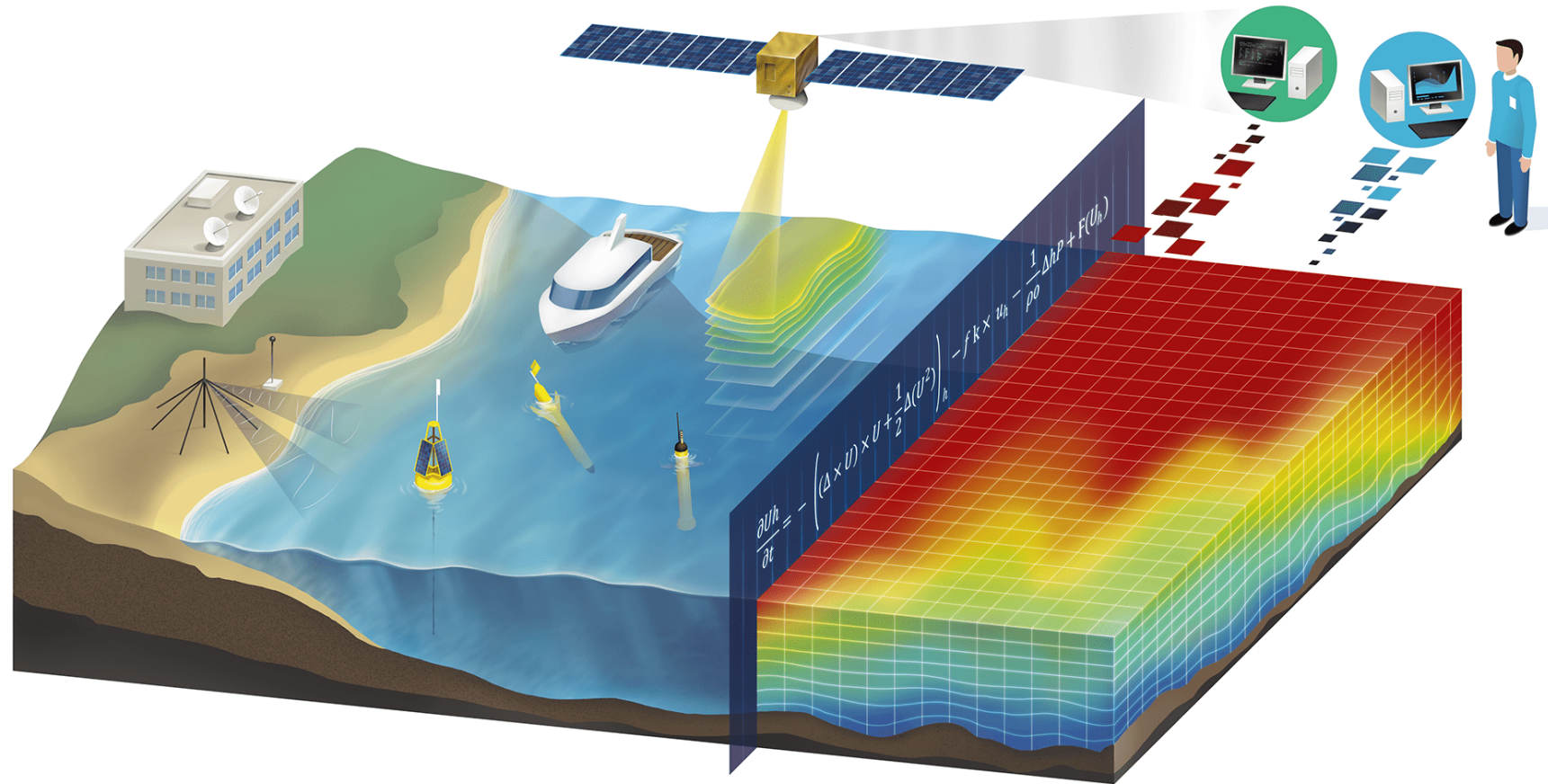


Figure 1. Ponar grab used for the sediment samplings 14 November, 2024 and 26 February, 2025.

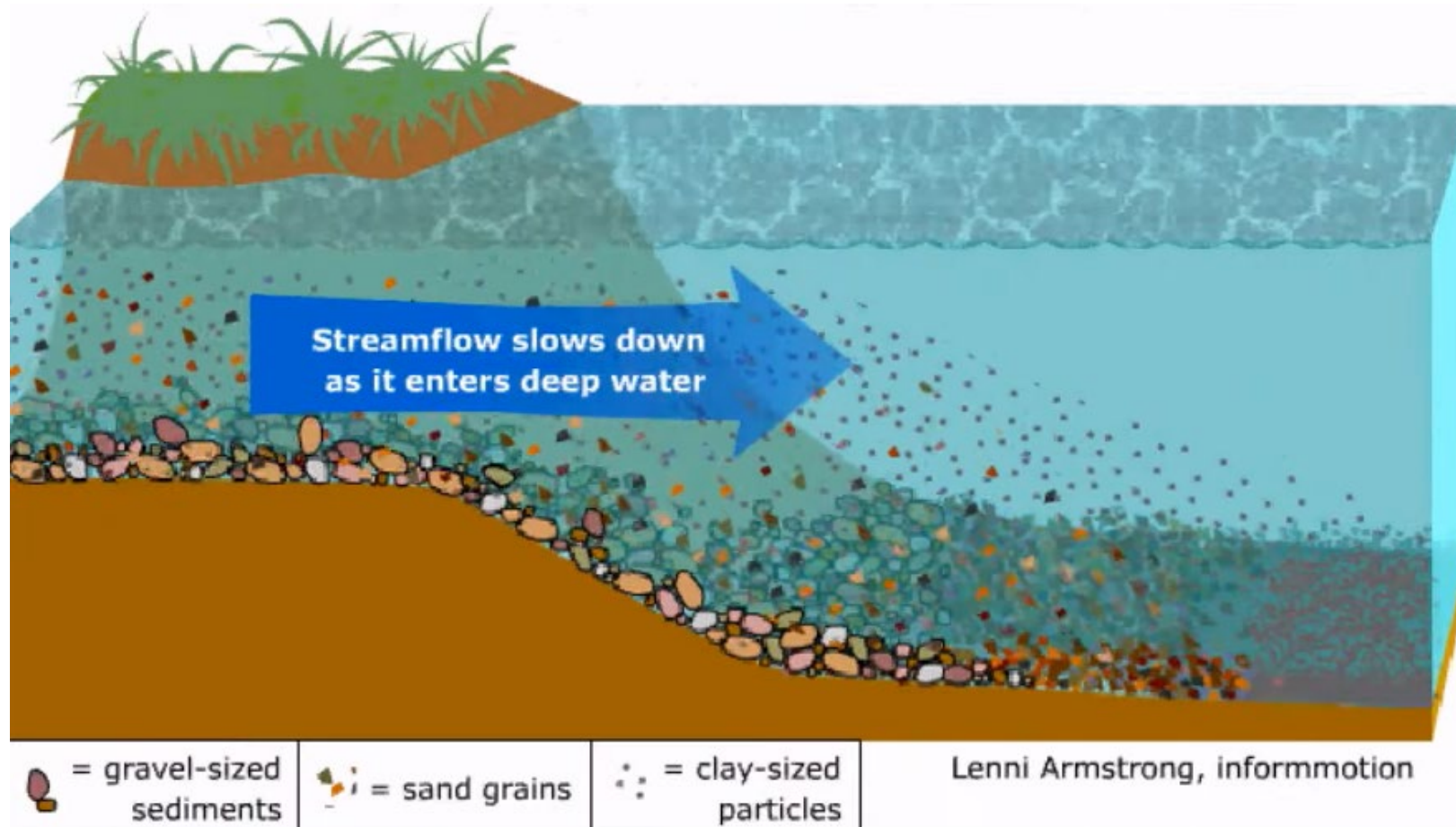
Numerical Modelling - Conceptual Overview

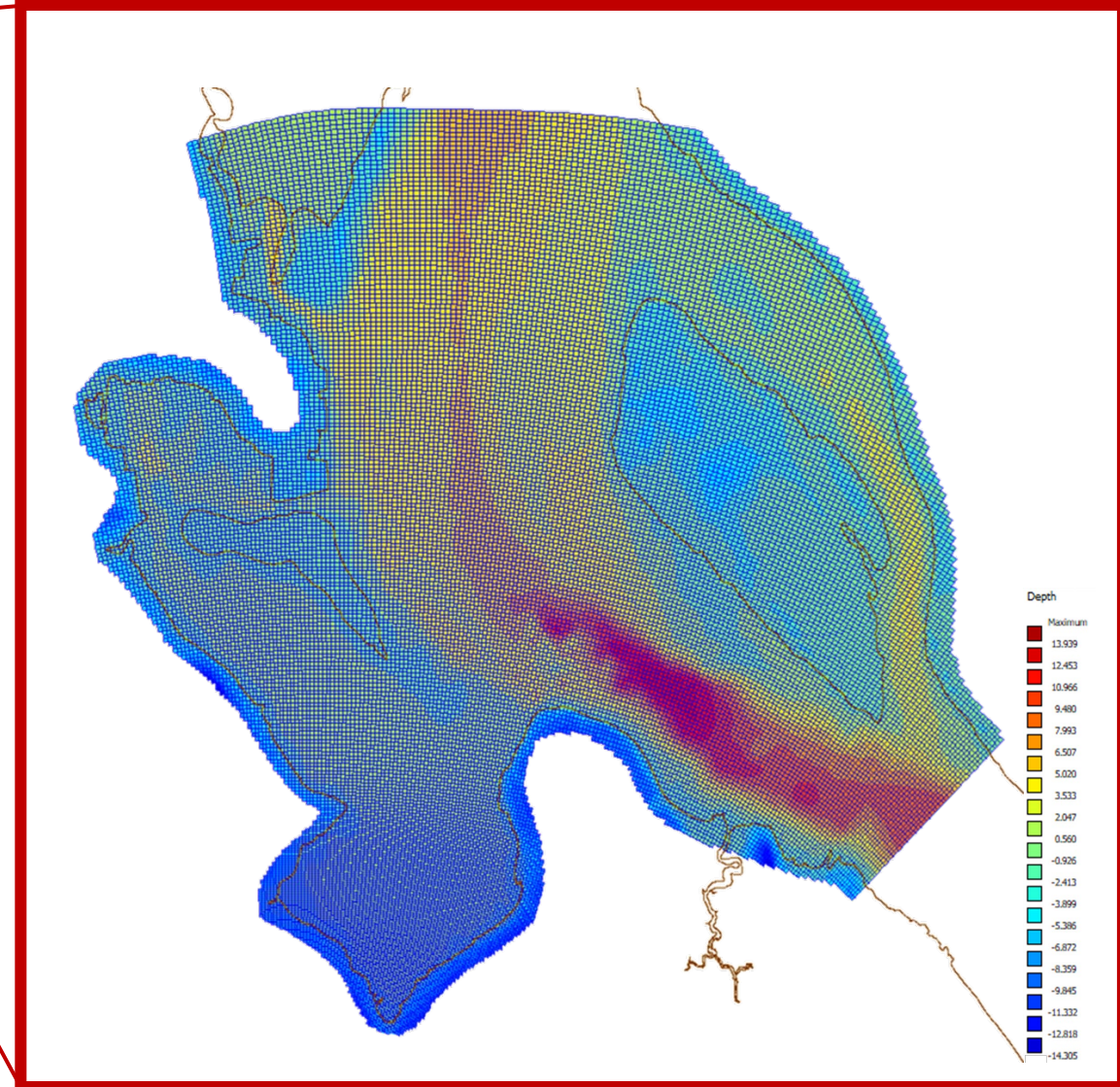
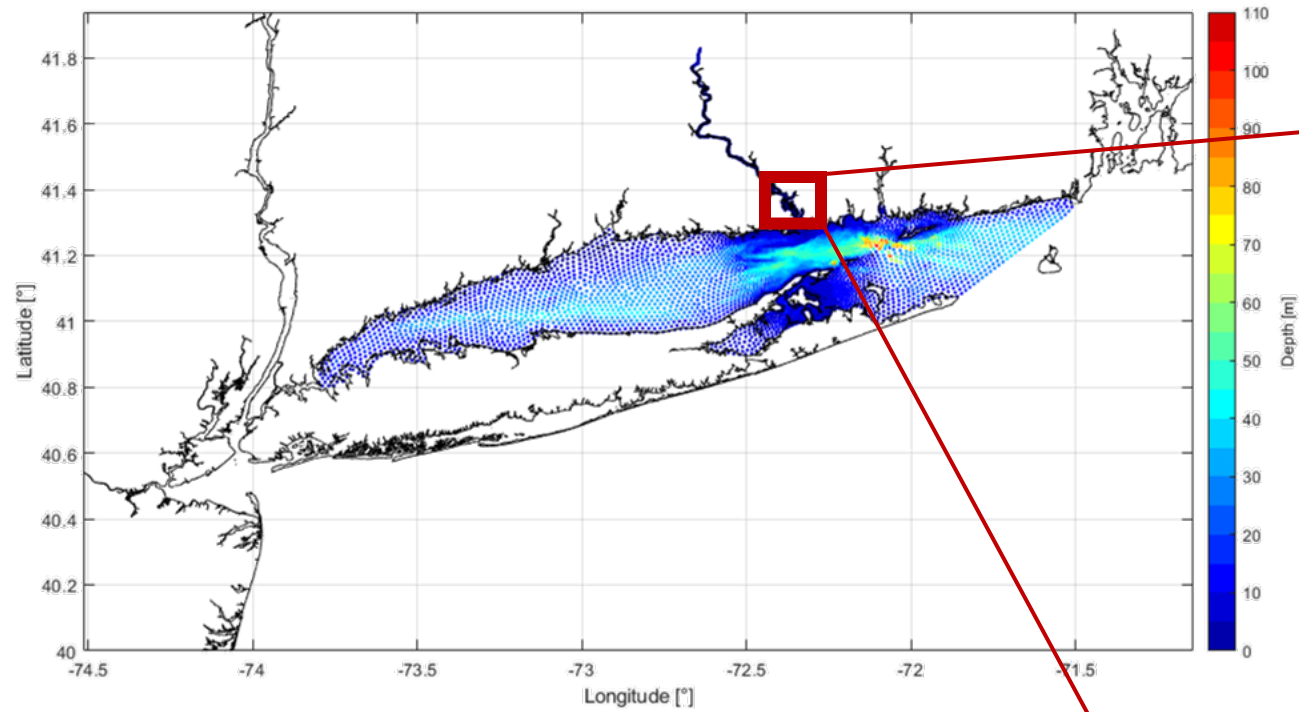
Broadly, 3 Stages

