

North Kingstown Groundwater Resources

April 16, 2015

North Kingstown's groundwater supplies are finite, irreplaceable and highly vulnerable to contamination.

- RI Dept of Health Drinking Water Assessment, 2003

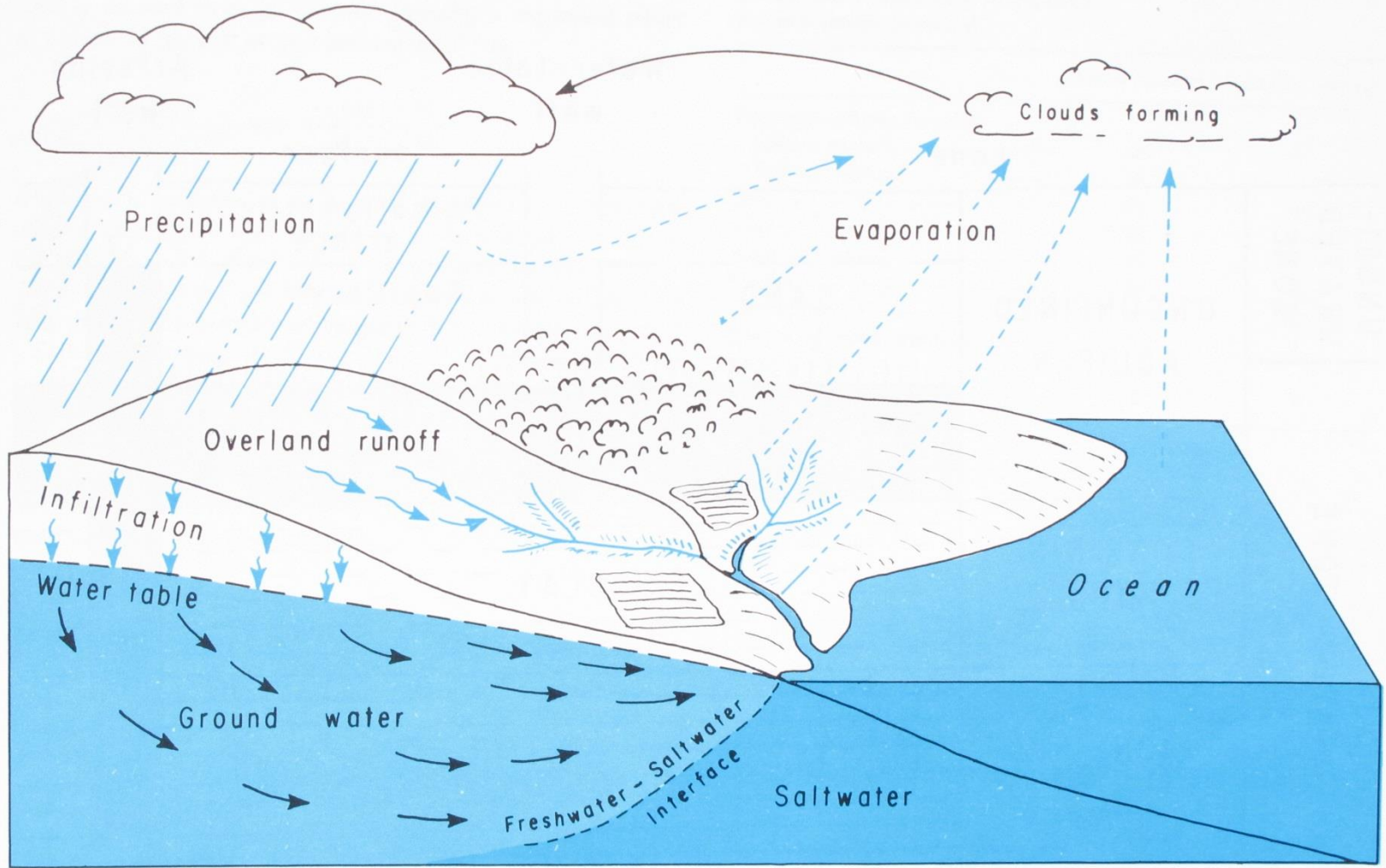


Overview

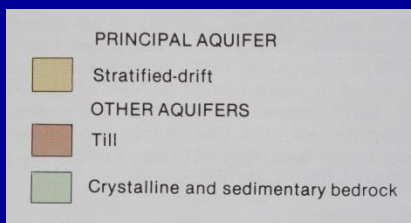
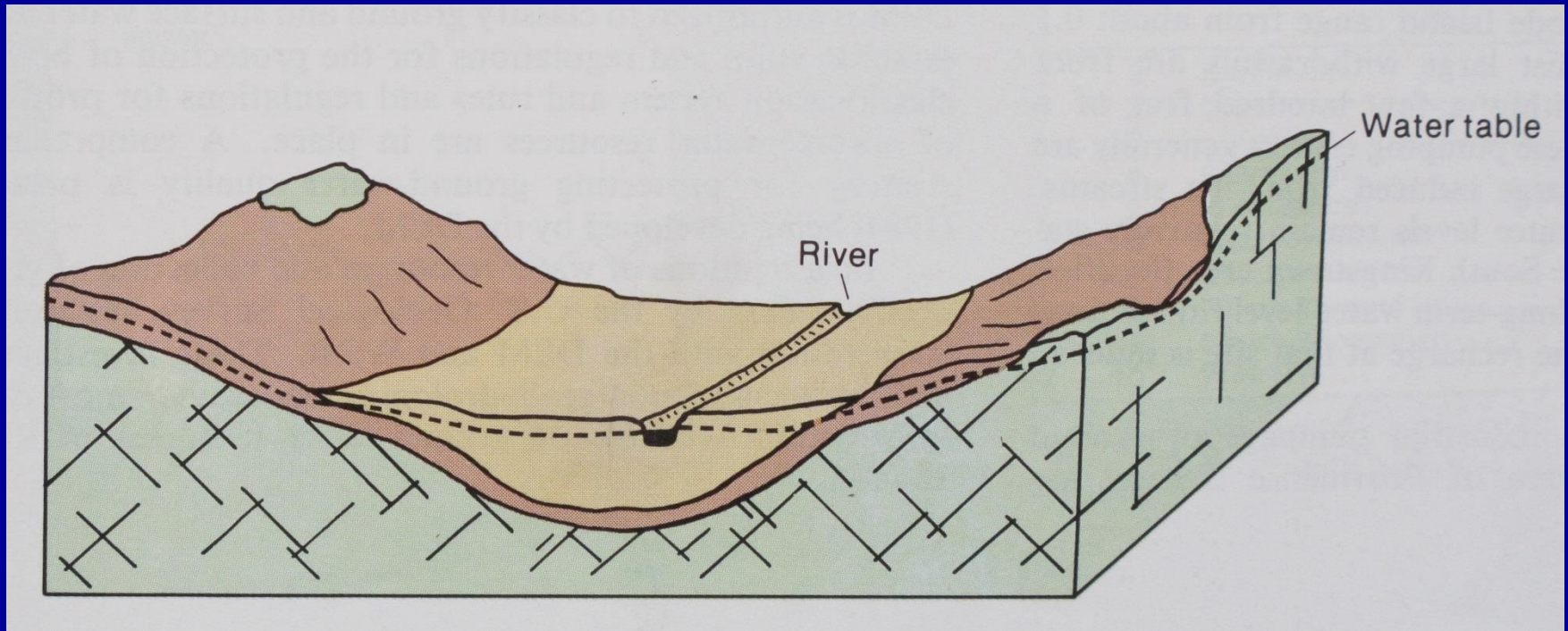
- Groundwater Resources
- Threats to Groundwater Quality
- Groundwater Protection – State
- Groundwater Protection –Town
- Onsite Wastewater Treatment Systems
- Stormwater Management
- Groundwater Withdrawals
- Watershed Planning



