Portland Water District

Sebago Lake Monitoring Programs

Lower Bay Bacteria Monitoring - 2021

Kirsten Ness

Introduction

Sebago Lake is the primary drinking water supply for the greater Portland area. The Portland Water District (PWD) treats and delivers drinking water to over 200,000 people in 11 communities. PWD has a waiver from the filtration requirements of the federal Safe Drinking Water Act. There are many criteria for obtaining and keeping the waiver, but one of the largest factors is the continued excellent water quality of Sebago Lake and PWD's watershed protection efforts. This waiver agreement requires ongoing monitoring of lake water quality.

PWD monitors Sebago Lake and the rivers and streams that drain to it through more than 10 monitoring and surveillance programs. In general, more samples are collected and tested for more parameters the closer one moves to the intake pipes, located in Lower Bay.

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 around Lower Bay are monitored for *E. coli* bacteria (see Figure 1). Samples are taken just below the water surface with sterile gloves and sterile collection vessels. Sample collection occurs during "normal" lake conditions, because the program is not designed to monitor extreme storm events or abnormal water circumstances. Samples are analyzed using the IDEXX Colilert method and are incubated at 35 degrees Celsuis for 24 hours.

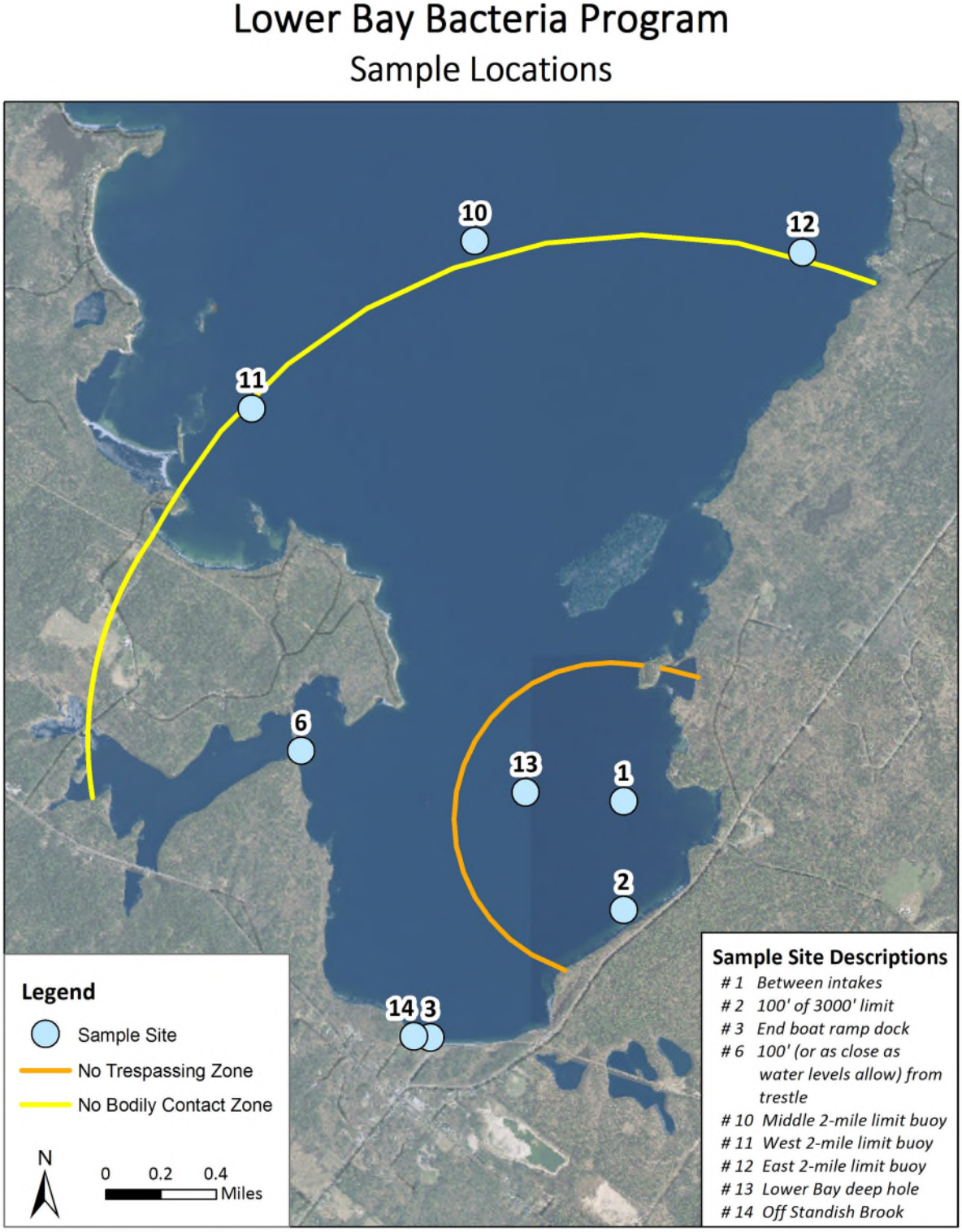

Figure 1: Lower Bay bacteria sampling locations for 2021.

