



# Sandhill Brook

## Watershed Description

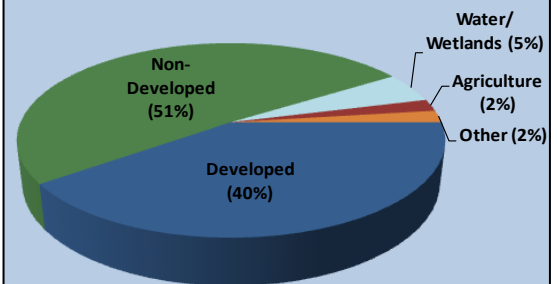
This **TMDL** applies to the Sandhill Brook assessment unit (RI0007028R-05), a 5.1-mile long stream located in North Kingstown, RI (Figure 1). The Town of North Kingstown is located on the eastern edge of the state, and is bordered by Narragansett Bay. Sandhill Brook is located in the northern section of town. The Sandhill Brook watershed is presented in Figure 2 with land use types indicated.

The headwaters of Sandhill Brook are in a forested area northeast of Cocumcussoc State Park. The brook flows northeast through a mix of forested and developed areas before being joined by a small tributary originating in Black Swamp. Sandhill Brook continues northeast through a commercial area, crossing Route 403, and entering an area characterized by residential development. The brook then flows into Saw Mill and Sandhill Ponds, crosses Route 1, and eventually empties into the Potowomut River in the northern section of the town.

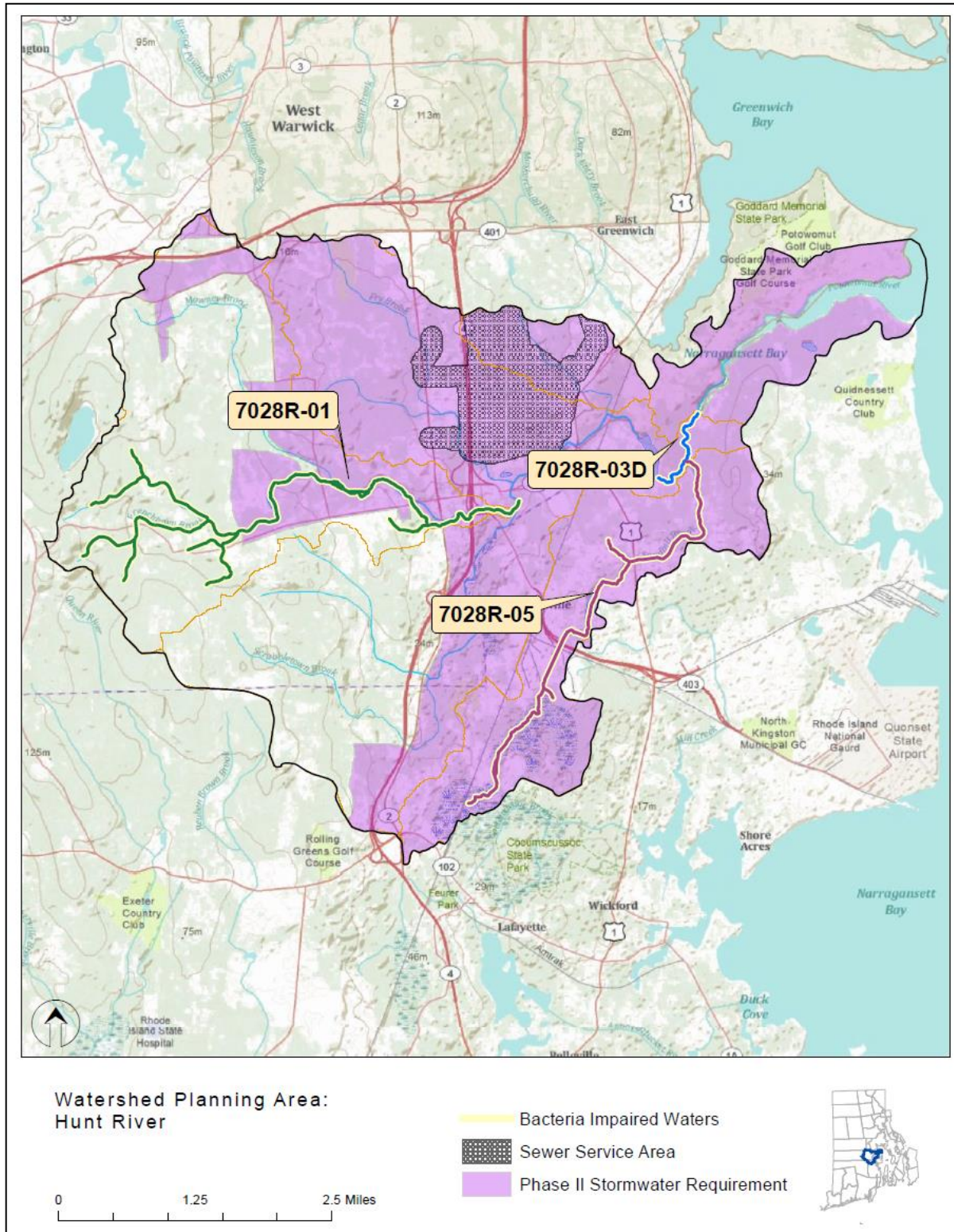
The Sandhill Brook watershed covers 3.7 square miles. As shown in the aerial image of Figure 3, non-developed areas occupy a large portion (51%) of the watershed. Developed uses occupy approximately 40%, wetlands and other surface waters occupy 5%, and other land uses combine to occupy 2%. Impervious surfaces cover a total of 16.9%.

