Wisconsin Lake & Pond Resource LLC

"Providing Professional Resources for Management of Your Lake or Pond"

Sludge Controlling Bacteria Within a Pond Ecosystem

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Abstract:

Ponds both private or public have a problem with the increase of sediment depth at the bottom of the pond, commonly known as "muck". Dredging has always been the go to source for help. However, a new type of microbial bacteria has been created by Aquafix, Inc. that may eliminate this problem. Aquafix, Inc. and Wisconsin Lake & Pond Resource LLC have teamed up to see if indeed these bacteria are the answer to all pond owners' prayers. The results show signs that they may be the answer for the reduction of sediment depth, amount of organic matter, and total phosphorous within a pond. There are no signs of stopping these bacteria from being the real ticket to helping a pond's overall state of healthiness.

Introduction:

Most ponds are constructed for either private recreation or required by the statues of the state as Storm-water Retention ponds. These ponds, whether private or public, are being managed for water quality parameters on a more regular basis. Examples of management being used are algae treatments, aeration, fish stocking, etc. However, one of the more important problems is usually overlooked. This problem is the constant increase of organic sediment (muck) throughout the years. The increase of organic sediment reduces the overall depth of the pond, adds available nutrients for algae/aquatic vegetation growth, and lessens the healthiness of the pond's ecosystem.

The most common way of removing the excessive amounts of organic sediment is by dredging, which can be very expensive and cost inhibitive. Dredging refers to the excavation of the bottom material of a pond or lake. The material is removed and placed somewhere on site or brought to a different area for disposal. Until recent years this was thought to be the only way to get rid of the excess sediment in a pond.

Microbial bacteria have been proven to be a very effective management tool in lakes and ponds. Bacteria clarify lake and pond water, break down organic matter, reduce accumulated bottom sludge, remediate ammonia and phosphates, minimize odors, eliminate excess nutrients, and safely accelerate biological activity to fortify overall pond health. (Seth Gade, 2009)

Bacteria are present in every aquatic system. Most often, indigenous (naturally occurring) bacteria are "lazy" and provide little management benefits. The natural

bacteria within a pond do not decompose or remove the solids fast enough to reduce the mass of sediment within a pond. This leads to build-up of solids and eventually dredging of the pond. For this reason, augmented bacteria are added to the system. We use bacteria for remediation of an unhealthy failing lake or pond, and as a water quality enhancer. Bacteria do require oxygen, which is achieved by properly aeration of the body of water.

Aquafix Inc., a wastewater treatment company, has cultured what may be the right species of bacteria to make this possible. If this is possible, dredging may be prolonged for many more years or even removed out of the help category for good.

Wisconsin Lake & Pond Resource LLC and Aquafix Inc. have teamed up to see if the Sludge Reducing Bacteria (SRB) that is being cultured truly has an impact on the amount of organic sediment that sits at the basin of a pond. Using a client's pond that Wisconsin Lake & Pond Resource provides professional management services; we started to research the exact effects the bacteria causes on the organic matter of the pond.

Materials and Methods:

Materials and Equipment used:

- 100 lbs/application WLPR Sediment Reducing Bacteria (400 lbs total)
- Stihl Blower with Hopper Attachment
- 5 lb Calibrated Scoop
- Measuring Rod
- Eckman Dredge
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- Plastic Bottles
- Bushnell Scout Rangefinder

On the first day of sampling, the pond's acreage was calculated using a Bushnell Scout rangefinder. This was taken at the longest and the widest point of the pond. The length and width measurements of the pond being studied are 84 feet by 243 feet. Using the formula of (Length X Width)/ 43,560 gave us a total of .469 acres. The pond's average depth at the beginning of the study was found to be 4.52 feet. This measurement was obtained by splitting the pond into nine equally spaced research points.

