NARRAGANSETT BAY WATERSHED COUNTS

ECONOMY · ENVIRONMENT · EQUITY

2014 REPORT



Narragansett Bay Watershed Report with a Spotlight on Marine and Freshwater Beaches

















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Watershed Counts is facilitated and supported by the URI Coastal Institute and the Narragansett Bay Estuary Program with additional support from the U.S. Environmental Protection Agency.

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2014 Watershed Counts Annual Report Executive Summary

Watershed Counts is a coalition of government agencies and other organizations who work together to report regularly on science-based indicators of the land and water resources of the Narragansett Bay region.

The 2014 Watershed Counts report highlights the health of our marine and freshwater beaches, how beaches are a large driver of our local economies, and challenges to beach health. An update on marine water quality is also provided and other indicators will be the focus of future reports.

Monitored marine beaches in the Narragansett Bay region:
- 69 RI marine beaches, 6 MA marine beaches
- Monitored by RI and MA state agencies with federal funding from the U.S. Environmental Protection Agency
- 36 RI and 5 MA marine beach closure events occurred in 2013 triggered by high levels of bacteria that is harmful to human health
- Closure events are more common during and directly after heavy rainfall in a short period of time

Monitored freshwater beaches in Narragansett Bay region:
- No federal funds currently allocated for freshwater beach monitoring in RI or MA
- Beach managers, local communities, and organizations collect samples and fund analyses at 36 RI and 52 MA monitored beaches
- Freshwater quality, human health, and the associated plants and animals would benefit from more attention and funding
- 5 RI and 16 MA freshwater beach closure events occurred in 2013 triggered by the presence of bacteria that are harmful to human health

Beach improvement projects by municipalities:
- Newport's $6 million investment in ultraviolet light treatment of stormwater and Bristol's $1.4 million in upgrades to the town beach have reduced beach closures
- Fewer beach closures and less disruption to the economy

Capital improvement projects to combined sewer and stormwater treatment facilities resulted in:
- Reductions in bacteria and nitrogen inputs to Narragansett Bay
- Additional days of open shellfishing in Upper Bay

Future impacts on marine and freshwater beaches:
- Sea level rise and increased frequency of storms, due to climate change, will inundate and erode marine beaches
- Intense precipitation events will become more frequent due to climate change resulting in increased stormwater runoff
- Implementing green infrastructure techniques can protect beaches by reducing pollutants and the volume of stormwater

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Investments in wastewater treatment pay off:



Narragansett Bay Commission, RI
- $360M investment in Phase I of the CSO project, estimated $216.5M cost for Phase II
- Storage of 65 million gallons of untreated wastewater and stormwater in CSO tunnel
- Contributed to 37% reduction in fecal coliform levels, improving conditions in the Upper Bay for recreation
- Estimated $113.6M investment in nitrogen removal upgrades
- 74% reduction in nitrogen loading from NBC facilities to improve marine water quality and reduce threat of fish kills



City of Fall River, MA
- $160M investment in addressing CSOs
- Storage of 38 million gallons of untreated wastewater and stormwater
- Construction began in 2005



Upper Blackstone Water Pollution Abatement District, MA
- $180M in treatment upgrades
- 61% reduction in nitrogen loadings
- 89% reduction in phosphorus loading to improve water quality in the Blackstone River

Watershed Counts is facilitated and supported by the URI Coastal Institute and the Narragansett Bay Estuary Program with additional support from the U.S. Environmental Protection Agency.



What is the Narragansett Bay watershed and why is it important?

Our watershed counts because the Narragansett Bay watershed region is not only the lifeblood of our community, it is the major source of our livelihoods and economic prosperity. The 2014 Watershed Counts Report highlights the Narragansett Bay watershed region and the critical role it serves as one of New England's most cherished resources. This year, the report shines a spotlight on marine and freshwater beaches and the critical importance of clean water at our bathing beaches.

Water-based activities are deeply embedded in the culture of RI and MA. Ask any resident why they live here, or any visitor why they return year after year, and they will likely say it's because they enjoy the beautiful waters of the Atlantic Ocean and Narragansett Bay. People endure long traffic jams just to be able to sit on a sandy beach on a hot summer day, cool down in the water, build sand castles, and look out over the horizon.

Our local leaders understand that clean water and open beaches are important to residents, and are catalysts to a healthy economy. Clean and healthy waters create jobs in the marine trades, fishing, shellfishing, and hospitality industries. The population swells in the summer months as tourists flock to summer homes from palatial "cottages" to charming "shacks" near the water, be they in the woods or by the shore. Both states understand that strong investments in clean water and environmental protection produce dividends from the many tourists that visit the shorelines of Massachusetts and Rhode Island. A healthy environment and the economy rely on each other. Environmental regulations protect beaches and other natural resources, our public health, and our quality of life. These protections should never be taken for granted.

With support from citizens, legislators, and regulators, RI and MA have made a strong commitment to environmental protection. Watershed Counts is the embodiment of that dedication, providing a forum where citizens can monitor the health of our environment, the evolving science of this complex ecosystem, and the actions needed to protect and preserve these valuable natural resources. Watershed Counts, a collaborative initiative co-facilitated by the URI Coastal Institute and the Narragansett Bay Estuary Program, relies on over 60 partners to work together to evaluate the conditions of the land and waters in and around the Narragansett Bay region.

What is a watershed?

A *watershed* is the area of land that drains to the same lake, stream, ocean, or other waterbody. In the case of the Narragansett Bay watershed, it is all of the land that drains into Narragansett Bay and it includes much of RI and lands in central and southeastern MA. This report examines not only the large Narragansett Bay Watershed but also the Wood-Pawcatuck Watershed and the Southeast Coastal Ponds Watershed along Rhode Island's south coast. Collectively , these areas are referred to as the Narragansett Bay Region.

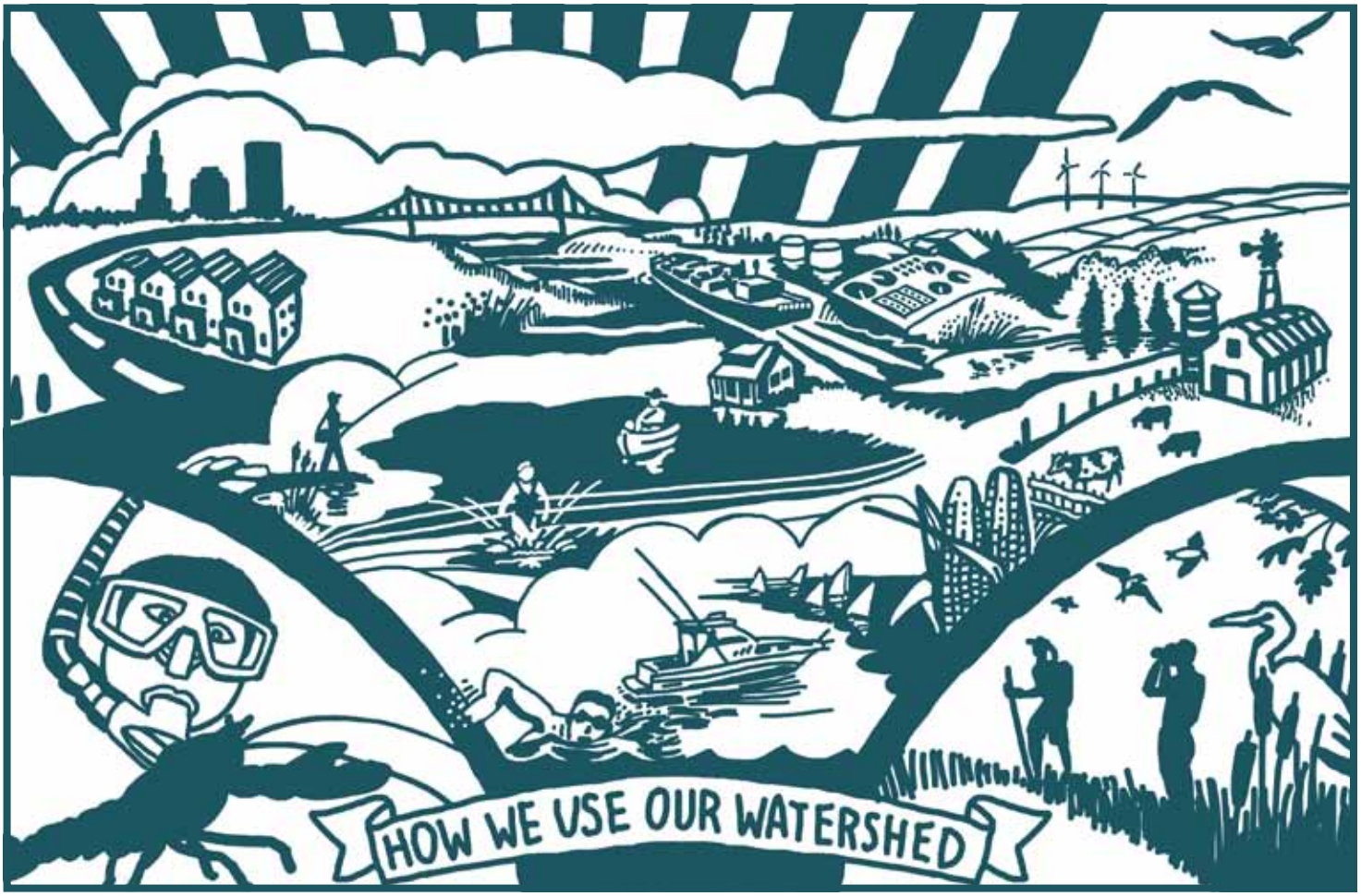
Narragansett Bay is an estuary—a partly enclosed coastal body of water with rivers or streams flowing into it and a free connection to the open ocean. On average, more than two billion gallons of fresh water flow daily from RI and Southeastern MA to mix with the salt waters of Narragansett Bay. This mixing of seawater and freshwater produces the unique estuarine habitat of the Bay that is home to a variety of plants and animals, and draws residents and tourists to its beautiful coasts.

Where does this freshwater come from?

Water is cycled through the atmosphere, and drains back through our watershed and ends up—eventually—in Narragansett Bay. Freshwater also enters the salt ponds along the southern Rhode Island coast, and much of the surface water in southwestern Rhode Island drains out through the Wood and the Pawcatuck Rivers into Little Narragansett Bay.

Watersheds cut across state, tribal, municipal, and community boundaries. Activities including industry, infrastructure, recreation, and restoration not only impact the watershed where they take place, but they can impact water supplies, flooding risks, and water quality farther downstream. Point source pollution (discharge into water that comes from a discrete, known source) and nonpoint source pollution (discharge into water that comes from diffuse sources) enter into streams and rivers and flow downhill to the sea. The issue of pollution in our waters is complex, requires broad-scale solutions, and needs coordination over a large area.

These are a few of the reasons that federal and state environmental agencies join forces with local governments and non-governmental organizations to help guide land use planning efforts, and to restore and protect rivers and streams in ways that provide multiple benefits to communities throughout the watershed. Since no single government institution has authority over watershed management, it is critical that we cooperate across government agencies and state lines, communicate clearly and effectively, and capitalize on public and private partnership efforts.



Followers of Watershed Counts since its inception in 2010 will notice a change in this year's report. For 2014, the partners agreed to focus on marine and freshwater beaches as a "spotlight" indicator. Beaches across both states are critically important to residents and local economies and beach water quality is directly impacted by the choices we make regarding land use, wastewater treatment, and our response to climate change.

The Watershed Counts Report distills the best available science into a report that clearly presents the facts to the general public. In this and future reports, we strive to engage the public in issues relating to the health of Narragansett Bay, its watershed and neighboring areas. The Watershed Counts Report will continue to be issued each year with a spotlight on relevant and timely indicators of Bay and watershed health. The consensus to focus the the 2014 spotlight on marine and freshwater beaches and beach water quality provides room for an analysis of beach closures, progress made to date with various capital improvement projects, ongoing problem areas, stormwater and green infrastructure improvements, and beach monitoring needs, as well as the interwoven aspect of climate change. All the Watershed Counts reports and summaries of past presentations can be found at www.watershedcounts.org.

Are there any state efforts Rhode Island voters should be aware of?

Governor Chafee and the Rhode Island General Assembly have approved a $53 million bond initiative for Clean Water, Open Space, and Healthy Communities, which will be on the 2014 ballot for Rhode Island voters. Over the last 30 years, Rhode Island voters have passed 12 similar bond initiatives. It is important that voters know what is included in the bond so they can make an informed decision at the polls in November.

As described by the Department of Environmental Management (DEM), this initiative would benefit the Narragansett Bay region:
The opportunity to promote and invest in a beautiful Rhode Island is significant, and the need for that investment is immediate. Rhode Island's greatest natural resource and a key driver to economic growth—Narragansett Bay—is threatened by polluted run-off and the damaging effects of climate change. Conversely, local food markets are booming, horticultural, and agricultural and landscape companies are doing more local business than ever, and our $2.26 billion dollar tourism sector is growing.

Excerpts from DEM's summary of the proposed bond initiative:

Capital for Clean Water—$20M
Municipalities and the Narragansett Bay Commission have identified more than $1.8 billion dollars of needed clean water infrastructure improvements ranging from wastewater treatment upgrades and storm water quality improvements to combined sewer overflow abatement projects. This funding stream would be administered through the State Clean Water Revolving Fund in order to provide low interest loans for these clean water investments. Each dollar invested in the program results in $3 to $4 loaned to borrowers, thus the $20 million dollar investment would result in up to $80 million dollars in loans.

Brownfield Remediation for Economic Development—$5M
Between 10,000 and 12,000 abandoned industrial sites, referred to as "brownfields," on over 100,000 acres of land lie idle in towns and cities across the state, much of it in prime commercial or industrial locations. This funding would help remediate these sites and make them suitable for development. Cleanup, reinvestment and re-use of these sites creates and attracts jobs, protects the urban environment, removes hazards, prevents sprawl, and reduces the cost of stormwater flooding.

Working with Nature to Prevent Floods—$3M
These funds would support local programs to improve community resiliency and public safety in the face of increased flooding, major storm events, and environmental degradation. Funds would be used for dam repair and removal projects, restoration and improved resiliency of vulnerable coastal habitats, and restoration of river and stream floodplains.

Scaling Up: Farmland Acquisition for Active Use—$3M
The state has lost over 80% of our farmland since 1940 and during the past 25 years has lost a greater percentage of farmland than any other state. This funding would protect the state's working farms and keep that land in the hands of our working farmers. Through the State Land Acquisition Program, DEM would purchase farmland in danger of converting to non-agricultural use, then affordably sell or lease the land to qualified farmers. Funds from sale of the land to farmers would be returned to the program account for re-use in new projects.

Local Recreation Grants—$4M
Municipalities have ever-growing needs for active recreational facilities that promote active, healthy recreational activities. These funds would help support projects such as development of fields for baseball, soccer, football; tennis courts and playgrounds. Examples of recent projects include Updates to Tucker Field in Cumberland ($200,000 DEM grant) and new tennis courts at Rotary Park in Westerly ($75,000 DEM grant).

For more information on the 2014 bond initiative, please visit the websites of The Nature Conservancy and the Rhode Island Land Trust Council.



Watersheds of the Narragansett Bay Region



Photo credit: SAVE THE BAY

Who are our watershed protectors?

The watersheds in and around Narragansett Bay have numerous champions that help protect and restore critical water resources including federal and state agencies and numerous non-governmental organizations. While the combined efforts of all these entities are essential, this report highlights the tireless work of local watershed groups, watershed councils, and land trusts. These local organizations work at the scale of individual rivers and smaller watersheds. These organizations sometimes have paid staff but most do their work through the volunteer efforts of many members and supporters.

