

# Naturalake Biosciences Case Study 2021

## AQUA DOC, Lake & Pond Management

**INTRODUCTION:** A retention basin, is a manmade body of water designed to mitigate the discharge of stormwater. These bodies of water are commonly built around neighborhoods and often serve a recreational purpose as well. Without proper management practices, these basins soon fill up with loose sediments and “muck”. Muck is an accumulation of decomposing organic matter that contains high levels of Phosphorus and Nitrogen. While left unchecked, muck can cause nuisance vegetation growth, noxious smells, Harmful Algal Blooms (HABs), and ultimately lead to human health concerns to those that live nearby.

A local community board contracted AQUA DOC to provide routine maintenance of several ponds shown in Figure 1. In addition, AQUA DOC was contracted to apply MuckBiotics (along with other Naturalake Biosciences products, See Discussion) to these ponds and record before and after depth measurements of the muck levels. MuckBiotics is a probiotic designed to accelerate the digestion of organic matter. These ponds have suffered multiple years constant runoff, and as a result, have accumulated critical levels of muck, Phosphorus, and algae.

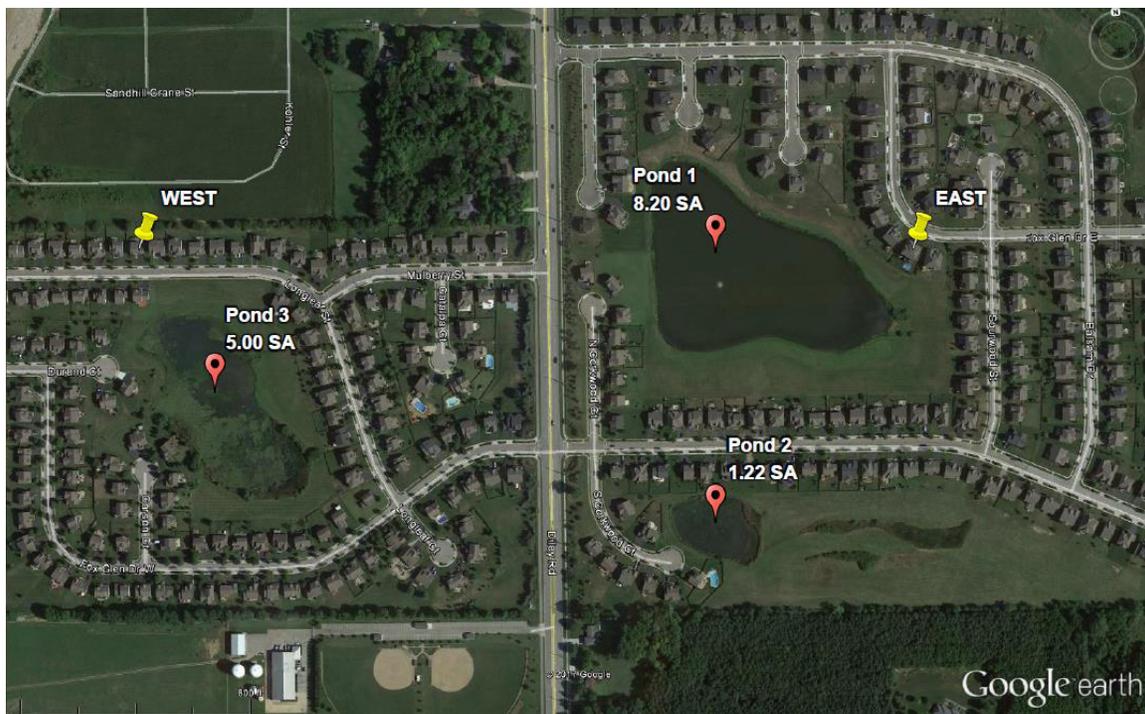


Figure 1. Map of ponds. Fox Glen Ponds labeled 1-3. Note: map orientation N.

**METHOD:** Due to certain limitations, MuckBiotics were only applied to sections of concern in each pond (inflows and littoral zones). Additionally, depth measurements were focused on Pond 2, while growth species/coverage and water clarity were focused in the other 2 ponds. A total of 410 lbs were evenly distributed across each pond with respects to size of pond/focus area. Each pond was monitored every 2 weeks from April to September and received supplemental algal treatments as well as infrequent herbicide applications. MuckBiotic applications were only made when consistant water temperatures were above 55 degrees Fahrenheit.

