Rhode Island Water Quality Improvements Linked to WWTF Pollutant Effluent Reductions

RIDEM Office of Water Resources

2023 National NPDES Permitting Meeting

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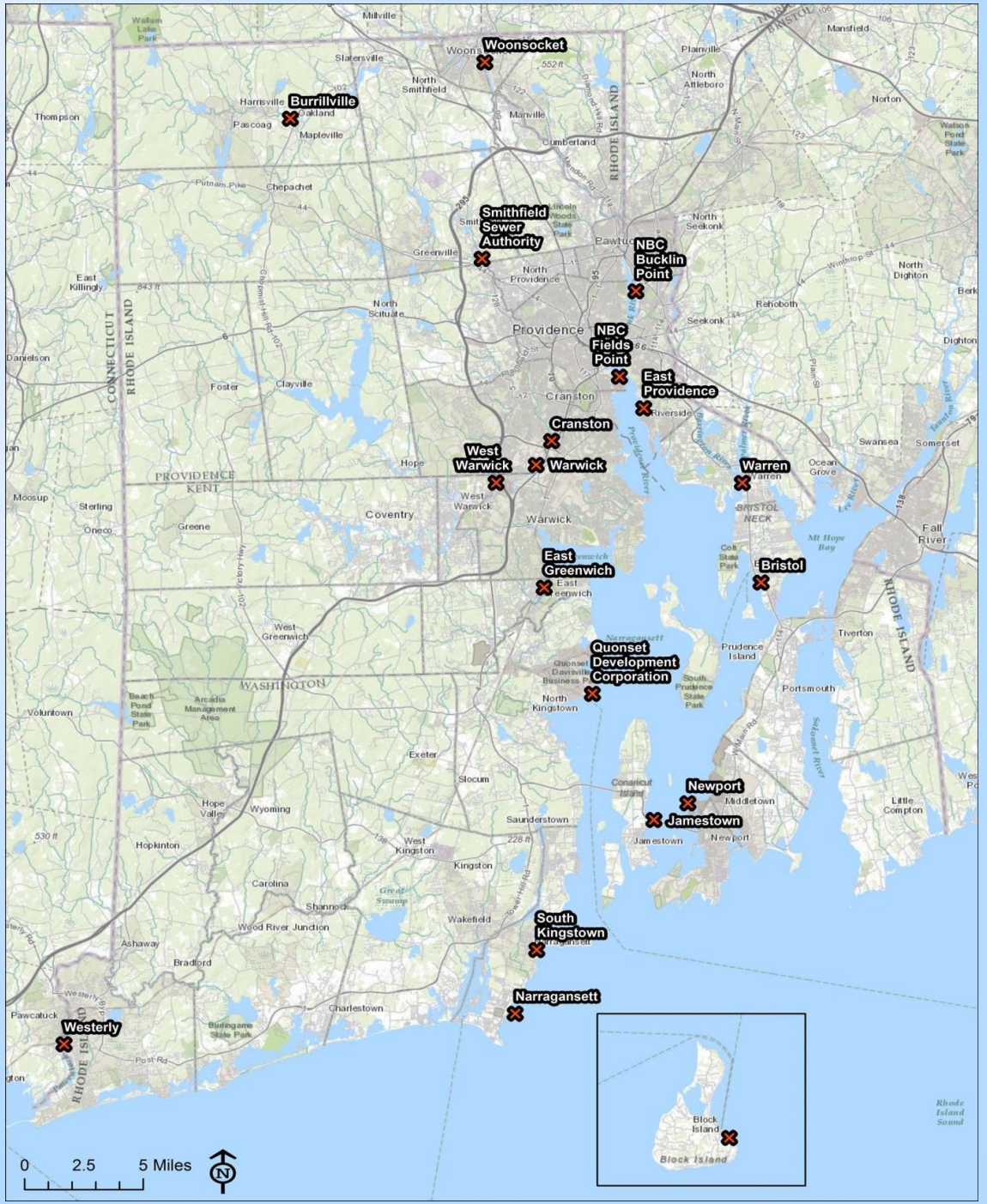
19 Rhode Island Municipal WWTFs

6 Freshwater Discharges

13 Saltwater Discharges

3 Systems with Combined Sewer Overflows



RI WWTF Design Flows
Relative Contribution

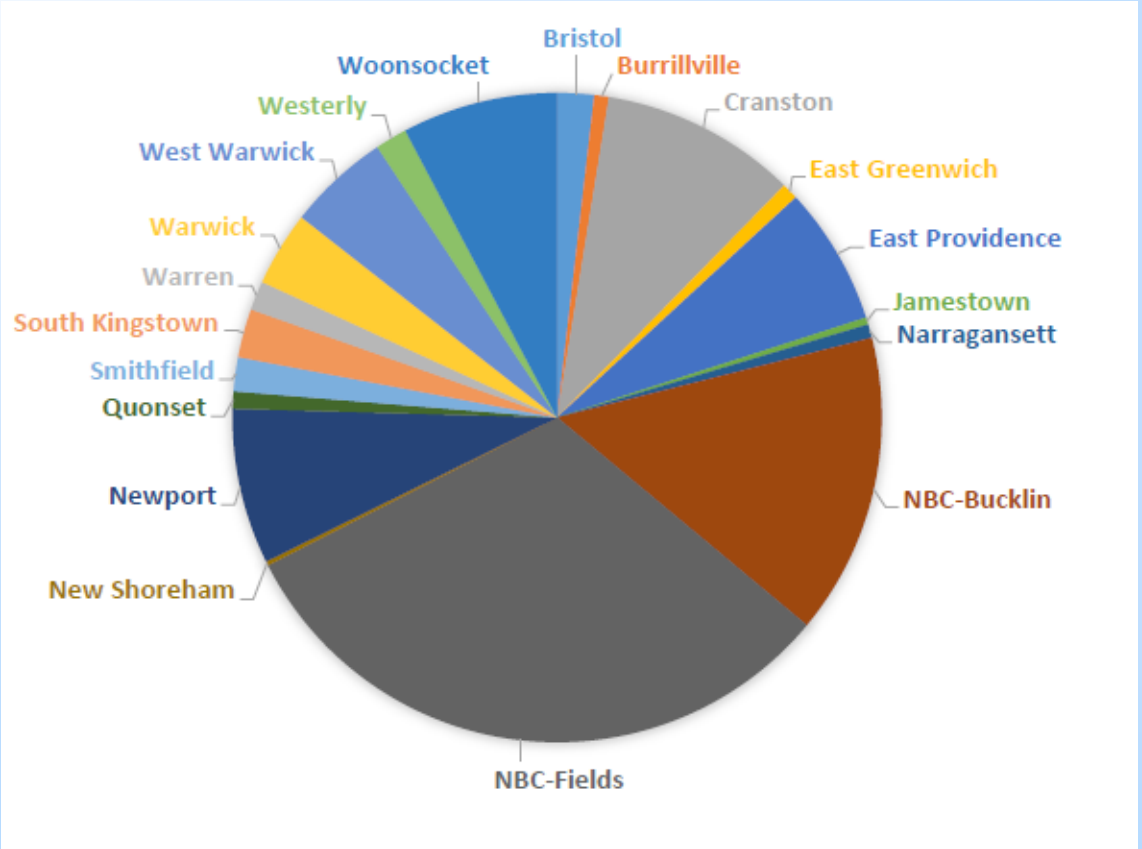


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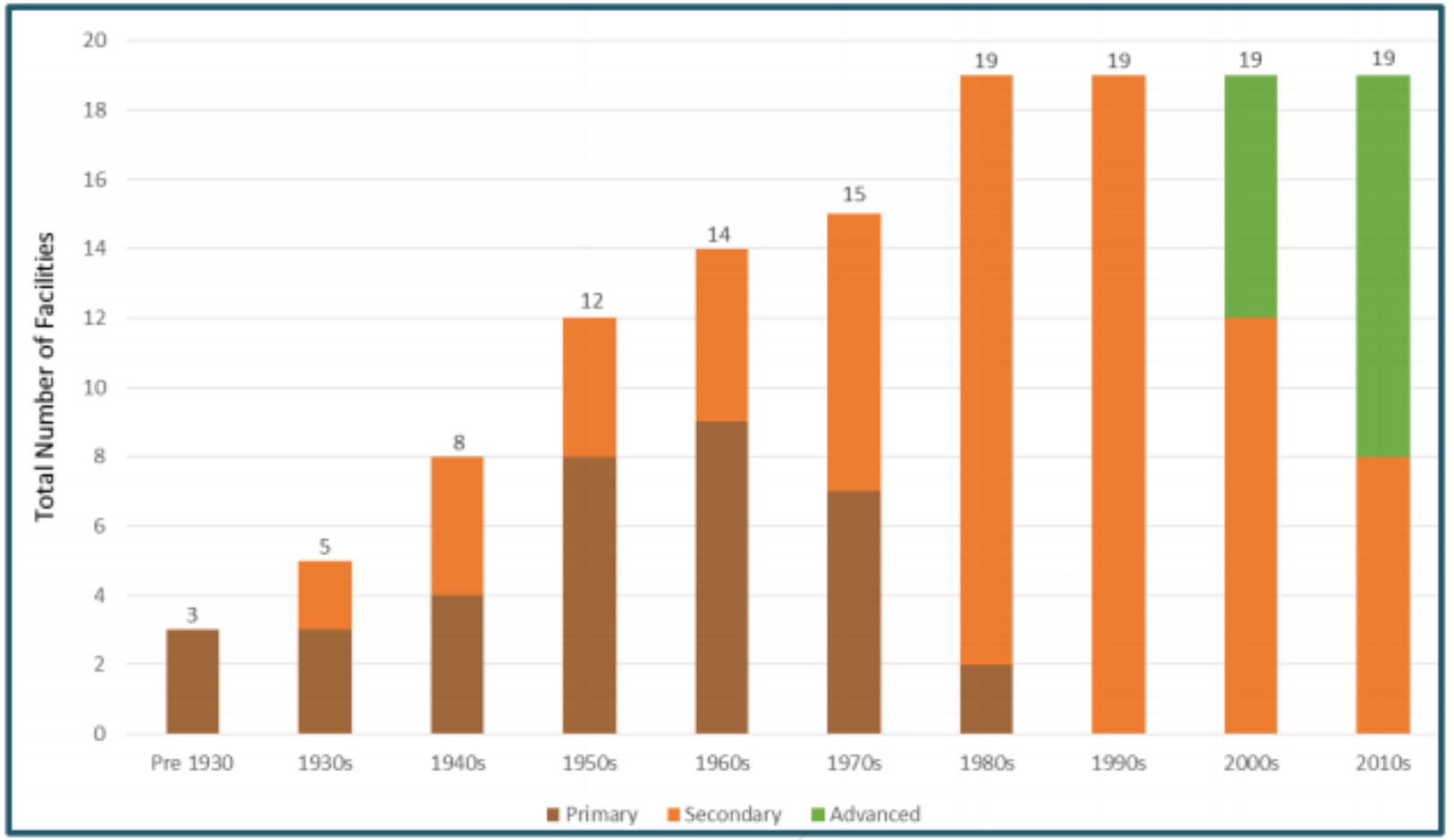
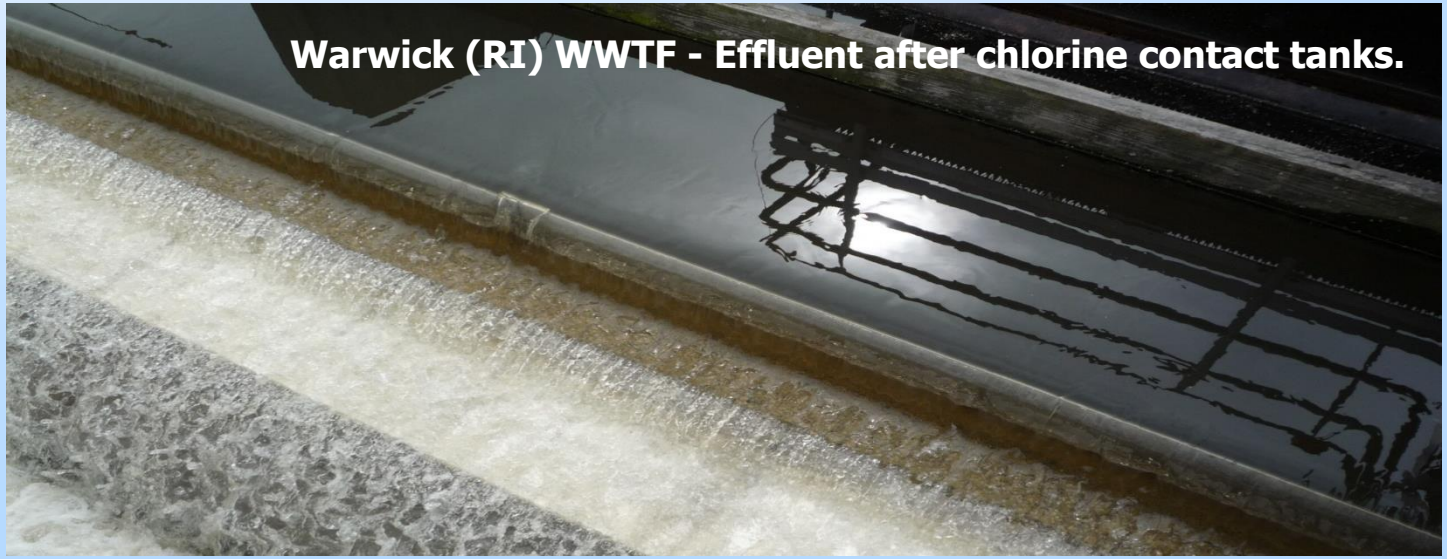
Figure 8, Trends in Level of Treatment at RI Wastewater Facilities
(Source: DEM)



