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# Source Water Protection Plan
# for
# Quonochontaug Neck

Developed by: Quonochontaug Source Water Steering Committee
Prepared by: Atlantic States Rural Water and Wastewater Association

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January 2015

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## *Introduction*

The purpose of the Quonochontaug Source Water Protection Plan is to reduce or eliminate existing and potential risks to the quality of water being supplied by the Quonochontaug East Beach Water Association (QEBWA) and Central Beach Fire District (CBFD) wells. The management plan included here outlines specific actions available to the water systems and Quonochontaug residents to protect the wellhead protection area (WHPA).

The plan was prepared by the Atlantic States Rural Water and Wastewater Association, in cooperation with the National Rural Water Association. Program funding was provided by the US Department of Agriculture (USDA) Source Water Protection Program. The purpose of the program is to provide technical assistance to rural and small communities for the development and implementation of Source Water Protection Plans.

Source Water Protection Plans written as part of this program build on the Source Water Assessment Program of the Rhode Island Department of Health (RI HEALTH), which was completed approximately 11 years ago. This program determined the susceptibility of the public water systems in Rhode Island to potential contaminant sources.

Proactively addressing the issue of source water protection helps to protect public health, decrease treatment costs, reduce the chances of water quality violations, and ensure the continued viability of the aquifer for drinking water purposes.

Within the past year the nitrate levels in the QEBWA/CBFD well field have risen to over 5 mg/l. The Maximum Contaminant Level (MCL) for nitrates is 10 mg/l and a level above 5 mg/l, while not a violation is considered the level at which proactive measures should be taken to prevent the level from rising to MCL.

Quonochontaug was chosen for participation in this program not only because of identified risks, but also because of the willingness of the QEBWA and CBFD systems and other Quonochontaug residents to put time and effort towards source water protection.

## *Local Source Water Protection Team*

The goal in having a Local Source Water Protection Team is to represent a cross section of the stakeholders on Quonochontaug Neck. A Source Water Protection Workshop was held on November 5, 2014 and 31 people from the community attended. Many of them assisted in the development of this plan and their work is appreciated. In the interest of space, only the core members of that larger team are listed here.

Marc Cohen – Atlantic States Rural Water and Wastewater Association
Matt Dowling – Charlestown Wastewater Manager
George Prior – Past CBFD Public Works Chairman
Pete Ogle – QEBWA Board Member

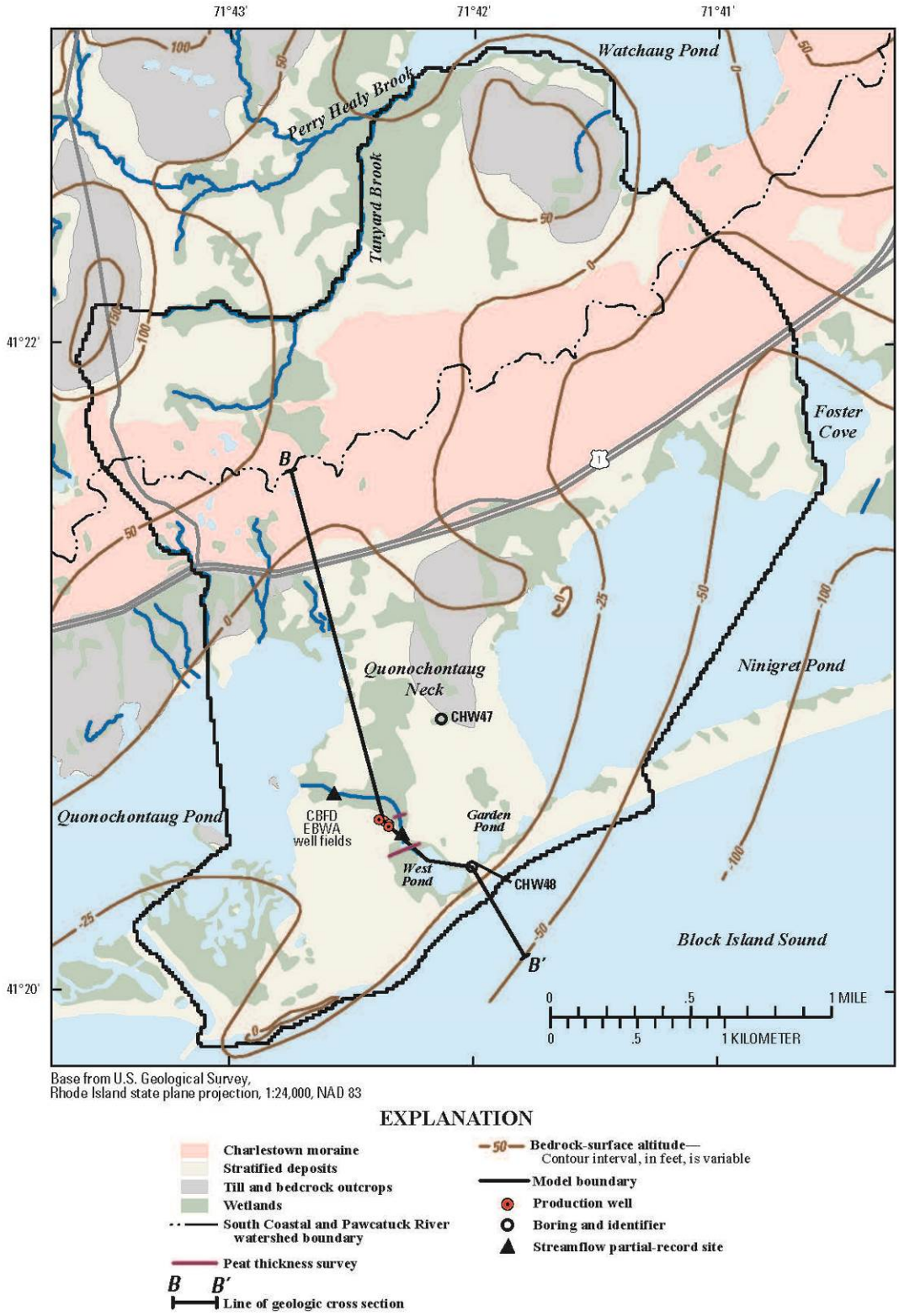



**Figure 1. Quonochontaug Neck bedrock contours surficial geology and section lines.**
**Source: http://pubs.usgs.gov/sir/2010/5060**

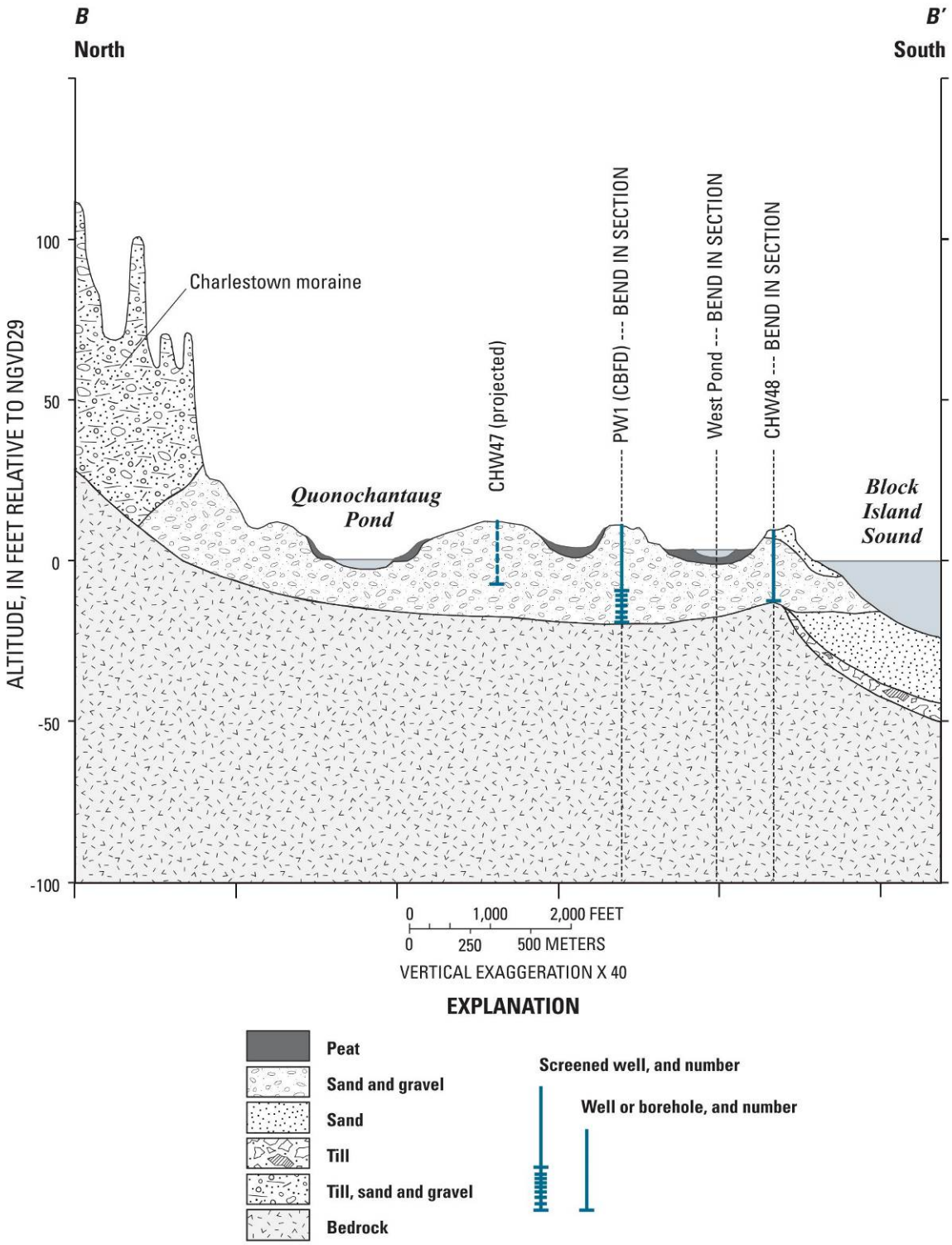



**Figure 2. Geologic cross section of Quonochontaug Neck**
**Source: http://pubs.usgs.gov/sir/2010/5060**

# *Quonochontaug Neck, Charlestown, Rhode Island*

## *Background*

Quonochontaug Neck is located in the southwest corner of Charlestown, Rhode Island. It is roughly one square mile in area (not including the Ninigret barrier beach) and bounded by the Rhode Island mainland to the north, Quonochontaug Salt Pond to the west, Ninigret Salt Pond to the east, and Block Island Sound to the south.

