



Maidford River (Segment 2A)

Watershed Description

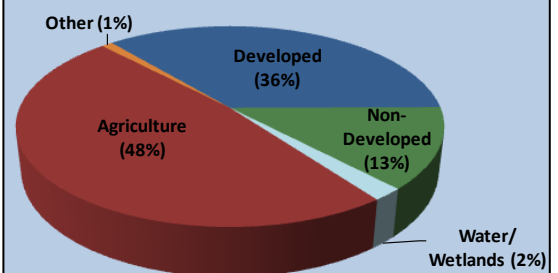
This **TMDL** applies to the Maidford River assessment unit (RI0007035R-02A), a 3.4-mile long stream segment located in Middletown, RI (Figure 1). The Town of Middletown is located on Aquidneck Island and the Maidford River is located in the southern portion of the Island. The Maidford River watershed is presented in Figure 2 with land use indicated.

The headwaters of the Maidford River begin in a small pond in a topographic depression south of Meadow Lane and east of East Main Road (Route 138) in the central part of the Town of Middletown. The river flows south through agricultural fields along Berkley Avenue and Paradise Avenue to Sachuest Point. This segment of the Maidford River ends just before the stream flows east along Nelson and Gardiner Ponds and discharges into the Sakonnet River, at Third Beach, though water from the lower segment is also diverted into Gardiner Pond. Nelson and Gardiner Ponds are two of the four surface water drinking reservoirs on Aquidneck Island. The Maidford River is connected to Paradise Brook, although the Maidford River only receives flow from Paradise Brook during periods of flooding and high flows (Berger, 2006a).

This portion of the Maidford River watershed covers 2.3 square miles. As shown in the aerial image of Figure 3, agricultural uses occupy approximately half (48%) of the Maidford River watershed. Developed uses (including residential and commercial uses) occupy approximately 36% of the land area. Impervious surfaces cover a total of 11.5% of the watershed. Non-developed areas, such as forests, occupy 13%, wetland and surface waters occupy 2%.

Assessment Unit Facts (RI0007035R-02A)

- **Town:** Middletown
- **Impaired Segment Length:** 3.4 miles
- **Classification:** Class AA
- **Direct Watershed:** 2.3 mi² (1482 acres)
- **Impervious Cover:** 11.5%
- **Watershed Planning Area:** Aquidneck Island (#1)