HYDROLOGIC CYCLE



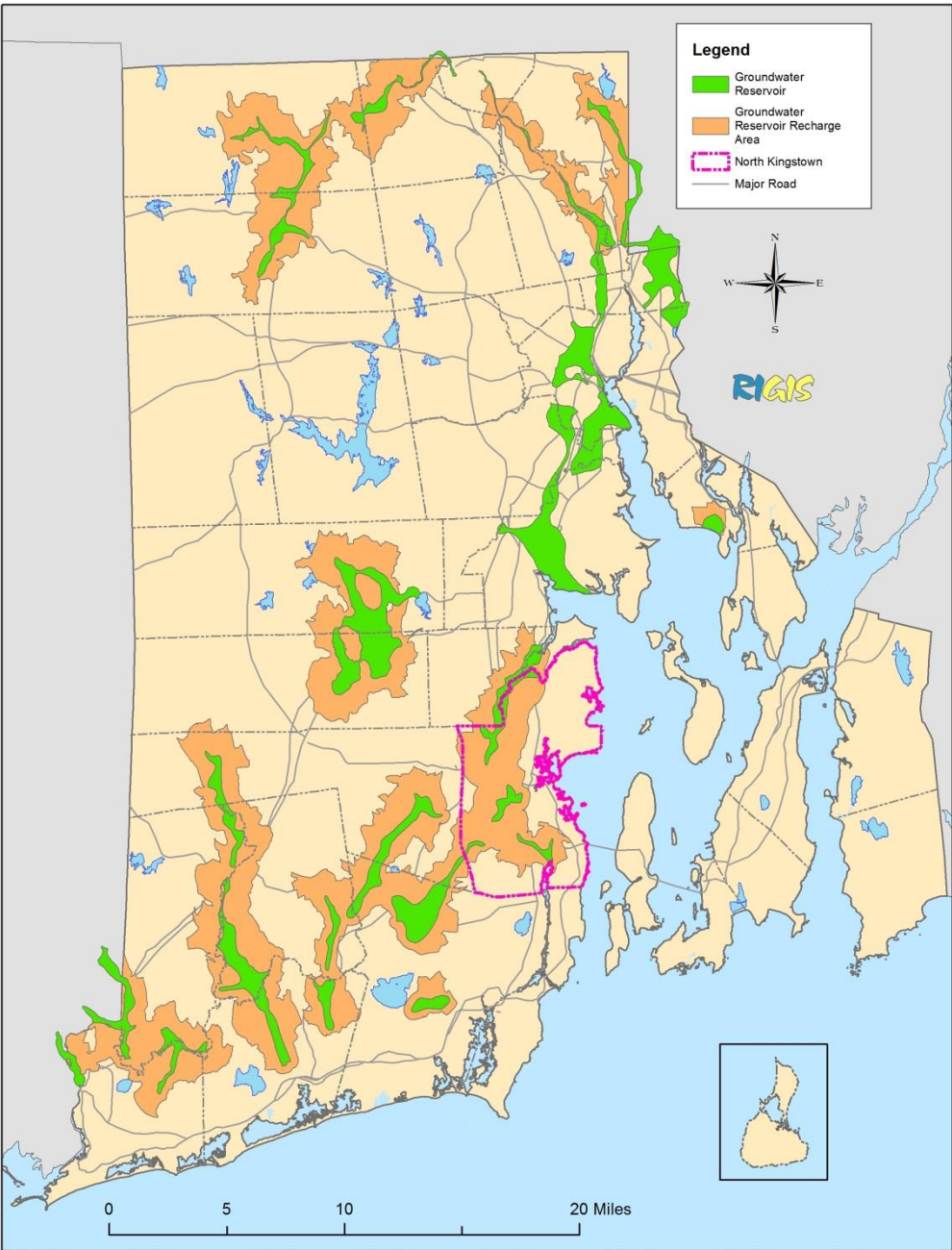
Principal Aquifers in Rhode Island



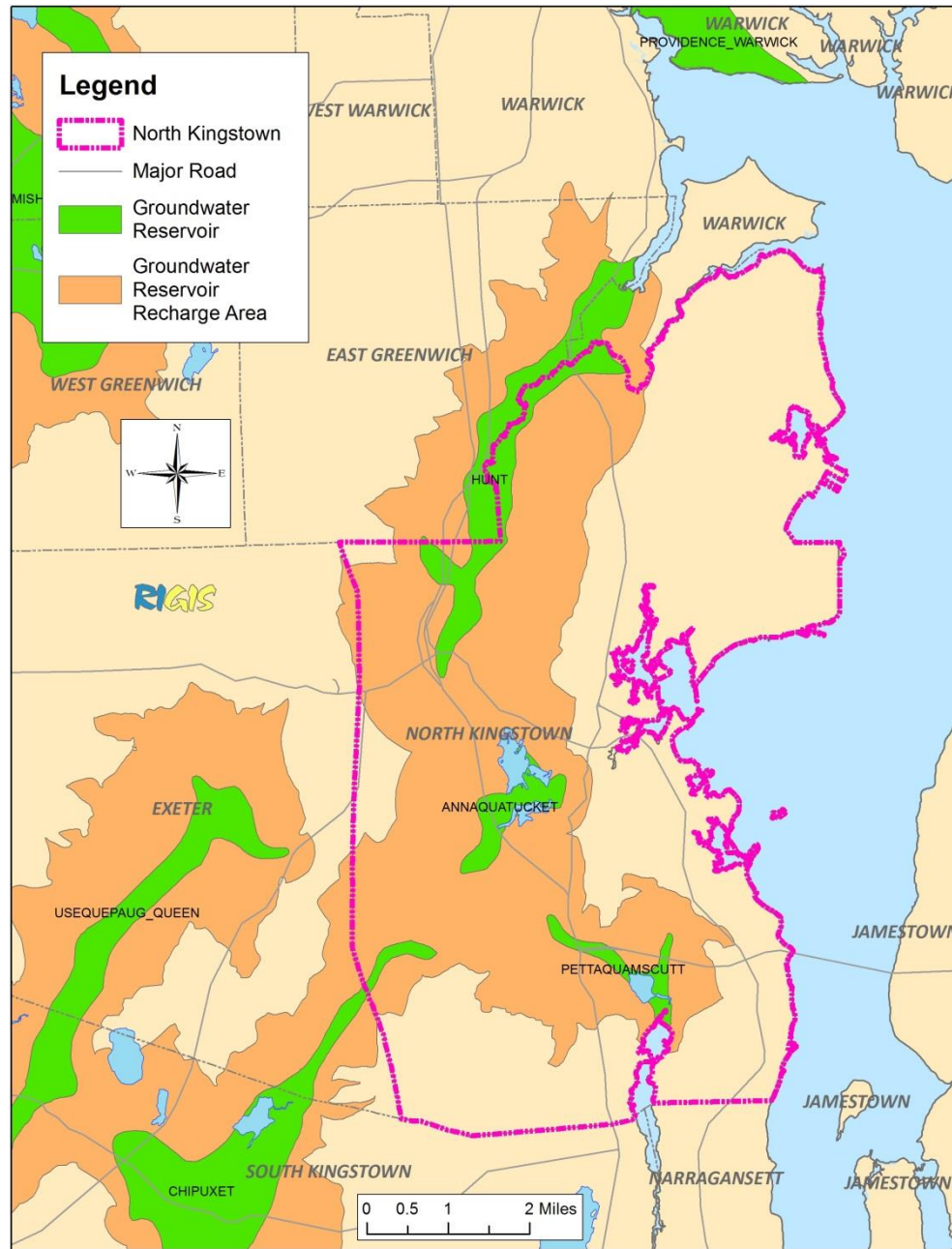
USGS Water Supply Paper 2275



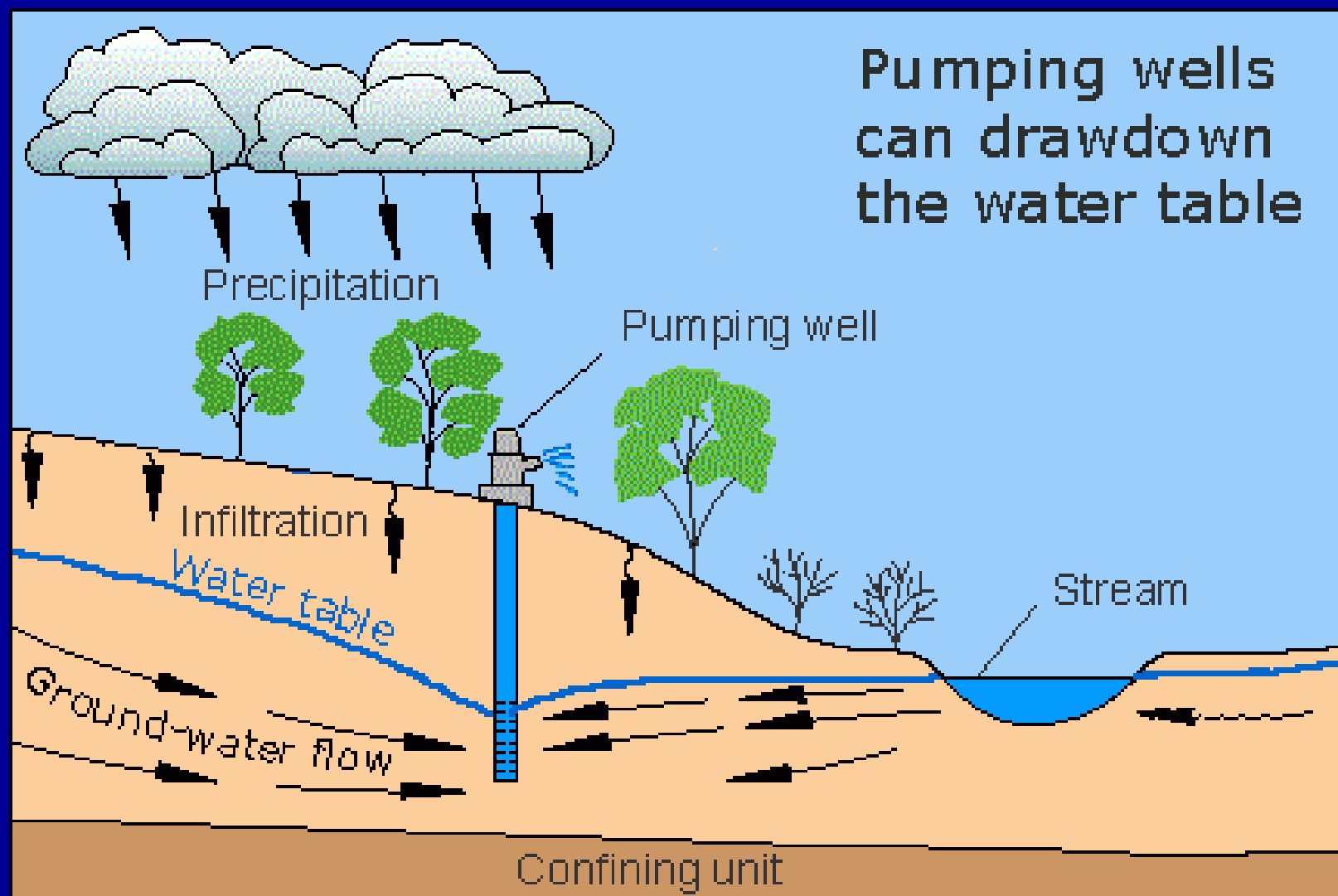
Groundwater Reservoirs and Their Recharge Areas



