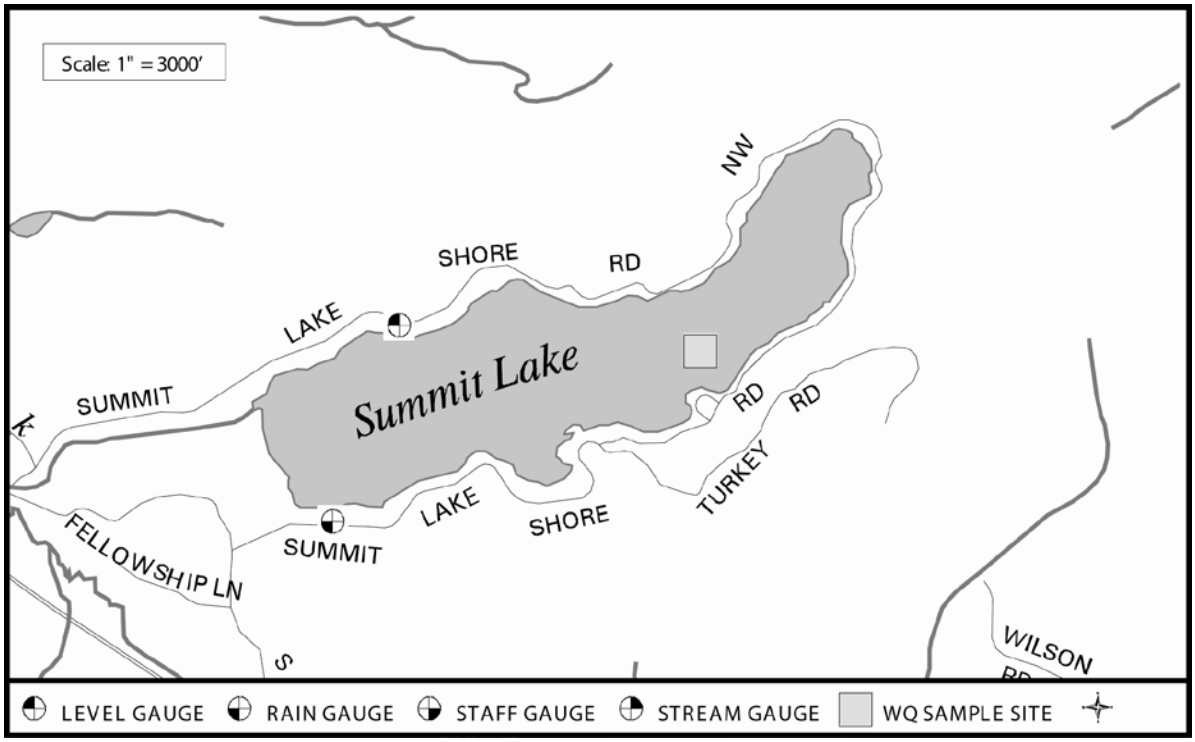
2017 Summit Lake Water Quality Report

Prepared by Thurston County Environmental Health Division



PART OF TOTTEN INLET WATERSHED

LENGTH OF LAKE: 2.2 miles

SHORELINE LENGTH: 5.6 miles

LAKE SIZE: 530 acres

BASIN SIZE: 2.8 square miles

MEAN DEPTH: 53 feet

MAXIMUM DEPTH: 100 feet

VOLUME: 28,000 acre-feet

PRIMARY LAND USES:

The majority of the basin is commercial forest with dense development concentrated along the shoreline. There are approximately 400 homes along the shoreline.

PRIMARY LAKE USE:
Domestic water supply, fishing, boating, swimming, and other water sports.

PUBLIC ACCESS:
Washington Department of Fish and Wildlife public boat launch; three small private community accesses; 126-acre boy-scout camp at the west end of the lake.

GENERAL TOPOGRAPHY:

The approximate altitude of the lake is 460 feet. The drainage is steep and rugged with slopes up to 80 percent. There are numerous springs and intermittent streams that flow into the lake. The outlet, at the west end of the lake, is controlled by flash boards and flows into Kennedy Creek.

GENERAL WATER QUALITY: (Excellent, Good, Fair, Poor)

Good to Excellent - The lake has low nutrient and chlorophyll-*a* levels and good water clarity. The lake is used as a drinking water source for most of the lake residents. Uses are not impeded by aquatic weeds or excessive algal growth.

OTHER DATA:

Thurston County Stormwater Program;
http://www.thurstoncountywa.gov/sw/Pages/monitoring.aspx

Washington Department of Ecology (Ecology), Environmental Assessment Program, (water quality data);
(360) 407-6000
https://fortress.wa.gov/ecy/wqamapviewer/StartPage.aspx

Thurston County Environmental Health Division;
(360) 867-2626
http://www.co.thurston.wa.us/health/ehrp/waterqualitymonitoring.html

Washington State Toxic Algae
Freshwater algae bloom monitoring program
https://www.nwtoxicalgae.org

GENERAL DISCUSSION:

Summit Lake is one of the deepest lakes in Thurston County, with a maximum depth of 30 meters (100 feet). Generally, ambient monitoring consists of monthly sampling, May through October, at one monitoring site located at deepest area of the lake. 2017 was an atypical year due to a long-lived toxic algae bloom. On May 4th 2017, environmental health staff responded to a citizen report of algal scum on the water. Consequently, the lake was sampled for algae toxins at King County Environmental Laboratory. Results were reported at the highest level observed in Summit Lake to date, 354 micrograms per liter (µg/L) of anatoxin-a. Subsequently, Thurston County Environmental Health continued monitoring toxin levels in the lake, which fluctuated over several weeks. As a result of the algal toxicity, ambient sampling was suspended until the toxin levels were safe for at least two consecutive weeks.

