

Oathill Lake Lake Restoration

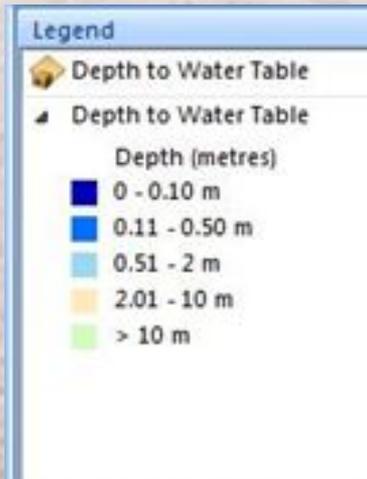
An aerial photograph of Oathill Lake, a large body of water surrounded by residential neighborhoods. The trees around the lake are in various stages of autumn, with some showing vibrant orange and red foliage, while others are bare. The lake's surface is calm, reflecting the sky. In the background, a dense urban area with many buildings is visible under a clear sky. The text 'Oathill Lake' and 'Lake Restoration' is overlaid in white on the left side of the image.

The Watershed

- Long history of farming ending with a pig farm
- Sub division development in stages over the past 45 years
- Drained wetlands and buried streams
- Now all urban housing
- Lots of sources of nutrient loading past and on going.
- Changes in hydrology -- all flow via storm sewers
- Riparian zone but all water passes under it in pipes

Changes

- Residents noticed changes in the wildlife using the Lake especially amphibians
- Increased algae growth and blooms of algae and zooplankton at odd times of the year.
- Lake was earlier stocked with Smallmouth bass by fisheries departments
- Loss of American eels due to impassable outlet control structure
- Heavily stocked for “put and take” Rainbow trout fishery – season never closed
- Resulted in riparian garbage and damage plus limiting use by other recreational users.
- But in 2009 extreme coliform counts and government posted warning signs to stay out of the water triggered community action.
- There is some coliform data from 2006 through 2008 with no evidence of high fecal coliform numbers
- In 2009 the lake turned brown, 11 stations were sampled throughout Oathill as well as at the area of its outfall into Lake Banook and the middle of Lake Banook. Very high FC counts in all. Sampling dates were July 22 and 27.
- Source never identified



Lake uses

- Long history of year round recreational use for angling, swimming, and skating recorded use dating back to the 1860's
- Summer water temperatures posted on our web page in real time brings swimmers from all over Dartmouth, Eastern Passage and Halifax
- Fish stocking has been changed to one year old Brook trout in numbers the lake can sustain and grow out
- Spring to fall angling only -- success matches that of wild lakes. Trout grow out well.
- Amphibians returning and more bird life.
- Heavily used walking trail –lots of dog traffic.

Oathill Lake Conservation Society

- <http://www.oathilllake.ca>
- membership is comprised of volunteers—all dedicated to improving and maintaining the health of this small lake and its parkland as a resource for walking, swimming, boating, skating, CC skiing and fishing.
- Education is the key to getting people involved and invested in our cause.
- But we also conduct environmental monitoring, and make scientifically-based recommendations to government agencies, whose policies and activities are seen to have the greatest influence on the health and integrity of the lake.

Oathill Lake Conservation Society

- OLCS was formally registered on July 7, 2010
- We have 69 paid family memberships in 2017 that is about 170 individuals.
- We have a mailing list (paying and non-paying combined) of approx. 144 households. This amounts to approx. 360 individuals.
- So, there are roughly 360 individuals who want to follow and be informed of what we do and 170 individuals who want to contribute financially to what we do.

Water sampling

- Water temperature, conductivity, oxygen, and pH on random dates 2010 to 2012
- 3 sites bi-weekly from mid August 2013 to Nov 2017 on going – WetPro YSI meter
- Water samples to the lab for analysis of a range of parameters. Twice this year in April and October.
- Water temperature data loggers each 1m in depth were not in in 2017 but had been since 2012