Quonochontaug Neck's natural history has greatly impacted the way people have used this land since the Native American Niantic Tribe (part of the larger Narragansett Tribe) first settled here and gave the area its name, which means home of the blackfish. Two glacial periods, roughly 21,000 and 17,000 years ago, left large boulders, rocks, gravel, sand and finer sediment along what would become the Rhode Island coast line. Rising sea levels that followed the glaciers created the salt ponds and barrier beaches from those glacial deposits. Those deposits typically range from a 20 to 30 feet on top of bedrock creating the rain-fed aquifer that provides the current residents of the Neck with drinking water. A map of Quonochontaug Neck with bedrock contours, surficial geology and cross-section line is shown in Figure 1. The geologic cross section is shown in Figure 2.

## *Source Water Inventory*

**RI DOH Delineations of Public Water Systems Based on Service Types**

*"A public well is a well that supplies water to a "public water system". All public water systems in RI are regulated by the Department of Health to ensure that the water quality meets drinking water standards. A public water system provides drinking water to 15 or more service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year. There are three categories of public water systems as described below.*

- *"Community System" – serves year-round residents; at least 15 service connections or at least 25 residents. Examples of wells serving community systems (community wells) include municipal wells, nursing home wells and mobile home park wells. All other public water systems are "non-community" systems.*
- *"Non-Transient Non-Community Systems" – a non-community system that regularly serves at least 25 of the same persons (non residents) over 6 months of the year. Wells serving schools and places of employment are non-transient non-community wells.*
- *"Transient Non-Community System" – a non-community system that does not regularly serve the same persons; but does serve at least 25 people at least 60 days of the year. Restaurants and hotels are typical examples of such non-community systems."*

RI DOH makes distinctions between water systems because the health risk of a contaminated water source increases the more often a person drinks that water. Therefore, the number of potential contaminants that water is tested for and the frequency of such tests varies according to the type of system.

Quonochontaug has two Community Systems and one Transient Non-Community System as shown in the following table:

**Community Systems**

| PWSID | System Name | # of Active Wells |
|---|---|---|
| RI1647511 | QUONOCHONTAUG EAST BEACH WATER ASSOC | 2 |
| RI1647512 | CENTRAL BEACH FIRE DISTRICT | 2 |

**Transient Non-Community Systems**

| PWSID | System Name | # of Active Wells |
|---|---|---|
| RI2519415 | BLUE SHUTTERS | 1 |

282 out of the 798 homes on Quonochontaug are serviced by the QEBWA and CBFD public water systems. A good description of these systems was included in Dr. Urish's report of January 2000:

> *"The water supply for CBFD and the EBWA are four 8 inch diameter wells drilled at depths of about 6 to 28 feet in an aquifer of glacial outwash material. The permeable sand and gravel of the aquifer is limited in thickness with a lower bedrock boundary ranging from 3 feet to 21 feet below mean sea level in the well recharge area. All four wells are within about 200 feet of each other and so compete with each other in drawing from the same portion of the aquifer."*

The QEBWA system has 110 connections and the CBFD system has 172 connections. The remaining 516 homes on Quonochontaug Neck (including three in the CBFD service area) have private wells.

### *Wellhead Protection Areas*

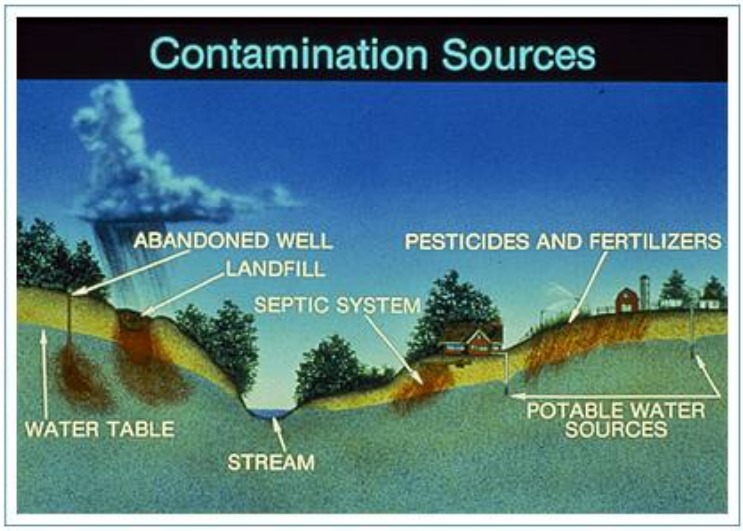



**Figure 3. Examples of potential contamination sources.**
**Source: http://www.epa.gov/ne/eco/drinkwater/pc_sourcewater_assessment.html**

In the case of Quonochontaug Neck, *source water* refers to the groundwater in and around the QEBWA/CBFD well field. Groundwater can be threatened in a variety of manners, as shown in Figure 3. Potential contaminants include nitrates, pathogens, fuels, solvents, herbicides, pesticides, and metals.

Wellhead protection areas (WHPAs) are the land areas from which groundwater will flow to the well under pumping conditions. The Rhode Island Department of Environmental Management (RI DEM) defines a WHPA as "the critical portion of a three-dimensional zone surrounding a public well or wellfield through which water will move toward and reach such well or wellfield." These land areas are the most important ones for source water protection. The WHPA for the QEBWA and CBFD wells has been delineated by RI DEM and is shown in Figure 4. This delineation is based on the maximum permitted pumping rate of all four wells. The USGS Report 2010-5060, *Delineation and Prediction Uncertainty of Areas Contributing Recharge to Selected Well Fields in Wetland and Coastal Settings, Southern Rhode Island,* included a delineation of the WHPA for a pumping rate equal to the average yearly pumping rate. It can be argued that neither rate is representative of actual withdrawal rates. The RI DEM delineation substantially overstates withdrawal and the yearly average understates it. A more meaningful rate might be the average pumping rate during the summer months when occupancy increases with seasonal residents. This plan will use the RI DEM delineation because it is the most conservative, it is recognized by state and federal regulators, and used by the town for planning cesspool phase-outs..

It is important to note that the recharge of the QEBWA/CBFD WHPA is only from rain that falls on Quonochontaug Neck. Also, nearby land use, lawn care and OWTS effluent have an impact on the QEBWA/CBFD wells in a relatively short time span, often within one year. Travel times for the maximum pumping rate are shown in Figure 5.

In discussing the area that contributes to the recharge of the well field, the *USGS Report 2010-5060* states:

> "*Estimated traveltimes ranged from less than 6 months to more than 50 years; 94 percent of the traveltimes were 10 years or less. The median traveltime to the well fields in this thin aquifer was 1.3 years. Water that recharges the aquifer near the well fields has the shortest traveltimes, whereas water originating in the till northeast of the well fields and in the stratified deposits along the southwest edge of the contributing area has the longest traveltimes."*

### *A Note on Private Wells*

This Source Water Protection Plan has been written with a focus on the QEBWA and CBFD public water systems. It should be noted, however, that all of the risks to groundwater quality affecting the public systems also affect the private wells on Quonochontaug Neck. Residents with private wells have equally strong reasons to educate themselves on water quality issues and to work to reduce contamination risks.

