MORSES POND ANNUAL REPORT: 2013

PREPARED FOR THE TOWN OF WELLESLEY

BY WATER RESOURCE SERVICES, INC.

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This report documents the implementation of the 2005 Comprehensive Morses Pond Management Plan through 2013. Program elements include: 1) phosphorus inactivation, 2) plant harvesting, 3) low impact development demonstration, 4) education, and 5) dredging.

Phosphorus Inactivation

Operational Background

A phosphorus inactivation system was established in the spring of 2008, in the north basin of Morses Pond. After testing and initial adjustment in 2008, the system has been operated in the spring and early summer of 2009 through 2013. The chemical pump station is portable, but is stationed for the treatment period at the Town of Wellesley Dale Street Pump Station. Four sets of lines run from the pump station into the north basin (Figure 1), each set consisting of an air feed line and two chemical feed lines. The phosphorus inactivation chemicals used for the treatment are aluminum sulfate (alum) and sodium aluminate (aluminate). Both are flocculating agents responsible for the inactivation of phosphorus, with alum creating acidic conditions and aluminate shifting the pH to a more basic level; both are added at a roughly 2:1 ratio (alum to aluminate, by volume) to balance the pH of treatments.

Two lines with single diffusers and sets of chemical ports near the end of each line run within the north basin to the mouths of Boulder Brook and Bogle Brook. This facilitates inlet treatment, generally considered the most effective means of inactivation, given mixing and settling as the streams proceed into the north basin. The other two lines, each with four diffusers and corresponding chemical ports, are spaced within the north basin itself to allow treatment of water in that basin. This allows treatment if operation is not possible from the start of a storm, or if additional treatment in the basin appears necessary. However, as spring progresses, dense vegetation within the north basin limits horizontal mixing and overall system efficiency, and these lines were removed in 2013.

After a year of initial testing (2008), alum and aluminate have been added to the north basin in May through at least late June to achieve a target total phosphorus level in the south basin of <20 ppb and preferably close to 10 ppb near the 4th of July (Table 1). Traditionally, algal blooms started about that time, necessitating copper treatments to regain water clarity and keep the beach open. It was thought that additional treatment during summer might not be necessary if the starting phosphorus level was low enough. No problems were noted in 2009, but algal blooms developed in August of 2010 and 2011. Responsive treatment helped, but was considered too late to prevent some loss of clarity. In 2010 the chemicals were available to respond to declining clarity in late July, but no action was taken. In 2011 the chemicals were not available when a response was deemed appropriate in late July, and it took two weeks to obtain the necessary chemicals. In 2012, sufficient chemical was on hand to respond to reductions in water clarity during summer, but system functionality problems limited the effectiveness of treatment. In 2013, chemicals were ordered and available from mid-July into August.

Figure 1. Phosphorus Inactivation System for Morses Pond

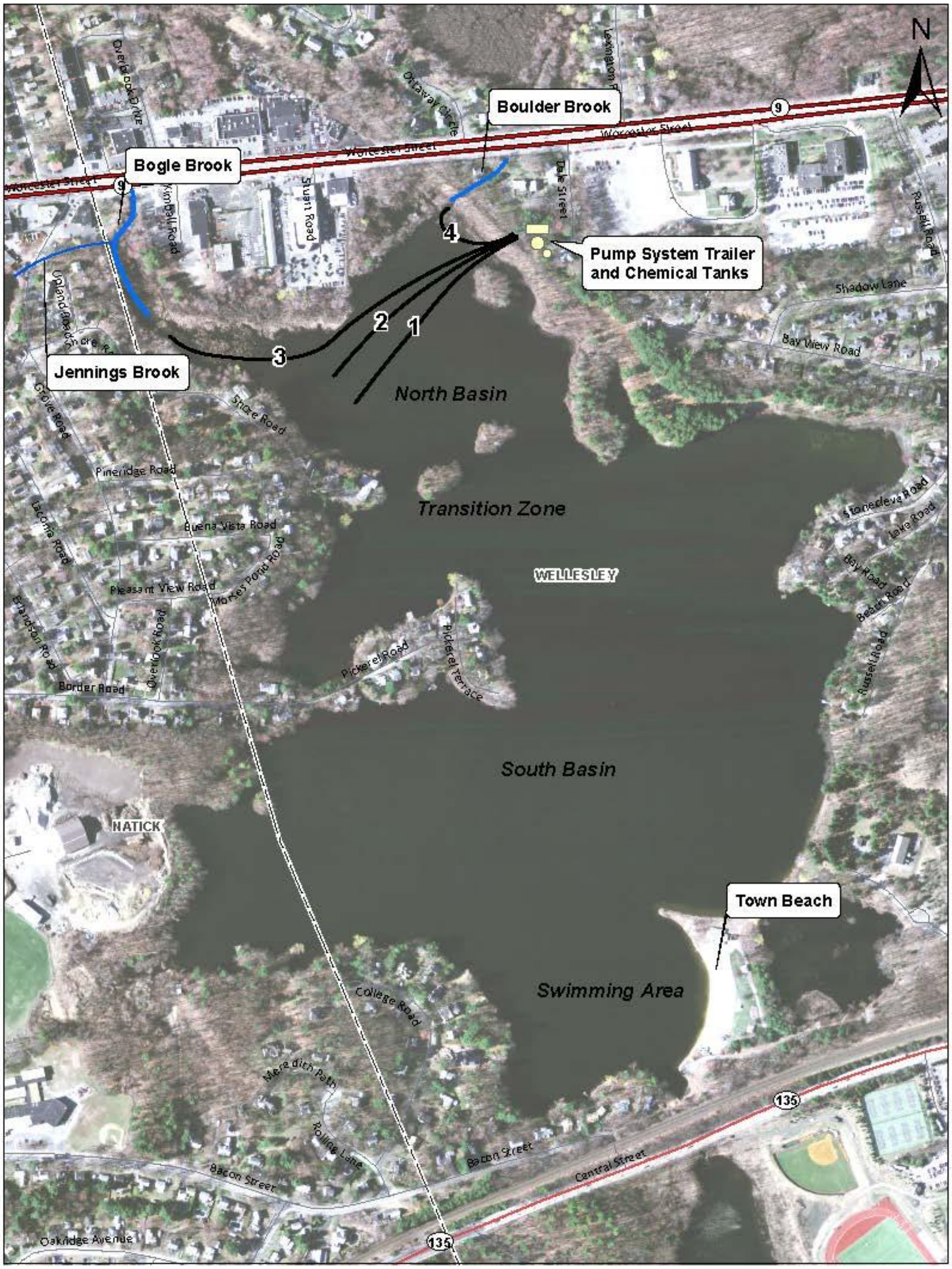


Table 1. Summary of Phosphorus Inactivation Effort, 2008-2013

Year	Applied Alum (gal)	Applied Aluminate (gal)	Period of Application	# of Treatment Days	Notes
2008	2000	1000	6/24 to 7/23	5	Testing and adjustment phase
2009	6002	2900	5/14 to 7/9	16	Very wet spring and summer
2010	4100	2080	5/11 to 7/9 + 8/24 & 8/25	13	Average spring, leftover chemical applied in late August.
2011	5000	2475	5/15 to 7/8 + 8/10 & 8/16	14	Wet spring and summer, attempted August treatments in response to bloom
2012	6000	3000	5/4 to 7/23 + 8/6 to 8/22	19	Poor system functionality hampered dosing during treatment
2013	6055	2785	4/26 to 5/24 +5/28 to 6/27+ 7/23 to 8/2	20	Very wet June. System overwhelmed on several dates.

Analysis of Program to Date

Water quality is assessed prior to the start of treatment, normally in May, early summer, and later in the summer in up to three areas: the north basin, the transition zone to the south basin just south of the islands, and near the town beach at the south end of the pond. Visual and water quality checks are made on an as needed basis, as part of normal operations or in response to complaints, major storms, or town needs. The complete water quality record for 2013 (Table 2) incorporates field and laboratory tests at multiple sites. A summary of phosphorus data for key periods since 2008 is provided (Table 3) to put the treatments and results in perspective. It is intended that total phosphorus will decrease through the treatment, such that values in the south basin, assessed in the swimming area near the outlet of the pond, will be lower than in the north basin, with the transition zone exhibiting intermediate values. Based on data collected since the early 1980s, total phosphorus in the south basin in excess of 20 ug/L tends to lead to algal blooms, while values <20 ug/L minimize blooms and values near 10 ug/L lead to highly desirable conditions (Figure 2).

Dissolved phosphorus, summarized in previous annual reports, tends to decline more sharply than total phosphorus, a likely indication that the aluminum is effectively binding phosphorus. Dissolved aluminum concentrations have been highly variable, sometimes rather high in the north basin and measurable in the south basin, but there is no evidence of any toxicity to fish or invertebrates in Morses Pond, despite extensive observation during treatment periods. The focus is on total phosphorus, as the long-term data base supports it use as the primary indicator of algal bloom potential.

Although treatment in 2008 started late and was largely experimental, results for total phosphorus at the end of the initial treatment period for 2008 were <20 μg/L. Similar results were achieved in 2009 and 2010; throughout these three years values approached the ideal 10 μg/L level in early summer. Total phosphorus remained somewhat elevated in early summer of 2011; we do not know if there was some lab error associated with the 2011 early summer values, but the water was the clearest it has been in many years at that time, so available phosphorus had to be very low, even if the total phosphorus was somewhat elevated.

