

CASTLE NECK RIVER RESTORATION MONITORING Pre-Restoration Baseline Findings (2024-2025)



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IPSWICH RIVER
WATERSHED ASSOCIATION

New Hampshire

North Shore, Massachusetts

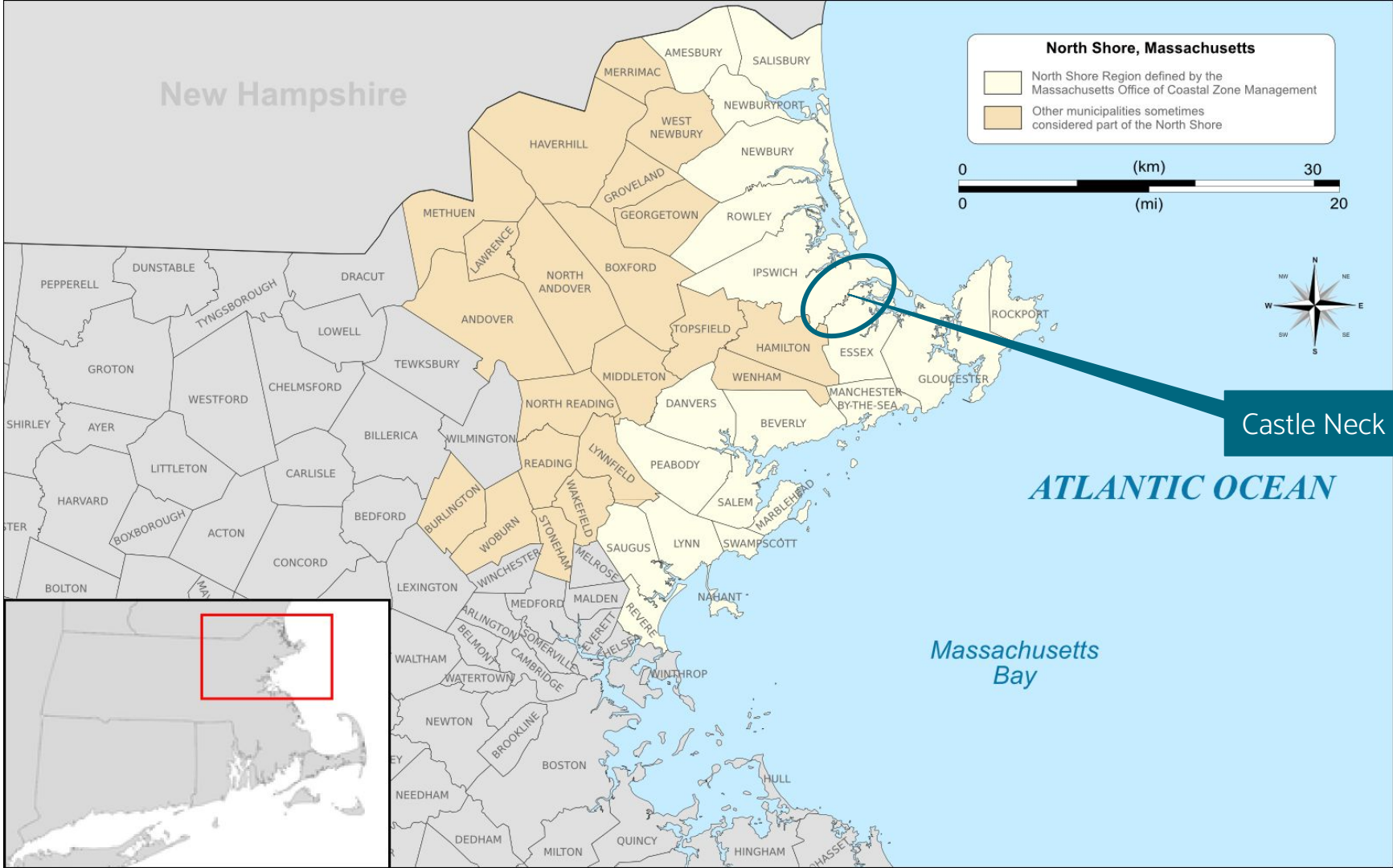
-  North Shore Region defined by the Massachusetts Office of Coastal Zone Management
-  Other municipalities sometimes considered part of the North Shore