**Figure 4. Wellhead Protection Area for the QEBWA /CBFD wells.**

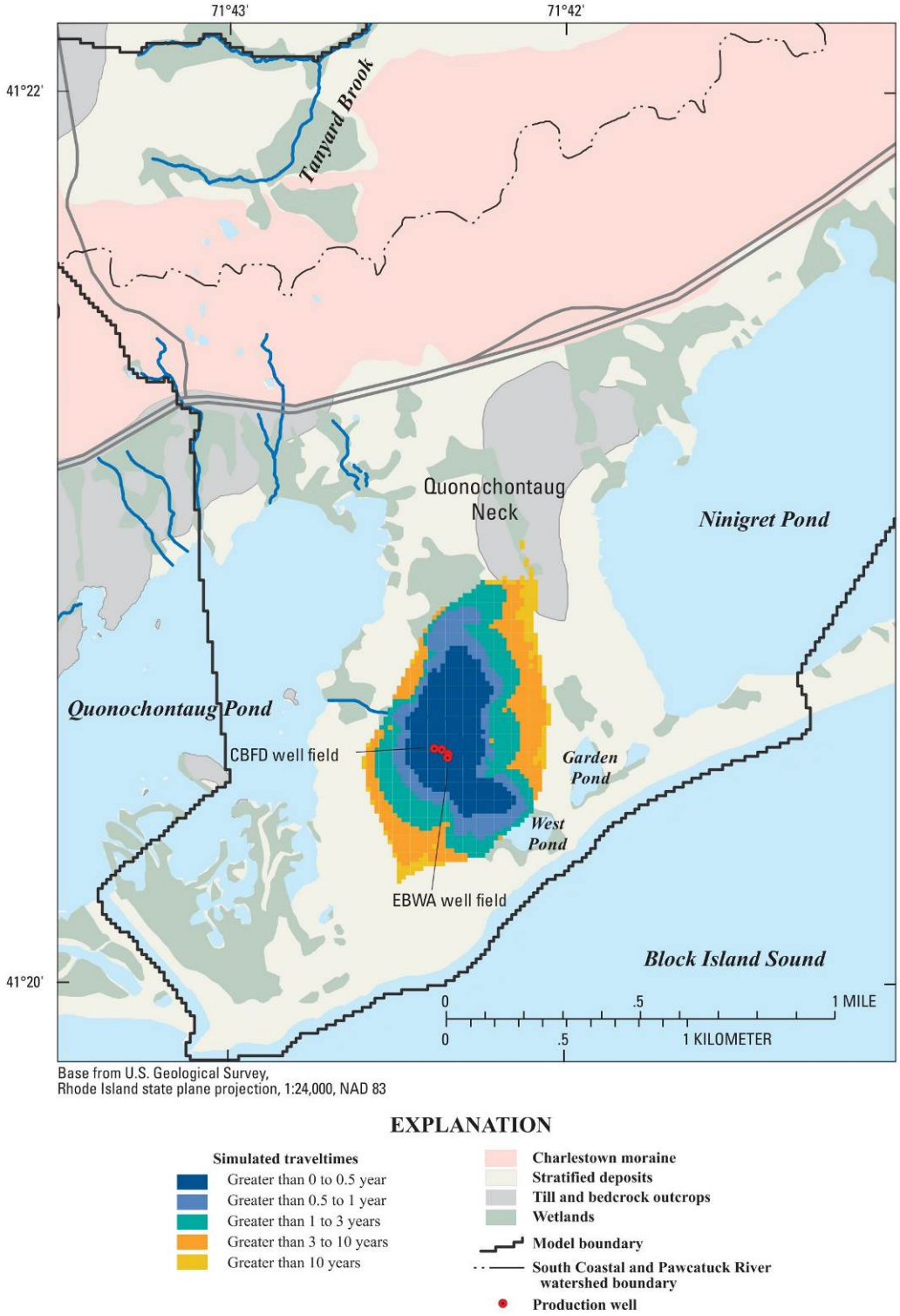



**Figure 5 Simulated traveltimes to QEBWA/CBFD wells at their maximum pumping rate of 230 gallons per minute. Source: http://pubs.usgs.gov/sir/2010/5060**

### *Existing Source Water Protection Measures*

Following is a sampling of source water protection initiatives that are already in place, or ongoing. This is not a comprehensive list, but is meant to demonstrate the level of commitment by the Town of Charlestown, QEBWA, CBFD, and residents of Quonochontaug Neck

- The Town has a Groundwater Protection District zoning overlay in place.
- The Town's Onsite Wastewater Management Program, has made major strides since its creation in 1993 towards protecting source water quality.
- The town's GIS office works closely with the town's Wastewater Management Office to monitor Onsite Wastewater Treatment Systems and other threats to water quality.
- Charlestown has developed a town-wide Source Water Protection Plan.
- The Town has initiated an ad hoc committee to discuss drinking water issues.
- QEBWA and CBFD have commissioned and/or have been part of Quonochontaug groundwater studies by Dr. Dan Urish, USGS, RI NEMO, URI graduate students and private consultants.
- Citizen groups, including the Salt Pond Coalition and the Wood-Pawcatuck Watershed Association, initiate projects that protect the town's water resources, provide environmental monitoring, and keep water quality issues in the public eye.
- A Quonochontaug private well owners group has been formed to educate the public about groundwater and develop strategies for protecting these sources.

## *RI DOH Source Water Assessment*

Approximately 11 years ago, RI DOH completed a state-wide survey of public drinking water supplies under the Source Water Assessment Program. This program was mandated with the 1996 reauthorization of the Safe Drinking Water Act. The purpose of the program was to evaluate the susceptibility to contamination of each public drinking water source in Rhode Island and communicate the results to the public.

The QEBWA and CBFD systems were rated jointly as a system with "high risk" of potential contamination. However, *"A ranking of HIGH does NOT mean that the water is unsafe to drink. It DOES mean that we must be especially aggressive in protecting the water supply."* Pollution risks listed in the Source Water Assessment are:

> *"High-intensity land uses, including recreational and residential, are densely clustered near the wells.*
>
> *Several roads are located near the wells, increasing the risk of hazardous material spills and road salt contamination."*

Unfortunately there are inconsistencies in the Source Water Assessment which raise questions about how useful it is. One recommendation of this plan is that the Rhode Island Department of Health update the Source Water Assessment for QEBWA and CBFD.

## *Confirmed Contaminant Detects of Concern in Source Water*

Recent testing results were reviewed for the two community systems and no contaminants have been detected at levels above the Maximum Contaminant Level (MCL). However nitrates are above the action level and will be the major focus of the plan.

### *Nitrates*

The Maximum Contaminant Level (MCL) for nitrates is 10 mg/L and the action level is 5 mg/l. Infants below six months who drink water containing nitrate in excess of the maximum contaminant level (MCL) could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.

The past 27 years of nitrate testing were obtained from RI DOH in order to see if there were recognizable trends. This data is presented in Figure 6 along with the annual rainfall for each year. (Yearly rainfall amounts are divided by 10 to show them on the same scale as the nitrate levels.) Nitrate levels during the 1990s and early 2000s.were more erratic in all wells than from 2005 till the present.

The period from 2005 through November of 2014 is shown in Figure 7 for better clarity. During this period there was higher rainfall from 2005 through 2012 (except 2007). It is interesting that the levels of nitrate generally dropped from 2008 to 2011 but began to increase in 2012, with all four wells having much higher levels in 2014.

The average rainfall at the NOAA Kingston, RI Station for 2008 through 2011 was about 59 inches, 16% above the longer term yearly average of 51 inches. The average rainfall for 2012 through 2014 was about 46 inches, 10% lower than the norm and 22% lower than the previous four years. This information does not demonstrate a causal relationship between rainfall and nitrate levels, but it might be something to investigate further. The amount of rainfall available to infiltrate and recharge the aquifer is also negatively impacted by the amount of impervious surface. When less rain falls and more runs off the problem is magnified. This will be discussed more below under **Assessment of Threats, Impervious Surfaces**.

