

Lovejoy Pond

WATER QUALITY REPORT

2021



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2021 Lovejoy Pond Water Quality Report

TABLE OF CONTENTS

2021 Water Quality Summary	1
Overview	2
Water Quality Monitoring in 2021	2
Secchi Disk Transparency (Water Clarity)	3
Dissolved Oxygen and Temperature	4
Total Phosphorus (TP)	6
Chlorophyll (Chl-a)	7
Discussion.....	8
Next Steps	8

TABLE OF FIGURES

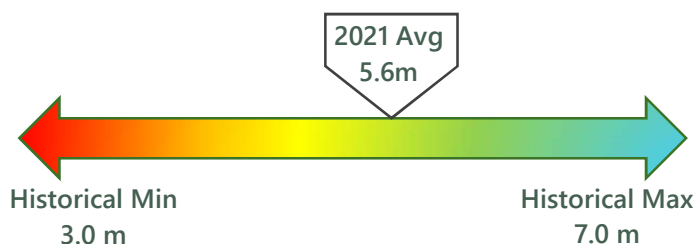
Figure 1. Lovejoy Pond Monitoring Stations.....	2
Figure 2. 2021 Secchi Disk Transparency, Station 1	3
Figure 3. Average Annual Secchi Disk Transparency (water clarity), Station 1, 1976-2021.....	4
Figure 4. 2021 Dissolved Oxygen and Temperature Profiles, Station 1	5
Figure 5. Annual Average Total Phosphorus data collected 1976-2021, Station 1.....	7
Figure 6. Annual average and peak chlorophyll-a, station 1, 1976-2021	7

2021 Water Quality Summary¹

Monitoring on Lovejoy Pond occurred on nine dates between May and September 2021 by Whitney Baker of 30 Mile River Watershed Association (30 Mile) and volunteers from the Lovejoy Pond Improvement Association (LPIA).

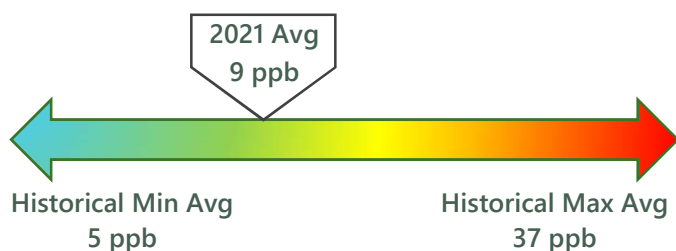
Water clarity readings in 2021 ranged from 5.13 meters (July 19th) to 6.45 meters (August 25th) with an annual average of 5.63 meters. 11 readings were collected in 2021 in total.

Water Clarity (m)	
2021 Water Clarity Average	5.6
Historical SDT Average	5.5
Maine Lakes SDT Average	4.8



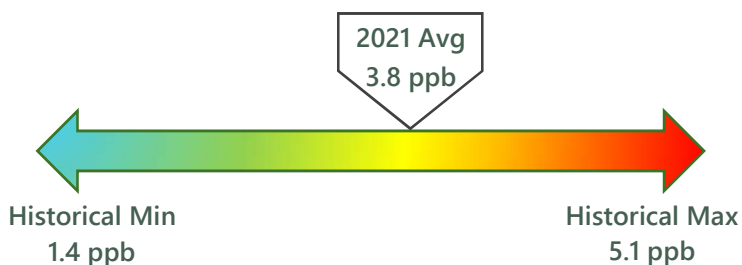
Four (4) samples were collected and analyzed for **Total Phosphorus**. Laboratory results ranged from 8 ppb (parts per billion) to 11 ppb with an average of 9 ppb.

Total Phosphorus (ppb)	
2021 TP Average	9
Historical TP Average	13
Maine Lakes TP Average	12



Chlorophyll was measured four (4) times in 2021. Results ranged from 3 ppb to 5 ppb with an annual average of 3.8 ppb.

Chlorophyll-a (ppb)	
2021 Chl-a Average	3.8
2021 Peak Chl-a	5.0
Historical Chl-a Average	3.1
Maine Lakes Chl-a Average	5.4



Nine (9) **Dissolved Oxygen (DO)** profiles were collected in 2021. Anoxia (DO <2 ppm) was documented in only the bottom meter of the pond during the month of July.