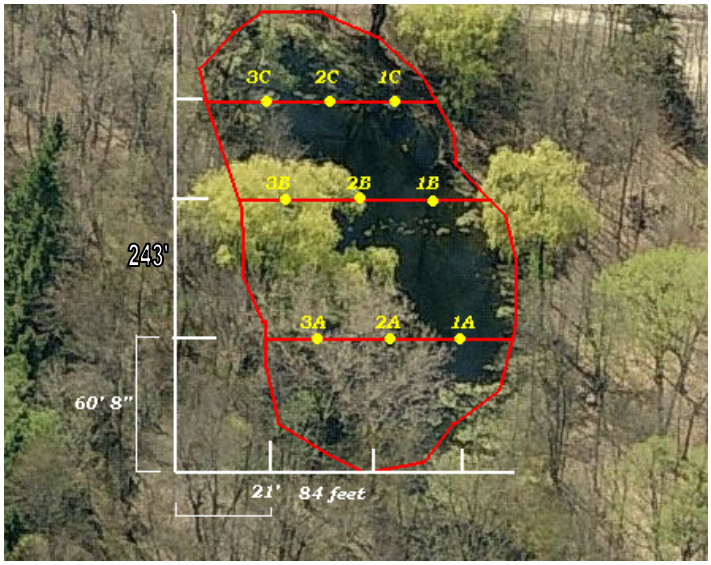


Figure 1. Aerial View of Charlesworth Pond from North

After all nine points were marked and recorded, we lowered a measuring rod (calibrated into inches) into the water until the rod rested at the top of the organic sediment. The depth was marked off and recorded. After the depth of the pond was recorded, the rod was then pushed into the soft sediment until it stopped on the gravel/clay basin of the pond (the original hard pan). This measurement was also recorded.

Figure 2. Taking Sediment and Water Depths

At each of the nine points, a sediment sample was obtained using an Eckman dredge and then deposited into a plastic bottle provided by Northern Lake Service, Inc. All bottles were completely filled with the soft sediment material. This was performed a second time when all monthly applications were finished in September.

Figure 3. Preparing to use Eckman dredge

Figure 4. Putting sediment material into plastic sampling bottle

After all nine sediment depths, water depths, and sediment samples were collected and recorded; the first application of 100 pounds of WLPR Sediment Reducing Bacteria was applied. The pond was divided into four sections of 60'8''X21' for the treatment. Twenty-five pounds were distributed across the surface of these sections equally. A container calibrated to hold five pounds of SRB was used to fill the hopper of the blower.

Figure 5. Picture of blower with hopper attachment used for bacteria application

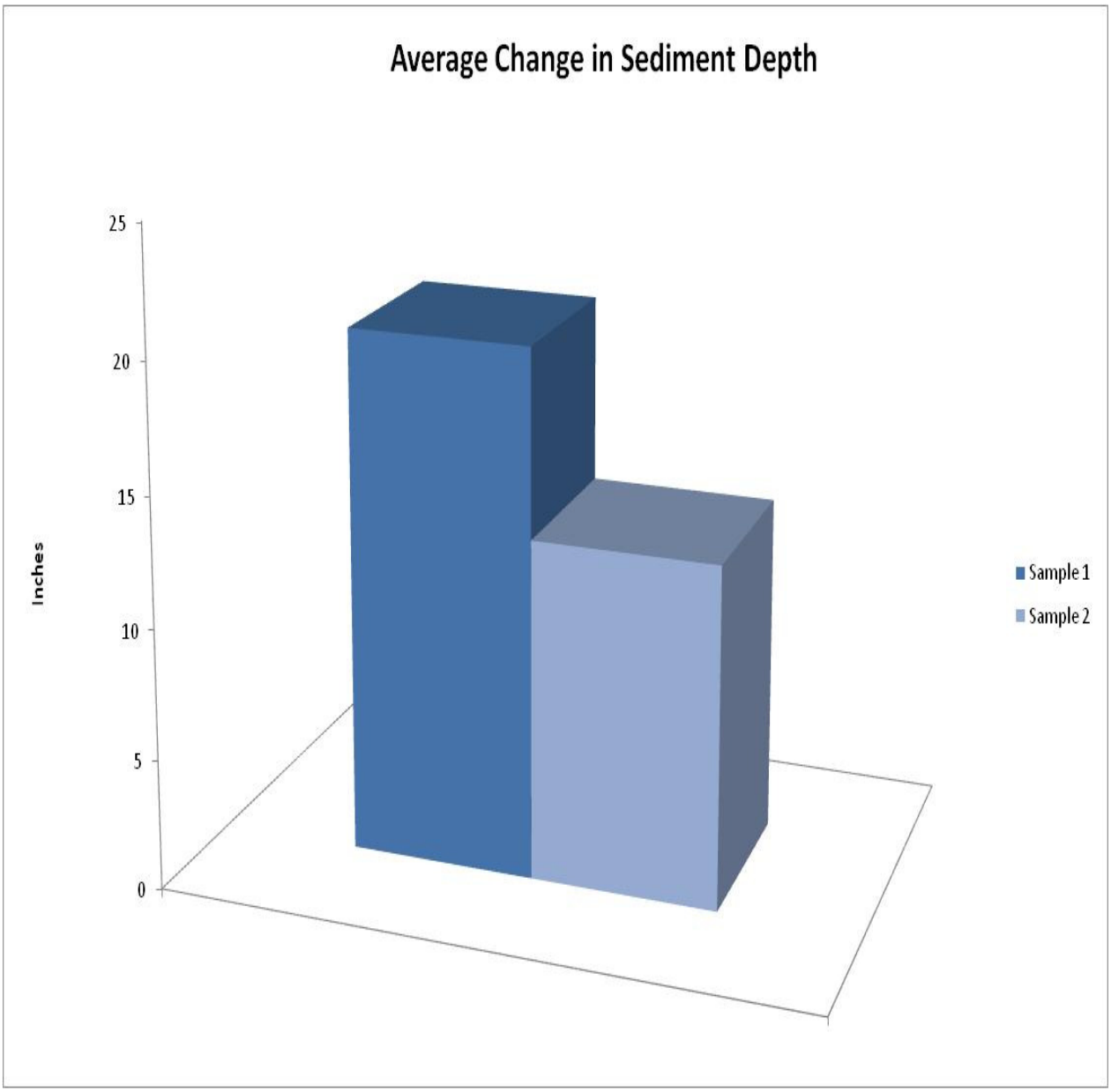
Figure 6. Application of Sediment Bacteria (note-not the Charlesworth Research Pond)

