



Presumpscot Regional Land Trust

February 2, 2017

To the Windham Town Council,

We want to thank you for allocating monies to the Windham Land Trust through the 2016 Windham Watershed Protection Grant. Windham Land Trust has appreciated the support that the Town of Windham has given us through these grant funds. As you know, Windham Land Trust merged with Presumpscot Regional Land Trust and Presumpscot River Watch on October 2, 2016. It is our hope that the Town of Windham will continue to support our water quality monitoring in the Town of Windham into the future. The same care and stewardship of our preserves and of water quality monitoring will continue by the newly merged Presumpscot Regional Land Trust.

Sincerely,

Priscilla Payne

Co-President

Presumpscot Regional Land Trust

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Presumpscot Regional Land Trust

2016 Windham Watershed Protection Grant Final Report

Accomplishments

- Windham Land Trust volunteers completed 200 hours of service in water quality monitoring and stewarding native plants along Otter and Black Brook.
- Volunteers tested water quality throughout the 2016 season at five strategic locations along Black and Otter Brook. Each site was tested for temperature, dissolved oxygen and E. coli (bacteria).
- Hired consultants, FB Environmental, who analyzed the results and produced a report that is attached. Major findings from the report:
 - Otter Brook and Black Brook: E. coli was present at all sampling sites with increased levels compared to 2015.
 - Levels of E. coli in Black Brook were remarkably high.
 - It is very important to continue to monitor water quality in both brooks as they both have impairments.
- A GPS was purchased to better locate, map and track water quality testing sites.
- Finally this spring we will be using the remaining \$261 of the grant funds to buy and plant native red osier dogwood plants along Otter Brook to help with remediation. These planting were postponed from fall of 2016 to spring of 2017 due to drought conditions.
- The Presumpscot Regional Land Trust, with the merger has now added an ongoing Presumpscot River water quality monitoring program. This program will include water quality monitoring sites throughout Windham including the Windham Land Trust sites along Otter and Black Brook.

Equipment

- Presumpscot Regional Land Trust is now responsible for and maintains:
 - A GPS devise,
 - Years of data and reports from Windham Land Trust's past water quality testing,
 - The stewardship for the native plants along Otter and Black Brooks added to help remediation of the impaired streams.



Presumpscot Regional Land Trust

CATEGORY	GRANT	WLT/PRLT	TOTAL	DETAILS
EXPENSE				
Water Quality Tests	\$450		\$450	15 E. Coli Bacteria Tests at \$30/test, tested at Katahdin Labs
Water Quality Test Analysis and Report	\$1,000		\$1,000	Hired FB Environmental at \$50/hour for 20 hours
GPS Unit	\$289		\$289	Garmin E Trex, for location finding related to water quality monitoring sites
Volunteer Hours		\$3,000	\$3,000	200 Volunteer hours by WLT members at \$15/hour
Native Plantings	\$261			Purchase red osier dogwood trees spring 2017 to plant along Otter Brook
TOTAL	\$2,000	\$3,000	\$5,000	
INCOME				
Windham Watershed Protection Grant	\$2,000			
Windham Land Trust Volunteer Labor	\$3,000			200 volunteer hours by WLT members at \$15/hour
TOTAL	\$5,000			

OTTER BROOK & BLACK BROOK

2016 WATER QUALITY REPORT



PREPARED FOR:



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INTRODUCTION

The purpose of this report is to summarize the water quality data collected by Windham Land Trust volunteers in the summer of 2016. In September of 2016, the Windham Land Trust officially merged with the Presumpscot Regional Land Trust to work collaboratively towards stronger conservation in the Presumpscot River watershed. This report fulfills the contractual obligation between the Windham Land Trust and FBE Environmental, established before the unification.