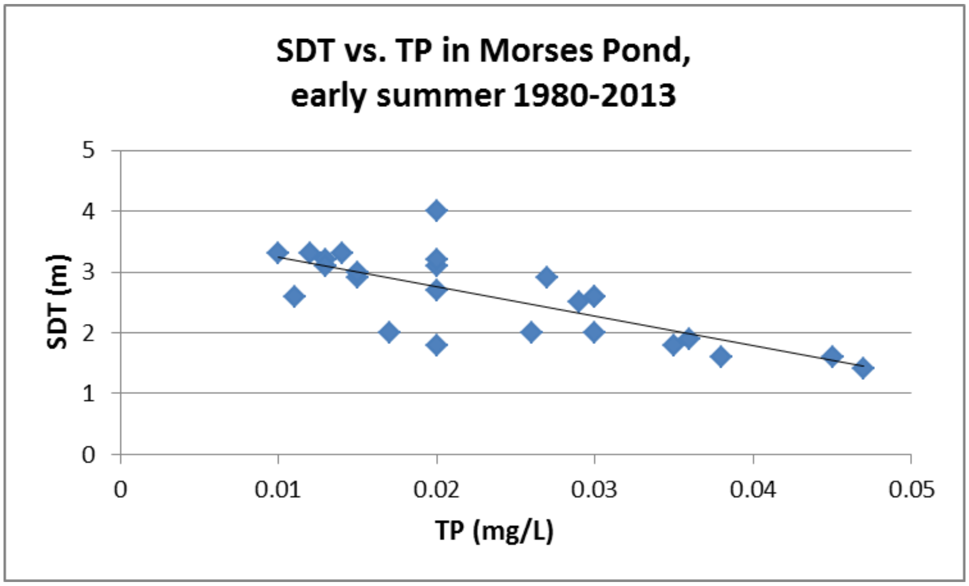
Table 2. Water quality record for Morses Pond in 2013.

	Depth	Temp	Oxygen	Oxygen	Sp. Cond	pH	Turbidity	Alkalinity	Total P	Secchi	Chl-a
Station	**meters**	**°C**	**mg/l**	**% Sat**	**µS/cm**	**Units**	**NTU**	**mg/L**	**µg/L**	**meters**	**µg/L**
5/13/2013											
North Basin											
MP-N-2 (dredged)	0.1	19.4	8.4	93.0	414	7.5	2.8				
	1.0	18.6	8.5	92.3	416	7.4	2.6				
	2.0	17.2	7.1	75.2	411	7.2	2.7				
	3.0	14.6	9.7	96.4	410	7.2	2.6				
South Basin											
MP-B-1									0.014		
MP-1	0.1	19.4	9.4	103.5	448	8.1	2.4	45.0	0.024	3.3	0.7
	2.0	19.4	9.3	103.0	447	7.8	2.4				
	4.0	14.7	10.3	103.4	447	7.6	2.4				
	6.0	11.2	2.1	19.5	458	7.0	10.2		0.075		
6/3/2013											
North Basin											
Bogle Brook	0.1							18	26		
Boulder Brook	0.1							23	46		
South Basin											
MP-B-1	0.1							28	20	2.8	1.3
MP-B-2	0.1								16		
6/21/2013											
North Basin											
MP-N-1	0.5	21.8	8.9	102.8	230	7.6	1.1		51		
MP-N-2 (dredged)	0.5	19.7	8.5	93.7	230	7.3	1.2		44		
	3.0	14.4	5.4	53.5	173	7.0	2.8				
Transition Zone											
MP-T-1	1.0	21.0	8.3	94.4	232	7.3	1.3		11		
MP-T-2	1.0	20.3	7.6	85.5	232	7.3	1.3		46		
South Basin											
MP-1	0.3	24.2	9.9	119.3	230	7.8	1.5	36.0	36	1.9	5.9
	1.0	22.5	10.4	122.0	231	7.8	1.5				
	2.0	19.4	6.9	75.6	216	7.3	1.5				
	3.0	17.6	5.9	63.0	236	7.2	1.7				
	4.0	16.9	3.9	41.3	264	7.1	1.6				
	5.0	14.6	1.1	11.3	394	6.8	3.2				
	6.0	14.0	0.2	1.6	408	6.6	5.7	26.0	39		
MP-B-1	0.1								34		
MP-B-2	0.1								33		
7/24/2013											
South Basin											
MP-B-1									27	2.2	
MP-B-2									30		

Table 3. Water Quality Testing Results Relating to the Phosphorus Inactivation System

Year	Location	Pre-Application TP (ug/L)	Early Summer TP (ug/L)	Late Summer TP (ug/L)	Algae Issues
2008	North Basin	28	18		some cloudiness, early summer is really July 23 at end of treatment
	Transition Zone	31	22		Some cloudiness, brownish color,
	Swimming Area	21	12		no blooms, early summer is really July 23 at end of
2009	North Basin	35	40	63	mats
	Transition Zone	35	39		Cloudy
	Swimming Area	15	10	27	no blooms
2010	North Basin	26	46	53	evident
	Transition Zone	28	21	32	Brownish color, minimally cloudy
	Swimming Area	19	15	43	Generally clear, no blooms until
2011	North Basin	53	33	130	Cloudy, mats
	Transition Zone	48	29	95	Slightly brownish
	Swimming Area	30	29	60	years in late June, but short-lived
2012	North Basin	32	24	48	growth
	Transition Zone	28	37	28	Brownish most
	Swimming Area	20	27	24	Had bloom in mid-July
2013	North Basin		47		Very wet June, system overwhelmed
	Transition Zone		78		
	Swimming Area	14 - 24	33	28	Continued treatment kept TP down, but not to target level

Figure 2. Relationship between water clarity and total phosphorus in Morses Pond, 1980-2013.



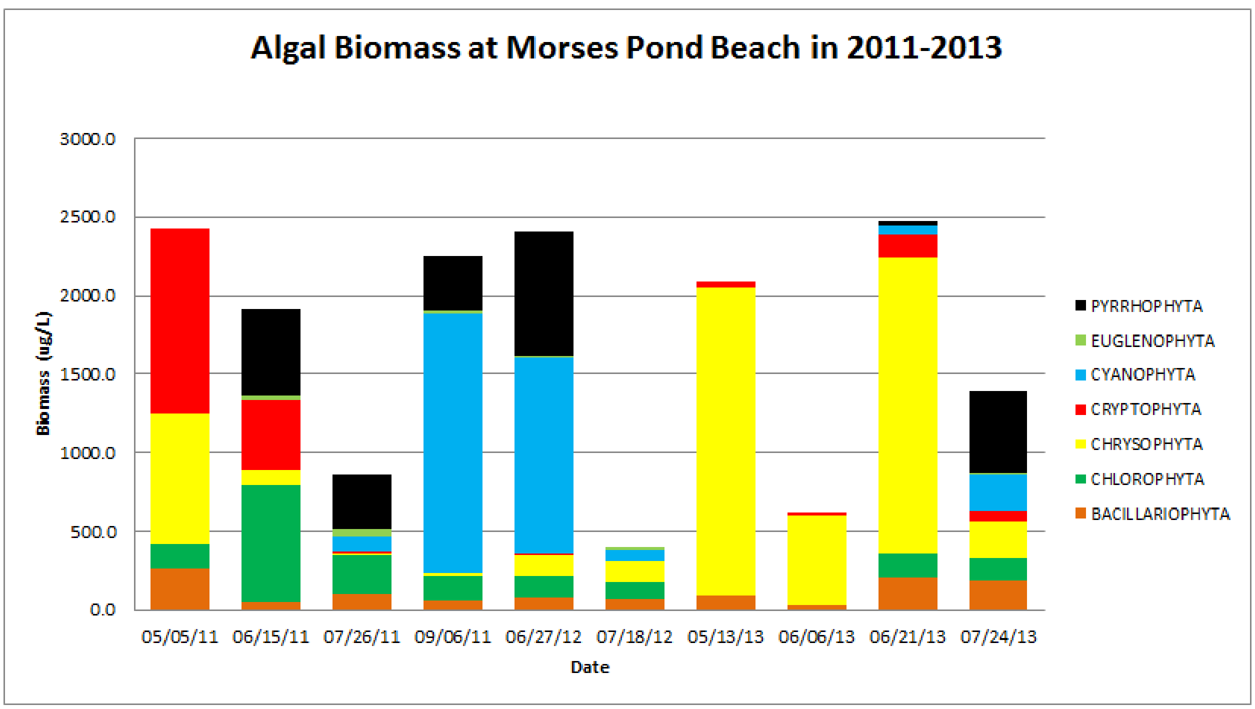
Treatment problems were encountered on most treatment days in 2012, and total phosphorus increased in early summer of 2012. Frequent and timely repairs kept the treatments going, but they were not as efficient and apparently not as effective as in the previous three years. Detention capacity of the north basin was limited by shallow depth resulting from years of sediment deposition; dredging was planned for fall 2012. Consequently, the combination of treatment and detention was insufficient to prevent a bloom from forming in mid-July, and the phosphorus level in the south basin was >20 ug/L. A copper treatment was conducted in the swimming area to reduce algae and increase clarity in mid-July, but a major storm within a few days resulted in a major flushing of the lake. The storm inputs were treated with aluminum, and no further algal blooms occurred in the summer of 2012.

System repairs by the Wellesley DPW and WRS Inc. made more effective treatment possible in 2013, but rain in June was about 2.5 times the long-term average, and not all incoming runoff could be treated. Phosphorus levels never reached the early summer target, although continued treatment kept values lower than they would have been through early August, when treatment was ceased. Fortunately, high runoff leads to a higher flushing rate, and no algal blooms occurred in 2013.

Algal data for 2011-2013 illustrate processes in Morses Pond over the summer (Figure 3). Moderate densities of mainly coldwater forms in spring give way to lower densities more typical late spring forms such as green algae in June, with those densities further reduced and species composition further altered by the aluminum treatments, such that relatively low biomass of largely innocuous forms is observed in July of 2011. Lack of treatment allows algal densities to rebound over the rest of the summer, with blue-greens becoming dominant by September 2011. In 2012, conditions at the end of June were already similar to those in September of 2011, and algal density increased for the next two weeks, resulting in a bloom (there is no strict definition of a bloom, but biomass in excess of 5000 ug/L would be a reasonable threshold). No sample was collected during the mid-July 2012 bloom, as there was a major storm just before we arrived at the lake, and it was thoroughly flushed. This resulted in low algal biomass on July 18, 2012, and was not the result of treatment. Biomass remained below late summer 2011 or early summer 2012 values for the rest of the summer of 2012, which may be due to the treatment of storms during summer of 2012. However, those treatments were not as efficient as they should have been, owing to frequent equipment malfunctions. Maintaining the algal assemblage features of mid-July 2011 is an appropriate goal for the phosphorus inactivation project.

