Land Use and Water Quality in RI

Presentation to Legislative Land Use Commission

April 26, 2022

by

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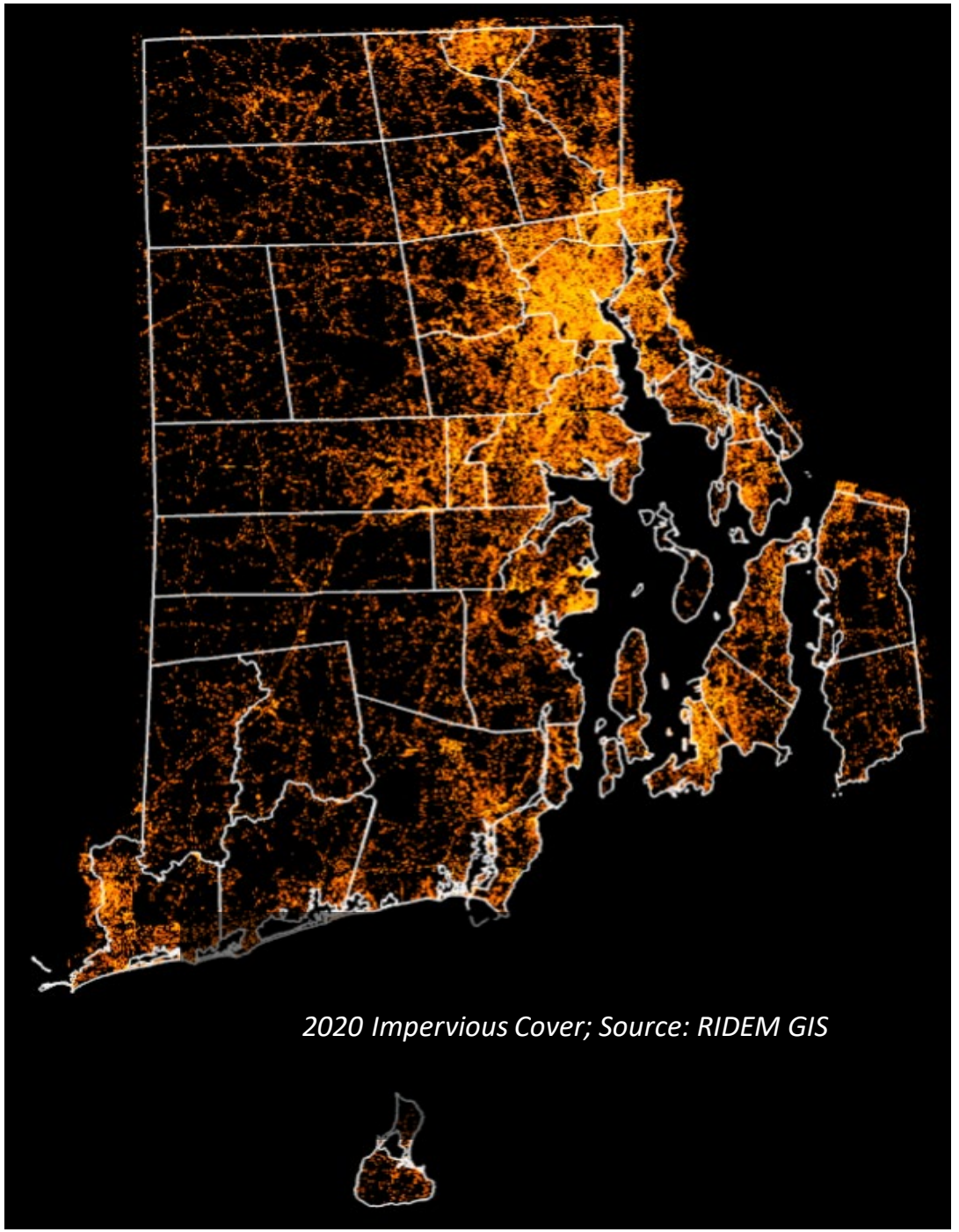
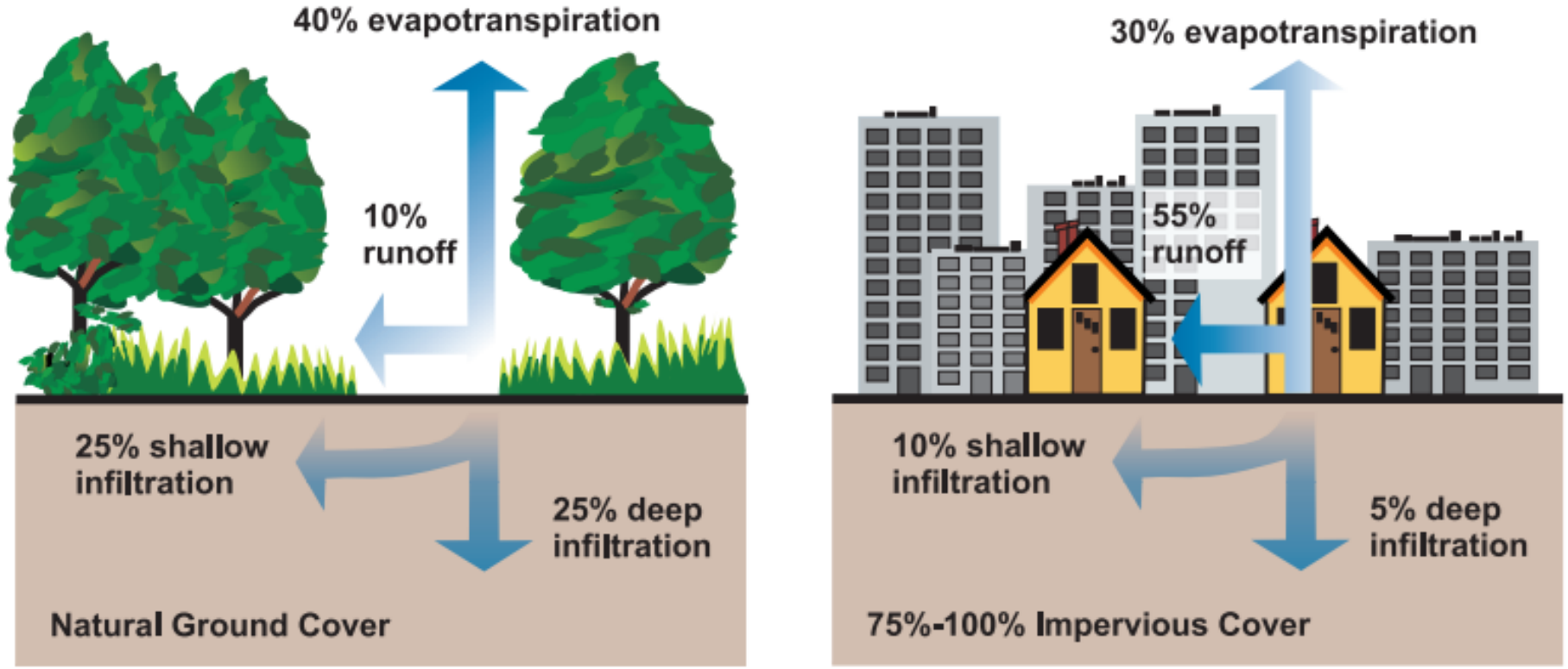


2020 Impervious Cover; Source: RIDEM GIS

Relationship between impervious cover and “water cycle”



Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

Urban landscapes covered by impervious surfaces prevent rainwater from draining naturally into the soil


Stormwater is directed into drains and pipes, bringing pollutants with it.

URBANIZATION

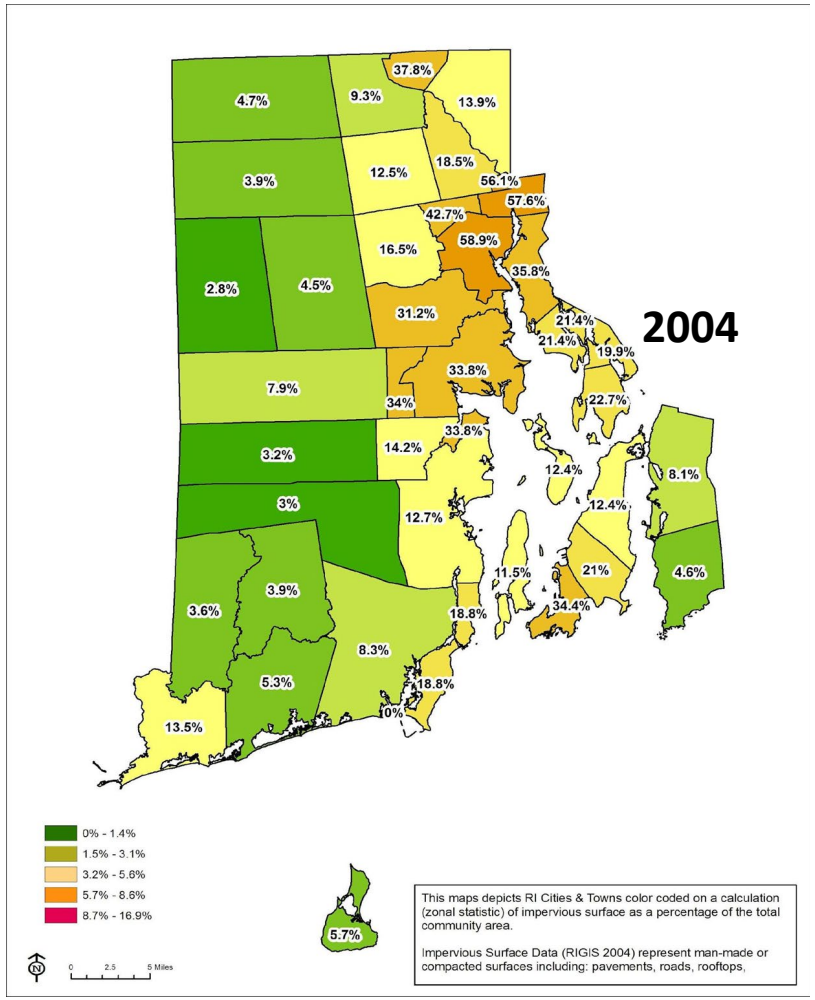
Hydrology
Less Groundwater Recharge
Lower Baseflow
Flashier Streams
More Runoff Volume