Wastewater Disinfection



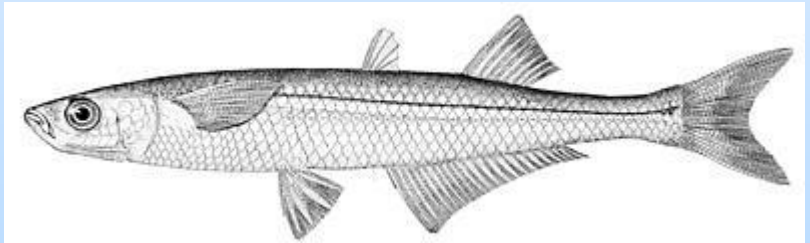
https://www.southbendin.gov/government/content/treatment-plant
https://www.tpomag.com/editorial/2015/01/asset_management_gets_big_attention_at_the_newly_upgraded_plant_bucklin_poi

Limiting Chlorine to Protect Aquatic Life

EPA saltwater standard based on most sensitive of 24 species.

Eastern Oyster

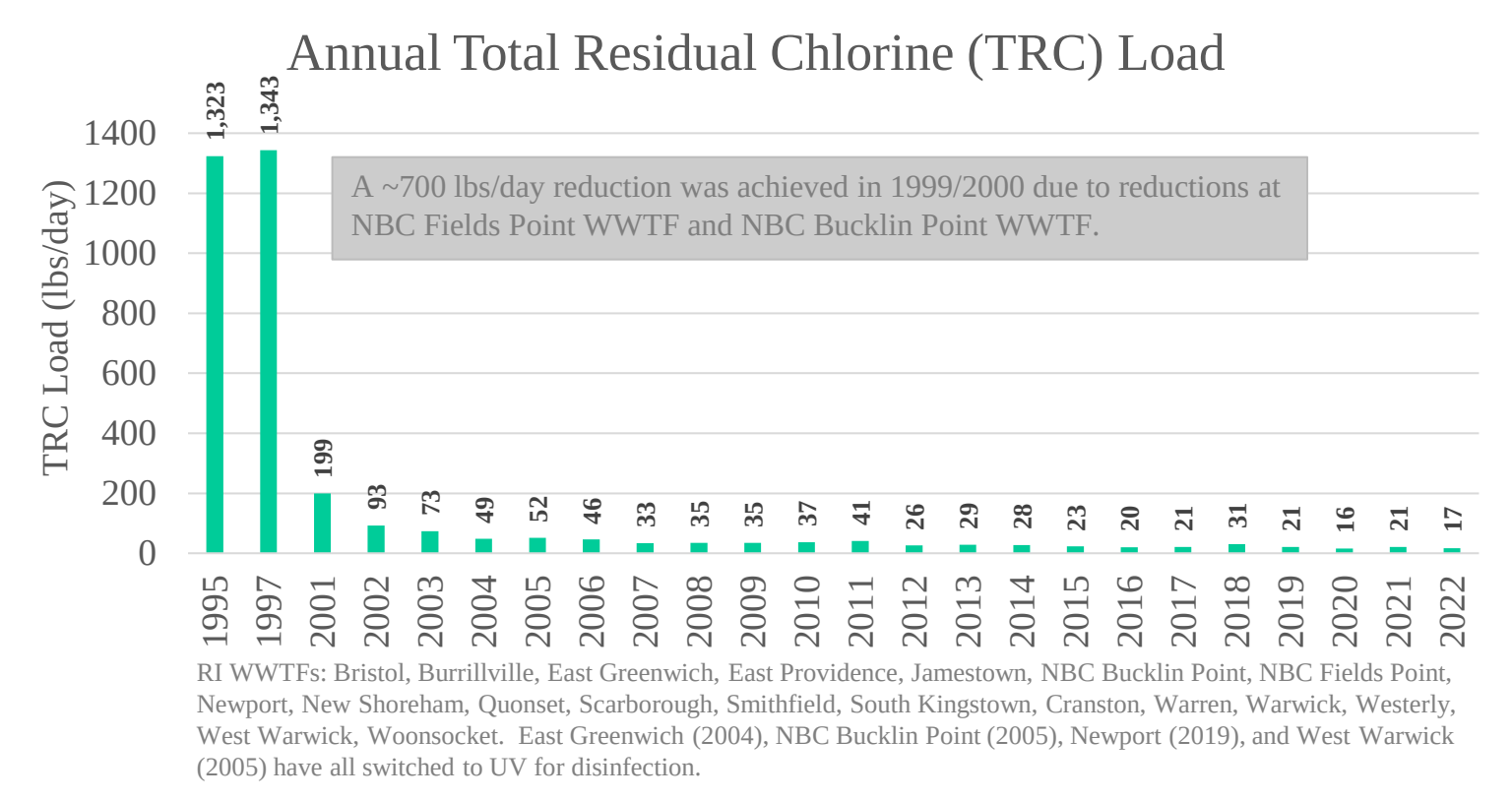
Coho



Atlantic silverside

https://commons.wikimedia.org/wiki/File:Coho.jpg
https://commons.wikimedia.org/wiki/File:Atlantic_silverside.jpg
https://commons.wikimedia.org/wiki/File:Eastern_Oyster_(Crassostrea_virginica)_Top_(16114506758).jpg

Rhode Island WWTF Total Residual Chlorine Load



As of 2023, four of the nineteen WWTFs have switched to UV disinfection eliminating their TRC discharge.

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Excess Nitrogen in Narragansett Bay

WWTF Nitrogen Reductions

WWTFs impacting Upper Narragansett Bay (including Greenwich Bay)

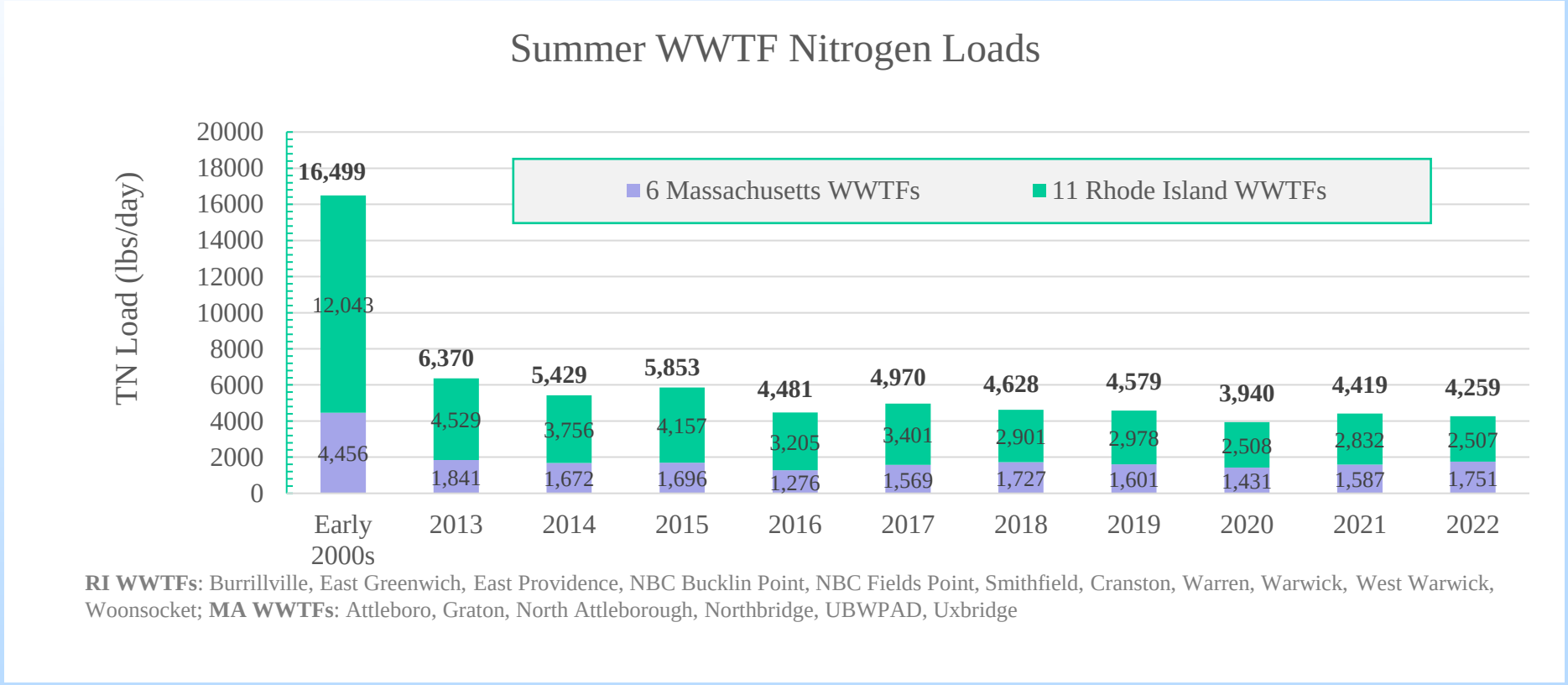
74.2% Summer (May through October) Total Nitrogen Load Reduction from six Massachusetts and eleven Rhode Island WWTFs between early 2000s and 2022.