¹ Scale bars illustrate the range of data collected for each parameter over the historical monitoring record for general comparison with the 2021 monitoring results. The blue end represents the historical minimum (best), and the red end represents the historical maximum (worst) of all monitoring data collected.

Overview

Lovejoy Pond is located in the towns of Readfield, Fayette, and Wayne in Kennebec County, Maine and has a direct watershed area of approximately 4 square miles. Its indirect, upstream watershed is very large (42 square miles) and includes the upstream drainages of Echo Lake, Taylor Pond, Minnehonk Lake, David Pond, Parker Pond, Flying Pond, and several other smaller ponds and tributaries flowing into each of the above. Lovejoy Pond drains to a single outlet located at the south end of the lake that flows south to Pickerel Pond and Pocasset Lake in Wayne. Lovejoy does not have a public boat launch.

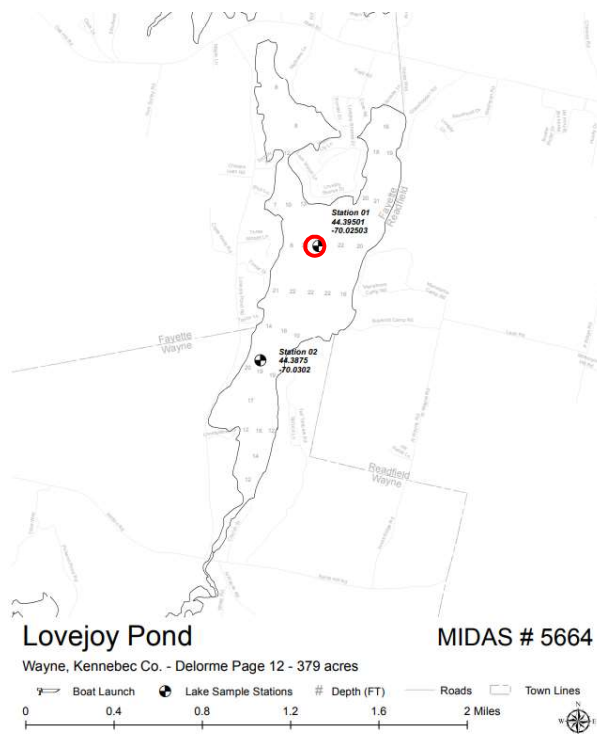


Figure 1. Lovejoy Pond Monitoring Stations.

Water quality monitoring on Lovejoy Pond takes place at the deepest spot in the lake (Maine DEP Station 1), also known as the “deep spot.” Station 1 is 7 meters (22 ft) deep (Figure 1). Monitoring in 2021 was completed by Whitney Baker of 30 Mile River Watershed Association (30 Mile) and volunteers from the Lovejoy Pond Improvement Association (LPIA). A special thanks to the 2021 volunteers:



2021 water quality volunteer, Deb Aseltine.

Deb Aseltine
Ted & Mary Becker
Roberta “Sookie” Weymouth

Water quality data was collected on nine dates between May and September. Parameters include Secchi disk transparency, dissolved oxygen and temperature, phosphorus, chlorophyll, and advanced chemistry parameters (pH, Alkalinity, Color, and Conductivity).

Secchi Disk Transparency (Water Clarity)

Secchi disk transparency (SDT) is an indicator of water clarity. To measure water clarity, a black and white disk is lowered into the water and the reading is taken at the depth at which it is no longer visible. Factors that affect water clarity include algal growth, zooplankton densities, natural water color, and suspended silt or sediment particles.

Water Clarity (m)	
2021 Water Clarity Average	5.6
Historical SDT Average	5.5
Maine Lakes SDT Average	4.8

Water clarity readings in 2021 ranged from 5.13 meters (July 19th) to 6.45 meters (August 25th) with an annual average of 5.63 meters. 11 readings were collected over nine monitoring days in 2021 (Figure 2).

