

2021 Lake Water Quality Report

Prepared by Thurston County Environmental Health



INTRODUCTION

Thurston County maintains an ambient monitoring program that collected surface water quality data in lakes and streams since 1988. The objectives of the surface water monitoring program are to collect baseline information about the water quality and quantity in Thurston County streams and lakes; identify problem areas; and to track trends in water quality over time.

This report summarizes data collected by Thurston County Environmental Health (TCEH) during the 2021 monitoring season. Monthly water quality data were collected from May to October at thirteen sites on ten lakes throughout Thurston County. Sampling sites in the lakes were selected by the deepest areas of each lake as determined by available bathymetric maps. Lake Lawrence, Long Lake, and Lake St. Clair each have two separate basins resulting in two sampling sites. The introduction to each lake includes a map with the sampling site, a brief description of the lake size, depth, topography, uses and general water quality.

METHODS

In 2021, Thurston County Environmental Health (TCEH) conducted monthly monitoring at ten lakes within Thurston County from May to October. Water quality parameters were measured using a YSI EXO multi-parameter sonde that included temperature, pH, dissolved oxygen, and conductivity. These parameters were measured at one or two-meter increments from the surface down to the bottom. The nutrients total phosphorus and total nitrogen were sampled from the surface and near the lake bottom using a Kemmerer sampler. Chlorophyll-a and pheophytin-a composite samples were taken from different depths within the epilimnion (warm surface layer). Secchi disk visibility (or water clarity) was measured using a standard black and white quadrant disk. Table 1 shows the parameters, units, and method of sampling performed at each lake throughout the season.

Table 1. List of parameters, units, method, and sampling locations

Parameter	Units	Method	Sampling Location
Transparency	meters	Secchi Disk	Depth where disk is no longer visible
Color	#1 to #11	Custer Color Strip	Color of water on white portion of Secchi Desk
Vertical Water Quality Profile	<ul style="list-style-type: none"> • Water Temperature (°C) • Dissolved Oxygen (mg/L) • pH (standard units) • Specific Conductivity (µS/cm) 	YSI EXO1 Multi-parameter Sonde	~ 0.5 meter below the water surface to ~ 0.5 meter above the bottom sediments
Total Phosphorus	mg/L	Grab Samples with Kemmerer	Surface Sample: ~ 0.5 meter below the surface Bottom Sample: ~ 0.5 meter above the benthos
Total Nitrogen	mg/L	Grab Samples with Kemmerer	Surface Sample: ~ 0.5 meter below the surface Bottom Sample: ~ 0.5 meter above the benthos
Chlorohyll-a	µg/L	Composite of Multiple Grab Samples	Photic Zone
Phaeo-a	µg/L	Composite of Multiple Grab Samples	Photic Zone
Algae Identification*	Genera, Present, Dominant, Subdominant	Composite of Multiple Grab Samples	Photic Zone

Transparency and Color

Color can reveal information about a lake's nutrient load, algal growth, water quality and surrounding landscape. High concentrations of algae cause the watercolor to appear green, golden, or red. Weather, rocks and soil, land use practices, and types of trees and plants influence dissolved and suspended materials in the lake. Tannins and lignins, naturally occurring organic compounds from decomposition, can color the water yellow to brown.

Transparency of water to light has been used to approximate turbidity and phytoplankton populations. Secchi depth is closely correlated with the percentage of light transmission through water. The depth at which the Secchi disk is no longer visible approximates 10% of surface light; however, suspended particles in the water affect accuracy. TCEH recommends visibility of at least 1.2 meters, or four feet, at public swimming beaches

TCEH observed the color of the water against the white background of the Secchi disk at one-meter depth and compared it to the Custer Color Strip (Figure 1).



Figure 1. TCEH compared the color of the water on the Secchi disk (1 m) to the Custer Color Strip

Nutrients

Total Phosphorus

Compared to the rich supply of other elements required for nutrition or structure, phosphorus is the least abundant and most commonly limits biological productivity. Lakes in this region experience undesirable algae growth when the annual average surface phosphorus level reaches 30 $\mu\text{g/L}$ (Gilliom, R.J. 1984). The action value is 20 $\mu\text{g/L}$ (WAC 173-201A-230, 2021) at lower mesotrophic level of the lake.

Total Nitrogen

Nitrogen also limiting to lake productivity, but supplies are more readily augmented by inputs from external sources. The State of Washington does not have established action levels for surface total nitrogen.

Cyanobacteria

Cyanobacteria, also known as blue-green algae, is a class of single celled organisms found in fresh and salt water. Warm temperatures, sunlight, and excess nutrients can cause blue-green algae to reproduce rapidly, creating blooms. These blooms may contain toxins, known as cyanotoxin, which can cause sickness in people and animals.

Washington State Department of Health sets recreational guidelines for freshwater cyanobacteria blooms when toxins are determined to be present (Table 2). TCEH samples local lakes in response to visible blooms in accordance with EPA standards. When these samples contain toxins above recreational guideline, warning signs are posted at local access points and public notices are published.

Table 2. Freshwater Cyanobacterial Recreational Guidelines

Toxin	Recreational Guideline
Microcystin	$\geq 8 \mu\text{g/L}$
Anatoxin	$\geq 1 \mu\text{g/L}$
Cylindrospermopsin	$\geq 15 \mu\text{g/L}$
Saxitoxin	$\geq 75 \mu\text{g/L}$

Trophic State Indices (TSI)

The most used method to classify lakes is called the Carlson's Trophic State Index (Carlson, 1977). Based on the productivity, this method uses three index variables: transparency (secchi disk depth), chlorophyll-a, and phosphorus concentrations. Table 3 provides the index values for each trophic classification.

Table 3. Trophic State Index variables

TSI Value	Trophic State	Productivity	Water Quality Classification
0 to 40	oligotrophic	Low	Good
41 to 50	mesotrophic	Medium	Fair
> 50	eutrophic	High	Poor

Quality Assurance and Quality Control (QA/QC)

Each sample day TCEH collected 10% replicate samples and trip blanks to assess total variation for laboratory samples (TCEH samples 3-4 lakes per day). Water quality data was collected with a Yellow Springs Instruments (YSI) EXO 1. The instrument was calibrated before each sample day. Instrument drift data were routinely collected within 24 hours of the sampling event.

Offutt Lake

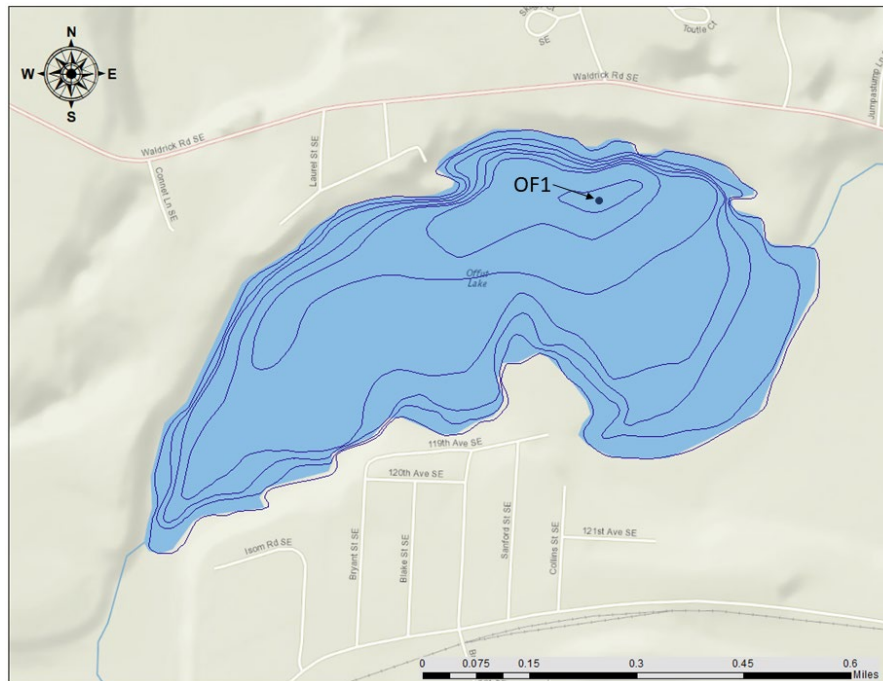


Figure 24. Offutt Lake map showing location of sample site.

PART OF DESCHUTES RIVER WATERSHED

- **SHORELINE LENGTH:** 2.9 miles
- **LAKE SIZE:** 0.30 square miles (195 acres)
- **BASIN SIZE:** 2.7 square miles
- **MEAN DEPTH:** 4.6 meters (15 feet)
- **MAXIMUM DEPTH:** 7.6 meters (25 feet)
- **VOLUME:** 2,900 acre-feet

PRIMARY LAND USE:

The Offutt (also spelled Offut) Lake watershed is primarily suburban residential with some undeveloped forest cover primarily in wetland areas. The sample site OF1 is near a private swim area on the northern side of the lake (Figure 1).

PRIMARY LAKE USE:

Offutt Lake is used for fishing, swimming, and boating (5 mph).

PUBLIC ACCESS:

The Washington Department of Fish and Wildlife operates one public boat launch on the north side of the lake off 116th Ave SE.

GENERAL TOPOGRAPHY:

Offutt Lake is a Puget Sound lowland lake at an elevation of 234 feet above mean sea level.

GENERAL WATER QUALITY:

Poor – In 2020 and 2021, Offut Lake was eutrophic. The surface total phosphorus concentration exceeded the action level for mesotrophic lakes in both years. Transparency was less than the long-term average.

CYANOBACTERIA BLOOMS:

Offutt Lake experienced three cyanobacteria blooms during 2020 and 2021. None of these blooms exceeded state recreational guidelines.

2021 Lakes Report

In 2020 and 2021, Offutt Lake was classified as eutrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. Offutt Lake had been classified as eutrophic in all sampling years (Figure 2).