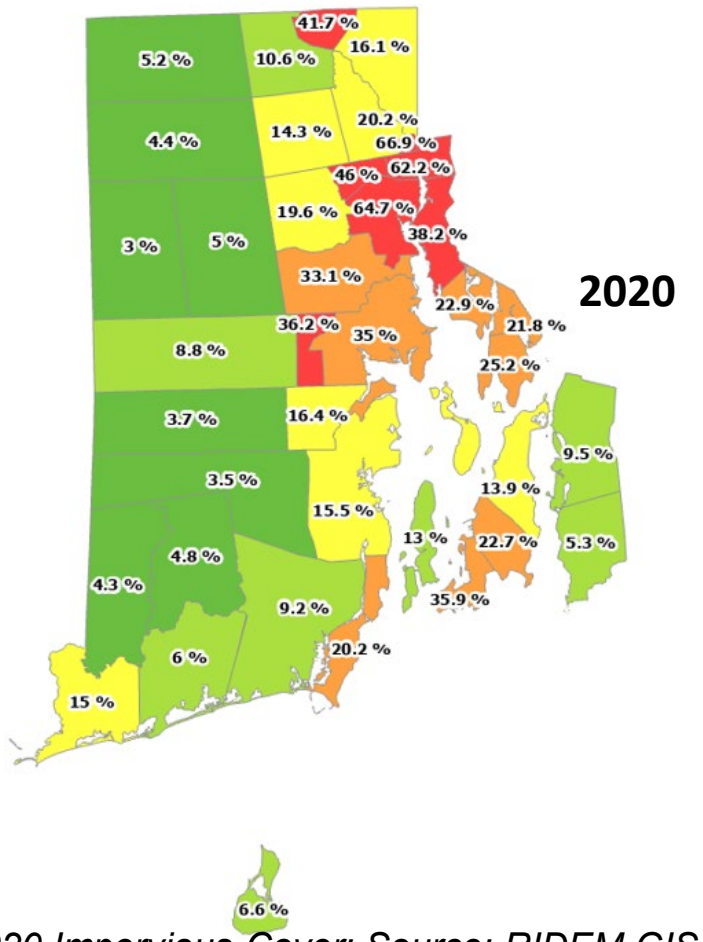
Water Quality
Elevated Pollutant Concentrations
More Sediment
Elevated Temperatures

Stream Morphology
Altered morphology and Stability
Habitat degradation

WATER RESOURCE IMPAIRMENT
Impacted Aquatic Life and Loss of Beneficial Uses

% Impervious Cover by Municipality

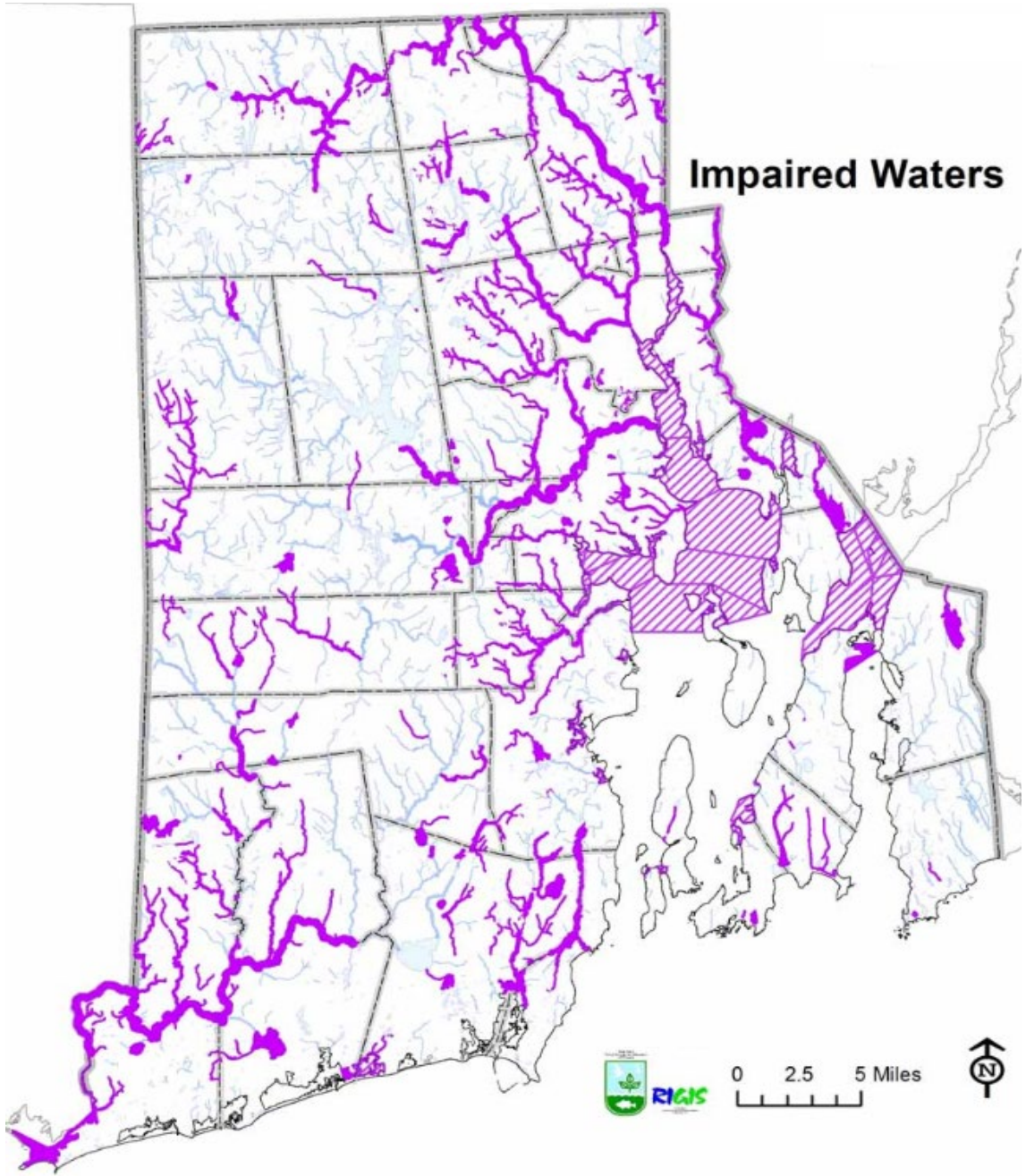




2020 Impervious Cover; Source: RIDEM GIS

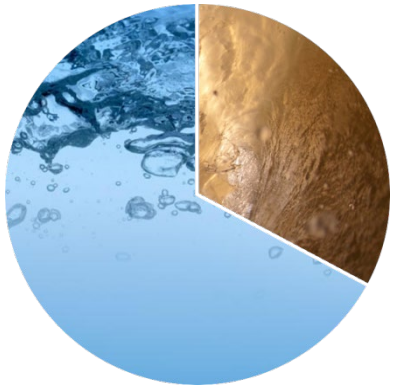
- Impacts to stream biota can be seen at 4-6% IC
- Impacts to water quality can be seen at ~ 10% IC