- 1) Design and build
 - Mesh, geometry, topography, resolution, time step, preprocessing code
- 2) Compile and test
 - "Installing" the model correctly, conducting test runs
- 3) Calibrate and validate
 - Ensuring the model reproduces the measurement (i.e., it's realistic)
- 4) Run experiments
 - Test different conditions, note response, test interventions etc.



Numerical Modelling - Conceptual Overview





AGU PUBLICATIONS

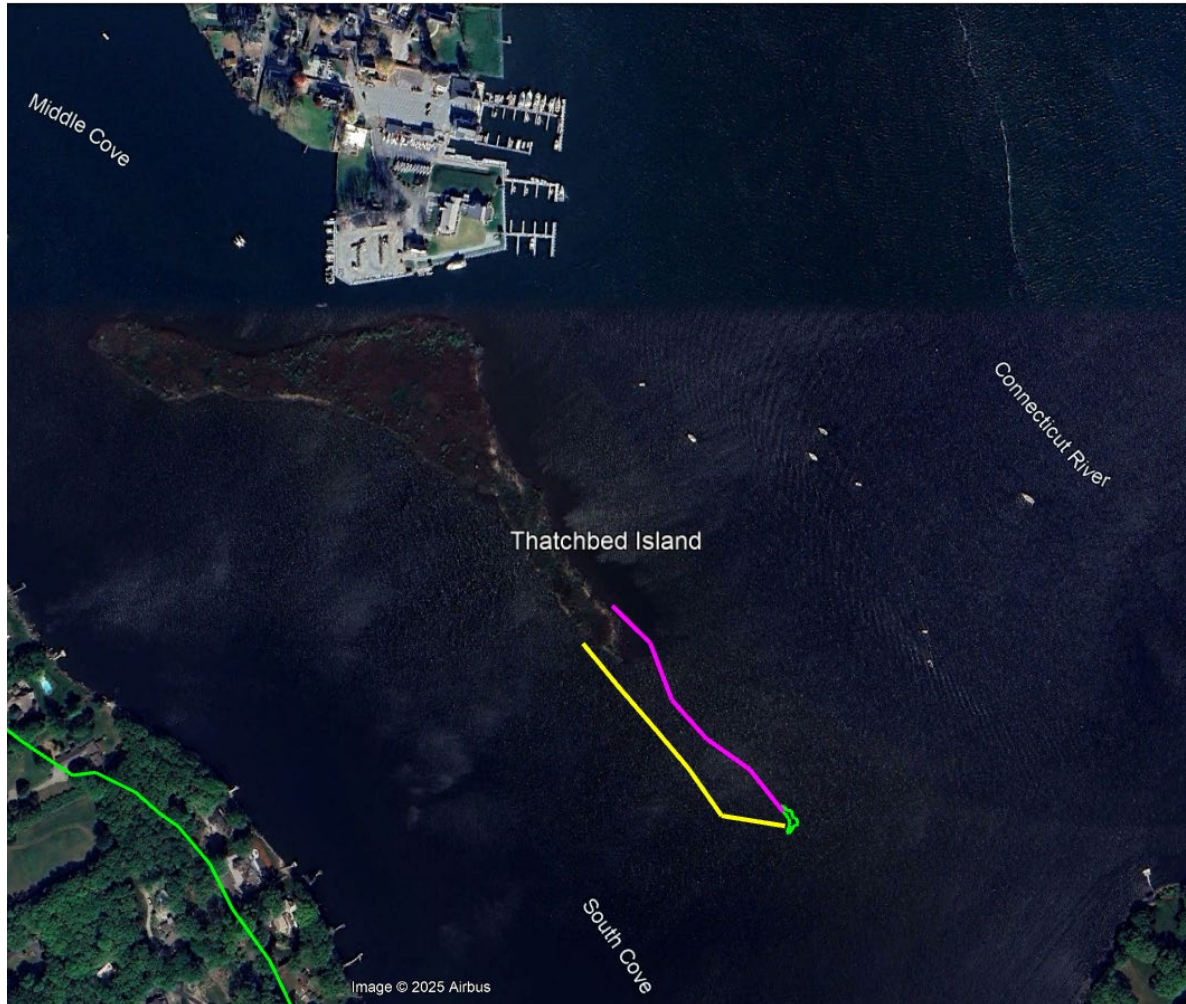
JGR

Journal of Geophysical Research: Oceans

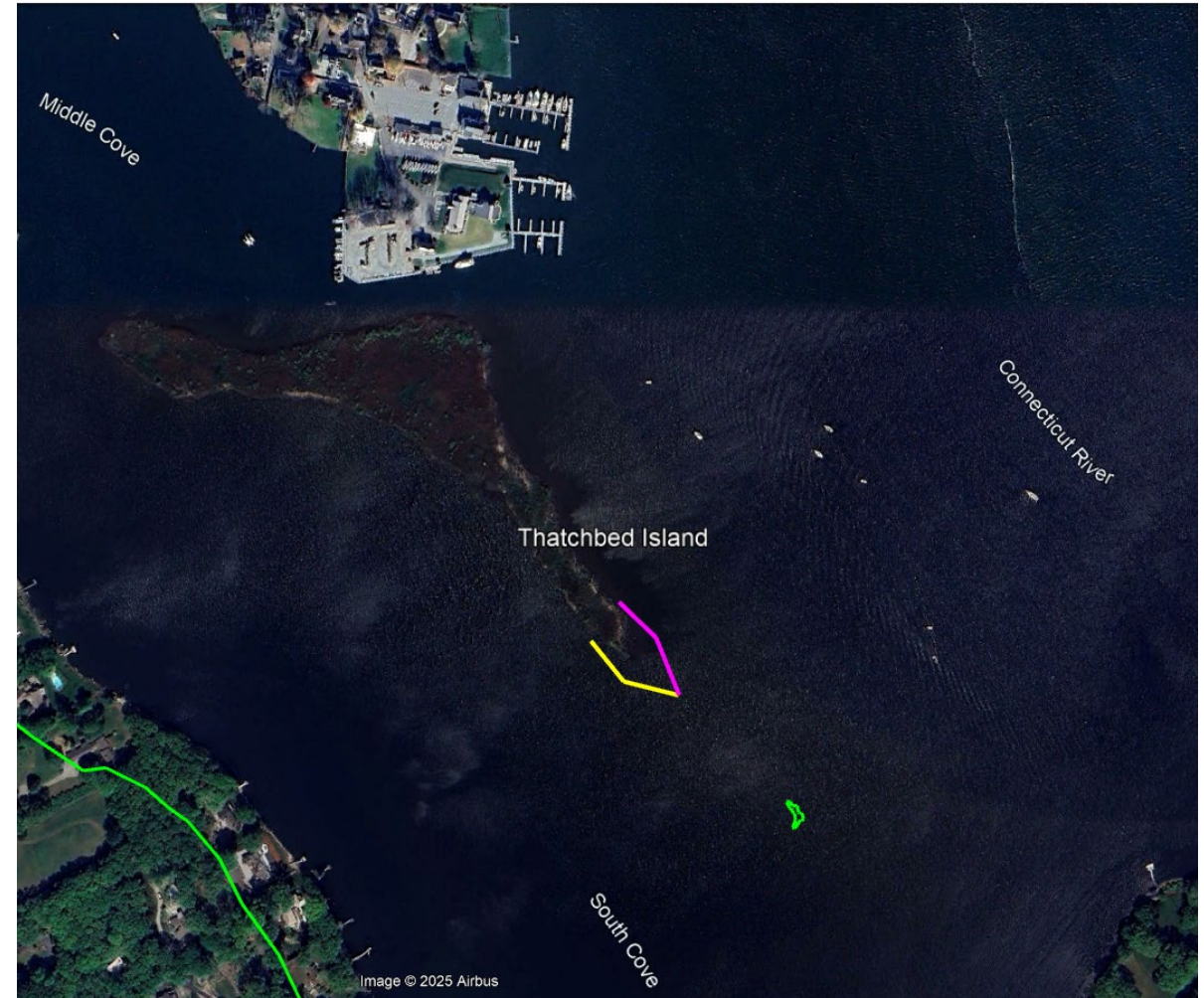
Turbulent and numerical mixing in a salt wedge estuary: Dependence on grid resolution, bottom roughness, and turbulence closure

David K. Ralston ¹, Geoffrey W. Cowles ², W. Rockwell Geyer ¹, and Rusty C. Holleman ³

¹Applied Ocean Physics and Engineering Department, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA, ²Department of Fisheries Oceanography, University of Massachusetts Dartmouth, New Bedford, Massachusetts, USA, ³San Francisco Estuary Institute, Richmond, California, USA



Envirotubes Configuration 1



Envirotubes Configuration 2

3 simulation periods

- P1 = 2013-10-31 until 2013-11-09 = 9 days
- P2 = 2014-05-01 until 2014-05-16 = 15 days
- P3 = 2017-06-24 until 2017-06-29 = 5 days