Ambient monitoring in 2017 took place monthly, July through October. Thurston County measured temperature, dissolved oxygen, pH, color, and conductivity at 2-meter increments from the lake surface to the bottom. Water clarity was measured using a standard secchi disk. Thurston County collected water samples near the lake surface (*surface*) and near the bottom (*benthic*). Samples were analyzed for total phosphorus (TP) and total nitrogen (TN) by IEH Analytical Laboratories, Seattle, WA. Three-point composite samples were collected from the *epilimnion* (warm surface layer), or photic zone, and analyzed for chlorophyll-*a* and pheophytin by IEH Analytical Laboratories.

Field Parameters

The 2017 monthly temperature, dissolved oxygen, pH, and conductivity profiles are graphically represented in the following sections of this report. The term "*thermal stratification*" refers to a condition in the lake when there are two distinct thermal layers of water, a warm upper layer (*epilimnion*) and a cold oxygen depleted bottom layer (*hypolimnion*). Summit Lake is typically thermally stratified throughout the sampling season, as depicted in the aforementioned profile graphs.

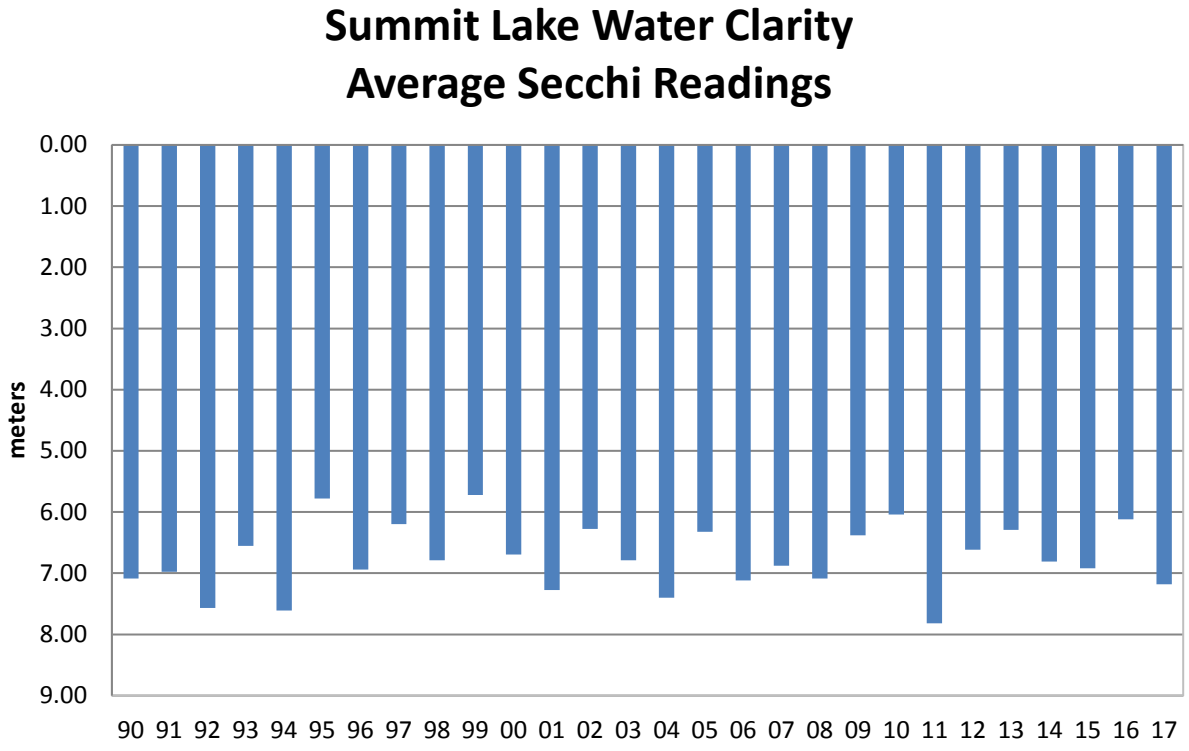
In July 2017, the lake was stratified with the temperature in the surface water (immediately below the surface), at 21.45º C. and the benthic water temperature at 8.472º C. The surface temperature was the warmest in August at 22.89º C. Throughout the sampling season, the *benthic* (immediately above the lake bottom) temperature ranged between 8.47 º C and 8.72º C.

During periods when the lake is thermally stratified, there is no exchange of oxygen from the atmosphere into the bottom waters. During periods of stratification, bacterial decomposition of organic material in the hypolimnion depletes the available dissolved oxygen in the bottom waters. In 2017, benthic oxygen levels were not depleted until October with a concentration of 0.89 mg/L.

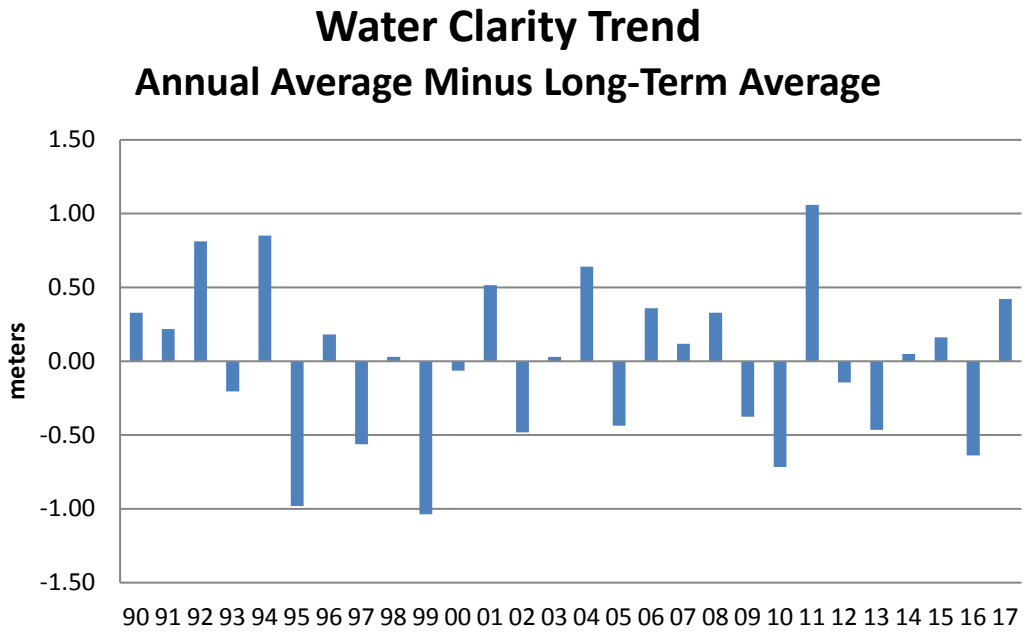
Anoxic conditions cause phosphorus from the sediments to be released into the water near the lake bottom. When the lake mixes in late-summer/early-fall, phosphorus-rich benthic water in close contact with sediments is transported towards the surface, which can stimulate algae growth.