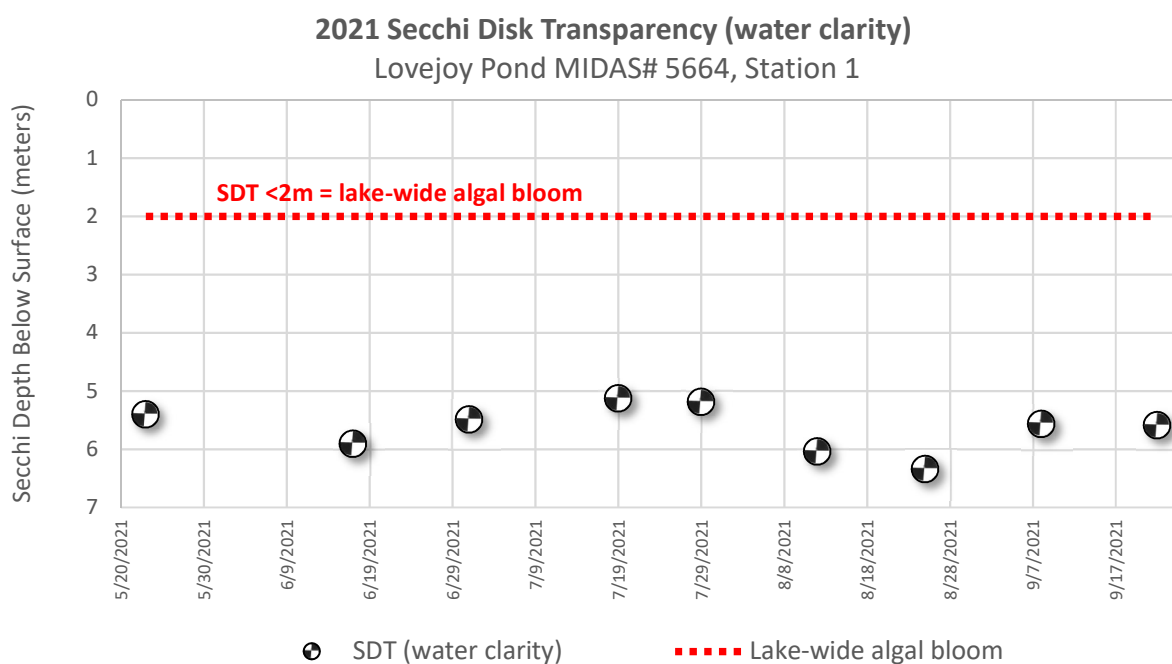


Figure 2. 2021 Secchi Disk Transparency, Station 1

SDT data has been collected during 34 years throughout the historical monitoring period spanning the past 45 years. SDT readings in Lovejoy Pond have ranged from 3.0 m (1984) to 7.0 m (2020) with an average annual reading of 5.5 m (Figure 3). It is important to note that water clarity readings in Lovejoy Pond can sometimes be physically restricted by the depth of the lake. Occasionally, the Secchi disk will touch the bottom of the lake while still visible.