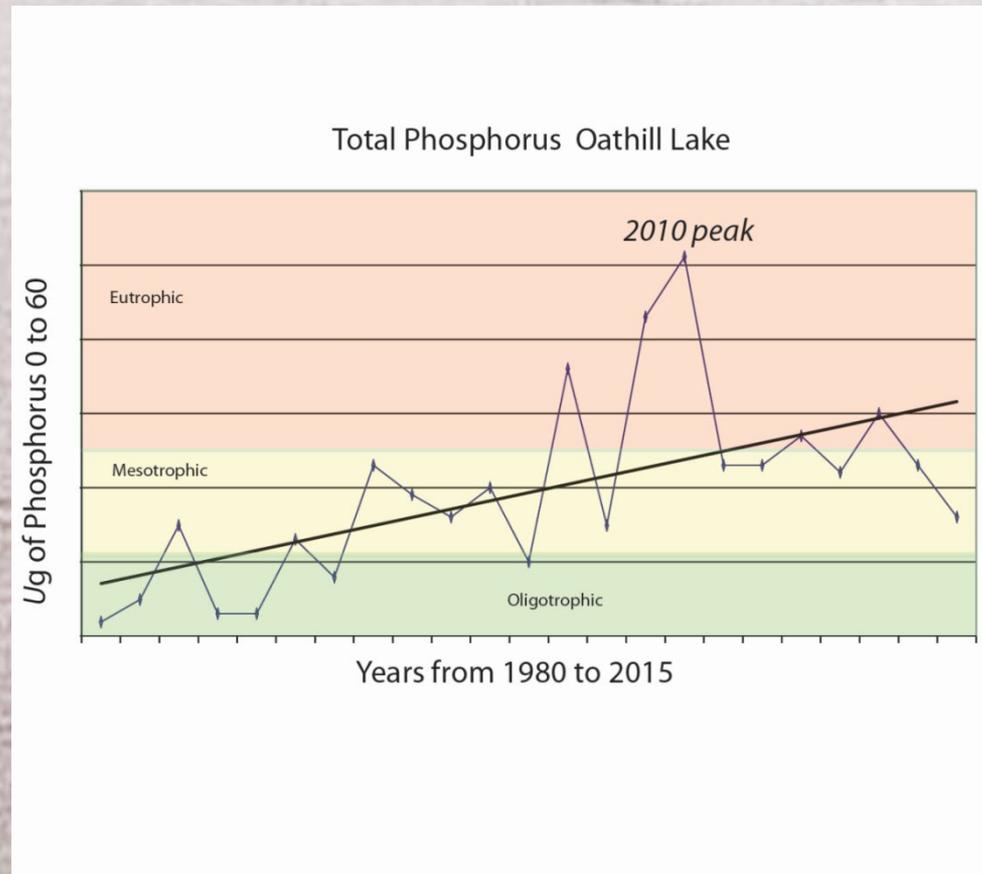


Issue Nutrients

- Oathill is over fed (high mesotrophic to eutrophic)
- The controlling nutrient is Phosphorous
- The P cycle in lakes is very complex
- Basically two sources
 - Input from land
 - Cycling in lake
- Two forms
 - biologically available
 - Not biologically available most bound with metals (Fe & Mn) and oxygen
- At some point in the past this loading tipped the nutrient balance over a threshold resulting in too much plant growth leading to loss of oxygen in the bottom and the release of P from the Fe an Mn bound sediments which greatly accelerated more growth and oxygen depletion.

Total Phosphorus

- Want to be in green or low yellow zones
- Quite good till 2007 then a steep climb
- Peaks in 2010
- We don't have a 2016 or 2017 value on the graph but the trend did stay low likely due to improved bottom oxygen