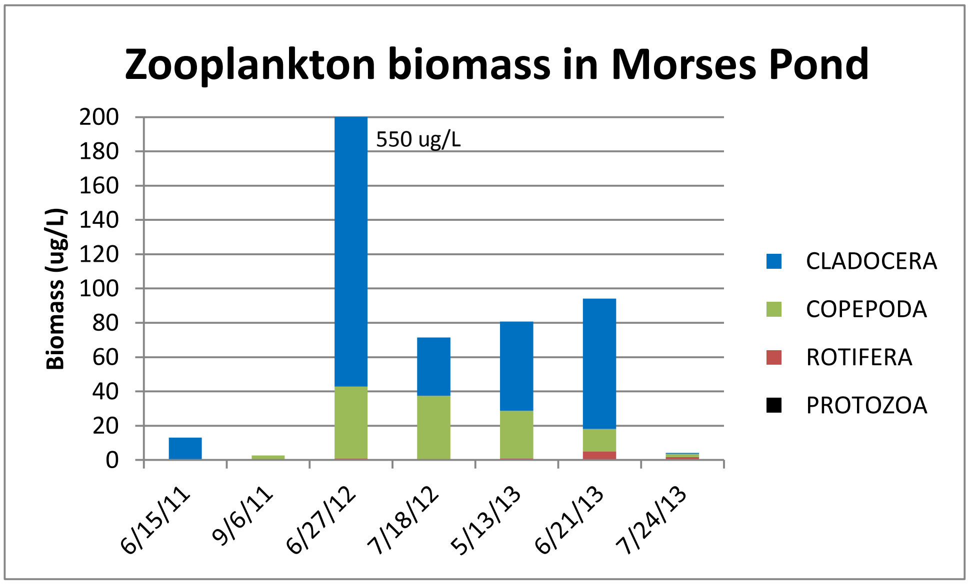
Algae in 2013 were dominated by golden algae through June at concentrations no higher than 2500 ug/L, a desirable target. There was a shift in July to a more mixed assemblage that included greens and blue-greens, but still at acceptably low overall biomass levels. Treatment may have helped keep nutrient ratios in a zone that does not favor blue-greens (higher N:P ratios by virtue of P inactivation), but flushing is more likely to have been responsible for maintenance of desirable biomass levels. Additionally, completed dredging of the north basin enhanced detention capacity and should aid phosphorus reduction in the south basin. However, phosphorus levels exceeded the targeted 20 ug/L threshold most if not all of the time, which was not surprising in light of the frequent and intense storms in 2013.

Figure 3. Algal Data for 2011-2013



Zooplankton have also been sampled, and while not as tightly linked to nutrients, provide important information on the link between algae and fish (Figure 4). Zooplankton biomass varies strongly between and within years. Values <25 ug/L are low and values higher than 100 ug/L are high; Morses Pond values span that range and more. Values in later summer are expected to be lower than in late spring or early summer, as fish predation by young-of-the-year fish (those hatching that year) reduces populations of zooplankters. Spring levels will depend on water quality, predation by adult fish, and available algae, which are food for zooplankton. The dominant zooplankton tend to be cladocerans and copepods, both groups of micro-crustaceans. *Daphnia*, among the larger cladocerans, filters the water to accumulate algae as food, and can increase water clarity markedly. *Daphnia* abundance was elevated in late spring of both 2012 and 2013, but not in 2011, but it was present in all three years, a good sign. The late summer zooplankton population was very low in 2011 and 2013, but was substantial in 2012. Variation does not appear to relate to aluminum treatments, which could be toxic at high concentration and high or low pH; the treatment protocols minimize this probability. Variation in fish reproduction and predation are suspected as the main causes of zooplankton variability, although flushing rate may have some influence as well.

Figure 4. Zooplankton data for 2011-2013.



The record of treatment in 2013 is provided in Table 4, including the rainfall record. Storm events covering 47 days occurred, up from 25 in 2012, and 124 hours of treatment were conducted, up from 76.5 in 2102. A total of 5885 gallons of alum and 2685 gallons of aluminate were applied. Three chemical deliveries were taken, with the middle one slightly less than the normal 2000 gallons of alum and 1000 gallons of aluminate. The ratio of alum to aluminate applied was 2.2:1 overall, but varied considerably by storm. Problems largely related to clogging of the aluminate lines, an ongoing problem. No toxicity problems were noted as a result, however, and the dilution of the chemicals was substantial, so none would be expected, but this was the second year in a row with ratio control problems due to aluminate, which is more viscous and clogs lines more easily. The application rate averaged 47 gallons of alum per hour and 22 gallons of aluminate per hour, mostly by design; we set the dose lower in response to more frequent and larger storms, to make the chemicals last longer. Doses at high levels of phosphorus are more efficient, so this should have been effective as well as efficient if all storm water could have been treated.

Table 4. Rainfall record and related treatment actions in 2013.

	May				June				July				August			
	Precip	Treatment			Precip	Treatment			Precip	Treatment			Precip	Treatment		
Day of Month	Inches	Hours	Alum (gal)	S.A. (gal)	Inches	Hours	Alum (gal)	S.A. (gal)	Inches	Hours	Alum (gal)	S.A. (gal)	Inches	Hours	Alum (gal)	S.A. (gal)
1									0.03	-	-	-	-	-	-	-
2													0.13	16.8	920	430
3					0.71	2.8	85	100								
4																
5																
6					0.02	-	-	-								
7					3.07	9.0	575	260								
8	0.37	17.0	330	200	0.54	-	-	-	0.01	-	-	-	0.07	-	-	-
9	0.61	3.0	80	40					0.17	-	-	-	1.62	-	-	-
10	0.06	-	-	-	0.88	9.0	380	190								
11	0.02	3.8	90	45	1.38	9.0	380	190								
12	0.04	-	-	-	0.07	-	-	-								
13					0.72	-	-	-								
14					1.02	-	-	-								
15																
16									0.01	-	-	-				
17					0.43	2.5	130	70								
18					0.63	2.7	330	140								
19	0.17	13.0	800	125												
20	0.04	1.0	-	15												
21	0.01	3.5	50	25					0.01	-	-	-				
22	0.05	-	-	-												
23	0.05	-	-	-					1.76	12.0	1100	590				
24	0.57	7.8	140	70	0.33	-	-	-								
25	0.34	1.5	130	3					0.27	-	-	-				
26	0.05	-	-	-	0.04	-	-	-	1.00	-	-	-	0.01	-	-	-
27					0.03	1.2	45	35					0.01	-	-	-
28					0.45	-	-	-	0.01	-	-	-				
29	0.84	5.9	320	95	0.07	-	-	-	0.33	-	-	-				
30		2.8	0	62	0.11	-	-	-								
31																
Sum	3.2	59.1	1940	680	10.5	36.2	1925	985	3.6	12.0	1100	590	1.8	16.8	920	430
# of Days	14.0				17.0				10.0				6.0			
Departure from normal	-0.27				6.82				0.18				-1.51			
Greatest 24 hr	0.98 on 8+9				3.58 on 7+8				1.76 on 23				1.62 on 9			

Notes:

Blue background denotes system maintenance

(-) dash mark denotes rainy day not treated

4/26/2013: System maintenance 110 (gal) Alum used and 80 (gal) S.A. used

5/30/2013: System maintenance on non-rainy day

The multiple sources of problems with the phosphorus inactivation system in 2012 were largely solved by system maintenance and improvement by the Wellesley DPW (all elements on the trailer) and WRS Inc. (all lines in the lake), at least initially, but some clogs at the exit ports by aluminate occurred later in the season and the aluminate line from the pump to the manifold that determines chemical distribution uncoupled during the next to last treatment as a function of increased pressure, resulting in an aluminate spill at the Dale Street site. Aluminate is corrosive, but once reacted with water on site, it becomes inert (much like treatment in the lake). Additionally, one DPW worker was sprayed by aluminate while doing maintenance on the system; rapid response by the fire department managed this emergency effectively and the worker was not seriously injured. Additional safety precautions were put in place as a result. However, continued problems with aluminate, corroborated through discussion with people using aluminate in other lake applications, indicates the need to find a substitute.

From known issues and four years of experience, the following adjustments were made in 2013:

1. Use of only the inlet lines. Treatment at the inlets is preferable, but requires greater responsiveness to catch most of each storm. The other two sets of lines were removed from the lake.
2. The Bogle Brook line was routed along the northern shoreline, in the water but away from possible boat traffic or harvester operations. This enhances servicing as well as limiting potential damage.
3. Removed the diffusers and installed a manifold at the end of each chemical line, allowing multi-port injection of alum and aluminate at each inlet. Ports were set so that the pressure enhanced mixing when injected into the stream. This eliminated the need for compressed air except to flush the chemical lines at the end of the season.
4. The two pumps were maintained. New diaphragms and check valves were installed, along with general cleaning. Pumps functioned well in 2013.
5. The manifold system that directs air and chemicals to the various in-lake lines was overhauled. It was corroded in several locations. The system was repaired and pressure tested, and worked well in 2013.

Problems in 2013 were almost entirely a function of aluminate not moving through the lines as expected, which is a consequence of higher viscosity and corrosiveness. The primary suggested change for 2014 is to find a substitute. Investigation suggests that polyaluminum chloride (PACl), a hydrated form of aluminum that does not greatly impact pH and is much less viscous, might be a viable substitute for both alum and aluminate. Initial lab results from bench testing with PACl at several doses yielded >97% removal of dissolved P, so it appears that PACl is worth applying in 2014. We plan to run additional tests to better define optimal doses and confirm the initial results within the next few months.

