

**Lake Shirley  
Lunenburg/Shirley, Massachusetts  
2023 Year-End Treatment Report**

November 28, 2023

Report Prepared by: SOLitude Lake Management  
590 Lake Street  
Shrewsbury, MA 01545

Report Prepared for: Ms. Joanna Bilotta, President  
Lake Shirley Improvement Corporation (LSIC)  
PO Box 567  
Shirley, MA 01464  
[jobilotta@comcast.net](mailto:jobilotta@comcast.net)

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Dear Joanna:

In accordance with the aquatic plant management contract between SOLitude Lake Management (SOLitude) and the Lake Shirley Improvement Corporation (LSIC) for Lake Shirley, the following document serves to provide this year's treatment and survey results, as well as management recommendations for next season. The continued objective of the program is to manage non-native and nuisance aquatic vegetation as well as potentially harmful cyanobacteria (blue-green algae) blooms. Multiple monitoring events, herbicide/algaecide treatment and reporting are key tasks of the project.

All management activities were consistent with the Order of Conditions [DEP File #284-0474 (Shirley), DEP File #208-1168 (Lunenburg)] and the License to Apply Chemicals issued by MA DEP (#WM04-0001193).

**2023 Management Program Summary**

Program Task	Date Completed
Received Approved License to Apply Chemicals	May 15, 2023
Early Season Survey	June 13, 2023
Herbicide Treatment	July 11, 2023



### ***Pre-Treatment Survey***

The pre-treatment survey, conducted on June 13th, incorporated a combination of SLM's historical qualitative assessment and Geosyntec's quantitative procedures, similar to surveys of prior years. Data on species composition, plant growth density, and plant biomass was collected at 66 different points throughout the lake. These points are identical to the point #'s associated with Geosyntec data in the past. A pre-treatment survey is conducted to determine the growth of all target species, such as fanwort (*Cabomba caroliniana*), curly-leaf pondweed (*Potamogeton crispus*), Eurasian milfoil (*Myriophyllum spicatum*) and variable milfoil (*Myriophyllum heterophyllum*). The survey also identifies any potential nuisance species based on native plant density.

Thinleaf pondweed (*Potamogeton spp.*) was the most common plant observed in this year's survey and was found at two-thirds of the survey points and was dominant at nearly half. Other target species include non-native curlyleaf pondweed. Other common native species observed this year include bladderwort (*Utricularia sp.*), macroalgae (*Nitella sp.* & *Chara sp.*) and clasping leaf pondweed (*Potamogeton perfoliatus*). Tapegrass (*Vallisneria americana*), which has been a common target in past treatments, was not very prominent this year, present at only 17% of the points and dominant at only 2%. Fanwort, which is non-native plant but not currently a target for management, was quite widespread this year, being present at 44% of the survey points, but dominant at only 15% of the points.

Per the Lake Management Plan, areas of the lake that exhibit either density or biomass factors of 3 or greater (>50%) are candidates for management. Additionally, any growth of non-native species, in this case curlyleaf pondweed and fanwort can also be treated. Some candidate areas were not designated for treatment due to their proximity to undeveloped shorelines and/or the dominance of non-nuisance species (ex. Stonewort/Chara, Coontail, Robbins pondweed) or the dominance was mostly of fanwort (*Cabomba caroliniana*) for which management action is limited due to budget constraints and practicality of effective herbicide options.

No areas were designated for treatment with flumioxazin in 2023 to manage fanwort. Several key areas of the lake were treated in 2020 & 2021, but due to DEP restrictions on the use of flumioxazin, these areas cannot be treated again for a three year period (use of flumioxazin is restricted to once every four years). Diquat, a contact herbicide, was proposed for use at a rate (1.0-1.5 gallons per acre) to control pondweeds and any areas that exhibited a dense population of tape grass would be treated with Nautique or copper sulfate.

Approximately 34.5 acres were originally designated for treatment. The pre-treatment report, which includes plant survey data and the proposed treatment map, is **attached**. The Lunenburg Conservation Commission approved this treatment plan at their June 20th meeting and the Shirley Conservation Commission approved the plan at their June 26th meeting. As allowed in the approval, some areas were expanded/added on the day of treatment due to observations of nuisance growth that have developed since the June 13th survey, increasing the total treatment area to 56.5 acres.