WWTFs impacting all of Narragansett Bay (including Upper Narragansett Bay and Taunton River)

49% Annual Total Nitrogen Reduction[1] between early 2000s and 2013-2015 with WWTFs discharging 55% of annual load to the entire Bay in 2013-2015.

[1]Narragansett Bay Estuary Program. 2017. State of Narragansett Bay and Its Watershed (Chapter 8, Nutrient Loading, pages 166-189). Technical Report. Providence, RI.

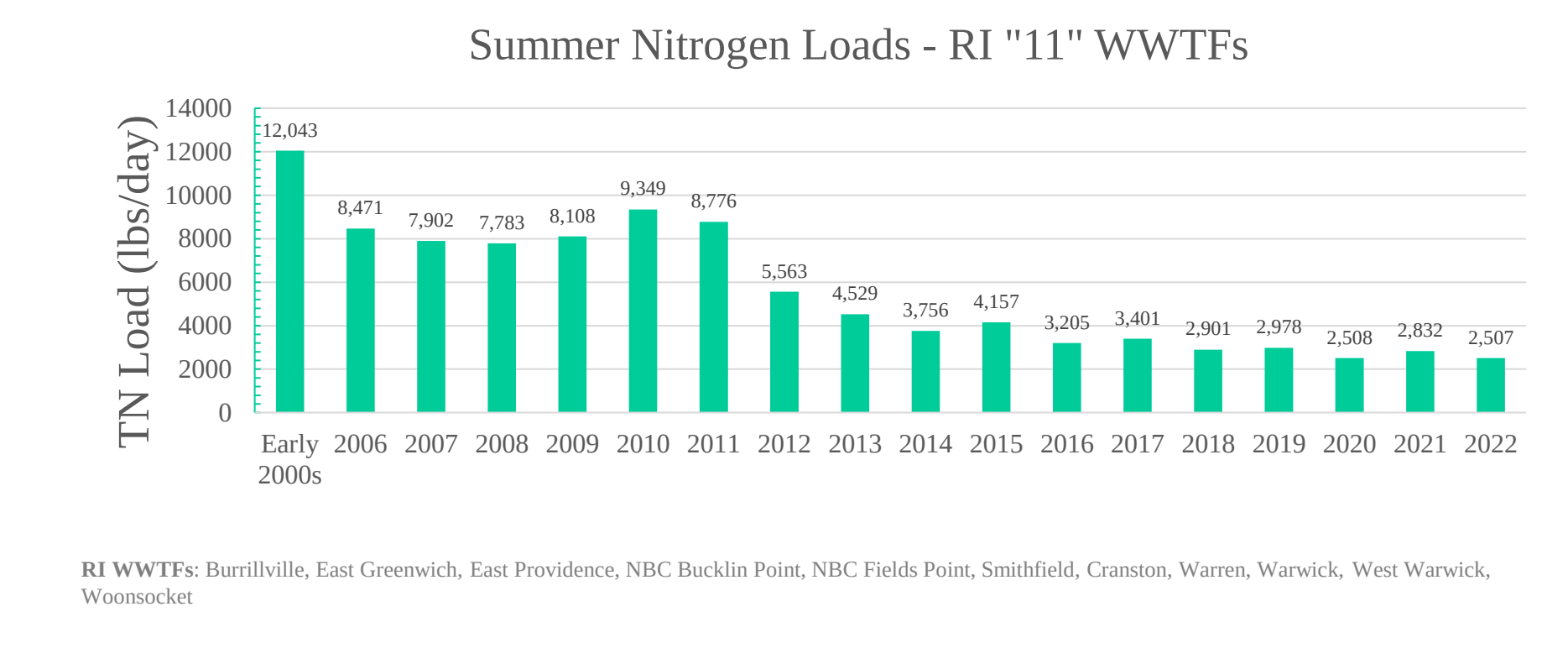
RI and MA WWTFs Summer Nitrogen Loads



RI WWTFs: Burrillville, East Greenwich, East Providence, NBC Bucklin Point, NBC Fields Point, Smithfield, Cranston, Warren, Warwick, West Warwick, Woonsocket; **MA WWTFs**: Attleboro, Graton, North Attleborough, Northbridge, UBWPAD, Uxbridge

Summer load reductions from the eleven Rhode Island WWTFs and six Massachusetts WWTFs that impact Upper Narragansett Bay are ~74% from the early 2000s.

Rhode Island WWTF Summer Nitrogen Loads



RI WWTFs: Burrillville, East Greenwich, East Providence, NBC Bucklin Point, NBC Fields Point, Smithfield, Cranston, Warren, Warwick, West Warwick, Woonsocket

Twelve of the nineteen Rhode Island WWTFs have nitrogen limits. Eleven of these discharges impact upper Narragansett Bay. These eleven have achieved >75% reduction in summer total nitrogen loads since the early 2000s.

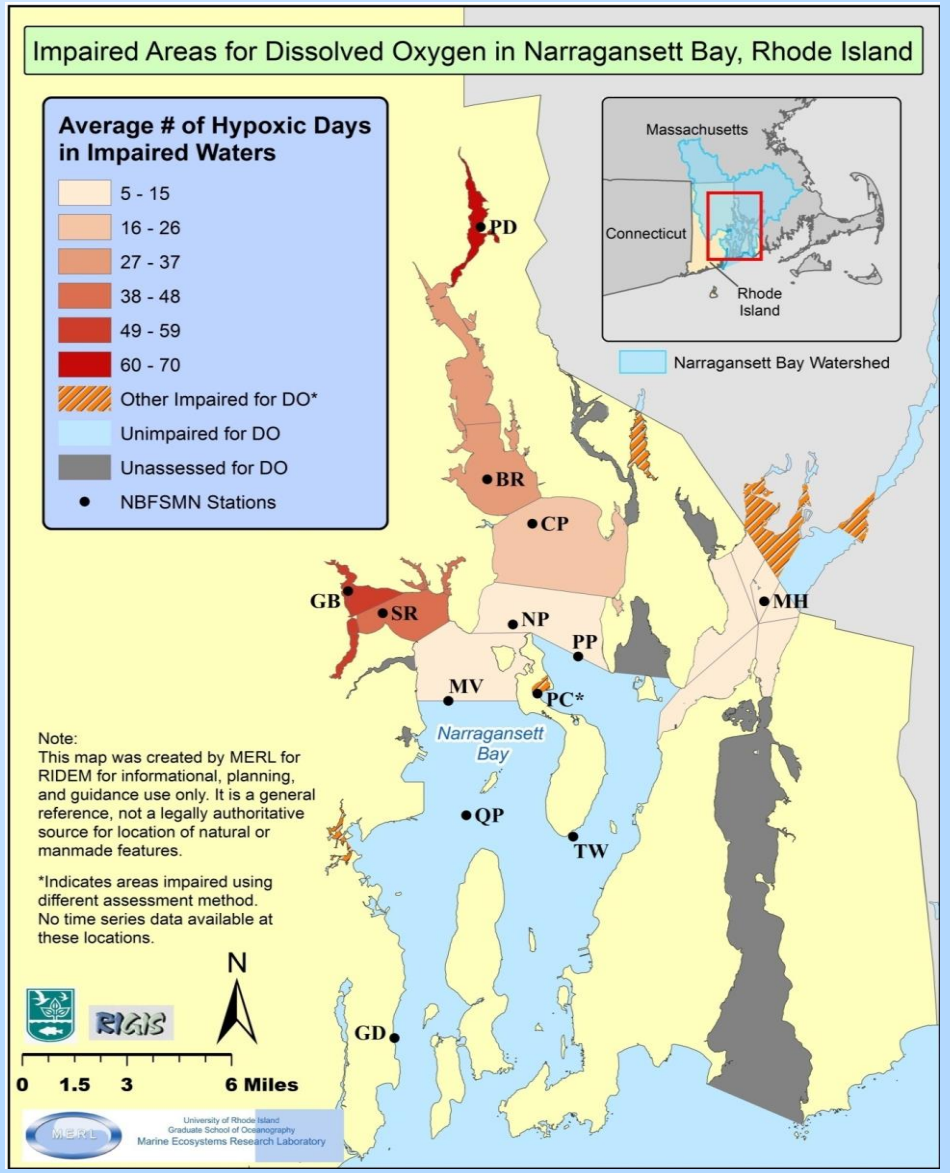
Hypoxia in Narragansett Bay

In 2006, DEM adopted saltwater oxygen criteria developed at EPA Narragansett Lab based on a 95% larval survivability for four most sensitive species studied, which included lobster.

Narragansett Bay has a complex coastline with multiple passages and embayments. There is a north to south gradient in nutrient pollution, primary productivity, chlorophyll levels, and hypoxia.

Seasonal intermittent hypoxia events from May to October threaten ecological health with the most intense hypoxia occurring in the north (Seekonk River) and west (Greenwich Bay).

