

January 5, 2016

Saratoga Lake Protection and Improvement District
PO Box 2551
Ballston Spa, NY 12020

Re: 2016 Aquatic Plant Monitoring Program Summary Report – Saratoga Lake, Saratoga Springs, NY.

Dear Commissioners:

This report summarizes the Monitoring Program performed by SOLitude Lake Management on Saratoga Lake during the 2016 season. The objective of the program was focused on documenting the growth extent of non-native, invasive aquatic plant species Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) throughout the littoral zone.

MANAGEMENT HISTORY

Starting in the early 1980's, Saratoga Lake has struggled with non-native aquatic plant growth. Eurasian watermilfoil (EWM) and curly-leaf pondweed (CLP) are the most widespread plants and have been the primary focus of recent management efforts. Water chestnut (*Trapa natans*) has also been present in varying densities for several years, but most of the growth has been found between the Kayaderoseras Creek inlet and along the shorelines of Fish Creek. Volunteer hand-pulling efforts coordinated by SLPID and the Saratoga Lake Association have kept water chestnut growth under control.

Lake-wide mechanical harvesting efforts to control EWM and nuisance aquatic plant growth began in the mid 1980's. More comprehensive planning and management efforts began in the late 1990's, which led to an integrated management plan that has incorporated mechanical harvesting, winter drawdown, and large-scale herbicide treatments. Between 1994 and 2004 it was estimated that the dense beds of EWM had increased from 400 acres to over 700 acres. In 2007, 2008, and 2009 a sequential whole-lake herbicide treatment program was completed to control the dense beds of EWM. Between 2010 and 2015, annual spot-treatments were conducted to prevent EWM from returning to pre-treatment dominance. No herbicide treatments were performed in 2016, but SLPID's harvesting program has continued annually.

Management efforts have been monitored and guided by ongoing input to SLPID by The L.A. Group and by Dean Long. Annual aquatic plant surveys are conducted by RPI's Darrin Fresh Water Institute (DFWI), performing surveys in 1994, 2004, and annually since 2007. SOLitude Lake Management



(formerly Aquatic Control Technology) has been involved with lake management efforts since 2000 and has performed the majority of in-lake treatment work along with assisting with ongoing monitoring efforts. Even though no herbicide treatments were planned for the 2016 season, additional surveying efforts were planned to help guide future management efforts.

VEGETATION & MAPPING SUMMARY

Two surveys were conducted by two SÖLitude Lake Management (SLM) Biologists to document aquatic invasive species growth and identify general native, aquatic plant species assemblages. Biovolume and bathymetric mapping of the littoral zone was also updated during these two survey efforts. Referenced maps and images from the surveys are attached in Appendix A.

Early-season Survey

On June 16th to 17th, 2016 two SLM Biologists conducted a whole-lake survey to document areas of target species growth. As with past monitoring, the majority of EWM growth occurred in the northern- and southern-most portions of the lake (Figures 1), while the eastern shoreline supported higher CLP growth (Figure 2). The cove bordering Kayaderosseras Creek and its respective wetland visibly supported the highest native species richness along with dense patches of EWM and sparse CLP. Similar to DFWI's findings, natives still seem to dominate abundance across the lake, and succumb to exotic overgrowth in isolated areas.

A high presence of zebra mussels was noted during the survey, where all plants pulled on board were coated with a wide range of mussel sizes.

Late-season Survey

The late-season survey performed on October 19th to 20th, 2016 focused on bathymetric mapping of the littoral zone and identifying any new areas of EWM growth. Due to the CLP life cycle, CLP was not present during the survey. Dense areas of EWM growth were consistent with the early-season survey, though one previously undocumented area was noted. The area was set slightly off of the eastern shore about half-way down, and plateaued between 10-15 feet with dense growth of EWM along with trace Richardson's pondweed (*Potamogeton richardsonii*) and large-leaf pondweed (*Potamogeton amplifolius*). Another, smaller area had been treated previously in 2009 and 2010, and occurred outwards of the sailboat moorings in the Kayaderosseras Creek cove.

