Upper Narragansett Bay Water Quality

Sins of the Past & Future Opportunities

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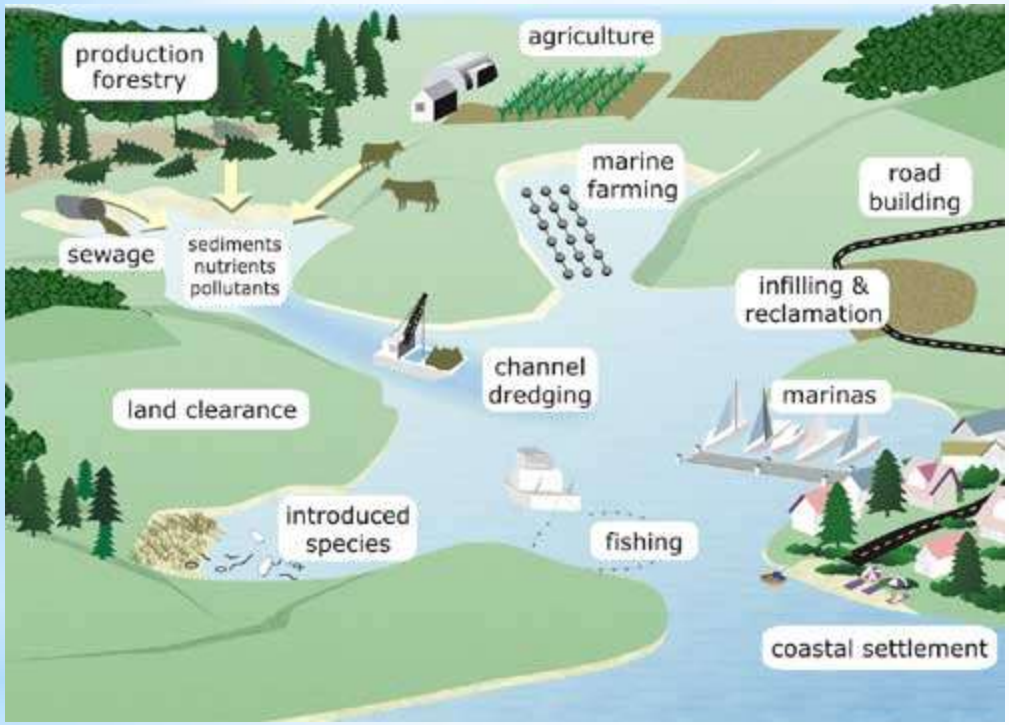
Nutrients are NOT the only problem!
Issues affecting WQ in Upper Bay…



www.waikatoregion.govt.nz

- Loss of wetlands & eelgrass
- Contaminated Sediments
- Alteration of coastline
- Change in hydrodynamics
- Climate Change
- Installed Dams & Breakwalls
- Silted up Rivers/Filled Bay
- Impervious cover/Runoff
- Stratification of the Water Column

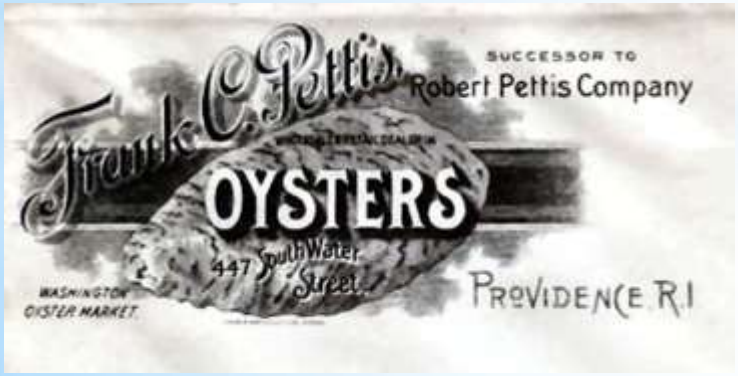
Many Ecosystem-wide problems began decades ago…