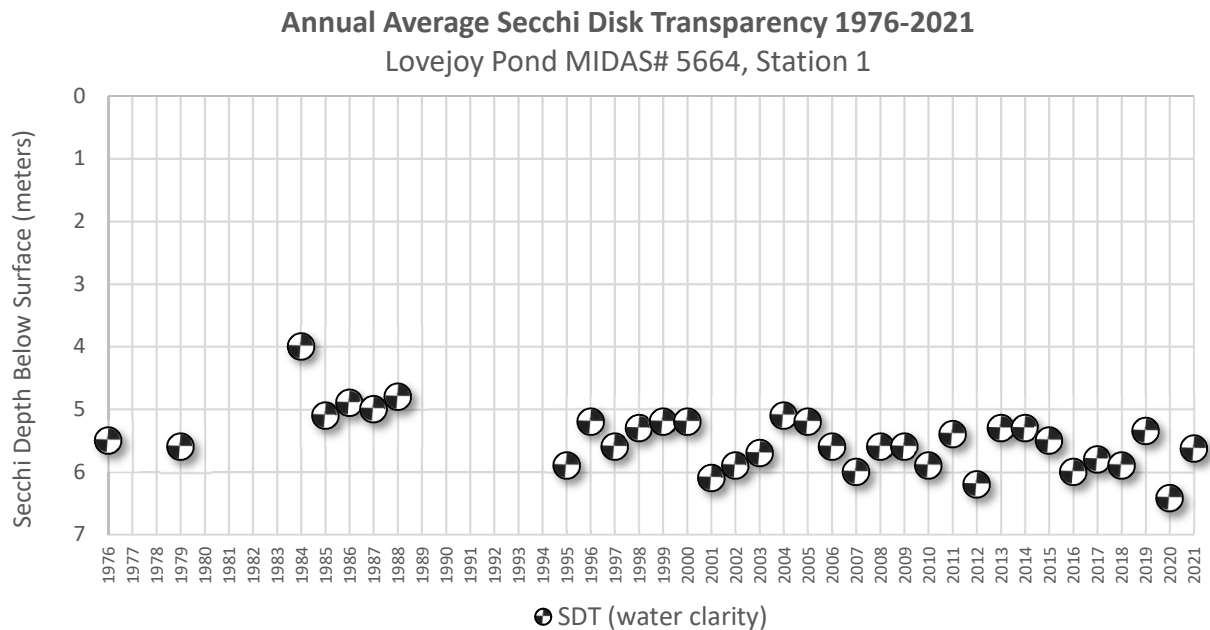


Figure 3. Average Annual Secchi Disk Transparency (water clarity), Station 1, 1976-2021

Dissolved Oxygen and Temperature

Dissolved oxygen (DO) is a critical indicator of the health of the lake system. DO is produced through photosynthesis, consumed during respiration and decomposition, and is influenced by wind, wave action, weather events, and lake productivity. A good supply of oxygen is essential for fish and other aquatic species, with most fish species requiring a DO concentration of 5 ppm (parts per million) or more. As lakes become more biologically productive in the summer, oxygen can decline as decomposition occurs in deep areas of the lake. Loss of oxygen may indicate a stressed and changing ecosystem. Understanding the pattern and extent of oxygen loss in deep areas of the lake is important to understanding changes between the years and through a single season, and is particular concerning for Lovejoy Pond because it may be more vulnerable for internal phosphorus loading due to its unique sediment chemistry.²

As lake water is warmed during the summer, deep lakes will thermally stratify to form three distinct temperature layers. There is a warm layer at the surface (epilimnion), a thin transitional layer (metalimnion), and a deep cold layer (hypolimnion) that becomes isolated from the surface and oxygen resupply. Shallow lakes may experience brief or periodic occurrences of thermal stratification throughout the open water season, but most often shallow lakes are homothermous,

²Lovejoy Pond appears on Maine DEP's list of "Threatened Lakes" on the NPS Priority Watersheds List (https://www.maine.gov/dep/land/watershed/nps_priority_list/NPS%20Priority%20List%20-%20Lakes20.pdf) due to its sediment chemistry. Sediment results suggest that the lake is more vulnerable to internal phosphorus loading, a phenomenon that can occur when deep waters become anoxic (DO loss <2 ppm) resulting in phosphorus release from the bottom sediments exposed to anoxic waters.

with consistent temperature and dissolved oxygen levels from the lake surface to the lake bottom. Pocasset Lake is considered a homothermous lake, which is typical of lakes of similar depth as wind events can facilitate water mixing and easily disrupt thermal stratification. However, Lovejoy Pond does occasionally stratify in the summer, and low levels of DO were documented in recent years with DO <5 ppm in 2017, 2018, 2019, 2020 and 2021. DO <2 ppm (anoxia) was documented in 2019 and 2021. Continued and consistent monitoring will provide greater understanding of DO trends in Lovejoy Pond.

Nine (9) DO and temperature profiles were collected in 2021. DO <5 ppm was documented in profiles collected in late June through August in only the bottom-most meter of the Pond. DO <2 ppm (anoxia) was documented in the bottom-most meter of the pond during the month of July (Figure 4).