Not every river basin has a watershed protector, but the Narragansett Bay region has many organizations that are dedicated to protect these local waterways. In the following pages, we will tour the region's waters starting with the northwestern headwaters of Narragansett Bay—the Blackstone River. The report will then highlight the work of organizations in the Pawtuxet River watershed and the Taunton River watershed. Lastly, the report will provide an overview of the work being done in the Wood-Pawcatuck Watershed that feeds into Little Narragansett Bay as well as the Southwestern Coastal Ponds Watershed that feeds into Block Island Sound.

The list of organizations below is certainly not meant to cover all the organizations working in the Narragansett Bay region, but it does provide a sense of the strength of the Bay's watershed protection efforts.

What do our watersheds look like?

The three major watersheds in our area are the Narragansett Bay, Wood-Pawcatuck, and Southwest Coastal Ponds watersheds. For comparison, an acre is about 3/4 the size of a professional football field and there are 640 acres per square mile.

Watershed	Total Acres	Percent Preserved	Percent Impervious
Narragansett Bay	1,092,999	15	15
Wood-Pawcatuck	193,235	31	4
SW Coastal Ponds	35,930	24	14

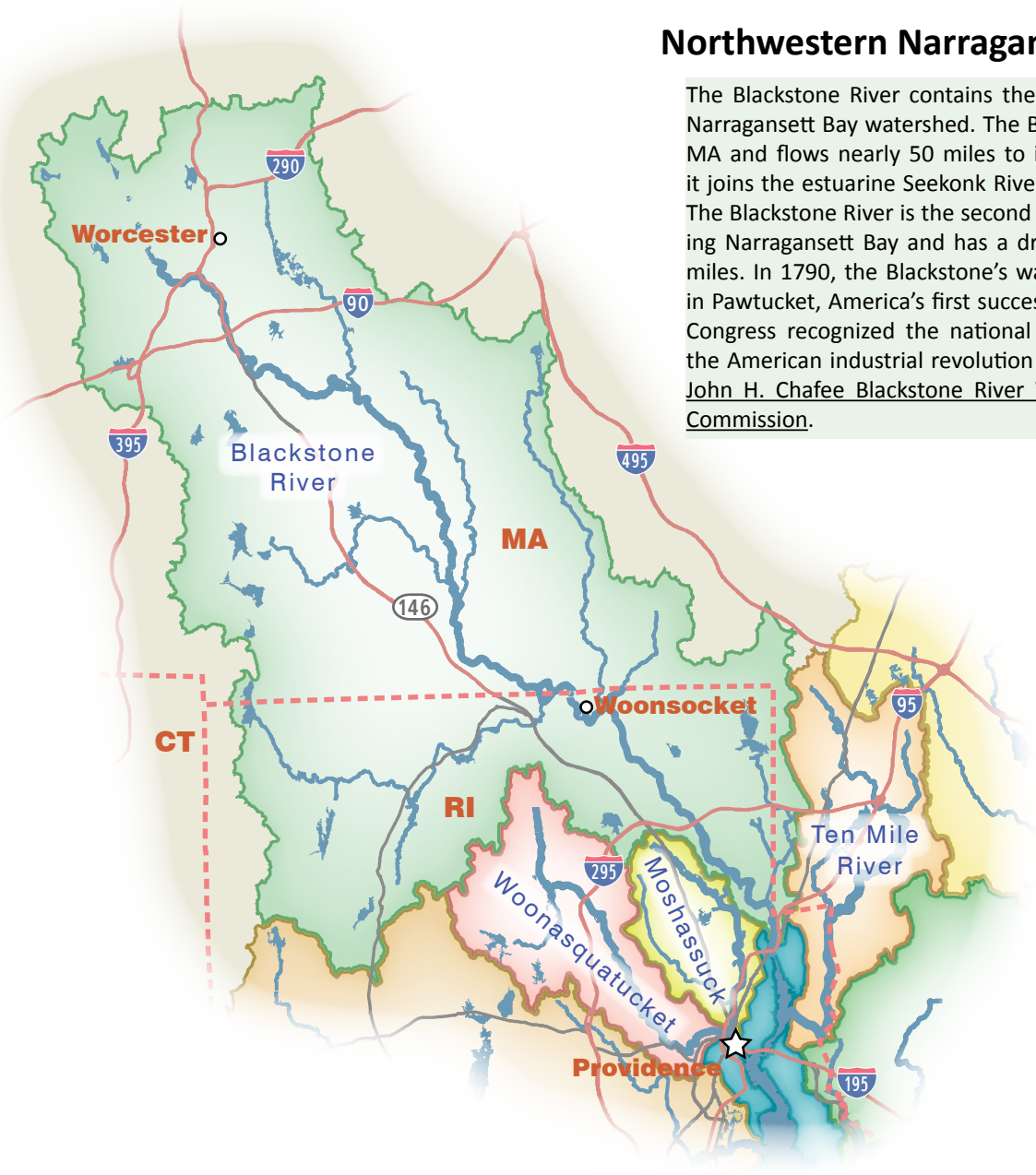
Watershed facts

- 60% of the Narragansett Bay watershed is located in MA and 40% is located in RI.
- 19% of the Wood-Pawcatuck Watershed is located in CT.
- The Blackstone, Taunton, and Pawtuxet Rivers provide the majority of fresh water that flows into Narragansett Bay.

Watershed Counts applauds the commitment of these local watershed groups, watershed councils, and land trusts and other similar groups for the ongoing work to protect Narragansett Bay. For more information about other groups in both RI and MA, please visit the following organizations: Rhode Island Rivers Council, Massachusetts Rivers Alliance, Massachusetts Land Trust Coalition, Save the Lakes, and the Rhode Island Land Trust Council.


Watersheds of
Narragansett Bay
Boston
Worcester
MASSACHUSETTS
Blackstone
Watershed
Taunton
Watershed
Brockton
RHODE ISLAND
Taunton
CONNECTICUT
Providence
Pawtuxet
Watershed
Warwick
Fall River
New Bedford
Narragansett Bay
Wood-
Pawcatuck
Watershed
Buzzards Bay
Newport
Southwest Coastal Ponds Watershed
Westerly
Rhode Island Sound
Block Island Sound
Data Sources: RIGIS; the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division; and the State of Connecticut, CT Geographic Information System.
This map was produced by B. G. Hooke Consulting for WATERSHED COUNTS
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Northwestern Narragansett Bay Watersheds



The Blackstone River contains the northwestern headwaters of the Narragansett Bay watershed. The Blackstone originates in Worcester, MA and flows nearly 50 miles to its mouth in Pawtucket, RI where it joins the estuarine Seekonk River and flows into Narragansett Bay. The Blackstone River is the second largest freshwater tributary entering Narragansett Bay and has a drainage area of nearly 550 square miles. In 1790, the Blackstone's waters first powered the Slater Mill in Pawtucket, America's first successful cotton spinning mill. In 1986, Congress recognized the national significance of this birthplace of the American industrial revolution through the establishment of the John H. Chafee Blackstone River Valley National Heritage Corridor Commission.

A key watershed group that helps to protect and restore the Blackstone River is the Blackstone River Coalition. The Coalition is a partnership of organizations working to protect and restore the Blackstone River watershed. The Coalition's goal is to reinvigorate a grassroots spirit to restore the Blackstone. The Coalition is made up of numerous watershed organizations including the Blackstone Headwaters Coalition, the Blackstone River Watershed Association, and the Blackstone River Watershed Council/Friends of the Blackstone. In addition, the Greater Worcester Land Trust has spent over 25 years protecting critical lands for open space and water quality protection in and around Worcester.

The Woonasquatucket River begins in the town of North Smithfield, RI and flows 19 miles south and east to downtown Providence, where it joins the Moshassuck River before emptying into the estuarine Providence River. Meaning "the place where the salt water ends", the Woonasquatucket watershed covers 50 square miles in the towns of North Smithfield, Smithfield, Johnston, North Providence, and Providence. The Woonasquatucket River Watershed Council, formed in 1998, promotes the restoration and preservation of the Woonasquatucket River watershed.

The Moshassuck River, "the river where moose watered"—as named by Narragansett Indians—begins in Lincoln, RI and flows over 10 miles into downtown Providence. As a result of its industrial past, the river has five ponds, one reservoir, and 11 dams. The Moshassuck is joined by its major tributary, the West River, about a mile from Providence. In 2006, the Friends of the Moshassuck was designated the official Watershed Council for the Moshassuck and its tributary the West River by the Rhode Island Rivers Council.

The Ten Mile River is located in southeastern MA and a small portion of northeastern RI. The Ten Mile River flows into the Seekonk and Providence Rivers of Narragansett Bay. It is over 22 miles in length and picks up flow from two major tributaries, the Seven Mile River and the Bungay River. The Ten Mile River Watershed Council promotes the restoration of the Ten Mile River watershed and encourages and supports recreational activities within the watershed.

Map Data Sources: RIGIS; the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division; and the State of Connecticut, CT Geographic Information System.

This map was produced by B. G. Hooke Consulting for Watershed Counts.

Western Narragansett Bay Watersheds



The headwaters of the Pawtuxet River are in the hills of western RI and ends in historic Pawtuxet Village between the cities of Warwick and Cranston. The Pawtuxet River watershed is the largest watershed in RI and includes 64 ponds, 93 brooks, 7 tributary rivers, and 167 dams (9 of which are located between the Scituate Reservoir and the mouth of the Pawtuxet River). In March of 2010, a rain event produced the greatest flooding of the Pawtuxet River in recorded history with a record river level of 20.79 feet, nearly 12 feet above flood stage. The Pawtuxet River Authority & Watershed Council is a non-profit agency created by the RI General Assembly in 1972 to protect the Pawtuxet River watershed.

In 1925, a dam was built across the north branch of the Pawtuxet to create the Scituate Reservoir which is run by the Providence Water Supply Board and presently provides drinking water to nearly two-thirds of Rhode Island's population. Drinking water is supplied entirely from reservoirs located in a forested 92.8 square mile watershed. The water treatment plant has a maximum treatment capacity of 144 million gallons of water per day and remains the largest treatment facility in New England. The Scituate Land Trust was created in 1990 to help further protect and preserve the lands in and around the Scituate Reservoir.

Buckeye Brook is one of the few remaining undammed fish runs on Narragansett Bay. Alewives and blueback herring migrate from the sea into Warwick Pond to spawn, unaided by fish ladders. These species are an important component of the Narragansett Bay's ecosystem and are important bait fish for larger fish. The Buckeye Brook Coalition is a state designated Watershed Council that was formed to focus attention on Buckeye Brook and its watershed.

The Hunt River is centrally located in RI on the westerly side of Narragansett Bay. The watershed drains approximately 25 square miles and includes parts of Exeter, North Kingstown, East Greenwich, West Greenwich, Coventry, West Warwick, and Warwick. The mission of the Friends of the Hunt River Watershed is to protect and preserve the Hunt River watershed, aquifer, and ecosystem by implementing a monitoring program and by educating the community on the importance of water quality and quantity issues.

The Narrow River runs parallel to the West Passage of Narragansett Bay and the Narrow River watershed lies within the towns of North Kingstown, Narragansett, and South Kingstown. The "river" is more appropriately described as a composite of a tidal inlet and back bay, an estuary, and two ponds. The Narrow River Preservation Association works to preserve, protect, and restore the natural environment and the quality of life for all communities within the Narrow River estuary and watershed. The Narrow River Land Trust provides additional protection through land conservation efforts.

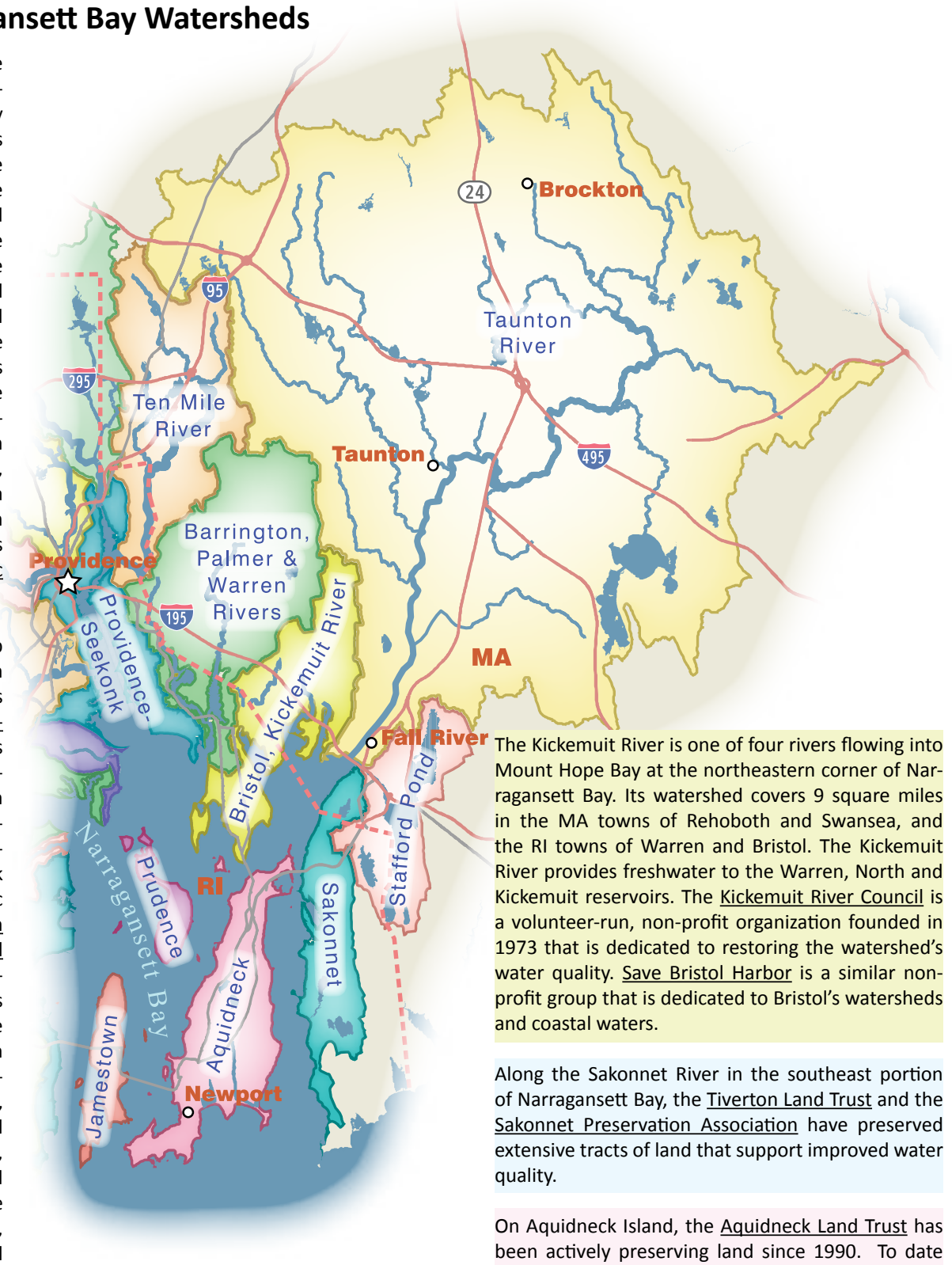
Map Data Sources: RIGIS; the State of Connecticut, CT Geographic Information System.

This map was produced by B. G. Hooke Consulting for Watershed Counts.

Eastern Narragansett Bay Watersheds

The Taunton River is the largest freshwater contributor to Narragansett Bay and travels over 40 miles to Mount Hope Bay. The Taunton's watershed is the second largest in MA and includes over 560 square miles. The Taunton is the longest undammed tidal river in New England and is an extremely diverse and intact ecosystem. It is tidal for 18 miles from the Bay, with saltwater ending about 12 miles from the mouth. On March 30, 2009, President Obama designated the main stem of the Taunton River as a National Wild & Scenic River.