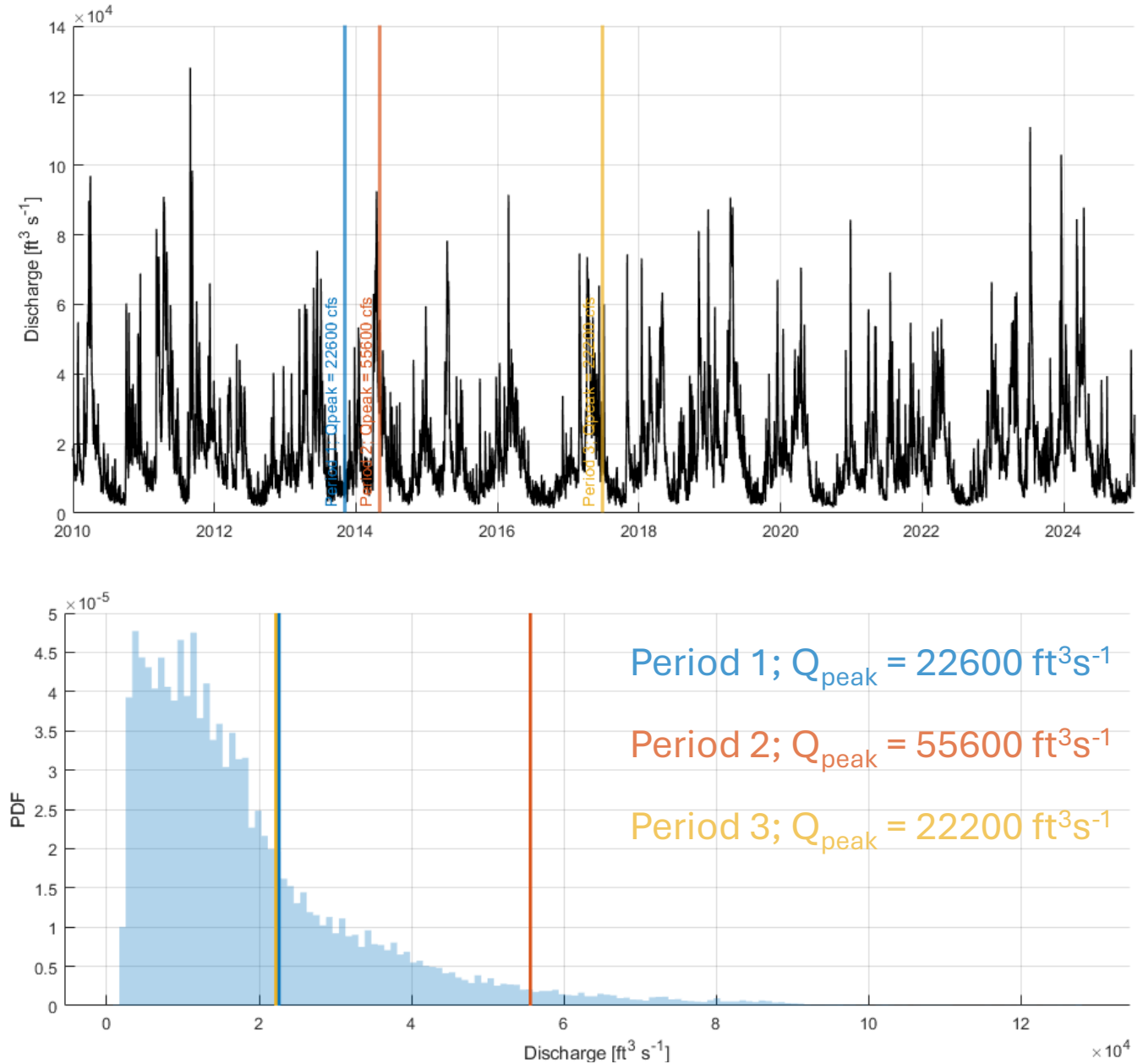
* extended forcing...

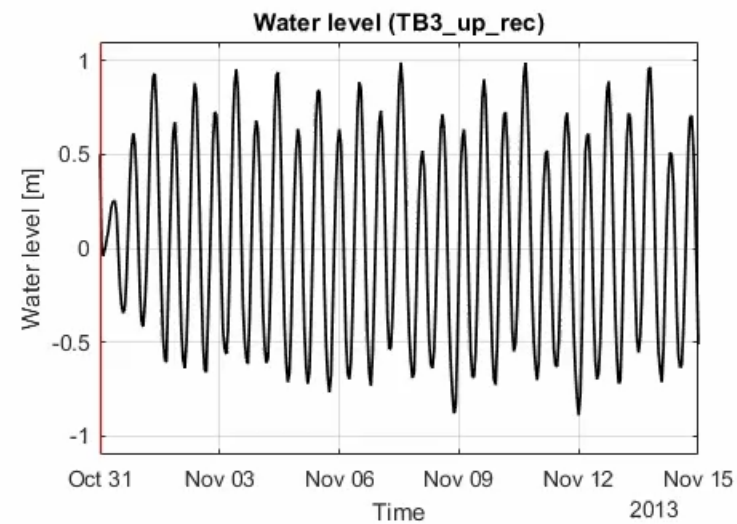
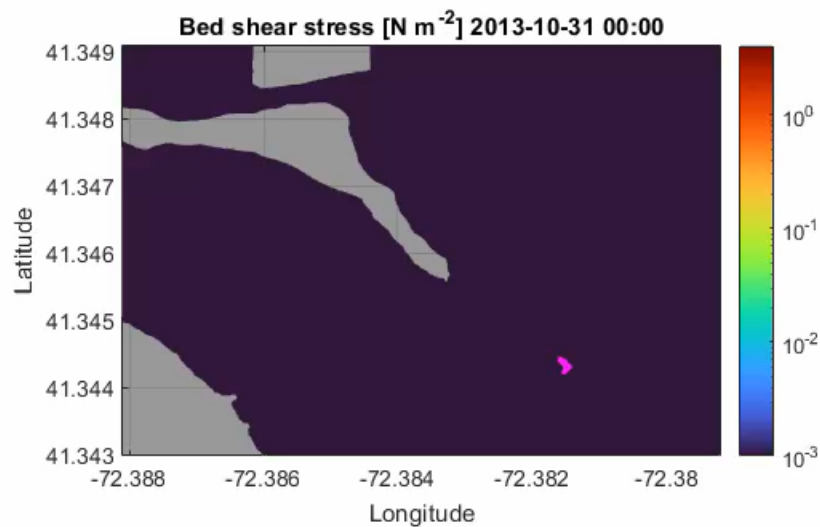
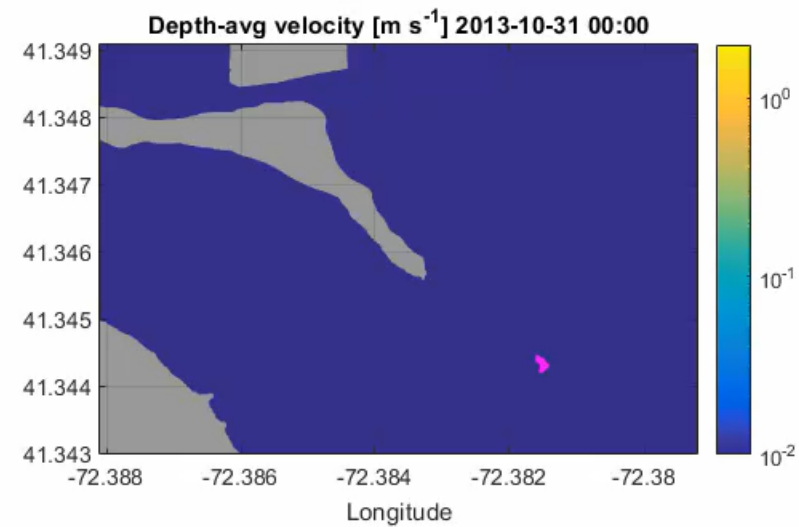
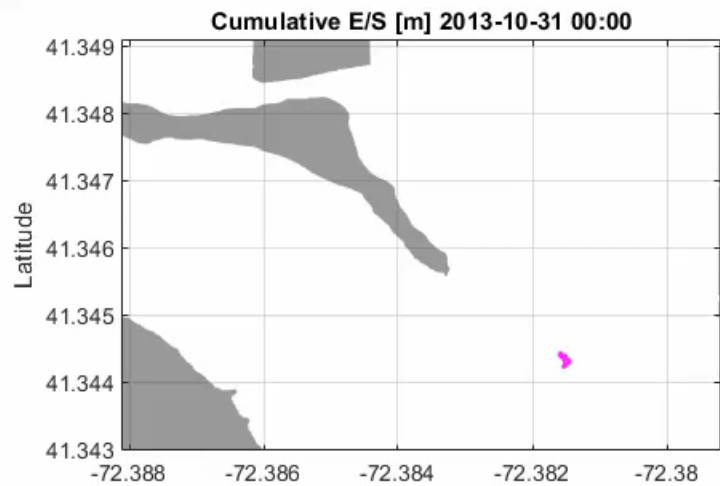
P1E = 2013-10-31 until 2013-11-15 = 15 days

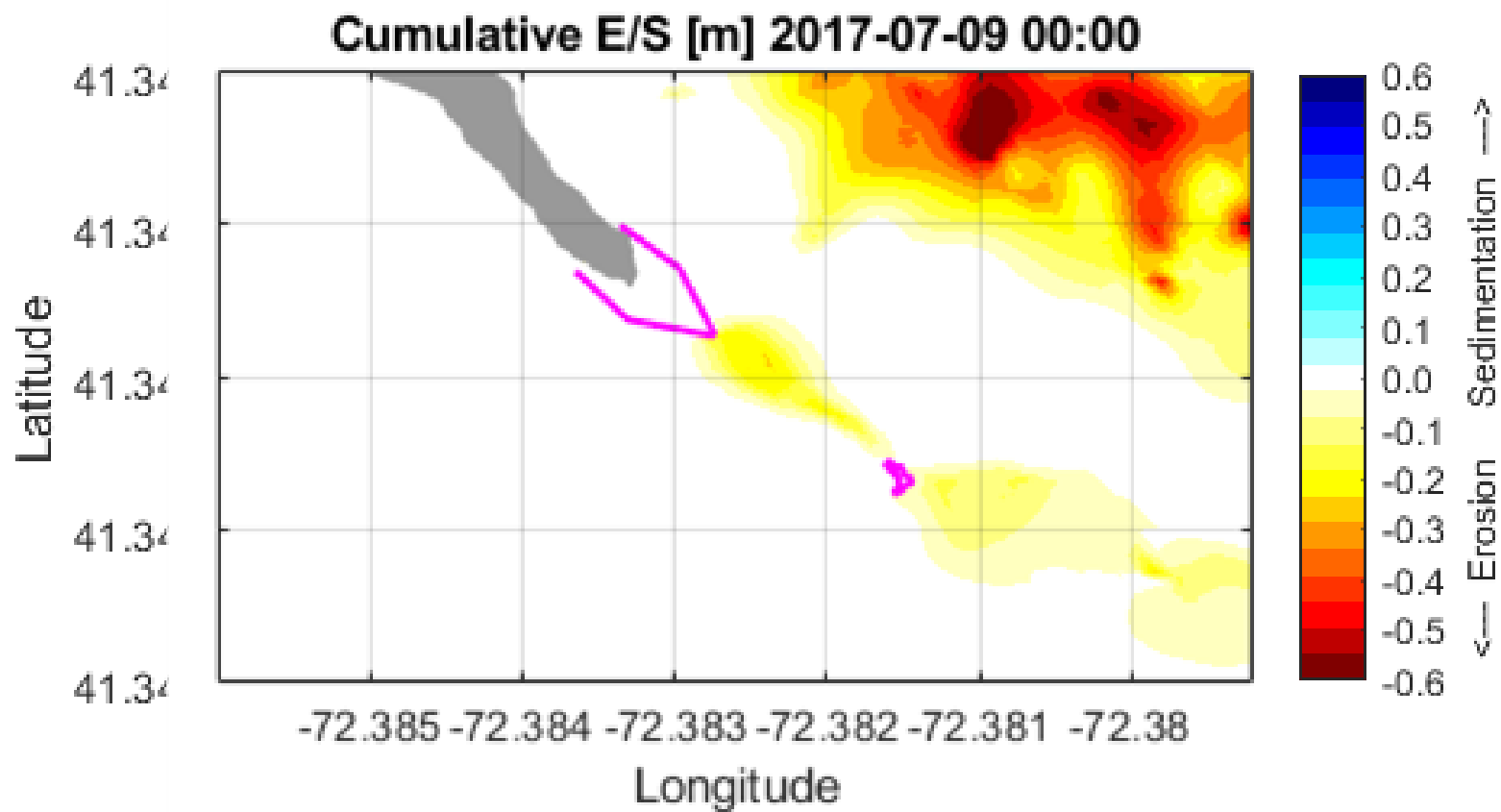
P2E = 2014-05-01 until 2014-05-16 = 15 days