Based on the results of 2013 activities, it would be possible to move the pump house and manifold from the trailer to a ground location within the enclosure and next to the chemical tanks. Power must still come from the pump station on Dale Street, and routing a permanent line to the pumps would be desirable, but is not essential. Whether this should be done before 2014 activities or we should go one more year with the trailer arrangement is worth discussion. We are inclined at this point to maintain the trailer arrangement in 2014, as successful use of PACl could signify a change in tank piping and possible system automation, and changes made now might have to be altered again.

Plant Harvesting

Harvesting Strategy

The Town of Wellesley initiated the enhanced Morses Pond vegetation harvesting program in 2007. The zoned vegetation harvesting strategy originates from the 2005 pilot program and comprehensive management plan written that year. For the pilot program, Morses Pond was divided into seven zones in order to better track the harvesting process. Figure 5 shows these zones and Morses Pond bathymetry. Harvesting protocols have been adjusted through experience to maximize effectiveness and minimize undesirable impacts, such as free fragments that accumulate along shore. The refinement process was detailed in the 2010 annual report. The current approach is to harvest all areas by the end of June, sometimes using both harvesters, with a cutting order and pattern that limits fragment accumulation, especially at the town swimming beach. A second cutting occurs in August and sometimes into September.

The keys to successful harvesting include:

- Initiating harvesting by the Memorial Day weekend.
- Cutting the southwest cove (Area 6) first, then proceeding through Areas 2, 3 and 4 in order of
- Cutting with or against the wind, but not perpendicular to the wind, to aid fragment collection.
- Limiting harvesting on very windy days (a safety concern as well as fragment control measure).

The second, older harvester has been used mainly to collect fragments released by the larger, newer harvester, or to accelerate harvesting at key times and in key places, and this approach has worked well.

Harvesting Record

Records provided by the Town of Wellesley indicate the harvesting effort expended on Morses Pond (Table 5). Although the record is not always complete, records have been kept since 2007. Between late May and early September, from 2007 through 2013, harvesting was conducted on a range of 43 to 70 days. This represents a range of 303 to 460 total hours devoted to some aspect of the harvesting program, and 223 to 304 hours of actual harvesting time. Data for 2012 are inconsistent with those of other years, for reasons we have not been able to ascertain, and are not included in further analysis. Part of the much higher output in 2012 is due to cutting in area 1 in preparation for dredging; plant density is very high in this section of the pond, which is not normally harvested. Excluding 2012 data, an average of 5.1 to 5.5 hours per day are spent on actual cutting. Approximately another 1-2 hours per day are expended on hauling plants, harvester maintenance, and related tasks other than actual cutting or offloading, accounting for the larger total time commitment of 6.6 to 7.7 hr/day. The harvesting effort has resulted in the removal of 224,000 to 292,000 pounds of plants (wet weight) per year.

The weight per load is fairly constant at around 2900 lbs, and the hours of cutting performed per day is also fairly consistent at slightly more than 5 hr/day, so total weights are largely a function of days spent harvesting. Some periods are more productive than others, owing to areas of variable plant density and distance to the offloading area between the beach and outlet. Yet the harvester has met its goal of at least one complete cut of the roughly 45 acres of dense vegetation outside area 1 before the 4th of July weekend in each year. Harvesting in August and September has also occurred as planned. The equipment appears to have been the correct choice for the Morses Pond program.

Figure 5. Plant Management Zones for Morses Pond.

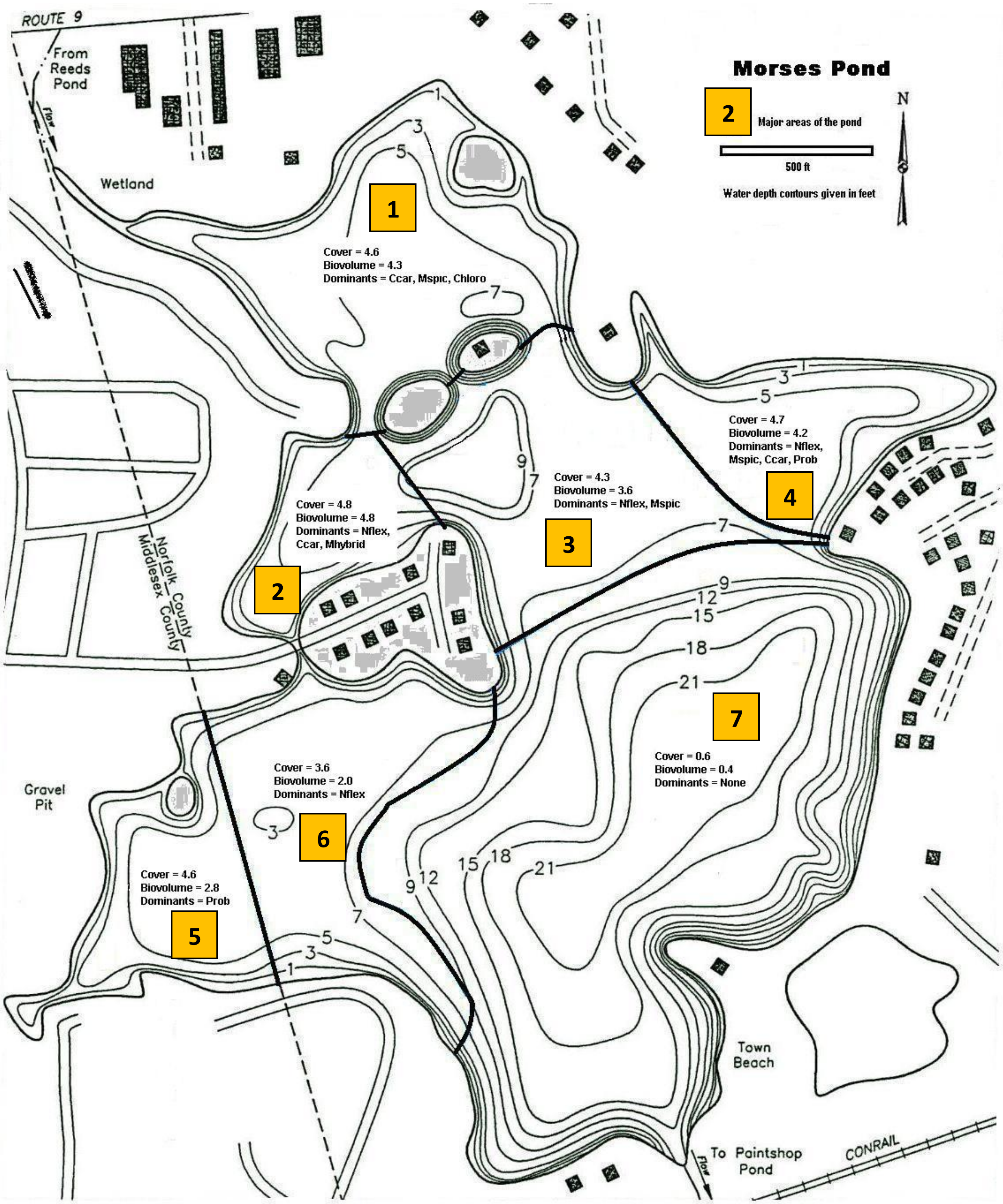


Table 5. Harvesting Record for Morses Pond.

Year	Days of Harvesting per Year	Total Hours per Year	Cutting Hours per Year	Total Hr/Day	Cutting Hr/Day	Total Loads	Total Weight	Weight/ Day	Weight/ Load	Weight/ Total Hr	Weight/ Cutting Hr
	(Days)	(Hr)	(Hr)	(Hr)	(Hr)	(Load)	(Pounds)	(Pounds)	(Pounds)	(Pounds)	(Pounds)
2007	49	359	255	7.3	5.2	109	NA	NA	NA	NA	NA
2008	43	NA	NA	NA	NA	NA	270320	6287	NA	NA	NA
2009	57	390	304	6.8	5.3	78	224060	3931	2891	575	738
2010	44	303	223	6.9	5.1	78	226960	5278	2900	749	1017
2011	54	414	291	7.7	5.4	102	292000	5407	2863	706	1003
2012	70	460	296	6.6	4.2	124.5	807760	11539	6488	1756	2729
2013	76	519.5	335	6.8	4.4	119.5	595277	7833	4981	1146	1777
For 2009 total hours, assumes 1.5 hr/harvesting day of non-cutting time, based on values for those days with total and cutting hours.											
For 2010 total weight, assumes 202,000 pounds resulting from hydroraking, based on values for days when hydroraking occurred.											
For 2012, harvesting includes Area 1, which had very dense plant growths and may account for additional weight removed.											

We are missing plant weight data from 2007 and hourly activity data from 2008, and the identification of plants being targeted by harvesting is not always consistent with what has been observed by staff in the field. There have been changes in personnel and procedures, so continued training should be emphasized. There were problems with plant fragment creation and accumulation along shorelines in 2009, and while some fragment release is unavoidable, adjustments were made that greatly improved performance in subsequent years. Overall, the plant harvesting program has been proceeding well, achieving desirable results, and being adjusted to enhance performance as warranted.

There was a change in the primary harvester operator in 2012, and an additional operator was added in 2013. Training was conducted in spring of 2013, as the record for 2012 suggested some irregularities in reporting. Data for harvesting activities in 2012 and 2013 suggest considerably greater plant weight was harvested in those two years, owing to more days of harvesting and more plant weight per load. The total number of loads was up while the hours per day spent on total harvesting effort was about the same, although the actual time per day spent cutting decreased. The differences in the harvesting log for 2012-2013 vs. previous years may be related to harvesting denser areas, particularly area 1 in preparation for dredging, as this yields more plants per unit of cutting time and involves longer trips to the offloading site near the outlet. DPW staff also indicated better record keeping in 2012 and 2013.