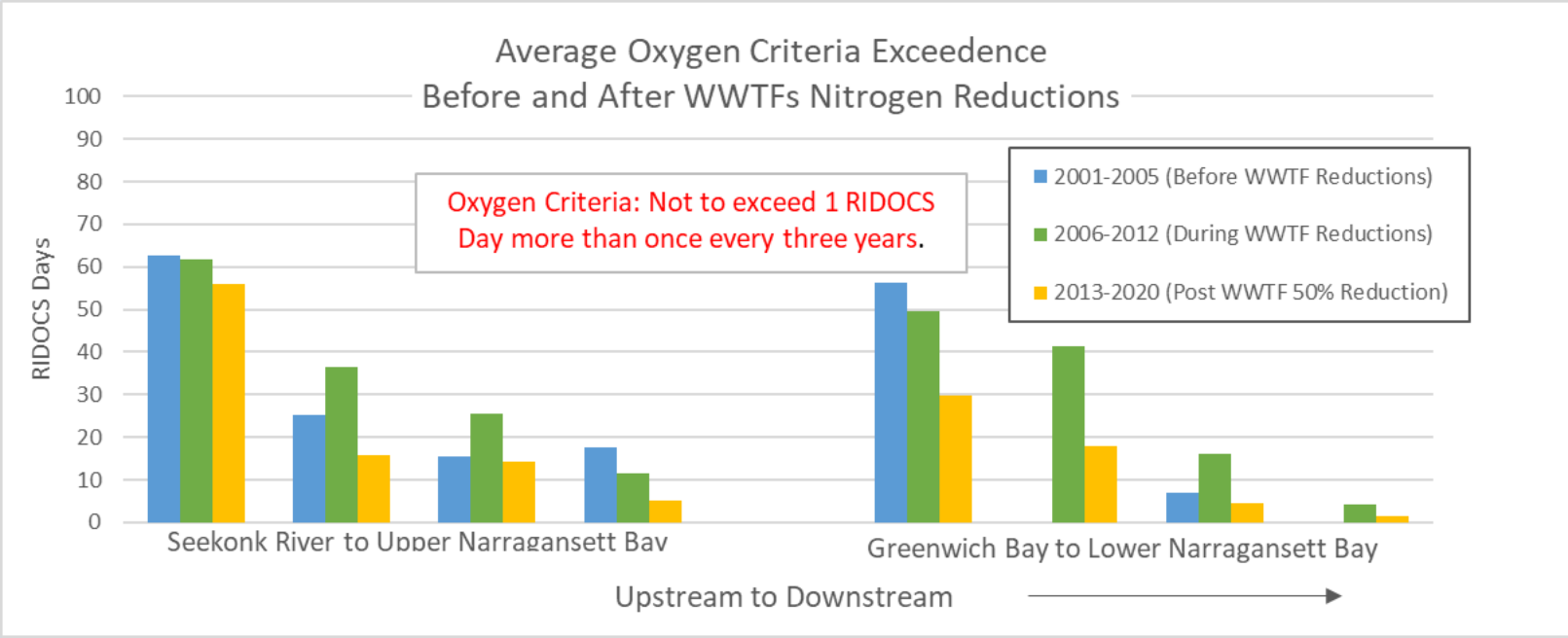
Hypoxia events (< 2.9 mg L^{-1}) last from ~1 day to about ~2 weeks (typically 2-7 days). Typically, 2 to 5 events per season, depending upon location

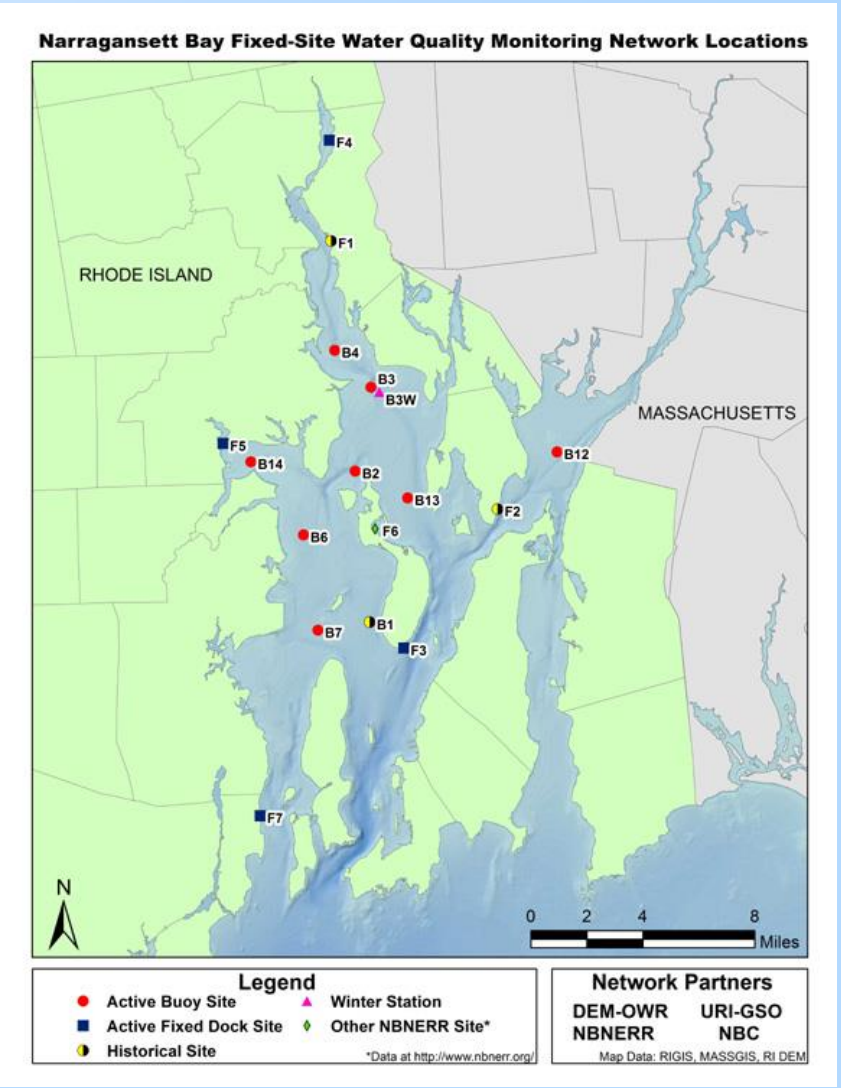


Water Quality Improvements

Linked to WWTF Investments

Less low oxygen days throughout the Narragansett Bay. Greenwich Bay is seeing a 10-17% reduction in hypoxia although it remains severely hypoxic.





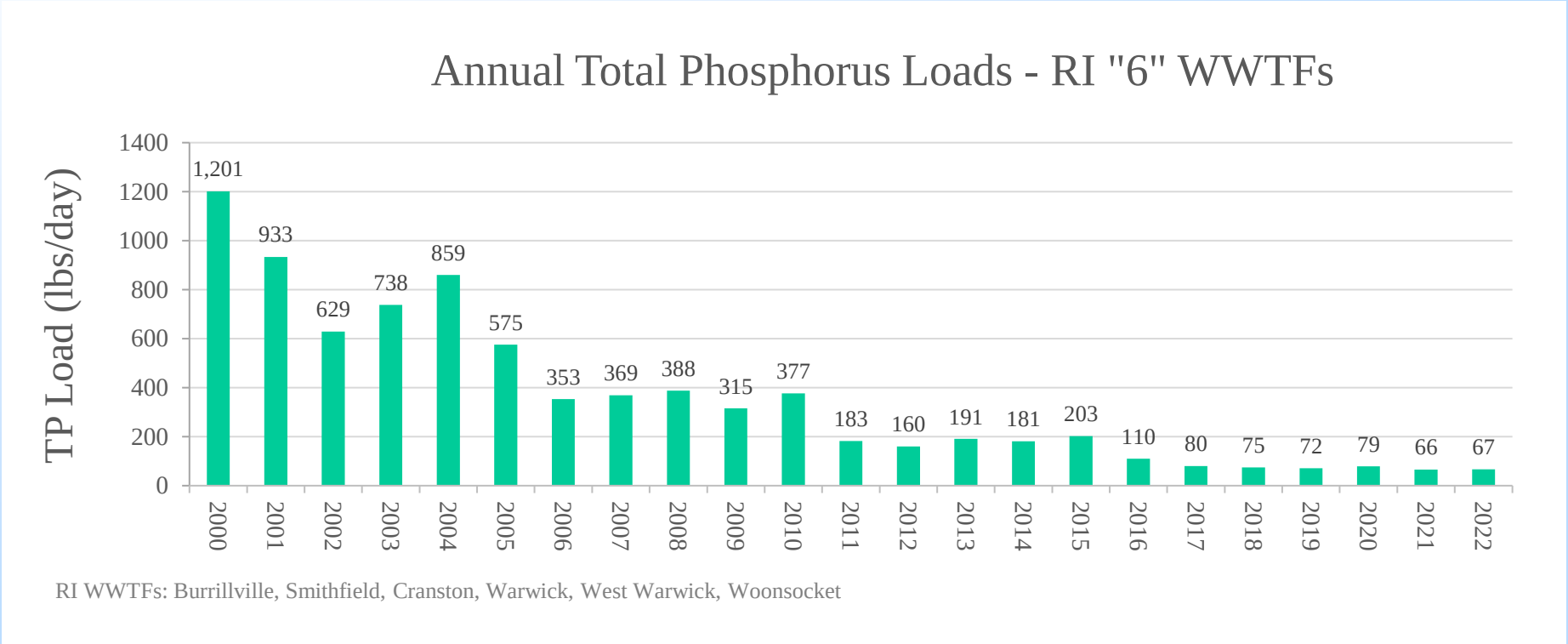
Phosphorus Reductions

Total phosphorus load to all Narragansett Bay (including Upper Narragansett Bay and Taunton River)

Reductions at RI and MA WWTFs along the Blackstone, Pawtuxet, Taunton, Ten Mile, and Woonasquatucket Rivers contributed to a 37% annual reduction in Bay-wide phosphorus loads from the early 2000s to 2013-15 and a 57% reduction between the early 2000s and 1982-83[1].

[1]Narragansett Bay Estuary Program. 2017. State of Narragansett Bay and Its Watershed (Chapter 8, Nutrient Loading, pages 166-189). Technical Report. Providence, RI.