The local watershed group overseeing the protection of the Taunton River is the Taunton River Watershed Alliance which was founded in 1988. The Alliance works closely with Mass Audubon to protect the Taunton. As a result of the National Park Service's Wild & Scenic designation, the Taunton River Stewardship Council was created. The Stewardship Council includes representatives from the 10 towns along the main stem of the Taunton River (Berkley, Bridgewater, Dighton, Freetown, Fall River, Halifax, Middleboro, Raynham, Somerset, and Taunton) as well as the State of Massachusetts, the Dighton Intertribal Indian Council, the National Park Service, Save The Bay, The Nature Conservancy, the Southeastern Regional Planning & Economic Development District, the Taunton River Watershed Alliance, and two local land trusts (the Wildlands Trust and the Natural Resources Trust of Bridgewater). The Wildlands Trust was founded in 1973 and works to conserve land and preserve the natural heritage of Southeastern MA. They have helped to ensure the protection of nearly 10,000 acres of important habitats and landscapes, woodlands, ponds, coastal areas, agricultural lands, and river systems.



The Kickemuit River is one of four rivers flowing into Mount Hope Bay at the northeastern corner of Narragansett Bay. Its watershed covers 9 square miles in the MA towns of Rehoboth and Swansea, and the RI towns of Warren and Bristol. The Kickemuit River provides freshwater to the Warren, North and Kickemuit reservoirs. The Kickemuit River Council is a volunteer-run, non-profit organization founded in 1973 that is dedicated to restoring the watershed's water quality. Save Bristol Harbor is a similar non-profit group that is dedicated to Bristol's watersheds and coastal waters.

Along the Sakonnet River in the southeast portion of Narragansett Bay, the Tiverton Land Trust and the Sakonnet Preservation Association have preserved extensive tracts of land that support improved water quality.

On Aquidneck Island, the Aquidneck Land Trust has been actively preserving land since 1990. To date over 2,000 acres, or 20% of the Island, has been conserved. These efforts are critical to protect the drinking water reservoirs and watersheds on Aquidneck Island.

Map Data Sources: RIGIS; the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division.

This map was produced by B. G. Hooke Consulting for Watershed Counts.

Watersheds Neighboring Narragansett Bay



The Wood-Pawcatuck Watershed stretches across the southwestern border of RI into the southeastern part of CT. Its seven major drainage basins include the Queen, Wood, Chickasheen, Chipuxet, Shunock, Green Falls, and Pawcatuck Rivers, and their tributaries. It includes all or portions of 10 RI towns and 4 CT towns and the watershed drains into Little Narragansett Bay, part of the Block Island Sound. The entire watershed covers an area of over 193,000 acres (300 square miles), or roughly one-quarter the size of RI. About 70% of RI's globally rare species are found within the watershed. The Wood-Pawcatuck Watershed Association was established in 1983 in response to a groundswell of interest generated by a National Park Service study conducted that year, which identified the Wood and Pawcatuck Rivers as "...unique and irreplaceable resources." The Westerly Land Trust has protected floodplains and wetlands along both sides of the Pawcatuck River. The Grills Preserve, over 500 acres in all, has more than 2.5 miles of frontage on the Pawcatuck River.

The Southwestern Coastal Ponds form a series of separate small watersheds that all flow to Block Island Sound. Portions of Westerly, Charlestown, South Kingstown, and Narragansett Indian land are located in this area that runs along most of RI's south shore. It includes several large coastal salt ponds and some brackish ponds, from west to east: Winnapaug Pond, Quonochontaug Pond, Ninigret Pond, Green Hill Pond, Trustom Pond (brackish), Card Pond (brackish), Potter Pond, and Point Judith Pond. The salt ponds are valuable spawning and nursery grounds for many aquatic species and are prime feeding areas for migrating waterfowl. The Salt Ponds Coalition serves as a steward for the RI coastal salt ponds, which contribute substantially to tourism and fishing—the economic lifeblood of communities in southern Rhode Island. One of the land trusts working in the Southwestern Coastal Ponds Watershed is the South Kingstown Land Trust. This organization has completed over 150 land preservation projects during the past 30 years, protecting over 2,600 acres.

Map Data Sources: RIGIS; and the State of Connecticut, CT Geographic Information System.

This map was produced by B. G. Hooke Consulting for Watershed Counts.



Marine and Freshwater Beaches

Photo credit: JULIAN COLTON

What happens when something you take for granted suddenly disappears?

Residents and visitors alike experienced that disorienting feeling during the summer of 2013, when local beaches in the Narragansett Bay region were closed for 41 separate events (36 in RI and 5 in MA) due to pet waste, stormwater, failing septic systems, and other sources.

When beaches are closed in the summer people are understandably upset. How could this happen to my neighborhood beach? What do I tell my kids? These questions were being asked throughout the watershed, and especially in the iconic Warwick neighborhood of Oakland Beach. By the end of last summer, Oakland Beach had been closed to swimming for 27 days.

Beaches are deeply embedded in the culture of RI and MA. Think of salty breezes, beach pavilions with hot dogs, lemonade and stuffies. Families go treasure hunting on the beaches of Narragansett Bay for shells, sea glass, and driftwood.

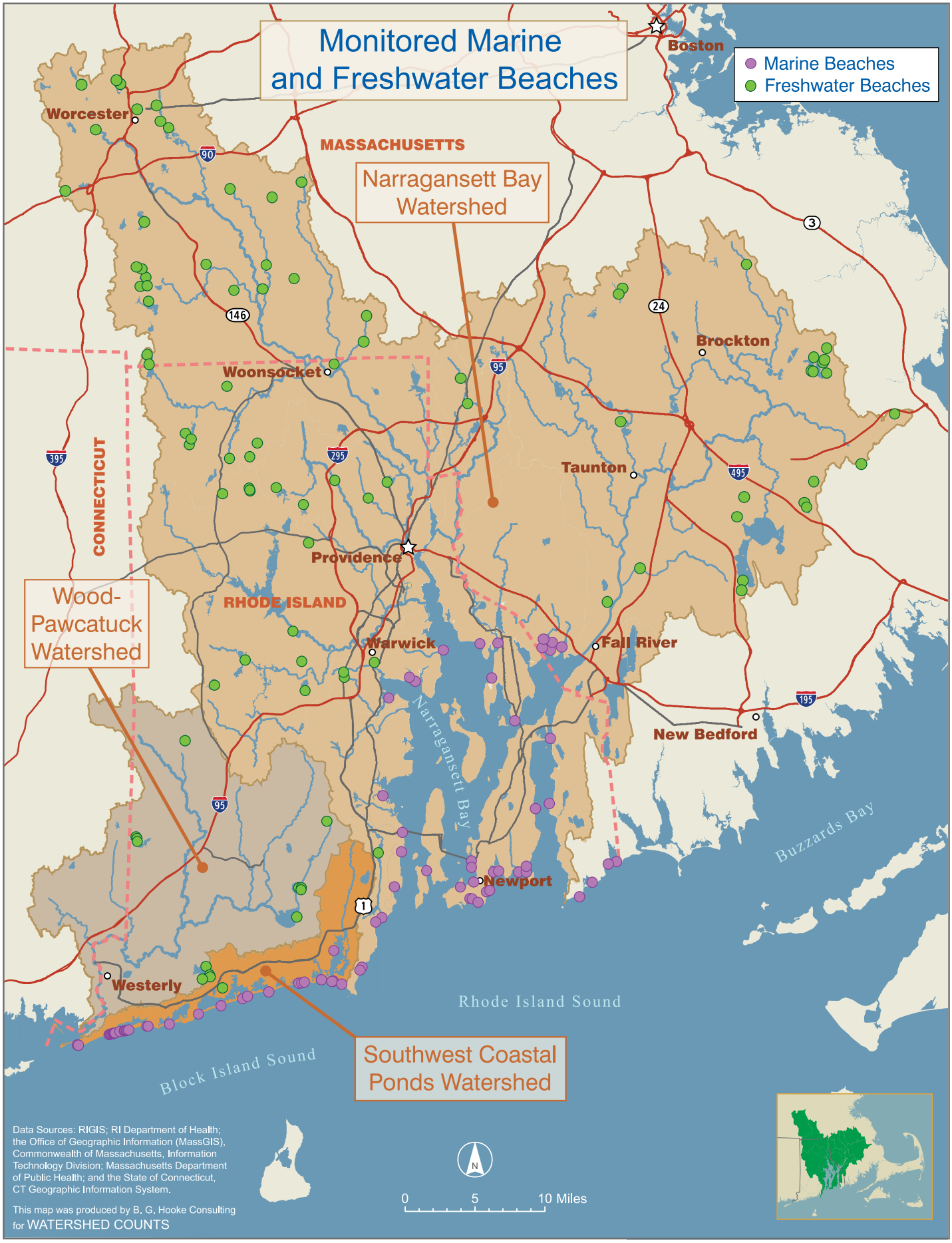
During their treasure hunts they might pause to watch shellfishermen in their skiffs just offshore, doing the backbreaking work of harvesting with bullrakes, pulling up bushels of cherrystones and chowder clams. Surfcasters ply both sandy and rocky beaches in search of the mighty striped bass that feed just offshore. They fish at all hours, and especially at dusk and dawn. Beneath the surface, just below that distinct, floating red and white flag, divers spearfish for stripers and tautog, which they will eventually grill.

Kayakers—alone or in groups—drive to the beach to launch their boats into the Bay. They paddle about just to enjoy being in, on, and near the water. Sometimes you will see a kayaker break out a fishing rod and fish for stripers, bluefish, or fluke. Surfers from all over the country enjoy our beaches because they offer huge, dramatic swells. And not just in summer. In the freezing cold of winter, you'll see dozens of surfers in black dry suits, working the waters off Newport, Narragansett, and Westerly in the never-ending pursuit of the prefect wave. People walking their dogs on the beach will pause and marvel as surfers catch and ride waves, and paddle back out for more. They might retreat to the warmth of their cars in the beach parking lot, just to extend their stay on the beach and enjoy the rhythm of the surf.

Beaches give people a timeless sense of place, and a retreat to contemplate life's most important thoughts, decisions, and meanings. People walk on the beach to talk about and work out their difficult, challenging circumstances. They offer space for hope and renewal, and for the gathering of generations to share life's most simple pleasures. They are also a place for pure, carefree fun.

We love our beaches, and we like to enjoy them with peace of mind. That is why the Town of Bristol committed the time, energy, and resources to fix local pollution problems. They reclaimed their town beach from years of "No Swimming per Order of Department of Health" signs. In the summer of 2013, Bristol Town Beach remained open every day. Kids who attended day camps in previous years and were instructed not to enter the water on many occasions finally dove into the waters off Bristol Town Beach.

But Bristol is just one beach. All along the shores of Narragansett Bay similar green infrastructure plans are emerging. Many of our local leaders understand that clean and open beaches are important to residents, and are catalysts to a healthy economy. Clean and healthy waters create jobs in the marine trades, fishing, shellfishing, and the tourism and hospitality industries. Property values also benefit from clean waterways. Beaches are treasures that need regular maintenance and long-term investment. The following provides an overview of beach issues in RI and MA as well as specific case studies of communities that have invested or need to further invest in the protection of our priceless beaches.


Monitored Marine and Freshwater Beaches
Marine Beaches
Freshwater Beaches
Boston
Worcester
MASSACHUSETTS
Narragansett Bay Watershed
Brockton
Woonsocket
CONNECTICUT
Taunton
Providence
RHODE ISLAND
Wood-Pawcatuck Watershed
Warwick
Fall River
New Bedford
Narragansett Bay
Buzzards Bay
Newport
Westerly
Rhode Island Sound
Block Island Sound
Southwest Coastal Ponds Watershed
Data Sources: RIGIS; RI Department of Health; the Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division; Massachusetts Department of Public Health; and the State of Connecticut, CT Geographic Information System.
This map was produced by B. G. Hooke Consulting for WATERSHED COUNTS
N
0
5
10 Miles

How are beaches monitored for health concerns?

To make sure beaches are safe for swimming and recreation, beach managers in RI and MA sample water for the bacteria Enterococci or *E. coli*. These bacteria are found in human and animal intestines that often indicate the presence of disease-causing organisms associated with fecal contamination. When high levels of these bacteria are present in waters off beaches, it indicates that contamination has occured from sources that include discharges of raw sewage from combined sewer overflows, failing septic systems, cesspools, or a large number of wild and domestic animals. Fecal contamination of our beach waters can lead to a wide range of health complications including ear, nose, and throat problems, gastroenteritis, dysentery, hepatitis, and respiratory illness. Because there are so many potential pathogens and testing for all of them is not feasible, Enterococci and *E. coli* are used as an indicator for the presence of human pathogens.

Licensed saltwater beaches are sampled regularly for Enterococci. The standard in both Rhode Island and Massachusetts is 104 colony forming units per 100 milliliters of saltwater (just under ½ cup). In RI, any sample above the standard is considered unsafe for swimming, and in MA two consecutive samples above the standard are needed to close a beach. Once a beach violates state criteria, it is closed until new samples indicate that conditions have improved. This is referred to as one closure event. A closure event may last one day or several days depending on how quickly the Enterococci die off or are flushed out of the system.

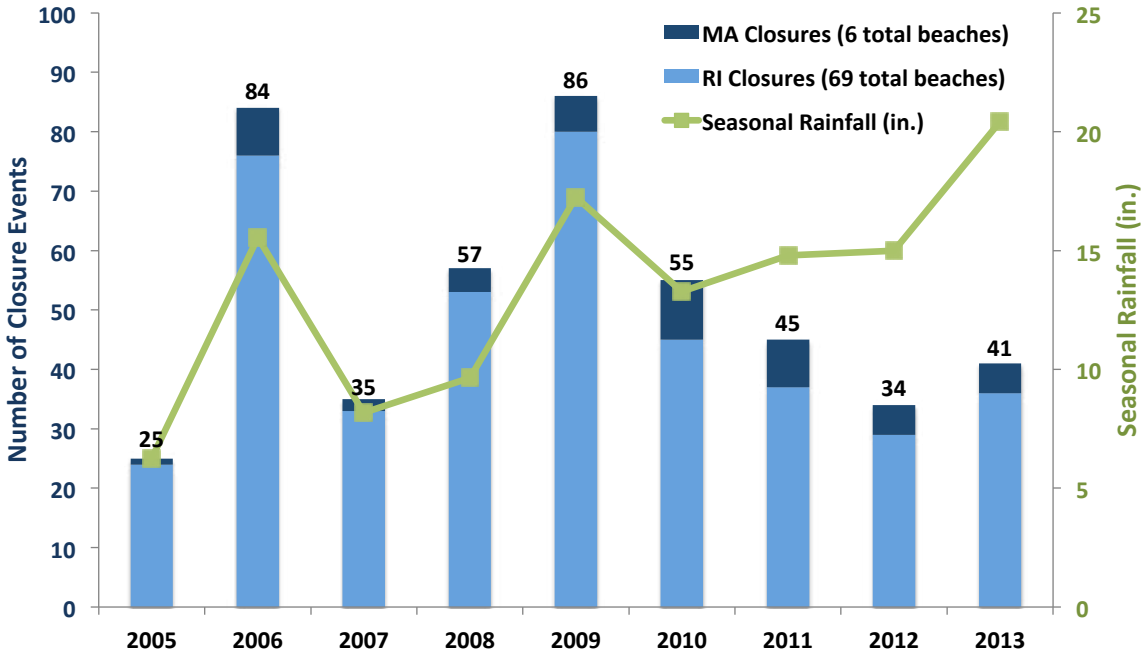
The graph below shows the number of closures out of 69 monitored RI marine beaches (not including Block Island) and 6 monitored MA marine beaches in the Narragansett Bay region. There were 36 RI closure events, with none of these in Little Compton or the Southwest Coastal Ponds Watershed.

