Moshassuck River (Segment 1B)

Watershed Description

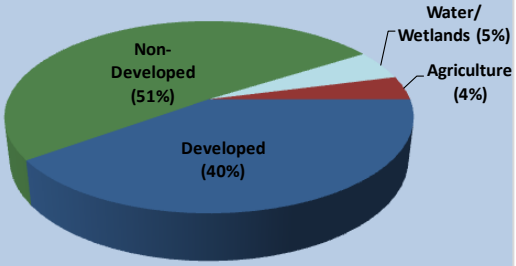
This **TMDL** applies to the Moshassuck River assessment unit (RI0003008R-01B), a 2.1-mile long stream located in Lincoln, Pawtucket, and Central Falls, RI (Figure 1). The towns are located in the northeastern corner of the state. The Moshassuck River watershed is presented in Figure 2 with land use types indicated.

The main branch of the Moshassuck River begins near the intersection of Routes 116 and 146 in Lincoln, RI. The upstream portion of the Moshassuck River is also impaired for bacteria (Segment 1A). Segment 1A flows through Lincoln and empties into Barney Pond. This impaired segment of the Moshassuck River (Segment 1B) begins at the outlet of Barney Pond. The river flows southeast through a residential area and enters Bleachery and Scott Ponds. At the outlet of the ponds, the river continues south through a heavily developed residential and commercial area along Route 122. A stream originating in a small pond in Central Falls joins with the main branch of the Moshassuck River. This impaired segment ends as the river enters the northern portion of Pawtucket. The Moshassuck River continues south into Providence, and joins with the Woonasquatucket River to form the Providence River.

This segment of the Moshassuck River watershed covers 8.6 square miles. The central portion of the watershed is largely non-developed and includes the North Central Conservation Area, Lincoln Woods State Park, and the Woodland Street Conservation Area. Developed areas occupy 40% of the land area and consist of mostly medium-density residential neighborhoods, commercial, and transportation uses. Development is concentrated in the southern portion of the watershed. Agricultural uses occupy 4% of the land area and wetland and surface waters occupy 5%.

Assessment Unit Facts (RI0003008R-01B)

- **Town:** Lincoln, Pawtucket, and Central Falls
- **Impaired Segment Length:** 2.1 miles
- **Classification:** Class B
- **Direct Watershed:** 8.6 mi² (5525 acres)
- **Impervious Cover:** 20.2%
- **Watershed Planning Area:** Moshassuck (#9)