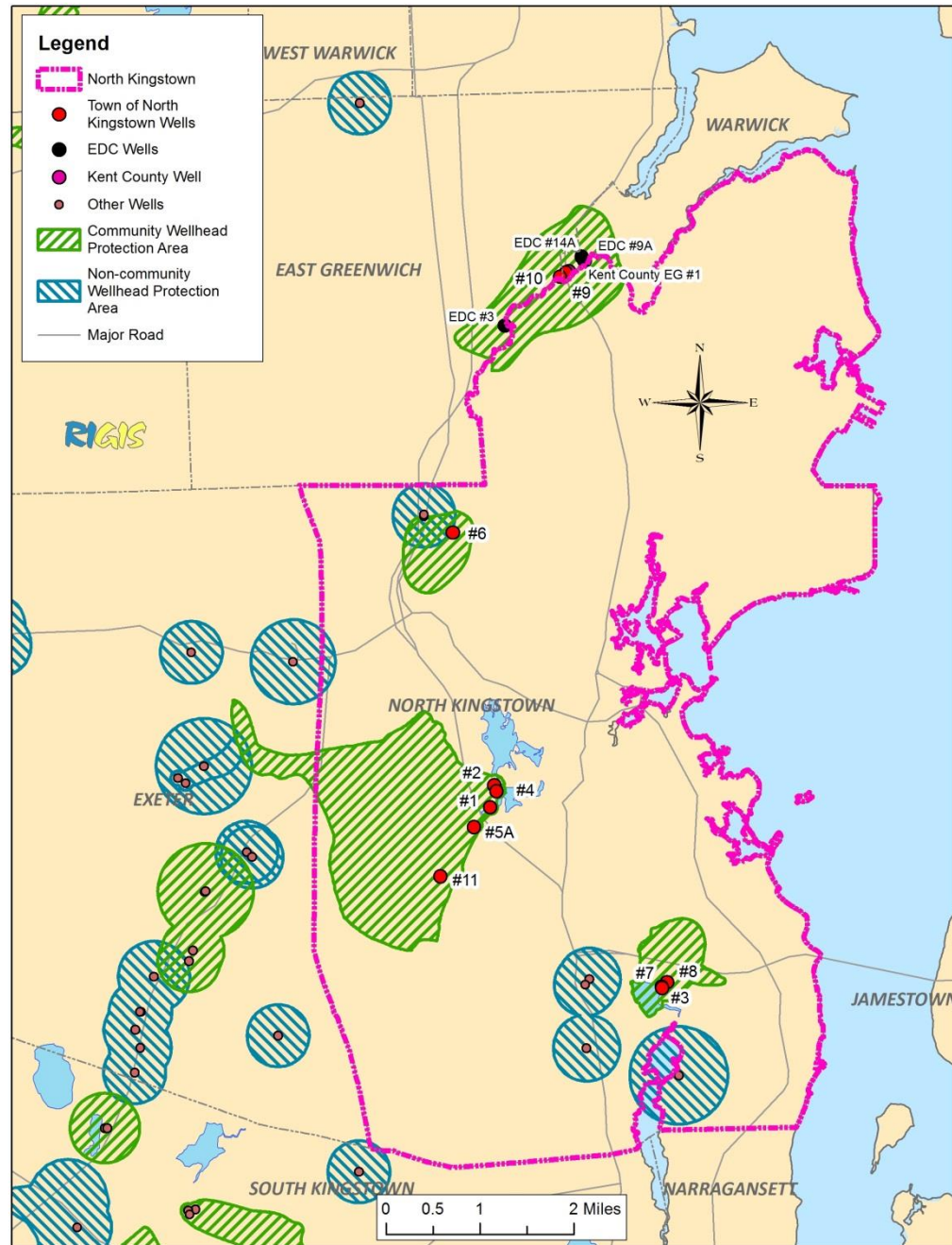
North Kingstown Groundwater Reservoirs and Their Recharge Areas



Pumping wells can drawdown the water table



North Kingstown Wellhead Protection Areas



EPA Sole Source Aquifer Program

(US Safe Drinking Water Act)

Sole Source Aquifer:

- **Aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer.**
- **No alternative drinking water source(s) that could physically, legally and economically supply all those who depend on the aquifer for drinking water.**

All proposed projects receiving federal funds are subject to review to ensure that they do not endanger the water source.

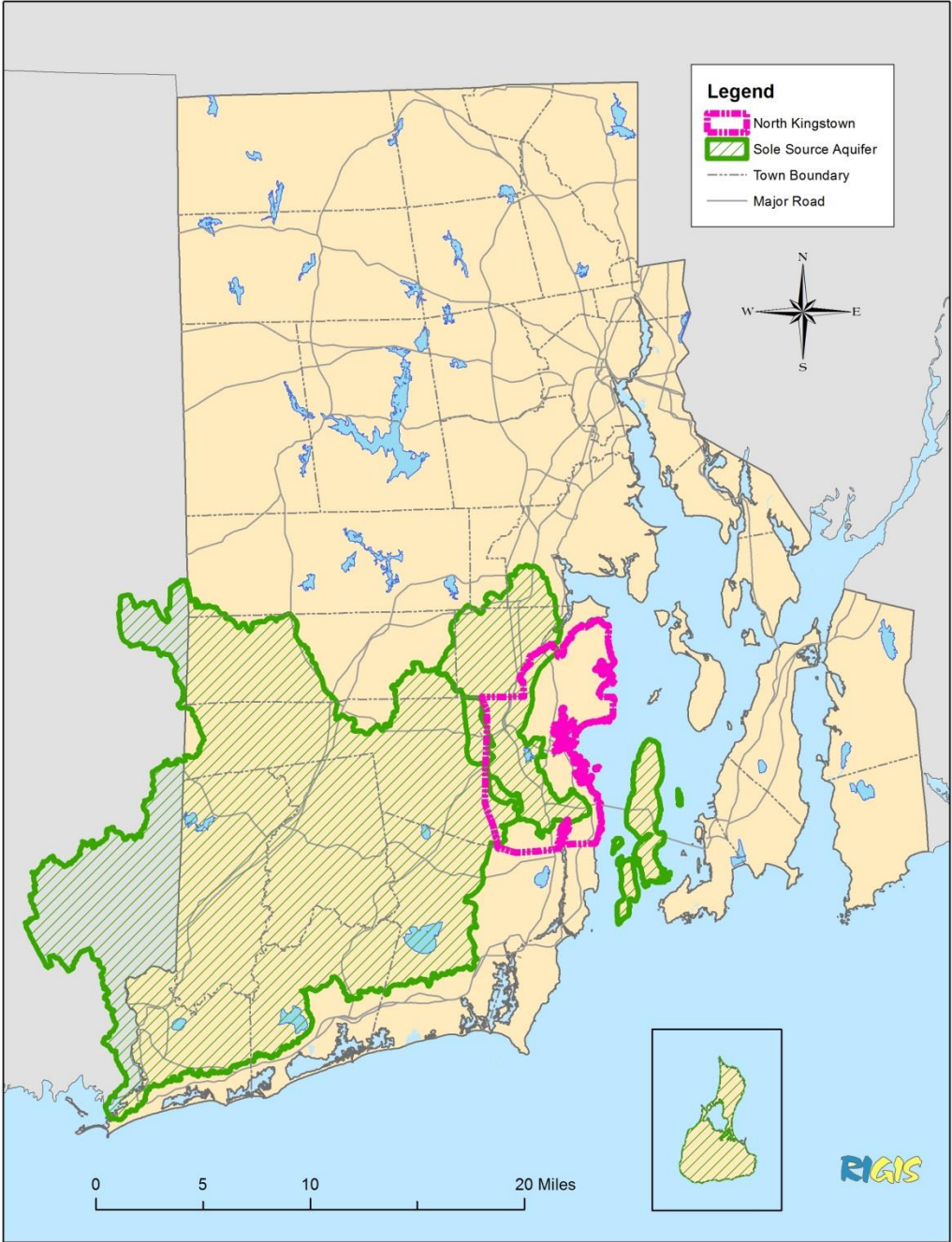
RI: 4 Sole Source Aquifers:

