

Portland Water District
Sebago Lake Monitoring Programs
Lower Bay Bacteria Monitoring
Presenting data from 1977 to 2020
Laurel Jackson

Introduction

Sebago Lake is the primary drinking water supply for nearly 200,000 people in 11 Greater Portland communities. Lake water was first pumped to Portland in 1869, from an intake located in the southernmost part of the lake, referred to as Lower Bay. In 1907, the Portland Water District was chartered by the Maine Legislature to provide water and wastewater services to the region. Since its inception, the District has been actively monitoring and working to protect Sebago Lake.

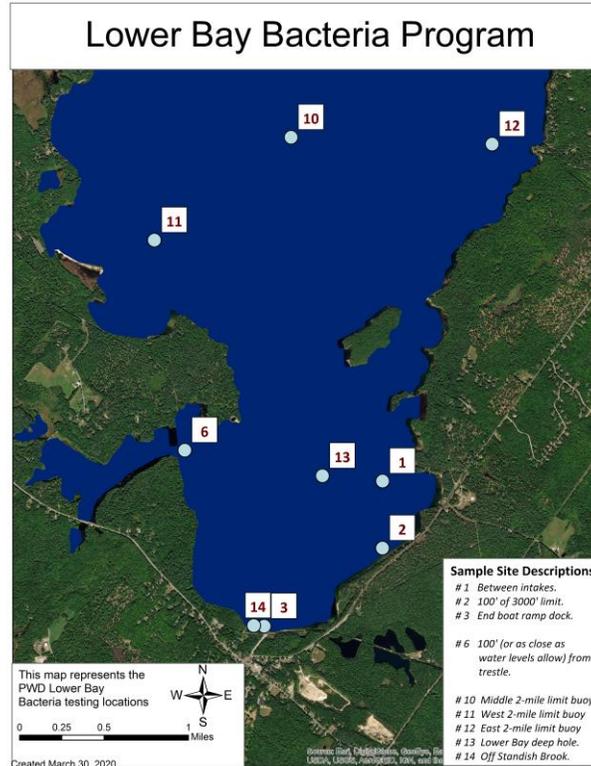
In 1993, the District was granted a waiver to the filtration requirements of the federal Safe Drinking Water Act (SDWA) based in part on the purity of the water and the effectiveness of watershed protection efforts. This waiver agreement requires ongoing monitoring of lake water quality. The District maintains more than 10 monitoring and surveillance programs throughout the watershed and lake. In general, as one moves closer to the intakes, more samples are collected and tested for more parameters.

This report summarizes results of the Lower Bay Bacteria Monitoring Program. The purpose of the program is to monitor *Esherichia coli* (*E. coli*) bacteria levels at various sites around Lower Bay, ensure levels are within historic ranges, and if not, identify possible sources of contamination.

Methods

Bacteria sampling occurs once a month from May to October. Nine locations in Lower Bay are monitored for *E. coli* bacteria (see map for locations). Previously, the samples were analyzed for both *E. coli* bacteria and fecal coliform bacteria. The Standard Operating Procedure was changed in 2019 in order to streamline the program and increase efficiency. There is a strong correlation between *E. coli* levels and fecal coliform bacteria levels. A side-by-side analysis was performed that illustrated this fact before other District monitoring programs transitioned from fecal coliform analysis to *E. coli* analysis.

Samples are taken just below the water surface with sterile gloves and sterile collection vessels. Samples are taken during “normal” lake conditions and are not designed to monitor extreme storm events or abnormal water circumstances. Samples are analyzed according standard operating procedures outlined in Standard Methods for the Examination of Water and Wastewater, 20th Edition (SM9223B3).



