



Meadow Brook

Watershed Description

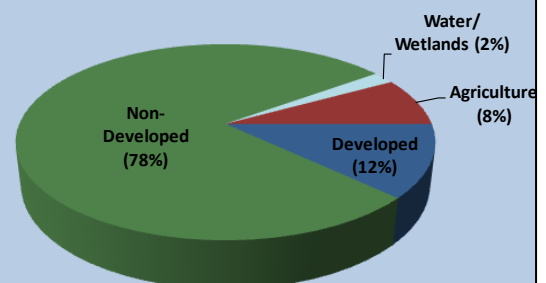
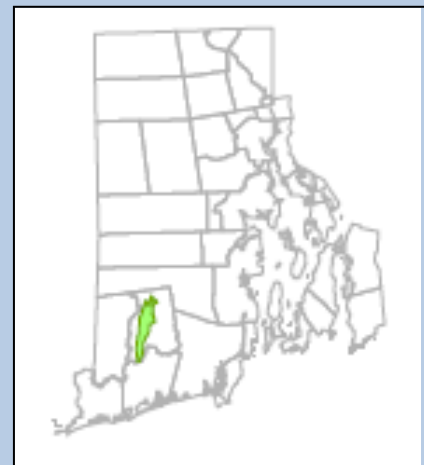
This **TMDL** applies to the Meadow Brook assessment unit (RI0008039R-13), a 10-mile long stream located in Richmond, RI (Figure 1). The Town of Richmond is located in the southwestern portion of the state and is bordered to the east by South Kingstown, to the west by Hopkinton, to the north by Exeter, and to the south by Charlestown. Meadow Brook is located in the western portion of town. The Meadow Brook watershed is presented in Figure 2 with land use types indicated.

Meadow Brook begins in a forested area near Baker Pine Road. The brook flows south parallel to Route 112 and passes east of Richmond Sand and Gravel. Meadow Brook crosses the intersection of Routes 112 and 138 and flows east, along the edge of the Meadow Brook Golf Course and through residential developments. The brook continues south, flows through the Carolina Wildlife Management Area, and crosses Pine Hill Road. The brook then flows through an area characterized by agriculture and forms Meadow Brook Pond before it empties into the Pawcatuck River near the border with Charlestown.

The Meadow Brook watershed covers 8.1 square miles. The watershed is predominately non-developed (78%) and includes a portion of the Carolina Wildlife Management Area. Developed uses (including residential, commercial, and transportation uses) occupy approximately 12%. Agricultural land uses occupy 8% and are concentrated in the southern portion of the watershed. Open water and wetland areas occupy 2% of the Meadow Brook watershed.

Assessment Unit Facts *(RI0008039R-13)*

- **Town:** Richmond
- **Impaired Segment Length:** 10 miles
- **Classification:** Class A
- **Direct Watershed:** 8.1 mi² (5157 acres)
- **Impervious Cover:** 4.2%
- **Watershed Planning Area:** Wood-Pawcatuck (#23)



