| | | | |
|---|---|---|---|
| TO: | William Turner, Westford Conservation Commission | DATE: | September 11, 2013 |
| FROM: | Carl Nielsen, CLM | ESS PROJECT NO.: | N475-001 |
| SUBJECT: | Nabnasset Lake – Annual Report Card | | |
| COPY TO: | David Brody, Nabnasset Lake Association<br>Dan Doherty, Nabnasset Lake Association | | |

## SUMMARY OF ANNUAL MONITORING WITH REPORT CARD

ESS Group, Inc. (ESS) completed our survey of Nabnasset Lake on August 29, 2013 per the conditions established previously by the Westford Conservation Commission. The attached "Nabnasset Lake Management Annual Report Card for 2013" summarizes our findings based on the conditions at the time of survey. ESS has also included Tables 1a, 1b and 1c summarizing the water quality testing results obtained on August 29 and Table 2 summarizing the Shipley Swamp plant plot data from this year and prior years for comparison. A photolog containing images of each plant plot is also attached. Figure 1 is provided to illustrate the areas of invasive plant cover observed in 2013.

### Summary of Findings

#### Water Quality

Water quality within Nabnasset Lake remains in good to excellent condition in 2013 (Table 1a). A surface and bottom sample was collected from within Nabnasset Lake and a single surface sample was collected near the outlet of Shipley Swamp. Total phosphorus levels at the surface remain well below the critical threshold (0.02 mg/l) at which water quality shows the effects of degradation through nutrient enrichment via associated algal blooms. This year, total phosphorus near the bottom of Nabnasset Lake was also in lower than in recent years (0.018 mg/L). Given the development of cyanobacteria (blue-green algae) blooms on Nabnasset Lake at the end of the summer in 2012, these low phosphorus levels should be considered desirable. Excessive phosphorus may encourage nuisance cyanobacteria growth because many of these species can fix nitrogen (a primary nutrient) directly from the atmosphere, thereby allowing them to outcompete beneficial algae during the late summer to early autumn months.

Dissolved oxygen, specific conductance and turbidity levels observed fall within the normal range that would be expected in a healthy Merrimack River watershed lake and are comparable to previous years (Table 1b). A temperature and dissolved oxygen profile collected from within the lake indicates that a thermocline appears to be in development between five and six meters below the water surface (Table 1c). This is also consistent with data obtained in previous years.

**Table 1a. Laboratory Measured Water Quality Data for Nabnasset Lake, August 29, 2013**

| Sample ID | Total Phosphorus (mg/L) | Total Nitrogen (mg/L) |
|---|---|---|
| WQ-1 (Shipley Swamp) | 0.011 | 0.73 |
| WQ-2S (Lake Surface) | 0.011 | 0.72 |
| WQ-2B (Lake Bottom)* | 0.018 | 0.70 |

* Depth = 19.7 feet (6.0 m)

© 2012 ESS Group, Inc.

**Table 1b. Field Measured Water Quality Parameters for Nabnasset Lake, August 29, 2013**

| Sample ID | Dissolved Oxygen (mg/L) | Dissolved Oxygen (% Saturation) | Specific Conductance (µmhos/cm) | Turbidity (FTU) | Temperature (°C) | pH (SU) |
|---|---|---|---|---|---|---|
| WQ-1 (Shipley Swamp) | 5.84 | 71.0 | 0.31 | 0.94 | 24.7 | 7.5 |
| WQ-2S (Lake Surface) | 8.30 | 101.4 | 0.3 | NS | 24.9 | 7.5 |
| WQ-2B (Lake Bottom)* | 0.03 | 0.3 | 0.3 | 3.40 | 20.9 | 6.95 |

* Depth = 19.7 feet (6.0 m)

