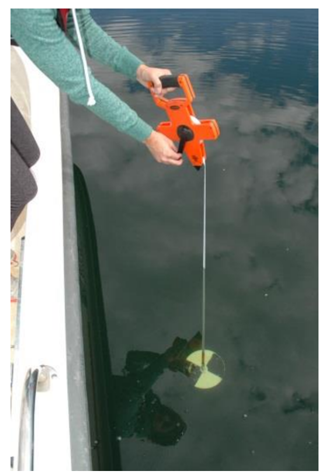
# Water Quality Summary: Water Clarity

## 2017 Barr Lake & Milton Reservoir

Twenty times a year since 2003, **Barr Lake** and **Milton Reservoir** have been sampled for water quality. These 300 trips to both reservoirs have produced an abundance of data and information. This is Part 7 of 8 of a water quality summary series for 2017 calendar year for both reservoirs. The other summaries focused on pH, Chl-a, oxygen, temperature, phosphorus, and nitrogen; this one discusses water clarity.

**The Big Picture** – Eutrophication is the addition of nutrients to water bodies resulting in nuisance algae growth and sedimentation. This natural process usually occurs over a long geological period of time. Many lakes, reservoirs, and even estuaries and bays throughout the world experience "*cultural eutrophication*". This term means that water bodies tend to become more productive and shallower over relatively short periods of time due to increased inputs of nutrients and sediments from human activities. Accelerated aging of lakes causes a quick biological response – severe algae growth. This response then leads to other chemical and physical changes within the water – pH, oxygen, water clarity and color, fish, plants, and aesthetics can all change.

**Secchi Depth –** This is the measurement of water clarity. There are many things that influence water clarity - algae, zooplankton, silt and dirt, and anything else that is suspended in the water. Water also has dissolved elements (e.g., tannic acids from decomposing organic matter) that change the color of water and impact clarity. Water clarity is mostly influenced by planktonic algae in Barr and Milton. During major rain events, incoming water can be turbid from dirt and urban runoff. Clarity is another response variable reflecting the overall condition of the reservoir and the watershed.



Measuring water clarity with a Secchi Disk on the shady side of the boat

Water clarity is expressed in units of meters (m) or feet (ft) and measured with a Secchi disk. The disk is an 8" diameter, black and white disk that is lowered in the water until it disappears. This practice of measuring water clarity has been around since 1865, and it is a useful way to quickly measure the health of a lake and track changes in water quality. Volunteers across the country use the Secchi disk as part of citizen science-based lake monitoring programs.

People are comfortable getting into the water and being able to see their feet thus, water clarity of two meters or better is considered desirable. There is no state wide standard for water clarity, but any clarity over 2 meters would be favorable for **Barr** and **Milton**.

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**2017 Water Clarity Data –** Secchi depth is measured from the shady side of the boat during each visit. The disk is attached to a tape measure. The disk is first lowered until it disappears, at which point a measurement is taken, representing the lowering depth. Then the disk is lowered a couple of meters more and raised until the disk reappears, representing the raising depth. The average of the lowering and raising depth is the Secchi depth. For 2017, there were 20 depths recorded for each reservoir (Table 1).

Table 1. Barr Lake and Milton Reservoir 2017 clarity data (m). Bold values are less than 2 meters.

