Tilton Pond

WATER QUALITY REPORT

2023

30 Mile River Watershed Association
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2023 Tilton Pond Water Quality Report

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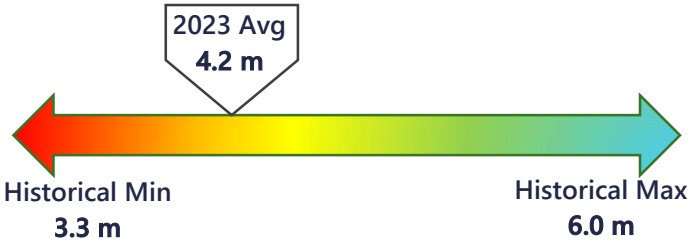
2023 Water Quality Summary[1]

Monitoring on Tilton Pond occurred monthly, July through September, in 2023 by Whitney Baker and Silas Mohlar of 30 Mile River Watershed Association (30 Mile) and local volunteers.

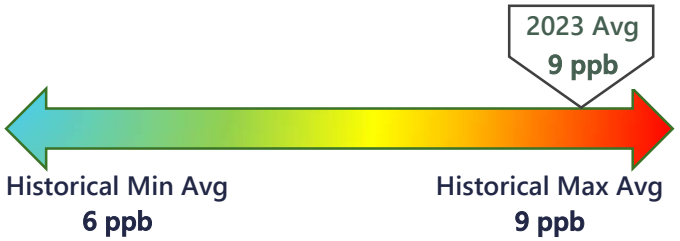
Water clarity readings in 2023 ranged from 3.6 meters (September 13th) to 4.7 meters (June 15th) with an annual average of 4.2 meters. Nine (9) total readings were collected over six (6) monitoring days in 2023.

Water Clarity (m)	
2023 Water Clarity Average	4.2
Historical SDT Average	4.7
Maine Lakes SDT Average	4.8



Three (3) samples were collected and analyzed for **Total Phosphorus**. Laboratory results ranged from 8 ppb (parts per billion) to 9 ppb with an average of 9 ppb.

Total Phosphorus (ppb)	
2023 TP Average	9
Historical TP Average	8
Maine Lakes TP Average	12



Chlorophyll was measured three (3) times in 2023. Results ranged from 6 ppb (August 16th) to 9 ppb (September 12th) with an annual average of 7 ppb.

Chlorophyll-a (ppb)	
2023 Chl-a Average	7
2023 Peak Chl-a	9
Historical Chl-a Average	5
Maine Lakes Chl-a Average	5

Three (3) **Dissolved Oxygen (DO)** profiles were collected in 2023. Anoxia (DO <2 ppm) was first encountered in deep waters in waters 8 meters and deeper in July, and grew to include all waters 3 meters and deeper by September.

[1] Scale bars illustrate the range of data collected for each parameter over the historical monitoring record for general comparison with the 2023 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

Tilton Pond is a 100-acre pond located in the town of Fayette in Kennebec County, ME. Tilton Pond has a maximum depth of 13 m (44 ft) and an average depth of 5 m (16 ft). The watershed area draining to the pond is roughly 2 square miles and includes the smaller drainages of several small intermittent and perennial streams that drain to the pond. Water from Tilton Pond flows to a single outlet located at the north end of the pond that flows northeast into nearby David Pond.

Water quality data has been collected from Tilton Pond since 1997 by Maine DEP, volunteers monitors certified through Lake Stewards of Maine, and more recently, 30 Mile River Watershed Association.