Castle Neck River

ATLANTIC OCEAN

Massachusetts Bay





Project Site

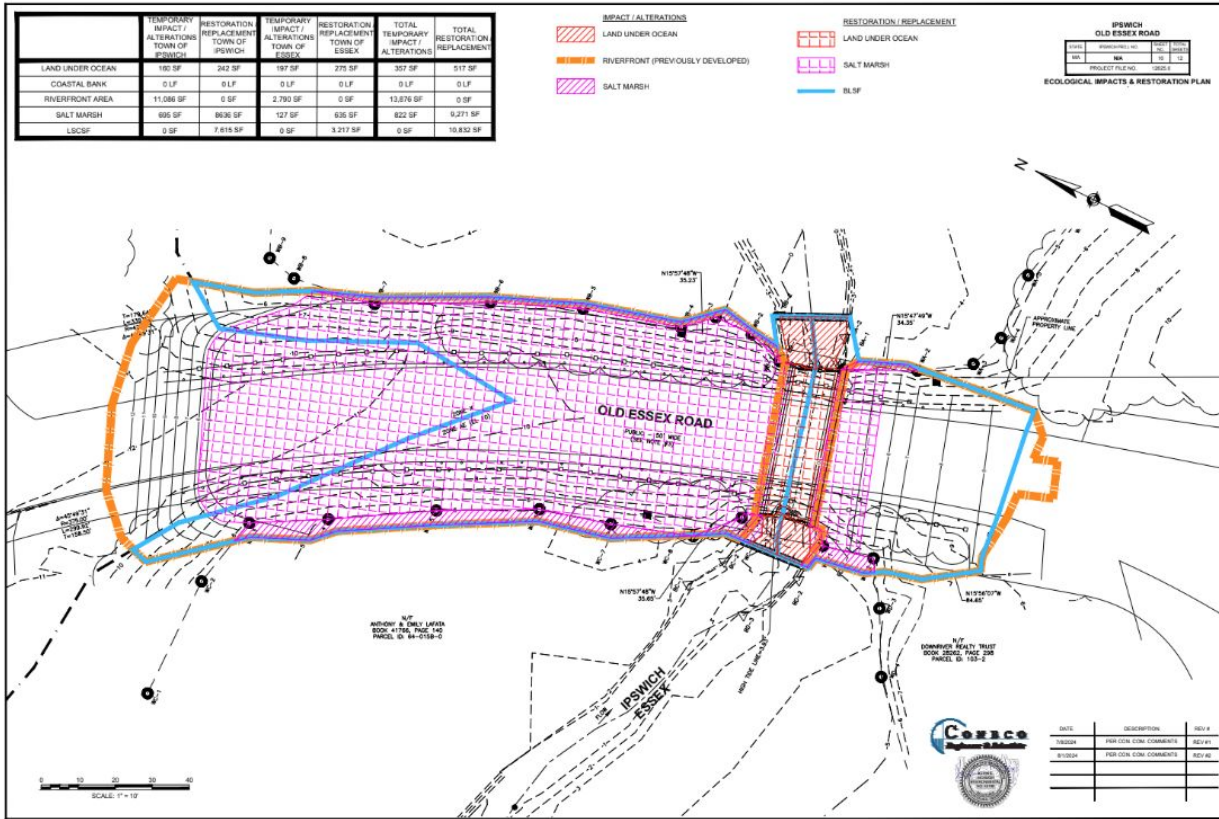


Old Essex Road culvert is **undersized** and **restricts tidal flow**
Roadway **fragments marsh habitat**

Impacts:

- Pooling
- Erosion
- Delayed tidal flux
- Impaired marsh health
- Limited stream and habitat connectivity

PROJECT IMPORTANCE

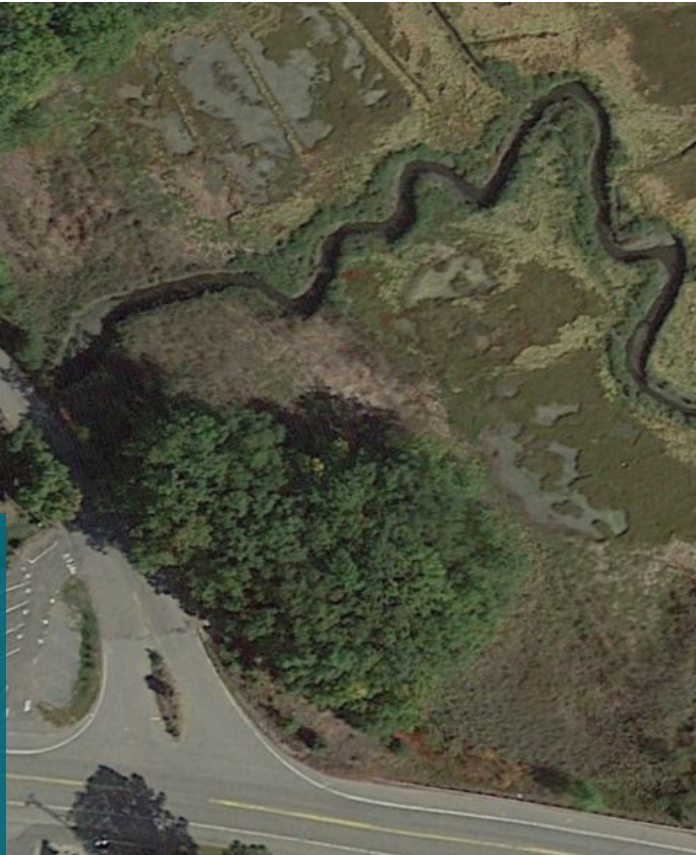


ABOUT THE PROJECT

Remove ~14,000 sq ft of roadway
 Remove undersized culvert
 Daylight Castle Neck River
 Goals:

- Restore tidal exchange
- Improve water quality
- Reconnect marsh habitat

MONITORING OBJECTIVES

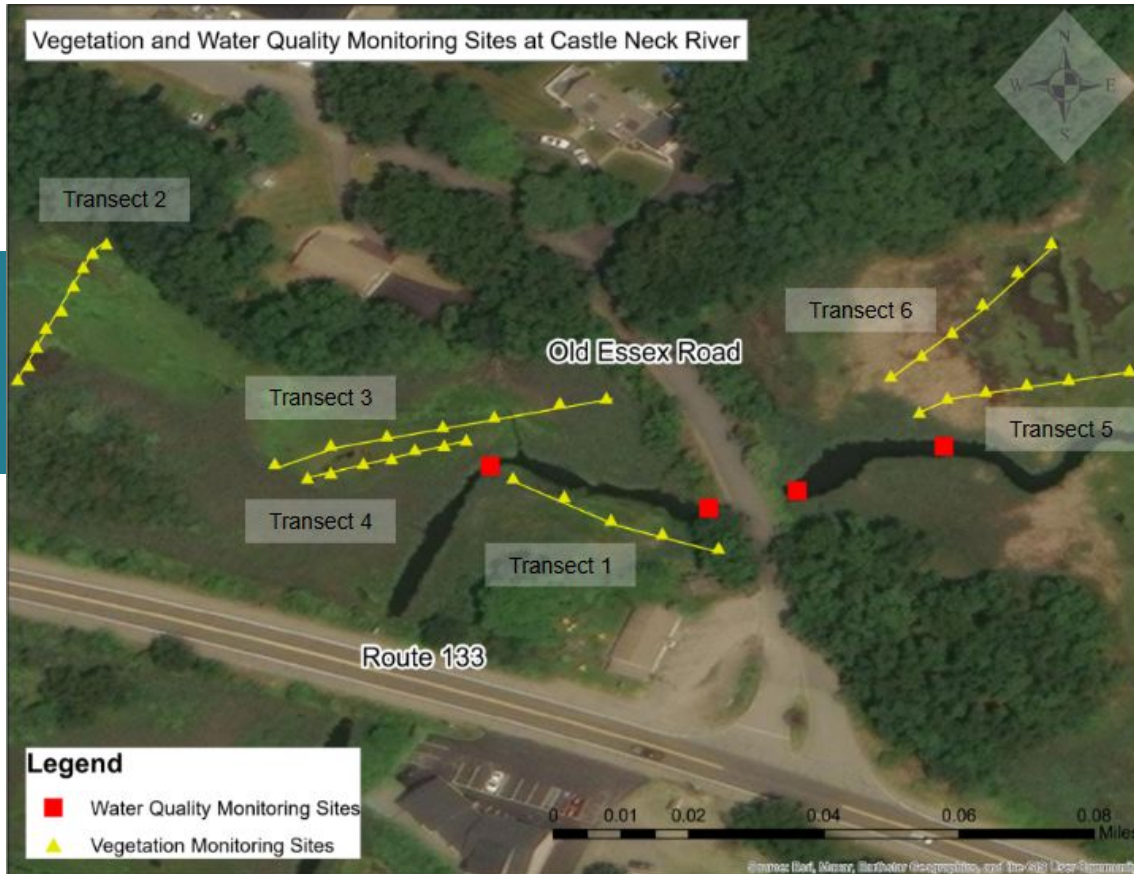


Establish pre-restoration baseline conditions

Track ecosystem health indicators:

- Water quality
- Marsh vegetation composition
- Forage fish species abundance

Enable future pre vs. post restoration comparisons



PROJECT MAP

2 Discrete Stations

- Inlet & Outlet

4 Continuous Stations

- Upstream, Inlet, Outlet, & Downstream

6 Vegetation Transects

- 4 on the upstream end, 2 on the downstream end



**DISCRETE WATER
QUALITY
MONITORING**



**CONTINUOUS
WATER QUALITY
MONITORING**



**MARSH
VEGETATION
TRANSECT
SURVEYS**



**FORAGE FISH
SAMPLING**



Parameters: Temperature, Dissolved Oxygen, Conductivity & Salinity

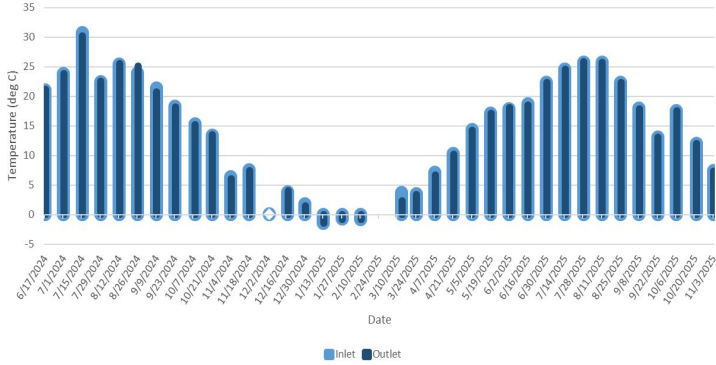
Purpose: Detect culvert impacts on water quality

