January 4, 2005

Division of Natural Resources
Town of Concord
141 Keyes Road
Concord, MA 01742

Re: Project Completion Report for Nuisance Aquatic Plant Management Program at Warner's Pond - 2004

Dear Commissioners:

During the summer of 1999, Aquatic Control was contracted by the Town of Concord to prepare a management plan for Warner's Pond. The study was prompted by concerns over increased aquatic plant coverage that was causing a loss of open-water conditions. Findings of the 1999 study characterized Warner's Pond as a relatively shallow impoundment of Nashoba Brook, with an extensive watershed area, significant sediment deposition, and fairly abundant aquatic plant growth. Established populations of three non-indigenous aquatic plants, water chestnut, fanwort and variable watermilfoil, presented the most immediate threat to the loss of open-water at Warner's Pond. Growth of exotic purple loosestrife and invasive water willow was also threatening loss of shallow water areas and shoreline access. Recommended management activities included diligent removal of water chestnut, and the establishment of a vegetation management zone throughout the developed eastern half of the pond and habitat preservation zones in the western half of the pond.

Initially, we identified water chestnut to be the most significant threat to open-water habitat, however, an aggressive campaign of volunteer hand-pulling and mechanical harvesting has successfully controlled the water chestnut resulting in a significant decrease in the water chestnut population. Unfortunately, while control of water chestnut has been gained, there has been a dramatic increase in the fanwort coverage throughout the waterbody. The notable increase in fanwort density has severely impaired recreational access to the pond during mid-summer, prompting the Town to hire Aquatic Control again in 2003 to perform an aquatic vegetation survey at Warner's Pond, and to update management recommendations.

Our 2003 survey replicated the comprehensive transect/data point survey methodology used in 1999. During the September 2003 survey, we found fanwort to account for nearly 54% of the total plant growth in Warners Pond. (A list of plants encountered during the 2003 survey can be found in Table 2 in the Appendix.) Fanwort was clearly the most problematic invasive plant in Warner's Pond. Water chestnut was being effectively controlled with harvesting and hand-pulling and variable watermilfoil was still only found in a few locations and was secondary to the fanwort growth. Due to the considerable flow through the system and the inability to manipulate water levels with the existing dam, chemical treatment cannot be performed cost-effectively in Warner's Pond. Instead, we recommended harvesting the problematic fanwort in open water areas to maintain a usable waterbody and a demonstration hydro-raking operation to clear individual shorelines of purple loosestrife and other invasive, emergent plants.

Following an early season survey conducted by Marc Bellaud, Senior Biologist at Aquatic Control, and submission of a recommended work plan, the Town of Concord, in cooperation with USF&W and Aquatic Control performed a nuisance vegetation management program on Warners Pond during the summer of 2004. The following report reviews the information collected during both early and late surveys conducted in 2004, the success of the harvesting and hydro-rake programs, and gives recommendations for the future management of Warners Pond.

PROJECT SUMMARY

Early Season Survey

The early season survey took place on 6/11/04 and was conducted by Marc Bellaud. The primary goal of the survey was to establish priority harvesting areas for the upcoming summer and identify potential hydro-rake sites along shore. To establish these areas, the entire pond was inspected and areas were prioritized for harvesting based on the severity of the fanwort problem and access for harvesting equipment. Depth, bottom composition, and vegetation assemblages were recorded at 11 of the previously established (during the 1999 and 2003 surveys) data point locations (see Figure 2) around the pond to help monitor the success of the current management plan. In addition, shoreline access points for the abutting properties were inspected to determine which sites were the highest priorities for a demonstration hydo-raking effort (see Figure 1).

Although much of the 44 acre open water area of the lake has been severely impacted by the presence of Fanwort, 25 acres in the eastern half of the pond were identified as the priority harvest area and 13 access points were noted as potential shoreline hydro-rake locations (see Figure 1).

Fanwort plants were generally still 1-2 feet below the surface at the time of our 6/11/04 inspection and harvesting in early to mid July appeared to be optimal, to maximize the duration of control that could be achieved from a single cutting. There was more flexibility in the timing of the demonstration hydro-raking operation. It was ultimately dictated by Aquatic Control's equipment availability and the work was performed in late August.