Watershed Land Uses

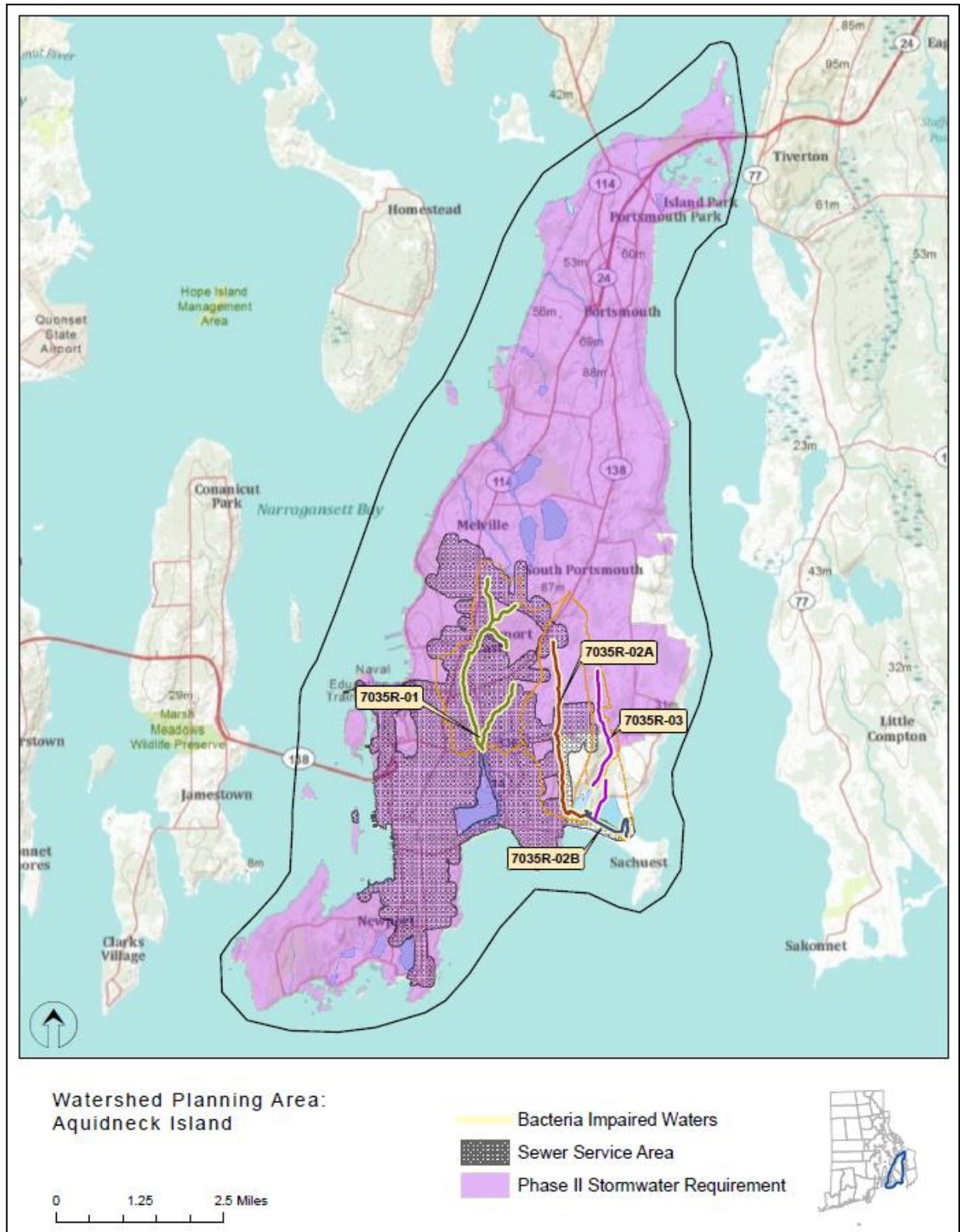


Figure 1: Map of Aquidneck Island with impaired segments addressed by the Statewide Bacteria TMDL, sewer service areas, and stormwater regulated zones.