Watershed Land Uses

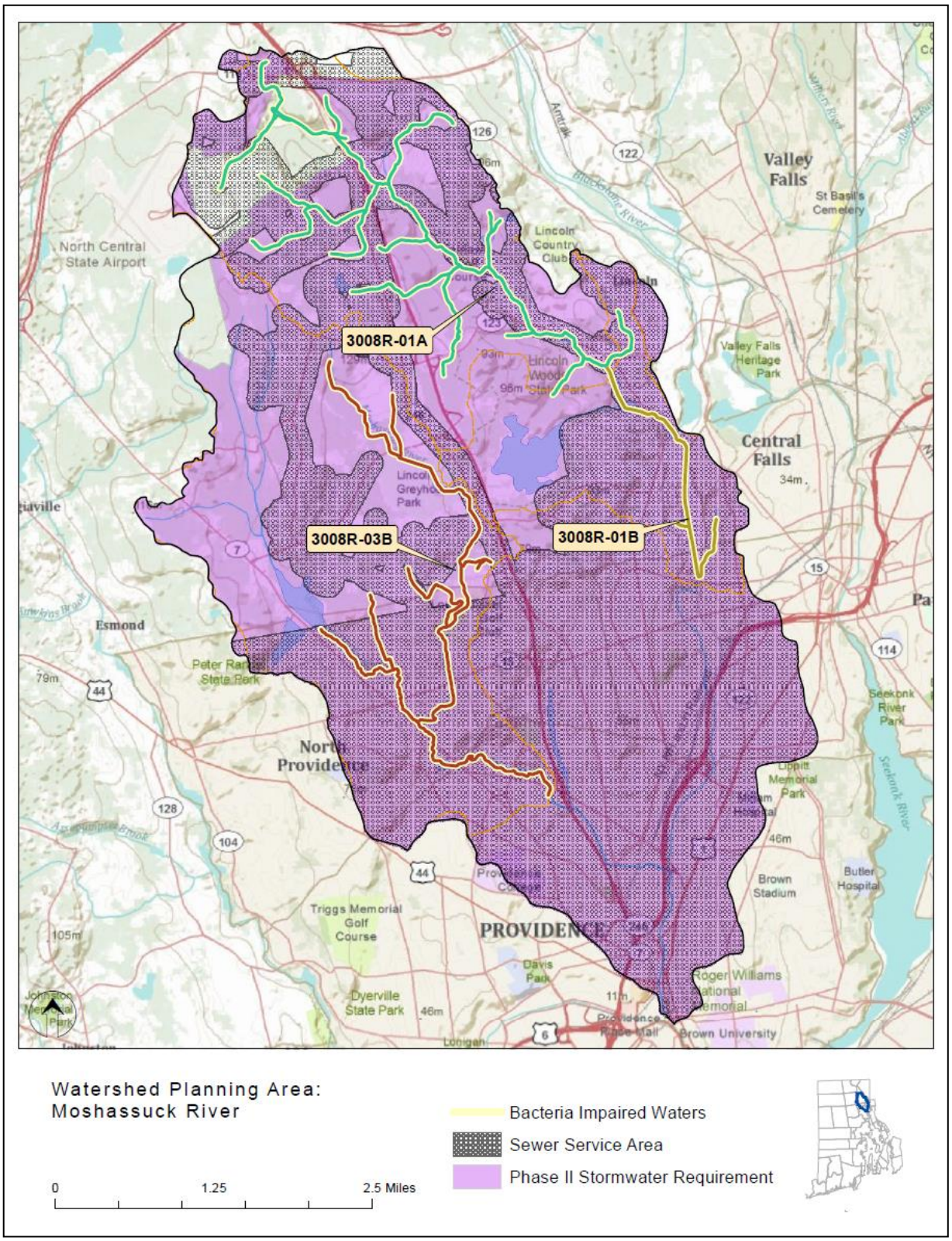


Figure 1: ***Map of Moshassuck River Watershed Planning Area with impaired segments addressed by the Statewide Bacteria TMDL, sewered areas, and stormwater regulated zones.***

