

Thoughts on Higgins Lake

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From: David Jude, Limnologist and fishery biologist

At the suggestion of Dianne Wagner, I was asked to make some suggestions on the management of Higgins Lake with particular reference to water quality and the health and integrity of the lake for residents. I have had the opportunity to view the lake intimately from shore to shore and I have been around the entire lake now many times. I am aware that lake water level is controlled by the Cut River through manipulation of boards controlling water flow. I also have consulted the MDNR database to find out that there are many cold water fishes in the lake, including lake trout and brown trout, one of which I observed dead on the beach. I have also observed many minnows on the beach, and have seen white suckers and heard about large northern pike and that yellow perch is a popular sport fish. I also consulted the DEQ database to see what kind of water quality data might exist. Higgins Lake appears to be oligotrophic, has a deep Secchi disk reading (high water clarity), and low total phosphorus levels from the few data I examined. I also read a report by Rex Lowe that described the algal flora that was present on the bottom at several stations in Higgins Lake. The predominate soil type based on the many sandy beaches I have seen and walked on is sand, which suggests that development around the lake may be a major source of nutrient enrichment, since runoff from the watershed, lawn fertilization by residents, and the presence of septic tanks will discharge nutrients into the soil. These nutrients then will quickly percolate into the ground water and enter the lake. Since the lake is large (>10,000 acres) and has several very deep basins, it has been able to withstand these perturbations and apparently maintain good water quality. However, I have no idea about whether the water quality of the lake has been deteriorating since I have not done any extensive reading or trying to discover past data and reports which would provide historical perspectives on what the water quality was like then and how it has changed now. I understand the lake association does collect Secchi disk data and probably some water quality data as part of the DEQ's program for lakes, which will be a good start on delineating recent trends and for comparison with historical datasets. I also am aware that Limno Tech did some work on the lake in the past. Typically I also look at the records maintained by the Institute for Fishery Research in Ann Arbor. This group, which is the research arm of the MDNR, maintains historical records on lake work they have done in the past in Michigan lakes. I am sure an extensive library of past works would be available there for constructing a history of the water quality of Higgins Lake so as to ascertain directions for maintaining or improving water quality in the lake. For example, many of Michigan lakes were mapped during winter back in the 1940s, and during these projects, fish samples, water quality, and some mapping of wetlands was done as part of the work. These records can be invaluable in constructing a history of how the dissolved oxygen pattern may have changed along with nutrient enrichment over time.

Therefore, some things you might think about doing are assembled here for your consideration with the caveat that I have not done any kind of extensive work on this lake and I may be missing substantial reports that may have attempted some of the things I will recommend. First, you need to have a set of

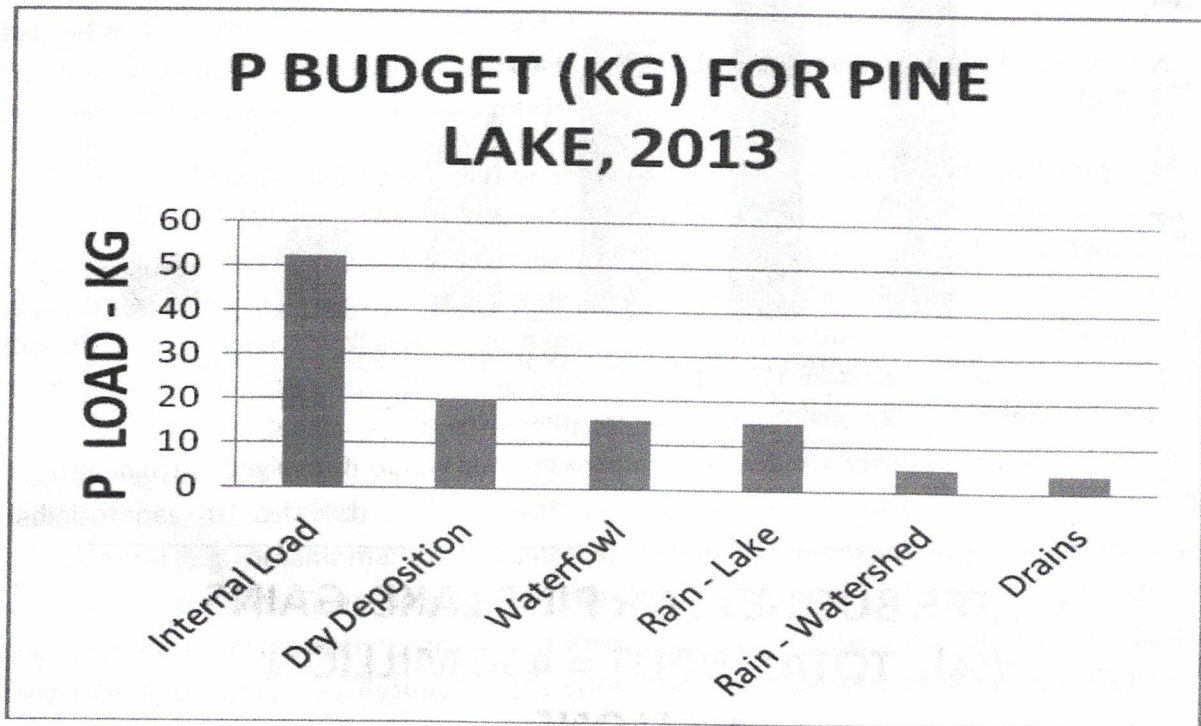
objectives for the lake. The obvious ones would include sustaining or improving the water quality and ecosystem integrity of Higgins Lake. There are many threats to the lake, including nutrient assault from development (especially septic tanks), invasive species (which you are dealing with already I think with control of Eurasian milfoil and presence of zebra mussels which you are not dealing with), the swimmers itch problem, which you are also dealing with, how to deal with the water level issue, and the more mundane issues of too many boats on the lake during summer. Second, you need to have someone summarize the existing water quality data and other related reports and provide a narrative on what the historical water quality conditions were, how they have changed, and what steps might be needed to reverse cultural eutrophication (nutrient enrichment) of Higgins Lake.

