

**Working Toward Nutrient Reduction in a  
Eutrophic Urban Estuary:  
*Ribbed Mussel Biofiltration in Jamaica Bay***



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## Existing Conditions in Jamaica Bay

- Expansive natural area located in New York City
- Part of the Hudson-Raritan Estuary
- Existing habitat loss & degradation
  - Direct habitat displacement & fragmentation
  - Historic landfilling
  - Degraded water quality (CSOs, stormwater runoff, dredging)

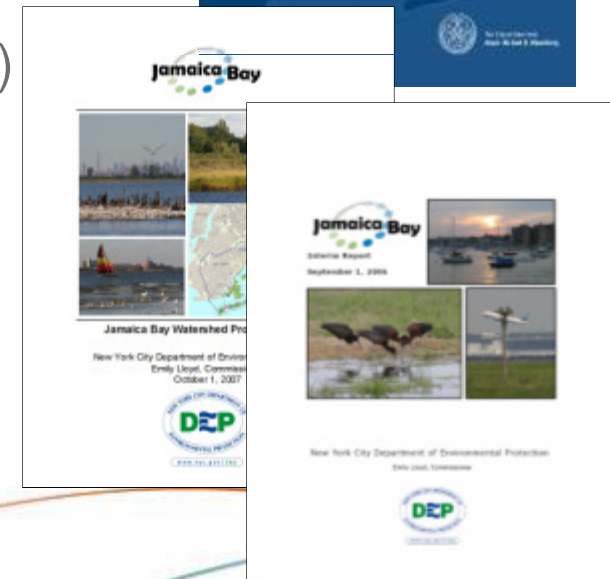


Ribbed Mussel Biofiltration in Jamaica Bay

# Restoration Planning in Jamaica Bay

*“seeks active solutions to long term problems instead of reactive fixes aimed at current issues”*

- PlaNYC (2006)
  - Water Quality Initiative - Introduce 20 m<sup>3</sup> of ribbed mussels
- Jamaica Bay Watershed Protection Plan (2007)
  - Water quality modeling (CSO, BMPs)
  - Watershed Planning
  - Pilot BMPs (blue/green roofs, porous pavement, tree pits, etc.)
  - **Ecosystem Restoration Pilots**



## Ribbed Mussels for Biofiltration

- Ribbed Mussel *Geukensia demissa*
  - Bivalve inhabits intertidal salt marshes
  - Abundant in dense aggregations
    - Up to 8000/m<sup>2</sup>
  - Tolerant of degraded conditions
  - Early reproduction (20-25 mm)
  - Short dispersal distances
  - High filtration rates, similar to oysters
  - Inedible, low risk of illegal takings



## Ribbed Mussel Biofiltration in Jamaica Bay

# Partners/Collaborators

- New York City Department of Environmental Protection
- Biohabitats
- Hazen & Sawyer
- HDR-HydroQual
- Miller's Launch



# Pilot Study Planning

- Goals
  - Test effectiveness of ribbed mussels to remove nutrients & Organic Matter
  - Test alternative techniques to grow up to 10 m<sup>3</sup> of mussels
  - Guide further development of mussel biofiltration

