Crookfall Brook

Watershed Description

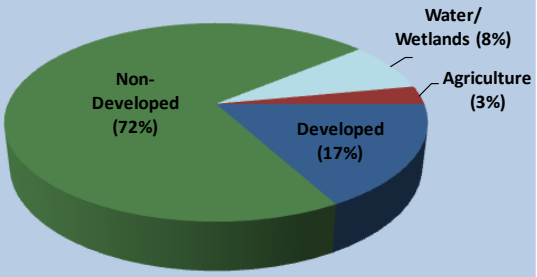
This **TMDL** applies to the Crookfall Brook assessment unit (RI0001004R-01), a 6.1-mile long stream located in the Towns of Lincoln, North Smithfield, and Smithfield, RI (Figure 1). The towns are located in the northeastern corner of Rhode Island. Crookfall Brook flows along the town line between North Smithfield and Lincoln. The Crookfall Brook watershed is presented in Figure 2 with land use types indicated.

Crookfall Brook originates in a forested area north of the North Central State Airport in Smithfield. The brook continues into Lincoln, crosses Route 116, and flows north through a series of wetland areas. A tributary from the outlet of Woonsocket Reservoir Number Three joins Crookfall Brook just north of Interstate 295. Crookfall Brook continues north through forested land, under Reservoir Road, and enters a commercial area. The brook crosses Route 146 near Majestic Honda and the RI Sports Center. It flows north between Route 99 and Old Smithfield Road and crosses Sayles Hill Road. The brook then empties into the Woonsocket Reservoir Numbers Two and One. Crookfall Brook then flows out of Reservoir Number One, under Old River Road, and eventually empties into the Blackstone River.

The Crookfall Brook watershed covers 7.9 square miles. As shown in the aerial image of Figure 3, non-developed lands occupy a large portion (72%) of the watershed. Developed uses (including residential, commercial, and transportation uses) occupy approximately 17% of the land area. Impervious surfaces cover a total of 8.5%. Wetland and surface waters occupy 8%, and agricultural use accounts for a small portion of the watershed (3%).

Assessment Unit Facts (RI0001004R-01)

- **Town:** Lincoln, North Smithfield, Smithfield
- **Impaired Segment Length:** 6.1 miles
- **Classification:** Class AA
- **Direct Watershed:** 7.9 mi^2 (5,069 acres)
- **Impervious Cover:** 8.5%
- **Watershed Planning Area:** Branch - Blackstone (#8)