Since CLP was not present during the survey, ciBioBase mapping results do not contribute growth towards biovolume readings. EWM and few pondweed species were still standing in the water column, while most other plant species had begun to seasonally die back.

Bathymetry & Biovolume Mapping

Mapping efforts employed ciBioBase and The Mapping Network post-processing to assess biovolume and bathymetry measurements throughout the littoral zone of Saratoga Lake. Multiple data sets were utilized including readings collected during the two surveys in 2016, historic data sets collected by SLM in prior years and a shoreline survey data set produced by CT Male Associates. The littoral zone is defined as the photic zone capable of supporting vegetative growth, and is dependent on season-long water clarity and shoreline turbidity influences. As suggested by ciBioBase and visual observation, vegetation growth in Saratoga Lake is inhibited between approximately 15-20 feet deep.



As previously noted through visual observation, the highest biovolume occurs in the northern- and southern-most portions of the lake, with two high-volume areas half-way down the western and eastern shorelines (Figure 3). Much of the biovolume consists of pondweed species and EWM, as they typically grow largest within the water column relative to other native species present in Saratoga Lake (identified by DFWI).

Updated bathymetric contours (Figure 4) of the littoral zone have now been compiled and will allow for accurate calculations of water volume in proposed treatment areas.

DISCUSSION AND RECOMMENDATIONS

Even though no herbicide treatments occurred in 2016, the frequency of occurrence of EWM remained fairly consistent with the 2015 survey results reported by DFWI. EWM beds are most noticeable along the northeast shoreline off of Franklin's Beach and along the southern shoreline between Brown's Beach and the South Shore Marina. Native plant growth is also extensive in these areas, dominated by water stargrass (*Zosterella dubia*) in the shallow areas and a mix of pondweed species in deeper water.

Due to the distribution of EWM and CLP growth seen during the 2016 surveys, we believe spot treatment along the southern shoreline will provide the most benefit during the 2017 season. Due to current NYSDEC regulations, herbicide choices are limited for the 2017 season. Fluridone (Sonar) and triclopyr (Renovate) herbicides have water use restrictions on the product specimen labels that carry restrictions on water use until in-lake concentrations have dropped below 1 part per billion (ppb). Based on the current NYSDEC dilution model, use of these products would necessitate excessive notification and water use restrictions throughout Saratoga Lake and likely downstream to the Hudson River. To avoid excessive notification and restrictions, we recommend a combination treatment with 2,4-D granular (Navigate) and endothall (Aquathol K) herbicides. This combination treatment has been used extensively to manage EWM and CLP infestations in the Midwest. We have also had experience using this combination at Cossayuna Lake and at Glen Lake in New York. The additive effect of using the two herbicides enhances the systemic control of 2,4-D to provide extended control of EWM and also controls CLP. We recommend seeking permit approval to treat 100-150 acres of growth at the southern end of the lake. Treatment will likely be scheduled for the mid-late May period.

In addition to the herbicide treatment, we recommend the following monitoring efforts to assess the treatment effectiveness:

- Early-season visual inspection to evaluate EWM and CLP distribution, and finalize the 2017 treatment scope.
- Post-treatment survey and water quality sampling required by permit conditions
- Hydro-raking assistance to remove water chestnut plants from shallow areas near the mouth of Kayaderosseras Creek.
- Late season survey to validate findings of DFWI survey and to plan future management efforts.

