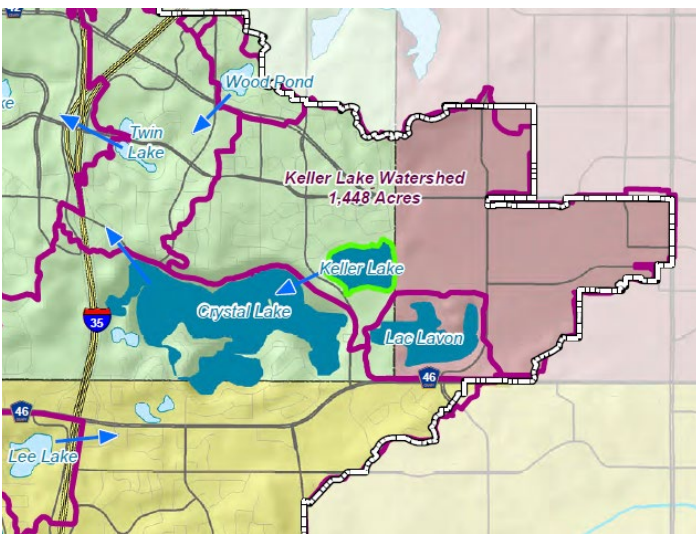




Keller Lake 2023 Management Level Monitoring



The Black Dog Watershed Management Organization (BDWMO) performs monitoring of its strategic waterbodies on a 5-year rotating basis. BDWMO monitored Keller Lake in 2023. Monitoring results presented in this report include:

- Water chemistry:
 - Phosphorus
 - Chlorophyll-*a*
 - Secchi Disc Transparency
 - Chloride
- Phytoplankton (algae)
- Water levels
- Aquatic Plants

About Keller Lake

BDWMO Classification	Strategic waterbody
MDNR ID number	19-0025P
Watershed Area	1,447 acres
Lake Area	50 acres
Average Depth	4.8 feet
Maximum Depth	8 feet
Ordinary High Water Level	--
Normal Water Level	934.3 feet
100-year Flood Level	938.6 feet
Downstream Resource	Crystal Lake
Location (city)	Apple Valley, Burnsville
Public Access	Park on south shore
MPCA Classification	Shallow lake
MPCA Impairments	Nutrients
Aquatic Invasive Species	Curly-leaf pondweed Eurasian watermilfoil

Summary and Recommendations

- Continued good water quality; phosphorus, chlorophyll-*a*, and Secchi disc transparency better than MPCA standards
- Recency of alum treatments (2018, 2021) prevent accurate trend analysis
- Chloride below Minnesota Standard
- Low amount of phytoplankton (algae) in summer; algal community includes desirable green algae
- Submergent plant community is poor and dominated by invasive curlyleaf pondweed and Eurasian watermilfoil
- Recommend continued water quality monitoring, aquatic plant monitoring, and implementation of stormwater best management practices in the watershed as opportunities allow

Introduction

Keller Lake is a shallow lake that lies on the border of Burnsville and Apple Valley. Keller Lake receives runoff from both cities. Keller Lake’s outlet discharges to Crystal Lake to the west.

The Keller Lake watershed land use is low density residential and park. Keller Lake is used for wildlife habitat and a variety of recreational purposes, including fishing, swimming, and aesthetic viewing. Burnsville and Apple Valley both have public parks on the south shore of the lake. The City of Apple Valley park has access for launching canoes on the lake. There is no public boat ramp for launching trailered boats on Keller Lake.

Keller Lake received in-lake alum treatments (aluminum sulfate and sodium aluminate) in Spring 2019 and Fall 2021 to reduce internal loading of phosphorus from lake sediments. During the years of 2003-2008, a ferric chloride phosphorus removal system pumped deep water from Crystal Lake, treated it with ferric chloride to remove phosphorus, and discharged the treated water (i.e. phosphorus removed) to a storm sewer that ran to Keller Lake.