**Table 1c. Dissolved Oxygen and Temperature Profile at the In-lake Sampling Station (WQ-2), August 29, 2013***

| Depth (m) | Temperature (°C) | Dissolved Oxygen (mg/L) | Dissolved Oxygen (% Saturation) |
|---|---|---|---|
| 0.0 | 24.9 | 8.30 | 101.4 |
| 1.0 | 25.0 | 8.28 | 102.4 |
| 2.0 | 25.0 | 8.35 | 103.2 |
| 3.0 | 25.0 | 8.30 | 101.5 |
| 4.0 | 25.1 | 8.30 | 98.9 |
| 5.0 | 25.1 | 4.60 | 60.0 |
| 6.0 | 20.9 | 0.03 | 0.3 |

*Data from below 6.0 meters was not included due to probe contact with sediment at this point

### Invertebrate Community

The invertebrate community in the Nabnasset Lake and Shipley Swamp was comparable to observations made during prior assessments.

Freshwater mussel densities were lower than the record high densities seen in 2012. However, for many years mussel densities in the monitored areas of Nabnasset Lake have shown a great deal of interannual variability. Therefore, this pattern in observed densities is not unusual.

Other mollusks, including two species of gastropods were found in Nabnasset Lake in 2013. Mollusks were also present in Shipley Swamp, albeit at lower densities than in Nabnasset Lake.

Observed diversity of other invertebrates in Nabnasset Lake and Shipley Swamp was less than in 2012 and species composition was different. However, much of this may be attributable to seasonality. Furthermore, a variety of habitat supportive of a healthy aquatic invertebrate community was observed.

### Erosion

As in previous years, only slight evidence of erosion was observed in the area immediately downstream of the dam. This erosion does not appear to have increased over prior years.

Only minor wave erosion was observed along the Nabnasset Lake shoreline. No increase in shoreline erosion or shoreline sloughing was observed.

© 2013 ESS Group, Inc.

**Plant Community**

ESS conducted an aquatic plant survey within the five predefined areas of the pond: the north shore, south shore, shallow cove, outlet cove and submerged island (Figure 1). The results of the survey indicate that Nabnasset Lake continues to support the native aquatic plant community previously observed. Native species observed during the August 29, 2013 survey included tapegrass (*Vallisneria americana*), white water lily (*Nymphaea odorata*), yellow water lily (*Nuphar lutea variegata*), floating-leaf pondweed (*Potamogeton epihydrus*), thinleaf pondweed (*Potamogeon pusillus*), busy naiad (*Najas flexilis*), and spikerush (*Eleocharis sp.*).

Three aquatic invasive species, curly-leaf pondweed (*Potamogeton crispus*), variable-leaf milfoil (*Myriophyllum heterophyllum*), and brittle naiad (*Najas minor*) have been previously documented in Nabnasset Lake.

Curly-leaf pondweed growth was minimal during our August 29, 2013 survey, with only isolated small plants observed. Due to the life cycle of this species, it is not typically present in high densities during the late summer period. The presence of this species in late summer suggests that sprouts from seeds and turions (winter buds) will return to form beds in spring 2014.

As in 2012, no variable-leaf milfoil was observed in Nabnasset Lake during the 2013 aquatic plant survey. This suggests that management of the pond is effectively controlling this species.