Water Quality Impairments



Stormwater contributes to pollution of RI's waters

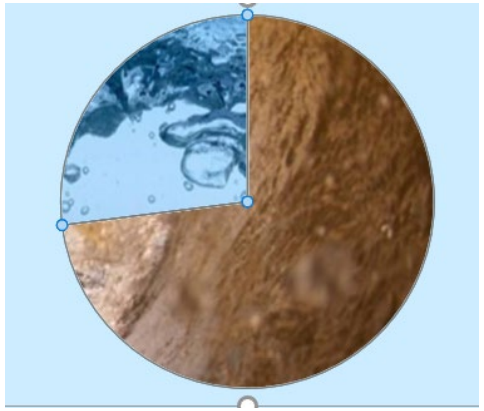
Bay & other Coastal Waters



36% polluted

98% of estuarine waters surveyed

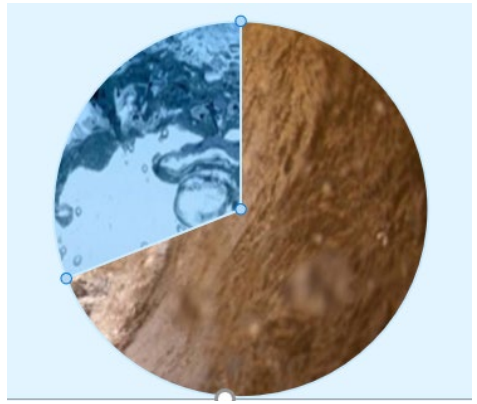
Lakes & Ponds



73% polluted

84% of lakes surveyed

Rivers



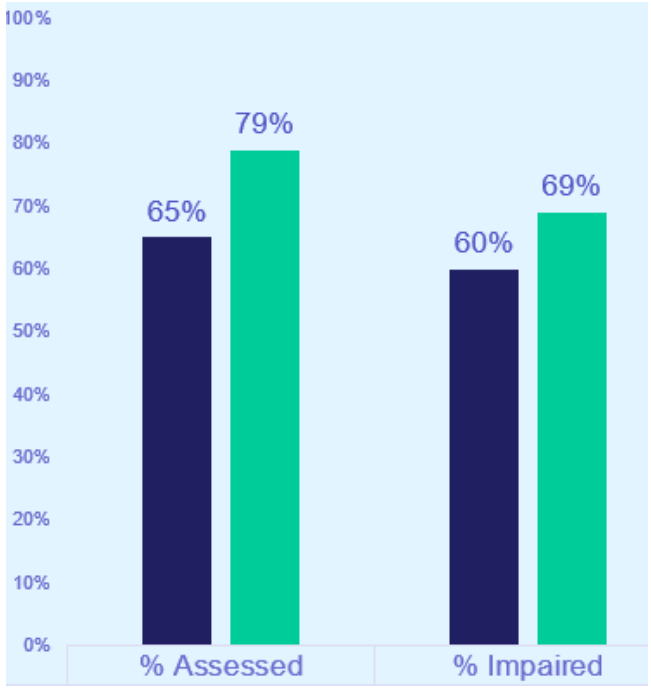
69% polluted

79% of rivers surveyed

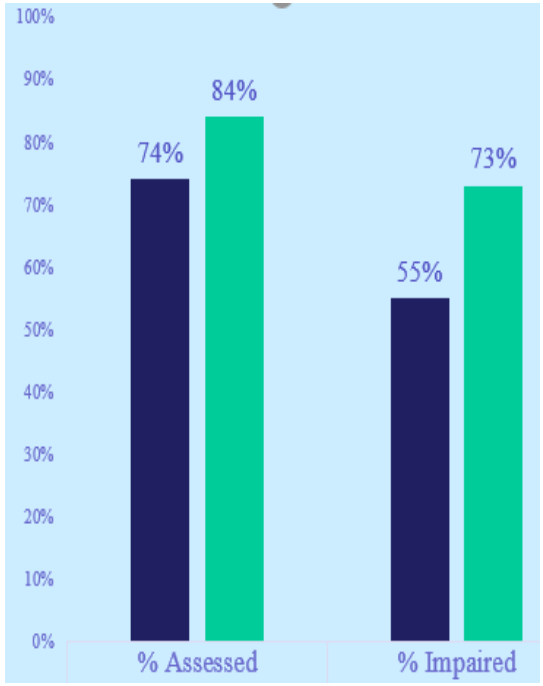
Source: 2022 Integrated Report

Trends in RI's Water Quality

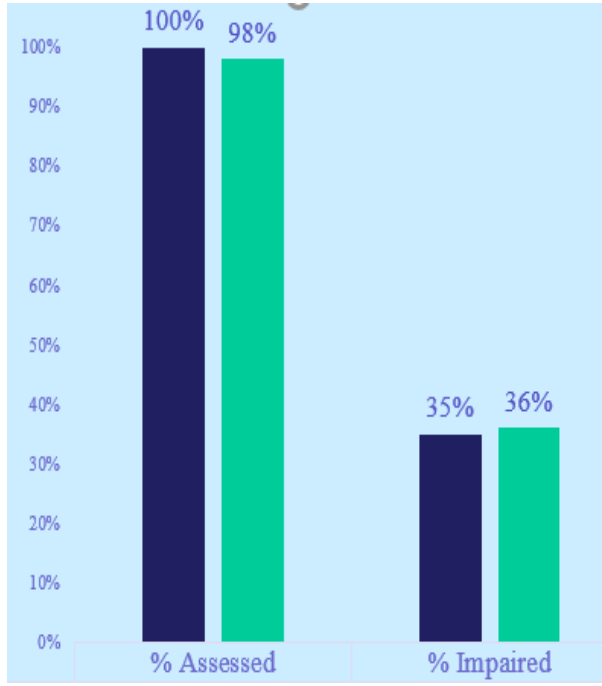
more waters assessed and more found polluted



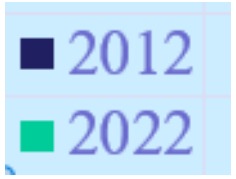
Rivers



Lakes & Ponds



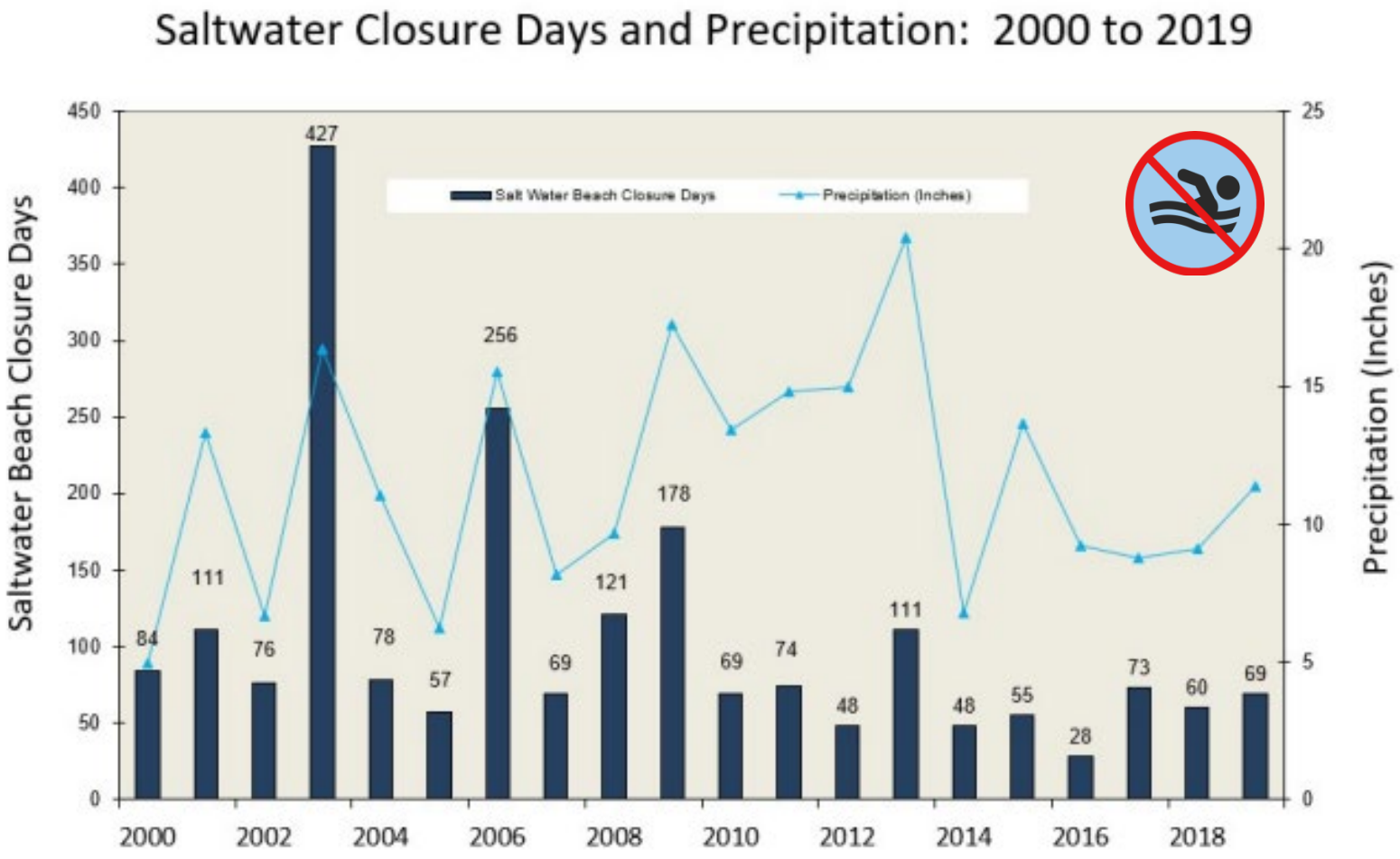
Estuaries



Sources: 2012 and 2022 Integrated Reports

Bacteria levels unsafe for recreational uses

Beach closures due to unsafe bacteria levels correlated with precipitation to some degree