Key Finding: No measurable difference between inlet and outlet

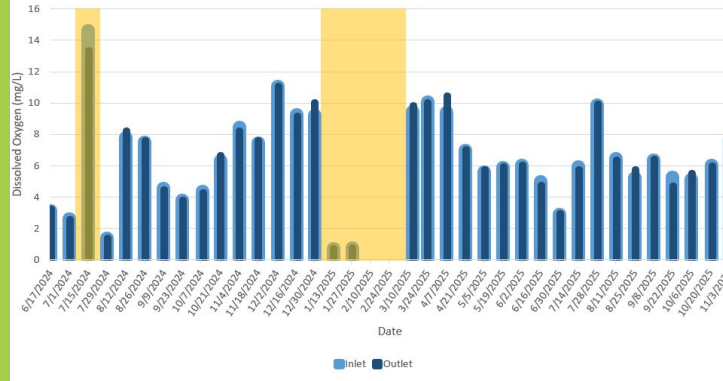
DISCRETE WATER QUALITY MONITORING

DISCRETE WATER QUALITY MONITORING RESULTS

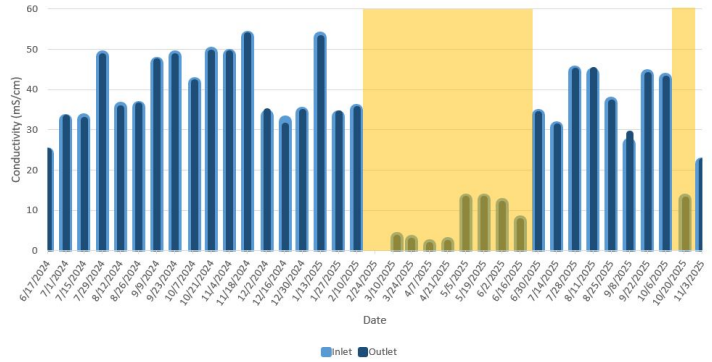
Temperature over Time



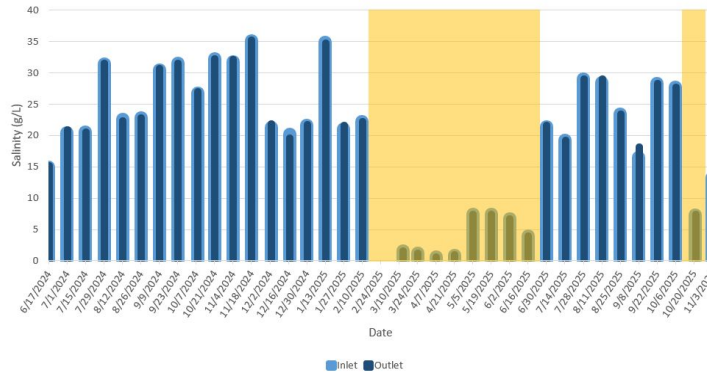
Dissolved Oxygen over Time

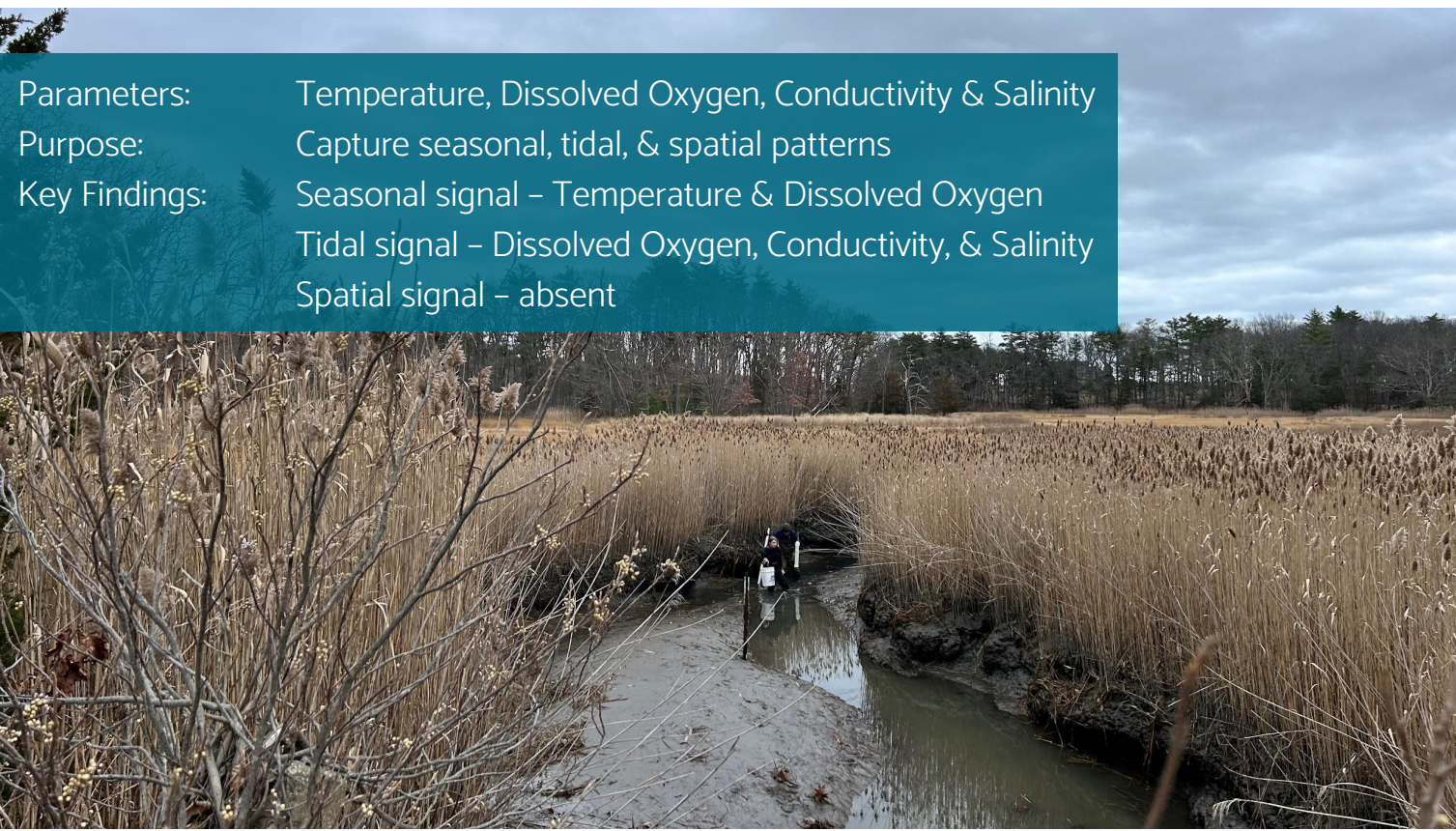


Conductivity over Time



Salinity over Time



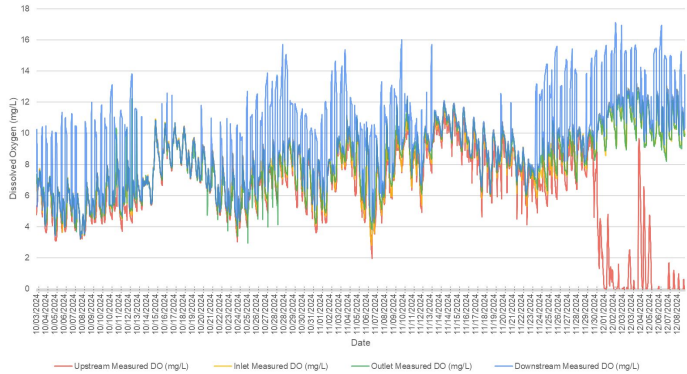


Parameters: Temperature, Dissolved Oxygen, Conductivity & Salinity
