

LAKE ST CATHERINE  
AQUATIC VEGETATION MANAGEMENT PROGRAM  
2013 ANNUAL REPORT

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**AQUATIC CONTROL TECHNOLOGY**

POND AND LAKE MANAGEMENT SPECIALISTS

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- Appendix A: Herbicide Residue Testing Results
- Appendix B: Comprehensive Aquatic Vegetation Survey Information

## INTRODUCTION

The 2013 season marked the tenth year of Aquatic Control’s involvement in the Integrated Management Plan at Lake St. Catherine developed to control of non-native Eurasian watermilfoil (*Myriophyllum spicatum*) in the lake. Milfoil management efforts under this plan have included a whole-lake Sonar (fluridone) herbicide treatment in 2004 followed by annual spot-treatments with Renovate (triclopyr) herbicide and diver assisted suction harvesting and hand-pulling.

Management activities in 2013 included spot-treatment of six areas, totaling approximately 42 acres, as well as diver hand-pulling and diver assisted suction harvesting. These efforts were consistent with the current five-year Integrated Management Plan (2009-2013).

The following report summarizes the results of 2013 Treatment Program and details findings from the late season comprehensive aquatic plant survey that has been performed annually to document in-lake plant conditions and help evaluate and refine management goals. Specific information on the 2013 diver hand-pulling and diver assisted suction harvesting efforts will be provided by the Lake St. Catherine Association (LSCA) under a separate cover.

## HERBICIDE TREATMENT PROGRAM - 2013

### Program Chronology

A chronology of the 2013 treatment program is provided below:

- DEC permit issuance (ANC 2009-C02)..... May 2009
- Pre-treatment inspection and finalize treatment areas..... May 15
- Treatment of approximately 41.9 acres with Renovate OTF ..... June 17
- Herbicide residue monitoring..... June 18 & June 26
- Comprehensive aquatic plant survey .....September 24 & 25

### Pre-Treatment Inspection

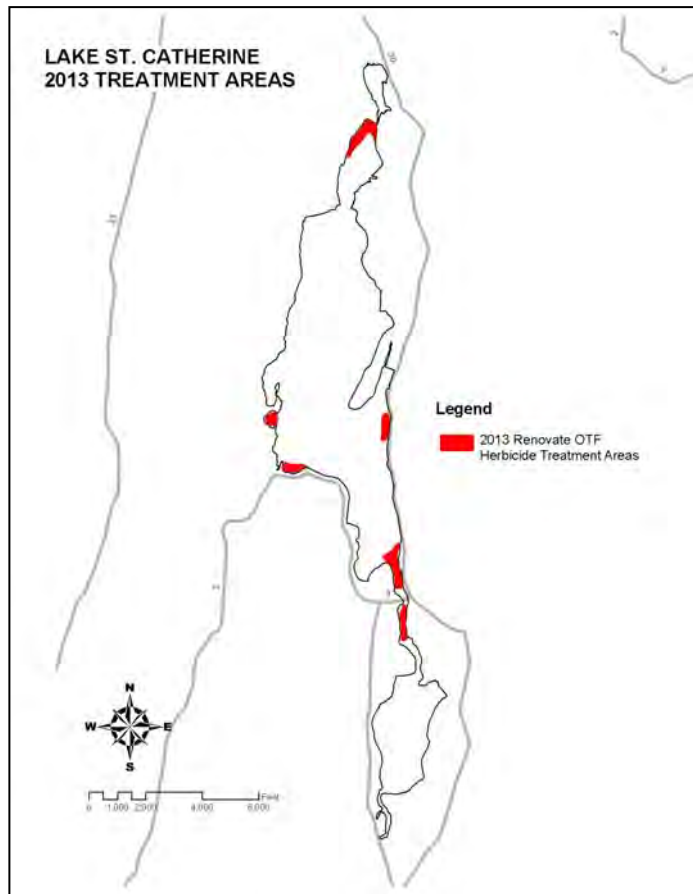
On May 15, 2013 the entire shoreline littoral area of Lake St. Catherine (Lily Pond, Main Lake and Little Lake) was surveyed by Aquatic Control Technology to determine the stage of milfoil growth and to make adjustments to the 2013 treatment scope. Results of the survey were communicated to LSCA for their input and final determination on proposed treatment areas. At the time of the survey milfoil growth was actively growing and was generally within 2-4 feet of the surface.

### **Summary of 2013 Treatment**

Ultimately six areas totaling 41.9 acres were targeted for treatment (Figure 1). Consistent with previous years, each treatment area was evaluated with regards to milfoil cover/distribution as well as several other factors including: the potential for increased milfoil spread; the potential for effective treatment; and the overall benefit of milfoil control with respect to the lake, lake residents and other potential users. A final treatment map was provided to DEC for review and approval.

The treatment date of Wednesday, June 17, 2013 was selected to allow enough time to comply with the notification requirements of ANC Permit #2009-C02 and so that the two-day swimming restriction (day of treatment and one additional day) would not be imposed over a weekend.

Weather conditions on the day of treatment were overcast in the morning a clearing to sun in the afternoon. The air temperature was roughly 75° F; wind was out of the southwest estimated at <5 mph. Surface water temperature in the main basin was approximately 19.8°C.



The treatment was conducted with a 23 foot work skiff. The granular herbicide was applied using two stern mounted spreaders. The treatment boat was equipped with a Differential/WAAS GPS navigation system to insure that the herbicide was evenly applied to the designated treatment areas. The State Boat Ramp located on the channel between the Main Lake and Little Lake was used as the base of operations.

Treatment was performed as a split application whereby roughly 70% of the herbicide was applied to each of the designated areas initially and then the remaining 30% was applied several hours later. There was approximately 3-4 hours between each application. This split application approach was used to increase concentration-exposure-time and increase the efficacy of treatment. Renovate OTF herbicide was applied at a target dose of 2.25 ppm in the bottom 4-feet of the water column. A total of 10,056 pounds of Renovate OTF (granular) were applied to the six treatment areas. The herbicide application took approximately 7 hours to complete.

## **Herbicide Residue Testing**

In compliance with conditions of the ANC Permit #2009-C02, water samples were collected from within and immediately downstream of Lake St. Catherine following treatment for analysis of triclopyr concentrations. Sampling was required 24 hours following treatment and then at least monthly until concentrations at all sample locations dropped below 75 ppb, which was the drinking water restriction imposed by DEC.

A map of the sampling locations is attached to the end of this report (Appendix A). Sampling instructions and sample bottles were provided to LSCA representatives by ACT and SePRO. Collected samples were shipped via overnight delivery to SePRO's laboratory in Whittakers, North Carolina.

Samples were collected on June 18 and June 26. The highest in-lake concentration detected during the initial sampling round was 0.754 ppm (754 ppb), which was collected at the northern end of the main basin 24 hrs post treatment. On June 26, 9 days post-treatment, triclopyr concentrations at all sample locations were below the 75 ppb drinking water threshold. Results from site A which had the highest concentration during the first round of sampling had dropped -98% to 0.0184 ppm or 18.4 ppb. The average lake-wide concentrations had also dropped significantly from 0.288 ppm or 288 ppb to 0.0147 or 14.7 ppb.

**Table 1: FasTEST Sampling Results (ppb)**

<b>Site</b>	<b>18-Jun</b>	<b>26-Jun</b>
A	754.4	18.4
B	57.3	9.3
C	61.3	10.5
D	7.4	9.0
E	237.0	10.7
F	363.3	21.9
G	535.6	22.8
H	<1.0	

## **LATE SEASON COMPREHENSIVE AQUATIC VEGETATION SURVEY**

### **Survey Methods**

The late season comprehensive aquatic vegetation survey conducted on September 24 & 25 replicated the methods that were employed in the previous years of this management program.

All three major lake basins were systematically toured by boat. Transect and data point locations established in 2001, were relocated using a Differential GPS system (Appendix B – Figure 1). The following information was recorded at each data point: aquatic plants present, dominant species, percent total plant cover, plant biomass and percent milfoil cover. Water depths that were recorded during the pre-treatment survey were checked using a high-resolution depth finder. In most cases, the water depth at the data point was within 1 foot of what was recorded in 2001. The plant community was assessed through visual inspection, use of a long-handled rake and throw-rake, and with an Aqua-Vu underwater camera system. Plants were identified to genus and species level when possible. Plant cover was given a percentage rank based on the areal coverage of plants within an approximate 400 square foot area assessed at each data point. Generally, in areas with 100% cover, bottom sediments could not be seen through the vegetation. Percentages less than 100% indicated the amount of bottom area covered by plant

growth. The percentage of Eurasian watermilfoil was also recorded at each data point. In addition to cover percentage, a plant biomass index was assigned at each data point to document the amount of plant growth vertically through the water column. Plant biomass was estimated on a scale of 0-4, as follows:

- 0 No biomass; plants generally absent
- 1 Low biomass; plants growing only as a low layer on the sediment
- 2 Moderate biomass; plants protruding well into the water column but generally not reaching the water surface
- 3 High biomass; plants filling enough of the water column and/or covering enough of the water surface to be considered a possible recreational nuisance or habitat impairment
- 4 Extremely high biomass; water column filled and/or surface completely covered, obvious nuisance conditions and habitat impairment severe

Field data recorded at each transect and data point location is provided in the Field Survey Data Table found in Appendix B.

### **Survey Findings**

Quantitative measures of the aquatic plant community documented in 2013 were comparable to prior years. While milfoil distribution (FOC - frequency of occurrence) and abundance (% cover) has fluctuated annually, overall vegetative cover and biomass indices remain relatively static in all three basins (Lilly Pond, Lake St. Catherine & Little Lake).

The composition of the vegetative community has also remained relatively unchanged since 2001 and is dominated by native pondweed species, namely: *Potamogeton robbinsii*, *Potamogeton illinoensis*, *Potamogeton amplifolius*, *Potamogeton zosteriformis* & *Certophyllum demersum*. Diversity has also been maintained throughout the course of management with 18 different aquatic plant species identified this fall.

Comparative data for all three basins from data collected during late season between 2001 and 2013 is listed below (Table 2).

**Table 2: Summary of Survey Data**

<b><u>LILY POND</u></b>	<b><u>2001</u></b>	<b><u>2004</u></b>	<b><u>2005</u></b>	<b><u>2006</u></b>	<b><u>2007</u></b>	<b><u>2008</u></b>	<b><u>2009</u></b>	<b><u>2010</u></b>	<b><u>2011</u></b>	<b><u>2012</u></b>	<b><u>2013</u></b>
Total Number of Data Points	24	24	24	22	24	24	24	24	24	24	24
Total Plant Cover	90%	80%	98%	88%	91%	98%	94%	98%	93%	94%	96%
Milfoil Cover	9%	6%	2%	0%	2%	7%	<1%	<1%	<1%	1%	5%
Plant Biomass Index	3.1	2.5	3.3	2.5	2.8	3.3	2.7	2.3	2.9	3.1	3.5

<b><u>LAKE ST. CATHERINE</u></b>											
Total Number of Data Points	129	129	129	129	129	129	129	129	129	129	129
Total Plant Cover	66%	46%	51%	57%	58%	66%	58%	63%	59%	56%	63%
Milfoil Cover	43%	16%	0%	4%	11%	4%	5%	2%	7%	8%	16%
Plant Biomass Index	1.9	1.5	1.6	1.8	2.0	2.0	2.0	1.3	1.8	1.5	2.0

<b><u>LITTLE LAKE</u></b>											
Total Number of Data Points	43	43	43	43	43	43	43	43	43	43	43
Total Plant Cover	72%	66%	78%	83%	83%	77%	58%	62%	76%	81%	80%
Milfoil Cover	15%	0%	0%	2%	7%	10%	<1%	5%	9%	14%	7%
Plant Biomass Index	2.3	2.1	2.4	2.9	2.8	2.7	2.2	2.7	3.3	2.5	3.0