Secchi Disk Water Clarity

Water clarity in a lake is measured with a device called a secchi disk. Summit Lake is one of the clearest lakes in Thurston County. The average water clarity for the 2017 season was 7.18 meters (23.56 feet), however data is skewed due to the reduction in sampling months as a result of the toxic algae bloom. In the four months sampled in 2017, the water clarity ranged from 6.02 meters in September to 8.33 meters in August (19.75 to 27.33 feet). The graph below shows the annual averages for water clarity since 1990.



Water clarity trends are depicted on the trend graph below. The graph shows the difference between each average annual secchi reading and the long-term average for the entire period of record (6.76 meters). When the bar is above the "0" line, it indicates that the average water clarity for that year was better than the long-term average. A bar below the "0" line indicates that the water clarity for that year was poorer than the long-term average. Graphing the water clarity data in this way helps to show trends in water quality versus normal annual fluctuations. For Summit Lake, there is no obvious upward or downward trend in water clarity, just variation plus or minus of approximately one meter from the long-term average, however water clarity has decreased since 2011.



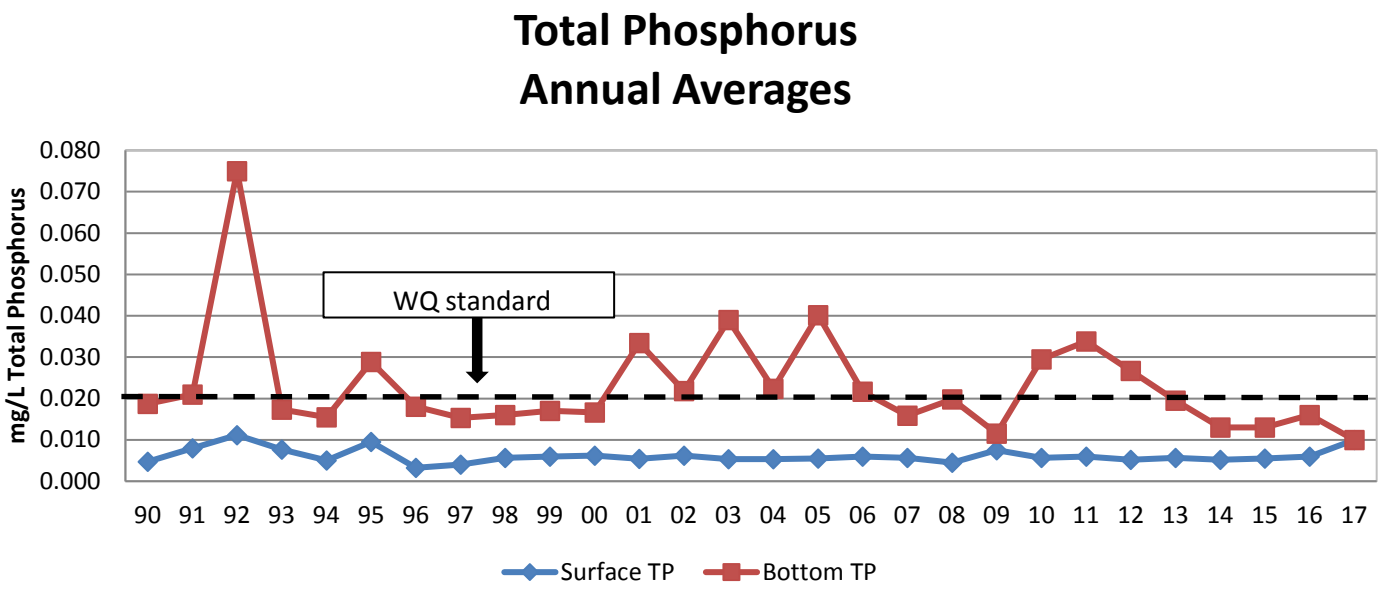
Total Phosphorus and Nitrogen

Generally, lakes in the Puget Sound region with summer average surface total phosphorus (TP) concentrations greater than 0.030 milligrams per liter (mg/L) experience undesirable algae growth which interferes with recreational uses of the lake (*USGS Water Supply Paper 2240*). The action level established in WAC 173-201A, "*Water Quality Standards for Surface Water of the State of Washington*" is 0.020 mg/L.