There have been some plant controls additional to mechanical harvesting with “standard” weed cutters. A benthic barrier was installed at the swimming beach in 2008 as a pilot study, but no further application occurred. As of 2011, the original benthic barrier was still in place, but is mostly buried in the sand. Hydroraking of shallow areas was desired by many shoreline residents, and was planned for 2009. However, equipment problems precluded execution of hydroraking beyond the beach area. Hydroraking of peripheral areas was conducted in 2010, with residents paying for those services off their shoreline parcels. Hand harvesting of water chestnut is practiced each spring by a group of volunteers supported by the town. This effort has kept water chestnut in check, with only scattered plants found and removed each year. In 2013 there was no hydroraking, but dredging of sand deposits to deepen the north basin facilitated beach nourishment in the swimming area, and any plants in that area were buried by sand transported in the dredging pipeline.

Plant Surveys

Plant surveys were conducted in early to mid-May of 2008, 2009, and 2010 prior to plant harvesting to determine the assemblage features and facilitate recommendation of any program adjustments. These surveys have helped to identify areas supporting very dense aquatic plant growths and helps set priorities for harvesting. Shoreline surveys were also performed to guide localized plant control by shoreline residents, including proposed hydroraking. In 2011, with the harvesting program protocols generally well known to the DPW staff involved in the project, we opted to survey the plants at selected stations during the harvesting, allowing some comparison among harvested areas as a consequence of harvesting. This process was repeated in 2012 and 2013 for continued comparison of harvested vs unharvested areas.

Methods

Surveys applied the point-intercept method, resulting in 306 survey points on Morses Pond the same as utilized during the 2005 vegetation survey that set the stage for the comprehensive plan as relates to plant control in Morses Pond. The point-intercept methodology is intended to document the spatial distribution and percent cover and biovolume of aquatic plants at specific re-locatable sites. At each point the following information is recorded:

- The GPS waypoint.
- Water depth using a metal graduated rod or a mechanical depth finder.
- Plant cover and biovolume ratings using a standardized system.
- Relative abundance of plant species.

For each plant species, staff recorded whether the species was present at trace (one or two sprigs), sparse (a handful of the plant), moderate (a few handfuls of the plant), or dense (many handfuls of the plant) levels at each site. Plant cover represents the total surface area covered in plants (2 dimensions). For cover, areas with no plants were assigned a “0,” areas with approximately 1-25% cover were assigned a “1,” a “2” for 26-50%, a “3” for 51-75%, a “4” for 76-99%, and a “5” for 100% cover. Like plant cover, a quartile scale was used to express plant biovolume, defined as the estimated volume of living plant material filling the water column (3 dimensions). For biovolume, 0= no plants, 1= 1-25%, 2=26-50%, 3=51-75%, 4=76-100%, and 5= 100% of plants filling the water column.

Shoreline surveys to support hydroraking were described in the 2010 annual report. No such surveys were conducted after 2010. The number of points surveyed has been reduced since 2011, based on statistical analysis of how many points are necessary to get an accurate appraisal of plant conditions, but the choice of points is randomized within each established zone each year, so the 306 point configuration remains valid and useful.

Multi-Year Results

Overall, Morses Pond exhibits moderate to dense vegetation cover and biovolume prior to harvesting each year. With the exception of the deeper southern basin (Zone 7), plant cover averages at least 3 (>50% coverage) in each year and average biovolume for a majority of the pond was ranked between 2 to 3 (plants taking up 25-50% of the water column). As an early season survey, this represents a plant assemblage sure to interfere with swimming and boating during summer without some form of control. Harvesting is perceived by most lake users to have improved recreational conditions, but we have yet to see any ongoing control of plants, particularly invasive species; regrowth each year is substantial.

For the point-intercept surveys, 35 species are known from Morses Pond, with 23 plant species detected in 2005, 20 plant species encountered in the 2008 and 2009 surveys, 24 in 2010 and 2011, 25 species in 2012 and 20 species in 2013 (Table 6). The complete list is provided in Table 5. Oscillations in species richness are largely a function of a few rare species being found or not found in any given year; the dominant suite of species remains the same. The four invasive submerged aquatic plant species routinely encountered are:

- *Cabomba caroliniana* (Fanwort)
- *Myriophyllum spicatum* (Eurasian watermilfoil)
- *Myriophyllum heterophyllum* (Variable watermilfoil)
- *Potamogeton crispus* (Curlyleaf pondweed)

Note that *Trapa natans*, water chestnut, is also known from Morses Pond, but owing to the efforts of volunteer water chestnut pullers, it has never been found in the standard survey. Also note that *Lythrum salicaria* (Purple loosestrife) is a peripheral species that is abundant but not always picked up by our aquatic surveys.

Fanwort is the most abundant invasive plant species, with both Eurasian and variable milfoil also common to abundant. It appeared that Eurasian milfoil had been declining in recent years in favor of variable milfoil, but Eurasian milfoil experienced resurgence in 2013; this is oscillation between these two species that we have observed previously. It is somewhat unusual for these two invasive species to co-occur, so slight changes in water quality or other habitat variables may alter the balance between them. The native species coontail, common naiad, waterweed and white water lily remain common, but the normally common bigleaf pondweed was not observed in the 2013 surveys. The native and very desirable Robbins pondweed appears to be declining, although it has been stable for the last two years, and harvester operators have been trained to avoid this species to be sure that harvesting is not a cause of decline.

Another invasive plant, curly leaf pondweed, can be a dominant in the spring, but tends to die back during summer and not create major issues for swimming and fishing during summer. An invasive wetland species, purple loosestrife, was observed on the northern basin shoreline in all survey years. Note that the original 2005 survey was performed during summer, while the 2008-2013 surveys were conducted during spring. This shift can affect detection of some species. For example, spotted pondweed tends to bloom between June and August, limiting detection in spring surveys, while curly-leaf pondweed usually dies back by early July, limiting its detection in summer surveys.

Table 6. Plant Species Found in Morses Pond, 2005-2013.

		Plant Rating for Year						
Scientific Name	**Common Name**	**2005**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Brasenia schreberi	Watershield							P
Callitriche sp.	Water starwort	P		P				
Cabomba caroliniana	Fanwort	A	A	A	A	A	A	A
Ceratophyllum demersum	Coontail	C	C	C	A	C	C	C
Chlorophyta	Green algae	C	C	C	A		P	C
Cyanobacteria	Blue green algae		P		C	P	P	
Decodon verticillatus	Swamp loosestrife	C	P		P	P		
Elodea canadensis	Waterweed	C	C	C	C	C	C	C
Lemna Minor	Duckweed	P	P	P	P	P	P	P
Lythrum salicaria	Purple loosestrife	P	P	P	P	P	P	
Myriophyllum heterophyllum	Variable watermilfoil	P	C	C	A	A	A	C
Myriophyllum spicatum	Eurasian watermilfoil	A	A	A	A	C	C	A
Najas flexilis	Common naiad	C	C	C	C	P	P	P
Nymphaea odorata	White water lily	C	C	C	C	C	C	C
Nuphar variegatum	Yellow water lily	C	P	P	P	P	P	P
Polygonum amphibium	Smartweed	P	P	P	P	P	P	P
Pontederia cordata	Pickerelweed	P		P	P			P
Potamogeton amplifolius	Broadleaf pondweed	C	C	C	C	C	C	
Potamogeton crispus	Crispy pondweed		C	C	C	P	P	P
Potamogeton epihydrus	Ribbonleaf pondweed		P	P	P	P	P	P
Potamogeton perfoliatus	Claspingleaf pondweed					P	P	
Potamogeton pulcher	Spotted pondweed	P			P	P	P	P
Potamogeton pusillus	Thinleaf pondweed					P	P	P
Potamogeton robbinsii	Fern-leaf pondweed	C	C	C	C	P	P	P
Potamogeton zosteriformis	Flatstem pondweed						P	P
Ranunculus sp.	Water crowfoot							
Salix sp.	Willow				P			
Sagittaria gramineus	Submerged arrowhead	P	P	P		P	P	
Sparganium sp.	Burreed							
Spirodela polyrhiza	Big duckweed	P				P		P
Typha latifolia	Cattail			P				
Trapa natans	Water chestnut							
Utricularia geminiscapa	Bladderwort	P	P		P		P	P
Utricularia gibba	Bladderwort	C				P		
Valisneria americana	Water celery				P	P	P	
Wolffia columbiana	Watermeal	P			P		P	
	# of Species	23	20	20	24	24	25	20
	P=Present, C=Common, A=Abundant							

Assessment of Harvesting Impacts

The 2011, 2012 and 2013 surveys were conducted during the spring harvesting effort, allowing a comparison between harvested and unharvested areas. Harvesting was only about halfway through the spring effort, so this affects which zones are characterized as harvested or unharvested. Ultimately, zones 2, 3, 4 and 6 are harvested, with zone 1 being the north basin and zone 5 being the Natick portion of the western cove. Zone 7 is the deep central area, where few plants grow, although sometimes the shoreline area along the southeast and southwest portions of zone 7 needs attention. Here we report on just the 2013 comparison, but the results have been similar in all three years.

Cover (Figure 6) is not greatly altered, as the harvester does not cut to the very bottom of the pond and this measure is two-dimensional. Biovolume (Figure 7) assesses the portion of the water column filled by plants in three dimensions, and is more directly relevant to how people perceive pond condition. The 2013 data shows considerable reduction between harvested and unharvested zones. It is apparent that harvesting, even just the first half of the spring effort, has a clear impact on plant biovolume.

Discernible frequency reductions from harvesting are few. White water lily (Figure 8) and yellow water lily (Figure 9) showed decreases, while no apparent change is observed for the major invasive species fanwort (Figure 10), variable milfoil (Figure 11), and Eurasian milfoil (Figure 12). Harvesting does not remove the whole plant in most cases, but biomass is reduced, so the frequency of occurrence of the plants (presence/absence of a plant at a survey location) is largely unchanged while biovolume measures decrease. Those species that are reduced in frequency are more susceptible to harvesting; for example, the bulk of the plant biomass is at the surface for water lilies.

Conclusions Relating to Plants and Mechanical Harvesting

The plant community of Morses Pond would still be too dense in most areas without harvesting and is dominated by invasive species. Harvesting with the new harvester and an adjusted approach appears to be controlling biomass and the portion of the water column filled, but shifts in species dominance are not extreme; invasive species have not yet been greatly reduced in frequency of occurrence. Harvesting keeps areas open for habitat and recreational use, but must occur each year to maintain those gains. Harvesting is a reliable maintenance technique, but has not yet been demonstrated as a strong force in shaping the plant community in Morses Pond.