Pond 1 was measured at 8.20 surface acres with a maximum water depth of approximately 3-4 ft. It received 150 lbs of MuckBiotics dosed in 5 separate visits. The first 1/3 of the East side of the pond and littoral zone received the bulk of the applications. Applications were made roughly once a month (30 lbs per application, May-September). Growth was noted between April - June in Table 1 with a max coverage of 80% of the pond. Growth was again noted between September - November with a max coverage of 20% (See Results).

<b>Pond 1 Recorded Growth: April - June</b>		
<b><u>Name</u></b>	<b><u>Type</u></b>	<b><u>Max Coverage</u></b>
Spirogyra	Filamentous Algae	40%
Pithophora	Filamentous Algae	70%
Chara	Macro- Algae	40%
Microcystis	Cyanobacteria (Blue-green Algae)	20%
Broad-leaf Pondweed	Rooted-floating Vegetation	20%
Narrow-leaf Pondweed	Submerged Vegetation	50%
Sago Pondweed	Submerged Vegetation	20%
<b>Total Coverage =</b>		<b>80%</b>

Table 1. List of identified growths in Pond 1, their classifications, and max coverage from April - June.

Pond 2 was measured at 1.22 surface acres with a maximum water depth of approximately 2 ft. It received 60 lbs of MuckBiotics dosed in 6 separate visits. Applications were applied evenly throughout the pond and roughly every 21-30 days (10 lbs per application, May-September). Growth was noted between April - June in Table 2 with a max coverage of 40% of the pond. Growth was again noted between September - November with a max coverage of 20% (See Results).

Pond 2 Recorded Growth: April - June		
<u>Name</u>	<u>Type</u>	<u>Max Coverage</u>
Spirogyra	Filamentous Algae	30%
Pithophora	Filamentous Algae	30%
Broad-leaf Pondweed	Rooted-floating Vegetation	<10%
Watermeal	Floating Vegetation	<10%
<b>Total Coverage =</b>		40%

Table 2. List of identified growths in Pond 2, their classifications, and max coverage from April - June.

Furthermore, Pond 2 was mapped in 50 ft increments. A depth analysis was performed in April to measure both water depth and sediment (muck) depth at each corresponding cross-section represented in Figure 2. Data was recorded in Table 3 and marked to show muck level trends. Overall, there was an average water depth of 1.21 ft, and average sediment depth of 0.96 ft.



Figure 2. Pond 2 map including grid, intervals are 50x50ft. Pond area is 1.22 ac. Note: map orientation N.

Fox Glen Pond 2: Before							
Date: 4/23/19		Size: 1.22 SA		Orientation: 0° N			
	ft	A	B	C	D	E	F
<b>1</b>	Depth	X	0.25	0.75	1.00	1.00	X
	Sediment	X	1.50	1.50	1.00	1.25	X
<b>2</b>	Depth	1.00	2.00	1.50	1.50	1.00	X
	Sediment	1.00	0.75	1.00	1.00	1.25	X
<b>3</b>	Depth	X	1.50	2.25	2.00	1.50	X
	Sediment	X	1.00	0.75	1.00	0.75	X
<b>4</b>	Depth	X	0.50	1.50	1.50	1.50	0.25
	Sediment	X	1.00	0.75	1.25	0.75	0.25
<b>5</b>	Depth	X	X	X	X	0.50	X
	Sediment	X	X	X	X	0.50	X
Average Water Depth =						1.21	ft
Average Sediment Depth =						0.96	ft
Total Sediment (0.96 ft sed. X 1.22 SA) =						1.17	ac-ft
Total Sediment (1.17 ac-ft x 1,615 yd <sup>3</sup> /ac-ft) =						1,893	yd <sup>3</sup>

Table 3. April water and sediment depths at corresponding transects. Color coding indicates trends in sediment depth.

Pond 3 was measured at 5.00 surface acres with a max water depth of approximately 2 ft. It received 200 lbs of MuckBiotics dosed in 4 separate visits. Applications were applied evenly throughout the pond once a month (50 lbs per application, May-August). Growth was noted between April - June in Table 4 with a max coverage of 90% of the pond. Growth was again noted between September - November with a max coverage of 20% (See Results).

Pond 3 Recorded Growth: April - June		
Name	Type	Max Coverage
Spirogyra	Filamentous Algae	50%
Pithophora	Filamentous Algae	90%
Duckweed	Floating Vegetation	20%
Broad-leaf Pondweed	Rooted-floating Vegetation	<10%
Narrow-leaf Pondweed	Submerged Vegetation	80%
Coontail	Submerged Vegetation	30%
Total Coverage =		90%

Table 4. List of identified growths in Pond 3, their classifications, and max coverage from April - June.