Third, either in conjunction with or separate from, you should consider a paleolimnological study of the lake. (Google: what the muck of Walden Pond tells us- NY times article- it has a great summary of what this is and what you can learn from it). Here we core the deep hole (sedimentation basin) during winter thru the ice. We get a record in the mud in the tube of sediment that comes up, then diatoms (their silica shell stays in the mud), pollen kinds, and other measurements (chironomid – insect head capsules) can elucidate changes that occurred. For example, you would see a signature when the forest was burned or cut down early on, when settlement started to pollute the lake, etc. Typical analyses begin with dating the sediments by measuring several natural and man-made radioisotopes (to establish a date-depth relationship in the core), then measuring both geochemical (e.g., organic matter, phosphorus) and biological remains (e.g., diatom algae, algae pigments) in the core. Depending on what analyses are run, data are interpreted to understand the history of sedimentation, erosion, nutrient dynamics in the lake, and algae, plant and invertebrate communities. Results provide critical lake management information including:

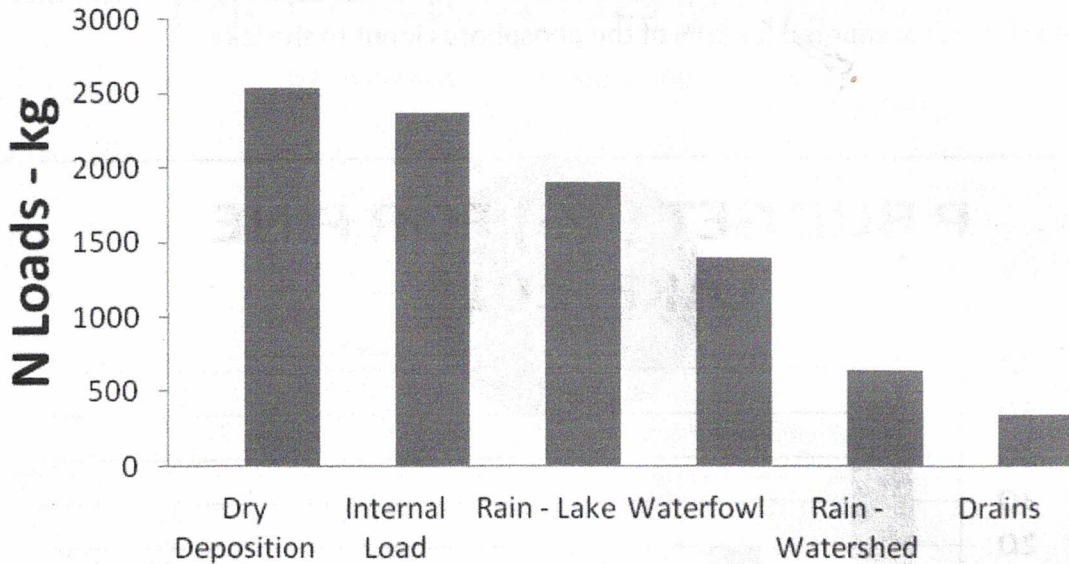
- 1) A baseline of what lake condition the lake started with (its original trophic status),
- 2) A timeline of changes that have occurred in the lake (what effects have logging, settlement, development had on the lake?), and importantly why those changes happened,
- 3) A record of how the lake has responded to past management,
- 4) What are reasonable management targets for the lake?
- 5) What the current trajectory of the lake is (where is the lake headed, is the lake getting increasingly eutrophic, and is it vulnerable to further nutrient loading?).

Fourth, you should consider construction of a rough nutrient budget and water budget for the lake. These can be very expensive, time-consuming studies or I have done a couple that are presumably cheaper, but results are probably less reliable, since I relied on literature values in some cases because some of the parameters are very difficult to measure on the lake (ground water input for example, you can get that by subtraction). However, you can get some

obvious conclusions from such studies. I show examples of nutrient budgets for phosphorus and nitrogen and a water budget for a lake I have worked on to show what these might look like. I did not show one other one I worked on, but it showed that septic tank effluent that seeped into the lake accounted for 80% of the phosphorus input to the lake.

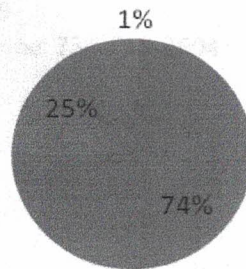


N BUDGET FOR PINE LAKE, 2013



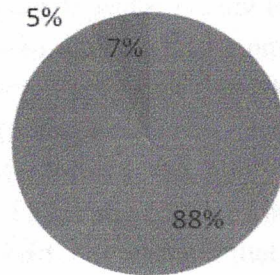
WATER BUDGET FOR PINE LAKE: GAINS (%) (%). TOTAL INPUT = 450 MILLION GALLONS

■ Drains ■ Rain - Lake ■ Rain - Watershed



WATER BUDGET FOR PINE LAKE: LOSSES (%) (%). TOTAL LOSS = 329 MILLION GAL

■ Evaporation ■ Golf course ■ Riparians



These are some thoughts and ideas I had about Higgins Lake. I would be glad to talk to you about these recommendations and expand on them further to help guide you to some useful studies that will lead to constructive activities that will help preserve Higgins Lake ecosystem health.

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