Need to look at Historical Record

The Bay's Historic Oyster Industry

- Oyster Productivity Reached its peak in 1910
- Leased oyster beds covered 5,000 acres in the Providence River & upper Bay (Fuller 1905)
- Generated $45,000 in 1903 dollars from lease fees (Fuller 1905)
- Produced ~7,000 metric tons of oysters a year (Rice et al 2000)
- People became sick from contaminated oysters, due to bacterial pollution
- Fishery began to decline in 1911

due to anthropogenic inputs, disease & Great Hurricane of 1938



http://thesaltysailor.com/rhodeisland-philatelic/rhodeisland/commercial22.htm

Photo in 41°N (vol 4; issue 2); from 1912 annual report of the RI Shellfisheries Commission

Map of Providence Harbor in 1910

- Based on 1865 – 1878 “Hydrography”
- Map Clearly Shows:
  - ✓ Wetlands & Eel Grass Beds
  - ✓ Oyster Beds (5000 leased acres)
  - ✓ Seekonk River - 37’ deep
  - ✓ Prov River Channel - 25’ deep

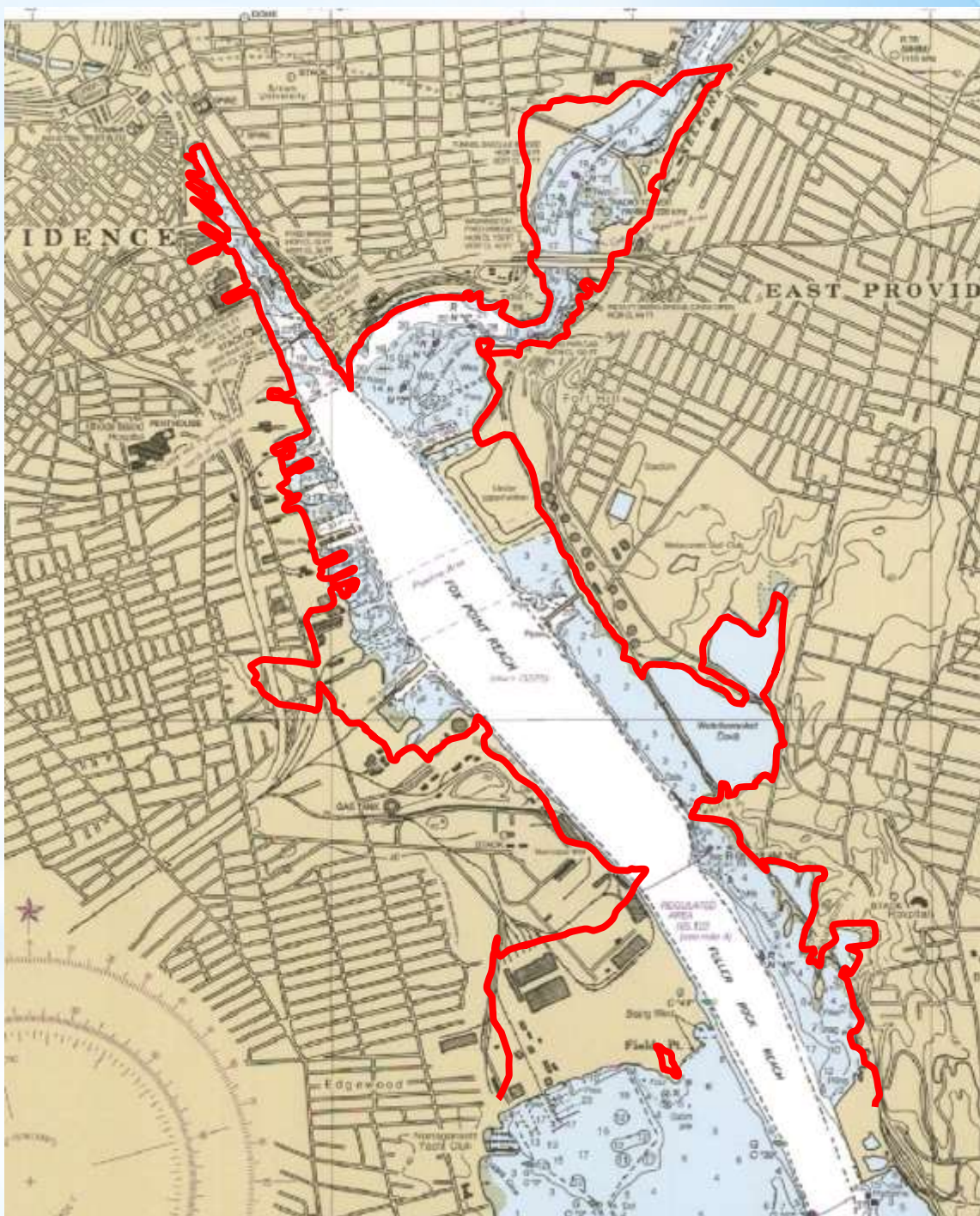
Map of Providence Harbor in 1910

- 1910 Coast Line in Red
- City plans to Fill Bay and Build Roads
- Note:
  - ✓ Much Shallower River
  - ✓ Starved Goat Island
- What was flow circulation pattern in 1910?

Upper Providence River Today

1910 Coastline in Red

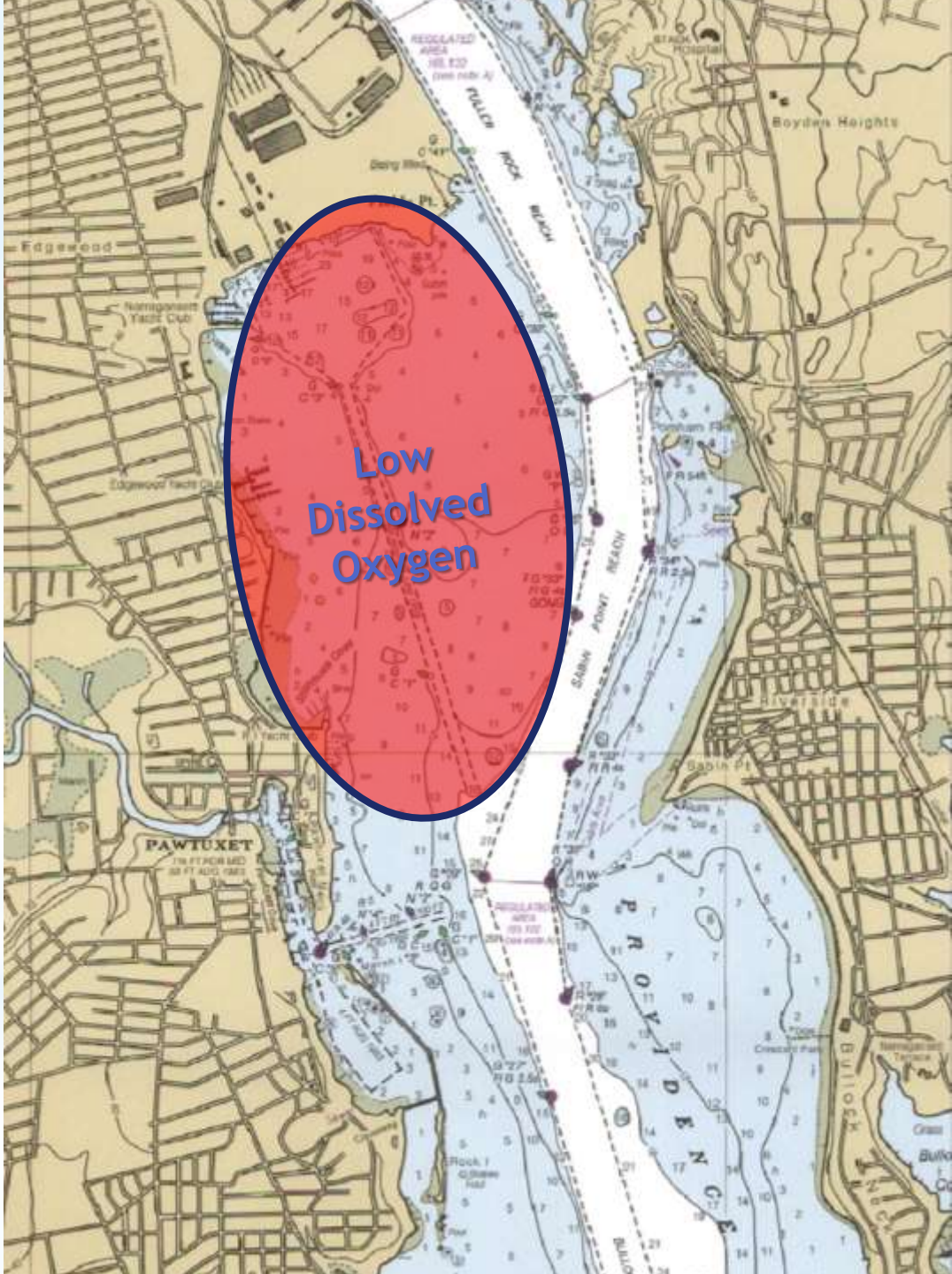
- We Filled the Bay & Wetlands
- Built the Hurricane Barrier
- Built Pawtuxet River Breakwall
- Allowed Rivers to Silt up
- Dredged Channel to 50+’



