Town of Barnstable
Long Pond & Mystic Lake
Non-Native Vegetation Management Program

Long Pond & Mystic Lake Hydrilla (*Hydrilla verticillata*) Management

Project Completion Report for 2013 Hydrilla Management Performed at Long Pond & Mystic Lake – Barnstable, MA

February 2014

Prepared for:

Town of Barnstable

Prepared by:

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The following report summarizes the 2013 Hydrilla Management Programs at Long Pond and Mystic Lake in Barnstable, MA. The report will discuss results of the vegetation and tuber monitoring performed at Long Pond as well as the monitoring and treatment process at Mystic Lake.

Long Pond

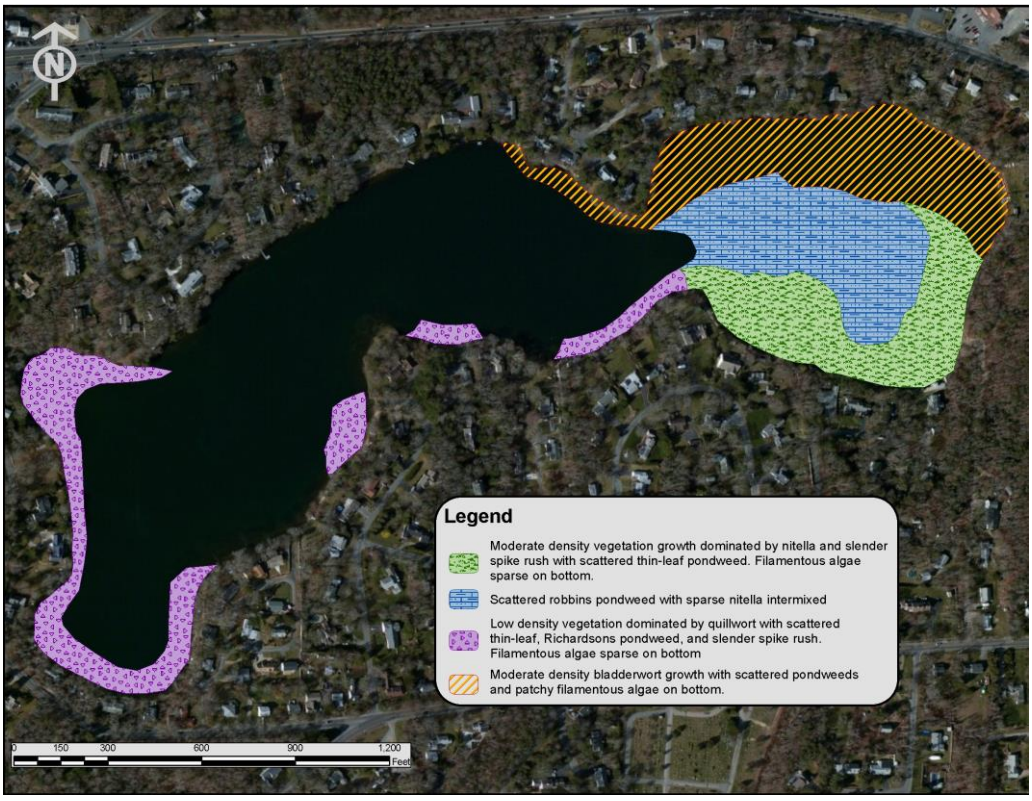
In-lake work performed at Long Pond consisted of early and late season vegetation surveys and tuber monitoring. No hydrilla or hydrilla tubers were found during any of the surveys in 2013, so no treatment was recommended or performed.

Early-Season Survey

An early season survey was performed on June 11. During the survey the littoral zone of the pond was systematically toured by two snorkelers.

Vegetation composition and distribution was generally consistent with previous years and was dominated by: stonewort (*Nitella sp.*), slender spike rush (*Eleocharis tenuis*), quillwort (*Isoetes sp.*), bladderwort (*Utricularia sp.*) and thinleaf pondweed (*Potamogeton pusillus)* with lesser amounts of golden hedge hyssop (*Gratiola sp.*), robbins pondweed (*Potamogeton robbinsii*), ribbon-leaf pondweed *(Potamogeton epihydrus*), and filamentous algae.

