

## **Bolton Lakes Proposed 2021 Scope of Project Work:**

The Bolton Lakes management program as a whole encompasses water quality monitoring, aquatic plant surveying, invasive plants management, watershed management, and a considerable amount of educational outreach and public involvement. The Bolton lakes maintain moderate water quality, but cyanobacteria blooms have occurred on both lakes on multiple occasions in the last decade. Following a dramatic cyanobacteria bloom in Lower Bolton in 2012, the Towns have committed to ongoing monitoring and overall lakes management. In the past half decade, aquatic invasive species have become a greater threat and nuisance to the overall lake ecosystems and recreational value.

Despite successful eradication of Fanwort in 2013, Lower Bolton lake currently has a growing infestation of Curly-leaf pondweed (*Potamogeton crispus*). The current management plan for invasive Curly-leaf pondweed at Lower Bolton is to minimize the spread of plants to new areas of the lake. This process requires multiple steps:

1. Early season professional aquatic plant survey to search the shoreline for invasive Curly-leaf pondweed growth. This survey is typically performed in May, but is dependent on annual temperatures and tips about general plant growth from resident volunteers from the Friends of Bolton Lakes, a not-for profit organization.
  2. Determine if Curly-leaf pondweed distribution and growth warrant an herbicide treatment, or could be managed in another way, like diver hand-pulling or benthic barriers to control small patches and scattered single new plants.
  3. Management action as early as reasonable and feasible, prior to seasonal turion development and release.
  4. Follow-up inspection of invasive Curly-leaf pondweed to ensure adequate control.
  5. Fall aquatic plant survey to search for autumn sprouting of Curly-leaf pondweed turions and to document the presence of all native and invasive aquatic plants. Both the early season and late-season comprehensive aquatic plant surveys maintain a record of invasive and native plant coverage throughout the management period. These surveys track management impacts to native species and also scan the littoral zone for potential new infestations (like Fanwort from upstream Middle Bolton or new invasive plants introduced via boaters from nearby lakes – main threat is Hydrilla from Coventry lake).
  6. Late-season Curly-leaf pondweed management, if needed, to hopefully prevent new growth in the following year. Late season management has historically been limited to diver hand harvesting, but this grant aims to secure funding for the purchase of ‘rapid-response’ benthic barriers to be shared among the Bolton lakes.
  7. Cyanobacteria algaecide treatments are used occasionally to curtail potentially dense blooms and keep Lower Bolton lake open for late-summer recreation. It is unknown if a bloom will occur or if it will need treatment in 2021, but the permit is currently being filed by Solitude licensed applicators.
  8. Water quality monitoring for long-term cyanobacteria monitoring and management. This includes sampling, lab analyses, data interpretation, testing equipment, etc.
- Estimated consultant costs for Lower Bolton aquatic plant surveys, data entry/all-species statistical comparison, GIS mapping of invasive species, recommendations, and ongoing communication: **\$6,000**
  - Curly-leaf Diquat application costs for Lower Bolton 2021: **\$5,144**
  - Emergency ½ lake copper sulfate treatment: **\$3,200**

In-kind services related to the Lower Bolton project oversight by Town officials and volunteer monitoring and outreach time is half of the total \$4,930 total in-kind services budget: \$2,465.

Aquatic plant management efforts at Middle Bolton are similar, but take place on a different timeline due to the nature of invasive Fanwort growth.