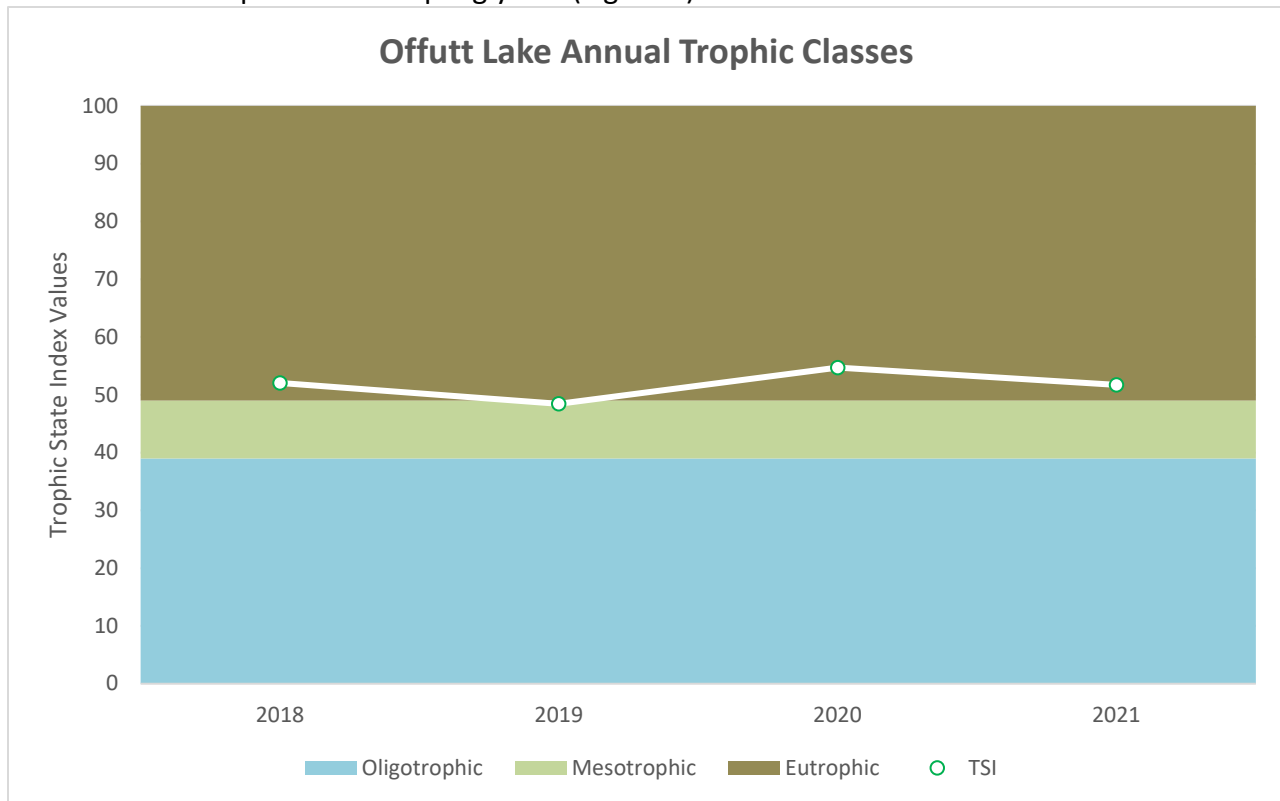


Figure 15. Offutt Lake Trophic State Index from 2018 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Offutt Lake each year and how many times the results were above state recreational guidelines for any toxin detected.

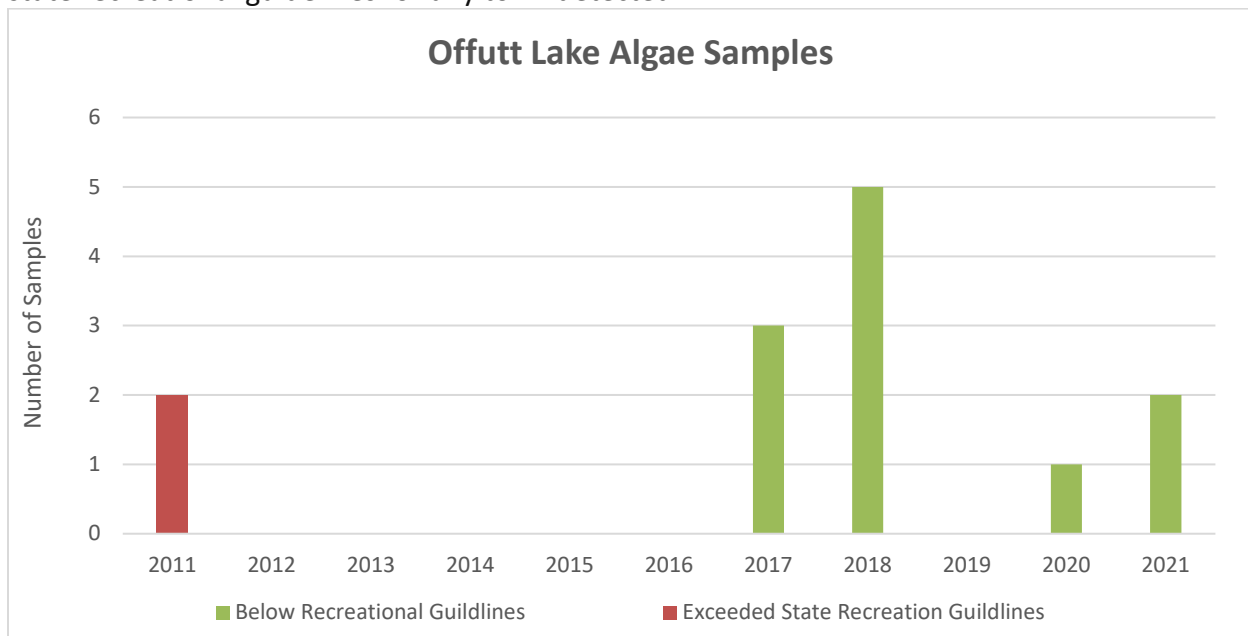


Figure 16. Offutt Lake algae bloom samples 2011 to 2021.

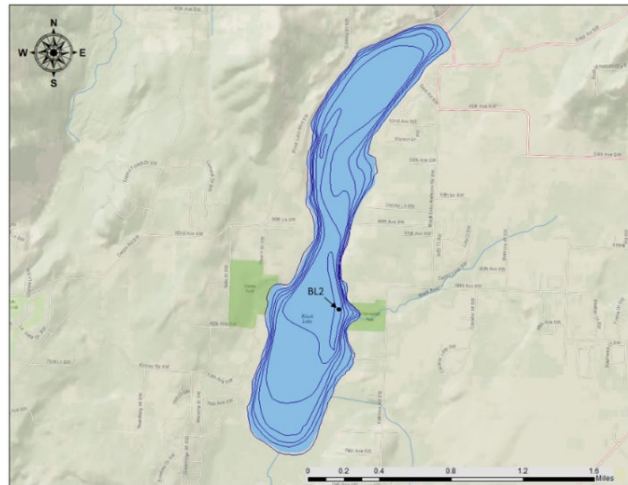
RESULTS**Black Lake**

Figure 2. Black Lake map showing location of sample site.

PART OF BUDD INLET WATERSHED

- **SHORELINE LENGTH:** 6 miles
- **LAKE SIZE:** 0.9 square miles (570 acres)
- **BASIN SIZE:** 10.1 square miles
- **MEAN DEPTH:** 19 feet (5.8 meters)
- **MAXIMUM DEPTH:** 29 feet (8.8 meters)
- **VOLUME:** 11,000 acre-feet

PRIMARY LAND USE:

A large percentage of the lake shore is moderate-density residential. There are two large mobile home parks on the east shoreline and two RV commercial resorts on the west side of the lake. The south and north ends are dominated by extensive wetland systems (Figure 1).

PRIMARY LAKE USE:

Black Lake is used for fishing, boating, swimming, and other water sports.

PUBLIC ACCESS:

The Washington Department of Fish and Wildlife operates one public boat launch. Thurston County manages Kenneydell Park, which has a swim area. Black Lake can also be accessed at two private resorts, one church camp, and several private community areas.

TOPOGRAPHY:

The approximate altitude of the lake is 130 feet above mean sea level. Two tributaries originate in wetlands on the east side of the lake. On the west side, there is one year-round stream and several intermittent streams that flow into the lake. The lake outlet is through an artificially lowered exit stream called Black Lake Ditch at the north end of the lake, which flows to Percival Creek. Periodically, beaver dam the outlet ditch. The historic outlet was to the south via the Black River, which is now obstructed by beaver dams and vegetation.

WATER QUALITY:

Fair – In 2020, Black Lake was eutrophic. The mean Total Phosphorus (TP) concentration was above the action level. Productivity was high and transparency was less than average. In 2021, Black Lake's water quality improved slight, becoming Mesotrophic. Transparency increased while productivity remained relatively high.

CYANOBACTERIA BLOOMS:

Black Lake experienced nine cyanobacteria blooms during 2020 and 2021. One bloom exceeded state recreational guidelines in 2021.

In 2020, Black Lake was classified as eutrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. Black Lake had been classified as eutrophic in all sampling years since 1995 but showed some improvement in 2021 with the TSI moving into the mesotrophic classification (Figure 2).

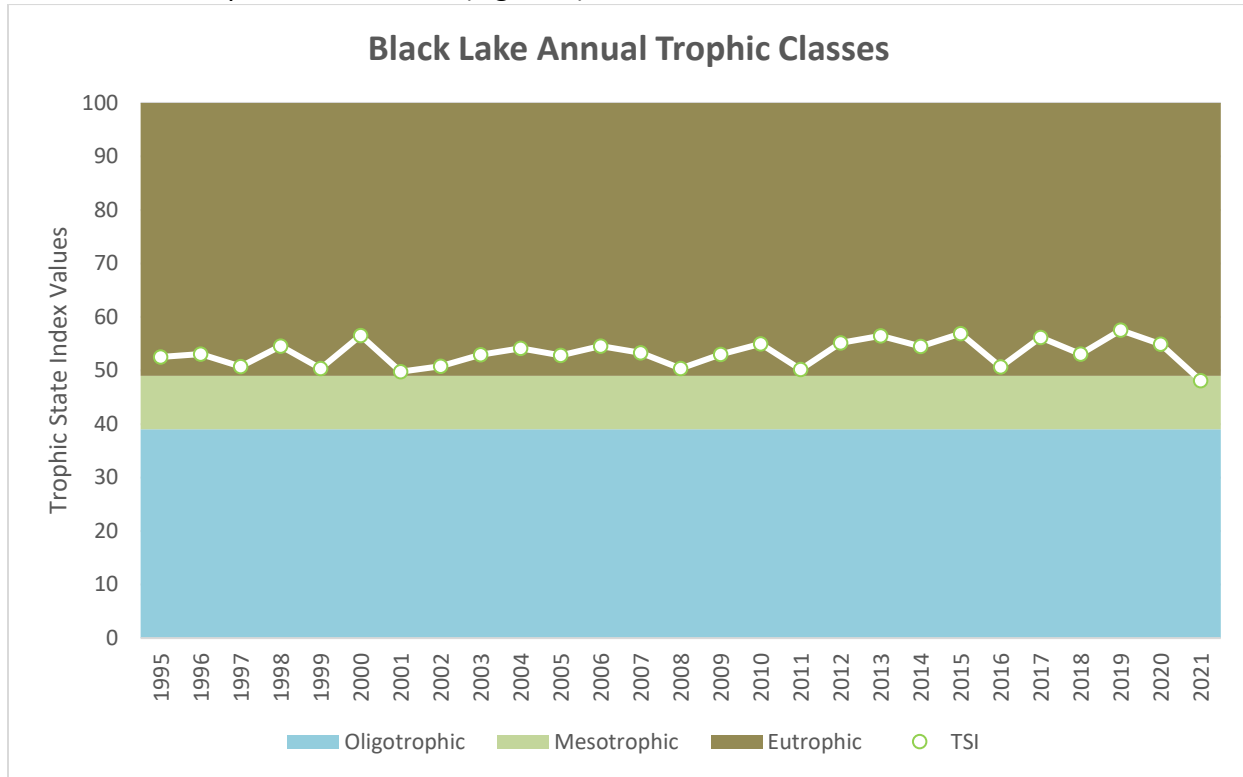


Figure 3. Black Lake Trophic State Index from 1995 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Black Lake each year and how many times the results were above state recreational guidelines for any toxin detected.