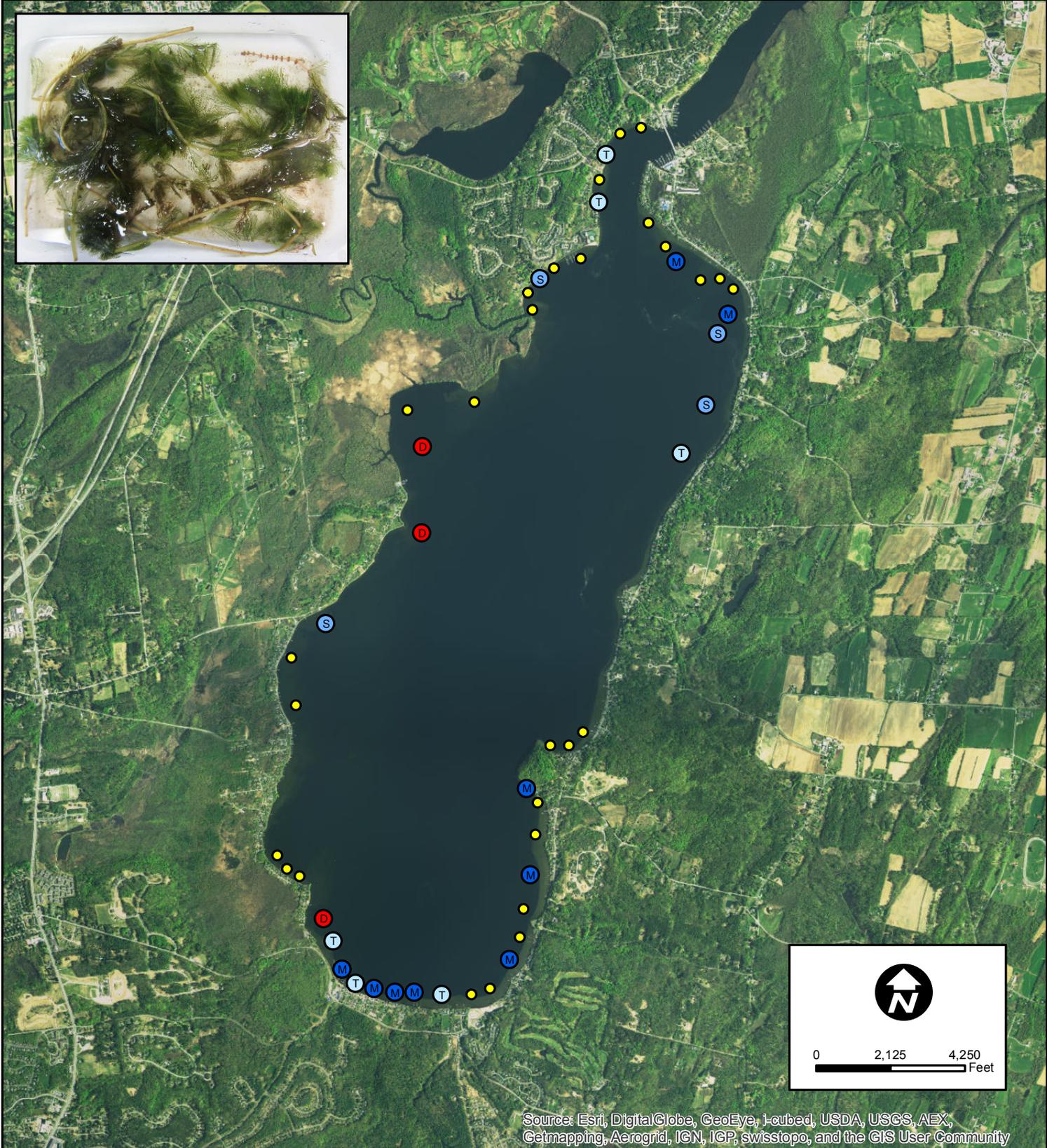
Please feel free to contact us if you have any questions or require any additional information.

Supporting Materials

- Maps
 - Figure 1. Eurasian Watermilfoil Distribution
 - Figure 2. Curly-leaf Pondweed Distribution
 - Figure 3. Biovolume
 - Figure 4. Updated Littoral Zone Bathymetry
- 2016 Surveys Images