Purpose: Capture seasonal, tidal, & spatial patterns
Key Findings: Seasonal signal – Temperature & Dissolved Oxygen
Tidal signal – Dissolved Oxygen, Conductivity, & Salinity
Spatial signal – absent

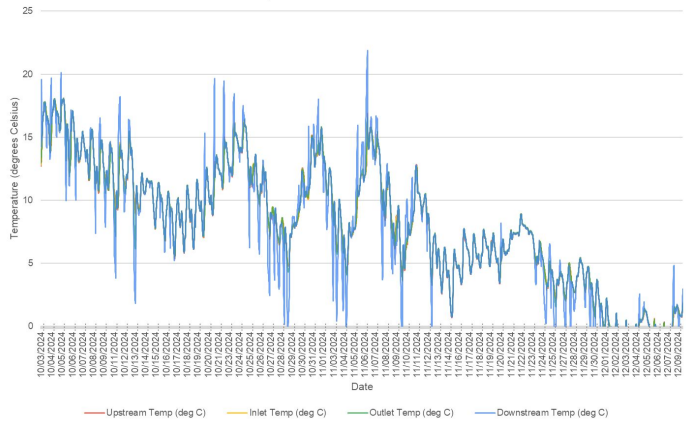
**CONTINUOUS WATER
QUALITY MONITORING**

CONTINUOUS WATER QUALITY MONITORING RESULTS - 2024

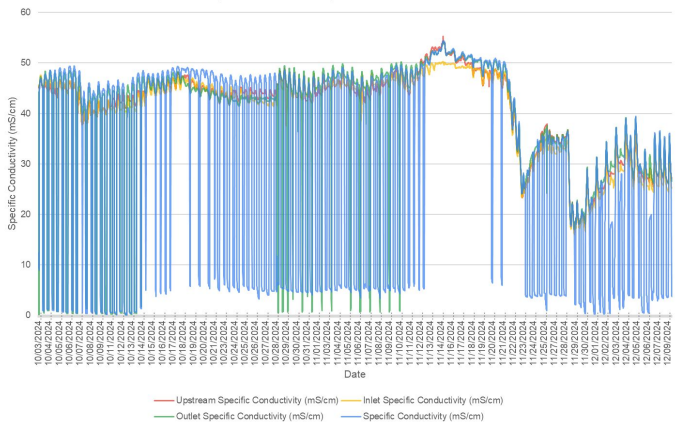
2024 Dissolved Oxygen Data in Castle Neck River



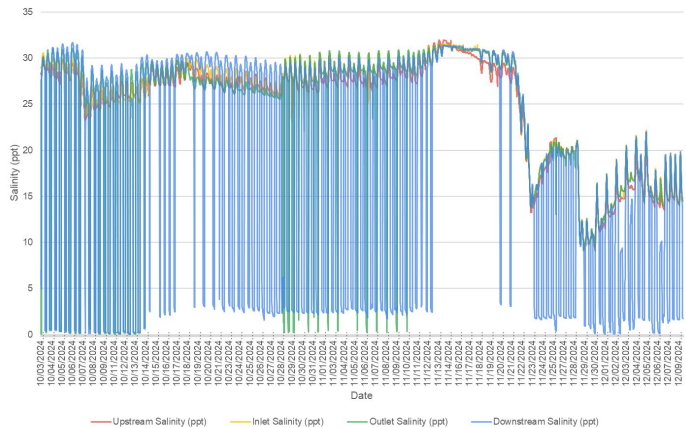
2024 Temperature Data in Castle Neck River