Source: 2019 RHODE ISLAND BEACH AND RECREATIONAL WATER QUALITY REPORT

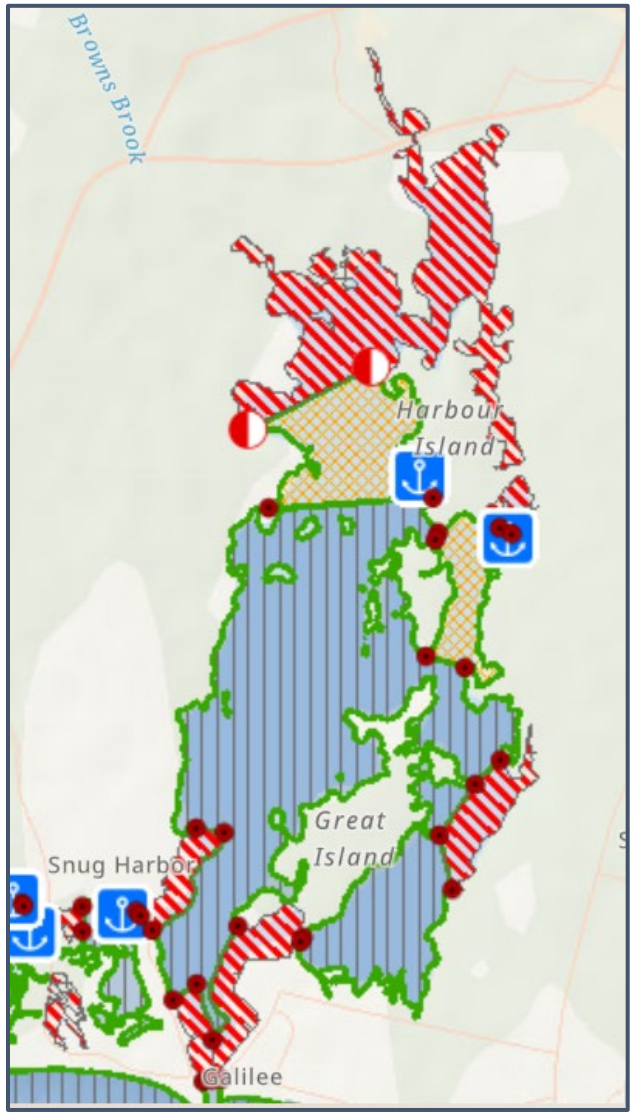
Rhode Island's tourism industry supports nearly 38,000 jobs and brings in over $5 billion annually.

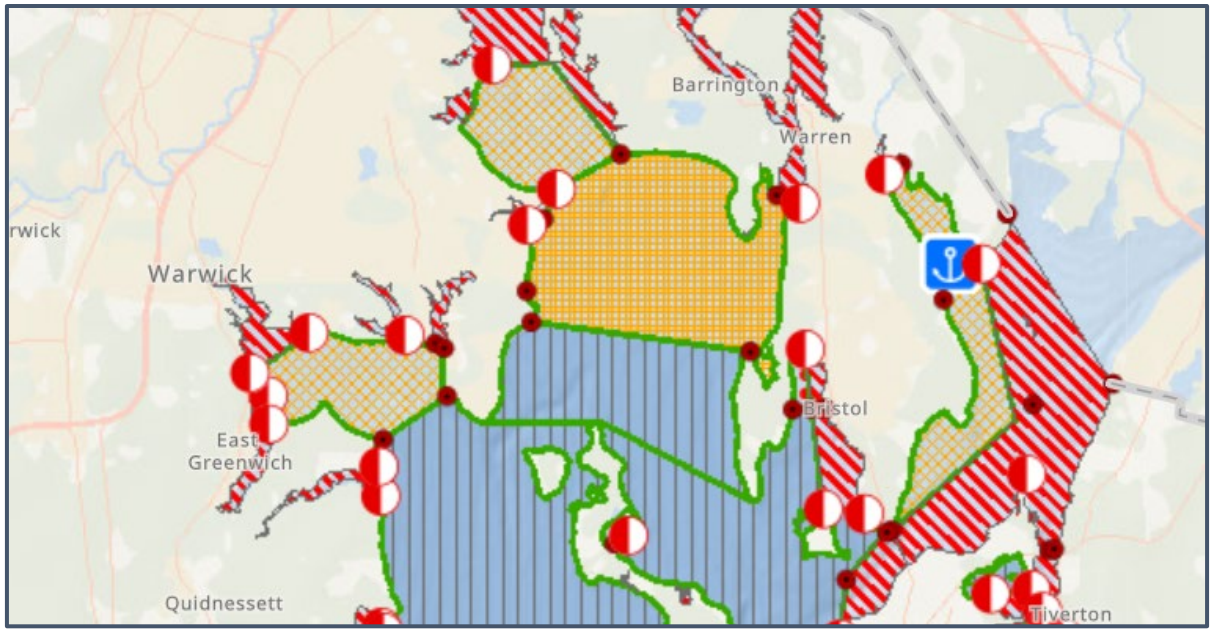
Source: HIS Global Insights 2012 report

Beach closures have far reaching economic impacts

MISQUAMICUT BEACH

Elevated levels of bacteria in stormwater routinely cause closure of shellfishing waters managed as conditionally approved





Excess nutrients in stormwater cause excessive algal growth & cyanobacteria blooms which make the water unsafe for recreation

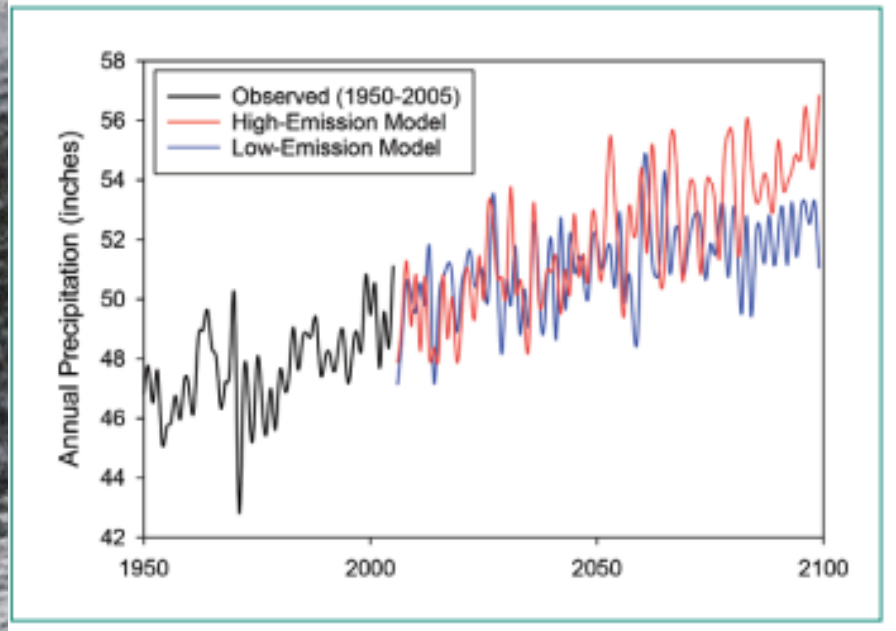
Fresh Waters with Cyanobacteria Advisories

2021: Roger Williams Park Ponds, Warwick Pond, Worden Pond, Johnson's Pond, Brickyard Pond Tiogue Lake, Larkin Pond, Slack Reservoir, Wenscott Reservoir, Sachem Pond, Warwick Pond, Melville Ponds, Blackamore Pond, Spectacle Pond, Upper J.L. Curran Reservoir, Mashapaug Pond, Georgiaville Pond, Almy Pond

Water Supply Reservoirs

Stafford Pond (2020), Paradise Pond (2019), Watson Reservoir (2019), Lawton Valley Reservoir (2017), Sisson Pond (2017), St. Mary's Pond (2017), North and South Easton Ponds (2016 & 2015)

Managing stormwater is one of the biggest water quality challenges facing the state



From a water quantity perspective, even relatively small storms present challenges for infrastructure built 60 years ago. Cause = increased volumes of runoff from development and more intense rainfall experienced with climate change

How is stormwater managed in RI?

