Educational Opportunities at Penn & Fountain: Facilitating Public Access, Enhancing Ecological Diversity, Water Quality, and Shoreline Protection on Jamaica Bay

Penn & Fountain Landfill
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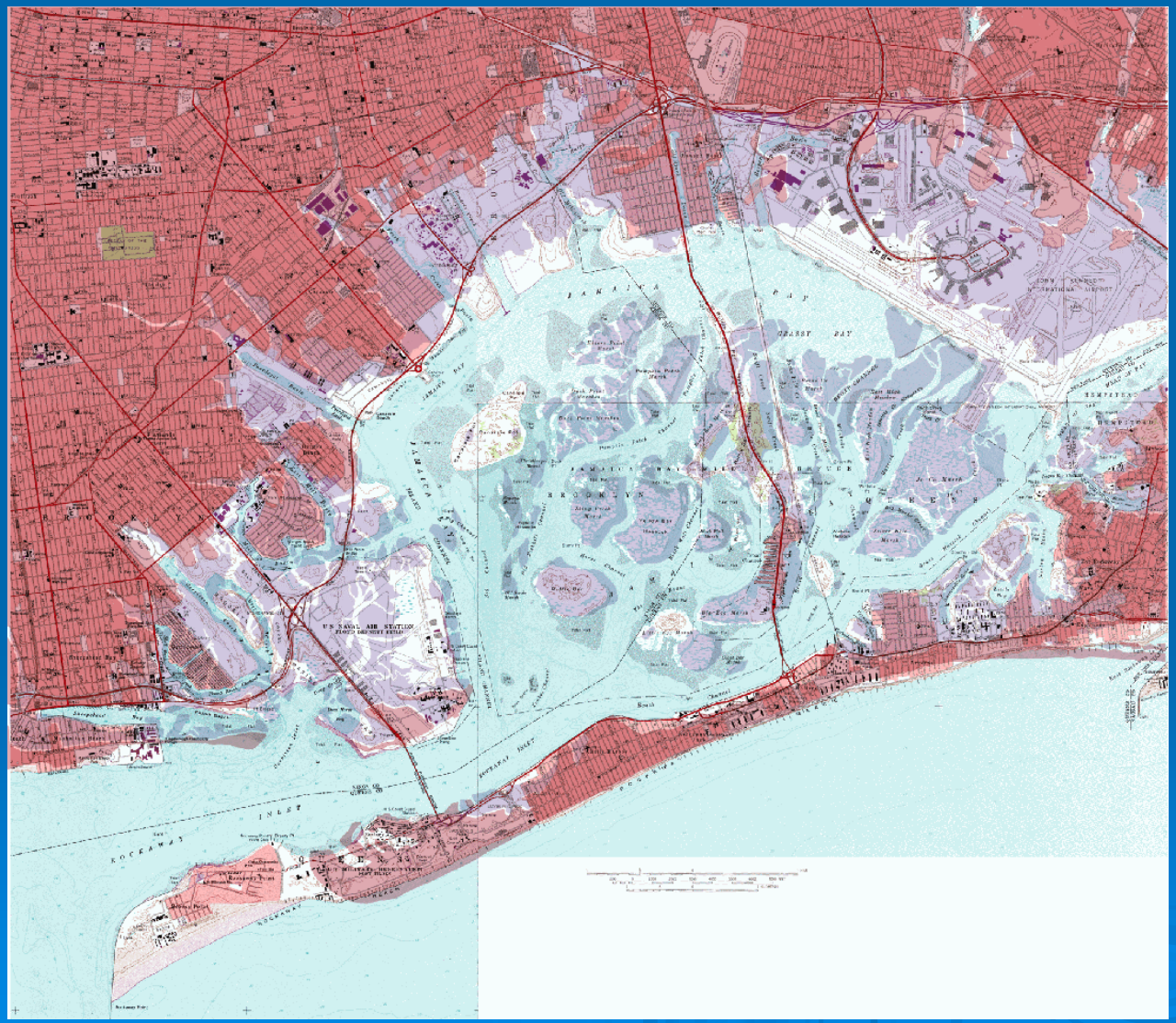
Coupling Educational Opportunities with the Development of Ecological Structures in the Park & Surrounding Estuary

- Biodiversity:
  - Salt marsh (*Spartina*) systems, mussel and seaweed beds, potential for eelgrass, oyster reefs
  - Use infrastructure and restoration to support many other species
  - Landfill biodiversity, stormwater capture, migrating bird support
- Water filtration capacity can remove nitrogen from the water column
  - Favorably impact wastewater discharges from 26th Ward WPCP and combined sewer
  - Reduce algal blooms → increase submerged aquatic vegetation
- Protection of coastline from storm impact
- Re-creation of the connection between surrounding human communities and Jamaica Bay

Historic Marshes and Fill in Jamaica Bay: Learning the History of the Place



The entire edge of Jamaica Bay is landfill.