1. Early season professional Fanwort survey to search all previously known locations of invasive Fanwort, typically in early June – as Fanwort tends to grow later in the season and may not be visible prior to early June.
  2. Depending on general plant growth and any potential Fanwort fragment sightings from the Middle Bolton lake residents and Friends of Bolton Lakes volunteers, a full aquatic plant survey and Fanwort search is performed in mid-summer. This survey is extremely detailed and involves transect searching of the entire lake (mostly littoral) with a resolution fine-enough to detect single Fanwort plants, even in relatively poor water clarity. Survey methods rely heavily on SONAR, raking, and view scope searching. The goal is to find the ‘needle-in-the-haystack’ Fanwort clumps and appropriately manage for eradication. This survey also serves as the pre-treatment survey to document the presence and extent of invasive Variable milfoil, which is treated on a rotating basis, as needed. Invasive species maps are provided to the public.
  3. Follow-up Fanwort and/or Variable milfoil management as necessary. The plan for 2021 is to secure funding for an emergency Fanwort spot treatment, and if no spot treatment is required in 2021 (if no Fanwort is found), funds will be spent on the purchase of high-quality and durable benthic matting material that can be used for covering small pop-up Fanwort patches in the future. The costs for less than 5-acres of Clipper treatment will be able to purchase at least 1,000 square feet of non-woven geotextile fabric panels from Solitude. The Towns will cover the cost of installation if any additional funding is needed.
  4. Post-management Fanwort inspection and overall aquatic plant survey to document the frequency, density, and growth forms of all native and invasive aquatic plants in Middle Bolton, as well as specific notes about effectiveness of Fanwort seasonal management efforts.
  5. Water quality monitoring for long-term cyanobacteria monitoring and management. This includes sampling, lab analyses, data interpretation, testing equipment, etc.
- Estimated consultant costs for Middle Bolton aquatic plant surveys, data entry/all-species statistical comparison, GIS mapping of invasive species, recommendations, and ongoing communication. **\$6,000**
  - Fanwort treatment and/or benthic barrier purchase amount: **\$4,840** (5-acre Clipper treatment) + \$700 per additional acre if needed.
  - Benthic barrier installation costs, if needed. \$150/hr for underwater install; could be done by volunteers if Fanwort in less than 3ft of water.

In-kind services related to the Middle Bolton project oversight by Town officials and volunteer monitoring and outreach time is half of the total \$4,930 total in-kind services budget: \$2,465.

**Public Outreach and Education** is essential to align the aquatic invasive species control and the water quality management. This aspect of the program will require the following.

1. Boat Launch ambassador to educate lake visitors about invasive species; training, on-site supplies, and equipment.
  2. Watershed Signage that will alert visitors and residents to be mindful of the transmission of invasive species. Included will be permanently erected signs at each boat launch notifying the users to be vigilant, 11 watershed street signs mounted strategically along access roads within the watershed, 5-6 sandwich board signs, Welcome brochures [see attachment] for placement in each town hall, mailing to new residents and handouts at various public functions and events.
  3. Fees that are attributable to DEEP, CFL and other educational seminars.
  4. Expenses associated with spring and fall public forums hosted by the FBL and presentations by guest experts to enlighten areas residents of invasive species, erosion control, i.e., rain gardens, landscaping techniques, etc.
  5. Equipment used to detect cyanobacteria, nutrient loads, water clarity data, etc.
- Costs for 2021 educational signage, equipment, fees, forum expenses, supplies, on-line access. **\$2,950** total.
  - Cyanobacteria Sample Microscopic Identification = **\$1,200** for ten total samples across both lakes
  - Laboratory costs for volunteer nitrogen and phosphorus monitoring = **\$2,480** for both lakes combined
  - Year-end data analysis, reporting, recommendations, and planning for 2022 AIS management = **\$1,400** for both Middle and Lower Bolton lakes.