Since 2007, the State of Maine and the Windham Land Trust have monitored water quality in Otter Brook and Black Brook, first order headwater streams that eventually flow into the Presumpscot River. Small headwater streams such as Otter Brook and Black Brook are vital to the success of both aquatic and terrestrial ecosystems. Development pressures threaten the water quality and aquatic life in headwater streams through stressors such as pollutant inputs (including nutrients), channel alteration and floodplain degradation. In 2012, Otter Brook was listed by the Maine Department of Environmental Protection (Maine DEP) on their 303(d) list as impaired for not meeting its statutory Class B standard for aquatic life use due to poor dissolved oxygen (DO) (Maine DEP, 2012). According to the nonpoint source total maximum daily load (TMDL) for Otter Brook, the primary threat to water quality is agricultural land in the watershed (31% of total land area and 40% of the shoreline, which can deliver excess nutrients to the stream (Maine DEP, 2012). Additionally, Otter Brook was listed as impaired for primary contact recreational use due to elevated *Escherichia coli* (*E. coli*) bacteria in the 2009 Maine Statewide Bacteria TMDL (Maine DEP, 2009). Otter Brook has been monitored since 2007, however, monitoring was infrequent in both time and space. As a result of the 2009 bacteria impairment and limited available resources, sampling over the past few years at Otter Brook has been focused on monitoring *E. coli*. Canine Detection on October 22, 2014 indicated that the source of these high bacteria counts could be human wastewater, as six of the ten locations visited at Otter Brook were identified as having presence of human wastewater (see Technical Memorandum, 10/27/2014).

As previously noted, Black Brook is also listed as impaired on the EPA's 303(d) list for DO in its Class B statutory class and was listed to be included in future updates to the statewide bacteria TMDL in 2010 (Maine DEP, 2012). Black Brook is non-attaining for aquatic life use due to the impaired DO levels. Sampling at Black Brook also dates back to 2007, however, bacteria results were limited to 2011 and were not collected in 2013 and 2014. In 2015 and 2016, bacteria samples at Black Brook were taken at two locations.



Otter Brook in 2013. Photo Credit: FBE.



Black Brook. Photo Credit: Windham Land Trust.

WATER QUALITY SUMMARY

OTTER BROOK

Grab samples were taken three times across the 2016 field season at three locations along Otter Brook (May 27, July 8, September 9) (Table 1, Map in Appendix 1).

Table 1. Sampling location descriptions at Otter Brook

SITE	DESCRIPTION
OB - 1	Located off of Pope Road (located off of Center Brook Drive)
OB - 2	Located by the upper culvert crossing on Windham Center Road
OB - 3	Located by the culvert on River Road

Bacteria

In 2016, bacteria were present across all sampling sites and dates and indicate continued elevated levels of bacteria. Compared to 2015, average annual *E. coli* counts increased at sites OB-1 and OB-2 and decreased at site OB-3 with the highest geometric mean at site OB – 2 (219.3 MPN/100ml), at the crossing with Windham Center Road. Bacteria in stream water is often associated with the amount of precipitation and antecedent moisture conditions prior to sampling. Precipitation can cause significant runoff from the surrounding watershed, flushing bacteria from urban and agricultural systems into the stream channel. This makes it important to sample for bacteria across variable precipitation and stream flows. However, as evident in Table 3, sampling at Otter Brook has primarily been limited to times with little prior precipitation. Generally, wet weather conditions exist when at least 0.25 inches of rainfall within the preceding 24-hour period but heavier precipitation events (greater than 1 inch) are even more helpful for correlating precipitation and bacteria.

GLOSSARY OF KEY TERMS USED IN THIS REPORT

Escherichia coli (*E. coli*): An indicator of the presence of fecal contamination in the watershed. By itself, *E. coli* is generally not a threat to human health, but it can be associated with disease-causing organisms. *E. coli* is measured in MPN / 100 ml which stands for **M**ost **P**robable **N**umber of bacteria in 100 ml of sample.

Dissolved Oxygen (DO): The concentration of oxygen that is dissolved in the water. DO is critical to the healthy metabolism of many creatures that reside in the water. DO levels in lake water are influenced by a number of factors, including water temperature, concentration of algae and other plants in the water, and amount of nutrients and organic matter that flow into the waterbody from the watershed. Too little oxygen severely reduces the diversity and abundance of aquatic organisms.