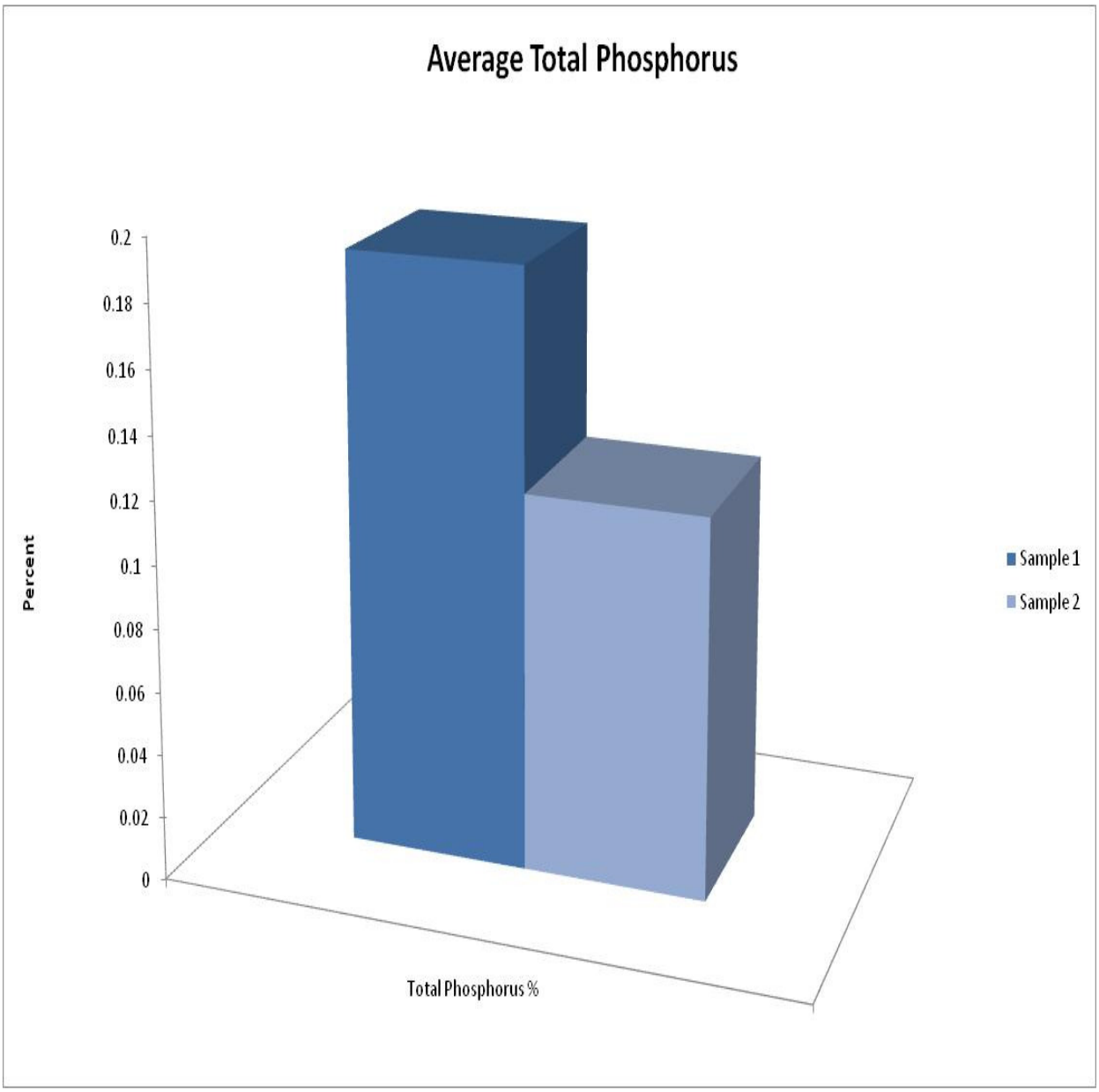
The hundred pounds of bacteria was then applied for the next four months (May to September). Once the final application was applied in September, another measurement of overall sediment depth was recorded along with a visual measurement of water clarity. We compared these results to the first application also being noted. Note that a second overall water depth was not recorded due to the pond dropping an excess of two feet over the time period of the study.