Watershed Land Uses

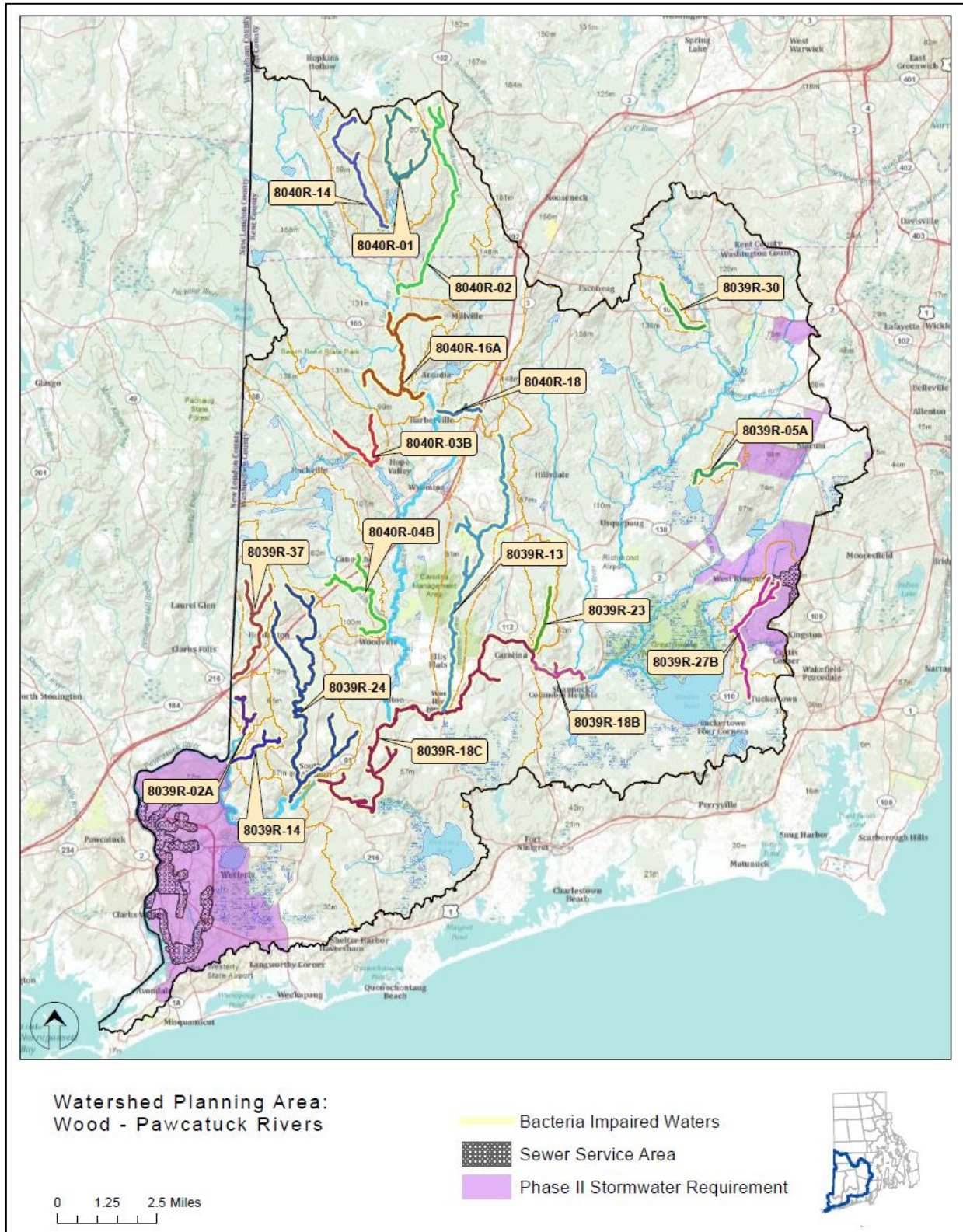


Figure 1: Map of the Wood-Pawcatuck Planning Area with impaired segments addressed by the Statewide Bacteria TMDL, sewered areas, and stormwater regulated zones.