**Table 3: Species List and Frequency of Occurrence (entire lake system)**

Macrophyte Species	Common Name	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Potamogeton robbinsii</i>	Pondweed	52%	76%	88%	74%	77%	68%	84%	78%	57%	76%	76%
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	94%	44%	17%	33%	74%	65%	38%	40%	43%	51%	64%
<i>Potamogeton amplifolius</i>	Large-leaf	33%	38%	43%	49%	52%	53%	51%	56%	23%	35%	32%
<i>Najas flexilis</i>	Naiad	22%	0%	8%	39%	34%	22%	15%	16%	14%	8%	4%
<i>Potamogeton illinoensis</i>	Illinois pondweed	4%	1%	2%	9%	23%	39%	29%	36%	35%	53%	56%
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	28%	3%	29%	29%	23%	19%	16%	26%	22%	20%	23%
<i>Zosterella dubia</i>	Water stargrass	1%	1%	9%	8%	23%	17%	7%	13%	4%	2%	4%
<i>Ceratophyllum demersum</i>	Coontail	20%	8%	11%	12%	21%	18%	17%	22%	10%	21%	15%
<i>Nitella / Chara</i>	Stonewort	17%	6%	36%	40%	14%	14%	13%	2%	2%	1%	0%
<i>Nymphaea odorata</i>	White waterlily	16%	5%	11%	10%	11%	11%	10%	7%	7%	12%	12%
<i>Vallisneria americana</i>	Wild celery/Tapegrass	29%	13%	2%	4%	9%	8%	15%	15%	14%	15%	18%
<i>Brasenia schreberi</i>	Watershield	4%	8%	7%	7%	7%	6%	5%	5%	5%	3%	4%
<i>Utricularia vulgaris</i>	Common bladderwort	8%	9%	2%	6%	7%	7%	11%	8%	2%	4%	4%
<i>Elodea canadensis</i>	Waterweed	32%	1%	1%	1%	5%	43%	60%	30%	10%	14%	23%
<i>Chlorophyta</i>	Filamentous green algae	2%	37%	26%	7%	4%	8%	3%	2%	3%	4%	3%
<i>Potamogeton crispus</i>	Curly-leaf pondweed	2%	1%	7%	5%	3%	1%	0%	0%	1%	1%	0%
<i>Potamogeton epihydrus</i>	Ribbon-leaf pondweed	2%	6%	7%	3%	3%	5%	1%	1%	1%	4%	1%
<i>Nuphar variegatum</i>	Yellow waterlily	5%	5%	5%	2%	2%	1%	2%	1%	2%	1%	1%
<i>Potamogeton gramineus</i>	Variable pondweed	23%	1%	6%	6%	2%	4%	4%	4%	11%	8%	3%
<i>Isoetes sp.</i>	Quillwort	2%	6%	2%	5%	2%	3%	1%	0%	1%	1%	0%
<i>Utricularia gibba</i>	Creeping bladderwort	2%	0%	1%	5%	1%	1%	4%	1%	0%	0%	0%
<i>Eleocharis sp.</i>	Spikerush	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Lemna minor</i>	Duckweed	7%	1%	0%	1%	0%	1%	1%	0%	0%	0%	0%
<i>Megalodonta beckii</i>	Water marigold	3%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%

### **Lily Pond**

Milfoil FOC continued to increase between 2012 and 2013, rising to roughly 42%. Despite the increase (+12.5%), milfoil growth remained low density averaging less than 5% cover in the basin. Consistent with 2012, the most prominent growth of milfoil was in southwestern portion of Lily Pond. A few dense, topped-out patches were noted immediately abutting the western shore. Only scattered low density or singular milfoil plants were observed elsewhere in Lily Pond.

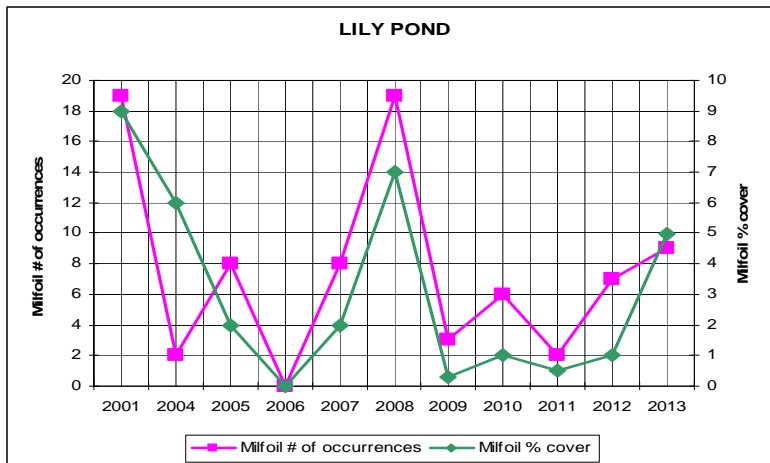
Native species in Lily Pond remained healthy with both cover and distribution indices similar to what has been recorded in previous years. *Potamogeton robbinsii* (100%) remained the most abundant plant in the basin followed by *Ceratophyllum demersum* (66.7%). *Potamogeton illinoensis* and *Potamogeton zosteriformis* were also abundant and were encountered 45.8% and 29.2% of the surveyed data points respectively. FOC and percent cover of other plant species in Lily Pond was similar to previous years.



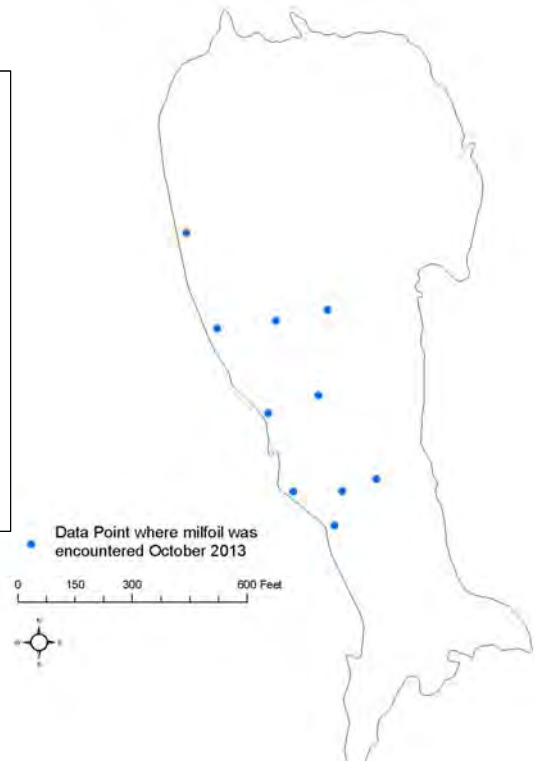
**Table 4: Lily Pond – Species List and Frequency of Occurrence**

Macrophyte Species	Lily Pond										
	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Potamogeton robbinsii</i>	95.8%	91.7%	95.8%	95.5%	91.7%	87.5%	95.8%	95.8%	87.5%	95.8%	100%
<i>Ceratophyllum demersum</i>	70.8%	4.2%	50.0%	45.5%	83.3%	83.3%	83.3%	79.2%	75.0%	62.5%	66.7%
<i>Potamogeton amplifolius</i>	33.3%	100.0%	91.7%	77.3%	79.2%	87.5%	91.7%	87.5%	37.5%	45.8%	75.0%
<i>Potamogeton illinoensis</i>	0.0%	4.2%	8.3%	9.1%	45.8%	41.7%	25.0%	16.7%	45.8%	41.7%	45.8%
<i>Myriophyllum spicatum</i>	79.2%	8.3%	33.3%	0.0%	33.3%	79.2%	12.5%	25.0%	8.3%	29.2%	41.7%
<i>Potamogeton zosteriformis</i>	58.3%	8.3%	62.5%	0.0%	25.0%	45.8%	12.5%	66.7%	45.8%	33.3%	29.2%
<i>Zosterella dubia</i>	4.2%	0.0%	37.5%	0.0%	25.0%	20.8%	8.3%	50.0%	0.0%	0.0%	0.0%
<i>Nymphaea odorata</i>	62.5%	16.7%	29.2%	9.1%	20.8%	25.0%	33.3%	16.7%	25.0%	29.2%	37.5%
<i>Potamogeton crispus</i>	4.2%	4.2%	4.2%	4.5%	12.5%	0.0%	0.0%	0.0%	4.2%	0.0%	0.0%
Chlorophyta	0.0%	29.2%	95.8%	31.8%	8.3%	29.2%	12.5%	4.2%	16.7%	20.8%	16.7%
<i>Elodea canadensis</i>	29.2%	0.0%	8.3%	0.0%	8.3%	29.2%	45.8%	79.2%	16.7%	29.2%	16.7%
<i>Utricularia vulgaris</i>	29.2%	37.5%	0.0%	27.3%	4.2%	12.5%	16.7%	4.2%	16.7%	20.8%	16.7%
<i>Chara sp. / Nitella sp.</i>	0.0%	0.0%	0.0%	4.5%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Wolffia sp.</i>	0.0%	0.0%	0.0%	4.5%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Potamogeton epiphydrus</i>	0.0%	12.5%	4.2%	0.0%	4.2%	4.2%	4.2%	0.0%	4.2%	4.2%	0.0%
<i>Potamogeton gramineus</i>	16.7%	0.0%	8.3%	0.0%	4.2%	0.0%	8.3%	0.0%	8.3%	8.3%	0.0%
<i>Utricularia gibba</i>	0.0%	0.0%	0.0%	40.9%	0.0%	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%
<i>Potamogeton natans</i>	0.0%	0.0%	0.0%	9.1%	0.0%	8.3%	8.3%	12.5%	8.3%	0.0%	0.0%
<i>Lemna minor</i>	45.8%	8.3%	0.0%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Brasenia schreberi</i>	4.2%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Isoetes sp.</i>	0.0%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Najas flexilis</i>	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Nuphar variegatum</i>	16.7%	16.7%	16.7%	0.0%	0.0%	0.0%	0.0%	4.2%	4.2%	0.0%	0.0%
<i>Vallisneria americana</i>	33.3%	45.8%	0.0%	0.0%	0.0%	0.0%	8.3%	4.2%	4.2%	0.0%	0.0%

**Chart 1: Lily Pond: *Myriophyllum spicatum* Number of Occurrences and Percent Cover**



**Lily Pond**



### Lake St. Catherine (Main Basin)

The distribution and composition of native plant species in the main basin of Lake St. Catherine was consistent with recent years. *Potamogeton robbinsii* remained the most common plant species in the main basin and was recorded at 66.4% of the surveyed locations. *Myriophyllum spicatum* was secondary in abundance and was recorded at 65.6% of surveyed data point locations in the Main Lake. *Potamogeton illinoensis* remained well distributed and was recorded over half of the surveyed data points (57%). Cover of other native plant species remained relatively consistent with previous years and only minor fluctuations in distribution indices were evident between 2012 and 2013.

**Table 5: Lake St. Catherine – Species List and Frequency of Occurrence (main basin)**

Macrophyte Species	Lake St. Catherine										
	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Myriophyllum spicatum</i>	98.4%	65.1%	14.7%	35.7%	76.7%	58.9%	44.2%	27.9%	49.6%	46.5%	65.6%
<i>Potamogeton robbinsii</i>	31.0%	65.1%	82.2%	62.0%	66.7%	58.1%	78.3%	72.9%	58.1%	66.7%	66.4%
<i>Najas flexilis</i>	19.4%	0.0%	12.4%	56.6%	50.4%	34.1%	21.7%	24.8%	20.2%	12.4%	5.5%
<i>Potamogeton amplifolius</i>	28.7%	14.7%	25.6%	34.1%	38.8%	38.0%	41.1%	44.2%	25.6%	34.9%	27.3%
<i>Potamogeton zosteriformis</i>	24.0%	2.3%	31.0%	41.9%	27.9%	18.6%	19.4%	23.3%	30.2%	20.2%	20.3%
<i>Zosterella dubia</i>	0.0%	0.8%	4.7%	11.6%	27.9%	21.7%	7.8%	8.5%	5.4%	1.6%	1.6%
<i>Chara sp. / Nitella sp.</i>	1.6%	17.1%	62.0%	57.4%	20.9%	21.7%	19.4%	2.3%	0.8%	0.0%	0.0%
<i>Potamogeton illinoensis</i>	6.2%	0.8%	0.8%	8.5%	15.5%	34.1%	23.3%	31.0%	32.6%	53.3%	57.0%
<i>Potamogeton pusillus</i>	0.0%	0.0%	0.0%	5.4%	12.4%	6.3%	5.4%	11.6%	12.4%	4.7%	3.9%
<i>Ceratophyllum demersum</i>	10.9%	10.9%	6.2%	7.0%	10.9%	10.1%	7.8%	14.0%	6.2%	10.9%	1.6%
<i>Vallisneria americana</i>	14.0%	3.1%	0.8%	3.1%	8.5%	9.3%	13.2%	13.2%	10.1%	9.3%	14.8%
<i>Elodea canadensis</i>	27.9%	0.0%	0.0%	0.8%	4.7%	51.9%	71.3%	14.7%	8.5%	7.0%	18.8%
<i>Nymphaea odorata</i>	3.1%	1.6%	2.3%	3.1%	3.1%	3.1%	3.1%	1.6%	2.3%	1.6%	0.8%
<i>Brasenia schreberi</i>	0.0%	0.8%	0.8%	2.3%	2.3%	2.3%	2.3%	1.6%	2.3%	0.8%	0.8%
<i>Chlorophyta</i>	0.0%	43.4%	14.7%	3.1%	2.3%	3.9%	0.8%	0.8%	3.1%	2.3%	0.0%
<i>Isoetes sp.</i>	2.3%	8.5%	0.8%	6.2%	2.3%	4.7%	0.0%	0.0%	0.8%	0.8%	0.0%
<i>Potamogeton gramineus</i>	17.8%	0.0%	4.7%	1.6%	2.3%	6.2%	3.1%	6.2%	14.7%	9.3%	3.1%
<i>Potamogeton crispus</i>	1.6%	0.0%	9.3%	5.4%	1.6%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Potamogeton epihydrus</i>	2.3%	3.1%	5.4%	2.3%	0.8%	3.9%	0.8%	0.8%	0.8%	2.3%	0.0%
<i>Nuphar variegatum</i>	0.8%	0.0%	0.0%	0.8%	0.8%	0.0%	0.0%	0.8%	0.8%	0.0%	0.0%
<i>Utricularia vulgaris</i>	0.8%	0.8%	0.8%	0.0%	0.0%	1.6%	0.8%	3.1%	0.0%	0.8%	0.0%
<i>Lemna minor</i>	1.6%	0.0%	0.0%	0.0%	0.0%	0.8%	0.8%	0.0%	0.0%	0.0%	0.0%
<i>Megalodonta beckii</i>	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