## Site Selection



## Design

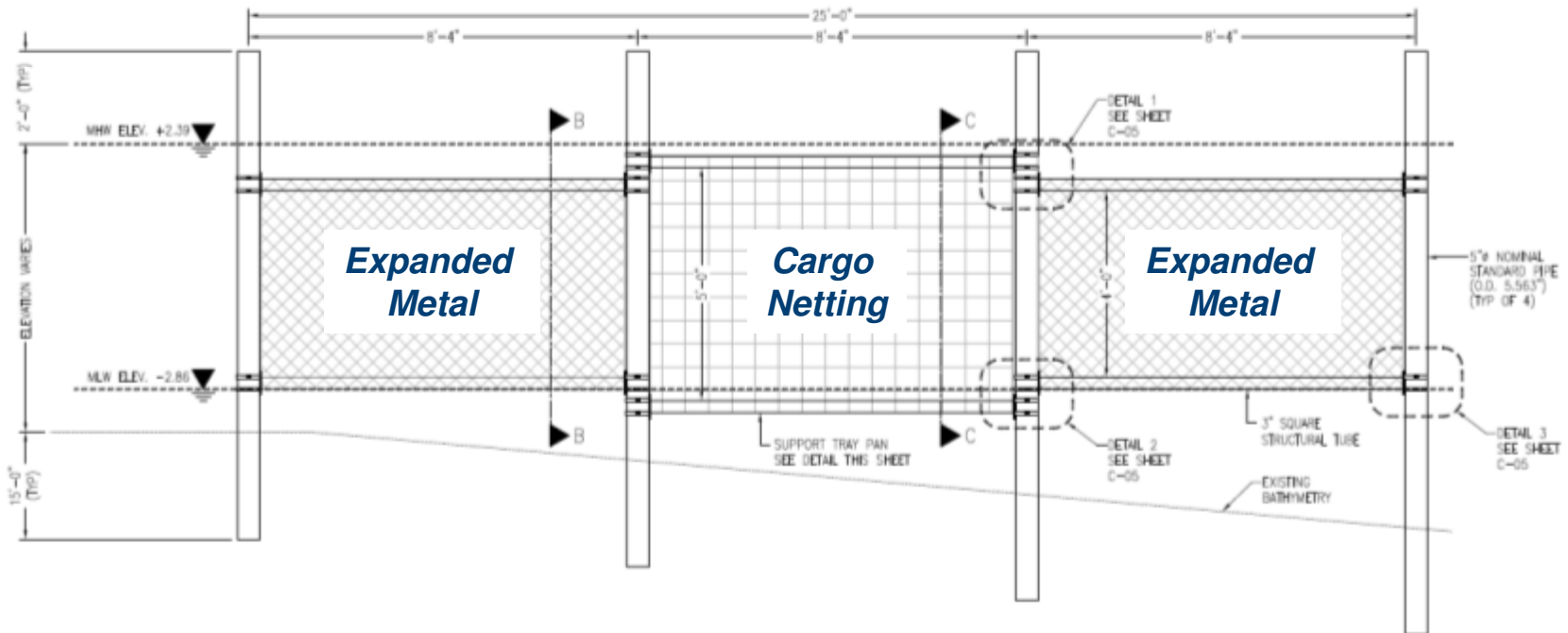
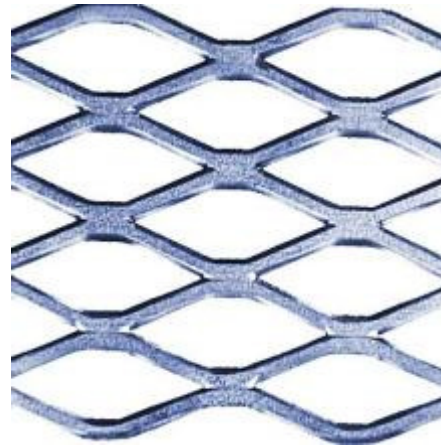
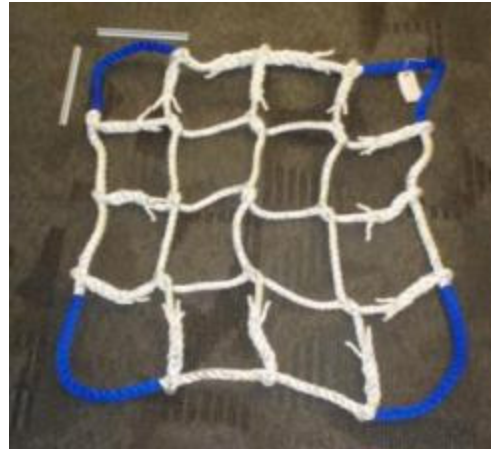


- Acceptability of substrate as habitat
- Maximize surface area
- Minimize cost (off-the-shelf materials, ease of installation)
- Durability (salt water, flows)
- Minimize benthic impacts
- Sampling access
- Ease of removal (2-yr study)