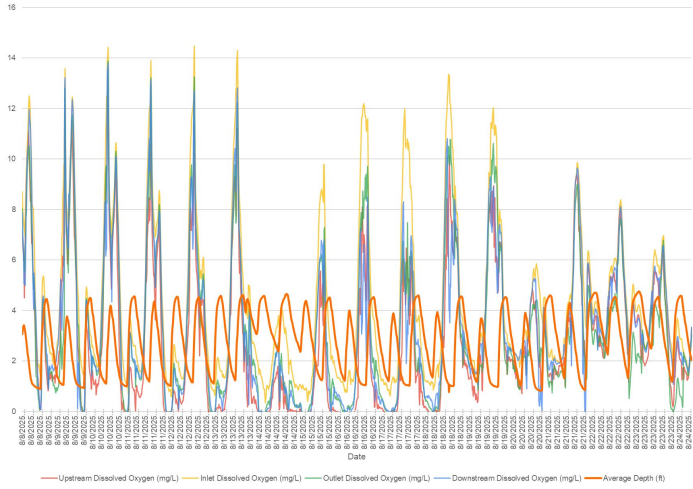
2024 Specific Conductivity Data in Castle Neck River



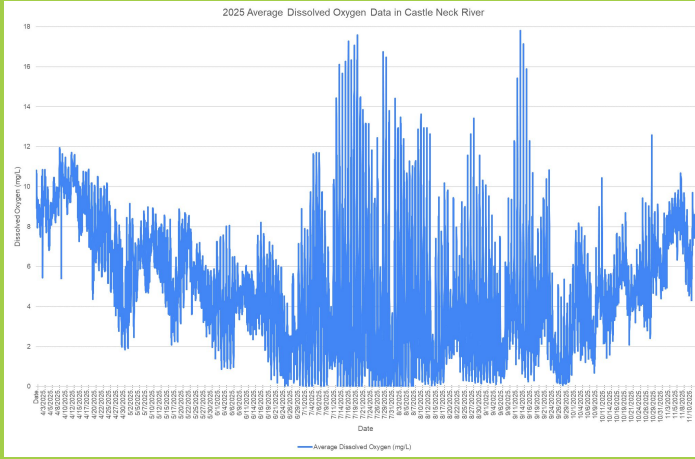
2024 Salinity Data in Castle Neck River



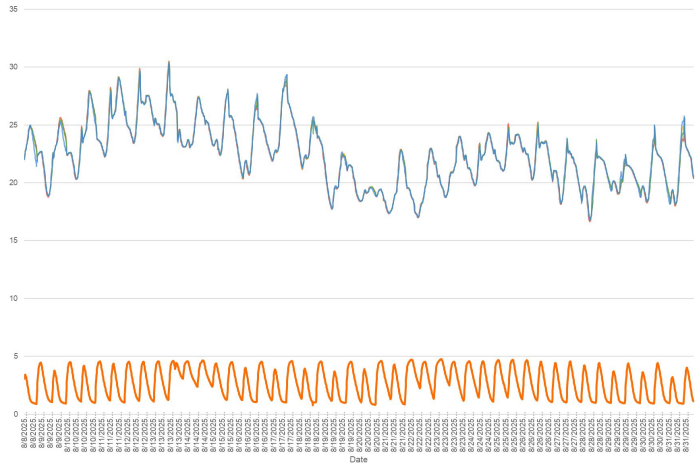
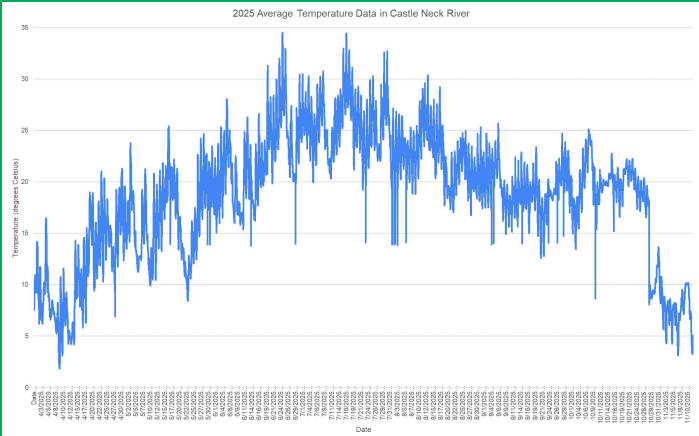
August 2025 Dissolved Oxygen Data in Castle Neck River



