David Pond

WATER QUALITY REPORT

2022

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30 Mile River
WATERSHED ASSOCIATION

2022 David Pond Water Quality Report

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2022 Water Quality Summary[1]

Monitoring on David Pond occurred on nine dates between June and October 2022 by Whitney Baker, Silas Mohlar, and Tess Gioia of 30 Mile River Watershed Association (30 Mile) and local volunteers.

Water clarity readings in 2022 ranged from 5.6 meters (June 15th) to 8.4 meters (October 5th) with an annual average of 6.8 meters. 14 readings were collected in 2022 in total.

Water Clarity (m)	
2022 Water Clarity Average	6.8
Historical SDT Average	5.8
Maine Lakes SDT Average	4.8

2022 Avg
6.8 m

Historical Min
4.3 m
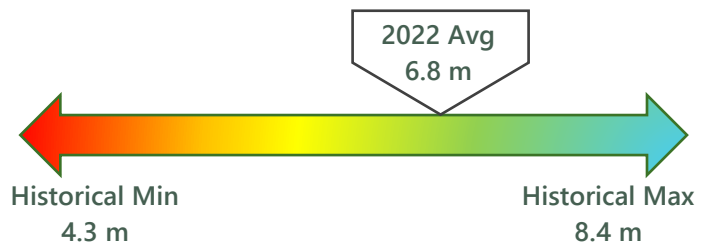
Historical Max
8.4 m

Five (5) samples were collected and analyzed for **Total Phosphorus**. Laboratory results ranged from 6 ppb (parts per billion) to 8 ppb with an average of 8 ppb.

Total Phosphorus (ppb)	
2022 TP Average	8.0
Historical TP Average	7.3
Maine Lakes TP Average	12

2022 Avg
8 ppb

Historical Min Avg
6.0 ppb

Historical Max Avg
10.0 ppb
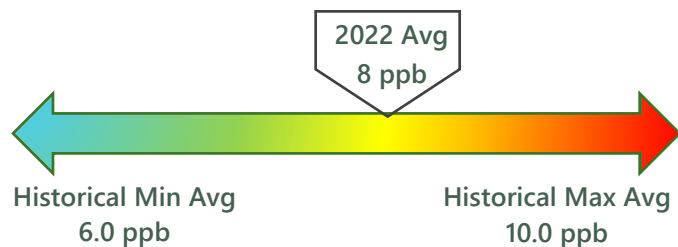
Chlorophyll was measured five (5) times in 2022. Results ranged from 2 ppb to 4 ppb with an annual average of 3 ppb.

Chlorophyll-a (ppb)	
2022 Chl-a Average	3
2022 Peak Chl-a	4
Historical Chl-a Average	3.4
Maine Lakes Chl-a Average	5.4

2022 Avg
3 ppb

Historical Min
1.0 ppb

Historical Max
7.0 ppb
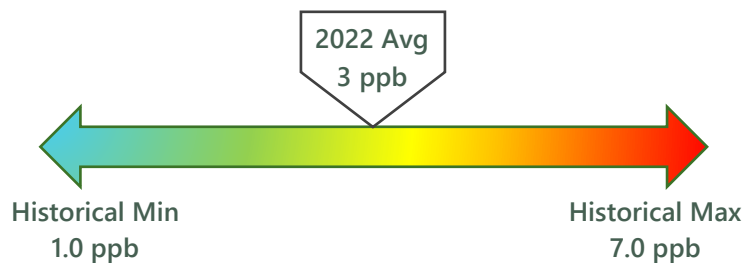
Nine (9) **Dissolved Oxygen (DO)** profiles were collected in 2022. Anoxia (DO <2 ppm) was first encountered at 8 meters in July, but this zone of anoxia grew to include all waters 6 meters and deeper by September.

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[1] Scale bars illustrate the range of data collected for each parameter over the historical monitoring record for general comparison with the 2022 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

David Pond is located in the town of Fayette in Kennebec County, Maine and has a direct watershed area of just over 2 square miles, and an indirect upstream watershed of approximately 2 square miles, which includes the drainages of Tilton and Basin Ponds. David Pond has a single outlet located at the north end of the northern basin that crosses Sandy River Road in Chesterville and continues into Parker Pond.