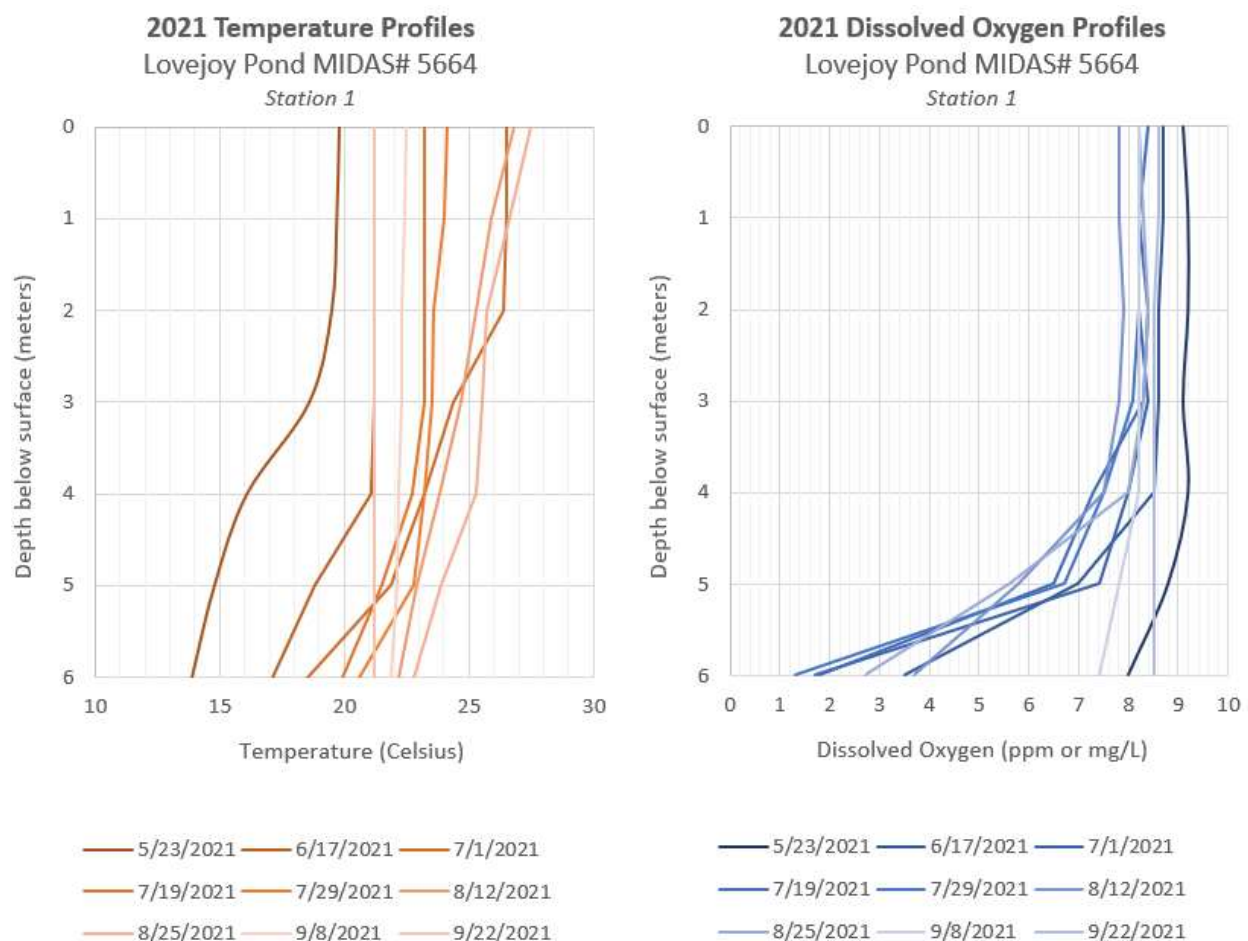


Figure 4. 2021 Dissolved Oxygen and Temperature Profiles, Station 1

Water surface temperatures through the monitoring season ranged from 20.2 C (70 F) to 27.5 C (82 F) with an average surface water temperature of 24.1 C (75 F) between June and September. Continued collection of bi-weekly DO and temperature profiles will identify trends and changes

occurring in Lovejoy Pond in order to better understand variations in thermal stratification and the extent and severity of the low DO and anoxic zones throughout the monitoring season.

Total Phosphorus (TP)

Phosphorus is the nutrient that most influences the growth of algae in lakes. Because its natural occurrence in lakes is very small, phosphorus “limits” the growth of algae in lake ecosystems. Small increases in phosphorus in lake water can cause substantial increases in algal growth, hindering lake health as well as the economic, recreational, and aesthetic value of the lake. Tracking in-lake phosphorus levels over time is another way of monitoring change in lake water quality trends.

