Pawcatuck River Segment 18C

Watershed Description

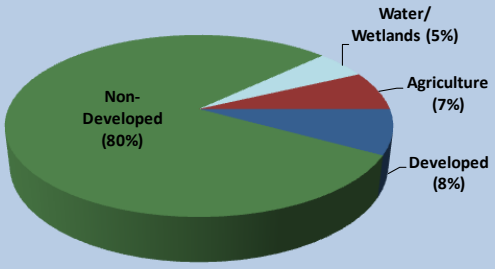
This **TMDL** applies to the Pawcatuck River assessment unit (RI00080439R-18C), a 14.2-mile long stream segment located in Charlestown, Richmond, Hopkinton, and Westerly, RI (Figure 1). The Pawcatuck River watershed is presented in Figures 2 and 3 with land use types indicated.

The headwaters of the Pawcatuck River are located in Wordens Pond in South Kingstown (RIDEM, 2010b). The Pawcatuck River leaves Wordens Pond and enters the Great Swamp Management Area. Another impaired segment of the Pawcatuck River (Segment 18B) begins near the Village of Kenyon and ends just before Route 112. This impaired segment of the river (Segment 18C) begins just west of Route 112 near the border of Richmond and Charlestown in the Village of Carolina. The river flows southwest, crosses Route 91, and continues along the eastern border of the Carolina Wildlife Management Area. The river then flows through the northern portion of Indian Cedar Swamp and is joined by the Wood River, another river impaired for bacteria. The Pawcatuck River Segment 18C then flows south along the western border of the Burlingame Wildlife Management Area, and is joined by Poquiant Brook, a small outlet stream from Watchaug Pond. This impaired segment then flows west and ends near the Village of Bradford, along the Hopkinton-Westerly town border. The Pawcatuck River continues into Westerly and eventually empties into Little Narragansett Bay (RIDEM, 2010b).

This segment of the Pawcatuck River watershed covers 218 square miles. Non-developed areas occupy a large portion (80%) of the watershed. Developed uses cover approximately 8%. Agricultural land uses occupy 7% and wetlands and other surface waters account for 5%.

Assessment Unit Facts (RI0008039R-18C)

- **Towns:** Charlestown, Richmond, Hopkinton, and Westerly
- **Impaired Segment Length:** 14.2 miles
- **Classification:** Class B
- **Direct Watershed:** 218 mi^2 (139,451 acres)
- **Impervious Cover:** 3.4%
- **Watershed Planning Area:** Pawcatuck – Pawcatuck (#23)