Project Total Funds (not including in-kind services) = **\$33,214**

Total Grant-requested funds = \$24,910.50

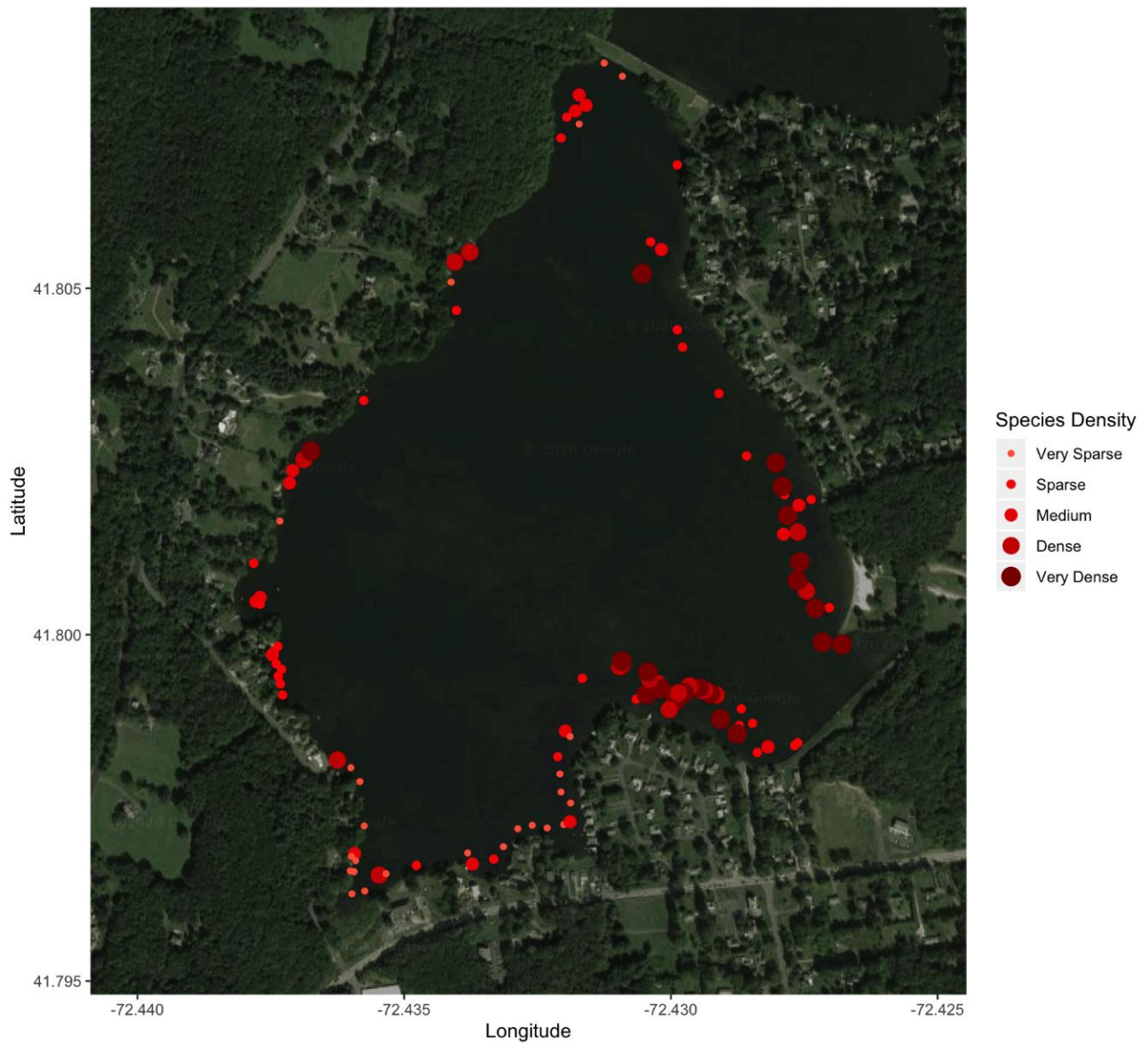
Direct Towns matching funds = \$8,303.50

In-kind services Town & FBL match (added to direct match) = \$4,930

**Project Total (including in-kind services match) = \$38,144**

Supporting maps are provided in the pages below.