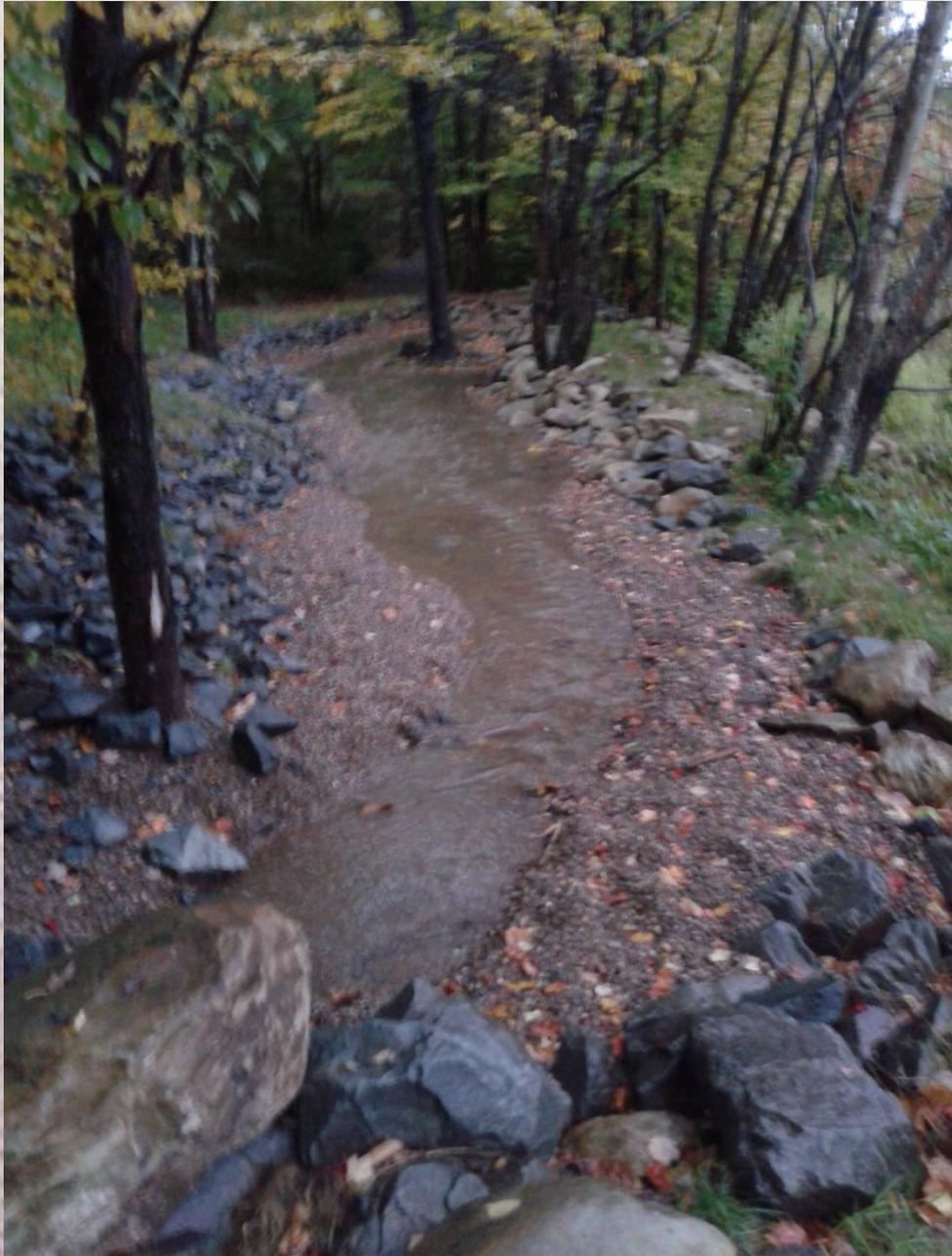


How do we fix this?

- Lower P input from the watershed through best management practices and education
- Divert storm sewers into wetlands to capture nutrients
- Get the oxygen back into the lake water to keep the Phosphorus bound to the metals and
- Over several years decay the excess plant material on the bottom

Divert storm sewer flow into wetland vegetation

- Could not use in-lake wetland as we have to harvest the plants
- Water testing shows highest concentration/amount of nutrients in low flows – easy for small area of plants to remove them.
- Diverted storm sewer into built wetland
- HRM and a Dillon design – built a water retention pond
- Needs to be turned into a wetland
- Now have 15cm pea-stone in bottom to control insects and hold cattails
- Want to plant cattails and willows to take up the nutrients
- Plan is to harvest aquatic plants each fall to remove the nutrient load
- Still working on this – needs plants dense enough to discourage dogs and kids