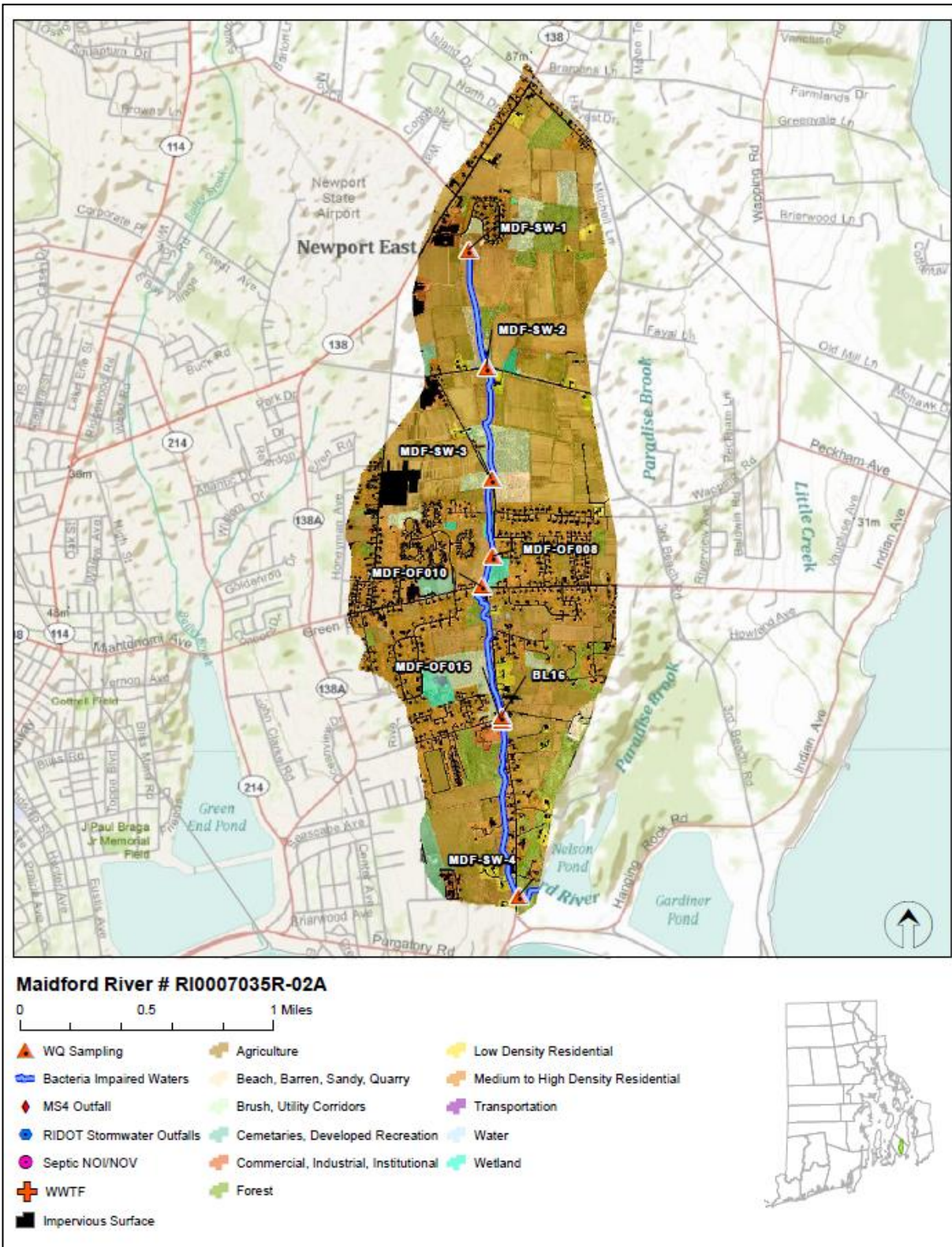


Figure 2: Map of the Maidford River watershed with impaired segment, sampling locations, and land cover indicated.

Why is a TMDL Needed?

The Maidford River Segment 2A is a Class AA fresh water stream and a tributary within Newport's public drinking water supply system. However, as it is not a terminal reservoir, its applicable designated uses are primary and secondary contact recreation (RIDEM, 2009). Due to its location within a drinking water supply and its designation as a critical habitat for rare and endangered species, the Maidford River Segment 2A has been designated by RIDEM as a Special Resource Protection Water (SRPW), providing them with special protections under RIDEM's Antidegradation Provisions. SRPWs are high quality surface waters that have been identified as having significant ecological or recreational uses and/or are public water supplies.



Figure 3: Partial aerial view of the Maidford River watershed (Source: Google Maps)

From 2000-2003 and 2005, water samples were collected from five sampling locations (Figure 2) and analyzed for the indicator bacteria, fecal coliform. The water quality criteria for fecal coliform, along with bacteria sampling results from 2000-2003 and 2005 and associated statistics are presented in Table 1. During all years sampled and at all five sampling locations, the 90th percentile maximum for these data exceeded the water quality criteria value. The geometric mean criterion for fecal coliform was exceeded at three of the five stations.

To aid in identifying possible bacteria sources, the geometric mean and 90th percentile values were also calculated for each station for wet and dry weather sample days, where appropriate. Both wet and dry 90th percentile values exceeded the water quality criteria for fecal coliform bacteria, with wet-weather values higher than dry-weather values. All wet-weather and most dry-weather geometric mean values exceeded the water quality criteria, with wet-weather values also higher than dry-weather values.

Due to the elevated bacteria measurements presented in Table 1, the Maidford River 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.

This segment of the Maidford River has also been assessed by RIDEM as not meeting water quality standards for biodiversity and lead, though no TMDLs have been completed for these impairments.

Potential Bacteria Sources

There are several potential sources of bacteria in the Maidford River watershed including agricultural activities, stormwater runoff from developed areas, and illicit discharges.

Agricultural Activities

As indicated in Figures 2 and 3, the Maidford River watershed is highly agricultural (48%), particularly in the northern and central portions of the watershed. Agricultural operations are an important economic activity and landscape feature in many areas of the state. There are approximately 14 farms in the Town of Middletown, and multiple cattle farms are located within the watershed itself (Berger, 2006a). Agricultural practices such as allowing livestock to graze near streams, crossing livestock through waterbodies, and spreading manure as fertilizer may contribute to bacterial contamination. A 2003 Department of Health ribotyping study and a 2005 DNA-analysis in the Maidford River identified cattle and other farm animals as a major source of bacteria to the northern portion of the river (Berger, 2006a).

Developed Area Stormwater Runoff

The Maidford River watershed is 36% developed and is characterized by medium to high density residential development. The watershed also has an impervious cover of 11.5%. 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. Based on the Maidford River watershed's imperviousness, adverse stormwater impacts to the receiving stream appear likely. As discussed in Section 6.3 of the Core TMDL Document, as a general rule, impaired streams with watersheds having more than 10% impervious cover are assumed to be impacted by stormwater runoff.