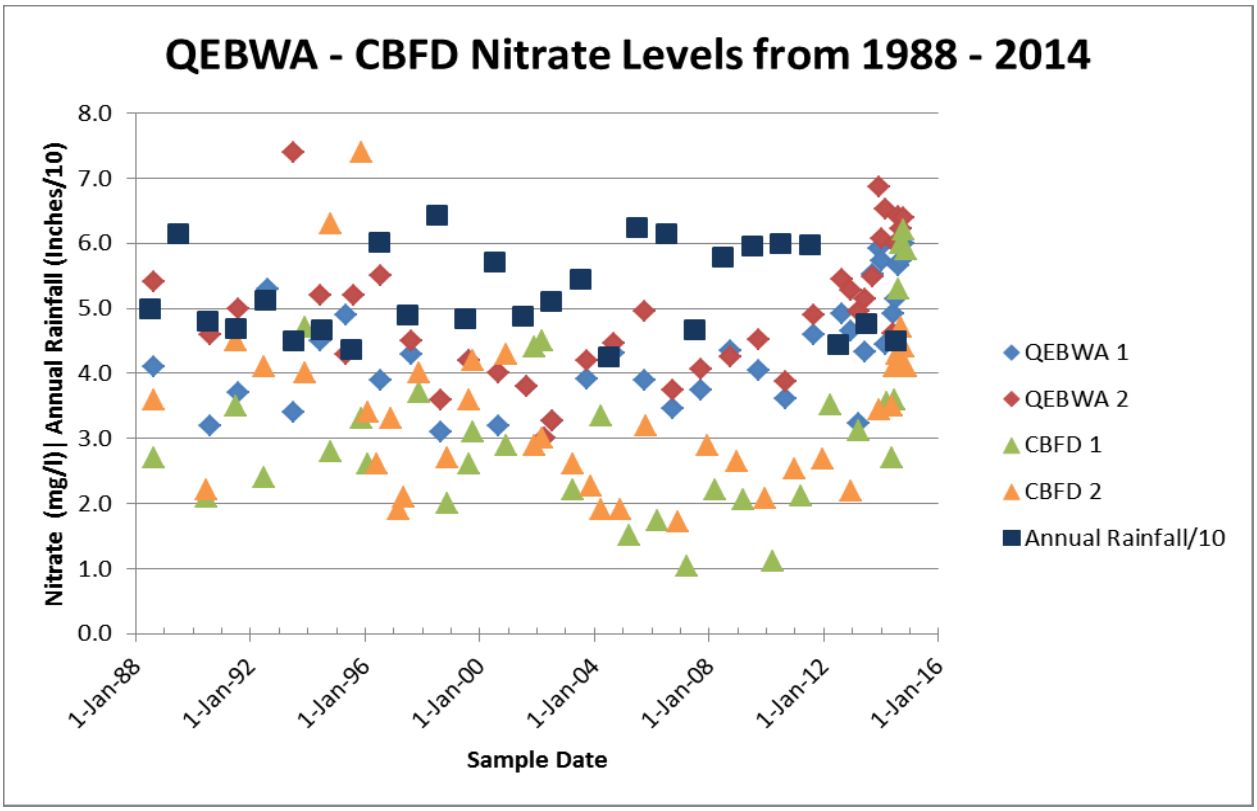



**Figure 6. Nitrate levels in QEBWA/CBFD wells since 1988.**

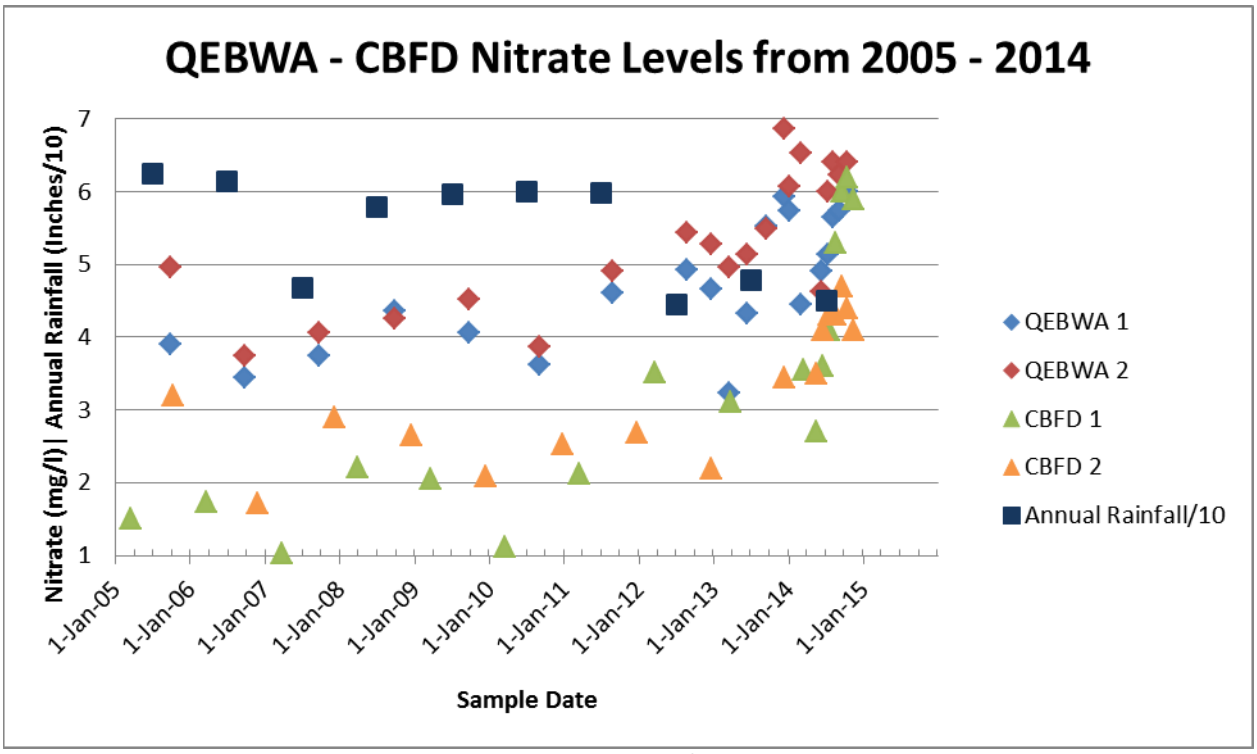



**Figure 7. Nitrate levels in QEBWA/CBFD wells since 2005.**

# *Assessment of Threats*

## *Roadways*

Roadways are a potential source of contamination due to the risk of petroleum leaks from vehicles, and the possibility of an accident involving a truck involved in bulk shipments of materials such as home heating oil. The application of road salts can cause elevated levels of sodium and chlorides.

## *Salt-Water Intrusion*

Figure 8 shows the way in which fresh groundwater and the saltwater of the ocean interact near any coast. The closer one is to the coast, the shallower the level at which salt water is reached.

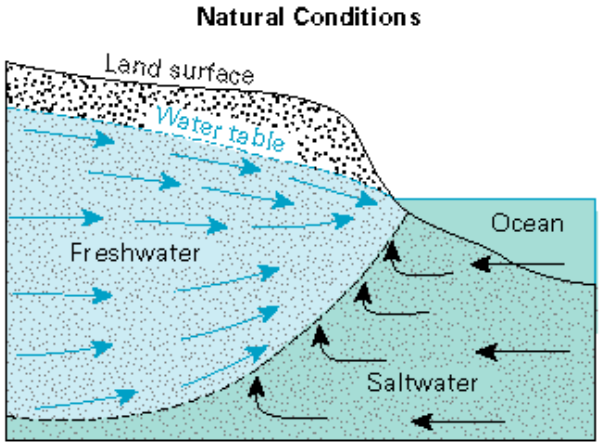



**Figure 8. Freshwater/Salt Water interface in coastal area, natural conditions.**
**Source: http://pubs.usgs.gov/gip/gw/quality.html**

Any groundwater pumping near a coastal area will affect this pattern, drawing salt water up towards the well (**Error! Reference source not found.** 9). The higher the pumping rate, the more likely it is that the groundwater aquifer is at risk of salt-water contamination.

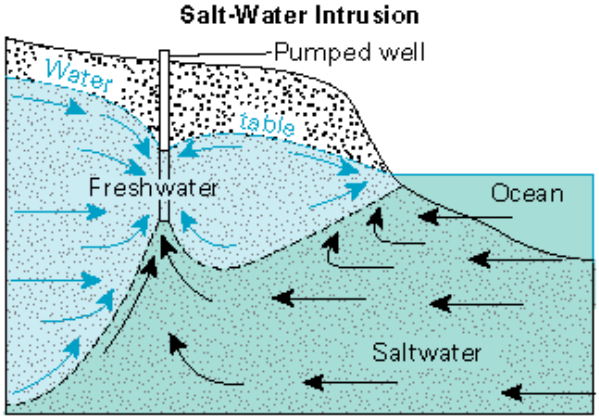



**Figure 9. Freshwater/Salt Water interface in coastal area, pumping conditions.**
**Source: http://pubs.usgs.gov/gip/gw/quality.html**

Saltwater intrusion has not yet been issue on Quonochontaug Neck, but it is important that the community water systems and the private well owners manage the limited water supply to maintain conditions that will not encourage saltwater to displace the freshwater in the aquifer.

Increasing rainwater infiltration and water conservation are two critical components in fighting salt-water intrusion. However, challenges to conservation include leaks; unattended, non-winterized homes where a leak would not be immediately noticed if a pipe burst; and excessive outdoor water use.

### *Heating Oil*

Leaking heating oil tanks can pose a risk to groundwater quality. Over time, water from condensation and sludge from impurities in the oil can cause corrosion, leading to leaks. The legs of above-ground tanks can also break, causing tanks to topple and spill.

Appendix A is a brochure prepared by the Massachusetts Department of Environmental Protection about precautions that should be taken with home heating oil tanks.

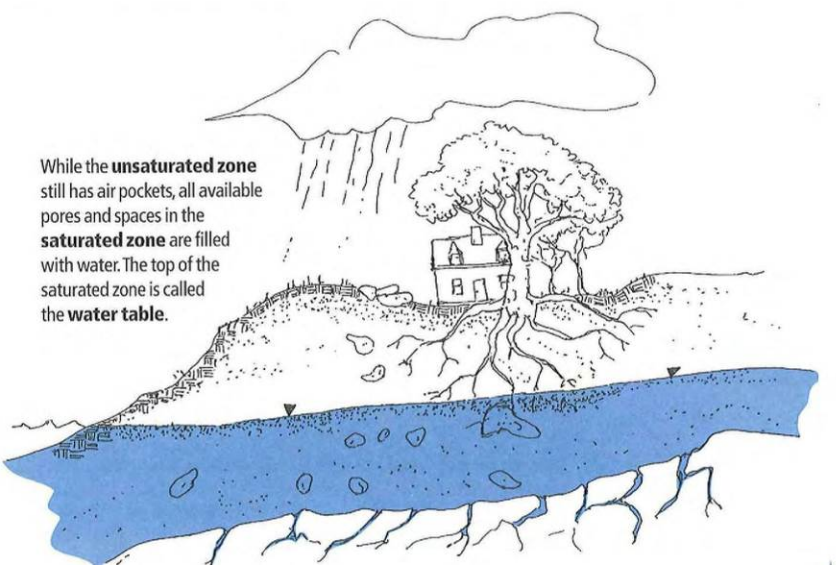
### *Lawn Care*

Residential landscape care and maintenance involve the use of fertilizers, herbicides, and pesticides. Most of these products are highly soluble in water and can be transported through groundwater to wells.

Residents of Quonochontaug Neck are encouraged to not chemically treat their lawns and use fertilizer with no phosphates and small amounts of nitrogen compounds. Examples of outreach material for residents is provided in Appendix B.

### *Impervious Surfaces and Infiltration*

Infiltration is controlled by three mechanisms, the rate of entry of rainwater through the soil surface, the movement through the unsaturated zone and the level of saturation in the soil.




The surface entry rate may be slowed or stopped by a thin layer of silts and clay on the soil surface, buildings, or pavement. Movement through the unsaturated zone depends on the characteristics of the soil. The speed at which water travels through soil is termed its permeability. A very permeable soil can become nearly impermeable due to human activity. Also, when soil near the surface becomes saturated, either by rain water entering or the rising of the water table, no more water can enter the soil and it runs off.

Impervious surfaces have been recognized as a problem for many years. They prevent rain water from infiltrating into the ground, increasing runoff. Increased runoff, along with the increasing number of intense rain events, cause more erosion and carry more pollution into surface waterbodies. Reduced infiltration lowers the amount of water available to recharge aquifers in both surficial material (till, sand, gravel) and bedrock where it is available for drinking and maintaining flow in surface waters during summers.

What is less understood is that many surfaces we assume to be pervious are really not. One of the most striking example is the suburban lawn. The reason that most lawns are relatively impervious is that they are typically built on heavily compacted soil and/or the soil is compacted by mowing and other maintenance activities. In *Effect of urban soil compaction on infiltration rate,* J. H. Gregory, et al. found that in sandy soils:

> *"Average non-compacted infiltration rates ranged from … 14.8 to 25.0 in hr-1 for natural forest, … 25.1 to 25.7 in hr-1 for planted forest, and … 8.9 in hr-1 for pasture sites. Average infiltration rates on compacted soils ranged … 0.3-6.9 in hr-1, … 6.3 to 7.4 in hr-1, and … 0.9 in hr- for the same respective sites. Although there was wide variability in infiltration rates across both compacted and non-compacted sites, construction activity or compaction treatments reduced infiltration rates 70 to 99 percent. … When studying the effect of different levels of compaction due to light and heavy construction equipment, it was not as important how heavy the equipment was but whether compaction occurred at all."*

Results from Connecticut NRCS field testing found similar results. In the table below lawns are more compact (have a higher Bulk Density) than woods or pasture soils and have permeabilities that are reduced by 99% or more than pasture soils.