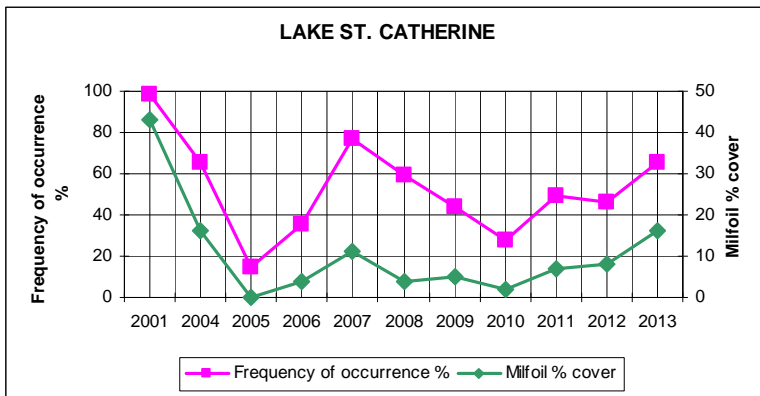
Milfoil FOC increased notably between 2012 and 2013 from 46.5% to 65.6%. Relative percent cover of milfoil also increase and was the dominant species at over half (53%) of the locations where recorded compared to only 27% in 2012. Average cover of milfoil also doubled between 2012 to 2013 in the Main Lake increasing from 8% to 16%.

An increase in both milfoil cover and distribution was also apparent outside of the surveyed data points with dense beds noted around the shoreline of the Main Lake. Despite annual treatments in high-use areas and continued use of diver suction hand-pulling, milfoil growth remains widespread in the Main Lake. And while acceptable control has been achieved by sport treatments and hand-pulling both quantitative and qualitative indices indicate an increase in milfoil frequency (cover) and distribution.

Locations of milfoil observed during the survey were recorded with a GPS unit. The collected GPS points as well as an estimated extent of dense milfoil beds observed during the September 2013 survey are depicted in Figure 2.

Chart 2 (below) represents year-to-year change in milfoil frequency and cover in the main basin.

**Chart 2: *Myriophyllum spicatum* Frequency of Occurrence and Percent Cover**



**Little Lake**

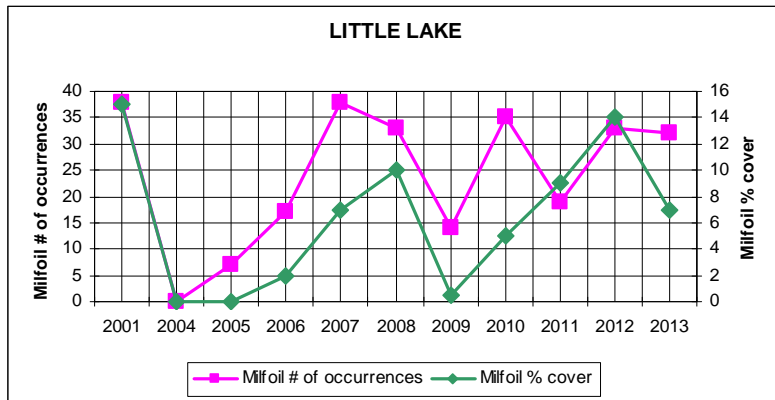
*Potamogeton robbinsii* and *Potamogeton illinoensis* continue to dominated the aquatic plant community in Little Lake accounting for a large percentage of the plant density recorded during the September 2013 survey. *Vallisneria americana*, *Elodea canadensis*, *Ceratophyllum demersum*, and *Potamogeton amplifolius* remain common in Little Lake and were encountered at 40%, 40%, 28% & 20% of the surveyed data points, respectively.

Despite a reported mid-summer crash of *Myriophyllum spicatum* its frequency of occurrence remained high (~ 75%) in Little Lake. Where found, however, cover of milfoil was fairly low and was only the dominant species at 3 of the 32 locations where documented. Average milfoil density was also low at just over 6% estimated cover.

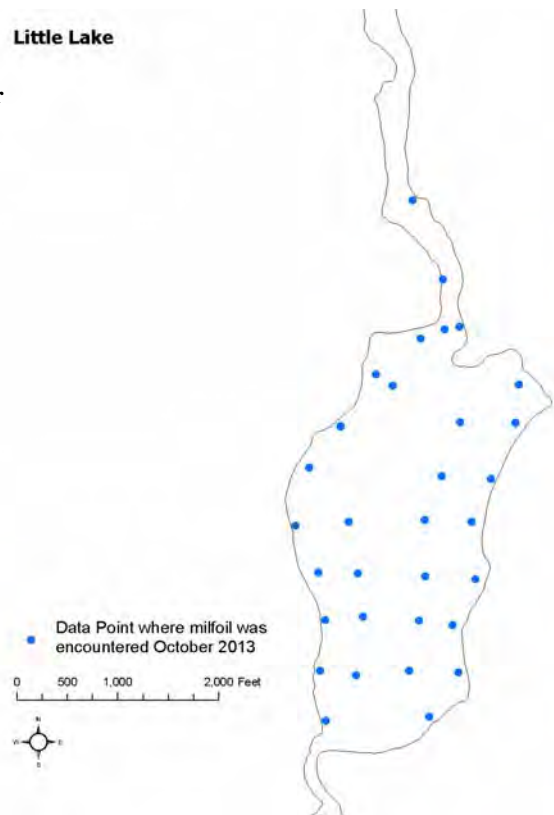
**Table 6: Little Lake – Species List and Frequency of Occurrence**

Macrophyte Species	Little Lake										
	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Potamogeton robbinsii</i>	88.4%	100.0%	100.0%	100.0%	100.0%	88.4%	95.3%	81.4%	86.0%	90.7%	93.0%
<i>Myriophyllum spicatum</i>	88.4%	0.0%	16.3%	39.5%	88.4%	76.7%	32.6%	81.4%	44.2%	76.6%	74.4%
<i>Potamogeton amplifolius</i>	44.2%	72.1%	69.8%	76.7%	74.4%	76.7%	55.8%	72.1%	27.9%	30.2%	20.9%
<i>Potamogeton illinoensis</i>	0.0%	0.0%	0.0%	9.3%	32.6%	46.5%	48.5%	36.2%	62.8%	60.5%	60.5%
<i>Utricularia vulgaris</i>	16.3%	18.6%	7.0%	11.6%	30.2%	18.6%	34.9%	25.6%	4.7%	2.3%	9.3%
<i>Nymphaea odorata</i>	30.2%	9.3%	25.6%	30.2%	27.9%	10.1%	18.6%	18.6%	23.3%	32.6%	30.2%
<i>Brasenia schreberi</i>	14.0%	30.2%	30.2%	23.3%	25.6%	20.9%	14.0%	11.6%	14.0%	11.6%	14.0%
<i>Ceratophyllum demersum</i>	20.9%	0.0%	2.3%	9.3%	16.3%	7.0%	9.3%	16.3%	27.9%	27.9%	27.9%
<i>Vallisneria americana</i>	72.1%	25.6%	7.0%	9.3%	14.0%	9.3%	25.6%	25.6%	34.9%	39.5%	39.5%
<i>Potamogeton zosteriformis</i>	23.3%	2.3%	4.7%	4.7%	7.0%	4.7%	7.0%	9.3%	9.3%	14.0%	27.9%
<i>Zosterella dubia</i>	2.3%	2.3%	4.7%	0.0%	7.0%	2.3%	4.7%	4.7%	2.3%	4.7%	14.0%
<i>Potamogeton pusillus</i>	0.0%	0.0%	0.0%	2.3%	7.0%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Chlorophyta	7.0%	20.9%	20.9%	4.7%	7.0%	9.3%	2.3%	2.3%	2.3%	2.3%	2.3%
<i>Nuphar variegatum</i>	9.3%	14.0%	11.6%	7.0%	7.0%	2.3%	7.0%	2.3%	4.7%	2.3%	2.3%
<i>Potamogeton epihydrus</i>	0.0%	11.6%	14.0%	7.0%	7.0%	7.0%	0.0%	0.0%	2.3%	9.3%	2.3%
<i>Utricularia gibba</i>	7.0%	0.0%	2.3%	0.0%	4.7%	2.3%	14.0%	4.7%	0.0%	0.0%	0.0%
<i>Najas flexilis</i>	39.5%	0.0%	0.0%	4.7%	2.3%	0.0%	4.7%	0.0%	4.7%	0.0%	2.3%
<i>Elodea canadensis</i>	46.5%	4.7%	0.0%	0.0%	2.3%	23.3%	34.9%	46.5%	20.9%	27.9%	39.5%
<i>Chara sp. / Nitella sp.</i>	7.0%	4.7%	7.0%	11.6%	0.0%	0.0%	2.3%	0.0%	4.7%	2.3%	0.0%
<i>Potamogeton gramineus</i>	41.9%	4.7%	9.3%	23.3%	0.0%	0.0%	4.7%	0.0%	4.7%	4.7%	2.3%
<i>Isoetes sp.</i>	0.0%	0.0%	4.7%	2.3%	0.0%	0.0%	2.3%	0.0%	0.0%	2.3%	0.0%
<i>Potamogeton crispus</i>	0.0%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%
<i>Polygonum sp.</i>	0.0%	0.0%	0.0%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Eleocharis sp.</i>	4.7%	4.7%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<i>Megalodonta beckii</i>	7.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%	0.0%

**Chart 3: *Myriophyllum spicatum* Number of Occurrences and Percent Cover**



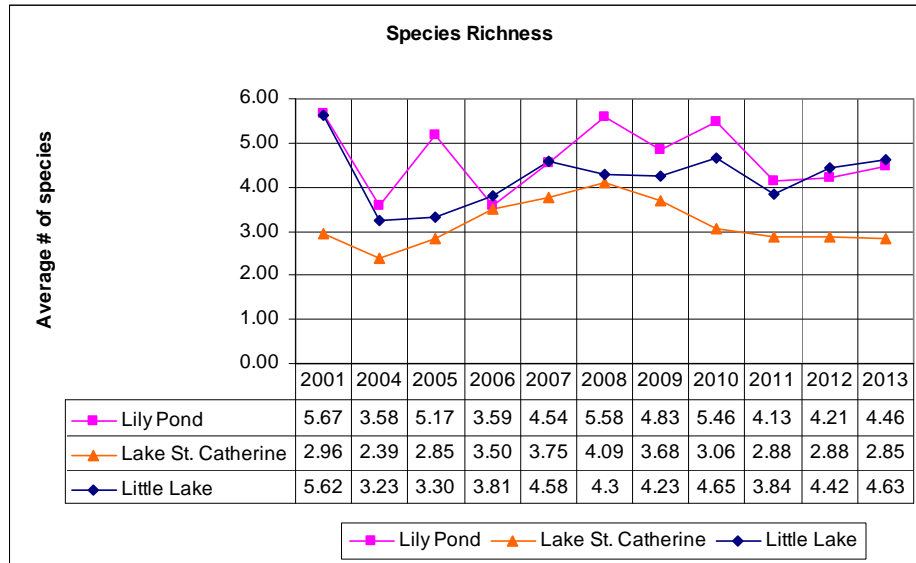
**Little Lake**



**Species Richness**

Species richness in all three basins was consistent with findings from the past five years. It does not appear that the maintenance herbicide treatments or other management practices have adversely impacted species richness or native plant diversity.