Harvesting Operation

The harvesting operation at Warners Pond began on 7/9/04 and continued until 7/22/04. The harvesting was done with a USF&W aquatic weed harvester, on loan from the USF&W to the Town of Concord. Of the 13 days which the Town had the harvester, 9 days of varying lengths were spent harvesting, totaling 45 harvesting hours. Within this amount of time the harvester was able to cut approximately 21 acres, (see Figure 2) and generate 23 truckloads of organic debris.

The USF&W harvester in use cut an 8 foot swath up to 5 feet deep. Where possible the fanwort was cut to 5 feet below the surface to maximize the efficacy of the harvesting program. Shallower areas, particularly the western third of the determined harvesting zone, were cut as low as possible, however, in certain places this meant that vegetation could only be cut a foot or so below the surface.

Once cut, harvested material was transported on the harvester and was dumped on shore at the boat launch. The Town later loaded and hauled the harvested material to Marabello's for permanent disposal. Two trucks were used reportedly used to haul the material. One was a 6-wheel dump truck with a 7 cubic yard capacity and the other was a one-ton dump truck with a 3 cubic yard capacity.

Hyro-Raking Operation

The hydro-raking portion of the management program was performed by Aquatic Control and took place 8/24/04 through 8/27/04. The main objective of the hydro-raking program was to remove invasive emergent plants, root mats, and sediment build-up from the 13 individual access points located around the pond. All 13 access sites were potential locations for the demonstration hydro-raking work; however, budgeting constraints limited hydro-raking to the properties located in the outlet canal. The original management plan called for a minimum of 24 hydo-raking hours with no transport barge. However, due to shoreline access limitations in the outlet canal, it was necessary for Aquatic Control to use its Harvester/Transport Barge to transport the raked material back to the boat launch access point.

In the end, Aquatic Control's hydro-rake and transport barge were mobilized for a total of 35 hours, 18 and 17 hours respectively. Within this amount of time we were able to successfully clear approximately 6 individual shorelines, all of which were located in the outlet canal at the southern end of the pond. Although less than half of the proposed hydo-raking sites were successfully managed, they act as a prudent demonstration of the hydro-raking capabilities, and provide good reference from which budgeting for such activities can be measured for future management of these areas.

RESULTS OF LATE SEASON SURVEY

The late season survey was preformed on 9/29/04 and was again conducted by Marc Bellaud. This survey was conducted in the same manner as the early season survey, including a visual inspection of the entire pond and data collection at the 11 previously sampled georeferenced data points. The purpose of re-surveying some of the data points was to document the effectiveness of the 2004 management activities.

The results of the late season survey were optimistic and showed that the harvesting program was relatively effective at controlling the problematic fanwort growth for the majority of the summer. Within the surveyed sites it was shown that the fanwort remained an average of about 2 feet under the water's surface. Even though fanwort was regrowing, harvesting did maintain open-water conditions on the surface through the month of September.

Though the late season survey was not intended to characterize the entire aquatic plant community of Warners Pond, the dominant aquatic plants present, percent total plant cover, percent fanwort cover, and biomass, were all recorded at the 11 data points previously described, to gauge the effectiveness of the harvesting opertation. A comparison of the results from the late 2003 and the late 2004 surveys at these points is listed below in Table 1.

Table 1-Warners Pond Late Season Survey Results

	September 2003 Survey Data					September 2004 Survey Data					
Data Point	Water Depth	Vegetation	Total Plant % Cover	Fanwort % Cover	Biomass Index	Water Depth	Vegetation	Total Plant % Cover	Fanwort % Cover	Biomass Index	Depth Below Surface (ft)
C6	4	Cc, Nu, Cd, Ny	100	80	4	4	Cu, Nu, Cd	80	70	3	2
D9	4.25	Cc, Ny, Pz, Cd	100	60	4	5	Cc, Ny, Cd	80	60	3	2
E5	4.25	Cc, Ny, Mh, Cd, Pz	100	70	4	4	Ny, Cc, Cd, Pz	100	60	3.5	1
E6	4.5	Cc, Nu, Ny, Mh	100	80	4	4.5	Cu, Nu, Cd	90	80	3	2
E7	5.5	Cc	25	100	2	5.5	Cc, Cd	50	90	2	3
E8	4.25	Cc, Ny, Cd	100	80	4	4	Cc, Cd, Ny	90	80	3	2
F6	4.5	Cc, Mh	100	80	4	5.5	Cc, Ny	70	80	3	3.5
G6	4	Cc, Ny, Cd, Mh, Nu	100	80	4	4	Cc, Ny, Cd, Mh, Nu	100	80	4	0
G7	4.5	Cc, Ny, Cd	100	90	4	4.5	Cc, Ny, Cd	100	90	4	0.5
G8	7.5		0	0	0	7.5		0	0	0	
G9	4.25	Cc, Ny	100	90	4	4.25	Cc, Ny	100	90	3.5	3.5
Averages:			**84.09**	**73.64**	**3.45**	**4.80**		**78.18**	**70.91**	**2.91**	**1.95**

