

**LAKE ST CATHERINE
AQUATIC VEGETATION MANAGEMENT PROGRAM
2016 ANNUAL REPORT**

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

1 INTRODUCTION

The 2016 season marked the thirteenth year of Solitude Lake Management’s (formerly Aquatic Control Technology) involvement in the Integrated Management Plan at Lake St. Catherine developed to control the 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 2016 included spot-treatment of six areas, totaling approximately 66.8 acres with Renovate OTF (triclopyr granular) and Renovate 3 (triclopyr liquid) herbicides as well as diver hand-pulling and diver assisted suction harvesting. These efforts were consistent with the current five-year Integrated Management Plan (2014-2019).

The following report summarizes the results of 2016 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 2016 diver hand-pulling and diver assisted suction harvesting efforts will be provided by the Lake St. Catherine Association (LSCA) under a separate cover.

2. HERBICIDE TREATMENT PROGRAM - 2016

2.1 Program Chronology

A chronology of the 2016 treatment program is provided below:

- Pre-treatment inspection and finalize treatment areas..... May 18
- Treatment of approximately 66.8 acres with Renovate OTF June 27
- Herbicide residue monitoring June 28, July 5, & August 10
- Comprehensive aquatic plant survey..... September 19 & 20

2.2 Pre-Treatment Inspection

On May 18th the entire shoreline littoral area of Lake St. Catherine (Lily Pond, Main Lake and Little Lake) was surveyed by Solitude Lake Management to determine the stage of milfoil growth. EWM plants were generally 3-6 feet tall and showing active growth with red tips on the apical meristems. Results of the survey were communicated to LSCA for their input and final determination on proposed treatment areas.

2.3 Summary of 2016 Treatment

Six areas totaling 66.8 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 Monday, June 27, 2016 was selected to allow enough time to comply with the notification requirements of ANC Permit #2014-C01 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 partly sunny with the air temperature at 75° F; wind was out of the southwest estimated at <5-10 mph. Surface water temperature in the main basin was approximately 24.1°C.

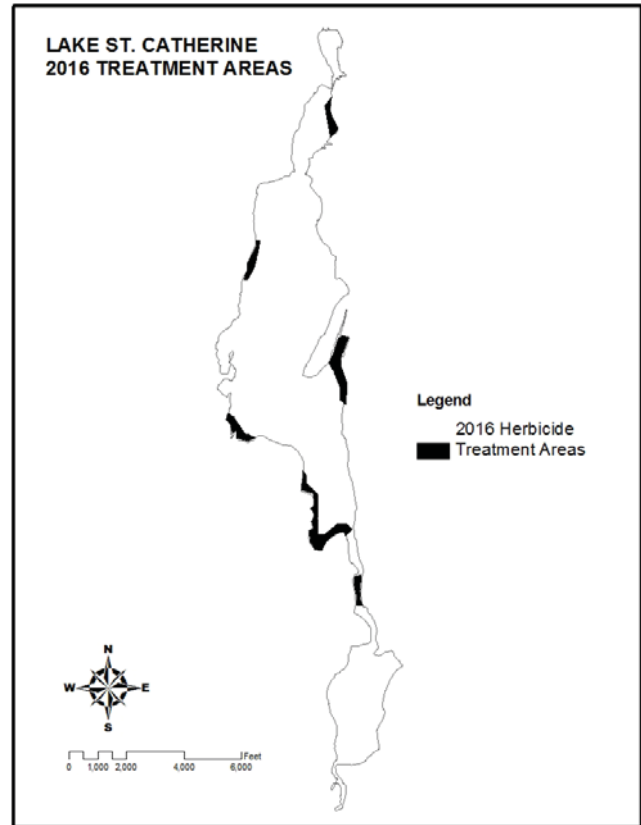


Figure 1: 2016 Treatment

The treatment was conducted with a 20-foot aluminum work skiff. The granular Renovate OTF herbicide was applied using a calibrated educator system. The liquid Renovate 3 herbicide was injected at depth subsurface using weighted hoses that trail the spray boat. An onboard GPS unit was used to provide real-time guidance and ensure an even application in each of the treated 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 has been used in recent years to increase concentration-exposure-time and help increase treatment efficacy. Both Renovate 3 (liquid) and Renovate OTF (granular) formulations of triclopyr herbicide were used at Lake St. Catherine in 2016. The granular formulation has proven to be effective for steeply sloped areas, smaller EWM beds and in areas where there is potential for excessive dilution from untreated water. The liquid formulation was used in larger treatment blocks and cove areas that were not subject to as much dilution.

The application rate for Renovate OTF was 2.25 ppm in bottom 4-6 feet or 240 lbs/ac). The liquid Renovate 3 was applied at 1.5 ppm assuming 6 -foot average depth. A total of 4440 pounds of Renovate OTF and 362 gallons of Renovate 3 were applied. The treatment took approximately 6.75 hours to complete.

2.4 Herbicide Residue Testing

In compliance with conditions of the ANC Permit #2014-C01, 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 SLM and SePRO. Collected samples were shipped via overnight delivery to SePRO’s laboratory in Whittakers, North Carolina.

Samples were collected on June 28, July 5 and August 10. Consistent with what we have documented in the past few years post-treatment triclopyr residues dropped quickly with only two in-treatment sample locations above the 75ppb threshold after 24 hrs. One week post-treatment all 8 sample locations were below the 75ppb threshold. All sample locations were “non-detect” (<1 ppb) by August 10, just over six weeks post-treatment.

Table 1: FasTEST Sampling Results (ppb)

Site	28-June	05-July	10-August
1/F	1.1	11.9	< 1
2/E	268.8	2.7	< 1
3/D	53.2	17.4	< 1
4/C	71.4	13.1	< 1
5/B	351.8	21.6	< 1
6/A	7.9	55.3	< 1
7	3.1	3.4	< 1
8	< 1	2.2	< 1

3 LATE SEASON COMPREHENSIVE AQUATIC VEGETATION SURVEY

3.1 Survey Methods

The late season comprehensive aquatic vegetation survey conducted on September 19 & 20 replicated the methods that were employed in the previous years of this management program.

All three major lake basins were systematically toured by boat by SŌLitude biologists Amanda Mahaney and Emily Mayer. 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. The plant community was assessed through visual inspection, use of a 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.

3.2 Survey Findings

Quantitative measures of the aquatic plant community documented in 2016 were comparable to prior years. While milfoil distribution (FOC - frequency of occurrence) and abundance (% cover) has continued to decrease for the past four years, overall vegetative cover has also experienced relatively minor decreases between 2015 and 2016.

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*, *Elodea canadensis*, *Zosterella dubia*, *Potamogeton amplifolius*. Diversity has also been maintained throughout the course of management with 26 different aquatic plant species identified this fall and an average of 4 species per point.

Comparative data for all three basins from data collected during late season between 2001 and 2016 is listed below (Table 2).

Table 2: Summary of Survey Data

LILY POND	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Data Points	24	24	24	22	24	24	24	24	24	24	24	24	24	24
Total Plant Cover	90%	80%	98%	88%	91%	98%	94%	98%	93%	94%	96%	94%	90%	78%
Milfoil Cover	9%	6%	2%	0%	2%	7%	<1%	<1%	<1%	1%	5%	1.5%	2.2%	7%
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	3.4	3.5	3.2

LAKE ST. CATHERINE														
# of Data Points	129	129	129	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%	63%	63%	37%
Milfoil Cover	43%	16%	0%	4%	11%	4%	5%	2%	7%	8%	16%	15%	7%	6%
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	2.0	2.0	2.6

LITTLE LAKE														
# of Data Points	43	43	43	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%	86%	96%	54%
Milfoil Cover	15%	0%	0%	2%	7%	10%	<1%	5%	9%	14%	7%	10%	42%	25%
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	3.2	3.8	3.8

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

Macrophyte Species	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<i>Myriophyllum spicatum</i>	94%	44%	17%	33%	74%	65%	38%	40%	43%	51%	64%	54%	48%	25%
<i>Najas flexilis</i>	22%	0%	8%	39%	34%	22%	15%	16%	14%	8%	4%	7%	10%	9.1%
<i>Zosterella dubia</i>	1%	1%	9%	8%	23%	17%	7%	13%	4%	2%	4%	11%	15%	19%
<i>Ceratophyllum demersum</i>	20%	8%	11%	12%	21%	18%	17%	22%	10%	21%	15%	17%	15%	14%
<i>Nitella / Chara</i>	17%	6%	36%	40%	14%	14%	13%	2%	2%	1%	0%	3%	19%	5%
<i>Nuphar variegatum</i>	5%	5%	5%	2%	2%	1%	2%	1%	2%	1%	1%	0%	2%	<1%
<i>Nymphaea odorata</i>	16%	5%	11%	10%	11%	11%	10%	7%	7%	12%	12%	14%	13%	8%
<i>Vallisneria americana</i>	29%	13%	2%	4%	9%	8%	15%	15%	14%	15%	18%	19%	26%	21%
<i>Brasenia schreberi</i>	4%	8%	7%	7%	7%	6%	5%	5%	5%	3%	4%	4%	3%	3%
<i>Utricularia vulgaris</i>	8%	9%	2%	6%	7%	7%	11%	8%	2%	4%	4%	7%	7%	4%
<i>Elodea canadensis</i>	32%	1%	1%	1%	5%	43%	60%	30%	10%	14%	23%	12%	30%	38%
<i>Chlorophyta</i>	2%	37%	26%	7%	4%	8%	3%	2%	3%	4%	3%	4%	2%	<1%
<i>Potamogeton amplifolius</i>	33%	38%	43%	49%	52%	53%	51%	56%	23%	35%	32%	31%	13%	20%
<i>Potamogeton robbinsii</i>	52%	76%	88%	74%	77%	68%	84%	78%	57%	76%	76%	73%	57%	58%
<i>Potamogeton crispus</i>	2%	1%	7%	5%	3%	1%	0%	0%	1%	1%	0%	1%	0%	<1%
<i>Potamogeton epihydrus</i>	2%	6%	7%	3%	3%	5%	1%	1%	1%	4%	1%	2%	<1%	1%
<i>Potamogeton illinoensis</i>	4%	1%	2%	9%	23%	39%	29%	36%	35%	53%	56%	57%	44%	47%
<i>Potamogeton zosteriformis</i>	28%	3%	29%	29%	23%	19%	16%	26%	22%	20%	23%	36%	15%	16%
<i>Potamogeton praelongus</i>	0%	0%	0%	0%	0%	0%	0%	0%	0%	<1%	<1%	3%	6%	10%
<i>Potamogeton gramineus</i>	23%	1%	6%	6%	2%	4%	4%	4%	11%	8%	3%	3%	4%	3%
<i>Isoetes sp.</i>	2%	6%	2%	5%	2%	3%	1%	0%	1%	1%	0%	0%	1%	<1%
<i>Utricularia gibba</i>	2%	0%	1%	5%	1%	1%	4%	1%	0%	0%	0%	0%	2%	5%
<i>Eleocharis asicularia</i>	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	<1%
<i>Lemna minor</i>	7%	1%	0%	1%	0%	1%	1%	0%	0%	0%	0%	0%	<1%	<1%
<i>Megalodonta beckii</i>	3%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0.5%	0%	0%
<i>Najas minor</i>	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	<1%	2%

3.3 Lily Pond

The milfoil in Lily Pond has not been incorporated in the annual treatment program for three years, causing the milfoil to increase in minor increments.

Native species in Lily Pond remained healthy with both cover and distribution indices similar to what has been recorded in previous years. *Potamogeton robbinsii* (70%) remained the most abundant plant in the basin followed by *Ceratophyllum demersum* (66%), *Elodea canadensis* (62%) *Zosterella dubia* (58%), and *Potamogeton amplifolius* (45%). *Potamogeton illinoensis* and *Potamogeton zosteriformis* were also abundant and were encountered at both 45% of the surveyed data points, respectively. FOC and percent cover of other plant species in Lily Pond was similar to previous years. Eurasian milfoil frequency increase slightly since 2015 due to lack of treatment during the 2016 management season.