P3E = 2017-06-24 until 2017-07-09 = 15 days

Scaled 25 x

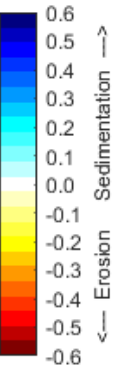
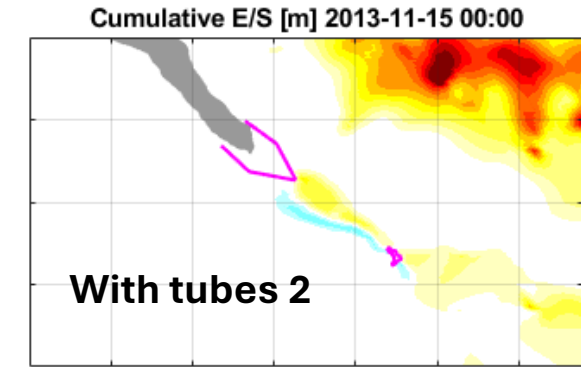
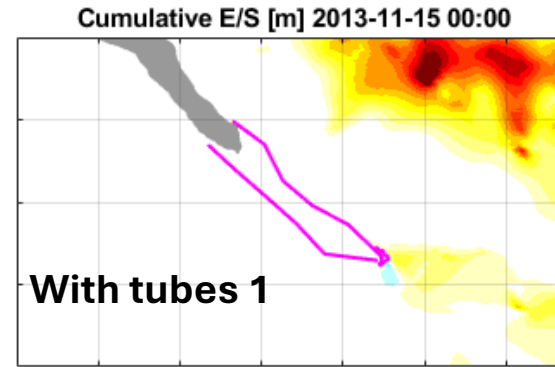
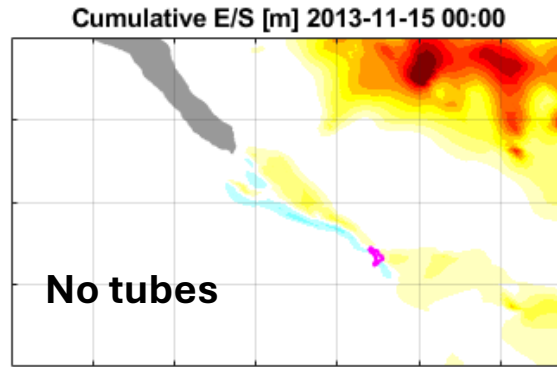






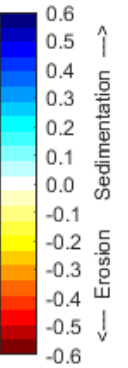
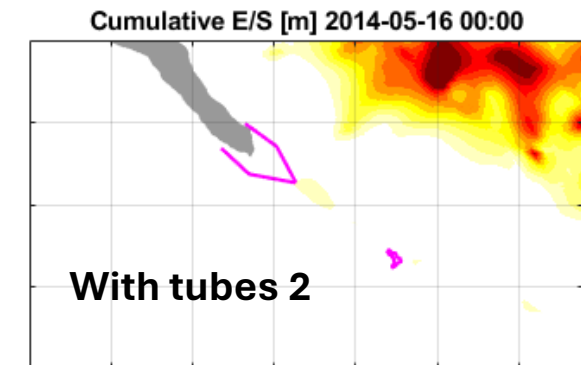
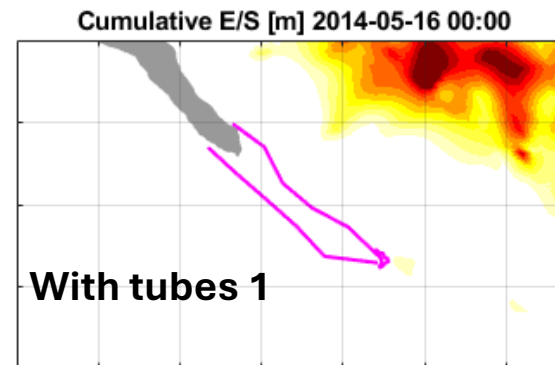
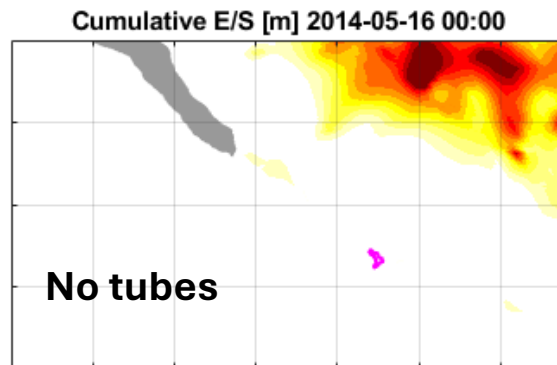
Period 1

(lower river discharge)



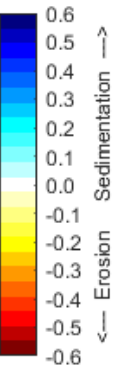
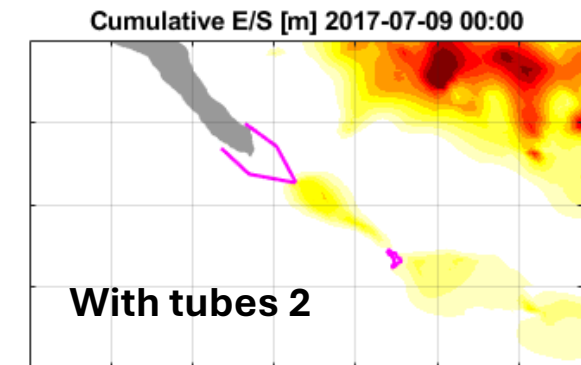
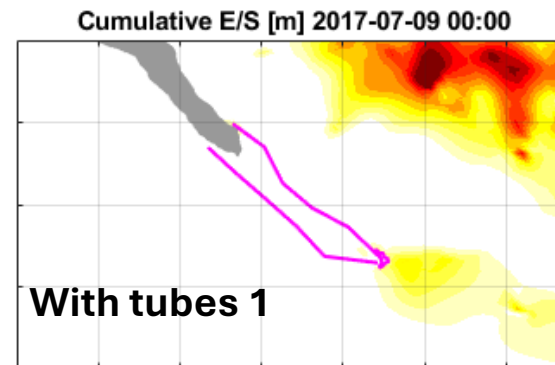
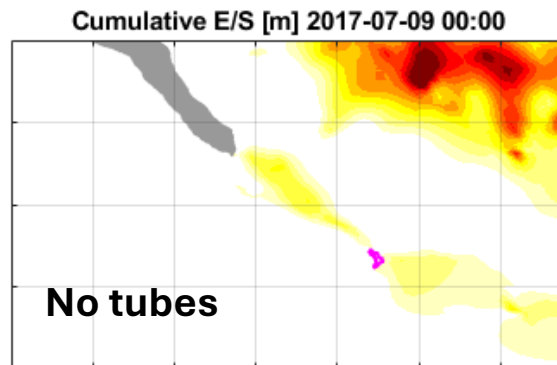
Period 2

(higher river discharge)

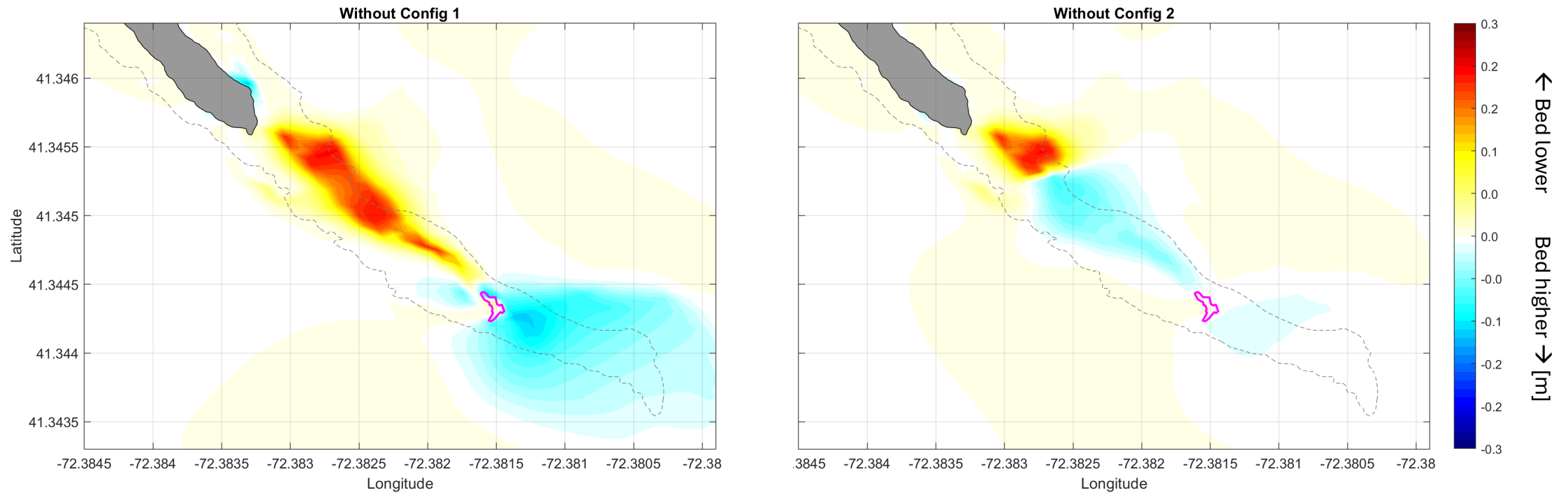


Period 3

(lower river discharge)