Much of the bay bottom has been dredged, filled, or otherwise greatly changed.

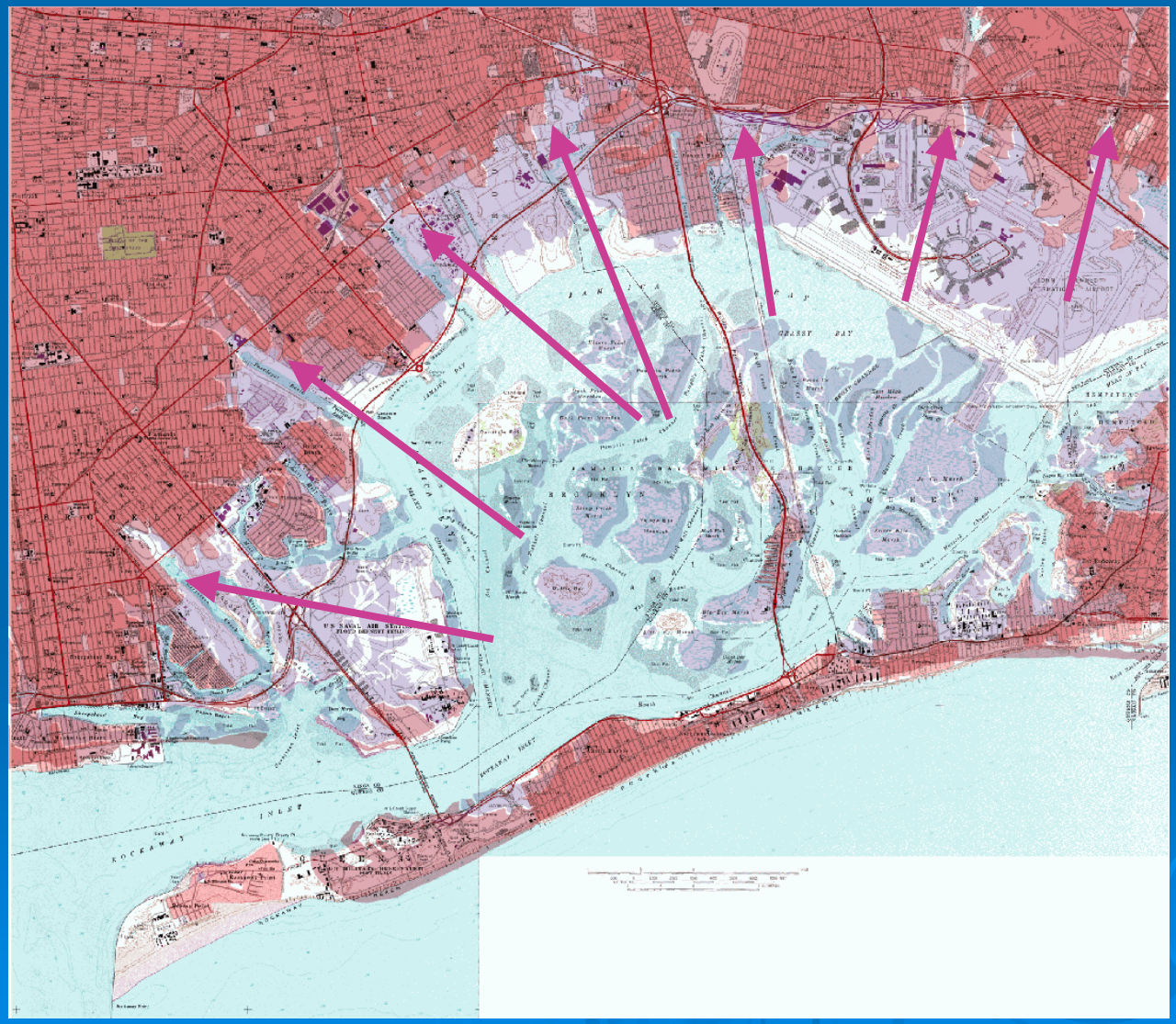
The Park can focus on a primary educational and scientific question: How can human-built structures enhance biodiversity and ecological productivity?

A National and Historical Perspective: Marsh & Habitat Loss in Louisiana

FOR 7,000 YEARS, THE MISSISSIPPI RIVER flooded Louisiana's coast with land-building sediment. The amount of new land this sediment created exceeded the amount of land lost to natural processes of subsidence, erosion and sea-level rise.