The largest percentage of beach closures were in and around Greenwich Bay (please see case study). There were 5 MA closure events in 2013. The graph also has a line depicting the amount of seasonal rainfall that we received each of those years. As you can see, closure events are strongly influenced by the duration and intensity of precipitation events. This is because major rainfall events generate stormwater runoff which may carry bacteria into our waters from failing on-site wastewater systems, leaking sewer pipes, pet wastes, wildlife and other sources.

From 2005 through 2009, the amount of rainfall was highly correlated with the number of closure events. Since 2009 though, communities in both RI and MA have taken steps to reduce the flow of bacteria into the surrounding waters—even during high rainfall events—and you see that there are fewer beach closures even when we receive more inches of seasonal rainfall. This is a clear example of how our investments in the improvement of stormwater and wastewater infrastructure are starting to pay off.

Freshwater beaches are also monitored for Enterococci in RI and Enterococci or *E. coli* in MA but the standard for these beaches is 61 Enterococci or 235 *E. coli* colony forming units per 100 mL of freshwater (remember: 100 mL is just under ½ cup). Unlike the federal funding that supports the monitoring of our saltwater beaches, freshwater monitoring programs are funded by local communities and organizations. This means that the data we have on freshwater beach closures is not as complete or continuous as that from our saltwater beaches. However, RI had 5 closure events (out of 36 monitored freshwater beaches) and MA had 16 closure events (out of 52 monitored freshwater beaches). Given the number of people in both states that recreate in or around freshwater, it is an area that could benefit from more attention and funding.

Seasonal Marine Beach Closure Events and Seasonal Rainfall (in.) in the Narragansett Bay Region



Source: Rhode Island Department of Health and Massachusetts Department of Public Health, Beach Monitoring Programs


Photo credit: BRIAN JONES

What are the programs that help us monitor our beaches?

Federal Beach Program

•The U.S. Congress passed the Beaches Environmental Assessment and Coastal Health (BEACH) Act in 2000.

•The National Beach Program is managed by the U.S. Environmental Protection Agency. The program aims to improve water quality testing at coastal and Great Lakes beaches and to help beach managers better inform the public when there are water quality problems.

•The U.S. Environmental Protection Agency annually awards grants to 35 eligible states, territories, and Tribal nations to develop and implement beach water quality monitoring and notification programs for recreational beaches—this includes both RI and MA.

•Currently, the U.S. Environmental Protection Agency does not provide funds to monitor freshwater bathing beaches outside of the Great Lakes.

Rhode Island Marine Beaches

•The U.S. Environmental Protection Agency has awarded over $2.6 million to the RI Department of Health for beach monitoring, including $201,000 in 2013.

•There are 69 state licensed beaches that are required by RI law to be monitored from Memorial Day to Labor Day.

•The frequency of this monitoring is determined based on a risk-based classification.

—Tier 1: beaches that pose the highest risk for illness due to the number of bathers, known sources of contamination, and/or geography of the facility.

—Tier 2: beaches that pose a low to moderate risk for human illness.

—Tier 3: beaches that pose little to no risk to human health.

Massachusetts Marine Beaches

•The U.S. Environmental Protection Agency has awarded over $3.1 million to the MA Department of Public Health for beach monitoring, including $239,000 in 2013.

•There are nearly 600 monitored coastal beaches in MA, but only six of those are in the Narragansett Bay watershed.

•MA has its own beach statute that closely mirrors the BEACH Act and requires town health agents to close a swimming beach when bacteria levels are high.

Freshwater Beaches

•Neither RI nor MA has funding to pay for the analysis of samples collected at freshwater beaches.

•Freshwater beach managers are responsible for sampling and following RI Department of Health or MA Department of Public Health regulations.

•While the success of the BEACH program can be seen across both states at saltwater beaches, additional funding and support is needed at freshwater beaches.

Rhode Island Urban Beach Initiative

•The Urban Beach Initiative was launched in the summer of 2010 by the RI Department of Health.

•The primary goal is to identify areas in the upper Narragansett Bay that are used for recreation but are not licensed for swimming.

•Beach surveys and water samples are collected from Memorial Day through Labor Day by the RI Department of Health and Save the Bay.



Photos credit: RI SEA GRANT

How will climate change impact our beaches?

Climate change is no longer the encroaching villain of the future—it is here now. We are already experiencing increased temperatures, sea level rise, and stronger storms and these changes will only get worse in the coming decades. However, we can take action now to adapt and prepare for them with plans for and investment in coastal resiliency.

Sea Level Rise

Sea level rise is expected to be greater in New England than the global average, and we could see up to a five-foot rise by 2100. Most of the coast of the Narragansett Bay region is developed and beaches are edged by houses and buildings, roads, parking lots and other hardened structures. These structures prevent the beaches from naturally migrating inland with rising sea level, which results in "coastal squeeze", and the gradual disappearance of the wide beaches we are used to as the water eventually moves right up next to the structures.

Rising Temperature

Water temperatures in Narragansett Bay have risen about three degrees Fahrenheit since 1960, and ocean temperatures in the U.S. Northeast are expected to increase by another 4-8 degrees Fahrenheit by 2100. The bacteria that are monitored for the safety of beaches—both freshwater and marine—to be open for human use thrive in warmer waters. Increased temperatures may result in more or longer beach closures. Freshwater and marine algae also grow faster in warmer waters resulting the algae "blooms" that may wash up on your favorite marine beach or ruin your prized freshwater oasis.

Intense Precipitation Events

Annual average precipitation, which includes both rain and snow, has been increasing over the last century and this trend is projected to continue. When you look at the pattern of rainfall, something else becomes apparent: the frequency of intense rainfall events has also increased. When we get large amounts of precipitation in a short amount of time, the stormwater runoff can overwhelm our treatment facilities and result in sewage being flushed into the Narragansett Bay or freshwater lakes and ponds, which is even more of a problem in areas with large amounts of impervious surface like cities and industrial areas. This resulting stormwater runoff can lead to more beach closure events. At the same time, it is anticipated that there will be drier than normal events between the intense precipitation events, less snow, and longer summer-like months.

More Frequent Storms

The Narragansett Bay region will likely see more intense tropical cyclones in the future even though the number of storms may not significantly increase. More intense tropical storms, hurricanes, and Nor'easters are the triple threat. They have high levels of storm surge that build upon the already rising sea levels. They also contribute to higher levels of stormwater runoff and flooding that impact our freshwater areas and the towns that support our beachgoers.

Where can I find more information?

The RI Climate Change Collaborative created the Waves of Change website dedicated to discussing the changes we can expect from climate change as well as the environmental, economic, and societal impacts that are coming. It is not a lost cause though. There are many actions you can take, and that are being taken on your behalf, that will help mitigate the impacts of climate change.

If you want to dive into the science behind these predictions, you will find all of the details for the United States in the National Climate Assessment (chapter 16 provides an overview for the Northeast). For a worldwide perspective, the Intergovernmental Panel on Climate Change report will be finalized in October 2014.



What is the connection between beach closures and shellfish growing areas?

As with licensed bathing beaches, the waters of Narragansett Bay and surrounding coastal areas are routinely monitored for bacteria in areas designated for shellfish consumption. Water is sampled because, if disease-causing bacteria are present at elevated levels in the water, the bacteria can accumulate in the shellfish and cause illness in the people who eat them. Shellfish that are commonly harvested include clams (quahogs and littlenecks), oysters, and mussels.

When areas are approved for harvesting, shellfish can be taken from these areas year-round and regardless of weather conditions, whether by recreational diggers or commercial shellfishermen. Conditionally approved areas are places where shellfish can be taken unless rainfall exceeds a certain amount—which varies depending upon the conditional area. In these areas, stormwater runoff washing urban landscapes, and/or overflows from the combined sanitary sewage-stormwater system contribute to unacceptably high levels of bacteria in the water following rain storms.

Where can you harvest shellfish in Narragansett Bay?

The RI Department of Environmental Management, Office of Water Resources is responsible for surveying RI's marine waters and providing classification for molluscan shellfish harvesting. To maintain certification of these waters for the harvest of shellfish for direct human consumption and inter-state commerce, the Office of Water Resources routinely monitors bacteria levels and also conducts shoreline surveys of the state's shellfish growing waters to inventory potential and actual pollution sources. These waters are assessed annually to determine the appropriate classification for shellfish harvesting.

Currently, 74% of RI's waters designated for shellfish consumption are approved for harvesting. An additional 14% are conditionally approved due to wet weather exceedances of the fecal coliform bacteria standard. Typically the waters are closed for a period of 7 days, which allows time for bacteria to die-off and shellfish to flush themselves of harmful bacteria. The Office of Water Resources manages conditionally approved shellfish growing areas in the Upper Narragansett Bay, Greenwich Bay, and Mt. Hope Bay.

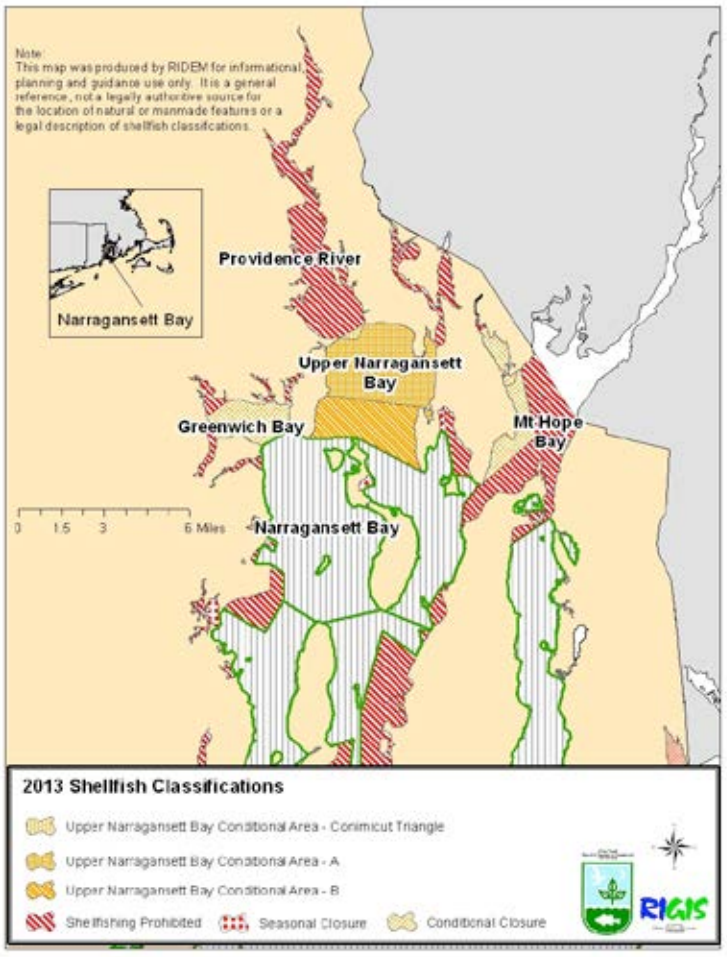
The MA Division of Marine Fisheries carries out sanitary surveys of Shellfish Growing Areas to determine their suitability for human consumption. In MA, towns are responsible for maintaining and enhancing shellfish production. A shellfish constable is responsible for enforcement of federal, state, and local shellfish regulations and management.

In Mount Hope Bay, there are five shellfish growing areas that are regulated by the MA Division of Marine Fisheries and by the local shellfish constables. The five shellfish growing areas in MA total about 6,845 acres: Mt. Hope Bay (1,602 acres), Taunton River (3,681 acres), Lee River (740 acres), Cole River (716 acres), and Palmer River (106 acres). The Mt. Hope Bay, Lee River, and Cole River shellfish growing areas contain sections classified as conditionally approved. The Taunton River and Lee River shellfish growing areas have sections that are classified as either prohibited or restricted. All five areas contain sections where shellfish harvesting is prohibited.

Have investments in clean water helped shellfishing?

The current closure criteria for the Upper Narragansett Bay Conditional Area, first put into effect in 2011, reflects improvements in marine water quality resulting from the Narragansett Bay Commission's ongoing combined sewer overflow (CSO) abatement project. With completion of Phase I in 2008, the volume of combined sewage that flows untreated into the Narragansett Bay near Providence has been significantly reduced. As a result, there was a 36% increase in the number of acres-days that the Upper Bay was open to shellfishing in 2013 as compared to 2004, a year having comparable rainfall. Completion of the Phase II CSO improvements in 2015 will bring additional improvements as more CSOs are connected to the tunnel and more combined sewage is treated at the Fields Point Wastewater Treatment Facility.

As part of the RI Department of Environmental Management's broader responsibilities to manage the state's shellfish resource, an effort is underway to create the state's first Shellfish Management Plan. The goal of the project is to provide for the comprehensive management and protection of the state's shellfish resources, such as quahogs and oysters.



CASE STUDY

Investing in Pollution Solutions



Combined Sewer Overflow Tunnel — Photo credit: NARRAGANSETT BAY COMMISSION

Both the greater Providence and Fall River metropolitan areas have sewer systems that are combined with stormwater systems. As it rains, stormwater collects contaminants such as pollutants, sediments, oils, pathogens, and litter as it runs off into catch basins and stormwater pipes. This contaminated stormwater flows into the combined sewage systems where it is then treated by a wastewater treatment facility. While this combined waste stream (containing both wastewater from homes, industries and businesses as well as contaminated stormwater from streets) is properly treated on most days, during periods of heavy rain the combined sewer systems can overflow directly into the rivers which connect to Narragansett Bay.

These discharges can contain high levels of disease-causing organisms, toxic pollutants, floatables, nutrients, oxygen-demanding compounds, oil and grease, and other pollutants. When this happens, water quality standards that are set by the state and federal regulating agencies are exceeded. These exceedences can pose a risk to human health, can threaten aquatic life and its habitat, and can interfere with the use and enjoyment of Narragansett Bay.

Over the past two decades, the citizens of northern RI and Fall River, MA, have invested hundreds of millions of dollars to reduce the impact of combined sewage overflows (CSOs) through the construction of these environmentally significant projects. This critical work reflects a significant bi-state commitment to improving the water quality in Narragansett Bay.

The nationally recognized Narragansett Bay Commission, which is leading CSO abatement in the Providence metropolitan area, recently completed Phase I of the three-phase, 20-year long CSO abatement program. In Phase I, the Commission completed construction of a 3-mile long, 26-foot diameter deep rock storage tunnel 300 feet below the City of Providence with the capacity to store up to 65 million gallons of untreated wastewater and stormwater.

Phase II of the project is expected to be completed in 2015. Phase II consists of redirecting 14 CSOs to the Phase I tunnel, construction of a wetlands treatment facility, and sewer separation projects. The Phase I project was a $360 million investment and the estimated Phase II cost is $216.5 million.

Phase III is now estimated at $603 million and is aimed to address overflows in Central Falls and Pawtucket which discharge into the Seekonk River. Narragansett Bay Commission is re-evaluating the technologies and methods for Phase III in order to acknowledge the growing costs for ratepayers and find effective and less costly solutions for pollution abatement.

The CSO storage tunnel has already helped reduce anthropogenic pollution with the goal of improving environmental health. The completion of the Providence CSO storage tunnel in combination with more localized efforts have led to improvements in water quality and the potential for new beaches to be opened for swimming. Also, the RI Department of Environmental Management re-



Photo credit: PETER GOLDBERG

corded reduced pathogens, allowing it to change shellfishing closure criteria and to allow increased shellfishing in the Upper Bay.