### ***Herbicide Treatment***

The herbicide treatment was conducted on July 11th, for target species as specified in the pre-treatment report. Treatment was conducted with Tribune (diquat) and Nautique (copper). As with all treatments, the lake community and the two towns were notified prior to treatment by LSIC. Several means of notification were utilized: placement of a written notice in the newspaper(s); placement of large, printed signs at major road intersections/locations around the lake and posting of numerous 8.5 inch by 11-inch orange colored, printed signs around the lake shoreline and other means of communication/notification.



The treatment was performed with a 20-foot airboat equipped with a tank, pump, and subsurface injection system. By injecting the diluted herbicide sub-surface, it eliminates the potential for aerial drift. GPS guidance was used to monitor the position of the boat and its relation to the treatment areas. The treatment proceeded smoothly and without any issues, **Figure 1** shows the final treatment areas and GPS recorded treatment tracks. A summary of the treatment specifications is as follows.

**Table 1 – Herbicide Treatment Specifications**

<b>Treatment Date</b>	July 11 <sup>th</sup>
<b>Product</b>	Tribune (diquat) & Nautique (copper)
<b>Treatment Area</b>	56.5 acres
<b>Quantity</b>	88.5 gallons – Tribune 5 gallons - Nautique
<b>GPS Tracks</b>	See Figure 1
<b>Applicator name</b>	Rocco Notaro, MA Certification #AL-0053966
<b>Site Conditions</b>	Weather: Fair, winds 8-12 MPH West, 80°F Water Temp: 26.8°C at surface, 23.0°C near bottom Dissolved Oxygen: 7.7 mg/l at surface; 4.15 mg/l near bottom (9-feet) Water clarity: 5'3"

No algaecide treatments were required this year.

**Post Treatment Inspection**

A post-treatment inspection was conducted on September 5th to evaluate the efficacy of the herbicide treatment. Overall, the treatment worked well on the targeted species, especially the pondweeds throughout the lake. Unfortunately, the growth of other species had increased significantly by late summer, especially tapegrass, naiad and fanwort. These species were either not present or were present at levels below the management threshold at the time of the pre-treatment survey. As required in the new Order of Conditions, the final data point survey was completed by Aquatic Restoration Consulting LLC under separate contract with the LSIC.

**Anticipated Management in 2024**

Based on the results of the 2023 management program, we anticipate seeing continued, minimal growth of watermilfoil this coming summer, however there is a chance that curly-leaf pondweed will be present in significant proportions early in the season as well as fanwort a short time after. Native growth, primarily tape grass and naiad along with nuisance pondweeds, will also likely require management later in the season. We will continue to proceed and determine treatment needs based on the established criteria.

Changes in plant composition and density between the pre-treatment survey, the day of treatment and later in the season continues to be a challenge with the management program. Due to the fact that pre-treatment data needs to be collected, compiled and then presented to the Conservation Commissions at one of their regularly scheduled meetings before we can proceed with treatment, there are very often significant changes from when the data is collected and when the treatment is conducted. Additionally, since the data must be collected earlier in the season, it is not always reflective of the nuisance conditions that can become apparent at the lake in the late summer (late July through late August).



This was especially noticeable this year, with many reports of nuisance growth received from residents in the August to September timeframe. This year the survey was conducted a couple of weeks earlier than in 2022, so we recommend returning to a late June/early July survey and mid-late July treatment schedule. This should help alleviate the issue to some degree. Additionally, we recommend incorporating the previous fall survey data into the treatment plan as those areas that experienced nuisance growth in the late summer/fall can generally be expected to occur again the following year. Including this data into the treatment plan formulation should help address areas that will meet management criteria later in the summer.

One of the other likely reasons that this year's late summer conditions were particularly bad is the proliferation of fanwort. Aside from periodic, localized treatments with flumioxazin the LSIC relies primarily on the winter drawdown to control fanwort because widespread use of flumioxazin is not feasible given the current DEP restrictions of its use and whole lake treatment using fluridone is not financially feasible. Unfortunately recent drawdowns have been relatively ineffective due to warm weather and high water levels. This has allowed the fanwort to expand significantly in biomass.