In the 20th century, levees erected along the banks prevented river sediment from reaching coastal marshes, upsetting the balance between land lost and land gained, initiating the now catastrophic retreat of Louisiana's wetlands.

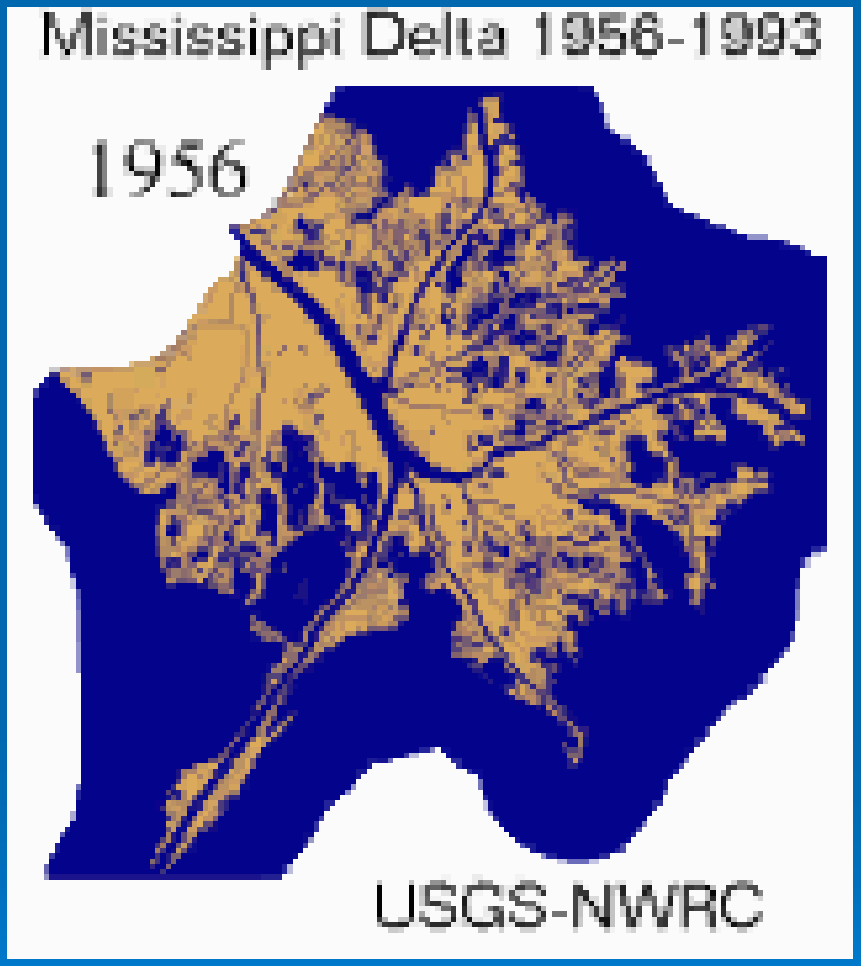
Sediment Budget Decrease is the Probable Cause of Marsh Island Loss in Jamaica Bay

