2015 State of the Lake Report

By Herb Lenon (Summarized from BreAnne Grabill's PLM Report, 2015

Invasive Species and Lake Management Committee

This is the 7th year of monitoring and managing Portage Lake, starting in the fall of 2008. Included is the treatment of invasive plant species in and around the lake and monitoring of the water quality of the lake, streams and storm drains of the watershed, so as to detect changes/threats that might occur in the lake ecosystem which would impair enjoyment of the water resource and also protect property values. Our goal is always to protect the lake ecosystem so as to allow recreational use of the lake and promote a healthy fishery.

A. Lake Monitoring – This involves several components:

1.) **Aquatic Vegetation (Aquatic Macrophyte) Surveys:** Complete aquatic plant surveys of the lake were conducted on June 5, July 22, August 6, August 27, and September 22. This included the State of Michigan **AVAS (Aquatic Vegetative Assessment Survey) Method** which gives the distribution and densities of species found.

Results:

17 native plant species - an excellent beneficial diversity and density is maintained; increased some since 2008 when Eurasian Water Milfoil (EWM) was taking over but consistent since 2010.
2 exotic species – EWM and Curlyleaf Pondweed which dies-off naturally by mid-summer.
2 emergent species – Phragmites and Purple Loosestrife.

Invasive Species control:

Herbicide treatment of the invasive **EWM** was down significantly this year. The acreages treated are as follows:

2015 – 79.35 acres; 2014 – 176.05 acres; 2013 – 129.75 acres; 2012 – 145 acres; 2011- 22 acres; 2010 – 86 acres; 2009 – 161.5 acres.

Treatment of the emergent **Phragmites** and **Purple Loosestrife** was also down significantly this year as follows:

2015 - 4 acres; 2014 – 6.2 acres; 2013 – 7.9 acres; 2012 – 13.5 acres; 2011 – 7 acres; 2010 – 10 acres; 2009 – 83 acres.

Because of hybridization of EWM with the native Northern Water Milfoil, higher application rates of herbicides are required. In the spring of 2015 a State of Michigan grant was received by Northern Technological University (MTU). Our lake was chosen as one of 15 lakes to be included in the study of the genetics of hybridization of water milfoil, and to determine the

herbicide sensitivity of each hybrid genotype. Consequently, our lake manager is involved with carefully taking samples of Milfoil from our lake to be analyzed by MTU. This should be a significant help to us in the effective control of EWM.

The diversity of native plants continues to confirm the selectivity of the herbicides used to control invasive plant species.

2.) Phytoplankton: This includes the free-floating microscopic algal plant life in the water column that represents the primary producer level for the aquatic food chain. Samples were collected in June, August and September. Three phyla (major groups) were found with each sampling: Blue-green Algae (least desirable), Green Algae, and Diatoms (most desirable). Five species from the 3 groups were present in June and August and 10 present in September, thus more diversity in the fall. Overall, the concentration of phytoplankton was low. Blue-green algae can be a concern if abundant due to a toxin that is produced, but the population is not high enough to be a concern. Blue-green algae are also not filtered out by zebra mussels unlike the other genera (their main food) and this results in a shift in the balance of these algal groups (more abundant blue-green algae).

3.) Zooplankton: These are the mainly or nearly microscopic invertebrates in the water column and are the primary consumers in the food chain, feeding on the phytoplankton. There are 3 main groups: Cladocera sp., Rotifer sp., and Copepod sp. All three groups were represented with several species in each group. They are dependent on phytoplankton for their food, while fish feed largely on zooplankton.

4.) Lake Water Quality: The two deep basins (each 60 ft. deep, #1 in the west lake basin and #2 in the center of the lake) were sampled in profile (top to bottom) on June 19, August 8 and September 24. Fourteen parameters were evaluated each time, of which many had values similar to previous years.

With a second hard winter last year with extreme cold and above average snow fall, the lake experienced greater ice coverage and deeper snow depths than usual and lower oxygen levels. The spring melting of snow and ice was increased with heavy rains, leading to a flushing into the lake from the outside watershed and an increase in lake depth. All of this produced a substantial amount of nutrients, debris, sediment and other unknown, potentially harmful, substances into the lake. The longer cool spring and cool summer impacted the plants with late and slow growth and development. It was mid-summer before there was much growth.