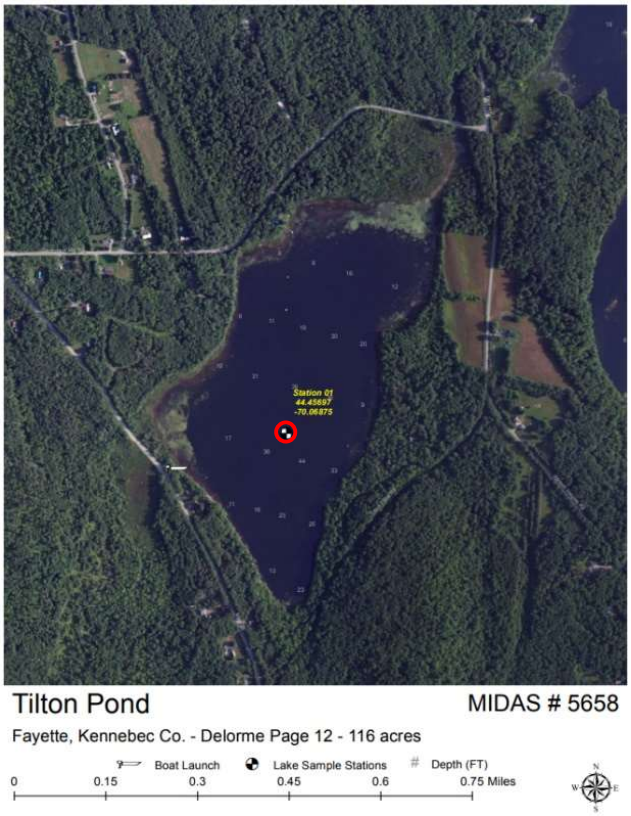


Figure 1. Station 01, Tilton Pond, Fayette, Maine.

Water Quality Monitoring in 2023

Tilton Pond in September 2023

In 2023, 30 Mile River staff Whitney Baker and Silas Mohlar visited Tilton Pond monthly, July through September with the help from local certified water clarity monitor, James Brogan. Parameters collected include Secchi disk transparency, dissolved oxygen and temperature, phosphorus, chlorophyll, and advanced chemistry parameters (pH, Alkalinity, Color, and Conductivity). Monitoring on Tilton Pond takes place at the deepest spot in the pond - aka Station 01 (Figure 1).

A special Thanks to Tilton Pond's volunteer water quality monitor, James Brogan!

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)	
2023 Water Clarity Average	4.2
Historical SDT Average	4.7
Maine Lakes SDT Average	4.8