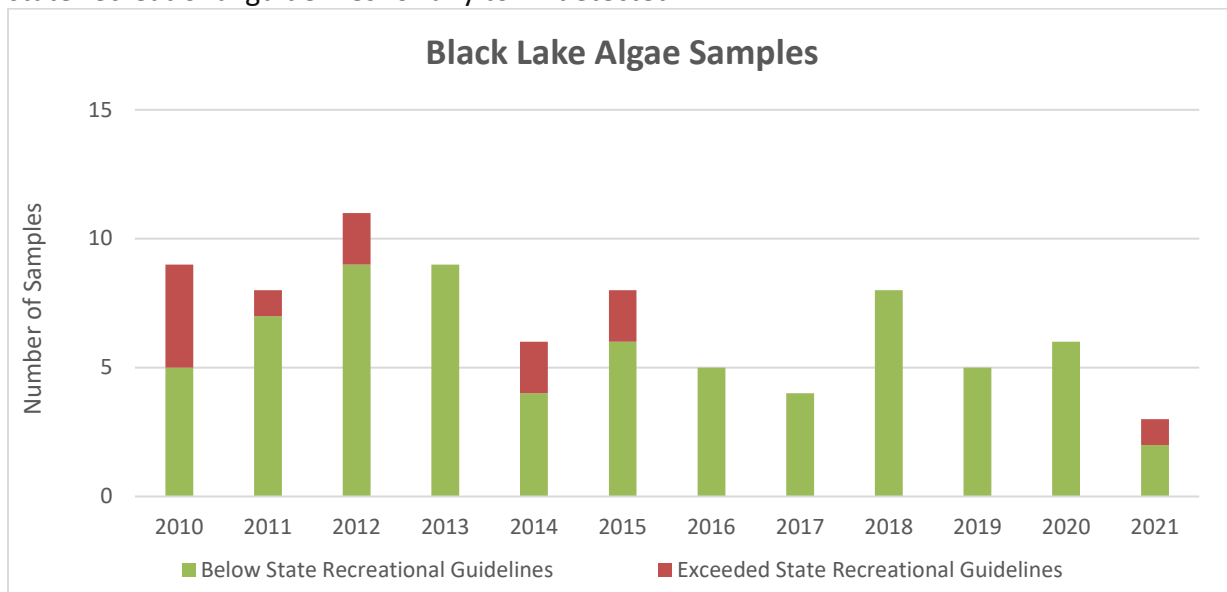


Figure 4. Black Lake algae bloom samples 2010 to 2021.

Deep Lake

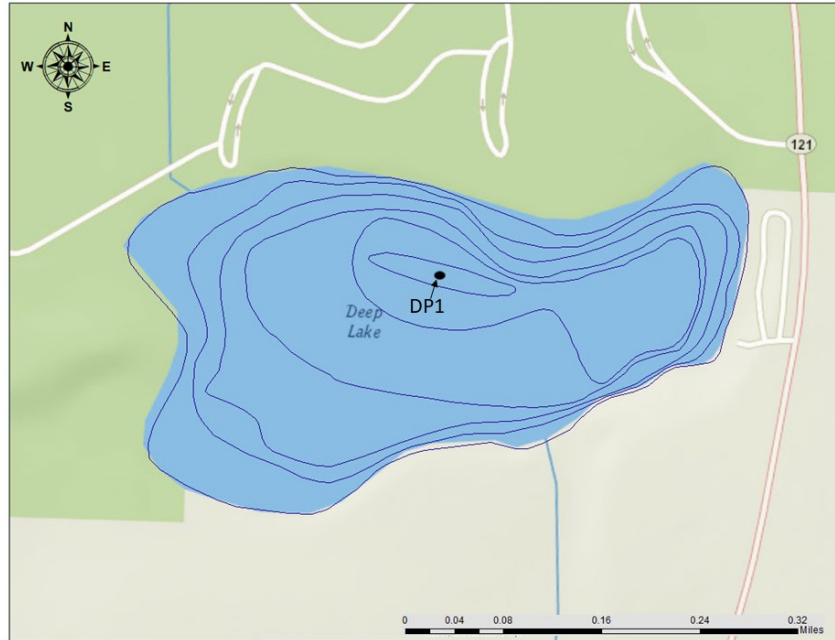


Figure 5. Deep Lake map showing location of sample site.

PART OF BLACK RIVER WATERSHED

- **SHORELINE LENGTH:** 1.4 miles
- **LAKE SIZE:** 0.10 square miles (66 acres)
- **BASIN SIZE:** 1.2 square miles
- **MEAN DEPTH:** 3.7 meters (12 feet)
- **MAXIMUM DEPTH:** 5.2 meters (17 feet)
- **VOLUME:** 770 acre-feet

PRIMARY LAND USE:

Most of the watershed is inside Millersylvania State Park, a 903-acre park used for camping, hiking, and water recreation. The sample site DP1 is in the deepest part of the lake (Figure 1).

PRIMARY LAKE USE:

Deep Lake is used for fishing, swimming, and boating.

PUBLIC ACCESS:

Millersylvania State Park has three swimming beaches that are very popular in the summer. A private resort is located on the east side of the lake.

TOPOGRAPHY:

The approximate altitude of the lake is 198 feet. The lake is situated between gentle hills (elevation 300 feet). There is a small unnamed inlet on the southeast side of the lake and an unnamed outlet on the northwest side of the lake. The outlet creek flows into Scott Lake.

WATER QUALITY:

Fair – In 2020 and 2021, Deep Lake was classified as mesotrophic. Transparency was less in both years than the long-term average. Chlorophyll-a concentration improved in 2021, while surface TP remained constant for both years.

CYANOBACTERIA BLOOMS:

Deep Lake did not experience any sampled cyanobacteria blooms during 2020. In 2021, three blooms were sampled, and one bloom exceeded state recreational guidelines.

In 2020 and 2021, Deep Lake was classified as mesotrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. Deep Lake had been classified as mesotrophic in all sampling years since 2006 (Figure 2).

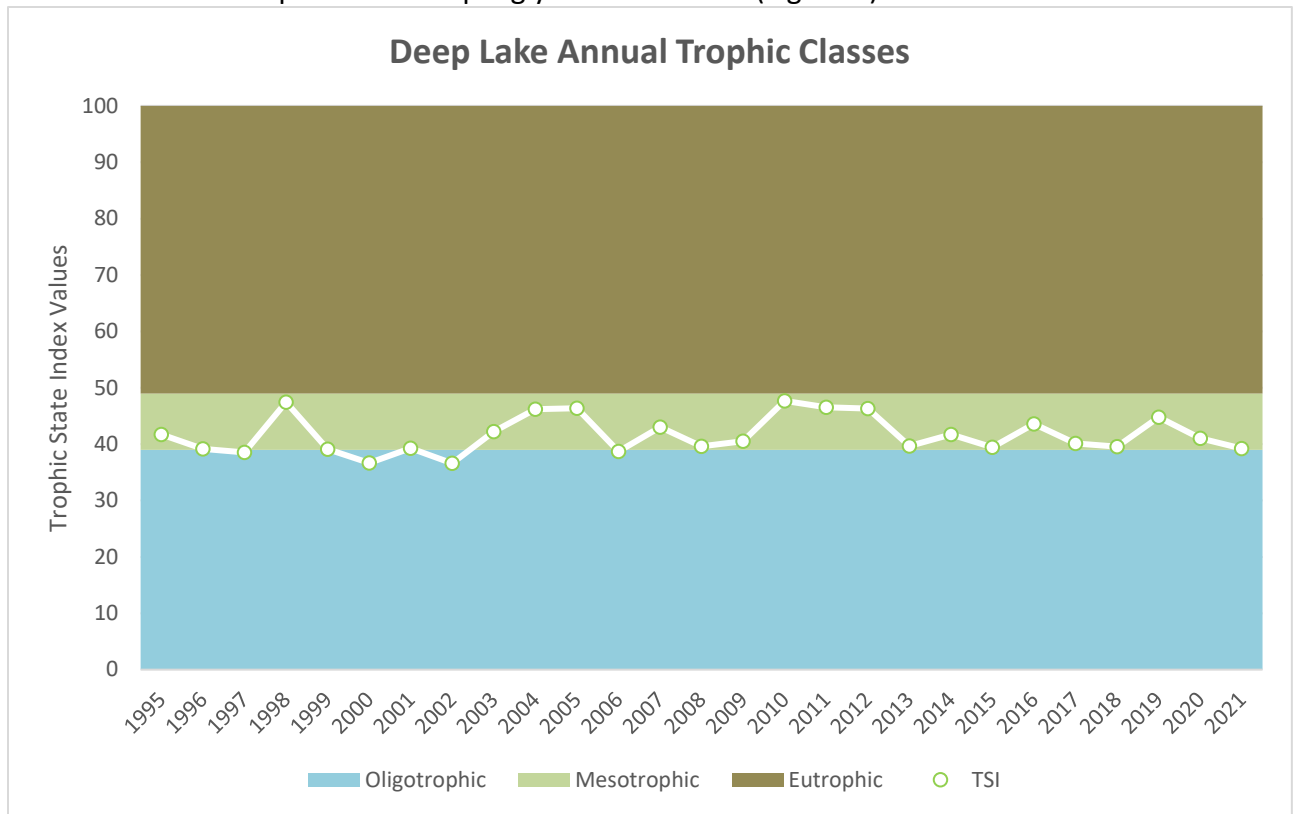


Figure 6. Deep Lake Trophic State Index from 1995 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Deep Lake each year and how many times the results were above state recreational guidelines for any toxin detected.

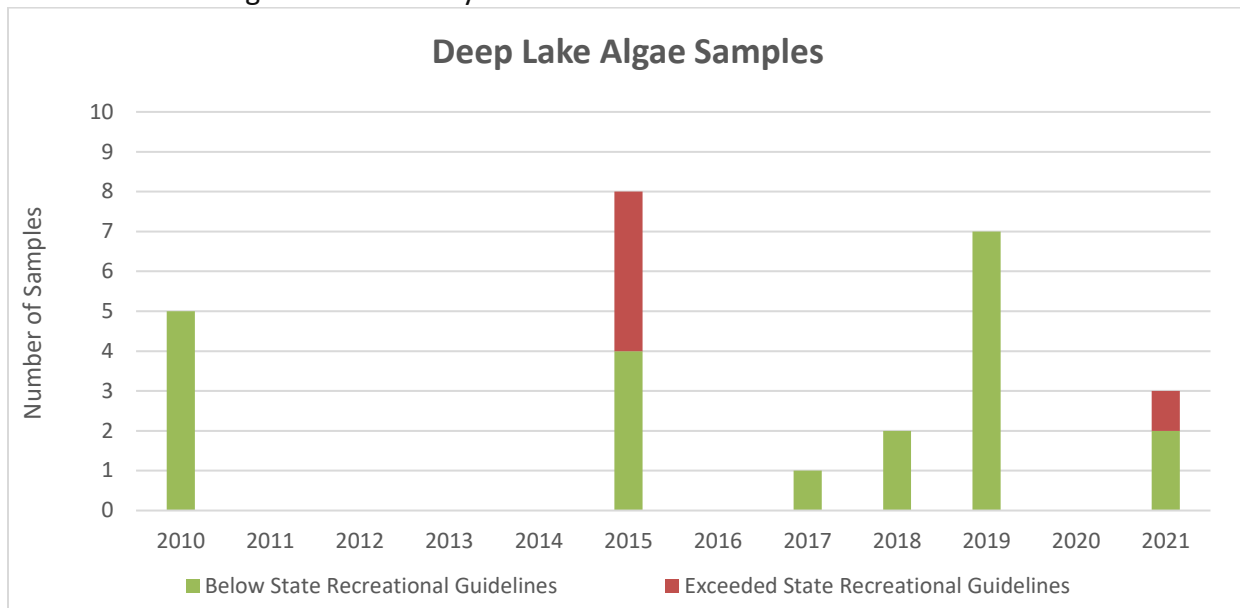


Figure 7. Deep Lake algae bloom samples 2010 to 2021.