Results and Discussion

E. coli is a type of fecal coliform bacteria that is found in the guts of warm-blooded animals and is used by water utilities as an indicator of possible contamination and pathogens in the water. Sources of *E. coli* contamination can include: sewage, animal waste, and soil erosion, as a small percentage of fecal bacteria are associated with soil. *E. coli* is used as an indicator organism because it has been shown to be a reliable indicator of contamination, and it is not practical to test every sample for all the pathogens that could be present in water.

The District's action level for *E. coli* in Lower Bay is 10 MPN/100 mL (MPN = most probable number) which, based on historical data, represents a level higher than the expected results. Sampling events that result in *E. coli* levels above the action level are re-sampled and, if the level remains high, investigated to try to determine the cause.

In 2021, no sampling events exceeded the action level of 10 MPN/100ml (see Table 1). Overall, E. coli concentrations in Lower Bay are very low for environmental samples and are lower than other sites around Sebago Lake. Data below will be discussed in groups of sites: sites within the 3000ft No Trespassing Zone, sites within the 2 Mile No Bodily Contact Zone but outside the 3000 ft No Trespassing Zone, and sites along the 2 Mile No Bodily Contact Zone limit.

Table 1: 2021 *E. coli* data (MPN/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
5/21/2021	0	0	0	1	0	0	0	0	4
6/23/2021	0	0	0	0	0	0	0	1	0
7/12/2021	0	4	3	8	2	1	2	1	1
8/24/2021	1	2	1	8	1	0	0	0	1
9/28/2021	0	2	0	2	0	0	0	1	1
10/13/2021	1	1	0	0	0	0	1	1	0

Sites within the 3000ft No Trespassing Zone (Sites 1, 2, 13)

Bacteria concentrations from the sampling location above the water intakes pipes (Site 1) are among the lowest in Sebago Lake. The average *E. coli* concentration above the intakes from 2009 to 2021 is 0.4 MPN/100 ml. Since 2009, no samples within the 3000ft No Trespassing Zone have shown *E. coli* levels higher than 4 MPN/100ml (Figure 2).