**RESULTS:** Pond 1 experienced a 60% reduction in max growth. Several types of growths were reduced to 0% by the end of November. A minimum total coverage of 20% was recorded in November as well. Majority of remaining growth was vascular growth. Broad-leaf Pond did not experience any changes, however, had migrated to shallower areas that were previously hosted by primarily algal species. Noted but not documented, a minor amount of Spatterdock (Emergent Vegetation) began to grow after algal levels decreased.

<b>Pond 1 Recorded Growth</b>					
<u>Name</u>	<u>Type</u>	<u>Apr – Jun Max Coverage</u>	<u>Sept – Nov Max Coverage</u>	<u>% Difference</u>	<u>Nov Min Coverage</u>
Spirogyra	Filamentous Algae	40%	<5%	*-35%	0%
Pithophora	Filamentous Algae	70%	10%	-60%	0%
Chara	Macro- Algae	40%	0%	-40%	0%
Microcystis	Blue-green Algae	20%	0%	-20%	0%
Broad-leaf Pondweed	Rooted-floating Vegetation	20%	20%	0%	20%
Narrow-leaf Pondweed	Submerged Vegetation	50%	<5%	*-45%	<5%
Sago Pondweed	Submerged Vegetation	20%	20%	0%	10%
*Approximately	<b>Total Coverage =</b>	80%	20%	-60%	20%

Table 5: List of identified growths in Pond 1, their classifications, and coverages from April - November.



Figure 3. Before (June) and After (October) photos of Pond 1.

Pond 2 experienced a 30% reduction in maximum growth. Similar to Pond 1; several types of growths were reduced to 0% by the end of November. A minimum total coverage of 20% was recorded in November as well. Majority of remaining growth was vascular growth. Broad-leaf Pondweed experiences a rough 5% increase in coverage.

<b>Pond 2 Recorded Growth</b>						
<u>Name</u>	<u>Type</u>	<u>Apr - Jun</u> <u>Max Coverage</u>	<u>Sept - Nov</u> <u>Max Coverage</u>	<u>%</u> <u>Difference</u>	<u>Nov Min</u> <u>Coverage</u>	
Spirogyra	Filamentous Algae	30%	<5%	*-25%	0%	
Pithophora	Filamentous Algae	30%	<10%	-20%	0%	
Broad-leaf Pondweed	Rooted-floating Vegetation	<10%	10%	*+5%	10%	
Watermeal	Floating Vegetation	<10%	<1%	*-5%	<1%	
*Approximately		<b>Total Coverage =</b>	40%	10%	-30%	10%

Table 6: List of identified growths in Pond 2, their classifications, and coverages from April - November.

Pond 2 also experienced a tremendous reduction in muck. The average sediment depth saw a 0.3 ft reduction, and respectfully, the average water depth increased 0.3 ft. Overall, the pond resulted in a 597 yd<sup>3</sup> reduction in muck volume. Some transects even experienced reductions as high as 50%.

<b>Fox Glen Pond 2: Before</b>							
<b>Date: 4/23/19</b>		<b>Size: 1.22 SA</b>		<b>Orientation: 0° N</b>			
	<b>ft</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>1</b>	Depth	X	0.25	0.75	1.00	1.00	X
	Sediment	X	1.50	1.50	1.00	1.25	X
<b>2</b>	Depth	1.00	2.00	1.50	1.50	1.00	X
	Sediment	1.00	0.75	1.00	1.00	1.25	X
<b>3</b>	Depth	X	1.50	2.25	2.00	1.50	X
	Sediment	X	1.00	0.75	1.00	0.75	X
<b>4</b>	Depth	X	0.50	1.50	1.50	1.50	0.25
	Sediment	X	1.00	0.75	1.25	0.75	0.25
<b>5</b>	Depth	X	X	X	X	0.50	X
	Sediment	X	X	X	X	0.50	X
<b>Average Water Depth =</b>						<b>1.21</b>	<b>ft</b>
<b>Average Sediment Depth =</b>						<b>0.96</b>	<b>ft</b>
<b>Total Sediment (0.96 ft sed. X 1.22 SA) =</b>						<b>1.17</b>	<b>ac-ft</b>
<b>Total Sediment (1.17 ac-ft x 1,615 yd<sup>3</sup>/ac-ft) =</b>						<b>1,893</b>	<b>yd<sup>3</sup></b>

Table 6: List of identified growths in Pond 2, their classifications, and coverages from April - November.