**Table 7: Species Richness by Basin**

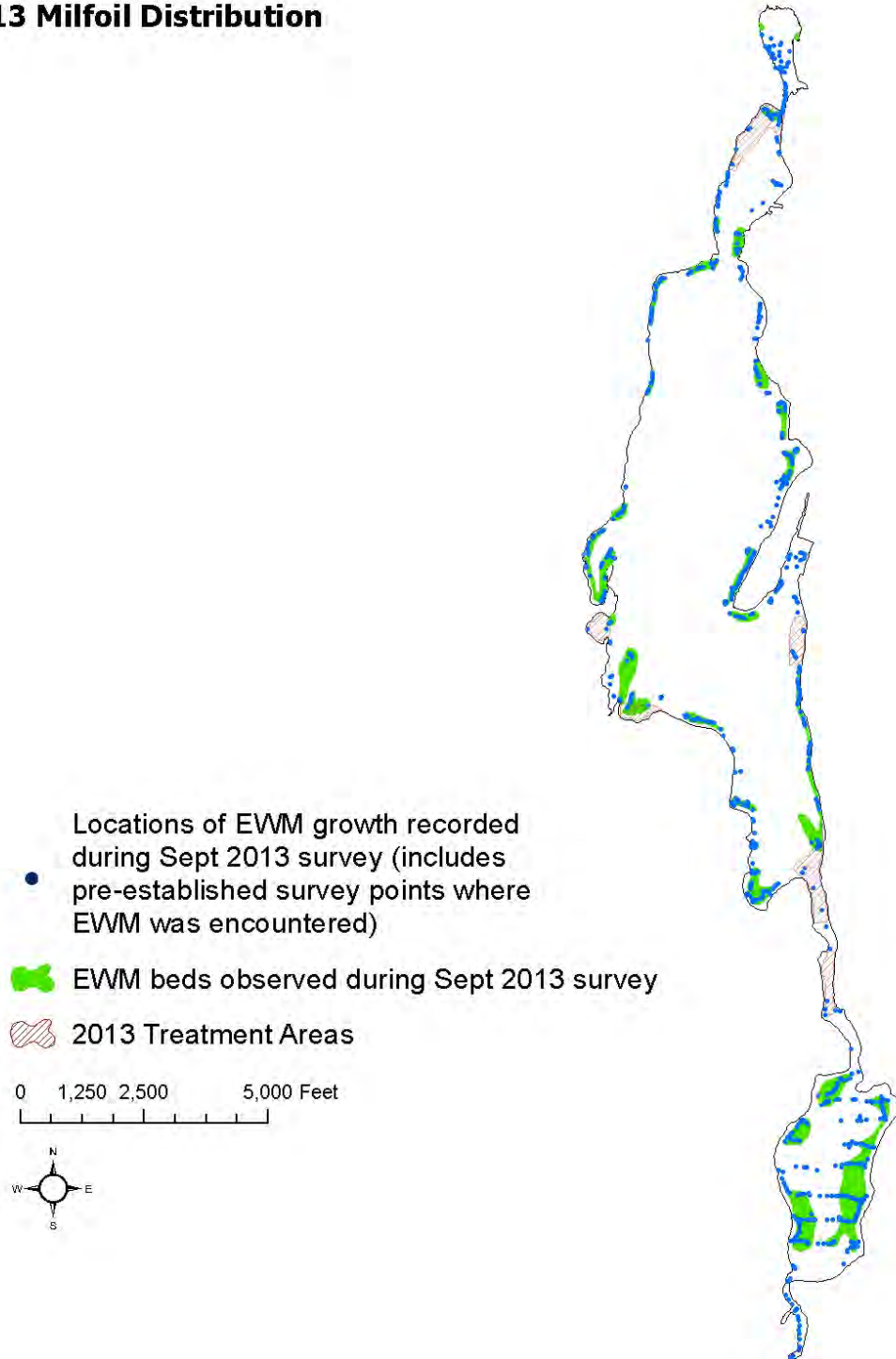


**Late Season Milfoil Bed Mapping**

Milfoil beds were visually surveyed and mapped during the late season survey. Weather conditions and visibility were good with little wind and partly cloudy skies for most of the survey. As with past mapping efforts areas of milfoil growth were visually identified or found using a high-resolution depth finder and an underwater camera. Locations where milfoil was encountered were recorded using a GPS unit. A map of the GPS referenced milfoil locations and estimated extent of dense milfoil beds is shown in Figure 2.

Figure 2: Late season Eurasian watermilfoil distribution and Estimated Extent of Dense Milfoil Beds

### 2013 Milfoil Distribution



## **SUMMARY OF 2013 AQUATIC VEGETATION MANAGEMENT PROGRAM**

### **Renovate Herbicide Treatments**

Results of the 2013 Renovate OTF herbicide treatment program were consistent with treatment efforts performed in the Lake St. Catherine system in recent years. While some notable milfoil re-growth was noted in Area A, nearest the connection to Lily Pond, milfoil in other treatment areas responded very well and only scattered low-growing milfoil plants found in September. Based on results from other Renovate at Lake St. Catherine treatments we would expect to see reasonably good control of milfoil in these areas through the 2014 season.

After numerous years of use at Lake St. Catherine it is clear that Renovate is highly selective for milfoil and its use has not had a perceptible impact on other non-target aquatic plant species. While there continued to be fluctuations in the frequency of occurrence and species richness indices, no major shifts in plant composition have been documented following any of the Renovate applications performed at the lake. Based on data collected in the Lake St. Catherine system and other Vermont lakes, seasonal variability in native plant populations as well as the limitations of the data point survey methodology likely account for many of the documented year to year changes.

### **Spread Prevention and Non-Chemical Control Activities**

As required by the DEC Permit, non-chemical milfoil control activities continued at Lake St. Catherine during the 2013 season. Efforts included volunteer monitoring, volunteer and paid hand harvesting and diver assisted suction harvesting. Details of the non-chemical control efforts will be provided by LSCA under separate cover.

## **DISCUSSION**

Recent milfoil management efforts at Lake St. Catherine have focused on controlling areas of dense milfoil growth and maintaining it at scattered or trace levels. Renovate OTF herbicide treatments have proven effective at providing selective control of milfoil where used, however, benefits from treatment have typically only been maintained for two growing seasons. While generally effective, Renovate has also demonstrated some limitations when used in open water or smaller treatment areas where increased dilution and decreased concentration-exposure-time (CET) have resulted in less than optimal results. To maximize the effectiveness of annual treatments Aquatic Control has tried to identify and select treatment areas with the greatest chance of successful milfoil control. Additionally we have tried to improve CET by: delaying treatment until mid-June when more active plant tissue was present to maximize herbicide absorption; treating larger contiguous areas; and performing split-applications to extend the time that triclopyr was released off of the granule carrier.

It is apparent that there are still limitations of the Renovate OTF formulation to provide sufficient CET to insure complete milfoil control for partial lake or shoreline applications. Early studies with triclopyr on Eurasian watermilfoil suggested that CET's of 1.5 ppm were needed for 24 hours or 0.5 ppm were needed for 48 hours to insure >85% reduction of milfoil biomass (Netherland and Getsinger 1992). The first round of samples collected from the treatment areas this year showed maximum triclopyr concentrations of 0.754 ppm in North Bay and considerably lower concentrations in all other tested

locations. Future treatment efforts should continue to focus on improving the CET and ultimately longer-term milfoil control.

## **RECOMMENDATIONS FOR 2014 SEASON**

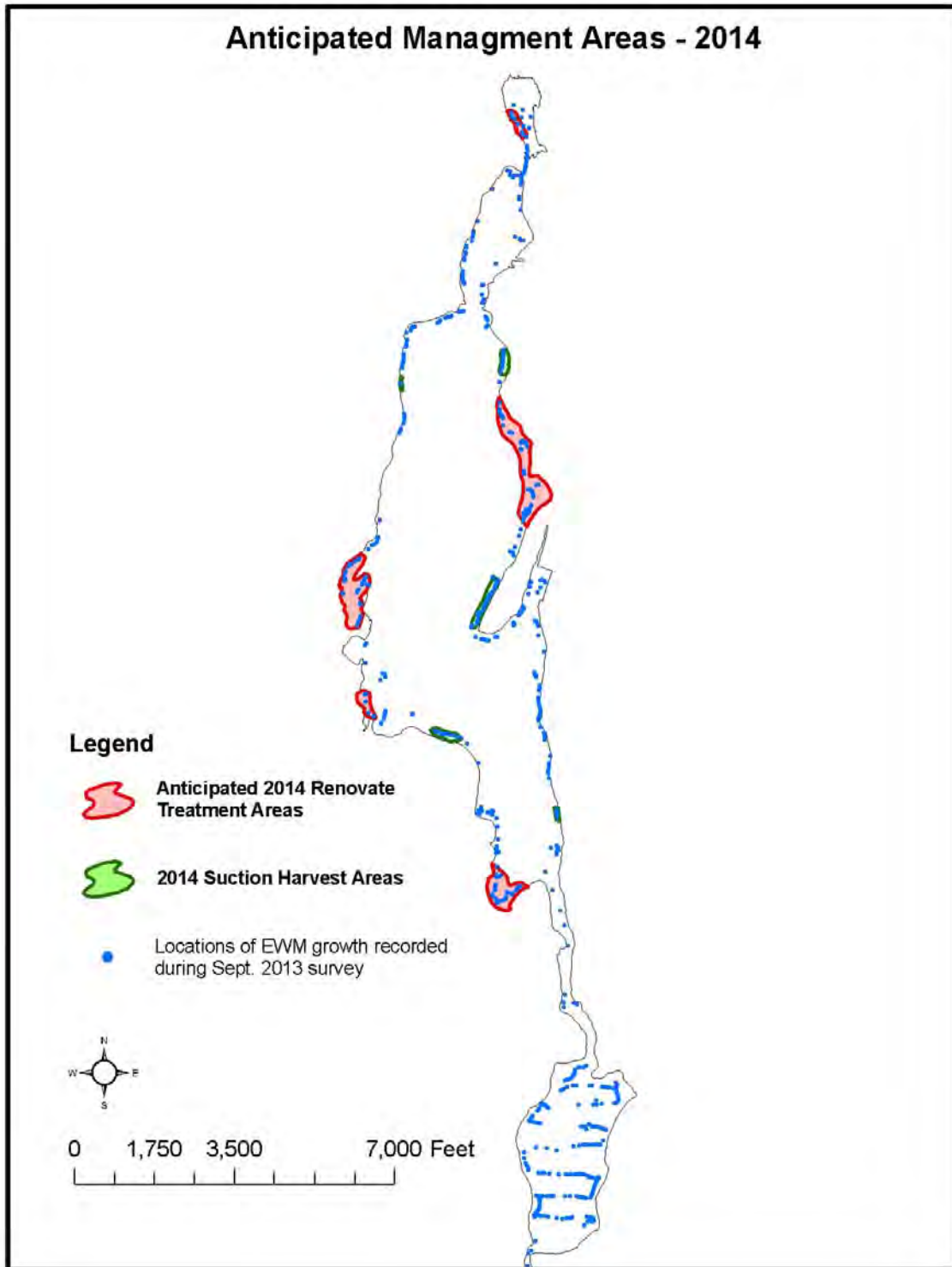
Results from the 2013 Renovate OTF treatment program have reinforced what we already knew, and have highlighted the difficulty faced with regards to achieving and maintaining CET. Unless alternative herbicides are permitted for use at the lake, or new products become available, it is likely that the use of Renovate (triclopyr) will remain the only viable herbicide option for milfoil control at Lake St. Catherine. As we have seen at Lake St. Catherine and other sites, the concentration-exposure-time (CET) when using Renovate is critical for achieving good milfoil control. When evaluating future treatment sites lessons learned regarding treatment timing, herbicide formulation (granular vs. liquid, etc.), method of application (i.e. split-treatment), potential for dilution and herbicide dosage will all taken into consideration.

Aquatic Control will be working with the LSC Association over the winter (2013/14) to update and improve the long-term management plan for Lake St. Catherine. Some of the considerations that will be discussed in the management plan include:

- Continued use of Renovate (triclopyr) herbicide treatments in cove areas and large-block treatment areas where herbicide concentrations can be most effectively maintained.
- Potential use of alternate triclopyr formulations (liquid vs. granular)
- Options for improving herbicide concentration-exposure-time (i.e. treatment timing, target location, application method, etc.)
- Potential use of alternate herbicide chemistries for control of milfoil in open-water areas and along exposed shorelines where adequate CET cannot be maintained with triclopyr.
- Establish definitive treatment (i.e. management) areas and no-management (habitat preservation) areas.
- Continued use of non-chemical control strategies, specifically diver hand-pulling and suction harvesting, along steeply sloped and exposed areas and for areas with lower density milfoil growth.
- Consider mechanical harvesting and other non-chemical control strategies in Little Lake and possibly Lily Pond, where both milfoil and native plants can reach nuisance levels.