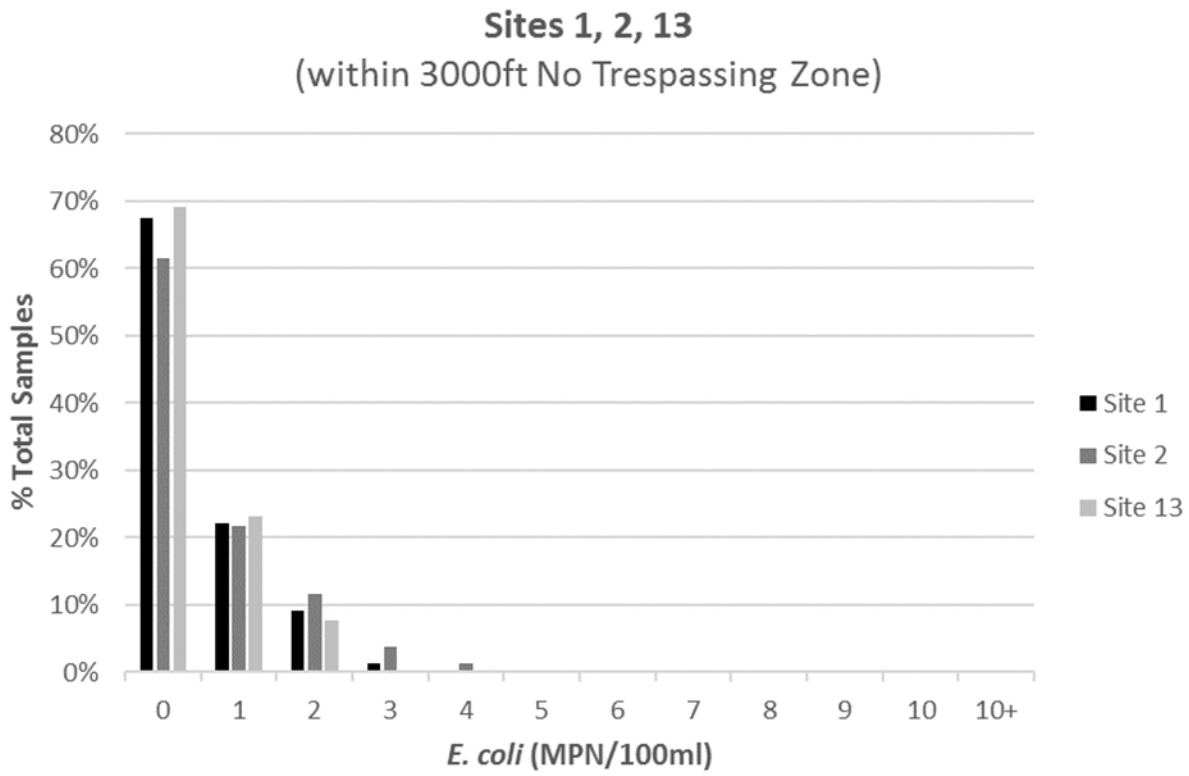

Figure 2. Frequency distribution of samples taken within the 3000ft No Trespassing Zone from 2009-2021. 100% of the samples are at or below 4 MPN/100 ml.

Sites along the 2 Mile No Bodily Contact Limit (Sites 10, 11, 12)

Sites 10, 11, and 12 are located along the boundary of the 2 Mile No Bodily Contact Zone in Lower Bay. Like the sites within the 3000ft No Trespassing Zone, the *E. coli* concentrations are very low (Figure 3). From 2009-2021, the average *E. coli* concentrations were 0.3, 0.9, and 0.3 MPN/100ml at sites 10, 11, and 12, respectively.