Watershed Land Uses

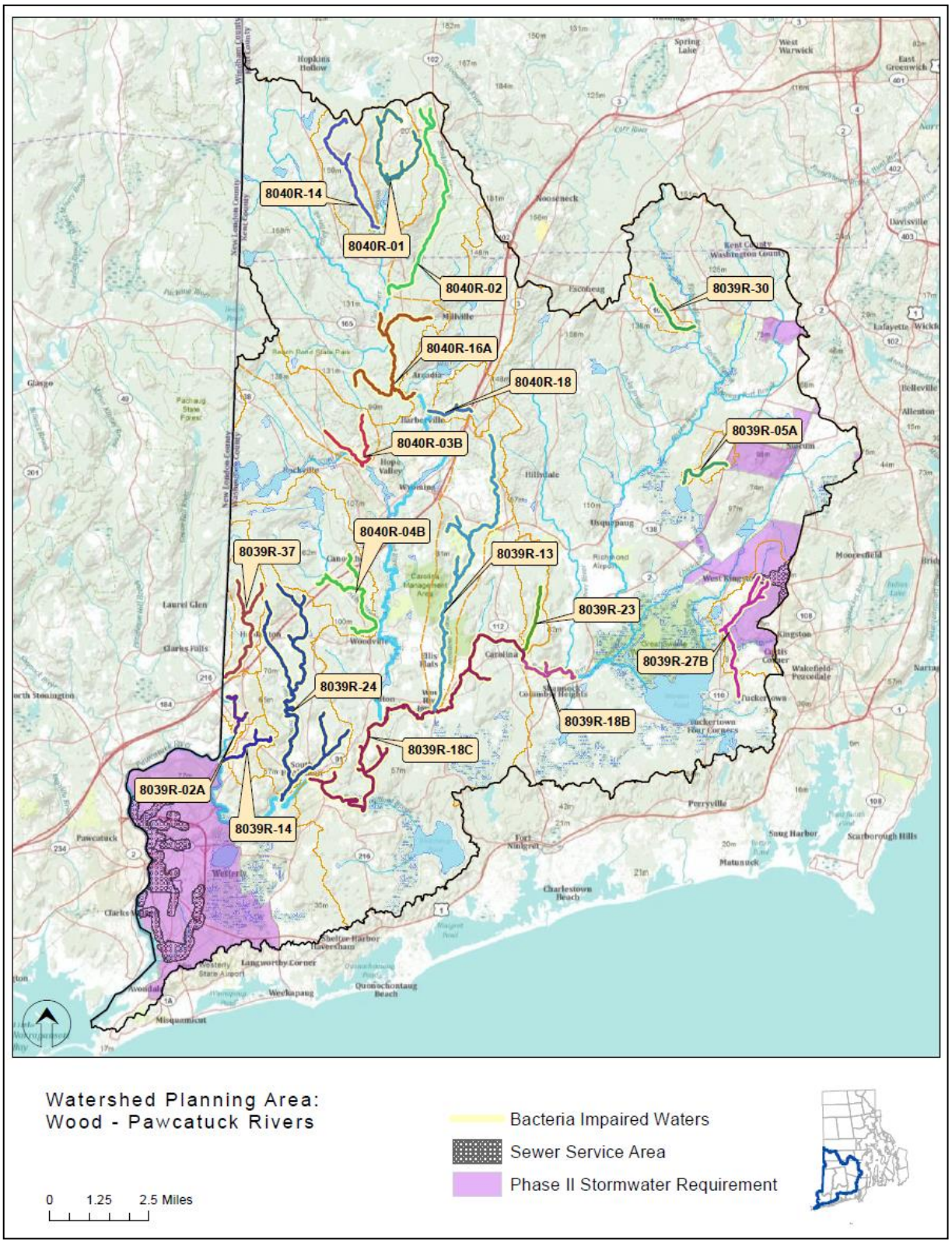


Figure 1: ***Map of the Wood-Pawcatuck Watershed Planning Area with impaired segments addressed by the Statewide Bacteria TMDL, sewered areas, and stormwater regulated zones.***