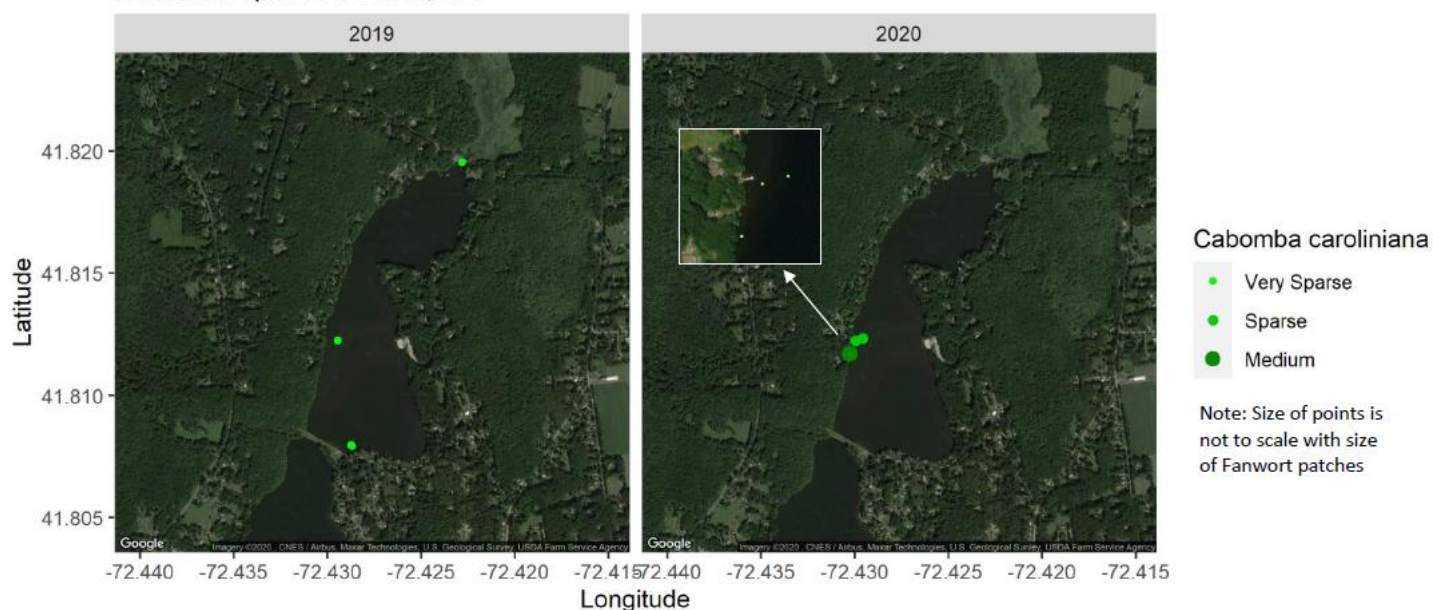
5-22-2020 & 6-22-2020 Lower Bolton Potamogeton crispus  
Northeast Aquatic Research, LLC



Additional years of aquatic plant native and invasive species are available upon request.

## Middle Bolton Lake 2019-2020 Invasive Fanwort

Northeast Aquatic Research, LLC



2020 Fanwort Locations and Plant Bed Descriptions:

| Latitude | Longitude | Water Depth (ft) | Description of Fanwort  |
|----------|-----------|------------------|---|
| 41.81234 | -72.4296  | 5.9              | one large plant raked up, not seen from surface / cannot determine bed size |
| 41.81225 | -72.4299  | 1.8              | scattered single plants within rocks and Variable milfoil                   |
| 41.81169 | -72.4302  | 2.9              | 2 patches each 5ft in diameter  |