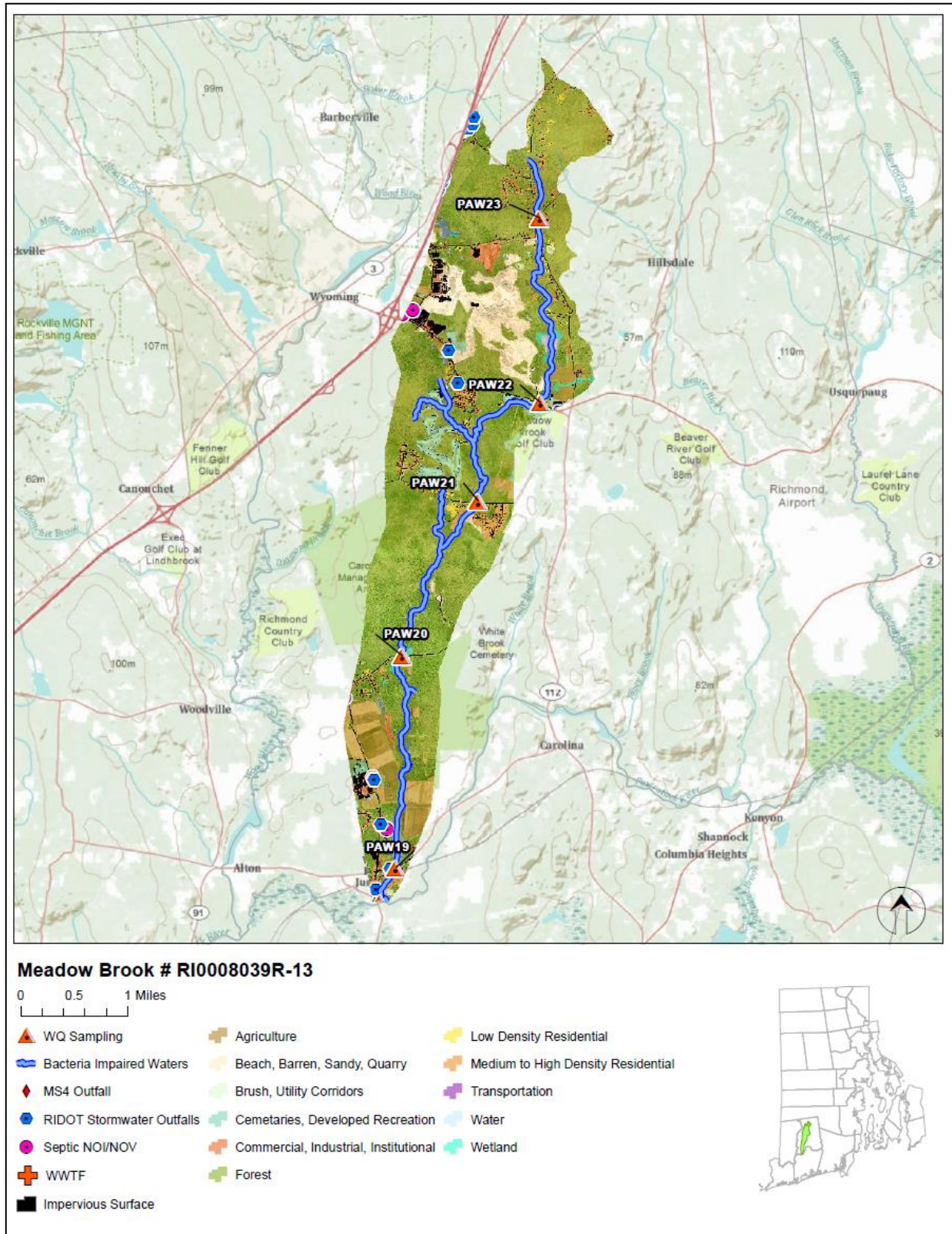


Figure 2: Map of the Meadow Brook watershed with impaired segment, sampling locations, and land cover indicated.

Why is a TMDL Needed?

Meadow Brook is a Class A fresh water stream, and its applicable designated uses are primary and secondary contact recreation and fish and wildlife habitat (RIDEM, 2009). From 2005 to 2006 and in 2008, water samples were collected from five sampling locations and analyzed for the indicator bacteria, enterococci. The water quality criteria for enterococci, along with bacteria sampling results from 2005-2006 and 2008 and associated statistics are presented in Table 1. The geometric mean was calculated for all stations and exceeded the water quality criteria for enterococci at all stations except PAW23, which is located in the headwaters of the brook. All samples were taken in dry-weather conditions.

Due to the elevated bacteria measurements presented in Table 1, Meadow Brook does not meet Rhode Island's bacteria water quality standards, is identified as impaired, and was placed on the 303(d) list (RIDEM, 2008). The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with state water quality standards.



Figure 3: Partial aerial view of the Meadow Brook watershed (Source: Google Maps)

Potential Bacteria Sources

There are several potential sources of bacteria in the Meadow Brook watershed including malfunctioning onsite wastewater treatment systems, agricultural and stormwater runoff, and waterfowl, wildlife, and domestic animal waste.