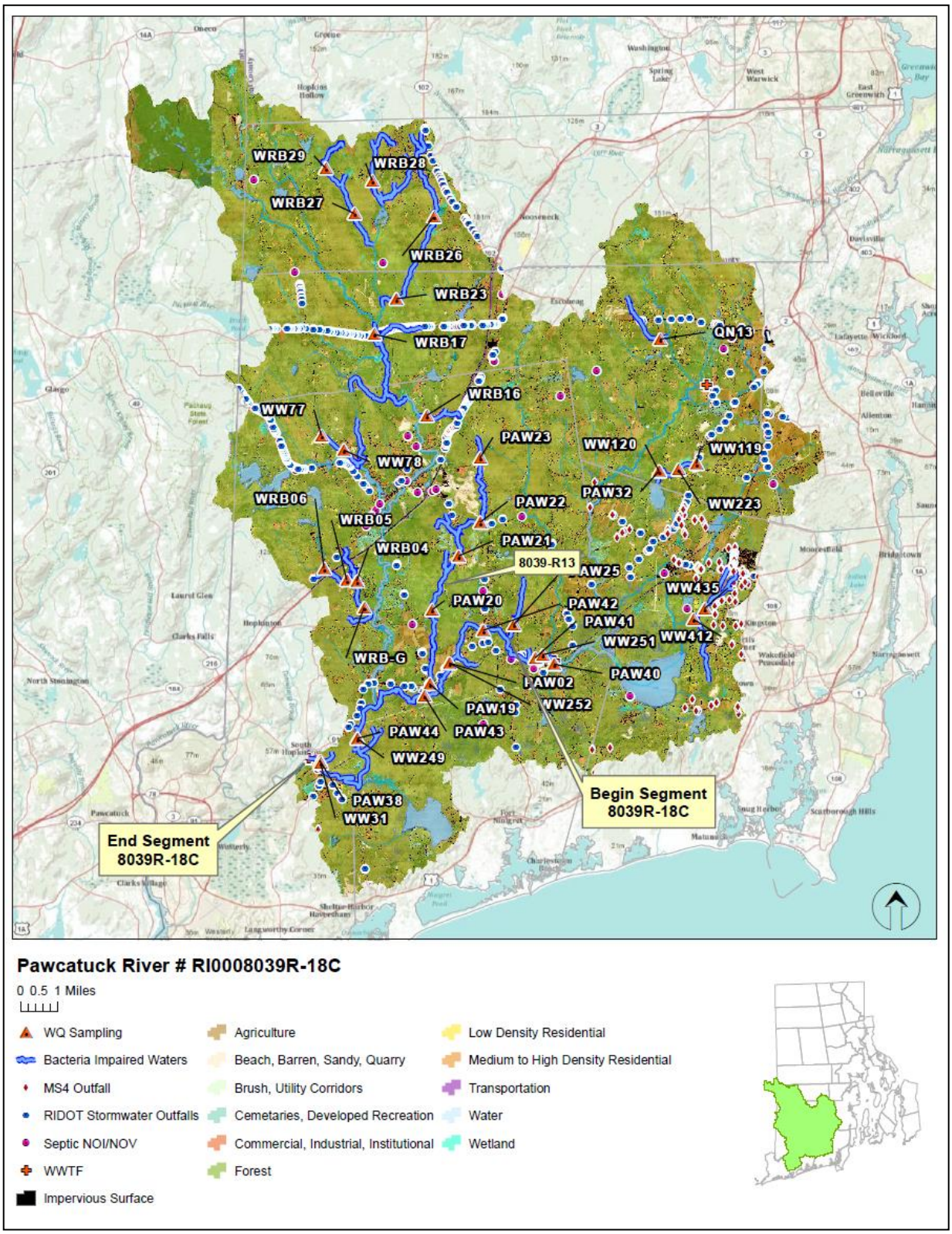


Figure 2: ***Map of the Pawcatuck River (Segment 18C) watershed with impaired segments, sampling locations, and land cover indicated.***