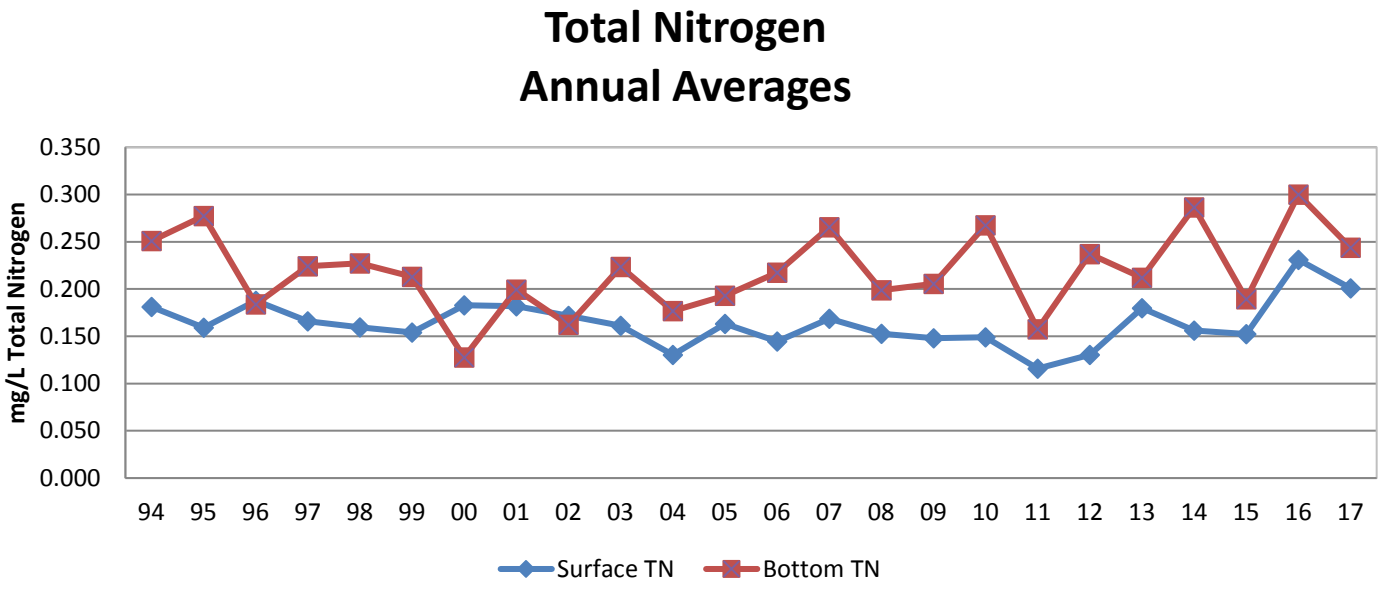
In the four months sampled in 2017, the average surface TP concentration was 0.006 mg/L. Monthly 2017 TP concentrations ranged from 0.004 to 0.011 mg/L, below the state action level. In Summit Lake, as with most freshwater lakes, algae production is limited by the amount of available TP. Summit Lake is low in nutrients, and as a result has low algae and aquatic plant production.

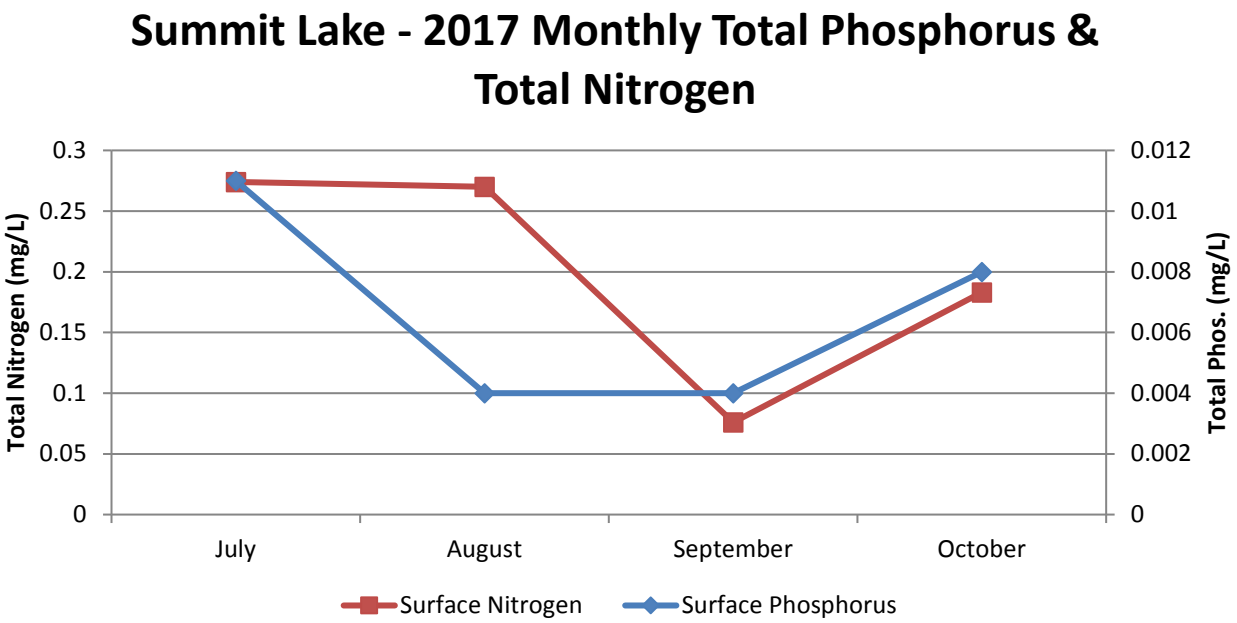
The benthic TP concentrations have declined since 2011. For the last four consecutive sampling years (2014-2017) benthic phosphorus concentrations were below 0.020 mg/L.

It is important to note that 2017 data is skewed due to reduced sample size. All comparable years, sampling occurred over 6 months. However, 2017 sampling only represents four consecutive months of data due to the toxic algae bloom that occurred from early May through late June.