Figure 1 – 2013 Early Season Vegetation Distribution Map



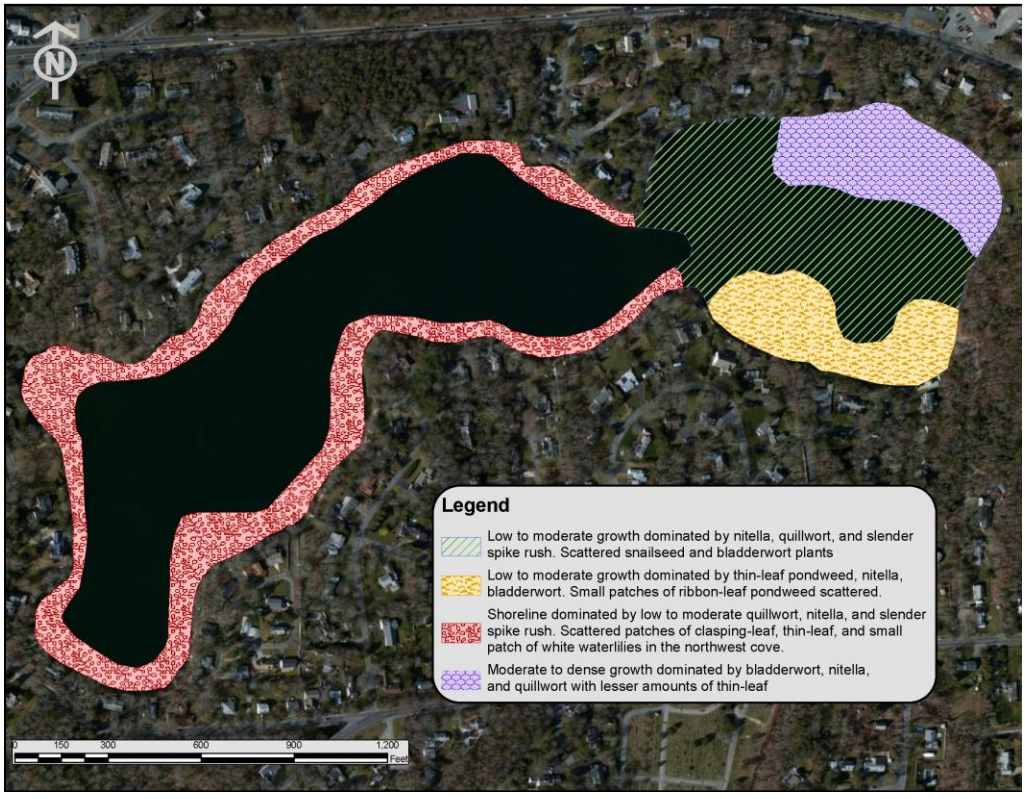
The greatest density and diversity of plants remains in the eastern basin, where despite repeated treatment native pondweed has continued to increase over the past few years. Aquatic plant growth in the middle portion of the pond and in the western basin remains confined to the narrow littoral area. Plant growth in these areas was less diverse consisting primarily of low-density quillwort and thinleaf pondweed with scattered occurrences of slender Spikerush, snailseed pondweed, and robbins pondweed. A map of the representative conditions observed on June 11 is depicted above.

Late-Season Snorkel Survey

A late season survey was performed on August 19. During the survey the entire shoreline of the pond was systematically toured by snorkeling. Consistent with previous snorkeling survey efforts performed at Long Pond the snorkeler was slowly towed behind a boat throughout the littoral areas of the pond to identify dominant plant species and visually characterize the distribution and density of various plant assemblages.

The vegetation composition observed on August 19 was similar to what was recorded in June and was dominated by: stonewort, slender spike rush and quillwort which were abundant throughout the littoral area of the pond. Plant diversity remained greatest in the eastern basin where moderate to dense areas of pondweed (*P. robbinsii, P. bicupulatus, P. epihydrus*) and bladderwort were found along the northern and southern shorelines. Aquatic plant growth in the middle portion and western basin remained dominated by low-density growth of quillwort, nitella and slender spikerush, which accounted for greater than 95% of the vegetation observed in these portions of the lake. Some scattered growth of thinleaf pondweed, robbins pondweed and clasping-leaf pondweed (*Potamogeton richarsonii*) were also observed. Low density patches of white waterlily were also noted in the cove along the northern shore in the western basin. A map of the representative conditions observed on August 18 is depicted below.