David Pond is a relatively shallow lake with a maximum depth of 11 m (37 ft) and an average depth of just 3 m (10 ft). The Pond has a surface area covering approximately 300 acres. David Pond does not have a public boat launch.
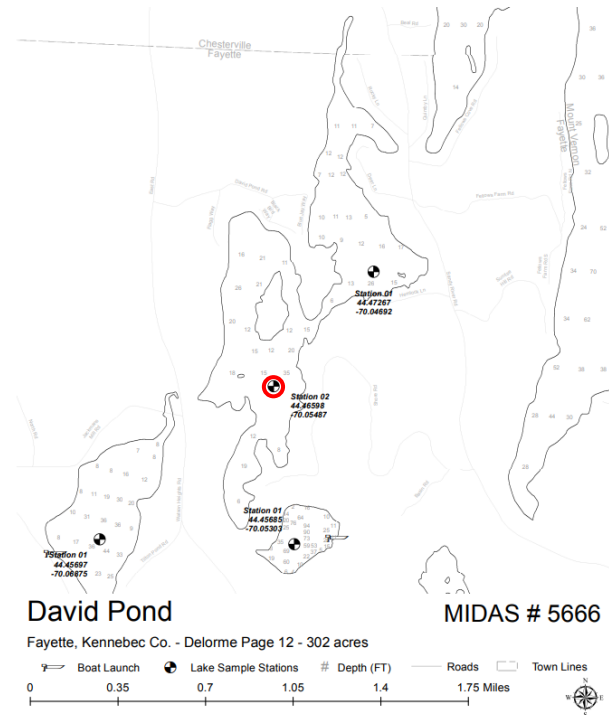

Figure 1. David Pond Monitoring Stations, Maine DEP.

Water Quality Monitoring in 2022

Water quality monitoring on David Pond takes place at the deepest spot in the lake (Maine DEP Station 2), also known as the "deep spot", located in the south basin. Station 2 is just over 11 meters (37 ft) deep (Figure 1). Monitoring in 2022 was completed by Whitney Baker, Silas Mohlar, and Tess Gioia of 30 Mile River Watershed Association (30 Mile) and local volunteers. A special thanks to our 2022 water quality volunteers on David Pond:

David Pond on October 5th, 2022

Kirstie Ludwig &
Fred Jackman

Water quality data was collected on nine dates between June and October. 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)	
2022 Water Clarity Average	6.8
Historical SDT Average	5.8
Maine Lakes SDT Average	4.8

Water clarity readings in 2022 ranged from 5.6 meters (June 15th) to 8.4 meters (October 5th) with an annual average of 6.8 meters. 14 total readings were collected over 9 monitoring days in 2022 (Figure 2).
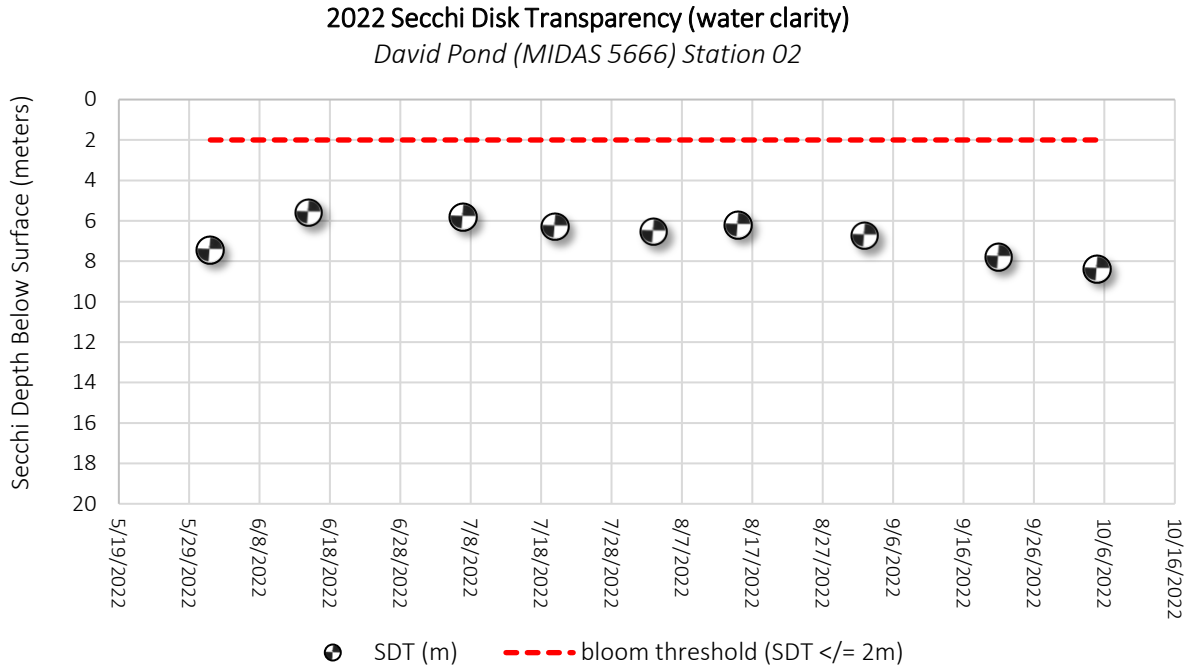