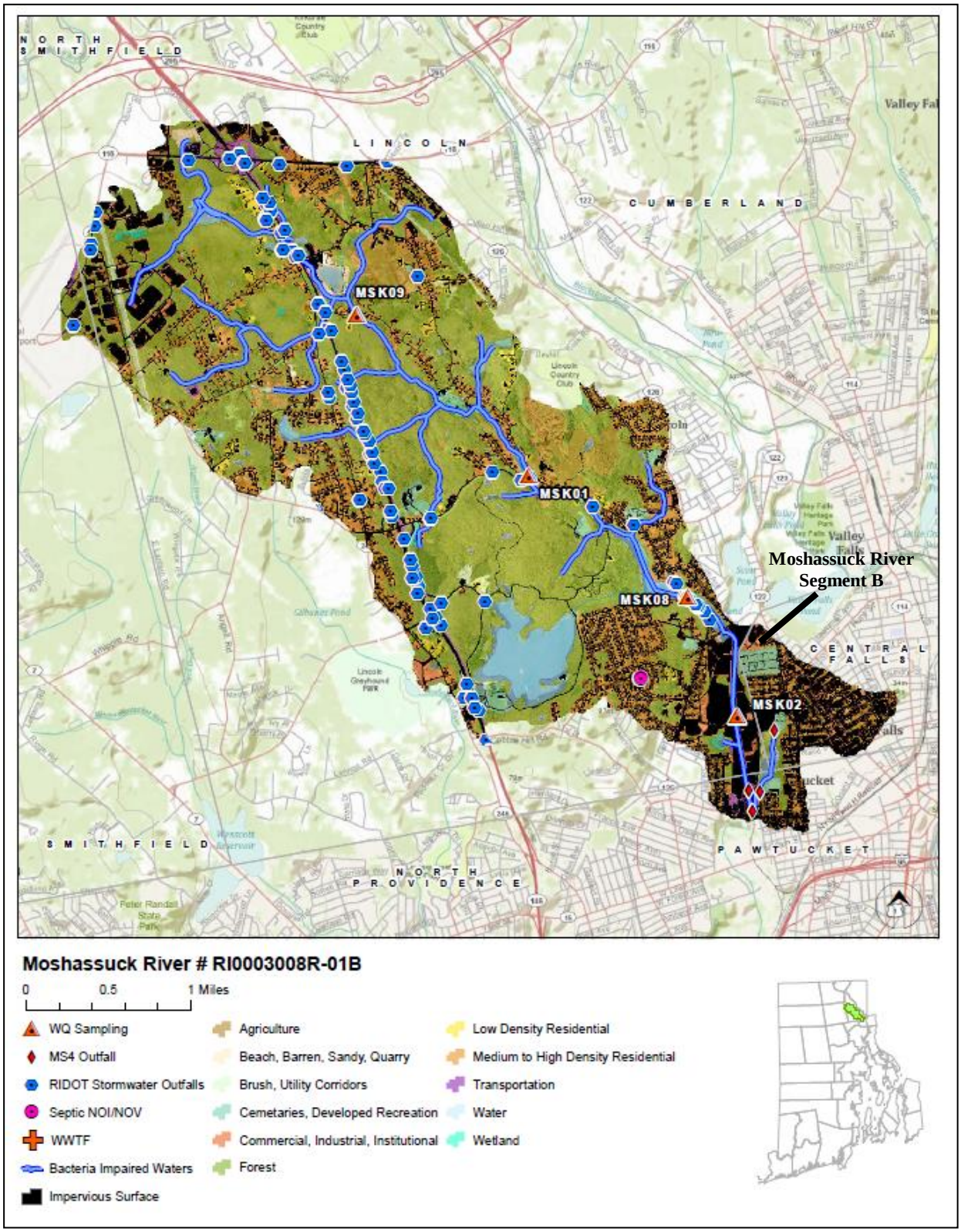


Figure 2: ***Map of the Moshassuck River (Segment 1B) watershed with impaired segments, sampling locations, and land cover indicated.***

Why is a TMDL Needed?

The Moshassuck River is a Class B fresh water stream with designated uses of primary and secondary contact recreation and fish and wildlife habitat (RIDEM, 2009). From 2008-2009, water samples were collected from two sampling locations (MSK02 and MSK08) and analyzed for the indicator bacteria, enterococci. The water quality criteria for enterococci, along with bacteria sampling results from 2008-2009 and associated statistics are presented in Table 1. The geometric mean was calculated for both stations and exceeded the water quality criteria for enterococci at Station MSK02.

To aid in identifying possible bacteria sources, the geometric mean value was also calculated for wet and dry-weather sample days for both stations. Both wet and dry-weather geometric mean values exceeded the water quality criteria for enterococci at Station MSK02, with wet-weather values higher than dry-weather values.

Due to the elevated bacteria measurements presented in Table 1, the Moshassuck River assessment unit does not meet Rhode Island's water quality standards. The segment was identified as impaired and 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 impairments and identifies 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 Moshassuck River Watershed (Source: Google Maps)***

The Moshassuck River (Segment 1B) has also been assessed by RIDEM as impaired for biodiversity. No TMDL has been completed for this impairment.

Potential Bacteria Sources

Previous investigations have concluded that there are several potential sources of bacteria in the Moshassuck River watershed including stormwater runoff from developed areas, illicit discharges, malfunctioning onsite wastewater treatment systems, agricultural activities, and wildlife and domestic animal waste (C&E, 2004). Each type of potential bacteria sources is described briefly below.

Developed Area Stormwater Runoff

Though the majority of the Moshassuck River watershed is non-developed, impervious surfaces cover approximately 20.2% and are located primarily in commercial areas in the southern portion of the watershed. Impervious cover is defined as land surface areas, such as roofs and roads that force water to run off land surfaces, rather then infiltrating into the soil. Impervious cover provides a useful metric for the potential for adverse stormwater impacts. As discussed in Section 6.3 of the Core TMDL Document, as a general rule, impaired streams with watersheds having higher than 10% impervious cover are assumed to be affected by stormwater runoff.