Figure 2 – 2013 Late Season Vegetation Distribution Map



HYDRILLA TUBER SAMPLING

Sampling of tubers and turions in the early and late growing season was again performed to quantify changes in density. The sampling was conducted by replicating the collection methods and sample sites first established in 2002, plus five additional sites established in 2004. The sample sites were located using waypoints on a hand-held GPS unit. Ten replicate samples were collected from each of the ten one square meter sample sites using a modified post-hole type digger. Each of the sediment samples were screened on site to extract all tubers and/or turions present.

A summary of the tuber sampling performed at Long Pond in 2013 follows:

Table 1 - 2013 Pre & Post-Treatment Tuber Sampling Data

Sampling Locations	Qualitative Sediment Type	Early Season – June 26, 2013	Late Season – Oct. 15, 2013
Site # 1	Sand and organic muck	0	0
Site # 2	Organic muck	0	0
Site # 3	Sand and organic muck	0	0
Site # 4	Sand and gravel	0	0
Site # 5	Soft peaty muck	0	0
Site # 6	Sand and organic muck	0	0
Site # 7	Sand and gravel	0	0
Site # 8	Sand and organic muck	0	0
Site # 9	Organic muck	0	0
Site # 10	Sand and organic muck	0	0
Total # of Tubers		**0**	**0**

Table 2 – 2002-2013 Tuber Sampling Data[1]

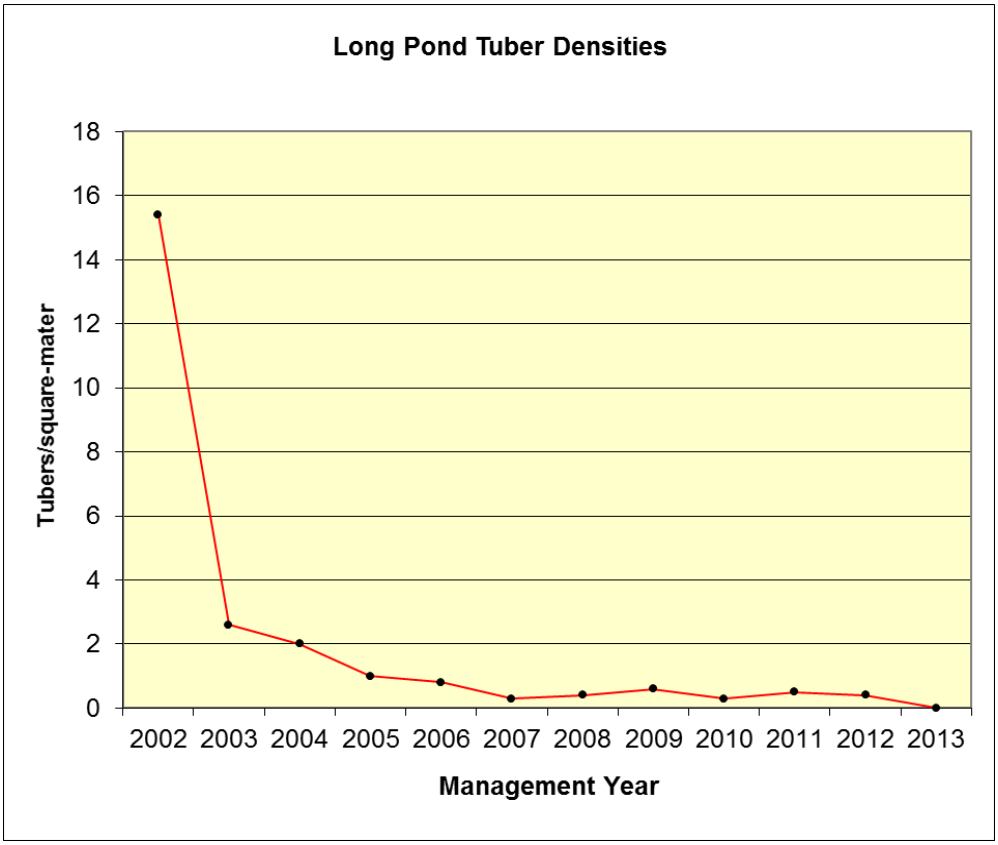
Management Year	Total # of Tubers Collected PRE-Treatment	Total # of Tubers Collected POST-Treatment
2002	77	13
2003	13	5
2004	10	2
2005	10	3
2006	8	0
2007	3	0
2008	4	3
2009	6	1
2010	3	0
2011	5	1
2012	4	2
2013	0	0