At the time of the September 2003 survey the fanwort in Warners Pond had reached the surface in almost all infested areas. When the pond was inspected in late September 2004, fanwort was still present at most locations, but its biomass was reduced and the plants were on average 2 feet below the surface. The reduction in plant cover and biomass between the two survey years is a direct result of the harvesting program, and it highlights the success of the harvesting campaign.

The individual shorefronts that were hydro-raked in the outlet canal remained clear of nuisance emergent vegetation. The hydro-rake was able to remove most of the overgrown emergent vegetation and the accumulated leaf litter and sediment deposits. The property owners were left with clear access to the pond. This strategy appears to be an effective way to reclaim shoreline access points that have become overgrown with invasive vegetation.

SUMMARY

Overall it appears that the harvesting program can achieve acceptable control of the fanwort on Warner's Pond for the majority of the summer. Although there was little to no change in the overall composition of the aquatic plant community as a result of the harvesting program, this initial harvesting effort showed that one midseason cut of the fanwort can provide significant control in helping to maintain open water habitat for the entire summer.

As has been discussed before, Warner's Pond's unique characteristics severely limit the management options that can be used in a waterbody facing a fanwort infestation. Sonar is the only EPA and State registered aquatic herbicide that effectively controls fanwort. Unfortunately, Warner's Pond is not a good candidate for Sonar treatment because of its rapid flushing rate and inability to manipulate water levels and outflow rates. Without significant changes in our ability to manipulate the water level and outflow rates at Warner's Pond, it seems that mechanical harvesting of the fanwort is really the only option for fanwort control. For this reason, it is our recommendation that you continue with the same work plan that was in place this past year. Since acceptable season-long control of the fanwort was achieved with only one mid season harvest, we recommend a similar harvesting regiment be followed in the coming year.

As with any program of this nature, it is always helpful if more time can be spent harvesting to ensure greater pond-wide control of fanwort. In this regards, it may be prudent for the Town to investigate further onshore disposal options since a great deal of harvesting time is lost in transportation of the harvested material to the onshore locations. In our opinion, the only possible supplementary unloading location would be located in the northeast corner of the pond in the field abutting the shoreline. It appears that with minimal shoreline improvements this area could be a suitable offloading location. It is then possible that the harvested vegetation could be stockpiled in the field and later used as compost. This would eliminate the need to truck the material to an offsite disposal location. Obviously, the Town would need to approach the current owner/operator of the agricultural field to see if this is a possibility.

In terms of hydro-raking, it was shown through our demonstrative hydro-raking program that control of shoreline emergent plants can be achieved and shoreline access points can be reclaimed. It is our recommendation that the Town or pond Association consider an allocation of funds for an on-going hydro-raking program. However, unlike the harvesting program, it would not be expected that hydro-raking would have to be performed on an annual basis to maintain acceptable shoreline growth. Once an area has been hydro-raked, and much of the hydro-soil and sediment build-up has been removed, it is reasonable to expect multi-year control of the nuisance shoreline growth. The duration of control could be further extended with minimal onshore maintenance, including hand pulling of returning nuisance plants such as purple loosestrife. The benefit to an on-going hydro-raking program would result in sustained community access to the pond. In time, it would be expected that the annual cost of a hydro-

raking program would drop significantly, provided that the shoreline environments respond as we expect, and if these areas were properly maintained in subsequent years after raking was performed.

For the moment it appears that the current non-native and invasive aquatic plants infesting Warners Pond are being managed appropriately. It is thus the recommendation of Aquatic Control to continue with a similar mechanical harvesting and hydro-raking management program in the coming years. This will insure that open-water conditions are maintained during the summer months. In the interest of documenting the future efficacy of the program it is also recommended that we continue to monitor the status of the pond through a late season survey. Monitoring the lake and its reaction to the management program is an important tool in ensuring that the appropriate techniques are being used to accommodate the desires of the Town and its residents.