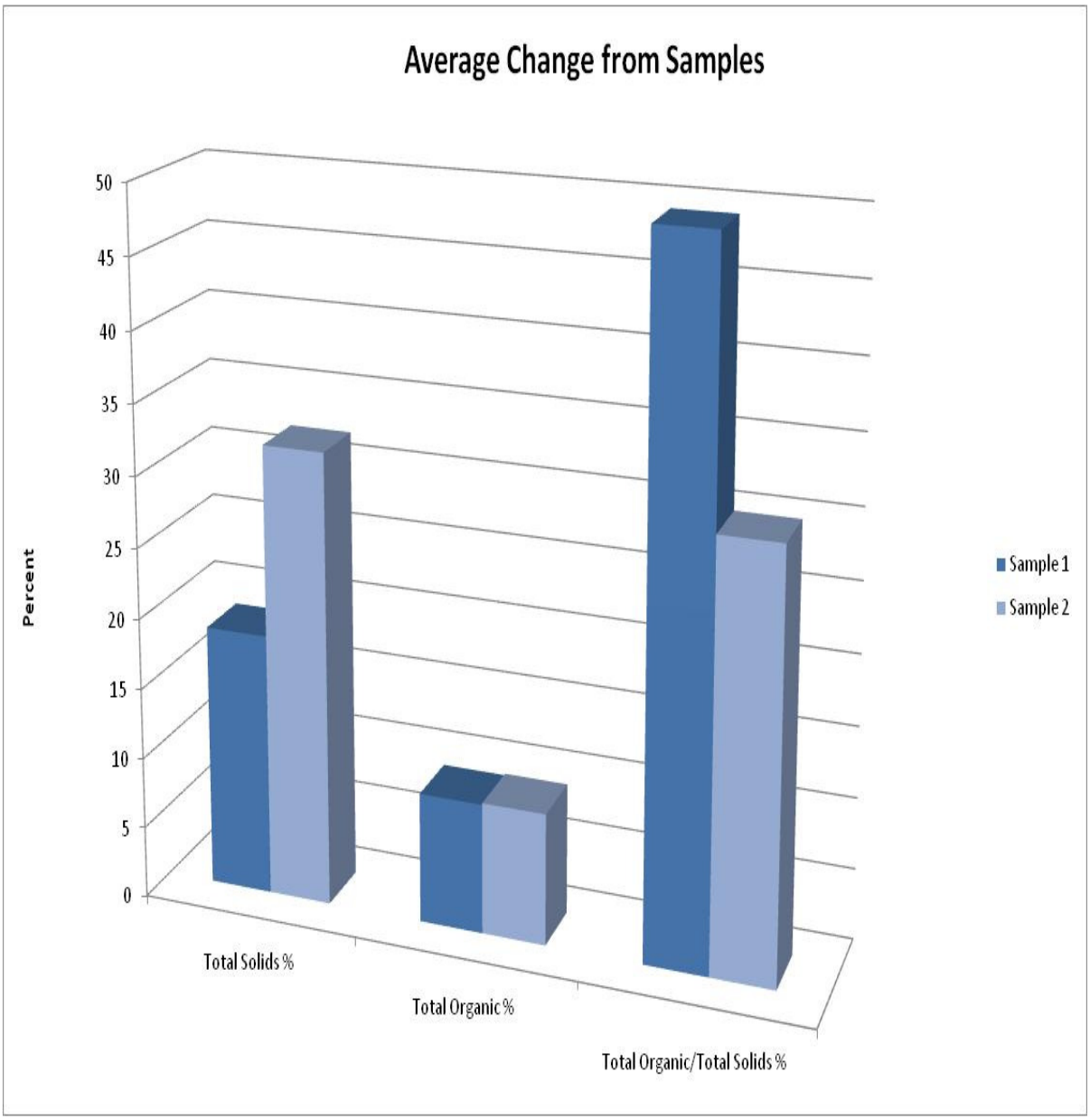
Sediment samples were also taken at all nine points after the final application. All of the samples were then sent off to the labs at Northern Lake Service, Inc. and tested for the presence of organic material within the soft sediment. The sediment was tested for total solids percent by weight, percent organics, and total phosphorous within each sample.