- **Block Island (1983)**
- **Wood - Pawcatuck (1988)**
- **Hunt - Annaquatucket - Pettaquamscutt (HAP) (1988)**
- **Jamestown (Conanicut Island) (2008)**

New England -- 16 Sole Source Aquifers



EPA Sole Source Aquifers



Aquifer Studies

USGS:

- Hydrologic characteristics/yield of HAP aquifers, 1968 (Water Supply Paper 1775)
- Hunt Recharge Area Report, 1986 (unpublished)
- HAP water table conditions report (Water Resources Investigations Report 97-4167)
- HAP numerical modelling of groundwater flow to wells and impacts on stream flow, 2001 (Professional Paper 1636)
- Water Use and Availability in the West Narragansett Bay Area, Coastal Rhode Island, 1995-99 (Scientific Investigations Report 2005-5256)
- HAP well field contributing area modelling study, 2012 (Scientific Investigations Report 2012-5114)

DEM:

- Hydrogeologic Investigation of Hunt Aquifer, 1987 (Fuss & O'Neill)
- Nonpoint Source Pollution/Stormwater Evaluation within Hunt Aquifer, 1998

EPA: Annaquatucket wellhead protection area pilot project, 1991

Towns and Suppliers:

- Hunt aquifer wellhead protection area study, 1992 (Goldberg- Zoino & Assoc)



Threats to Groundwater Quality

Activities generating a waste stream or which involve a chemical material have the potential to contaminate groundwater.



Threats to Groundwater Quality

Storage tanks – underground and above ground

- Petroleum products, chemicals, metals

Septic systems (onsite wastewater treatment systems – OWTS)

- Pathogens, nutrients (nitrogen and phosphorus), pharmaceuticals and personal care products (and other contaminants of emerging concern), household hazardous materials

Non-sanitary discharges to groundwater (process water, floor drains)

- Petroleum products, chemicals, metals

Agriculture

- Pathogens, fertilizers (nitrogen and phosphorus), pesticides, petroleum wastes

Lawn care

- Fertilizers and pesticides



Floor Drains



Threats to Groundwater Quality

Old waste disposal sites

- Chemicals, petroleum products, metals, nutrients

Stormwater infiltration

- Pathogens, nutrients (nitrogen, phosphorus), metals, petroleum products, salt

Salt storage and application

- Sodium and chloride





Groundwater Protection

Shared responsibility between Federal, State, Local governments, and Individuals

Federal :

- **Provide resources/expertise for protection and restoration (EPA, USGS)**

State:

- **Identify critical resources, set standards -- DEM**
- **Regulate pollution sources -- DEM**
- **Regulate public water systems, private well testing standards -- Health Dept**

Local government

- **Land use planning – zoning codes**
- **Enforcement of building codes**
- **Eyes on the ground**

Individuals, Businesses

- **Every day we make decisions as town residents, business owners that can affect our water quality.**



State Role – Groundwater Classification

Provides a framework for protection and remediation of groundwater

- Four class system
- Groundwater quality standards established for each class

GAA and GA: protected to maintain drinking water quality (90% of the state)

GB and GC: known or presumed to be unsuitable for drinking water

GAA : (21% of RI, 46% of NK)

- Groundwater reservoirs and their recharge areas
- Wellhead protection areas for community public wells
- Block Island

GA: (70% of RI, 45% of NK)

- Drinking water not within GAA areas

GB: (9% of RI, 8% of NK)

- Highly urbanized areas of the state
- Old waste disposal sites

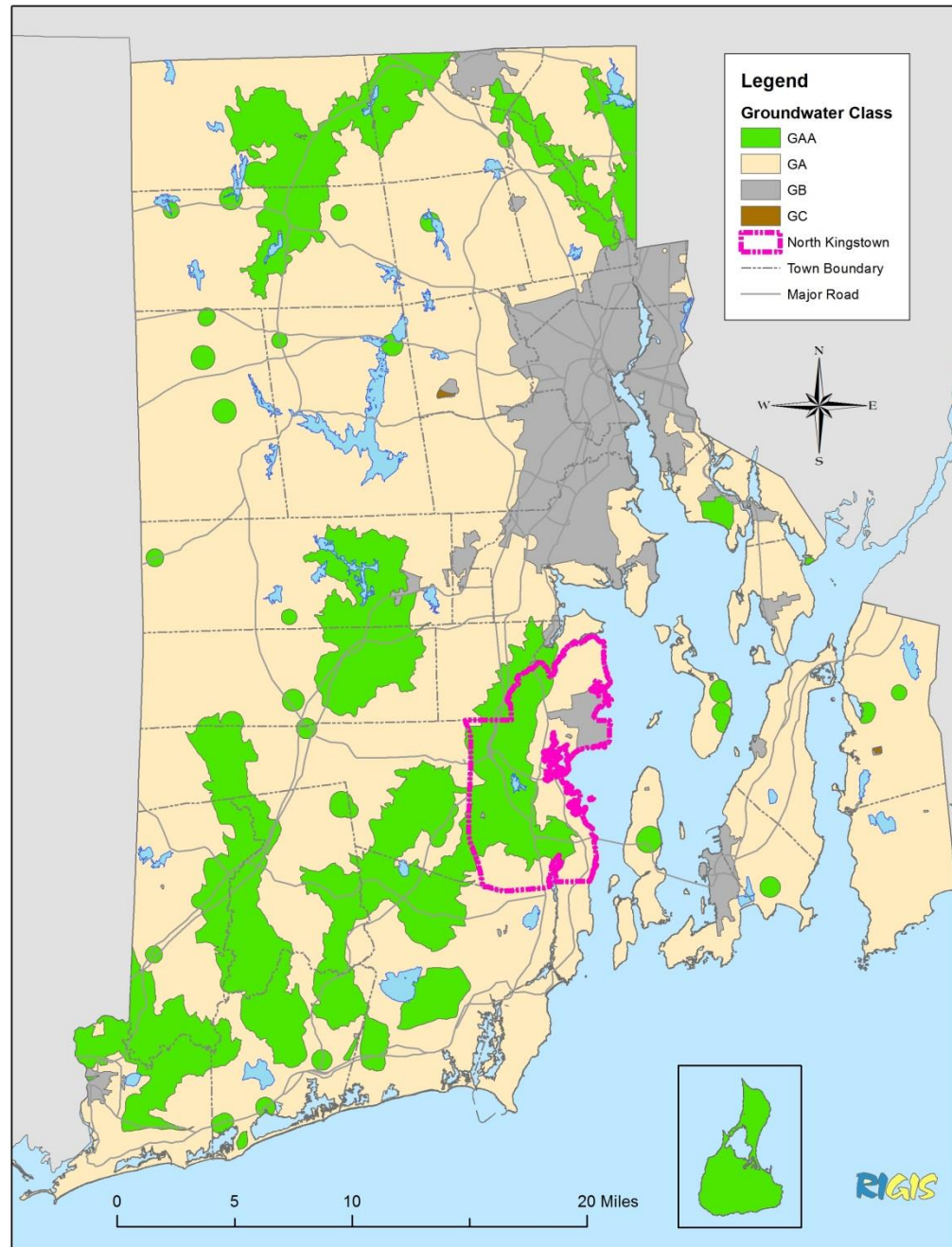
GC: (.02% of RI, 0% of NK)