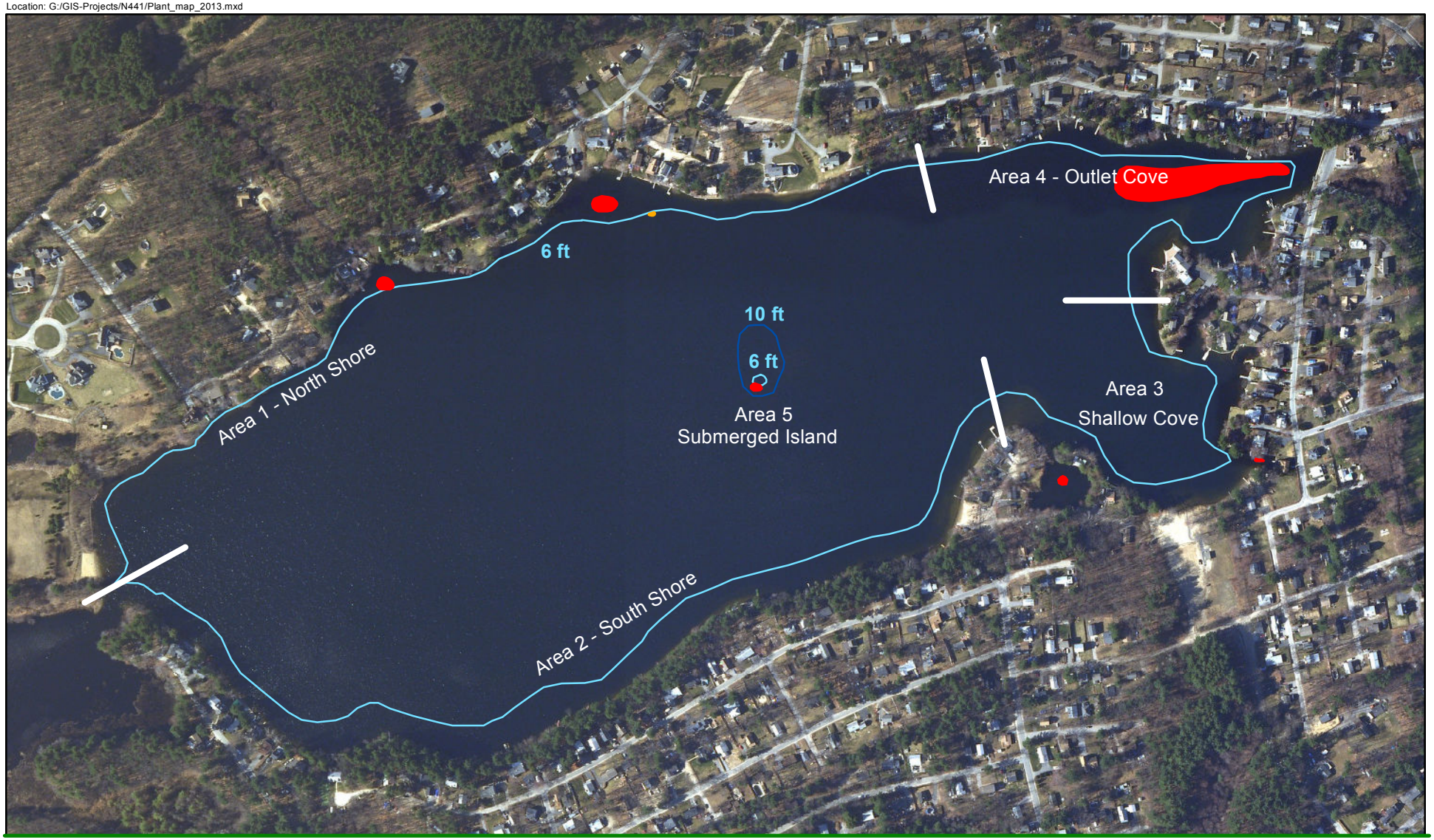
Brittle naiad, originally observed by ESS in 2009 just to the west of Edwards Beach and then in larger patches in 2011, was observed within four of the five aquatic plant monitoring areas in Nabnasset Lake during the 2013 survey. Therefore, brittle naiad appears to be established and widespread in the lake. This species easily fragments when seed is set in late summer, an attribute that allows it to spread seed widely. Although it has not yet been observed to form dense monotypic mats and exclude native plants, this potential does exist.

The primary emergent exotic plant species of concern at Nabnasset Lake and Shipley Swamp is purple loosestrife (*Lythrum salicaria*). As in previous years, this emergent wetland species was observed growing in scattered patches along the shoreline of Nabnasset Lake and within Shipley Swamp. The trends in purple loosestrife cover in Shipley Swamp have varied from location to location. Cover has declined steadily since 2004 at Plot A, varied from year to year at Plot B, and remained very low to nil at Plot C (Table 2). This species should continue to be monitored closely and treated as needed to prevent further spread.