Sincerely,

AQUATIC CONTROL TECHNOLOGY, INC.

Marc Bellaud
Senior Biologist

Gerald N. Smith
President/Aquatic Biologist

APPENDIX

- **2003 Dominant Aquatic Plant List**
- **Figure 1 – 2004 Harvesting and Hydro-Raking Plan**
- **Figure 2 – 2004 Harvested Area**
- **Photographic Documentation**

TABLE 2

DOMINANT AQUATIC PLANTS IN WARNER'S POND - 2003

Scientific Name	Common Name	Abbreviation Used in Field Survey Data and Maps	Plant Type	Distribution	Present in 1999
Callitriche	Water Starwort	Ca	Submersed	Sparse – found in a few locations west of Boy Scout Island	Y
Cabomba caroliniana	Fanwort	Cc	Submersed (Non-Native)	Abundant – dominant plant throughout majority of pond	Y
Ceratophyllum demersum	Coontail	Cd	Submersed	Common – secondary to fanwort	Y
Decodon verticillatus	Water Willow	Dv	Emergent	Abundant – along shoreline in western half of pond, patches elsewhere	Y
Lemna sp.	Duckweed	L	Floating	Common – scattered throughout pond in low densities	Y
Lythrum salicaria	Purple Loosestrife	Ly	Emergent (Non-Native)	Scattered/Common – growing along shoreline margins, mixed into dense water willow stands near inlet on western shore	Y
Myriophyllum heterophyllum	Variable Watermilfoil	Mh	Submersed (Non-Native)	Scattered – patches found north and south of Boy Scout Island	Y
Nuphar luteum	Yellow Waterlily	Nu	Floating-Leafed	Abundant – extensive beds in western half of pond, scattered patches and shoreline growth elsewhere	Y
Nymphaea odorata	White Waterlily	Ny	Floating-Leafed	Abundant – extensive beds in western half of pond, scattered patches and shoreline growth elsewhere	Y
Potamogeton epihydrus	Ribbon-Leaf Pondweed	Pe	Submersed	Scattered – mixed in with other submersed plants in several locations	Y
Potamogeton natans	Floating-Leaf Pondweed	L	Submersed	Sparse – confined to inlet area	Y
Potamogeton pusillus	Thin-Leaf Pondweed	Pp	Submersed	Sparse – confined to inlet area	N
Potamogeton zosteriformis	Flat-Stem Pondweed	Pz	Submersed	Sparse – found along eastern shore	N
Pontederia cordata	Pickerelweed	Po	Emergent	Sparse – a few small shoreline patches were found	Y
Polygonum sp.	Water Smartweed	Py	Floating-Leafed	Sparse – a few patches southwest of Boy Scout Island	N
Sparganium sp.	Burreed	Sp	Emergent	Sparse – only found near inlet	N
Wolffia sp.	Watermeal	W	Floating	Common – scattered throughout pond in low densities	Y

No Vegetation

~13 Acres

Sandbar

~12 acres

Disposal at boat landing

Boat Landing
Base of Operations

Disposal in canal

N
W E
S

WARNERS POND
Concord, MA

2004 Harvesting and Hydro-Raking Plan

FIGURE	SURVEY DATE	MAP DATE
1	6/11/04	7/8/04

LEGEND

Recommended harvest areas
Total Area ~ 25 acres

Potential shoreline hydro-rake locations

Orthophoto coverage courtesy of MassGIS

SCALE

60 0 60 120 180 240 Feet

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C6

D9

E5 E6 E7 E8

F6

G6 G7 G7 G8

N

W E

S

WARNERS POND
Concord, MA

Areas Harvested in 2004

FIGURE	SURVEY DATE	MAP DATE
2	9/29/04	1/6/05

LEGEND

- Recommended harvest areas Total Area ~ 25 acres
- Actual harvested area as reported by the Town of Concord ~21 acres
- Data points surveyed in 2003 & 2004