FIGURE 1

EURASIAN WATER MILFOIL (*Myriophyllum spicatum*) Distribution



Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

SARATOGA LAKE
Aquatic Vegetation Survey
June 16-17, 2016

50 points

Percent
 Distribution

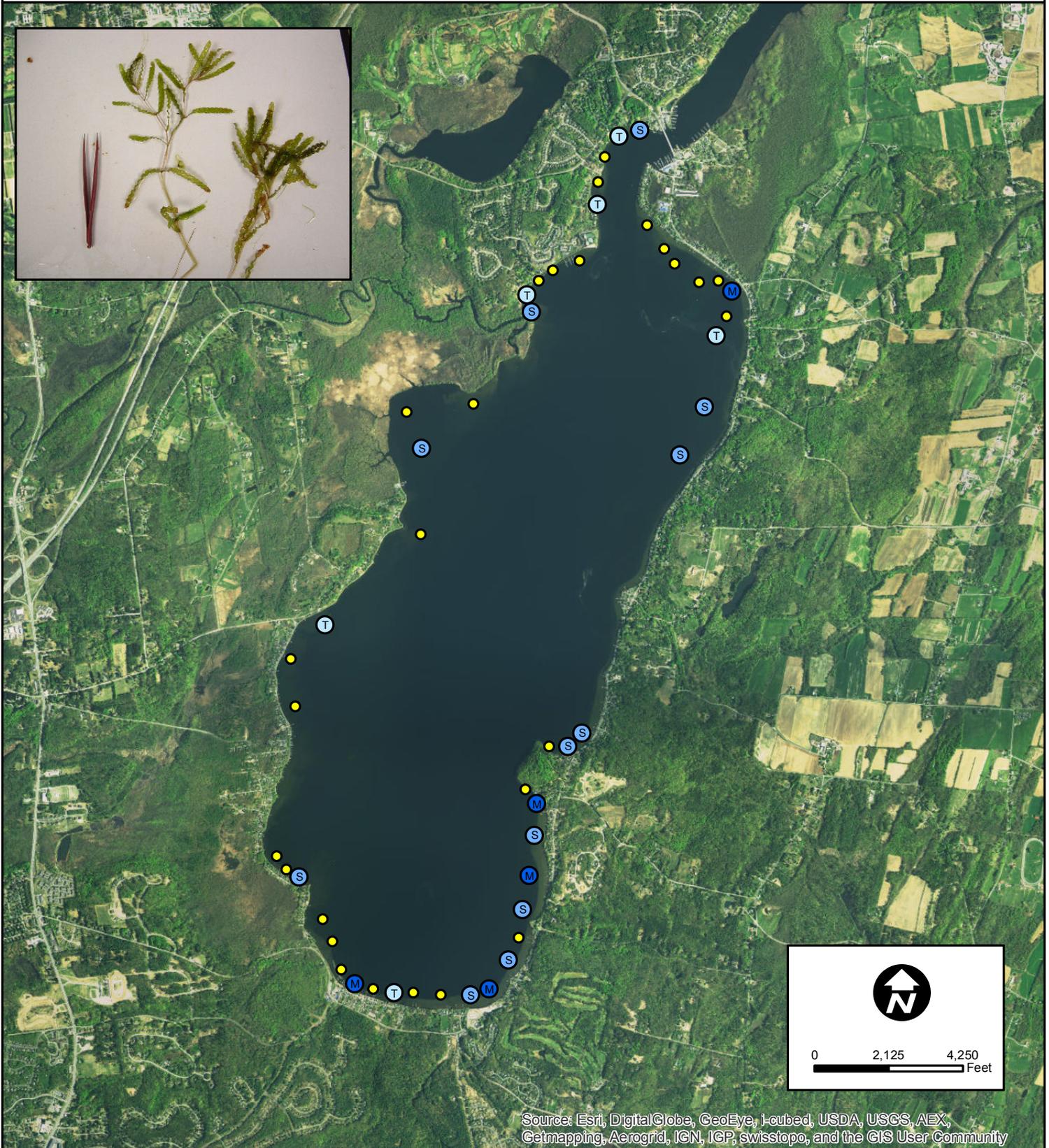
Abundance	Sites	Percent
Total	22	44%
Trace	6	27%
Sparse	4	18%
Medium	9	41%
Dense	3	14%

Plant Density

- No Plants
- T Trace Plants
- S Sparse Plants
- M Medium Plants
- D Dense Plants