The below graph illustrates the average annual TN over the period of record for both benthic and surface TN. Surface and benthic TN concentrations fluctuate over the period of record, with no anomalous spikes. Benthic TN decreased since 2016 from 0.300 mg/L to 0.244 mg/L in 2017; and surface TN also decreased from 0.231 mg/L in 2016 to 0.201 mg/L in 2017. No regulatory standard is in place for TN in surface waters.





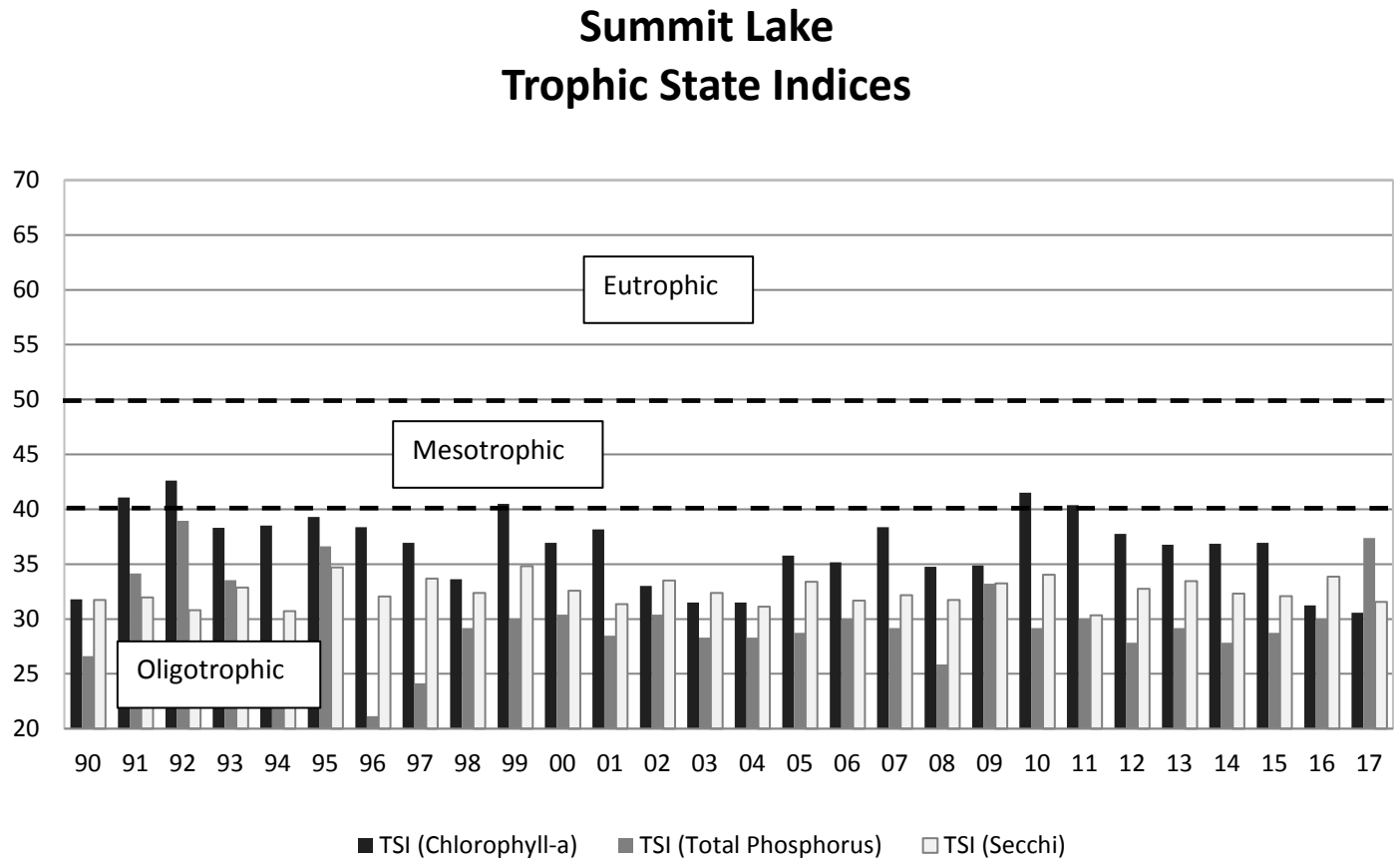
The graph above depicts the monthly surface TP & TN over the 2017 sampling season. All months in the 2017 sampling season were in compliance with the state regulatory TP action level of 0.020 mg/L. Surface TP decreased throughout the sampling season with concentrations in July 2017 of 0.011 mg/L, to 0.008 mg/L in October.

Surface TN was elevated in July and August 2017 at concentrations of 0.270 mg/L, then decreased in September with a slight increase again in October.

Trophic State Indices

Carlson Trophic State Indices (TSIs) are used to express the degree of productivity in a lake. Average summer TP, chlorophyll-*a*, and secchi disk readings are each used to calculate TSIs. A TSI of 0 to 40 indicates an *oligotrophic*, or low productivity, lake. A TSI of 41 to 50 indicates a *mesotrophic*, or moderately productive, lake. A TSI of greater than 50 indicates a *eutrophic*, or highly productive lake, which are typically characterized by poor water clarity and high algae growth.

Summit Lake is an *oligotrophic*, or low productivity, lake. The Summit Lake 2017 TSIs for TP, chlorophyll-*a*, and secchi disk were 37, 31, and 34, respectively. Summit Lake TSIs are predominantly within the *oligotrophic* range for all three parameters, over the period of record. An *oligotrophic* lake is characterized by low nutrient levels, low algae growth, and good water clarity. Because Summit Lake is clear and typically low in algae and aquatic plant growth, it is popular with recreational users. It is also used as a domestic water source for the majority of residences around the lakeshore, due to the absence of an adequate groundwater supply.