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

Macrophyte Species	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<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%	100%	68.0%	70.8%
<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%	54.2%	64.0%	66.7%
<i>Potamogeton amplifolius</i>	33.3%	100%	91.7%	77.3%	79.2%	87.5%	91.7%	87.5%	37.5%	45.8%	75.0%	75.0%	24.0%	50.0%
<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%	54.2%	16.0%	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%	16.7%	28.0%	37.5%
<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%	66.7%	48.0%	45.8%
<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%	16.7%	40.0%	58.3%
<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%	37.5%	28.0%	33.3%
<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%	0.0%	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%	29.2%	8.0%	10.0%
<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%	12.5%	48.0%	62.5%
<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%	29.2%	28.0%	29.2%
<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%	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%	0.0%	0.0%	0.0%
<i>Potamogeton epihydrus</i>	0.0%	12.5%	4.2%	0.0%	4.2%	4.2%	4.2%	0.0%	4.2%	4.2%	0.0%	0.0%	0.0%	4.2%
<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%	0.0%	0.0%	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%	0.0%	12.0%	25%
<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%	12.5%	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%	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%	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%	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%	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%	0.0%	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%	0.0%	4.0%	37.5%

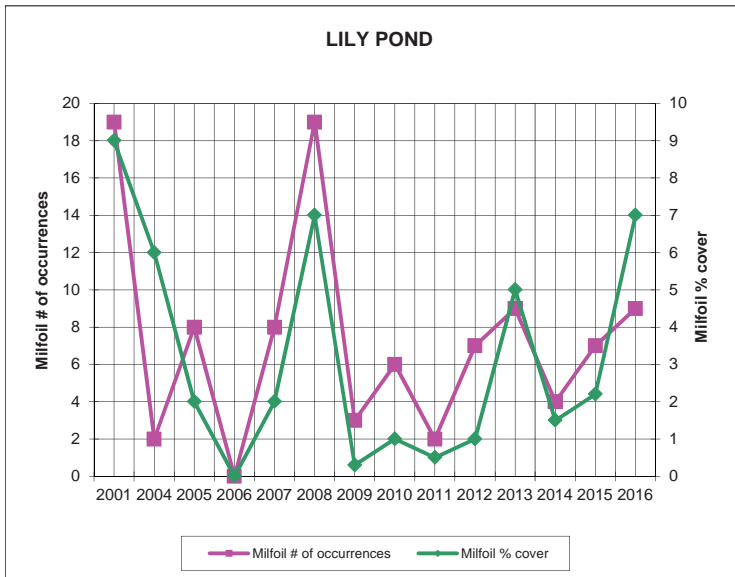


Chart 1: Lily Pond: *Myriophyllum spicatum*
Frequency of Occurrences and Percent Cover

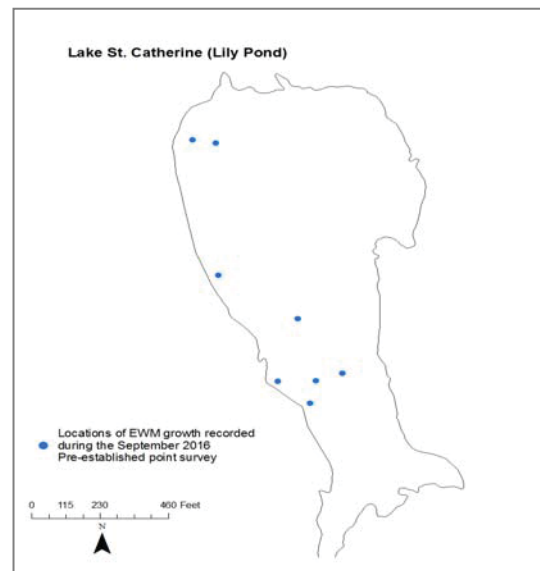


Figure 2: Data points of *M. spicatum*
In Lily Pond during the 2016 September survey

3.4 Lake St. Catherine (Main Basin)

The distribution and composition of native plant species in the main basin of Lake St. Catherine has seen various fluctuations in species FOC. *Potamogeton robbinsii* remained the most common plant species in the main basin and was recorded at 46.6% of the surveyed locations. Progressive treatment results have begun to allow native species to contend with Eurasian milfoil. For the past four years, *Myriophyllum spicatum* has shown consistent decreases in occurrences, but remains not far behind the third most frequent, *Elodea canadensis* (36.6%), at 34.4%. *Zosterella dubia* (Water Stargrass) distribution has continued to rise each year-increasing 10% from 2015 to 2016. Cover of other native plant species remained relatively consistent with previous years and only minor fluctuations in distribution indices were evident between 2015 and 2016.

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

Macrophyte Species	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<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%	55.5%	39.4%	34.4%
<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%	60.9%	49.2%	46.6%
<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%	6.3%	15.9%	1.5%
<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%	25.0%	11.4%	12.2%
<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%	32.0%	9.8%	3.8%
<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%	13.3%	12.9%	23.7%
<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%	4.7%	15.9%	9.2%
<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%	55.5%	40.2%	38.2%
<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%	0.0%	14.4%	1.5%
<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%	4.7%	3.0%	4.6%
<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%	14.1%	22.7%	19.8%
<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%	7.0%	29.5%	36.6%
<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%	2.3%	5.3%	2.3%
<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%	2.3%	3.0%	3.1%
<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%	0.0%	0.0%	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%	0.0%	1.5%	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%	3.9%	6.1%	3.8%
<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%	0.8%	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%	1.6%	0.0%	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%	0.0%	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%	0.8%	0.8%	0.8%
<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%	0.0%	0.8%	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%	0.0%	0.0%	0.0%

Milfoil FOC decreased between 2015 and 2016 from 39.4% to 34.4%, due in large part to successful treatment of a few of the large dense beds of milfoil. Robbins Pondweed (*P. robbinsii*) continues to dominate the littoral zone with 50% of the locations where found. Average cover of milfoil displayed a favorable reduction in the Main Lake from 2014 to 2015, decreasing from 15.4% to roughly 12.8%.

Despite positive milfoil control within the treated areas, cover and distribution continued to increase outside of the surveyed data points with several dense beds noted around the shoreline of the Main Lake. While the annual spot-treatments and diver suction hand-pulling efforts have been relatively effective, milfoil growth remains well distributed in the Main Lake.

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 2016 survey are depicted in Figure 2.

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

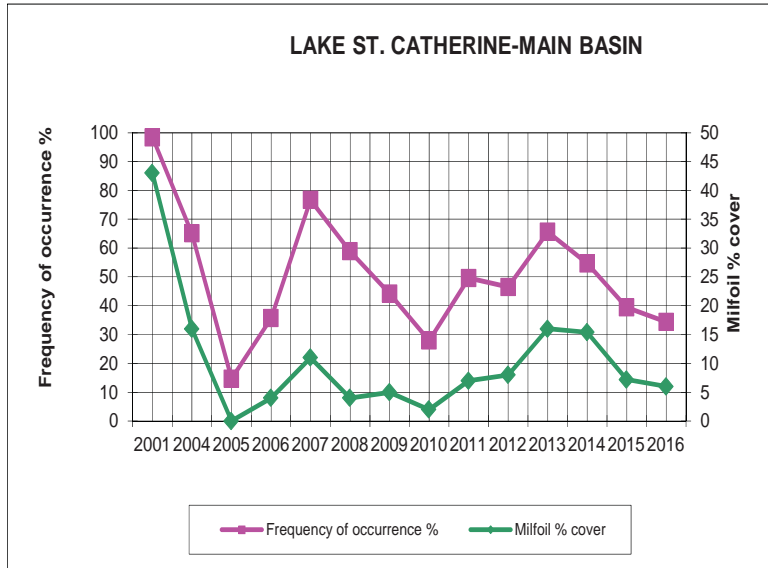


Chart 2: *Myriophyllum spicatum* Frequency of Occurrence and Percent Cover

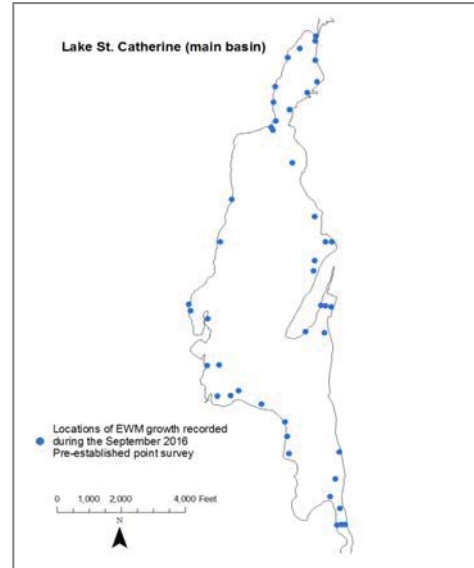


Figure 3: Data points of *M. spicatum* in the Main basin during the 2016 September

3.5 Little Lake

The plant assemblage in Little Lake is highly diverse with year to year plant coverage of over 50%. About sixteen (16) different species exist in this basin, allowed by the consistently shallow depth (average depth of 6 feet). The shallow nature of Little Lake allows for maximum growth of plant matter within the water column, possibly hindering recreational activities. The most common plant species are *Potamogeton robbinsii* (84%), *M. spicatum* (74%), and *Potamogeton illinoensis* (72%), followed by *Vallisneria americana* (35%), *Potamogeton amplifolius* (28%), and *Elodea canadensis* (28%). Curly-leaf Pondweed (*Potamogeton crispus*) is present in Little Lake, but because of its irregular growth habit, was found at less than 1%.

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

Macrophyte Species	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<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%	95.3%	72.7%	83.7%
<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%	72.1%	86.4%	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%	23.3%	13.6%	27.9%
<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%	65.1%	70.55%	72.1%
<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%	14.0%	13.6%	0.0%
<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%	37.2%	27.3%	11.6%
<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%	11.6%	2.3%	2.3%

Macrophyte Species	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<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%	34.9%	22.7%	14.0%
<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%	44.2%	50.0%	34.9%
<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%	32.6%	11.4%	18.6%
<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%	2.3%	9.1%	9.3%
<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%	0.0%	2.3%	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%	0.0%	2.3%	4.1%
<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%	0.0%	6.8%	4.7%
<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%	2.3%	2.3%	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%	0.0%	2.3%	7.0%
<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%	14.0%	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%	25.6%	22.7%	27.9%
<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%	0.0%	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%	0.0%	0.0%	0.0%
<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%	0.0%	0.0%	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%	0.0%	0.0%	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%	0.0%	0.0%	N/A
<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%	0.0%	0.0%	N/A
<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%	0.0%	0.0%	0.0%