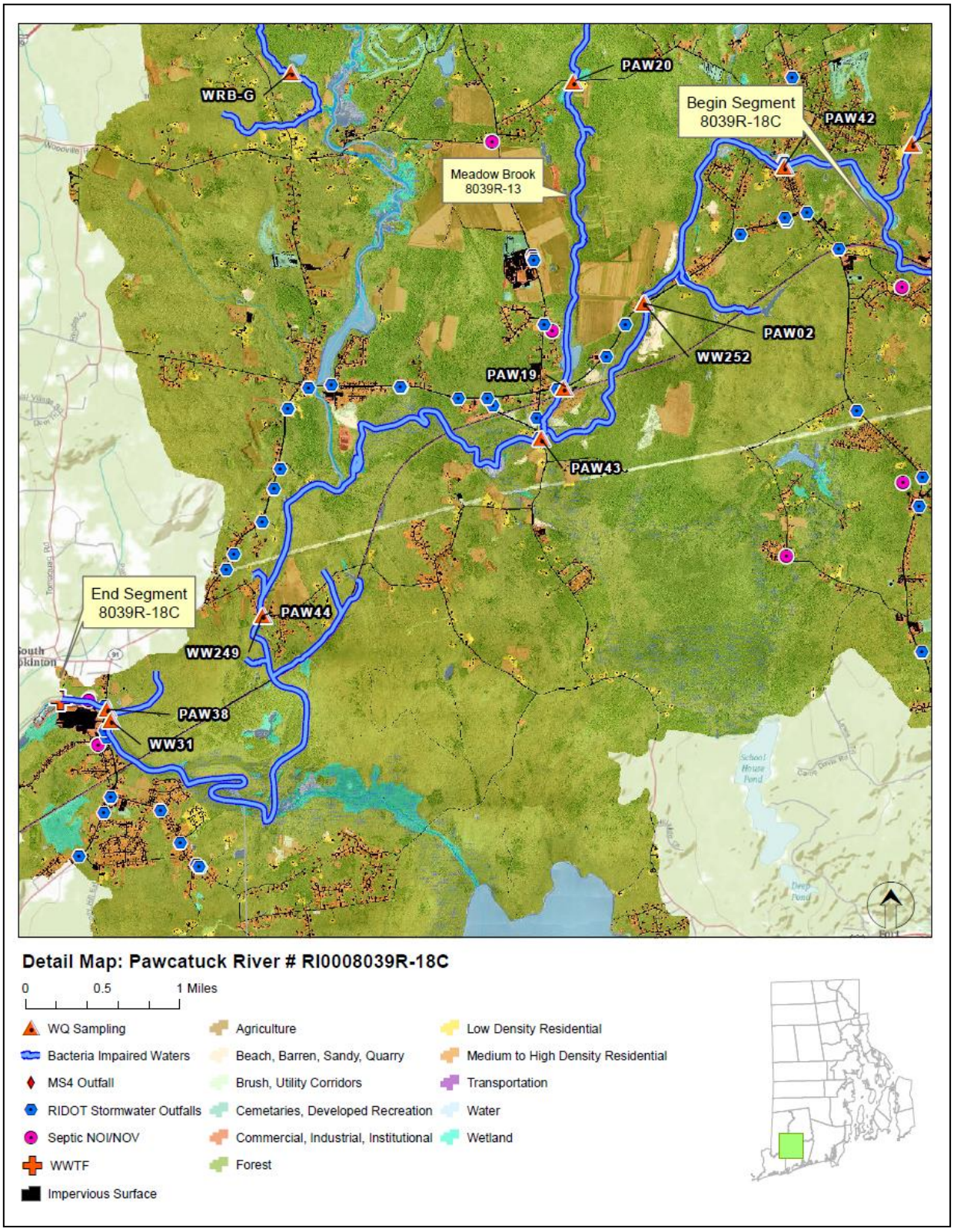


Figure 3: ***Zoomed map of the Pawcatuck River (Segment 18C) watershed with impaired segments, sampling locations, and land cover indicated.***

Why is a TMDL Needed?

The Pawcatuck River Segment 18C is a Class B fresh water stream, and its applicable designated uses are primary and secondary contact recreation and fish and wildlife habitat (RIDEM, 2009). This segment of the Pawcatuck River has been designated by RIDEM as a Special Resource Protection Water (SRPW), which provides the River with special protections under RIDEM's Antidegradation Provisions. SRPWs are high quality surface waters that include public water supplies and waterbodies having significant ecological or recreational uses. The Pawcatuck River Segment 18C is designated an SRPW for conservation, critical habitat (rare and endangered species, and as a wild and scenic waterbody.

Figure 4: ***Partial aerial view of the Pawcatuck River watershed. (Source: Google Maps)***

In 2005-2008, water samples were collected from six sampling locations (Figures 2 and 3) and analyzed for the indicator bacteria, enterococci. The water quality criteria for enterococci, along with bacteria sampling results from 2005-2008 and associated statistics are presented in Table 1. Throughout the study period, the water quality criteria for enterococci were exceeded at four of the six stations. To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days, where appropriate. These calculations were limited to two stations near the end of the impaired segment (WW249/PAW44 and WW31) as all other stations only had dry-weather data. The wet-weather geometric mean values exceeded the water quality criteria for enterococci at the two stations.

Due to the elevated bacteria measurements presented in Table 1, the Pawcatuck River Segment 18C 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.

Potential Bacteria Sources

There are several potential sources of bacteria in the Pawcatuck River watershed including malfunctioning onsite wastewater treatment systems, agricultural activities, waterfowl and wildlife waste, and stormwater runoff from developed areas.

Onsite Wastewater Treatment Systems

All residents in the towns of Charlestown, Richmond, and Hopkinton rely on onsite wastewater treatment systems (OWTS), such as septic systems and cesspools. While a small section of the Town of Westerly relies on a municipal sanitary sewer system, the area surrounding this impaired segment of the Pawcatuck River is not located near this portion of Westerly, and all residents living near the river rely on OWTS. 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 Figures 2 and 3, multiple OWTS Notices of Violation/Notices of Intent to Violate (NOV/NOI) have been issued by the RIDEM Office of Compliance and Inspection in the Pawcatuck River watershed, and many of the NOV/NOIs have been issued to residents near this impaired segment of the Pawcatuck River.

Agricultural Activities

The Pawcatuck River watershed has multiple agricultural operations. Comprising 7% of the land cover in this sub-watershed, agricultural operations are an important economic activity and landscape feature in the state's rural areas. However, agricultural runoff may contain multiple pollutants, including 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. This impaired segment of the Pawcatuck River has multiple farms located near the banks of the river, including Riverside Farm in Charlestown, RI, a 65-acre Christmas tree farm that is also home to multiple species of animals. Water quality data from stations PAW43 and WW249/PAW44, located near agricultural operations on Burdickville Road and Kings Factory Road, exceeded the water quality criteria for enterococci, suggesting that activities and/or runoff from these farms may be contributing bacteria to the Pawcatuck River.