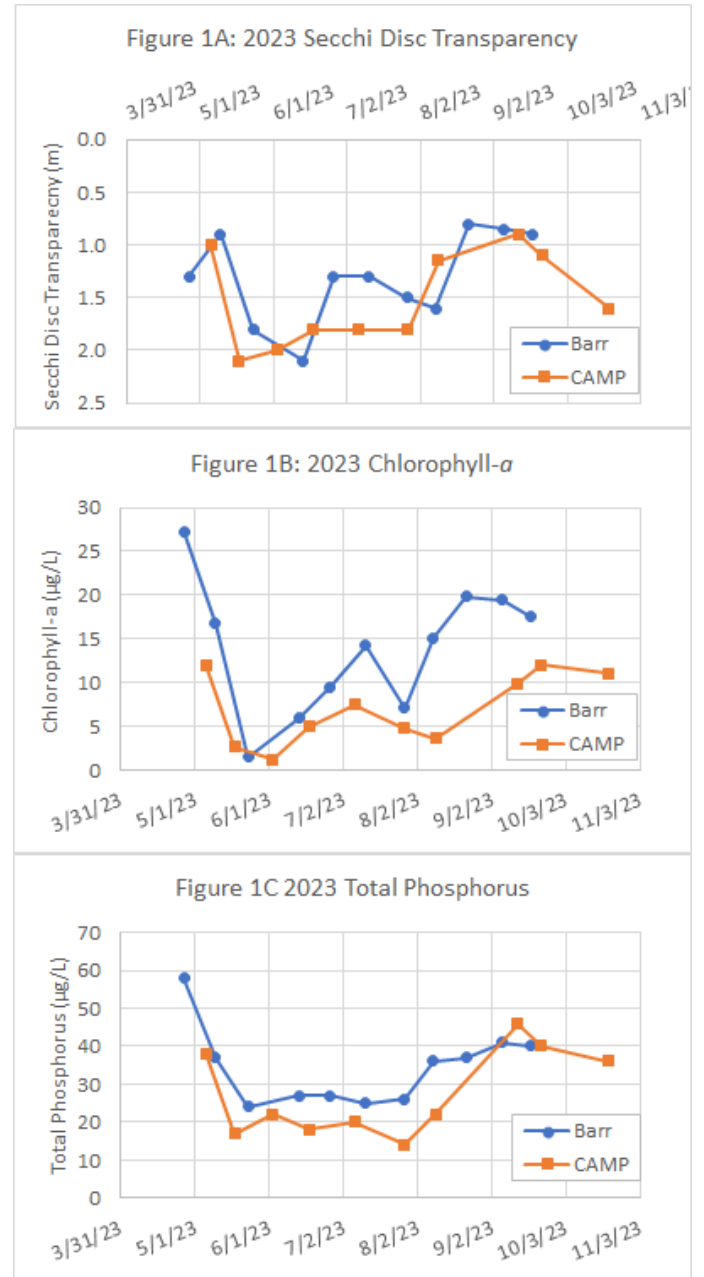
2023 Water Quality Monitoring

Water quality monitoring performed by BDWMO in 2023 included eleven sampling events between April and September. Measured parameters included:

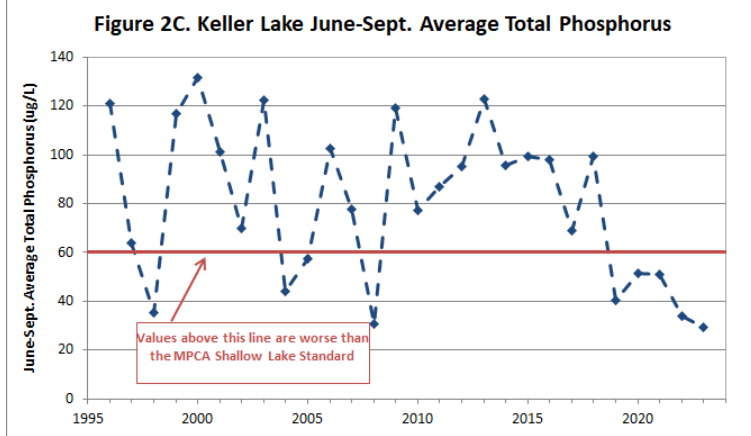
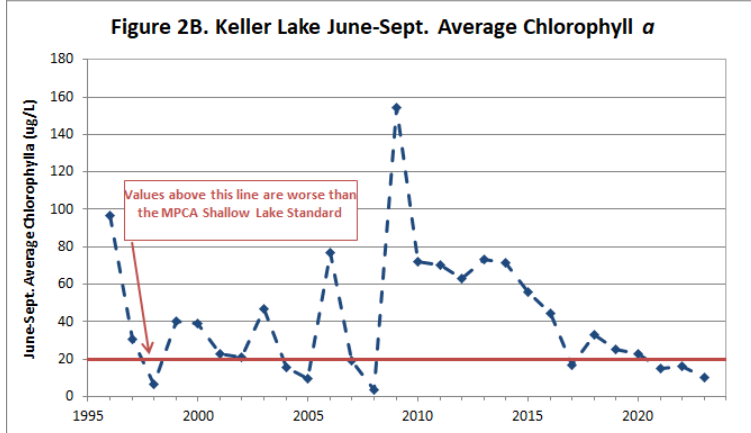
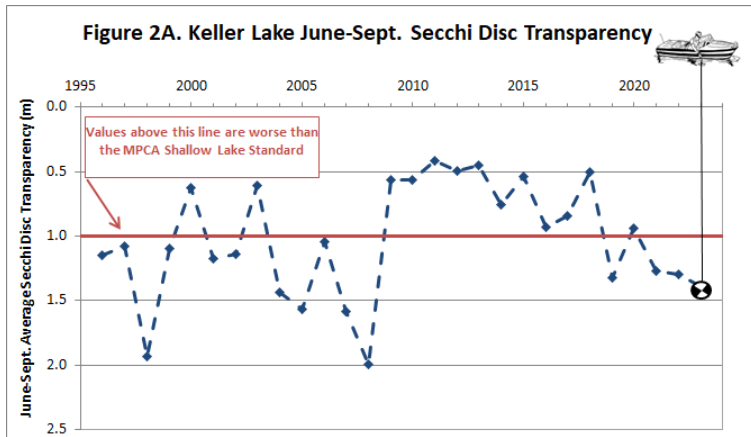
- Secchi disc transparency
- Chlorophyll-*a*
- Total phosphorus
- Chloride
- Field parameters including:
 - Temperature
 - Dissolved oxygen
 - Specific conductivity
 - pH

A volunteer also collected water samples in 2023 through the Metropolitan Council’s Citizen Assisted Monitoring Program (CAMP). Results of 2023 Barr and CAMP water quality monitoring events are presented in Figure 1A through 1C. Data collected in 2023 show high concentrations of total phosphorus and chlorophyll-*a* in April. Conditions improved from mid-May through July. Concentrations of phosphorus and chlorophyll-*a* increased in August and September (as is common). The

CAMP data is generally consistent with data collected by Barr.



Conditions in Keller Lake observed during the June 13, 2023 water quality sampling event.



Summer Averages of Water Quality

The 2023 summer (June-September) averages of water quality parameters were calculated for Keller Lake and plotted with previous years' summer averages (see Figure 2). Note that Keller Lake is a shallow lake with submerged vegetation throughout, and it is sometimes not possible to get a Secchi disc reading that isn't obscured by vegetation. Therefore, individual SDT and summer average SDT presented in figures may indicate worse water clarity than actual conditions.

The alum treatments conducted in Keller lake in Spring 2019 and Fall 2021 resulted in an immediate change in water quality conditions compared to years prior. Prior to the alum treatment, summer averages of total phosphorus were worse than the applicable state standard consecutively from 2009 through 2018. In all five years following the initial alum treatment in Spring 2019 (2019-2023), summer-average total phosphorus has been better than the MPCA shallow lake standard (see Figure 2C). Summer average SDT was worse than the MPCA standard in 2020, but better than standard in 2019, and from 2021 through 2023 (see Figure 2A). Summer average chlorophyll-*a* concentrations were worse than the standard in 2019 and 2020, and better than the standard from 2021 through 2023.