As part of Phase II requirements, Lincoln, Pawtucket, and Central Falls have mapped outfalls to surface water bodies, including the Moshassuck River. The Rhode Island Department of Transportation (RIDOT) has also mapped stormwater outfalls within the Moshassuck River watershed. Multiple outfalls have been identified within the watershed, particularly along Routes 123, 126, and 146 (Figure 2). As stormwater is known to carry a suite of pollutants, including bacteria and wet-weather geometric mean values exceeded the water quality criteria for enterococci at one station in the watershed, stormwater runoff is a likely source of bacteria to the Moshassuck River.

Onsite Wastewater Treatment Systems

The Moshassuck River watershed is mostly sewered, but also relies partially 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). As shown in Figure 2, one OWTS Notice of Violation/Notice of Intent to Violate has been issued by the RIDEM Office of Compliance and Inspection within the Moshassuck River watershed.

Sewer Leaks

As shown in Figure 1, sewered areas in the Town of Lincoln follow major roadways in the northern portion of the watershed. The southern portion of the watershed, including Central Falls and Pawtucket are completely serviced by a municipal sanitary sewer system and includes sewer lines directly adjacent to this impaired segment. Municipal wastewater is treated by the Narragansett Bay Commission system

and discharged to the Providence River (Berger, 2004). The extensive sewage collection system within the watershed increases the risk of sewer system leaks and subsequent contamination.

Waterfowl, Wildlife, and Domestic Animal Waste

Non-developed land accounts for 51% of the watershed area. The Moshassuck River flows through the North Central Conservation Area, Lincoln Woods State Park, the Woodland Street Conservation Area, and multiple ponds that are home to multiple species of wildlife and waterfowl. Continued development and encroachment into wildlife areas can cause densities to increase and animal waste to be more prevalent closer to the river. 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.

Domestic animals are also potential sources of bacteria to the Moshassuck River. Medium-density residential developments are common in the northern and southern portions of the watershed. If residents are not properly disposing of pet waste, the bacteria associated with that waste could enter and contaminate the stream.

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 Moshassuck 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 would also be beneficial.

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

Stormwater Management

The Town of Lincoln (RIPDES permit RIR040021), the City of Pawtucket (RIPDES permit RIR040024), the City of Central Falls (RIPDES permit RIR040041) and RIDOT (RIPDES permit RIR040036) are municipal separate storm sewer (MS4) operators in the Moshassuck River watershed and have prepared the required Phase II Stormwater Management Plans (SWMPP). The entire watershed is included in the regulated area.

Lincoln, Pawtucket, and Central Falls' SWMPPs outline goals for the reduction of stormwater runoff to the Moshassuck 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 municipalities' catch basins, implementing annual street sweeping programs, adopting construction erosion and sediment control and post-construction stormwater control ordinances, and conducting public education activities (RIDEM, 2010a).

The Town of Lincoln and the Cities of Pawtucket and Central Falls have all adopted an illicit discharge detection and elimination ordinance (RIDEM, 2010a; Berger, 2004). This type of ordinance prohibits illicit discharges to the MS4 and provides an enforcement mechanism. The municipalities should continue to prioritize areas to identify and eliminate illicit discharges in the Moshassuck River watershed. Illicit discharges can be identified through continued dry-weather outfall sampling and microbial source tracking.

RIDOT also 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. 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.

While these first steps are important to reduce the effects of stormwater runoff to the Moshassuck River, additional efforts are needed to restore the river's water quality. As mentioned previously, the Moshassuck River watershed has an impervious cover of 20.2%, a level where stormwater impacts are expected. At this threshold, RIDEM is requiring the MS4 operators to revise their post-construction stormwater ordinances as described in Section 6.3 of the Core TMDL Document. The municipalities and RIDOT should also evaluate whether the six minimum measures alone are sufficient to meet the bacteria reduction targets. Per Part IV.D of the General Permit, the MS4 operators should ensure that their minimum measures are consistent with the recommendation of Section 6.2 of the Core TMDL Document. Changes to the SWMPPs should be documented in a TMDL Implementation Plan (TMDL IP) and should comply with relevant provisions Part IV.D of the RIPDES Stormwater General Permit (RIDEM, 2010b), which are summarized in Section 6.2 (Numbers 1 through 5) of the Core TMDL Document.

The municipalities should continue to implement the goals of its Phase II SWMPP including dry-weather sampling, extensive street and catch basin cleaning, and public education activities. RIDOT should also continue to implement the goals of its Phase II SWMPP.