Native species diversity in Shipley Swamp continues to be high. A complete list of plants found within the Shipley Swamp vegetation plots is provided in Table 2.

© 2013 ESS Group, Inc.

Location: G:/GIS-Projects/N441/Plant_map_2013.mxd




NABNASSET LAKE
Westford, Massachusetts

Scale = 1" = 500'
0 500 Feet

Source: 1) MassGIS, Color Ortho Photos, 2001
2) ESS, Plant cover, 2013; 3) ACT, Bathymetry, 2002

**Legend**

**Invasive Species Cover**

- Brittle Naiad (Sparse, 1.44 acres)
- Curly-leaf Pondweed (Sparse, <0.1 acre)

**Aquatic Invasive Macrophyte Survey**
**August 29, 2013**

**Figure 1**

**Table 2. Plant Plot Monitoring Data from 2002 to Present Showing Percent Plant Cover in each 4-m$^2$ Plot***

| | | 2002 (April) | | | 2004 (August) | | | 2007 (June) | | | 2009 (September) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **Plot A** | **Plot B** | **Plot C** | **Plot A** | **Plot B** | **Plot C** | **Plot A** | **Plot B** | **Plot C** | **Plot A** | **Plot B** | **Plot C** |
| Red Maple | *Acer rubrum* | | | | | | | | | | | | |
| Speckled Alder | *Alnus incana* | | | | | | | | | | | | |
| Swamp Milkweed | *Asclepias incarnata* | | | | | | | | | | | 5% | |
| Watershield | *Brasenia schreberi* | | | | | | | | | | | | |
| Water Calla | *Calla palustris* | | | 3% | | | | | | | | | |
| Sedge | *Carex sp.* | | | 50% | | | | | | | | | |
| Coontail | *Ceratophyllum demersum* | | | | | | | | | | | | |
| Leatherleaf | *Chamaedaphne calyculata* | | | 10% | | | | | | | | | |
| Muskgrass | *Chara sp.* | | | | | | | | | | | | |
| Filamentous Green Algae | Chlorophyta | | | | | Trace | | | | | | | |
| Sweet Pepperbush | *Clethra alnifolia* | | | | | | | | | | | | |
| Flatsedge | *Cyperus sp.* | | | | | | | | | | | | |
| Swamp Loosestrife | *Decodon verticillatus* | | | | | | | | | | | | |
| Three-way Sedge | *Dulichium arundinaceum* | | | | | | | | | | | | |
| Spike rush | *Eleocharis sp.* | | | | 3% | 35% | | | 50% | | | 50% | |
| Golden Hedge Hyssop | *Gratiola aurea* | | | | | 3% | | | 3% | | | 15% | |
| Marsh St. Johns Wort | *Hypericum virginicum* | | | | Trace | 10% | | | 10% | | | 10% | |
| Jewelweed | *Impatiens capensis* | | | | | | | | | | | | |
| Bog Laurel | *Kalmia polifolia* | | | 1% | | | | | | | | | |
| Duckweed | *Lemna minor* | | | | | | | | | | | | |
| Purple Loosestrife | *Lythrum salicaria* | 40% | | | 10% | | 3% | 10% | 3% | 3% | 5% | 5% | |
| Mint | *Mentha sp.* | | | | | 3% | | | 3% | | | | |
| Moss | *Musci sp.* | | | | | | | | | | | | 80% |
| Variable Watermilfoil | *Myriophyllum heterophyllum* | | | | | | | | | | | | |
| Slender Waternymph | *Najas flexilis* | | | | 3% | | | | | | | | |
| Spatterdock | *Nuphar variegatum* | | 3% | | | | | | | | | | |
| White Water Lily | *Nymphaea odorata* | | | | 10% | 40% | | 10% | 10% | | 10% | 10% | |
| Arrow Arum | *Peltandra virginica* | | | | Trace | 3% | Trace | | 3% | Trace | | | 5% |
| Water Smartweed | *Polyganum sp.* | | | | | | | | | | | | |
| Pickerelweed | *Pontedaria cordata* | | | | | | 3% | | | | | | |
| Ribbonleaf Pondweed | *Potamogetan epihydrus* | | | | | 10% | | | | 5% | | | |
| Oakes Pondweed | *Potamogetan natans* | | | | | | | | | | | | Trace |
| Woolgrass | *Scripus cyperinus* | | | | 3% | | | | | | | | |
| Bur-reed | *Sparganium americana* | 5% | 3% | | | | | | | | | | |
| Sphagnum | *Sphagnum sp.* | | | 10% | | | | | | 5% | | | |
| Steeplebush | *Spiraea tomentosa* | | | | | | | | | | | | |
| Broad Leaved Cattail | *Typha latifolia* | | 20% | | 3% | | | 80% | | | 80% | | |
| Flat-leaf Bladderwort | *Utricularia intermedia* | | | | | | | | | | | | |
| Common Bladderwort | *Utricularia macrorhiza (vulgaris)* | | | | | 3% | | | 3% | 3% | | | |
| Highbush Blueberry | *Vaccinium corymbosum* | | | 10% | | | | | | 3% | | | 10% |
| Wild Rice | *Zizania aquatica* | | | | 80% | | 90% | 2% | | 80% | 5% | 5% | 5% |