FIGURE 2

CURLY-LEAF PONDWEED (*Potamogeton crispus*) Distribution



Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

**SARATOGA LAKE
Aquatic Vegetation Survey
June 16-17, 2016**

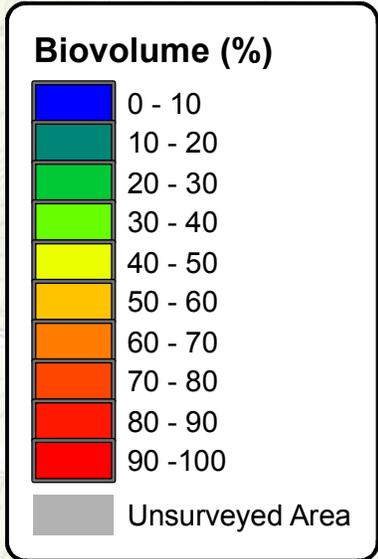
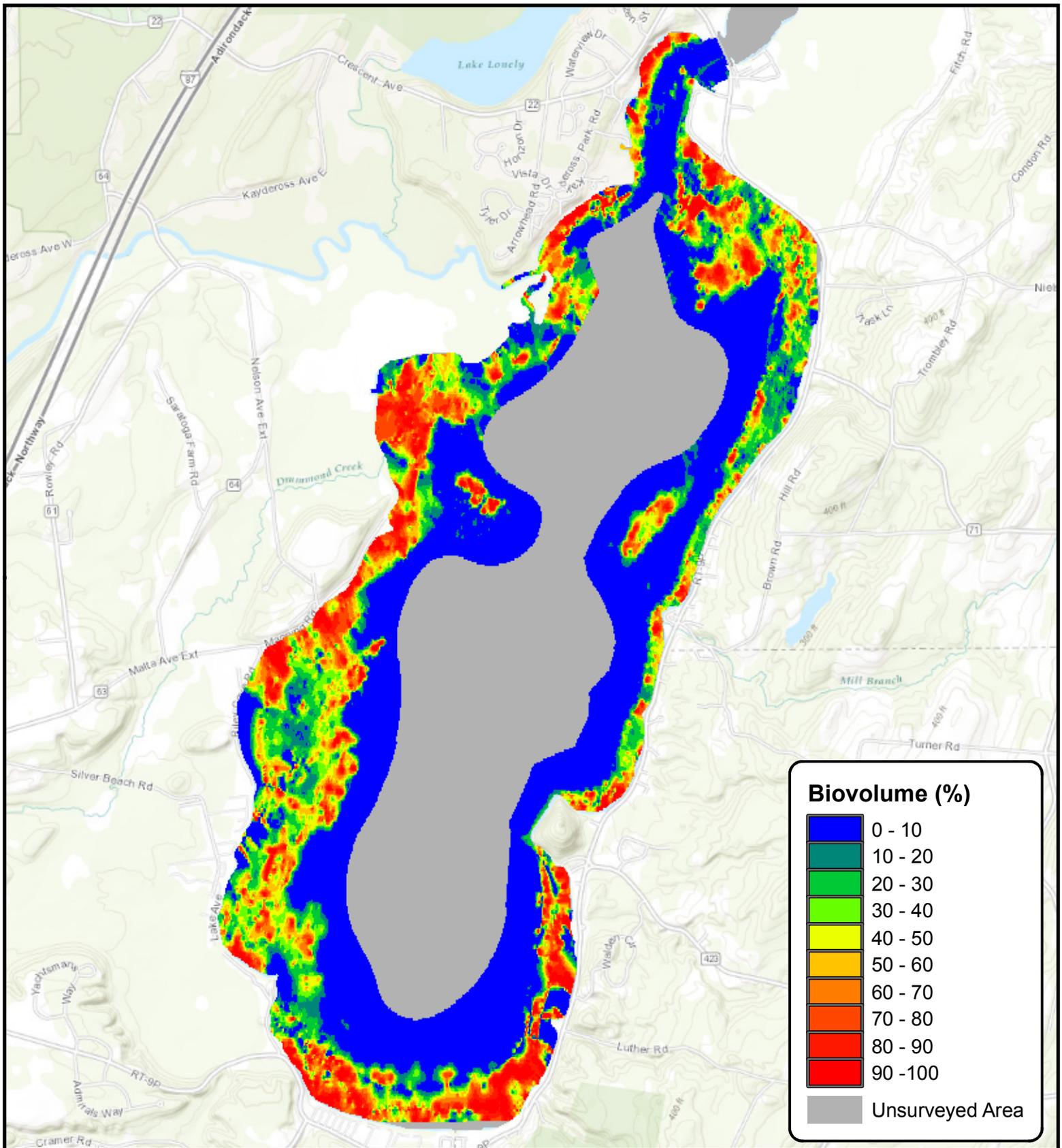
50 points