Algae

The monitoring program no longer includes identification of algae species present in the lake, however toxin levels are tested in response to an algae bloom. Prior to 2017, only relatively minor and localized blue-green algae blooms have been observed. In May and June 2017, Summit Lake experienced an eight week long algal bloom with levels of the toxin anatoxin-*a* as high as 354.3 micrograms per liter. In November, an algal bloom with another toxin, microcystin was detected at levels below the advisory level.

Some species of blue-green algae can produce toxins that can cause illness in people, pets, and wildlife if ingested. Pets are particularly vulnerable to poisoning from toxic algae blooms due to their lower body weight combined with their tendency to ingest higher doses of water. In recent years, an increase in documented toxic blue-green algae blooms in Washington lakes was noted.

In response to this pattern, Washington Department of Health established state recreational guidance limits for several algae toxins, and Washington Department of Ecology funds statewide laboratory services to test for toxins during algae blooms. When severe algae blooms do occur, Thurston County Environmental Health staff send samples for analysis to determine if, and how much, algae toxin is present. Although toxin testing is now possible, lake residents and users should always observe lake conditions and avoid contact with lake water where an algae bloom is occurring.

More information about blue-green algae and swimming safety information is available through the Thurston County website: www.co.thurston.wa.us/health/ehadm/swimming/swimming_index.html

Major Issues:

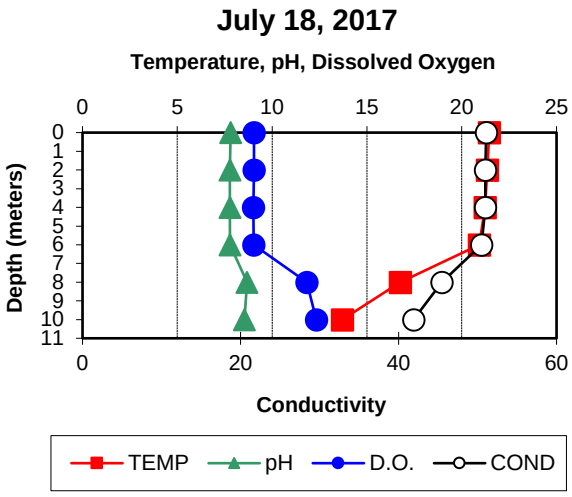
- Steep slopes, shallow soils, and generally small lots sizes make siting and functioning of on-site sewage systems around the lake difficult. A 1992-1997 sanitary survey of 330 on-site sewage systems around the lake perimeter found 58 systems were failing (18%). Nearly all of the 58 failing systems were repaired. However, a systematic evaluation of the septic systems surrounding the lake has not been done in over twenty years.
- The majority of lakeshore residents use lake water as their domestic water supply, and many do not disinfect it prior to use. Surface waters cannot be adequately protected from contamination to be safely used as a domestic water supply without treatment. A public health advisory issued in 1987 advises against consumption of untreated lake water at Summit Lake.
- Toxic algae containing anatoxin-a persisted at Summit Lake for 2 months in 2017. During algal blooms Summit Lake residents are without an in home source of drinking water, as there are no NSF certified systems to treat drinking water contaminated with anatoxin-a.
- The high density residential activities along the shoreline and forestry activities in the upper watershed pose a concern for water quality.

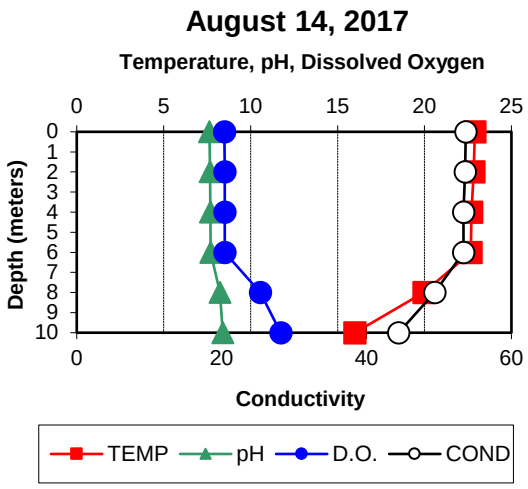
Recommendations:

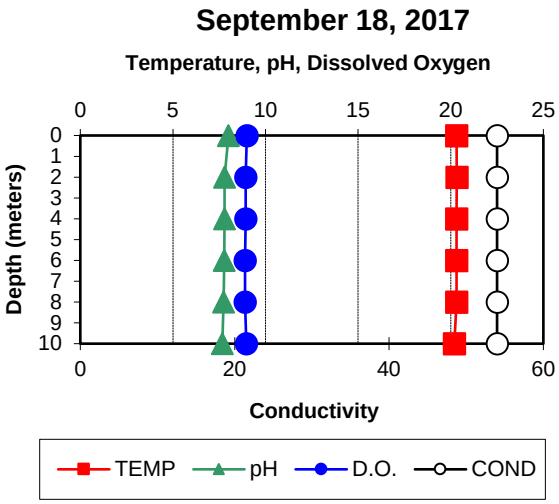
- Educate lake residents on the proper application (agronomic rates) of fertilizers.
- Conduct dye tests and inspect on-site septic systems to ensure they are operational, not leaking and contributing nutrients into the lake that increase the likelihood of algae blooms.
- Identify all outfalls and stormwater conveyances discharging to the lake. Conduct dry weather outfall screening and identification. Sample outfalls that are actively discharging to the lake for nutrients.