Plankton blooms

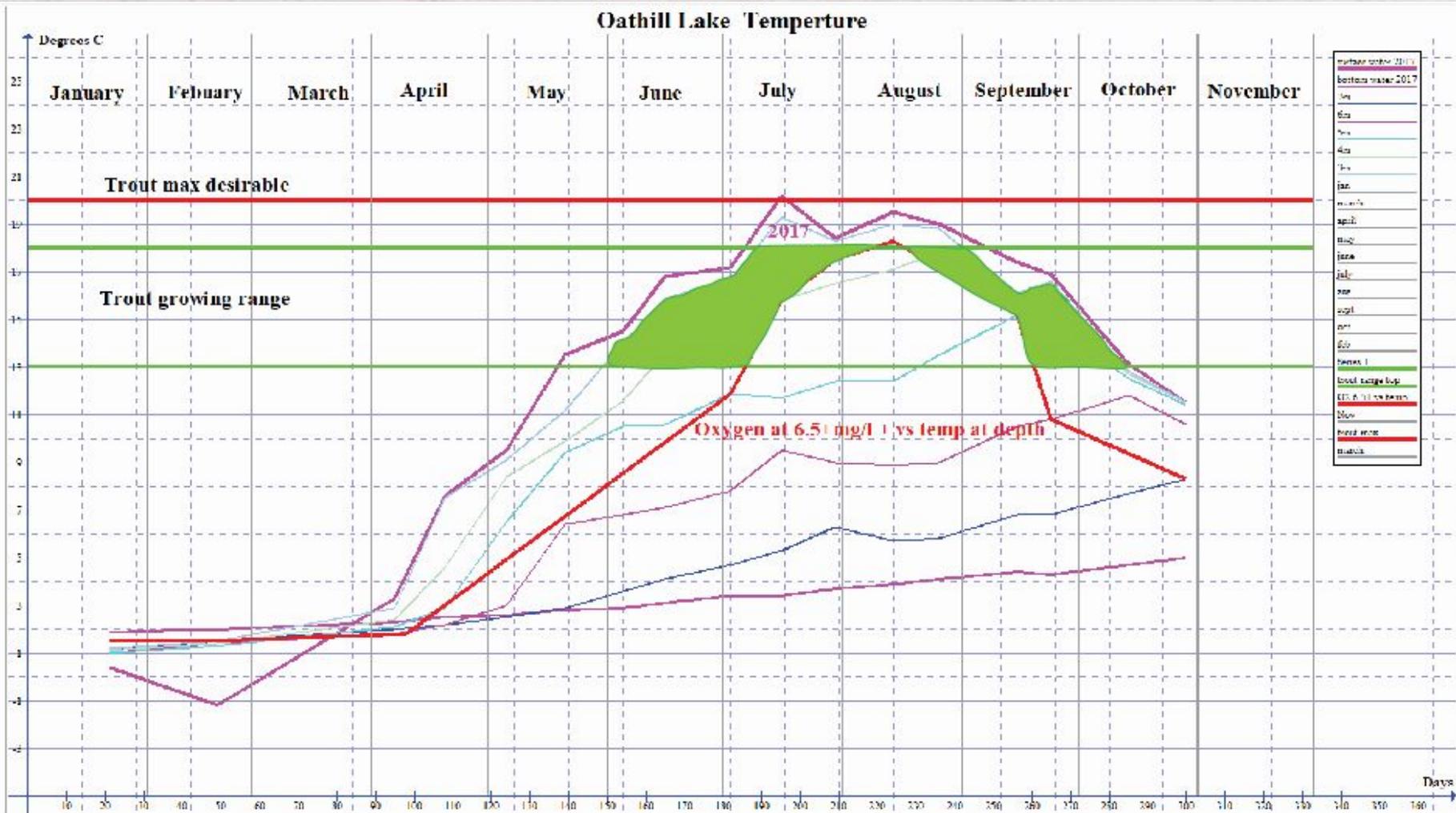
- July 29 and
October 9, 2017



Issue Temperature & Oxygen

- Indicator of good WQ are trout's habitat needs
- Growth between 13 and 18⁰ C
- Max desirable 20⁰ C
- Above that the trout move to colder water or if they can't are subject to stress, disease and more predation
- Oxygen levels above 6.5mg/l so are for good physical activity

