

**SUMMARY OF VARIABLE-LEAVED MILFOIL 2007  
SURVEY**

**CRYSTAL LAKE, ELLINGTON/STAFFORD,  
CONNECTICUT**

*Prepared For:*

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December 4, 2007  
(Final Report)

**Introduction**

The distribution of variable-leaved milfoil (*Myriophyllum heterophyllum*) in Crystal Lake Ellington, Stafford Springs, Connecticut, was surveyed during the fall of 2007. Prior surveys conducted in 2000, 2003, and 2006, showed that milfoil coverage in the lake is increasing. A demonstration Suction Harvesting project was conducted in 2006 to provide information about the effectiveness of this method to remove variable-leaved milfoil. The summary report from that project, “Demonstration Milfoil Suction Harvesting Project, Crystal Lake, Ellington/Stafford, Connecticut”, dated June 18, 2007, by Northeast Aquatic Research, documented that Suction Harvesting was a viable method to remove milfoil from Crystal Lake. In order to plan for future suction harvesting activities at Crystal Lake updated mapping was needed to make an accurate estimate of the costs of harvesting milfoil from the lake. This report provides that undated mapping and gives new estimates of the acres of milfoil coverage in the lake, the costs, and time required to harvest milfoil from Crystal Lake.

Crystal Lake in, Ellington, Stafford Springs, Connecticut, has been infested with the invasive non-native, rooted aquatic plant variable-leaved milfoil for several years. Northeast Aquatic Research conducted three lake-wide surveys to map the distribution of aquatic plants in the lake, 2000, 2003 and 2006. In each survey the area of the lake infested with milfoil was found to have increased. The 2007 survey showed that new areas are now infested with milfoil bringing the total surface area coverage to almost 20 acres. The surface areas, in acres, for each specific area of infestation in Crystal Lake are given in **Table 1**.

**Table 1. Record of Milfoil Coverage Observed In Crystal Lake.**

Area	Acres			
	2000	2003	2006	2007
South Wetland Cove	1.87	1.88	1.88	1.27*
Southern Lake	0	0	0	3.95
North Wetland Cove	2.00	5.50	6.20	5.75
North Lake	~	2.00	2.00	6.73
Outlet Cove	0.27	0.27	1.50	1.50
West Shore	~	<i>Isolated plants</i>	<i>Isolated plants</i>	<i>No plants found</i>
<b>Total</b>	<b>4.14</b>	<b>9.64</b>	<b>11.58</b>	<b>19.6</b>
Route 140 Pond			0.86	0.86

\* = cove had large areas that were dry so could not be completely surveyed.

## **Areas Of Milfoil Infestation**

### 1) South Wetland Cove:

The south wetland cove contains two very dense stands of milfoil. Milfoil in each bed was luxuriant and growing to the water surface. In prior surveys variable-leaved milfoil was found scattered throughout the cove mixed with the other native aquatic species. This year, 2007, the cove was partially dry with some areas exposed mud flats. These areas could not be surveyed, although milfoil could be seen growing on some of the mud surfaces.

### 2) Southern Lake:

The south side of the lake, off shore of the town beach and outside of the South Wetland Cove, was found to contain a new infestation of milfoil. . The area of milfoil coverage consisted of scattered shoots of milfoil in three different areas. The largest was off shore of the town beach where milfoil was found as plentiful clumps of shoots. The two smaller beds were off shore of the South Wetland Cove where plants were more isolated, occurring as single shoots. Plants were not observed in these areas during prior surveys.

### 3) North Wetland Cove:

The North Wetland Cove was found to contained dense growths of milfoil in association with other aquatic plants mostly water lilies and water shield. Again, these beds were not mapped because of the difficulty in accessing the cove due to the prolific water lily coverage.