Orthophoto coverage courtesy of MassGIS

SCALE

50 0 50 100150 Feet

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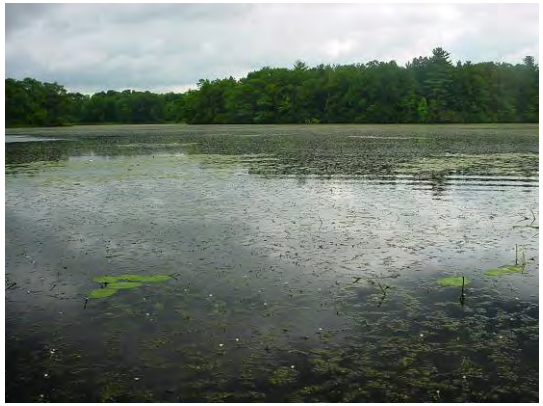
WARNERS POND – Concord, MA

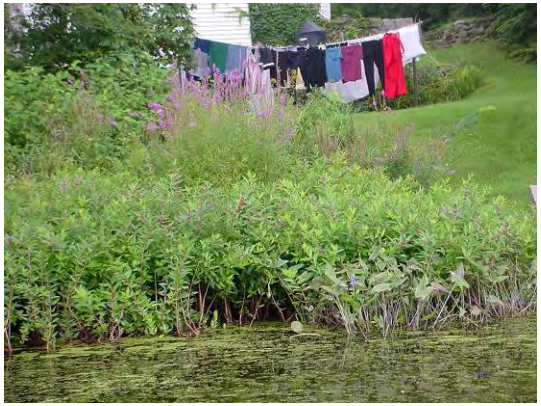
2004 Invasive Aquatic Plant Management Program – photodocumentation

Before 2003

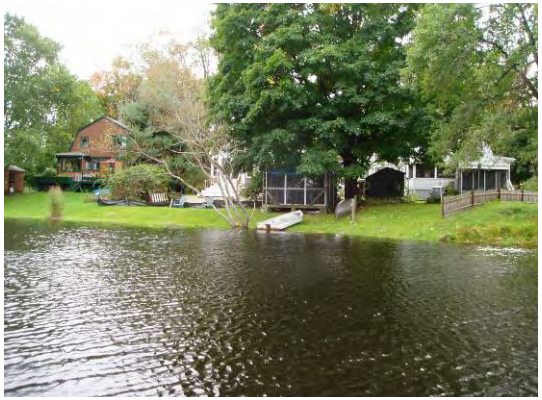


9/2/03 – Looking northwest from boat launch - fanwort (*Cabomba caroliniana)* flowers breaking the surface, dense cover

Before 2003



9/2/03 – Representative shoreline growth of invasive emergent vegetation

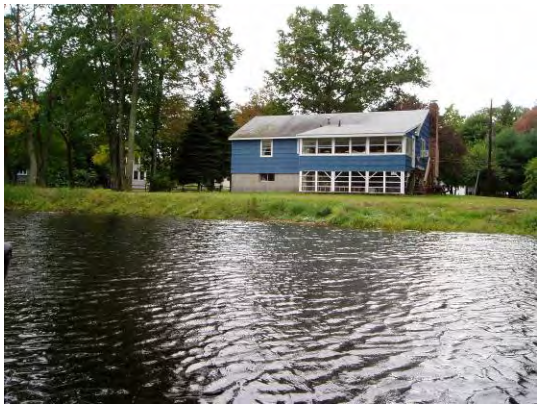


9/29/04 – Post hydro-raking, cleared shoreline in southern outlet canal

After 2004

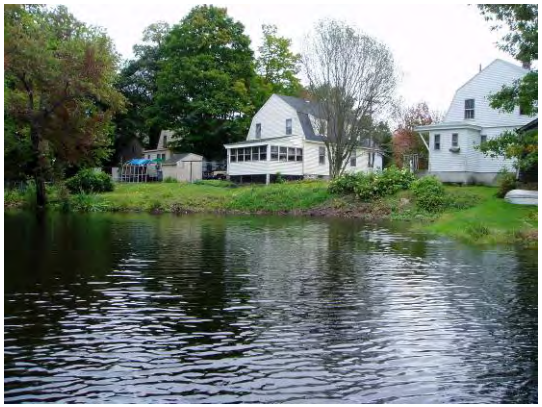
9/29/04 – Looking south from boat launch – area supported dense fanwort cover in Sept. 2003

After 2004



9/29/04 – Post hydro-raking, cleared shoreline in southern outlet canal

After 2004



9/29/04 – Post hydro-raking, cleared shoreline in southern outlet canal