* Percent cover based on surface area occupied, due to variations in plant heights and rounding estimates the total coverage can exceed 100%.

**Table 2. Plant Plot Monitoring Data from 2002 to Present Sho**

| | | 2011 (August) | | | 2012 (May) | | | 2013 (August) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **Plot A** | **Plot B** | **Plot C** | **Plot A** | **Plot B** | **Plot C** | **Plot A** | **Plot B** | **Plot C** |
| Red Maple | *Acer rubrum* | | | | | Trace | | 5% | | |
| Speckled Alder | *Alnus incana* | | 15% | | | 20% | | | 25% | |
| Swamp Milkweed | *Asclepias incarnata* | | | | | | | | | |
| Watershield | *Brasenia schreberi* | | | Trace | | | | | | 5% |
| Water Calla | *Calla palustris* | | | | | | | | | |
| Sedge | *Carex sp.* | | | | | Trace | | | 5% | |
| Coontail | *Ceratophyllum demersum* | | | | | | | | Trace | |
| Leatherleaf | *Chamaedaphne calyculata* | | 5% | | | 10% | | | 5% | |
| Muskgrass | *Chara sp.* | | | 20% | | | | | | 15% |
| Filamentous Green Algae | Chlorophyta | | | | | | | | | |
| Sweet Pepperbush | *Clethra alnifolia* | | Trace | | | 5% | | | 5% | |
| Flatsedge | *Cyperus sp.* | | Trace | | | | | | | |
| Swamp Loosestrife | *Decodon verticillatus* | | 5% | | | Trace | | | | |
| Three-way Sedge | *Dulichium arundinaceum* | | Trace | | | Trace | | | | |
| Spike rush | *Eleocharis sp.* | | 40% | | | 40% | | | 30% | |
| Golden Hedge Hyssop | *Gratiola aurea* | | 25% | | | | | | | |
| Marsh St. Johns Wort | *Hypericum virginicum* | | 15% | | | Trace | | | 5% | |
| Jewelweed | *Impatiens capensis* | | | | | | | Trace | | |
| Bog Laurel | *Kalmia polifolia* | | | | | | | | | |
| Duckweed | *Lemna minor* | | | | | | | 30% | | |
| Purple Loosestrife | *Lythrum salicaria* | Trace | 10% | | Trace | 10% | | Trace | 5% | |
| Mint | *Mentha sp.* | | Trace | | | | | | | |
| Moss | *Musci sp.* | | | | | | | | | |
| Variable Watermilfoil | *Myriophyllum heterophyllum* | | | Trace | | | | | | |
| Slender Waternymph | *Najas flexilis* | | | Trace | | | | | | |
| Spatterdock | *Nuphar variegatum* | | | | | | | | | 20% |
| White Water Lily | *Nymphaea odorata* | 10% | 15% | 10% | | 10% | 15% | 40% | 50% | 60% |
| Arrow Arum | *Peltandra virginica* | | | | | | | Trac e | | |
| Water Smartweed | *Polyganum sp.* | | | | | | | Trac e | 5% | |
| Pickerelweed | *Pontedaria cordata* | | | 5% | | | 10% | | | |
| Ribbonleaf Pondweed | *Potamogetan epihydrus* | | | 15% | | | | | Trace | |
| Oakes Pondweed | *Potamogetan natans* | | | 10% | | | | | | |
| Woolgrass | *Scripus cyperinus* | | Trace | | Trace | Trace | | | 10% | 5% |
| Bur-reed | *Sparganium americana* | | | 10% | | | | | | |
| Sphagnum | *Sphagnum sp.* | | | | Trace | 5% | | | | |
| Steeplebush | *Spiraea tomentosa* | | | | | 5% | | Trace | 5% | |
| Broad Leaved Cattail | *Typha latifolia* | 80% | | | 60% | | | 35% | 5% | |
| Flat-leaf Bladderwort | *Utricularia intermedia* | | | Trace | | | 5% | | | |
| Common Bladderwort | *Utricularia macrorhiza (vulgaris)* | | | | | | | | | 10% |
| Highbush Blueberry | *Vaccinium corymbosum* | | | 10% | | | 15% | 10% | | 5% |
| Wild Rice | *Zizania aquatica* | | Trace | | | | | | 5% | 5% |