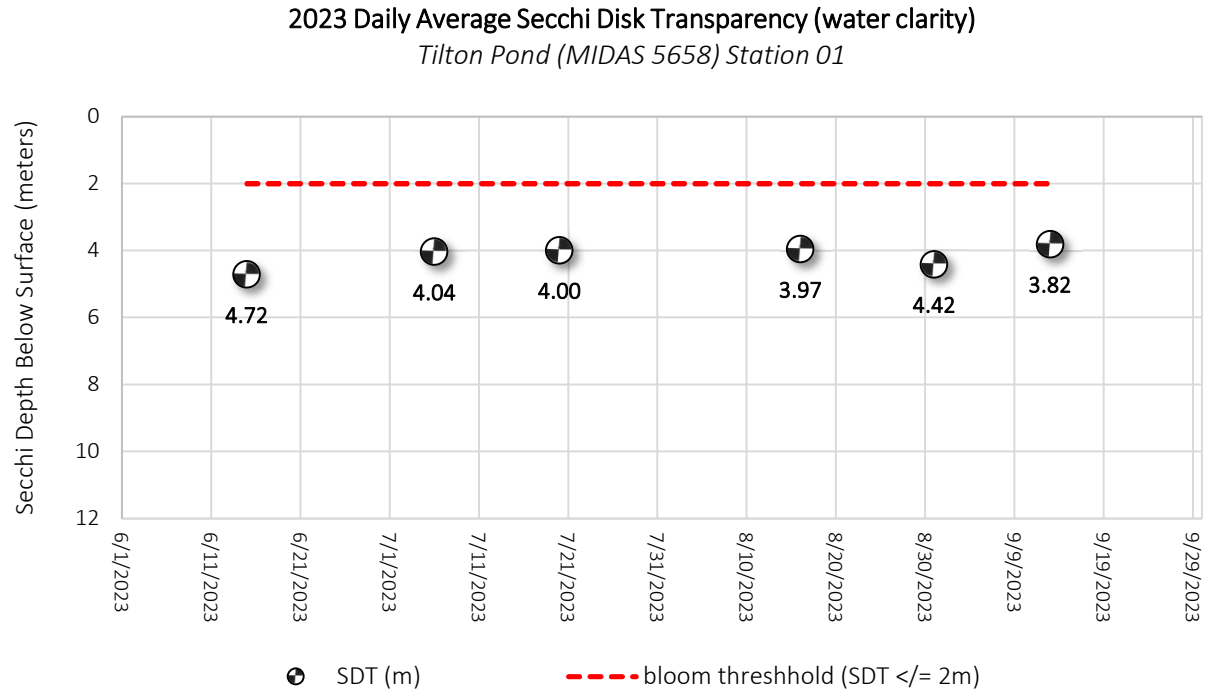


Figure 2. 2023 Secchi Disk Transparency, Tilton Pond, Station 01

Water clarity readings in 2023 ranged from 3.6 meters (9/13/2023) to 4.7 meters (6/15/2023) with an annual average of 4.2 meters. Nine (9) total readings were collected over six (6) monitoring days in 2023 (Figure 2).

Historically, SDT readings have ranged from 3.3 meters (1997) to 6.0 m (2022) with an average annual reading of 4.7 meters. In the recent five years leading up to 2023, average water clarity has ranged between 4.8 meters (2019) and 5.3 meters (2022). Water clarity in 2023 was below average in comparison (Figure 3).

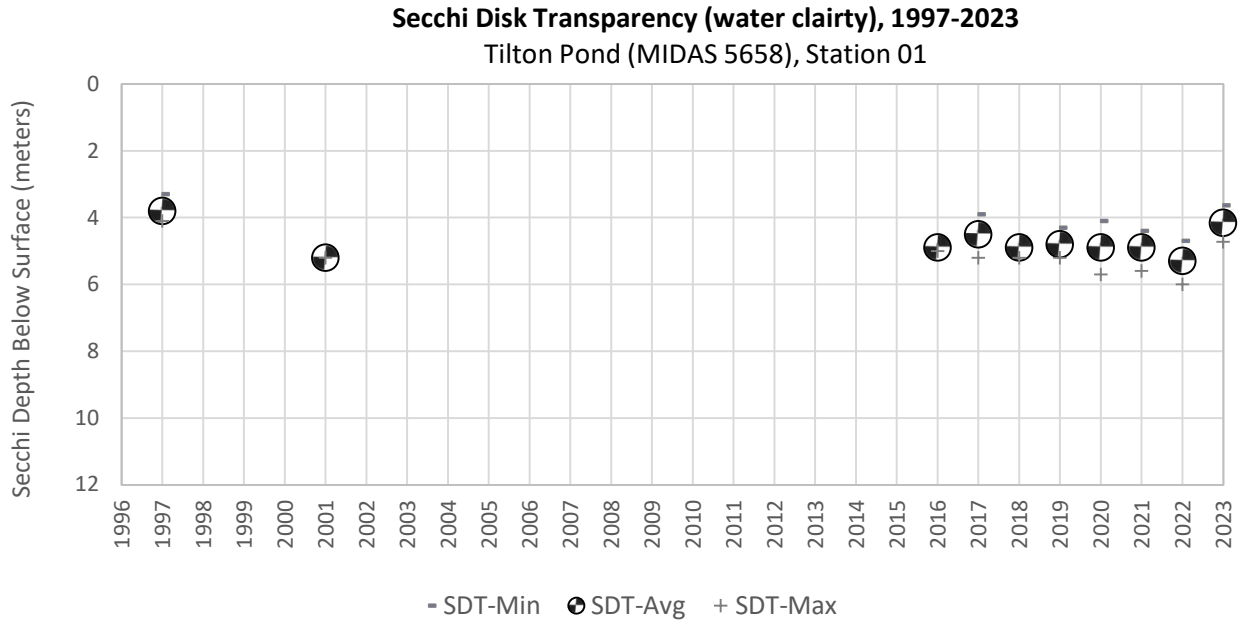


Figure 3. Tilton Pond Historical Secchi Disk Transparency, Station 01, 1997-2023

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 mg/L or more. *Anoxia* can occur when DO drops below 2 mg/L. As lake water is warmed during the summer, lakes will form three distinct temperature layers. There is a warm layer at the surface (epilimnion), a thin transitional layer (metalimnion or thermocline), and a deep cold layer (hypolimnion). The change in water temperature and density at the metalimnion acts as a physical barrier that prevents mixing of the upper and lower layers for several months during summer and early fall.