A major shift in the plant community in just a few years was never expected, and the possible outcomes of harvesting were discussed in the comprehensive management report. Experience elsewhere indicates that with sustained harvesting pressure, some desirable, low growing plants will increase in abundance at the expense of the invasive species that fill the water column, but the process takes years and is affected by many factors, not all of which can be easily controlled. Continued invasion, weather patterns, and frequency and severity of harvesting are all important influences. The DPW staff performing harvesting services has changed over time, and it has been suggested that the current staff provides improved operation, so we may see more impact on invasive species in coming years. In the meantime, harvesting is meeting its primary goal, which has always been to maintain open water for recreation and habitat enhancement.

Figure 6. Cover Comparison Between Harvested and Unharvested Zones of Morses Pond in 2013.

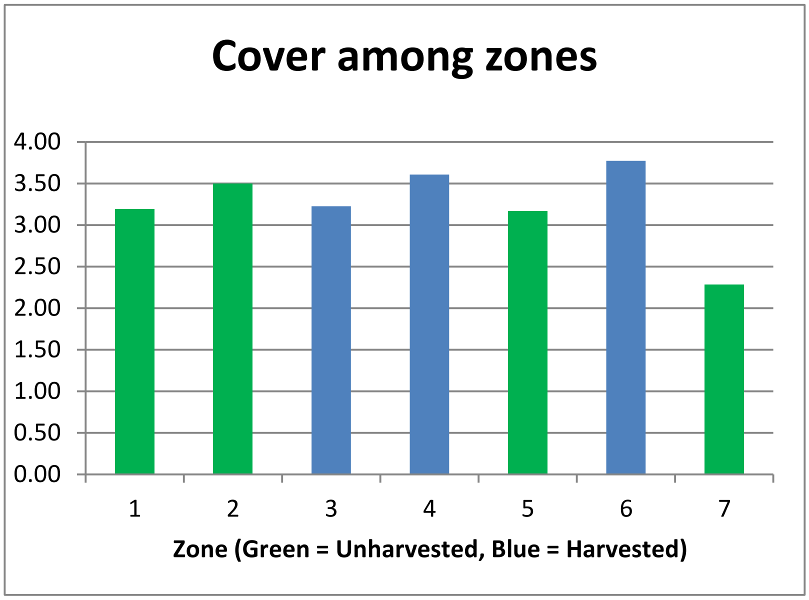


Figure 7. Biovolume Comparison Between Harvested and Unharvested Zones of Morses Pond in 2013.

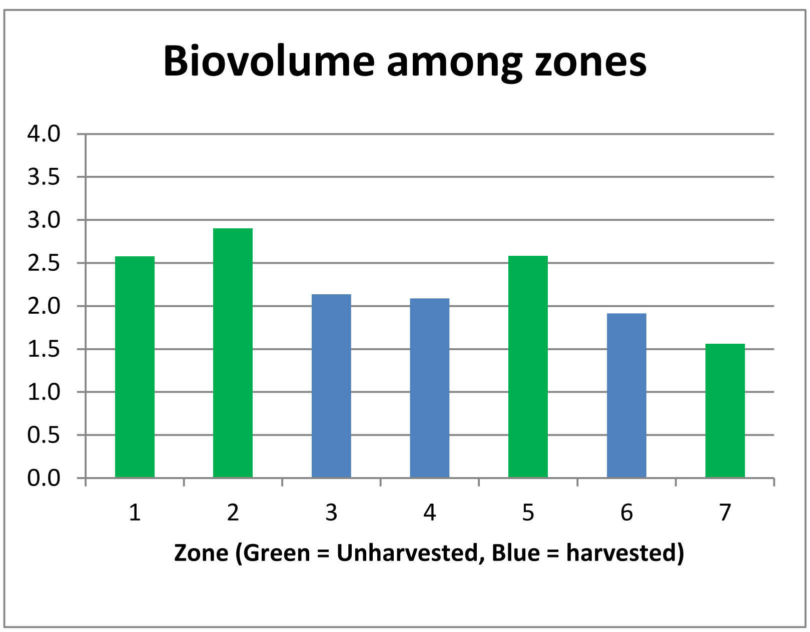


Figure 8. Comparison of White Water Lily Frequency Between Harvested and Unharvested Zones.

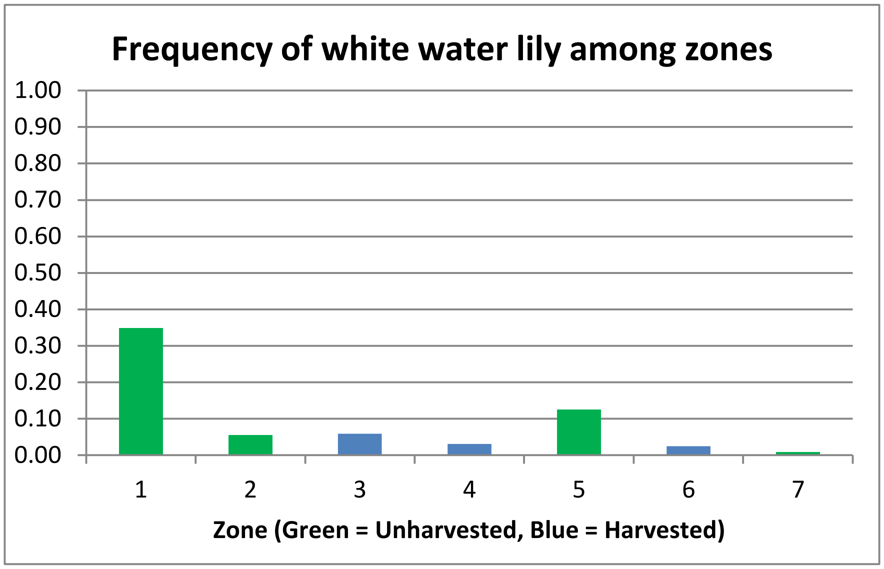


Figure 9. Comparison of Yellow Water Lily Frequency Between Harvested and Unharvested Zones.

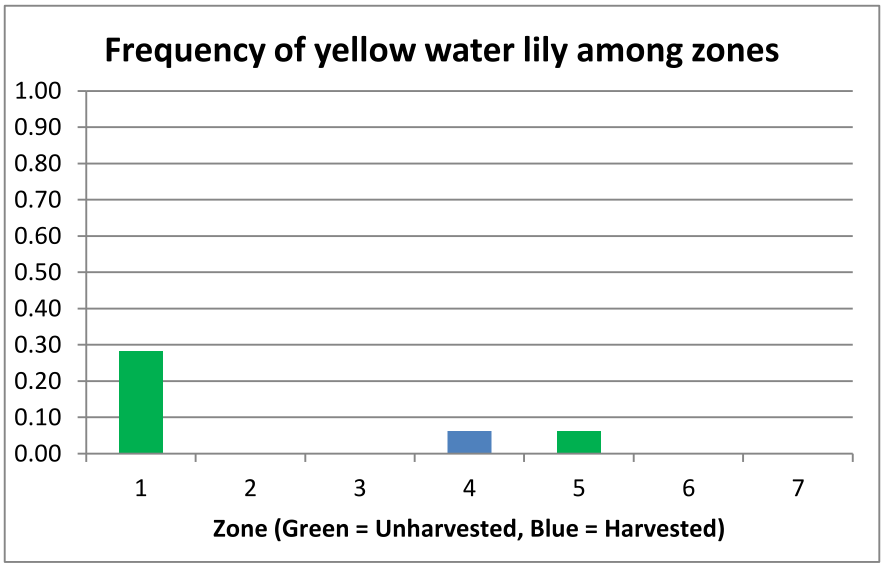


Figure 10. Comparison of Fanwort Frequency Between Harvested and Unharvested Zones.

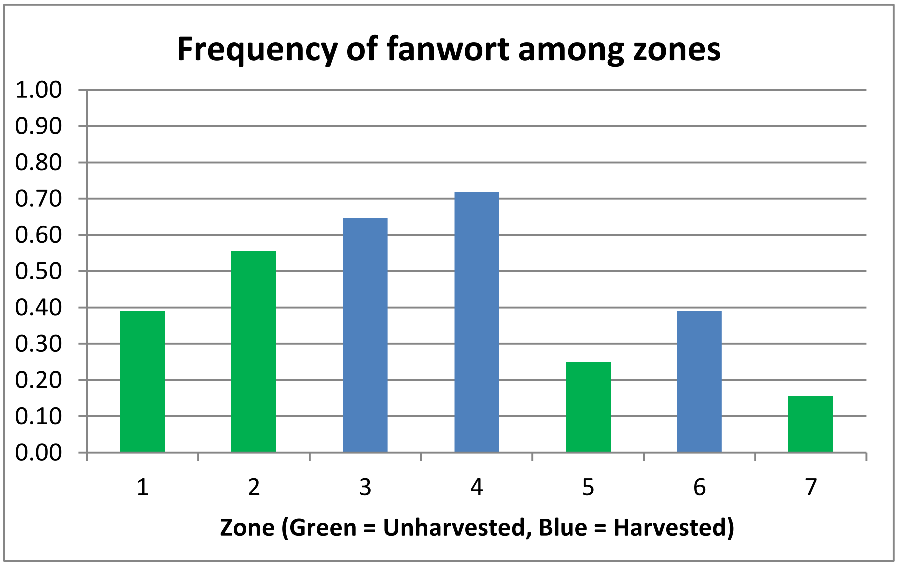


Figure 11. Comparison of Variable Milfoil Frequency Between Harvested and Unharvested Zones.