Because of the immediate and significant impact of the alum treatments on recent water quality of Keller Lake, water quality trend analysis (typically updated annually) has not been performed for Keller Lake since the alum treatments. Although the most recent summer average water quality data meets BDWMO goals for Keller Lake and state standards, the 10-year summer average concentrations of total phosphorus and chlorophyll-*a* still exceed applicable state standards.

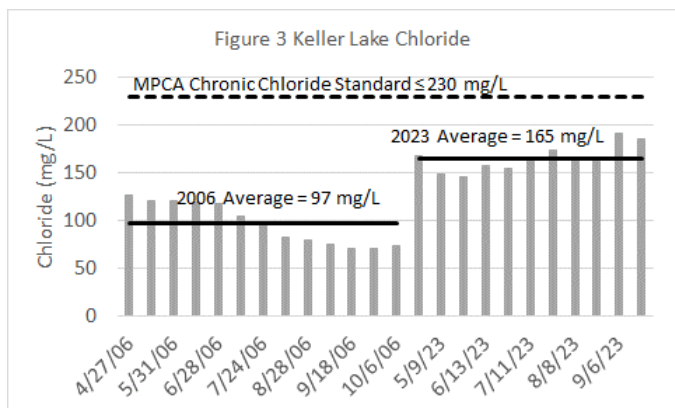
Additional years of data may be needed before the BDWMO or cities can petition the MPCA to remove Keller Lake from the impaired waters list due to excess nutrients. The BDWMO will continue to annually monitor the water quality of Keller Lake through CAMP and perform management level monitoring again in 2028.

Parameter	MPCA Standard	BDWMO Goal	2014-2023 June-Sept Average
Secchi Disc Transparency (m)	1.0	1.0	1.0*
Chlorophyll <i>a</i> (ug/L)	20	20	31
Total Phosphorus (ug/L)	60	60	67

* Secchi disc resting on lake bottom or submerged vegetation during some measurements.

Chlorides

Chloride concentrations in area lakes have increased since the early 1990s due to increased use of road salt in winter. The ferric chloride phosphorus removal system that operated from 2003-2008 would have contributed chloride to Keller Lake during that period. Because high chloride concentrations can harm fish and plant life, the MPCA has established maximum and chronic chloride standards. A lake is considered impaired if two or more measurements exceed the chronic standard (230 mg/L) within a 3-year period or if one measurement exceeds the maximum standard (860 mg/L).

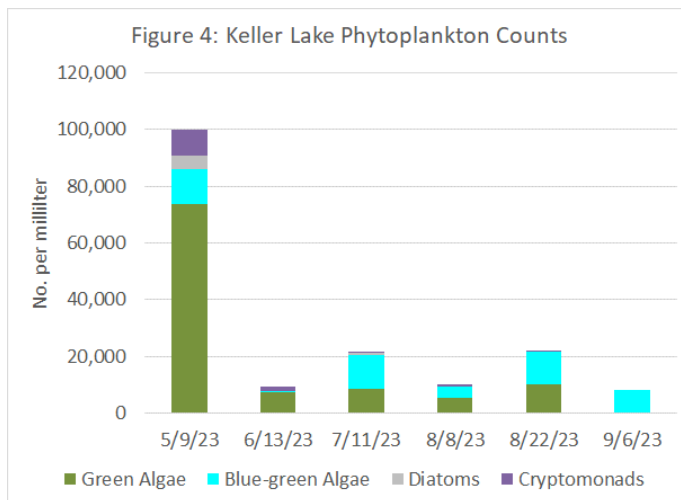


Chloride was measured in Keller Lake in 2023, and previously in 2006 (Figure 3). Chloride remained below the chronic standard in all samples. The annual average increased from 97 mg/L in 2006 to 165 mg/L in 2023.