Wildlife and Waterfowl Waste

Approximately 80% of the Pawcatuck River 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. The impaired segment of the Pawcatuck River flows through the Carolina and Burlingame Wildlife Management Areas, as well as through other woodland and wetland areas. Waste from wildlife and waterfowl that frequent these areas may be contributing bacteria to the Pawcatuck River Segment 18C.

Developed Area Stormwater Runoff

Approximately 8% of the Pawcatuck River watershed is developed and most of the development is concentrated along major roads in the watershed, particularly in the Village of Bradford near the end of this impaired segment. The Pawcatuck River watershed has an impervious cover of approximately 3.4%. 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 the Pawcatuck River, 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.

The Rhode Island Department of Transportation (RIDOT) has identified and mapped stormwater outfalls in the Pawcatuck River watershed. As shown in Figures 2 and 3, multiple RIDOT outfalls are found in the watershed, particularly along major highways.

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 Pawcatuck River watershed. These activities could potentially 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 Pawcatuck River watershed rely on OWTS (septic systems or cesspools). Charlestown and Westerly have approved Onsite Wastewater Management Plans, while Hopkinton and Richmond have draft plans. These plans provide a framework for managing the OWTS. As part of the onsite wastewater planning process, Charlestown formed a Wastewater Management Commission in

1993 and adopted an OWTS ordinance in 1994 that initially required OWTS to be pumped once every three years. This ordinance was revised in 1998 to provide for inspection-based pumping (Dillmann, 1999). 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 Charlestown is eligible for Rhode Island's Community Septic System Loan Program (CSSLP) and has received 1.1 million dollars from the program since 1999. CSSLP allows towns to assist citizens with the replacement of older and failing systems through low-interest loans. Though the Towns of Richmond, Hopkinton, and Westerly are not currently eligible for CSSLP, it is recommended that the town develop a program to assist citizens with the replacement of older and failing systems.

Agricultural Activities

If not already in place, agricultural producers, particularly upstream of the Kings Factory Road and Burdickville Road sampling stations, should work with the RIDEM Division of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) to develop conservation plans for their farming activities within the watershed. NRCS and the RIDEM Division of Agriculture should ensure that all agricultural operations within the watershed have 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.

Wildlife and Waterfowl Waste

The towns should develop education and outreach programs to highlight the importance of picking up after dogs and other pets and not feeding waterfowl. Animal waste should be disposed of away from any waterway or stormwater system. The towns should work with volunteers to map locations where animal waste is a significant and a 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 the impacts of wildlife and waterfowl to the Pawcatuck River. They can allow tall, coarse vegetation to grow in areas along the shores of the Pawcatuck River that are frequented by waterfowl and wildlife. 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, contributes to water quality impairments in the Pawcatuck River and can harm human health and the environment.

Stormwater Management

RIDOT (RIPDES permit RIR040036) is a municipal separate storm sewer (MS4) operator in the Pawcatuck River watershed has prepared a Phase II Stormwater Management Plan (SWMPP) for state-owned roads in Rhode Island. Though the Towns of Charlestown (RIPDES permit RIR040040) and Westerly (RIPDES permit RIR044014) are regulated by the Phase II program, the Pawcatuck River watershed is outside of the regulated area.

The Towns of Hopkinton and Richmond are not currently regulated under the Phase II Program. However, it is anticipated that Richmond will be regulated within the next few years. The Town of Richmond has developed an initial Phase II SWMPP in anticipation of Phase II regulations in the future (Fuss and O'Neill, 2007). Richmond's 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. The town has not mapped or identified their stormwater outfalls or adopted an IDDE ordinance.

The Town of Westerly adopted an illicit discharge detection and elimination ordinance in 2008. The Towns of Charlestown, Hopkinton, and Richmond do not currently have ordinances to address illicit discharges. 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 vicinity of the sampling locations be monitored to check for illicit discharges. Illicit discharges can be identified through continued dry weather outfall sampling and microbial source tracking.

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.