2025 Average Dissolved Oxygen Data in Castle Neck River



August 2025 Temperature Data in Castle Neck River



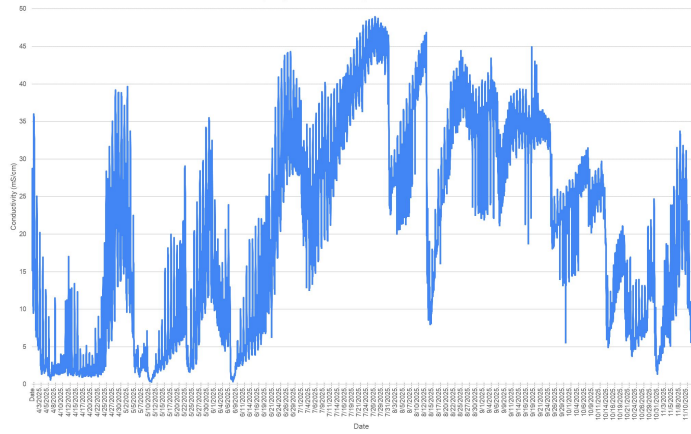
CONTINUOUS WATER QUALITY MONITORING RESULTS - 2025

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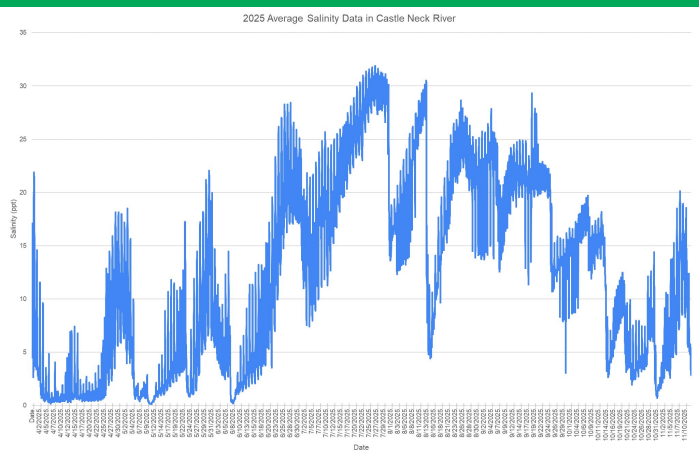
August 2025 Specific Conductivity Data in Castle Neck River



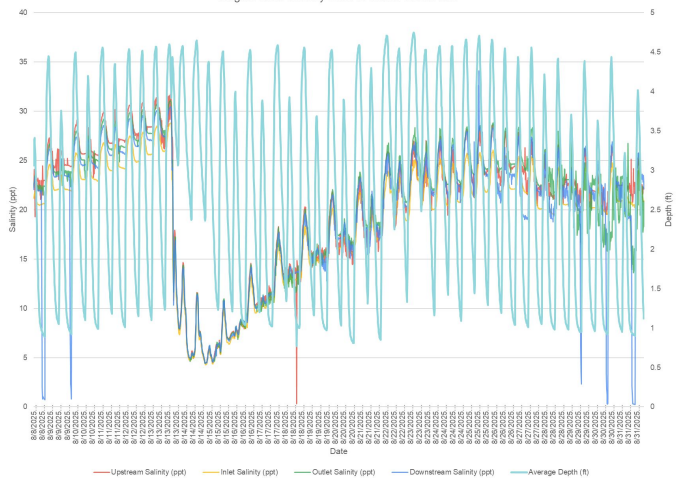
2025 Average Specific Conductivity Data in Castle Neck River