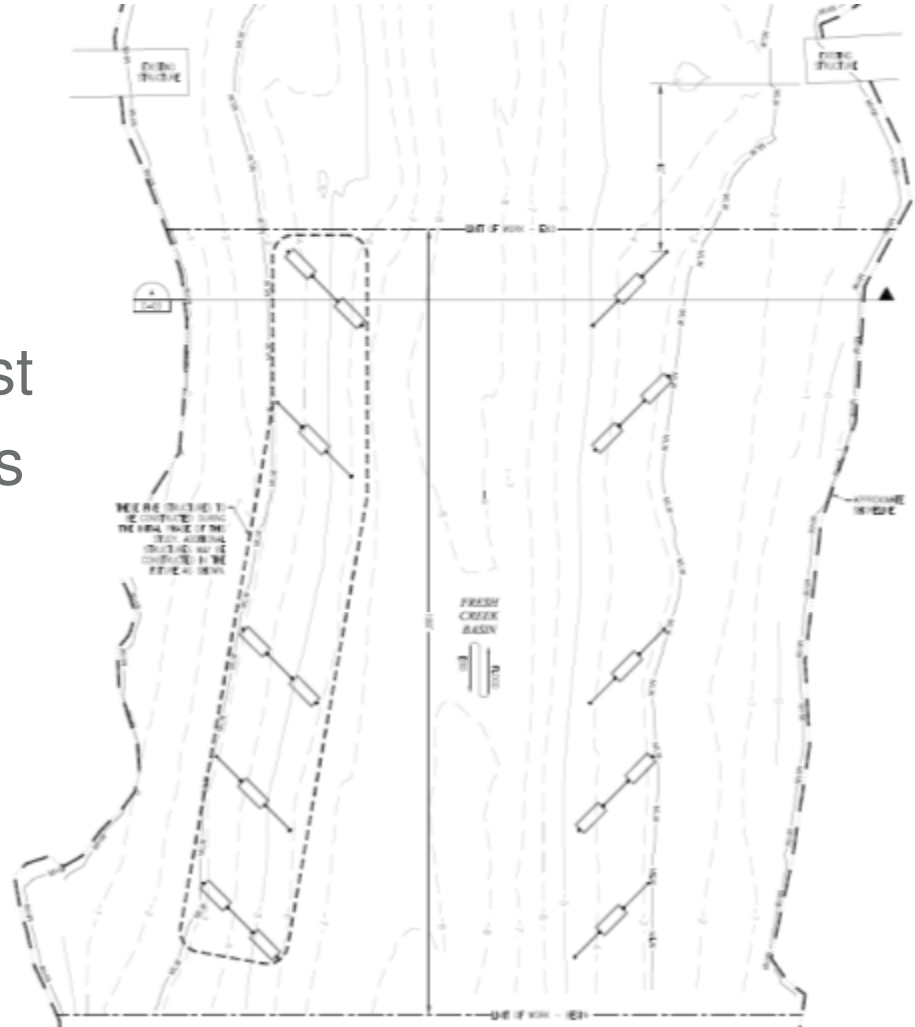
# Ribbed Mussel Biofiltration in Jamaica Bay