Figure 3. 2022 Secchi Disk Transparency Daily Averages, Station 2

SDT data has been collected during 18 years throughout the historical monitoring period spanning the past 40 years. SDT readings in David Pond have ranged from 4.3 m (2009 and 2012) to 8.4 m (2022) with a historical average of 5.7 m (Figure 3).
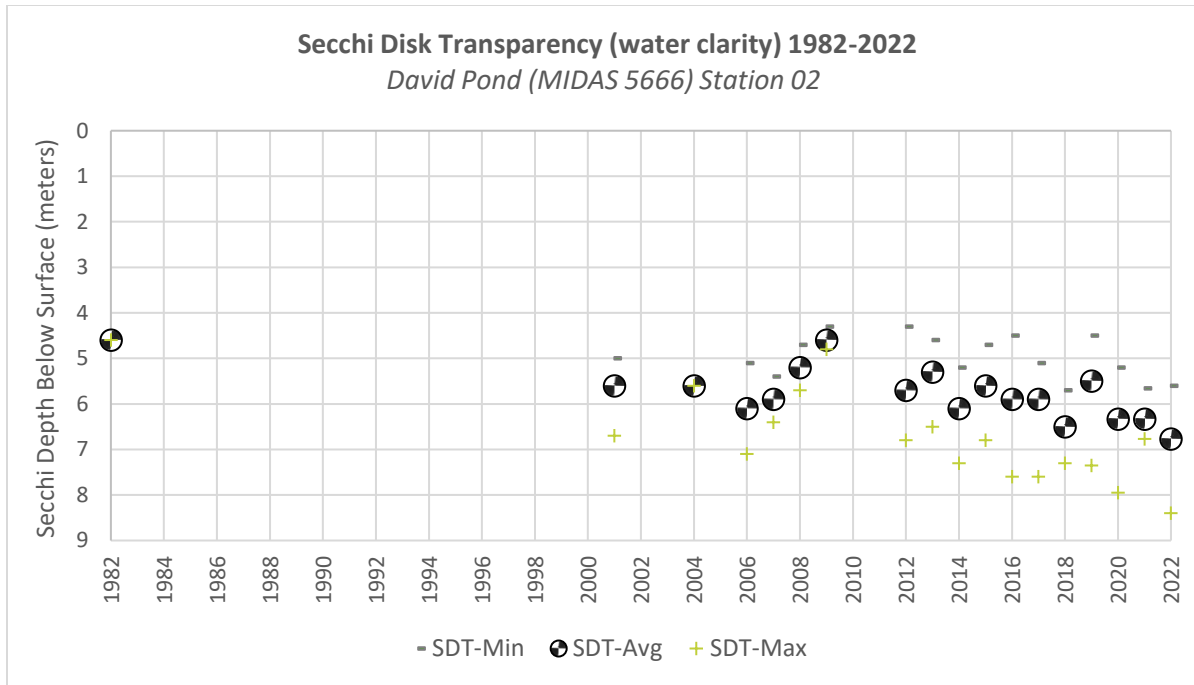
Secchi Disk Transparency (water clarity) 1982-2022
David Pond (MIDAS 5666) Station 02

Figure 5. Historical Secchi Disk Transparency, Station 2, 1982-2022

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 waters is important to understanding changes between the years and throughout a single season, and is particular concerning for David Pond because it may be more vulnerable to internal phosphorus loading due to its unique sediment chemistry.[2]

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), and a deep cold layer (hypolimnion) that becomes isolated from the surface and oxygen resupply. In

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[2]David 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 from samples collected from the bottom of David Pond 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.