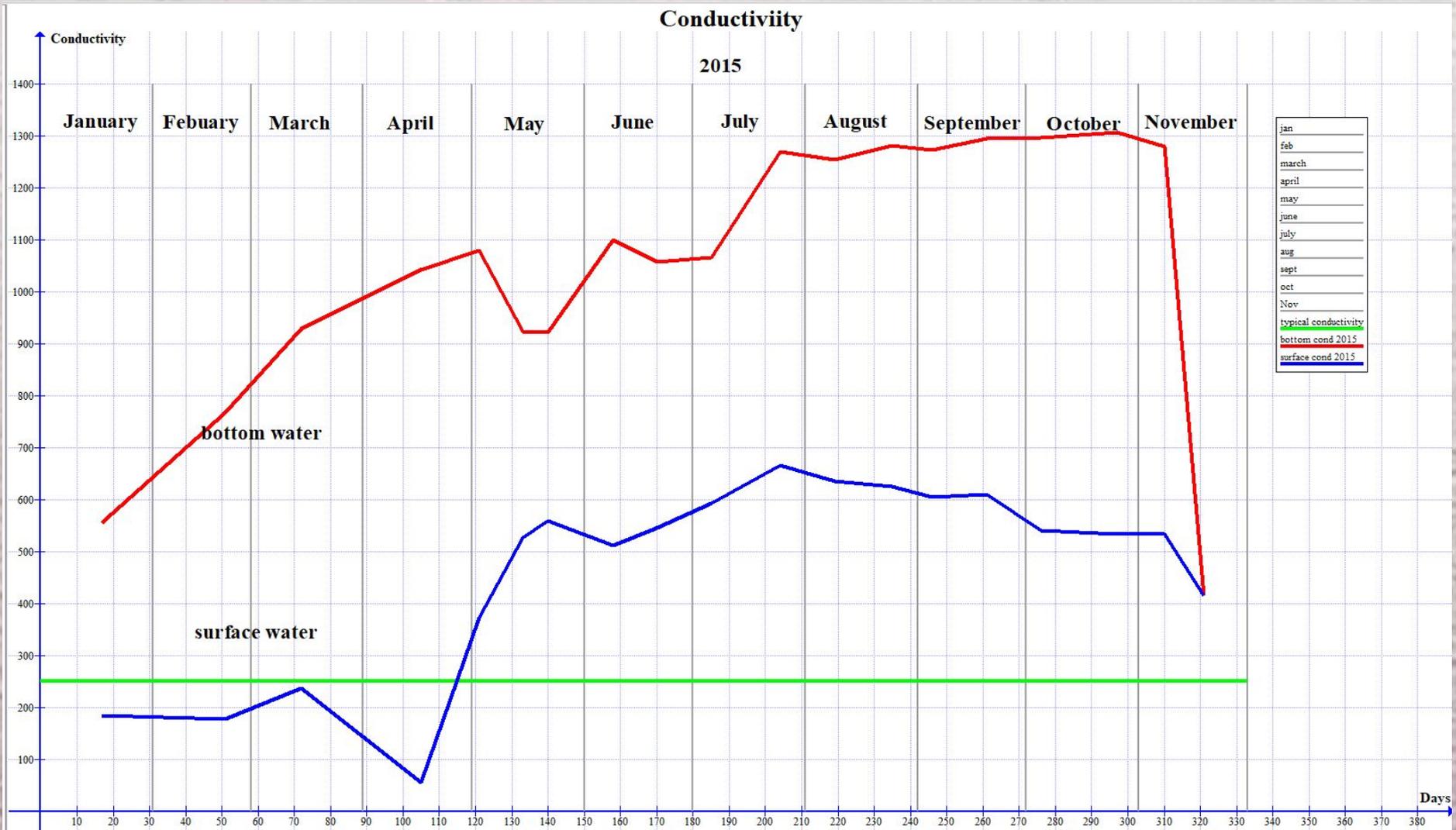
Trout Growth Area Depth, O₂ and Temp



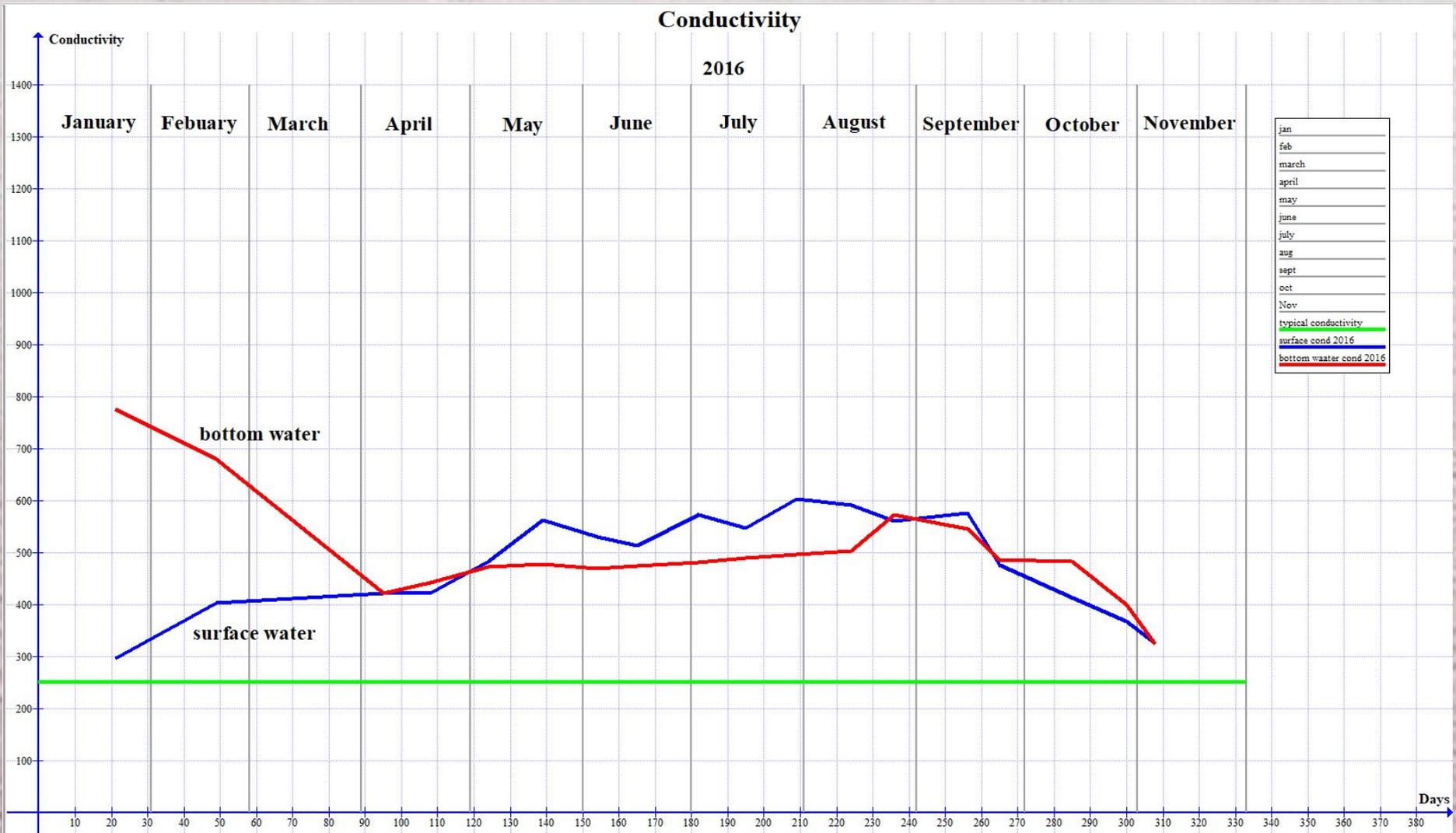
Issue Conductivity

- Conductivity varies with the ion concentration changes – good indicator of chemical changes
- High winter conductivity is due to road salt
- High summer conductivity increase due to metals from de-oxygenated bottom sediments.
- 2017 in the bottom water; the road salt was the highest we have seen – it declined slightly over the summer and Mn increased.