Figure 3: Anticipated 2014 Management Areas



## REFERENCES

Netherland, M.D. and K.D. Getsinger. 1992. Efficacy of Triclopyr on Eurasian Watermilfoil: Concentration and Exposure Time Effects. *J. Aquat. Plant Manage.* 30: 1-5.

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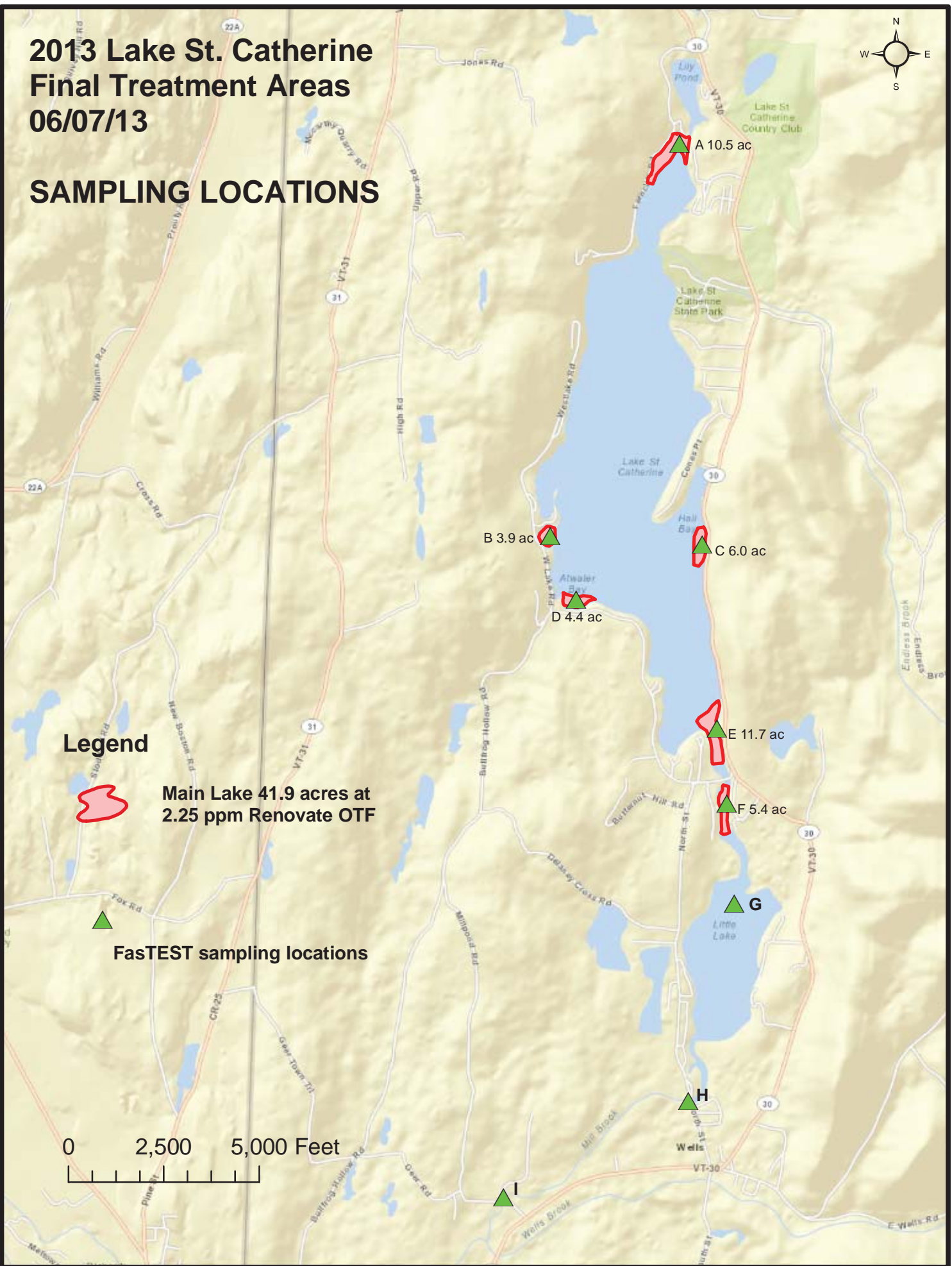
# ***APPENDIX A***

## **Herbicide Residue Testing Results**

- Sampling Location Map
- Sampling Results Summary
- SePRO Laboratory Report – 6/18/13 sampling round
- SePRO Laboratory Report – 6/26/13 sampling round

# 2013 Lake St. Catherine Final Treatment Areas 06/07/13

## SAMPLING LOCATIONS



# Lake St. Catherine 2013 Renovate Assay Results

Treatment Date: 6/17/13

Site	18-Jun	26-Jun
A	754.4	18.4
B	57.3	9.3
C	61.3	10.5
D	7.4	9
E	237	10.7
F	363.3	21.9
G	535.6	22.8
H	<1.0	



**Chain of Custody:** 2013-10559-00

**Page 1 of 2 Total Pages**

**Customer Company**

Company Name: Aquatic Control Tech Inc  
Address: 11 John Road  
Sutton, MA 01590-2509

**Customer Contact**

Contact Person: Marc Bellaud  
E-Mail Address: mbellaud@aquaticcontroltech.com  
Phone: (508) 865-1000  
Fax:

**Waterbody Information**

Waterbody: Lake St. Catherine - MA      Waterbody Size (acres): 0.00      Depth Average: 0.0

**Sample Information**

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
24359	A	<b>Renovate/Triclopyr (µg/L)</b>	<b>754.4</b>	06/18/2013		
24360	B	<b>Renovate/Triclopyr (µg/L)</b>	<b>57.3</b>	06/18/2013		
24361	C	<b>Renovate/Triclopyr (µg/L)</b>	<b>61.3</b>	06/18/2013		
24362	D	<b>Renovate/Triclopyr (µg/L)</b>	<b>7.4</b>	06/18/2013		
24363	E	<b>Renovate/Triclopyr (µg/L)</b>	<b>237.0</b>	06/18/2013		
24364	F	<b>Renovate/Triclopyr (µg/L)</b>	<b>363.3</b>	06/18/2013		
24365	G	<b>Renovate/Triclopyr (µg/L)</b>	<b>535.6</b>	06/18/2013		
24366	H	<b>Renovate/Triclopyr (µg/L)</b>	<b>&lt; 1.00</b>	06/18/2013		

**Original**



Waterbody Information

Waterbody: Lake St. Catherine - MA Waterbody Size (acres): 0.00 Depth Average: 0.0

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
--------	-----------------	-------------	---------	---------------	---------------	---------------------

ANALYSIS STATEMENTS:  
 SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.  
 PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.  
 QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.  
 COMMENTS: No significant observations were made unless noted in the report.

Laboratory Information

Date Received:	06/19/2013	Sample Preparation Date:	06/19/2013
Time Received:	10:00	Date Analysis Performed:	06/20/2013
Date Results Sent:	06/20/2013		

*Disclaimer: The results listed within this Laboratory Report relate only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a dry weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the exclusive use of SRTC Laboratory and its client. This report shall not be reproduced, except in full, without written permission from SRTC Laboratory. The Chain of Custody is included and is an essential component of this report.  
 This entire report was reviewed and approved for release.*

*Reviewed By:  SRTC Laboratory Manager*

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**Page 1 of 2 Total Pages**

**Customer Company**

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**Customer Contact**

Contact Person: Marc Bellaud  
E-Mail Address: mbellaud@aquaticcontroltech.com  
Phone: (508) 865-1000  
Fax:

**Waterbody Information**

Waterbody: Lake St. Catherine - MA      Waterbody Size (acres): 0.00      Depth Average: 0.0

**Sample Information**

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
24652	A	<b>Renovate/Triclopyr (µg/L)</b>	<b>18.4</b>	06/26/2013		
24653	B	<b>Renovate/Triclopyr (µg/L)</b>	<b>9.3</b>	06/26/2013		
24654	D	<b>Renovate/Triclopyr (µg/L)</b>	<b>9.0</b>	06/26/2013		
24655	C	<b>Renovate/Triclopyr (µg/L)</b>	<b>10.5</b>	06/26/2013		
24656	F	<b>Renovate/Triclopyr (µg/L)</b>	<b>21.9</b>	06/26/2013		
24657	G	<b>Renovate/Triclopyr (µg/L)</b>	<b>22.8</b>	06/26/2013		
24658	E	<b>Renovate/Triclopyr (µg/L)</b>	<b>10.7</b>	06/26/2013		

**Original**





Waterbody Information

Waterbody: Lake St. Catherine - MA Waterbody Size (acres): 0.00 Depth Average: 0.0

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
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ANALYSIS STATEMENTS:  
SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.  
PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.  
QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.  
COMMENTS: No significant observations were made unless noted in the report.

Laboratory Information

Date Received:	06/27/2013	Sample Preparation Date:	06/27/2013
Time Received:	10:00	Date Analysis Performed:	06/28/2013
Date Results Sent:	06/28/2013		

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This entire report was reviewed and approved for release.*

*Reviewed By:  SRTC Laboratory Manager*

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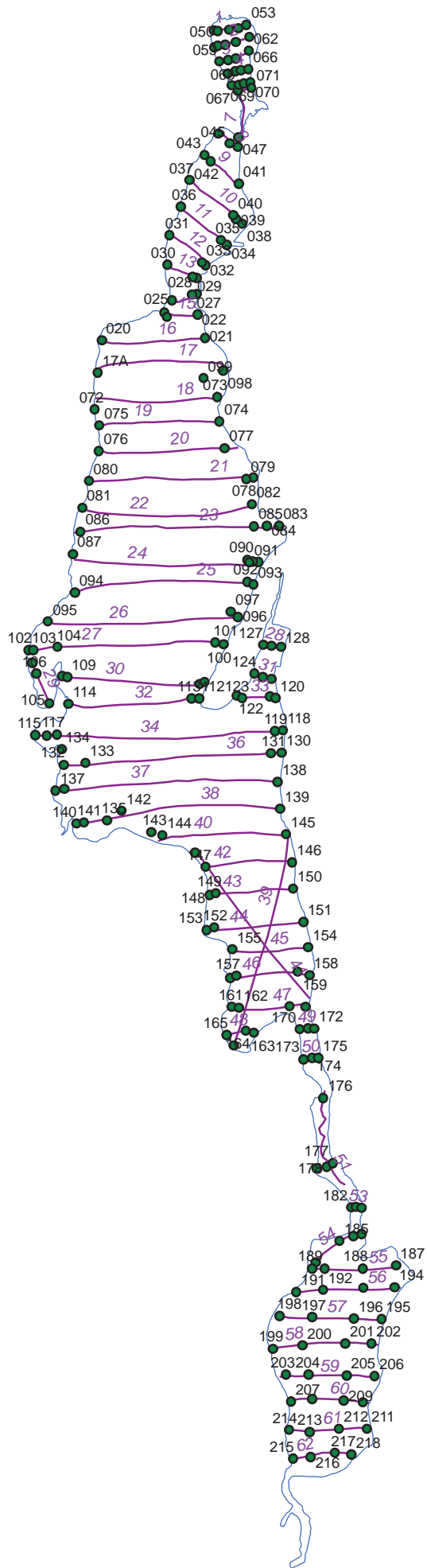
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## ***APPENDIX B***

### **Comprehensive Aquatic Vegetation Survey Information**

- Data Point Sampling Location Map
- Field Data Table
- Overall Vegetation Density Map
- Vegetation Species Distribution Maps
- Late Season Milfoil Distribution - 2013



## Lake St. Catherine

Poultney & Wells, VT

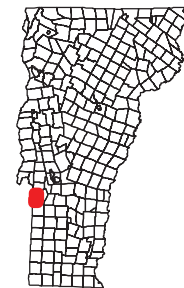
Transects & Data Point Locations  
for Vegetation Survey

FIGURE:	SURVEY DATE:	MAP DATE:
B-1	9/24 & 9/25/13	10/18/13

## Legend

● Data point locations recorded with GPs unit during ACT/ ReMetrix 2001 survey. Sampling replicated during ACT 2007 survey. Data points relocated with DGPS unit with sub-meter accuracy.

— Transects recorded during ACT/ ReMetrix 2001 survey using DGPS.