In 2008, all stormwater outfalls and catch basins throughout Middletown were mapped as part of Phase II requirements (Berger, 2008). The Maidford River was shown to receive discharges from approximately 25 stormwater outfalls. Since stormwater is known to carry a suite of pollutants, including bacteria, and wet-weather geometric mean and 90th percentile values exceeded the water quality criteria for fecal coliform, stormwater is a likely source of bacterial contamination to the Maidford River.

Onsite Wastewater Treatment Systems

The Maidford River watershed is mostly sewered, but also relies on onsite wastewater treatment systems (OWTS), such as septic systems and cesspools. Failing OWTS can be significant sources of bacteria by allowing improperly treated waste to reach surface waters (RI HEALTH, 2003). However, as shown in Figure 2, no OWTS Notices of Violation/Notices of Intent to Violate have been issued by the RIDEM Office of Compliance and Inspection in the Maidford River watershed.

Sewer Leaks

Sewer system leaks and other illicit discharges have historically been reported in Middletown (Berger, 2008). One of Middletown's two municipal sewer system's interceptor lines runs parallel to this segment of the Maidford River near Paradise Avenue (Berger, 2006b). Any leaks to this line would likely contribute bacteria to the Maidford River.

Waterfowl, Wildlife, and Domestic Animal Waste

Waterfowl, wildlife, and domestic animals within the Maidford River watershed represent another potential source of bacteria. 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.

Existing Local Management and Recommended Next Steps

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

Based on existing ordinances and previous investigations (RI HEALTH, 2003), the following steps are recommended to support water quality goals.

Agricultural Activities

If not already in place, agricultural producers within the Maidford River watershed should work with the RIDEM Division of Agriculture and the U.S. Department of Agriculture Natural Resources and Conservation Service (NRCS) to develop conservation plans for their farming activities within the watershed. These plans should ensure that there are sufficient stream buffers, that fencing exists to

restrict access of livestock and horses to streams and wetlands, and that animal waste handling, disposal, and other appropriate BMPs are in place. Fencing or natural vegetative buffers should be installed to mitigate the potential for bacteria contamination from animals, particularly in the northern portion of the watershed where cattle farms have previously been identified as potential sources of bacteria to the Maidford River.

Stormwater Management

The Town of Middletown (RIPDES permit RIR040032) and the Rhode Island Department of Transportation (RIDOT, RIPDES permit RIR040036) are municipal separate storm sewer system (MS4) operators in the Maidford River watershed and both have prepared the required Phase II Stormwater Management Plans (SWMPP). The entire watershed is regulated under the Phase II program. Middletown's SWMPP (2008) outlines the goals for the reduction of stormwater runoff to the Maidford River through the implementation of Best Management Practices (BMPs). Many of these BMPs are now in place, including mapping all stormwater outfalls, instituting annual inspections and cleaning of the town's 1400 catch basins, implementing an annual street sweeping program, adopting construction erosion and sediment control and post-construction stormwater ordinances, and conducting public education activities (RIDEM, 2010a).

In 2006, the Town of Middletown adopted an illicit discharge detection and elimination ordinance, based on the model ordinance developed by the Center for Watershed Protection (Berger, 2008). This ordinance prohibits illicit discharges to the MS4 and provides an enforcement mechanism. The town should continue to locate priority areas to identify and eliminate illicit discharges in the Maidford River watershed (Berger, 2008). Illicit discharges can be identified through continued dry weather outfall sampling and microbial source tracking. Future efforts should also be focused on identifying and remediating the sources of dry weather flows in stormwater outfall MR10.

RIDOT has completed a SWMPP for state-owned roads in the watershed. 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, not just for the urbanized and densely populated areas that are required by the permit. 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. Storm Water Pollution Prevention Plans (SWPPP) 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.

While these first steps are important to reduce the effects of stormwater runoff to the Maidford River, additional efforts are needed to restore the river's water quality. As mentioned previously, the Maidford River watershed has an impervious cover of 11.5%, a level where stormwater impacts are expected. At this threshold, RIDEM is requiring the MS4 operators to revise their post-construction ordinances and continue to comply with and adapt the minimum measures to reflect the bacteria impairments in the regulated areas. Information regarding plans to revise the post construction ordinance should be documented in a TMDL Implementation Plan (TMDL IP). Unless otherwise noted in this waterbody summary, any other TMDL IP requirements described in Section 6.2 of the Core TMDL Document are not applicable to the MS4 operators' for watershed areas having impervious cover between 10 and 15 %. Information regarding how the MS4 operators' minimum measures are addressing the pollutant of concern (i.e. bacteria) should be documented in the MS4 operators' annual report, consistent with Part IV.G.2.d of the RIPDES General Permit (RIDEM, 2010b). Further detail is also included in Sections 6.3 of the Core TMDL Document.