## Design



## Construction

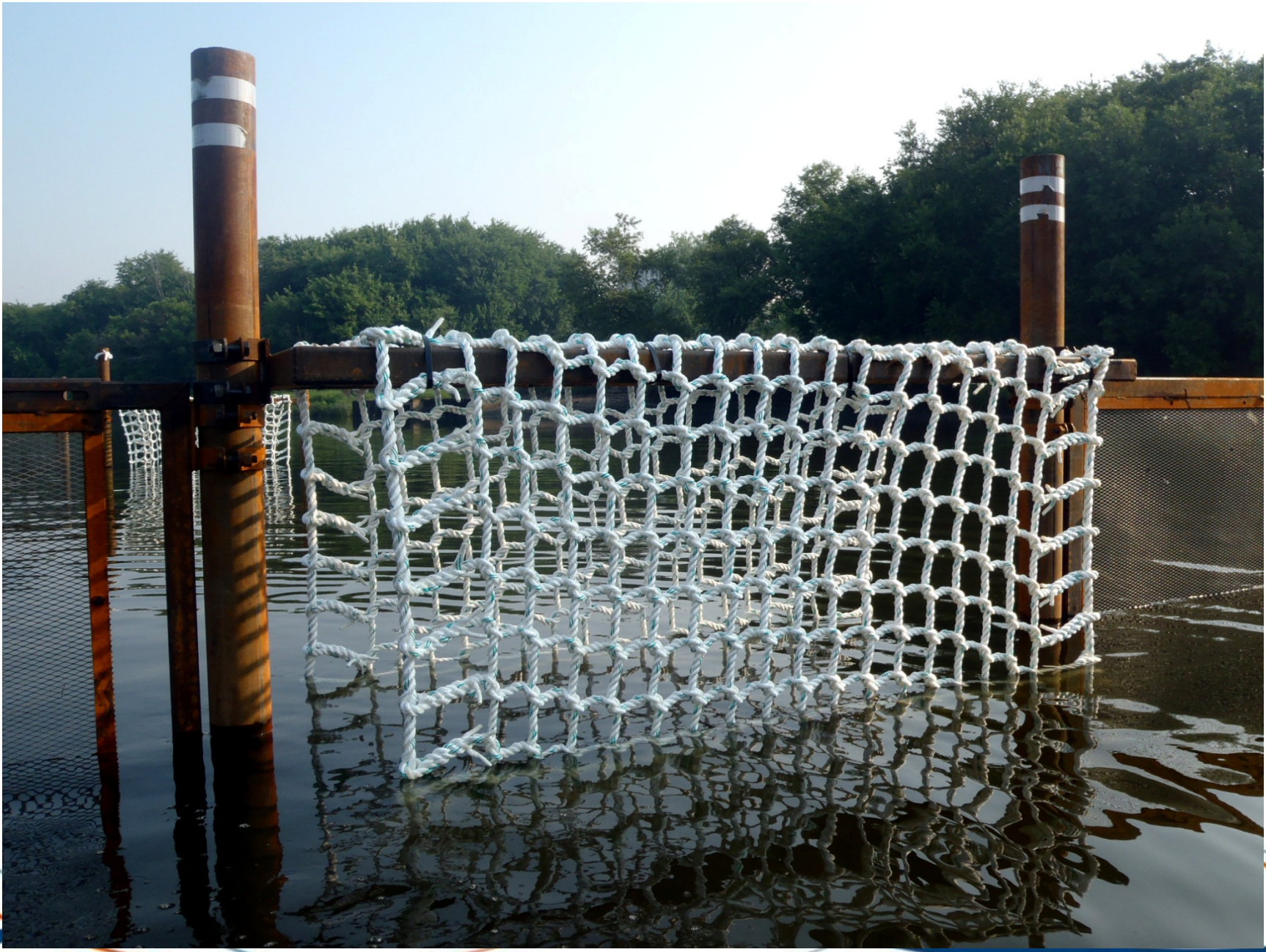
- Constraints
  - Permitting
  - Novelty + Tides = \$\$\$ Cost
  - Timing: Spawning mussels
  - Closure of Fresh Creek
- Design Adjustability
- Construction
  - July 13 – 21, 2011