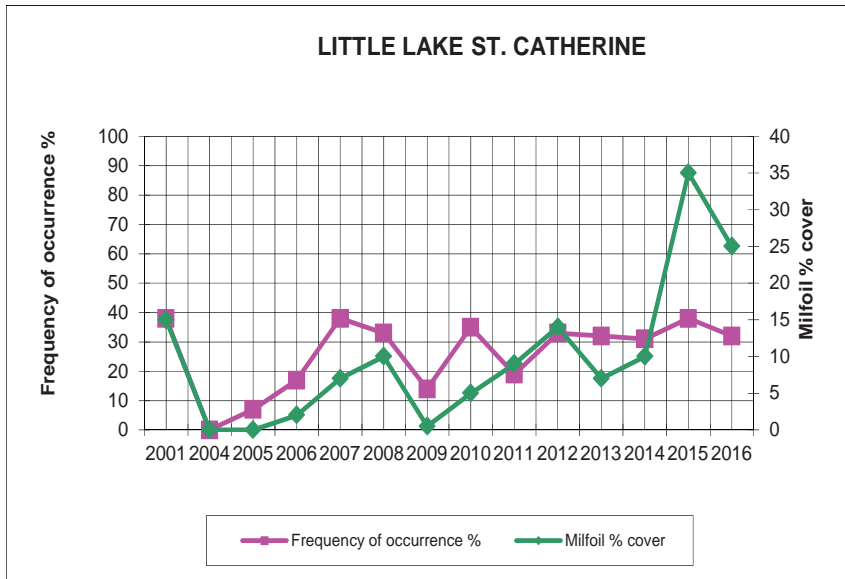


Chart 3: *Myriophyllum spicatum* Frequency of Occurrences and Percent Cover

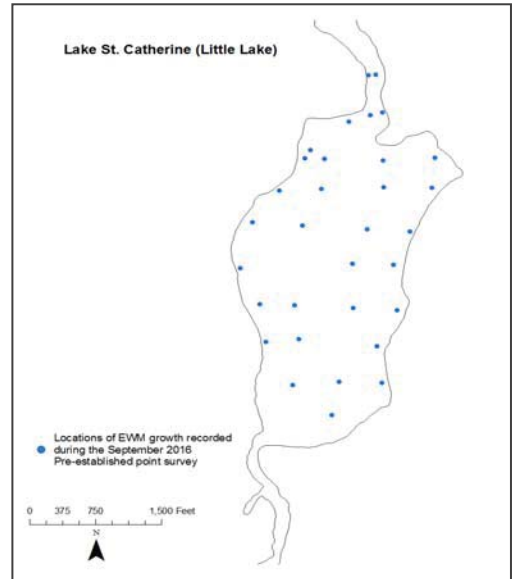


Figure 4: Data points of *M. spicatum* during the 2016 September survey

3.6 Species Richness

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

Chart 4: Species Richness by Basin

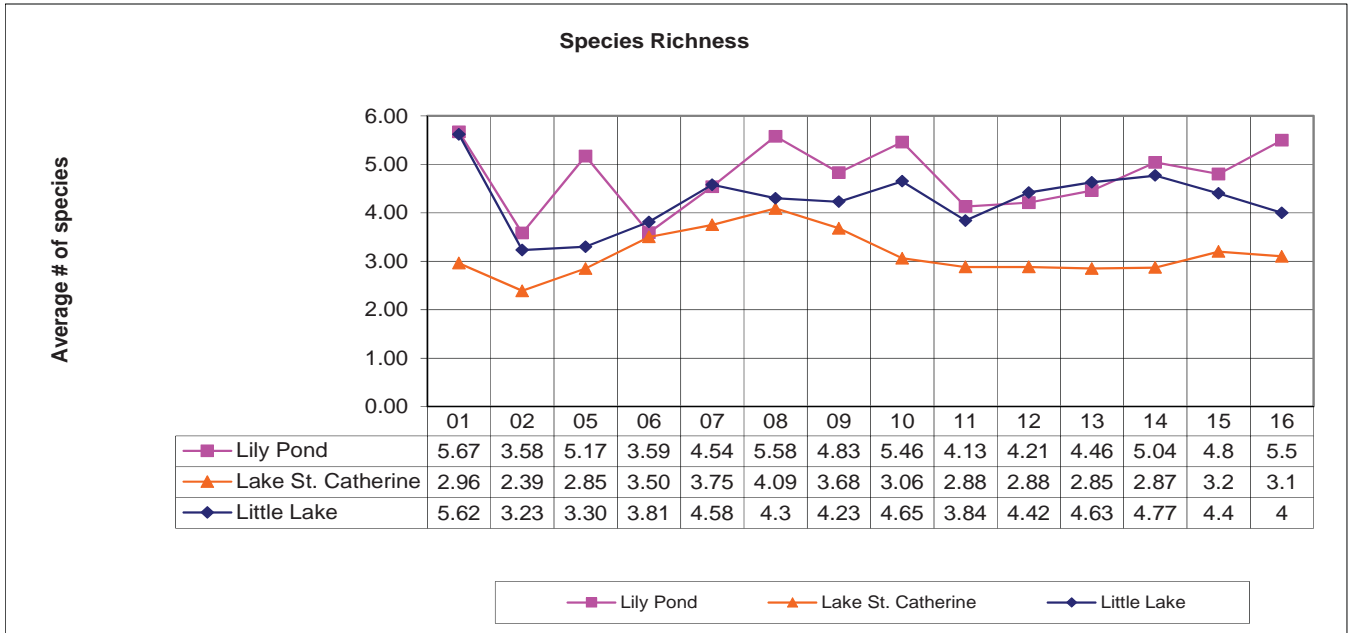
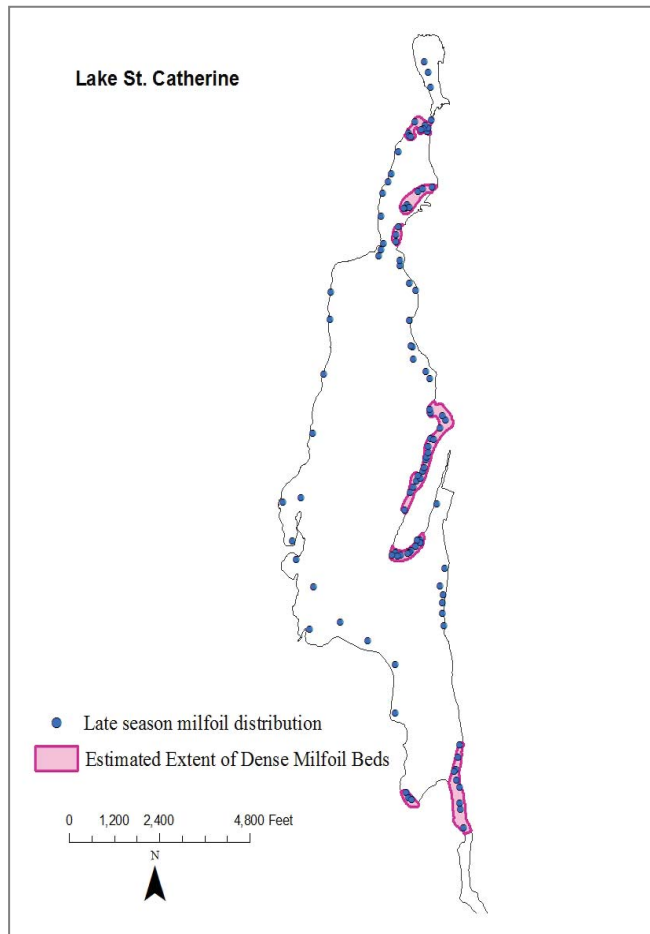


Figure 5: Late season Eurasian Water-milfoil distribution & Estimated Extent of Dense Milfoil Beds

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 part 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 4.



4 SUMMARY OF 2016 AQUATIC VEGETATION MANAGEMENT PROGRAM

4.1 Renovate Herbicide Treatments

Results of the 2016 Renovate OTF (triclopyr granular) herbicide treatment program were consistent with treatment efforts performed in the Lake St. Catherine system in recent years. While some low density growth was observed around the outer extent of a few of the treated areas, milfoil control within the treated areas was excellent with little to no viable milfoil growth observed in any of the treated areas. No discernable difference in treatment efficacy was noted between the areas treated with the granular versus the liquid triclopyr formulations, however, we will have to wait until 2017 to see if carry-over control varies between sites treated with different formulations.

After many years of use at Lake St. Catherine it is clear that triclopyr is highly selective for milfoil and its use has not had a discernable impact on other non-target native aquatic plant species. While we continue to document fluctuations in the frequency of occurrence and species richness indices, no major shifts in plant composition have been documented following any of the triclopyr 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.

4.2 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 2016 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.

5 DISCUSSION

Recent milfoil management efforts at Lake St. Catherine have focused on controlling areas of dense milfoil growth and maintaining it at non-nuisance levels. Renovate (granular & liquid) 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, triclopyr 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 treatments SŌLitude has tried to annually 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 CET. Future treatment efforts should continue to focus on improving the CET and ultimately longer-term milfoil control.

Given the positive results of the past two years we are discovering that plant maturity may be playing a bigger role in herbicide CET than previously considered. While timing of treatment(s) is dictated by a host of factors and will likely continue to be performed in mid-late June results from 2015 & 2016 suggest that plant maturity should be considered when scheduling future treatments at Lake St. Catherine.

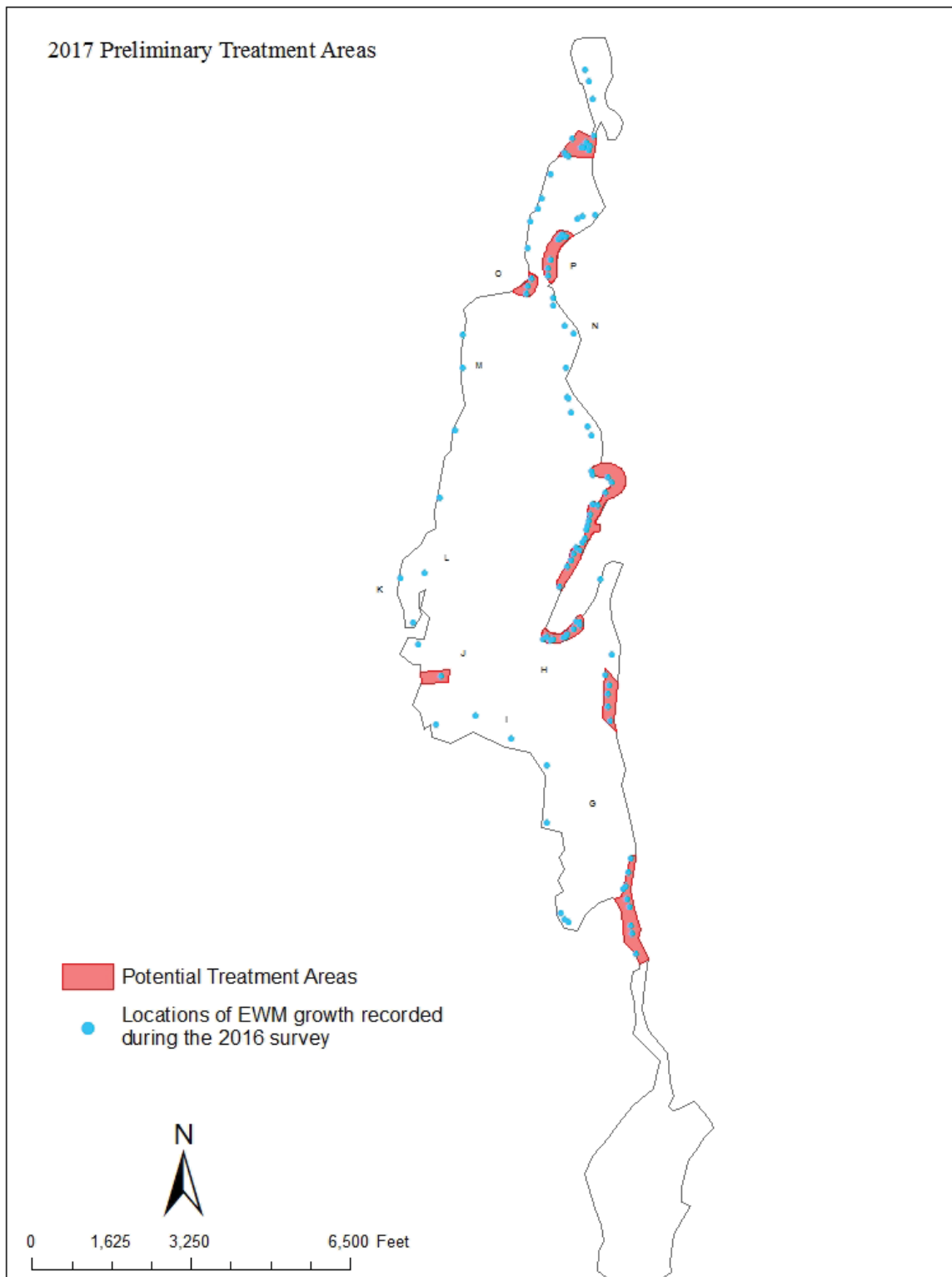
6 RECOMMENDATIONS FOR 2017 SEASON

Results from the 2016 Renovate treatment program were good with nearly complete control of milfoil in the six treated areas. Although some low-density milfoil was observed in a few of the treated areas, most of it was found along the edges where dilution is higher and CET is more challenging to maintain. As we have seen at Lake St. Catherine and other sites, the CET when using Renovate is critical for achieving good milfoil control so every effort should be made to maximize CET where possible.

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.

Preliminary 2017 treatment areas are depicted on the following page (Figure 6). Based on the density and distribution of milfoil growth observe this past fall we anticipate treatment of 50-70 acres in the main lake. Potential treatment areas will be inspected in the early spring and will be finalized with the LSCA and VT DEP prior to treatment.