**Percent
Distribution**

Abundance	Sites	Percent
Total	23	46%
Trace	6	26%
Sparse	12	52%
Medium	5	22%
Dense	0	0%

Plant Density

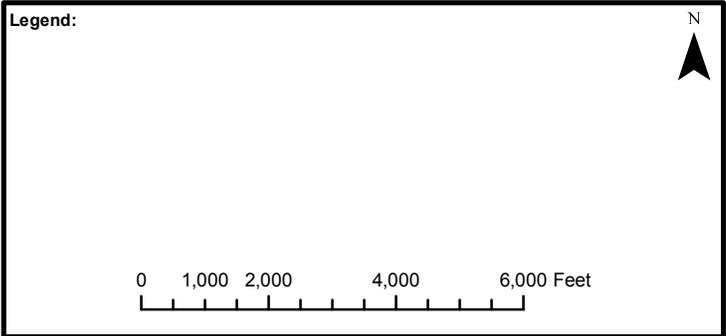
- No Plants
- T Trace Plants
- S Sparse Plants
- M Medium Plants
- D Dense Plants



Saratoga Lake
Saratoga, NY

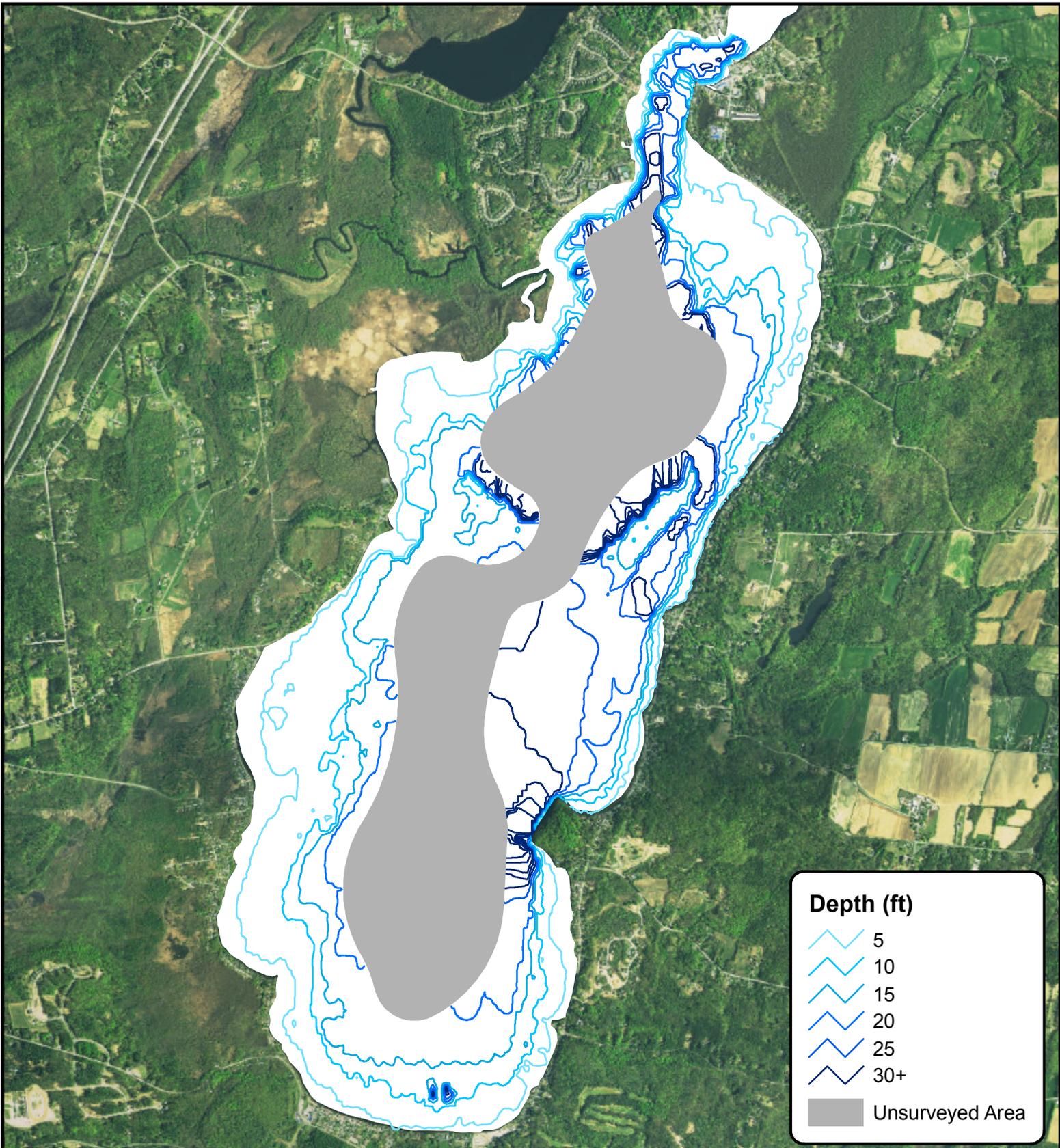
Biovolume

FIGURE:	SURVEY DATE:	MAP DATE:
3	2012-16	12/19/16



SOLITUDE
LAKE MANAGEMENT

590 LAKE STREET
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Depth (ft)

-  5
-  10
-  15
-  20
-  25
-  30+