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Transect	Point #	Distance from Shore	Depth (ft)	% Cover	% Ms Cover	Species Richness	Biomass	Pr	Ms	Pa	Ec	Pi	Nf	Pz	Cd	Zd	Ca	Ny	Mu	V	Fa	Pp	Uv	B	Pe	Pg	I	Pn	Ug	Nu	Pc	Lm	Ngram	Mb					
61	213	300	4	80	10	4	3	X	X		X	X							D																				
61	212	800	5	1	1	1	1	D	X	X	X	X			X			X																					
61	211	76	3	100	10	7	4	D	X	X	X	X			X			D																					
62	215	50	3	70	1	7	4	X	X	X	X	X			X			D																					
62	216	700	5	30	0	3	4	X				D																											
62	217	120	4	80	0	1	4	X	X			D						X																					
62	218	30	3	80	1	6	4	X	X			X						X																					
				79.56		4.63																																	
						2.95																																	
						Present		14		29		9		14		23		10		0		12		1		0		0		0		0		0		0			
						Dominant		3		0		3		0		0		3		0		5		0		0		0		0		0		0		0		0	
						Total		40		32		17		26		1		12		12		6		0		4		6		1		1		0		0		0	
						% Frequency		93.0%		74.4%		20.9%		39.5%		60.5%		2.3%		27.9%		27.9%		0.0%		14.0%		2.3%		0.0%		2.3%		0.0%		0.0%		0.0%	

Entire Lake

Pr	Ms	Pa	Ec	Pi	Nf	Pz	Cd	Zd	Ca	Ny	Mu	V	Fa	Pp	Uv	B	Pe	Pg	I	Pn	Ug	Nu	Pc	Lm	Ngram	Mb																					
68	93	51	38	83	7	43	30	8	0	18	0	25	5	4	8	6	1	4	0	0	0	1	0	0	0	0																					
81	33	11	7	27	1	2	0	0	0	5	0	11	0	1	0	1	0	1	0	0	0	0	0	0	0	0																					
149	126	62	45	110	8	45	30	8	0	23	0	36	5	5	8	7	1	5	0	0	0	1	0	0	0	0																					
				76.0%		64.3%		31.6%		23.0%		56.1%		4.1%		23.0%		15.3%		4.1%		0.0%		11.7%		0.0%		18.4%		2.6%		2.6%		4.1%		3.6%		0.5%		2.6%		0.0%		0.0%		0.0%	

12.836735

# 2013 TOTAL VEGETATION BIOMASS



## Legend

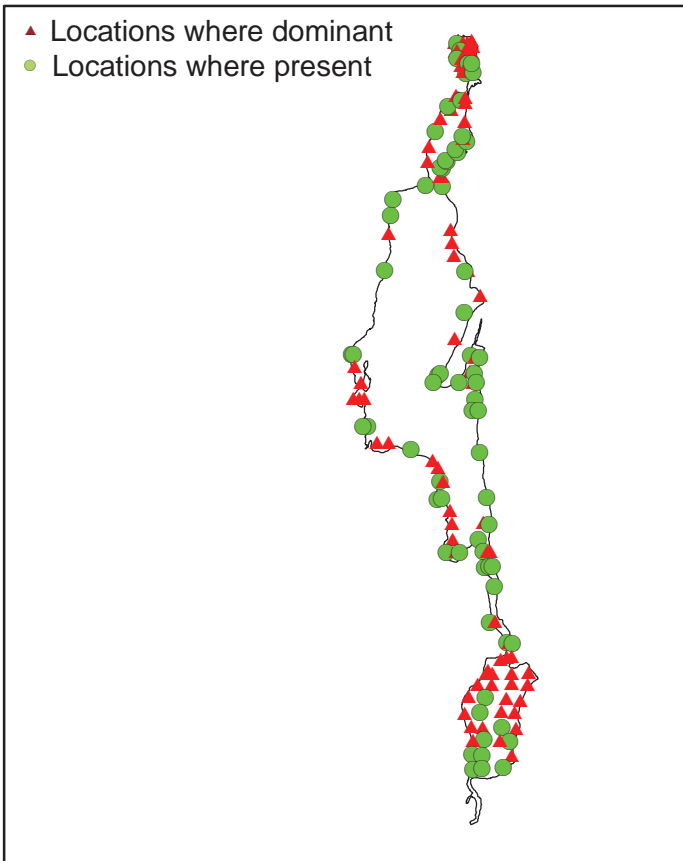
Biomass indices reported during 9/24 & 9/25/13 survey

- 1 - low biomass (along bottom)
- 2 - moderate biomass (in water column)
- 3 - high biomass (approaching surface)
- 4 - extremely high biomass (topped out)

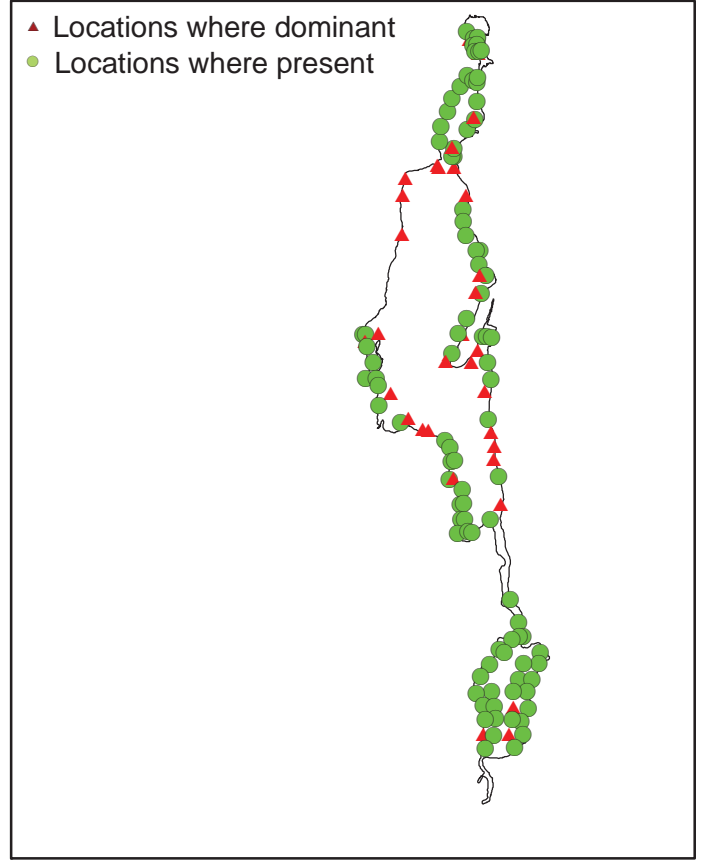




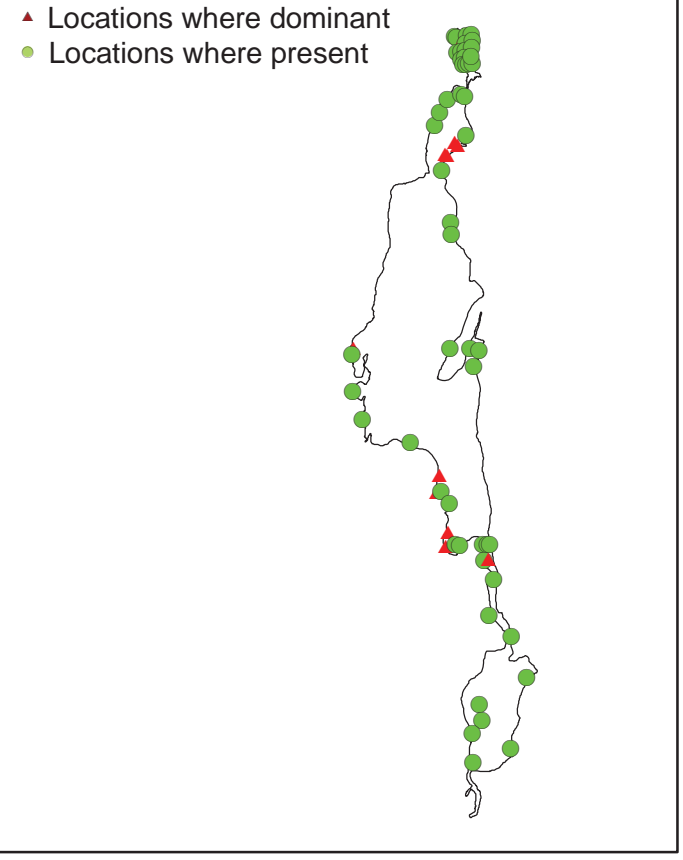
Distribution of *Potamogeton robbinsii*



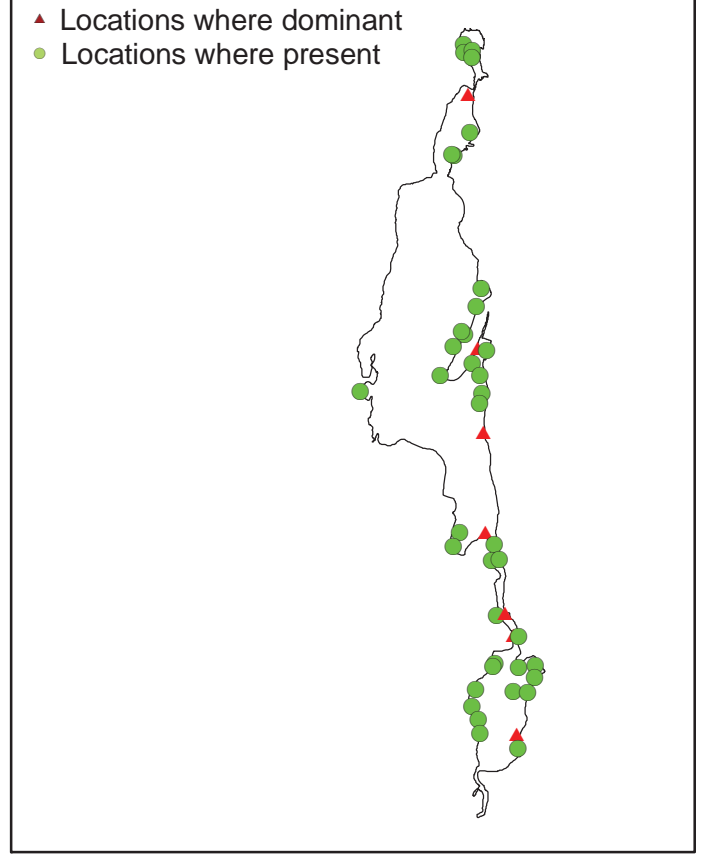
Distribution of *Myriophyllum spicatum*



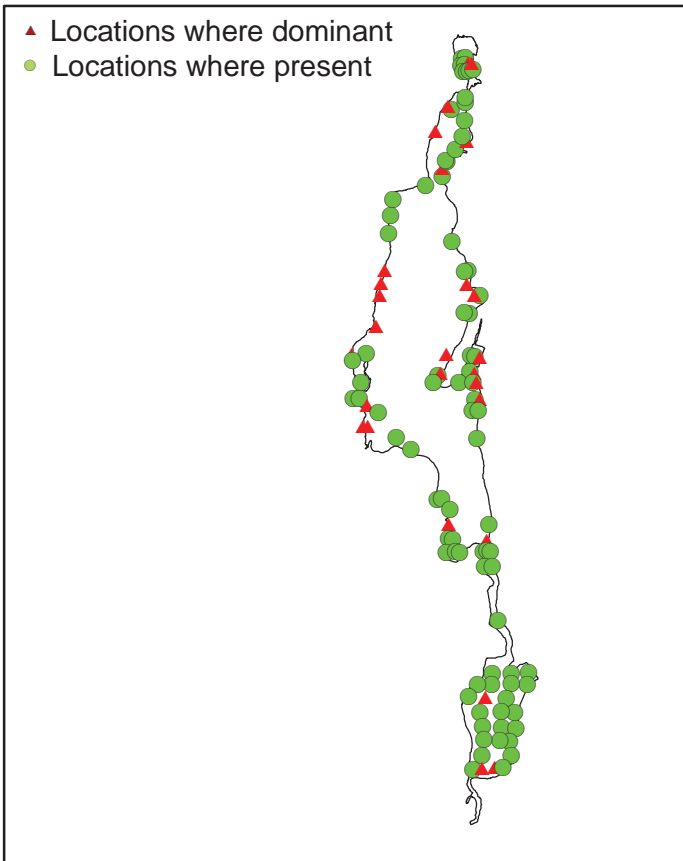
Distribution of *Potamogeton amplifolius*