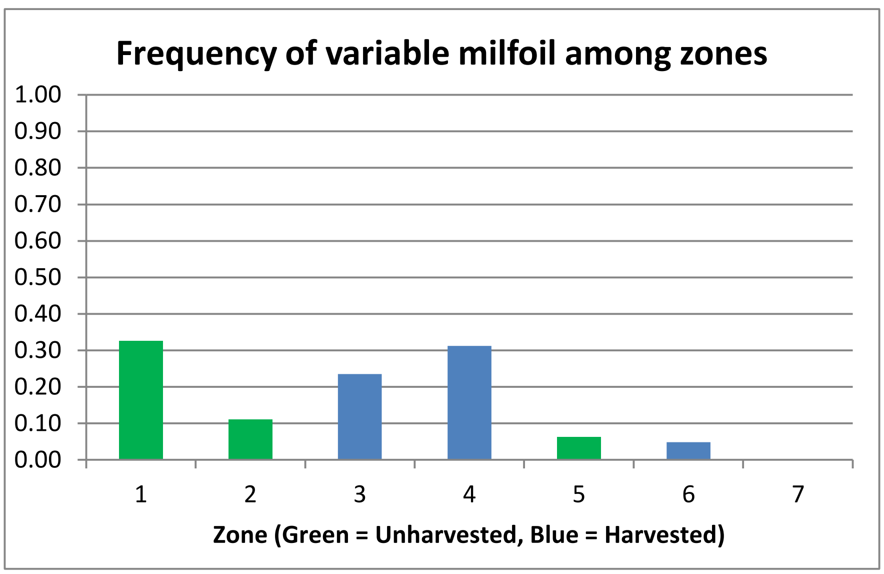
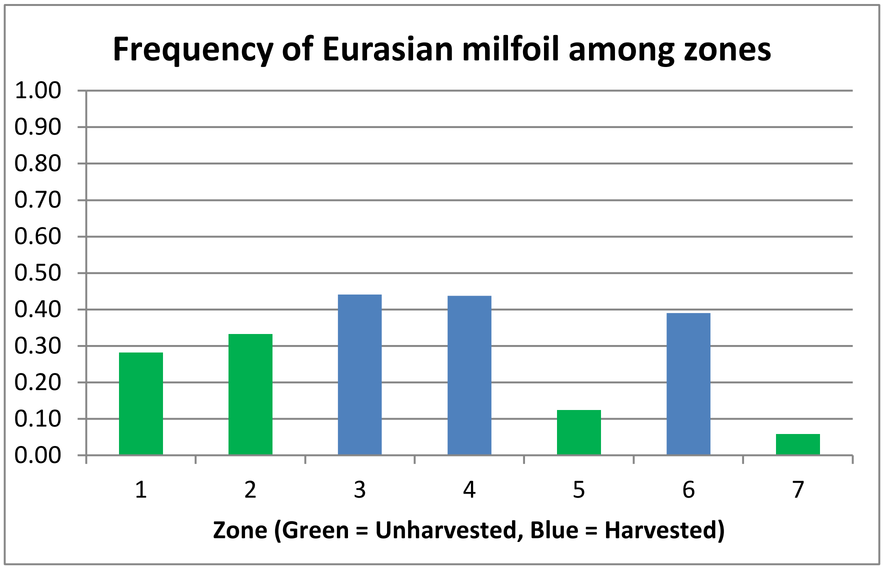


Figure 12. Comparison of Eurasian Milfoil Frequency Between Harvested and Unharvested Zones.



Hand Harvesting

A group of volunteers within the Friends of Morses Pond has accepted responsibility for finding and pulling out water chestnut (Trapa natans) plants in Morses Pond each spring and summer. This group uses kayaks and manual removal to eradicate pioneer infestations before seeds can be formed and deposited. This effort continues to be very successful; no water chestnut has been recorded in any lakewide plant survey to date. Plants are typically encountered in peripheral areas with considerable emergent or surface vegetation and are attributed to seeds being transported to Morses Pond by waterfowl, a common dispersal method for this invasive species.

As a seed producing annual species, water chestnut is best controlled by plant removal prior to seed production. Once seeds have been produced and dropped by the plant, removal will not prevent recurrence the following year. Consequently, it is important to locate each new plant and pull it prior to seed release, usually by the end of July. The Morses Pond program concentrates on early detection and removal, and has been supported by the town through the provision of kayaks, but is otherwise a completely volunteer effort that has proven very effective.

Compared to mechanical harvesting, less time is put into manual harvesting and fewer plants are removed, but the importance of this rapid response action should not be underestimated. No expansive water chestnut growth areas have been found in the pond since the manual removal process began, but there is no doubt that water chestnut would be well established if not for this volunteer effort. Rapid response to invasions by new species is extremely important to pond condition, and the volunteers are commended for their continued conduct of this program.

Note also that the beach staff hand pulls plants in the swimming area. This effort has been aided by the deposition of sand as part of the dredging program, but regrowth of some plants on top of the sand is expected and continued hand pulling is encouraged to minimize nuisance conditions in the swimming area.

Low Impact Development Demonstration

In the spring of 2008, AECOM evaluated public sites within the Morses Pond watershed for future application of Low Impact Development (LID) techniques. A desktop analysis was conducted on the approximately 60 parcels identified. Out of the 60 parcels, 13 locations were identified for further field investigation. Based on the field investigation, the Upham Elementary School and Bates Elementary School were chosen as the best properties for a LID demonstration.

The Upham Elementary School was selected for further design, and in 2009 preliminary design plans and specifications were prepared. The design included conversion of grassed islands and a portion of the paved play yard in front of the school to a series of water quality swales with added bioretention filtration of stormwater. The design also included a larger biorentention area behind the school by the ball field parking. AECOM worked with Wellesley DPW and the Natural Resource Commission (NRC) on fine tuning the design to provide a demonstration project that would provide water quality treatment with minimal maintenance requirements. In early 2011 the plans were rejected by the school board due to impacts to trees in the area. This was a surprising turn of events, and the NRC developed an alternative plan a LID demonstration project.

As an alternative, a demonstration project was completed in the Morses Pond beach complex area. This was viewed as a high visibility site during the beach season, and could be used to educate residents about the need for and potential of simple landscaping techniques in managing urban water quality. Two rain gardens were established and a roof drip line erosion control system was installed…
Still need info on this to include in the report. Figure of BMPs? Cost? Need for interpretive signage. Can be filled in here if desired, or provided separately and I can meld it into this section.

Education

The Town of Wellesley produced an informative brochure on the importance of phosphorus control many years ago, and has expanded on this approach to resident education since then. Everyone interacting with the Natural Resources Commission is provided an educational packet which contains brochures and other materials under the theme of the Green Wellesley Campaign. The packet focuses on protecting the environment and living a more sustainable lifestyle as a resident of Wellesley, although the contents are applicable to almost any town in the area. Included is information on:

- Understanding storm water and its impact on our streams and ponds.
- The impact of phosphorus on ponds.
- The importance of buffer strips and how to establish and maintain them.
- Managing residential storm water through rain gardens, infiltration trenches, rain barrels and other Low Impact Development (LID) techniques.
- Organic lawn and landscape management.
- Tree maintenance and related town bylaws.
- Recycling needs and options.
- Energy efficiency in the home.

The NRC has assembled an excellent suite of educational materials, and while it may take years to affect the cultural shift in our thinking and habits that protects and improves our environment, this is an important step in the right direction.

The Town also has bylaws relating to lawn watering and other residential activities that affect water quality in streams and lakes, including Morses Pond. The extent to which residents understand these regulations is uncertain, but the educational packet helps in this regard. The right messages are being sent, but reception and reaction have not been gauged recently.

In 2006 a survey was conducted by AECOM on behalf of the Town to assess resident awareness and practices. It appeared that more people handled their own lawn care than expected, and that most were anxious to learn about approaches that might have less impact on water quality. Most homeowners had little background knowledge of issues relating to fertilizer use and other residential management practices.

It was determined that a website would be a desriable additional means of communicating with residents on their role in protecting water quality through desirable residential practices. Morses Pond pages were constructed to be incorporated into the Town's website. Layout and content were adapted from existing materials and subject to review. Revision has been underway since summer of 2011, but town staff time for review and direction has been very limited. Expenditure of time and funds on the phosphorus inactivation system in 2012 and 2013 limited resources by the Pond Manager to devote to this effort as well. We need to revisit this resource, update and improve it, and perhaps resurvey the town population for environmental awareness and actions in 2014.

Dredging

The Town of Wellesley arranged for the North Basin to be dredged in the late 1970s; no dredging had been conducted since 1979, and both natural and anthropogenic sources of sediment have causes considerable infilling of the North Basin since that time. Dense growths of submergent and emergent vegetation limit recreational utility and habitat value in the North Basin, although some forms of water-dependent wildlife benefit from these conditions. While dense vegetation does provide some filtering capacity, the overall loss of depth limits detention time and facilitates resuspension during storms, threatening water quality in the main body of the pond. It was determined as part of the comprehensive planning process that the North Basin should be dredged again to restore detention capacity.

In 2009 the Town hired Apex Inc. to develop dredging plans and shepherd them through the dredging process. Sediment quantity and quality were assessed, plans were developed, and permits were secured. A number of complications arose, including the need to document yet again that Morses Pond was not a Great Pond under the laws of the Commonwealth and therefore not subject to Chapter 91, an additional regulatory process. That effort was ultimately successful.

More troublesome was the detection of metals and hydrocarbon contamination in the north basin, something not observed previously. However, dredging regulations and related contamination thresholds had changed since the previous sediment assessment in 2004, and not all the same tests were run in earlier sampling. The result was that the permitting process took longer than hoped and the cost to dispose of the sediment was considerably higher than initially expected. The targeted area was reduced to about two acres to both avoid areas of greater contamination and to attempt to keep the cost within the allocated amount.

An agreement was secured from the Catholic Diocese of Massachusetts to utilize the parking lot of the "closed" Catholic Church on Rt 9 as a dredged material processing area. However, material had to be removed by March of 2011, and delays in the permitting process caused bids to be secured for the work in September, with an anticipated starting date of early November 2010. Contractors were clearly uncertain about dredging in late autumn and achieving adequate dewatering over the winter to clear the parking area by spring. As a result, fewer contractors submitted bids, and the lowest bid was approximately twice the amount allocated for the dredging.