Total Phosphorus (ppb)	
2021 TP Average	9
Historical TP Average	13
Maine Lakes TP Average	12

Five (5) samples were collected by 30 Mile staff this year and analyzed for Total Phosphorus (TP). Samples were collected monthly between June and September. Four (4) of the phosphorus samples were collected from the pond’s surface using an integrated core sampler and are referred to as “epilimnetic core samples”. Laboratory results for epilimnetic core samples collected in 2021 ranged from 8 ppb to 11 ppb with an annual average of 9.3 ppb.

Generally speaking, in-lake phosphorus concentrations (epilimnetic samples) less than 10-12 ppb are ideal. Lakes with in-lake phosphorus concentrations of 13 ppb or more are able to sustain algal blooms, and blooms become frequent as in-lake average concentrations approach 20 ppb. Historically, the annual average in-lake phosphorus concentration in Lovjeoy Pond ranges from 5 ppb (2003) to 37 ppb (1985) with a historical annual average of 13 ppb (Figure 5).

One (1) sample was collected from the bottom of Lovejoy Pond in July using a Kemmerer grab sampler; this type of sample is known as a “bottom grab”. Bottom grabs are collected when anoxia is encountered anywhere in the dissolved oxygen profile, and help us determine if there is active phosphorus release from bottom sediments exposed to anoxic conditions. The laboratory result for the bottom grab sample collected in 2021 was 8 ppb.

Historically, bottom grab samples were collected in only five years throughout the 45-year monitoring record (2021, 2019, 2017, 2014, and 1998). The historical annual average bottom grab TP concentration ranges from 8 ppb (2021) to 19 ppb (2014).

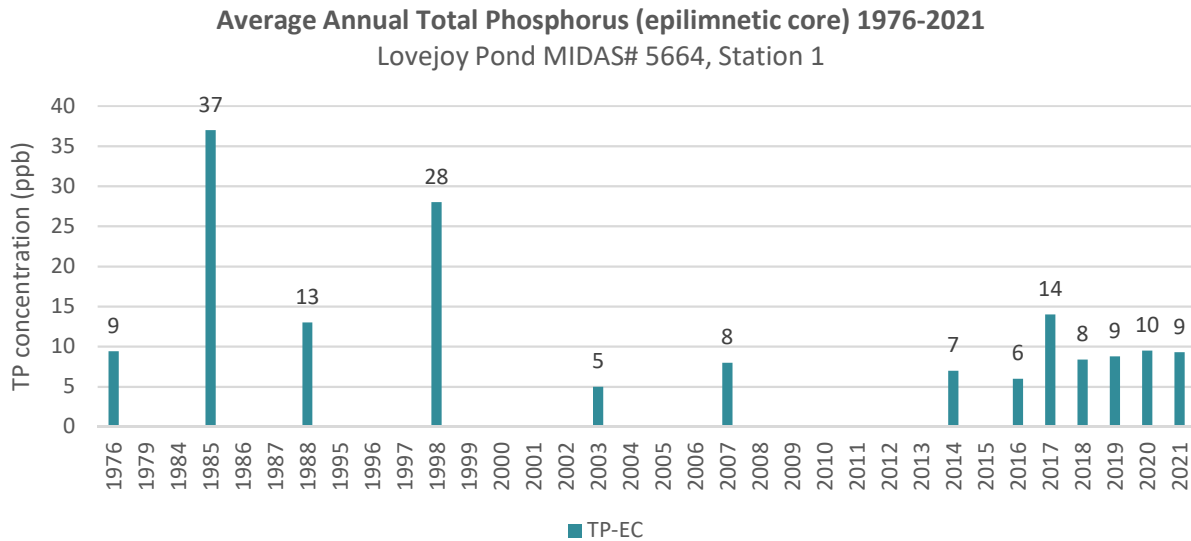


Figure 5. Annual Average Total Phosphorus data (epilimnetic core samples) collected 1976-2021, Station 1.

Chlorophyll (Chl-a)

Chlorophyll is found in plants (including algae), and is used to convert sunlight into energy. Measuring the concentration of Chlorophyll in lake water helps us estimate the algae population in the lake.