While we continue to recommend planning for a two-treatment approach, herbicide applications can be combined, as has been the case in recent years, depending on observed growth and availability of funding. The proposed plan for 2024 is as follows

**Table 2 – Proposed Plan for 2024**

Task	Schedule	Notes/Criteria
<b>Early Season Survey</b>	Mid/late April	Survey for early emerging plants, primarily curly leaf pondweed but also milfoil. Survey will be conducted at established survey points but will not include full collection of data.
<b>1<sup>st</sup> Treatment</b>	Early/Mid May	Treat all areas of the lake with curly leaf pondweed and milfoil
<b>Mid-Season Survey</b>	Late June/Early July	Full data point survey
<b>2<sup>nd</sup> Treatment</b>	Mid-Late July	Treat any additional areas of non-native growth, plus selected areas of problematic native plant growth based on density/biomass criteria.
<b>Late Season Survey (conducted by ARC)</b>	Late September/early October	Full data point survey

Tribune (diquat) herbicide alone will provide good control of milfoil, curly-leaf pondweed and naiad. Tapegrass is sometimes more difficult to control and, if needed, a combination of Tribune and a copper-based herbicide (Nautique) or algaecide (Captain/copper sulfate) should be used to increase effectiveness and produce more desirable results. Areas of fanwort will be evaluated for treatment with flumioxazin based on conditions and budget.

Monitoring of water clarity and algal populations (as necessary) provides timely information to guide algaecide treatments should such treatments be warranted. It continues to be of paramount importance to ensure that the water clarity monitoring is conducted on a regular basis (weekly or bi-weekly depending on general observation) from May-October and that results are provided to SOLitude and other project partners so that algaecide



treatments are scheduled in a timely manner. Should treatment of the algae be required in 2024, copper sulfate is again proposed for use.

We recommend LSIC continue to pursue an integrated approach to manage nuisance plants and algae utilizing drawdown and herbicide/algaecide as required. To address overall lake management and long-term goals, the LSIC should continue the investigation and implementation of alternative in-lake methods, watershed management, public education and diagnostic assessments.

We hope this report will be of help to LSIC in planning for 2024 and beyond. If you have any questions regarding this report, please feel free to contact me. We look forward to working with you again in the future.

590 Lake Street  
Shrewsbury, MA 010545



Phone: (508) 865-1000  
FAX: (508) 865-1220  
e-mail: [info@solitudelake.com](mailto:info@solitudelake.com)  
Internet: [www.solitudelakemanagement.com](http://www.solitudelakemanagement.com)

Date: June 19, 2023

To: Lunenburg Conservation Commission  
Shirley Conservation Commission

From: Dominic Meringolo, Senior Environmental Engineer/Project Manager

Re: Lake Shirley – Survey and Treatment Plan

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Dear Commissioners,

Based on a survey conducted by our Biologist on June 13th, we are recommending treatment to approximately 34.5-acres of Lake Shirley to manage nuisance weed growth. Thinleaf pondweed (*Potamogeton spp.*) was the most common plant observed in this year's survey. Other target species include non-native curlyleaf pondweed (*Potamogeton crispus*). Other common native species observed this year include bladderwort (*Utricularia sp.*), macroalgae (*Nitella sp. & Chara sp.*) and clasping leaf pondweed (*Potamogeton perfoliatus*). Tapegrass (*Vallisneria*), which has been a common target in past treatments, was not very prominent this year in most areas and does not require management.

Per the Lake Management Plan, areas of the lake that exhibit either density or biomass factors of 3 or greater (>50%) are candidates for management. Additionally, any growth of non-native species, in this case curlyleaf pondweed (*Potamogeton crispus*) can also be treated. Some candidate areas were not designated for treatment due to their proximity to undeveloped shorelines and/or the presence of non- nuisance species (ex. Stonewort/Chara, waterlilies).

Based on recommendation from Water Restoration Consulting the following areas will be checked again prior to treatment for the presence of coontail (*Ceratophyllum demersum*) and Robbins Pondweed (*Potamogeton robbinsii*), both of which are plants that we would like to see expand in the lake. If specimens of either species are observed, that area would not be treated.

Areas in the vicinity of points 1-7; Areas in the vicinity of points 21-22; Areas in the vicinity of points 30-31.

As was approved last year, we ask the Commission to allow us to make field changes on the day of treatment if we observe any additional areas of non-native curlyleaf pondweed or topped-out, problematic vegetation in other areas of the lake not depicted on the map.