Rhode Island Freshwater WWTF Phosphorus Load

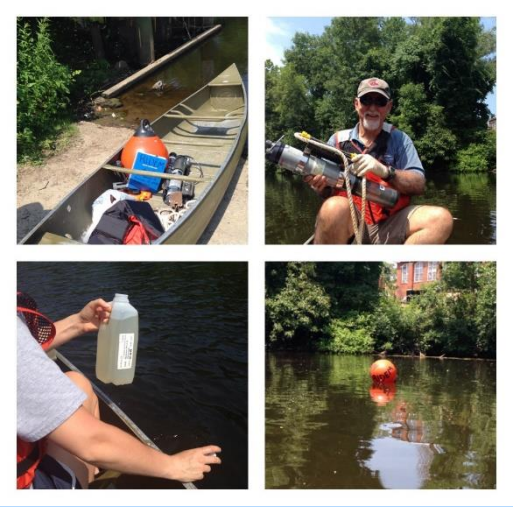


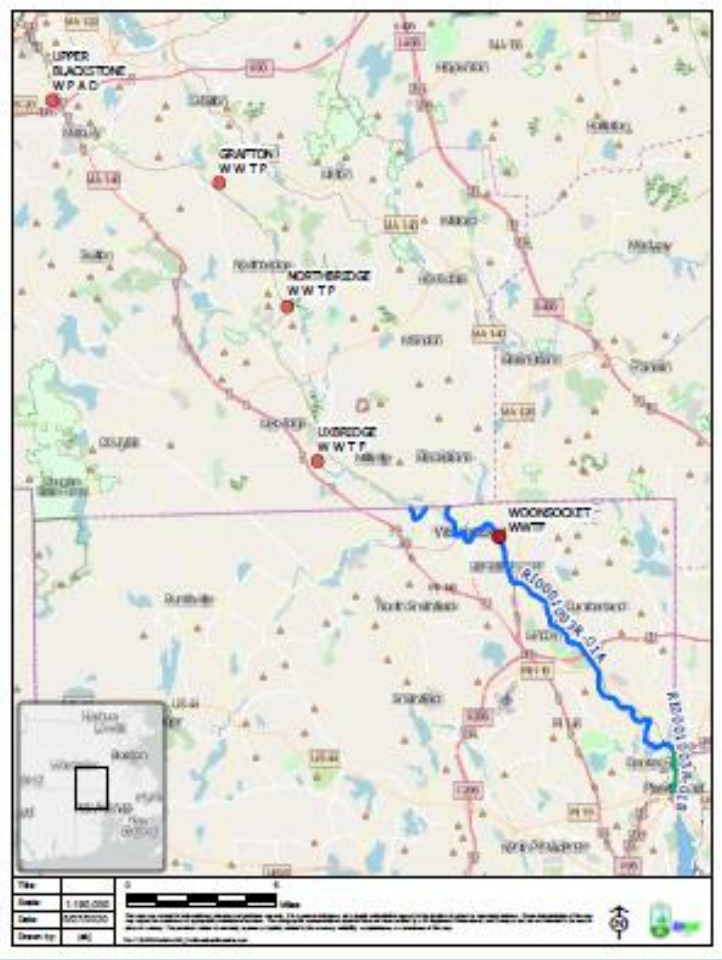
Six of the nineteen Rhode Island WWTFs discharge to three freshwater rivers within the metro Providence area. Annual total phosphorus load reductions from these six WWTFs are >90% since the early 2000s.

Water Quality Restoration
Linked to WWTF Investments

Blackstone River*

- Removed Aquatic Life Use Parameters (Dissolved Oxygen and Total Phosphorus) from 303(d) List of Impaired Waters in 2018-2020.
- Phosphorus Reductions from one Rhode Island and four Massachusetts Wastewater Treatment Facilities.



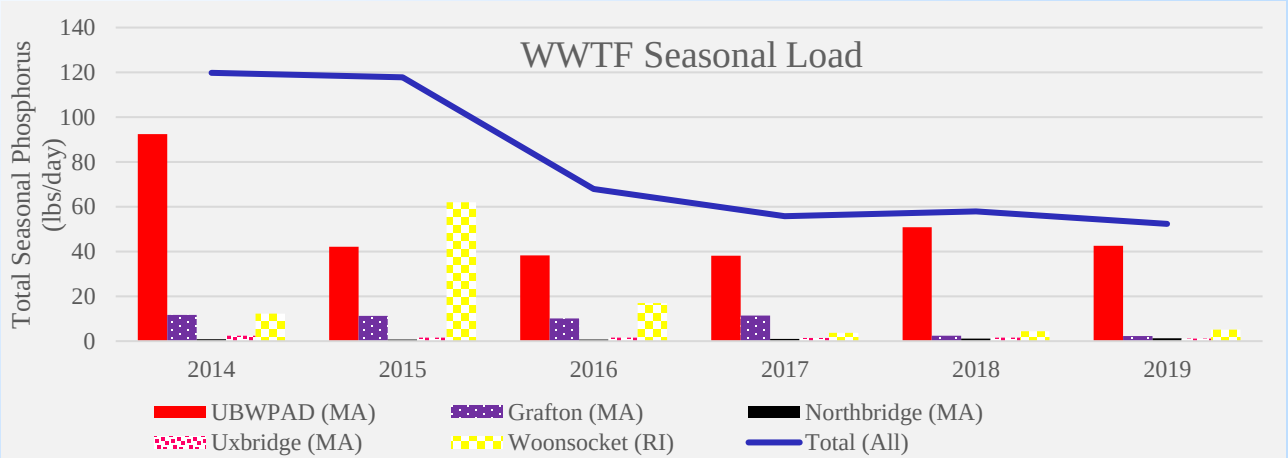


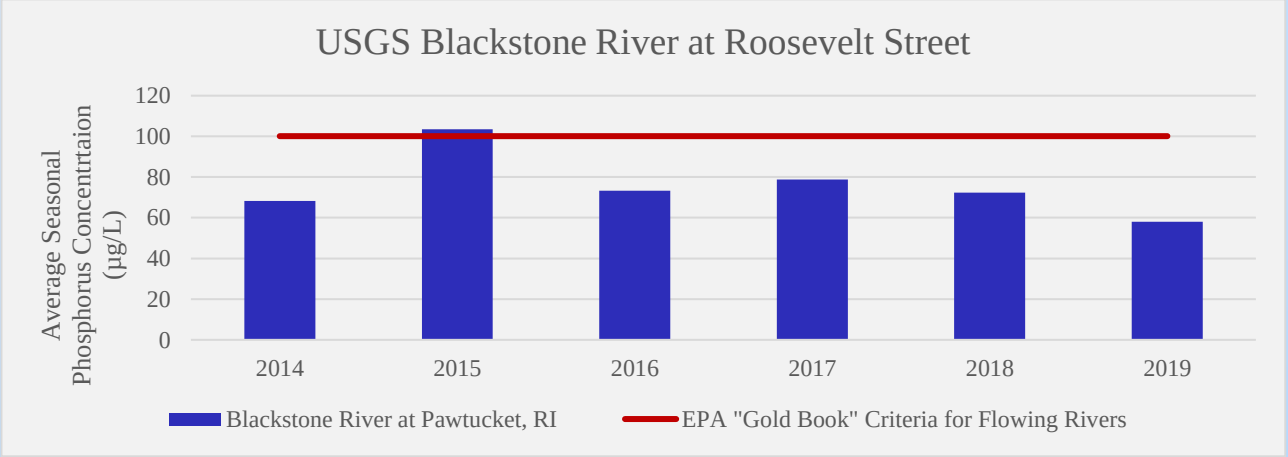
*Delisting applied only to RI Waters.

Water Quality Restoration
Linked to WWTF Investments

Total Phosphorus

Blackstone River*



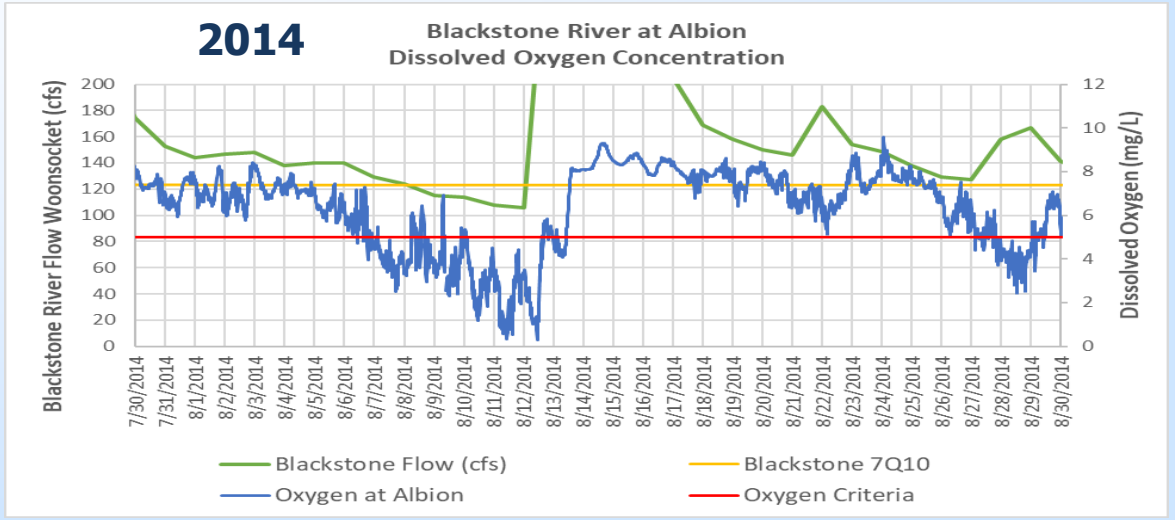


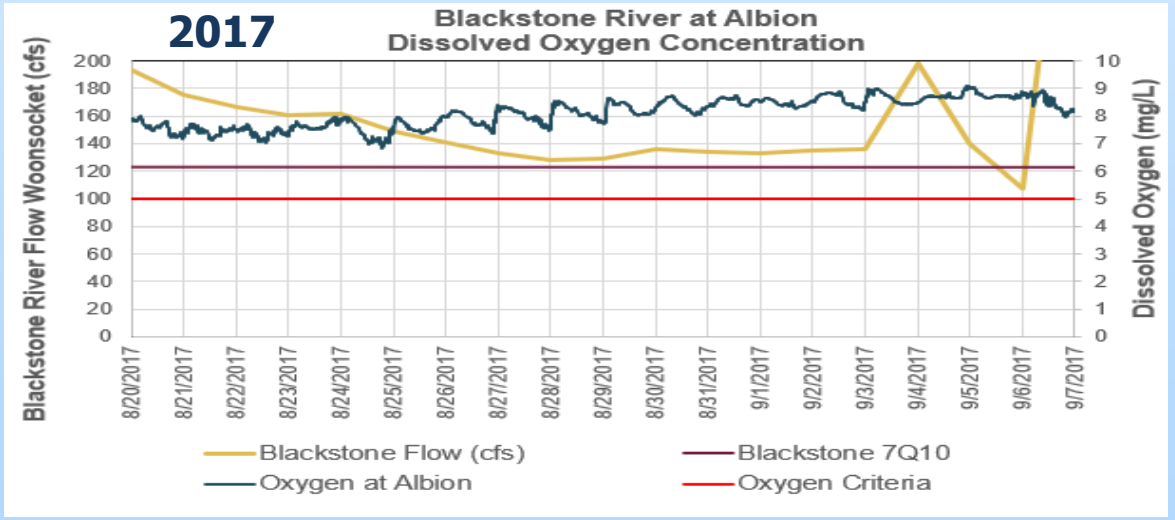
*Delisting applied only to RI Waters.

