



# Roger Williams Park Ponds

## Watershed Description

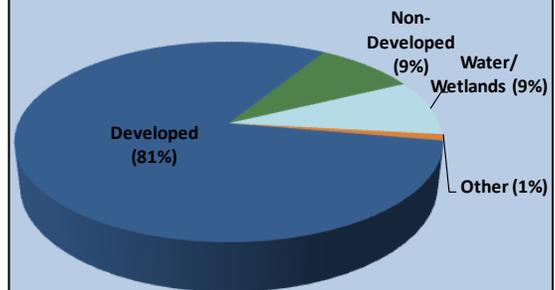
This **TMDL** applies to the Roger Williams Park Ponds assessment unit (RI0006017L-05), a 76-acre pond located in Providence, RI (Figure 1). The City of Providence is located in the eastern portion of the state and the Roger Williams Park Ponds are located in the southern corner of the city. The Roger Williams Park Ponds watershed is presented in Figure 2 with land use types indicated.

The Roger Williams Park Ponds are located in Roger Williams Park in the City of Providence, a large Victorian park that offers manicured grounds, an extensive roadway system, a zoo, museum, and other facilities. The ponds are bounded by Interstate 95 and Elmwood Avenue (Route 1) to the west, Broad Street and Warwick Avenue (Route 117) to the east, and Park Avenue (Route 12) to the south. The pond system is comprised of a series of hydrologically interconnected lakes including Roosevelt, Polo, Willow, Pleasure, Edgewood, Cunliff, and Elm. The main inlet to the ponds, located at the western edge of Roosevelt Lake, is culverted flow from Mashapaug Pond, another bacteria impaired waterbody, which is located just northwest of the park. There are no surface tributaries to the ponds. The main outlet of the pond system is located at the dam at the southern end of Elm Lake (RIDEM, 2007).

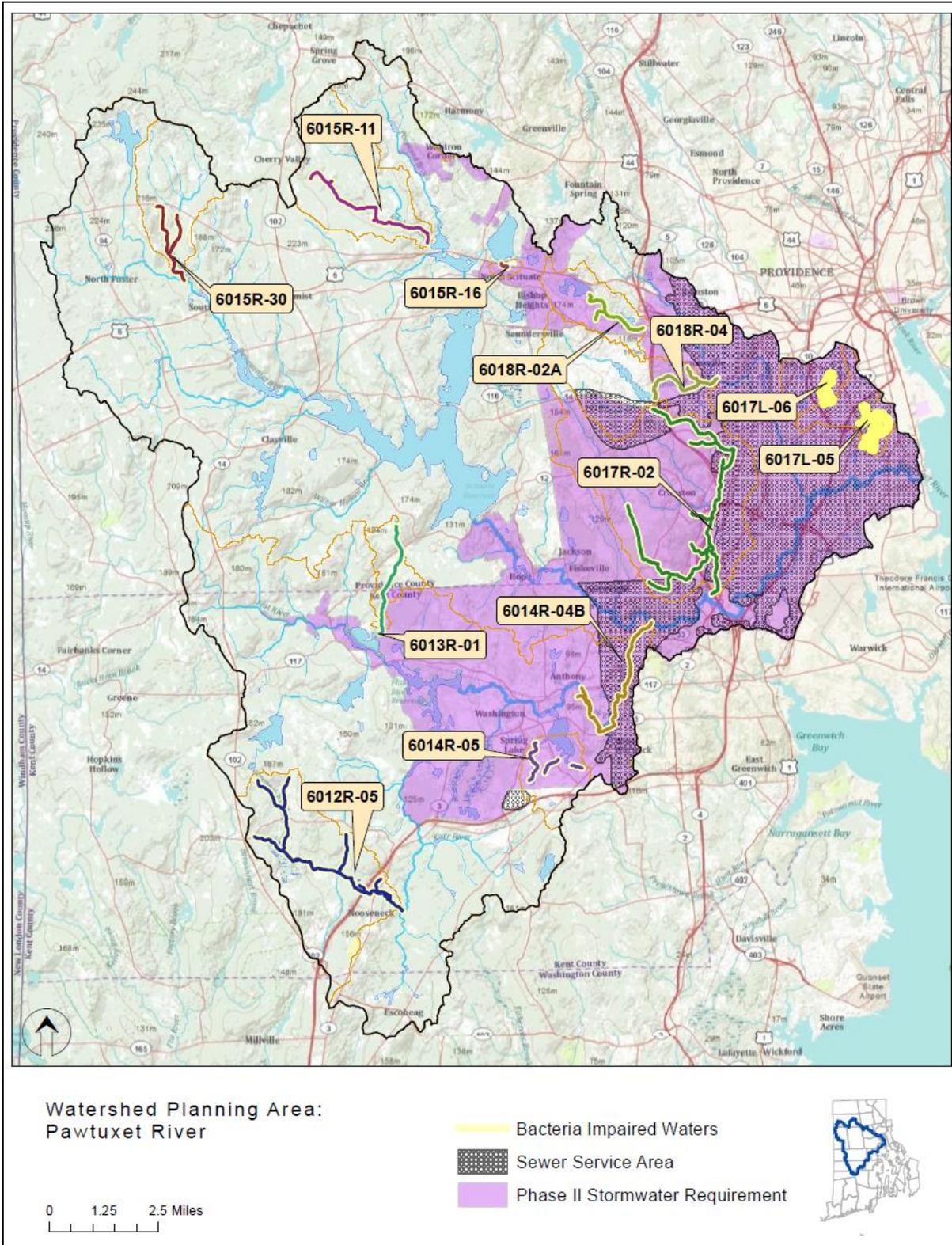
The Roger Williams Park Ponds watershed covers 4 square miles. As shown in the aerial image of Figure 3, developed areas (including residential, commercial, and transportation uses) occupy a large portion (81%) of the watershed. Non-developed uses cover approximately 9%, wetlands and other surface waters occupy 9%, and other land uses combine to cover 1%. Impervious surfaces cover a total of 58%.