Results and Discussion:

Sediment samples were collected during the first pond consult and once again after all four hundred pounds of SRB were applied to the pond over the four month period. The following results were tested and obtained from Northern Lake Service, Inc.


Average Change in Sediment Depth
Inches
25
20
15
10
5
0
Sample 1
Sample 2


Average Total Phosphorus
Percent
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Total Phosphorus %
Sample 1
Sample 2



As the data displays there was a significant drop of Phosphorous totals, percent organic to percent solid, and overall depth of the sediment. The ratios decreased significantly between the two samples. The ratio of total organic/total solids for the first sample was a high 49.3 percent. This shows the large amount of organic material that was actually within the substrate of the pond. Also the 19 percent phosphorous in the water could be the reason for the pond being covered in both filamentous algae and duckweed.

Drastic results were obtained after the second sediment collection was gathered. The ratio went from 49.3 percent, all the way down to 28.9 percent. The fact that the percentage went down approximately twenty percent in the four month study is remarkable. The total amount of phosphorous also showed a change in the positive direction for the pond's ecosystem. The phosphorous dropped seven percent over the time period of the study.

Both the drop in phosphorous and amount of organics in the sediment are great to see but the real eye opener is the reduction in the overall depth and clarity of the pond. The sediment depth lowered an incredible 7.21 inches. A water depth could not be taken the last time at the site due to the pond's water level dropping an approximate two feet. Also the visual clarity of the pond went from forty percent on day one to nearly ninety percent visibility on the last day of the study.

Looking at the results it is easy for an individual to say that the bacteria did indeed work. All of the assumed results of the SRB were at the end obtained. The reduction of sediment depth, phosphorous levels, and percentage of organics in the soil shows strong correlation with the alternative hypothesis that the bacteria will have an impact on the pond's ecosystem health in a positive way.

However, there are still many variables when dealing with anything outdoors. The amount of invertebrates in the pond sediment, weather conditions, amount of water run-off, time of year, etc. These can all have an impact on the selected items tested that we as biologists can't control. The size of the pond and location may also have an impact on whether the results were skewed in any way.

If more study on the microbial sludge reducing bacteria is to be done, a pond that does not collect large amounts of organic matter may be easier to watch over the years. The pond selected had many willow trees and hardwood trees surrounding its perimeter that may have put enough organic material into the pond to put the study back at ground zero. A pond that has a lot of "sludge" that is in more of an open environment may be easier to watch if a study is to go more than one season.