Geometric Mean: Similar to an arithmetic average, the geometric mean is a measure of the central tendency in a dataset. The benefit of a geometric mean is that it reduces the effect of outliers. Because of high variability in grab samples for bacteria, it is common practice to use the geometric mean to gain a realistic picture of bacterial contamination in a waterbody.

Dissolved Oxygen

Average DO observed during the 2016 season is above the minimum threshold to meet Class B status (7 ppm) at all sites along Otter Brook. Average observed DO at sites OB – 1, OB – 2, and OB – 3 is 9.5, 7.7, and 7.5 mg/L respectively (Table 2). DO in August was low at both OB – 2 and OB – 3 and remained low in September at OB – 3. Late summer is typically peak production for in-stream algal growth. When algal communities die, oxygen is consumed through decomposition and often streams experience periods of low DO. Excess algal growth can be fueled by nutrient inputs to the stream, particularly as a result of urban and agricultural runoff. Limiting nutrient input to the stream can reduce algal growth and increase DO levels to healthy conditions for aquatic life.



Table 2. Precipitation and *E. coli* data for Otter Brook (2014 - 2016). **Red** text indicates individual samples greater than the Maine Class B instantaneous standard for *E. coli* (236 MPN/100ml). Precipitation is cumulative.

DATE	PRECIPITATION*	<i>E. coli</i> (MPN/100ml)			DO (mg/L)		
	PRIOR 24 HRS	OB - 1	OB - 2	OB - 3	OB - 1	OB - 2	OB - 3
13-Jun-14	DRY	206.4	816.4	275.5	--	--	--
1-Aug-14	DRY	86.7	145	214.3	--	--	--
5-Sep-14	DRY	178.2	125.9	209.8	--	--	--
2014 GEOMETRIC MEAN:		147.2	246.1	231.4	--	--	--
29-May-15	WET	--	--	--	--	--	--
10-Jul-15	DRY	--	--	--	--	--	--
25-Sep-15	DRY	88.4	172.3	83.9	--	--	--
23-Oct-15	DRY	Present	Present	Present	--	--	--
13-Nov-15	DRY	44.1	113	133.3	--	--	--
2015 GEOMETRIC MEAN:		62.4	139.5	105.8	--	--	--
27-May-16	DRY	45.7	70.3	40.8	--	--	--
8-Jul-16	DRY	304.4	365.5	129.6	9.2	10.0	7.3
12-Aug-16	DRY	--	--	--	9.7	6.7	5.5
9-Sept-16	DRY	41.4	410.6	41.4	9.8	6.4	9.7
2016 GEOMETRIC MEAN:		83.2	219.3	60.3	--	--	--
AVERAGE:		--	--	--	9.5	7.7	7.5

*Precipitation is considered wet weather if there is greater than 0.25" of precipitation in the 24 hours prior to sampling. Weather data from station KPWM (Windham, ME. Weatherunderground.

BLACK BROOK

Monitoring at Black Brook in 2016 was limited to two sites (BB – 1 and BB – 2, Table 3) for *E. coli*, DO, and temperature. The 2015 sampling season was the first bacteria sampling at Black Brook since 2011 by the VRMP. The VRMP sampled at the crossing of Black Brook with River Road (RBK) and 2015 sampling by the WLT was upstream at the headwaters off 302 (BB – 1) and at the crossing with Windham Center Road (BB – 2) (Table 3).



Table 3. Sampling location descriptions at Black Brook

SITE	DESCRIPTION
BB - 1	Located at the headwaters on 302 near Hawk Farmstand
BB - 2	Located off Windham Center Road near culverts
RBK	Located at River Road crossing

Bacteria

All data collected in 2011, 2015, and 2016 indicates elevated levels of bacteria in Black Brook. Sampling in 2016 revealed remarkably high counts, with a count of 1,119.9 MPN at site BB – 1 on May 27 and elevated levels at both sites in May and July. Higher bacteria counts were generally associated with wet weather events prior to sampling (e.g., site RBK, July 30, 2011) as stormwater carries bacteria to nearby waterbodies.