The Town of Middletown should continue to implement the goals of its Phase II Stormwater Management Plan (2008) including dry weather sampling, extensive street and catch basin cleaning programs, and public education activities (Berger, 2008). RIDOT should also continue to implement its Phase II Stormwater Management Plan.

Onsite Wastewater Management

Though the majority of the Maidford River watershed is sewered, a portion of the watershed relies on OWTS. Currently, the Town of Middletown does not have an Onsite Wastewater Management Plan. As part of an onsite wastewater planning process, Middletown should adopt ordinances to establish enforceable mechanisms to ensure that existing OWTS are properly operated and maintained. RIDEM recommends that communities create an inventory of OWTS through mandatory inspections. Inspections encourage proper maintenance and identify failed and sub-standards systems. Policies that govern the eventual replacement of sub-standard OWTS and cesspools within a reasonable time frame should be adopted. The Rhode Island Wastewater Information Systems (RIWIS) can help develop an initial inventory of OWTS and can track voluntary inspection and pumping programs (RIDEM, 2010b).

The Town of Middletown 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.

Waterfowl, Wildlife, and Domestic Animal Waste

Middletown's education and outreach programs should highlight the importance of picking up after horses, dogs, and other pets and not feeding waterfowl, particularly in the lower portion of the watershed. Animal wastes should be disposed of away from any waterway or stormwater system. Middletown should work with volunteers from the town to map locations where animal waste is a significant and chronic problem. This work should be incorporated into the municipalities' Phase II plans and should result in an evaluation of 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.

The town 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 the Maidford River 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 the Maidford River and can harm human health and the environment. Middletown should ensure that discussion of this regulation is included in their SWMPPs.

Land Use Protection

Currently, the Maidford River watershed is approximately 64% undeveloped, a large portion of which is in agricultural production. A portion of the undeveloped lands is protected as open space. As source waters to the Newport water supply system, preserving these natural areas is particularly important. Woodland and wetland areas within the Maidford River watershed absorb and filter pollutants from stormwater and agricultural runoff, and help protect both water quality in the stream and stream channel stability. These areas represent approximately 15% of the land use in the Maidford River watershed. It is important to preserve these undeveloped areas, and institute controls on development in the Maidford River watershed (RI HEALTH, 2003).

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

Table 1: Maidford River Bacteria Data

Waterbody ID: RI0007035R-02A

Watershed Planning Area: 1 – Aquidneck Island

Characteristics: Freshwater, Class AA, Tributary within a Public Drinking Supply, Primary and Secondary Contact Recreation, Special Resource Protection Water (SRPW)

Impairment: Fecal Coliform (MPN/100mL)

Water Quality Criteria for Fecal Coliform:

Geometric Mean: 200 MPN/100 mL

90th Percentile Maximum: 400 MPN/100 mL

Percent Reduction to meet TMDL: 100% (Includes Margin of Safety)

Data: 2000-2003; 2005 from RIDEM

Single Sample Fecal Coliform (MPN/100 mL) Results for the Maidford River (2000-2003; 2005) with Geometric Mean and 90th Percentile Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
MDF-SW1 [‡]	Maidford Headwaters	10/5/2005	500	Dry	320	1160
MDF-SW1 [‡]	Maidford Headwaters	8/31/2005	1600	Wet		
MDF-SW1 [‡]	Maidford Headwaters	7/8/2005	280	Wet		
MDF-SW1 [‡]	Maidford Headwaters	6/24/2005	500	Dry		
MDF-SW1 [‡]	Maidford Headwaters	6/12/2005	30	Dry		
MDF-SW2 [‡]	Wyatt Road	10/5/2005	300	Dry	746	1600
MDF-SW2 [‡]	Wyatt Road	8/31/2005	1600	Wet		
MDF-SW2 [‡]	Wyatt Road	8/18/2005	1600	Dry		
MDF-SW2 [‡]	Wyatt Road	7/8/2005	900	Wet		
MDF-SW2 [‡]	Wyatt Road	6/24/2005	500	Dry		
MDF-SW2 [‡]	Wyatt Road	6/12/2005	500	Dry		
MDF-SW3 [‡]	Berkeley Road	10/5/2005	1400	Dry	678	1600
MDF-SW3 [‡]	Berkeley Road	8/31/2005	1600	Wet		
MDF-SW3 [‡]	Berkeley Road	8/18/2005	300	Dry		
MDF-SW3 [‡]	Berkeley Road	7/8/2005	1600	Wet		
MDF-SW3 [‡]	Berkeley Road	6/24/2005	300	Dry		
MDF-SW3 [‡]	Berkeley Road	6/12/2005	300	Dry		