* Percent cover based on surface area occupied, due to variation

**Summary and Recommendations**

Overall, the existing management program of winter drawdown on an as-needed basis combined with close monitoring efforts and judicious and targeted contact herbicide treatments continues to be effective in controlling the growth of curly-leaf pondweed and variable-leaf milfoil within Nabnasset Lake. This control has been achieved without significant apparent impact to non-target aquatic life.

Variable-leaf milfoil growth currently appears to be under control in Nabnasset Lake. Therefore, no herbicide application for milfoil will likely be necessary in 2014. However, early-season monitoring in 2014 should be completed to confirm this. Similarly, drawdown for milfoil control is not expected to be necessary for winter 2013-14. No fragments of variable-leaf milfoil were noted in the lake. However, upstream sources of variable-leaf milfoil are known to exist and close monitoring in the lake is still recommended.

Curly-leaf pondweed continues to be present in Nabnasset Lake and will likely return early in the growing season of 2014. Although winter drawdown does appear to have provided control of this species above the 6-foot depth contour, we recommend that problem patches of curly-leaf pondweed in deeper waters be treated with diquat or hand pulled prior to seed and turion formation, which occurs by early June.

Brittle naiad has increased its cover in Nabnasset Lake since first observed in 2009 and is growing both both above and below the 6-foot depth contour. This plant reproduces primarily from seed and may not respond to drawdown in the same way that variable-leaf milfoil and, to a lesser extent, curly-leaf pondweed have. Therefore, diquat could be used to manage brittle naiad, as needed. This would be most effective if performed prior to the seed set anytime between early June and late August.

If you have any questions regarding this report or the future management of Nabnasset Lake please call Carl Nielsen at (401) 330-1224.

© 2012 ESS Group, Inc.