Figure 4. Before (June) and After (October) photos of Pond 2.

Pond 3 experienced an 80% reduction in max growth. Again, several types of growths were reduced to 0% by the end of November. A minimum total coverage of 5% was recorded in November as well. Majority of remaining growth was vascular growth. Broad-leaf Pondweed experiences a rough 5% increase in coverage.

<b>Pond 3 Recorded Growth</b>					
<b>Name</b>	<b>Type</b>	<b>Apr – Jun Max Coverage</b>	<b>Sept - Nov Max Coverage</b>	<b>% Difference</b>	<b>Nov Min Coverage</b>
Spirogyra	Filamentous Algae	50%	<5%	*-45%	0%
Pithophora	Filamentous Algae	90%	<10%	*-80%	0%
Duckweed	Floatiing Vegetation	20%	<10%	*-10%	<1%
Broad-leaf Pondweed	Rooted-floating Vegetation	<10%	10%	*+5%	5%
Narrow-leaf Pondweed	Submerged Vegetation	80%	<5%	*-75%	0%
Coontail	Submerged Vegetation	30%	10%	-20%	5%
*Approximately	<b>Total Coverage =</b>	90%	10%	-80%	5%

Table 8: List of identified growths in Pond 3, their classifications, and coverages from April - November.



Figure 5. Before (June) and After (October) photos of Pond 3.

**DISCUSSION:** Overall, after applying 460 lbs of MuckBiotics all ponds experienced a significant reduction in nuisance vegetation and algae. This can be attributed to the great reduction in muck levels. Additional Naturalake Biosciences products that were used to help promote beneficial bacteria included: Summer Slam, Pondzilla Pro, and Aqua Sticker. Reducing the total amount of muck directly reduces the total amount of Phosphorus residing within the muck. Phosphorus is the limiting nutrient required for nearly all green growing organisms. In abundant quantities, it causes major algal blooms in lakes and ponds. At critical levels, different types of blue-green algae can propagate, capable of producing deleterious and potentially lethal toxins. This poses major health concerns to neighboring houses, especially small children and pets. All organic matter contains levels of Phosphorus, therefore all organic materials that enter a body of water (grass clippings, leaves, bird waste, fish waste, etc.) will increase the muck level, thus increasing the Phosphorus level. This bioaccumulation is inevitable and cannot be stopped, however, it can be reduced with probiotics such as MuckBiotics. In doing so, one can promote the health of the aquatic ecosystem as well as extend the life of a pond or lake.



Figure 6. Granular spreader used to distribute MuckBiotics to hard-to-reach areas.

Allowing excessive accumulation of muck can lead to environmental concerns as well. Major algal blooms can block out sunlight and even prevent oxygen from diffusing into the water. In doing so, these algal species out compete native vegetation that benefit a lake or pond. Vegetation and algae compete for nutrients, therefore promoting native aquatic plants can also reduce nutrient loads and indirectly reduce algal blooms. In this study, Broad-leaf Pondweed growth was either unaffected by the application of MuckBiotics or promoted. This is a mutualistic benefit, as more of this native vegetation grows, it will help reduce Phosphorus, as well as provide surface area for the beneficial bacteria to host.

High levels of muck can also cause poor water clarity and quality. In addition to algal blooms blocking visibility, the loose sediment can become mixed into the water column. Water clarity was measured during the study but deemed too erroneous to discuss. Inconsistent readings were measured due to level of growth and heavy water flow periods. However, it was noted that there was an overall improvement in water clarity in November after much of the algal growth had dwindled and rain was less prevalent. In nearly all sections of each pond, sunlight was able to reach the bottom of the pond.

Some complications which occurred during the study could not be accounted for. Pond 1 and Pond 3 control much of the stormwater runoff of the neighborhood. Therefore, these two ponds experience heavier water flow during rain events. As a result, sediment depth readings could change too drastically between those periods and provide inaccurate data. The depth study was focused in Pond 2 because it received the lowest amount of runoff. Additionally, Pond 2 was designed as a bioretention pond, therefore it receives a lot of organic loading from local flora, as well as, it was small enough to easily control a more accurate depth study. After much of the algal growth had dwindled and rain was less prevalent. In nearly all sections of each pond, sunlight was able to reach the bottom of the pond.