David Pond, severe oxygen loss in the hypolimnion typically occurs in July through September each year.

DO <5 ppm was documented in every profile collected in 2022 and was first encountered in 9 meters of water in June but grew to include all waters 5 meters and deeper by August. Severe oxygen loss (DO <2 ppm, a.k.a. "anoxia") was first documented at a depth of 8 meters in July but this zone of anoxic water grew to include waters 6 meters and deeper in September (Figure 4).

Though oxygen loss in the deep areas of David Pond is not uncommon in recent years, historical data is limited with DO data collection starting somewhat recently in 2013. David Pond supports a warm water fishery (large and smallmouth bass, and chain pickerel) due to the oxygen deficiency in the deeper, cool waters of the pond.[3]
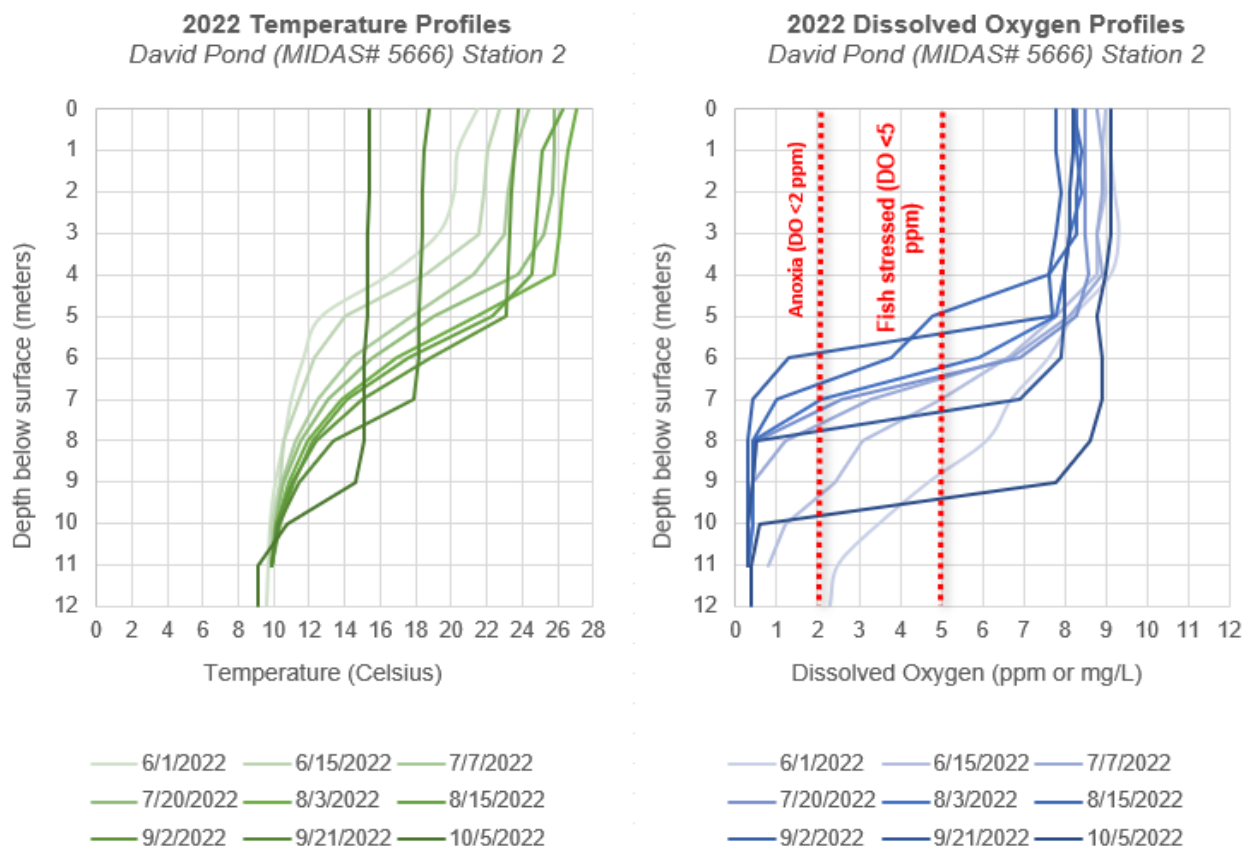