No additional areas are proposed for flumioxazin (a/k/a Clipper) herbicide treatment this year. In the proposed treatment areas, Tribune (diquat) herbicide will be used for treatment at a rate of 1.0-1.5 gallons per acre and a copper-based product, either Nautique or copper sulfate, will be used as needed in areas dominated by tapegrass, however this should be quite limited this year.

Treatment is tentatively scheduled for July 11<sup>th</sup>.

A map of the recommended treatment areas is attached as well as the June 13th survey data table. On the map of the proposed treatment areas, the data points that meet management criteria are included. The LSIC & SOLitude Lake Management will be attending upcoming meetings of the Conservation Commissions to discuss this plan and answer any questions.

Regards,

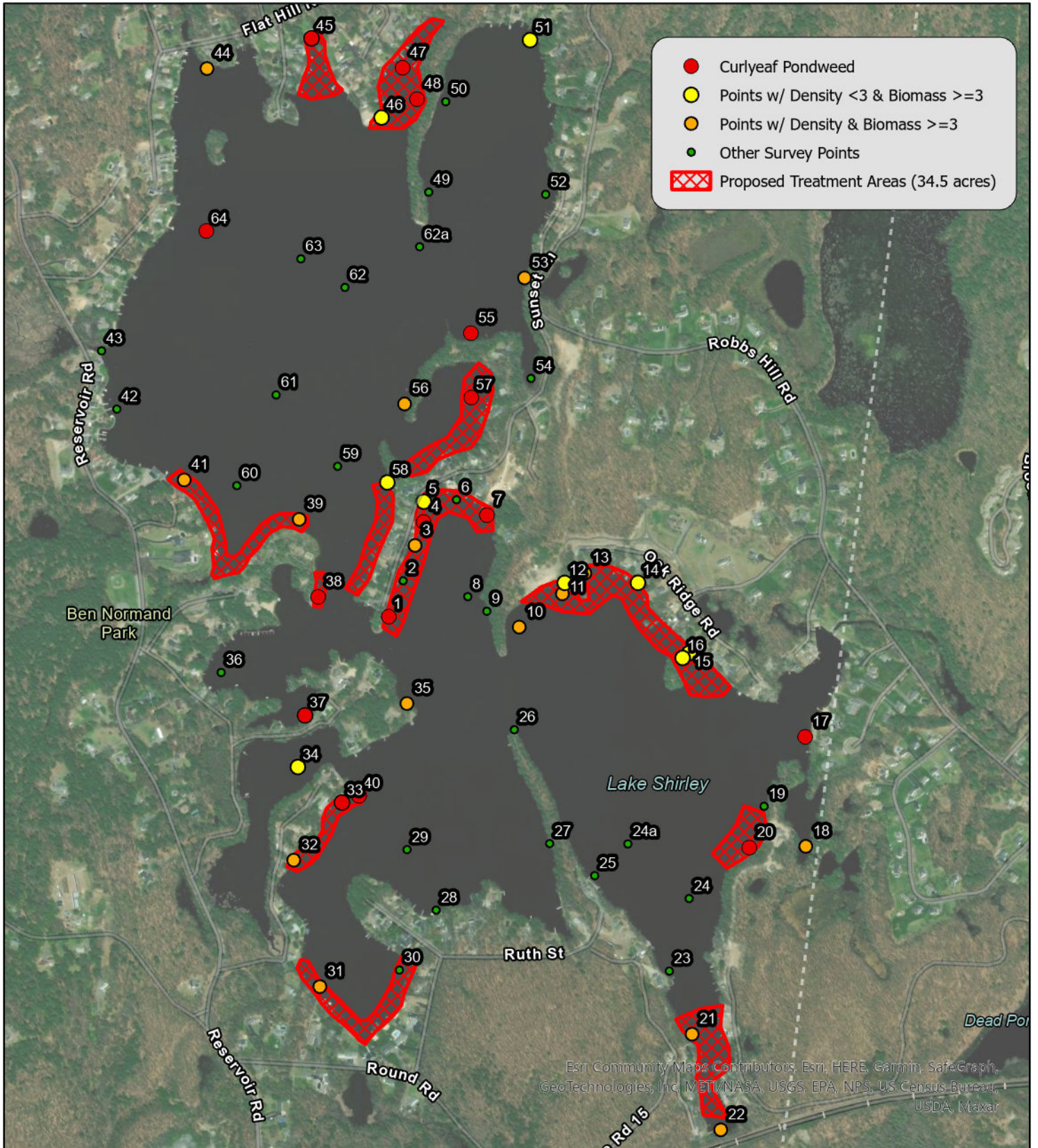
**SOLitude Lake Management**

A handwritten signature in black ink that reads "Dominic Meringolo". The signature is written in a cursive, flowing style.