[1] *– The sample set, as of the Post-Treatment 2004 collection, was increased from 50 samples (10 replicate samples from five one square meter sample sites) to 100 samples (10 replicate samples from 10 one square-meter sample sites) and has remained that way through the 2009 Post-Treatment collection.*

- The line graph below shows pre-treatment tuber densities since the inception of the program in 2002. The graph depicts a steady decline in tuber density since 2002 to where densities are now at zero.

- This data is likely not statistically significant due to the small data set. It does allow for a look at the general trends and fluctuations in tuber density over time. Prior to the implementation of any

management in 2002 the relative tuber density was calculated at approximately 15.4 tubers/m^2. Since that time we have observed at steady decline in tuber density. Since 2006 the calculated tuber density has been less than 1 tuber/m^2 and for this first time in the program history no tubers were collected during the growing season.



Mystic Lake

In 2010 a few small areas of hydrilla were discovered in Mystic Lake. Between 2010 and 2012 benthic barriers were installed and hand-pulling/suction-harvesting was performed in an effort to eradicate hydrilla in the lake before it had a chance to establish and spread. Despite management efforts, hydrilla growth in the lake continued to thrive and expand. In the winter of 2012/13 Aquatic Control prepared and submitted a Notice of Intent for chemical treatment of the areas of dense hydrilla growth in Mystic Lake. The following portion of the report will discuss the herbicide treatment process at Mystic Lake as well as the observed response of the target hydrilla growth. Recommendations for the continued management of the hydrilla growth in Mystic Lake have also been provided.

The 2013 management program consisted of assessment, monitoring, and active management tasks. A brief outline of the 2013 Management Program is provided in the following chronology. All work performed in 2013 was consistent with the Order of Conditions issued for this project and the DEP License to Apply chemicals (#13258)