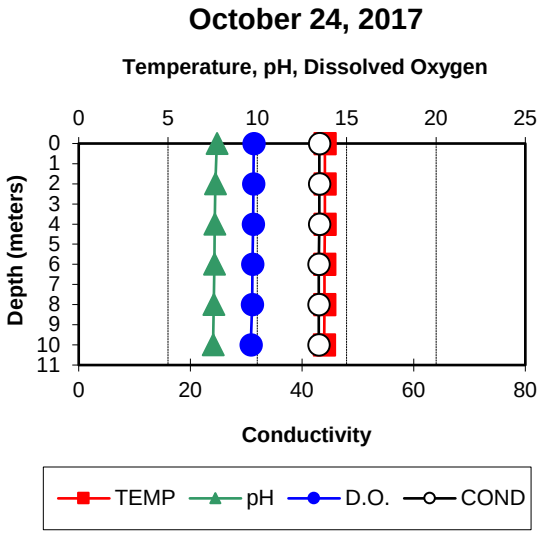
Funding Sources:

Thurston County funds will continue to support monitoring in 2018.


July 18, 2017
Temperature, pH, Dissolved Oxygen
Depth (meters)
Conductivity
TEMP
pH
D.O.
COND


August 14, 2017
Temperature, pH, Dissolved Oxygen
Depth (meters)
Conductivity
TEMP
pH
D.O.
COND


September 18, 2017
Temperature, pH, Dissolved Oxygen
Depth (meters)
Conductivity
TEMP
pH
D.O.
COND


October 24, 2017
Temperature, pH, Dissolved Oxygen
Depth (meters)
Conductivity
TEMP
pH
D.O.
COND

Thurston County Water Resources Annual Report - 2017

Summit Lake, Main (North) Basin

Site ID# *TOTSUL010*

Date	*Time*	*Bottom Depth m*	*Bottom Sample Depth m*	*Surface TP mg/L*	*Bottom TP mg/L*	*Surface TN mg/L*	*Bottom TN mg/L*	*Secchi m*	*Chl a ug/L*	*Phae a ug/L*	*Water*	*Lake Notes*
7/17/2017	9:40	24.7	24.3	0.011	0.005	0.274	0.364	8.27	0.5	0.1	#1 clear	Chl a & algae composite @ 0, 2,4 & 6m.
8/14/2017	11:50	24.8	24.5	0.004	0.013	0.270	0.364	8.33	0.8	0.1	#2 clear	Chl a & algae composite @ 0, 2, 4 & 6m.
9/18/2017	10:00	22.36	-	0.004	0.03	0.076	0.05	6.02	1.1	0.1	#1clear	Chl a & algae composite @ 2,4, 6, 8 & 10m
10/24/2017	09:30	25	-	0.008	0.008	0.183	0.169	6.1	1	0.2	#1 clear	Chl a & algae composite @ 4, 8 & 12m.

Averages: **Surface Total Phosphorus** *0.01 mg/L*
Secchi *7.18 meters*
Chl a *1.0 µg*

County	Site	Collect Date	Parameter	Toxin Conc. (µg/L)	MDL (µg/L)	Above State Guideline
Thurston	Summit	5/4/2017	Anatoxin-a	354	0.01	Yes
Thurston	Summit	5/4/2017	Microcystin	0.275	0.15	No
Thurston	Summit	5/4/2017	Saxitoxin	<MDL	0.02	No
Thurston	Summit	5/9/2017	Anatoxin-a	0.019	0.01	No
Thurston	Summit	5/9/2017	Anatoxin-a	6.16	0.01	Yes
Thurston	Summit	5/9/2017	Anatoxin-a	0.02	0.01	No
Thurston	Summit	5/9/2017	Anatoxin-a	50.4	0.01	Yes
Thurston	Summit	5/9/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	5/9/2017	Anatoxin-a	0.012	0.01	No
Thurston	Summit	5/9/2017	Anatoxin-a	69.2	0.01	Yes
Thurston	Summit	5/9/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/9/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/9/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/9/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/9/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/9/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/9/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/11/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	5/15/2017	Anatoxin-a	0.137	0.01	No
Thurston	Summit	5/15/2017	Anatoxin-a	176	0.01	Yes
Thurston	Summit	5/15/2017	Anatoxin-a	0.012	0.01	No
Thurston	Summit	5/15/2017	Anatoxin-a	0.014	0.01	No
Thurston	Summit	5/15/2017	Anatoxin-a	0.212	0.01	No
Thurston	Summit	5/15/2017	Anatoxin-a	0.026	0.01	No
Thurston	Summit	5/15/2017	Anatoxin-a	1.62	0.01	Yes
Thurston	Summit	5/15/2017	Anatoxin-a	182	0.01	Yes
Thurston	Summit	5/22/2017	Anatoxin-a	65.9	0.01	Yes
Thurston	Summit	5/22/2017	Anatoxin-a	0.193	0.01	No
Thurston	Summit	5/22/2017	Anatoxin-a	115	0.01	Yes
Thurston	Summit	5/22/2017	Anatoxin-a	0.672	0.01	No
Thurston	Summit	5/22/2017	Anatoxin-a	0.016	0.01	No
Thurston	Summit	5/22/2017	Anatoxin-a	0.16	0.01	No
Thurston	Summit	5/22/2017	Anatoxin-a	1.87	0.01	Yes
Thurston	Summit	5/22/2017	Cylindrospermopsin	<MDL	0.1	No
Thurston	Summit	5/22/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	5/22/2017	Saxitoxin	<MDL	0.02	No
Thurston	Summit	5/23/2017	Anatoxin-a	59.1	0.01	Yes
Thurston	Summit	5/23/2017	Microcystin	<MDL	0.16	No