Figure 6: Preliminary 2017 Management Areas

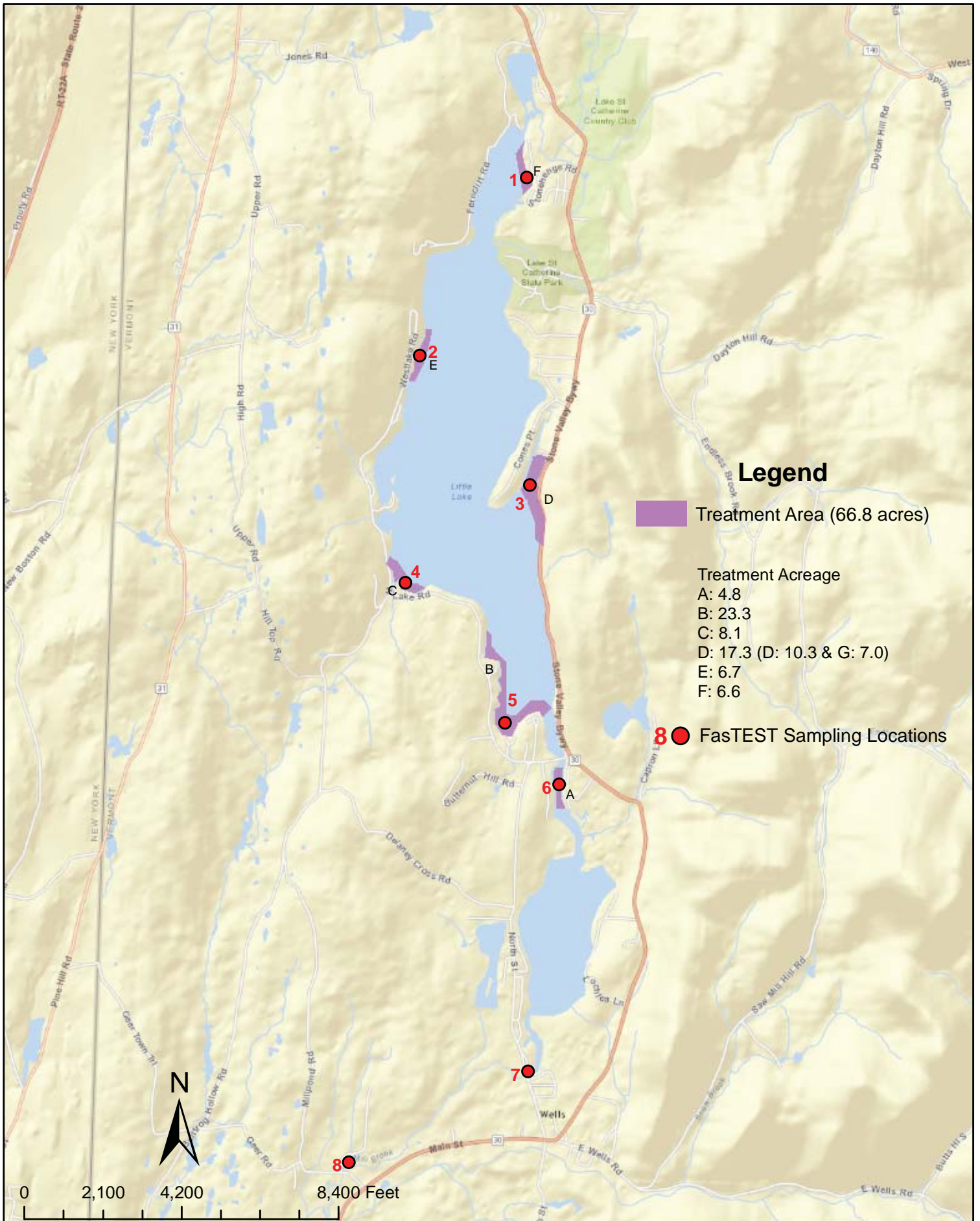


APPENDIX A

Herbicide Residue Testing Results

- Sampling Location Map
- SePRO Laboratory Report – 6/28/2016 sampling round
- SePRO Laboratory Report – 07/05/2016 sampling round
- SePRO Laboratory Report – 8/10/2016 sampling round

2016 Lake St. Catherine - FasTEST Sampling Locations





16013 Watson Seed Farm Road, Whitakers, NC 27891

Chain of Custody: COC136 **LABORATORY REPORT**

Customer Company Customer Contact

Company Name SOLitude Lake Management	Contact Person: Marc Bellaud
Address: PO Box 969, Virginia Beach, VA 23451	E-mail Address: mbellaud@solitude.com
	Phone: 888.480.5253

Waterbody Information

Waterbody:	Lake St. Catherine - VT
Waterbody size:	1100
Depth Average:	25

Sample ID	Sample Location	Test	Method	Results	Sampling Date / Time
CTM531-1	8	Triclopyr (ug/L)	FAST 02	<1	06/28/2016
CTM530-1	7	Triclopyr (ug/L)	FAST 02	3.1	06/28/2016
CTM529-1	6	Triclopyr (ug/L)	FAST 02	7.9	06/28/2016
CTM528-1	5	Triclopyr (ug/L)	FAST 02	351.8	06/28/2016
CTM527-1	4	Triclopyr (ug/L)	FAST 02	71.4	06/28/2016
CTM526-1	3	Triclopyr (ug/L)	FAST 02	53.2	06/28/2016
CTM525-1	2	Triclopyr (ug/L)	FAST 02	268.8	06/28/2016
CTM524-1	1	Triclopyr (ug/L)	FAST 02	1.1	06/28/2016

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

16013 Watson Seed Farm Road, Whitakers, NC 27891

Chain of Custody: COC154 **LABORATORY REPORT**

Customer Company Customer Contact

Company Name SOLitude Lake Management	Contact Person: Marc Bellaud
Address: 1320 Brookwood Drive, Ste. H Little Rock, AR 72202	E-mail Address: mbellaud@solitude.com
	Phone: 508.885.0101

Waterbody Information

Waterbody:	Lake St. Catherine - VT
Waterbody size:	1100
Depth Average:	25

Sample ID	Sample Location	Test	Method	Results	Sampling Date / Time
CTM578-1	8	Triclopyr (ug/L)	FAST 02	2.2	07/05/2016
CTM577-1	7	Triclopyr (ug/L)	FAST 02	3.4	07/05/2016
CTM576-1	6	Triclopyr (ug/L)	FAST 02	55.3	07/05/2016
CTM575-1	5	Triclopyr (ug/L)	FAST 02	21.6	07/05/2016
CTM574-1	4	Triclopyr (ug/L)	FAST 02	13.1	07/05/2016
CTM573-1	3	Triclopyr (ug/L)	FAST 02	17.4	07/05/2016
CTM572-1	2	Triclopyr (ug/L)	FAST 02	2.7	07/05/2016
CTM571-1	1	Triclopyr (ug/L)	FAST 02	11.9	07/05/2016

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

16013 Watson Seed Farm Road, Whitakers, NC 27891

Chain of Custody: COC451 **LABORATORY REPORT**

Customer Company Customer Contact

Company Name SOLitude Lake Management	Contact Person: Marc Bellaud
Address: 1320 Brookwood Drive, Ste. H Little Rock, AR 72202	E-mail Address: mbellaud@solitude.com
	Phone: 508.885.0101

Waterbody Information

Waterbody:	Lake St. Catherine - VT
Waterbody size:	1100
Depth Average:	25

Sample ID	Sample Location	Test	Method	Results	Sampling Date / Time
CTM1512-1	8	Triclopyr (ug/L)	FAST 02	<1	08/10/2016
CTM1511-1	7	Triclopyr (ug/L)	FAST 02	<1	08/10/2016
CTM1510-1	6	Triclopyr (ug/L)	FAST 02	<1	08/10/2016
CTM1509-1	5	Triclopyr (ug/L)	FAST 02	<1	08/10/2016
CTM1508-1	4	Triclopyr (ug/L)	FAST 02	<1	08/10/2016
CTM1507-1	3	Triclopyr (ug/L)	FAST 02	<1	08/10/2016
CTM1506-1	2	Triclopyr (ug/L)	FAST 02	<1	08/10/2016
CTM1505-1	1	Triclopyr (ug/L)	FAST 02	<1	08/10/2016

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.

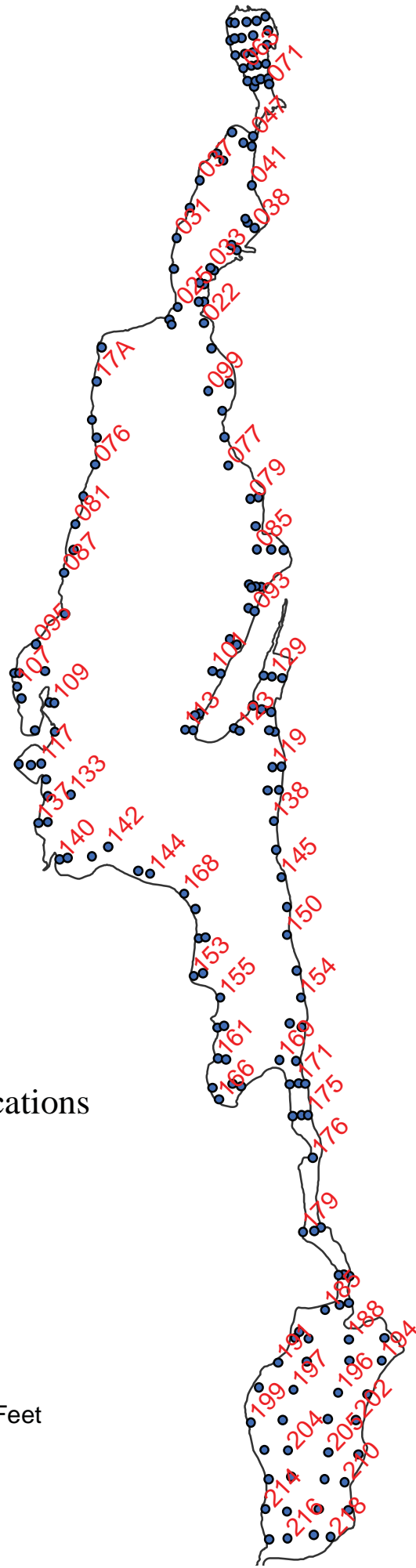
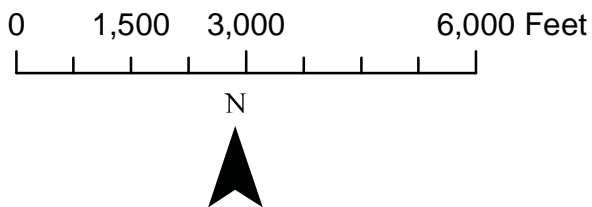
APPENDIX B

Comprehensive Aquatic Vegetation Survey Information

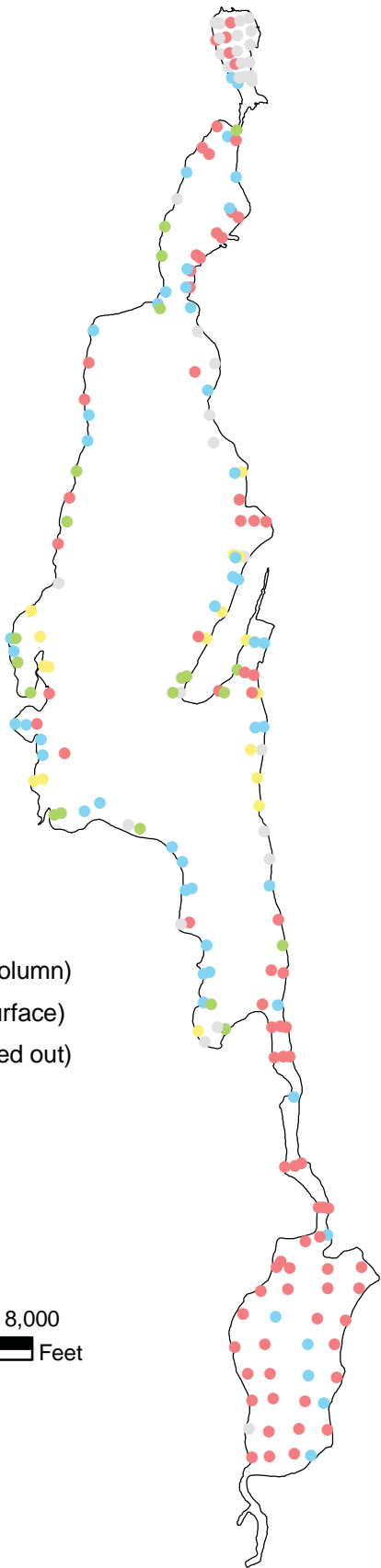
- Data Point Sampling Location Map
- Field Data Table
- Overall Vegetation Density Map
- Vegetation Species Distribution Maps
- Late Season Milfoil Distribution - 2016