Watershed Land Uses

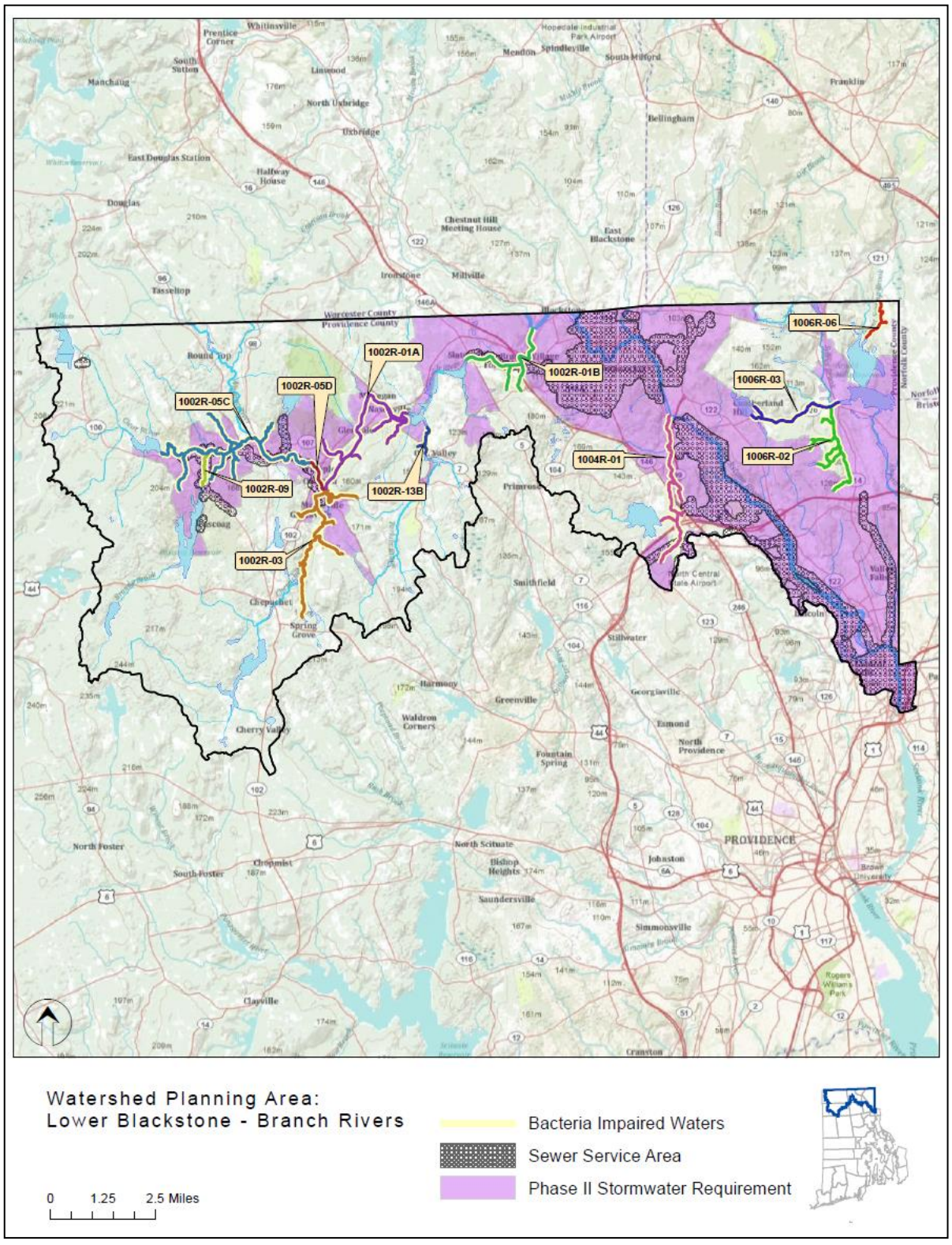


Figure 1: ***Map of the Branch-Blackstone Watershed Planning Area with impaired segments addressed by the Statewide Bacteria TMDL, sewered areas, and stormwater regulated zones.***