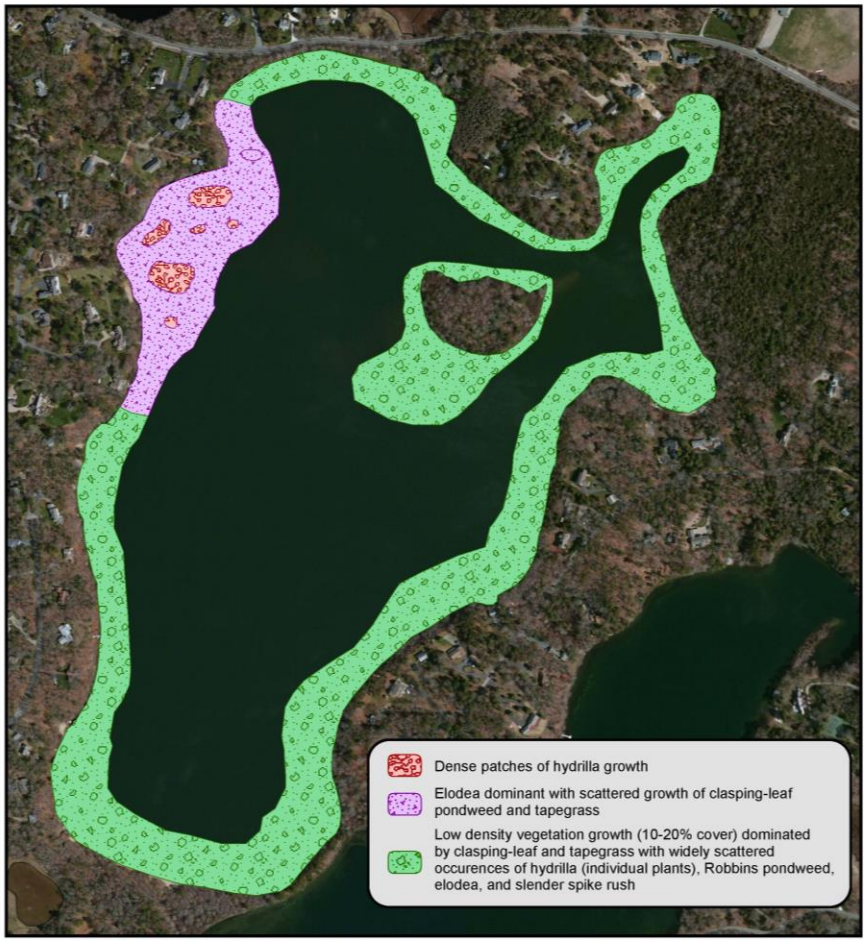
2013 Treatment Program Chronology

- Received approved MA DEP *License to Apply Chemicals* 6/5/13
- Pre-Treatment tuber sampling & Initial vegetation survey 7/5/13
- Split-treatment with Aquathol K ..... 7/22 & 7/23/13
- Post-treatment inspection 8/7/13
- Post-Treatment vegetation survey & tuber density sampling 10/11/12

Pre-Treatment Survey

A pre-treatment survey was performed on July 5. During the survey the shoreline of Mystic Lake was systematically toured by boat and snorkeled. The vegetation was identified visually and by plant collection with a throw-rake.

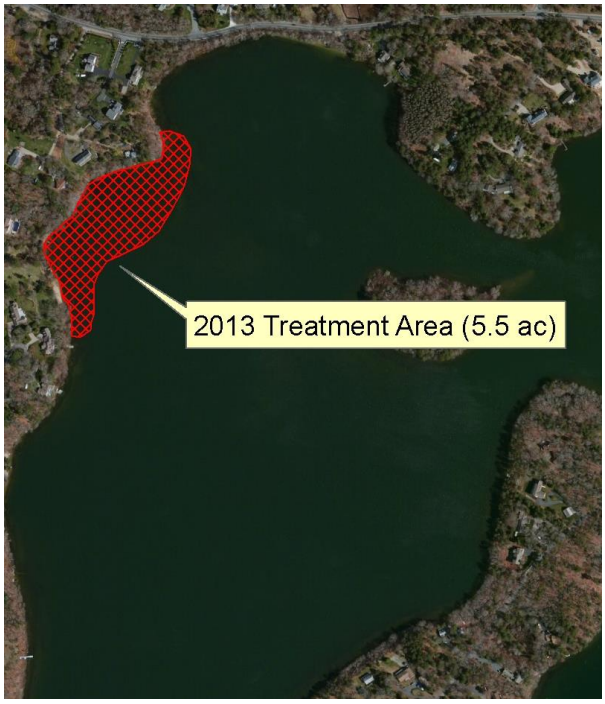
Figure 3 – 2013 Pre-Treatment Vegetation Distribution Map



Vegetation was generally confined to the immediate shoreline, extending roughly 75-100' feet from shore to a depth of 10-12 feet creating a contiguous ring around the lake. The plant assemblage was generally characterized by low-density growth of clasping-leaf pondweed and tapegrass (*Vallisneria americana)* with scattered occurrences of hydrilla (mostly individual plants), Robbins pondweed, common waterweed (*Elodea canadensis*) and slender spikerush. Pockets of hydrilla were observed around much of the lake shoreline, all of which had been previously identified by the lake association. The only area that supported dense contiguous hydrilla growth was the cove area along the western shore (the ~5.5 acre area designated herbicide treatment area). This area was the only area in the lake that had dense growth of the native plant waterweed. Hydrilla growth was still immature in early July and was only 4-6" inches in height. A map of the representative conditions observed on July 5 is above.

Summary of 2013 Treatment

Treatment of the 5.5 acre cove area was performed on Monday July 22 & Tuesday July 23 (see picture right).



The treatment was conducted with an 18 foot work skiff equipped with a specialized low pressure spray system. The liquid Aquathol K herbicide was applied subsurface using weighted hoses to avoid aerial drift of the herbicide. The treatment boat was equipped with a Differential/WAAS GPS navigation system to insure that the herbicide was evenly applied to the designated treatment area.