Phytoplankton (Algae)

Phytoplankton, or algae, are small aquatic plants naturally present in lakes. Phytoplankton derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton (microscopic animals), which are eaten by fish. Excess phytoplankton can reduce water clarity while low numbers of phytoplankton can negatively impact zooplankton, and consequently, fish populations.

Figure 4 summarizes the number and major groups of phytoplankton in Keller Lake in 2023. Green algae were most dominant during the May sampling event, when overall algal density was greatest. Green algae are a good source of food for zooplankton and are indicative of healthy aquatic ecosystems. Blue-green algae, diatoms, and cryptomonads were also present in smaller numbers.



Blue-green algae numbers exceeded all other algae types during the July, late-August, and September sampling events. Blue-green algae thrive in warm, nutrient-rich water and can grow rapidly under certain conditions, causing “blooms.” Blue-green algae can produce algal toxins that may be harmful to humans and animals and are also a poor-quality food for zooplankton.

Harmful Algal Blooms

During algal blooms, some blue-green algae (cyanobacteria) can produce toxins that can be harmful to humans and animals if ingested. Such algal blooms can occur rapidly under specific aquatic conditions (e.g., high temperatures). Not all blue-green algae produce toxins and laboratory testing is necessary to determine the presence and concentration of algal toxins in lake water.



Lake with a thick blue-green algal bloom (MPCA).

BDWMO residents should look to their respective Cities for information and communications regarding harmful algal blooms and associated public health guidance (such as beach closures or bodily contact warnings). Additional information is available from the [MPCA](#) and [MDH](#).

Macrophytes (Aquatic Plants)

The BDWMO assesses the health of a lake’s submerged aquatic plant community based on the number of species present and the “quality” of the species as measured by the Floristic Quality Index (FQI). The FQI considers the number of different species and the sensitivity of each species to disturbance (referred to as a “C-value”). Higher C-values and FQI indicate better lake health. The BDWMO established goals for the number of native species and FQI of strategic waterbodies.

Parameter	BDWMO Goal	2023 Results
Floristic Quality Index (submergent zone)	≥17.8	5.8
Native Species (submergent zone)	≥11	3

A total of five aquatic plant species were identified in the submergent zone in 2023, including three native species and two non-native aquatic invasive plants. In 2020 and 2022, the Cities of Apple Valley and Burnsville partnered to transplant native aquatic plant species into the lake to increase native plant diversity.

Aquatic Invasive Species

Curly-leaf pondweed (CLP) was found at 24% of sampling points in May, 2022 and 3% of sampling sites in August, 2022. CLP was not observed in Keller Lake in 2023. CLP often out-competes native vegetation early in the growing season and dies off in early to mid-summer, which creates a sudden loss of habitat and releases nutrients into the water that can produce algal blooms and create turbid water conditions. The presence of CLP in Keller Lake is a factor in the lake’s the poor native submerged vegetation and water quality. The Cities of Burnsville and Apple Valley partnered to perform herbicide treatments of CLP from 2017 through 2021.

Eurasian watermilfoil (EWM) can create dense, nuisance growths at the lake surface, and have a negative impact on recreational activities and may also crowd out native plant species. EWM was found at 46% of sampling points in April 2023, 100% of sampling points in June 2023, and 92% of sampling locations in July 2023. The Cities of Apple Valley and Burnsville partnered to perform herbicide treatments of EWM in 2022 and 2023.