## **Assessment Unit Facts** **(RI0007028R-05)**

- **Town:** North Kingstown
- **Impaired Segment Length:** 5.1 miles
- **Classification:** Class B
- **Direct Watershed:** 3.7 mi<sup>2</sup> (2395 acres)
- **Impervious Cover:** 16.9%
- **Watershed Planning Area:** Hunt River (#6)

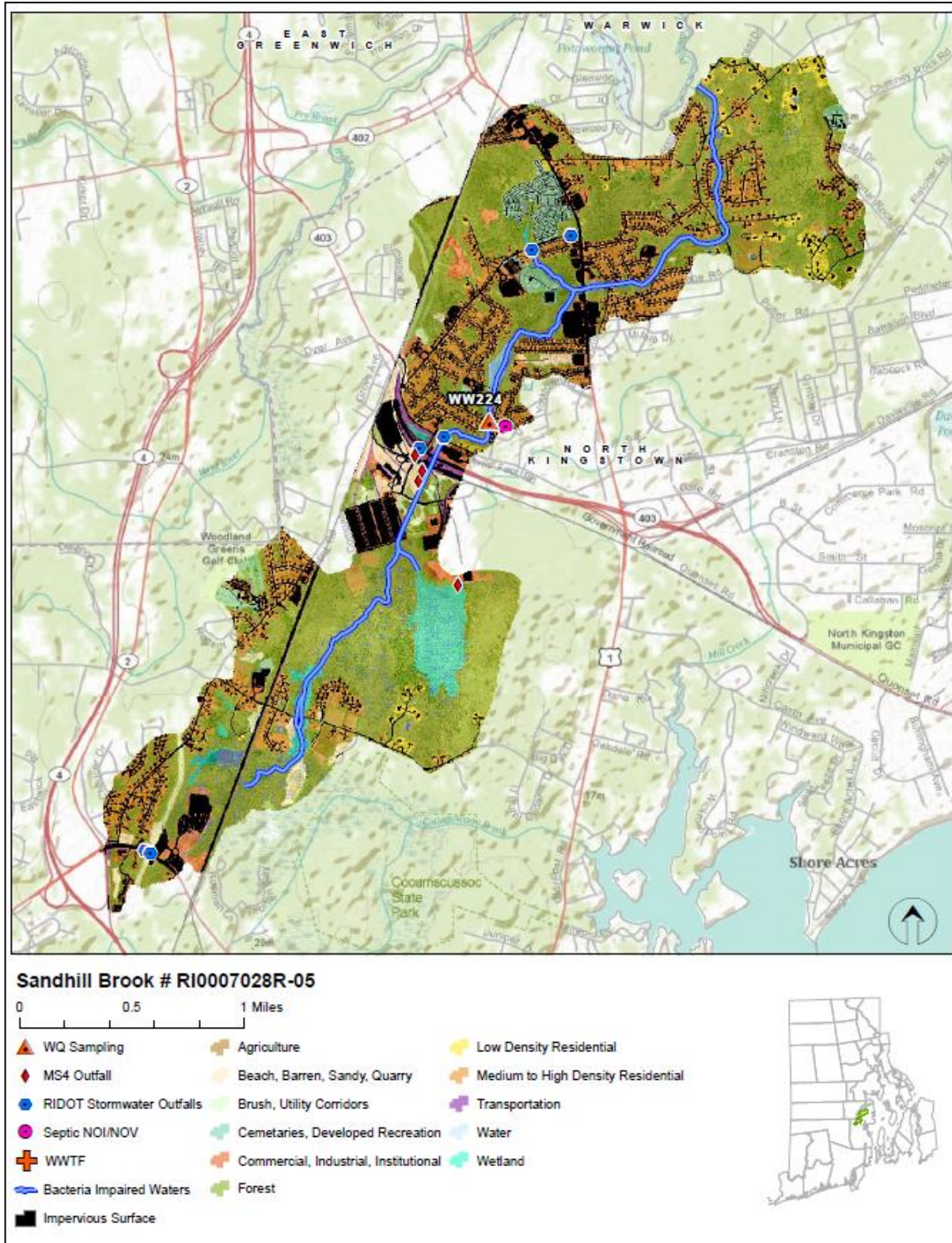


**Watershed Land Uses**



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





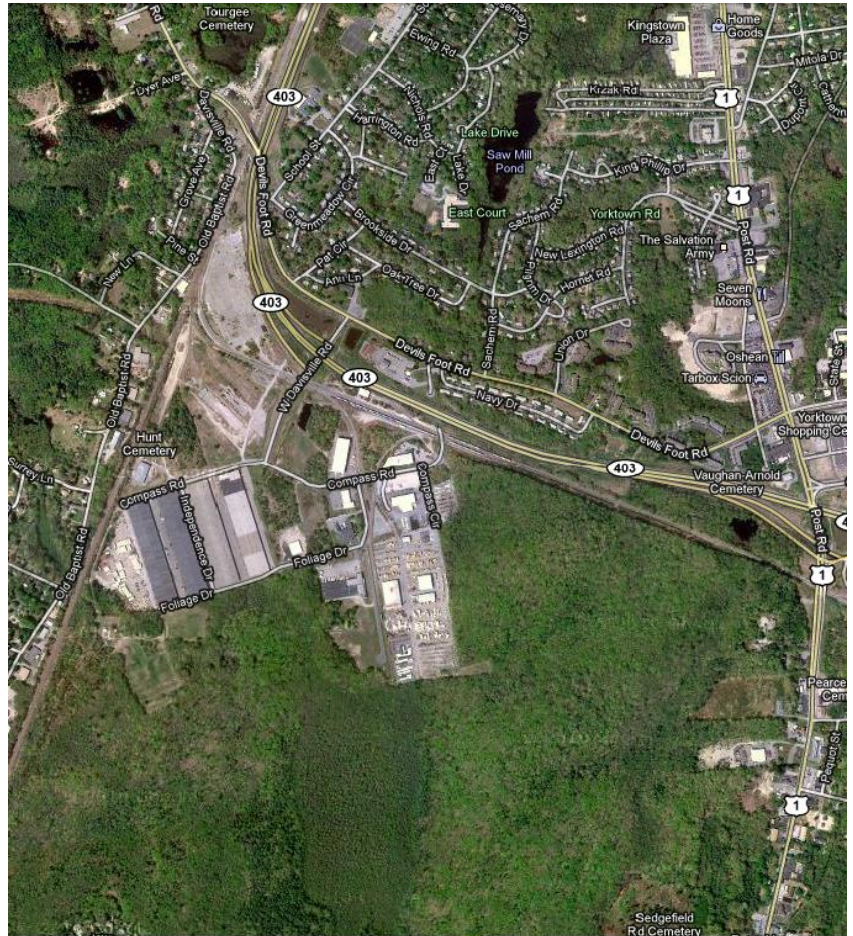
**Figure 2: Map of the Sandhill Brook watershed with impaired segment, sampling location, and land cover indicated.**



### Why is a TMDL Needed?

Sandhill Brook 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). From 2003-2008, water samples were collected from one sampling location (WW224) and analyzed for the indicator bacteria, fecal coliform. The water quality criteria for fecal coliform, along with bacteria sampling results from 2003-2008 and associated statistics are presented in Table 1. The geometric mean and 90<sup>th</sup> percentile maximum exceeded the water quality criteria for fecal coliform.