Treatment was performed as a split application whereby roughly 50% of the herbicide was applied to the designated treatment area on the first day of treatment and then the remaining 50% was applied 24 hours later. This split application approach was used to increase concentration-exposure-time (CET) and increase the efficacy of treatment. Aquathol K herbicide was applied at a target dose of 1.5ppm during each application for a total dose of 3.0 ppm over the course of the two day treatment.

Post-Treatment Inspections and Survey

Inspections of the treatment area were performed on August 7 and August 19, seventeen and twenty eight days after treatment, respectively. During both surveys the treatment area was inspected by an Aquatic Control biologist to assess treatment impact and hydrilla and non-target plant viability. On August 7 the entire area was surveyed by snorkeling. A boat and plant collection techniques were used on August 19.

Impacts from the treatment were slow to develop and on August 7 most of the plants in the treatment area appeared relatively unharmed. While the plants appeared to have stopped growing and were the same height as they were prior to treatment, they were still green and erect in the water column. By August 19, twenty eight days after treatment, the hydrilla in the treatment area was showing more typical signs of herbicide exposure having lost their vibrant green color to a more yellowish brown, losing leaflets on the lower portion of their stems and becoming very brittle.

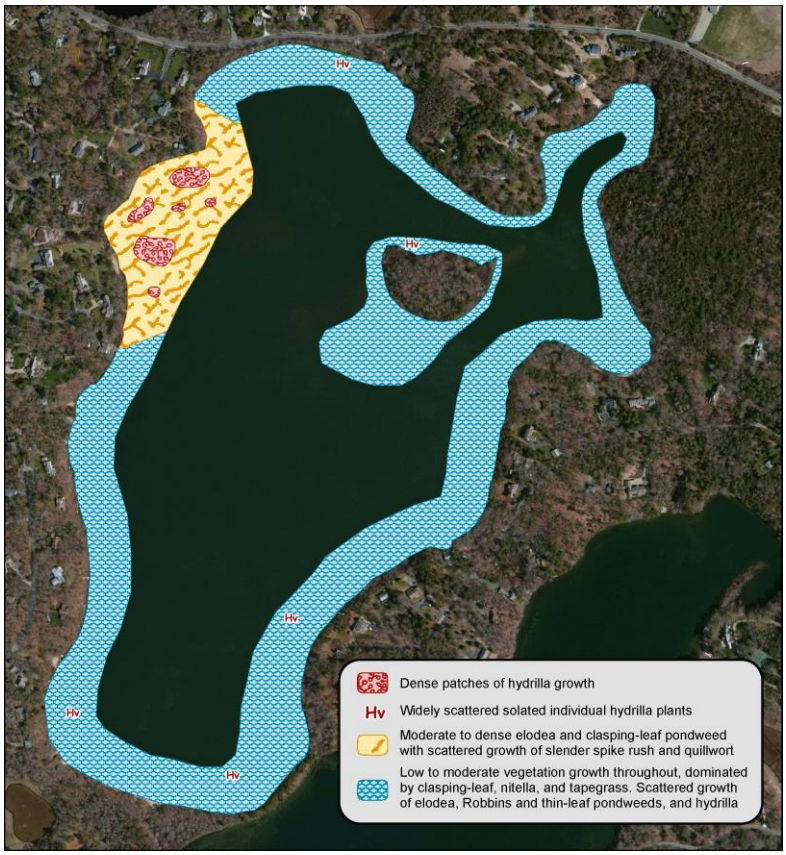
Representative Hydrilla growth on August 19

Representative Hydrilla growth on October 15

Hydrilla was still evident in the treatment area at the time of the late season survey on October 15, however impacts from the herbicide were more evident, and most of the observed growth was limp and lying on the lake bottom. No signs of tuber production were evident within the treatment area but some of the plants observed on the periphery of the treated area were not as degraded, so it is possible that some recovery and tuber production did occur outside of the 5.5 acres area.

Native vegetation remained healthy throughout the treatment process with little to no observed impacts on non-target species. Elodea, which dominated the treatment area, remained healthy following treatment actually increasing in density, creating thick bottom cover throughout the treated area. Outside of the treatment area, vegetation distribution and composition was similar to what was recorded in early July and was characterized by low-moderate density cover of clasping-leaf pondweed, nitella and tapegrass. Healthy growth of thinleaf pondweed, robbins pondweed, slender spikerush and quillwort were also common and wide-spread but typically tertiary or quaternary in abundance. Low-density scattered hydrilla was also scattered around the littoral area, but most of the observed growth consisted of individual plants.

