Big Swan Lake Monitoring Summary 2018

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Big Swan Lake and its inlets have been monitored by Todd SWCD, RMBEL, and the lake association since 1980. The lake was listed as impaired for excess nutrients and eutrophication in 2009. It is currently part of the Mississippi River – Brainerd Major Watershed Restoration and Protection Strategy project through the Minnesota Pollution Control Agency. This project is targeted for completion in 2020 and will result in a report recommending phosphorus reduction for Big Swan Lake.

Big Swan Lake has five inlets and one outlet (Figure 1). Data was collected at these sites from 2008-2009 as a comprehensive water quality study by Todd SWCD and the Big Swan Lake Improvement District. The total suspended solids and nitrogen levels were relatively low and not a concern, therefore these parameters were dropped from future monitoring efforts. The phosphorus and *E.coli* were a concern on certain dates, and mainly corresponded with rain events. The most loading occurred in late March of 2009 at all the inlet sites. The phosphorus could have come from the snow melt and/or exposed fields.

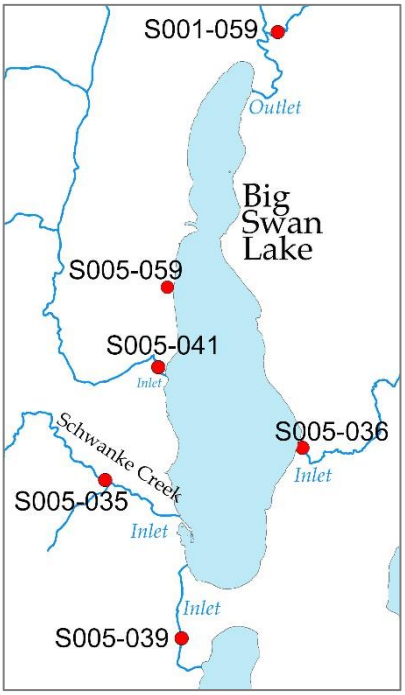

Figure 1. Big Swan Lake inlets and outlets.

In 2018 the Big Swan Lake Association hired RMBEL Staff to monitor the inlets and outlets. Overall, total suspended solids results do not appear to be a problem, so that test could be dropped from future monitoring. Results show that the water quality is on average with the area at the inlet from Lady Lake to the south (S005-039) and the inlet from Long Lake to the east (S005-036). There are some *E.coli* coming in from site S005-036, but this could be from waterfowl in that wetland complex since there don't appear to be any animal feedlots in that area. Site S005-059 does not have test results from 2018 due to minimal water flowage during the test period.

The phosphorus and *E.coli* on the west side of the lake (sites S005-035 and S005-041) are higher than the other sites, but they still fall within the expected range for the ecoregion (Table 1). This means that it is not outrageously high for the area.

Table 1. 2018 results for Big Swan Lake inlets and outlets. Sites are shown in Figure 1.

	E.coli			Total Phosphorus (ug/l)		
Sites	Average	Minimum	Maximum	Average	Minimum	Maximum
S001-059	66.7	12.1	122.3	63.3	25	209
S005-035	244.8	3.1	648.8	117.3	39	219
S005-036	140.4	13.5	487	37.8	23	45
S005-039	29.1	0	71.7	23.0	12	37
S005-041	216.5	4.1	410.6	118.5	71	230
Ecoregion Range	**40-360**			**60-150**		

The data from 2008-2009 show much higher maximums than 2018. This indicates loading during runoff events (Table 2).

Table 2. 2008-2009 results for Big Swan Lake inlets and outlets. Sites are shown in Figure 1.

	E.coli			Total Phosphorus (ug/l)		
Sites	Average	Minimum	Maximum	Average	Minimum	Maximum
S001-059	1.0	1.0	1.0	40.0	27.0	66.0
S005-035	566.4	2.0	2,419.6	111.0	33.0	937.0
S005-036	281.7	3.1	1,119.9	86.0	13.0	482.0
S005-039	341.9	1.0	2,419.6	56.0	19.0	394.0
S005-041	725.1	7.4	2,419.6	223.0	46.0	1,062.0
Ecoregion Range	**40-360**			**60-150**		

Test Explanation

Phosphorus is the main nutrient in the lake that feeds plants and algae. In general, the more phosphorus in the lake, the greener the water. *E.coli* is a bacteria that can make humans sick. It comes from warm-blooded animals including humans, birds, and cattle. This testing is unable to determine the source of the *E.coli*.