Conclusion:

If the results achieved in this study hold true, the results in ponds nationwide may be limitless. The need for dredging may be prolonged for tens to hundreds of years. This could save individuals a great deal of money. Being proactive and reducing the amount of pond sediment using these bacteria may lead to ponds never being dredged again. Aquafix, Inc. and Wisconsin Lake & Pond Resource, LLC are on the right path to something that may lead the way to the removal of the overlooked problem of sediment depth within a pond

Acknowledgements:

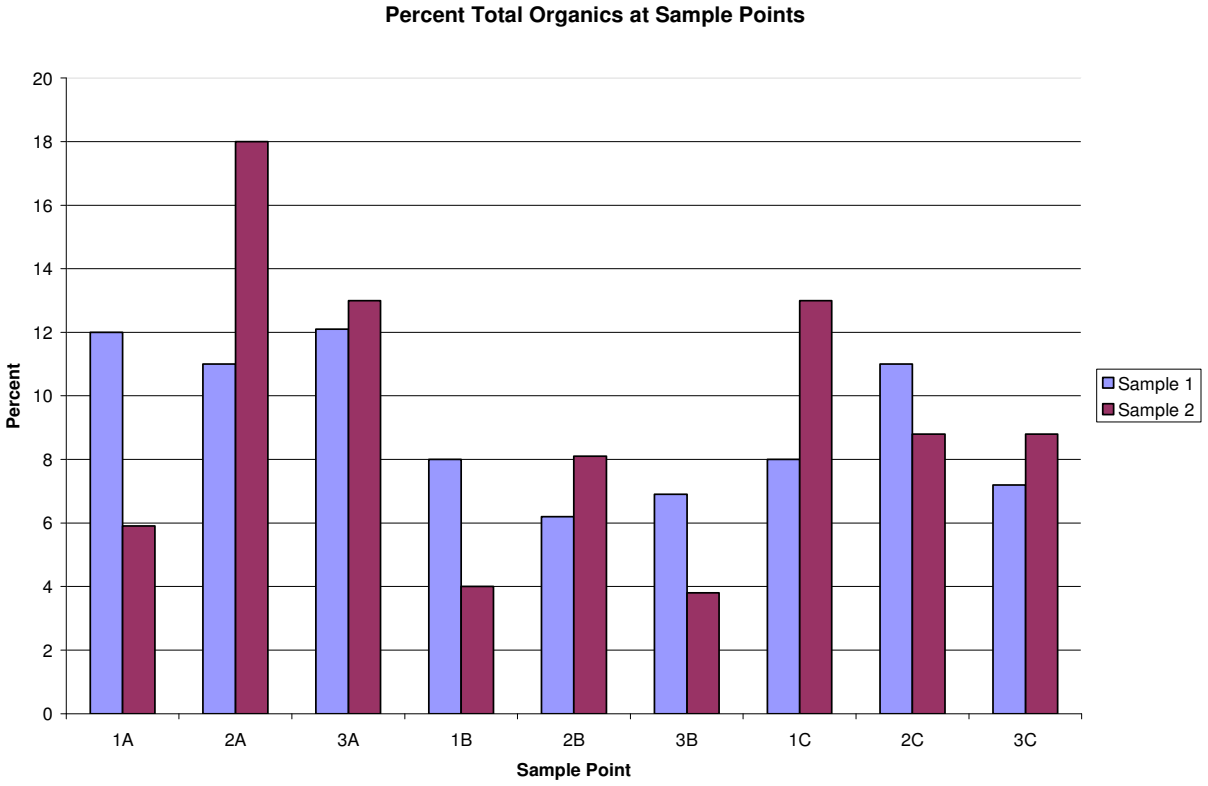
- Cory Zickert, Senior Biologists/Owner- Wisconsin Lake & Pond Resource, LLC
- Seth Gade, Pond Management Specialist- Wisconsin Lake & Pond Resource, LLC
- Aquafix, Inc.
- Northern Lake Service, Inc.