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

Land Use Protection

Woodland and wetland areas within the Pawcatuck River watershed 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 Pawcatuck River watershed, it is important to preserve these undeveloped areas, and institute controls on development in the watershed. The Hopkinton Land Trust was established in 2004 and has since protected 875 acres of land through property acquisition and conservation easements (Town of Hopkinton, 2011). The Town of Hopkinton should continue to work with the Land Trust to protect more of the undeveloped land in the town, with a focus on lands around the Pawcatuck River. Similar programs could be developed in Charlestown, Richmond, and Westerly to protect other portions of the Pawcatuck River watershed.

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

Table 1: Pawcatuck River Bacteria Data

***Waterbody ID*:** RI0008039R-18C

Watershed Planning Area: 23 – Wood-Pawcatuck

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

Impairment: Enterococci (colonies/100mL)

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

Percent Reduction to meet TMDL: **66% (Includes 5% Margin of Safety)**

Data: 2005-2008 from RIDEM

Single Sample Enterococci (colonies/100 mL) Results for the Pawcatuck River Segment 18C (2005 - 2008) with Geometric Mean Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
PAW42	Carolina, Rt. 112, just upstream of White Brook	7/31/2008	436	Dry	**137[†] (66%)***
PAW42	Carolina, Rt. 112, just upstream of White Brook	10/27/2006	59	Dry	
PAW42	Carolina, Rt. 112, just upstream of White Brook	8/9/2006	100	Dry	
PAW42	Carolina, Rt. 112, just upstream of White Brook	5/31/2006	45	Dry	
PAW42	Carolina, Rt. 112, just upstream of White Brook	9/21/2005	410	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	10/23/2008	57	Dry	106
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	8/16/2008	866	Dry	
PAW02	Pawcatuck River at Rt 91, USGS Gage 1117500	7/31/2008	137	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	7/11/2008	33	Dry	
PAW02	Pawcatuck River at Rt 91, USGS Gage 1117500	7/9/2008	61	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	10/18/2007	16	Dry	39
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	9/17/2007	112	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	8/17/2007	162	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	7/20/2007	108	Wet	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	6/15/2007	39	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	5/8/2007	3	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	10/18/2007	16	Dry	

Single Sample Enterococci (colonies/100 mL) Results for the Pawcatuck River Segment 18C (2005 - 2008) with Geometric Mean Statistics (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
PAW02	Pawcatuck River at Rt 91, USGS Gage 1117500	10/27/2006	1	Dry	35
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	10/25/2006	13	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	9/27/2006	76	Dry	
PAW02	Pawcatuck River at Rt 91, USGS Gage 1117500	8/9/2006	220	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	7/28/2006	66	Dry	
WW252	Pawcatuck River at Rt 91, USGS Gage 1117500	6/15/2006	29	Dry	
PAW02	Pawcatuck River at Rt 91, USGS Gage 1117500	5/31/2006	18	Dry	
PAW02	Pawcatuck River at Rt 91, USGS Gage 1117500	9/21/2005	280	Dry	
PAW43	Kings Factory Rd / Narragansett Tr	7/30/2008	411	Dry	92
PAW43	Kings Factory Rd / Narragansett Tr	7/9/2008	35	Dry	
PAW43	Kings Factory Rd / Narragansett Tr	10/27/2006	35	Dry	
PAW43	Kings Factory Rd / Narragansett Tr	8/9/2006	180	Dry	
PAW43	Kings Factory Rd / Narragansett Tr	5/31/2006	36	Dry	
PAW43	Kings Factory Rd / Narragansett Tr	9/21/2005	190	Dry	
WW249	Burdickville Road, USGS Gage 1118010	10/25/2008	24	Dry	55
WW249	Burdickville Road, USGS Gage 1118010	9/20/2008	135	Dry	
WW249	Burdickville Road, USGS Gage 1118010	8/16/2008	313	Dry	
PAW44	Burdickville Road, USGS Gage 1118010	7/30/2008	210	Dry	
WW249	Burdickville Road, USGS Gage 1118010	7/12/2008	37	Dry	
PAW44	Burdickville Road, USGS Gage 1118010	7/9/2008	15	Dry	
WW249	Burdickville Road, USGS Gage 1118010	6/7/2008	31	Wet	
WW249	Burdickville Road, USGS Gage 1118010	5/10/2008	23	Wet	
WW249	Burdickville Road, USGS Gage 1118010	10/20/2007	189	Wet	50
WW249	Burdickville Road, USGS Gage 1118010	9/15/2007	462	Wet	
WW249	Burdickville Road, USGS Gage 1118010	8/18/2007	119	Dry	
WW249	Burdickville Road, USGS Gage 1118010	7/21/2007	18	Dry	
WW249	Burdickville Road, USGS Gage 1118010	6/15/2007	20	Dry	
WW249	Burdickville Road, USGS Gage 1118010	5/12/2007	4	Dry	