Lake Lawrence

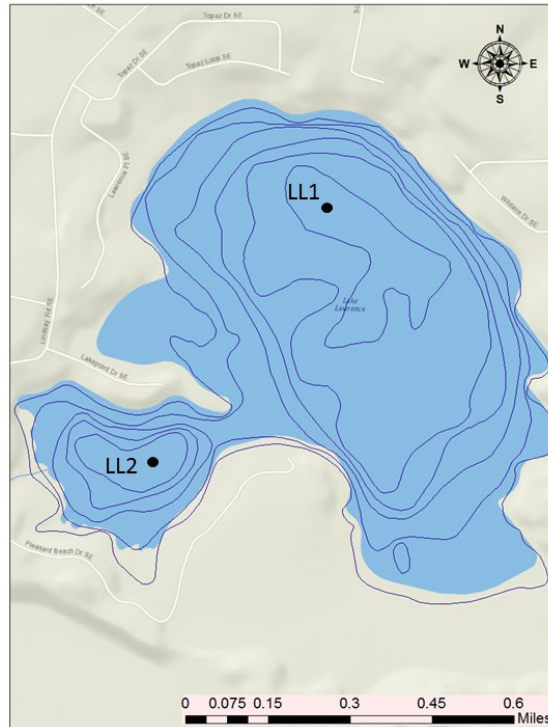


Figure 8. Lake Lawrence map showing location of sample sites (LL1 and LL2).

DESCHUTES RIVER WATERSHED

- **SHORELINE LENGTH:** 4.0 miles
- **LAKE SIZE:** 0.52 square miles (330 acres)
- **BASIN SIZE:** 3.35 square miles
- **MEAN DEPTH:** 4.0 meters (13 feet)
- **MAXIMUM DEPTH:** 7.9 meters (26 feet)
- **VOLUME:** 4,617 acre-feet

PRIMARY LAND USE:

Land use is primarily rural with some agriculture and undeveloped forest land.

PRIMARY LAKE USE:

Lake Lawrence is used for fishing, boating, swimming, and other water sports.

PUBLIC ACCESS:

Washington Department of Fish and Wildlife operate one public boat launch. Also, the lakeside residents have three private access points.

GENERAL TOPOGRAPHY:

Lake Lawrence is north of the Bald Hills, at an elevation of approximately 421 feet above mean sea level. The lake, which is very close to the Deschutes River, normally discharges to the river via a small stream. During extreme flooding events, the river water backs up into the lake.

GENERAL WATER QUALITY:

Poor – In 2020 and 2021 Lake Lawrence was eutrophic. Water quality is impaired by excessive nutrients. Harmful algal blooms have produced biotoxins that can cause illness.

CYANOBACTERIA BLOOMS:

Lake Lawrence experienced 22 cyanobacteria blooms during 2020 and 2021. Five of these blooms exceeded state recreational guidelines in 2021.

In 2020 and 2021, Lake Lawrence was classified as eutrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. Both basins of Lake Lawrence had been classified as eutrophic in all sampling years since 2009 (Figure 2).

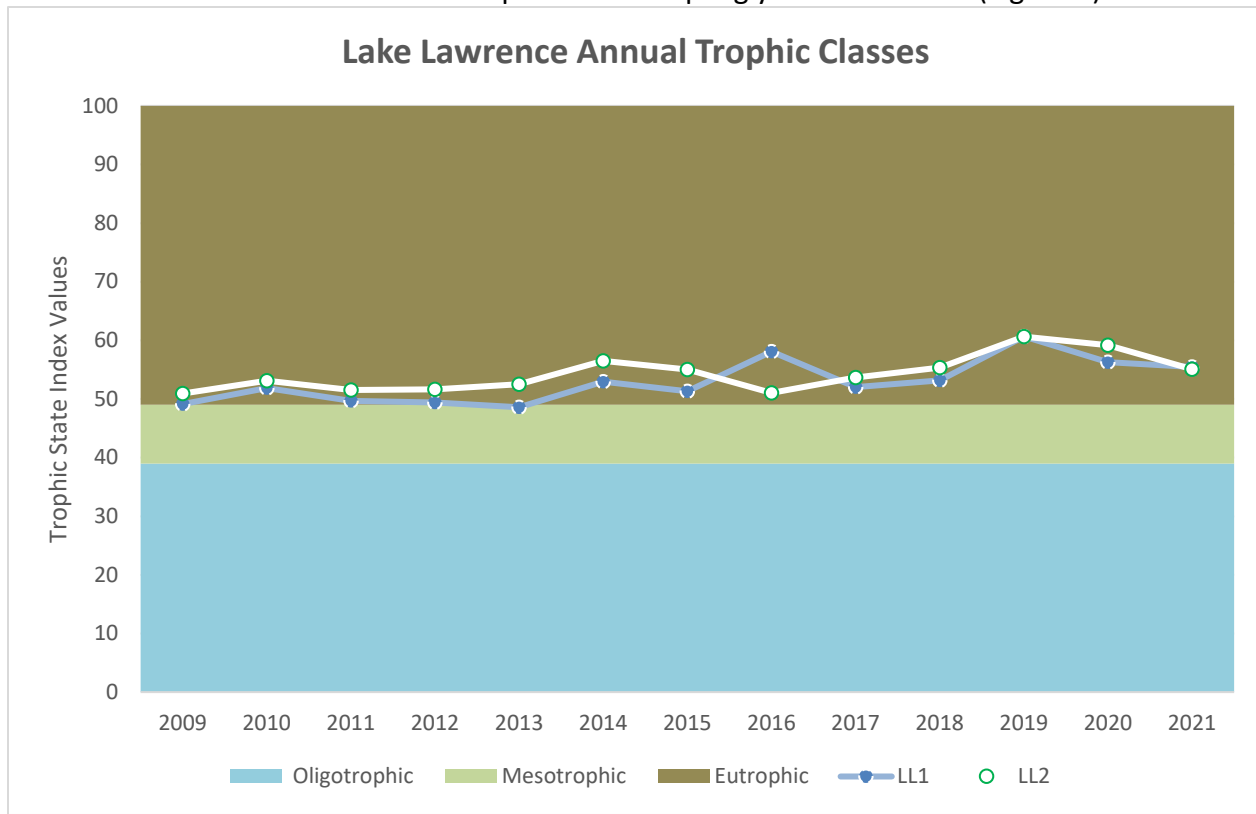


Figure 9. Lake Lawrence Lake Trophic State Index from 2009 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Lake Lawrence each year and how many times the results were above state recreational guidelines for any toxin detected.

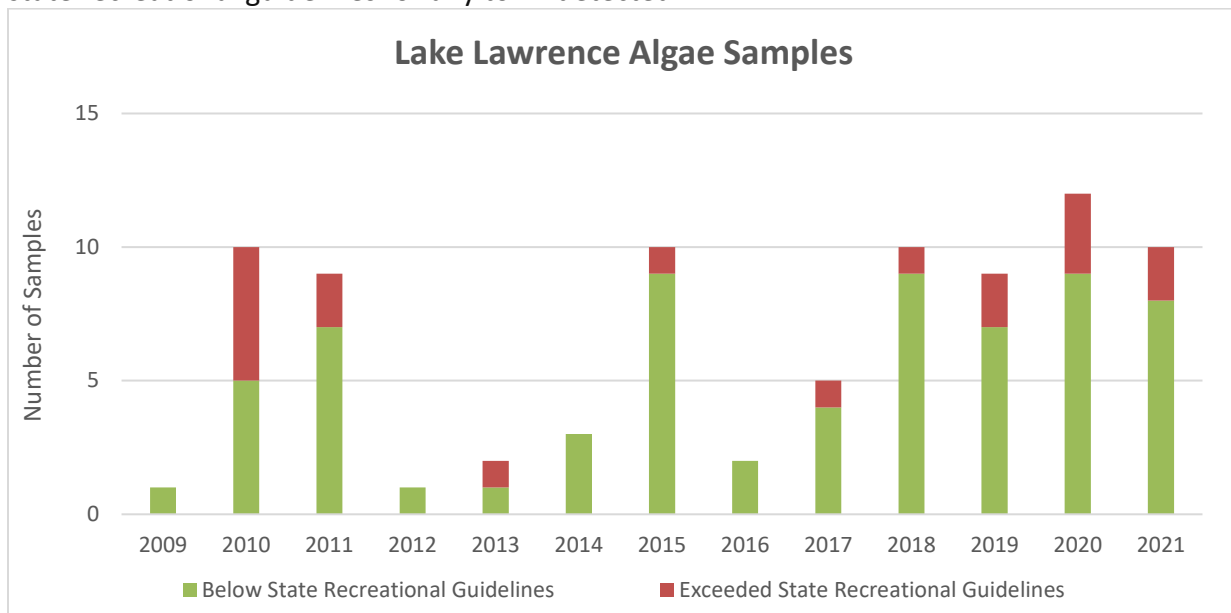


Figure 10. Lake Lawrence algae bloom samples 2009 to 2021.

Long Lake

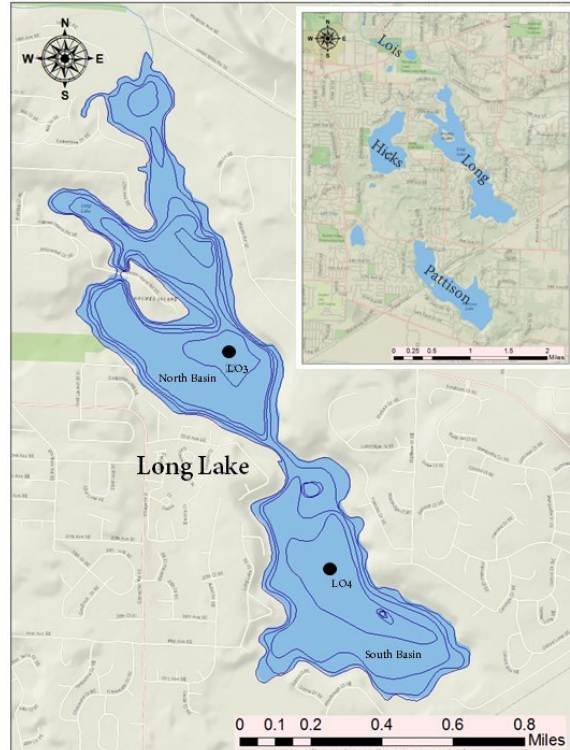


Figure 11. Long Lake map showing location of sample sites (LO3 and LL4).

HENDERSON INLET WATERSHED

- **SHORELINE LENGTH:** 7.1 miles
- **LAKE SIZE:** 0.52 square miles
- **BASIN SIZE:** 8.25 square miles
- **MEAN DEPTH:** 3.7 meters (12 feet)
- **MAXIMUM DEPTH:** 6.4 meters (21 feet)
- **VOLUME:** 3,900 acre-feet

PRIMARY LAND USE:

Primarily urban and suburban residential use, with a small percentage in agriculture and forest. Dense residential development exists along the lake shore.

PRIMARY LAKE USE:

Fishing, boating, swimming, and other water sports.

PUBLIC ACCESS:

Washington Department of Fish and Wildlife public boat launch; City of Lacey, Long Lake Park; 10 small private community entries.