## Assessment Unit Facts (RI0006017L-05)

- **Town:** Providence
- **Impaired Segment Size:** 76 acres
- **Classification:** Class B
- **Direct Watershed:** 4 mi<sup>2</sup> (2589 acres)
- **Impervious Cover:** 57.8%
- **Watershed Planning Area:** Pawtuxet (#12)



**Watershed Land Uses**



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

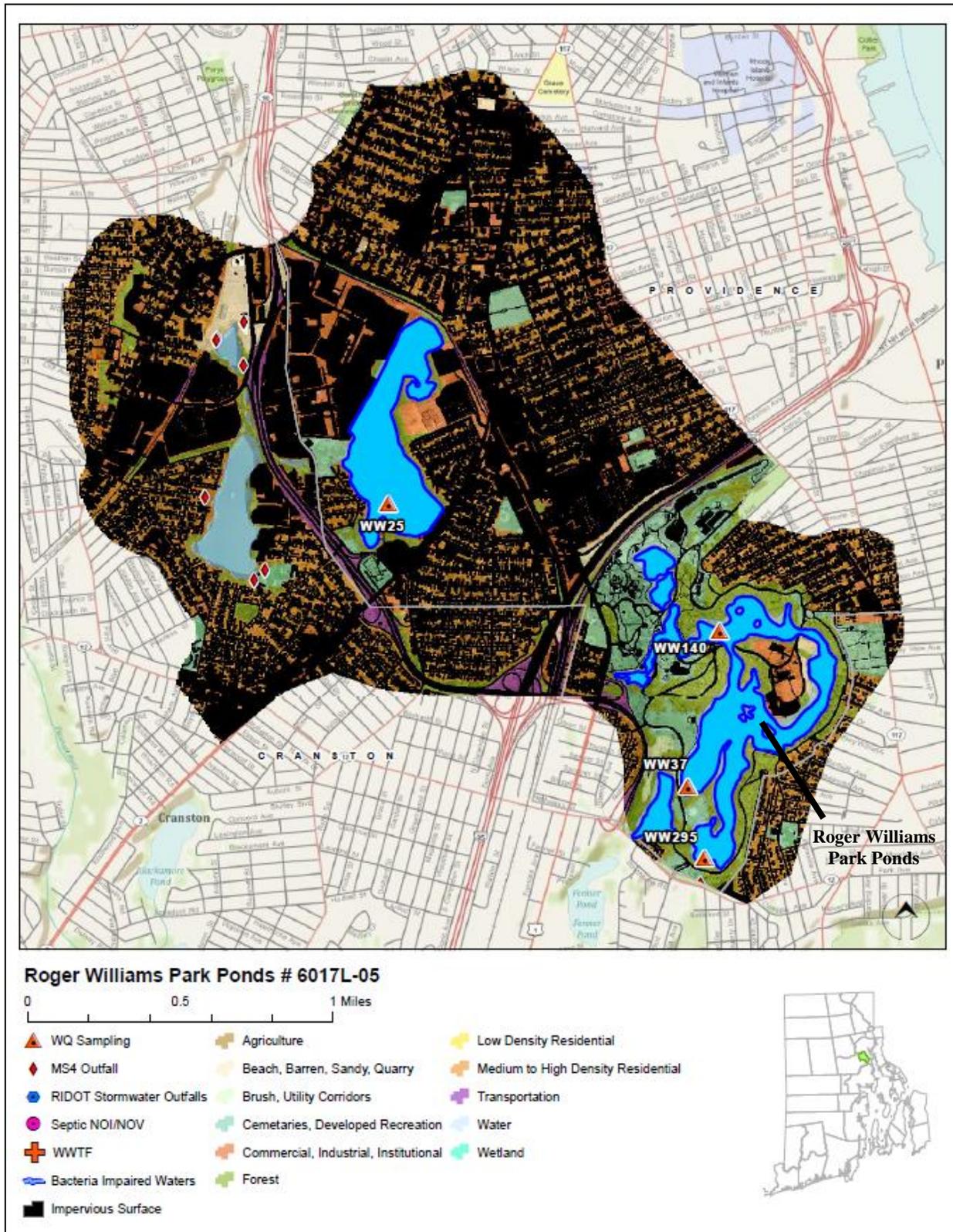
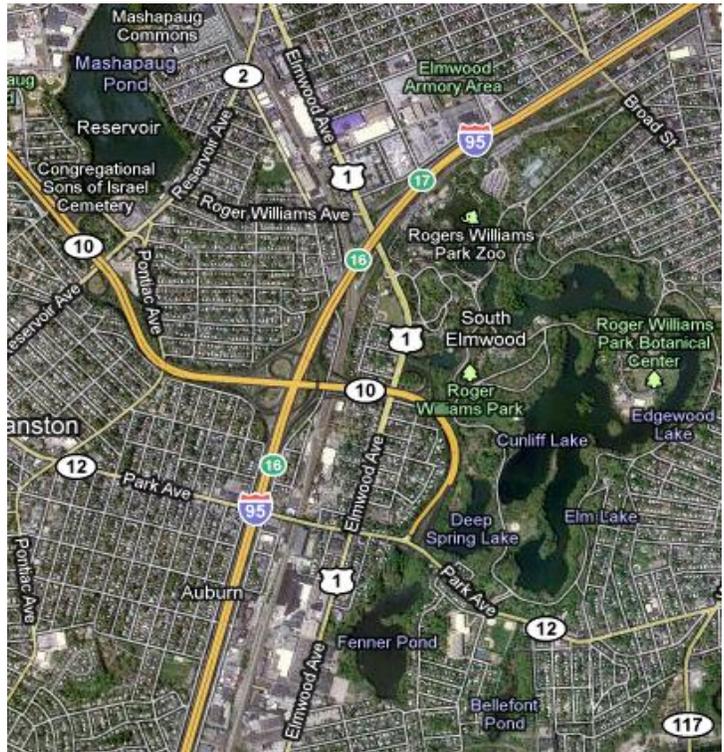


Figure 2: Map of the Roger Williams Park Ponds watershed with impaired segments, sampling locations, and land cover indicated.