## Nabnasset Lake Management Annual Report Card for 2013

| RESOURCE | A | B | C | D | F | GRADE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | '07 | '09 | '11 | '12 | '13 |
| **Plant Community (<6' deep)** | | | | | | | | | | |
| Aquatic Native Plants | Dominant | Common | Occasional | Rare | Absent | B | B | B | B | B |
| Emergent Native Plants | Dominant | Common | Occasional | Rare | Absent | B | B | B | B | B |
| Aquatic Exotic/Invasive Plants | Absent | Rare | Occasional | Common | Dominant | B | B | B | B | B |
| Emergent Exotic/Invasive Plants | Absent | Rare | Occasional | Common | Dominant | B | B | B | B | B |
| **Plant Community (>6' deep)** | | | | | | | | | | |
| Submerged Aquatic Native Plants | Dominant | Common | Occasional | Rare | Absent | B | A | B | B | B |
| Aquatic Exotic/Invasive Plants | Absent | Rare | Occasional | Common | Dominant | NS | B | C | C | B |
| **Invertebrate Community (<6' deep)** | | | | | | | | | | |
| Freshwater Mussels | >0.5/ft2 | 0.2-0.5/ft2 | 0.1-0.2/ft2 | 0-0.1/ft2 | Absent | D | D | D* | B | D |
| Other Macroinvertebrates | >8 taxa | 6-8 taxa | 3-5 taxa | 1-2 taxa | Absent | B | B | C | C | C |
| **Invertebrate Community (>6' deep)** | | | | | | | | | | |
| Freshwater Mussels | >0.5/ft2 | 0.2-0.5/ft2 | 0.1-0.2/ft2 | 0-0.1/ft2 | Absent | B | C | D | A | D |
| Other Macroinvertebrates | >8 taxa | 6-8 taxa | 3-8 taxa | 1-2 taxa | Absent | B | B | B | B | C |
| **Water Quality** | | | | | | | | | | |
| Clarity (turbidity/Secchi depth) | <1 NTU or >4m | 1-2 NTU or 3-4m | 2-5 NTU or 2-3m | 5-10 NTU or 1.2-2m | >10 NTU or <1.2m | A | B | C | B | B |
| Phosphorus Concentration (mg/L) | <0.01 | 0.01-0.02 | 0.02-0.03 | 0.03-0.05 | >0.05 | B | A | C | B | B |
| Nitrogen Concentration (mg/L) | <0.5 | 0.5-0.8 | 0.8-1.0 | 1.0-2.0 | >2.0 | D | B | C | D | B |
| Dissolved Oxygen at surface (mg/L) | >10.0 | 7.0-10.0 | 6.0-7.0 | 5.0-6.0 | <5.0 | B | B | B | B | B |
| **Erosion** | | | | | | | | | | |
| Shoreline | No evidence | Wave erosion only | Undercut banks | Bank failures | Numerous bank failings | B | B | B | B | B |
| Downstream of Dam | No evidence | Limited undercut banks | Extensive undercut banks | Loss of minor shoreline vegetation | Loss of trees and roots | B | B | B | B | B |
| **Shipley Swamp** | | | | | | | | | | |
| **Plant Community (<6' deep)** | | | | | | | | | | |
| Aquatic Native Plants | Dominant | Common | Occasional | Rare | Absent | A | A | A | A | A |
| Emergent Native Plants | Dominant | Common | Occasional | Rare | Absent | A | A | A | A | A |
| Aquatic Exotic/Invasive Plants | Absent | Rare | Occasional | Common | Dominant | B | B | C | B | A |
| Emergent Exotic/Invasive Plants | Absent | Rare | Occasional | Common | Dominant | C | C | C | C | C |
| **Plant Community (>6' deep)** | | | | | | | | | | |
| Aquatic Native Plants | Dominant | Common | Occasional | Rare | Absent | B | B | B | B | B |
| Aquatic Exotic/Invasive Plants | Absent | Rare | Occasional | Common | Dominant | B | B | B | B | A |
| **Invertebrate Community (<6' deep)** | | | | | | | | | | |
| Freshwater Mussels | >0.5/ft2 | 0.2-0.5/ft2 | 0.1-0.2/ft2 | 0-0.1/ft2 | Absent | D | D | D* | D | D |
| Other Macroinvertebrates | >8 taxa | 6-8 taxa | 3-8 taxa | 1-2 taxa | Absent | B | B | C | C | C |

NS: Not scored; *Based on observations by NLPA volunteers

2013 © ESS Group, Inc.