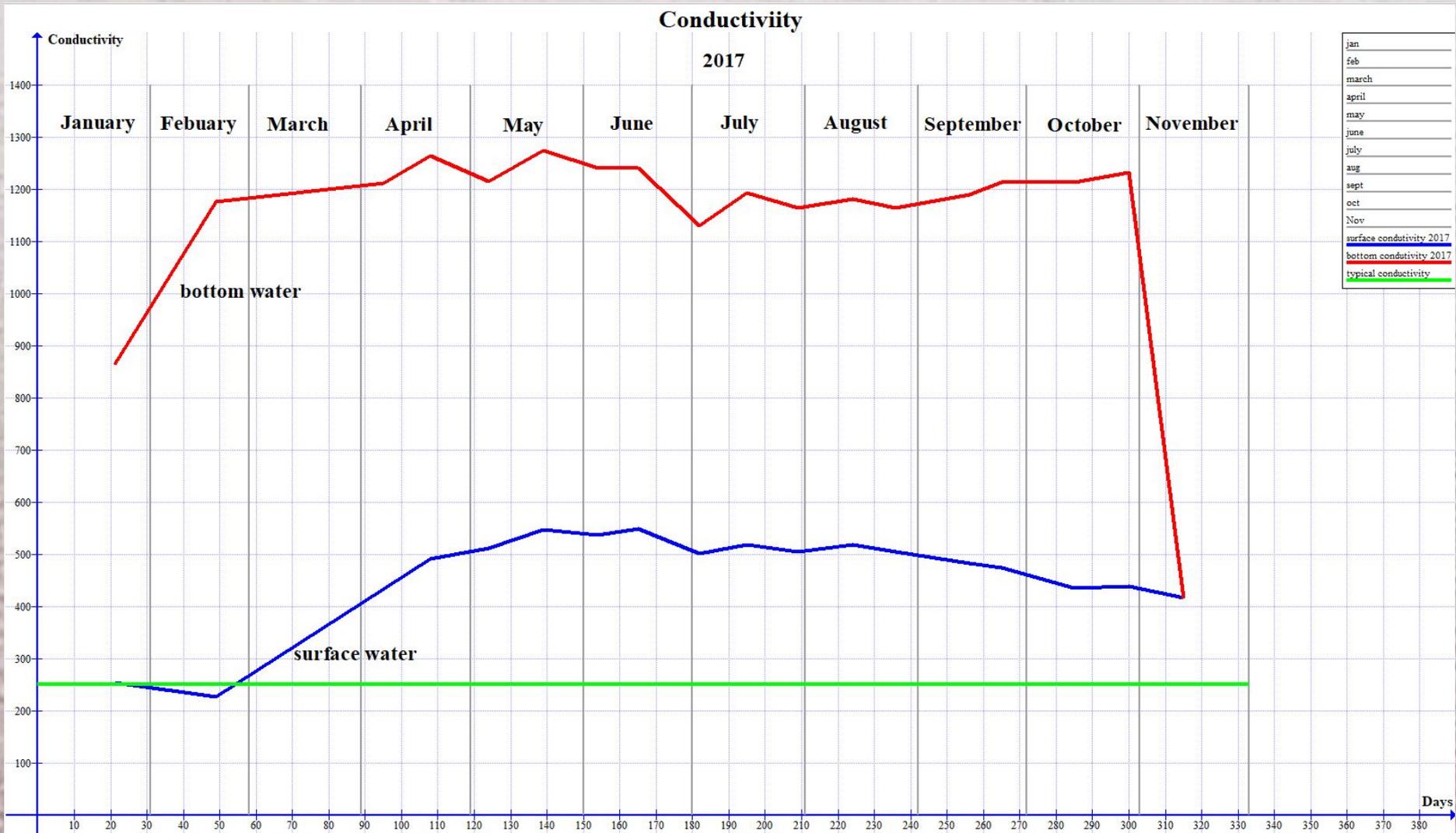
Conductivity 2015



Conductivity 2016



Conductivity 2017

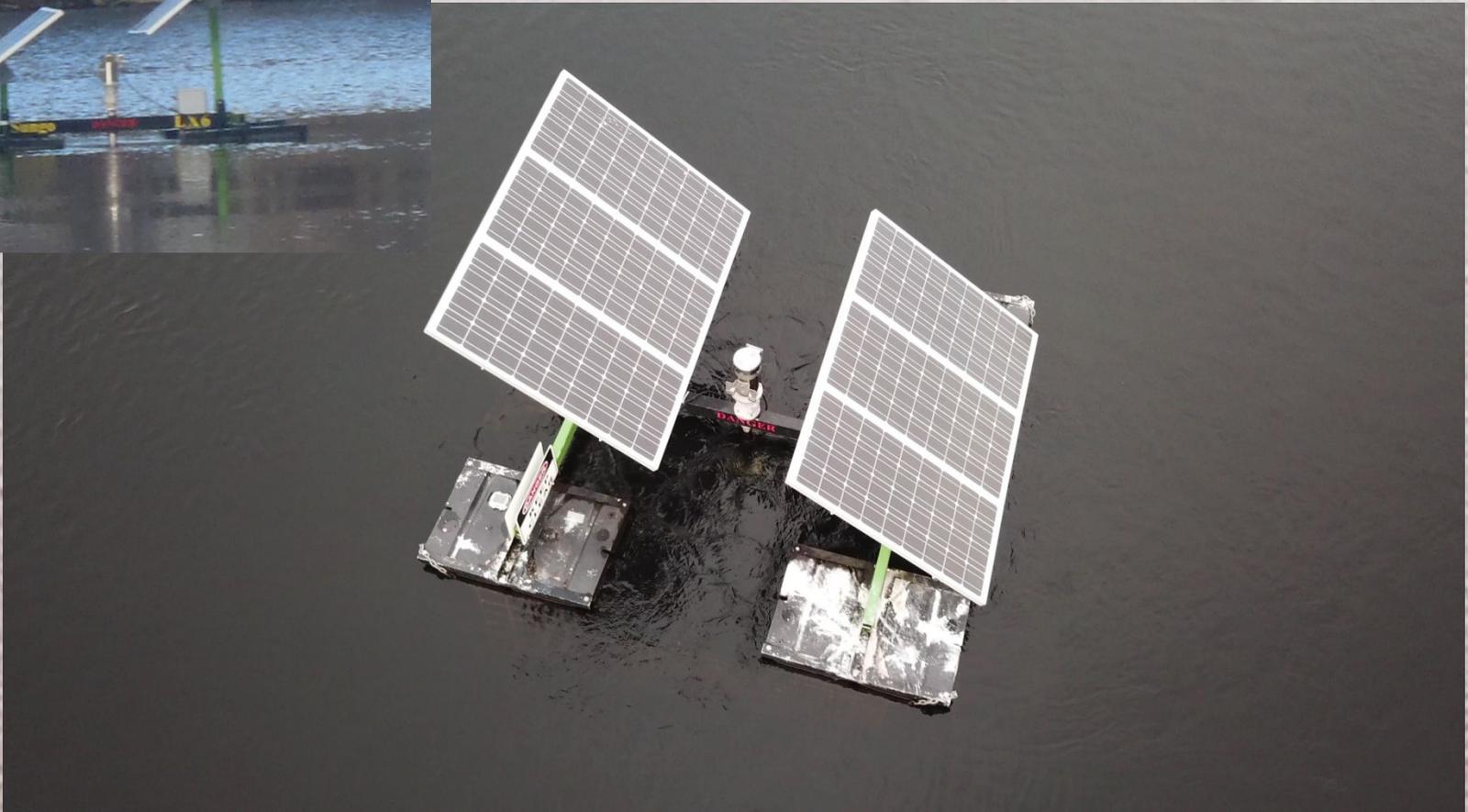


Issue oxygen

- For the trout and other fish species survival
- To prevent phosphorous release from the metal compounds on the bottom

An Aquago

getting the oxygen back

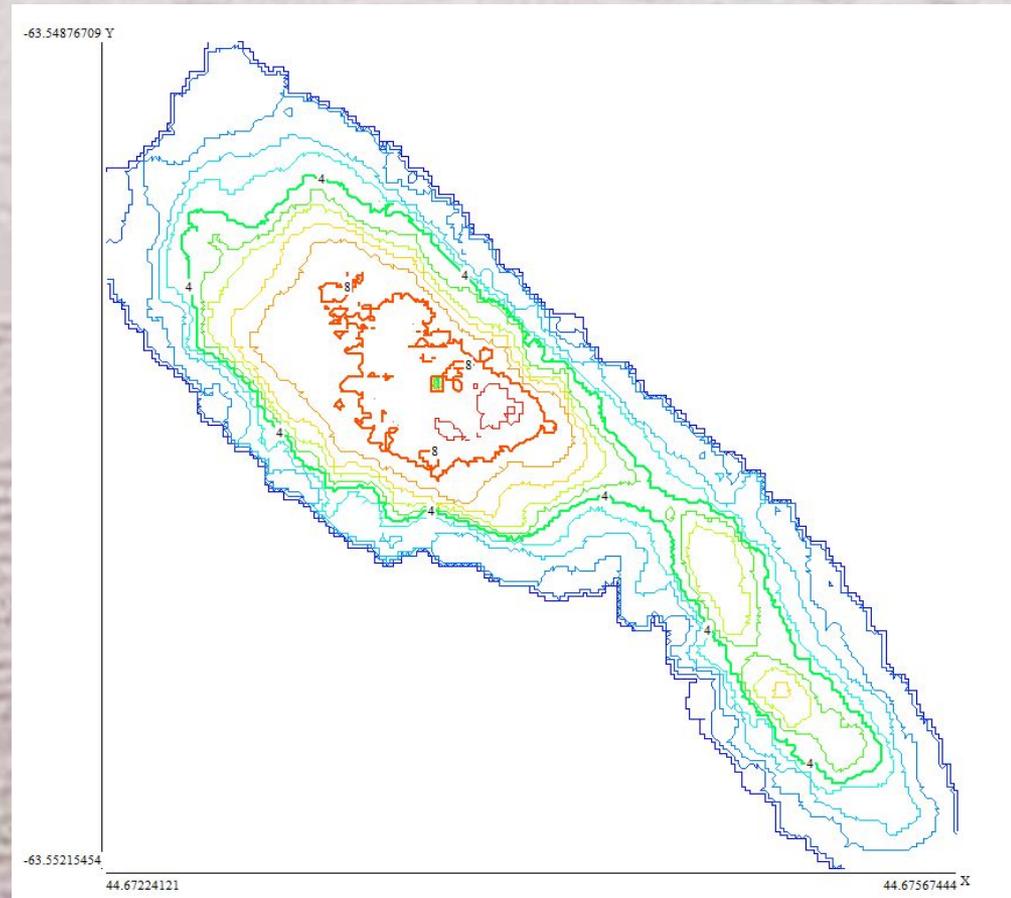


Aquago

- Solar powered water circulator
- 56 cm impeller draws water to the surface during the daylight
- The nutrients are taken up quickly by phytoplankton during the day when they are producing oxygen – not at night when they are consuming oxygen.
- Draws from above the thermocline so as not to break down summer stratification. So about 3 to 4m down.
- Diffusion during summer and spring and fall cycling will raise O_2 to the bottom