The Fall River CSO Abatement Program began in 1997 and is estimated at $160 million in construction costs to date. The approval of the public referenda by citizens of Fall River reflect the citizens' progressing views on environmental restoration and compliance with the federal Clean Water Act. The Fall River CSO Abatement Program is aimed at treating the wastewater and stormwater before it enters Mt. Hope Bay resulting in numerous public health and environmental benefits such as reducing the amount of floatables, turbidity, and fecal coliform. Fall River's Combined Sewer System treats 90,000 residents and covers stormwater runoff from 5,000 acres with 179 miles of sewer pipeline, 13 pumping stations, 19 CSO outfalls, 5,000 catch basins, and 4,500 manholes. The 19 CSO outfalls flow into the Taunton River and Mt. Hope Bay.

After decades of planning, the City of Fall River began construction in 2005 on a CSO Storage tunnel that has the capacity to store 38 million gallons of untreated wastewater and stormwater. The water is then directed to the recently upgraded Fall River Regional Waste Water Treatment Facility. The CSO Storage tunnel stores combined stormwater and wasterwater in heavy rain events for treatment, without the tunnel, the water would flow into Mount Hope Bay.

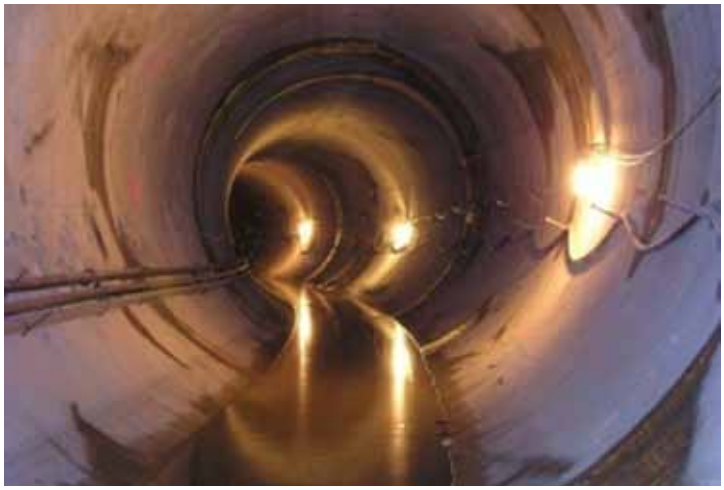
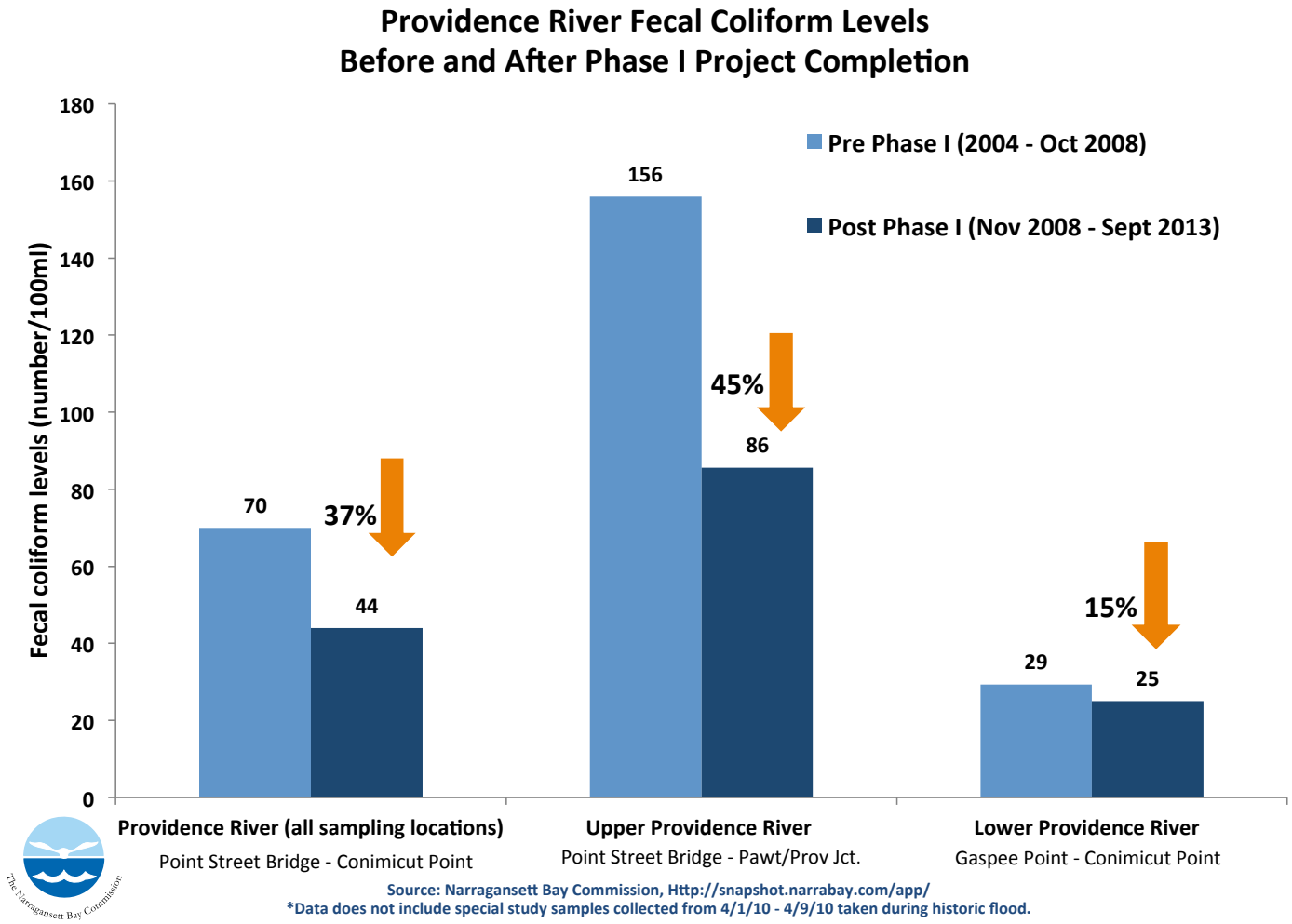


Photo credit: FALL RIVER WASTEWATER TREATMENT FACILITY

Construction of CSO treatment facilities is currently occurring at outfalls including a new CSO Screening and Disinfection Facility on President Avenue which will incorporate a multi-function building for both public and municipal purposes with an underground CSO treatment facility that is fully integrated into a refurbished park setting. Fall River and Providence residents have invested into their states' economies and futures by authorizing the construction of the CSO Pollution Abatement Projects.



CASE STUDY

Bristol Town Beach: Clean 'n' Green



Photos credit: BRISTOL DEPARTMENT OF PARKS AND RECREATION

The Town of Bristol through the Bristol Department of Parks and Recreation made significant investment to protect the Bristol Town Beach by installing green infrastructure to limit beach closures. With 85 beach closure days between 2000 and 2012 due to high levels of fecal coliform at Bristol Town Beach, Bristol decided to take action. First, the Town of Bristol developed partnerships with state, federal, and non-government organizations including the RI Department of Environmental Management, the RI Department of Health, the U.S. Environmental Protection Agency, and Save the Bay. These organizations brought important resources to Bristol's project including professional expertise and financial resources.

With this help, Bristol conducted an environmental assessment of the Bristol Town Beach and Sports Complex to determine the causes of beach contamination. The Town concluded that the main sources of pollution were the existing storm drains, two failing septic systems, runoff from the neighborhood north of the park, and high amounts of bird droppings. Pollutants and contaminants were also entering into the Bay from chemical fertilizers used on the sports fields and salt from nearby roads. A wetland complex, which would normally function as a natural filtration system, was also in very poor condition.



The renovation began by eliminating the use of two failing septic systems by connecting the properties to a public sewer line. The Town installed a new parking lot with six bio-retention rain gardens, which allows the runoff to be filtered through natural native vegetation before it is transported to an underground drainage basin. They also installed a hydrodynamic separator system to capture fine-particulate pollutants and a vegetated swale at the outfall of the drainage system, which removes silt and pollution from stormwater. Three bioretention cells were also installed in the parking lot which filter pollutants from runoff. The Town of Bristol planted over 125 trees to reduce the area's attraction to invasive Canada Geese, thereby reducing their droppings, planted marsh grass along the north side of the beach and planted a buffer of native plants on the northern border to prevent erosion. The Town built a gravel wet vegetated treatment system to address runoff from the neighborhood north of the park and renovated the natural wetland into which it emptied. The Town built two new playgrounds and provided environmental education programs for camp children.

These efforts have improved beach water quality by allowing storm water to be naturally filtered through vegetation instead of running directly into Narragansett Bay. As a result of the project, there has been a significant improvement in beach water quality and reduced beach closures to zero in 2013. The Bristol Town Beach and Sports Complex is a prime example of using new green infrastructure to curb pollutants by protecting and restoring the natural environment. Financing this project was achieved through a partnership of the Town, the RI Department of Environmental Management, and the U.S. Environmental Protection Agency. Nonpoint pollution programs provided $245,000 in grants, the State provided a $100,000 DEM Trails grant, and a low interest loan of $1,000,000 from the Clean Water State Revolving Fund.

Bristol is not alone in investing in their beaches. Warren and Barrington have recently joined Bristol in installing green infrastructure to remove pollutants and contaminants before they enter Narragansett Bay and pose a threat to area beaches.



CASE STUDY

Warwick: Seeking Solutions for Beach Closures

Photo credit: THE LAB OF DR. CAROL THORNBER, URI

The City of Warwick, the second largest city in RI, has nearly 40 miles of coastline and approximately 70 acres of sandy beaches dot the shoreline of Greenwich Bay and its coves. However, Warwick has four licensed saltwater beaches and two licensed freshwater beaches that suffer from numerous beach closures. The RI Department of Health tracks the number of days state licensed beaches are closed and in 2013 the total number of closures for all licensed beaches was 111 days. Of the total for all of RI, Warwick's beaches accounted for 52% with a total of 58 closed days. Oakland Beach had the most closed days in 2013 with 27 closed days with Conimicut Point Beach coming in at 17 and City Park Beach with 13.

To give some historic perspective, the Department of Health has compiled a list of beach closures from 2000 to 2013. In their ranking of licensed beaches with the largest number of beach closures, the City of Warwick has four of the top six beaches:

	closures*	days closed*
Atlantic Beach Club (Middletown)	47	105
Conimicut Point Beach (Warwick)	46	230
Oakland Beach (Warwick)	44	193
Goddard Memorial Park (Warwick)	39	110
Warren Town Beach (Warren)	35	166
City Park Beach (Warwick)	31	119

*The Department of Health tracks the number of beach closures (which represents the number of individual times the beach has been closed between 2000 and 2013) and also the number of days closed (which is the total number of days that the beach was closed over the same period).

In addition, the two licensed freshwater beaches in Warwick were frequently closed with Gorton Pond having 22 closures and 127 days closed and the Kent County YWCA with 14 closures and 65 days closed.

Three of Warwick's four licensed saltwater beaches are located in Greenwich Bay. According to the RI Department of Environmental Management in its 2005 report on bacterial impairments in Greenwich Bay, all segments of the Bay, its coves, and its tributaries violate water quality standards after rain events from high bacteria concentrations. The major bacteria sources are stormwater discharges from tributary streams, cesspools and failed septic systems, and domestic and wild animals.

The Greenwich Bay watershed still relies upon onsite wastewater treatment systems (OWTS) and older cesspools. Warwick has a history of failing septic systems. A large portion of Warwick relies upon the municipal sewer system and wastewater treatment facility. About 70% of the City's properties have sewers available, but about 13% of these are not connected to sewers. The remaining properties are awaiting sewer extensions or are located within areas that will not have sewers for the foreseeable future. RI Department of Environmental Management's report concluded that these sources of contamination be addressed through sewer extensions and tie-ins and, for those areas where sewers will not be extended, through replacement of sub-standard and/or failed OWTS. In 2005, the RI Coastal Resources Management Council adopted a Greenwich Bay Special Area Management Plan and required Warwick to adopt a mandatory tie-in schedule for residential and commercial areas that drain to Greenwich Bay. Other actions must be taken including requirements for septic systems to be properly maintained and operated, the construction of stormwater retrofit best management practices, pollution prevention efforts to address domestic animals, and programs to ensure that boaters fully utilize pump-out facilities.

While plans to address these issues have been in place since 2005, the progress to extend sewers and connect septic systems and cesspools has not kept pace with the goal of connecting all possible properties by 2015. Some residents have objected to connecting to the municipal sewer system because of costs and blame pets and wildlife on elevated bacterial contamination of local waters. Demands have been made for DNA evidence that proves that beach closures are caused by humans and not by other animals.

After years of debate, in November of 2013, the Warwick City Council took action to authorize the Warwick Sewer Authority to initiate a $56 million bond initiative to extend the Authority's sewage system, to upgrade the treatment plant, and install flood protection measures around the plant. The City is actively promoting programs for grants to assist low-to-moderate income property owners and low-interest loans for other owners to connect to the sewer system. Warwick has also recently hired a full-time engineer to specifically address stormwater management issues that will assist with beach contamination issues. Should these steps bring results, Warwick may be able to move off from the top of the list of towns with the most beach closures.



CASE STUDY

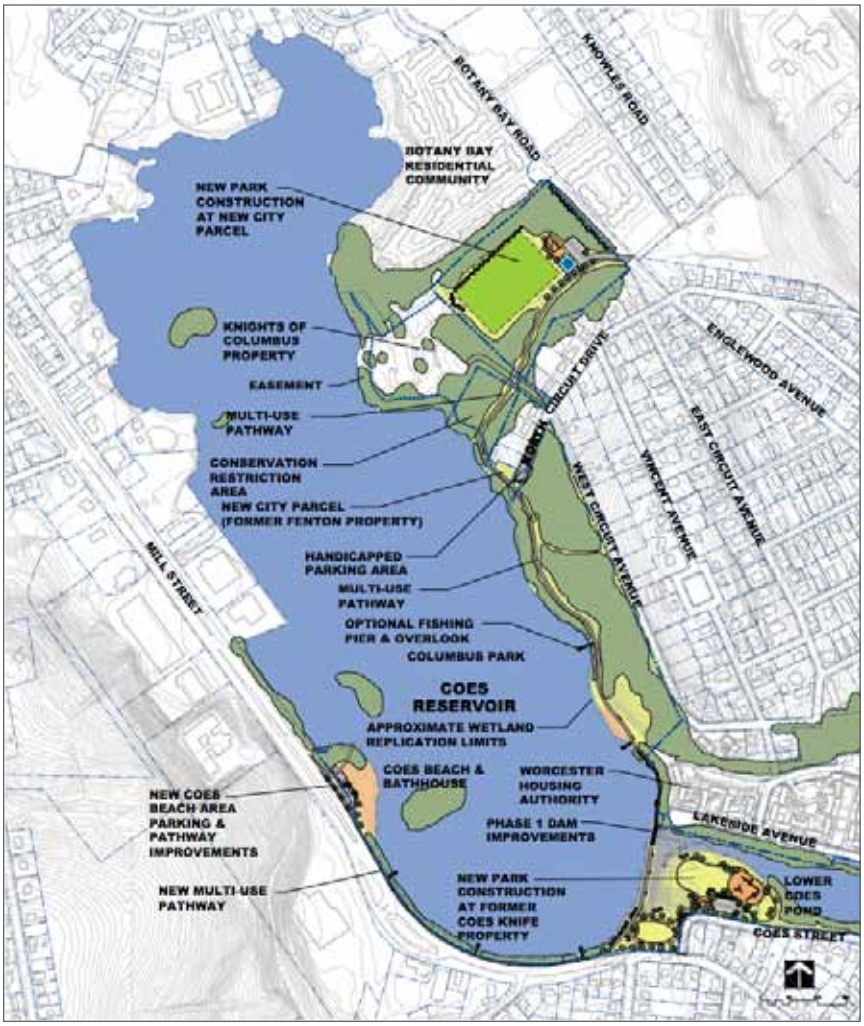
Urban Beach: Back to the Future

Photo credit: OLIVIA AHERN, NBEP

The City of Worcester, MA has a tremendous asset, Coes Pond, where the efforts of many are helping to restore an urban bathing beach with an attached trail of open space and recreational opportunities. Also known as Coes Reservoir, the pond has a rich history of swimming and boating as well as an industrial past that left contamination requiring the removal of soils filled with PCBs, like many industrial sites throughout the watershed. The Coes Knife Factory, run by the Coes brothers (inventors of the monkey wrench) produced specialty blades and knives. The City has invested millions to restore the Coes Knife site and update a spillway and bridge. These efforts have potential to provide a mile-long trail connection between the Coes Beach at Mill Street on the western side of the pond and open space purchases and recreational opportunities on the eastern shore.