TOPOGRAPHY:

The watershed is relatively flat with extensive wetlands between the lakes.

WATER QUALITY:

Poor – In 2020 and 2021 Long Lake was classified as eutrophic. For both years, transparency was lower than the long-term average, while surface TP concentration was above the action level (0.020 mg/L) for lakes in the Puget Lowlands.

CYANOBACTERIA BLOOMS:

Long Lake experienced 20 cyanobacteria blooms during 2020 and 2021. Five of those bloom exceeded state recreational guidelines in. The lake management district treated Long Lake with alum (aluminum sulfate, used to reduce phosphorus in lake water to aid in clarity) in spring of 2021.

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In 2020 and 2021, Long Lake was classified as eutrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. Both basins of Long Lake had been classified as eutrophic in all sampling years since 2016 (Figure 2).

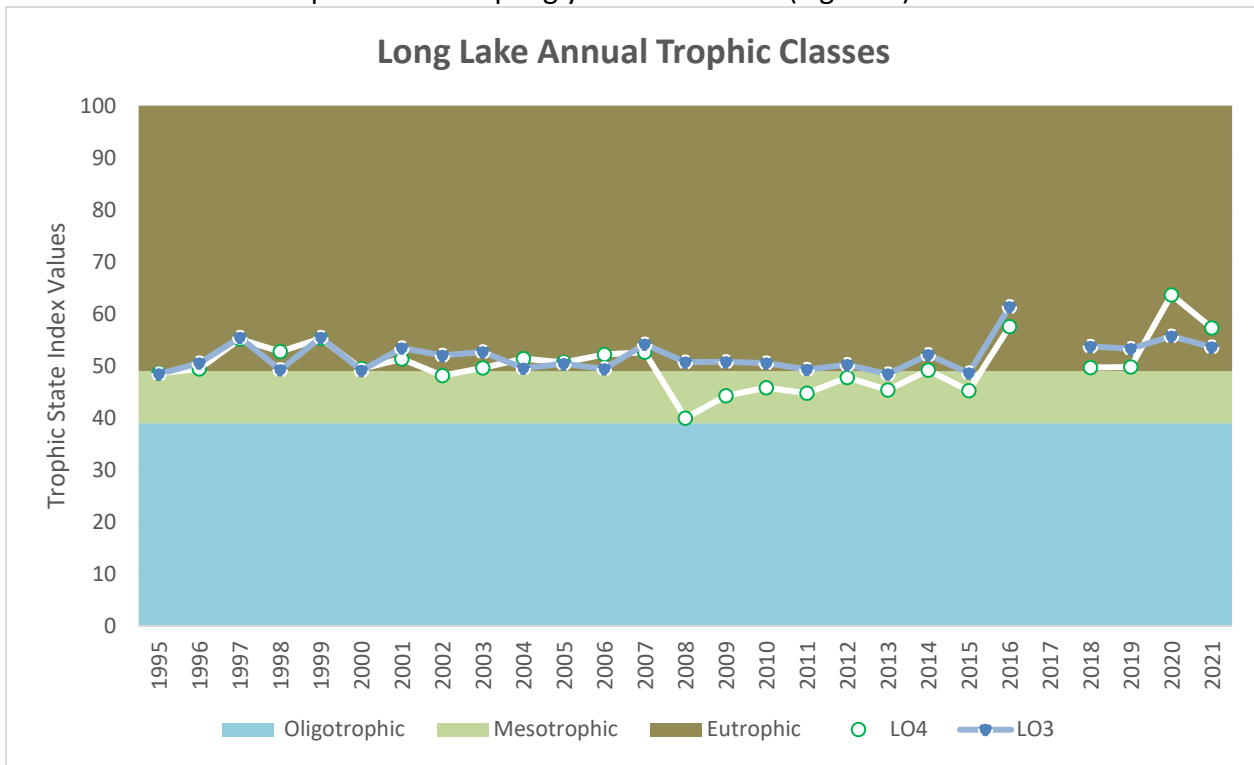


Figure 12. Long Lake Trophic State Index from 1995 to 2021, shown at both sampling sites (LO3 in the north basin and LO4 in the south basin).

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Long Lake each year and how many times the results were above state recreational guidelines for any toxin detected.

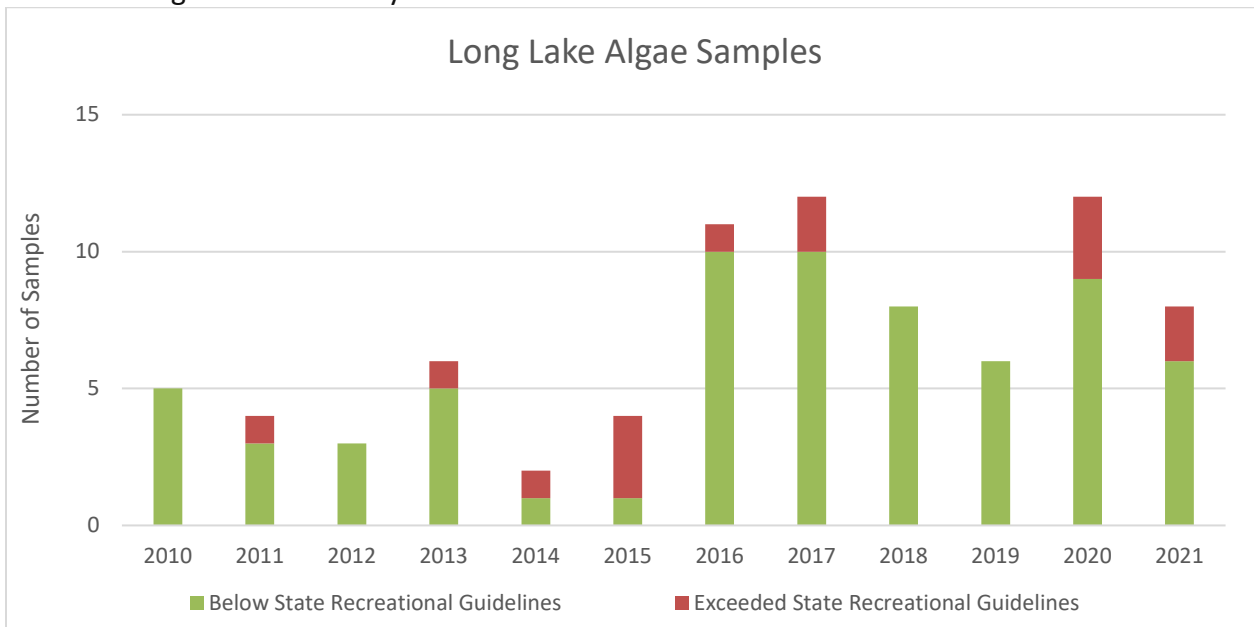


Figure 13. Long Lake algae bloom samples 2010 to 2021.

Pattison Lake

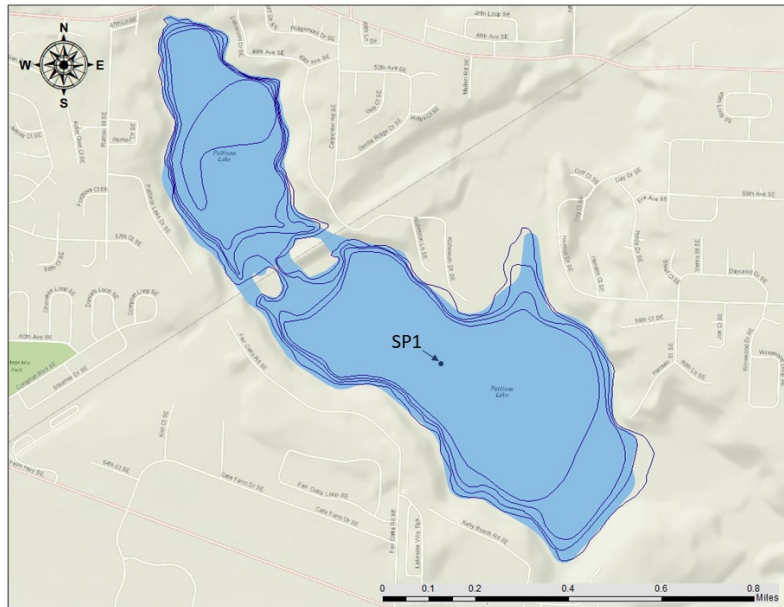


Figure 17. Pattison Lake map showing location of sample site SP1.

HENDERSON INLET WATERSHED

- **SHORELINE LENGTH:** 6.3 miles
- **LAKE SIZE:** 0.42 square miles (270 acres)
- **BASIN SIZE:** 3.8 square miles
- **MEAN DEPTH:** 4 meters (13 feet)
- **MAXIMUM DEPTH:** 6.7 meters (22 feet)
- **VOLUME:** 3,600 acre-feet

PRIMARY LAND USE:

The watershed is primarily suburban residential with some undeveloped forest cover primarily in wetland areas. The sample site SP1 is in the south basin (Figure 1).

PRIMARY LAKE USE:

Pattison Lake is used for fishing, swimming, and boating (under 5 mph).

PUBLIC ACCESS:

The Washington Department of Fish and Wildlife operates one public boat launch on the east side of the south basin.

TOPOGRAPHY:

Pattison Lake is a Puget Sound lowland lake at an elevation of 154 feet above mean sea level. Decades ago, it was divided into two basins, north and south, by placement of fill material for a railroad. Pattison Lake is second in a series of four lakes that begins with Hicks Lake. Hicks Lake drains into Pattison, and Pattison drains to Long Lake. The outlet from Long Lake flows through Lois Lake and ultimately becomes Woodland Creek, a tributary stream to Henderson Inlet.

WATER QUALITY:

Poor – In 2021, Pattison Lake was classified as eutrophic. Water clarity was below long-term averages. Water quality was further impaired by high levels of nutrients and algal blooms, which interfere with recreation and can produce surface scum and toxins.

CYANOBACTERIA BLOOMS:

Pattison Lake was sampled eight times due to cyanobacteria blooms from June through October 2021. One sample exceeding state recreational guidelines.

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In 2021, Pattison Lake continued to be classified as eutrophic based on an average of the three Trophic State Index (TSI) variables. Pattison Lake has been classified as eutrophic in all sampling years since 1996, except 2000.