## NOTES FOR COMPLETION OF REPORT

1. For the plant community assessment, the locations to be evaluated in Nabnasset Lake should include representative shoreline segments along the north and south shores, a shallow sloped cove, and the submerged island near the middle of the lake. For invertebrates, water quality, and erosion, the locations should be consistent with previous areas of assessment in order to compare with baseline data. In addition, water quality samples should be collected at the surface and bottom of the lake. Grades for each resource can be recorded for each individual area assessed in a field notebook, however, only a composite grade for the entire lake should be recorded on the report card.
2. Plant community assessment in Shipley Swamp should be consistent with the plant plot locations assessed during previous years. Macroinvertebrate sampling locations should also be consistent with sites sampled in the swamp previously. Grades for each resource can be recorded for each individual area assessed in a field notebook, however, only a composite grade for the entire swamp should be recorded on the report card.
3. Observations for plants and invertebrates made in shallow water (<6') should be made with appropriate gear including plant rakes, clam rake with ¼" mesh openings, and direct observation via aquascope® or snorkel gear. Observations made in deeper water (>6') must be made with either snorkel gear or underwater video camera.
4. A completed Report Card should be submitted to the Westford Conservation Commission and the Nabnasset Lake Preservation Association (NLPA) each year by no later than September 15th. Recommendations for the upcoming year should be provided along with the Report Card so that any management actions deemed necessary could be undertaken. Management recommendations are expected to focus on winter drawdown beginning in November, herbicide application the following June, a combination of drawdown and herbicide application, or no action.
5. Copies of any field notes, laboratory data, or other results used to derive the grade for each resource should be made available to the Conservation Commission and/or NLPA upon request.
6. Scoring for Plant Community Resources is based on an estimation the plant coverage within the littoral zone (lake area where light penetration reaches bottom) for each vegetation category listed on the Report Card. Scoring is defined as follows:
   - Absent — Vegetation category is not present at location observed
   - Rare — Vegetation category occupies <5% of the littoral bottom area
   - Occasional — Vegetation category occupies 5% to 10% of the littoral bottom area
   - Common — Vegetation category occupies 10% to 25% of the littoral bottom area
   - Dominant — Vegetation category occupies >25% of the littoral bottom area



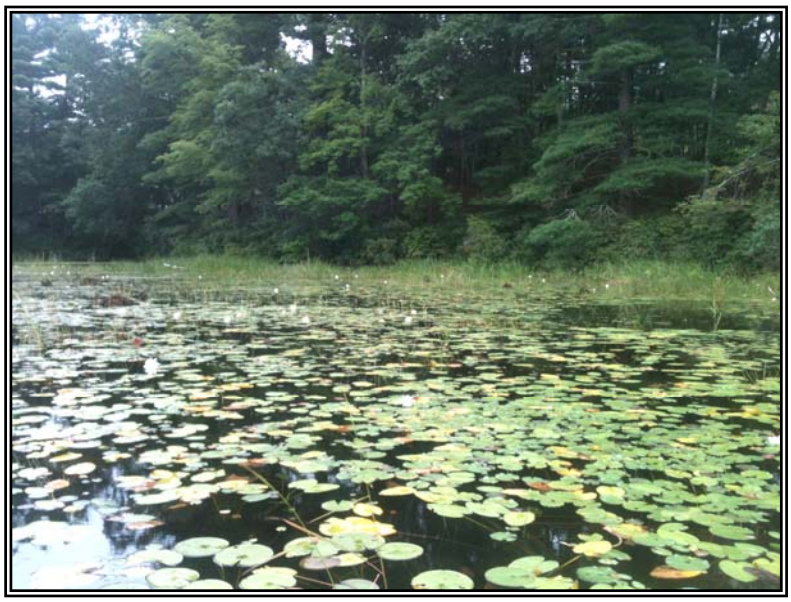
© 2013 ESS Group, Inc.

**Photograph No.: 1**
View of Shipley Swamp near vegetation plot A.

**Photograph No.: 2**
View of vegetation plot B.



© 2013 ESS Group, Inc.



**Photograph No.: 3**
View of vegetation plot C.



© 2013 ESS Group, Inc.