Figure 8. 2022 Dissolved Oxygen and Temperature Profiles, Station 2

Water surface temperatures through the 2022 monitoring season ranged from 15.4 C (59.7 F) to 27.1 C (80.8 F) with an average surface water temperature of 22.9 C (73.2 F) between June and October. Continued collection of bi-weekly DO and temperature profiles will identify trends and

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

changes occurring in David 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)	
2022 TP Average	6.6
Historical TP Average	7.3
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.

Nine (9) samples were collected by 30 Mile staff this year and analyzed for Total Phosphorus (TP). Samples were collected monthly between June and October. Five (5) of the phosphorus samples were collected from the top layer of David Pond using an integrated core sampler and are referred to as "epilimnetic core samples". Laboratory results for epilimnetic core samples collected in 2022 ranged from 6 ppb to 8 ppb with an annual average of 8 ppb.
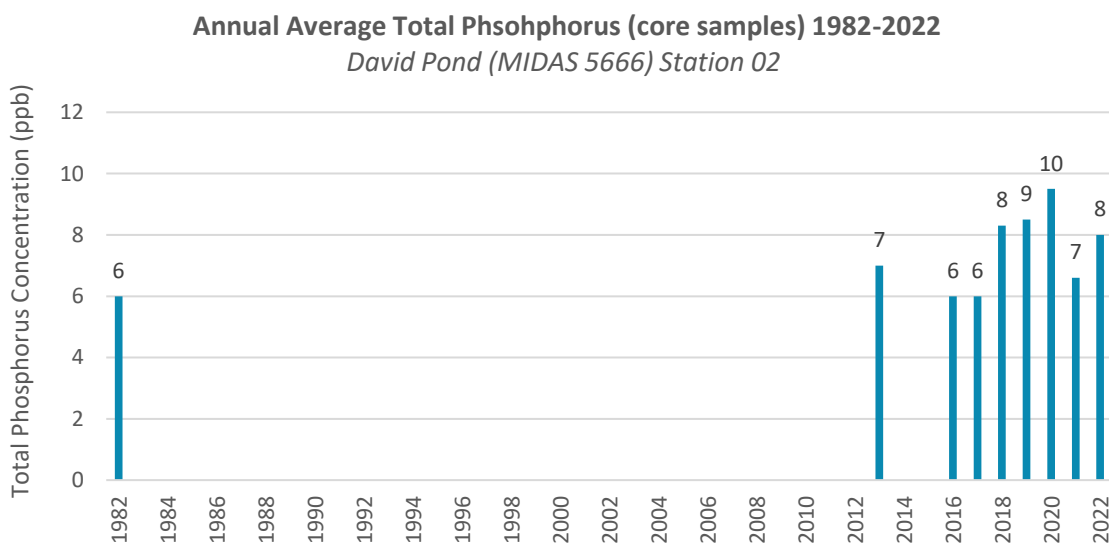

Figure 9.Annual Average Total Phosphorus data (epilimnetic core samples) collected 1982-2022, Station 2.

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 David Pond has ranged from 6 ppb (1982, 2016, 2017, and 2022) to 10 ppb (2020) with a historical average annual concentration of 7.3 ppb (Figure 5). TP data for David Pond is also quite limited, with data collected only 9 years throughout the ~40-year monitoring record starting in 1982.