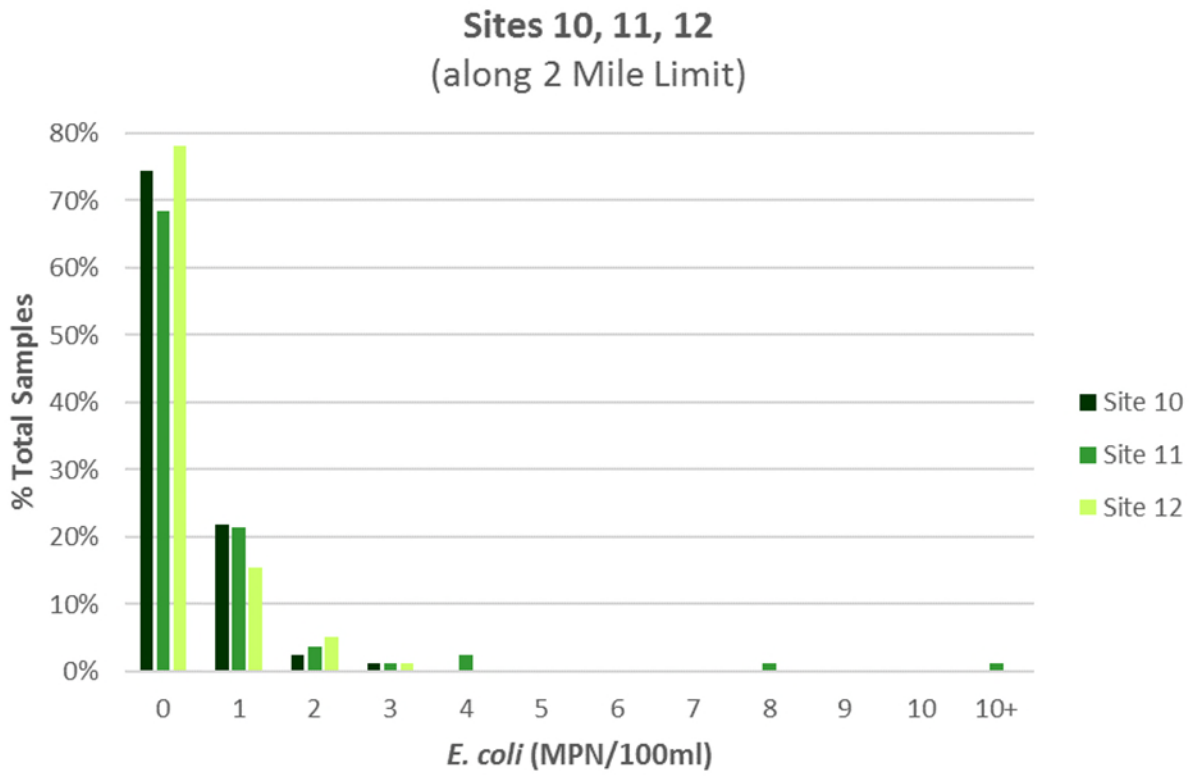

Figure 3. Frequency distribution of samples taken at sites along the 2 Mile No Bodily Contact Zone from 2009-2021. 99% of the samples at Sites 10, 11, and 12 have *E. coli* levels between 0 and 10 MPN/100ml.

Sites within 2 Mile No Bodily Contact Zone but outside the 3000ft No Trespassing Zone (Sites 3, 6, 14)
Bacteria concentrations at sites outside the 3000ft No Trespassing Zone but still within the 2 Mile Limit No Bodily Contact Zone are slightly higher than sites within the No Trespassing Zone (Figure 4). For environmental samples, the numbers are still very low. The average *E. coli* concentration at the Trestle (Site 6) is 1.7 MPN/100ml, which is the highest of all the sample sites around Lower Bay. The site is located at the outlet of a backwater area of the lake that is fed by the Sticky River and a tributary along Smith Mill Rd. in Standish.

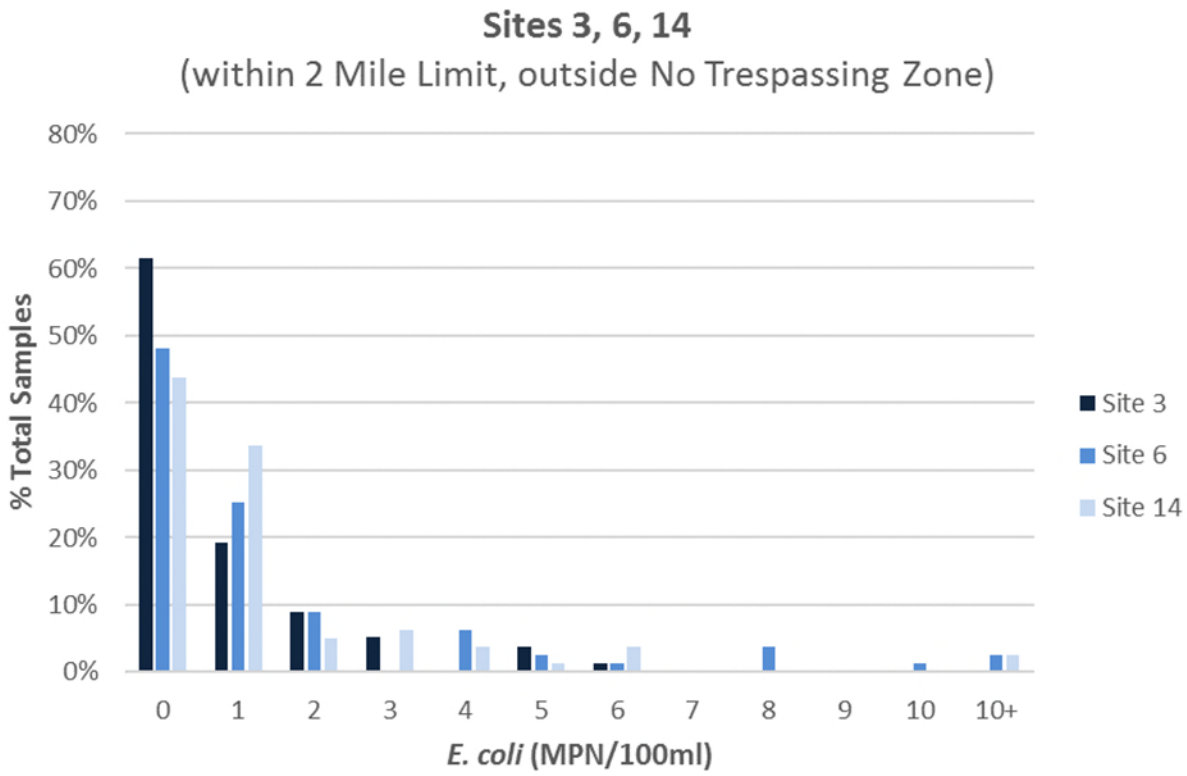

Figure 4. Frequency distribution of samples taken outside the 3000ft No Trespassing Zone but within the 2 Mile Limit from 2009-2021. 98% of samples at Sites 3, 6, and 14 have *E. coli* levels between 0 and 10 MPN/100mL.