Lake St. Catherine

- Point-Intercept Point Locations



2016 TOTAL VEGETATION BIOMASS



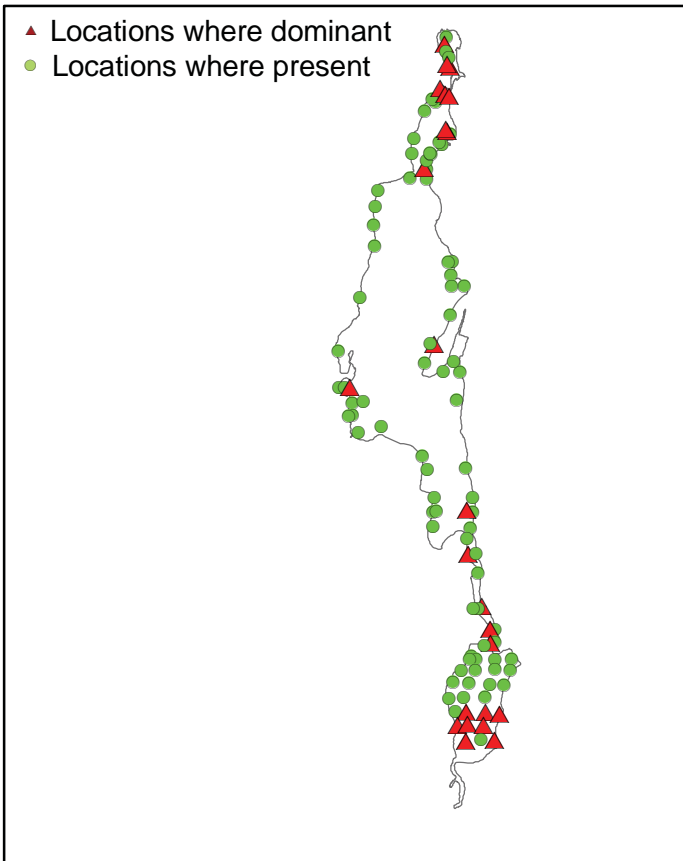
Legend

Biomass indices reported during 9/20/2016 survey

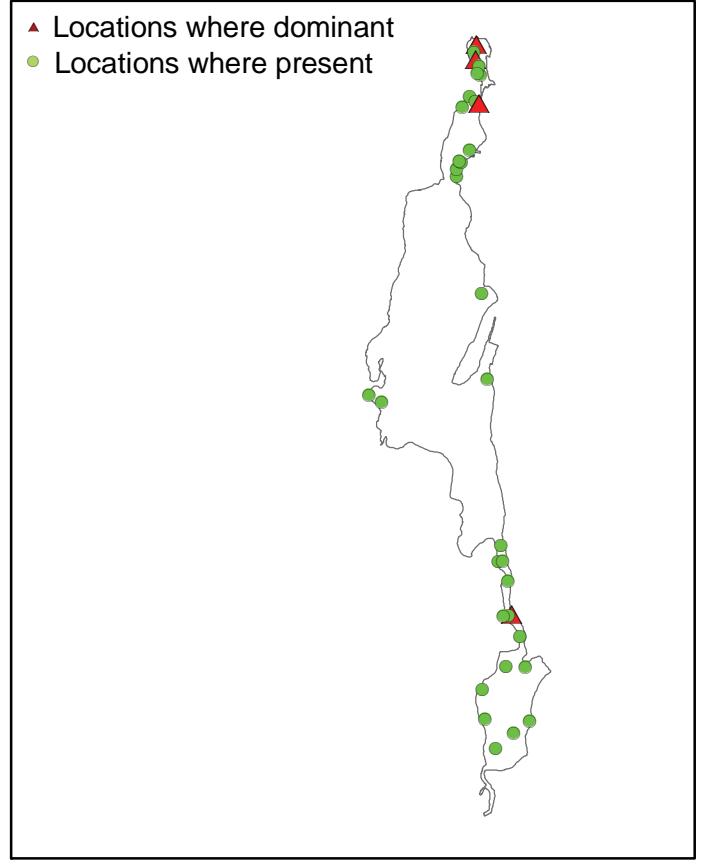
- 1 - low biomass (along bottom)
- 2 - moderate biomass (in water column)
- 3 - high biomass (approaching surface)
- 4 - extremely high biomass (topped out)



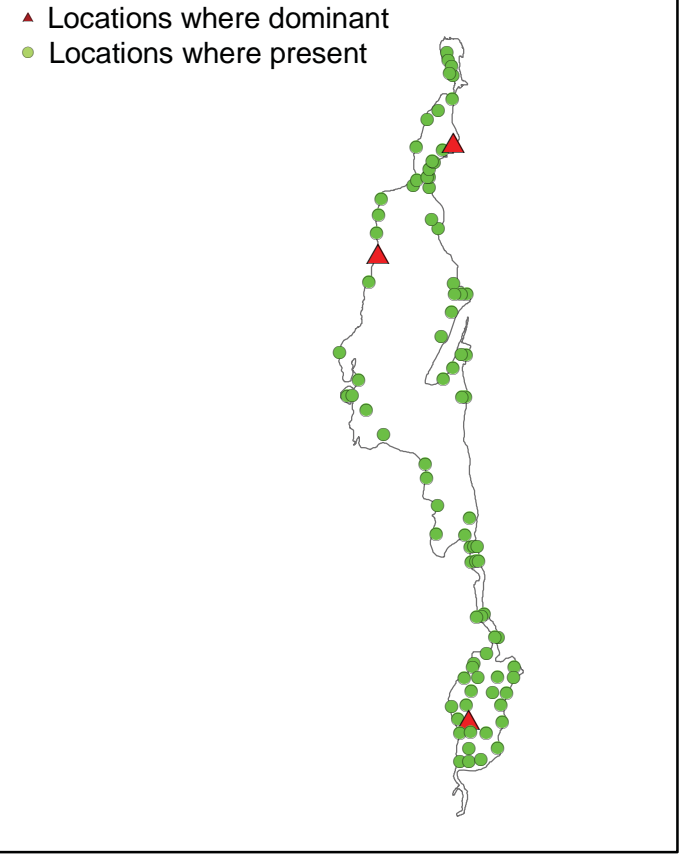
Distribution of *Potamogeton robbinsii*



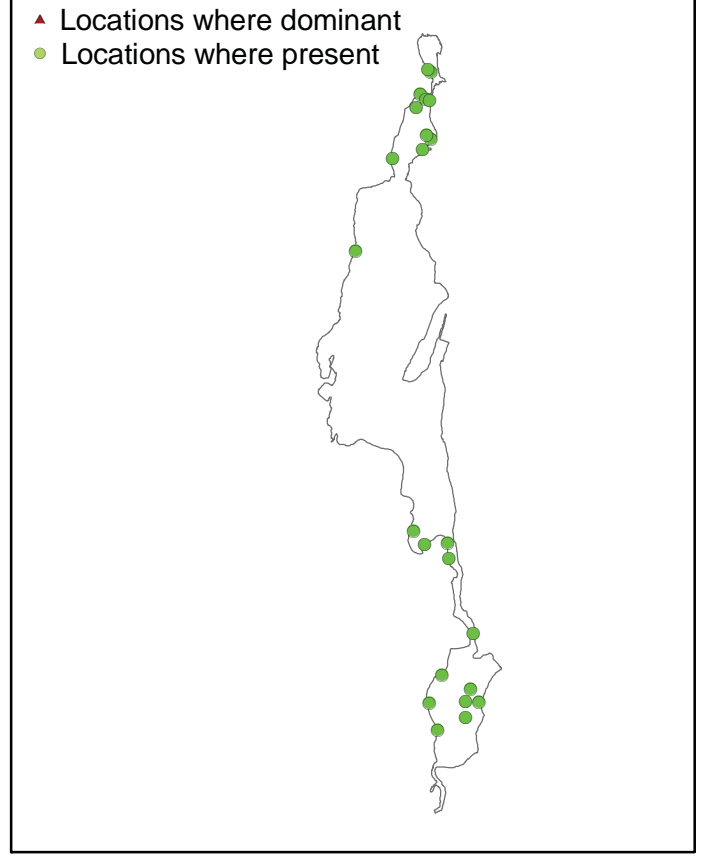
Distribution of *Potamogeton amplifolius*



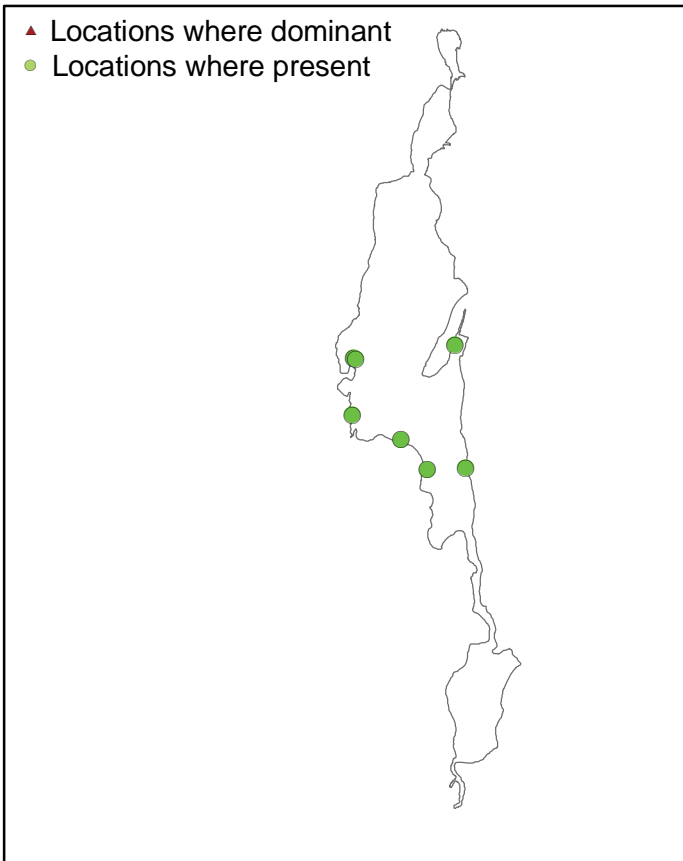
Distribution of *Potamogeton illionensis*



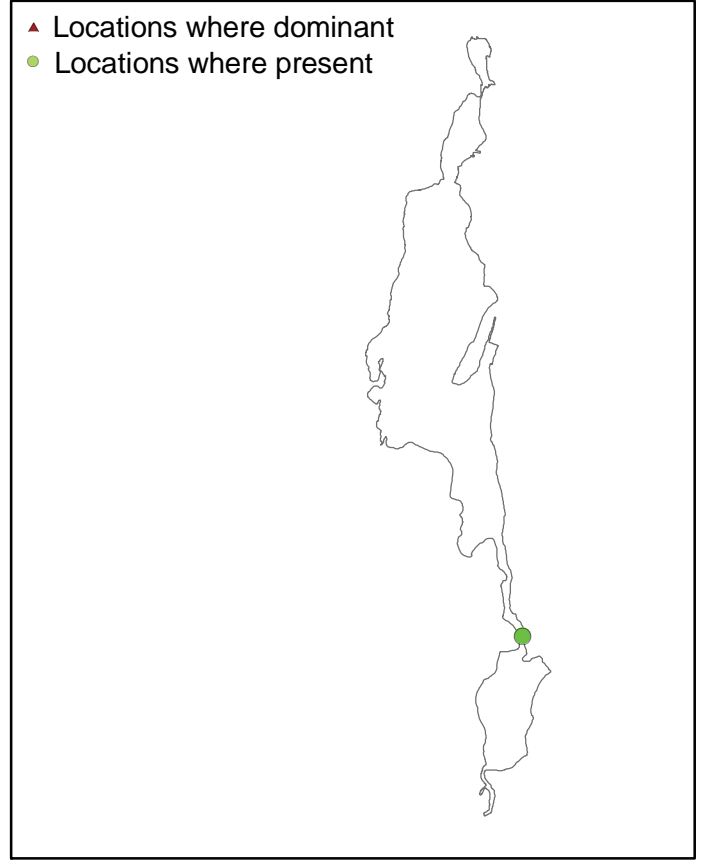
Distribution of *Potamogeton zosterformis*