- DEM permitted solid waste disposal areas



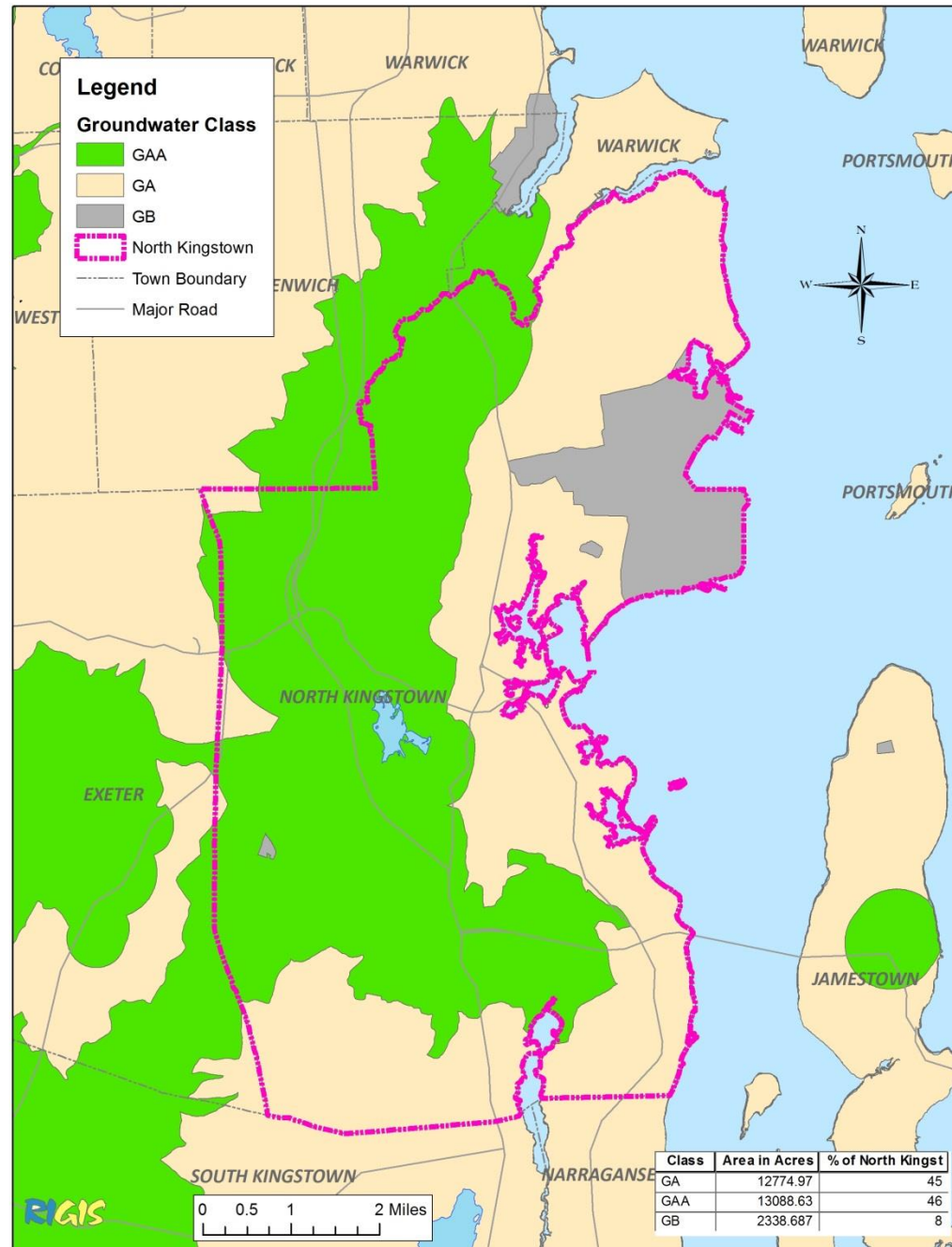
Groundwater Classification

91% of RI is
GAA or GA



North Kingstown Groundwater Classification

GAA 46%
GA 45%
GB 8%



State Role – Pollution Source Control

Siting Prohibitions and Setbacks:

- Prohibitions in GAA and Wellhead Protection Areas
- Setbacks from public and private wells

Design and Performance Standards:

- Construction standards
- Treatment standards

State Regulatory Programs for Potential Sources of Groundwater Contamination:

- Underground Storage Tanks
- Onsite Wastewater Treatment Systems (OWTS) (sanitary waste)
- Groundwater Discharge Rules (non-sanitary waste, including stormwater)
- Solid and Hazardous Waste Disposal
- Wastewater Treatment Facility Sludge Disposal (includes biosolids)
- Dredge Material Disposal



Town Protection Activities

- Adoption of groundwater zoning
- Petitioned EPA for Sole Source Aquifer Designation
- Formed a Groundwater Committee
- Prepared a Groundwater Protection Plan
- Prepared the Hunt Wellhead Protection Plan
- Established discharge limits for OWTS
- Adopted the Wastewater Management Ordinance
- Numerous education efforts: newsletters, fact sheets, outreach meetings, water quality projects, etc.
- Land acquisition -- 20% of town is preserved open space, majority of this within groundwater overlay districts



Zoning Ordinance -- What Area to Protect?

North Kingstown Ordinances (Sec. 21-186)

Zone 1:

- Groundwater Reservoirs
- DEM Wellhead Protection Areas for public wells

Zone 2:

Whichever is more conservative (larger area) of:

- The DEM designated recharge areas to the groundwater reservoirs , OR
- The US Geological Survey identified line of zero transmissivity



Zoning Ordinance – How Protect?

Identification of permitted uses, prohibited uses and those uses requiring a special use permit.

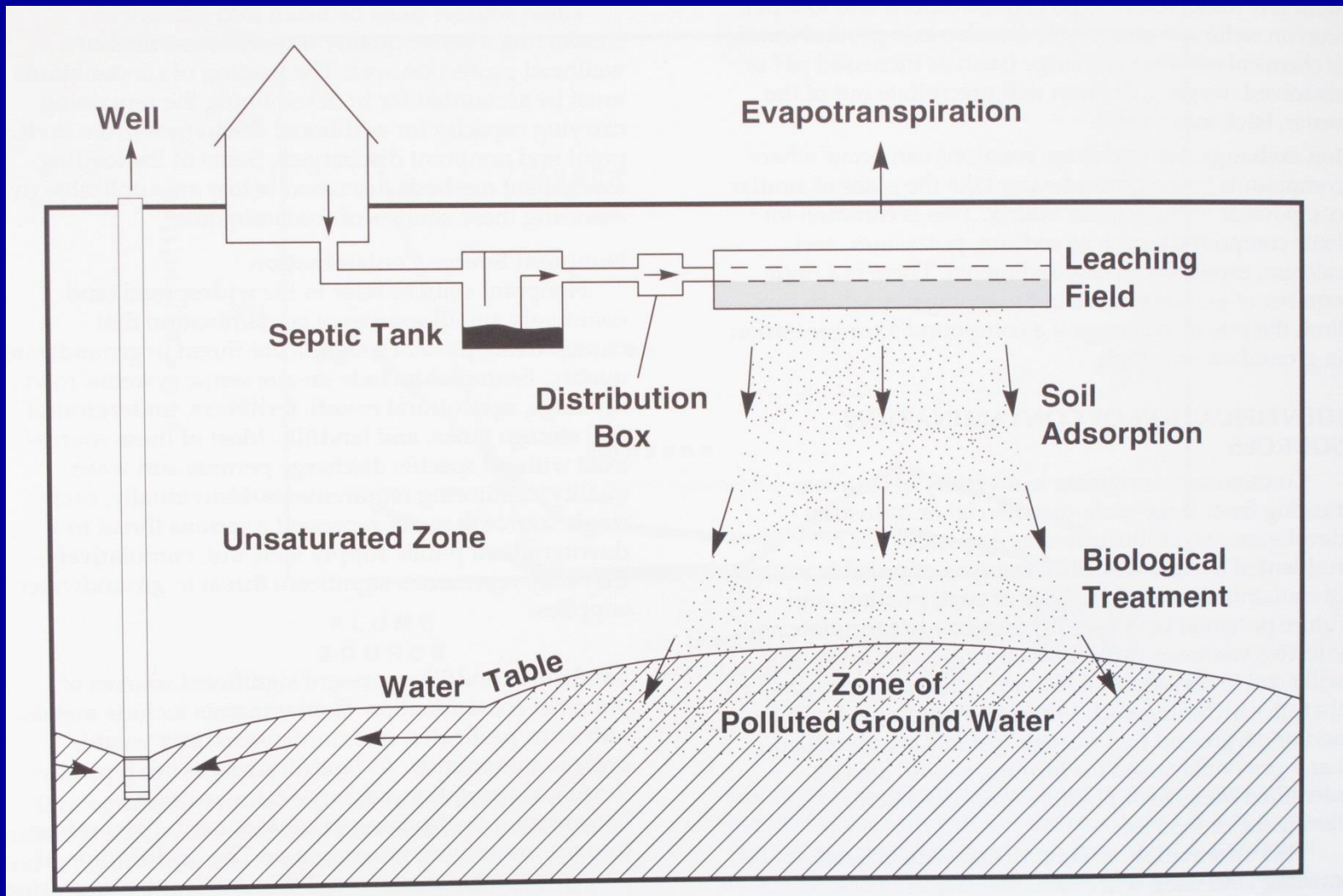
Evaluation of the RISK to groundwater quality from specific uses.

Considerations include:

- What materials are likely to be used on-site?
- Are these materials a threat to groundwater if released (accidentally or intentionally)?
- What volume of these materials will be stored on-site?
- What is the likelihood of a spill or a leak of materials?
- What is in the wastewater?
- What is the likely volume of wastewater?
- What happens to the wastewater in the subsurface?