### Why is a TMDL Needed?

Roger Williams Park Ponds is a Class B freshwater lake, and its applicable designated uses are primary and secondary contact recreation and fish and wildlife habitat (RIDEM, 2009). From 2001-2005, water samples were collected from three sampling locations (WW37, WW140, WW295) and analyzed for the indicator bacteria, fecal coliform. The water quality criteria for fecal coliform, along with bacteria sampling results from 2001-2005 and associated statistics, are presented in Table 1. The geometric mean and 90<sup>th</sup> percentile maximum was calculated for station WW37 and exceeded Rhode Island's water quality criteria for fecal coliform. Statistics were not calculated for stations WW140 and WW295 as there were insufficient data to calculate these values.



**Figure 3: Partial aerial view of the Roger Williams Park Ponds watershed. (Source: Google Maps)**

To aid in identifying possible bacteria sources, the geometric mean and 90<sup>th</sup> percentile maximum were also calculated for wet and dry weather sample days at station WW37. Both wet and dry 90<sup>th</sup> percentile values exceeded water quality standards for fecal coliform, while only the wet-weather geometric mean value exceeded the standards. Wet-weather values were much higher than dry-weather values.

Due to the elevated bacteria measurements presented in Table 1, the Roger Williams Park Ponds do 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.

The Roger Williams Park Ponds have previously been assessed by RIDEM as not meeting water quality standards for phosphorus, excess algal growth (chlorophyll a), and dissolved oxygen. These impairments were addressed in the TMDL for Phosphorus to Address Nine Eutrophic Ponds in Rhode Island (2007).

### Potential Bacteria Sources

There are several potential sources of bacteria in the Roger Williams Park Ponds watershed including stormwater runoff, animal waste, and sewer system leaks. The 2007 TMDL for Phosphorus to Address Nine Eutrophic Ponds in Rhode Island identified inputs from Mashapaug Pond (another impaired waterbody), stormwater runoff, and fecal-related nutrients from waterfowl and wildlife as the most significant sources of phosphorus to the Roger Williams Park Pond system. These sources may also be contributing to bacterial contamination of the Roger Williams Park Ponds.

#### Developed Area Stormwater Runoff

The Roger Williams Park Ponds watershed has an impervious cover of approximately 58%. 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 and as part of the work for the 2007 TMDL for Phosphorus to Address Nine Eutrophic Ponds in Rhode Island, all stormwater outfalls discharging directly to the Roger Williams Park Pond system have been identified and mapped by the City of Providence and the Rhode Island Department of Transportation (RIDOT). Twenty-four storm drains and two areas of concentrated surface flow have been identified. These outfalls were shown to carry stormwater from both high-density residential areas near the park and from the park itself (RIDEM, 2007). As stormwater is known to carry a suite of pollutants, including bacteria, it is a likely source of bacteria to the Roger Williams Park Ponds.

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

The Roger Williams Park Ponds watershed is predominately developed, with a combination of residential, commercial, and transportation uses. Waste from domestic animals such as dogs, may be contributing to bacteria concentrations in the pond system.

Though the watershed is highly developed, the area surrounding the ponds is predominately forested or maintained lawn. Many of these areas are home to multiple species of wildlife 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. Large populations of ducks and geese

have been shown to congregate in many of these areas (RIDEM, 2007; Fuss and O'Neill, 2004). Several of these ponds also have extensive areas of eroded shoreline. The Roger Williams Park Zoo is also located near the pond system and is a potential bacteria source to the Roger Williams Park Ponds systems.

### Sewer Leaks

The Roger Williams Park Ponds watershed is completely sewered, as shown in Figure 1. Sewer system leaks and other illicit discharges near the ponds are possible based on dry-weather bacteria data (Table 1). Municipal wastewater is treated within the Narragansett Bay Commission system and discharged to the Providence River. The extensive sewage collection system within the watershed increases the risk of sewer system leaks and subsequent contamination.

### 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 Roger Williams Park Ponds watershed. These activities could include sampling at several different locations and under different weather conditions (e.g., wet and dry). Field reconnaissance surveys focused on 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.