**Permeability Measurements of Sampled Layers within 20 " of Soil Surface**

| Site | Bulk Density (g/cm3) | Permeability (in/hr) |
|---|---|---|
| Woods | 1.42 | 15 |
| Pasture | 1.47 | 9.9 |
| Subdivision Lawn (1) | 1.79 | 0.14 |
| Garage Lawn | 1.82 | 0.13 |
| Cleared Woods | 1.83 | 0.13 |
| Subdivision Lawn (2) | 2.03 | 0.03 |
| Athletic field | 1.95 | 0.01 |
| Concrete | 2.4 | 0.00 |

**Figure 10. These activities compact soils and reduce infiltration rates.**

**Figure 11. Standing water may be the result of soil compaction.**

### *On-Site Wastewater Treatment Systems (OWTS)*

Quonochontaug Neck is not sewered. All of the homes have OWTS. The Town of Charlestown was proactive in implementing a Wastewater Management Plan, a Cesspool Phaseout ordinance and adding staff to manage these programs. As a result there are no cesspools remaining on Quonochontaug Neck and any new or replacement systems must be advanced systems capable of nitrate removal.

A benefit associated with properly functioning OWTSs is that they allow a significant portion of the water withdrawn from the aquifer to return to it. The downside is that if they are not used properly, they can be a means of injecting contaminants into the groundwater. And even a well maintained advanced system will only remove about 50% of the nitrates from the wastewater.

It is not only the public wells that are at risk by septic systems. Most homes on Quonochontaug Neck have private wells located very close to OWTSs. Outreach material for OWTS owners are included in Appendix C

It is expected that Charlestown's Wastewater Management Program will continue to monitor OWTS on Quonochontaug. System upgrades and replacements over time will help mitigate expected increases in nitrate input into the groundwater from increasing average residency.

# *Management Plan*

## *Outreach and Education*

Public education and awareness is a key part of this Source Water Protection Plan because everyone in on Quonochontaug Neck poses a risk to ground and surface water. Most homeowners will work to protect their local ground and surface water if they know how to minimize contamination risks. Outreach to Quonochontaug residents will be done through mailings, media and/or public meetings to increase awareness of the link between land use and drinking water quality and to involve the public in source water protection activities. The three most important areas to focus on should be infilatrating stormwater, septic system maintenance and lawn care.

Examples of outreach material are included as Appendices A, B & C. Other materials are available from the RI DOH, RI DEM, RI NEMO, EPA, Charlestown Wastewater Management, RI USDA/NRCS and the Conservation District. Some useful links are:
**RI DOH:** http://www.health.ri.gov/water/about/yourwater/
**RI DEM:** http://www.dem.ri.gov/programs/benviron/water/quality/prot/index.htm
**RI NEMO:** http://web.uri.edu/nemo/
**EPA:** http://water.epa.gov/drink/ and http://cfpub.epa.gov/watertrain/
**Charlestown Wastewater Management:** http://www.charlestownri.org (under Town Departments tab)
**RI NRCS:** http://www.nrcs.usda.gov/wps/portal/nrcs/main/ri/soils/
**Southern RI Conservation District:** http://www.sricd.org/

QEBWA and CBFD should consider installing signs at the periphery of the WHPA so residents and visitors are aware that their actions impact a public water supply.

## *Increasing Infiltration to Recharge Aquifer*

Quonochontaug water systems, homeowner associations and private residents can improve the quality and quantity of drinking water available by incorporating or retrofitting landscape projects with rain gardens, bioswales and other Low Impact Development (LID) practices. These practices remove pollutants and increase the amount of infiltration thereby increasing the amount of water available in the aquifer. Figure demonstrates how recharge basins are able to lessen the impact of well drawdown and reduce the risk of saltwater intrusion in coastal areas.

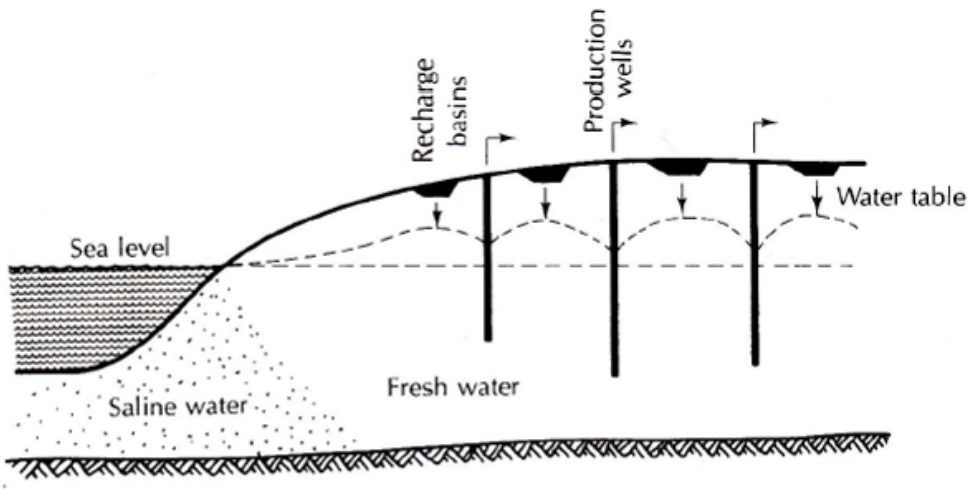



**Figure 12. Artificially recharged water can help to prevent salt-water intrusion.**
**Source: Applied Hydrology, Fourth Edition. C. W. Fetter. 2001.**
**Merrill Publishing Company, Upper Saddle River, NJ.**

Rain gardens are an option that is available at the household level. Figure 13 shows how stormwater from roofs and imperious surfaces can be directed into the ground by a rain garden. The URI Sustainable Landscaping website has additional information about rain gardens, including a plant list suitable to Rhode Island's climate: http://www.uri.edu/ce/healthylandscapes/raingarden.htm. Examples are provided in Appendix D

A simple rain garden/bioswale can be constructed by a home owner at very little cost. Using native grasses instead of plantings can reduce that cost even more. If the soil is compacted, it may require light equipment to loosen it up and some organic amendment.

**Figure 13 Increased groundwater infiltration caused by a rain garden.**
**Source: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/water/?cid=nrcs144p2_057468**

**Infiltration Example**

- The average annual occupancy of East Beach homes is 1.5 people/house.
- This is about 27,000 gallons per house per year of nitrate laden wastewater at about 46ppm N, about 10 pounds of N. (based on MANAGE Report assumptions).
- A 25 ft x 40 ft house with 1,000 sq ft of roof intercepts about 30,000 gallons per year of rain water.
- Thus by infiltrating all rain water that falls on the roof, the nitrate concentration from the average house can be cut in half.

Recommendations regarding infiltration are:

1. Do a survey of the soils within the WPHA of the QEBWA/CBFD wells to determine a more accurate value of soil density and infiltration rates in that area. This service may be available from the RI NRCS.
2. If the infiltration rates are very low, compare the cost of providing better infiltration to other options being considered for reducing nitrates.
3. The impact of LID retrofit projects will show results sooner if implemented in the areas closest to the well field (i.e. in the area of the shortest travel times). However improving infiltration across Quonochontaug Neck will help improve water quality and quantity for the future and for private well owners.
4. As a demonstration project, QEBWA and CBFD should consider retrofitting the tennis courts on Sea Breeze Avenue with a system for capturing run off from the courts and infiltrating it rather than letting it run into wetlands and out to Quonochontaug Pond.

### *Testing of Private Wells and Mapping of Results*

The required water quality tests for the QEBWA and CBFD wells detect contaminants in the aquifer only at the locations of their public wells. However, information from other points in the aquifer could be gathered by collecting the results when homeowners who use private wells get their water tested. This information could then be mapped to spot any trends as they emerge. It would be important to obtain as much information available regarding the well type, depth and where the well is screened. Charlestown Wastewater Management has indicated that it is willing to coordinate this effort and map the data. To have this effort be successful it would need to include outreach and education, as many homeowners are not willing to make testing information public. Cost of testing is another hurdle, but there may be opportunities for funding this effort.

Recording the water levels of abandoned shallow dug wells periodically would also provide valuable information on the status of the aquifer and the extent that improved infiltration is having on recharging it. A survey could be made to see how many are left, whether the owner would allow access and what locations would provide the useful information.

### *Coordinate Management of the QEBWA and CBFD wells*

Addressing the nitrate level in the Quonochontaug aquifer will require time. Coordinating the management of the QEBWA and CBFD well withdrawals could help provide that time. The QEBWA and CBFD well fields are really one well field. The best arrangement for managing this well field would be to have one entity doing it. Barring that, it would be advantageous to interconnect the systems and

coordinate management so that there are more options regarding which wells are active and what pumping rates are used.

Appendix E includes more specific recommendations regarding coordinated management of the two systems from Dr. Urich's 2000 report.

### *Form a Source Water Protection Steering Committee*

The following people comprise the Quonochontaug Neck Source Water Protection Steering Committee. They represent some of the key communities on Quonochontaug and assisted in the development of this protection plan. They are committed to implementing the prevention measures outlined above. This committee will meet at least once a year to assess progress and review and update the plan.

Marc Cohen – ASRWWA
Matt Dowling – Charlestown Wastewater Manager
George Prior – Past CBFD Public Works Chairman
Pete Ogle – QEBWA Board Member

### *Management Plan Responsibilities*

The following table lists the Management Plan objectives and the organization(s) responsible for leading their implementation.

**Quonochontaug SWPP implementation Responsibility**

| Management Plan Item | Lead Organizations |
|---|---|
| Outreach and education, including:<br>Water conservation<br>On-site Wastewater Treatment System (OWTS) care and maintenance<br>Lawn care<br>Household hazardous materials<br>Water conservation<br>Rain gardens | ASRWWA<br>RI NEMO<br>Charlestown Wastewater Management |
| Increase Infiltration to recharge aquifer | QEBWA<br>CBFD<br>Quonochontaug homeowner associations<br>Quonochontaug homeowners |
| Test private wells and map results | Charlestown Wastewater Management |
| Coordinate management of QEBWA and CBFD wells | QEBWA<br>CBFD |

## *Contingency Plan*

Contingency plans for the QEBWA and CBFD system are on file in systems' offices.