Single Sample Enterococci (colonies/100 mL) Results for the Pawcatuck River Segment 18C (2005 - 2008) with Geometric Mean Statistics (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
PAW44	Burdickville Road, USGS Gage 1118010	10/27/2006	24	Dry	
WW249	Burdickville Road, USGS Gage 1118010	9/30/2006	42	Wet	
WW249	Burdickville Road, USGS Gage 1118010	8/26/2006	240	Wet	
PAW44	Burdickville Road, USGS Gage 1118010	8/9/2006	290	Dry	
WW249	Burdickville Road, USGS Gage 1118010	7/29/2006	91	Wet	64
WW249	Burdickville Road, USGS Gage 1118010	6/17/2006	43	Dry	
PAW44	Burdickville Road, USGS Gage 1118010	5/31/2006	30	Dry	
WW249	Burdickville Road, USGS Gage 1118010	5/20/2006	31	Wet	
PAW44	Burdickville Road, USGS Gage 1118010	9/21/2005	68	Dry	
WW31	Pawcatuck River at Bradford	10/25/2008	28	Dry	
WW31	Pawcatuck River at Bradford	9/25/2008	30	Dry	
WW31	Pawcatuck River at Bradford	8/16/2008	127	Dry	50
WW31	Pawcatuck River at Bradford	7/12/2008	27	Dry	
WW31	Pawcatuck River at Bradford	5/10/2008	113	Wet	
WW31	Pawcatuck River at Bradford	10/20/2007	61	Wet	
WW31	Pawcatuck River at Bradford	9/15/2007	255	Wet	
WW31	Pawcatuck River at Bradford	7/21/2007	10	Dry	
WW31	Pawcatuck River at Bradford	6/16/2007	24	Dry	
WW31	Pawcatuck River at Bradford	5/12/2007	2	Dry	48
WW31	Pawcatuck River at Bradford	9/29/2006	38	Wet	
WW31	Pawcatuck River at Bradford	8/26/2006	548	Wet	
WW31	Pawcatuck River at Bradford	6/17/2006	73	Dry	
WW31	Pawcatuck River at Bradford	5/20/2006	128	Wet	
PAW38	Upstr Bradford Dyeing, Rt 91 (Alton-Bradford Rd)	7/30/2008	125	Dry	
PAW38	Upstr Bradford Dyeing, Rt 91 (Alton-Bradford Rd)	7/9/2008	23	Dry	
PAW38	Upstr Bradford Dyeing, Rt 91 (Alton-Bradford Rd)	10/27/2006	1	Dry	29
PAW38	Upstr Bradford Dyeing, Rt 91 (Alton-Bradford Rd)	8/9/2006	73	Dry	
PAW38	Upstr Bradford Dyeing, Rt 91 (Alton-Bradford Rd)	5/31/2006	37	Dry	
PAW38	Upstr Bradford Dyeing, Rt 91 (Alton-Bradford Rd)	9/21/2005	80	Dry	

Shaded cells indicate an exceedance of water quality criteria
* Includes 5% Margin of Safety
† Indicated geometric mean used to calculate the 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
PAW42	Carolina, Rt. 112, upstrm White Brook	2005-2008	0	5	137	NA	137
WW252 PAW02	Pawcatuck River at Rt 91, USGS Gage 1117500	2005-2008	1	17	50	NA	47
PAW43	Kings Factory Rd / Narragansett Tr	2005-2008	0	6	92	NA	92
WW249 PAW44	Burdickville Road, USGS Gage 1118010	2005-2008	8	15	57	81	47
WW31	Pawcatuck River at Bradford	2006-2008	6	8	49	129	24
PAW38	Pawcatuck River Upstream of Bradford Dyeing, Rt 91 (Alton-Bradford Rd)	2005-2008	0	6	29	NA	29

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

References

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