The notable findings in water quality are as follows:

a.) Temperature and Dissolved Oxygen: Both basins (1 and 2) had good oxygen levels and were beginning to stratify by June 19 with basin 1 being most strongly stratified due to less wind effect on it. By August and in September both basins were strongly stratified and down to anoxic levels at the bottom (0.1-0.18 mg/L) which is lower than last year (2.72 mg/L and 7.59 mg/L). Under such anoxic conditions you usually see internal nutrient-loading of phosphorus from the bottom substrate which leads to eutrophication (lake enrichment). This was not seen, however, as all phosphorus values in both basins from top to bottom were <10 mg/L which suggest an instrument failure or some abnormality. I believe strongly that nutrient-loading was taking place, as seen in previous years.

b.) Secchi Disk (Water Clarity) Readings: There was increased clarity in June and decreased clarity in August and September but similar to last year. There seems to be a relationship with zebra mussels and gobies. The mussels filter the water which increases clarity while the gobies eat the mussels which decreases clarity.

c.) Total Phosphorus (TP): In both basins and all times sampled the TP was reported as <10 ug. This is highly unlikely and must be due to error or malfunction of equipment. Last year there were values as high as 61 ug/L at the bottom of basin 1 in September. This year with the lowest dissolved oxygen at the bottom of both basins in August and September it would highly expect that TP would be the highest ever. Hopefully, next year will tell the story. Phosphorus is usually the limiting factor for plant growth in most Michigan lakes, so it is an extremely important parameter to evaluate. It is also the nutrient that becomes locked up in the bottom substrate when the dissolved oxygen is not too low, and is released from the substrate when the oxygen is low, below 3 ug/L, and this is what we call internal-loading.

d.) Total Kejeldhal Nitrogen (TKN): Nitrogen is an important plant nutrient but not usually a limiting one. TKN is a measure of all forms of nitrogen, including nitrates and ammonia. There was a real spike in TKN in August, especially in basin 1, while being consistently low from 2009 to this year. Thus, it is important to continually watch this parameter in the future, but it helps to break it down and look at the two main components, nitrates and ammonia (next).

e.) Nitrates: Most all nitrate values are low, considered slightly enriched.

f.) Ammonia: Most ammonia values are low and within a range for a healthy fishery, which can be a concern if ammonia is high.

g.) Total Dissolved Solids (TDS) and Turbidity: These parameters are about the same as last year.

h.) Conductivity: Conductivity was slightly higher in May and September which implies a slightly more rich, productive water, but not a concern at this point.

i.) Total Alkalinity: This was very similar to last year and suggests a relatively "soft" water lake.

j.) Oxidative Reduction Potential (ORP): This was slightly lower than last year, thus, a lower oxidized state, while high ORP's are indicative of healthier lakes. The lake is still within a desirable range (static).

K.) Chlorophyll-a: This is a measure of plankton growth in the water column and our values suggest moderate algae (phytoplankton) growth, and the values have slightly increased this year.

i.) E.Coli: Samples were collected one time from 3 sites in July: from the marina, Portage Pt. Inn. and the Covenant Camp. All values were very low, thus, no concern.

j. Shoreline Samples: Three sites along the NE areas of the east basin were sampled along with the 2 deep basins to see if there was any runoff effect from the shore area in this near the village. There was very little difference from the open lake water samples, thus, no significant runoff problem there.

B. Tributary Water Quality:

Seven streams were sampled in May and September. Flow rates were fairly low in most streams and was zero flow in Hanson Creek. The highest flows were in McCormick and Dunham Creeks. The main concerns were with Total Phosphorus (TP) which was very high in Stream #9 (empties into the lake at Easy Street) and especially high in September. McCormick Creek was next most high in both months. Hansen Creek was high in September but was stagnant at both samplings. These 3 streams were all significantly higher in TP than any lake samples, thus, contributing to lake enrichment. Turbidity was high in Stream #9 in both samples and significantly higher than any lake samples. Total Dissolved Solids (TDS) was also higher in all stream than lake samples. TKN was high in McCormick and Onekama Streams relative to surface water in the May sampling, suggesting runoff nitrogen fertilization of lawn at that time.

C. Storm Drains:

Four storm drain sites were sampled on May 8, all had very low flows with one stagnant (4th Street). TP was high in all samples and highest in 3rd Street, relative to lake samples. TKN was relatively high, especially in 1st Street and somewhat in Zosel Park drain. Nitrates were relatively high in all samples except 1st Street.

D. Trophic Classification of the Lake:

Lakes are classified according to Carlson's Trophic State Index based on a formula using Secci Disk, TP and Chl-a values from the lake. Portage Lake is classified accordingly as mesotrophic to moderately eutrophic classes (oligotrophic = low productivity lake, mesotrophic = medium productivity, and eutrophic = high productivity lake). The most desirable lake would be less than eutrophic for most recreational, beauty and fisheries and that is about where we are with Portage Lake.

Conclusion:

Aquatic vegetation and water quality should continue to be monitored to document the condition of the lake and to provide warning of any changes in the condition of the lake that need to be addressed by additional lake management activities.