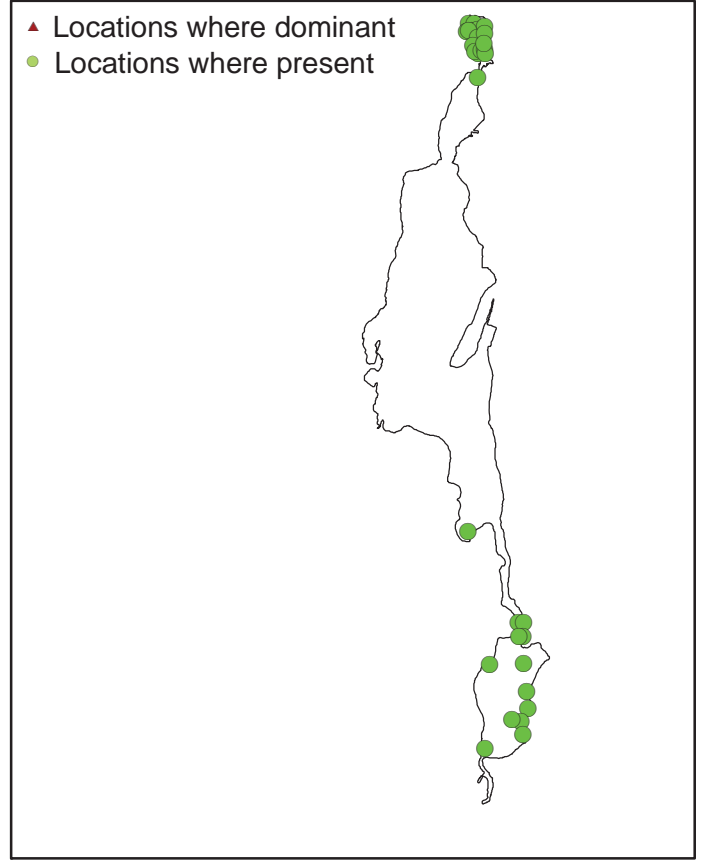
Distribution of *Elodea canadensis*



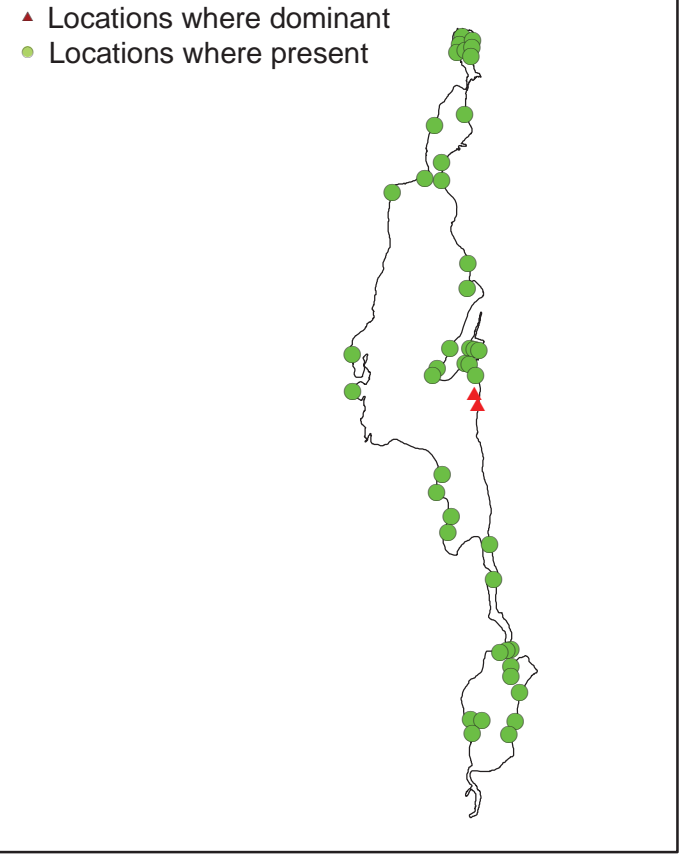
### Distribution of *Potamogeton illionensis*



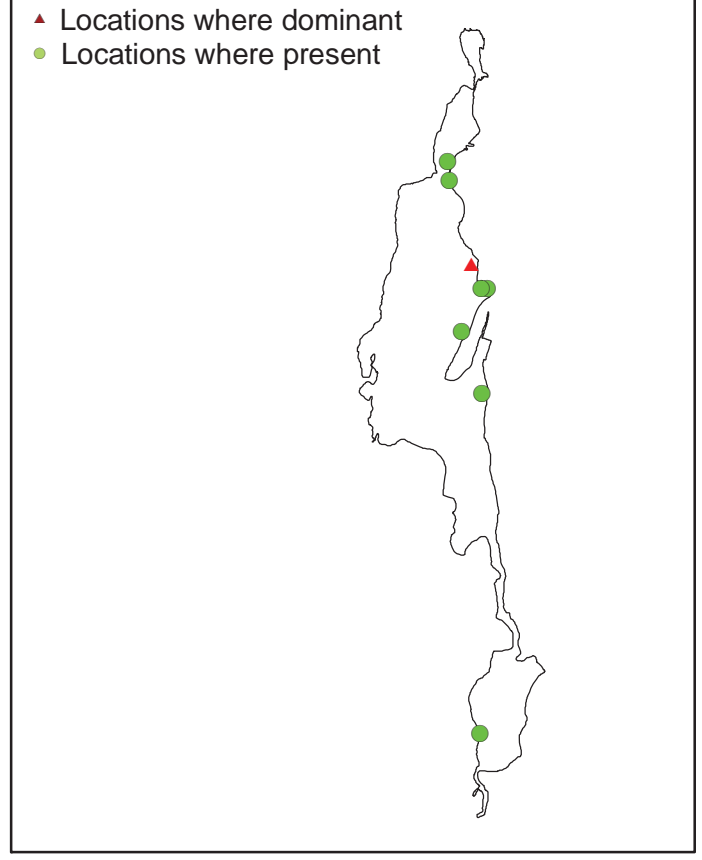
### Distribution of *Ceratophyllum demersum*



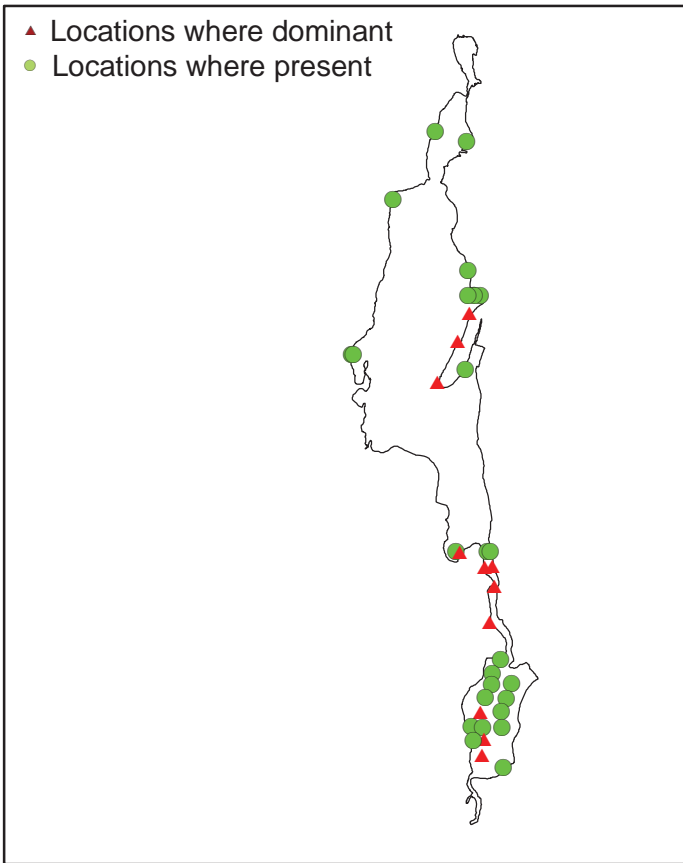
### Distribution of *Potamogeton zosteriformis*



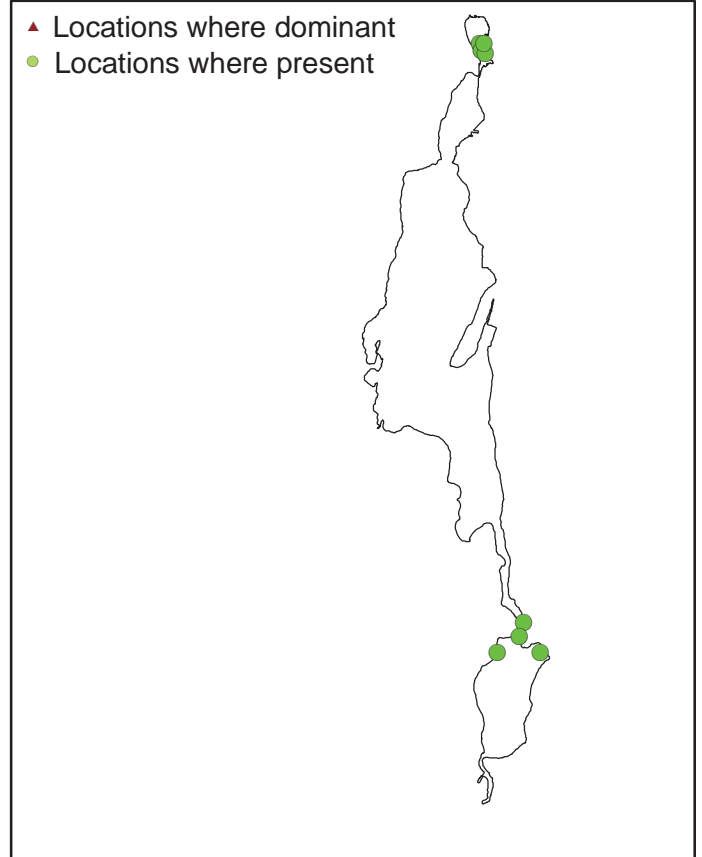
### Distribution of *Najas flexilis*



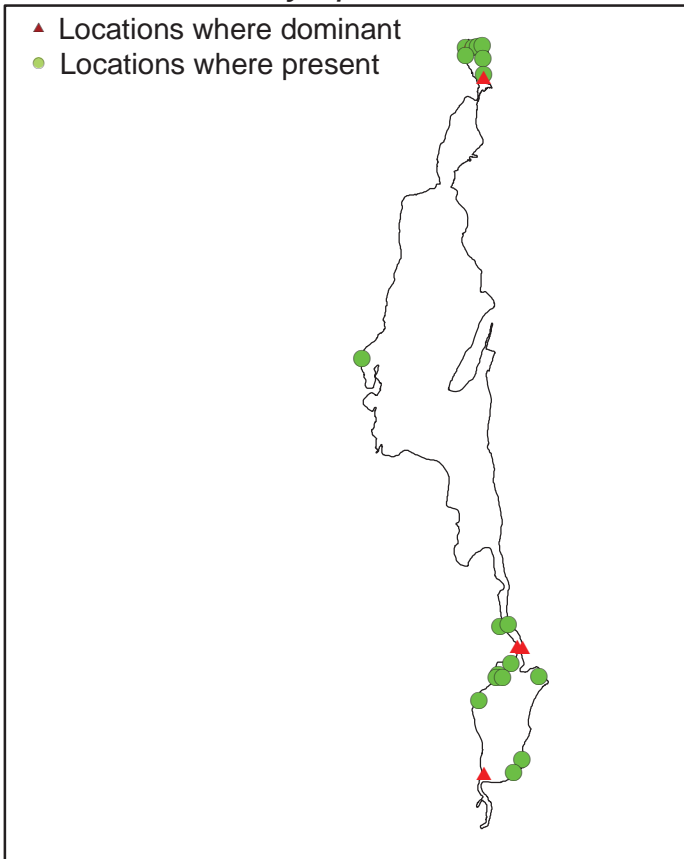
### Distribution of *Vallisneria americana*



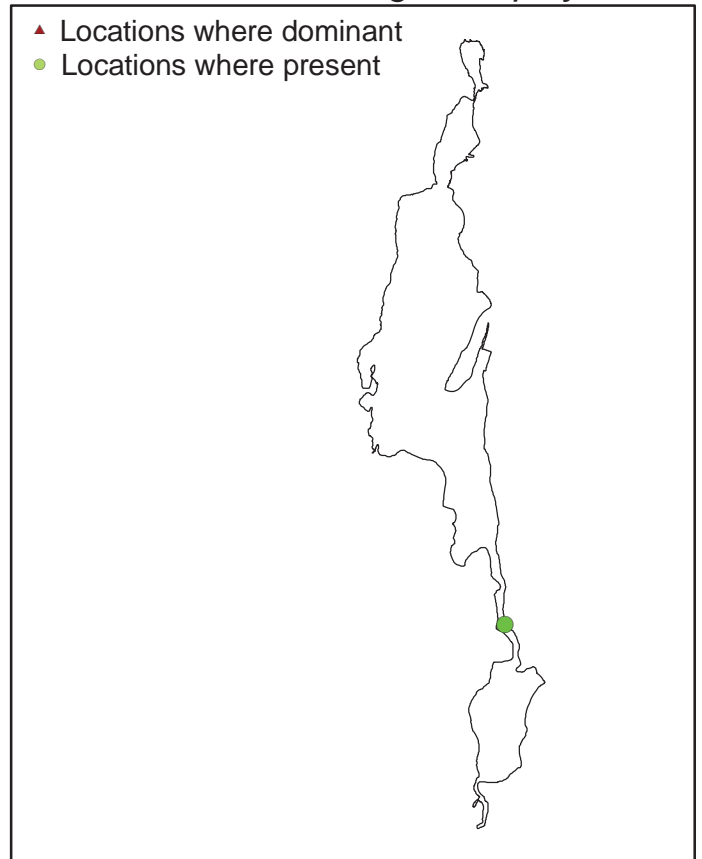
### Distribution of *Utricularia vulgaris*