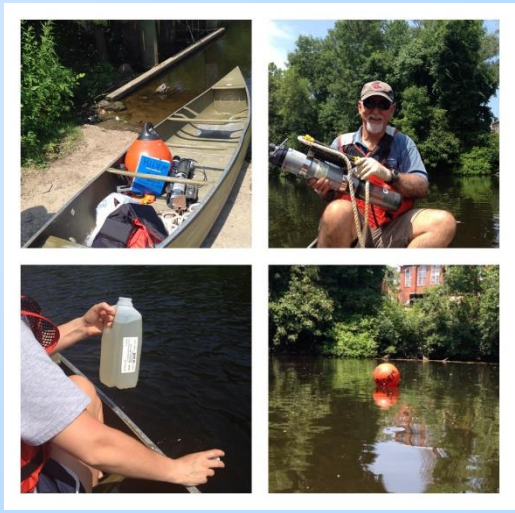
Water Quality Restoration

Linked to WWTF Investments

Dissolved Oxygen Blackstone River*







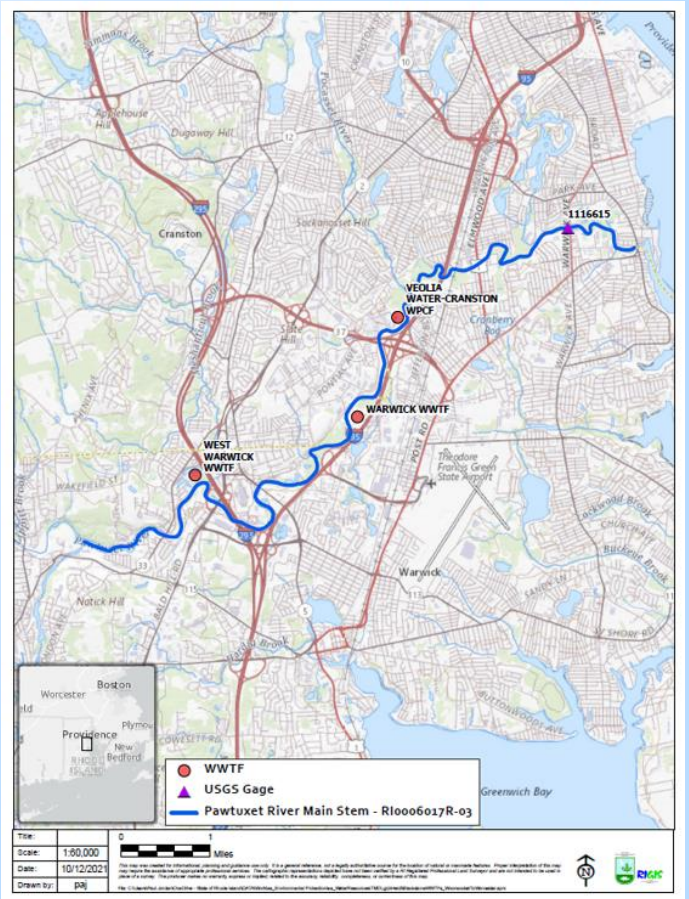
*Delisting applied only to RI Waters.

Water Quality Restoration
Linked to WWTF Investments

Pawtuxet River Main Stem

- Removed Aquatic Life Use Parameters (Total Phosphorus and Dissolved Oxygen) from 303(d) List of Impaired Waters in 2022 and 2008, respectively.
- Phosphorus Reductions at three Rhode Island Wastewater Treatment Facilities.

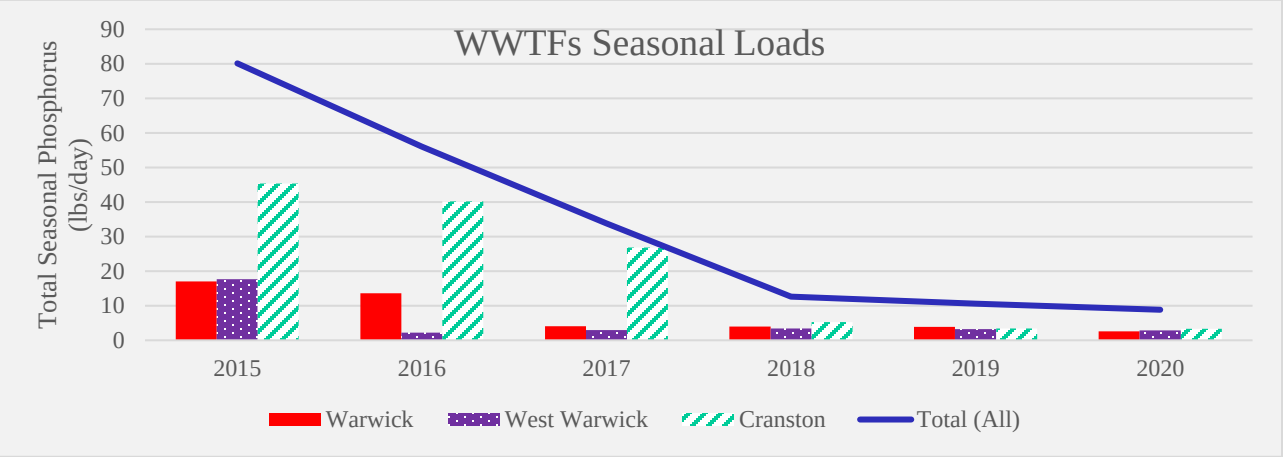
Pawtuxet River
2008 Dissolved Oxygen Monitoring

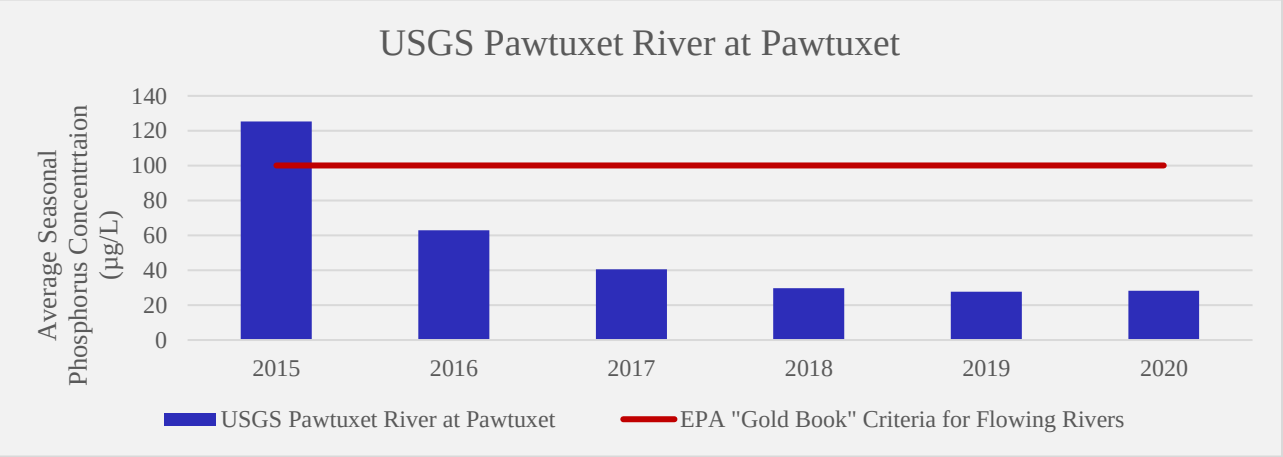


Pawtuxet River Waterbody Segment with WWTFs and Monitoring Station

Water Quality Restoration
Linked to WWTF Investments

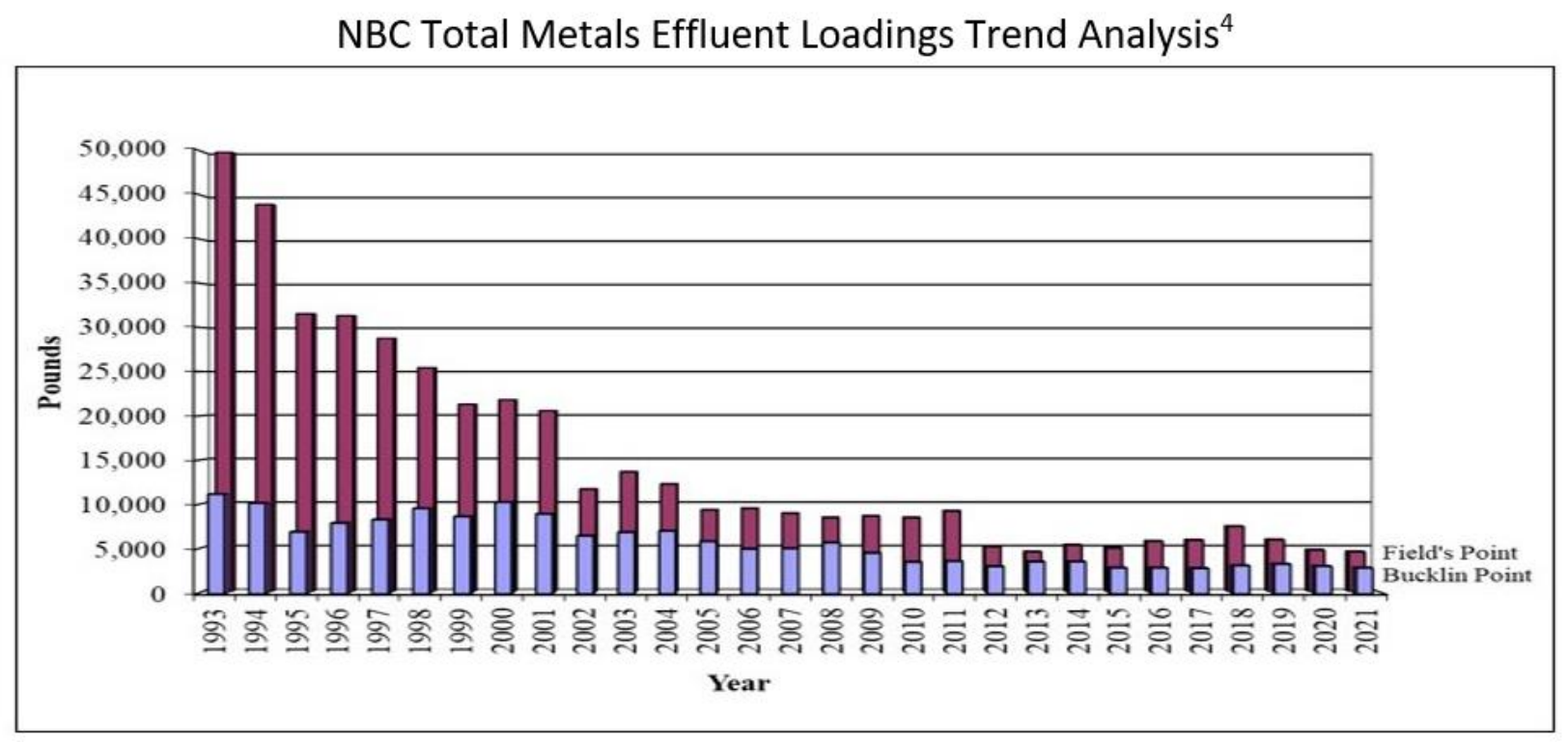
Pawtuxet River Main Stem





Metals

NBC Fields Point and Bucklin Point WWTFs were the largest sources of metals from RI WWTFs.