### Stormwater Management

The City of Providence (RIPDES permit RIR040005) and RIDOT (RIPDES permit RIR040036) are municipal separate storm sewer (MS4) operators in the Roger Williams Park Ponds watershed and have prepared the required Phase II Stormwater Management Plans (SWMPP). The entire watershed area is regulated under the Phase II program.

Providence's SWMPP outlines goals for the reduction of stormwater runoff to the Roger Williams Park Ponds 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).

The City of Providence adopted an illicit discharge detection and elimination ordinance in 2005 (RIDEM, 2010a). These ordinances prohibit illicit discharges to the MS4 and provide an enforcement mechanism. The city should continue to select priority areas to identify and eliminate illicit discharges in the Roger Williams Park Ponds 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. Stormwater Pollution Prevention Plans (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 in reducing the effects of stormwater runoff to the Roger Williams Park Ponds, additional efforts are needed to restore the river's water quality. As mentioned previously, the Roger Williams Park Ponds watershed has an impervious cover of 58%, 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. Providence 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.

In addition, the Eutrophic Ponds TMDL (2007) determined that structural BMPs are necessary to improve water quality in the Roger Williams Park Ponds. RIDEM identified priority outfalls for treatment in Table 4.4 of the Eutrophic Ponds TMDL document. The BMPs should be designed to target bacterial pollution reduction as well as phosphorus reductions. Further information can be found in the Eutrophic Ponds TMDL. One TMDL IP may be submitted to address both bacteria and phosphorus TMDL requirements.

**Priority Outfalls for Roger Williams Park Ponds (Table 4.4 in the 2007 Eutrophic Ponds TMDL)**

| <b>Outfall ID</b> | <b>Location</b>                                    | <b>Possible Ownership<sup>1</sup></b> |
|-------------------|--|---------------------------------------|
| RWP-Q             | 48" Diameter. Eastern End Roosevelt Lake           | Providence, RIDOT, Cranston           |
| RWP-S             | 48" Diameter. Eastern Shore Willow Lake            | Providence                            |
| RWP-V             | 74" x 24" Box Culvert. Eastern Shore Polo Lake     | Providence                            |
| RWP-H             | 30" x 42" Oval Culvert. Southern End Edgewood Lake | Providence                            |
| RWP-A             | 24" Diameter. Northern End Pleasure Lake           | Providence                            |
| RWP-D             | 24" Diameter. Eastern End Pleasure Lake            | Providence                            |
| RWP-I             | 24"Diameter. Southern End Edgewood Lake            | Providence                            |
| RWP-U             | 24" Diameter. Northern End Polo Lake               | Providence                            |

<sup>1</sup> Ownership inferred from proximity to state or local roadways.

The City of Providence 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. The city has recently hired a contractor to undertake the Roger Williams Park Ponds restoration project. The overall goal of the project is to restore and improve both water quality and biodiversity in the 100-acre urban pond complex. The project will develop a strategy for restoring the ponds, including structural and non-structural BMPs both within the park as well as the watershed extending beyond the park boundary. RIDOT should also continue to implement its Phase II SWMPP.

Waterfowl, Wildlife, and Domestic Animal Waste

The City of Providence has multiple programs in place to decrease problems from animal waste. Section 4-27 of Providence’s City Ordinance requires owners to properly dispose of pet waste. Violating this law is punishable through fines. The city also has a leash law in public spaces and signage and dog-waste receptacles in many public places throughout the watershed (Fuss and O’Neill, 2004). The Roger Williams Park Zoo is also located near the ponds. RIDEM should continue to ensure that waste from the multiple animals within the zoo is being handled and disposed of properly. Due to the concentration of residential neighborhoods, parks, and the zoo adjacent to the Roger Williams Park Ponds, further efforts should be taken to limit bacterial contributions from animal waste to the ponds.

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. The city should work with volunteers 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 additional signage, providing more pet waste receptacles or pet waste digester systems in high-use areas, enacting stricter ordinances requiring clean-up of pet waste, and targeting educational and outreach programs in problem areas.