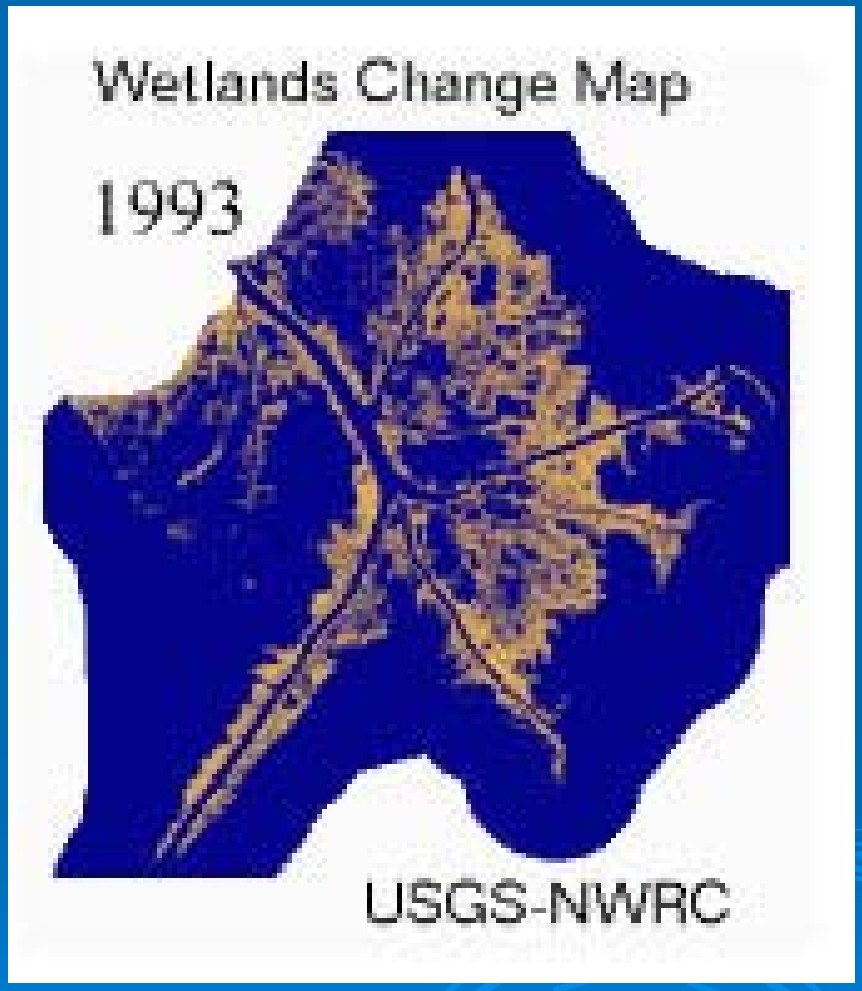


While many hypotheses have been put forth on the causes of marsh loss in Jamaica Bay, the filling and elimination of creeks, covering of the land with impervious surfaces, and encasing stormwater flow in pipes has cut off sediment inputs.

Arrows indicate a few of the creeks which have been removed.

Marsh Loss in Louisiana





The USGS has documented patterns of marsh loss in the Mississippi Delta by comparing aerial photographs over the past four decades

Marsh Loss in New York

The New York State Department of Environmental Conservation has documented similar patterns of marsh loss in Jamaica Bay by comparing aerial photographs from the past several decades.

Tsunami Damage and Marsh Loss

The Asian Tsunami: A Protective Role for Coastal Vegetation

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- The 26 December 2004 Indian Ocean tsunami had major effects on coastal communities and ecosystems. An assessment of coastlines after the tsunami indicates that coastal vegetation such as mangroves and beach forests helped to provide protection and reduce effects on adjacent communities.

- In recent years, mangroves and other coastal vegetation have been cleared or degraded along many coastlines, increasing their vulnerability to storm and tsunami damage. Establishing or strengthening greenbelts of mangroves and other coastal forests may play a key role in reducing the effect of future extreme events.

Coral or oyster reefs, mangroves or other coastal marshes, and forests or other vegetation may provide the only cost effective and ecologically beneficial means available for protecting vulnerable coastal landscapes

While the physical position and structure of marshes and oyster reefs affords protection from waves and storm surges, their location in wind driven and tidal flow enhances exchange and removal of nutrients and pollutants.

Learning about Pollutants in Jamaica Bay: Salt Marsh Nitrogen Removal

- *Spartina alterniflora*- marsh grass
- Filters, stores, and removes excess nitrogen from water column