As lakes become more biologically productive in the summer, oxygen can decline in the hypolimnion as decomposition occurs in deep areas of the lake. While oxygen loss at the bottom of a deep lake is common in the summer months, excessive loss of oxygen may indicate a stressed and changing ecosystem. Monitoring the pattern and extent of oxygen loss in deep areas of Tilton Pond is important to understanding changes between the years and throughout a single

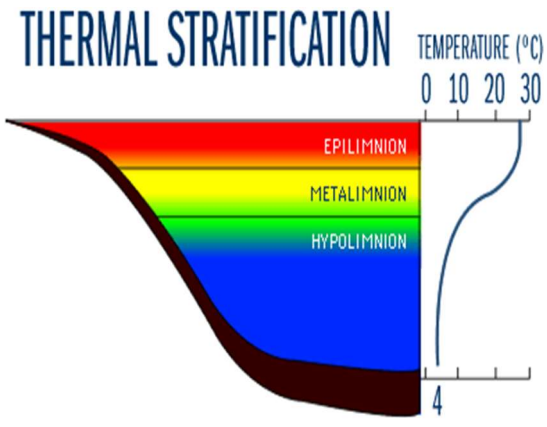


Figure 4. Thermal Stratification in a deep lake. Image source: www.waterontheweb.org.

season and is particularly important for lakes that may be more vulnerable for internal phosphorus loading due to unique lake sediment chemistry.[2]

In Tilton Pond, anoxia (DO < 2mg/L) in the hypolimnion has been observed in DO and temperature profiles collected in summer and fall since monitoring began in 1997.

Three (3) DO and temperature profiles were collected in 2023. DO <5 mg/L was documented in every profile collected – observed in all waters 2-3 meters and deeper. DO <2 mg/L (anoxia) was first documented in waters 8 meters and deeper in July, with the zone of anoxic water growing to include all waters 3 meters and deeper by mid-September (Figure 5).