Dissolved Oxygen

In 2016, DO was measured at sites BB – 1 and BB - 2 during sample collection. DO was below the Maine State Standard for Class B streams for all measurements, with higher DO in July for both sites. No readings are available at site BB – 1 in September because low flows made it difficult to obtain an accurate reading. Upstream wetlands and stagnant water could be contributing to low DO at Black Brook. Standing water, such as that found in wetlands, can easily become depleted of oxygen without a continuous flow. Additionally, 2016 was a drought in Maine, contributing to the low water levels in both Otter and Black Brook. Data collected at River Road in 2011 suggests that DO increases downstream, however, a dataset collected over a longer time frame is needed to reveal significant patterns in the dataset.

Table 4. Precipitation, *E. coli*, and DO data for Black Brook from 2011 through 2016. **Red** text indicates individual samples greater than the Maine Class B instantaneous standard for *E. coli* (236 MPN/100ml).

DATE	PRECIPITATION*	E. coli (MPN/100ml)			DO (mg/L)		
	PRIOR 24 HRS	BB - 1	BB - 2	RBK	BB - 1	BB - 2	RBK
21-May-11	WET	--	--	195.6	--	--	7.8
4-Jun-11	DRY	--	--	118.7	--	--	8.2
18-Jun-11	DRY	--	--	56.3	--	--	7.1
2-Jul-11	DRY	--	--	38.2	--	--	6.4
30-Jul-11	WET	--	--	2,419.6*	--	--	3.6
13-Aug-11	DRY	--	--	214.3	--	--	6.9
27-Aug-11	DRY	--	--	275.5	--	--	6.6
2011 GEOMETRIC MEAN:		--	--	184.0	--	--	
2011 AVERAGE:		--	--	--	--	--	6.7
25-Sep-15	DRY	--	51.2	--	--	--	--
23-Oct-15	DRY	Present	Present	--	--	--	--
13-Nov-15	DRY	14.6	42.6	--	--	--	--
2015 GEOMETRIC MEAN:		--	46.7	--	--	--	--
27-May-16	DRY	1,119.9	290.0	--	--	--	--
08-Jul-16	DRY	249.6	435.2	--	6.0	4.8	--
12-Aug-16		--	--	--	1.3	2.4	--
09-Sep-16	DRY	-- ⁺	84.2	--	-- ⁺	2.6	--
2016 GEOMETRIC MEAN:		528.7	355.3	--	--	--	--
2016 AVERAGE:		--	--	--	3.7	3.3	--

*Precipitation is considered wet weather if there is greater than 0.25" of precipitation in the 24 hours prior to sampling.

Weather data from station KPWM (Windham, ME) Weatherunderground

*2,419.6 MPN/100ml is the maximum detection limit

⁺ Flow was too low at this site to obtain sample

RECOMMENDATIONS

It is our recommendation that both Otter Brook and Black Brook continue to be sampled in the 2017 season for *E. coli* (MPN/100 ml) and field tested for DO and temperature. Sampling in 2016 was limited due to available resources and volunteers but if resources allow, we recommend expanding monitoring efforts in 2017 to monthly samples and the inclusion of wet weather events. Additionally, we recommend performing bracketed sampling in both streams to isolate the source of the elevated bacteria.

Despite diligent efforts to monitor these streams over the last few years, the dataset is small and it is difficult to identify the sources or assess trends of bacterial contamination with few sampling points. Given the recent merger between the Windham Land Trust and the Presumpscot River Watch into the Presumpscot Land Trust, it is our recommendation that a follow-up plan be developed to address monitoring in areas with documented water quality concerns, such as Otter Brook and Black Brook.