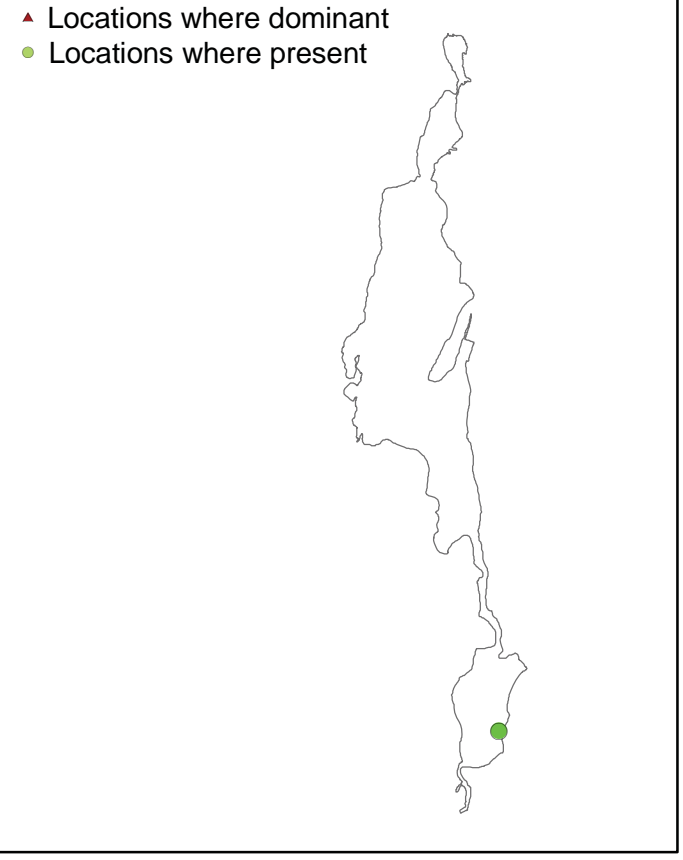
Distribution of *Potamogeton pusillus*



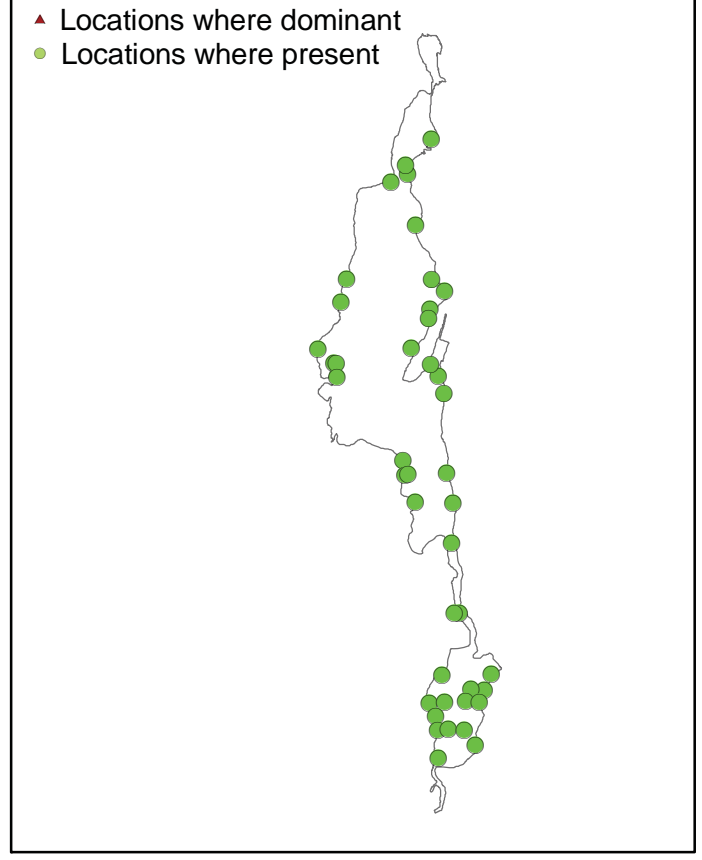
Distribution of *Potamogeton epiphydrus*



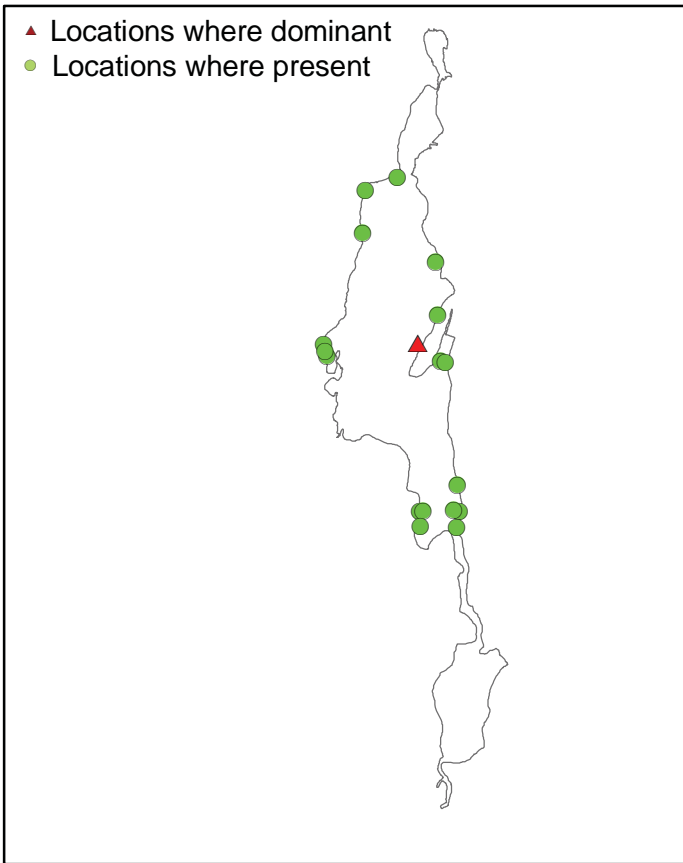
Distribution of *Potamogeton crispus*



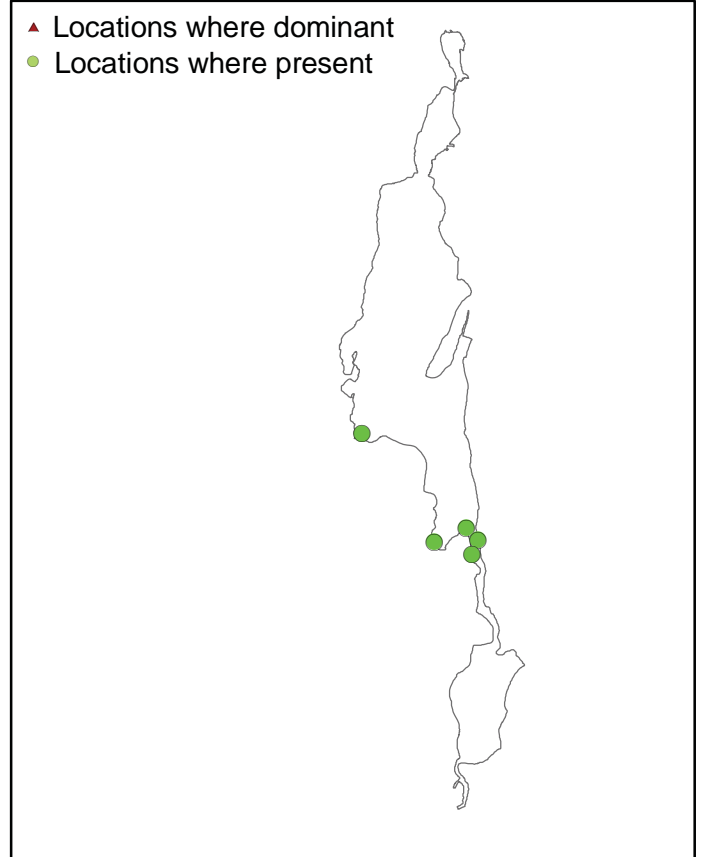
Distribution of *Vallisneria americana*



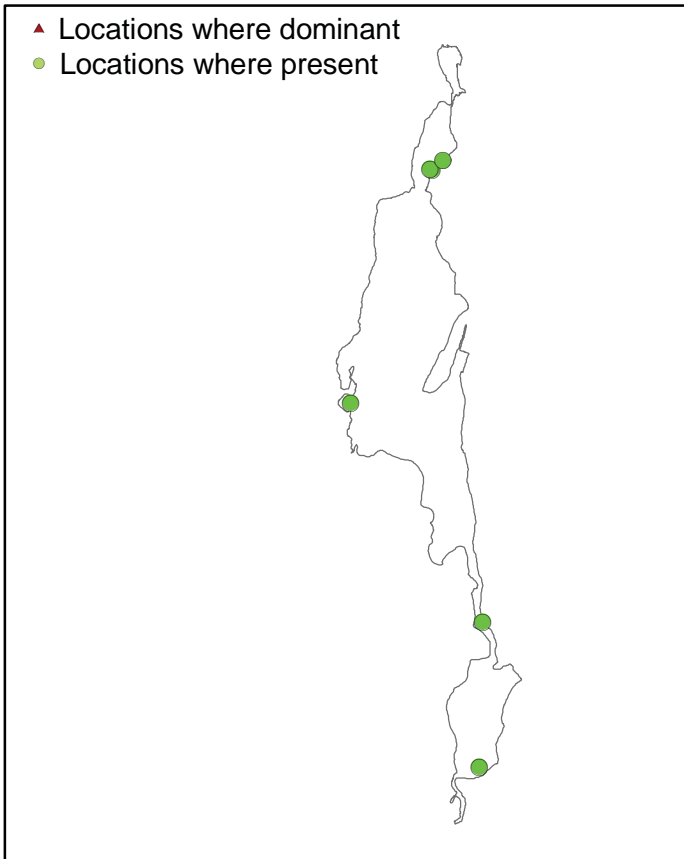
Distribution of *Potamogeton praelongus*