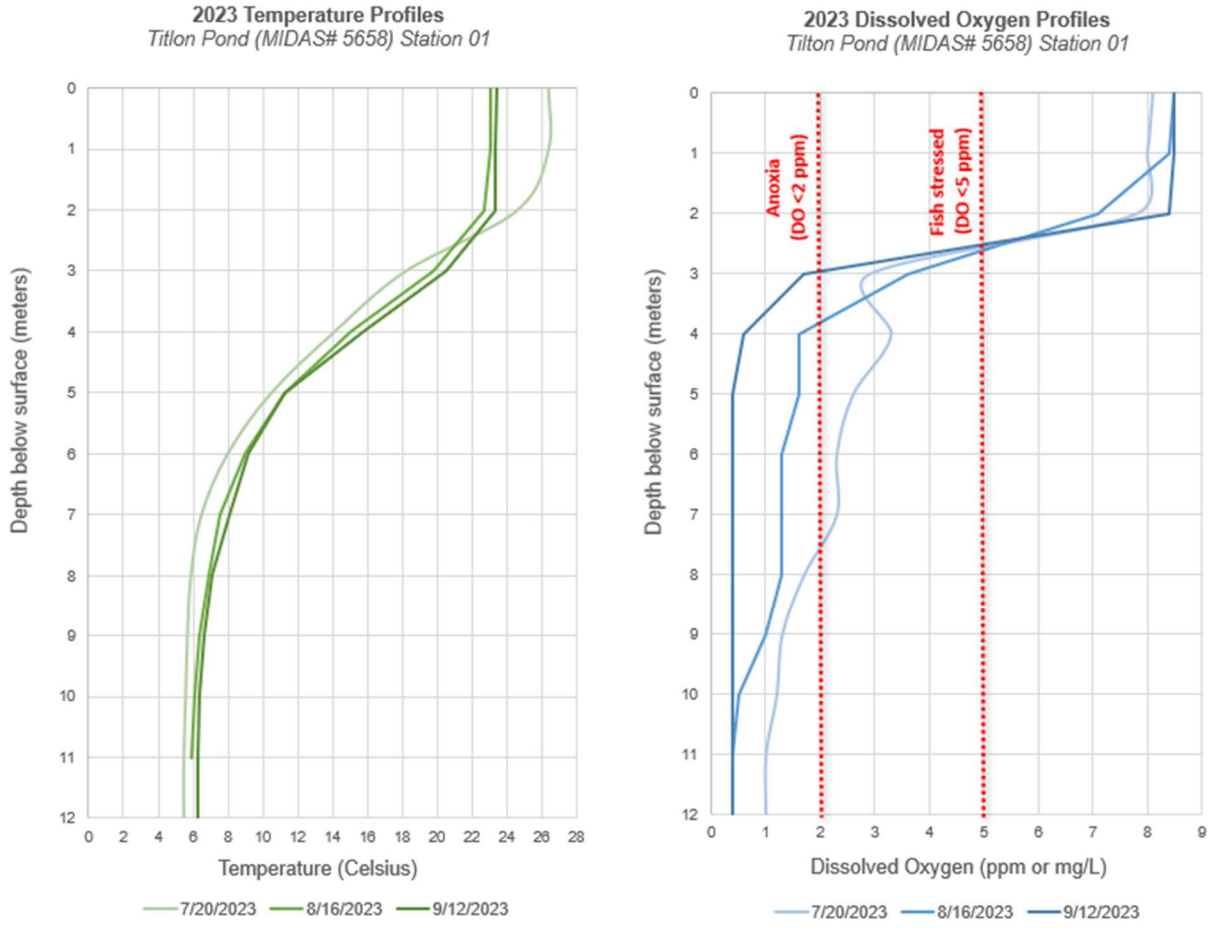


Figure 5. 2023 Tilton Pond Dissolved Oxygen and Temperature Profiles, Station 01

Oxygen depletion is not uncommon in Tilton Pond, making it unsuitable for cold-water fish species that rely on deep, cold-water refuge in the summer months with an adequate oxygen supply. Despite this, Tilton Pond has been stocked with brook trout in the past years, but due to the

[2]Some lakes in Maine may be more vulnerable than others to internal phosphorus loading, a phenomenon that can occur when deep waters become anoxic (DO loss <2 mg/L) resulting in phosphorus release from the bottom sediments exposed to anoxic waters.

discovery of an invasive plant, Swollen Bladderwort (*U. inflata*) this summer, the public boat launch off Route 17 has become carry-in only, for the time being. With this restriction in place, the Department of Maine Inland Fisheries & Wildlife will not stock Tilton Pond due to inequitable access.

Tilton Pond does support a warm water fishery of bass, pickerel, and other warm water fish[3]. These warmwater fish are able to withstand lower oxygen levels and warmer waters nearer to the surface of Tilton Pond. Other species may capitalize on cold water springs and tributary outlets in the summer.

Water surface temperatures throughout the monitoring season (July – September) ranged from 23.1 C (73.0 F) to 26.4 C (81.5 F) with an average surface water temperature of 24.3 C (76.1 F). Continued collection of bi-weekly DO and temperature profiles will identify trends and changes occurring in Tilton 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)

Total Phosphorus (ppb)	
2023 TP Average	9
Historical TP Average	8
Maine Lakes TP Average	12

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.

Six (6) samples were collected by 30 Mile staff this year and analyzed for Total Phosphorus (TP). Samples were collected monthly between July and September. Three (3) of the phosphorus samples were collected from the top layer of Tilton Pond using an integrated core sampler and are referred to as "epilimnetic core samples". Laboratory results for epilimnetic core samples collected in 2023 ranged from 8 ppb to 9 ppb with annual average of 9 ppb.

Generally speaking, in-lake phosphorus concentrations (epilimnetic core samples) less than 10 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, epilimnetic phosphorus samples have only been collected during seven (7) years (1997, 2001, 2017, 2018, 2019, 2022, and 2023) throughout the monitoring period. Annual

[3] Maine Department of Inland Fisheries & Wildlife. Lake Survey Maps – Tilton Pond. Accessed online: https://www.maine.gov/ifw/docs/lake-survey-maps/kennebec/tilton_pond.pdf.

average results have ranged between 6ppb (2001) and 9 ppb (2017 and 2023) with a historical annual average of 8 ppb (Figure 6).