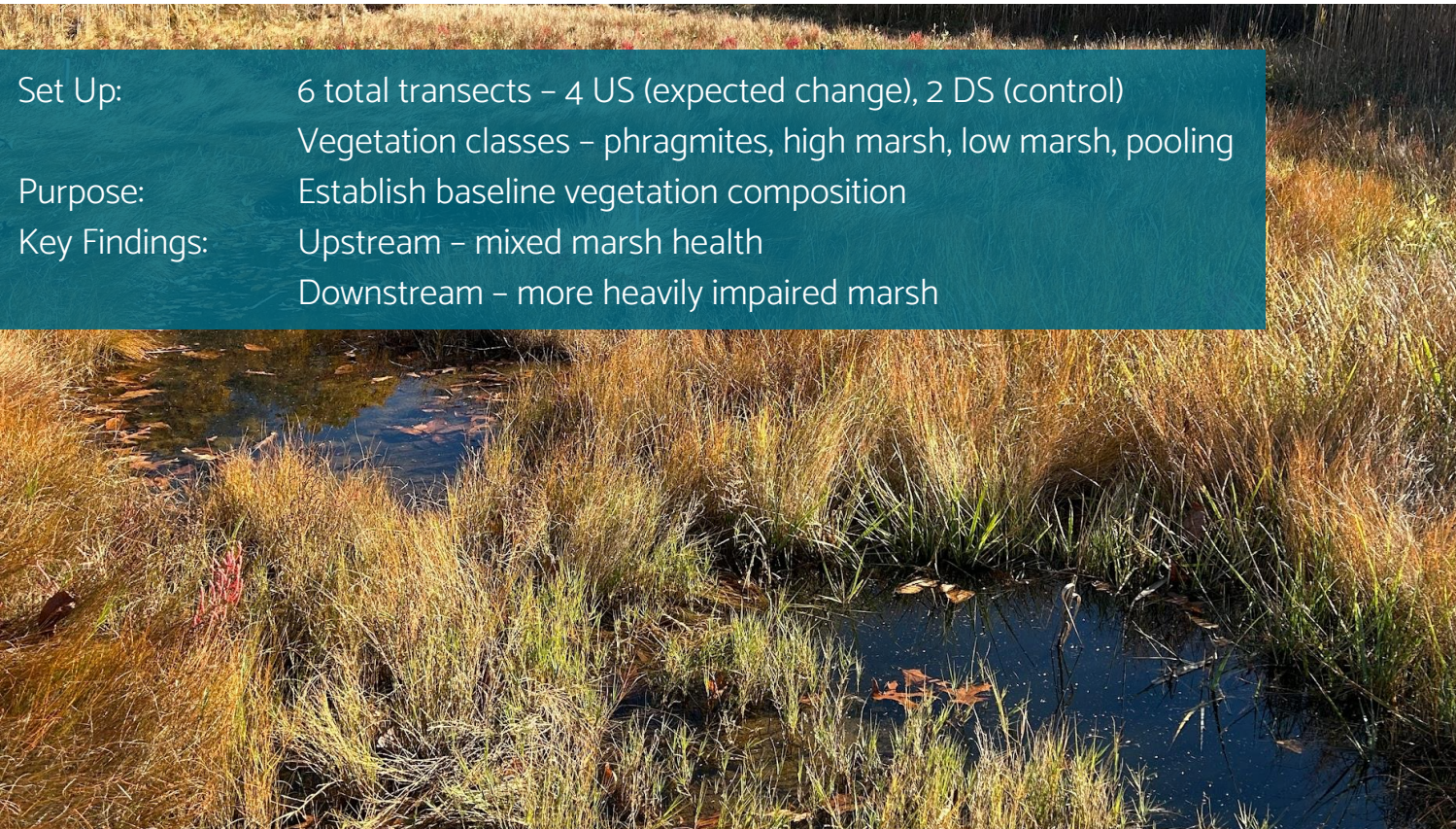


2025 Average Salinity Data in Castle Neck River



August 2025 Salinity Data in Castle Neck River





Set Up: 6 total transects – 4 US (expected change), 2 DS (control)
Vegetation classes – phragmites, high marsh, low marsh, pooling

Purpose: Establish baseline vegetation composition

Key Findings: Upstream – mixed marsh health
Downstream – more heavily impaired marsh

MARSH VEGETATION MONITORING

Table 9. Vegetation Transect Survey Results for Transect 1

	Phragmites	Pooling	High Marsh	Low Marsh	Other
Point 1.1	35			50	15
Point 1.2	15		50	15	20
Point 1.3	5		45	45	5
Point 1.4	45		5	5	45

Table 10. Vegetation Transect Survey Results for Transect 2

	Phragmites	Pooling	High Marsh	Low Marsh	Other
Point 2.1	80		5		15
Point 2.2	40		60		
Point 2.3			100		
Point 2.4			100		
Point 2.5	5	5	80	10	
Point 2.6		20	60	20	
Point 2.7		60	20	20	
Point 2.8	30	65		5	

Table 11. Vegetation Transect Survey Results for Transect 3

	Phragmites	Pooling	High Marsh	Low Marsh	Other
Point 3.1	5		65	10	20
Point 3.2			75		25
Point 3.3	5		55	5	35
Point 3.4	20		45	10	25
Point 3.5	5		55	10	30
Point 3.6	80		15	5	

Table 12. Vegetation Transect Survey Results for Transect 4

	Phragmites	Pooling	High Marsh	Low Marsh	Other
Point 4.1	5	5	65		25
Point 4.2		80	10		10
Point 4.3		60	30		10
Point 4.4			40		60
Point 4.5			55	10	35
Point 4.6			55	30	15



Saltbush

VEGETATION MONITORING RESULTS - UPSTREAM

Table 13. Vegetation Transect Survey Results for Transect 5

	Phragmites	Pooling	High Marsh	Low Marsh	Other
Point 5.1	50		45		5
Point 5.2	40		30	20	10
Point 5.3	5	20	40	20	15
Point 5.4		40	45	10	5
Point 5.5		15	65	10	10

Table 14. Vegetation Transect Survey Results for Transect 6

	Phragmites	Pooling	High Marsh	Low Marsh	Other
Point 6.1	5	15	50	30	
Point 6.2	40	10	25	20	5
Point 6.3	20	5	35	30	10
Point 6.4	40	5	10	30	15
Point 6.5	5	30	15	30	20



Common Glasswort

VEGETATION MONITORING RESULTS - DOWNSTREAM

FORAGE FISH SAMPLING



Set Up:

Deploy Fyke net for 24 hours

Purpose:

Measure relative abundance of forage fish species

Key Findings:

Catch dominated by mummichogs

Near total absence of other species

May indicate poor water quality/lack of suitable habitat

ESTABLISHED BASELINE CONDITIONS

Water quality shows tidal & temporal signals
Marsh vegetation shows widespread impairment
Fish community dominated by tolerant species
Strong justification for restoration

VALUE OF PRE-RESTORATION DATASET

Provides a clear reference point
Captures seasonal & tidal variability
Strengthens ability to measure restoration success
Informs adaptive monitoring design

POST RESTORATION MONITORING & LESSONS LEARNED

More QA/QC & frequent logger checks
Take loggers out for cleaning/recalibration
Incorporation of more datasets (e.g., precipitation)

BROADER IMPLICATIONS

Framework for future tidal restoration projects
Demonstrates importance of long-term baselines
Integrates science & community engagement

THANK YOU

Does anyone have any questions?

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