To aid in identifying possible bacteria sources, wet and dry weather geometric mean and 90<sup>th</sup> percentile values were also calculated for station WW224. Both wet and dry-weather values exceeded the water quality criteria for fecal coliform, with wet-weather values higher than dry-weather values.



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

Due to the elevated bacteria measurements presented in Table 1, Sandhill 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 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 Sandhill Brook watershed including malfunctioning onsite wastewater treatment systems, stormwater runoff from developed areas, and wildlife and domestic animal waste.

#### Onsite Wastewater Treatment Systems

Approximately 96% of the town of North Kingstown relies on onsite wastewater treatment systems (OWTS) such as cesspools and septic systems. A small section of the town located in the northeast corner in the Quonset Point/Davisville Industrial Park has a small wastewater treatment plant. RIDEM has identified 730 cesspools throughout North Kingstown that are impacted by the cesspool phaseout law. The cesspool phaseout law is described in Section 6.7 of the Core TMDL Document. The Sandhill Brook watershed relies exclusively on OWTS (Town of North Kingstown, 2000). Failing OWTS can be significant sources of bacteria by allowing improperly treated waste to reach surface waters (RI HEALTH, 2003). Many areas in the Town of North Kingstown have inherent environmental conditions, such as a high groundwater table, poor soil type, and restricted lot sizes, that require careful siting and diligent maintenance of OWTS (Town of North Kingstown, 2000).

Failing or inadequate OWTS, including cesspools, have previously been identified as potential sources of bacteria to Sandhill Brook (Town of North Kingstown, 2000). 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 in the Sandhill Brook watershed.

#### Illicit Discharges

Other illicit discharges, or any discharge to a municipal separate storm sewer system (MS4) that is not composed entirely of stormwater, may also be contributing bacteria to Sandhill Brook. Figure 2 identifies multiple MS4 outfalls along the stream and several near sampling station WW224

#### Developed Area Stormwater Runoff

The Sandhill Brook watershed has an impervious cover of 16.9%. 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. 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.

In accordance with Phase II requirements, 452 stormwater outfalls and their receiving waterbodies in North Kingstown have been identified and mapped (VHB, 2004). The town is continuing to update the map and identify additional outfalls. Multiple stormwater outfalls have been identified along Sandhill Brook (Figure 2).

#### Waterfowl, Wildlife, and Domestic Animal Waste

Portion of the Sandhill Brook watershed are predominately undeveloped, particularly in the southern portion of the watershed. Though just outside of the watershed boundary, Cocumcussoc State Park is home to multiple species of wildlife and waterfowl that may enter the watershed. Large wetland areas within the watershed, specifically Black Swamp, are also home to various animals. 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 northern portion of the watershed is characterized by residential development. Waste from domestic animals such as dogs, may also be contributing to bacteria concentrations in Sandhill Brook.

#### 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 Sandhill Brook 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, the following steps are recommended to support water quality goals.

#### Onsite Wastewater Management

All residents of the Sandhill Brook watershed rely on OWTS (septic systems or cesspools). The Town of North Kingstown has an approved Onsite Wastewater Management Plan that provides a framework for managing the OWTS (Town of North Kingstown, 2000). As all of the drinking water for the town comes from groundwater, the town is particularly interested in protecting the quality of their groundwater through measures such as limiting contamination from OWTS. As such, North Kingstown has an active Wastewater Management Committee (formed in 1996), that has worked to develop (1999) and adopt (2005) an ordinance requiring all OWTS in North Kingstown be inspected and pumped if

necessary, once every three years (Geremia, 2009; Town of North Kingstown, 2000). The Committee has also established methods for tracking the location, age, and maintenance history of all OWTS in North Kingstown and developed four wastewater management districts to provide more comprehensive protection of surface and groundwater (Geremia, 2009). North Kingstown should continue to track the maintenance history of all OWTS, and enforce the inspection and pump-out ordinance.

The Town of North Kingstown is eligible for Rhode Island's Community Septic System Loan Program (CSSLP), and has obtained 1.6 million dollars in CSSLP money since 2002. The CSSLP program provides low-interest loans to residents to help with maintenance and replacement of OWTS. North Kingstown should continue to provide funds to residents through the CSSLP.

### Stormwater Management

The Town of North Kingstown (RIPDES permit RIR040028) and RIDOT (RIPDES permit RIR040036) are municipal separate storm sewer (MS4) operators in the Sandhill Brook watershed and have prepared Phase II Stormwater Management Plans (SWMPP). The entire watershed area is regulated under the Phase II program.