# *Appendix A: Home Heating Oil Fact Sheet – MA DEP*

Massachusetts Department of ENVIRONMENTAL PROTECTION

fact sheet

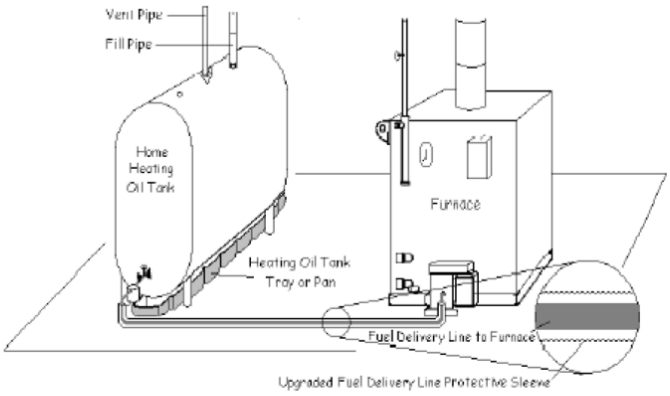
**Tips For Maintaining Your Home Heating System:**
**Prevent Heating Oil Leaks and Spills**

Cleaning up oil leaks from home heating systems can be very expensive. The average cost can range between $20,000 and $50,000, with some cleanups costing significantly more. Here are some ways to save money, help prevent leaks and spills, and protect the environment.

**For all heating oil systems:**

- Annually:
  - Inspect for leaks. Look at the tank, fuel delivery line, valves, piping, and fittings.
  - Have your oil company:
    - Clean the furnace and repair or replace damaged parts. A well-maintained furnace means lower fuel bills and cleaner emissions.
    - Install an oil **safety valve** or replace the fuel delivery line with one encased in a **protective sleeve.** These are inexpensive upgrades. Contact the fire department to determine if a permit is required for this work.
  - Each fall, inspect the vent pipe to ensure that it is free of obstructions and that an audible signal (whistle) is on the vent. Oil company personnel listen for the whistle to help avoid overfills, a common source of spills.
- At least every 10 years, have the oil tank cleaned out. Over time, water (from condensation) and sludge can cause corrosion resulting in leaks.
- When appropriate:
  - Remove abandoned fill and vent pipes immediately.
  - Clearly mark the location of the tank's fill pipe.
  - Consider upgrading to a modern, fuel-efficient furnace.

Typical Above-Ground Home Heating Oil System



- Determine if the underground storage tank is made of steel (common) or fiberglass (rare). Most steel underground storage tanks will last approximately 10 to 20 years. If the tank is older than that or the age is unknown, replace it with an above-ground storage tank. Locate your new tank under a shelter, or inside a basement or garage, to prevent rust, corrosion, or damage.

**For outdoor above-ground tanks:**

- Ask your oil company to inspect the stability of the above-ground tank. A full 275-gallon tank weighs more than 2,000 pounds! They have metal legs and should sit on a concrete pad. If the legs become loose or the pad cracks, the tank can fall over and rupture.

- Replace an outdoor above-ground storage tank that has been uncovered for 10 years or longer. These tanks rust from the inside out, so cleaning or painting the outside does not usually prolong their life.

- Protect the tank from the weather, such as falling snow and ice, and prevent ruptures by tree limbs.

**For indoor above-ground tanks:**

- Inspect indoor above-ground storage tanks for signs of pitting and corrosion, particularly at the bottom of the tank. Tanks primarily rust from the inside out, so if signs of aging are present, replace the tank. Indoor tanks do not last more than about 30 years, and often their lifespan is much shorter.

- Consider placing a plastic heating oil tray or pan under the tank. This makes it easier to keep the tank area clean and help identify and contain small leaks.

If your oil company offers to perform a "tightness test," ask if this could cause a problem. Generally, these tests should NOT be performed on older residential heating oil systems. Because of the pressure used during a tightness test, older equipment can fail, causing a leak or spill. If you have a tank, fuel delivery line, valves, piping, and fittings on which it is inadvisable to perform a tightness test because of age or condition, then it is probably better to replace the equipment that is causing the concern.

Visit our web site: http://mass.gov/dep/cleanup/laws/facts.htm to review related documents, including "Heating Oil Delivery Lines" (http://www.mass.gov/dep/cleanup/deline.pdf).

If you suspect an oil leak or spill, **immediately** contact your oil company and fire department for assistance. Leaks or spills of 10 gallons or more must be reported to DEP within 2 hours. To report a leak or spill, call DEP (within 2 hours) and the fire department.

DEP's 24-hour statewide emergency response number is 888-304-1133.

Massachusetts Department of Environmental Protection
One Winter Street
Boston, MA 02108-4746

Commonwealth of Massachusetts
Mitt Romney, Governor
Kerry Healey, Lt. Governor

Executive Office of Environmental Affairs
Ellen Roy Herzfelder, Secretary

Department of Environmental Protection
Robert W. Golledge, Jr., Commissioner

Produced by the Bureau of Waste Site Cleanup, 1/02/rev. 5/04.
Printed on recycled paper

This information is available in alternate format by calling our ADA Coordinator at (617) 292-5565.

# *Appendix B: Lawn Care Outreach Example*

## *Nitrogen affects our drinking water, too!*

Recent sampling results from Charlestown's drinking water wells have shown that nitrate (a form of nitrogen) tends to be elevated in areas of high-density residential property, such as the neighborhoods near the salt ponds.

Nitrate levels above 10 milligrams per liter (mg/L) are particularly dangerous for infants, who can be at risk for "blue baby" syndrome.

Several private wells in Charlestown occasionally have nitrate levels above 10 mg/L, and many more have results in the 5-10 mg/L range.

When we work to protect our salt ponds from the effects of nitrogen, we're also protecting our drinking water supplies... and vice versa. It's a win-win situation.

For more information on private wells, please visit URI's Drinking Water Protection Resource Center at http://www.uri.edu/ce/wq/RESOURCES/dwater/index.htm

## *Keep it up*

In addition to being conscientious about our lawn care practices, we can help decrease nitrogen levels in our salt ponds and drinking wells by:

- Replacing cesspools and failed septic systems, and making sure that all septic systems are properly maintained.
- Always picking up dog poop and putting it in the trash.
- Not feeding waterfowl.
- Building rain gardens to decrease stormwater runoff.
- On shoreline property, creating a vegetated buffer to discourage geese and to prevent the lawn from being fertilized right up to the water.

## For More Information

**Visit the following websites:**

www.CharlestownRI.org

www.RIStormwaterSolutions.org

**Or Call:**

**The Town of Charlestown Office of Wastewater Management at (401) 364-5030**

Know where it goes

URI Rhode Island

atlantic states

Know where it goes.....

# Beautiful Lawns, Healthy Salt Ponds

Town of Charlestown Stormwater Management Program

TOWN OF CHARLESTOWN

(401) 364-5030

## The salt ponds - a resource for all of us

Charlestown's three salt ponds provide beautiful views, habitats for fish and shellfish, and a place to relax. These unique environments help to keep property values high and draw tourists to our town.

However, when water entering the ponds carries excess nitrogen from fertilizers, septic systems, and animal waste, it has a greater effect than we might expect.

Fort Neck Cove—Ninigret Pond

This excess nitrogen "fertilizes" algae, setting off a series of steps which lead to:

- Murky waters and mucky bottoms
- Decreased shellfish populations
- That "rotten egg" smell
- Clogged boat propellers
- Less appealing beaches

## When we understand where excess nitrogen comes from, we can start to reduce it.

***You can make a difference.....***

## Keep your lawn looking great...naturally!

A few small changes in your lawn care practices can mean a healthier lawn or garden and less pollutants for our waters.

**Reducing or eliminating fertilizer can go a long way towards restoring the salt ponds.**

- Mow at the highest setting on your lawn mower; longer grass helps to conserve water and control weeds.
- Leave grass clippings on the lawn to improve its health and quality; you'll also require less fertilizer.
- Consider letting your lawn go dormant if there's a drought. It will come back in the fall.

## Sweep spills back onto the lawn

Anything that's lying on pavement is more easily washed by stormwater into drainage features or down storm drains into our salt ponds.

If any chemical or yard debris get on the sidewalk or driveway, sweep them back onto the lawn.

Don't hose the driveway to get it clean.

## If you MUST fertilize...

Fertilize sparingly. Fertilize only once a year, doing so in September is best. There are cooler temperatures, ample rain, and weeds are dying back.

If you must apply fertilizer in the spring, do so after the grass is actively growing. A good rule of thumb is to wait until you've mowed the lawn three times.

Consider using organic fertilizers such as bone meal, blood meal, compost, or organic blends. No matter what product you use, though, be sure to follow the manufacturer's directions for application rate and timing.

When you're fertilizing the lawn, remember you're not just fertilizing the lawn....

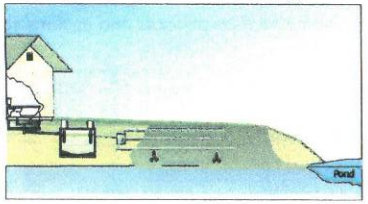
Use slow-release fertilizers. The label should read: slow release or time release fertilizer with water-insoluble, slowly-available, or slowly-available soluble nitrogen.

# Appendix C: Wastewater Management Outreach Example

## The Inspection Process

The inspector will first check the drainage area for evidence of system failure, check the tank for evidence of leak or backup and then measure solids accumulation to see if pumping is needed. If the tank is pumped, the inside must be inspected while empty. Pumping is standard at all **First Maintenance Inspections**.

The inspector will generate a report that describes the system, identifies maintenance requirements and recommend a schedule for the next **Routine Maintenance Inspection** and pumping. The inspector also submits a copy of the report to the Town and provides you a copy.




Conventional Septic System with Septic Tank and Trench Drainfield

A **Change of Ownership Inspection** is required by the Town when a property is sold and requires a **Functional Inspection.**

**All Advanced Treatment Systems and Denitrification systems** must have a Maintenance Agreement in place with a State Approved Service Provider at all times and must be serviced at least annually.