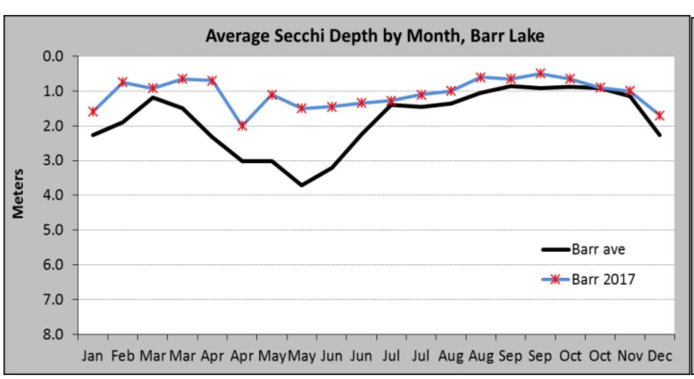
| Month | Secchi Depth (Barr) | Secchi Depth (Milton) |
|---|---|---|
| Jan | **1.60** | **1.40** |
| Feb | **0.75** | **0.95** |
| Mar | **0.92** | **0.68** |
| Mar | **0.65** | **0.45** |
| Apr | **0.70** | **0.65** |
| Apr | 2.00 | 3.30 |
| May | **1.10** | 4.00 |
| May | **1.50** | 3.20 |
| Jun | **1.45** | 2.80 |
| Jun | **1.35** | **1.15** |
| Jul | **1.28** | 2.00 |
| Jul | **1.10** | 2.45 |
| Aug | **1.00** | **1.30** |
| Aug | **0.60** | 2.20 |
| Sep | **0.65** | **0.90** |
| Sep | **0.50** | **0.85** |
| Oct | **0.65** | **0.80** |
| Oct | **0.90** | 3.00 |
| Nov | **1.00** | 4.25 |
| Dec | **1.70** | 5.40 |

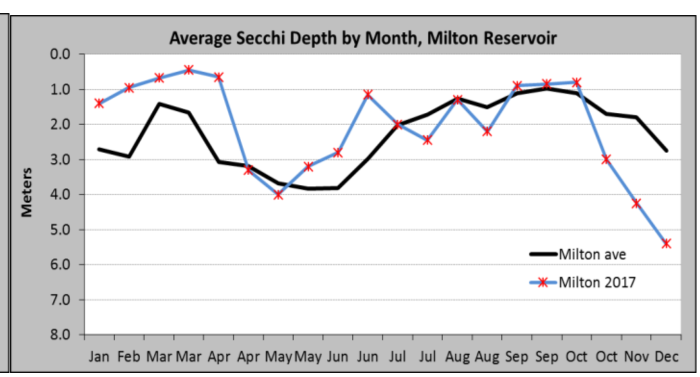
The average Secchi depth for **Barr Lake** in 2017 was 1.07 m and 2.09 m for **Milton Reservoir**. Both reservoirs experienced a spring clearing phase when the zooplankton were grazing on the diatom bloom. Milton's clarity was best in fall/winter. Barr's spring clearing was much shorter and shallower than previous years.

The growing season (July 1 – September 30) average for **Barr Lake** was 0.86 m and 1.62 m for **Milton Reservoir**. Typically, the growing season average is lower than the annual average because of increased algal growth during this period.

Figure 1 shows the annual cycle and 2017 results for water clarity. **Barr Lake's** clarity changed in response to algal activity. The diatom growth resulted in three feet of clarity all spring except for late April. There were no major blue-green algae blooms in 2017 but plenty of diatoms and other species of algae. **Milton Reservoir** had a normal water clarity year except for the early spring and late fall. Two blue-green algal blooms, one in late June and in August, created low water clarity. The reservoir filled early and water clarity significantly improved in October. The deepest reading was 5.40 meters or 17.7 feet of clarity for Milton in December

Figure 1. 2017 water clarity data compared to WQ target and 2003-2017 annual average



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**TSI Score –** The Trophic Status Index (TSI) is a scoring system that measures the eutrophic level of a lake or reservoir by using water clarity, phosphorus, and Chl-a. The widely used Carlson TSI was developed by Bob Carlson in 1977. The Carlson TSI is a way to integrate complicated environmental measurements into a single score that is comparable between lakes. The TSI works well in north temperate lakes that are phosphorus limited. The TSI is not a perfect fit for Barr and Milton but you can learn from it. This is the reason why the average TSI is much different compared to the TSI score associated with just water clarity. The phosphorus TSI scores are in the hypereutrophic range (off the chart even) while the water clarity is more eutrophic (Figure 2). The TSI values within the eutrophic to mesotrophic range (45 – 60) seem to be a reasonable score for warm-water, shallow reservoirs such as Barr Lake and Milton Reservoir.

Figure 2. 2017 TSI scores for Barr and Milton, July - September