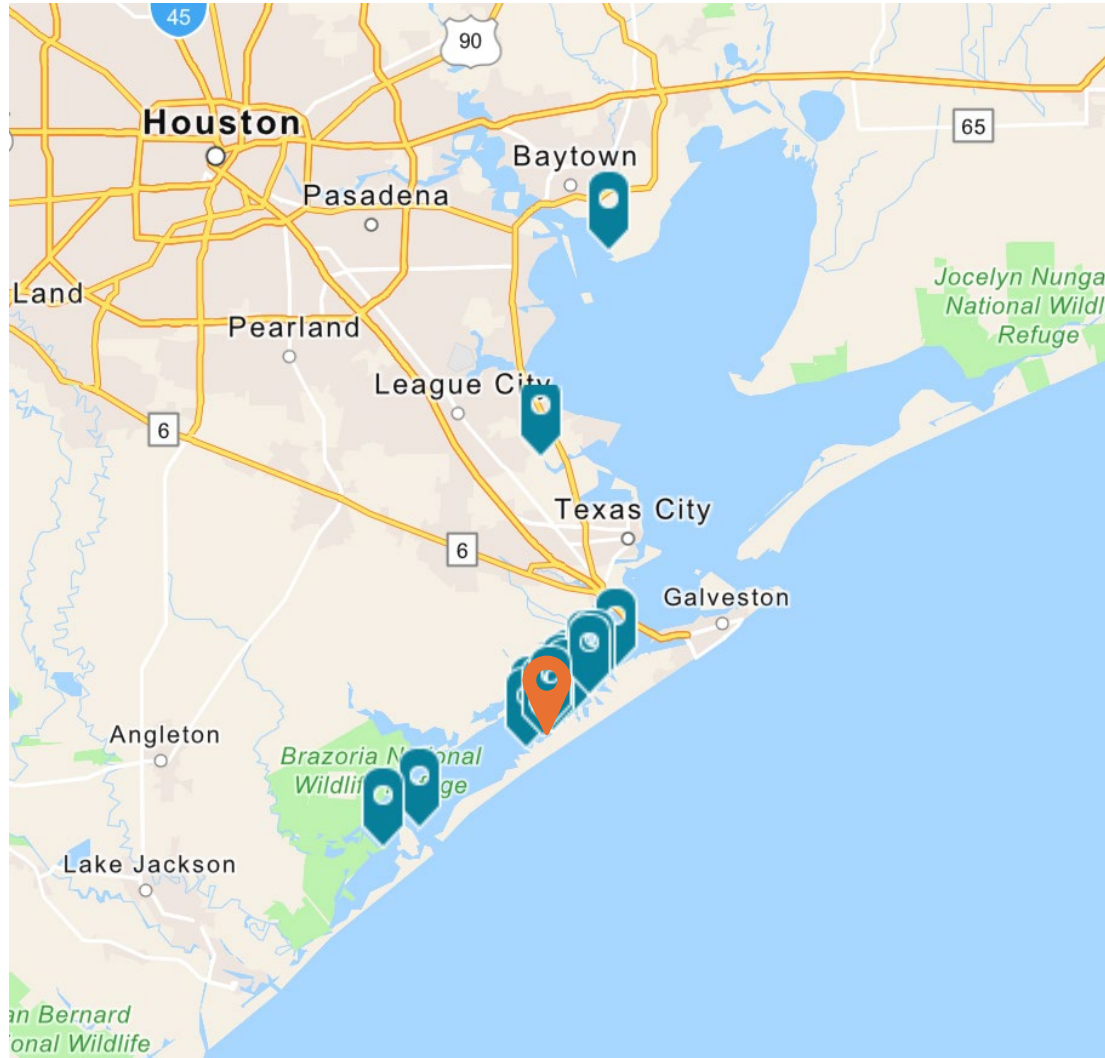


Difference in net bed level change



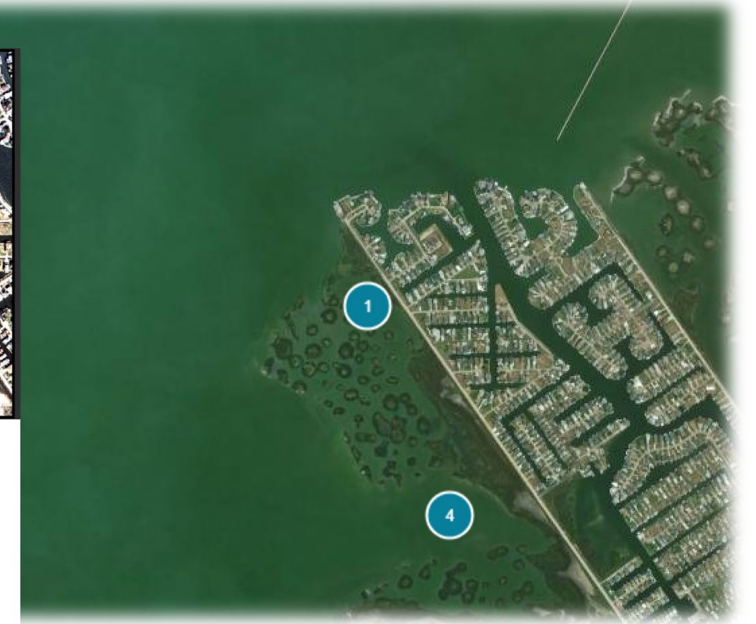
Findings

- Virtual Envirotube deployments and backfill in the model reduced erosion in the vicinity of the SE tail of Thatchbed Island.
- The impact of virtual deployments was more pronounced during lower river discharge scenarios (which do not necessarily translate to more energetic forcing near the Island).
- Under more erosive conditions Configuration 1 (larger) provides noticeably more benefit than Configuration 2 (smaller).
- When erosion is weak (e.g. Period 2), differences between Configurations 1 and 2 is negligible.
- The simulations suggest that significant remote impacts of the interventions are unlikely.

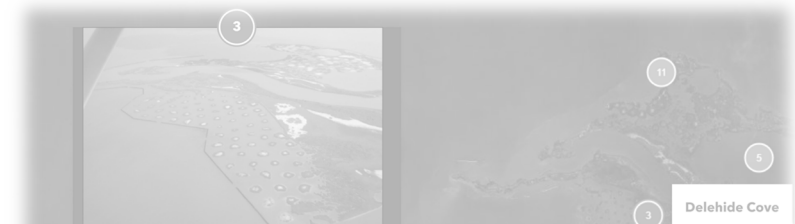


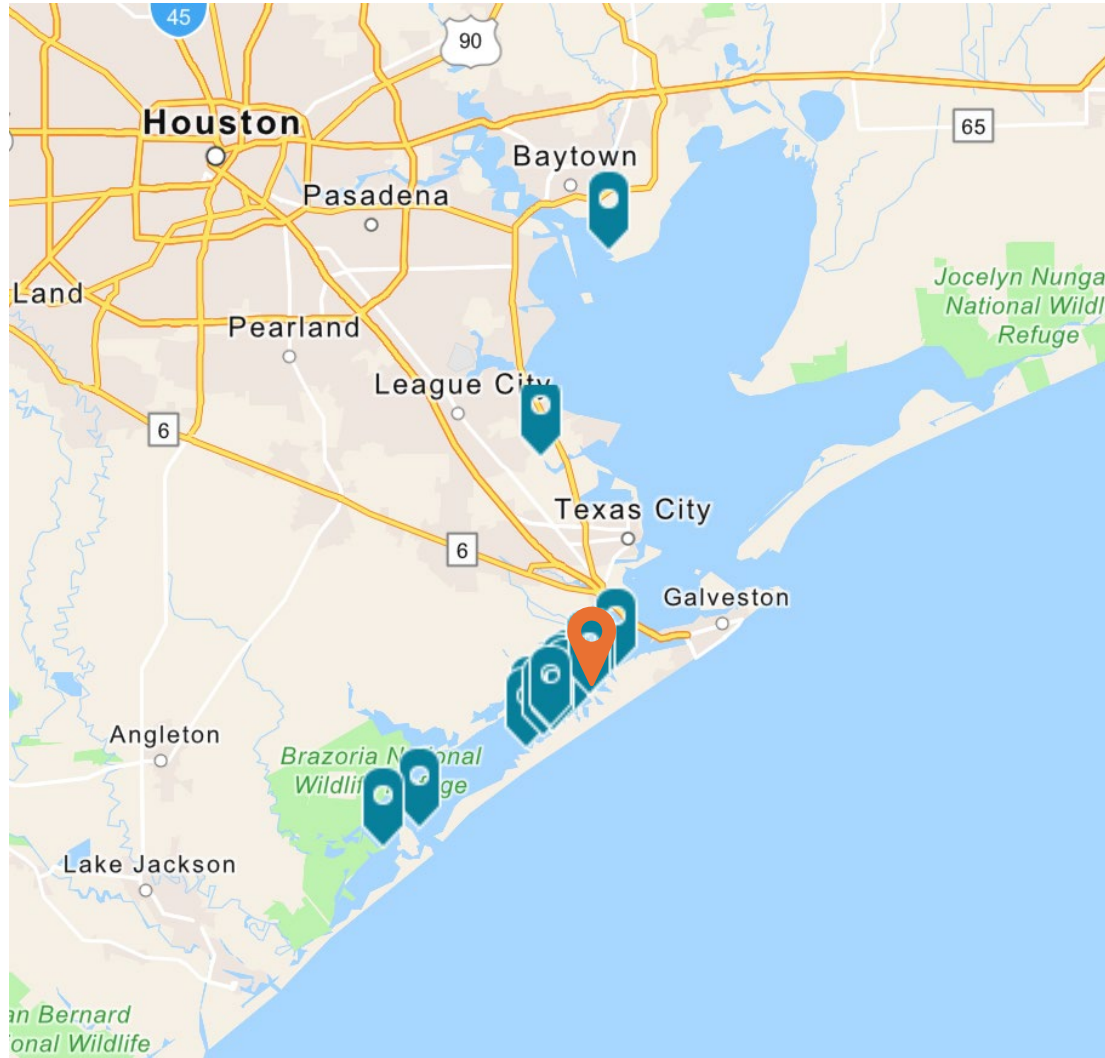
Jumbile Cove I

*Jumbile Cove Restoration Project
Phase I (May-August 2001)*



2800 LF tube





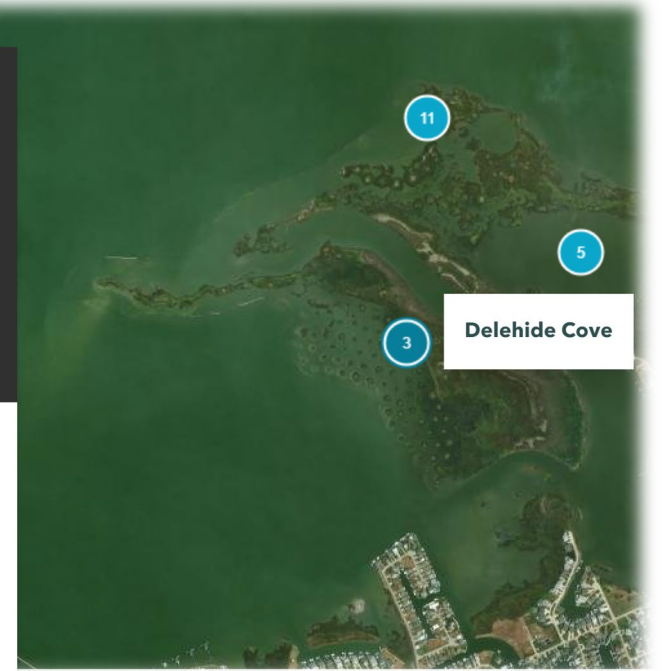
Jumble Cove I

Jumble Cove Restoration Project
Phase I (May-August 2001)

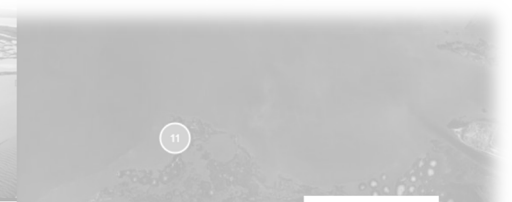


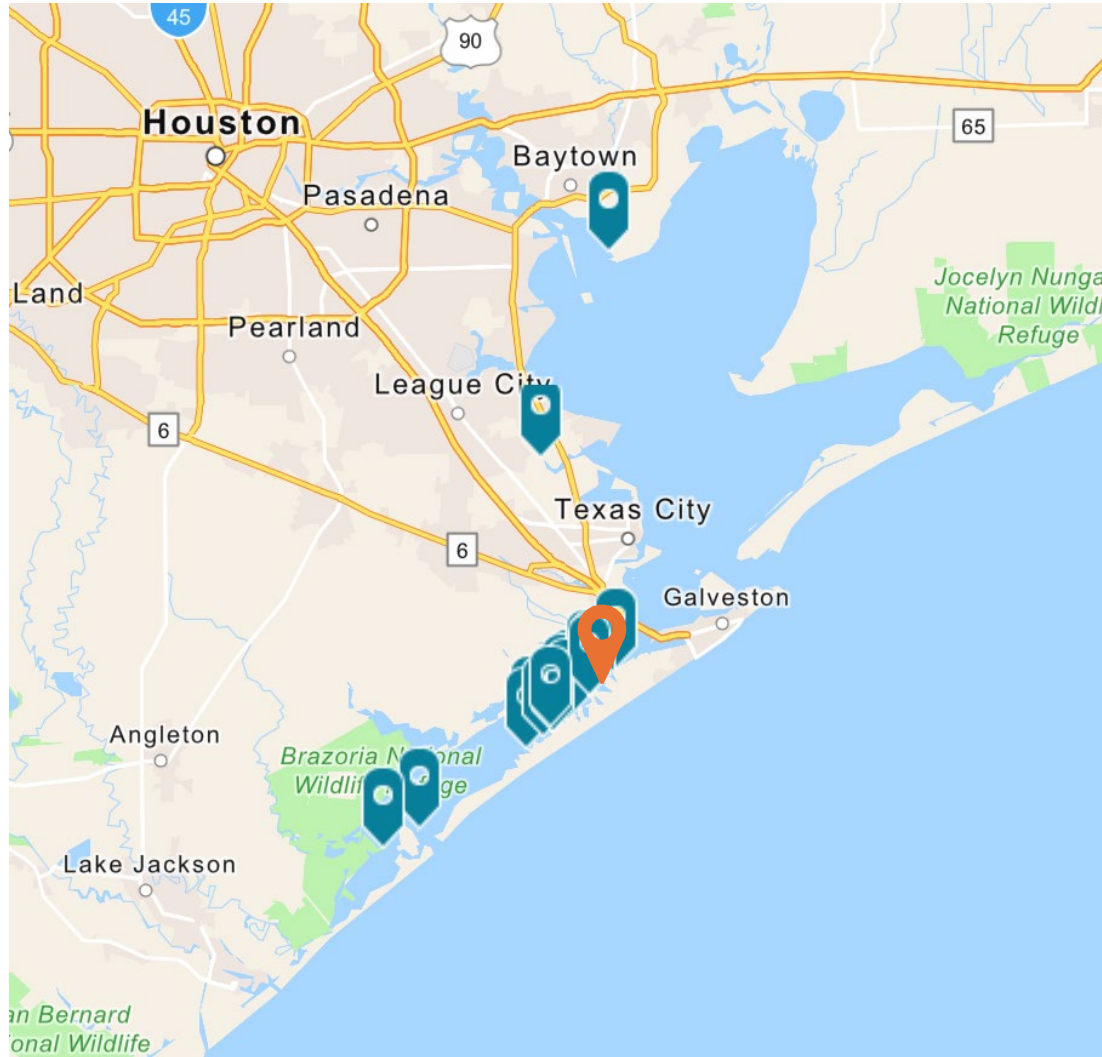
Delehide Cove

Delehide Cove Wetland and Water
Quality Protection Project (July
2003-April 2004)