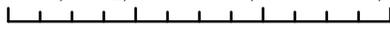
 Unsurveyed Area

Saratoga Lake
 Saratoga, NY
 Updated Littoral Zone
 Bathymetry

FIGURE:	SURVEY DATE:	MAP DATE:
4	2012-16	12/19/16

Legend:

N


0 1,000 2,000 4,000 6,000 Feet


SOLITUDE
 LAKE MANAGEMENT

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Season Surveys Images



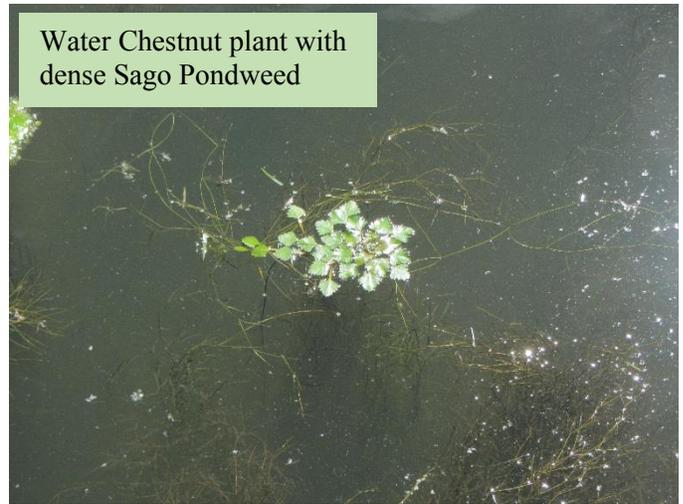
October 2016
Survey Conditions



Dense Illinois
Pondweed patch



Dense Eurasian
milfoil bed



Water Chestnut plant with
dense Sago Pondweed



Forked Duckweed found in
Kayaderosseras Creek Cove