**All Cesspools** must be inspected and pumped annually until their required replacement under Charlestown's Cesspool Phase-out Program.

## Inspection Results

**You have a standard system in good repair.** If your system needs pumping it must be done within 30-days of inspection. If it does not need pumping, a schedule for pumping and next inspection will be set by the inspector.

**Your system requires repair or replacement.** Property owners have 60-days to apply for a permit from the RIDEM to repair the system. The Town Wastewater Manager can assist in the process and has fact sheets on how to proceed.

**You have a cesspool.** All cesspools in Charlestown are required to be removed and replaced with a system suitable for the Wastewater Management District. Contact the Town Wastewater Manager for details.

- ***Low Interest Loans Are Available*** for system repair and cesspool replacement through Charlestown's Community Septic System Loan Program.

## For More Information

**Visit the following websites:**

www.CharlestownRI.org
http://www.uri.edu/ce/wq/OWT/index.htm

**Or Call:**
**The Town of Charlestown Office of Wastewater Management at (401) 364-5030**

**Know where it goes.....**

# Charlestown's On-Site Wastewater Management Program

Fort Neck in Ninigret Pond

**Town of Charlestown Wastewater Management Office**

TOWN OF CHARLESTOWN

**(401) 364-5030**

## Groundwater-Our Most Important Resource!

All of Charlestown relies solely on groundwater for drinking water (through private and public wells) and every household and business in Charlestown relies on septic systems for sewage disposal. Therefore, substandard, malfunctioning and failing septic systems have the potential to significantly impact our health and our environment.

Proper maintenance and care of your septic system is of utmost importance! **Charlestown's Wastewater Ordinance is designed to enhance your septic system performance and longevity, while minimizing costs.** The program tracks the status of all septic systems in Town through a required inspection process and records are maintained in a comprehensive database.

An important element of the program is the flexibility of inspection frequency, which is based on your septic systems history: **How often you have your system inspected can be adjusted in order to match the need for pumping, and thus can vary from one to five years.**

## What's Required....

**A Town Ordinance requires inspection, maintenance and pumping out your septic system.**

- You will receive a Town notice indicating when your next inspection is required.
- Your septic service provider must be approved by the Town of Charlestown. A list of approved inspectors is available from the Office of Wastewater Management. The inspector will follow inspection procedures specified by RIDEM and the Town of Charlestown Ordinance.

- Inspections are required every one to five years based on system age, use and the results of previous inspections.
- Advanced / Denitrification Systems and Cesspools must be inspected annually.
- Systems are required to be inspected prior to a point of sale.
- Pumping is based only on the results of the inspection. If the tank does not need pumping at the time of inspection, it will be scheduled based on the accumulation rate of material in the tank.

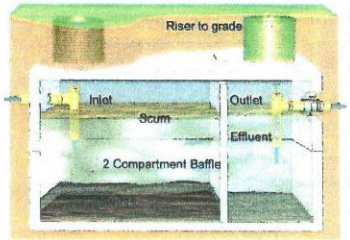
***Substandard septic systems are a major source of pollution to Charlestown's groundwater supplies, salt ponds and inland waters.***
***You can help protect our waters.....***

## Preparing for the Inspection

The cost of an inspection depends partly on the time required. Save money by preparing in advance. Follow these steps:

**Collect data** on your system. Gather past inspection reports and maps, copies of which can be found at Town Hall.

**Get informed** about the inspection process. The Wastewater Manager has information on the inspection process and options that may lower the cost of future inspections and improve system performance.




A typical two compartment Septic Tank that allows clear water to exit to the soil treatment area.

**Be present** for the inspection. By getting to know your system and discussing its use and history with the inspector, they may have information or actions that can help you save $ and protect your system.

***Obtain Septic System Fact Sheets and Additional Information at the Office of Wastewater Management at Town Hall.***

# *Appendix D: Rain Garden Outreach Example*

University of Rhode Island Cooperative Extension

**RAIN GARDENS: A DESIGN GUIDE FOR HOMEOWNERS *in Rhode Island***

*Helping to improve water quality in your community*

*Adapted from University of Connecticut Cooperative Extension System*

***Consider a Rain Garden***

What is a rain garden? It is a depression (about 6 inches deep) that collects runoff from a roof, driveway or yard and allows it to infiltrate into the ground. Rain gardens are typically planted with shrubs or perennials, and can be colorful, landscaped areas in your yard that will also provide important environmental benefits.

Why build a rain garden at your home? You can make a difference! Every time it rains, water runs off impervious surfaces such as roofs, driveways, roads and parking lots, collecting pollutants along the way. This runoff has been cited by the United States Environmental Protection Agency as a major source of pollution to our nation's waterways. By building a rain garden at your home, you can reduce the amount of pollutants that leave your yard and enter nearby lakes, streams and ponds. As more rain gardens are installed, the amount of pollutants that reach Narragansett Bay will be lessened. We can all play a role in preserving the health of the Bay! *The intent of this brochure is to provide homeowners with an easy to use quick-reference tool for designing a rain garden at their home. Placement of the garden, sizing, installation, planting, and maintenance will be addressed.*

**Rain Gardens are beneficial to our environment in several ways. They:**

- Reduce the amount of pollutants that wash into lakes, streams, ponds and wetlands.
- Help sustain adequate stream flow during dry spells through infiltration and recharge.
- Enhance the beauty of your yard and the neighborhood.
- Help protect communities from flooding and drainage problems.
- Reduce the need for costly municipal storm water treatment structures.

*Adapted from University of Wisconsin Extension, Rain Gardens: A How-to Manual for Homeowners.*

***Concerns Regarding Rain Gardens***

We often hear we should avoid standing water on our property to decrease the amount of mosquitoes. Won't a rain garden create an unwanted pond?
No. A rain garden IS NOT a pond. A properly designed rain garden will hold water for only about 6 hours after a storm. Mosquitoes need much more time than this to lay and hatch eggs

Will it be expensive or difficult to install or maintain at my house?
Once the shallow depression (about 6 inches) is dug for the rain garden, it won't be any more expensive than planting other landscaped areas in your yard. Most of the recommended plants can be purchased at local nurseries, and once established, you maintain them just like any other plants in your yard.

***Designing your garden***

*Take some time to consider placement of your rain garden. It is important to locate your garden where it will collect the most amount of runoff possible. Placing your rain garden downhill from paved surfaces where water would naturally flow will maximize its ability to collect runoff. Some questions to answer at this point may be:*

- *Will the garden be close enough to the downspout to install a pipe without having the pipe be in the way or look out-of-place?*
- *Does the overall shape of the garden fit with the rest of my yard? Rain gardens are versatile; they can be any size or shape imaginable.*

***Step 1: Placement of the rain garden***

Here are some factors to consider when locating your rain garden:

- To avoid potential water problems, rain gardens should not be placed closer than about 10 feet from the foundation of a house with a basement.
- Do not build/locate the rain garden within 15 ft of a septic system, or 25 ft to a water supply or well.
- Avoid placing the rain garden in a low spot in the yard that always seems wet. Remember, a rain garden is not a water garden. Placing it in poorly drained soils may lead to slow infiltration and unwanted long term ponding.
- It is easier to construct and maintain a rain garden in a flat or slightly sloped area.

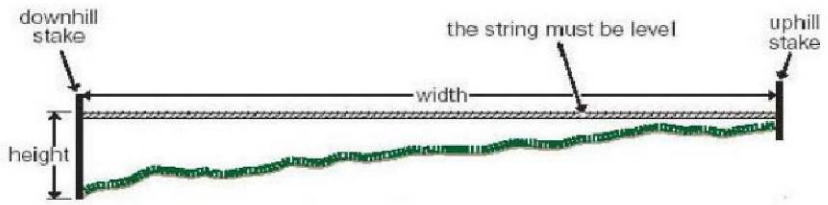
***Step 2: Soils***

Percolation Test - One way to determine if the soils are suitable at your rain garden site is to perform a small percolation test. Dig a hole about 12 inches deep by 6 inches in diameter and fill it with water. Let the water drain to give you saturated conditions. Refill the empty hole with water and measure the depth every hour for four hours. Determine how many inches drained per hour to find the percolation rate. A rate of one to one and a half inches per hour is ideal. If the water does not drain in 24 hours, the site is not appropriate for a rain garden.

Texture - The texture of the soil is an important factor that governs how water will infiltrate, and helps to determine the size of the rain garden. Send a sample of the soils in your rain garden site to the UConn Soil Testing Lab (http://soiltest.uconn.edu/sampling.php) to determine if your soils are sandy, silty or clayey.

***Step 3: Rain Garden Depth***

The slope of the land will help to determine how deep the rain garden should be. To find the slope of the rain garden location, a string should be tied to the base of an uphill stake then tied to a downhill stake using a string level to be sure the string is perfectly level. Divide the height (distance the string is above the ground from the lower stake) by the width (distance between the two stakes), which should both be in feet, and multiply the number by 100 to obtain the percent slope.




Use the following chart and the slope to determine the depth of your rain garden.

| Percent Slope | Typical Depth |
|---|---|
| Less than 4% | 3 – 5 inches |
| Between 5% - 7% | 6 – 7 inches |
| Between 8% - 12% | 8 inches |
| Greater than 12% | Consider another location |

***Step 4: Sizing Calculations***

This sizing method is designed to capture the majority (more than 90%) of runoff from the roof. If a gutter downspout will run directly into the garden, you will need to find area of the roof that contributes to that gutter. Don't worry, this doesn't require a trip to the roof!

- Just measure the footprint of your house (the area taken up by your house if you were looking down from above).
- Then, estimate how much of this area actually contributes to the gutter downspout. In other words, if it were raining, what portion of the roof area would be contributing water to the garden? This is your drainage area.
- Next, use the soil texture and depth of rain garden to find the proper sizing coefficient.

| Rain Garden Sizing Factors | | | |
|---|---|---|---|
| | **3-5" deep** | **6-7" deep** | **8" deep** |
| Sandy soil | 0.19 | 0.15 | 0.08 |
| Silty soil | 0.34 | 0.25 | 0.16 |
| Clayey soil* | 0.43 | 0.32 | 0.20 |

- Multiply your drainage area by your sizing coefficient. This is the size of your rain garden.