Onsite Wastewater Management

Though a large portion of the Moshassuck River watershed is sewered, a portion of the watershed in Lincoln relies on OWTS (Figure 1). Currently, the Town of Lincoln does not have an Onsite Wastewater Management Plan or a septic system ordinance. As part of the onsite wastewater planning process, Lincoln 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 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 Lincoln is currently not eligible for Rhode Island's 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.

Sewer Leaks

Wastewater from the Lincoln, Central Falls, and Pawtucket is treated by the Narragansett Bay Commission (NBC) (C&E, 2006). The system should be monitored for overextension and capacity limitations with a growing population. Aging wastewater infrastructure tasked with increasing loads is at a higher risk of rupture. If not already in place, the municipalities should develop a plan to identify leaks in the sewer system.

Waterfowl, Wildlife, and Domestic Animal Waste

The municipalities' education and outreach programs should highlight the importance of picking up after dogs and other pets. The municipalities should also incorporate educational materials focused on not feeding waterfowl, particularly around the small impoundments within the watershed, as part of their Phase II plan. Animal wastes should be disposed of away from any waterway or stormwater drainage system. The municipalities 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 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 also take several measures to minimize waterfowl-related impacts. They can allow tall, coarse vegetation to grow in areas along the shores of the many small impoundments along the streams course, which 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 Moshassuck River and can harm human health and the environment.

Land Use Protection

Many protected areas in the headwaters are habitats for numerous rare plants and animals (Town of Lincoln, 2003). Woodland and wetland areas within the Moshassuck River watershed, including the North Central Conservation Area and the Lincoln Woods State Park, also absorb and filter pollutants from stormwater runoff, and help protect both water quality in the stream and stream channel stability. As these areas represent over half of the land use in the Moshassuck River watershed, it is important to preserve these undeveloped areas, and to institute controls on development in Moshassuck River watershed.

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

Table 1: Moshassuck River Bacteria Data

***Waterbody ID*:** RI0003008R-01B

Watershed Planning Area: 9 – Moshassuck River

Characteristics: Freshwater, Class B, 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: **16% (Includes 5% Margin of Safety)**

Data: 2008-2009 from RIDEM

Single Sample Enterococci (colonies/100 mL) Results for the Moshassuck River (Segment 1B) (2008-2009) with Geometric Mean Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
MSK08	Moshassuck River at Barney Pond outlet (Rte 126/Smithfield Ave)	8/17/2009	166	Dry	28
MSK08	Moshassuck River at Barney Pond outlet (Rte 126/Smithfield Ave)	8/5/2009	50	Wet	
MSK08	Moshassuck River at Barney Pond outlet (Rte 126/Smithfield Ave)	7/7/2009	52	Wet	
MSK08	Moshassuck River at Barney Pond outlet (Rte 126/Smithfield Ave)	5/12/2009	5	Dry	
MSK08	Moshassuck River at Barney Pond outlet (Rte 126/Smithfield Ave)	9/22/2008	7	Dry	

Single Sample Enterococci (colonies/100 mL) Results for the Moshassuck River (Segment 1B) (2008-2009) with Geometric Mean Statistics (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
MSK02	Moshassuck River at Higginson Ave (btw 122 and 126 in Lincoln)	8/17/2009	488	Dry	**61† (16%)***
MSK02	Moshassuck River at Higginson Ave (btw 122 and 126 in Lincoln)	8/5/2009	52	Wet	
MSK02	Moshassuck River at Higginson Ave (btw 122 and 126 in Lincoln)	7/14/2009	82	Wet	
MSK02	Moshassuck River at Higginson Ave (btw 122 and 126 in Lincoln)	5/12/2009	30	Dry	
MSK02	Moshassuck River at Higginson Ave (btw 122 and 126 in Lincoln)	9/22/2008	13	Dry	

Shaded cells indicate an exceedance of water quality criteria

* Includes a 5% Margin of Safety

†Geometric mean used to calculate percent reduction

Wet and Dry-Weather Geometric Mean Enterococci Values for all Stations

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
MSK02	Moshassuck River at Higginson Ave (btw 122 and 126 in Lincoln)	2008-2009	2	3	61	65	58
MSK08	Moshassuck River at Barney Pond outlet (Rte 126/Smithfield Ave)	2008-2009	2	3	28	51	19

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from Weather Underground rain gage in Lincoln, RI

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