Onsite Wastewater Treatment Systems (OWTS)



OWTS – State Role

Sanitary waste -- waste from toilets, sinks (kitchen and bath), showers, washing machines, dishwashers. Human or animal source.

State Permitting:

- **Site Suitability – soil evaluation and other factors (location)**
- **Design Review – determine compliance with state standards for treatment, setbacks and construction**
- **Construction inspections during installation**
- **License designers and installers**
- **Advanced Treatment -- Process for approving advanced treatment systems**
- **Large Systems (>5000 gpd) – model nitrate concentrations in groundwater for compliance at property boundary (10 ppm)**
- **Denitrification systems – required for all new and repaired OWTS in the Salt Pond and Narrow River Critical Resource Areas (includes Pettaquamscutt Aquifer)**



OWTS – Nitrate

Nitrate:

- Drinking water standard of 10 ppm
- Can cause health impacts for small children
- Causes increase in algal growth in salt water environments leading to reduced oxygen levels
- Very mobile contaminant in groundwater
- Indicator of the potential for other contaminants in groundwater





OWTS – Town Role

Town Discharge Limits:

- **All new commercial and industrial development must show they can meet 5 ppm of nitrate at property line.**
- **Nonconforming residential lots (by area) must be a denitrification system**

Onsite Wastewater Management Plan:

- **Requires system inspection and maintenance every 3 years**

Administers Community Septic System Loan Program:

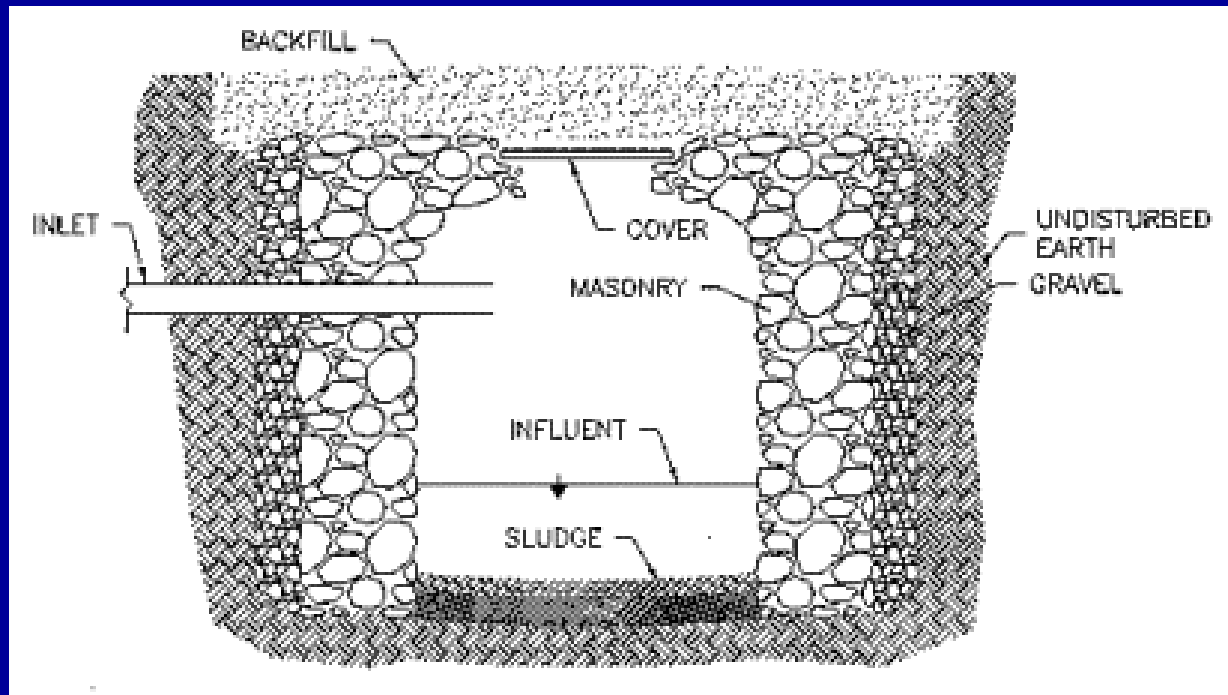
- **Access funds from the Clean Water Revolving Loan Fund**
- **Loaned to homeowners at 2% rate for up to 20 years**
- **North Kingstown has loaned out more than any other town – \$2.5 million**



What is a Cesspool?

A cesspool is any buried chamber that receives sewage from a building for disposal directly into the ground.

Could be a metal tank, a perforated concrete vault, stone lined pit, or even just a covered excavation.



What are the Problems with Cesspools?

Poor treatment of wastewater:

- Waste is concentrated in small area
- Disposal is deep under ground

Undersized for today's wastewater flows.

No construction standards – concerns for collapse.



Rhode Island Cesspool Act of 2007

Approximately 25,000 cesspools statewide

Cesspools within the following areas to be removed by January 1, 2014:

- Within 200 ft. of the inland edge of the coastal feature of a tidal waterbody (CRMC jurisdictional area).
- Within 200 ft. of a public drinking water well.
- Within 200 ft. of a water body with an intake for a drinking water supply.

Cesspools removed in the 200 ft. zones to date:

- Statewide: 677
- North Kingstown: 104
- Remaining Cesspools Statewide: 565
- Remaining Cesspools North Kingstown: 72



Large Capacity Cesspools

Serves any non-residential facility that has the capacity to serve more than 20 people per day or serves any multi-family residence or apartment building.

Use is Prohibited:

- US EPA rules from 2005
- 2008 OWTS Rules

What is Next? Options:

- Point of Sale Requirement – Currently proposed
- Change current law to expand the geographic scope (e.g., 200' inland water resources) or set statewide removal date.
- Regulatory changes (e.g., failure criteria)
- Enhance local requirements for cesspool phase-out



Stormwater Management

State Role

- Project permitting – reviewed for compliance with state Stormwater Manual
- Administer the federally required Phase II Program Municipal Separate Storm Sewer System Program (MS4) (see below)
- Permitting stormwater at industrial activities - standards to minimize impacts from activities exposed to stormwater

Town Role -- Implement the MS4 Program

Six stormwater management activities town must report on:

- Public education/outreach
- Public involvement/participation
- Illicit discharge detection and elimination
- Construction site runoff control
- Post construction runoff control
- Pollution prevention and good housekeeping



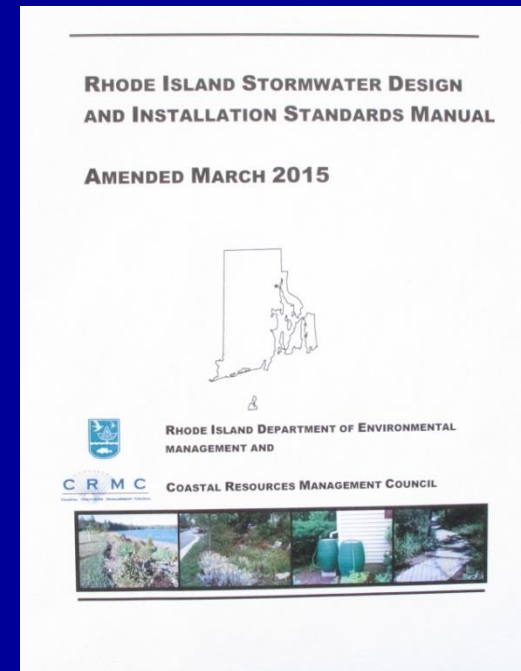
Stormwater Management

Maintain pre-development groundwater recharge and infiltration on site to the maximum extent practicable.

Use low impact design techniques as the primary method of stormwater control to the maximum extent practicable.

“The Smart Development for a Cleaner Bay Act of 2007” (RIGL 45-61.2-2)

LID - Low Impact Design: Site planning and design strategy intended to maintain or replicate predevelopment hydrology through the use of site planning, source control, and small scale practices integrated throughout the site to prevent, infiltrate and manage runoff as close to its source as possible.





Stormwater -- Groundwater Protection

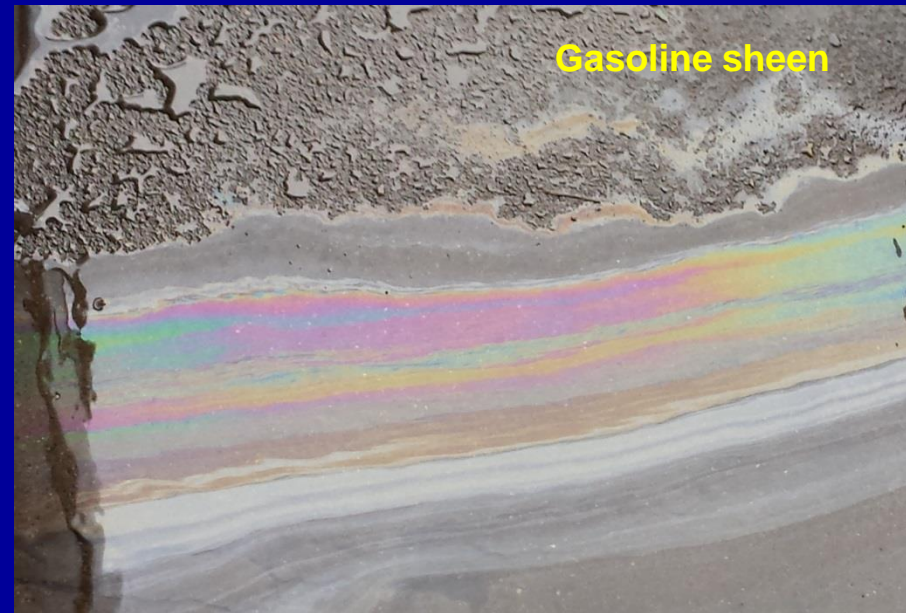
Minimize stormwater running over the landscape picking up pollutants (fertilizers, pesticides, metals, fuel, bacteria).