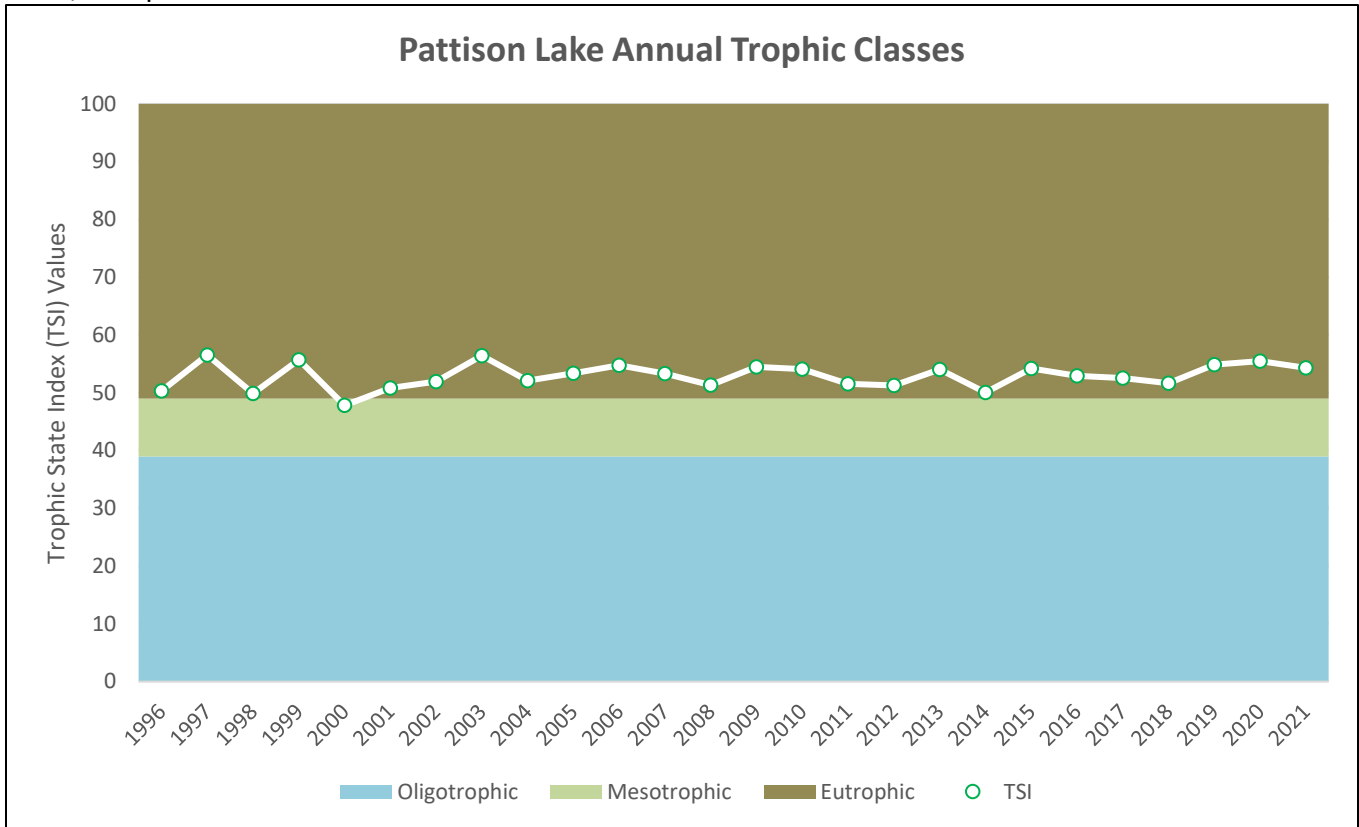


Figure 18. Pattison Lake Trophic State Index from 1996 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Pattison Lake each year and how many times the results were above state recreational guidelines for any toxin detected.

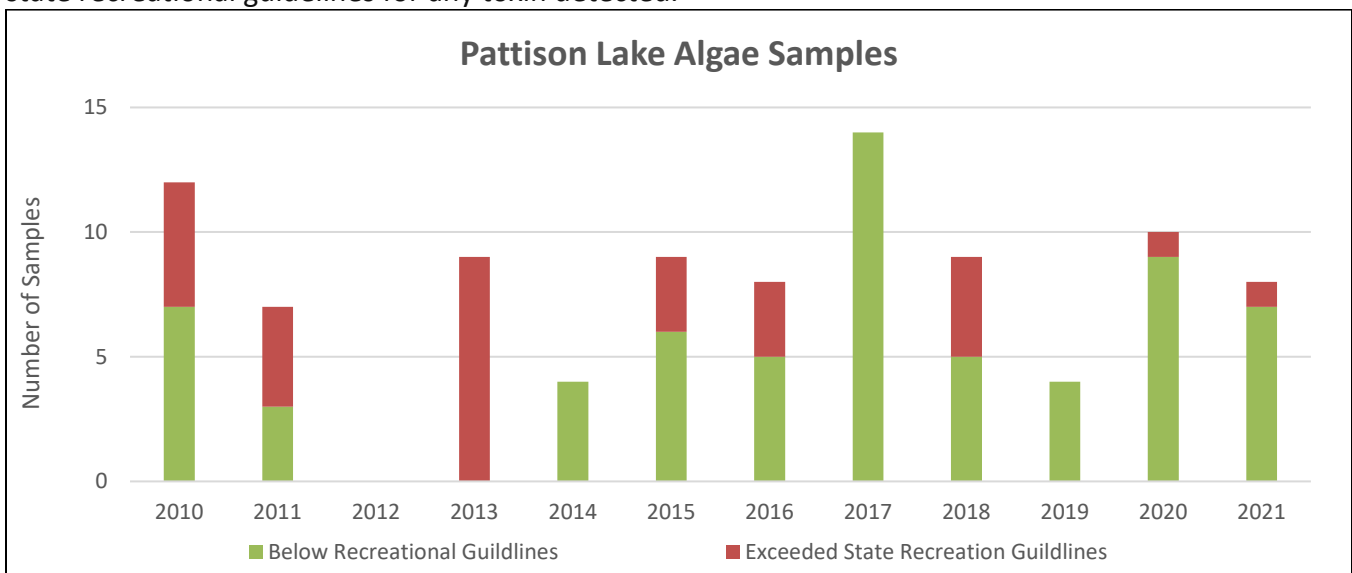


Figure 19. Pattison Lake algae bloom samples 2010 to 2021.

Lake St. Clair

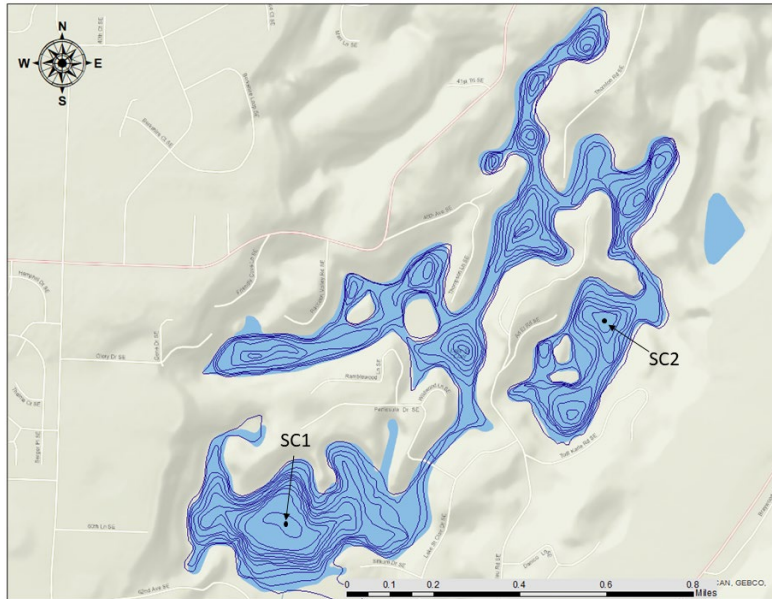


Figure 20. Lake St Clair map showing location of sample sites (SC1 and SC2).

NISQUALLY REACH WATERSHED

- **SHORELINE LENGTH:** 10.4 miles
- **LAKE SIZE:** 0.42 square miles (268 acres)
- **BASIN SIZE:** 20.9 square miles
- **MEAN DEPTH:** 10.4 meters (34 feet)
- **MAXIMUM DEPTH:** 33.5 meters (110 feet)
- **VOLUME:** 8,700 acre-feet

PRIMARY LAND USE:

Forestry and agriculture upland, with dense residential development along the shoreline. Some homeowners use the lake as their domestic water source.

PRIMARY LAKE USE:

Lake St. Clair is used for domestic water supply and fishing, boating, swimming, and other water sports.

PUBLIC ACCESS:

Washington Department of Fish and Wildlife operates two public boat launches.

GENERAL TOPOGRAPHY:

Lake St Clair is a kettle lake, irregularly shaped lake formed by ice blocks left during the glacial age. It has steep sides, numerous narrow arms, and four islands. Lake St Clair is fed by both surface and groundwater. Eaton Creek discharges into the lake from the south. Lake St. Claire is hydrologically connected to the groundwater system. The recharge area covers approximately 40-square miles. Groundwater enters the lake from the south and west, and exits the lake from the north, contributing to flow to McAllister Springs.

GENERAL WATER QUALITY:

Fair – In 2021, both basins of Lake St. Clair were mesotrophic. In 2019 and 2020, southwest was eutrophic, while the east basin remained mesotrophic. Transparency in both basins was greater than the long-term average in 2021.

CYANOBACTERIA BLOOMS:

Lake St Clair experienced four cyanobacteria blooms from 2019 to 2021. None of those blooms exceeded state recreational guidelines.

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In 2021, both basins of Lake St Clair were classified as mesotrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. This is a slight improvement for the southwest basin which was classified as eutrophic in 2019 and 2020 (Figure 2).

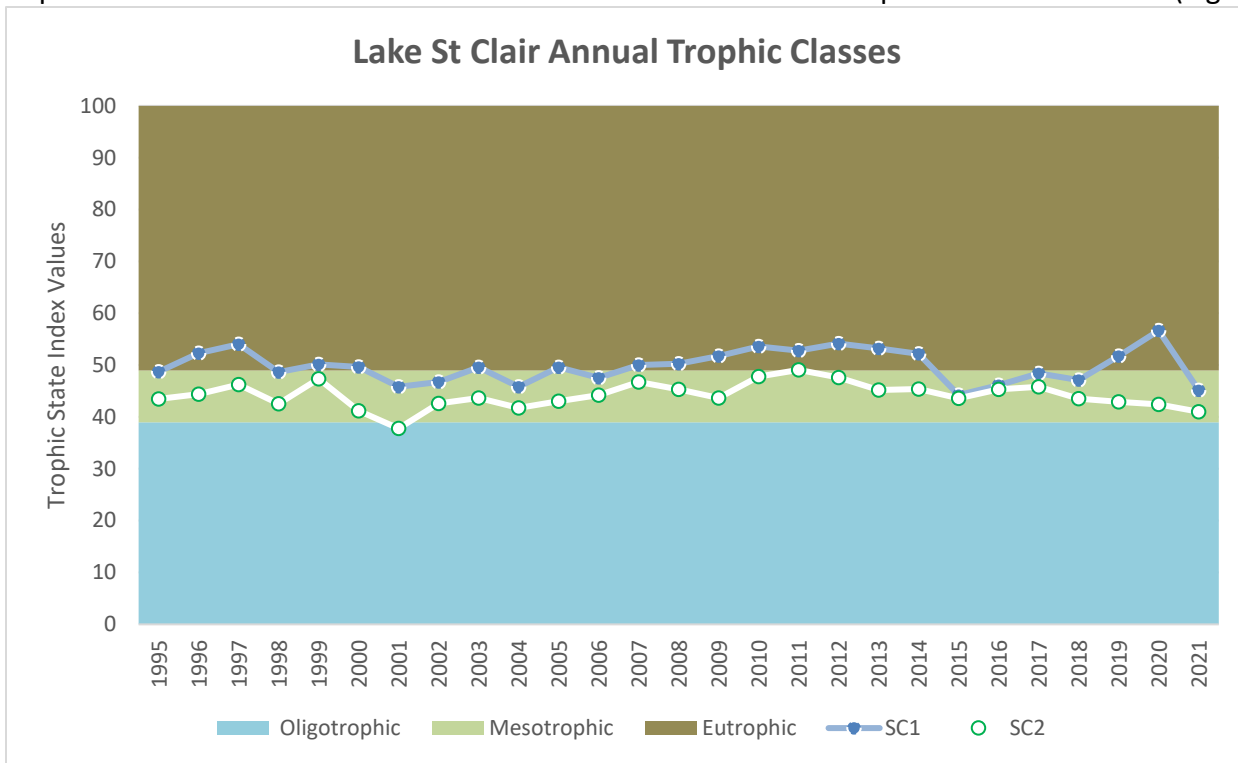


Figure 21. Lake St Clair Trophic State Index from 1995 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Lake St Clair each year and how many times the results were above state recreational guidelines for any toxin detected.