It was decided that no bid would be accepted and that the dredging project would be revisited in a year or two, when additional funds could be secured and when the timing of the project could be potentially made more advantageous. No further action occurred in 2011, but additional funds to pursue dredging were allocated in 2012 and the project was put out to bid successfully. Cashman Construction was the successful bidder, and Apex has acted as the Town's agent in the process. The Pond Manager has had minimal involvement with the dredging project and has limited information about progress, but dredging has now been completed.

Soft sediment was dredged in the fall of 2012. Soft sediment was dried in geotubes on the adjacent property (former St. James parish, eventually to be a town facility) until spring 2013, when it was hauled away and the parking area was restored to its former condition. Additional dredging of coarser sediment (mostly sand) exposed by soft sediment removal was conducted in the spring of 2013 and used for beach nourishment in the town swimming area. Visual inspection of the swimming area during summer 2013 indicated that the added sand buried most plants and created a more favorable substrate for human uses. However, by mid-summer there were some milfoil and fanwort plants colonizing the deposition area. No nuisance conditions were observed, but the substrate appears hospitable for at least some plant growth. Monitoring in spring 2014 is advised.

The reported sediment removal tally was 12,104 cubic yards (cy), with 6,383 cy of mainly muck sediments that was dried at the St. James site and disposed of in an approved landfill, and 5,721 cy of sandy material that was pumped to the beach area. The contract value was just under $820,000.

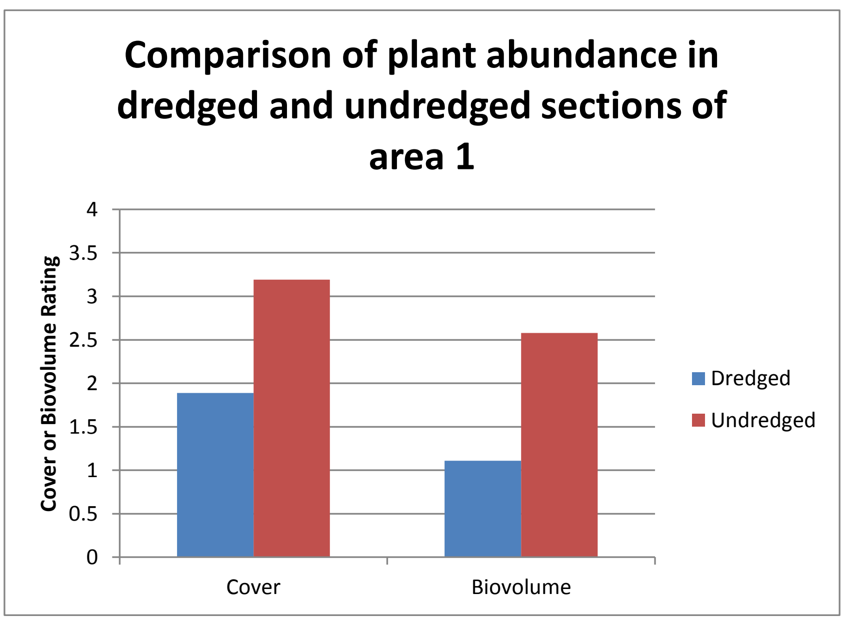
The dredging of the north basin was an expensive project and only a few acres of area have actually been dredged. Any sediment removal increases detention capacity of the north basin, however, an important settling and pollutant processing area within the pond, and is highly desirable. A smaller area was dredged to a deeper depth, expecting that other material will slough into the depression and result in a less topographically severe slope over time, but still providing increased detention time (about 20%

more). It may be desirable to hydrorake a channel through the dense growths to direct inflow from Bogle Brook to the newly deepened area, but this may not be necessary. Evaluation of flow path in 2013 indicated that most flow did move through the newly dredged area, maximizing detention.

Unfortunately, June flows were very high and actual detention time was inadequate to reduce phosphorus entering the main body of the lake (the south basin) to a desirable level. Conditions could have been much worse without the additional detention capacity created by the dredging project and the phosphorus inactivation treatment system, but there are limits to our in-lake capacity to manage inputs from a large urban watershed, and the very wet June 2013 created challenges and underscored the need for continued watershed management effort.

The plant survey included some points in the dredging area, allowing comparison with non-dredged, unharvested areas (Figure 13). Cover and biovolume were both substantially reduced. However, invasive submergent species were the most common plants found in the dredged areas, albeit at low densities. Visual assessment indicated some accumulation of fine silt after only a month since dredging ended, but this sloughing of nearby organic matter into the new "hole" was expected. The substrate is mostly sandy, but plant growth can be expected in water <8 ft deep. A substantial portion of this area is deeper than 8 ft, however, so regrowth may be low as a function of light limitation.

Figure 13. Comparison of plant cover and biovolume in area 1 for dredged and undredged sections.



Financial Summary

The entire allocation for FY13 was expended as of the end of June 2013, including $51,020 under the Pond Manager account and $7,140 under the monitoring account. Sometimes funds from the phosphorus inactivation account are allocated to WRS for additional labor as needed, but no funds were used by WRS in FY13. Rather, funds were used for chemical supplies and system repairs by the DPW.

As of the last invoice in September of 2012, 10.3% of the FY14 allocation for the Pond Manager was expended, while 17.5% of the FY14 allocation for monitoring was expended. This is normal for this point in the fiscal year. A total of $51,634 remains to be expended between now and June 30th of 2014. Most funds are expended between February and the end of June in this project, although we will have more testing and permitting work in the near future in this fiscal year than usual (see work plan below).

2014 Work Plan

The phosphorus inactivation and harvesting programs should proceed as in recent years, with improvements as warranted and supported by past experience and current budget. The education and LID programs should be dovetailed and advanced via the town website and follow up public actions. Such actions would appropriately focus on LID techniques (e.g., rain barrels and rain gardens) to minimize runoff, and minimization of pesticide and fertilizer use. Fortunately, phosphate lawn fertilizers are expected to be phased out over the next few years, but it may take another decade before the residual quantities in the watershed are exhausted. The dredging is now complete, and only monitoring is needed on an ongoing basis. The 2014 work plan is therefore structured to pursue the above goals, all part of the original comprehensive plan.

The following actions are suggested:

Phosphorus Inactivation

January – Complete testing for possible new aluminum formulation, make determination of any system change needs for 2014. Work with DPW to arrange for any changes to equipment on trailer.

February – Apply for permits necessary for 2014 application of aluminum to Morses Pond; this includes the License to Apply Chemicals from the DEP, and also a renewed Order of Conditions from the Wellesley Conservation Commission for 2014.

May – Check and repair in-lake components of the system (air and chemical feed lines) as needed, Hook up and test pumps and compressor. Order appropriate chemicals and receive early in the month if possible, to facilitate any further testing and system readiness by mid-May.

Mid-May –Initiate treatment at inlets in response to storm events. Continue into summer as needed. Track weather and focus June as key treatment time. Sample pond water prior to start of treatment and again in mid- to late June and again in July and August. Assess both inactivation success and impact of increased detention in the north basin as a result of dredging.

Harvesting

May – Get harvesters on the lake prior to Memorial Day if at all possible. Hold harvesting staff field meeting, if needed, to discuss the approach and ensure that common species can be identified. 2013 staff has been trained, but a refresher may be in order. Check swimming area for signs of plant colonization early in May.

May-June – Conduct spring harvesting program. Emphasize fragment minimization and maximum removal of invasive species.

June – Conduct plant survey, compare harvested and unharvested areas. Assess conditions going into the summer and adjust any priorities for the August-September harvesting effort. As part of this survey effort, since we will be covering most of the lake area anyway, evaluate shoreline plant conditions and any areas of shoreline erosion that might require attention. There will probably not be any hydroraking in 2014, but assessment should be conducted to support any needs in 2015, and erosion control needs are of interest to the NRC within 2014.

August-September – Conduct summer harvesting program.

Education

February – Convene a group to go over the web pages and request any final format adjustments.

April-May – Finalize content and publicize. Dovetail the Morses Pond pages with other town pages and the Friends of Morses Pond website to maximize impact.

Summer – Consider re-survey of residents regarding awareness of water and land management issues, actual landscape management practices, and impact of ongoing education campaigns.

Stormwater Control/LID Program

We can support town effort as desired and requested. We need to discuss how best to promote LID techniques beyond the educational packet and website, and what the Pond Manager can do to help.

Dredging

Actual dredging is complete. Track conditions in dredged area as part of water and plant monitoring program.

Financial Projections

Note that this work plan covers calendar year 2014, which spans FY14 and FY15. The suggested cost allocation is shown in Table 8. There are $51,634 remaining to be spent in FY14. With an expected December 2013 invoice of about $4350 (covering reporting and testing of alternative aluminum products), that will leave $47,284 to be expended in the first half of 2014, the second half of FY14. Work in the first half of FY15 is projected here as well, but depends to some extent on progress in the second half of FY14.

Note that while no allocation from the phosphorus inactivation account to pond manager activities is requested for FY15, it is suggested that the phosphorus inactivation account be increased by about $5000 to cover potentially increased chemical costs and possible system modifications to support improved safety and performance.

Table 7. Suggested financial allocations toward 2014 work plan

	Period	Jan-Jun	Jul-Dec
	Fiscal Year	FY14	FY15
Task	Account		
P Inactivation			
P inactivation system repairs	P Inactivation	$0.00	$0.00
P inactivation system operation	Pond Manager	$29,396.00	$5,000.00
P inactivation system monitoring	Monitoring	$5,888.00	$2,000.00
Harvesting			
Plant survey/harvesting support	Pond Manager	$6,000.00	$1,500.00
Education			
Web site upgrade/Ed. efforts	Pond Manager	$5,000.00	$5,000.00
Administrative			
Meetings	Pond Manager	$1,000.00	$2,000.00
Annual report	Pond Manager	$0.00	$3,000.00
		$47,284.00	$18,500.00