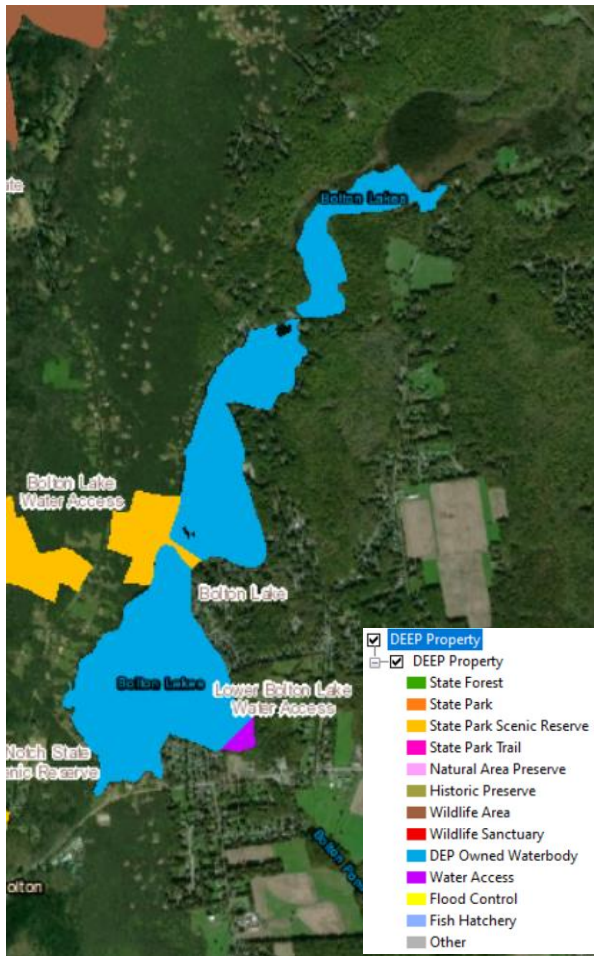
Additional years of aquatic plant native and invasive species are available upon request.

