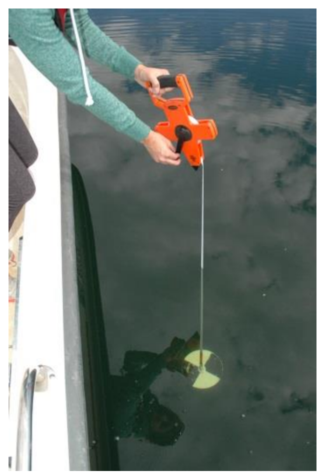
2016 Water Quality Summary Series – Water Clarity

Since 2003, water quality scientists have observed and sampled Barr Lake and Milton Reservoir twenty times a year for a variety of water quality parameters. These 260 trips to both reservoirs have produced an abundance of data and information. This is Part 7 of a continuing series summarizing the 2016 water quality data. The other summaries focused on pH, Chl-a, oxygen, temperature, phosphorus, and nitrogen; this one discusses water clarity.

The Big Picture – 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 impacts in the watershed. Eutrophication is a natural process, but it generally occurs over a much longer geological period. This 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 column – pH, oxygen, water clarity, water color, and aesthetics.



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

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 can affect clarity. 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 to the overall condition of the reservoir and the watershed.

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 standard for water clarity, but any clarity over 2 meters would be favorable for **Barr** and **Milton**.

2016 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. This is the lowering depth. Then the disk is lowered a couple of meters and then the raising depth is recorded once the disk reappears as it is brought up. The average of the lowering and raising depth is the Secchi depth. For 2016, there were 20 depths recorded for each reservoir (Table 1).

Table 1. Barr Lake and Milton Reservoir 2016 clarity data (m). Bold values are less than 2 meters.

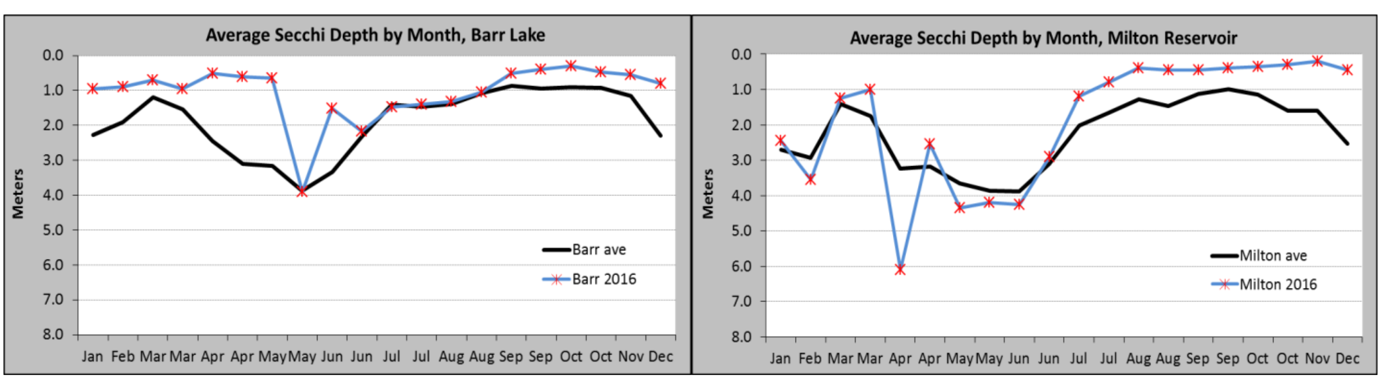
Month	Secchi Depth (Barr)	Secchi Depth (Milton)
Jan	**0.95**	2.45
Feb	**0.90**	3.55
Mar	**0.70**	**1.25**
Mar	**0.95**	**1.00**
Apr	**0.50**	6.10
Apr	**0.60**	2.55
May	**0.64**	4.35
May	3.91	4.20
Jun	**1.52**	4.25
Jun	2.16	2.90
Jul	**1.47**	**1.20**
Jul	**1.40**	**0.80**
Aug	**1.32**	**0.40**
Aug	**1.05**	**0.45**
Sep	**0.50**	**0.45**
Sep	**0.40**	**0.40**
Oct	**0.30**	**0.35**
Oct	**0.47**	**0.30**
Nov	**0.55**	**0.20**
Dec	**0.80**	**0.44**

The average Secchi depth for **Barr Lake** in 2016 was 1.05 m and 1.88 m for **Milton Reservoir**. Both reservoirs experience the typical spring clearing phase when the zooplankton are grazing on the diatom bloom. Milton's clarity under ice for January and February was also excellent. Barr's spring clearing was later and shorter than normal.

The growing season (July – September) average for **Barr Lake** was 1.02 m and 0.62 m for **Milton Reservoir**. Typically, the growing season average is lower than the annual average because of algal growth.

Figure 1 shows the annual cycle and 2016 results for water clarity. **Barr Lake's** clarity changed in response to algal activity. The spring diatom growth resulted in about three foot of clarity until early May. Then was relatively clear until August when the blue-green growth started. 2016 was a good example of an average water clarity year. **Milton Reservoir** had a normal water clarity year except for the fall. Algal blooms and lower than normal water depth kept the clarity less than a meter from July to December.

Figure 1.



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. 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 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. 2016 TSI scores for Barr and Milton, July - September