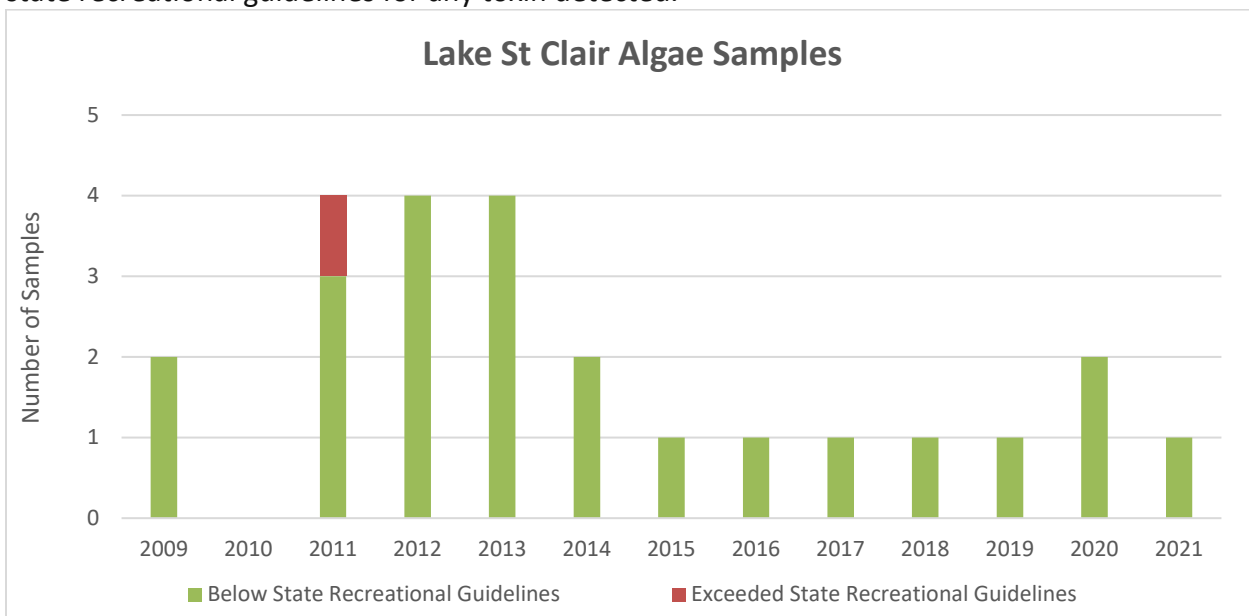


Figure 22. Lake St Clair algae bloom samples 2009 to 2021.

Summit Lake

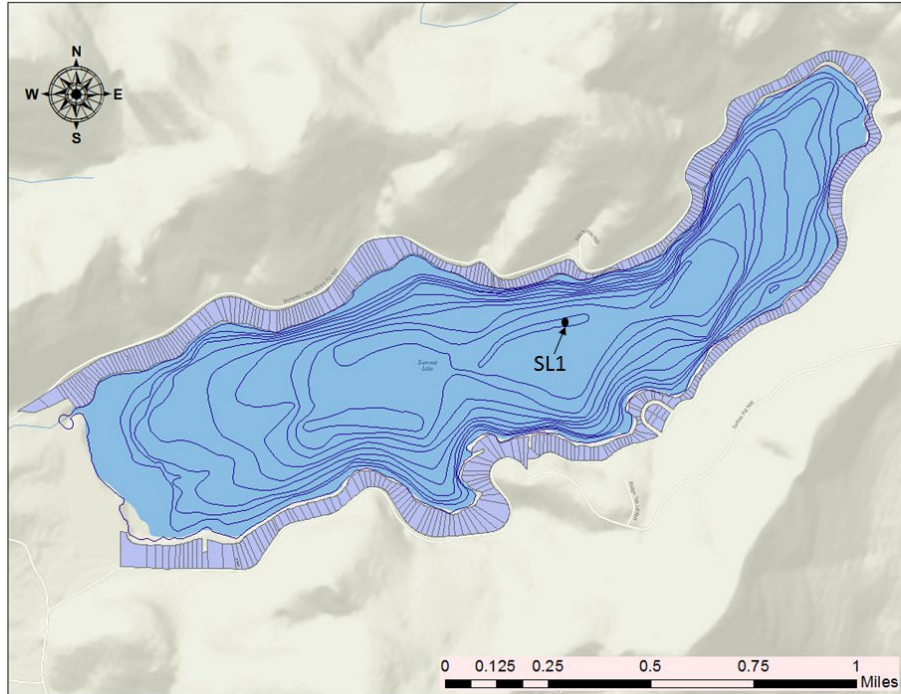


Figure 23. Summit Lake map showing location of sample site.

PART OF TOTTEN INLET WATERSHED

- **SHORELINE LENGTH:** 5.6 miles
- **LAKE SIZE:** 0.8 square miles (530 acres)
- **BASIN SIZE:** 2.8 square miles
- **MEAN DEPTH:** 16.2 meters (53 feet)
- **MAXIMUM DEPTH:** 30 meters (100 feet)
- **VOLUME:** 34,537,440 cubic meters (28,000 acre-feet)

PRIMARY LAND USE:

Most of the basin is commercial forest with dense development upslope of the lake or along the shoreline (Figure 1).

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.

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.

WATER QUALITY:

Good to Excellent – In 2021, Summit Lake continued to have low nutrient and chlorophyll-*a* levels and good water clarity.

CYANOBACTERIA BLOOMS:

Summit Lake experienced one cyanobacteria bloom during 2021, which did not exceed state recreational guidelines. As a drinking water source for most lake residents, it is essential to maintain safe water quality for consumption. In an effort to better understand Summit Lake algae blooms, TCEH plans to conduct scheduled algae monitoring in upcoming seasons.

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In 2021, Summit Lake was classified as oligotrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. Summit Lake had been classified as oligotrophic in all sampling years since 1995 (Figure 2).

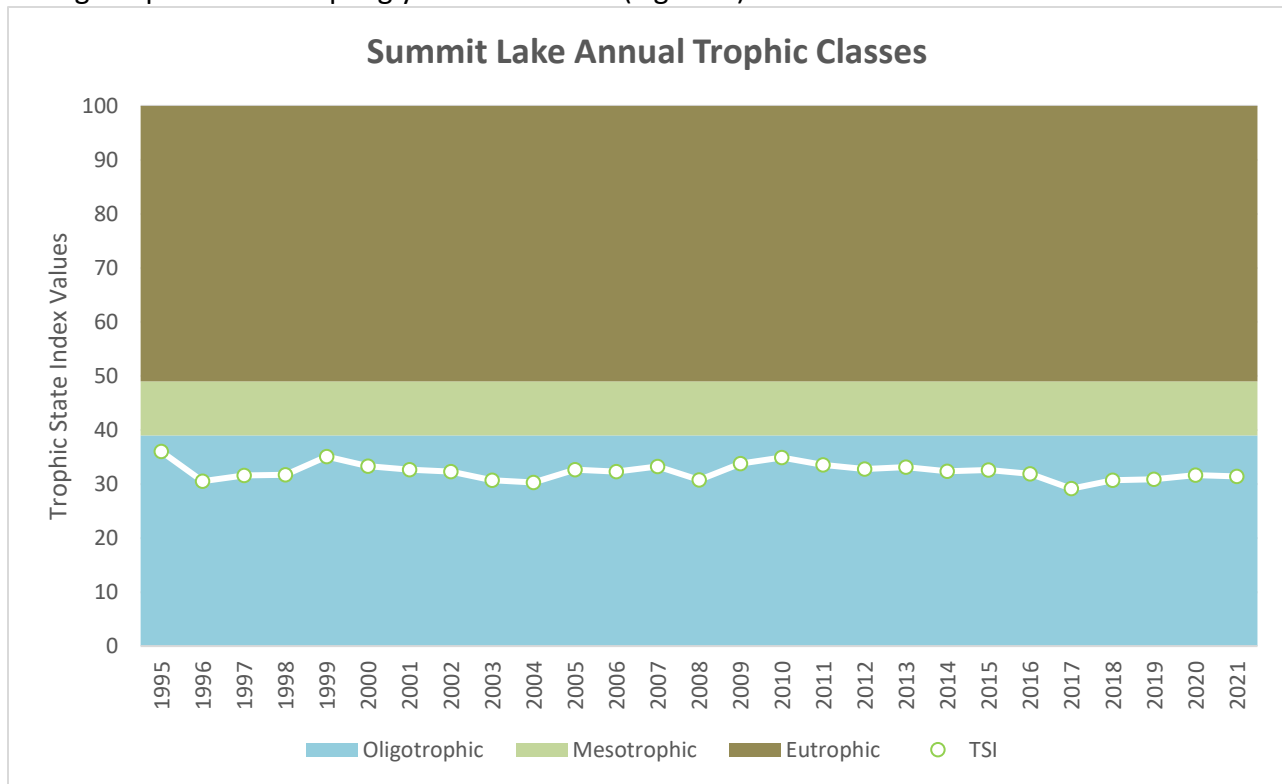


Figure 24. Summit Lake Trophic State Index from 1995 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Summit Lake each year and how many times the results were above state recreational guidelines for any toxin detected.

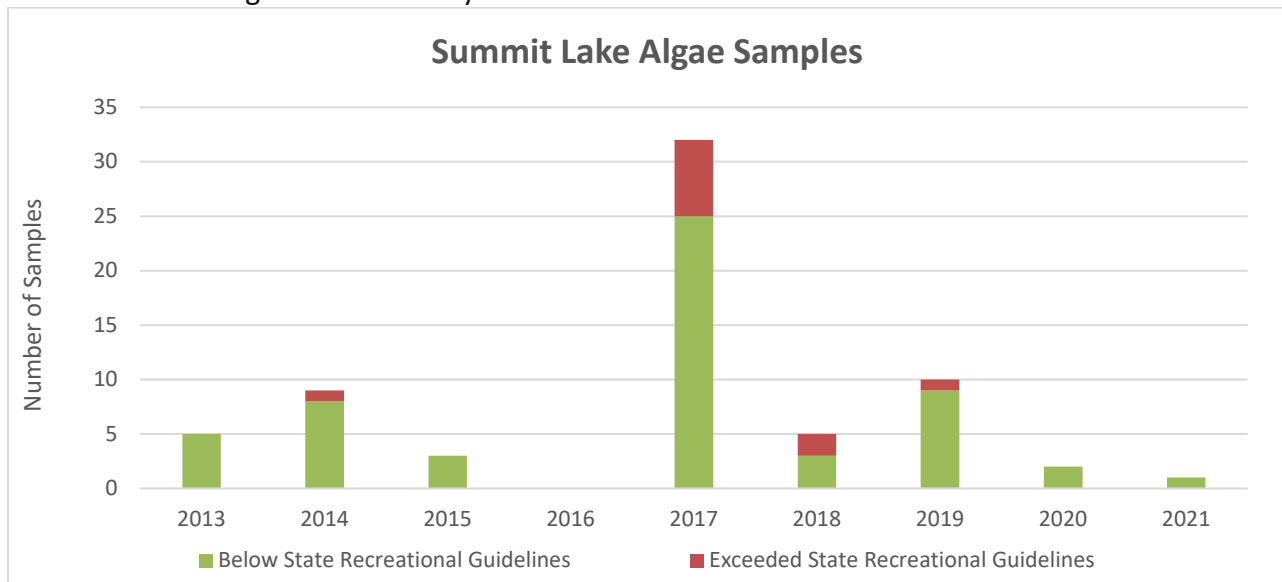


Figure 25. Summit Lake algae bloom samples 2013 to 2021.