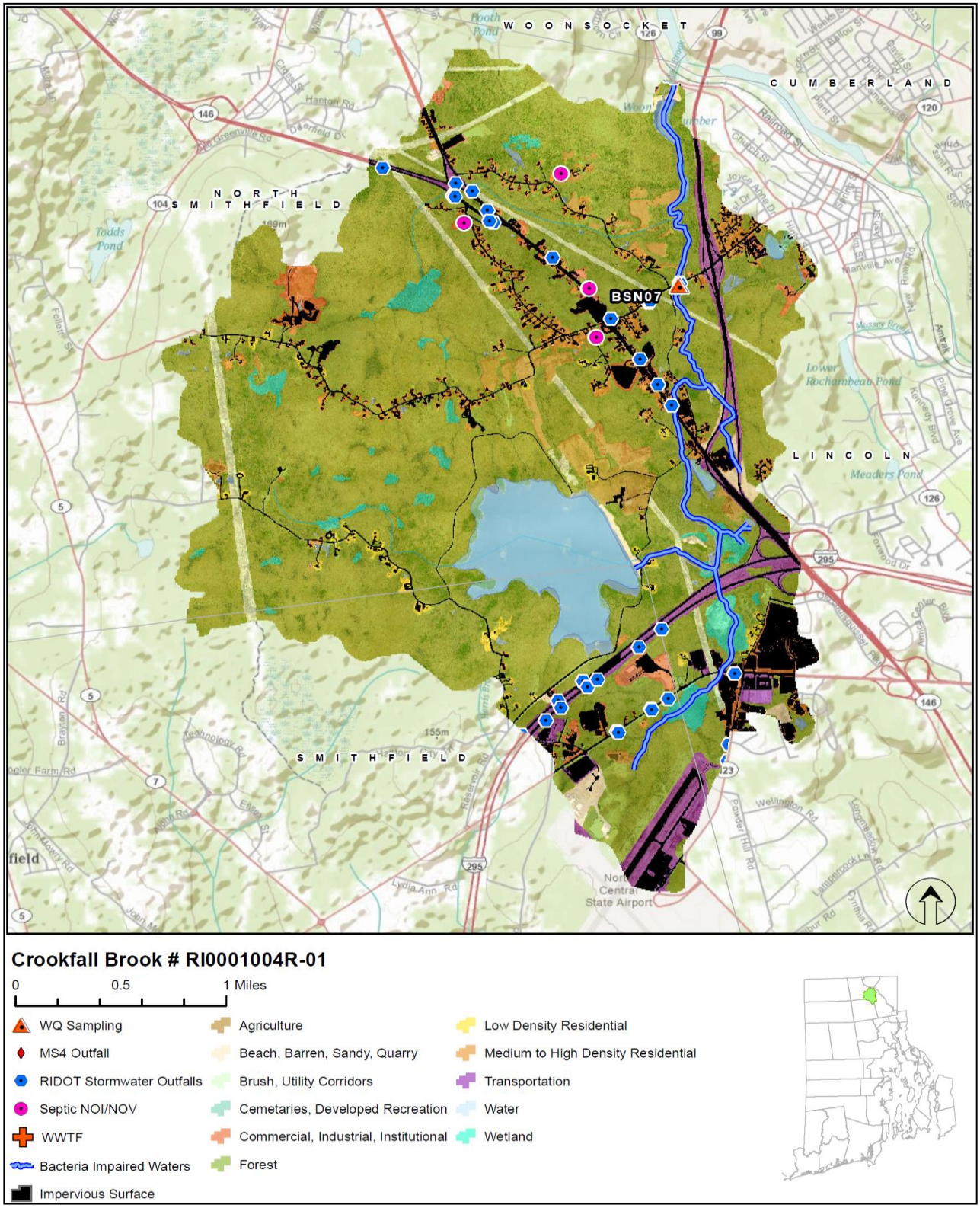


Figure 2: ***Map of the Crookfall Brook watershed with impaired segment, sampling location, and land cover indicated.***

Why is a TMDL Needed?

Crookfall Brook is a Class AA fresh water stream and is a tributary within Woonsocket'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 public drinking water supply, Crookfall Brook has been designated by RIDEM as a Special Resource Protection Water (SRPW), providing it 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 or are public water supplies.

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

From 2008-2009, water samples were collected from a single sampling location (BSN07) 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 exceeded the water quality criteria for enterococci at station BSN07 throughout the study period. All samples were taken in dry-weather conditions.

Due to the elevated bacteria measurements presented in Table 1, Crookfall Brook does not meet Rhode Island's bacteria water quality standards, was 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 impairments and identifies measures needed to restore water quality. The goal is for all water bodies to comply with state water quality standards.

Potential Bacteria Sources

There are several potential sources of bacteria in the Crookfall Brook watershed including failing onsite wastewater treatment systems, wildlife and domestic animal waste, and stormwater runoff from developed areas.

Onsite Wastewater Treatment Systems

Most residents in the Crookfall Brook watershed rely on onsite wastewater treatment systems (OWTS), such as septic systems and cesspools. The soils in much of the Crookfall Brook watershed are not well suited for OWTS due to wetness, flooding potential, slow percolation, and soil type (RI HEALTH, 2003). Failing OWTS can be significant sources of bacteria by allowing improperly treated waste to reach surface waters (Geremia, 2007). If OWTS 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, four OWTS Notices of Violation/Notices of Intent to Violate have been issued by the RIDEM Office of Compliance and Inspection in the Crookfall Brook watershed.