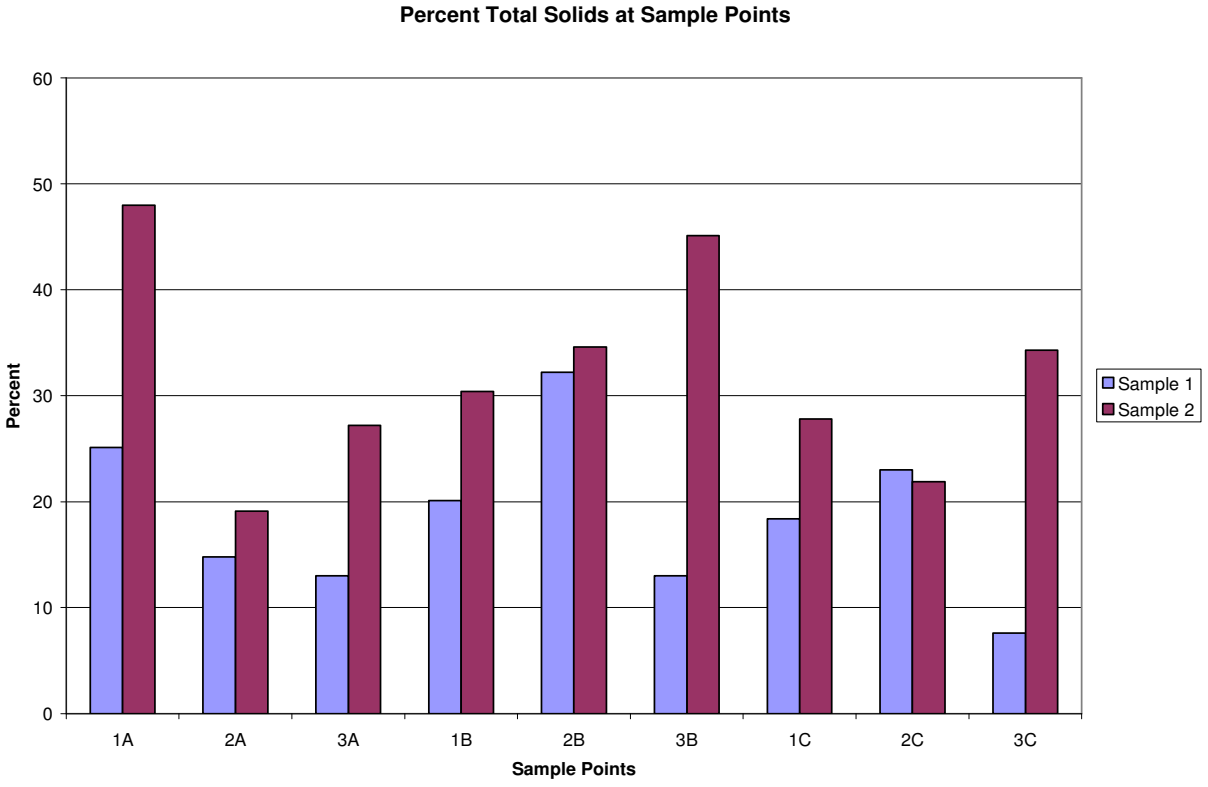
References:

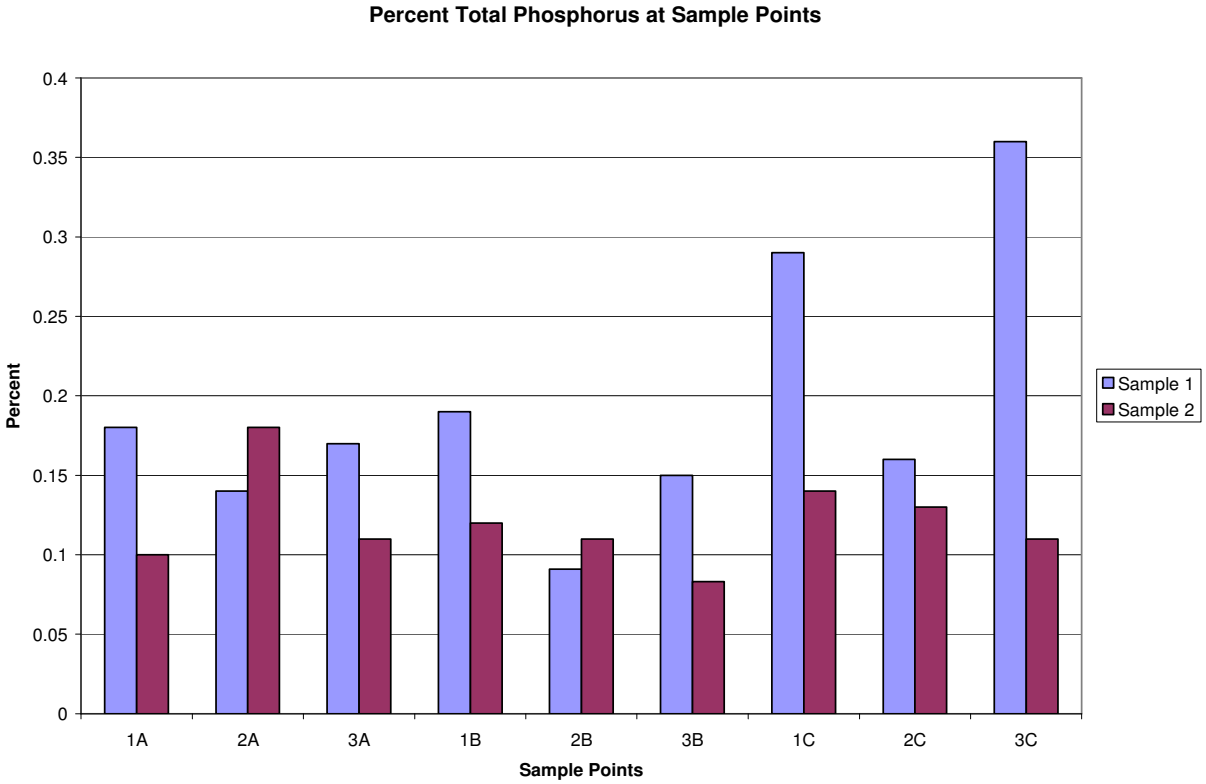
- Gade, Seth A. "Microbial Bacteria Benefits and Biology." Personal interview. 26 Oct. 2009.

Appendix:

Sample ID		First Sample	Second Sample
1A			
	Tot. Phos.	0.18%	0.10%
	Tot. Solids:	25.10%	48.00%
	Tot. Organic:	12.00%	5.90%
2A			
	Tot. Phos.:	0.14%	0.18%
	Tot. Solids:	14.80%	19.10%
	Tot. Organic:	11.00%	18.00%
3A			
	Tot. Phos.:	0.17%	0.11%
	Tot. Solids:	13.00%	27.20%
	Tot. Organic:	12.10%	13.00%
1B			
	Tot. Phos.:	0.19%	0.12%
	Tot. Solids:	20.10%	30.40%
	Tot. Organic:	8.00%	4.00%
2B			
	Tot. Phos.:	0.091%	0.11%
	Tot. Solids:	32.20%	34.60%
	Tot. Organic:	6.20%	8.10%
3B			
	Tot. Phos.:	0.15%	0.083%
	Tot. Solids:	13.00%	45.10%
	Tot. Organic:	6.90%	3.80%
1C			
	Tot. Phos.:	0.29%	0.14%
	Tot. Solids:	18.40%	27.8%
	Tot. Organic:	8.00%	13.00%
2C			
	Tot. Phos.:	0.16%	0.13%
	Tot. Solids:	23.00%	21.90%
	Tot. Organic:	11.00%	8.80%
3C			
	Tot. Phos.:	0.36%	0.11%
	Tot. Solids:	7.60%	34.3%
	Tot. Organic:	7.20%	8.80%


Percent Total Organics at Sample Points
Percent
20
18
16
14
12
10
8
6
4
2
0
1A
2A
3A
1B
2B
3B
1C
2C
3C
Sample Point
Sample 1
Sample 2


Percent Total Solids at Sample Points
Percent
60
50
40
30
20
10
0
1A
2A
3A
1B
2B
3B
1C
2C
3C
Sample Points
Sample 1
Sample 2


Percent Total Phosphorus at Sample Points
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Percent
1A
2A
3A
1B
2B
3B
1C
2C
3C
Sample Points
Sample 1
Sample 2