North Kingstown's SWMPP outlines goals for the reduction of stormwater runoff to Sandhill Brook 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 catch basins, implementing an annual street sweeping program, adopting construction erosion and sediment control and post-construction stormwater control ordinances, and conducting public education activities (RIDEM, 2010a).

In 2006, the Town of North Kingstown adopted an illicit discharge detection and elimination ordinance (RIDEM, 2010a). This ordinance prohibits illicit discharges to the MS4 and provides an enforcement mechanism. It is recommended that any stormwater outfalls discharging in the near vicinity of the sampling location be monitored to check for illicit discharges. 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 Sandhill Brook, additional efforts are needed to restore the river's water quality. As mentioned previously, the Sandhill Brook watershed has an impervious cover of 16.9%, a level where stormwater impacts are expected. At this threshold and due to the elevated wet-weather bacteria concentrations found in Sandhill Brook, this TMDL finds that structural BMPs are necessary to improve water quality in Sandhill Brook. Section 6.2 of the Core TMDL Document and Part IV.D of the RIPDES General Permit describe the MS4 requirements for areas where urbanized stormwater runoff has been found to be contributing to waterbody impairment. North Kingstown and RIDOT must assess the six minimum control measure BMPs included in their SWMPPs for compliance with this TMDL plan's provisions and provide measurable goals in a TMDL Implementation Plan (TMDL IP) for any needed amendments. In particular, they are required to adopt post-construction ordinances consistent with those described in Section 6.3 of the Core TMDL Document.

North Kingstown and RIDOT must also comply with the structural BMP requirements of Part IV.D of the RIPDES General Permit. These requirements include, but are not limited to, a BMP study that details the tasks necessary to design and construct BMPs that reduce the pollutant of concern and stormwater volumes to the *maximum extent feasible*. TMDL provisions apply to any MS4 operators contributing stormwater to the identified outfall regardless of outfall ownership. The BMP study should include all the components of Part IV.D.4 (RIDEM, 2003s) that were previously described in Number 6 in the TMDL IP section of Section 6.2 in the Core TMDL Document. It must evaluate the feasibility of distributing infiltration or equivalent BMPs throughout the drainage area of the priority outfalls as an alternative to end of pipe technologies since the amount of land available for BMP construction is limited. Records submitted to RIDEM by North Kingstown and RIDOT indicate that there are six RIDOT and seven North Kingstown outfalls in the watershed. North Kingstown and RIDOT are also required to modify their six minimum measures. .

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



### Waterfowl, Wildlife, and Domestic Animal Waste

North Kingstown's education and outreach programs should highlight the importance of picking up after dogs and other pets and not feeding waterfowl, particularly in the southern portion of the watershed. Animal wastes should be disposed of away from any waterway or stormwater system. North Kingstown 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.

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 Sandhill 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 Sandhill Brook and can harm human health and the environment.

### Land Use Protection

Woodland and wetland areas within the Sandhill Brook watershed, such as Black Swamp and the nearby Cocumcussoc State Park, 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 Sandhill Brook watershed, it is important to preserve these undeveloped areas, and institute controls on development in the watershed. The Town of North Kingstown has a longstanding groundwater protection program that includes regional planning and zoning restrictions based on aquifer locations. While this program is designed to protect the town's drinking water supply, it can also protect the water quality of Sandhill Brook and other surface waters in North Kingstown (RI HEALTH, 2003).

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

**Table 1: Sandhill Brook Bacteria Data**

**Waterbody ID:** RI0007028R-05

**Watershed Planning Area:** 6 – Hunt River

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

**Impairment:** Fecal Coliform (MPN/100mL)

**Water Quality Criteria for Fecal Coliform:**

Geometric Mean: 200 MPN/100 mL

90<sup>th</sup> Percentile Maximum: 400 MPN/100 mL

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

**Data:** 2003-2008 from RIDEM

**Single Sample Fecal Coliform (MPN/100 mL) Results for Sandhill Brook (2003-2008) with Geometric Mean and 90<sup>th</sup> Percentile Statistics**