Results and Discussion

E. coli bacteria is a type of fecal coliform bacteria found in the gastrointestinal tracts of warm-blooded animals. The presence of *E. coli* in water is a strong indication of recent sewage or animal waste contamination. Sewage may also contain many other types of disease-causing organisms such as Giardia, Cryptosporidium, typhoid, viral and bacterial gastroenteritis, and hepatitis A. Natural occurrences can also cause elevated *E. coli* levels. Examples include significant precipitation events that wash pollution from impervious surfaces and areas of development (animal feces, etc.) into the lake, and the erosion of soil into the lake since a small percentage of fecal bacteria is associated with soil. The District's action level for *E. coli* in Lower Bay is 10 MPN/100 mL which, based on historical data, represents a level higher than the expected results. Sample results at or above the action level warrant re-sampling and/or additional investigation as to the cause of the high result.

The most significant sampling sites are summarized below.

Intakes

Bacteria concentrations from the sampling location above the water intakes pipes are among the lowest in Sebago Lake. The average historical fecal coliform concentration above the intakes from 1977 to 2020 is 0.45 cfu/100 ml. The data table (Figure 1) is a frequency distribution of all samples taken from 2009 through 2020 and the *E. coli* bacteria level.

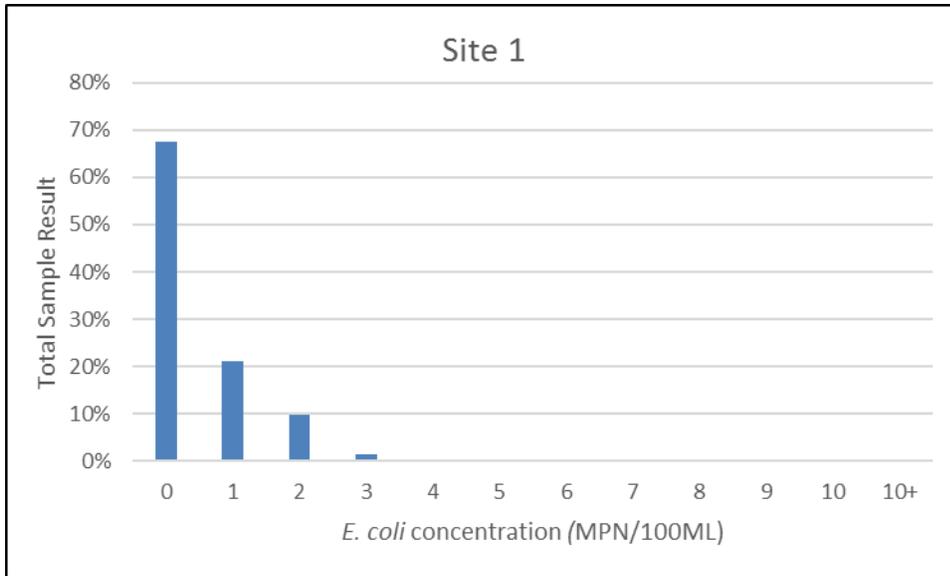


Figure 1. 68% of *E. coli* bacteria samples taken above the intakes (site #1) from 2009 to 2020 have 0 MPN/100 ml and 100% of samples are below 4 MPN/100 ml.

Standish Boat Ramp

Samples collected at the Standish boat ramp have historically high concentrations of fecal coliform bacteria. The average *E. coli* bacteria concentration at the Standish boat ramp is 0.80 MPN/100ml. The data table below is a frequency distribution of all samples taken and the number of fecal coliform CFU per 100 ml of lake water.