Water Quality Problems

- Edgewood Shoals area is DO impaired!!! WHY???

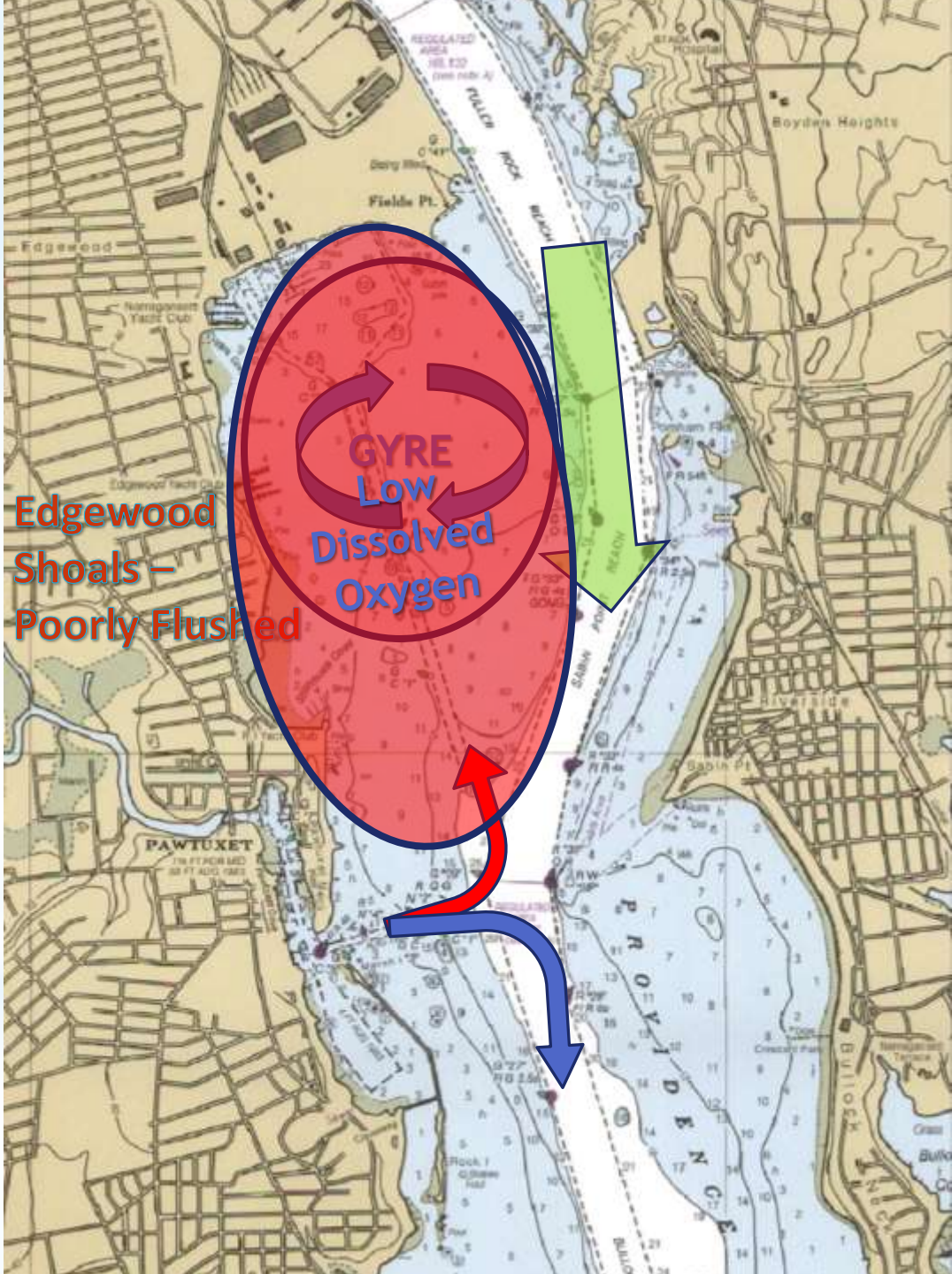
- ✓ We Changed Flow Circulation Patterns
- ✓ Poor flushing
- ✓ Nitrogen enrichment
- ✓ Stratification