Onsite Wastewater Treatment Systems

All residents in the Meadow Brook watershed rely on onsite wastewater treatment systems (OWTS) such as cesspools and septic systems. Failing OWTS can be significant sources of bacteria by allowing improperly treated waste to reach surface waters (RI HEALTH, 2003). If systems are improperly sized, malfunctioning, or in soils poorly suited for septic waste disposal, microorganisms such as bacteria, can easily enter surface water (USEPA, 2002). As shown in Figure 2, two OWTS Notices of Violation/Notices of Intent to Violate have been issued by the RIDEM Office of Compliance and Inspection in the Meadow Brook watershed.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in the state's rural areas. The Town of Richmond has multiple horse and dairy farms (Fuss and O'Neill, 2007). Agricultural runoff may contain pollutants, such as bacteria. Agricultural practices such as allowing livestock to graze near streams, crossing livestock through waterbodies, spreading manure as fertilizer, and improper disposal of manure can contribute to bacterial contamination.

Waterfowl, Wildlife and Domestic Animal Waste

Most of the Meadow Brook watershed is undeveloped. Wildlife, including waterfowl, may be a significant bacteria source to surface waters. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. As such these physical land alterations can exacerbate the impact of these natural sources on water quality. Waterfowl and wildlife living in the forested and wetland areas throughout the Carolina Management Area within the watershed may be contributing bacteria to Meadow Brook.

Residential development is concentrated in the western portion of the watershed. Waste from domestic animals, such as dogs, in these residential neighborhoods, may also be contributing to bacteria concentrations in Meadow Brook.

Geese are known to congregate in open areas including recreational fields and golf courses. In addition, to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas

and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants. Lastly, large populations of Canada Geese are also problematic for farmers, as they are known to destroy cover crops, which can lead to erosion of farm fields and potential further habitat damage downstream.

Developed Area Stormwater Runoff

Though only a small portion of the Meadow Brook watershed is developed, most of the development is concentrated in the northwestern and southern portions of the watershed. The Meadow Brook watershed has an impervious cover of 4.2%. Impervious cover is defined as land surface areas, such as roofs and roads that force water to run off land surfaces, rather than infiltrating into the soil. Impervious cover provides a useful metric for the potential for adverse stormwater impacts. While runoff from impervious areas in these portions of the watershed may be contributing bacteria to Meadow Brook, as discussed in Section 6.3 of the Core TMDL Document, as a general rule, impaired streams with watersheds having less than 10% impervious cover are assumed to be caused by sources other than urbanized stormwater runoff.

As part of Phase II requirements, the Rhode Island Department of Transportation (RIDOT) has identified and mapped stormwater outfalls within the Town of Richmond. As shown in Figure 2, multiple outfalls are found in the Meadow Brook watershed.

Existing Local Management and Recommended Next Steps

Additional bacteria data collection would be beneficial to support identification of sources of potentially harmful bacteria in the Meadow Brook watershed. These activities could include sampling at several different locations and under different weather conditions (e.g., wet and dry). Field reconnaissance surveys focused on stream buffers, stormwater runoff, and other source identification may also be beneficial.

Based on existing ordinances and previous investigations, the following steps are recommended to support water quality goals.

Onsite Wastewater Management

All residents of the Town of Richmond and the Meadow Brook watershed rely on OWTS (Fuss and O'Neill, 2007). The Town of Richmond has a draft Onsite Wastewater Management Plan that provides a framework for managing the OWTS. As part of an onsite wastewater planning process, Richmond should adopt ordinances to establish enforceable mechanisms to ensure that existing OWTS are properly

operated and maintained. RIDEM recommends that all communities create an inventory of onsite systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of sub-standard OWTS within a reasonable time frame should be adopted. The Rhode Island Wastewater Information System (RIWIS) can help develop an initial inventory of OWTS and can track voluntary inspection and pumping programs (RIDEM, 2010b).

The Town of Richmond is not eligible for the Community Septic System Loan Program (CSSLP). The CSSLP program provides low-interest loans to residents to help with maintenance and replacement of OWTS. It is recommended that the town develop a program to assist citizens with the replacement of older and failing systems.

Stormwater Management

RIDOT is a municipal separate storm sewer system (MS4) operator (RIPDES permit RIR040036) in the Meadow Brook watershed and has prepared the required Phase II Stormwater Management Plan for state-owned roads within the Rhode Island. The Town of Richmond is not currently regulated under the Phase II program. However, it is anticipated that Richmond will be regulated within the next few years (Fuss and O'Neill, 2007).