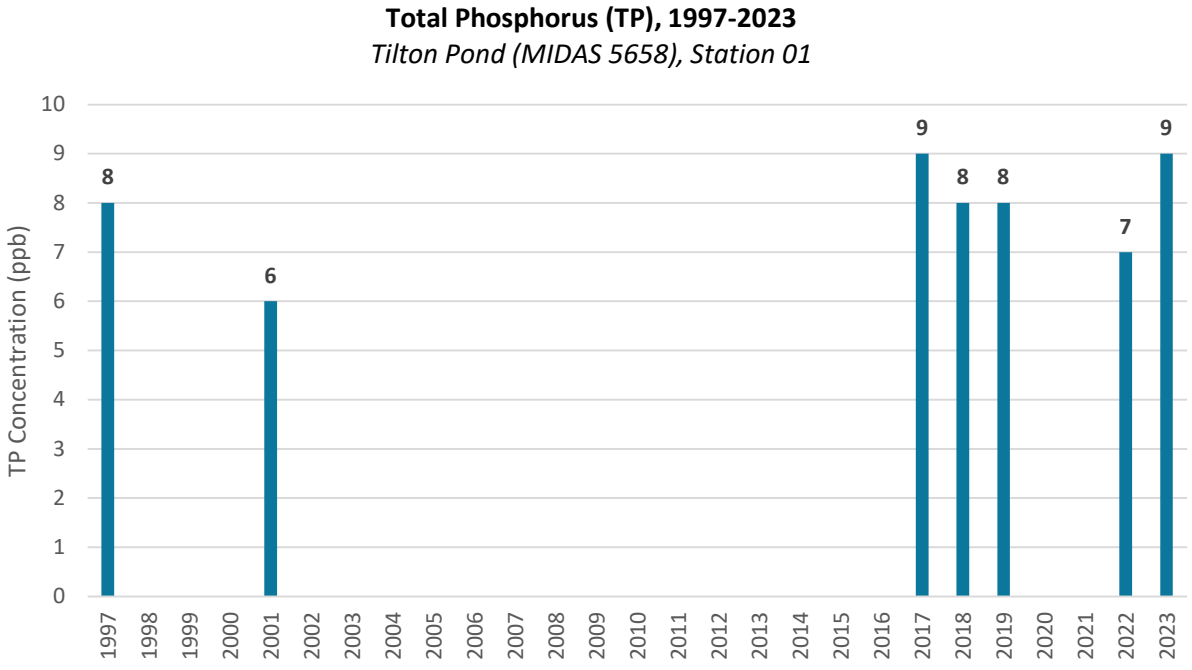


Figure 6. Annual Average Total Phosphorus data (epilimnetic core samples) collected 1997-2023, Station 01.

In 2023, three (3) samples were collected from the bottom of Tilton Pond 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. Laboratory results for bottom grab samples collected in 2023 were 11 ppb (July 20th), 16 ppb (August 16th), and 20 ppb (September 12th) for an annual average of 16 ppb (Figure 7).

Historically, bottom grab samples have been collected during the same years of the epilimnetic core samples, with the exception of 2022 . Annual average bottom grab results have ranged from 9 ppb (2001) to 16 ppb (2018 & 2023) with a historical average of 13 ppb.