Creating recreational opportunities in an urban setting is critical for the health of a community. At one time in the past, Coes Pond had two active beaches on each shore, one beach along Mill Street and one along Columbus Park. It was once an area that thrived during the summer with fishing derbies, water skiing competitions, and recreational swimming. However, in recent years the pond has filled with sediment and silt causing the water depth to decrease. During periods of heavy rainfall, stormwater runoff brings additional bacterial contamination from human sources, geese, and other wildlife. In addition, the City of Worcester decided not to have lifeguards at Columbus Park even though local residents still swim there.

Steps are being taken to restore Coes Pond. The City of Worcester purchased open spaces around Coes Pond and prepared a 2005 master plan that envisioned the restoration and development of Coes Pond as a recreational gem for the residents. Several years ago, the City hired a consultant with bird dogs to scare away geese from three public beaches, train volunteers to educate park users to not feed the birds, and, in some instances, oil the eggs to prevent migratory waterfowl from returning year after year in high numbers so close to the swimming beaches. Last year, Tatnuck Brook Watershed Association worked with the City to harvest patches of invasive water chestnut, a prolific water plant with thick foliage and sharp thorns.



Map: City of Worcester Department of Public Works and Parks

This year, a new coalition of concerned neighbors has organized the Friends of Coes Pond to enlist support from local universities to monitor and assess water quality and sediment samples. Friends of Coes Pond wants to bring to fruition the 2005 Coes Pond master plan. They plan to gain support from local businesses, city officials, agencies, schools, and universities to "restore, renew, develop, and beautify one of Worcester's finest water and open space resources." They hope to improve the condition of the Mill Street Beach at Coes Pond and develop the Coes Knife site with a park with open space and a playground with rubberized flooring and accessible equipment, wheelchair friendly walking paths, a gazebo, park benches, and picnic tables. The revitalization of the Mill Street Beach and the development of a new recreational open space in Worcester have the potential to be extremely beneficial as it would provide an invaluable recreational area for people of all ages and abilities to enjoy Coes Pond.

CASE STUDY

Easton's Beach: Ultraviolet Rays to the Rescue



Photos credit: DAVE MCLAUGHLIN/CLEAN OCEAN ACCESS

Tourism is a critical component of the Newport—and RI—economy. Visitors from around the world come to Newport during the beautiful summer months to see the grandeur of the Newport Mansions from the Cliff Walk, explore the shops at the wharfs, dine on local seafood, and splash in the waters of Easton's Beach. However, the City of Newport noticed that beach closures at Easton's Beach were becoming more and more common, especially during high rain events when Enterococci bacteria levels would exceed limits set by the U.S. Environmental Protection Agency.

These closures negatively impacted the experience of local and visiting beach-goers and the City of Newport decided to take action to improve its water quality and protect the tourism industry.

In May of 2011, the City of Newport began the operation of a new ultraviolet stormwater treatment plant located on the Newport-Middletown line. The plant operates Memorial Day to Labor Day and kicks in when it measures a quarter-inch or more of rain. When this occurs, stormwater drainage is funneled through bright ultraviolet lights, which kill the Enterococci bacteria before they are flushed into coastal waters near Easton's Beach.

The process to plan, approve, and construct the new $6 million stormwater treatment plant began in 2006 and was funded through a combination of Clean Water State Revolving Loan Funds, stimulus funds from the American Recovery and Reinvestment Act of 2009, Narragansett Bay and Watershed Restoration Fund, City of Newport sewer rates, and funding obtained by Rhode Island's U.S. Congressional delegates.

Easton's Beach has seen fewer closures due to high levels of Enterococci since the ultraviolet treatment plant went online and, in 2013, there were no beach closures. This has led to fewer disruptions to the tourism industry and the City of Newport is receiving the hoped-for return-on-investment. The next step it to ensure that the water is clean and safe year round, regardless if it is winter or summer or whether it has experienced heavy rainfall or none at all.

The City of Newport recognizes the value in water quality testing at state licensed beaches. Federal funding for water testing provided by the U.S. Environmental Protection Agency ends each year on Labor Day, as stated in law, which is typically the end of the busy tourist season. It has been generally assumed that the cooler water temperatures after this date reduce water quality issues.

In the fall of 2006, Clean Ocean Access, in partnership with Coastal Vision and with funding support from the RI Department of Health and the U.S. Environmental Protection Agency, developed a water-testing program for the off-season with a primary focus on Easton's Beach to determine if there were water quality concerns at other times of the year. This off-season water-testing program showed that water quality issues persisted even as water temperature decreased.



These results led Clean Ocean Access and the City of Newport to enter into an agreement in December 2006, to move toward year-round water testing at Easton's Beach. Clean Ocean Access agreed to contribute all manpower, logistics, management, and data analysis and the City of Newport agreed to fund the laboratory costs.

In the past six years, 240 water samples have been collected at Easton's Beach and, beginning in 2008, this sampling is conducted every Thursday. Forty-two of the 240 samples exceeded the water quality standard and some of these were outside of the typical Memorial Day to Labor Day beach season.

This collaborative non-profit/private/city government partnership continues to this day. Hundreds of people have come together to volunteer their time and talent to create a program that provides valuable insight into the water quality for Aquidneck Island.



CASE STUDY

Clean Coastlines: Beaches as Neighbors

Photo credit: CLEAN OCEAN ACCESS

On a sunny Saturday in September of 2006, Clean Ocean Access hosted a beach cleanup at Easton's Beach in Newport. Volunteers scoured the beach and filled an entire dumpster with trash. Clean Ocean Access achieved their goal of hosting a cleanup as part of the International Coastal Cleanup, local people got involved, and everyone felt good about helping to keep their beach clean. Little did Clean Ocean Access know what would happen next.

After the successful event in September 2006, Clean Ocean Access has taken their volunteer clean up crews to other spots along the shoreline that have natural beauty and hold a special place in our lives. They ventured out onto the Cliff Walk of Newport and the coastline of Middletown towards Second Beach before crossing the bridge to Jamestown and eventually venturing into Little Compton. Since that time, Clean Ocean Access has hosted coastal cleanups in five communities—Newport, Middletown, Portsmouth, Jamestown, Little Compton—and has covered over 99 miles of terrain and removed 48,000 pounds of marine debris.

How much trash has been collected?

With over 85 cleanups recorded and more happening about every other week, Clean Ocean Access efforts are making a difference. In 2013, Clean Ocean Access removed 8,578 pounds of marine debris that included 36,180 individual items. At most locations, the first cleanup removes large objects such as refrigerators, bed frames, and an abundance of lobster pots, tires, and large plastic items. After a few more events, the large objects are gone and more trash, ranging from consumer products to fishing gear and random pieces of plastic, is revealed. With time, Clean Ocean Access has seen a reduction in the amount of trash and is now shifting its focus to eliminating sources of trash through education, outreach, and advocacy.

What are the goals for the coming years?

In 2015 and 2016, Clean Ocean Access will expand its program to include five additional cleanup events per year while maintaining the 25 already scheduled. The goal is to perform at least one cleanup on each beach along the entire coastline of Aquidneck Island by the end of 2016 to gain a complete understanding of the health of our coastline. The long-term goal is to remove all marine debris from the coastal shoreline of Aquidneck Island by conducting regular cleanups, changing human behavior through education, outreach, and youth development, and advocating for corrective actions.

How can I get involved?

Coastal cleanups are the gateway for people to connect their coastal inspired lives with the importance of community service. Volunteering is an important way to serve the greater good of the community and the environment. Whether it is hanging posters before clean up events, running the events, recruiting more volunteers for the cleanups, or processing the data afterwards, there are a lot of ways for people to engage in their local community. Now is the time to get involved.





Marine Water Quality

Photo credit: MIKE LAPTEW PRODUCTIONS

How is the water quality in Narragansett Bay?

A healthy Narragansett Bay supports valuable fisheries and a wide variety of other marine life. One important aspect of ecosystem health is water quality. Watershed Counts has initially focused on dissolved oxygen (DO) as a key indicator of water quality, but we recognize that fully characterizing marine water quality requires monitoring and reporting on a larger set of indicators. Work to expand the range of Watershed Counts will involve consideration of additional marine water quality metrics in future reports.

This update focuses on the water quality in Narragansett Bay, including the named embayments such as Greenwich Bay and Mt. Hope Bay that are considered part of the Bay watershed. (Note: this section of the report does not include the marine waters associated with RI's southern shore coastal ponds or offshore waters such as Rhode Island Sound.) Narragansett Bay is 148.6 square miles and 140 of these are in RI. Based on assessments by the RI Department of Environmental Management and the MA Department of Environmental Protection, 32.5% of Narragansett Bay currently exhibits periods of unacceptably low DO. This includes 42.1 square miles in RI and 6.2 square miles in MA, with 23.6 square miles unassessed. In these areas, DO levels in the water are so low that the conditions result in potentially negative impacts on animals that live there such as fish, crabs, clams, and worms.

Why is dissolved oxygen important?

Marine organisms require healthy amounts of DO to survive, reproduce, and flourish. When low DO conditions occur in Narragansett Bay, some animals, such as fish, are able to travel to areas with higher levels of DO. Other organisms, such as clams, larval fish, and crabs, are not able to move or not able to move quickly enough to escape falling DO levels and are more likely to be negatively impacted. In certain extreme cases, these animals cannot cope with the low DO and die. Monitoring has documented that low DO conditions occur episodically throughout the upper portions of Narragansett Bay from May through October. Unfortunately, these low DO conditions overlap with the time of year that organisms are in their larval stages and very vulnerable to degraded environmental conditions. Even a single low DO event can have a severe negative impact on a wide range of marine life in several different ways from slowing down growth rates to causing fish kills as we saw in the 2003 Greenwich Bay fish kill.

These negative effects on finfish and shellfish populations have major implications for commercial and recreational fisheries in RI and MA. In general, concern grows when DO levels fall below about three milligrams per liter with such waters referred to as "hypoxic" or having low oxygen. If DO concentrations fall close to zero, the water is considered "anoxic," or having virtually no oxygen. The states of RI and MA have more specific DO criteria applicable to estuarine waters, including Narragansett Bay. RI's criteria are designed to protect the most sensitive life stage—survival effects on larvae. Protection of larval stages also affords protection of juvenile and adult stages of marine life. When DO criteria are exceeded consistently over several seasons in a section of Narragansett Bay then that section is classified as "impaired" for DO.

What causes low levels of dissolved oxygen?

Low DO is a symptom of nutrient enrichment—also known as eutrophication—in estuaries. In Narragansett Bay, the nutrient of concern is nitrogen. When present in excessive amounts, nitrogen can fuel the rapid growth of phytoplankton resulting in large blooms. When these phytoplankton die off, they sink to the bottom and decompose in a process that consumes oxygen. If not replenished during this process, DO levels in bay waters may become depleted.

Scientists are continuing to study the complex interactions that affect the formation of low DO conditions. Data from Narragansett Bay reveal the severity of low DO varies year to year. The sources of nitrogen to the Bay that contribute to this problem include wastewater treatment facility discharges, septic system and cesspool discharges, and stormwater runoff, among others. Physical factors affecting DO levels include river flows into the Bay, precipitation, winds, temperature, and circulation patterns. Low DO conditions can be intensified by increased amounts of freshwater entering the Bay through rainfall and stormwater. Increased amounts of precipitation resulting in higher freshwater flows from rivers and stormwater runoff can lead to the formation of a layer of freshwater over the seawater of the Bay, since freshwater is less dense. The freshwater layer acts to prevent oxygen in the air from easily reaching the bottom waters. This phenomenon is called stratification. Conditions involving stratification of the water column and excess nitrogen often lead to depletion of DO in the trapped bottom waters.

What are we doing to improve dissolved oxygen levels in upper Narragansett Bay?

The factors affecting hypoxia that we can control the most effectively are the manmade discharges that carry nitrogen into Narragansett Bay. The problem of low DO has been the focus of management attention for some time resulting in pollution control actions. In Rhode Island, to improve conditions in the Providence and Seekonk Rivers and the upper Narragansett Bay, a strategy to reduce nutrient loadings by 50% from 1995–96 levels is being implemented at 11 Rhode Island wastewater treatment facilities. Rhode Island sewer system ratepayers along with state taxpayers are investing over $250 million on wastewater treatment improvements to address nutrient pollution in upper Narragansett Bay and its tributaries. Calculations by RI Department of Environmental Management and the Narragansett Bay Commission both indicate the total nitrogen loading from the 11 targeted wastewater treatment facilities has been reduced by over 50% in comparison to 1995–96 levels. Planned wastewater treatment facility upgrades are continuing and in the future will allow the facilities to accept more flow consistent with their approved designs, while still achieving the 50% reduction target.

RI's two largest wastewater treatment facilities are Bucklin Point and Field's Point, which are owned and operated by the Narragansett Bay Commission, and are among those completing upgrades to reduce nitrogen discharges. The Narragansett Bay Commission reports that it has already reduced nitrogen discharges from its facilities by 74% from 2003 levels, the year of the historic Greenwich Bay fish kill. As of 2013, the upgrades at the Bucklin Point facility

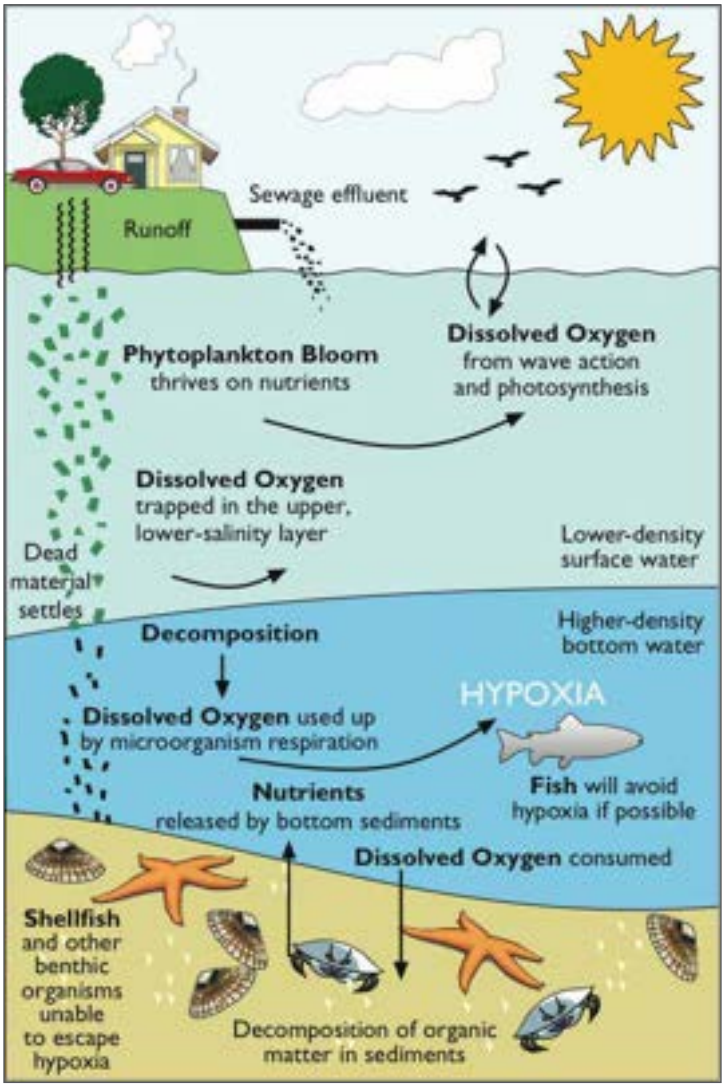


Figure credit: U.S. Environmental Protection Agency

were not complete; however, there has been a 66% reduction in the seasonal (May–October) average total nitrogen loading since 2003. At the Field's Point facility, construction was completed in late summer 2013 and the facility succeeded in reducing total nitrogen loading by 78% in comparison to 2003 levels. In the coming year, both facilities will be fully upgraded to meet their total nitrogen discharge permit limits.