The area of the lake outside the mouth of the North Wetland Cove has been mapped in the past as having the most prolific growths of the milfoil in the lake. This area was the site of the Suction Harvesting Demonstration Project in 2006. The milfoil occurs in two areas of different abundances, an inner core bed of about 2.7 acres where milfoil plants was growing at moderate to high density of between 40 to 80 % bottom cover, and an outer band of about 2.7 acres where plants are more isolated and sporadic and had lower density of between 1 – 10 % bottom cover. This year's survey identified new isolated shoots growing along the eastern lake shore in areas that had been previously clear of milfoil. These areas totaled about 0.3 acres.

The area of the suction harvest demonstration operation conducted in 2006 was also surveyed. No new growth of milfoil was observed in the 0.4 acre area. There were some scattered small shoots that were there observed in the harvested area during the post operation survey made in 2006 after the harvesting was finished. These small shoots are typically a foot of less in length and had been missed by the harvester. The presence of some missed plants indicates the need to revisit areas of harvesting later in the same season or the next year to remove these stragglers.

### 4) Outlet Cove:

The outlet cove refers to the narrow area of the lake between the sand bar and the dam. Within this area, milfoil has spread to almost completely cover the

bottom for about 1.5 acres. There was no change in this area in 2007.

5) North Lake and Northeast Shore:

In 2003, the underwater camera revealed milfoil growing along the eastern shore in deep water of up to 20 feet deep. This area is west around the point from the North Wetland Cove beds. In this area, about 2 acres in size, sporadic isolated small plants were found in mostly deeper water, between 10 – 20 feet. These plants were small, and had short shoot lengths. They were found at very low density, perhaps one / 20 -30 square feet, although the precise number per unit was not measured due to the depth of the water.

In 2007 many isolated shoots were found scattered along the northeast shore closer to shore in shallower water. These shoots had not been observed in prior surveys. I have expanded the size and scope of the infestation of this part of the lake due to the presence of more plants.

The area of the lake directly south of the sand bar has also been found to contain areas of milfoil. No plants had been found in this area during prior surveys. In this area the milfoil occurs as both isolated shoots and as clumps of shoots. Some areas contained dense clumps of shoots.

6) West Shore of the Lake:

Although additional single milfoil plants were found in isolated locations along the west shore of the lake I could not find any during the 2007 survey. The one small bed found during the 2003 survey within the cove of the Crystal Lake Boat Club also could not be found in 2007.

7) Tributary Pond:

A small, 0.86 acre, pond, located on the far side of CT Route 140 from the lake was found to be completely full of variable-leaved milfoil. The plant is dense and reaches the surface over the entire surface area of the pond. This pond discharged to the South Wetland area. On the day of the survey milfoil fragments were visible in the outlet stream going to the lake. The milfoil in the pond has the potential to re-infest the lake with new plant material, although probably at a slow rate. No change in the milfoil infestation of the pond was observed in 2007.

Summary

The area of the lake infested with milfoil had shown only small increases in the past. However, between 2006 and 2007, the area of infestation almost doubled in size. This suggests that the distribution of milfoil is now expanding rapidly in Crystal Lake. The apparent rate of increase was about 2 acres per year between 2000 and 2006. The large increase between 2006 and 2007, however, suggests that the rate of spread may be exponential instead of linear meaning that the annual increase in infested area may now be growing at a rate larger than 2 acres per year.

## Estimates of Suction Harvesting Costs

In 2006 the total suction harvester contracted cost for the trial operation was \$ 3,500, which included the two days of mobilization. The net cost of the harvesting alone was \$2,800 for a base price of \$175/hour. The area that was harvested was about 0.4 acres giving a per acre cost of between \$3,500 to \$7,000, depending on the density of the plants and quantity of shoots that are produced in each bed. The areas where the shoots are isolated and scattered will be less expensive than the areas where the plants are dense and produce long shoots. The use of suction harvesting to remove variable-leaved milfoil from Crystal Lake appears to be a viable method in the open water parts of the lake, the conditions were ideal for the use this method in Crystal Lake for the following reasons:

- 1) The lake water was very clear allowing excellent underwater vision,
- 2) There were no native plants growing with milfoil to interfere with milfoil removal,
- 3) The sediments were sand/gravel allowing for easy root removal, and causing less turbidity,
- 4) The water depths were not excessive, and
- 5) The target plants were growing in an open arrangement not in closed canopy dense stand. Although, suction harvesting is expensive and time consuming method, new estimates to remove milfoil from Crystal Lake based on 2007 distribution are given in **Table 2.**

The milfoil growing in Crystal Lake could also be controlled by the use of bottom barriers and herbicides. But these methods are either less efficient, as with bottom barriers that work on limited areas and take several weeks for control to work, or controversial, as would be an application of herbicide. Other methods would not work, such as drawdown, hydroraking, mechanical harvesting, and grass carp because of one or more reasons (Northeast Aquatic Research 2000<sup>1</sup>, Northeast Aquatic Research 2003<sup>2</sup>).

**Table 2. Suction Harvesting Costs And Time Requirements To Complete First Round of Milfoil Harvesting In The Open Water Areas Of Crystal Lake.**

<b>Bed</b>	<b>Cost</b>	<b>Hours</b>
North Wetland Cove		
Inner Core	\$ 19,100	109 hrs
Outer Band	\$ 10,700	60 hrs
Outlet Cove	\$ 10,500	60 hrs
North Lake		
Dense Area	\$ 9,000	50 hrs
Sparse Area	\$ 19,150	109 hrs
South Lake	\$ 13,800	79 hrs
South Wetland Cove	\$ 8,900	51 hrs
<b>Total</b>	<b>\$ 91,150</b>	<b>518 hrs (64 days)</b>

<sup>1</sup> Hapalosiphon Algae and Variable Water Milfoil Distribution and Abundance in Crystal Lake, Ellington/Stafford, 2000. Northeast Aquatic Research, May 22, 2001.

<sup>2</sup> 2003 Diagnostic Study of Crystal Lake, Ellington/Stafford, CT. Northeast Aquatic Research October 26, 2004

Because a small number of shoots remain after an area is harvested the site would need to be revisited the following year for clean up operation. Also annual, or bi-annual, (every two years) SCUBA surveys to check for the occurrence of isolated plants is necessary. Based on the observed densities of the beds during the 2007 survey the follow costs and time requirements would probably be between 5 and 10% of the original (see **Table 3** for estimates of follow-up costs). As long as milfoil remains present in the wetlands, and in the small tributary pond re-infestation will be possible although this would likely be at a slow rate. Barriers to prevent migration of shoots out of these areas into the lake will probably be necessary.

**Table 3. Suction Harvesting Costs And Time Requirements To Complete Second Round Maintenance Milfoil Harvesting In The Open Water Areas Of Crystal Lake.**

<b>Bed</b>	<b>Cost</b>	<b>Hours</b>
North Wetland Cove		
Inner Core	\$ 1,910	11
Outer Band	\$ 535	3
Outlet Cove	\$ 1,050	6
North Lake		
Dense Area	\$ 900	5
Sparse Area	\$ 958	5
South Lake	\$ 690	4
South Wetland Cove	\$ 890	5
<b>Total</b>	<b>\$ 6,935</b>	<b>39</b>

### **Recommendations**

- 1) Consider building, buying, or renting a harvester for dedicated use at Crystal Lake.
- 2) Consider fragment barriers along both wetlands to prevent movement of milfoil fragments into the lake. Also a barrier preventing fragments to get into the lake from the pond.
- 3) Establish a crew of weed watchers that can identify the plant and conduct surveys to make notes about growth density and keep track of the spread.
- 4) Enlist the aid of residents that can use SCUBA to make underwater surveys of the lake.
- 5) Consider the use of herbicides in the small pond that drains to the lake.
- 6) Conduct annual surveys of the whole lake to maintain the record of distribution of milfoil.
- 7) Ensure that no new invasive plants enter the lake by way of the boat ramp.
- 8) Consider having an inspector at the ramp to inspect all incoming boats for other invasive species such as Eurasian milfoil, Fanwort, Water Chestnut, Hydrilla, Curly-leaved pondweed.

**Map 1. Distribution of Variable-leaved Milfoil in Crystal Lake.**