## Photo of Clipper-treated Fanwort in 2021 (remaining on Oct. 20<sup>th</sup>, 2020)

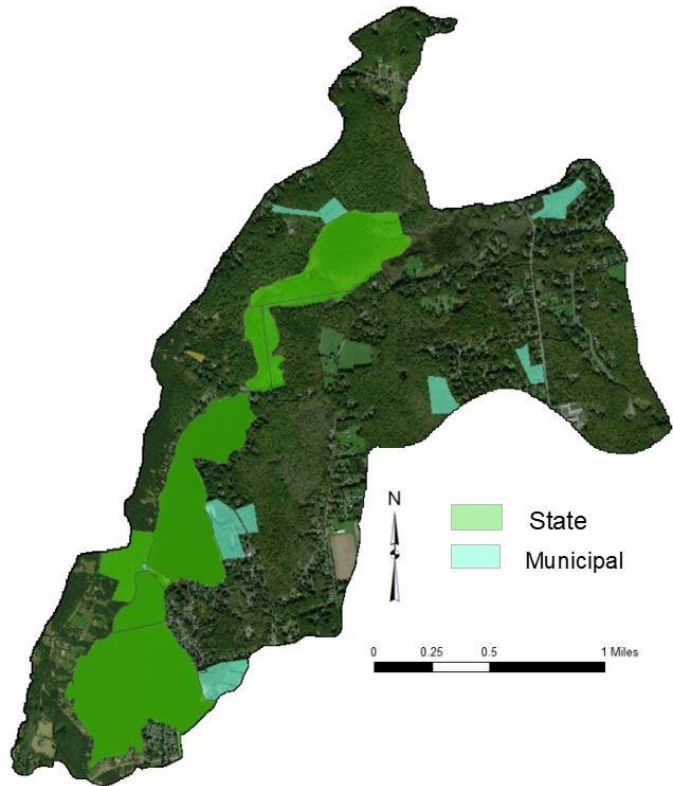




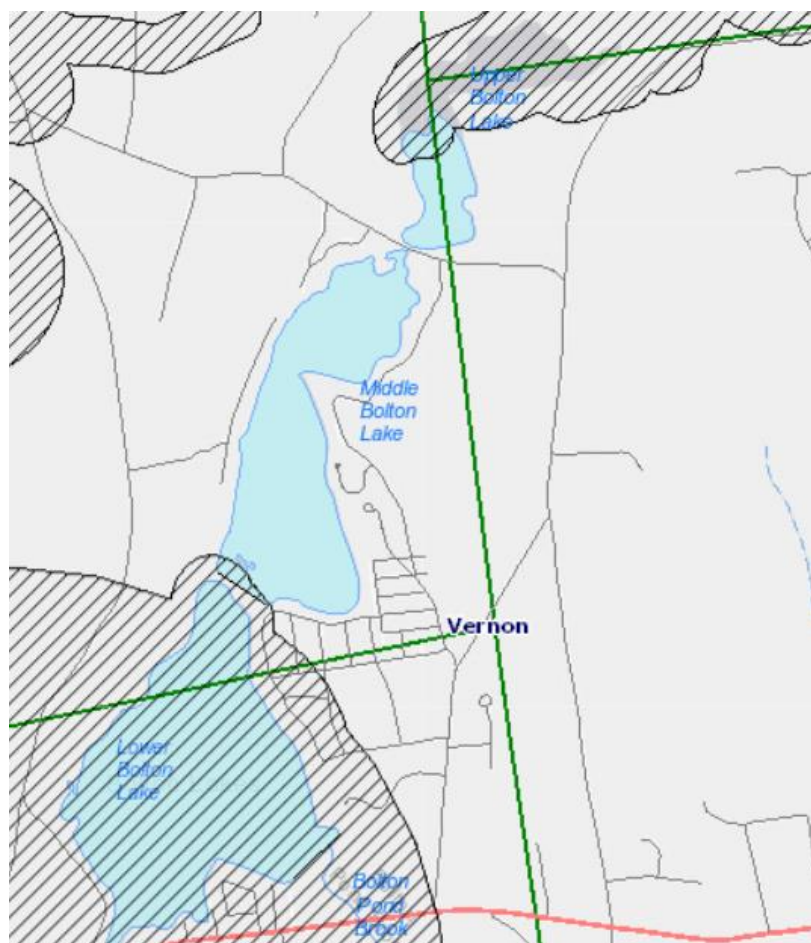
State-owned Waterbodies Overlay



State and Municipal Open Space



Natural Diversity Database (NDDDB) Overlay Map shows that Lower Bolton lake has a state-listed species known to be present. Records indicate CT DEEP has previously recorded the wood turtle (*Glyptemys insculpta*) and spotted turtle (*Clemmys guttata*), and treatment areas have been adjusted in the past to avoid previously recorded turtle locations near the Lower Bolton outlet and downstream area.



### Description of Northeast Aquatic Research Aquatic Plant Survey Methods:

The primary survey method employed at the Bolton Lakes is a meander style survey, where the lake is searched extensively for aquatic invasive species in a back and forth transect pattern across the littoral zones of the lakes. The distance between searching transects is determined based on water clarity on the day of the survey. Turbid water necessitates search transects that are closer together because plants are less visible from the surface. Survey waypoints are made regularly, spaced roughly 50-meters apart in a gridded pattern. All plant species and densities are recorded at each regularly-spaced waypoint. When aquatic invasive species are found, additional waypoints are made and data recorded. This is particularly important when mapping new clumps of invasive species, such as the frequently recorded single Curly-leaf pondweed clusters at Lower Bolton lake and the very small new patches of Fanwort at Middle Bolton lake. The regularly-spaced survey waypoints allow for comparison of native plants over time, to gauge the impact of AIS management, while the additional GPS points of invasive species allows for very detailed mapping and management oversight. Both the Lower Bolton and Middle Bolton plant management programs are attempting to prevent AIS takeover of relatively new invasions (past six years).

At each regularly-spaced waypoint, either a long-handled (16ft) rake, or a 14-tine double-sided garden rake attached to a 10m rope, is used to collect specimens of all species at the sampling points. Water depth, plant density for each species, and plant height (biomass estimate) in the water column for nuisance and invasive species are recorded at each waypoint. Presence and density of any filamentous green algae or filamentous benthic cyanobacteria mats are also recorded. Additional notes about plant conditions, growth habits, and sediment substrate are recorded as needed.