Wastewater treatment facility upgrades have also been implemented or are being pursued in the MA portion of the watershed that drains to upper Narragansett Bay. Six MA wastewater treatment facilities that discharge into tributaries of the Providence-Seekonk River system, including the Blackstone River, are targeted for upgrades to reduce nitrogen pollutant loadings.

The largest of these MA facilities, the Upper Blackstone Water Pollution Abatement District which services the Worcester region, has completed its $180 million upgrade funded by ratepayers and an American Recovery and Reinvestment Act (ARRA) grant. These improvements resulted in a 61% reduction in nitrogen loadings into the Blackstone River when compared to 2006 before the upgrades were made. The Upper Blackstone Water Pollution Abatement Dis-

trict also is working to reduce their phosphorus loading, which can promote algae growth that leads to low levels of DO in the Blackstone River, and have accomplished an 89% reduction.

In addition to reducing loadings from wastewater treatment facilities, a variety of management actions are targeting other sources of nitrogen within the Narragansett Bay watershed including septic systems, stormwater discharges and fertilizer use. Many of the actions, such as septic systems upgrades, cesspool phase-out, improved stormwater management, and adoption of low impact development practices, will protect rivers and lakes, as well as contribute to improved water quality in Narragansett Bay.

What do these data say about dissolved oxygen in Narragansett Bay in 2013?

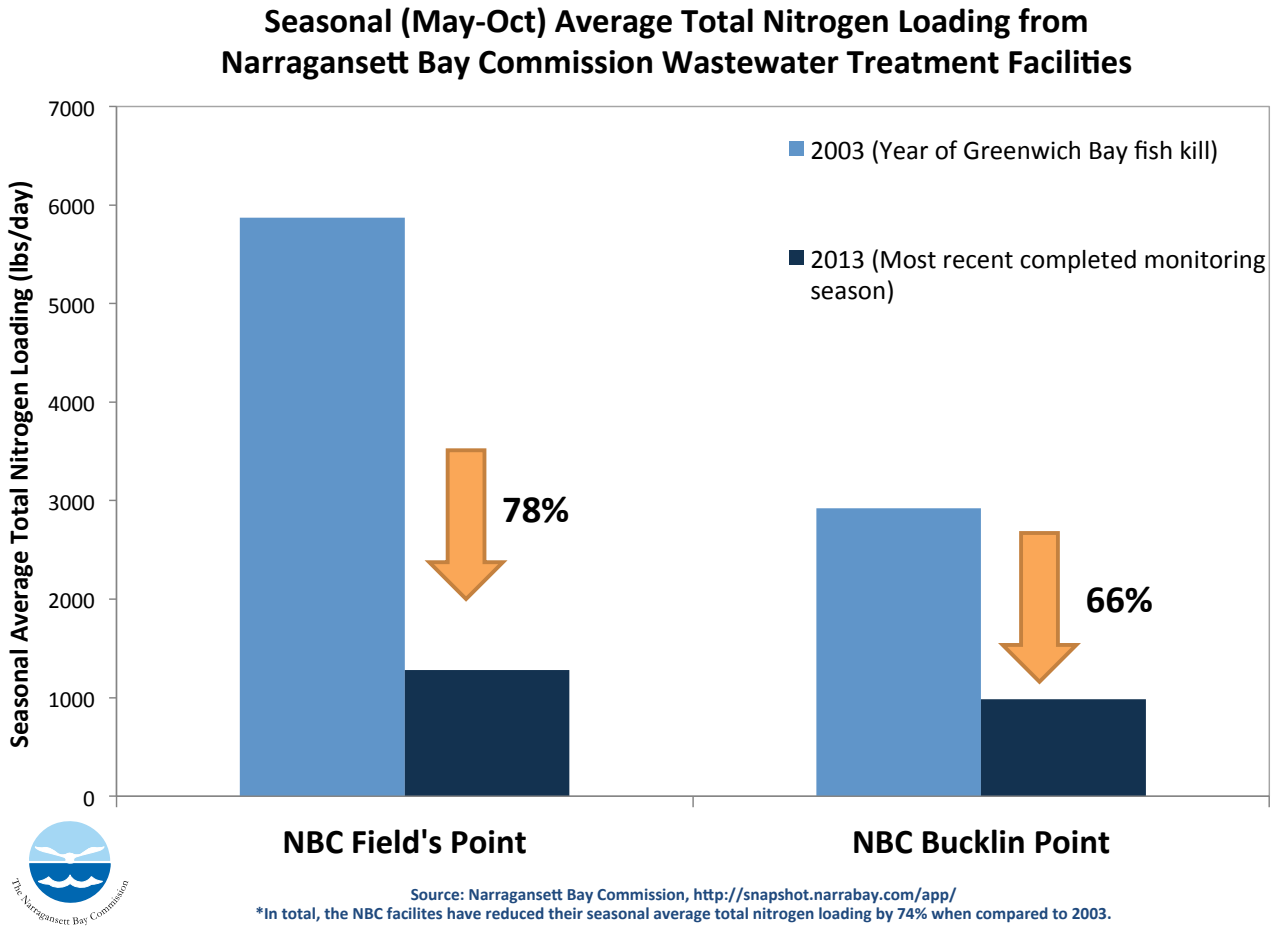
As noted above, prior water quality assessments indicate that about 32% of Narragansett Bay was impaired for DO. Data from 2013 reflected the continued occurrence of low DO in the upper Bay region.

Although no areas have been delisted as impaired for DO, a preliminary review of the 2013 data suggests that certain areas further down Narragansett Bay may be showing a decline in the number of exceedences of DO criteria in recent years. Further evaluation and continued monitoring is needed to verify this finding.

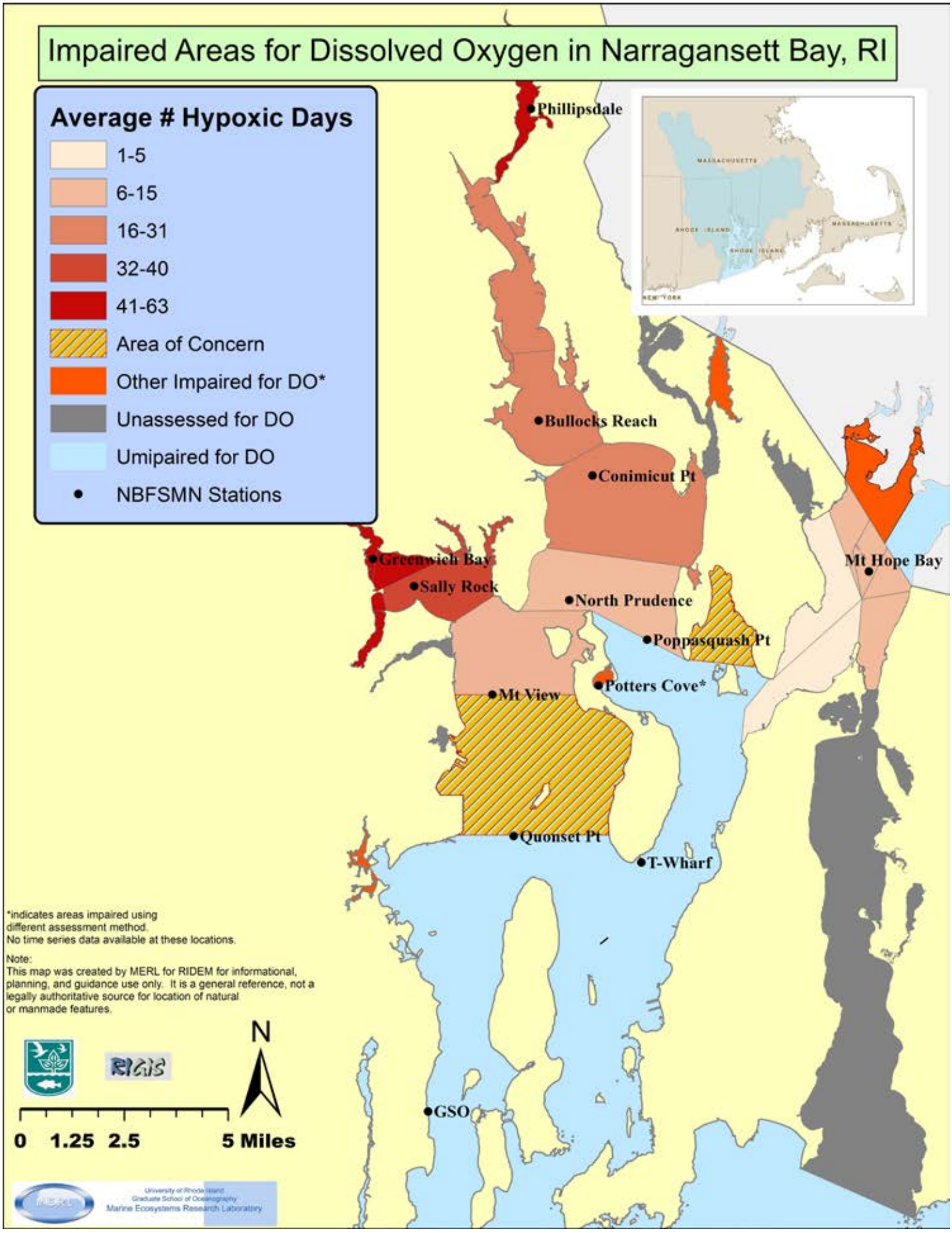
How do we know if marine water quality is improving?

Environmental monitoring is essential to tracking progress toward improved water quality in Narragansett Bay. A robust monitoring strategy allows us to fully understand the problem, assess conditions, inform stakeholders and decision makers, and assess the effectiveness of management actions. Two collaborative programs currently supply data used to assess low DO conditions: the Narragansett Bay Fixed-Site Monitoring Network and The Day Tripper spatial surveys. The programs are described in more detail in the latest report of the RI Environmental Monitoring Collaborative sponsored by the Rhode Island Bays, Rivers, and Watersheds Coordination Team. This information is also used in U.S. Environmental Protection Agency and National Oceanic and Atmospheric Administration funded research, management, and communication efforts.

Given the reductions in nitrogen pollutant loadings that have already been achieved and the additional reductions expected in the coming years, sustaining these core monitoring programs during this period of changing conditions is important. Data will need to be generated on an on-going basis in order properly determine trends and measure improvement in water quality in upper Narragansett Bay.



The Narragansett Bay Commission has reduced nitrogen loadings at each of its Field's Point and Bucklin Point wastewater treatment facilities by 74% when compared to 2003, which was the year of the Greenwich Bay fish kill.


Impaired Areas for Dissolved Oxygen in Narragansett Bay, RI
Average # Hypoxic Days
1-5
6-15
16-31
32-40
41-63
Area of Concern
Other Impaired for DO*
Unassessed for DO
Umipaired for DO
NBFSMN Stations
Phillipsdale
Bullocks Reach
Conimicut Pt
Greenwich Bay
Sally Rock
North Prudence
Poppasquash Pt
Mt View
Potters Cove*
Mt Hope Bay
Quonset Pt
T-Wharf
GSO
*indicates areas impaired using different assessment method.
No time series data available at these locations.
Note:
This map was created by MERL for RIDEM for informational, planning, and guidance use only. It is a general reference, not a legally authoritative source for location of natural or manmade features.
N
0 1.25 2.5 5 Miles
University of Rhode Island
Graduate School of Oceanography
Marine Ecosystems Research Laboratory

How has Narragansett Bay responded to changes in nutrient loading?

In Narragansett Bay, the 2003 Greenwich Bay fish kill resulted in a legislative mandate that wastewater treatment facilities decrease their nitrogen loading to the Bay, which was expected to improve water quality conditions over time. This will mean fewer nutrient inputs to the Bay that fuel algal blooms and a reduction in low DO events that lead to fish kills. These should lead to positive changes in habitat and a heathier, more diverse community of marine life.

How quickly will these changes occur? The answer to that is not known with certainty and scientific research shows that different estuaries respond differently to reduced nitrogen loading. There may be lag times between when we implement nutrient reduction strategies - like the Narragansett Bay Commission's recent improvements - and when we start to see the positive effects of those actions. We always should keep in mind that Narragansett Bay is a complex ecosystem that is influenced by numerous factors other than nutrient input, such as metal contamination, overfishing, and dredging.

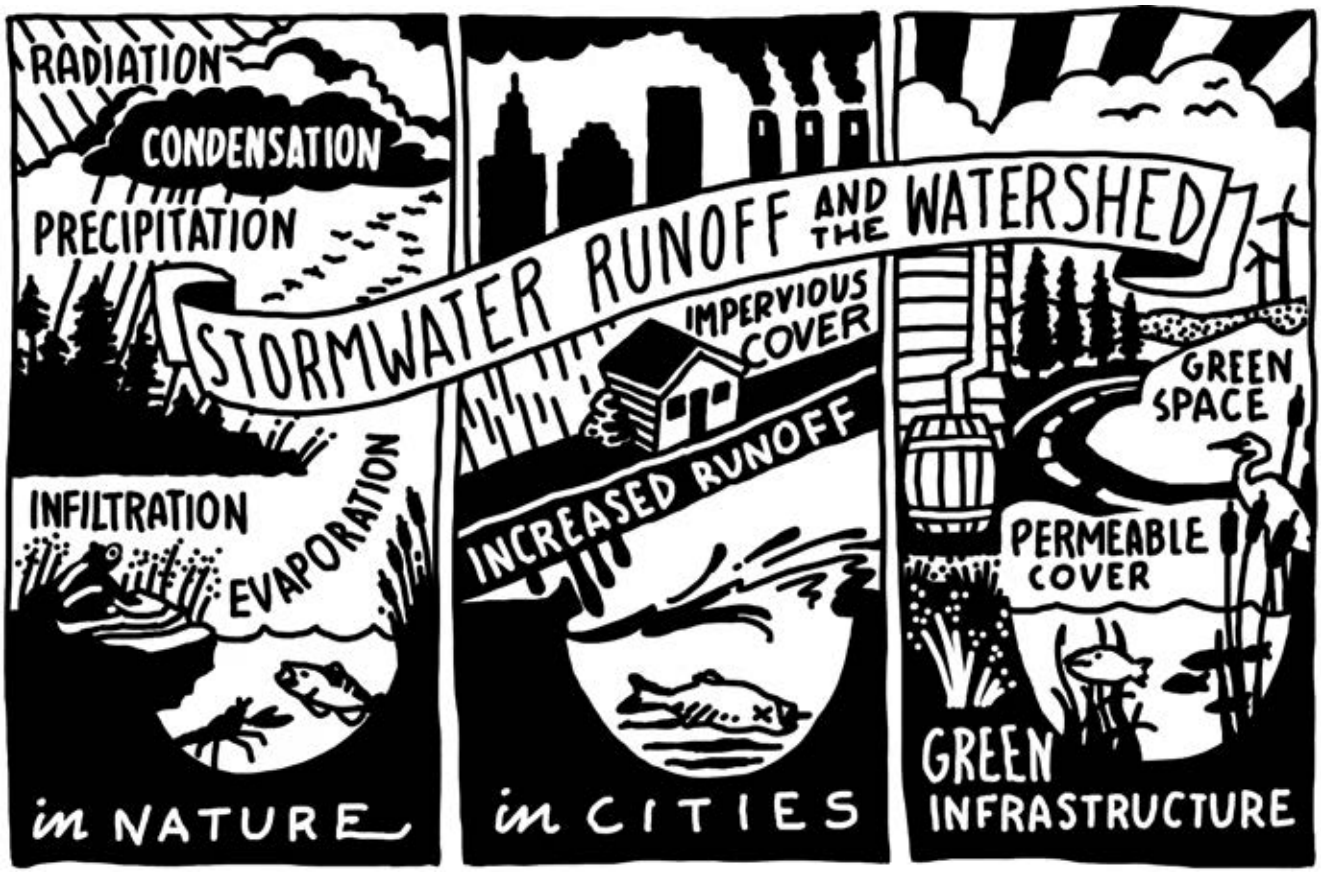
Understanding the response pattern of Narragansett Bay will require continued monitoring of marine water quality and the Bay's many biological communities. Recovery may not be immediately obvious, but the management actions we take to reduce nutrient inputs and the infrastructure investments we make to improve wastewater and stormwater treatment are expected to improve marine water quality. A sound understanding of how conditions are changing should be the foundation for future decisions on how to best protect and sustain a healthy Narragansett Bay ecosystem.