Chl-a (ppb)	
2021 Chl-a Average	3.8
2021 Peak Chl-a	5.0
Historical Chl-a Average	3.1
Maine Lakes Chl-a Average	5.4

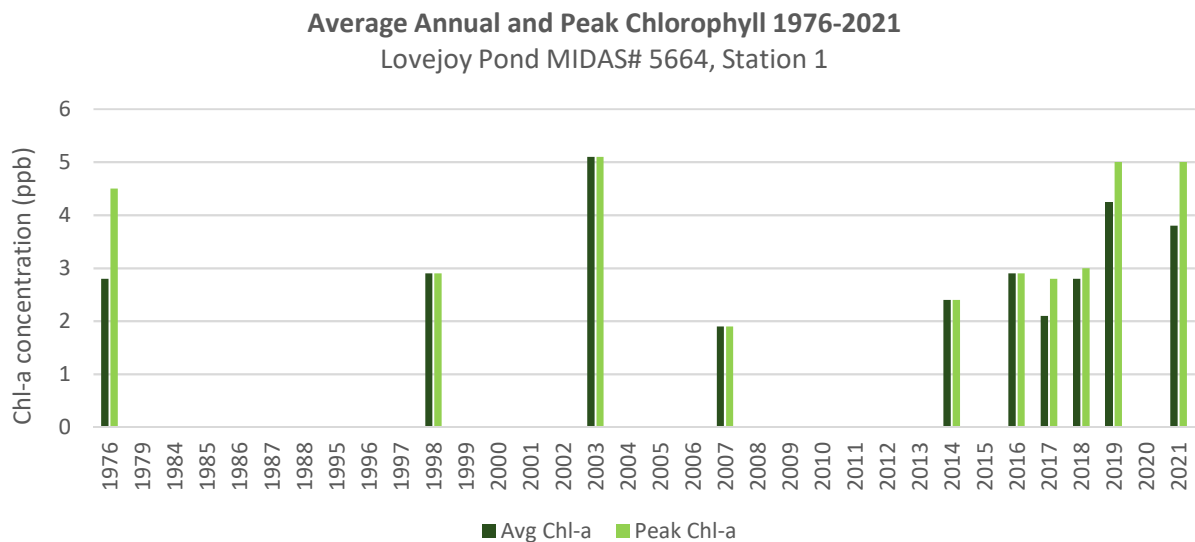


Figure 6. Annual average and peak chlorophyll-a, station 1, 1976-2021

Chlorophyll was measured four (4) times in 2021. Results ranged from 3 ppb to 5 ppb, with a 2021 annual average of 3.8 ppb. Historical monitoring data collected during 10 years between 1976-2021 ranged from 1.4 ppb (2017) to 5.1 ppb (2003) with a historical annual average of 3.1 ppb (Figure 6).

Discussion

2021 was 30 Mile's sixth year of monitoring Lovejoy Pond. Historical data presented in this report includes all monitoring data collected through 2018, submitted by volunteer monitors, 30 Mile staff, and other state agencies, that has undergone a thorough QA/QC process at Maine DEP. 2019, 2020, and 2021 data included in this report is data collected by 30 Mile only, and annual averages will be updated in next year's water quality report if Maine DEP has published the full dataset by the time of the report.

Five years of consecutive data collection for any given parameter will provide the baseline condition for water quality. 10 years of consecutive data collection is needed to meet the minimum data thresholds for determining trends over time. 30 Mile's monitoring program will continue to develop a robust dataset that can help our community identify and address water quality concerns in Lovejoy Pond.

Near real-time data for Lovejoy Pond's clarity (Secchi depth), and dissolved oxygen and temperature profiles can be found online at <https://30mileriver.org/lovejoy-pond/>, along with a link to the historical dataset and depth map.

Next Steps

1. **Continue bi-weekly baseline monitoring** between May and October each year to monitor seasonal and annual variability across all parameters, and better document changes and trends over time.
2. **Develop a LakeSmart Team** on Lovejoy Pond, providing education to shorefront property owners about polluted stormwater runoff, phosphorus, and the effects that watershed development can have on lake water quality.
3. Work with 30 Mile to **review the list of priority sites** identified during the 2020 watershed survey and determine next steps to address remaining sites through LakeSmart and 30 Mile's YCC and Technical Assistance programs.