In 2022, four (4) TP samples were collected from the bottom of David 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 2022 were 17 ppb (7/7/2022), 9 ppb (8/3/2022), 25 ppb (9/2/2022), and 22 (10/5/2022) with a 2022 annual average of 18 ppb.
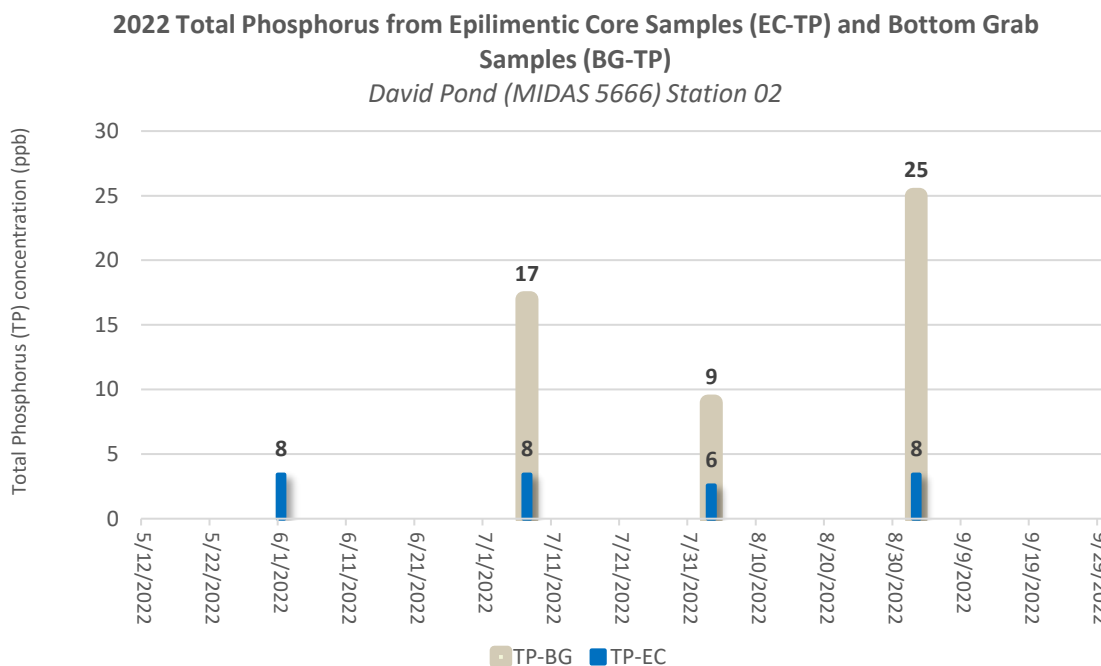
2022 Total Phosphorus from Epilimentic Core Samples (EC-TP) and Bottom Grab Samples (BG-TP)
David Pond (MIDAS 5666) Station 02

Figure 10.2022 TP core sample and bottom grab sample results from David Pond.

Historically, bottom grab samples were collected in 8 years throughout the ~40-year monitoring record. The historical average annual bottom grab TP concentration ranges from 12 ppb (2013) to 30 ppb (2018) with an overall historical average of 21 ppb.

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)	
2022 Chl-a Average	3.0
2022 Peak Chl-a	4.0
Historical Chl-a Average	3.4
Maine Lakes Chl-a Average	5.4

Chlorophyll was measured five (5) times in 2022. Results ranged from 2 ppb to 4 ppb, with a 2022 annual average of 3 ppb. Historical Chl-a data collected during 8 years between 1982-2022 has ranged from 1.0 ppb (2018) to 7 ppb (2013) with a historical average of 3.4 ppb.

Discussion

2022 was 30 Mile's seventh year of monitoring David 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, 2021, and 2022 data included in this report is data collected by 30 Mile only. 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 David Pond.

Near real-time data for David Pond's clarity (Secchi depth), and dissolved oxygen and temperature profiles can be found online at https://30mileriver.org/david-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. Continue to **deliver LakeSmart programming** on David Pond, providing education to shorefront property owners about polluted stormwater runoff, phosphorus, and the affects that watershed development can have on lake water quality.

3. Work with 30 Mile to **review the list of priority sites identified during the 2011 watershed survey** and determine next steps to address remaining sites through LakeSmart and 30 Mile's YCC and Technical Assistance programs.