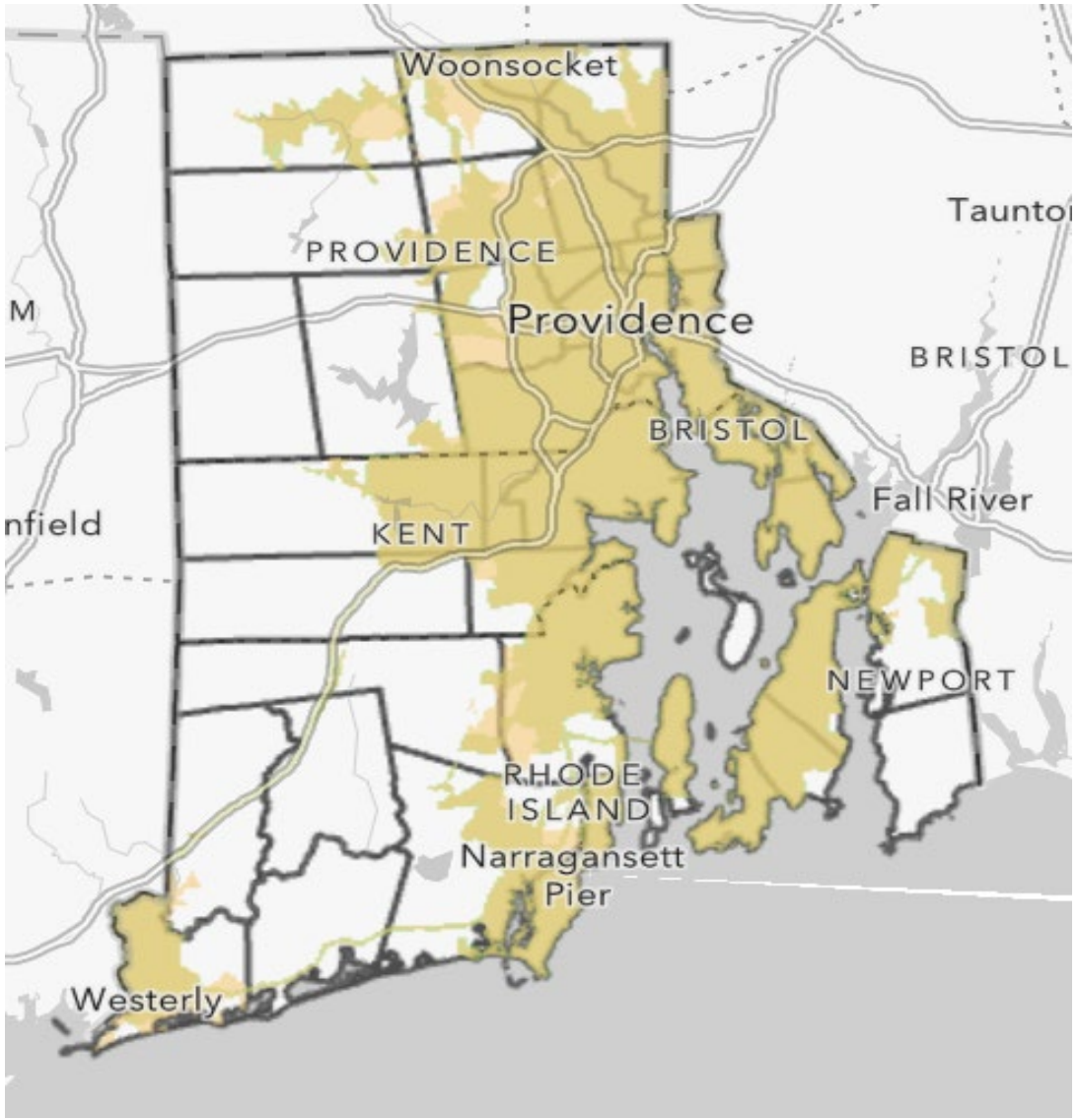
New & Re-development Projects

- RIDEM Freshwater Wetlands permits
- Coastal Resources Management Council permits
- RIDEM/RIPDES Construction Site permits

Existing Discharges (RIPDES)

- Stormwater permits for Municipal/RIDOT systems (MS4s)
- Stormwater permits for certain industries
- Individual permits for significant contributors

Municipal Separate Storm Sewer System (MS4) General Permit



Applies to:

- 34 municipalities
- 7 Federal, State and Quasi-state facilities

MS4 Permit Requirements

Municipalities must prepare & implement Stormwater Management Program Plans. Among other things, municipalities must:

- map outfalls and catch basins
- Sample outfalls for dry weather discharges to check for illicit connections
- Inspect catch basins annually, and clean as necessary
- Adopt ordinances and establish programs to regulate:
  - construction site runoff and erosion,
  - stormwater from new development & redevelopment, and
  - eliminate illicit discharges
- Revise SWMPPs to address stormwater issues identified in Total Maximum Daily Load reports.

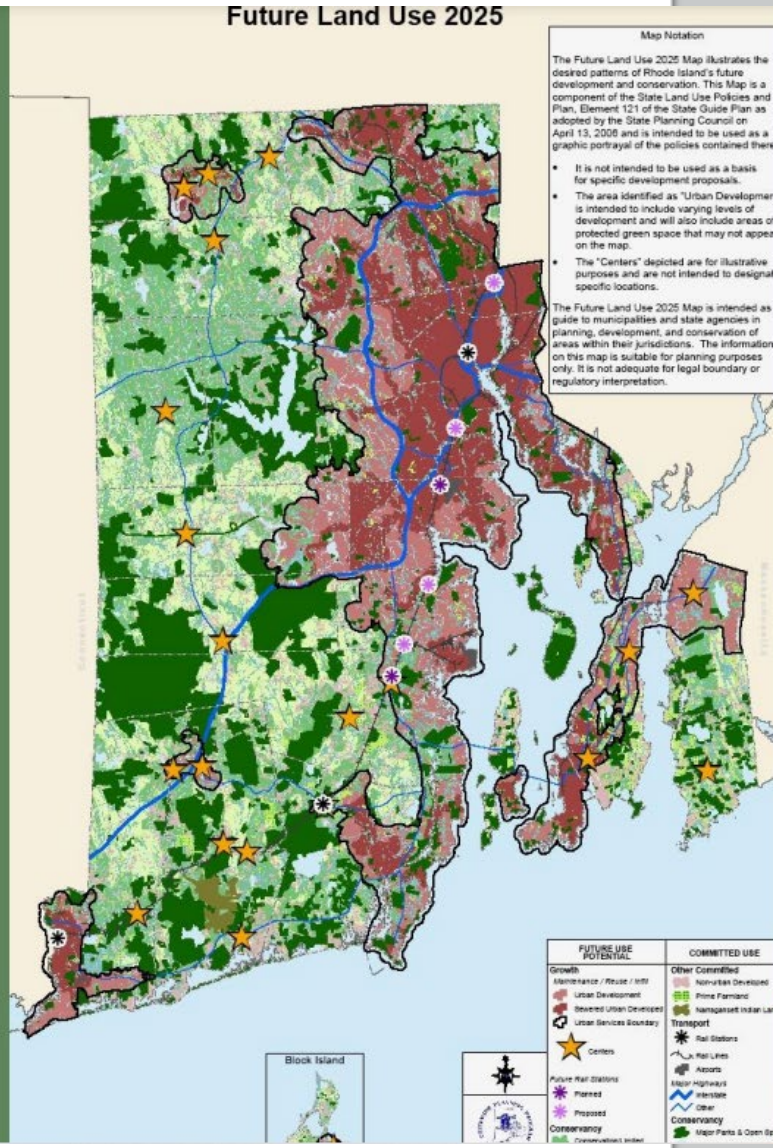
Once impaired, restoring water quality is very expensive!!!

Recommended approach:

- Land Use 2025: Protect critical water resources by directing growth to urban services boundary & other growth centers
- MS4 Permit: Use low impact development techniques to minimize water quality impacts from new development
- TMDLs: Incorporate stormwater retrofits into all redevelopment projects & phase in retrofits to existing discharges

What Does This Look Like?

- **Concentrates growth in:**
  - **Urban Service Boundary**
  - **Growth Centers**
- **Maximizes investment in existing infrastructure**
- **Promotes more efficient development:**
  - **Infill**
  - **Rehabilitation**
  - **Higher Densities**
- **Maintains Green and Open Space**



Low Impact Development (LID)

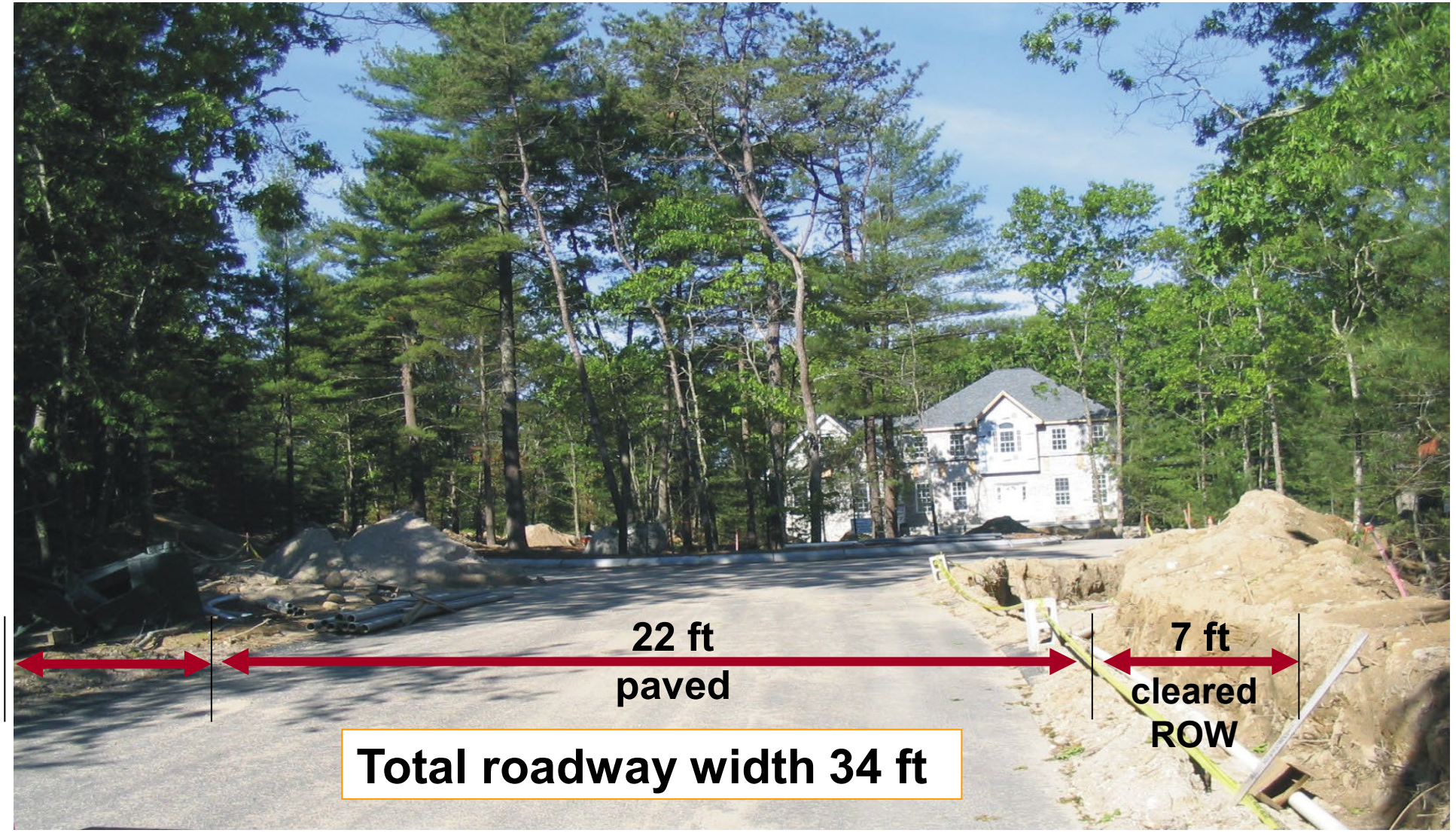
The new required standard for managing **stormwater runoff**, through careful site planning and design to:

Avoid site disturbance by using compact Development to protect natural site conditions and infiltration areas;
Reduce pavement and other impervious surfaces to minimize runoff.
Manage remaining runoff using vegetated, small scale treatment systems located at the point where runoff is generated, rather than piped drainage systems.

Example village LID project…

Cottages on Green, East Greenwich RI – Clustered homes conserve common open space; bioretention and swales integrated with the landscaping treat runoff.

Example suburban LID… compact Conservation Development with reduced pavement width and right of way



Usquqpaug Hills, South Kingstown, RI

Small building envelopes

- **minimize site disturbance and erosion,**
- **protect forest for natural infiltration**
- **small lawn size limits fertilizer use and watering.**

Vegetated cul de sac conserves tree canopy

Engineered Swales, Bioretention Basins and Porous Pavers

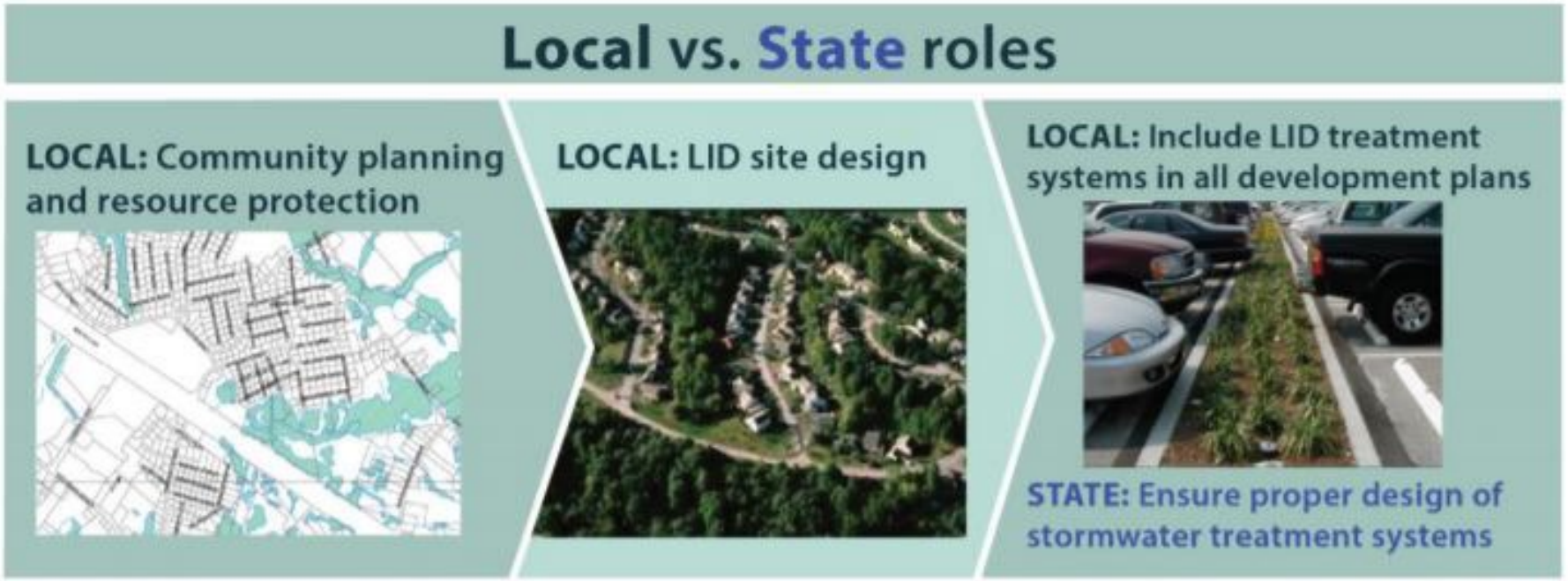
Jordan Cove, CT - subdivision road

Example Commercial LID - Bioretention

Bioretention in parking lot islands, North Kingstown

Example Urban LID Green Streets

Doesn't DEM oversee all of this?



- DEM sets Minimum Stormwater /LID Standards but relies on **towns to address LID site design through the Master Plan Stage** of development applications.
- DEM does not have the authority to override local decisions on the Master Plan.
- **DEM reviews the engineering plans at Preliminary Plan –** when it **is too late** to make major changes. Therefore, effective LID design at master plan is essential

Getting to the heart of the matter -

- **How much density is too much?**
- **What can municipalities do to protect critical water resources in high density areas?**

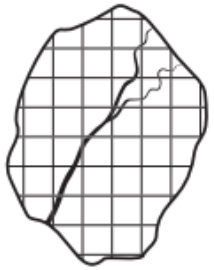
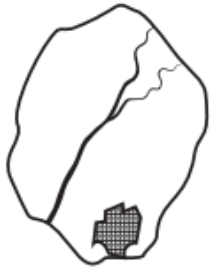
EPA United States Environmental Protection Agency

EPA 231-R-06-001
January 2006
www.epa.gov/smartgrowth

PROTECTING WATER RESOURCES WITH HIGHER-DENSITY DEVELOPMENT

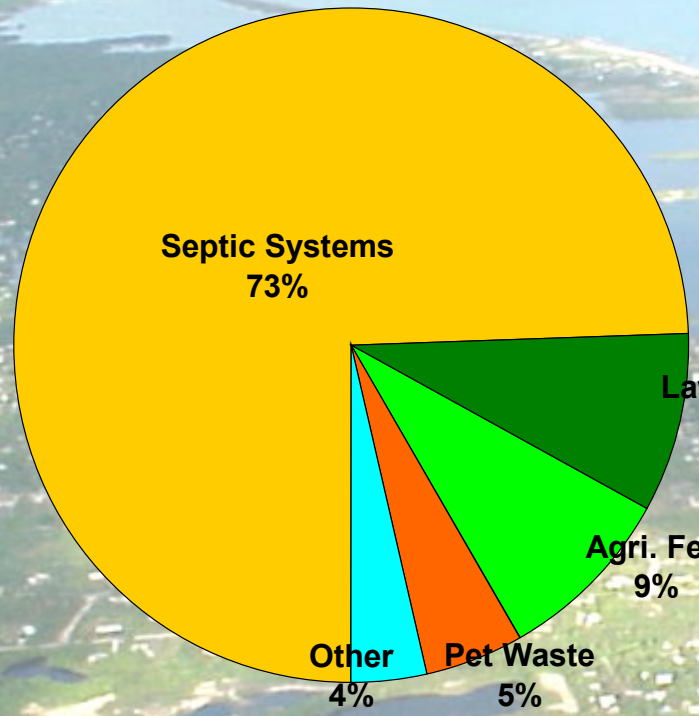
Office of Sustainable Communities
Smart Growth Program

EPA 2006: Compact growth can reduce runoff and protect water quality only when balanced with protected open space and pollution controls in the developed area.

Scenario A	Scenario B	Scenario C
		
10,000 houses on 10,000 acres at a density of *1 house per acre* consume 1 entire watershed.	10,000 houses on 2,500 acres at a density of *4 houses per acre* consume ¼ of 1 watershed.	10,000 houses on 1,250 acres at a density of *8 houses per acre* consume ⅛ of 1 watershed.