Dominic Meringolo  
Senior Environmental Engineer/Project Manager



Figure 1 - 2023 Proposed Treatment Areas



Esri Community Maps Contributors, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Maxar

Lake Shirley  
Lunenburg, MA

**Lake Shirley**

0 870 1,740 Feet

1:10,924

Map Date: 6/16/2023  
Prepared by: DMM  
Office: SHREWSBURY, MA



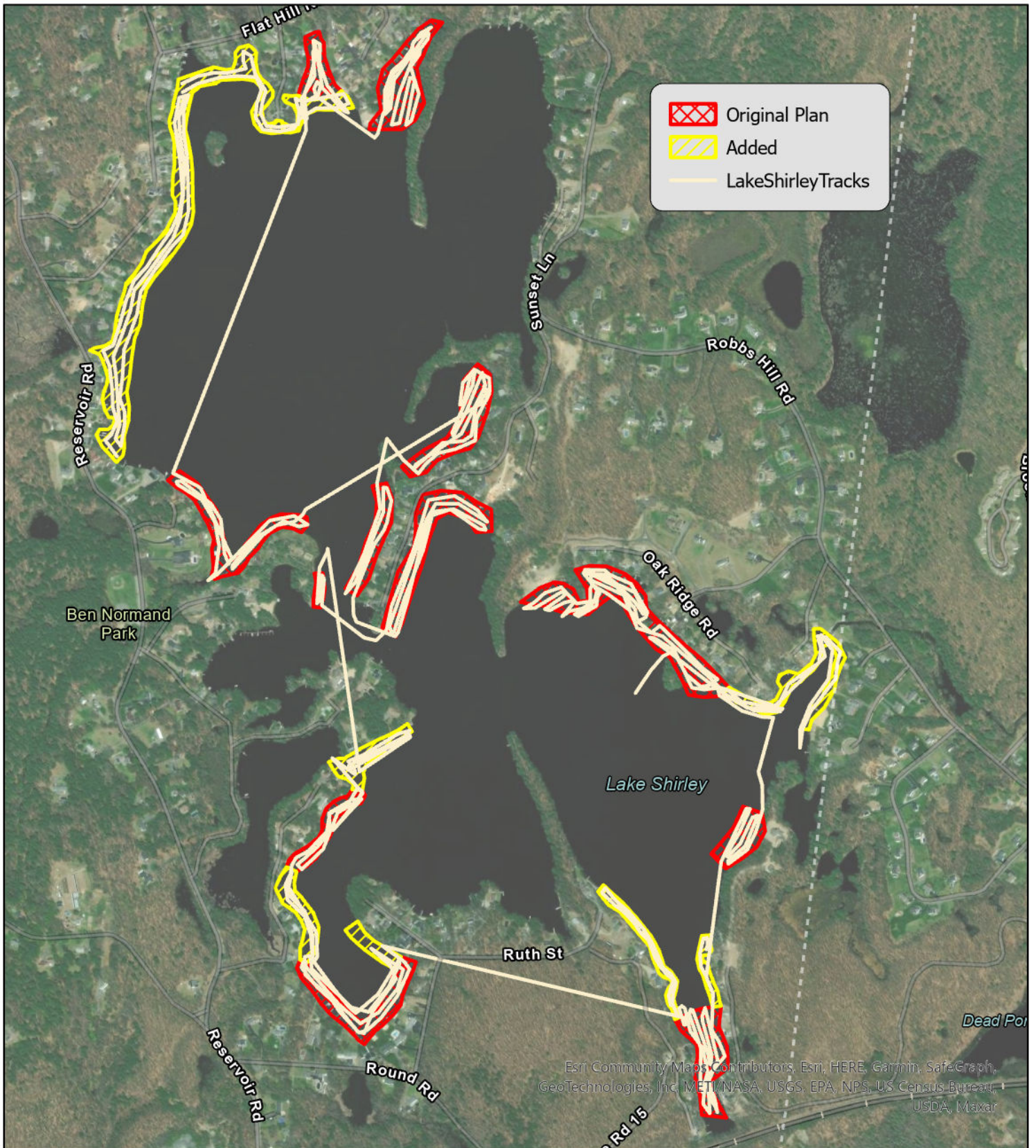
X= Present D = Dominant

Plant Species	# stations present	# stations dominant	% stations present	% stations dominant	Monitoring Locations																																														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24a	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39							
<i>Scientific Name</i>					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24a	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39							
<i>Cabomba caroliniana</i>	29	10	44%	15%		D	D	X	D	D	X	X	X	X	X	X	D	X	X		X	D					X		D	X		D		D					X		D		X								
<i>Elodea canadensis</i>	0	0	0%	0%																																															
<i>Vallisneria americana</i>	11	1	17%	2%	D						X		X				X																					X							X						
<i>Eleocharis sp.</i>	1	0	2%	0%																																															
<i>Utricularia Sp.</i>	12	0	18%	0%		X		X			X	X		X				X							X																						X				
<i>Chara sp.</i>	0	0	0%	0%																																															
<i>Nitella sp.</i>	11	2	17%	3%		X				X																X																					X				
<i>Macro</i>	10	2	15%	3%						X		D	D	X											X		X																			X	X	X		X	
<i>Potamogeton bicupulatus</i>	0	0	0%	0%																																															
<i>Najas flexilis</i>	5	2	8%	3%																							D																								
<i>Potamogeton gramineus</i>	1	1	2%	2%																																															
<i>Variou</i>	0	0	0%	0%																																															
<i>Najas gracillima</i>	4	1	6%	2%															X																																
<i>Potamogeton crispus</i>	15	3	23%	5%	X			X			X											X																													
<i>Potamogeton amplifolius</i>	2	1	3%	2%																																															