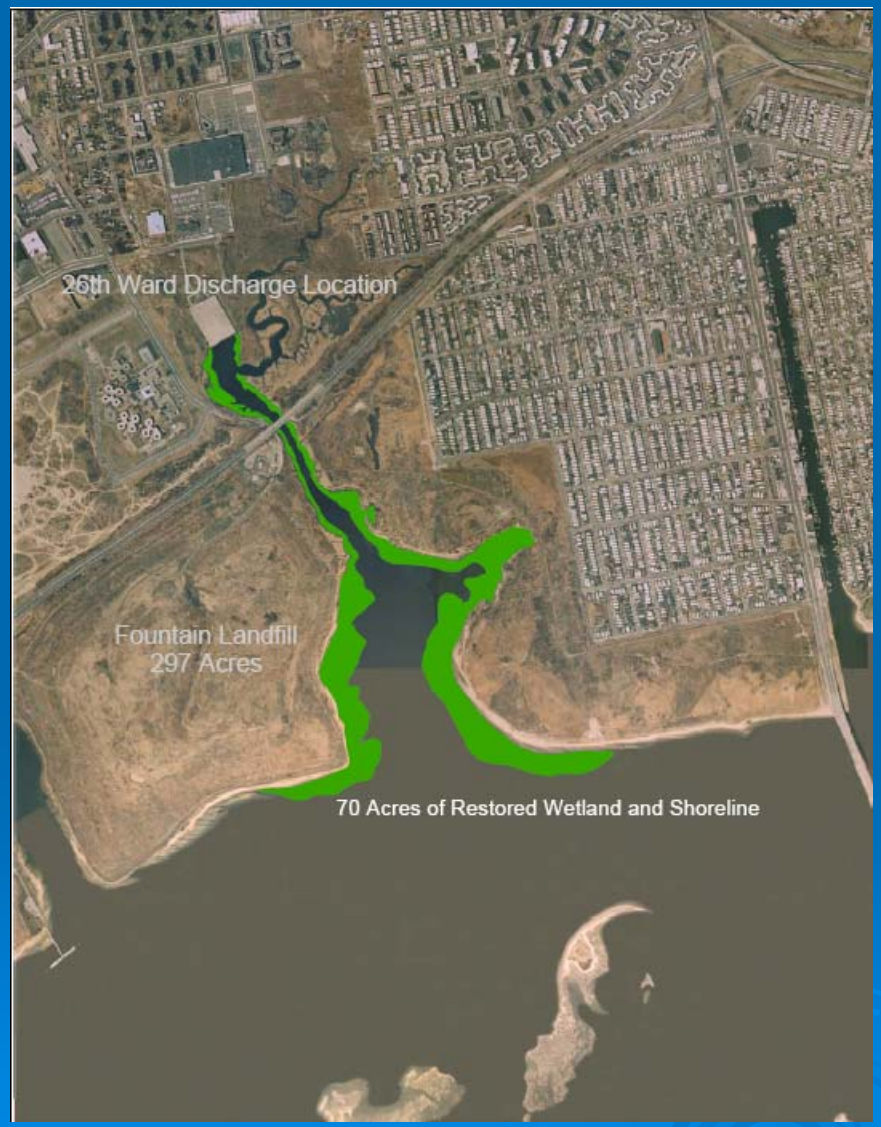
- Four wastewater treatment plants discharge into Jamaica Bay
- Nitrogen is a major problem pollutant in the Bay
- Saltmarsh removes between 40-200 lbs of nitrogen/acre/yr
- Removal mechanisms include denitrification and sediment burial

Learning about Problems in the Bay and the Technologies and Natural Systems that Treat Them: Nitrogen Budget of Area Surrounding Penn & Fountain

- 26th Ward Treatment Plant discharges approximately 14,000 lbs of Nitrogen per day

- Between 13,000 and 64,000 acres (20-80 sq. miles) of marsh would be required to treat one-half of these inputs

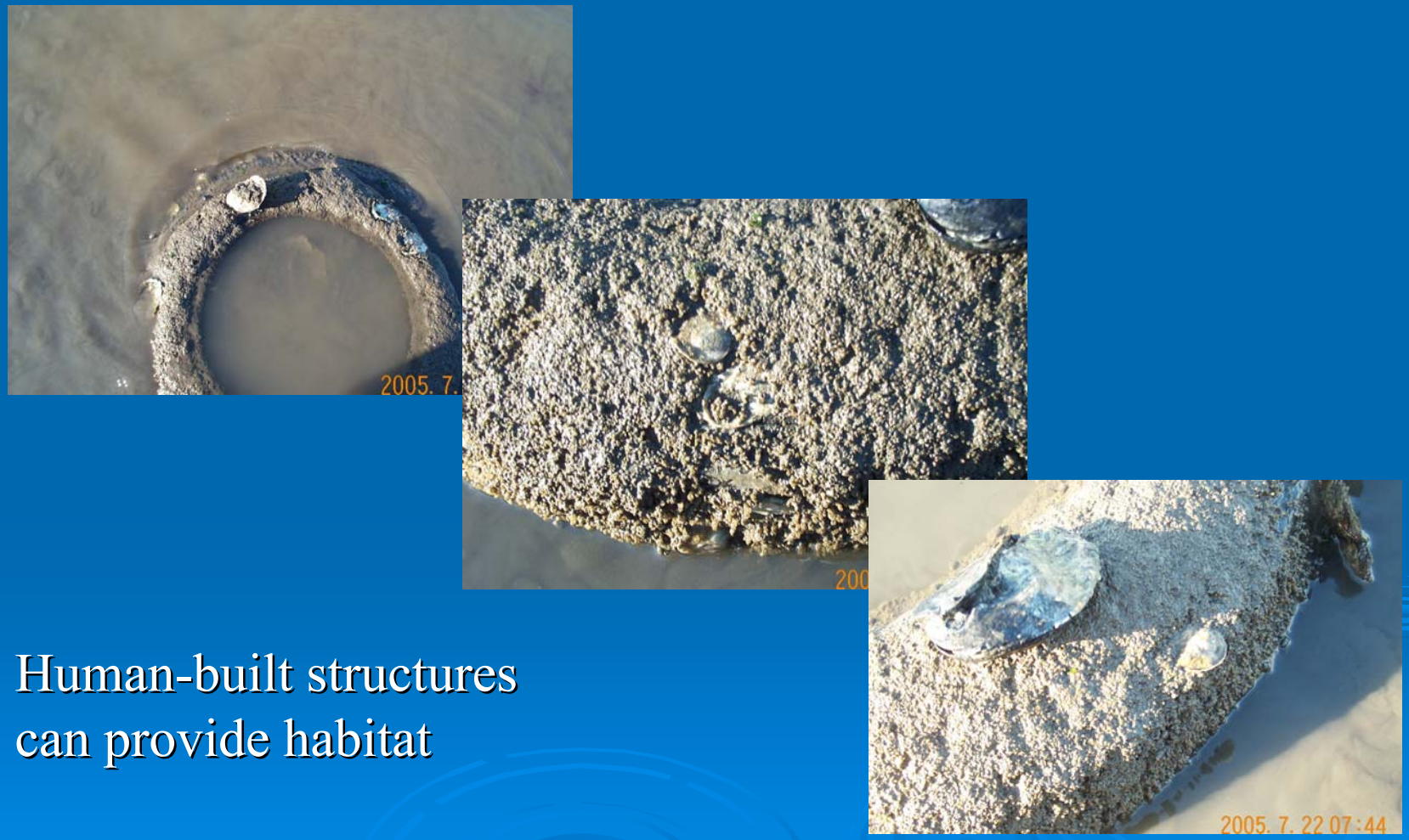
Wetland Treatment of 26th Ward Discharge