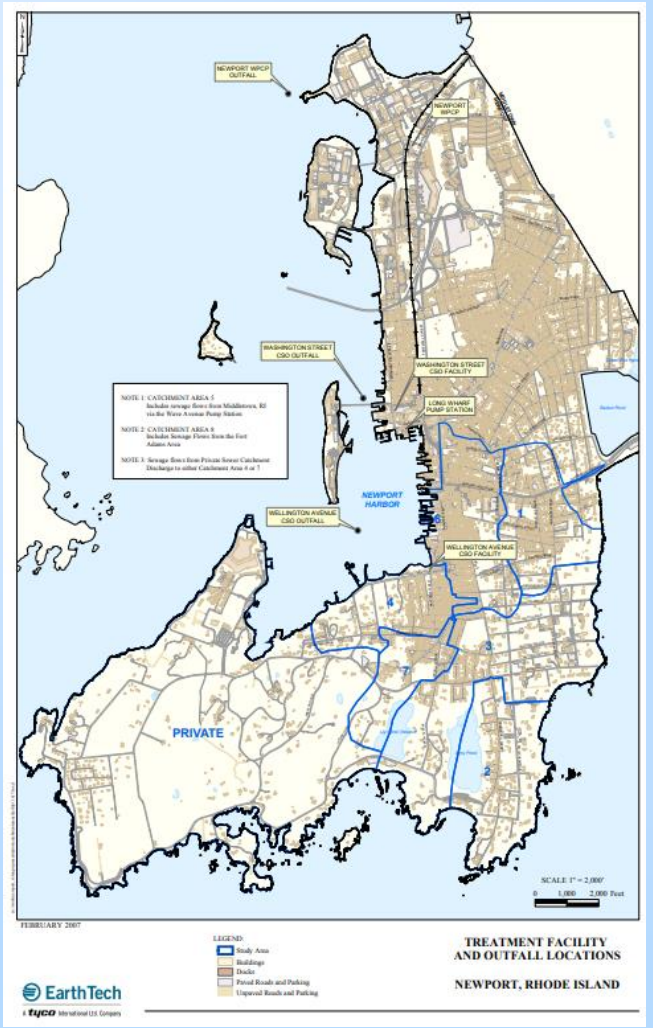


Narragansett Bay Commission. 2022. Pretreatment Annual Report January 1, 2021 – December 31, 2021 (Figure 23, Page 133). Providence, RI.

Combined Sewer Overflows Newport

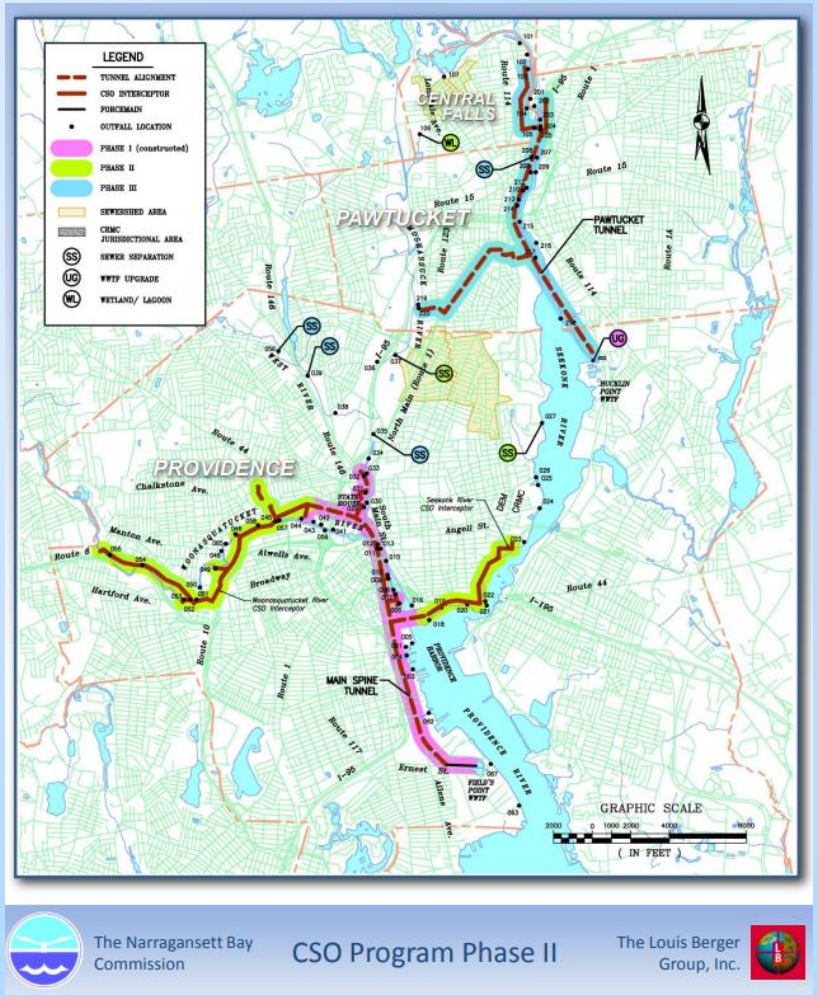
- Two CSO Locations
- Wellington Avenue CSO Facility
  - Primary treatment and chlorination in 1978. System modifications have significantly reduced the number of discharges (one discharge since 2016 during ~6-inch storm event).
- Washington Street CSO Facility
  - Primary treatment and chlorination in 1991. System modifications have reduced the number of discharges. Dechlorination added June 2016.

https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Departments/Utilities/W%20P%20C/CSO-REPORTS/CatchmentAreas.pdf



Combined Sewer Overflows
NBC Fields Point and NBC Bucklin Point

- CSO Locations reduced from 86 to 63 (2022)
- Fields Point Service Area
  - Wet Weather Facility Primary Treatment and Chlorination began 1995. Used 1-8 Times per Year Since CSO Phase I and II Completion in 2015.
  - Phase 1 CSO Tunnel Construction Complete in October 2008.
  - Phase 2 CSO Interceptor and sewer Separation Construction Complete in January 2015.
- Bucklin Point CSOs
  - Wet Weather Facility Constructed in December 2005 for primary treatment, chlorination, and dechlorination.
  - Phase 3 Divided into 4 Sub-Phases. Phase IIIA Design Complete with Project Completion in 2027-2028.



http://www.sna.providence.ri.us/sna4/wp-content/uploads/2012/06/PHASE-II-CSO-PROGRAM_LANDSCAPE_-UPDATED-6-4-2012.pdf

Water Quality Restoration
Linked to WWTF Investments

Upper Narragansett Bay

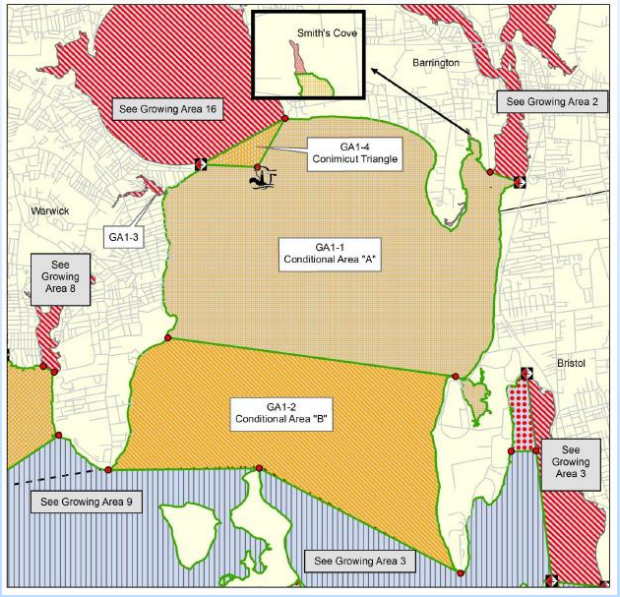
- Removed Shellfish Harvesting Use (fecal coliform) from 303(d) List of Impaired Waters in 2018-2020 after shellfish harvesting restrictions were removed in May 2017.
- CSO Infrastructure Improvements by the Narragansett Bay Commission.

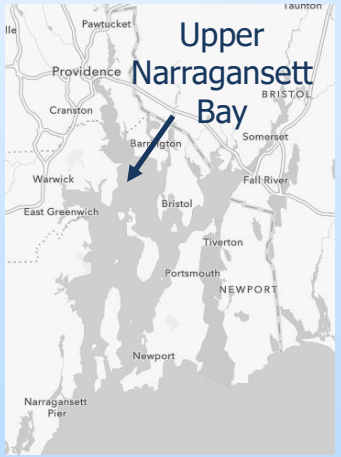
https://snapshot.narrabay.com/app/Services/MossFile.ashx?file=/s/emda/snapshot/Documents/Publications/Water%20Quality%20Reports/Water%20Quality%20Improvements%20Associated%20with%20Phase%20I%20CSO%20%20Tunnel.pdf

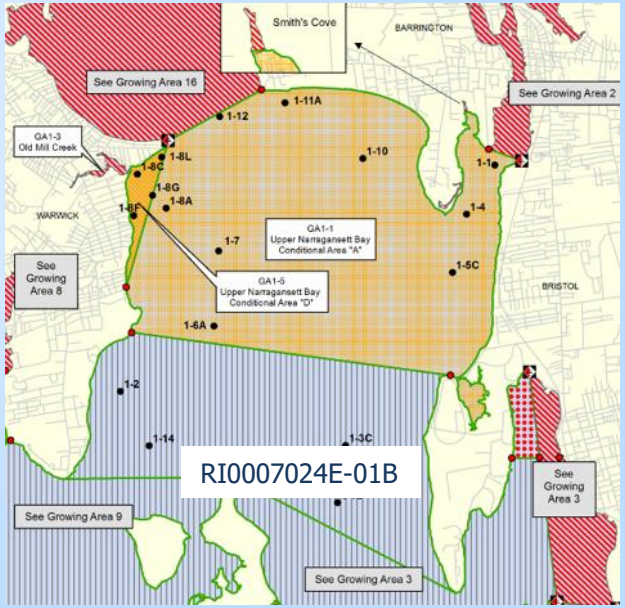
Water Quality Restoration
Linked to WWTF Investments

Upper Narragansett Bay

Shellfish harvesting restrictions removed in May 2017 after a ~70-year closure.



