

## Executive Summary

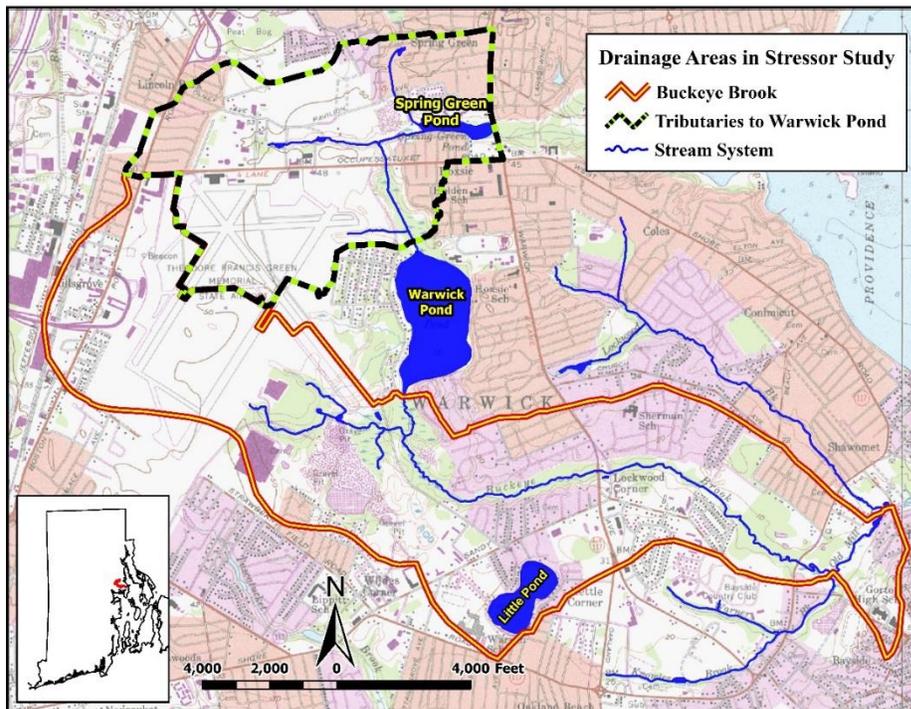
### TMDL for Buckeye Brook and the Tributaries to Warwick Pond

#### Addressing Benthic macroinvertebrate, Cadmium, Copper, Iron, and Dissolved Oxygen Impairments

This water quality restoration study, known formally as the Total Maximum Daily Load (TMDL) for Buckeye Brook and the Tributaries to Warwick Pond, addresses impairments identified from sampling conducted by the Rhode Island Department of Environmental Management (RIDEM). Impaired waters are those that do not meet water quality standards for their designated uses such as fishing, recreation (boating and swimming) and support of wildlife. The uses and causes of impairment for these waterways addressed by this study and a map of their watersheds are provided below:

#### Designated Uses and Impairments

Waterbody	Designated Use	Impairment
Tributaries to Warwick Pond	Fish and wildlife habitat, primary and secondary contact recreational	Benthic-macroinvertebrate, Cadmium, Iron
Buckeye Brook	Fish and wildlife habitat, primary and secondary contact recreational	Benthic-macroinvertebrate, Cadmium, Copper, Iron, Dissolved Oxygen



Federal law (Clean Water Act of 1972) requires that states determine the acceptable amount of pollution that a waterbody can receive and still meet water quality standards supportive of its various designated uses. Known as a Total Maximum Daily Load (TMDL), this analysis must be done for all pollutant(s) causing an impairment. The TMDL study uses available quality-assured data to determine what this acceptable load is, and sets the pollutant reductions required to restore water quality in support of the waterbody's designated uses. The TMDL provides a framework for identifying specific actions needed (implementation or cleanup plan) to achieve water quality standards.

#### Watershed Information

The Tributaries to Warwick Pond and Buckeye Brook and their watersheds are located entirely in the City of Warwick, north of Greenwich Bay. These watersheds are highly urbanized with impervious cover averaging 45% for the Tributaries, and 41% for Buckeye Brook. The area covered by the two watersheds include T.F. Green Airport as well as an uncapped landfill (Truk-Away) within the Buckeye Brook watershed boundary.