Plant density is determined using a combination of methods. The first, visual determination, is based on what is visible from the surface. This method involves using a hypothetical quadrat. In this method, one visually assesses an estimate of how much area is covered by the plant in question. The use of actual survey quadrats in the field is not appropriate for the large scale of most aquatic plant surveys, so surveyors must visualize a hypothetical quadrat, and estimate percent coverage accordingly. The second way to estimate the percent coverage of vegetation is to physically sample plants via manual raking. Rake-density estimates are semi-quantitatively recorded as a percent cover. When plants are not visible from the surface, the rake density estimates are paired with SONAR imaging to verify the overall density of plant growth beneath the surface. SONAR also provides scrolling images of bottom features and water depth, which allow for accurate estimates of plant height in the water column and marking the outer edges and depth extent of invasive species beds. When possible, both ways of estimating the percent cover are used at each waypoint, and the resulting estimate is recorded on the datasheet. Percent cover categories are as follows: Very Sparse/Trace (<1-10% cover), Sparse (11-19% cover), Medium/Moderate (20-59% cover), Dense (60-79% cover), Very Dense (80-100% cover).



NEAR staff performed full aquatic plant surveys in Lower Bolton lake from 2013-2018 and in 2020. The 2019 surveys only documented invasive and nuisance species.

NEAR Lower Bolton Species List (2019 surveys were for Invasive/Nuisance species only)

| Species List  | 2013       | 2014       | 2015       | 2016       | 2017       | 2018       | 2019       | 2020       |
|---|------------|------------|------------|------------|------------|------------|------------|------------|
| Large-leaf pondweed<br>( <i>Potamogeton amplifolius</i> )               | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        |
| Southern naiad<br>( <i>Najas guadalupensis</i> )                        | Yes        | Yes        | Yes        | Yes        | -          | Yes        |            | Yes        |
| Coontail<br>( <i>Ceratophyllum demersum</i> )                           | Yes        | -          | -          | -          | -          | -          |            | Yes        |
| Tape-grass<br>( <i>Vallisneria americana</i> )                          | Yes        | -          | Yes        | Yes        | Yes        | Yes        |            | Yes        |
| Snail-seed pondweed<br>( <i>Potamogeton bicupulatus</i> )               | -          | Yes        | -          | -          | -          | Yes        |            | -          |
| Elodea<br>( <i>Elodea nuttallii</i> )                                   | -          | -          | -          | -          | -          | -          |            | Yes        |
| Floating bladderwort<br>( <i>Utricularia radiata</i> )                  | -          | -          | -          | -          | -          | -          |            | -          |
| Arrowhead<br>( <i>Sagittaria graminea</i> )                             | -          | -          | Yes        | Yes        | -          | -          |            | Yes        |
| Bushy pondweed<br>( <i>Najas flexilis</i> )                             | -          | Yes        | -          | -          | Yes        | Yes        |            | Yes        |
| <b>Fanwort</b><br>( <i>Cabomba caroliniana</i> )                        | <b>Yes</b> | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   |
| <b>Mudmat</b><br>( <i>Glossostigma</i> sp.)                             | <b>-</b>   | <b>Yes</b> | <b>Yes</b> | <b>Yes</b> | <b>Yes</b> | <b>Yes</b> |            | <b>Yes</b> |
| Quillwort<br>( <i>Isoetes</i> sp.)                                      | -          | -          | -          | -          | -          | -          |            | -          |
| White waterlily<br>( <i>Nymphaea odorata</i> )                          | -          | -          | -          | -          | -          | -          |            | -          |
| <b>Variable leaved milfoil</b><br>( <i>Myriophyllum heterophyllum</i> ) | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   |            | <b>-</b>   |
| Red-leaf pondweed<br>( <i>Potamogeton epihydrus</i> )                   | -          | -          | -          | -          | -          | -          |            | -          |
| Muskgrass<br>( <i>Nitella</i> sp.)                                      | -          | Yes        | Yes        | Yes        | Yes        | Yes        |            | Yes        |
| Stonewort<br>( <i>Chara</i> sp.)  | -          | Yes        | Yes        | Yes        | -          | Yes        |            | -          |
| Hedgehyssop<br>( <i>Gratiola</i> sp.)                                   | -          | Yes        | -          | -          | -          | -          |            | -          |
| <b>Curly-leaf pondweed</b><br>( <i>Potamogeton crispus</i> )            | <b>-</b>   | <b>-</b>   | <b>Yes</b> | <b>Yes</b> | <b>Yes</b> | <b>Yes</b> | <b>Yes</b> | <b>Yes</b> |
| Needle spikerush<br>( <i>Eleocharis acicularis</i> )                    | -          | -          | -          | -          | -          | -          |            | Yes        |