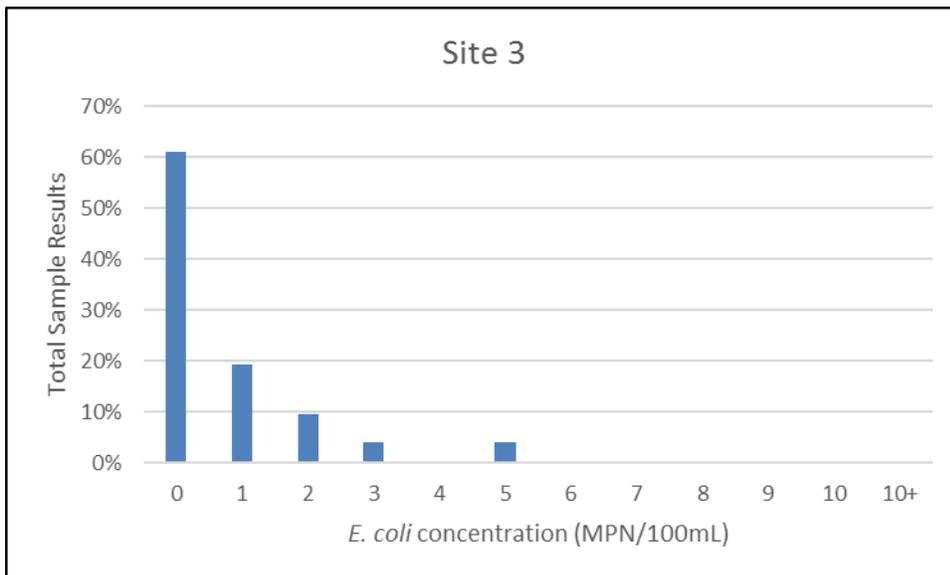


Figure 2. 100% of samples from the Standish boat ramp from 2009 to 2020 have *E. coli* levels between 0 and 10 MPN/100mL.

Trestle

Bacteria concentrations near the outlet of the Sticky River at the Trestle sample site have shown higher *E. coli* levels higher than average in Lower Bay. The data table below is a frequency distribution of all samples taken and the number of CFU per 100 ml of lake water.

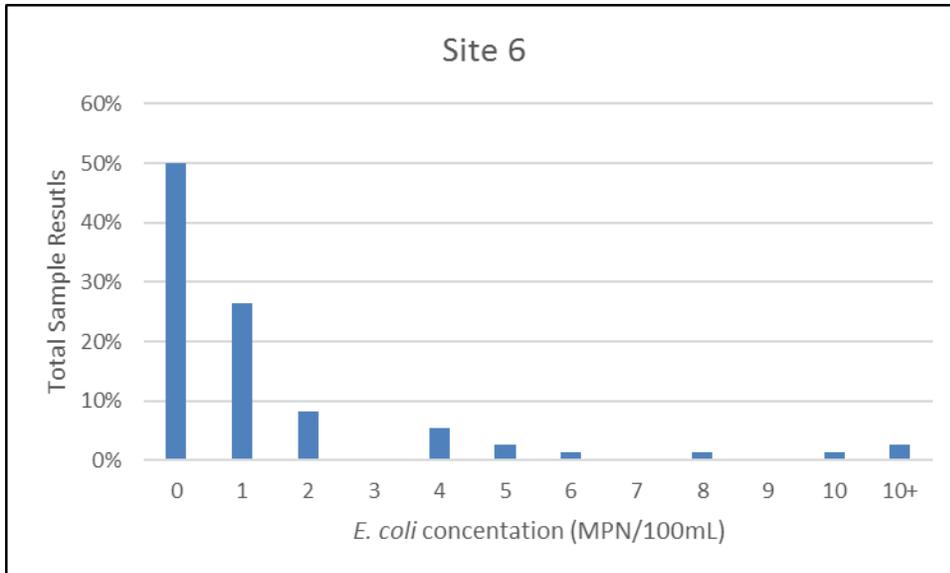


Figure 3. 97% of fecal coliform bacteria samples taken near the Trestle (site #6) from 2009 to 2020 have fecal concentrations between 0 and 10 CFU.

Standish Brook Outlet

Bacteria concentrations near the outlet of Standish brook contain the highest concentrations of *E. coli* bacteria in the Lower Bay. Interestingly, this site has the lowest percentage of samples with a result of 0 MPN/100mL. The data table below is a frequency distribution of all samples taken.