Water Quality Problems

ROMS Model Indicates:

- ✓ Jet of water down the shipping channel
- ✓ Sets up a clockwise Gyre on Shoal
- ✓ Bottom waters from Pawtuxet River transport Nitrogen onto the shoal

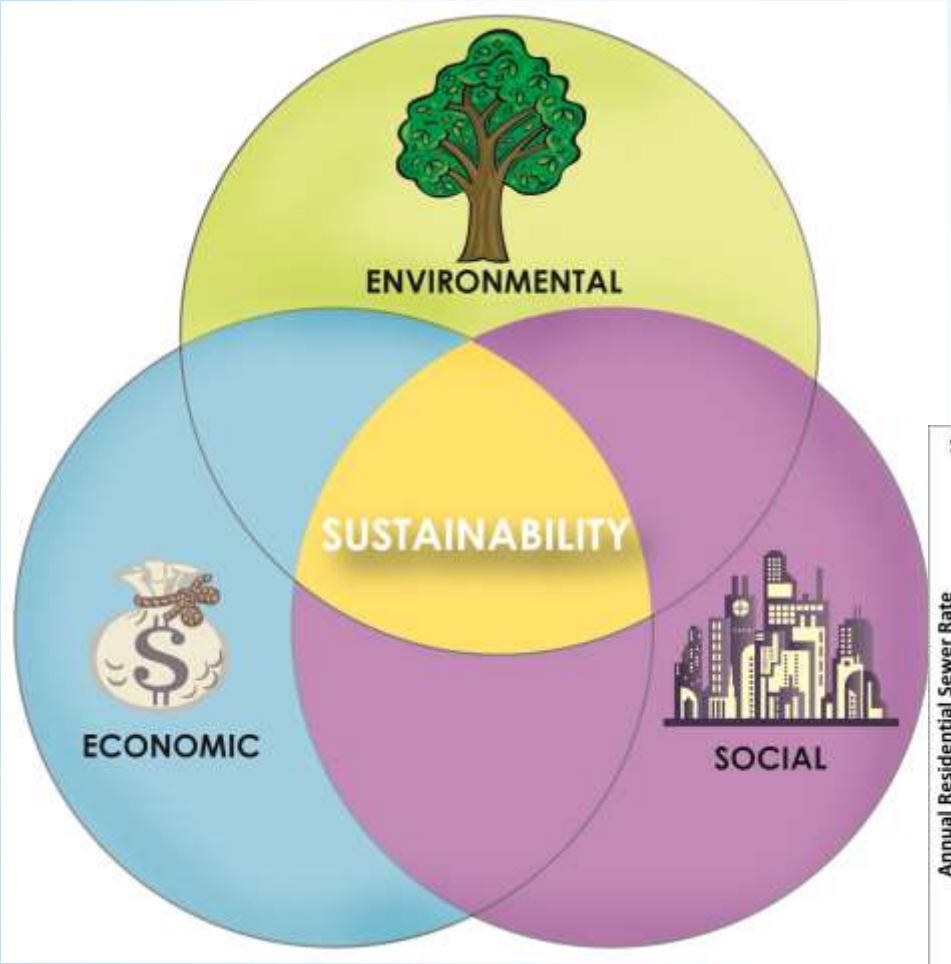


Possible Sustainable Solutions

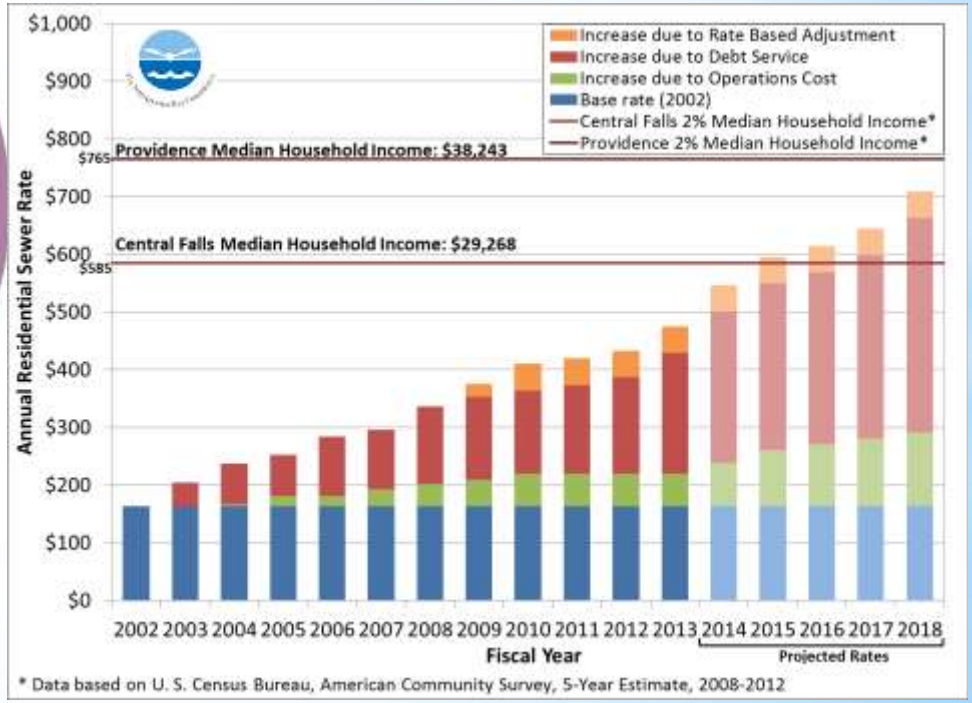
- *Lets take a Holistic Approach to Watershed Management*
- *Can we Improve Bay WQ By "Smart Engineering"?*

  - ✓ Selective Dredging?
  - ✓ Maybe create a channel to redirect flow over shoal- improve circulation?
  - ✓ Remove or open breakwalls to improve circulation?
  - ✓ Create Islands, Wetland Habitats, natural buffers?
  - ✓ Establish Bio-extraction or Aquaculture Projects?

Sustainable Solutions Needed!!!



- Sustainability = Achieving the "triple bottom line"
- Environmental, Economic & Social Sustainability
- Ecosystem Based Solutions
- How can we get it done?