## NEAR Middle Bolton Species List

| Species List   | 2019 | 2020 |
|--|------|------|
| Aquatic moss ( <i>Fontinalis sp.</i> )                           | Yes  | Yes  |
| Arrowhead ( <i>Sagittaria graminea</i> )                         | Yes  | Yes  |
| Broadleaf arrowhead ( <i>Sagittaria latifolia</i> )              | -    | Yes  |
| Cattail ( <i>Typha sp.</i> )                                     | Yes  | Yes  |
| Common bladderwort ( <i>Utricularia macrorhiza</i> )             | -    | Yes  |
| Common reed ( <i>Phragmites australis</i> )                      | Yes  | Yes  |
| Cyanobacteria benthic mat ( <i>Lyngbya</i> )                     | Yes  | Yes  |
| Emergent bur-reed ( <i>Sparganium sp.</i> )                      | -    | Yes  |
| Emergent spikerush ( <i>Eleocharis sp.</i> )                     | Yes  | -    |
| Fanwort ( <i>Cabomba caroliniana</i> )                           | Yes  | Yes  |
| Filamentous algae  | Yes  | Yes  |
| Floating bladderwort ( <i>Utricularia radiata</i> )              | Yes  | Yes  |
| Floating bur-reed ( <i>Sparganium fluctuans</i> )                | -    | Yes  |
| Humped bladderwort ( <i>Utricularia gibba</i> )                  | -    | Yes  |
| Lesser bladderwort ( <i>Utricularia minor</i> )                  | -    | Yes  |
| Low watermilfoil ( <i>Myriophyllum humile</i> )                  | -    | Yes  |
| Mudmat ( <i>Glossostigma cleistanthum</i> )                      | Yes  | -    |
| Needle spikerush ( <i>Eleocharis acicularis</i> )                | Yes  | Yes  |
| Pickerelweed ( <i>Pontedaria cordata</i> )                       | Yes  | Yes  |
| Primrose-Willow ( <i>Ludwigia sp.</i> )                          | -    | Yes  |
| Purple bladderwort ( <i>Utricularia purpurea</i> )               | Yes  | Yes  |
| Quillwort ( <i>Isoetes sp.</i> )                                 | Yes  | Yes  |
| Ribbon-Leaf pondweed ( <i>Potamogeton epihydrus</i> )            | Yes  | Yes  |
| Slender naiad ( <i>Najas flexilis</i> )                          | -    | Yes  |
| Small pondweed ( <i>Potamogeton pusillus</i> )                   | Yes  | Yes  |
| Snailseed pondweed ( <i>Potamogeton bicupulatus</i> )            | -    | Yes  |
| Softstem bulrush ( <i>Schoenoplectus sp.</i> )                   | -    | Yes  |
| Spotted pondweed ( <i>Potamogeton pulcher</i> )                  | Yes  | Yes  |
| Stonewort ( <i>Nitella sp.</i> )                                 | Yes  | Yes  |
| Variable-Leaf watermilfoil ( <i>Myriophyllum heterophyllum</i> ) | Yes  | Yes  |
| Watershield ( <i>Brasenia schreberi</i> )                        | Yes  | Yes  |
| White water lily ( <i>Nymphaea odorata</i> )                     | -    | Yes  |
| Yellow water lily ( <i>Nuphar variegata</i> )                    | Yes  | Yes  |

Both the Lower and Middle Bolton aquatic plant surveys suggest that herbicide treatments have not had prolonged impacts to the diversity of native species.