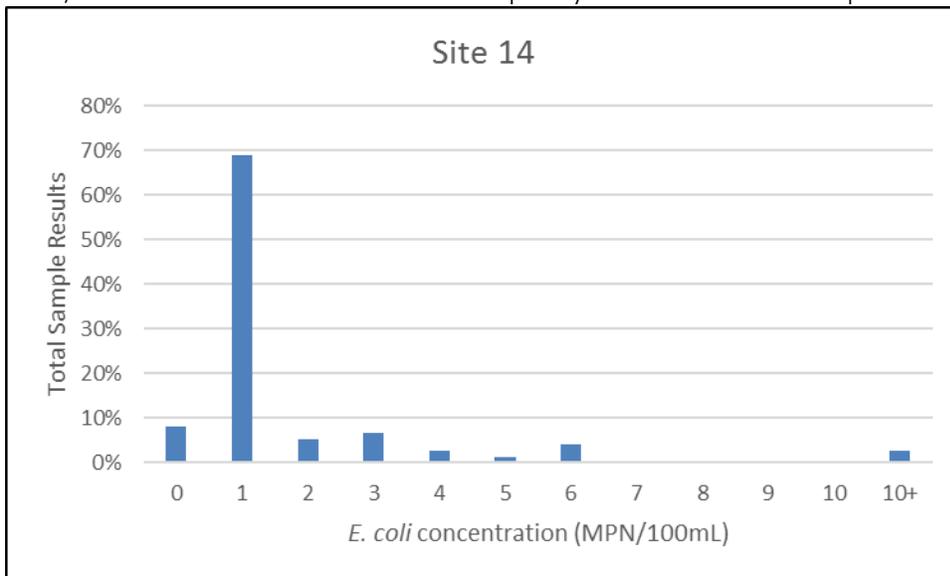


Figure 4. 97% of fecal coliform bacteria samples taken near Standish Brook (site #14) from 2009 to 2020 have fecal concentrations between 0 and 10 MPN/100mL.

All data from 2020 are presented below in Figure 7. There were no sampling events in 2020 that exceeded the action level of 10 cfu/100mL.

	Site 1	Site 2	Site 3	Site 6	Site 10	Site 11	Site 12	Site 13	Site 14
	Between Intakes	No Trespassing Limit	Standish Boat Ramp	Trestle	Middle-Two Mile Limit	West- Two-Mile Limit	East- Two Mile Limit	Lower Bay Deep Hole	Off Standish Brook
5/18/2020	0	0	0	1	0	0	0	1	1
6/9/2020	0	3	6	1	0	1	1	0	1
7/16/2020	1	3	2	8	0	0	0	1	3
8/20/2020	0	0	2	0	0	1	0	0	1
9/24/2020	2	0	1	0	0	0	0	0	1
10/21/2020	1	0	0	1	0	0	0	0	1

Figure 4. Total data set collected in 2020.

Conclusion

Bacteria levels around Lower Bay are very low for a multi-use lake. The sampling locations with the highest levels of *E. coli* bacteria are the outlet to Standish Brook (sampling site #14), the Standish boat ramp (sampling site # 3) and the trestle (sampling site #6). Among all sampling locations, site #6 and #14 are closest to tributary stream inputs (the Sticky River and Standish brook, respectively). The Standish boat launch site is subject to human presence while people are launching boats, loading/unloading supplies, and otherwise interacting with the lake. Although there is no bodily contact allowed, the high amount of activity in that area may contribute to fecal coliform occurrences.

Standish Brook has an urban watershed which drains residential and commercial watershed areas. Typical bacteria sources from a developed watershed are subsurface waste water disposal systems and pet waste contamination. Historical fecal coliform data collected from the outlet to Standish Brook shows levels ten-fold higher than most sampling locations in Lower Bay. Standish Brook is regularly monitored as part of PWD's Tributary Monitoring Program.

Overall, these values are considered low and comply with the maximum contaminant level for water treatment plant influent of 20 fecal coliform (cfu) per 100ml in 90% of samples. Nevertheless, it is interesting to note that locations with elevated fecal coliform bacteria levels often correspond with areas within close proximity of human activity. This correlation should be taken into account when considering appropriate activities in Lower Bay and throughout Sebago Lake.