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
WW224	Sandhill Brook at Brookside Drive	10/25/2008	2400	Wet	866	2288
WW224	Sandhill Brook at Brookside Drive	9/19/2008	380	Dry		
WW224	Sandhill Brook at Brookside Drive	8/14/2008	420	Dry		
WW224	Sandhill Brook at Brookside Drive	7/11/2008	2120	Dry		
WW224	Sandhill Brook at Brookside Drive	6/7/2008	600	Wet		
WW224	Sandhill Brook at Brookside Drive	10/19/2007	49500	Wet	6328	<b>34980<sup>†</sup> (100%)*</b>
WW224	Sandhill Brook at Brookside Drive	9/15/2007	3100	Wet		
WW224	Sandhill Brook at Brookside Drive	8/18/2007	1440	Dry		
WW224	Sandhill Brook at Brookside Drive	7/21/2007	13200	Wet		
WW224	Sandhill Brook at Brookside Drive	6/15/2007	3480	Dry		
WW224	Sandhill Brook at Brookside Drive	10/28/2006	9000	Wet	785	7800
WW224	Sandhill Brook at Brookside Drive	9/30/2006	720	Wet		
WW224	Sandhill Brook at Brookside Drive	8/26/2006	280	Dry		
WW224	Sandhill Brook at Brookside Drive	7/29/2006	960	Dry		
WW224	Sandhill Brook at Brookside Drive	10/15/2005	7000	Wet		
WW224	Sandhill Brook at Brookside Drive	8/20/2005	194	Dry		
WW224	Sandhill Brook at Brookside Drive	5/14/2005	78	Dry		

**Single Sample Fecal Coliform (MPN/100 mL) Results for Sandhill Brook (2003-2008) with Geometric Mean and 90<sup>th</sup> Percentile Statistics (continued)**

Station Name	Station Location	Date	Result	Wet/Dry	Geometric Mean	90th Percentile
WW224	Sandhill Brook at Brookside Drive	10/16/2004	80	Wet	928	24720
WW224	Sandhill Brook at Brookside Drive	9/18/2004	10800	Wet		
WW224	Sandhill Brook at Brookside Drive	7/24/2004	900	Wet		
WW224	Sandhill Brook at Brookside Drive	6/19/2004	34000	Wet		
WW224	Sandhill Brook at Brookside Drive	5/8/2004	26	Dry		
WW224	Sandhill Brook at Brookside Drive	10/4/2003	220	Dry	150	238
WW224	Sandhill Brook at Brookside Drive	9/20/2003	250	Wet		
WW224	Sandhill Brook at Brookside Drive	7/19/2003	149	Dry		
WW224	Sandhill Brook at Brookside Drive	6/7/2003	126	Wet		
WW224	Sandhill Brook at Brookside Drive	5/3/2003	74	Dry		

Shaded cells indicate an exceedance of water quality criteria  
 \* Includes Margin of Safety  
 † 90<sup>th</sup> percentile used to determine percent reduction

**Wet and Dry-Weather Geometric Mean Fecal Coliform Values for Station WW224**

Station Name	Station Location	Years Sampled	Number of Sample Days		Geometric Mean		
			Wet	Dry	All	Wet	Dry
WW224	Sandhill Brook	2003-2008	13	13	894	2292	324

Shaded cells indicate an exceedance of water quality criteria  
 Weather condition determined from rain gage at TF Green Airport in Warwick, RI

**Wet and Dry-Weather 90<sup>th</sup> Percentile Fecal Coliform Values for Station WW224**

Station Name	Station Location	Years Sampled	Number of Sample Days		90th Percentile Value		
			Wet	Dry	All	Wet	Dry
WW224	Sandhill Brook	2003-2008	13	13	11760	27760	1984

Shaded cells indicate an exceedance of water quality criteria  
 Weather condition determined from rain gage at TF Green Airport in Warwick, RI



### References

- James J. Geremia & Associates Inc. (2009). Town of North Kingstown, Rhode Island Comprehensive Wastewater Facilities Plan for the Post Road Corridor (December 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 (2010a). MS4 Compliance Status Report for RI Statewide Bacteria TMDL. 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). North Kingstown 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 Quality.
- Town of North Kingstown (2000). Onsite Wastewater Management Plan. November 2000.
- 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](http://www.epa.gov/owm/septic/pubs/septic_2002_osdm_all.pdf).
- VHB (2004). Municipal Stormwater Management Program Plan: North Kingstown, Rhode Island. Vanasse Hangen Brustlin, Inc. (March 2004).