County	Site	Collect Date	Parameter	Toxin Conc. (µg/L)	MDL (µg/L)	Above State Guideline
Thurston	Summit	5/30/2017	Anatoxin-a	0.061	0.01	No
Thurston	Summit	5/30/2017	Anatoxin-a	0.033	0.01	No
Thurston	Summit	5/30/2017	Anatoxin-a	19.9	0.01	Yes
Thurston	Summit	5/30/2017	Anatoxin-a	0.012	0.01	No
Thurston	Summit	5/30/2017	Anatoxin-a	0.028	0.01	No
Thurston	Summit	5/30/2017	Anatoxin-a	0.039	0.01	No
Thurston	Summit	5/30/2017	Anatoxin-a	0.036	0.01	No
Thurston	Summit	5/30/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	6/5/2017	Anatoxin-a	0.018	0.01	No
Thurston	Summit	6/5/2017	Anatoxin-a	0.021	0.01	No
Thurston	Summit	6/5/2017	Anatoxin-a	0.041	0.01	No
Thurston	Summit	6/5/2017	Anatoxin-a	0.062	0.01	No
Thurston	Summit	6/5/2017	Anatoxin-a	0.023	0.01	No
Thurston	Summit	6/5/2017	Anatoxin-a	0.017	0.01	No
Thurston	Summit	6/5/2017	Anatoxin-a	0.01	0.01	No
Thurston	Summit	6/5/2017	Cylindrospermopsin	<MDL	0.1	No
Thurston	Summit	6/5/2017	Cylindrospermopsin	<MDL	0.1	No
Thurston	Summit	6/5/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	6/5/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	6/5/2017	Saxitoxin	<MDL	0.02	No
Thurston	Summit	6/5/2017	Saxitoxin	<MDL	0.02	No
Thurston	Summit	6/12/2017	Anatoxin-a	<0.05	0.01	No
Thurston	Summit	6/12/2017	Anatoxin-a	0.127	0.01	No
Thurston	Summit	6/12/2017	Anatoxin-a	1.43	0.01	Yes
Thurston	Summit	6/12/2017	Anatoxin-a	0.064	0.01	No
Thurston	Summit	6/12/2017	Anatoxin-a	<0.05	0.01	No
Thurston	Summit	6/12/2017	Anatoxin-a	0.039	0.01	No
Thurston	Summit	6/12/2017	Anatoxin-a	<0.05	0.01	No
Thurston	Summit	6/12/2017	Cylindrospermopsin	<MDL	0.1	No
Thurston	Summit	6/12/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	6/12/2017	Saxitoxin	<MDL	0.02	No
Thurston	Summit	6/19/2017	Anatoxin-a	0.028	0.01	No
Thurston	Summit	6/19/2017	Anatoxin-a	0.025	0.01	No
Thurston	Summit	6/19/2017	Anatoxin-a	0.078	0.01	No
Thurston	Summit	6/19/2017	Anatoxin-a	0.025	0.01	No
Thurston	Summit	6/19/2017	Anatoxin-a	0.074	0.01	No
Thurston	Summit	6/19/2017	Anatoxin-a	0.025	0.01	No
Thurston	Summit	6/19/2017	Anatoxin-a	0.385	0.01	No

County	Site	Collect Date	Parameter	Toxin Conc. (µg/L)	MDL (µg/L)	Above State Guideline	
Thurston	Summit	6/19/2017	Cylindrospermopsin		<MDL	0.1	No
Thurston	Summit	6/19/2017	Cylindrospermopsin		<MDL	0.1	No
Thurston	Summit	6/19/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	6/19/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	6/19/2017	Saxitoxin		<MDL	0.02	No
Thurston	Summit	6/19/2017	Saxitoxin		<MDL	0.02	No
Thurston	Summit	6/26/2017	Anatoxin-a		0.026	0.01	No
Thurston	Summit	6/26/2017	Anatoxin-a		0.018	0.01	No
Thurston	Summit	6/26/2017	Anatoxin-a		0.05	0.01	No
Thurston	Summit	6/26/2017	Anatoxin-a		0.018	0.01	No
Thurston	Summit	6/26/2017	Anatoxin-a		0.046	0.01	No
Thurston	Summit	6/26/2017	Anatoxin-a		0.015	0.01	No
Thurston	Summit	6/26/2017	Anatoxin-a		0.016	0.01	No
Thurston	Summit	6/26/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/4/2017	Anatoxin-a		0.012	0.01	No
Thurston	Summit	7/4/2017	Anatoxin-a		0.053	0.01	No
Thurston	Summit	7/4/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/4/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/11/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	7/11/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/17/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	7/17/2017	Anatoxin-a		0.011	0.01	No
Thurston	Summit	7/17/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/17/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/24/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	7/24/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	7/24/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/24/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/31/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	7/31/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	7/31/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	7/31/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	8/7/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	8/7/2017	Anatoxin-a		<MDL	0.01	No
Thurston	Summit	8/7/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	8/7/2017	Microcystin		<MDL	0.15	No
Thurston	Summit	8/14/2017	Anatoxin-a		0.18	0.01	No
Thurston	Summit	8/14/2017	Microcystin		<MDL	0.15	No

County	Site	Collect Date	Parameter	Toxin Conc. (µg/L)	MDL (µg/L)	Above State Guideline
Thurston	Summit	8/22/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	8/22/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	8/22/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	8/22/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	8/29/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	8/29/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	8/29/2017	Microcystin	<MDL	0.16	No
Thurston	Summit	8/29/2017	Microcystin	<MDL	0.16	No
Thurston	Summit	9/5/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	9/5/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	9/5/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	9/5/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	9/11/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	9/11/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	9/11/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	9/11/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	9/18/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	9/18/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	9/26/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	9/26/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	9/26/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	9/26/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/3/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	10/3/2017	Anatoxin-a	0.014	0.01	No
Thurston	Summit	10/3/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/3/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/10/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	10/10/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	10/10/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/10/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/24/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	10/24/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	10/24/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/24/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/30/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	10/30/2017	Anatoxin-a	<MDL	0.01	No
Thurston	Summit	10/30/2017	Microcystin	<MDL	0.15	No
Thurston	Summit	10/30/2017	Microcystin	<MDL	0.15	No