- If 50 acres of marsh were restored near Fountain Avenue, it could only remove less than 1% of 26th Ward Nitrogen
- One square foot of mussels can filter approximately 2000 gallons of water per day
- About an acre of mussels would filter *all of the daily discharge* (65 MGD) from the 26th Ward Plant
- ≈ A one acre oyster reef, 3,000,000 oysters, could filter approximately 65 MGD

Historic, Present and Future Ecological Systems Contributions to Water Quality

Oysters and Barnacles Growing on Man-made Structures in the East River Estuary



Human-built structures
can provide habitat

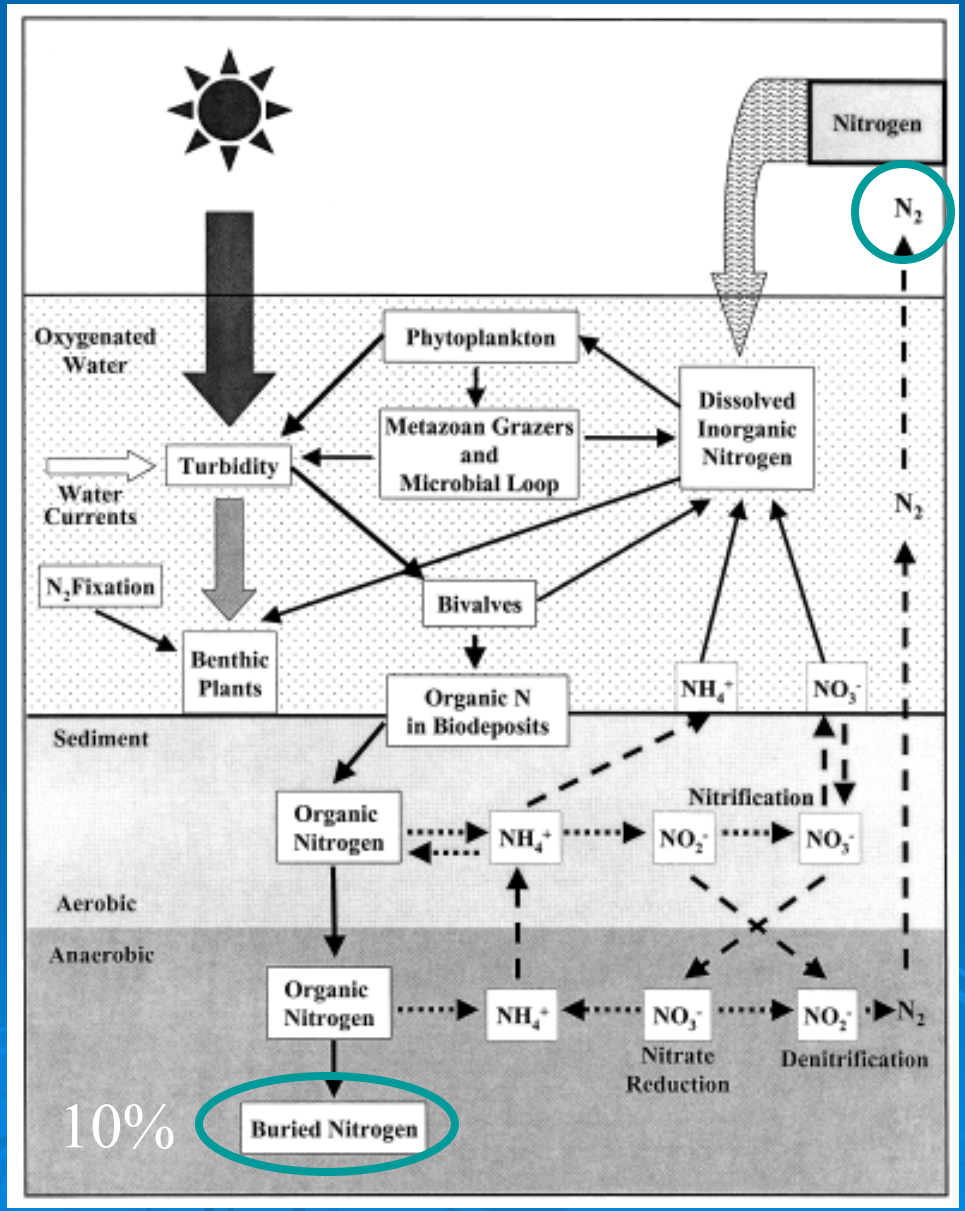
Recreating Historic Natural Communities:Reef Balls