RIDOT's SWMPP and its 2011 Compliance Update outline its goals for compliance with the General Permit statewide. It should be noted that RIDOT has chosen to enact the General Permit statewide, beyond the General Permit's requirements regarding stormwater from urbanized and densely populated areas, as well as from divided highways outside of the urbanized and densely populated areas. RIDOT has finished mapping its outfalls throughout the state and is working to better document and expand its catch basin inspection and maintenance programs along with its BMP maintenance program. SWMPPs are being utilized for RIDOT construction projects. RIDOT also funds the University of Rhode Island Cooperative Extension's Stormwater Phase II Public Outreach and Education Project, which provides participating MS4s with education and outreach programs that can be used to address TMDL public education recommendations.

The Town of Richmond has developed an initial Phase II SWMPP in anticipation of Phase II regulations in the future. This SWMPP outlines existing stormwater programs and notes goals for these programs in the future. Richmond currently has an annual cleaning and inspection program for its 450 catch basins, and an annual street sweeping program (Fuss and O'Neill, 2007). The town has not mapped or identified their stormwater outfalls or adopted an IDDE ordinance.

The Town of Richmond does not currently have an ordinance to address illicit discharges (Fuss and O'Neill, 2007). This type of ordinance prohibits illicit discharges to the storm drain system and

provides an enforcement mechanism. It is recommended that any stormwater outfalls discharging in the near vicinity of sampling locations with violations in the water quality criteria be monitored to check for illicit discharges. Illicit discharges can be identified through dry weather outfall sampling and microbial source tracking.

As it is assumed that stormwater runoff is not the major contributor of bacteria to Meadow Brook based on the watershed's imperviousness, RIDOT will have no changes to their Phase II permit requirements and no TMDL Implementation Plan (TMDL IP) will be required at this time.

Waterfowl, Wildlife, and Domestic Animal Waste

The Town of Richmond should develop education and outreach programs to highlight the importance of picking up after dogs and other pets and not feeding waterfowl. Animal wastes should be disposed of away from any waterway or stormwater system. Richmond should work with volunteers to map locations where animal waste is a significant and chronic problem. The town should also evaluate strategies to reduce the impact of animal waste on water quality. This may include installing signage, providing pet waste receptacles or pet waste digester systems in high-use areas, enacting ordinances requiring clean-up of pet waste, and targeting educational and outreach programs in problem areas.

Towns and residents can take several measures to minimize waterfowl-related impacts. They can allow tall, coarse vegetation to grow in areas along the shores of Meadow Brook that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to the water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. With few exceptions, Part XIV, Section 14.13, of Rhode Island's Hunting Regulations prohibits feeding wild waterfowl at any time in the state of Rhode Island. Educational programs should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in Meadow Brook and can harm human health and the environment. In addition to the options discussed above, there are various options for controlling nuisance populations of geese congregating in open areas. These other options can include making the habitat less hospitable for geese, using dogs or loud noises to discourage geese from congregating, or even hunting.

Agricultural Activities

If not already in place, agricultural producers should work with the RIDEM Division of Agriculture, and the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) to develop a conservation plan for farming activities, particularly at the horse farms in the watershed. NRCS and the RIDEM Division of Agriculture should continue to work with agricultural operations in the watershed to ensure that there are sufficient stream buffers, have fencing to restrict access of livestock and horses to streams and wetlands, and have animal waste handling, disposal, and other appropriate BMPs in place.

Land Use Protection

Woodland and wetland areas within the Meadow Brook watershed, particularly in the Carolina Wildlife Management Area absorb and filter pollutants from stormwater runoff, and help protect both water quality in the stream and stream channel stability. As these areas represent the majority of the land use in the Meadow Brook watershed, it is important to preserve these undeveloped areas, and institute controls on development in the watershed.

The steps outlined above will support the goal of mitigating bacteria sources and meeting water quality standards in Meadow Brook.