Large populations of ducks and geese have been shown to congregate in the Roger Williams Park Pond system (RIDEM, 2007; Fuss and O’Neill, 2004). The city and residents can take several measures to minimize bird-related impacts. They can allow tall, coarse vegetation to grow in areas along the shores of the Roger Williams Park Ponds 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 Roger Williams Park Ponds and can harm human health and the environment.

Land Use Protection

Woodland and wetland areas within the Roger Williams Park Ponds watershed absorb and filter pollutants from stormwater runoff, and help protect water quality. As these areas represent only a small portion of the land use in the Roger Williams Park Ponds watershed, it is important to preserve these sparse undeveloped areas, and 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 the Roger Williams Park Ponds.

**Table 1: Roger Williams Park Ponds Bacteria Data**

**Waterbody ID:** RI0006017L-05

**Watershed Planning Area:** 12 – Pawtuxet

**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: 400 MPN/100 mL

**Percent Reduction to meet TMDL: 100% (Includes 5% Margin of Safety)**

**Data:** 2001-2005 from RIDEM

**Single Sample Fecal Coliform (MPN/100 mL) Results for Roger Williams Park Ponds (2001-2005) with Geometric Mean and 90<sup>th</sup> Percentile Statistics**

| Station Name | Station Location | Date       | Result | Wet/Dry | Geometric Mean | 90th Percentile              |
|--------------|------------------|------------|--------|---------|----------------|------------------------------|
| WW295        | Elm Pond         | 7/20/2005  | 16     | Dry     | NA             | NA                           |
| WW37         | Cunliff's Pond   | 7/18/2003  | 20     | Wet     | 210            | 8130 <sup>†</sup><br>(100%)* |
| WW37         | Cunliff's Pond   | 5/3/2003   | 0      | Dry     |                |                              |
| WW37         | Cunliff's Pond   | 10/17/2002 | 985    | Wet     |                |                              |
| WW37         | Cunliff's Pond   | 7/25/2002  | 760    | Dry     |                |                              |
| WW37         | Cunliff's Pond   | 5/4/2002   | 350    | Dry     |                |                              |
| WW37         | Cunliff's Pond   | 10/18/2001 | 550    | Dry     |                |                              |
| WW37         | Cunliff's Pond   | 7/26/2001  | 530    | Wet     |                |                              |
| WW37         | Cunliff's Pond   | 6/23/2001  | 24800  | Wet     |                |                              |
| WW140        | Pleasure Pond    | 7/20/2005  | 100    | Dry     | NA             | NA                           |

Shaded cells indicate an exceedance of water quality criteria

\* Includes a 5% Margin of Safety

<sup>†</sup>90<sup>th</sup> percentile used to determine percent reduction

**Wet and Dry Weather Geometric Mean Fecal Coliform Values for all Stations**

| Station Name | Station Location          | Years Sampled | Number of Samples |     | 90th Percentile |     |     |
|--------------|---------------------------|---------------|-------------------|-----|-----------------|-----|-----|
|              |                           |               | Wet               | Dry | All             | Wet | Dry |
| WW295        | Elm Pond                  | 2005          | 0                 | 1   | NA              | NA  | NA  |
| WW37         | Roger Williams Park Ponds | 2001-2003     | 4                 | 4   | 210             | 713 | 62  |
| WW140        | Pleasure Pond             | 2005          | 0                 | 1   | NA              | NA  | NA  |

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

**Wet and Dry Weather 90<sup>th</sup> Percentile Fecal Coliform Values for all Stations**

| Station Name | Station Location          | Years Sampled | Number of Samples |     | 90th Percentile Value |       |     |
|--------------|---------------------------|---------------|-------------------|-----|-----------------------|-------|-----|
|              |                           |               | Wet               | Dry | All                   | Wet   | Dry |
| WW295        | Elm Pond                  | 2005          | 0                 | 1   | NA                    | NA    | NA  |
| WW37         | Roger Williams Park Ponds | 2001-2003     | 4                 | 4   | 8130                  | 17656 | 697 |
| WW140        | Pleasure Pond             | 2005          | 0                 | 1   | NA                    | NA    | NA  |

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

### References

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