Figure 4 – 2013 Post-Treatment Vegetation Distribution



HYDRILLA TUBER SAMPLING

Sampling of tubers and turions pre and post-treatment was performed to quantify changes in their densities. The sampling was conducted by replicating the collection methods and sample used at Long Pond since 2002. The sample sites were established using way points recorded by a hand-held GPS unit. Ten replicate samples were collected from each of the four one square meter sample sites using a modified post-hole type digger. Each of the sediment samples were screened on site to extract all tubers and/or turions present.

A summary of the tuber sampling performed at Mystic Lake in 2013 follows:

Table 3 - 2013 Pre & Post-Treatment Tuber Sampling Data – Mystic Lake

Sampling Locations	Qualitative Sediment Type	Pre-Treatment – July 5, 2013	Post-Treatment – Oct. 15, 2013
Site # 1	Sand and gravel	18	11
Site # 2	Sand and gravel	17	9
Site # 3	Sand and gravel	13	8
Site # 4	Sand and gravel	3	2
Total # of Tubers		**51**	**30**

- Sample sites 1-3 were located in the 5.5 acre treatment area where hydrilla densities were greatest and site 4 was located along the southern shoreline where an abundance of small hydrilla patches had been observed over the years.
- Based on the pre-treatment tuber sampling the tuber density within the designated treatment area was 16 tubers/m^2.
- Following the Aquathol K herbicide treatment we saw an approximate 42% reduction in tuber density within the treatment area.

MANAGEMENT RECOMMENDATIONS

We are happy to report that no hydrilla growth or viable tubers were observed at any time during the 2013 management season in Long Pond. This marks the first year since the inception of the management program back in 2002 that no active hydrilla management was required. Although we cannot be certain that this lack of growth represents true eradication, we are hopeful that it is, at a minimum, a sign of extended long-term control that requires minimal intermittent effort to sustain. Based on this past season we do not anticipate that active hydrilla management will be required at Long Pond in 2014. We strongly recommend, however, that the Town continue to closely monitor the vegetation community in order to identify any recolonization of hydrilla in the earliest possible stages. This will be imperative to rapid management response and sustaining long-term control of hydrilla in Long Pond.

<u>Mystic Lake</u>

We are confident that the Aquathol K treatment performed in 2013 effectively prevented successful hydrilla propagation within the treatment area. However, based on the hydrilla's somewhat slow response to the current treatment program, we feel that some minor modifications may elicit a faster and more complete kill of the targeted growth. Recent studies conducted by the herbicide manufacturer on the degradation and dissipation rates of endothall, suggest that in a partial lake treatment situation, like Mystic Lake, a split-dose treatment approach is necessary to achieve the

required contact-exposure-time (CET) for hydrilla control. These data also indicate that endothall concentrations typically fall below lethal levels approximately 8 hours after application. Understanding this information it appears that our split-dose treatment approach performed this past summer (1.5 ppm endothall on consecutive days - 24 hours apart) resulted in 12-16 hours of lag time between lethal doses. Although current research suggests that this is insufficient time for the plants to completely recover from the initial herbicide exposure, it may account for the slower and somewhat muted hydrilla response observed this past summer. For this reason we recommend again performing a split dose treatment, but with a shorter time span between each application. We feel that increased hydrilla response can be better achieved if the split treatments are performed 6-8 hours apart. This approach will maximize the CET and minimize the lag time between lethal herbicide concentrations.

Aside from this minor treatment modification, we feel that all other aspects of the hydrilla management program in Mystic Lake (snorkel surveys, manual hand-pulling, and benthic barrier installation) should continue as currently constituted. With this said these same hydrilla management efforts should be expanded to include Middle Pond, where two areas of hydrilla growth were discovered in 2013. Based on our hydrilla management experience we fully anticipate that active hydrilla management will be required in Mystic Lake and to a lesser extent Middle Pond in 2014. It is therefore our recommendation that the Town budget for a similar level of management effort in 2014.