O₂ Target

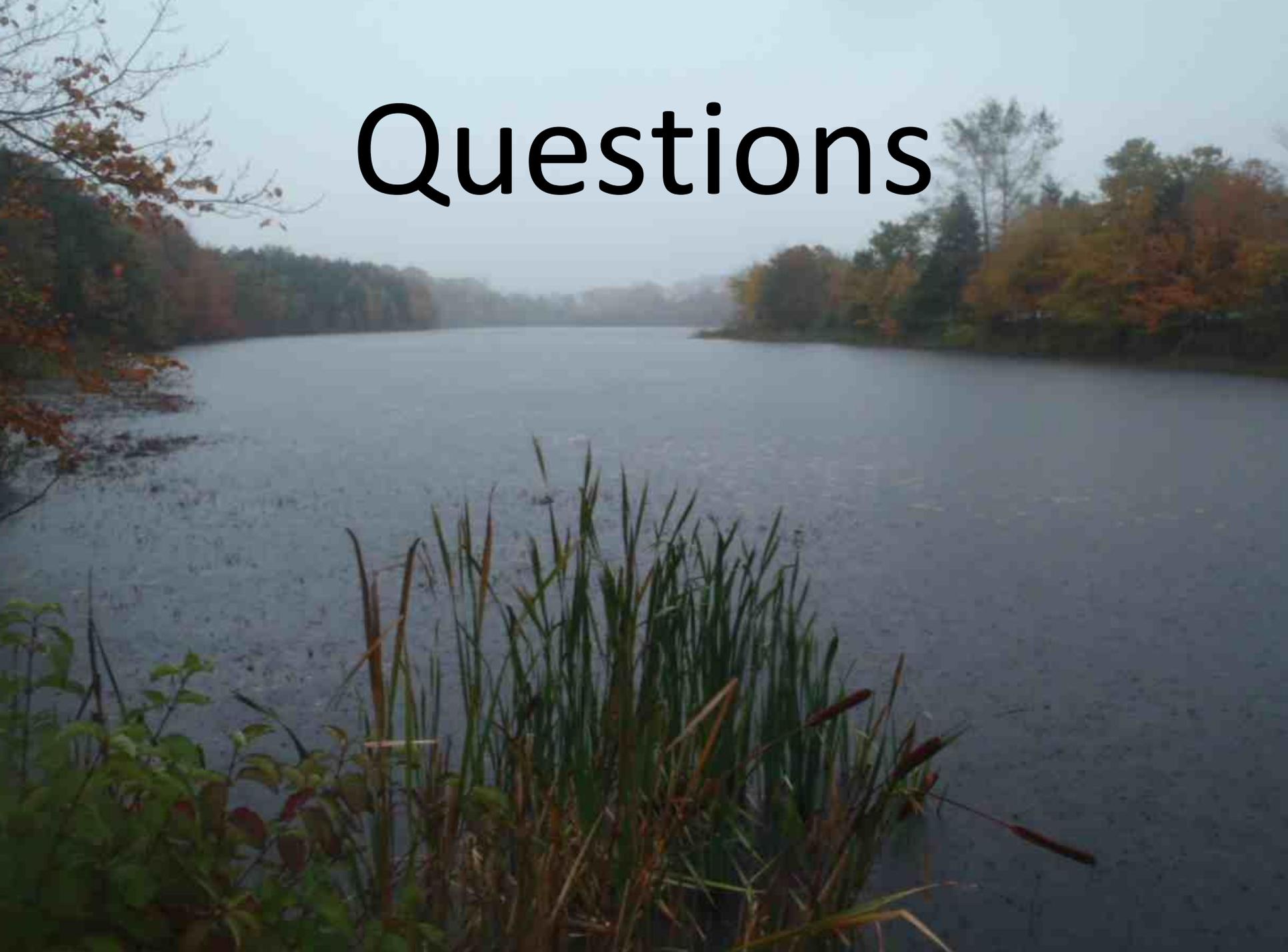
- Year 1 was to maintain O₂ above 2mg/l down to the 6m mark
- Year 2 hoped to do better but didn't between mid July to mid Sept
- Year 3 kept oxygen to the bottom around 1mg/l but low in water column
- Organic muck depth at 8.5m on the bottom has been reduces by 2/3. Gone from most of the lake



Aquago

- Over time O_2 levels at the bottom will be maintained above 2mg/l
- This will prevent the release of P from Fe and Mn compounds in the sediments.
- Bring the internal cycling of Phosphorous cycle under control
- Thus lowering the trophic level
- Time line 4 to 5 years of operation
- Mixing of summer water may lower the overall temperature above the thermocline by 1 to 2 degrees

Questions

A scenic view of a lake surrounded by trees with autumn foliage. The water is calm and reflects the overcast sky. In the foreground, there are tall reeds and some green plants. The trees on the banks are in various stages of autumn, with some showing vibrant orange and yellow leaves, while others are still green. The overall atmosphere is quiet and serene.