Sewer Leaks

Although most residents in the watershed utilize OWTS, limited areas are serviced by a municipal sewer system. Wastewater from the Town of North Smithfield is treated by the Woonsocket Regional Wastewater Treatment Facility (Geremia, 2007). Wastewater from the Town of Lincoln is treated by the Narragansett Bay Commission (NBC). The Town of Smithfield has a wastewater treatment plant located south of the watershed (Wright-Pierce, 2010). Though none of these wastewater treatment plants are located within the Crookfall Brook watershed, any leaks in the municipal sewer lines could contribute bacteria to the brook.

Waterfowl, Wildlife, and Domestic Animal Waste

The Crookfall Brook watershed is 72% forested area and 8% water and wetlands. Most of the forested area is west of Crookfall Brook, surrounding Woonsocket Reservoir Number Three. Large sections of the Crookfall Brook watershed provide sanctuary to a variety of wildlife including squirrel, deer, and waterfowl. 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 within the Crookfall Brook watershed represent another potential source of bacteria. Though few residential areas directly border Crookfall Brook, outfalls can carry bacteria from

improperly disposed pet waste to the brook. If residents are not properly disposing of pet waste, the bacteria associated with that waste could enter and contaminate the stream.

Developed Area Stormwater Runoff

The Crookfall Brook watershed has an impervious cover of 8.5%. 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. While runoff from impervious areas in these portions of the watershed may be contributing bacteria to Crookfall 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.

The Rhode Island Department of Transportation (RIDOT) has identified over twenty stormwater outfalls in the watershed. Three outfalls were identified as discharging directly to Crookfall Brook. Most outfalls are found along the major roadways, such as Interstate 295 and Routes 116 and 146.

Existing Local Management and Recommended Next Steps

The Towns of Lincoln, North Smithfield, and Smithfield have developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the Crookfall Brook. Additional bacteria data collection would be beneficial to support identification of sources of potentially harmful bacteria in the Crookfall Brook watershed. These activities could include sampling at several different locations and under different weather conditions (e.g., wet and dry), end of pipe sampling, and outfall investigation. Field reconnaissance surveys focusing on stream buffers, stormwater runoff, and other source identification may also be beneficial.

The towns' existing Comprehensive Plans provide a strong technical basis for beginning to reduce a suite of pollutants, including bacteria. A brief description of existing local programs and recommended next steps from the towns' Stormwater Phase II reports, Wastewater Facilities Plans, a Source Water Assessment, and other documents are provided below. Stakeholders should review these documents directly for more detailed information.

Onsite Wastewater Management

Though a small portion of the Crookfall Brook watershed is sewered, most residents rely on OWTS (Figure 1). Currently, the Town of Smithfield has an Onsite Wastewater Management Plan. North Smithfield has a draft Onsite Wastewater Management Plan and Lincoln does not have a completed

plan. The Towns of Smithfield, North Smithfield, and Lincoln do not have OWTS ordinances requiring all OWTS to be inspected and pumped routinely. As part of an onsite wastewater planning process, all towns 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).

Smithfield, North Smithfield, and Lincoln are not currently eligible for Rhode Island's Community Septic System Loan Program (CSSLP). CSSLP is a program that assists citizens with the replacement of older and failing systems through low-interest loans. It is recommended that the towns develop a program to assist citizens with the replacement of older and failing systems.

Waterfowl, Wildlife, and Domestic Animal Waste

The towns' education and outreach programs should 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. Lincoln, Smithfield, and North Smithfield should work with volunteers to map locations where animal waste is a significant and chronic problem. This work should be incorporated into the towns' 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 towns and residents can take several measures to minimize waterfowl-related impacts. The Brook's shores are largely vegetated. However, if the shore has been cleared, residents can allow tall, coarse vegetation to grow in areas along the shores of Crookfall 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 Crookfall Brook and can harm human health and the environment.