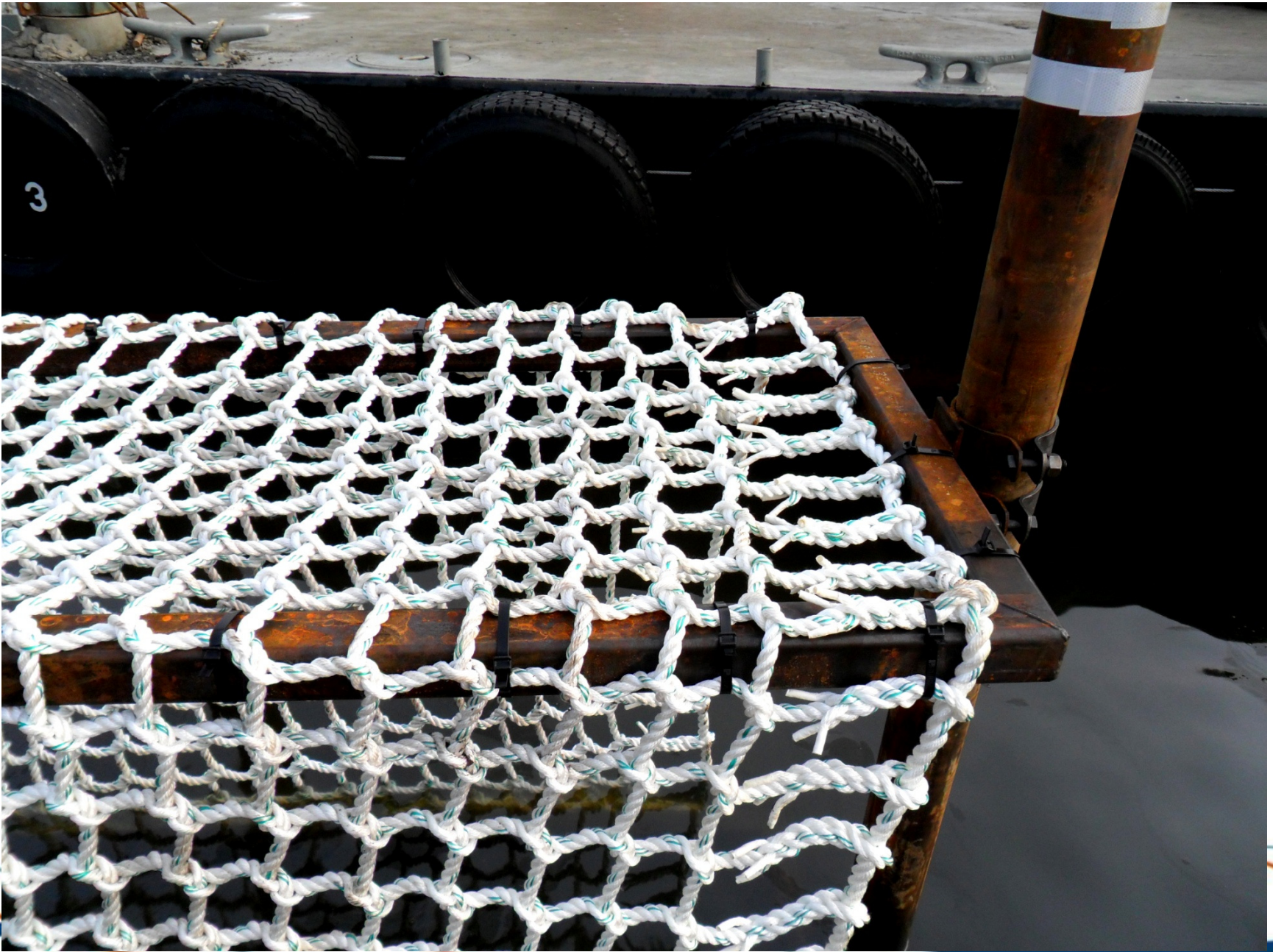
















Ribbed Mussel Biofiltration in Jamaica Bay

# Construction - Adjustability







## Monitoring

- Parameters
  - Pilot integrity (stability, scour/deposition, deflections, debris)
  - Water quality
  - Hydrodynamics
  - Mussel growth & density (estimate volume)
  - Nutrient/seston uptake (up & down-current)
  - Strongly bi-directional flow (ebb vs flood)

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## Conclusions & Next Steps

- Site and conditions ideal for mussel colonization & detection of water quality improvements
- Three arrays constructed, potential  $>3 \text{ m}^3$  of ribbed mussels after 1 year
- Continue monitoring
  - Track mussel spawn & substrate attachment
  - Schedule nutrient/seston uptake trials
- Evaluate potential for scale-ups



## Contacts

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