Ward Lake

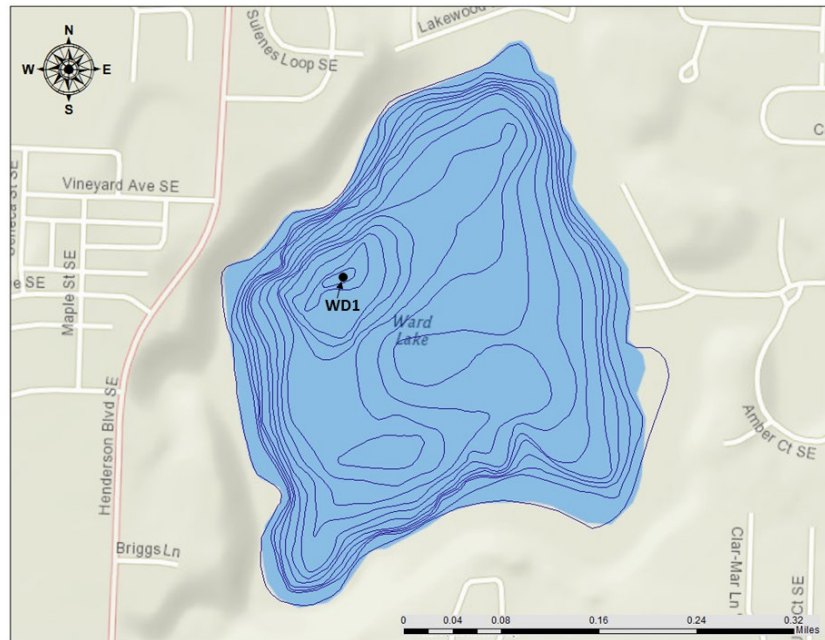


Figure 26. Ward Lake map showing location of sample site WD1.

DESCHUTES RIVER WATERSHED

- **SHORELINE LENGTH:** 1.4 miles
- **LAKE SIZE:** 0.1 square miles (65 acres)
- **BASIN SIZE:** 0.95 square miles
- **MEAN DEPTH:** 10 meters (33 feet)
- **MAXIMUM DEPTH:** 20 meters (67 feet)
- **VOLUME:** 2,100 acre-feet

PRIMARY LAND USE:

Most of the basin is suburban with moderate to high density residential housing. Historically there was a large plant nursery on the west side, but that area is now apartments and single-family homes.

PRIMARY LAKE USE:

Ward Lake is used for fishing, boating, and swimming.

PUBLIC ACCESS:

The Washington Department of Fish and Wildlife has one public boat launch. Four private access points exist for lakeside communities.

TOPOGRAPHY:

The Ward Lake sub-basin is 313 acres. The lake is located at an altitude of 131 feet above mean sea level. The topography of the basin is lowlands and rolling hills with occasional glacial depressions. Ward Lake is a kettle lake, a deep glacial depression, that is fed by groundwater. There is no surface inlet or outlet.

WATER QUALITY:

Fair – In 2021, Ward Lake was classified as mesotrophic. Transparency was less than the long-term average, while chlorophyll-a concentration improved from the previous year. The total phosphorus (TP) concentration was below the action level.

CYANOBACTERIA BLOOMS:

Ward Lake was sampled two times due to cyanobacteria blooms in 2021, no toxins were detected above Washington State Toxic Algae Advisory Levels.

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In 2021, Ward Lake was classified as mesotrophic based on an average of the three Trophic State Index (TSI) variables; chlorophyll, total phosphorus, and secchi depth. Ward Lake had been classified as mesotrophic or oligotrophic in all sampling years since 1995, except 2012 (Figure 2).

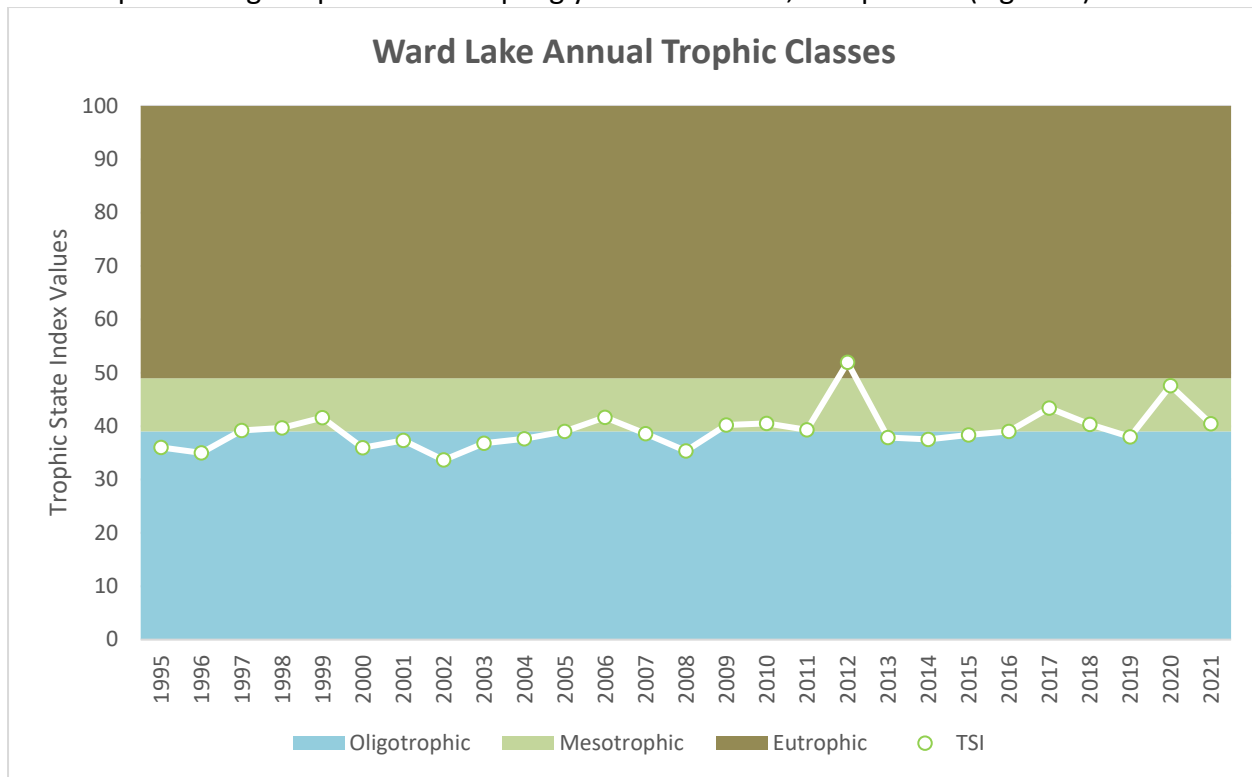


Figure 27. Ward Lake Trophic State Index from 1995 to 2021.

Thurston County collects cyanobacteria samples on a response basis. Samples are tested for 4 toxins, which have different recreational guideline for recommended health advisories. Figure 3 shows how many samples were collected at Ward Lake each year and how many times the results were above state recreational guidelines for any toxin detected.

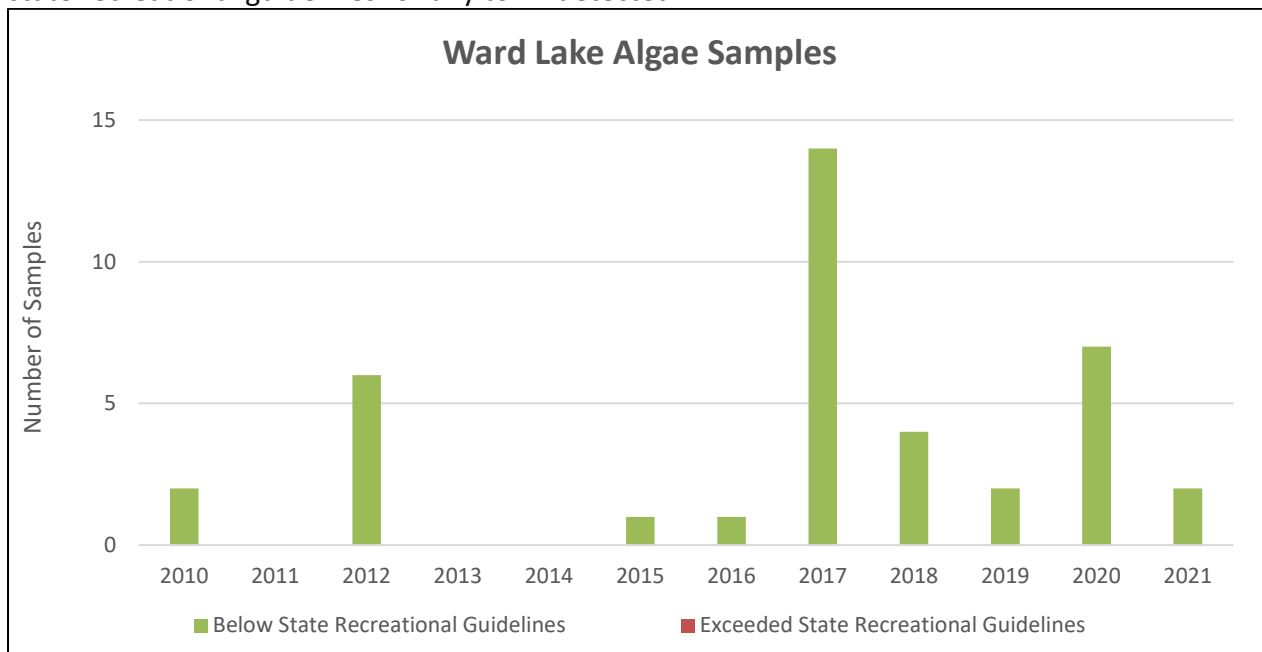


Figure 28. Ward Lake algae bloom samples 2010 to 2021.

DATA SOURCES:

Thurston County Community Planning and Economic Development
(360) 867-2075 or <https://www.thurstoncountywa.gov/cped>

Thurston County Environmental Health
(360) 867-2626 or <https://www.co.thurston.wa.us/health/ehrp/annualreport.html>

For additional information regarding toxic algae, please visit Washington State Toxic Algae
<https://www.nwtoxicalgae.org/>

For raw data, questions, and suggestions, contact the author of the 2021 report:
Sarah.Ashworth@co.thurston.wa.us

FUNDING SOURCE:

Thurston County Community Planning and Development (CPED).

LITERATURE CITED

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WAC. 2021. Chapter 173-201A-230, "*Water Quality Standards for Surface Water of the State of Washington.*"
<https://app.leg.wa.gov/WAC/default.aspx?cite=173-201A-230>