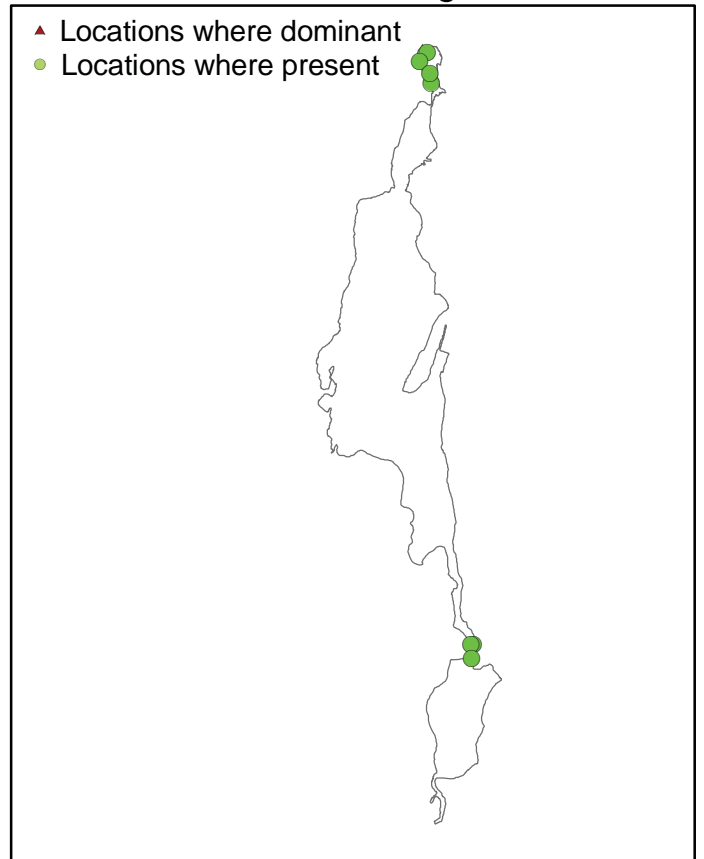
Distribution of *Potamogeton gramineus*



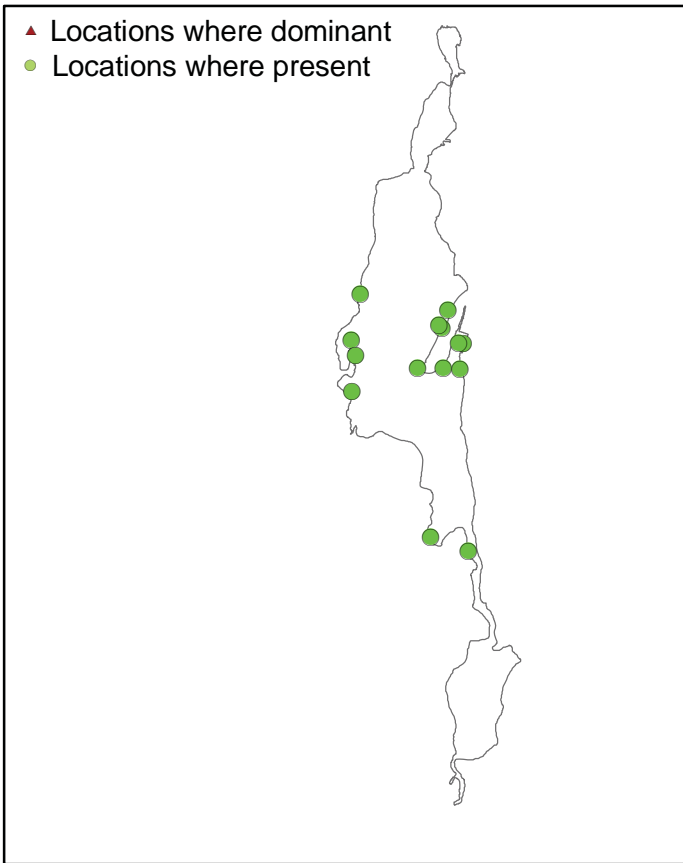
Distribution of *Brasenia schreberi*



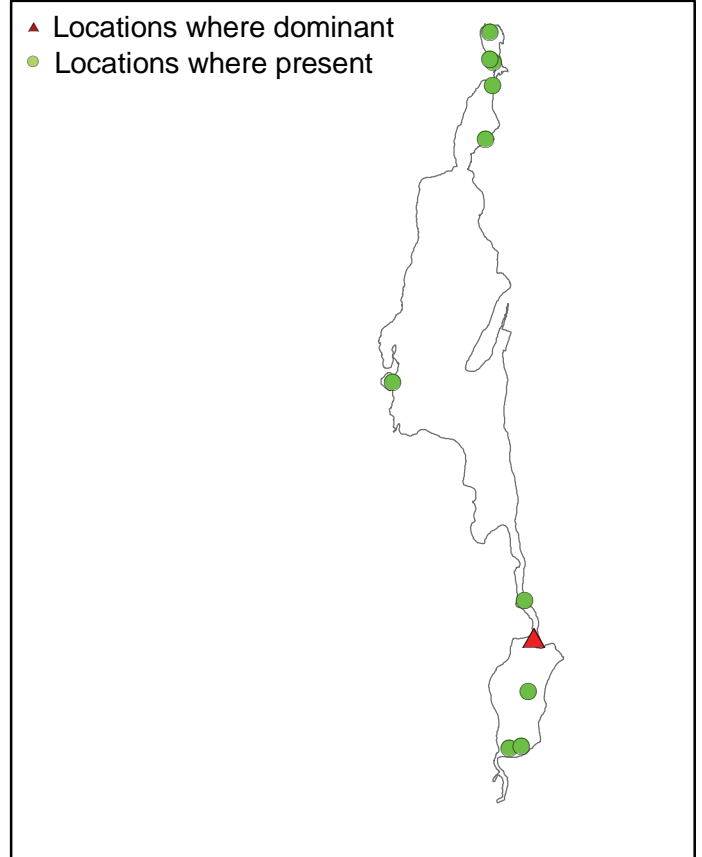
Distribution of *Utricularia gibba*



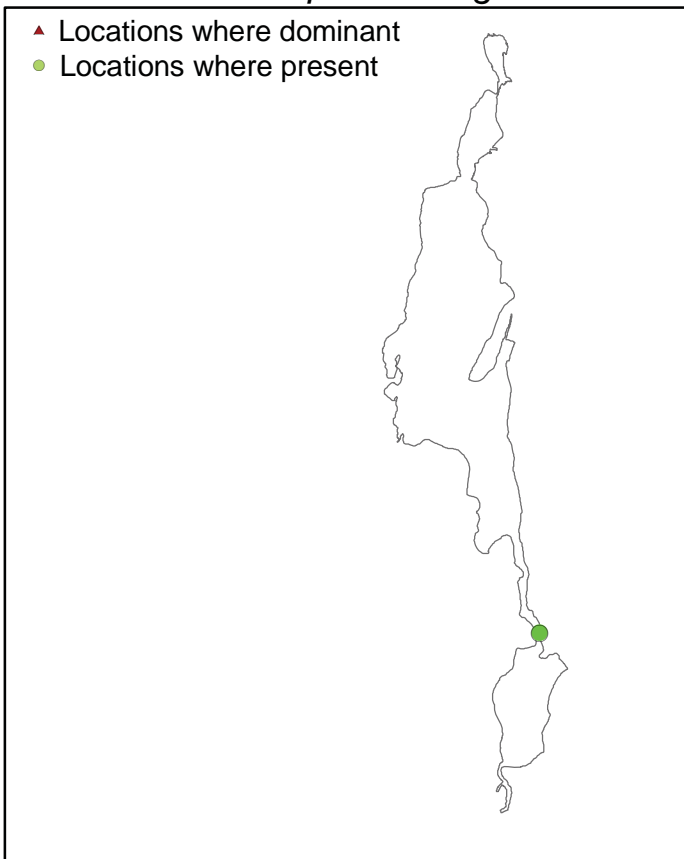
Distribution of *Nitella* spp.