Trend analysis result (MPCA)

The Minnesota Pollution Control Agency reports that for the years 1980 to 2017 there is strong evidence of a trend for improving water clarity on this lake, approximately 0.11 feet per year. https://cf.pca.state.mn.us/water/watershedweb/wdip/details.cfm?wid=77-0023-00

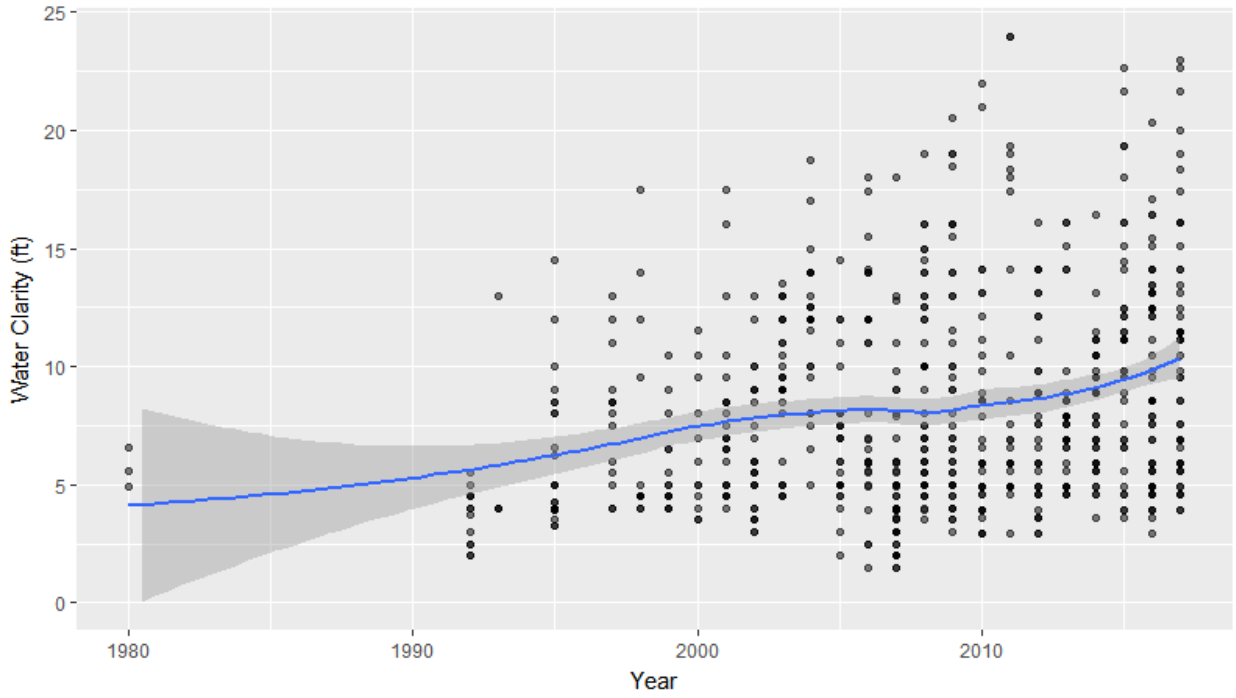

Figure 2. Trend analysis for Secchi disk transparency on Big Swan Lake (Source = MPCA).

Conclusions

Overall, the 2018 results show improvements over the 2008-2009 results (Tables 1-2). The high concentrations of phosphorus and *E.coli* tend to happen during large rain events. Land practices that would store the rain water and slow it's flow could help reduce phosphorus and *E.coli* concentrations. The lake is showing an improving trend in transparency, so the phosphorus in the streams does not appear to be negatively affecting the lake's water quality.

Future Recommendations

- Monitor in-lake water quality to track any changes in the lake.
- Could monitor total phosphorus and E.coli at sites S005-041 and S005-035 every couple years just to check on it. It wouldn't be necessary every year.
- Work with Todd SWCD to implement best management projects around the lakeshore such as wetland restoration, buffer strips and rain gardens.
- Educate shoreland owners about maintaining septic systems and installing shoreline buffers to limit the amount of phosphorus running into the lake.

Figure 3. Photo of site S005-041 on 09/19/2018.

Figure 4. Photo of site S005-035 on 08/23/2018.