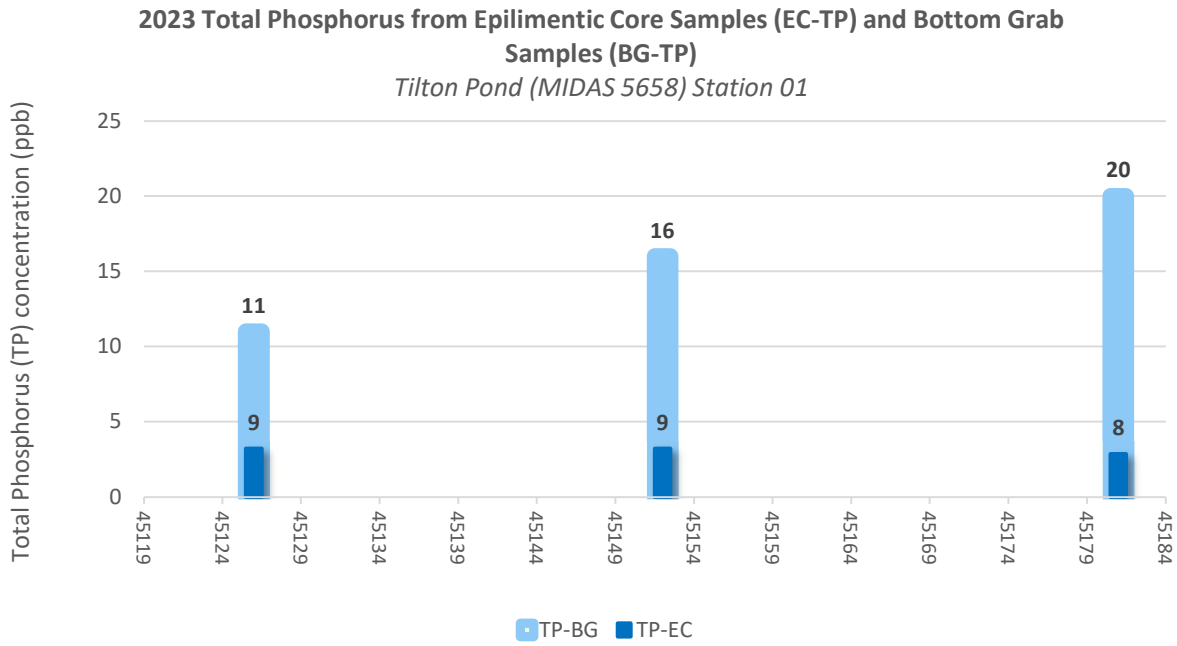


Figure 7. 2023 TP core sample and TP bottom grab sample results from Tilton Pond.

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. The higher the Chl-a value, the higher the amount of algae in the lake.

Chlorophyll-a (ppb)	
2023 Chl-a Average	7
2023 Peak Chl-a	9
Historical Chl-a Average	5
Maine Lakes Chl-a Average	5

Chlorophyll was measured three (3) times in 2023. Results ranged from 6 ppb to 9 ppb, with a 2023 annual average of 7 ppb. Chl-a on Tilton Pond has been analyzed during seven years (1997, 2001, 2017, 2018, 2019, 2022, and 2023) with annual averages ranging from 2.6 ppb (2001) to 9 ppb (2023) with a historical annual average of 5 ppb.

pH

pH helps determine which plant and animal species can live in the lake, and it governs biochemical processes that take place. The pH scale ranges from 0-14, with 7 being neutral. Water is increasingly acidic below 7, and increasingly alkaline above 7. A one unit

pH	
2023 pH	7.0
Historical pH Average	7.0
Maine Lakes Average	6.4

change in pH represents a tenfold change in acidity or alkalinity. The pH scale is the inverse log of the hydrogen ion concentration.

pH was measured 1 (one) time during the 2023 season on August 16th with a result of 7. Historically, pH has been data has been collected during seven (7) years throughout the 26-year monitoring record. Results have ranged from 6.9 (2018) to 7.2 (1997 & 2017) with a historical average of 7.

True Color

Color (PCU)	
2023 Color	40
Historical Color Average	28
Maine Lakes Color Average	21

Water color refers to the concentration of natural dissolved organic acids. This includes natural tannins and lignins dissolved in the water, often resulting in "tea" or "root beer" colored water. “True Color” is measured in Platinum Cobalt Units (PCU) after all particulates (including algae cells) have been filtered out of the sample. Colored lakes (>25 PCU) can have reduced transparency readings and increased phosphorus values. However, this does not mean the lakes produce more algae. The color simply reduces the transparency such that the reading is not a good measure of algal biomass. Chlorophyll-a (Chl-a) is the best indicator of algal productivity in colored lakes and should be used if possible. Tilton Pond is considered a colored lake.

One sample taken on August 16th was analyzed for true color and had a result of 40 PCU. Historically, color has been analyzed three (3) years out of the 26-year monitoring period, and results range from 19 PCU (2018) to 40 PCU (2023) with a historical average of 28 PCU.