Stormwater Runoff: what's the big deal?

If there is a big rainstorm event in a natural setting with lots of green space, the water soaks into the ground and flows through the soil which filters out any nutrients and pollutants before the water makes it to our rivers, lakes, and coasts. But, if that same rainstorm event occurs in a city, then we see a completely different result.

Urban areas typically have higher levels of impervious cover—roads, driveways, and roofs—that prevent the water from soaking into the underlying ground, where the soils act as a natural filtration system. Instead, the rainwater flows over concrete and asphalt, picking up more nutrients and pollutants, until it flows directly into our freshwater and marine water bodies where the pollutants can cause any number of problems including beach closures. Fourteen percent of the Narragansett Bay watershed is under impervious cover and ranges from 3% to 40% depending on what municipality you are in, but areas right along the coast tend to have more impervious cover.

We can help though. We can choose to reduce the amount of impervious cover—and increase the amount of green infrastructure—so nutrient-laden water can soak into the ground instead of running to storm drains, rivers, and ultimately the sea. Rain gardens, more trees, permeable pavements, and a whole list of green infrastructure alternatives can make our urban areas more aesthetically pleasing while protecting our environment.



Where are updates on the other indicators?

Watershed Counts has updated the Marine and Freshwater Beaches and Marine Water Quality Indicators for the 2014 Report. These indicators had updated information to report, and we significantly expanded the Beaches indicator to serve as our first "spotlight" indicator. However, we will continue to monitor the other indicators and provide updates when appropriate. Until then, a brief summary can be found below and additional information is available on our website: www.watershedcounts.org.



Land Use

Updated in 2013

- Land use influences our quality of life both on land and in the water. Urban development creates impervious cover that increases stormwater runoff and can decrease water quality. Protected open space provides natural stream flow and groundwater recharge areas as well as buffers to help filter stormwater.
- Although Rhode Island's population has only increased slightly since 1970, development has spread over the landscape.
- Citizens in Rhode Island and Massachusetts have made a significant commitment to preserving open spaces through statewide and local bond referenda and by supporting the work of local land trusts.
- Development is essential to the economies of our state and communities but it is critical we recognize the value of riparian buffers and vulnerable flood plains in order to build sustainably.
- While land use does change over time, the change is gradual and analysis is time and money intensive.



Fresh Water Flow

Updated in 2013

- In the Narragansett Bay watershed, river flows are affected by water withdrawals for residential, commercial, and agricultural uses. Interconnections between fresh water sources generally create a more resilient system.
- Effective management of the region's fresh waters relies heavily on monitoring data from stream gages and groundwater monitoring wells. These provide real-time information that allows for appropriate planning and response to changing conditions.
- The 2013 Watershed Counts report provides an overview of fresh water flow in Rhode Island and future reports would aim to include the Massachusetts portion of the Narragansett Bay Watershed in the analysis.
- The major RI public water suppliers submit monthly water demand data annually to the RI Water Resources Board.



Fresh Water Quality

Updated in 2013

- There are almost 2,800 miles of rivers and 44,000 acres of lakes in the Narragansett Bay region. These fresh waters are critical resources, providing habitat for fish and wildlife, exceptional opportunities for recreational boating, fishing and swimming, and drinking water for nearly two million people.
- In general, water quality is in the best shape in the upper headwater regions of the watersheds, but it is acceptable in only 21% of the river miles assessed and 18% of the lake acres assessed in the Narragansett Bay region.
- The 2013 Watershed Counts report includes an extensive analysis of lake, river, and stream quality as it relates to aquatic habitat, recreation, and fish consumption which can be found on our website.
- Investments in wastewater treatment upgrades have resulted in improvements to water quality, but more work is needed to address the problems of nutrient enrichment, algal blooms, urban runoff, and invasive species, among others.
- The state agencies that are responsible for monitoring and regulating fresh water quality are preparing a new assessment that will be the basis of an update of this indicator.



Climate Change

Updated in 2013

- Climate change is here. Residents of Rhode Island and Massachusetts—and people everywhere—are dealing with the impacts and will continue to face increased temperatures, storminess, and sea level rise in the years to come.
- In the past, climate change has been a unique indicator separate from the other Watershed Counts indicators. However, climate change is now interwoven into each indicator as it will impact environmental, economic, human, and community health.
- Climate change was addressed in the indicators that were updated in this report and we encourage you to visit www.riclimatechange.org for more information on what is changing, how it will impact you, and what you can do to prepare.



Invasive Species

Updated in 2012

- Plants and animals that are released in areas outside their native range that then grow and reproduce out of control, destabilize the environment, and harm native species and human activities are "invasive species".
- Many invasive species are already here and only a few of them are being effectively managed.
- States need to be vigilant to identify new invaders early and develop short-term and long-term management strategies.
- Discussions among Watershed Counts partners are currently focusing on how to best assess invasive species for inclusion in our annual report.



Natural Resource Economics

Updated in 2012

- The economies of Rhode Island and Massachusetts benefit from a strong travel and tourism sector, and residents benefit from the many outdoor recreational activities supported by the region's natural assets including beaches, rivers, and parks.
- Better data are needed to accurately track investments in environmental improvements and the resulting economic and social paybacks.
- Experts throughout the region are currently tackling the daunting task of placing a monetary value on our natural resources but it is a complicated and nuanced evaluation. We plan to update this indicator as information becomes available.

Southern New England Coastal Watershed Restoration Program

A new partnership has formed along the waters of southern New England. The Southern New England Coastal Watershed Restoration Program is comprised of public and private stakeholders collaborating to protect, enhance, and restore the waters from Westerly, Rhode Island to Pleasant Bay, Massachusetts. This area includes the watersheds of Narragansett Bay, Buzzards Bay, the Islands, and southern Cape Cod. (See 2012 Narragansett Bay Journal article). The United States Environmental Protection Agency (U.S. EPA) received $2,000,000 in funding to address projects in these coastal waters and watershed lands. United States Senator Jack Reed (D-RI), the Chairman of the Appropriations Subcommittee on Interior & Environment, spearheaded this effort to make this federal funding available to the Southern New England Coastal Watershed Restoration Program.

In this first year of funding, the U.S. EPA provided funds for this initiative as grants through the Narragansett Bay Estuary Program and the Buzzards Bay National Estuary Program. U.S. EPA Region 1 worked on a parallel track to fund priority nutrient projects on Cape Cod between the Buzzards Bay watershed and Pleasant Bay in Chatham, Massachusetts. The two estuary programs requested proposals and the solicitations specify that between $500,000 and $1,000,000 in federal funds is available to each estuary program. The maximum award for a single project is $400,000, but smaller projects were encouraged. The grants were made available to non-profit organizations, educational institutions, municipalities, and other government agencies to fund nutrient management projects in the greater Narragansett Bay Watershed in both Rhode Island and Massachusetts and the Buzzards Bay watershed in Massachusetts.

This funding is designed to support projects that reduce nutrient pollution from fertilizers, septic systems, and other sources to both fresh and saltwater systems. Nutrient pollution is widely regarded as one of the most significant water quality issues facing this region and is a major concern identified in the Comprehensive Conservation and Management Plans of both the Narragansett Bay Estuary Program and the Buzzards Bay National Estuary Program.

While this first year of funding will focus on nutrients, the Southern New England Coastal Watershed Restoration Program has long-term goals that include the protection, enhancement, and restoration of clean water, healthy diverse habitats, and associated populations of fish, shellfish, and other aquatic dependent organisms in the coastal watersheds of southern New England. The Program is a collaboration of federal, state, and non-governmental organizations with the goal to develop a coordinated strategy and innovative approaches to sustainably restore the region's coastal ecosystems.



Photo credit: OLIVIA AHERN, NBEP

Watershed Counts relies on the participation of the member organizations and the people who generously contribute their time and expertise to make sure the information is current, accurate, and clearly explained. We thank the people who contributed to the 2014 Watershed Counts report as well as everyone who was involved in the prior updating of indicators and are eager to dive back in during the coming years.



Fall Planning Meeting
Molly Allard, Northern RI Conservation District
Veronica Berounsky, Rhode Island Rivers Council
Walter Berry, USEPA Atlantic Ecology Division
Tom Borden, Narragansett Bay Estuary Program
Justin Bousquin, USEPA Atlantic Ecology Division
James Boyd, RI Coastal Resources Management Council
Mike Cassidy, Blackstone National Heritage Corridor
Peter Coffin, Blackstone River Coalition
Ames Colt, Rhode Island Bays, Rivers, and Watersheds Coordination Team
Kathy Crawley, RI Water Resources Board
Julia Crowley, Parmentier, Bryant University
Walt Galloway, Rhode Island Rivers Council
Greg Gerritt, Environmental Council of Rhode Island
Linda Green, URI Watershed Watch
David Gregg, Rhode Island Natural History Survey
Paul Gonsalves, Rhode Island Statewide Planning Program
Susan Gorelick, URI ENRE Graduate Program
Bruce Hooke, B.G. Hooke Consulting
Meg Kerr, Environment Council of Rhode Island Education Fund
Sue Kiernan, RI Department of Environmental Management
Tom Kutcher, Save the Bay
Alicia Lehrer, Woonasquatucket River Watershed Council
Marisa Mazzotta, USEPA Atlantic Ecology Division
Bryan Milstead, USEPA Atlantic Ecology Division
David Murray, Brown University
Mark Nimiroski, RI Department of Environmental Management
Claudette Ojo, USEPA Atlantic Ecology Division
Amie Parris, RI Department of Health
Michelle Peach, Rhode Island Natural History Survey
Marguerite Pelletier, USEPA Atlantic Ecology Division
Denise Poyer, Wood-Pawcatuck Watershed Association
Nicole Rohr, URI Coastal Institute
Heather Stoffel, URI Graduate School of Oceanography
Judith Swift, URI Coastal Institute
John Torgan, The Nature Conservancy
Tom Uva, Narragansett Bay Commission
Hal Walker, USEPA Atlantic Ecology Division
Jennifer West, Narragansett Bay Research Reserve
Caitlyn Whittle, USEPA Region 1

Marine and Freshwater Working Group
Tom Borden, Narragansett Bay Estuary Program
Walter Burke, Bristol Parks and Recreation
Rachel Calabro, Save the Bay
Michael Celona, Massachusetts Department of Public Health
Priscilla Chapman, Taunton River Watershed Alliance
Ames Colt, Rhode Island Bays, Rivers, and Watersheds Coordination Team
Vanessa Curran, Massachusetts Department of Public Health
John Faltus, RI Department of Environmental Management, Parks and Recreation
Dave Janik, Massachusetts Office of Coastal Zone Management
Jim Kelly, Narragansett Bay Commission
Sue Kiernan, RI Department of Environmental Management
Sarah Klein, Bristol Parks and Recreation
Tom Kutcher, Save the Bay
Dave McLaughlin, Clean Ocean Access, Aquidneck Island
William Mitchell, RI Department of Environmental Management, Parks and Recreation
Amie Parris, RI Department of Health
Heidi Ricci, Mass Audubon
Nicole Rohr, URI Coastal Institute
Caitlyn Whittle, USEPA Region 1

Marine Water Quality Working Group
Olivia Ahern, Narragansett Bay Estuary Program
Veronica Berounsky, Graduate School of Oceanography
Walter Berry, USEPA Atlantic Ecology Division
Tom Borden, Narragansett Bay Estuary Program
James Boyd, Coastal Resources Management Council
Sue Kiernan, RI Department of Environmental Management
Tom Kutcher, Save the Bay
David McLaughlin, Clean Ocean Access, Newport
Marguerite Pelletier, USEPA Atlantic Ecology Division
Warren Prell, Brown University
Steve Rego, USEPA Atlantic Ecology Division
Pamela Reitsma, Narragansett Bay Commission
Nicole Rohr, URI Coastal Institute
Heather Stoffel, Graduate School of Oceanography
Heidi Travers, RI Department of Environmental Management
Tom Uva, Narragansett Bay Commission
Hal Walker, USEPA Atlantic Ecology Division
Caitlyn Whittle, USEPA Region 1

Data and technical information for this report was provided by: RI Department of Environmental Management, MA Department of Environmental Protection, RI Department of Health, MA Department of Public Health, Narragansett Bay Commission, Upper Blackstone Water Pollution Abatement District, Clean Ocean Access, and the City of Fall River.

Watershed Counts Partners

The following partners made Watershed Counts work, please see links to partner websites here.

Aquidneck Land Trust
Audubon Society of Rhode Island
Blackstone River Coalition
Blackstone River Watershed Council / Friends of the Blackstone
Brown University
Buckeye Brook Coalition
Clean Ocean Access
Clean Water Action
Conservation Law Foundation
EcoAsset Inc.
ecoRI News
Environment Council of Rhode Island
Friends of the Moshassuck
Grow Smart Rhode Island
Kickemuit River Council
Mason & Associates, Inc.
Mass Audubon
Massachusetts Department of Environmental Protection
Massachusetts Department of Public Health
Narragansett Bay Commission
Narragansett Bay National Estuarine Research Reserve
Narragansett Bay Estuary Program
Narrow River Preservation Association
Pawtuxet River Authority & Watershed Council
RI Bays, Rivers, and Watersheds Coordination Team
RI Coastal Resources Management Council
RI Department of Administration
RI Department of Environmental Management
RI Department of Health
RI Department of Transportation
RI Environmental Monitoring Collaborative
RI Land Trust Council
RI Natural History Survey
RI Nursery and Landscape Association
RI Resource Conservation & Development Council, Inc.
RI Rivers Council
RI Sea Grant
RI Water Resources Board
Salt Ponds Coalition
Save The Bay
Save The Lakes
Surfrider Foundation
South Kingstown Land Trust
Taunton River Watershed Alliance
Ten Mile River Watershed Council
The Nature Conservancy
The Rhode Island Foundation
The Trust for Public Land
Town of North Kingstown, Dept. of Planning and Development
Upper Blackstone Water Pollution Abatement District
URI Coastal Institute
URI Coastal Resources Center
URI Cooperative Extension
URI Environmental & Natural Resource Economics
URI Graduate School of Oceanography
URI Watershed Watch
USDA Natural Resources Conservation Service
U.S. Environmental Protection Agency, Atlantic Ecology Division
U.S. Environmental Protection Agency, Region 1
U.S. Fish and Wildlife Service
Washington County Regional Planning Council
White Memorial Conservation Center
Wood-Pawcatuck Watershed Association
Woonasquatucket River Watershed Council


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