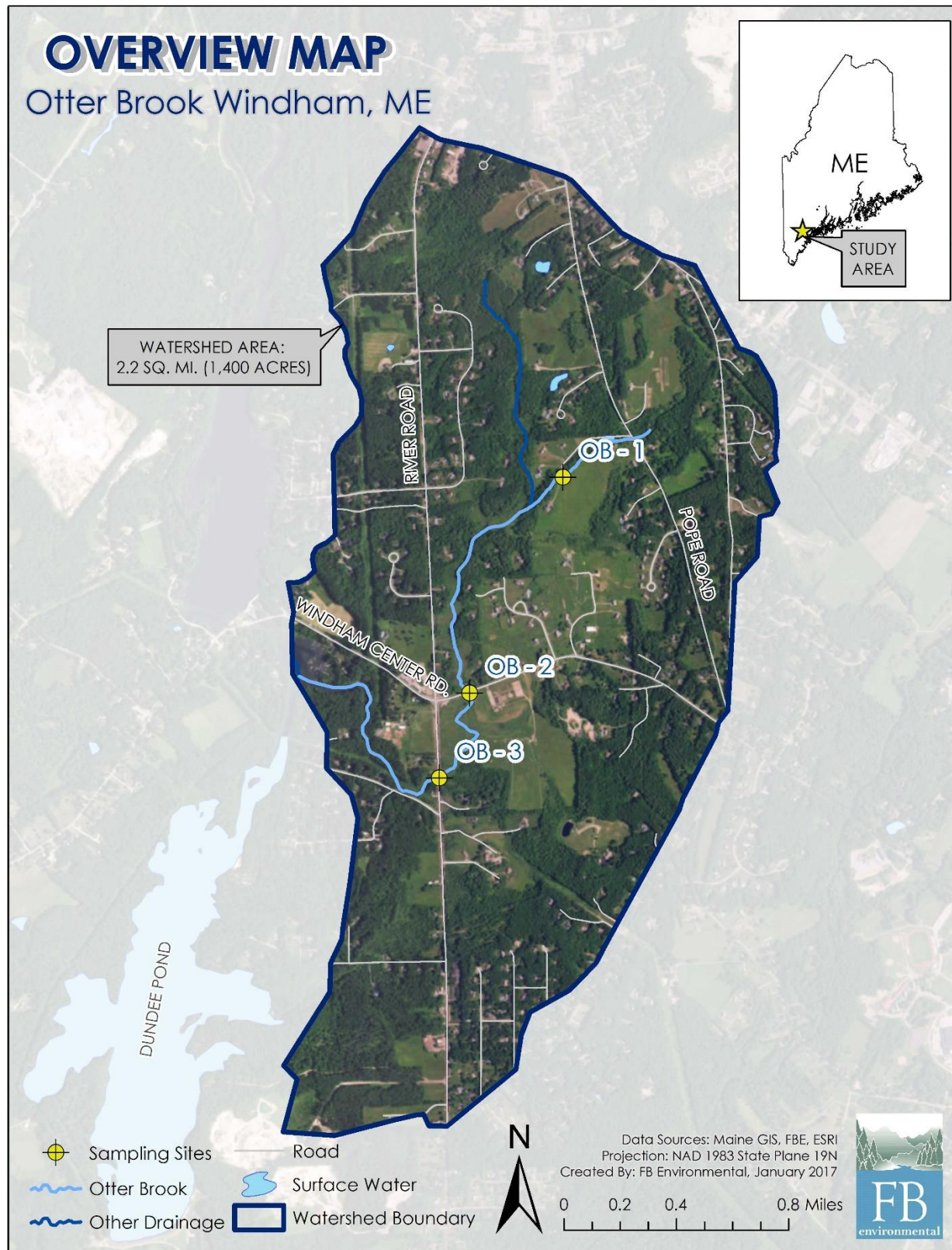
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Maine DEP (2009). Maine Statewide Bacteria TMDL. Retrieved from:
http://www.maine.gov/dep/water/monitoring/tmdl/2009/bacteria_report.pdf. *Note that Otter Brook was accidentally not included in the Appendix, however, it is recognized as impaired for bacteria by the U.S. EPA.*

APPENDIX I. Map of Otter Brook



APPENDIX II. Map of Black Brook