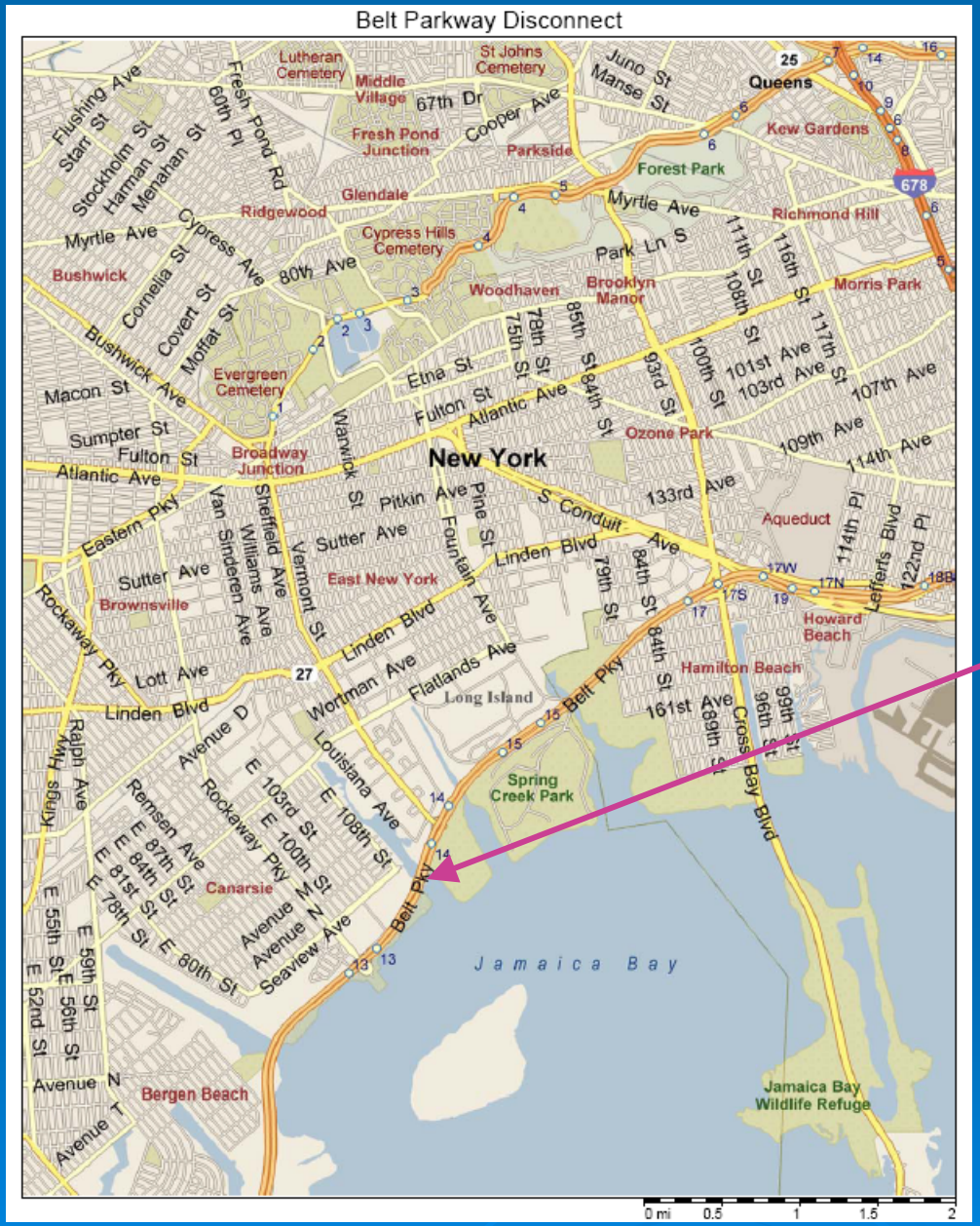
- Human-built structures can provide habitat