8100 LF tube



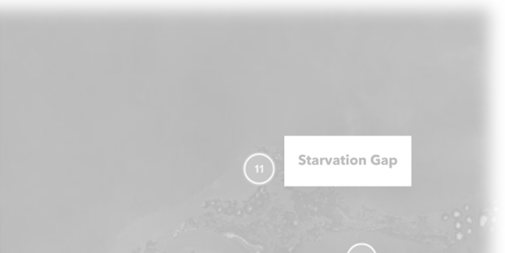
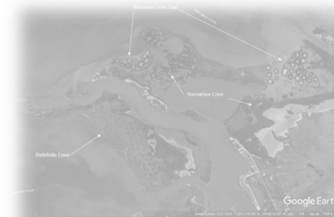


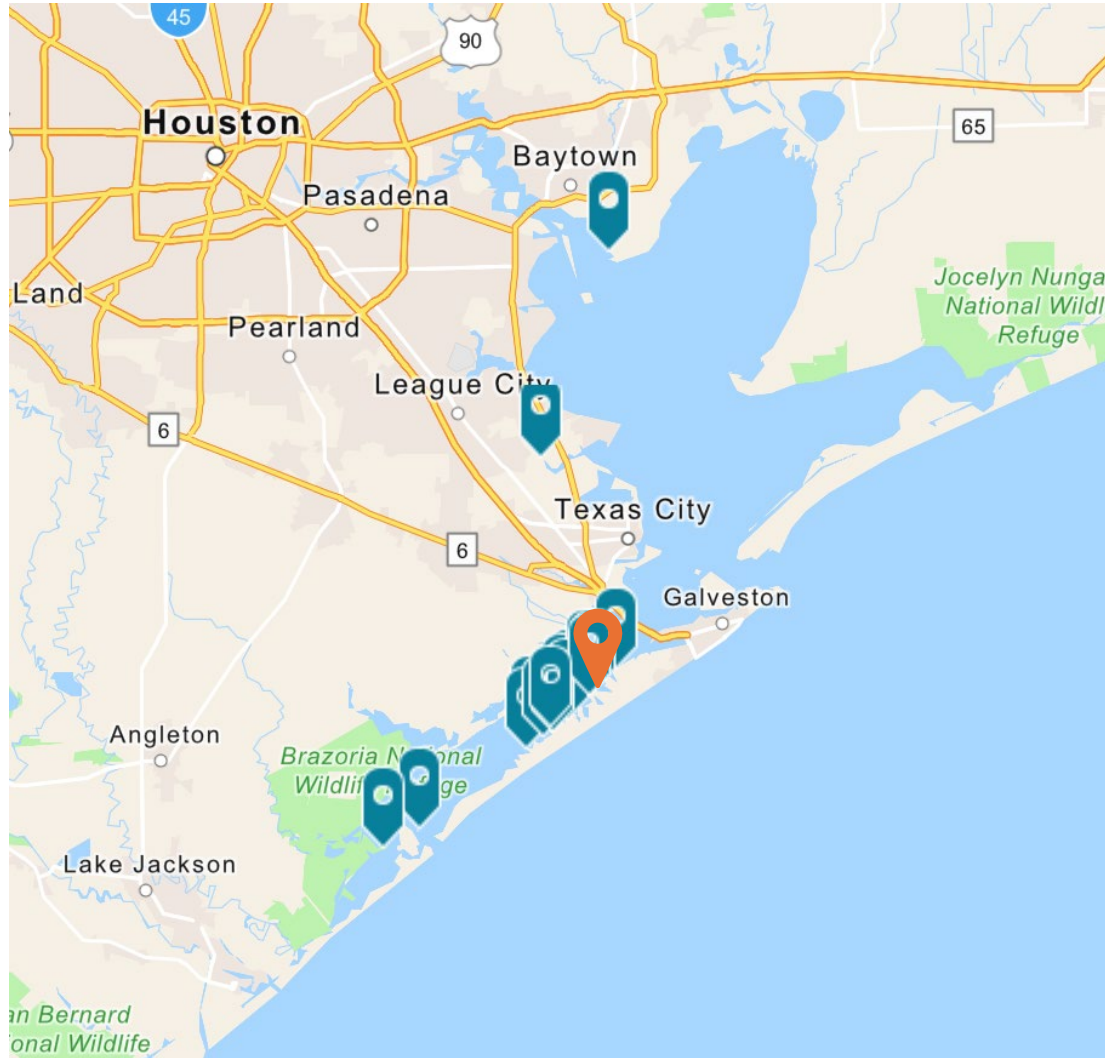
Starvation Cove

Starvation Cove Wetlands and Water Quality Protection Project (July-November 2005)



3200 LF tube





Starvation Cove

Starvation Cove Wetlands and Water Quality Protection Project (July-November 2005)



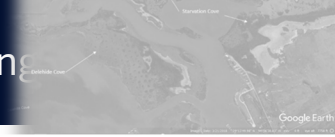
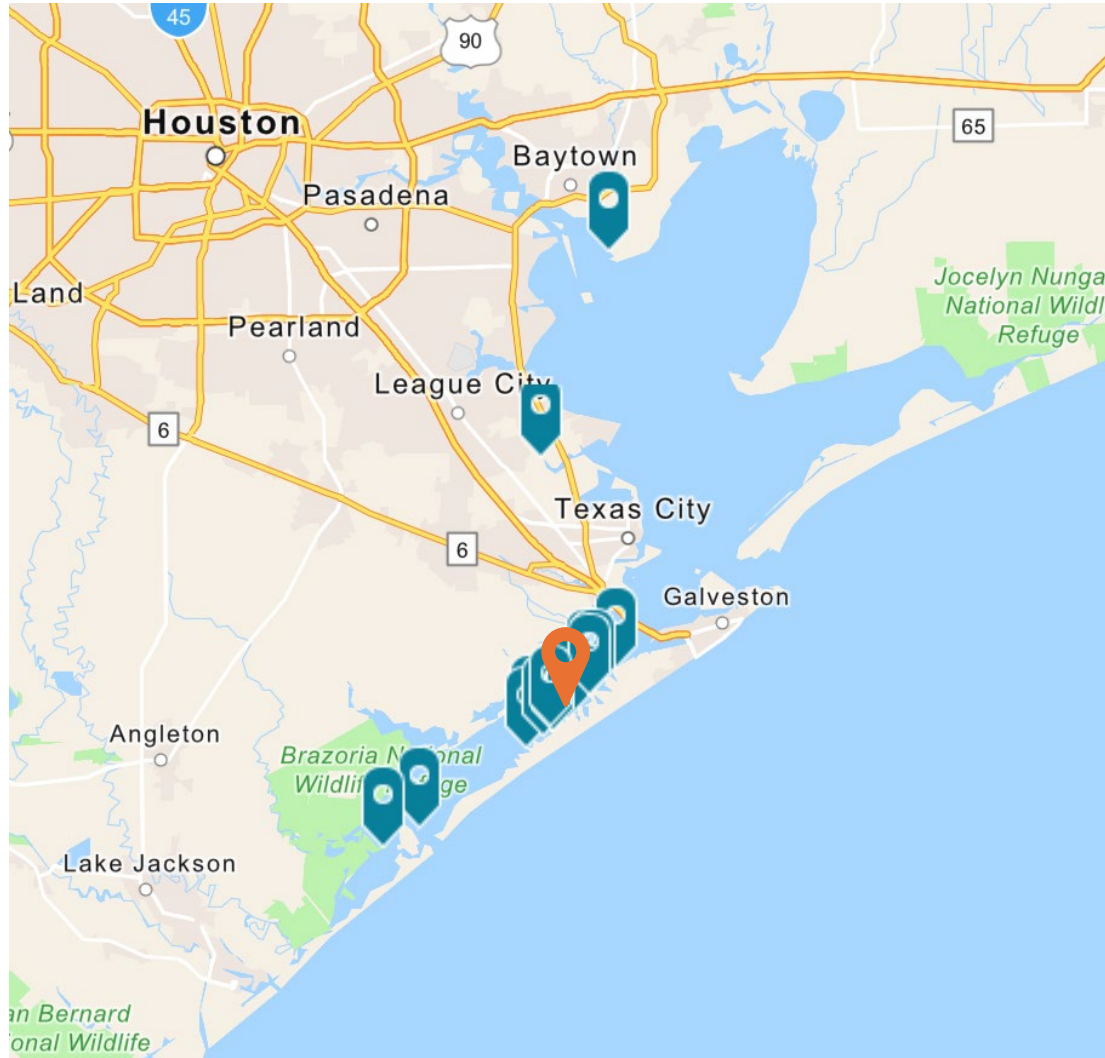
Starvation Gap

Starvation Gap Wetland and Water Quality Protection Project (April-August 2012)



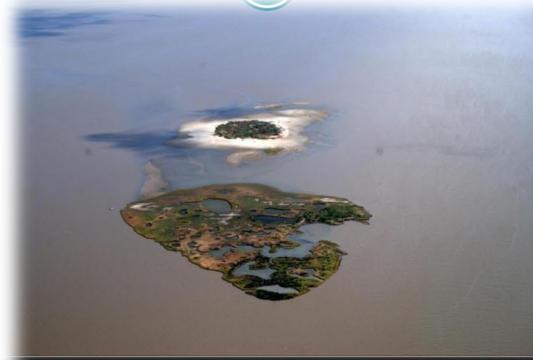
1350 LF tube





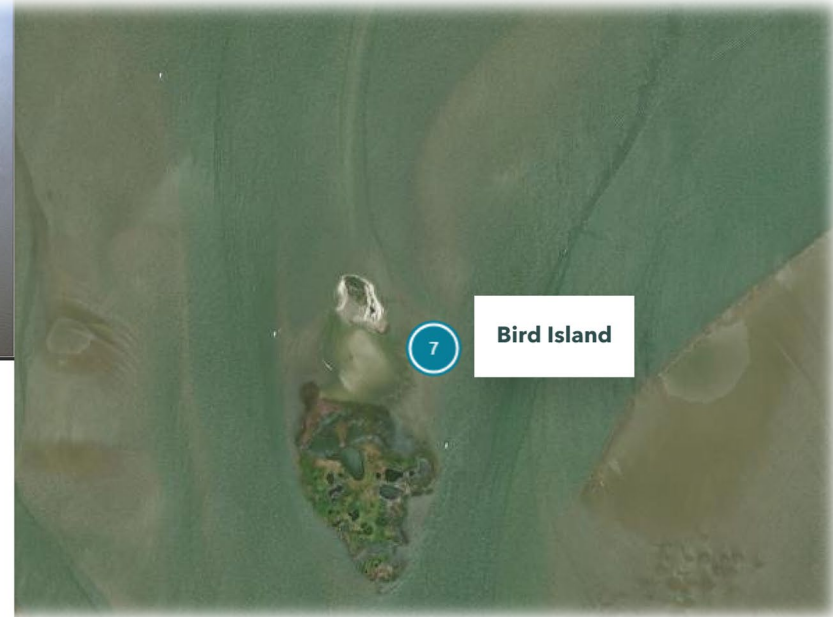
Starvation Gap

Starvation Gap Wetland and Water Quality Protection Project (April-August 2019)