Lower Bay sites compared to sites outside the 2 Mile No Bodily Contact Zone

Bacteria levels in Lower Bay are extremely low for environmental samples and are low when compared to other sites around Sebago Lake (Figure 5). The primary difference between the two groups of sites is the presence of people swimming at the sites outside of the 2 Mile No Bodily Contact Zone. People swimming and animal waste (from dogs and wild animals feeding on food left behind on the beach) introduces bacteria to the lake. However, the average *E. coli* levels for swimming beaches are still well below the recommended safe swimming *E. coli* level of 235 MPN/100ml.

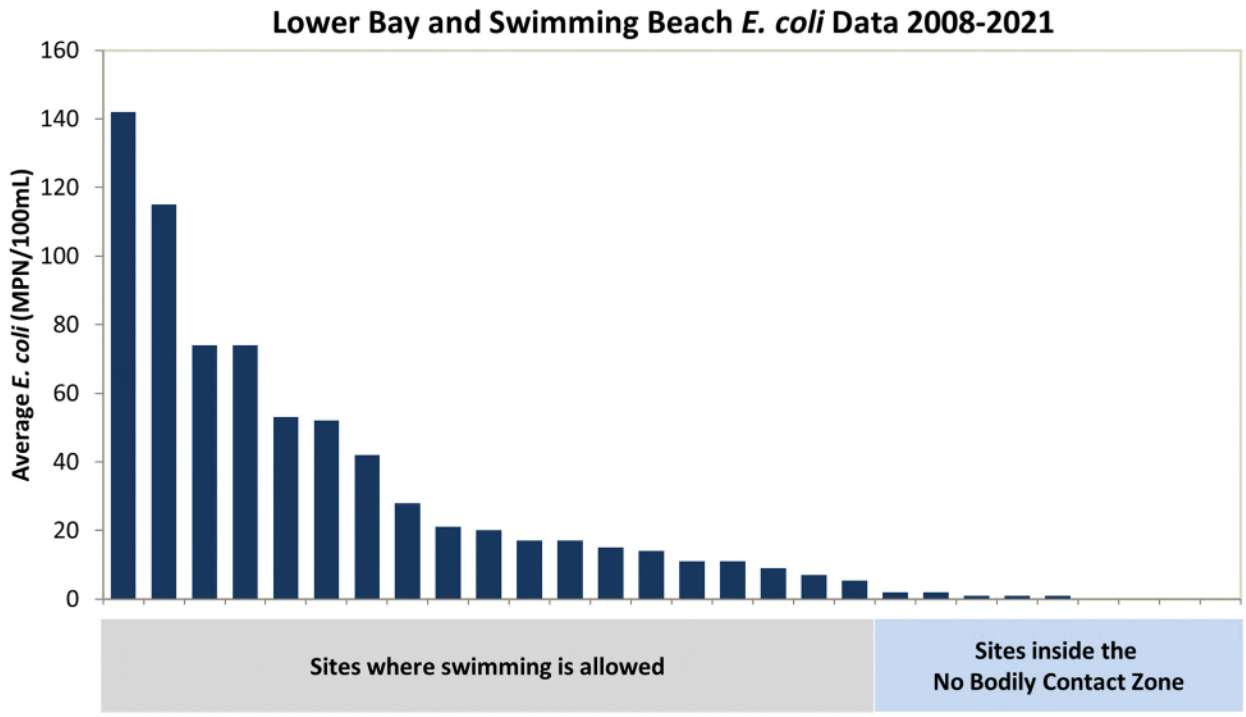

Figure 5. Average *E. coli* levels at sites outside the 2 Mile No Bodily Contact Zone where swimming is allowed compared to the Lower Bay sampling sites along and within the 2 Mile No Bodily Contact Zone.

Conclusion

Bacteria levels around Lower Bay are extremely low for a multi-use lake. A large part of providing safe drinking water to customers is managing risk, and low bacteria levels in the area around PWD's water intake pipes means a much lower risk of waterborne illness. Though PWD has multiple treatment processes to ensure the water's safety, if pathogens are not present in the first place, then they do not have to be removed. Because bacteria levels are higher where human activity is present, the 2 Mile No Bodily Contact Zone is an important zone of protection around PWD's water intake pipes. Continued monitoring of bacterial levels around Sebago Lake is an important tool for keeping an eye on Sebago Lake's quality with respect to public health.