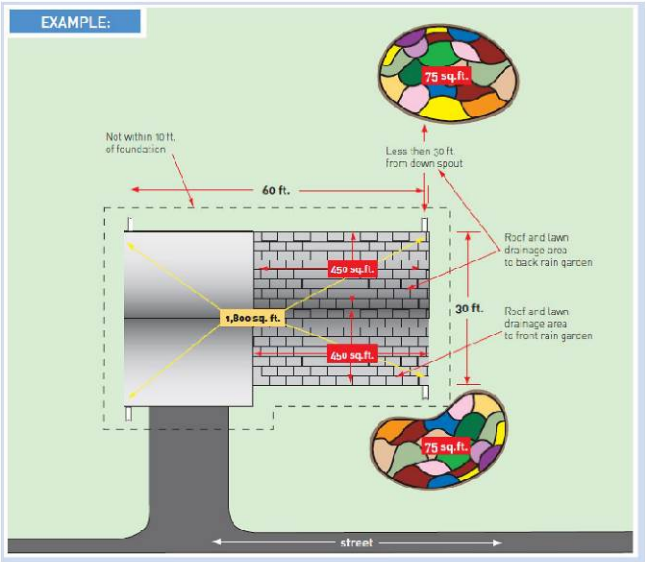
Remember, if the soils are poorly drained, or your test hole still had water after 24 hours, the site is not suitable for a rain garden. A more detailed design manual with accommodations for silty or clayey soils can be found at the following website: http://www.dnr.state.wi.us/runoff/rg/

**Example Sizing Calculation:**

Drainage Area = 450 $ft^2$
Rain Garden Depth = 8 in
Predominant Soil Type = Silty
Sizing Factor = 0.16

Drainage Area x Sizing Factor = Rain Garden Area

450 $ft^2$ x 0.16 = 72 $ft^2$




***Step 4 Installation***

Now it's time to start digging! Smaller gardens can be dug by hand with a shovel, or equipment can be rented for larger gardens. Most gardens for average sized homes can be dug by hand if you are in good health, or have some extra help.

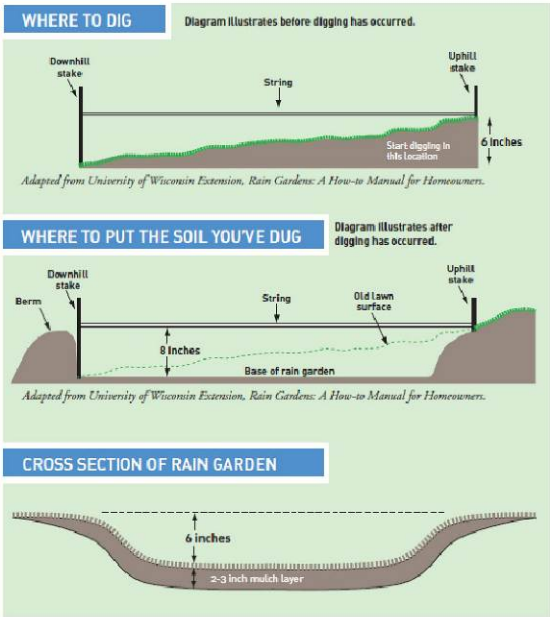
**Before digging, be sure to call the "DIG-SAFE" hotline to locate any underground utilities:**

Once you feel confident in the placement of the garden, **lay out the shape to define where to dig**. A string can be helpful for this.

If the yard is fairly level, you can just dig out the bowl to the proper depth or a couple of inches deeper if mulch will be used. If the yard is sloped, you may need to construct a small berm (mound) at the downslope side of the garden to prevent the soil from washing away after a storm. Use the soil that was removed from upslope side of the garden and add it to the downslope side.

**The bottom of the garden should be fairly level** to maintain the storage area inside the garden. A string or board can be helpful for this: just lay either across the garden (make sure the string is tight) at the level of the lawn, and measure down with a tape measure.

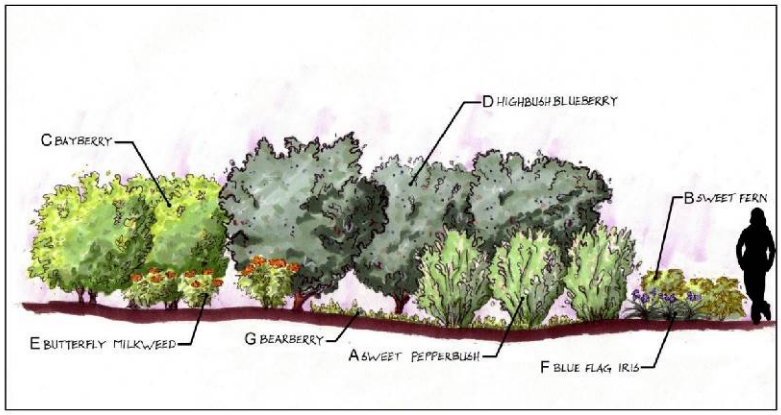
**Slope the edges of the garden**, but don't make them too steep. Steep slopes tend to erode easily. Mulch or a ground cover will help to stabilize the soils.
A word on newer houses... If you have a newer house or if heavy equipment has been used in the area of the rain garden, you may want to loosen up the soil with a rototiller, or by hand, to allow water to soak in more easily. In this situation or any other rain garden, compost or other soil conditioner can be added to enhance plant growth. Just dig the garden a bit deeper to account for the added material.

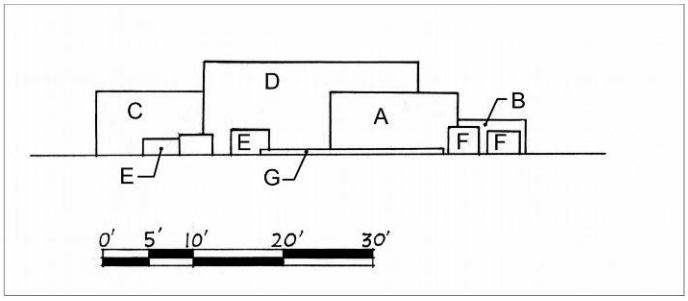


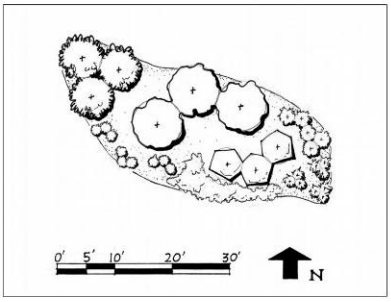

***Step 5: Planting***

Now it's time to plant! The plants that tend to do well in rain gardens are the ones that can tolerate wet conditions, but also very dry conditions. Many plants that are native to Rhode Island fit this description. Refer to:
http://www.uri.edu/cels/ceoc/coastalPlants/CoastalPlantGuide.htm for a list of perennials and shrubs (that will do well in most locations in full sun to partial shade), for Rhode Island rain gardens.

There are many ways to combine plants in a rain garden. Groupings of the same species tend to produce a nice visual impact, but it's really up to you. Be creative! Your local nursery may have suggestions for design layouts, and several examples are listed in the manual from Wisconsin mentioned earlier. See illustration below for an example of plant selections you could use for your rain garden. After planting, a vegetative ground cover or hardwood mulch can be applied to reduce weeds and conserve moisture. If using mulch, make sure that it is shredded hardwood, since pine bark chips tend to float.




***Step 6: Maintenance***

Maintaining your rain garden is not really much different from maintaining any other newly planted landscaped area. Plants will need to be watered until established, and weeding should be performed as necessary. In the years following installation, removal of dead plant material, and replacement of mulch can be performed. Shrubs can be pruned, if desired, but it is not necessary. Now you can sit back and enjoy the beauty of your rain garden, and also know that it is performing an important function in the protection of our water resources!

## *Appendix E: Recommendations for Coodinated Management of QEWA and CBFD Systems from Dr. Urish's 2000 Report*

"All four wells are within about 200 feet of each other and so compete with each other in drawing from the same portion of the aquifer." [Page (i)]

- "The following action is recommended:
  - Maintain existing drawdown controls for limiting well water withdrawal during the heavy use summer period. If not in effect for East Beach, it should be instituted.
  - Maintain close surveillance for system leaks, especially in the summer periods. This should include concern for the potential of private residence water system leaks and breaks.
  - Consider the addition of gravity storage tank(s) to buffer short term peak periods. …
  - Consider combined management of the Central Beach and East Beach systems to effect better operating efficiency and control." [Page (iv)]

- "The proximity of the two [CBFD] wells causes competition for a limited zone of contribution. The situation is further exacerbated by the existence of the two additional East Beach system wells about 200 feet away….Based on the well test and pumping experience there is no additional system capacity…In the short term, a primary concern is that of exceeding the well capacity. … which is limited by the induced drawdown at the well and inherent characteristics." [Page 22]

- "The capacity of the aquifer is limited, but can be optimally utilized by judicious pumping control, associated water quality monitoring and water use conservation when needed… The primary concern is water use peaking which occurs in the dry summer period when there is essentially no aquifer recharge." [Page 23]

- "The Central Beach and East Beach systems are really inseparable since the four wells are within 200 feet of each other and are drawing from the same aquifer." [Page 31]

- "A greater future potential concern is contamination caused by usage above system capacity; if the pumping is unable to meet user demands, then the higher elevations of the system may experience negative pressures and pull in external contaminated water from systems leaks and poor connections…The current pressure storage tanks provide less than an hour of storage which could be available in the event of pumping well loss through power loss or contamination. The addition of a 100,000 [gallon] elevated steel tank could maintain a safe positive pressure in the systems and supply the current 241 connected users (estimated 960 persons) [year 2000] with an emergency supply of about 34 gallons/person per day for 3 days…In addition, the supply allows pumping peaks to be reduced thus reducing stress and potential dewatering of the wells." [Page 32]