Bird Island

West Bay Bird Island Protection and Marsh Restoration Project (December-February 2006)



2000 LF tube

Hoecker's Point

20250820_113308.jpg

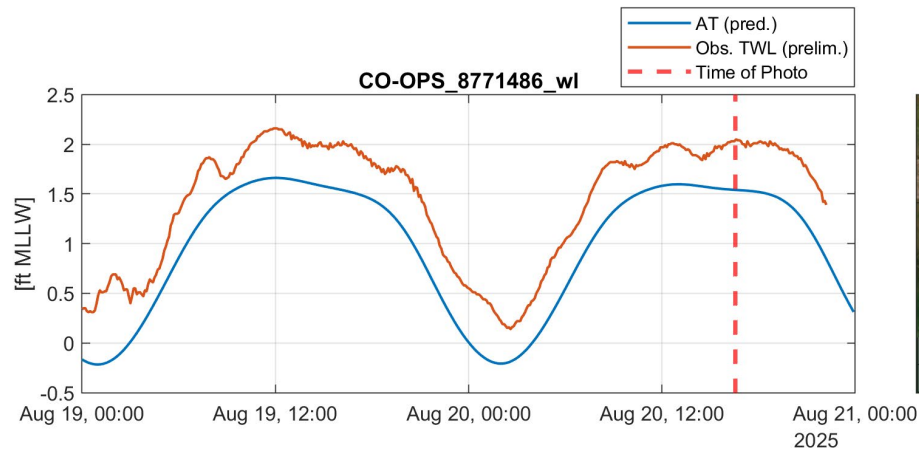
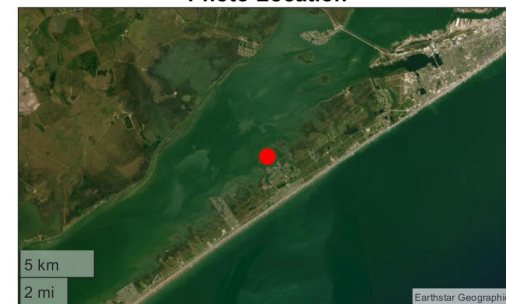
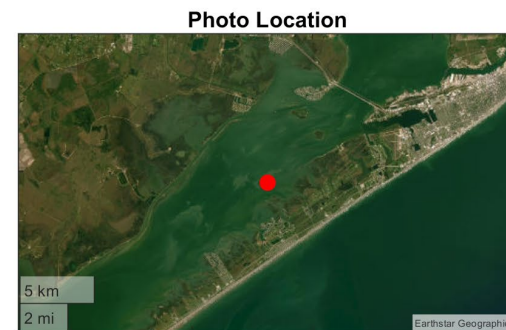
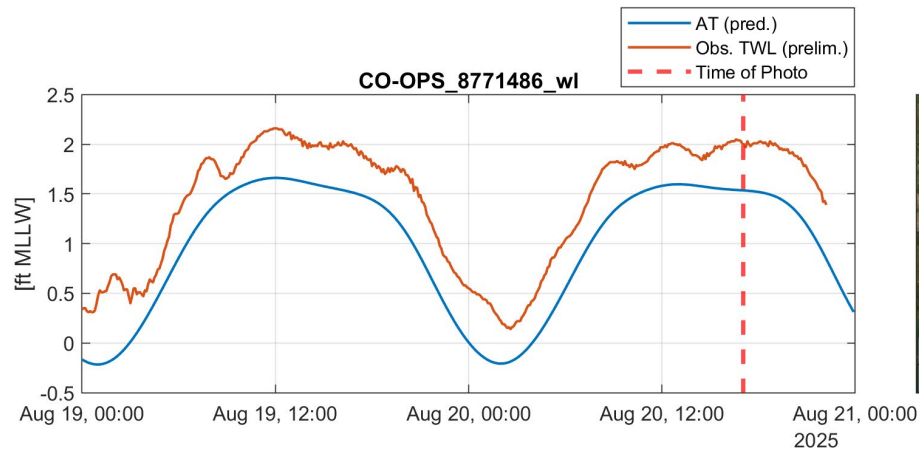


Photo Location



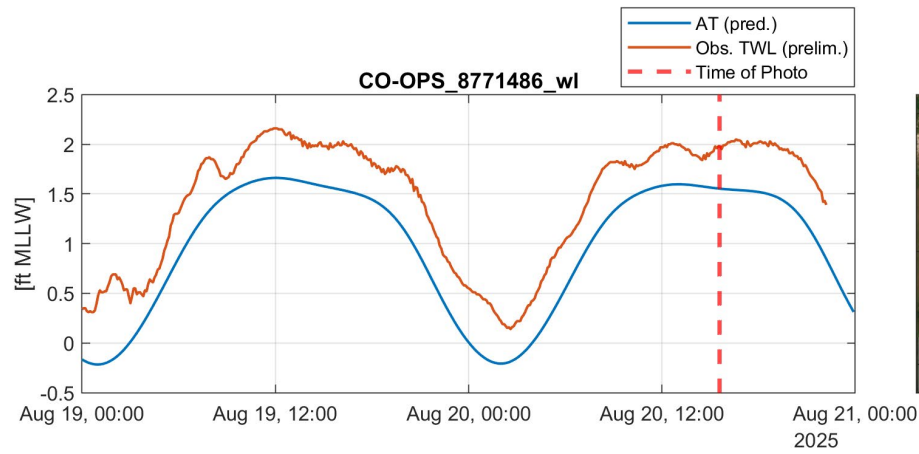
Starvation Cove

20250820_120221.jpg



Bird Island Cove

20250820_103455.jpg



What we learned from Interviews

Consensus

- Human interaction the #1 failure driver.
- Maintenance is unavoidable
- Design choices matter

Divergence

- Service life: ~5–10 yrs (high-maintenance, exposed sites) vs 15–25 yrs (well-sited, low-energy).
- Program stance: TX resource agencies largely moved away from geotubes in marsh settings; some stakeholders still value them where barge access is limited and budgets are tight.

What we need to look out at Thatchbed?

- Ice + Currents + floating debris
- Boat wakes & public interaction
- Navigation safety
- Materials & fill
- Longevity & end-of-life

Recommendations

- Phase implementation with a pilot at the southeast tail to prove constructability, verify performance, and quantify maintenance burden before scaling.
- Prefer stone sills at highest-energy/traffic margins; reserve geotextile containment for calmer segments.
- Set and survey crest/backfill/gap elevations in datum; establish an exclusion zone with marking/signage (no mooring/landing) and seasonal inspections (post-storm/ice).
- Require an operation and maintenance plan Define success metrics in advance

THANKS

CONTACT:

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Project Team:

James O'Donnell – Executive Director and Prof. Marine Sciences UConn

Yaprak Onat – Associate Director of Research

Marc De Vos – Research Associate

Alejandro Cifuentes-Lorenzen – Associate Research Scientist

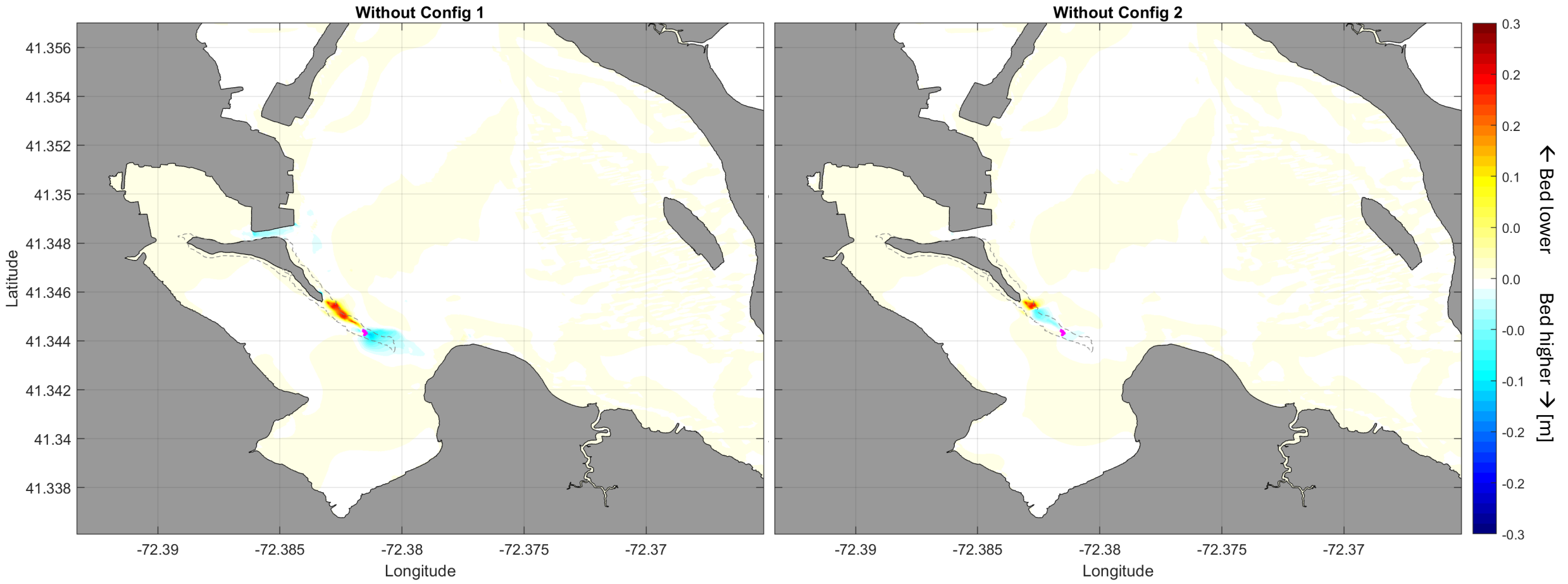
Kay Howard-Strobel – Research Associate

Carson Hill – Oceanographic Research Assistant

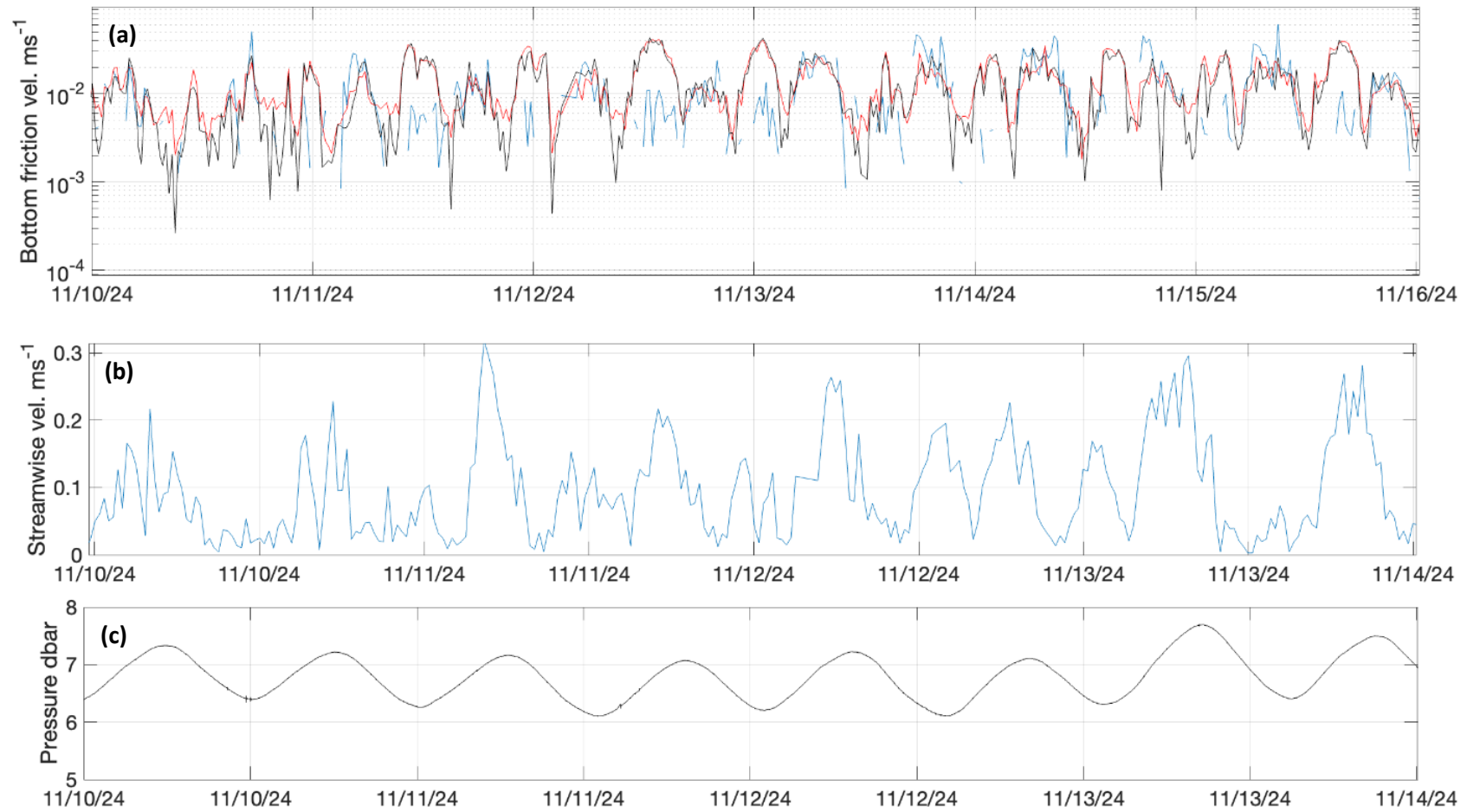
Nathan Robinson – Research Assistant

Extra Slides

Far-field impacts



Station	Description	Deployed Location (depth M)	Recovered Location (depth M)	Distance Moved (direction)	Deployment Dates (2024)	Deployment Length (days)
TB1-UP	Uplooking, mid-channel CT River	41° 21.614 N 72° 22.623 W (5.5)	41° 21.614 N 72° 22.623 W (5.5)	0	8 Nov-2024 -> 25 Feb 2025	109
TB1-DWN	Downlooking, mid-channel CT River	41° 21.626 N 72° 22.605 W (5.2)	41° 21.626 N 72° 22.605 W (6.8)	0	8 Nov -> 25 Nov	17 (battery limited)
TB2-UP	Uplooking, northeast side of Thatchbed Island	41° 20.878 N 72° 23.015 W (1.4)	41° 20.711 N 72° 22.895 W (1.2)	352 m (151°T)	8 Nov -> 31 Dec	53
TB2-DWN	Downlooking, northeast side of Thatchbed Island	41° 20.878 N 72° 23.009 W (1.4)	41° 20.878 N 72° 23.009 W (2.1)	0	8 Nov -> 26 Nov	18 (battery limited)
TB3-UP	Uplooking, southeast side of Thatchbed Island	41° 20.772 N 72° 22.950 W (1.1)	41° 20.724 N 72° 22.797 W (2.9)	231 m (112°T)	8 Nov -> 31 Dec	53
TB3-DWN	Downlooking, southeast side of Thatchbed Island	41° 20.778 N 72° 22.955 W (1.1)	41° 20.782 N 72° 22.976 W (1.8)	29.8 m (284°T)	8 Nov -> 31 Dec	53



[Figure 1](#). Example of processed data from the Nortek Aquadopp instruments at Thatchbed Island site TB1. Panel (a) shows bottom friction velocity. Panel (b) shows streamwise velocity of the mean flow and Panel (c) shows pressure at the instrument head.

SAMPLE STATISTICS

SAMPLE IDENTITY: TB Stn1 - 14 Nov 2024

SAMPLE TYPE: Unimodal, Poorly Sorted

TEXTURAL GROUP: Slightly Gravelly Sand

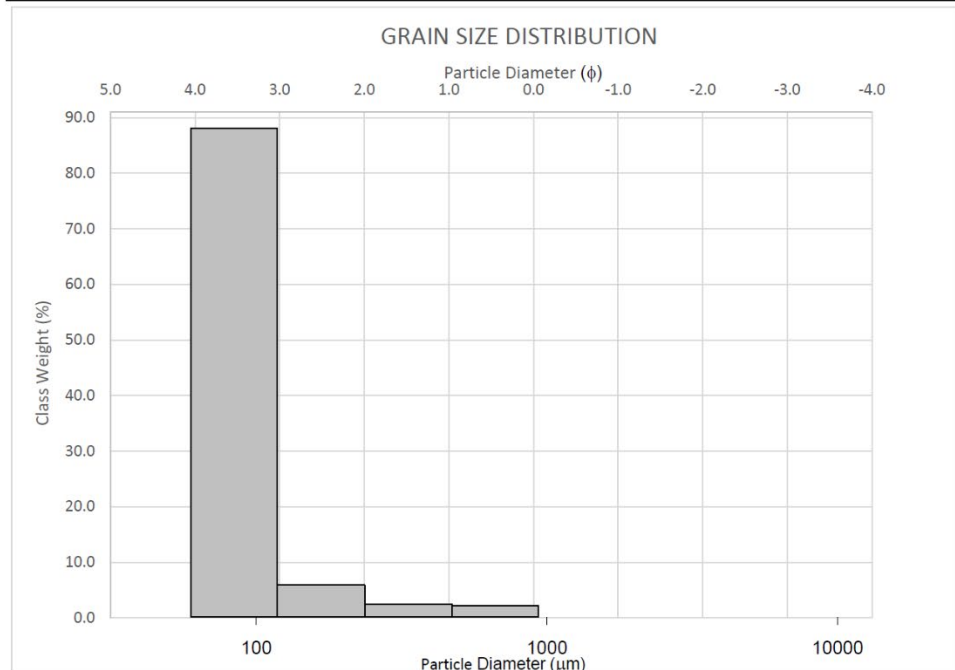
SEDIMENT NAME: Slightly Very Fine Gravelly Medium Sand

	μm		f		GRAIN SIZE DISTRIBUTION	
	μm	f	GRAVEL: 0.1%	V COARSE SAND: 0.9%	COARSE SAND: 22.1%	MEDIUM SAND: 63.6%
MODE 1:	375.0	1.500	SAND: 94.1%	COARSE SAND: 22.1%	FINE SAND: 5.8%	V FINE SAND: 1.7%
MODE 2:			MUD: 5.8%			
MODE 3:						
D ₁₀ :	168.4	0.408				
MEDIAN or D ₅₀ :	372.9	1.423				
D ₉₀ :	753.7	2.570				
(D ₉₀ / D ₁₀):	4.475	6.300				
(D ₉₀ - D ₁₀):	585.3	2.162				
(D ₇₅ / D ₂₅):	1.725	1.763				
(D ₇₅ - D ₂₅):	205.7	0.786				
					SILT: 5.1%	CLAY: 0.7%

	METHOD OF MOMENTS			FOLK & WARD METHOD		
	Arithmetic μm	Geometric μm	Logarithmic f	Geometric μm	Logarithmic f	Description
MEAN(\bar{x}):	434.0	314.3	1.670	391.3	1.354	Medium Sand
SORTING (s):	228.5	2.739	1.453	1.974	0.981	Poorly Sorted
SKEWNESS (Sk):	1.507	-2.748	2.748	-0.134	0.134	Fine Skewed
KURTOSIS (K):	9.867	10.66	10.66	2.275	2.275	Very Leptokurtic



■ Gravel ■ Sand ■ Mud



Station ID	Sample Date	Location		Depth (M)	Gravel+Sand:Silt:Clay			Textural Group	SMC (mg/L)	
		(Deg Dec.Min)			(%)				Near Btm	Btm
TB Stn1	14 Nov 2024	41° 21.6360' N	72° 22.6130' W	6.9	94.2	5.1	0.7	Slightly Gravelly Sand	11.7	17.2
TB Stn2	14 Nov 2024	41° 20.8823' N	72° 23.0180' W	2.9	80.3	7.0	12.7	Muddy Sand	19.0	17.3
TB Stn3	14 Nov 2024	41° 20.7792' N	72° 22.9548' W	2.0	41.7	58.3.2	6.2	Sandy Mud	11.7	18.5
TB Stn1	31 Dec 2024	41° 21.6360' N	72° 22.6130' W	7.0	-	-	-	-	3.3	3.5
TB Stn2	31 Dec 2024	41° 20.8823' N	72° 23.0180' W	2.1	-	-	-	-	2.9	3.2
TB Stn3	31 Dec 2024	41° 20.7792' N	72° 22.9548' W	1.9	-	-	-	-	3.5	3.6
TB SS1	26 Feb 2025	41° 21.3662' N	72° 22.9159' W	4.9	90.2	7.3	2.5	Sand	-	-
TB SS2	26 Feb 2025	41° 21.3484' N	72° 22.7552' W	5.3	99.2	<1	<1	Slightly Gravelly Sand	-	-
TB SS3	26 Feb 2025	41° 21.3232' N	72° 22.5973' W	3.8	99.2	<1	<1	Sand	-	-
TB SS4	26 Feb 2025	41° 21.3033' N	72° 22.4352' W	1.8	99.0	<1	<1	Sand	-	-
TB SS5	26 Feb 2025	41° 21.1449' N	72° 22.5610' W	3.3	99.2	<1	<1	Slightly Gravelly Sand	-	-
TB SS6	26 Feb 2025	41° 21.1596' N	72° 22.7049' W	3.5	99.1	<1	<1	Sand	-	-
TB SS7	26 Feb 2025	41° 21.1701' N	72° 22.8517' W	5.3	99.0	<1	<1	Slightly Gravelly Sand	-	-
TB SS8	26 Feb 2025	41° 21.1858' N	72° 22.9872' W	5.3	73.0	21.5	5.5	Slightly Gravelly Muddy Sand	-	-
TB SS9	26 Feb 2025	41° 20.8753' N	72° 23.0277' W	0.8	36.8	54.8	8.4	Sandy Mud	-	-
TB SS10	26 Feb 2025	41° 20.9057' N	72° 22.9076' W	4.8	95.5	2.6	1.9	Slightly Gravelly Sand	-	-
TB SS11	26 Feb 2025	41° 20.9288' N	72° 22.8013' W	4.7	99.4	<1	<1	Slightly Gravelly Sand	-	-
TB SS12	26 Feb 2025	41° 20.9603' N	72° 22.6965' W	3.7	99.5	<1	<1	Slightly Gravelly Sand	-	-
TB SS13	26 Feb 2025	41° 20.9896' N	72° 22.5917' W	4.0	99.4	<1	<1	Slightly Gravelly Sand	-	-
TB SS14	26 Feb 2025	41° 20.8648' N	72° 22.5135' W	4.1	99.4	<1	<1	Gravelly Sand	-	-
TB SS15	26 Feb 2025	41° 20.8165' N	72° 22.6029' W	4.8	99.0	<1	<1	Slightly Gravelly Sand	-	-
TB SS16	26 Feb 2025	41° 20.7494' N	72° 22.7147' W	7.3	98.7	0.2	1.1	Slightly Gravelly Sand	-	-
TB SS17	26 Feb 2025	41° 20.6885' N	72° 22.8139' W	3.7	70.6	25.7	3.7	Slightly Gravelly Muddy Sand	-	-
TB SS18	26 Feb 2025	41° 20.5595' N	72° 22.4086' W	5.5	98.5	<1	<1	Sandy Gravel	-	-
TB SS19	26 Feb 2025	41° 20.6161' N	72° 22.3471' W	11.7	98.7	<1	<1	Slightly Gravelly Sand	-	-
TB SS20	26 Feb 2025	41° 20.6707' N	72° 22.2926' W	2.4	99.4	<1	<1	Sand	-	-