- Treating and managing stormwater where it falls; and
- Infiltrating as much as possible

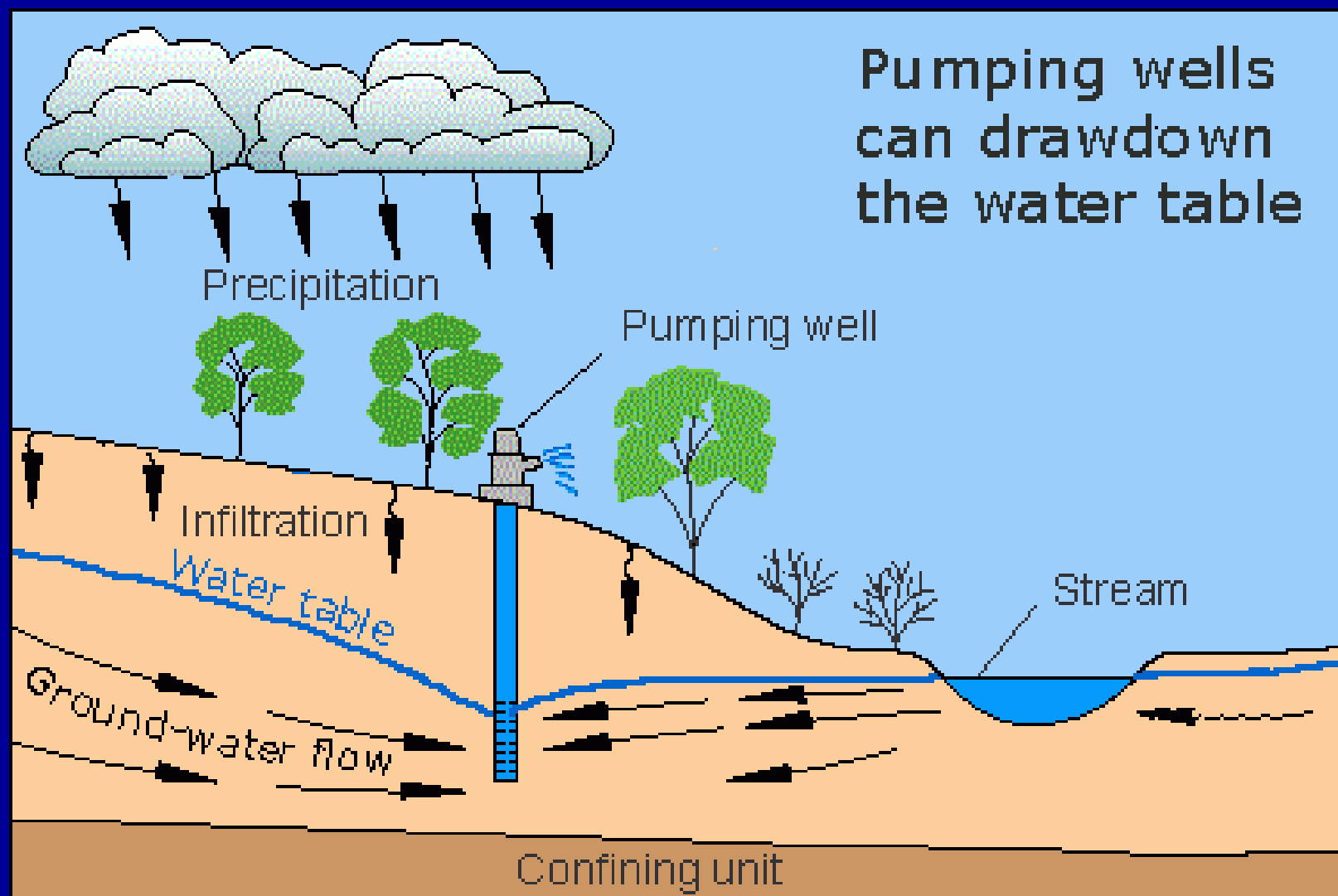
BUT -- We want to make sure that by infiltrating stormwater, we are not taking a potential surface water problem and turning it into a potential groundwater problem.

Stormwater Infiltration Standards:

- Vertical separation to groundwater
- Horizontal separation to wells
- Construction standards to ensure the infiltrating practice is treating the stormwater
- Prohibit infiltration at threatening land uses (gas stations, industrial sites, waste sites, outdoor storage and loading of hazardous materials)



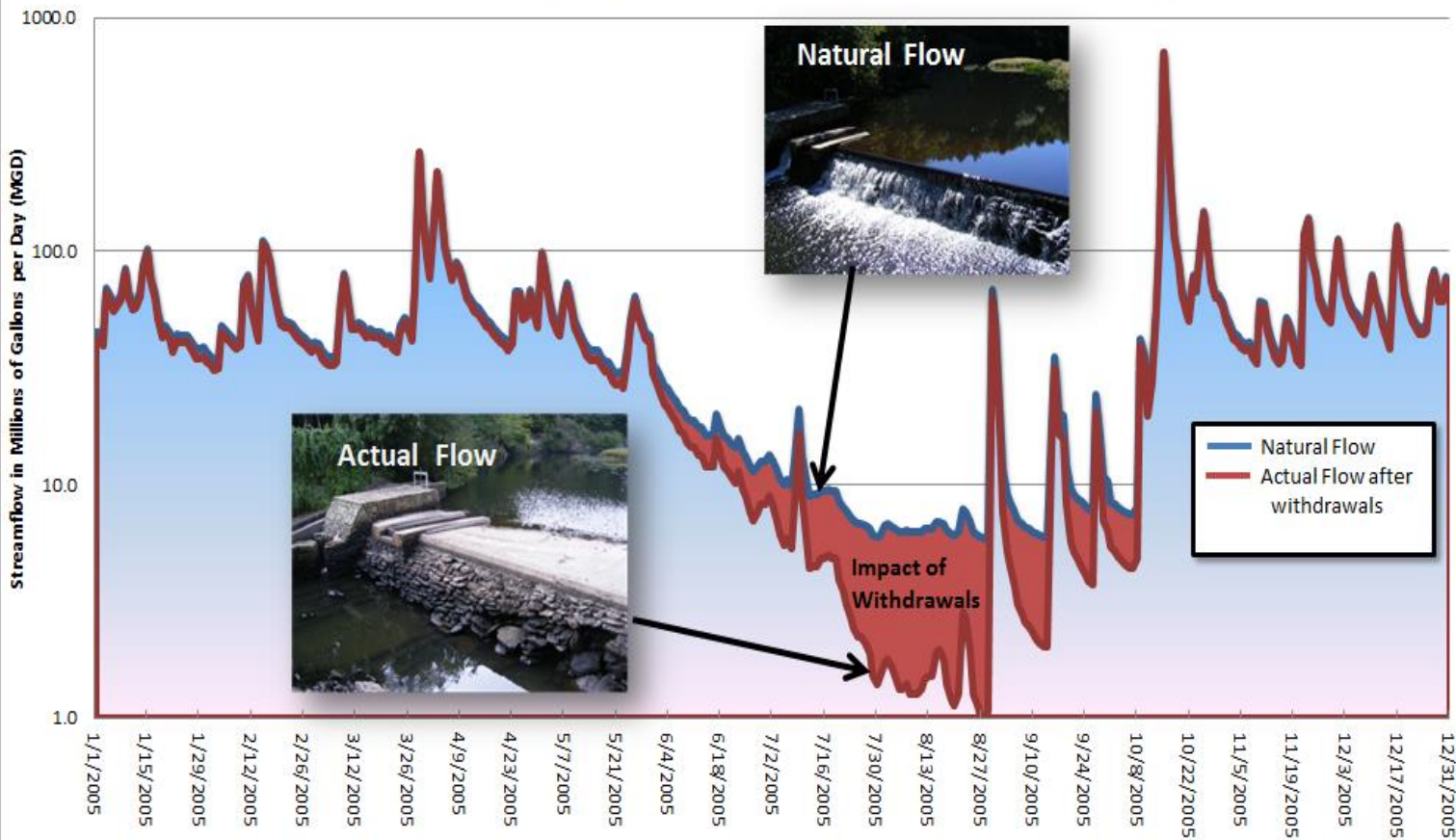
Pumping wells can drawdown the water table



Hunt River and NK Well #10



Streamflow in the Hunt River at Forge Road 01117000



RI Water Resources Board

Hunt River at Forge Road



Wetlands Near Pumping Well Cluster on Hunt River

-- August 2005

Summer Demand Management

- Minimize lawn watering
- Minimize lawn area
- Use drought tolerant grasses and shrubs
- Upgrade plumbing fixtures
- Keep trees on-site
- Install rain gages on irrigation systems



Sun Valley Stormwater Infiltration Project



Watershed Planning

Present a clear, comprehensive overview of the water quality and aquatic habitat conditions and issues.