Oyster Reef Nitrogen Removal Rates

- 30% of filtered nitrogen is removed from the water column
  - Released as N_2 gas (20%)
  - Buried in sediments (10%)

(Newell 2002 & 2004)





The Belt Parkway has, since its construction began seven decades ago, aimed to provide transportation around Jamaica Bay. At the same time, the roadway has cut off ready public access to the Bay itself. Both education and infrastructure are likely to be necessary to lead the public around it.

Soft edge (in purple)

Hard edge (linear bulkheads)

Public Access to Jamaica Bay

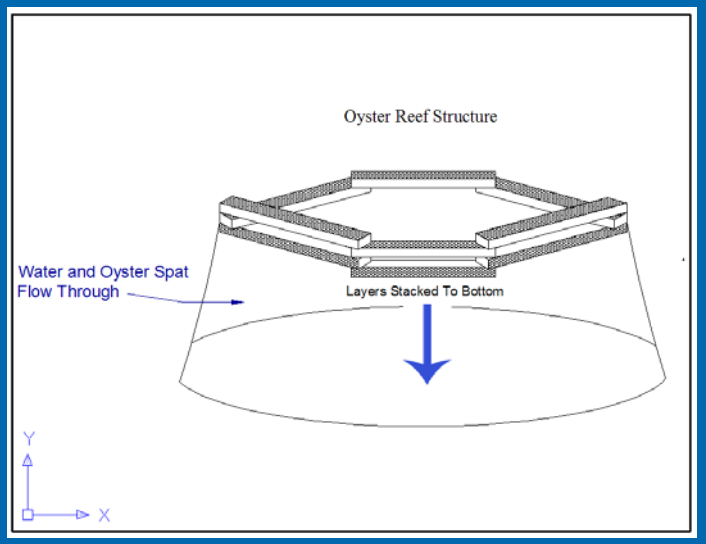
- A ‘Do It Now’ approach is needed-

- For this generation

Oyster Reef and Eelgrass Function

- Oyster reef restoration can make significant contributions to water quality

- Oysters and other filter feeders remove suspended particulates and deposit nutrients in sediments, decreasing turbidity



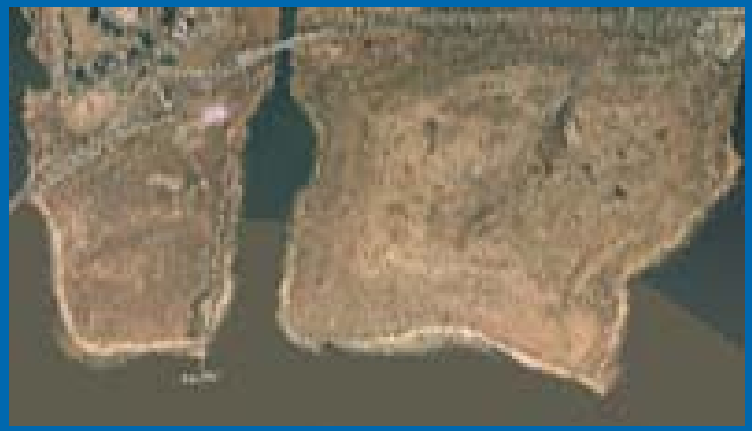
- Increased water clarity allows for eelgrass population development, increasing primary productivity

- Eel grass provides habitat for fish and other aquatic organisms

Penn & Fountain Ave Landfills

- 100 acres intertidal marsh could be built around the Penn & Fountain Avenue Landfills with 1,500,000 cubic yards of dredge sediments, cement lock or other treated dredged material, and/or rock blasted from harbor deepening .
- 100 acres of marsh could denitrify 2 tons of nitrate-nitrogen per year from Jamaica Bay.

Penn & Fountain Ave Landfills



Educational and Scientific Questions and Opprotunities

- Will more habitat types increase species diversity?
- Can restored habitat increase ecological productivity?
- Would more productive ecological systems decrease pollutants?