Conductivity

Conductivity (µMHOS/cm)	
2023 Conductivity	79.1
Historical Conductivity Average	68.0
Maine Lakes Conductivity Average	51.1

Conductivity measures the ability of water to carry electrical current and is directly related to the dissolved ions (charged particles) present in the water. Fishery biologists can use conductivity values to calculate fish yield estimates because conductivity will generally increase if there is an increase of pollutants entering the lake or pond. Stormwater runoff from developed areas and roadways is the most common pollutant in Maine lakes that can raise conductivity values. Conductivity is measured in micromhos per centimeter (µMHOS/cm).

One sample taken on August 16th was analyzed for conductivity and had a result of 79 µMOHS/cm. Historically, conductivity has been analyzed during five (5) years of the 26-year monitoring record,

and results ranged from 44 µMHOS/cm (1997) to 82 µMHOS/cm (2018) with a historical average of 68 µMHOS/cm.

Alkalinity

Alkalinity (mg/L)	
2023 Alkalinity	11
Historical Alkalinity Average	10
Maine Lakes Alkalinity Average	11.7

Alkalinity is also referred to as "buffering capacity." It is a measure primarily of naturally available bicarbonate, carbonate, and hydroxide ions in the water and is measured in milligrams per liter (mg/L). Measuring alkalinity is important to determining a lake's ability to neutralize acidic pollution from rainfall or snowmelt. Lakes with alkalinity values >20 mg/L are considered well buffered against pH changes over time. Lakes with low or zero alkalinity may have more variation in pH levels that can sometimes result in damage to aquatic life.

One sample taken on August 16th was analyzed for alkalinity and had a result of 11 mg/L. Historically, alkalinity has been analyzed during just four (4) years of the 26-year monitoring record starting in 1997, and results ranged from 9 mg/L (1997) to 11 mg/L (2017 & 2023) with a historical average of 10 mg/L.

Discussion

Thanks to a grant from the John Sage Foundation, 30 Mile was able to monitor Tilton Pond three times in 2023. 30 Mile began monitoring Tilton Pond in 2016 – visiting the pond just once per season. However, 30 Mile did not monitor Tilton Pond in 2020 or 2021 due to the Covid pandemic and changes in staff.

Historical data presented in this report includes all monitoring data collected on Tilton Pond through 2022, submitted by both volunteer monitors and state agencies, that has undergone a thorough QA/QC process at Maine DEP. 2023 data presented here is from 30 Mile and certified monitor, James Brogan, only.

The DO and temperature profiles collected on Tilton Pond show a large zone of severely anoxic water in the pond's hypolimnion for much of the monitoring season. Colored lakes and ponds contain higher levels of organic carbon in their waters. Lakes process carbon through decomposition at the lake bottom; decomposition requires oxygen. Colored lakes are known to have higher rates of decomposition and lower levels of oxygen. Additionally, colored lakes often support lower rates of photosynthesis by microscopic algae (which creates oxygen) since sunlight cannot penetrate the dark water.

Dark colored waters can also heat up more quickly following ice out in the spring and maintain strong thermal stratification for a longer period of time in late spring, summer, and fall. This means

a longer period of stratification where the hypolimnion of the lake is isolated from any oxygen resupply. A changing climate can certainly exacerbate these conditions as more frequent and intense storms increase the runoff of nutrients and organic matter (carbon) from the surrounding terrestrial landscape.

Five years of consecutive data collection for any given parameter will provide the baseline condition of the pond. 10 years of consecutive data collection is needed to meet the minimum data thresholds for determining trends. This effort will continue to develop a robust dataset that can help our community identify and address water quality concerns in Tilton Pond.

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

Next Steps

1. Continue **baseline monitoring** three times each summer to monitor seasonal and annual variability across all parameters, and better document changes and trends over time.

2. **Deliver LakeSmart programming** to the landowners on Tilton Pond, to provide education about polluted stormwater runoff and the effects of watershed development on lake water quality. For more information about this awesome program visit: https://www.lakes.me/lakesmart. To request a free LakeSmart evaluation from 30 Mile staff visit: https://30mileriver.org/lakesmart/