Table 1: Meadow Brook Bacteria Data

Waterbody ID: RI0008040R-13

Watershed Planning Area: 23 – Wood-Pawcatuck

Characteristics: Freshwater, Class A, Primary and Secondary Contact Recreation, Fish and Wildlife Habitat

Impairment: Enterococci (colonies/100mL)

Water Quality Criteria for Enterococci: Geometric Mean: 54 colonies/100 mL

Percent Reduction to meet TMDL: 71% (Includes 5% Margin of Safety)

Data: 2005-2006, 2008 from RIDEM

Single Sample Enterococci (colonies/100 mL) Results for Meadow Brook (2005 – 2006; 2008) including Geometric Mean Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean *
PAW23	Buttonwood Corner, Carolina Nooseneck Rd	10/27/2006	4	Dry	25
PAW23	Buttonwood Corner, Carolina Nooseneck Rd	8/9/2006	170	Dry	
PAW23	Buttonwood Corner, Carolina Nooseneck Rd	5/31/2006	24	Dry	
PAW22	Rt 138 (near Meadow Brook Golf Club)	10/27/2006	22	Dry	159 [†] (71%)*
PAW22	Rt 138 (near Meadow Brook Golf Club)	8/9/2006	920	Dry	
PAW22	Rt 138 (near Meadow Brook Golf Club)	5/31/2006	200	Dry	
PAW21	Kenyon Hill Trail, Richmond	10/27/2006	57	Dry	110
PAW21	Kenyon Hill Trail, Richmond	8/9/2006	340	Dry	
PAW21	Kenyon Hill Trail, Richmond	5/31/2006	68	Dry	
PAW21	Kenyon Hill Trail, Richmond	9/21/2005	110	Dry	
PAW20	USGS Gage 1117600, Pine Hill Road	7/31/2008	154	Dry	125
PAW20	USGS Gage 1117600, Pine Hill Road	10/27/2006	14	Dry	
PAW20	USGS Gage 1117600, Pine Hill Road	8/9/2006	650	Dry	
PAW20	USGS Gage 1117600, Pine Hill Road	5/31/2006	44	Dry	
PAW20	USGS Gage 1117600, Pine Hill Road	9/21/2005	490	Dry	
PAW19	Outlet of impoundment on Rte 91	7/30/2008	201	Dry	62
PAW19	Outlet of impoundment on Rte 91	10/27/2006	3	Dry	
PAW19	Outlet of impoundment on Rte 91	8/9/2006	2100	Dry	
PAW19	Outlet of impoundment on Rte 91	5/31/2006	12	Dry	

Shaded cells indicate an exceedance of water quality standards
 *Includes 5% Margin of Safety
 †Indicates geometric mean used to calculate percent reduction

Wet and Dry Weather Enterococci Geometric Mean Values for each Station

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
PAW23	Buttonwood Corner, Carolina Nooseneck Rd	2006	0	3	25	NA	25
PAW22	Rt 138 (near Meadow Brook Golf Club)	2006	0	3	159	NA	159
PAW21	Kenyon Hill Trail, Richmond	2005-2006	0	4	110	NA	110
PAW20	USGS Gage 1117600, Pine Hill Rd	2005-2008	0	5	125	NA	125
PAW19	Outlet of impoundment on Rte 91	2006-2008	0	4	62	NA	62

Shaded cells indicate an exceedance of water quality standards
 Weather condition determined from rain gage at URI in Kingston, RI

References

- Fuss and O'Neill (2007). Stormwater Management Program Plan. Town of Richmond, RI. October 2007.
- RIDEM (2008). State of Rhode Island and Providence Plantations 2008 303(d) List – List of Impaired Water Bodies. Rhode Island Department of Environmental Management.
- RIDEM (2009). State of Rhode Island and Providence Plantations Water Quality Regulations. Amended December, 2009. Rhode Island Department of Environmental Management.
- RIDEM (2010b). Total Maximum Daily Load Analysis for the Pawcatuck River and Little Narragansett Bay Waters (Bacteria Impairments). Rhode Island Department of Environmental Management.
- RI HEALTH (2003). Aquidneck Island Drinking Water Assessment Results, Source Water Protection Assessment conducted by the University of Rhode Island for the Rhode Island Department of Health, Office of Drinking Water Supply.
- USEPA (2002). Onsite Wastewater Treatment Systems Manual – Office of Water, Office of Research and Development – EPA/625/R-00/008. Online:
www.epa.gov/owm/septic/pubs/septic_2002_osdm_all.pdf.