Native Species

Three native species were identified in the submergent zone of Keller Lake in 2023:



Coontail (*Ceratophyllum demersum*)



Elodea (*Elodea canadensis*)



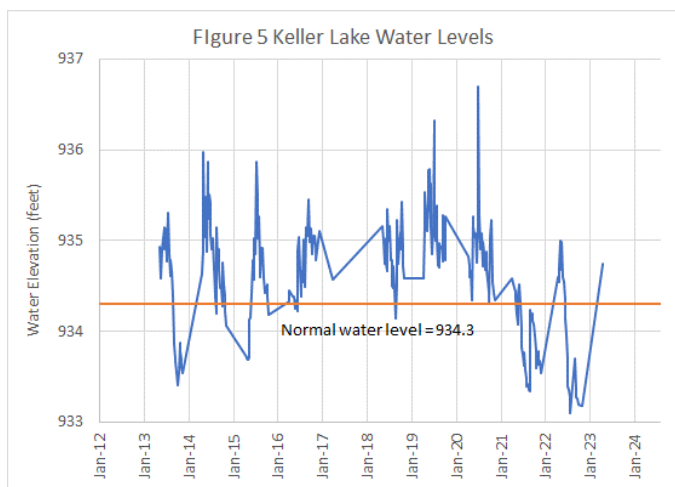
Stringy Pondweed (*Potamogeton pusillus*)

Fisheries

Fish surveys have been conducted on Keller Lake in recent years (2019 and 2021) by contractors hired by the City of Apple Valley. Bluegill sunfish were the dominant fish species. Largemouth bass, which prey on bluegill, were also present. The 2021 survey included removal of invasive goldfish present in Keller Lake. Goldfish are not native to Minnesota and can have negative impacts on water quality if present in high numbers due to disturbance of lake sediments and uprooting of aquatic vegetation while feeding. Reducing the number of bottom-feeding fish, including goldfish and non-native carp, can lead to improved water quality for shallow lakes like Keller Lake.

Water Levels

Keller Lake discharges to Crystal Lake over a weir structure, at an elevation of 934.3 feet (NGVD29). Water elevations have been measured at varying frequencies since 1957, with several years without measurements. Water elevation data has been collected each year 2013-present. Only one elevation reading was available for Keller Lake in 2023 (April 19, 2023). Lake elevations for years 2013-2023 are plotted in Figure 5.



During the period of 2013-2023, the lake elevation has fluctuated from a high of 936.7 feet in 2020 to a low of 933.1 feet in 2022, a difference of 3.6 feet. Record-breaking precipitation occurred in years 2019-2020 (as measured at MSP airport), while recent years have had below average precipitation.

Management Recommendations

Keller Lake continues to demonstrate improved water quality following the in-lake alum treatments performed in 2019 and 2021. Based on the 2023 monitoring results, Barr Engineering Co. (Barr) staff recommend that the BDWMO and/or member cities perform the following management actions:

- Continue CAMP water quality monitoring annually.
- Perform BDWMO management level monitoring in 2028.
- Continue aquatic vegetation monitoring and curlyleaf pondweed management.
- Continue management of non-native goldfish.

Ways to Get Involved

Because runoff from stormwater can be generated anywhere, anyone in the watershed can help protect ponds and lakes through their own actions!

Top 5 Things You Can Do to Protect Ponds & Lakes

- 1

Adopt a Storm Drain

Keep leaves, grass clippings and other debris off the street and storm drain in front of your house. Debris can clog storm drains or end up as pollution in your neighborhood pond.
- 2

Stop the Drops

Increase the number of raindrops that soak into the ground by installing a rain barrel (and using the water for your garden) or by directing downspouts onto your lawn or into a rain garden.
- 3

Walk Your Dog, Bring a Bag

Clean up your dog's droppings so they don't wash down a storm drain. Not only is it gross to step in, but your dog's waste harbors harmful bacteria and boosts algae growth in ponds.
- 4

Don't Feed the Storm Drain

Keep grass clippings and leaves out of the street so rain doesn't wash them into a storm drain. Also, never dump motor oil or paint down a storm drain.
- 5

Fertilize Your Lawn... Not the Street

Fertilizer that ends up on hard surfaces will likely be washed into a storm drain & sent to your neighborhood pond. In a pond, fertilizer causes an explosion of algae growth.

The Dakota County Soil and Water Conservation District also offers the [Landscaping for Clean Water](#) program which includes free educational classes, garden design courses, natural shoreline and garden maintenance workshops, and grants for homeowners that install a raingarden, native garden, or native shoreline planting.