Stormwater Management

The Towns of Lincoln (RIDPES permit RIR040021), Smithfield (RIPDES permit RIR040034), and North Smithfield (RIPDES Permit RIR040013) and RIDOT (RIPDES permit RIR040036) are municipal separate storm sewer system (MS4) operators in the Crookfall Brook watershed and have prepared the required Phase II Stormwater Management Plans (SWMPPs). Most of the Crookfall Brook watershed is included in the Phase II regulated area. However, portions of the watershed near the headwaters of Crookfall Brook at the outlet of Woonsocket Reservoir Number Three are not covered in the regulated area.

Lincoln, Smithfield, and North Smithfield SWMPPs outline goals for the reduction of stormwater runoff to Crookfall Brook through the implementation of Best Management Practices (BMPs). Many of these BMPs are now in place in all the watershed towns, including mapping all stormwater outfalls, instituting annual inspections and cleaning of the town's catch basins, and implementing an annual street sweeping program (RIDEM, 2010). Lincoln and Smithfield have adopted construction erosion and sediment control and post-construction stormwater control ordinances and conducted adequate public education activities (RIDEM, 2010). North Smithfield has not adopted these ordinances (RIDEM, 2010).

In 2005, the Town of Lincoln adopted an illicit discharge detection and elimination (IDDE) ordinance, based on the model ordinance developed by the Center for Watershed Protection (Berger, 2004). This type of ordinance prohibits illicit discharges to the MS4 and provides an enforcement mechanism. Lincoln should locate priority areas to identify and eliminate illicit discharges in the Crookfall Brook watershed. Illicit discharges can be identified through continued dry weather outfall sampling and microbial source tracking. It is recommended that both Smithfield and North Smithfield develop similar IDDE ordinances to help protect Crookfall Brook.

RIDOT has completed a SWMPP for state-owned road 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. Stormwater Pollution Prevention Plans (SWPPPs) 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 Crookfall Brook based on the watershed's imperviousness, the towns and RIDOT 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

Currently, the Crookfall Brook watershed is 72% undeveloped, however only a portion of the watershed is protected as open space. Protected lands include a buffer around each reservoir, and land along Crookfall Brook itself. As source waters to Woonsocket's water supply reservoirs, preserving these natural areas is particularly important. Woodland and wetland areas within the Crookfall Brook watershed absorb and filter pollutants from stormwater, and help protect both water quality in the stream and stream channel stability. As development is predicted to increase in the watershed (RI HEALTH, 2003), it is important to preserve undeveloped areas, and to 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 Crookfall Brook.

Table 1: Crookfall Brook Bacteria Data

***Waterbody ID*:** RI0001004R-01

Watershed Planning Area: 8 – Branch - Blackstone

Characteristics: Freshwater, Class AA, Tributary within a Public Drinking Supply, Primary and Secondary Contact Recreation, SRPW

Impairment: Enterococci (colonies/100mL)

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

Percent Reduction to meet TMDL: **41% (Includes 5% Margin of Safety)**

Data: 2008-2009 from RIDEM

Single Sample Enterococci (colonies/100 mL) Results for Crookfall Brook (2008-2009) with Geometric Mean Statistics

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean
BSN07	Crookfall Brook, Sayles Hill Road between 146 and 99 in Lincoln	8/20/2009	488	Dry	**85 (41%)***
BSN07	Crookfall Brook, Sayles Hill Road between 146 and 99 in Lincoln	7/20/2009	91	Dry	
BSN07	Crookfall Brook, Sayles Hill Road between 146 and 99 in Lincoln	7/15/2009	87	Dry	
BSN07	Crookfall Brook, Sayles Hill Road between 146 and 99 in Lincoln	5/20/2009	20	Dry	
BSN07	Crookfall Brook, Sayles Hill Road between 146 and 99 in Lincoln	9/17/2008	58	Dry	

Shaded cells indicate an exceedance of water quality criteria
*Includes 5% Margin of Safety

Wet and Dry Weather Geometric Mean Enterococci Values for Station BSN07

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
BSN07	Crookfall Brook, Sayles Hill Road between 146 and 99 in Lincoln	2008-2009	0	5	85	NA	85

Shaded cells indicate an exceedance of water quality criteria

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

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