## Summary of Sampling Results

Starting in 2008, RIDEM sampled selected sites in the two waterways, including airport outfall 008 and landfill stations to characterize the geographic extent and severity of impacts to benthic organisms in these streams and to identify potential causes or stressors contributing to the impairment. Moderate to severe impairments to the macroinvertebrate (insect) community were found throughout both waterways with the most severe being downstream of airport outfall 008 and the landfill. Taxa richness for periphyton (algae growing attached to the substrate) was less than expected and both waterways had a high number of species associated with instream disturbances such as high stormwater flows. A combination of stressors was found:

- Elevated levels of metals (iron, copper, and cadmium) in stream water;
- Low levels of dissolved oxygen in stream water,
- Extensive growth of iron fixing bacteria on stream substrates downstream of TF Green Airport outfalls and Truk-Away Landfill,
- Elevated levels of propylene glycol used in de-icing operations at the airport – since addressed with construction of a treatment and diversion system in October 2014, and
- Alterations to stream flow and habitat resulting from the uncontrolled discharge of stormwater running off roadways, parking lots and structures within these highly urbanized watersheds.

Both waterways had exceedances of the State's freshwater criteria for cadmium, copper and iron. Cadmium and iron exceedances occurred in both dry and wet weather surveys but copper was exceeded only during the wet weather surveys. The high iron levels resulted in the extensive growth of iron fixing bacteria forming a flocculent material covering stream substrates downstream of TF Green Airport outfalls and the landfill – in essence, smothering the streambed habitat used by macroinvertebrates. Toxicity testing found a chronic toxic affect from the summertime dry weather sample collected downstream of the landfill and outfall 008 on Daphnid (water flea) reproduction; otherwise, no statistically significant impacts on survivability, growth or reproduction related to toxicity for either daphnid or fathead minnow were observed from either the summertime dry weather or wintertime wet weather samples.

## Pollution Mitigation Measures

The study concluded that to meet water quality criteria and restore aquatic life, reductions of cadmium, copper and iron are required. The Tributaries to Warwick Pond require the following reductions: cadmium -59%, copper - 19%, and iron - 54%. Buckeye Brook, which includes the largest airport outfall and Truk-Away Landfill, requires these reductions: cadmium - 64%, copper - 53% and iron - 94%. Various actions are required to meet these targets.

Both watersheds require stormwater management controls to reduce runoff volumes, metals concentrations, and to mitigate hydrologic and habitat alterations that contribute to the aquatic life impairments. The City of Warwick and RI Department of Transportation (RIDOT) must continue ongoing efforts to properly manage stormwater and reduce stormwater volumes and metals discharged to these waterways. Actions include pollution prevention and non-structural measures such as establishment of construction and post construction controls, storm drain cleaning, and street sweeping. Both entities must also construct drainage retrofits to reduce metals and manage stormwater runoff volumes toward achieving the goal of reducing stormwater impacts as if the watersheds' impervious cover were reduced to 10% (established in EPA and RIDEM consent decrees for RIDOT and City of Warwick, respectively).

The RI Airport Corporation (RIAC) must continue to comply with its 2012 permit which includes operation of the de-icing management system for propylene glycol and management of stormwater discharges. Additional measures are needed to further reduce stormwater volumes and metals concentrations including mitigation of elevated levels of iron and cadmium found in groundwater that is collected and discharged via its outfalls in dry weather. RIDEM is currently working to issue a revised permit in 2018 to incorporate the TMDL provisions.

Truk-Away Landfill must be properly closed to prevent and mitigate contaminated leachate and runoff. Effort has begun by RI Department of Administration to work with core Potentially Responsible Parties to initiate site investigations and to set a schedule for permanently closing the landfill. Jay Packing, the only industrial facility issued an industrial stormwater permit (Multi-Sector General Permit) in Buckeye Brook watershed, must continue to implement preventative measures to identify and reduce potential sources of pollutants of concern.