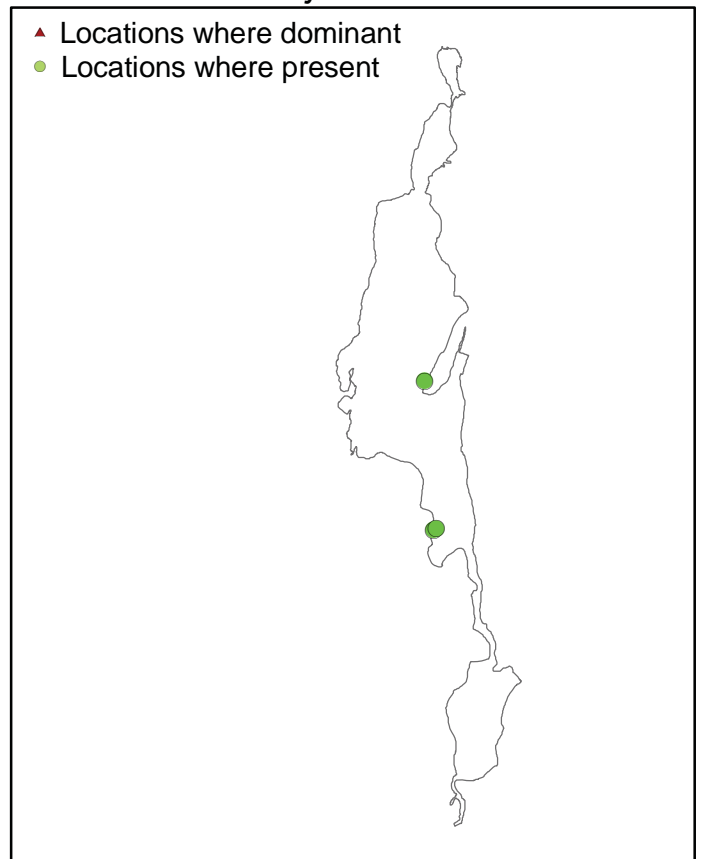
Distribution of *Nymphaea odorata*



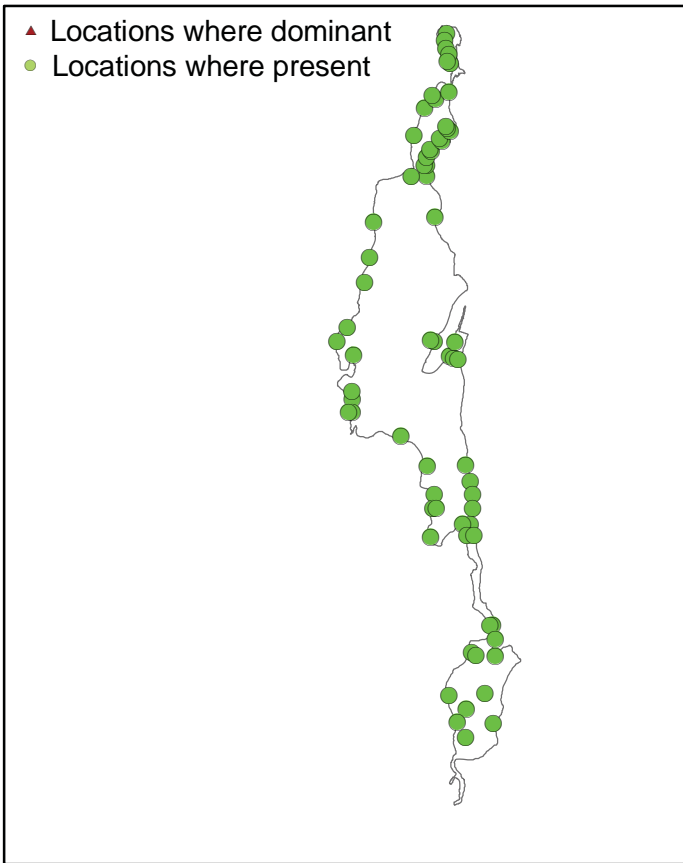
Distribution of *Nuphar variegatum*



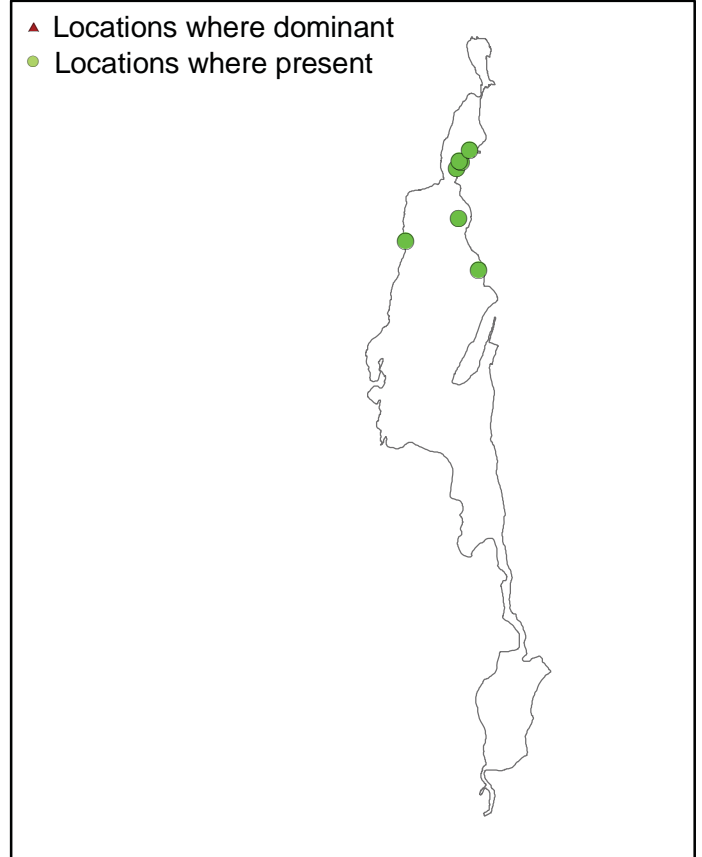
Distribution of *Najas minor*



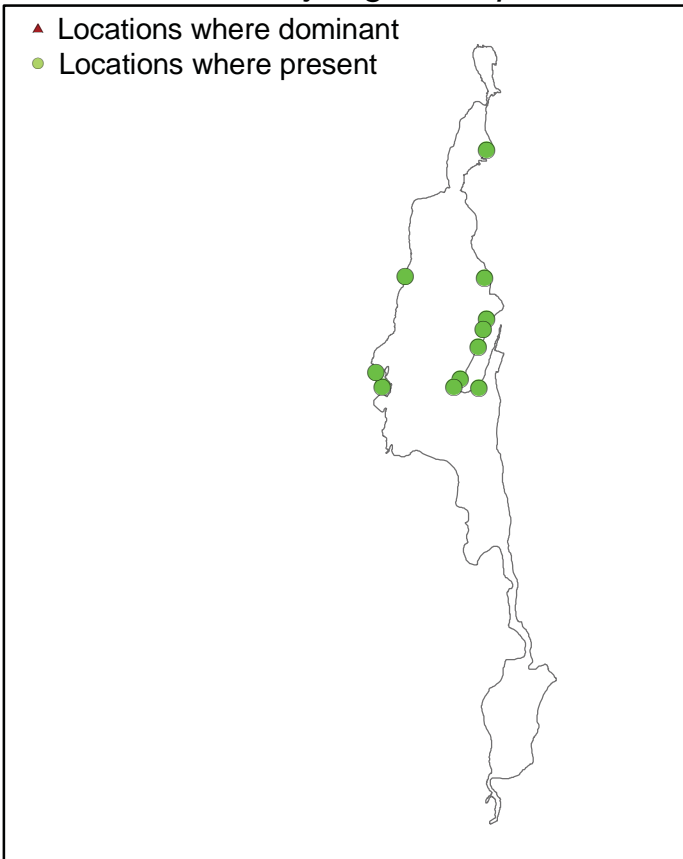
Distribution of *Elodea canadensis*



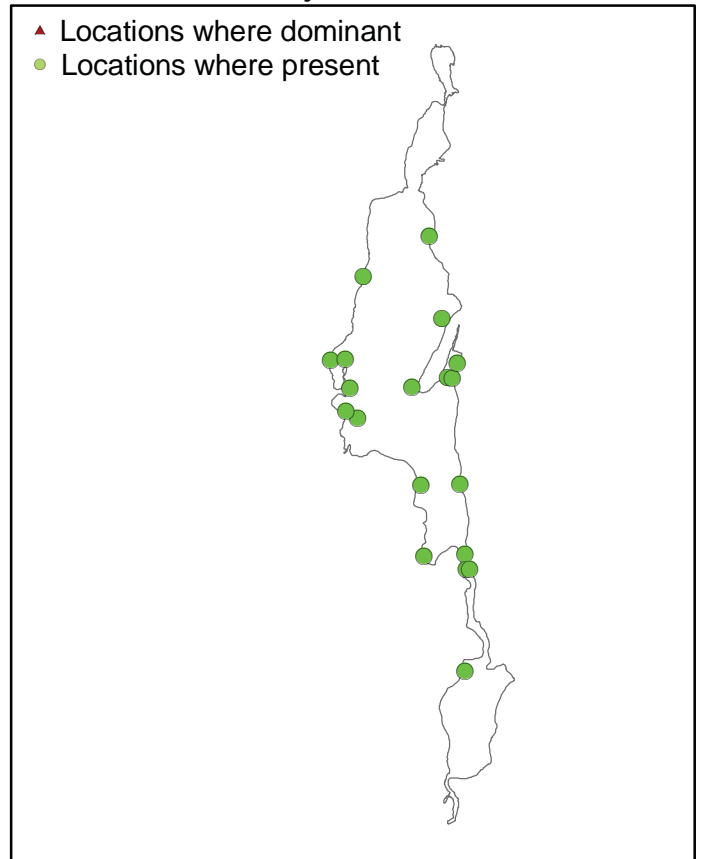
Distribution of *Elodea nuttallii*



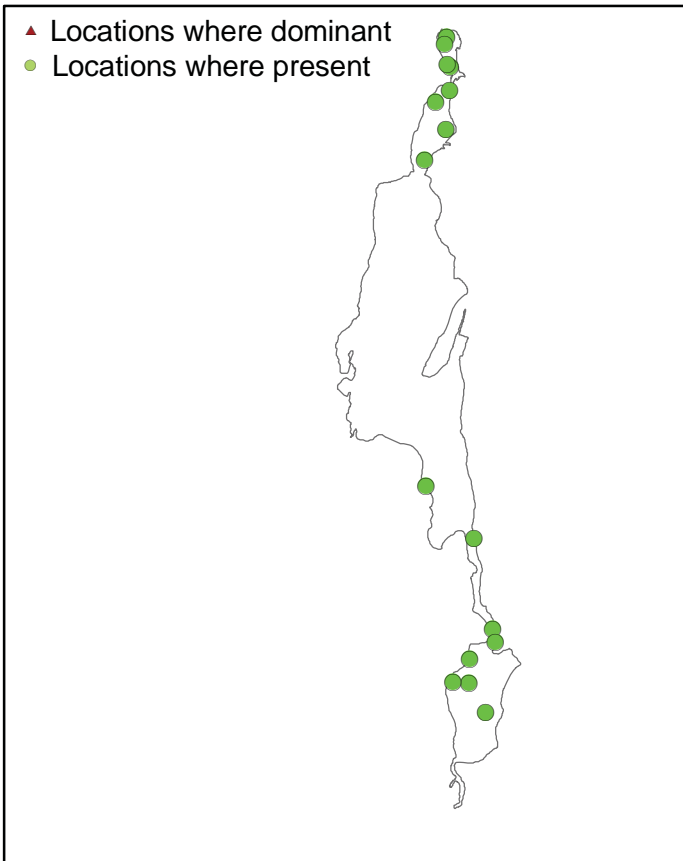
Distribution of *Najas guadalupensis*



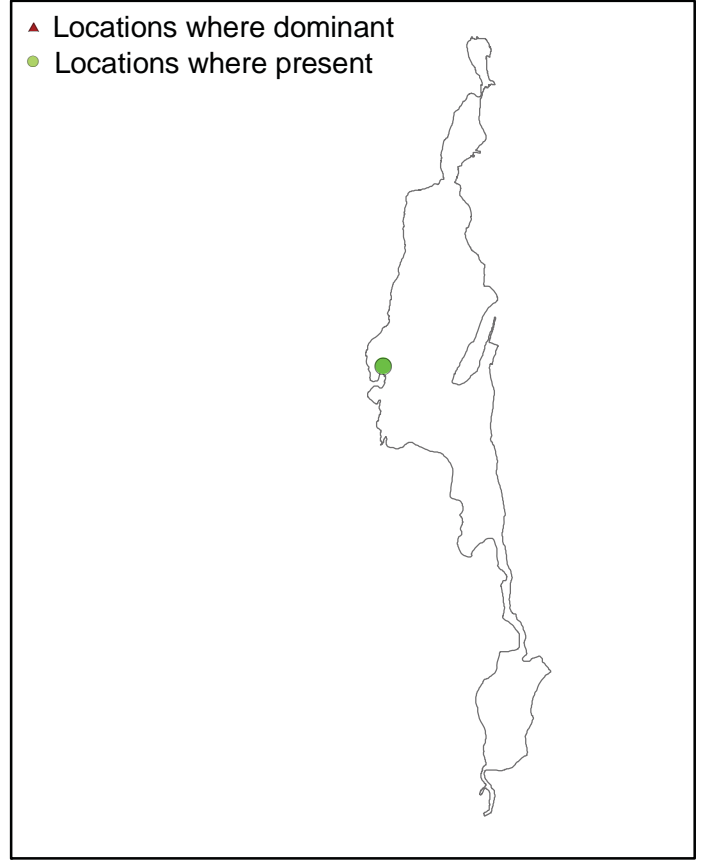
Distribution of *Najas flexilis*



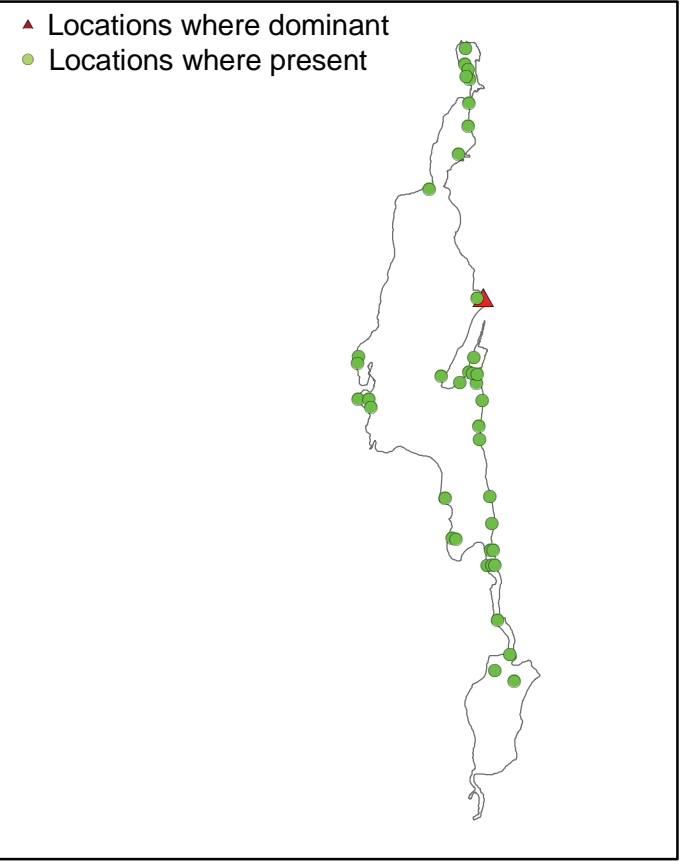
Distribution of *Ceratophyllum demersum*



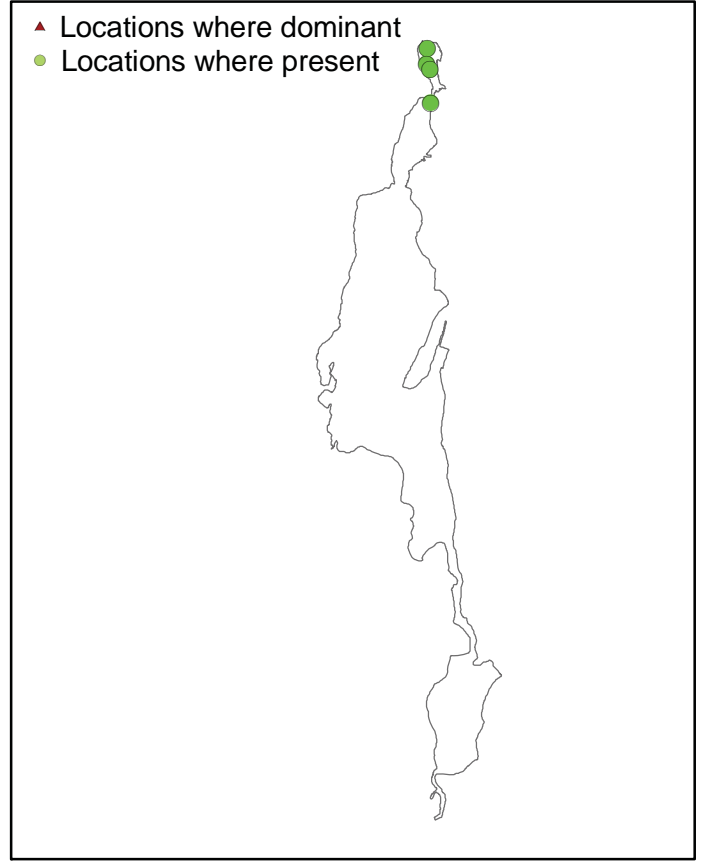
Distribution of *Potamogeton spirilus*



Distribution of *Zosterella dubia*



Distribution of *Utricularia vulgaris*



2016 Eurasian Milfoil Distribution