<i>Potamogeton epihydrus</i>	1	0	2%	0%																																															
<i>Potamogeton perfoliatus</i>	11	5	17%	8%			X								X																																				
<i>Potamogeton foliosus</i>	0	0	0%	0%																																															
<i>Ceratophyllum demersum</i>	0	0	0%	0%																																															
<i>Potamogeton zosteriformis</i>	0	0	0%	0%																																															
<i>Nuphar variegata</i>	1	0	2%	0%																																															
<i>Nymphaea odorata</i>	0	0	0%	0%																																															
<i>Fontinalis sp.</i>	0	0	0%	0%																																															
<i>Zosterella dubia</i>	3	1	5%	2%				X																																											
<i>Potamogeton confervoides</i>	1	0	2%	0%																																															
<i>Potamogeton pusillus</i>	0	0	0%	0%																																															
<i>Potamogeton sp. (thin)</i>	44	30	67%	45%	X	X	D	X	X	X	X	D	D	D	D	X	X	D	X	D																															
<i>Potamogeton robbinsii</i>	0	0	0%	0%																																															
<b>Species Richness</b>					2	4	3	5	2	3	6	4	4	3	3	2	3	4	4	2	4	3	1	2	2	2	2	3	0	2	3	0	1	0	1	3	1	4	5	3	2	2	4	3							
<b>Plant density index</b>					1	2	3	3	2	3	3	4	1	3	3	1	4	2	2	1	3	4	1	3	4	3	3	2	0	1	3	0	1	0	2	3	3	2	2	3	2	2	3	3							
<b>Plant biomass index</b>					2	2	3	3	3	2	3	2	1	4	4	4	4	3	3	3	3	3	4	2	3	4	3	2	2	0	2	2	0	2	0	2	4	3	3	4	4	4	2	3	4	3					

Key to Density and Biomass Indices		
Value	Density (% cover)	Biomass
0	Absent: 0%	No growth
1	Sparse: 1-25%	Scattered plant growth; or primarily at lake bottom
2	Moderate: 26-50%	Less abundant growth; or in less than half of water column
3	Dense: 51-75%	Substantial growth through majority of water column
4	Very Dense: 76-100%	Abundant growth throughout water column to surface



Figure 1 - 2023 Actual Treatment Areas (56.5 acres) & Treatment Tracks



Lake Shirley  
Lunenburg, MA

**Lake Shirley**

0 870 1,740 Feet

1:10,924

Map Date: 11/27/2023  
Prepared by: DMM  
Office: SHREWSBURY, MA