Identify actions that are necessary to restore and protect water quality and aquatic habitat.

Plan will address:

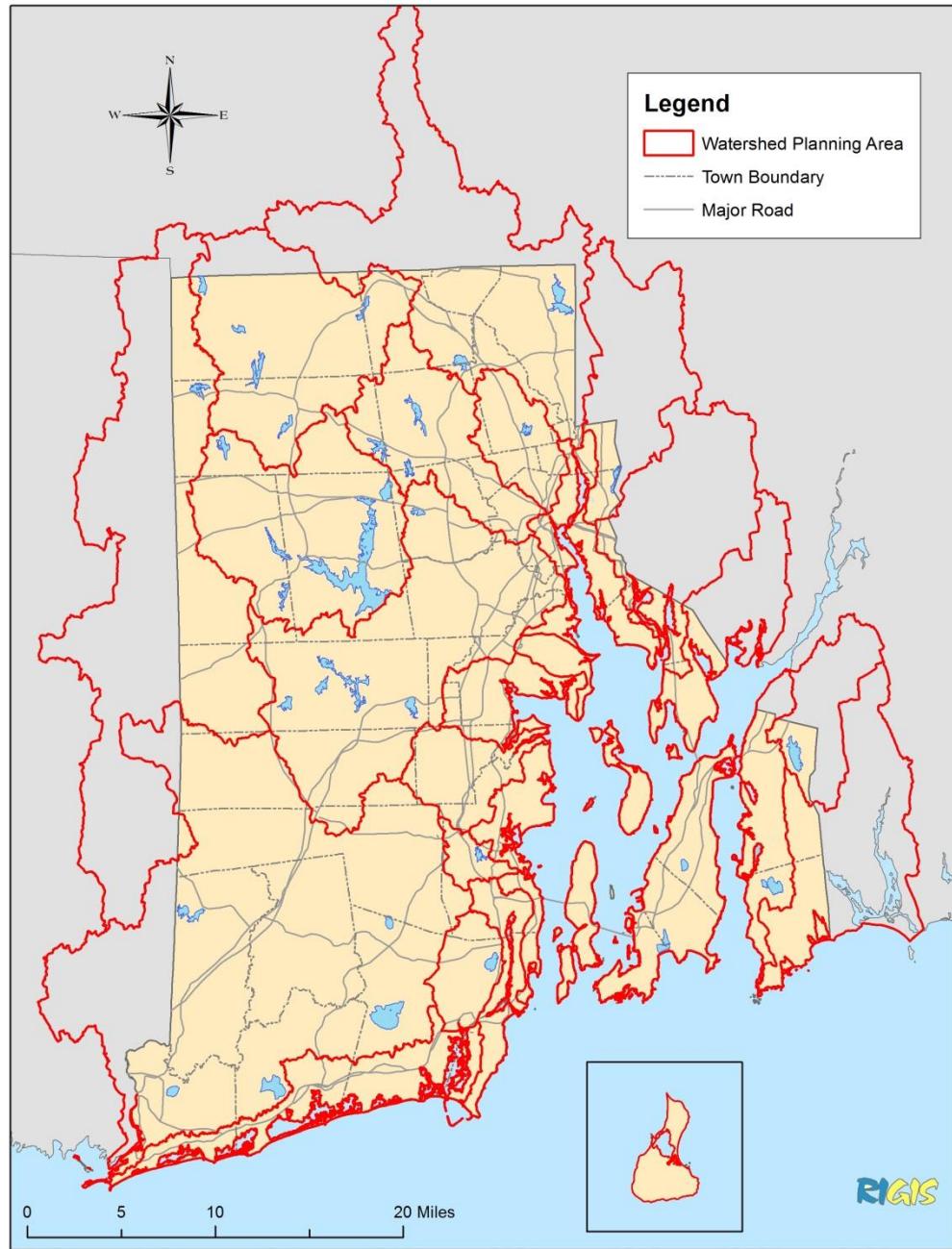
- Groundwater and surface water
- Freshwater and coastal

The Watershed Plan provides an opportunity to:

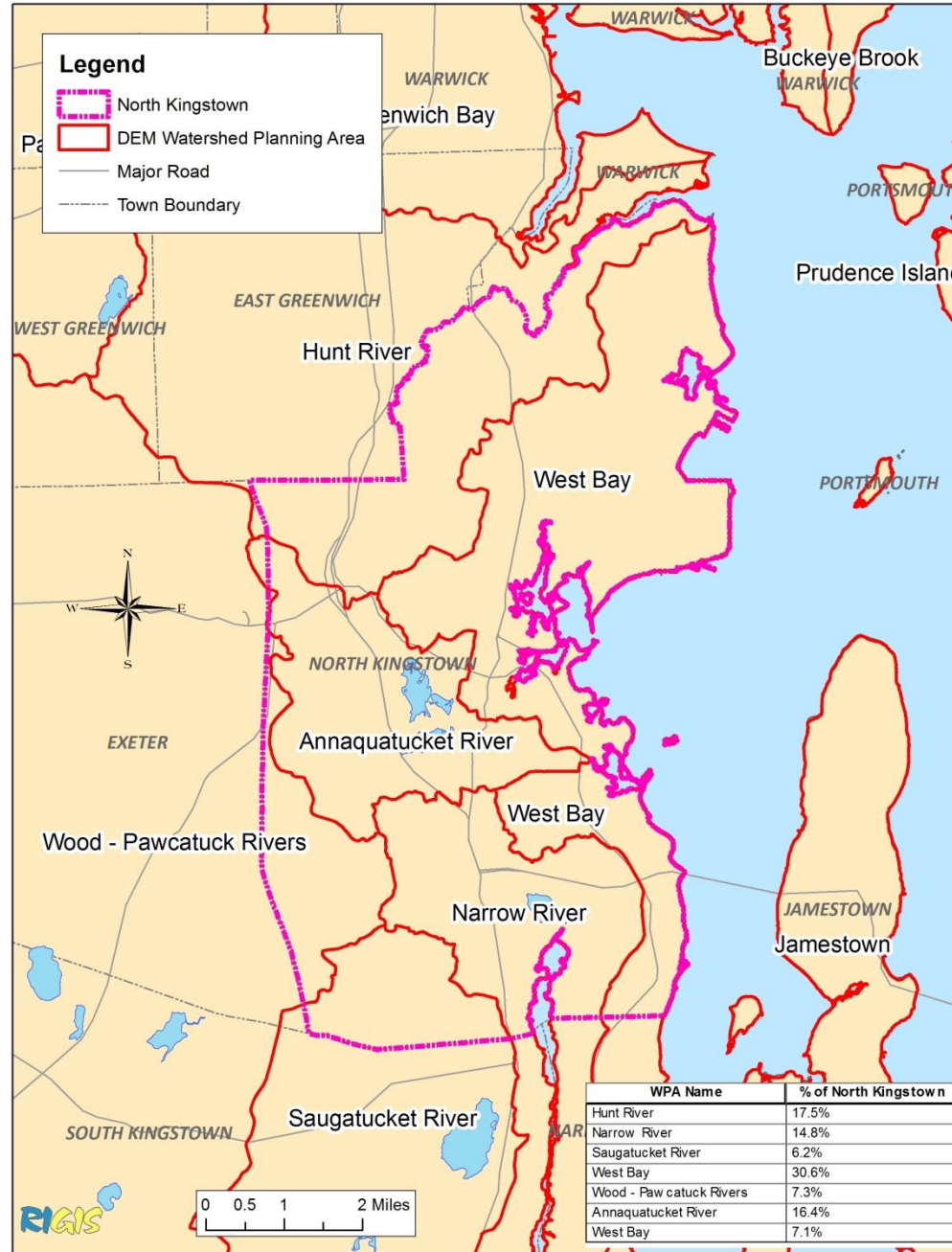
- Identify partners and stakeholders;
- Prioritize watershed issues;
- Prioritize actions to address the issues;
- Collaborate across all levels of the public and private sectors to determine and implement actions supported by sound science.



RI Watersheds



North Kingstown Watersheds



Groundwater Protection

- Ongoing Effort
- Roles for all levels of government and every citizen

We must be vigilant and continue to take the necessary steps to ensure lasting good water quality!!



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