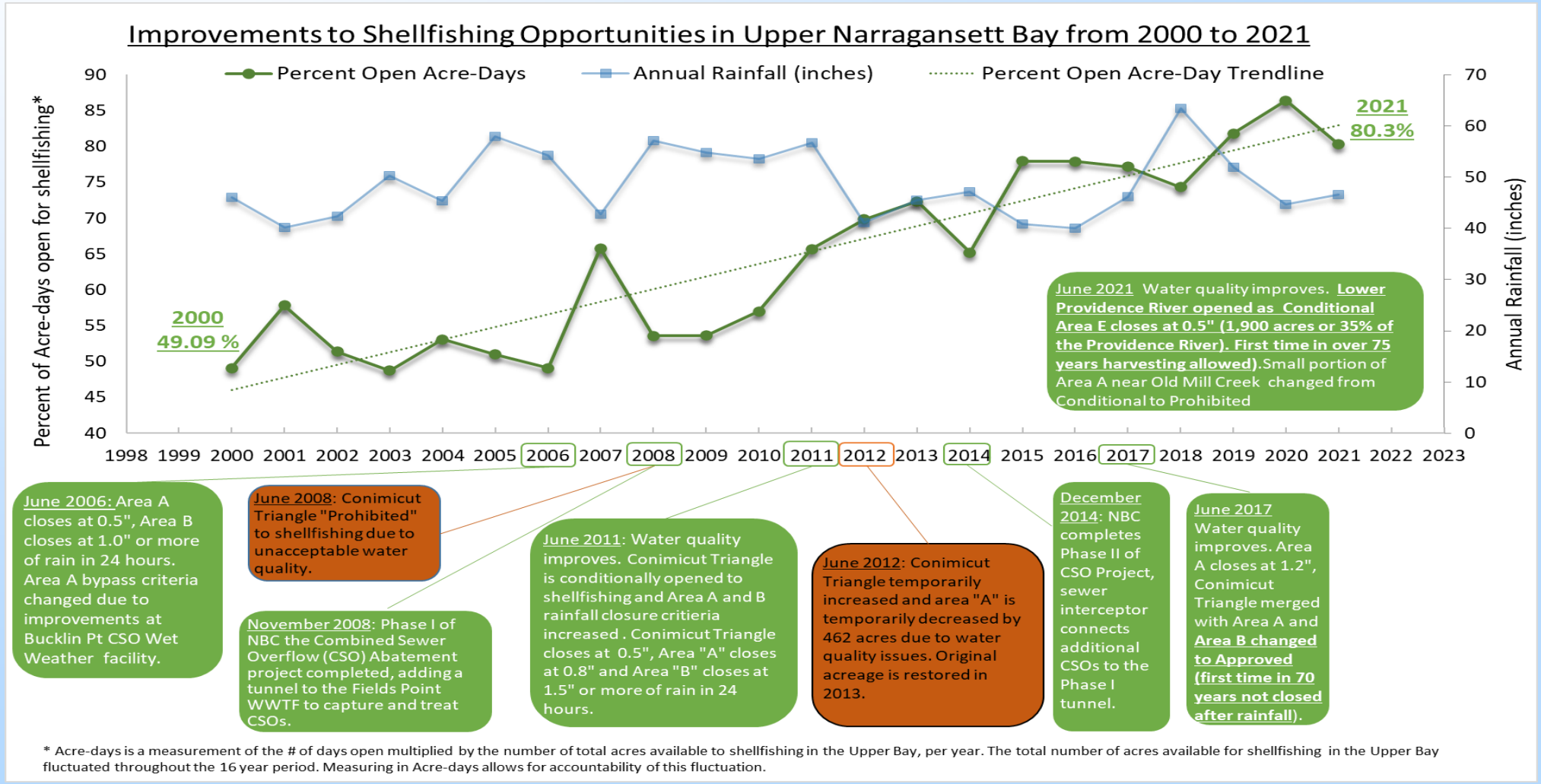




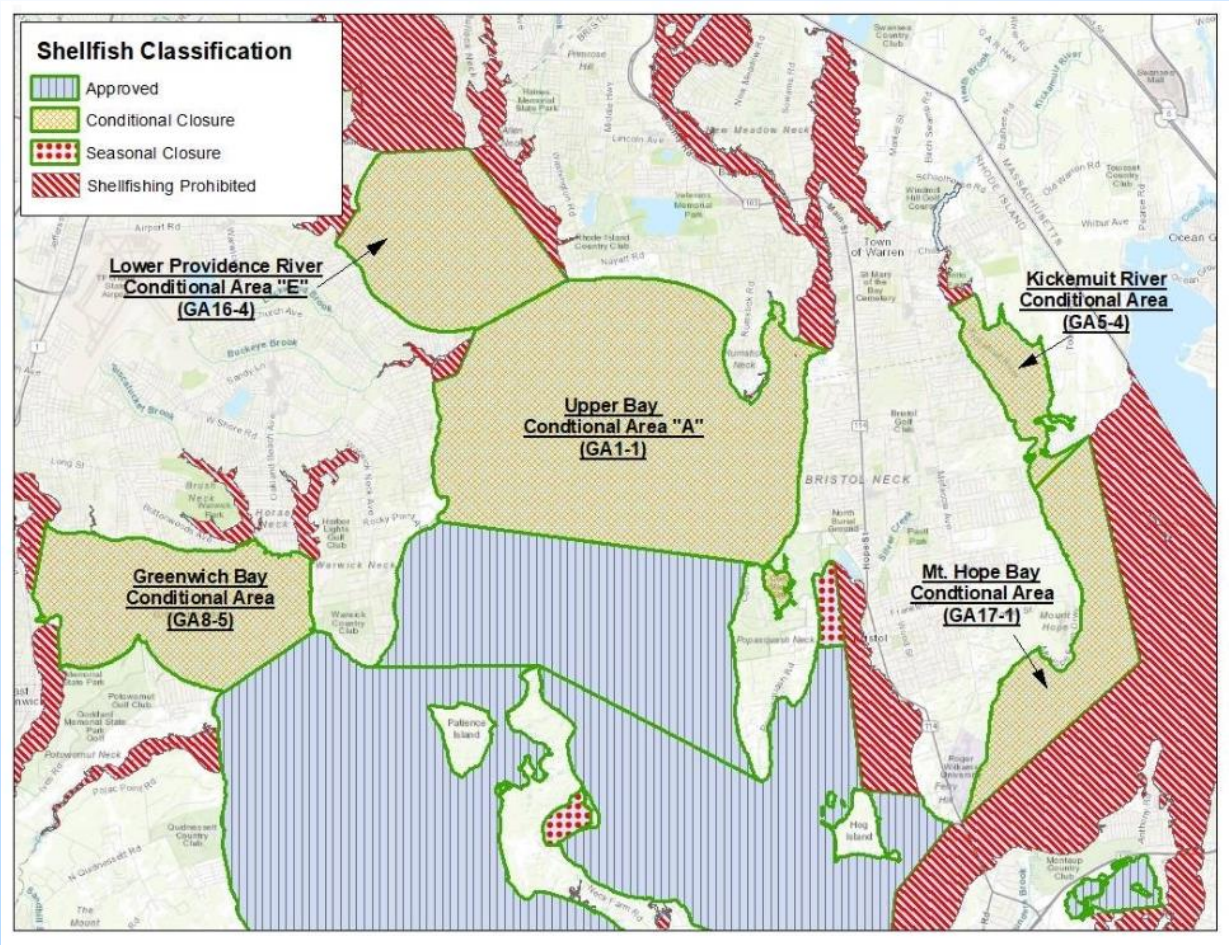
Shellfish Growing Area Map Showing Conditional Area B as a Conditional Shellfish Harvesting Water.

Shellfish Growing Area Map Showing Former Conditional Area B as an Approved Shellfish Harvesting Water.

Water Quality Restoration
Linked to WWTF Investments
Upper Narragansett Bay



Lower Providence River
Shellfish Harvesting Opens - 2021



Lower Providence River
(GA16-4)

1900 Acres
~4M Quahogs/Year

Lower Providence River
Shellfish Harvesting Opens May 26, 2021

Clammers back in Providence River

Alex Kuffner

The Providence Journal USA TODAY NETWORK

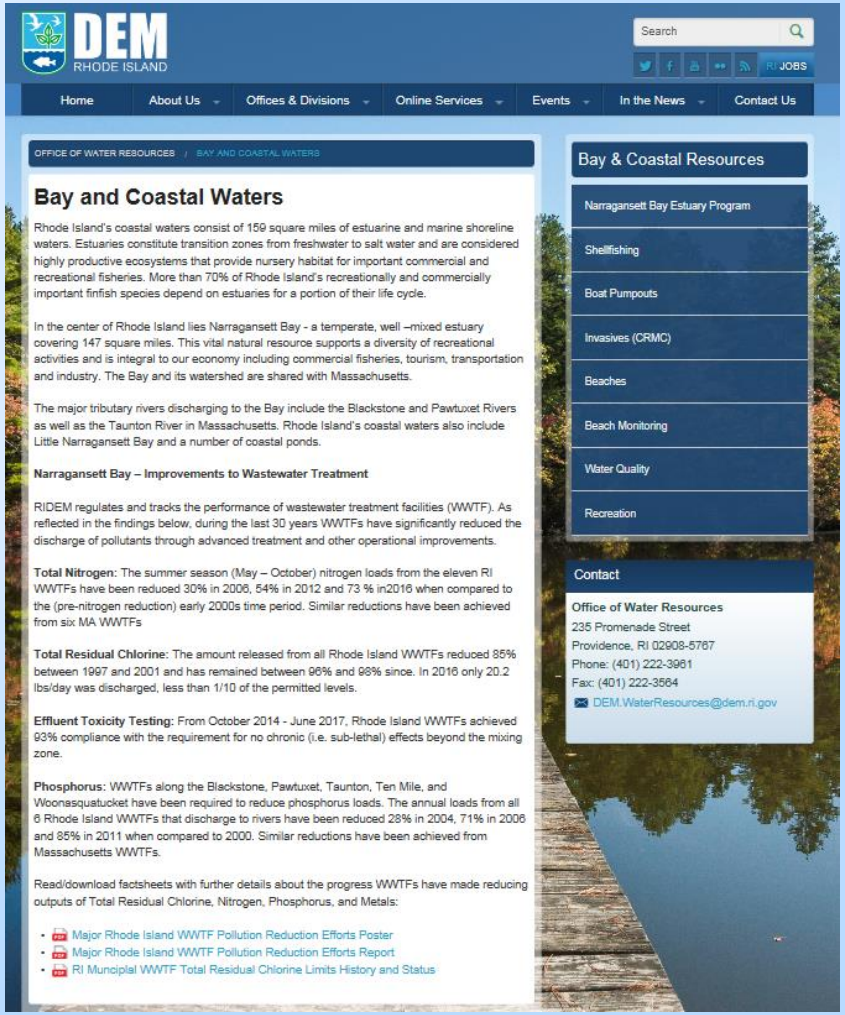
BARRINGTON — It was a scene that hadn't been witnessed in generations on the Providence River: an armada of quahoggers clustered in the waters between Bullock and Gaspee points, raking the bottom for clams.

DEM Poster and Papers

History of Rhode Island Wastewater Treatment Facility Construction & Upgrades

RI Municipal WWTF Total Residual Chlorine (TRC) Limits History

Major Wastewater Pollutant Reduction Efforts in RI Since Meeting Secondary Treatment Standards



http://www.dem.ri.gov/programs/water/bay/