Habitat Diversity

Dissolved Oxygen
>4.8 mg/L

Eelgrass Beds

Navigable Rivers
(fish & people)

Sustainable

Ecosystem based management

Holistic

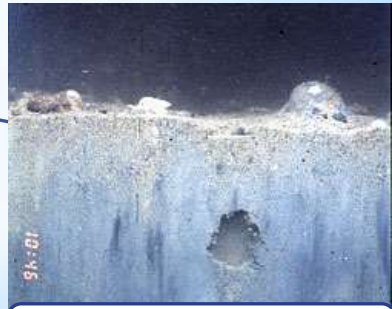
Harvestable Shellfish

EPA GOAL:
Fishable
Swimmable

Viable Fisheries
(safe to eat)

Cooperation

Collaboration



Clean Sediment

Shared Vision

Compromise

Increased Water Clarity

Biological Diversity

Open Upper Bay Beaches

Expert Stakeholder WQ Evaluation Process

- Goal: ***Complete Feasibility Study to Holistically Evaluate Sustainable Solutions to Improve Upper Bay Water Quality***

http://www.magazine.noaa.gov/stories/mag161.htm

- NBC/DEM Partnership Received $150,000 Grant from RI BRWCT to begin the process
- This project will evaluate solutions to improve DO water quality, by looking at the health of entire ecosystem
- Nationally others have employed various "out of the box" solutions in TMDLs

http://www.edc.uri.edu/restoration/html/intro/salt.htm

Beneficial Use of Excess Nitrogen

- Wetlands & salt marsh restoration – remove 250 to 630 g N m^{-2} yr^{-1}
- Bio-extraction –
  - ✓ Ribbed Mussels 1.2 % N
  - ✓ Algae…
- Relay aquaculture
  - ✓ Oysters - 0.52 g N/oyster
  - ✓ Quahogs -16.2 g N/kg meat
- **Goals & Benefits:**
  - ✓ Improved Fisheries - Shellfish & Benthic species Restoration & Enhancement
  - ✓ Habitat Creation & Restoration
  - ✓ Create Green Jobs for the Future
  - ✓ Best WQ Improvement for the Buck

Photos courtesy of: http://www.jaxshells.org/gdim.htm, http://viudeepbay.com/2012/02/12/design-and-construction-report-solar-flupsy-project/, algaebiodiesel.com, Cape Cod Cooperative Extension

Sustainable Solutions Feasibility Study

- Project Convened Expert Panels on:
  - ✓ Shellfish
  - ✓ Aquaculture
  - ✓ Salt Marsh/Wetlands
  - ✓ Fisheries
  - ✓ Dredging
  - ✓ Hydrodynamics
  - ✓ Eelgrass
  - ✓ Geology
  - ✓ Modeling
  - ✓ Habitat Restoration

- Expert panels reviewed & assessed sustainable solutions for Environmental Improvement:
  - ✓ Scientific rational
  - ✓ Feasibility
  - ✓ Regulatory roadblocks
  - ✓ Efficacy
  - ✓ Economic Value
  - ✓ Costs & Benefits

Initial Timeline of Study

- Year 1 – 2014 - 2015
  - ✓Hire Consultant
  - ✓Consultant compile background research
  - ✓Expert Panel meetings to develop & assess viable topics of investigation
  - ✓Stakeholder group to review list from Expert Panels
  - ✓Draft report developed – **Still Awaiting Consultant's Final Report**
- Years 2 & 3 – 2015/2016
  - ✓Modification of water quality models
  - ✓Validation of priority topics
  - ✓Priority topic pilot demonstration projects
  - ✓Identify and Test "Low Hanging Fruit" Opportunities
- **Coordination Team Disbanded and Project has not moved Forward**

Outcomes of the Process

- Developed a blueprint of "sustainable" ecosystem-based management solutions to improve water quality and ultimately restore upper Narragansett Bay
- Complete the FIRST TRUE Ecosystem Based Evaluation of an Estuary in the Nation!!!
- Provide a Robust Tool Box to DEM for TMDL development for Providence and Seekonk Rivers
- Identify opportunities to create sustainable jobs as we restore our Bay
- A Healthy Sustainable Narragansett Bay, more resilient to future challenges

Questions ???