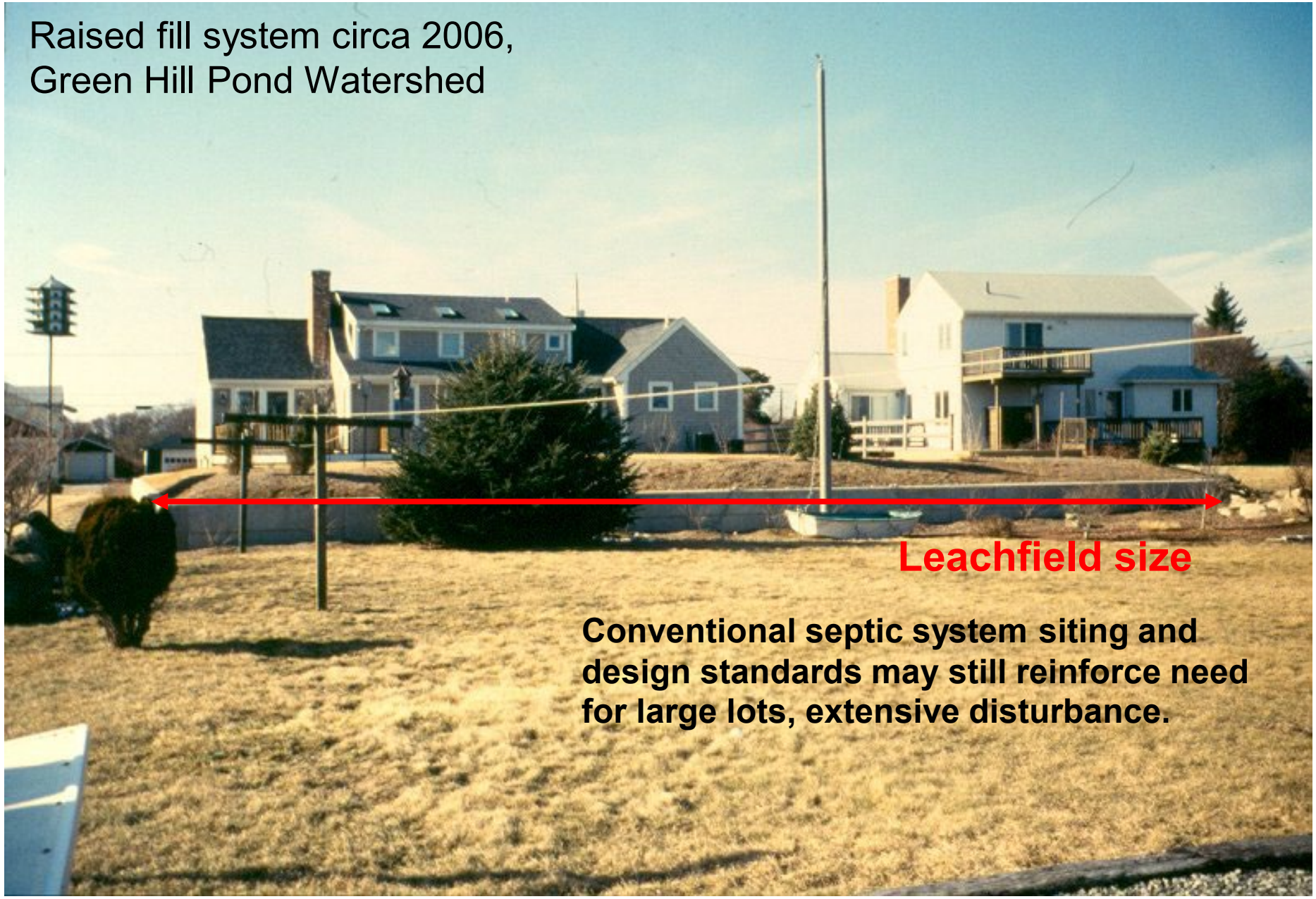
Green Hill Pond Watershed, South Kingstown and Charlestown, RI –
densely developed, substandard lots many 5,000 sq.ft. or less.

Estimated Percent Contribution of Nitrogen to Groundwater from Different Sources Current Land Use
Green Hill Pond Watershed



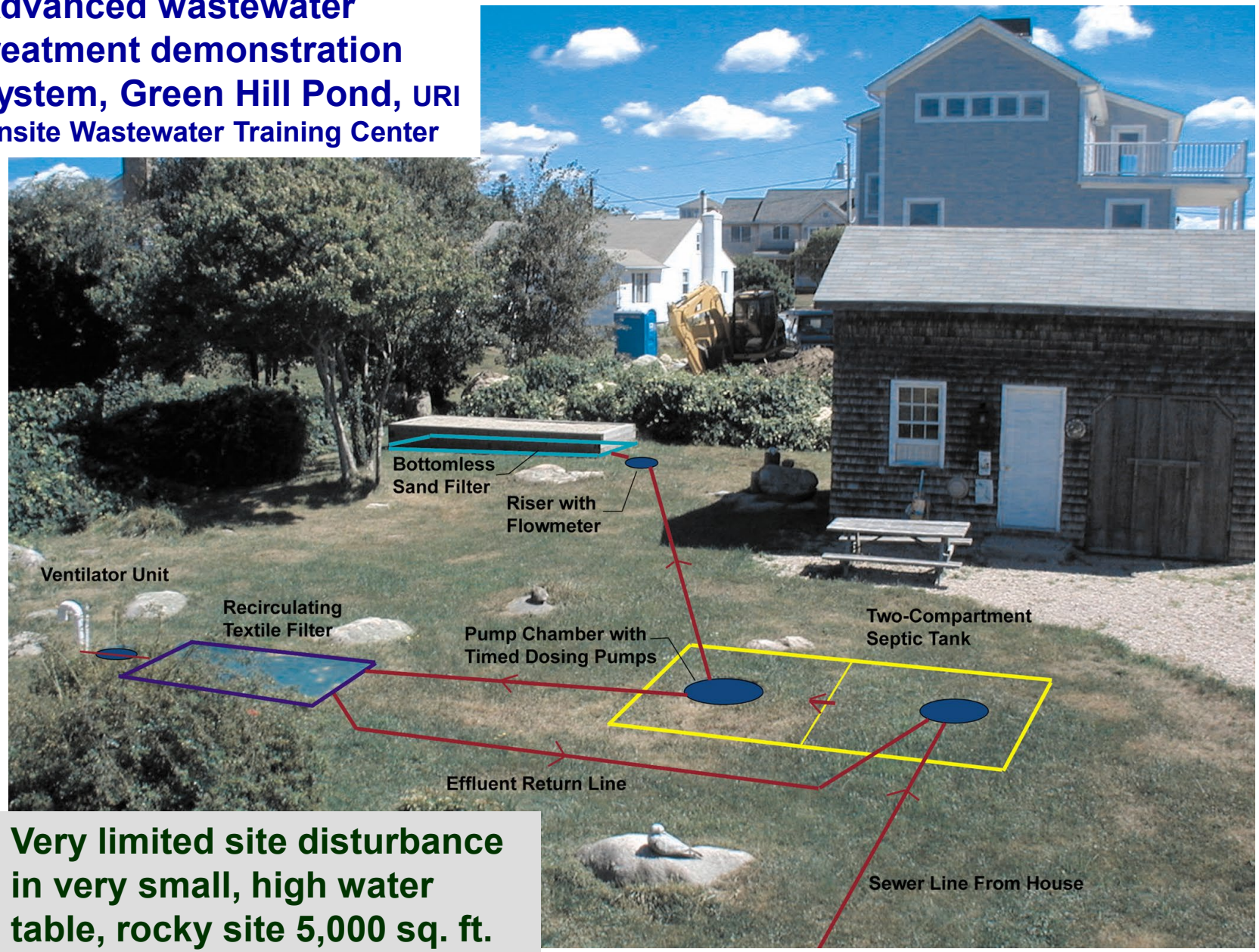
Green Hill Pond

- **Densely developed watershed on substandard lots of record.**
- **Pond Impaired, Shellfish ban due to bacteria**
- **High nitrogen in groundwater, private wells.**
- **Since ~ 2006, OWTS repairs, further development with use of advanced treatment systems, removal of cesspools in the Charlestown side has not improved water quality.**


Raised fill system circa 2006,
Green Hill Pond Watershed
Leachfield size
Conventional septic system siting and design standards may still reinforce need for large lots, extensive disturbance.

Advanced wastewater treatment demonstration system, Green Hill Pond, URI

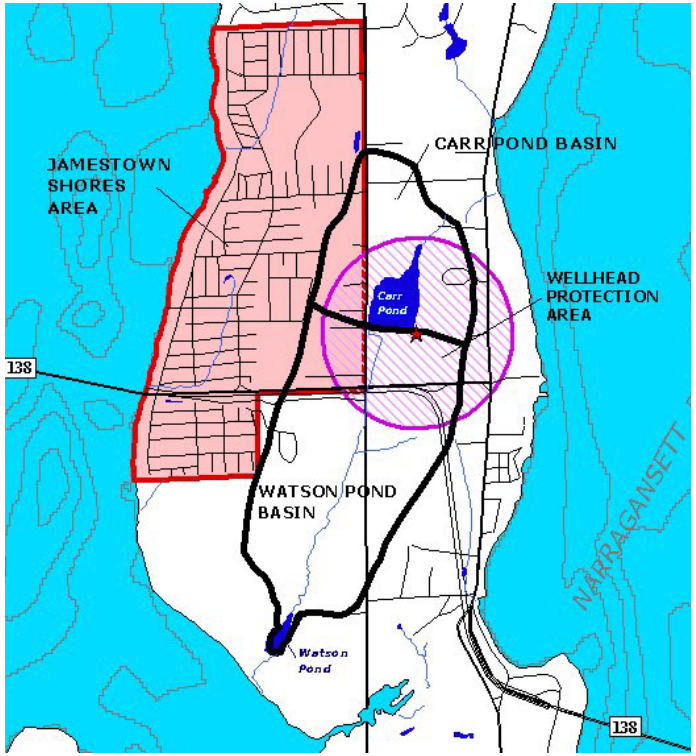
Onsite Wastewater Training Center



Very limited site disturbance in very small, high water table, rocky site 5,000 sq. ft.