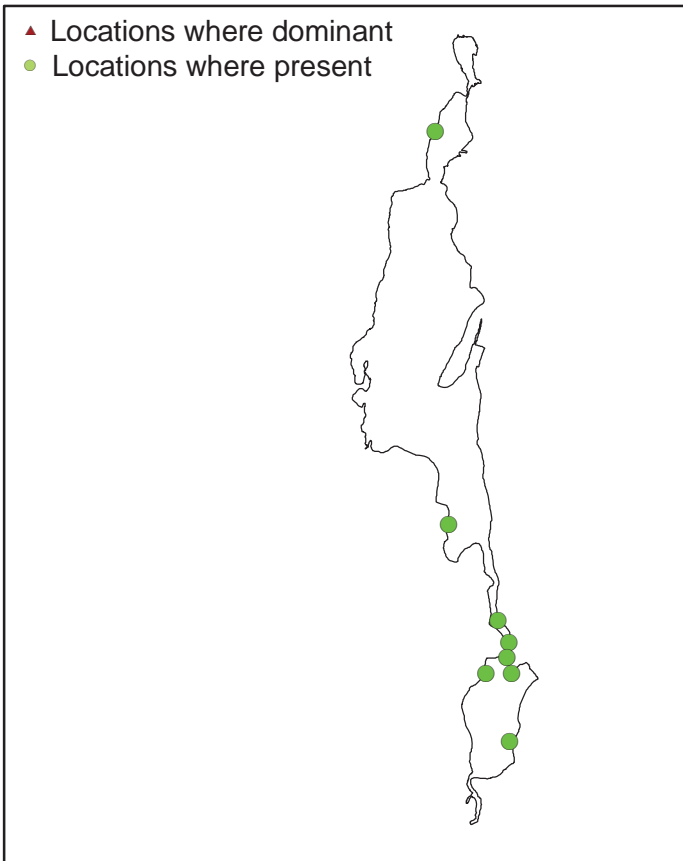
### Distribution of *Nymphaea odorata*



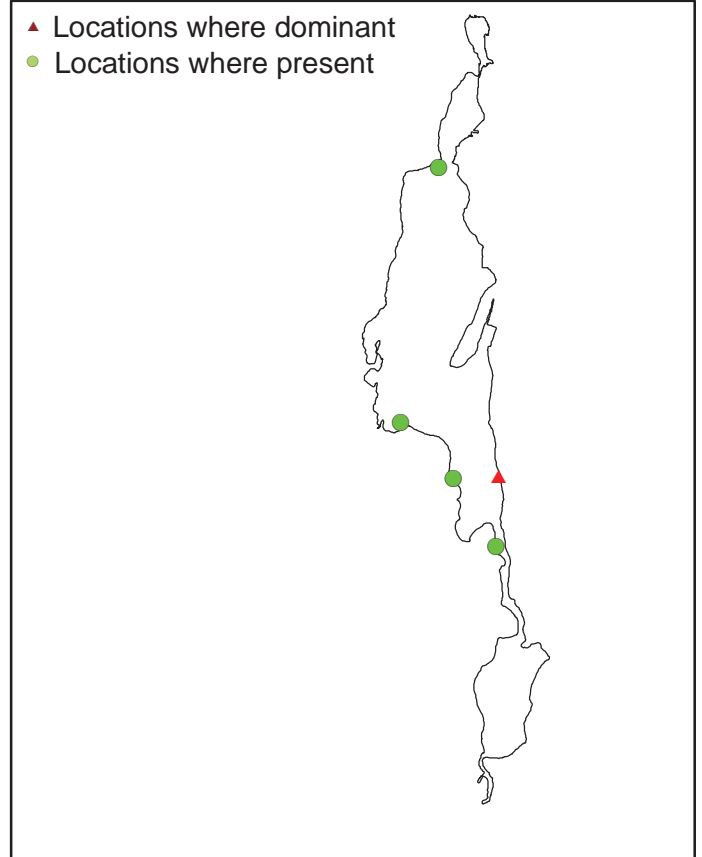
### Distribution of *Potamogeton epihydrus*



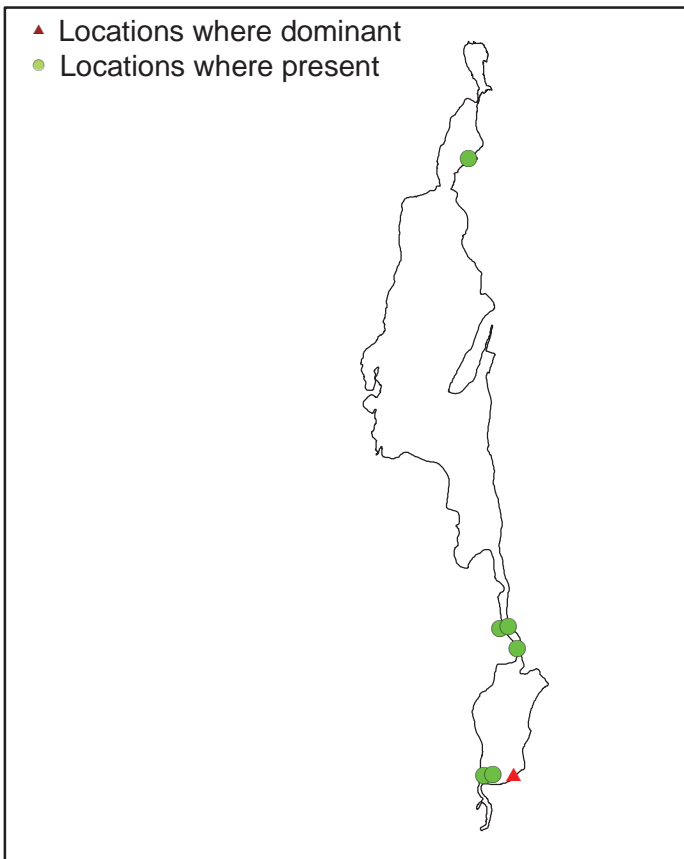
### Distribution of *Zosterella dubia*



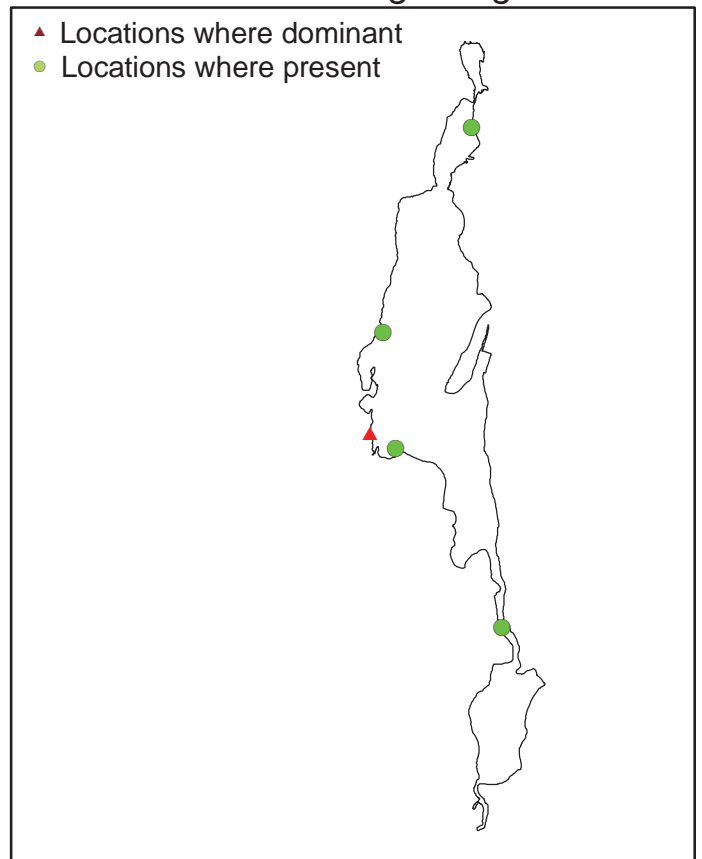
### Distribution of *Potamogeton pusillus*



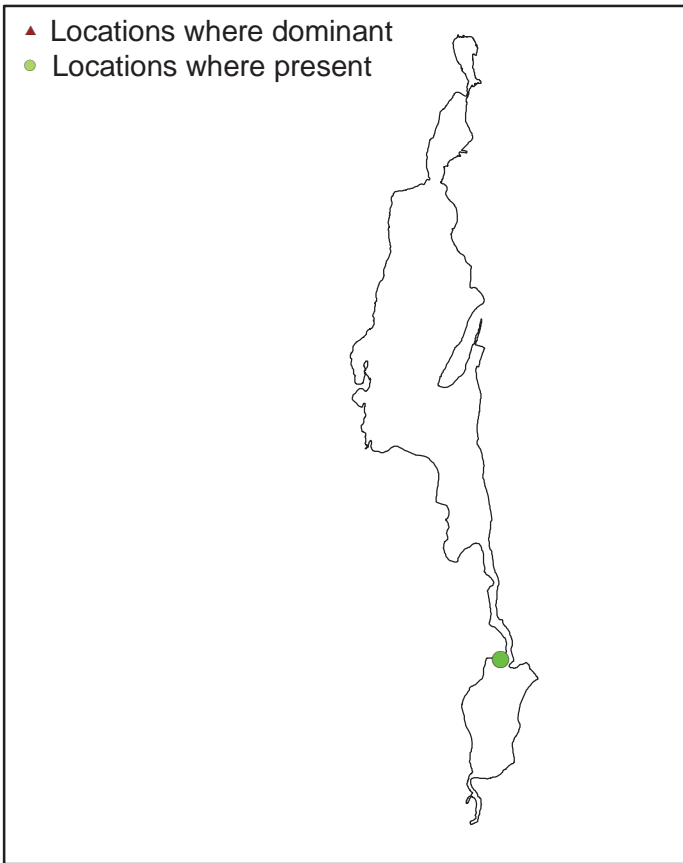
### Distribution of *Brasenia schreberi*



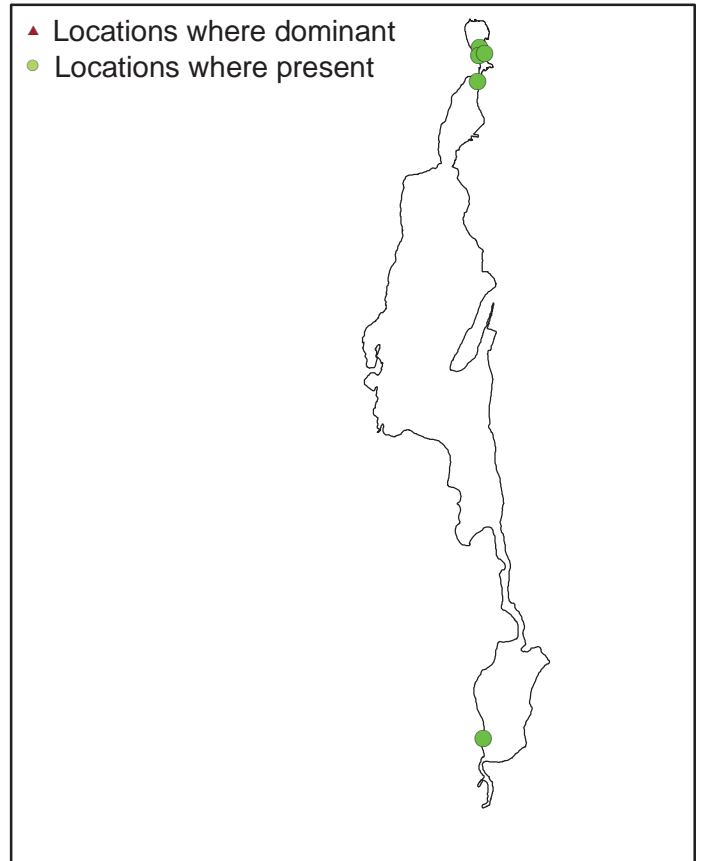
### Distribution of *Potamogeton gramineus*



### Distribution of *Nuphar variegatum*



### Distribution of Filamentous algae



# 2013 Milfoil Distribution

- Locations of EWM growth recorded during Sept 2013 survey (includes pre-established survey points where EWM was encountered)
- EWM beds observed during Sept 2013 survey
- ▨ 2013 Treatment Areas

0 1,250 2,500 5,000 Feet