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
BL16	Prospect Ave.	12/18/2003	210	Wet	152	650
BL16	Prospect Ave.	9/10/2003	560	Dry		
BL16	Prospect Ave.	6/16/2003	440	Dry		
BL16	Prospect Ave.	3/16/2003	62	Dry		
BL16	Prospect Ave.	12/18/2002	25	Dry		
BL16	Prospect Ave.	7/31/2002	390	Dry		
BL16	Prospect Ave.	6/11/2002	310	Dry		
BL16	Prospect Ave.	3/22/2002	43	Dry		
BL16	Prospect Ave.	11/2/2001	120	Dry		
BL16	Prospect Ave.	7/27/2001	2000	Wet		
BL16	Prospect Ave.	6/20/2001	740	Dry		
BL16	Prospect Ave.	3/20/2001	40	Dry		
BL16	Prospect Ave.	12/11/2000	190	Dry		
BL16	Prospect Ave.	9/18/2000	250	Dry		
BL16	Prospect Ave.	5/31/2000	69	Dry		
BL16	Prospect Ave.	3/16/2000	8	Dry		
MDF-SW4 [‡]	Paradise Avenue	10/5/2005	20	Dry	443	10160[†] (100%)*
MDF-SW4 [‡]	Paradise Avenue	8/31/2005	1600	Wet		
MDF-SW4 [‡]	Paradise Avenue	8/18/2005	140	Dry		
MDF-SW4 [‡]	Paradise Avenue	7/8/2005	170	Wet		
MDF-SW4 [‡]	Paradise Avenue	6/24/2005	1600	Dry		
MDF-SW4 [‡]	Paradise Avenue	6/12/2005	50	Dry		
WW	Paradise Avenue	9/18/2004	4200	Wet		
WW	Paradise Avenue	10/16/2004	34000	Wet		
OCI-8	Paradise Avenue	8/21/2000	75	Dry		

Shaded cells indicate an exceedance of water quality criteria

*Includes Margin of Safety

[†]Geometric mean or 90th percentile used to determine percent reduction

[‡]Station prefix is LBG

Wet and Dry Geometric Mean Fecal Coliform Values for all Stations

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
MDF-SW1 [‡]	Maidford Headwaters	2005	2	3	320	669	196
MDF-SW2 [‡]	Wyatt Road	2005	2	4	746	693	589
MDF-SW3 [‡]	Berkeley Road	2005	2	4	678	1600	441
BL16	Prospect Ave.	2000-2003	2	14	152	648	123
MDF-SW4 [‡] , WW, OCI-8	Paradise Avenue	2000, 2004-2005	4	5	443	2496	111

Shaded cells indicate an exceedance of water quality criteria
 Weather condition determined from rain gage at Newport County Airport in Middletown, RI or at Kingston, RI if
 Newport data was not available.
[‡] Station prefix is LBG

Wet and Dry Weather 90th Percentile Fecal Coliform Values for all Stations

Station Name	Station Location	Years Sampled	Number of Samples		90th Percentile Value		
			Wet	Dry	All	Wet	Dry
MDF-SW1 [‡]	Maidford Headwaters	2005	2	3	1160	1468	500
MDF-SW2 [‡]	Wyatt Road	2005	2	4	1600	1530	1270
MDF-SW3 [‡]	Berkeley Road	2005	2	4	1600	1600	1070
BL16	Prospect Ave.	2000-2003	2	14	650	1821	524
MDF-SW4 [‡] , WW, OCI-8	Paradise Avenue	2000, 2004-2005	4	5	10160	25060	1016

Shaded cells indicate an exceedance of water quality criteria
 Weather condition determined from rain gage at Newport County Airport in Middletown, RI or at Kingston, RI if
 Newport data was not available
[‡] Station prefix is LBG

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