Wastewater impacts to private wells in Jamestown Shores

1996 field study by A. Veeger (1996)



Study area

- Densely developed, unsewered area with private wells, slowly permeable, high water table soils.
- 119 private wells sampled.
- Lot size mostly < ½ acre to 7,500 sq.ft.

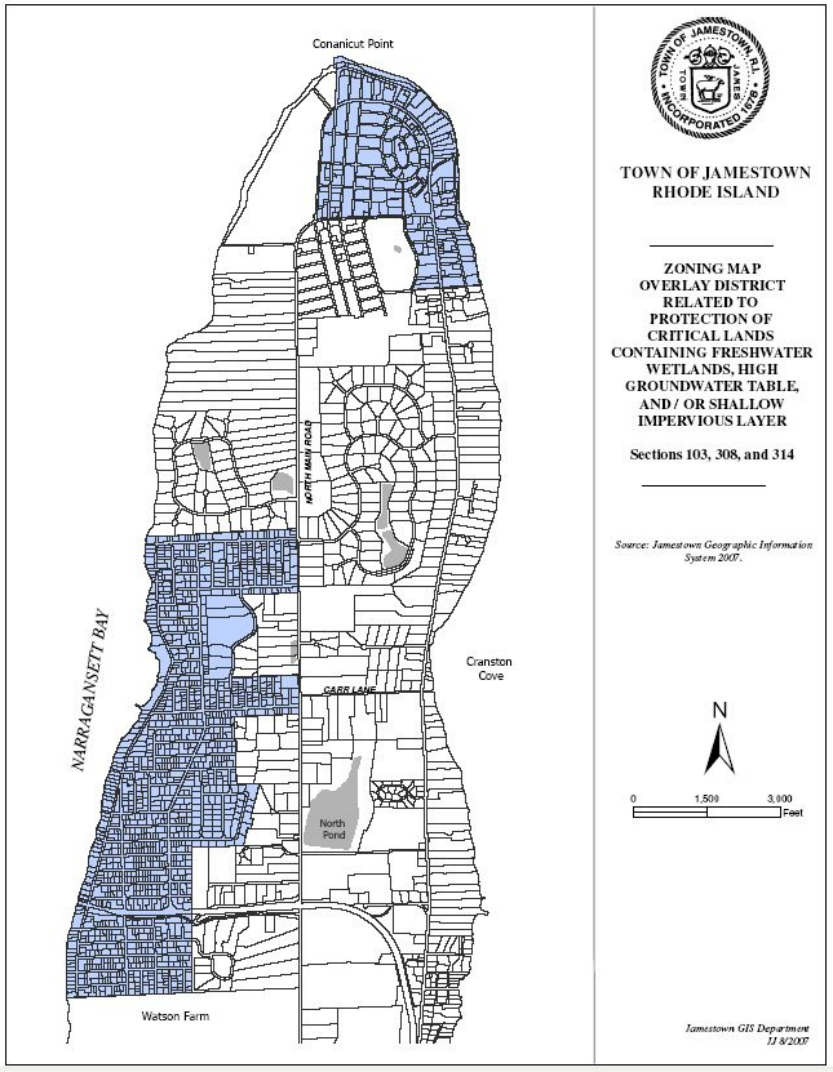
Results

High nitrate was associated with fecal coliform and small lot size

- Fecal Coliform bacteria detected in 15% of wells.
- Lots < 1 acre were most likely to have Fecal Coliform detects.
- Wells with bacteria detects averaged close to 4 mg/l nitrate-N

Wastewater impacts to private wells

1996 field study by A. Veeger (1996)



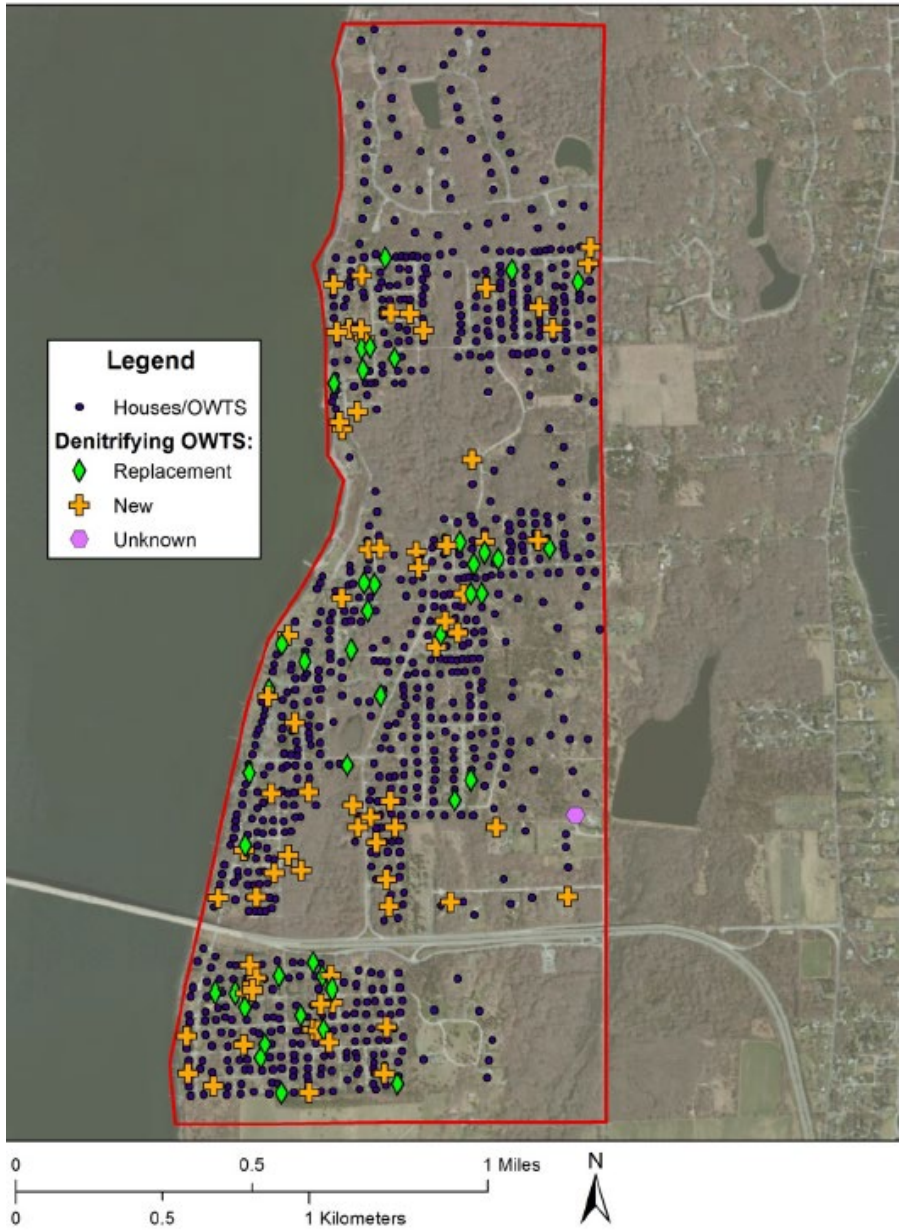
Jamestown High Water Table District, lots < 40,000 sf (in blue area)

As a result of this study:

Town adopted the "High water table ordinance" for lots < 1 acre:

- limits impervious cover,
- requires on-lot stormwater management,
- advanced wastewater treatment.

Wastewater impacts to private wells



To evaluate change in groundwater quality with use of advanced treatment systems under the high water table ordinance, a similar groundwater study was completed in 2013 (A. Parmenter, URI NRS Dept.)

Results:

- The average concentration of nitrogen in groundwater **increased** due to continued development on marginal lots **using advanced on-site wastewater treatment systems** (OWTS)

- Many OWTS approved by DEM with **reduced wetland setbacks.**

- **Use of advanced OWTS and improved stormwater controls were not enough to prevent groundwater nitrogen concentrations from continuing to increase with new development on these highly marginal lots.**

Final thoughts *- Higher density paired with preserved open space can protect water quality* ***but requires resources for greater town oversight that most small rural communities lack****.*

Pro-active groundwater protection actions taken by NK

1. Formed Groundwater committee
2. Groundwater Protection Plan and Overlay zone
3. 5 mg/l nitrate discharge limit for OWTS
4. Wastewater mgt ordinance with maintenance requirements, education and enforcement
5. Numerous and ongoing public education efforts, - speaking in schools, festivals, newsletters with water bill .
6. Police enforcement of water bans.
7. Open space land acquisition.
8. Recently updated groundwater overlay ordinance.

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