

Saugus River Watershed Action Plan to Address Invasive Aquatic Vegetation

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INTRODUCTION

The Saugus River Watershed Council is a non-profit organization founded in 1991 to protect and restore the natural resources of the Saugus River watershed. Thanks to a generous two-year grant from the Massachusetts Environmental Trust, SRWC initiated a comprehensive effort to begin identifying and working to remove aquatic invasive vegetation from the Saugus River watershed.

SRWC hired GeoSyntec Consultants to provide technical expertise associated with identifying and developing recommendations to address freshwater aquatic invasive vegetation in the upper reaches of the Saugus River watershed.

An advisory group was established to provide additional expertise and input from stakeholders throughout the project period. SRWC gratefully acknowledges the participation, technical advice, feedback, and volunteer assistance from the following members of the technical advisory group:

- Betty Adelson, Lynnfield Conservation Commission
- Marc Albert, National Park Service
- Dan and Pam Burgess, volunteers
- Rick Dawe, Lynn Water and Sewer Commission
- Anthony Guthro, Massachusetts Department of Conservation and Recreation
- Bob Hartzel, GeoSyntec Consultants
- Doug Heath, U.S. Environmental Protection Agency
- Joe James, Friends of Rumney Marsh
- Joan LeBlanc, Saugus River Watershed Council
- Frank McKinnon, Saugus Conservation Commission
- Chris Payne, Saugus River Watershed Council
- Elaine Vreeland, Wakefield Conservation Commission

Special thanks also to the following individuals for technical advice, support and feedback regarding the monitoring protocol and interpretation of results associated with our evaluation of algal blooms in Lake Quannapowitt.

- Joan Beskenis, MA Department of Environmental Protection
- Mike Celona, MA Department of Public Health
- Jody Connor, NH Department of Environmental Services
- Roger Frymire, volunteer
- Jim Haney, University of New Hampshire
- Doug Heath, U.S. Environmental Protection Agency
- Michael Hill, U.S. Environmental Protection Agency

This Action Plan summarizes the scientific research conducted to assess aquatic invasive vegetation in the watershed and provides short and long-term recommendations for monitoring and removing them.

SECTION 1: AQUATIC VEGETATION ASSESSMENT

1.1 Introduction

Geosyntec Consultants (Geosyntec) was contracted by the Saugus River Watershed Council (SRWC) to conduct preliminary aquatic vegetation assessments at selected water bodies within the Saugus River Watershed. The purpose of the preliminary vegetation assessments was (1) to determine the presence of non-native, invasive species and (2) to identify water bodies where more detailed field investigations and/or efforts to control invasive plants are recommended.

1.2 Methodology

On August 1, 2007, June 19, 2008, and July 10, 2008, Geosyntec and the Saugus River Watershed Council conducted field surveys to identify aquatic vegetation species within the following water bodies:

Water Body	Town	Other
Reedy Meadow Lower Pond	Lynnfield/Wakefield	
Reedy Meadow Upper Pond	Lynnfield/Wakefield	
Saugus River (downstream of LWSC Dam)	Lynnfield/Wakefield	
Saugus River (LWSC Dam to Kimball Lane)	Lynnfield/Wakefield	
LWSC Diversion Canal	Lynnfield	
Pillings Pond	Lynnfield	
Hawkes Pond	Lynnfield/Saugus	Lynn Woods Reservation
Griswold Pond	Saugus	Golden Hills ACEC
Unnamed Pond south of Griswold Pond	Saugus	Golden Hills ACEC
Spring Pond	Saugus	Golden Hills ACEC
Silver Lake	Saugus	Breakheart Reservation
Pearce Lake	Saugus	Breakheart Reservation
Walden Pond	Lynn/Saugus	Lynn Woods Reservation
Flax Pond	Lynn	
Sluice Pond	Lynn	

The water bodies listed above were selected for assessment by Joan LeBlanc of the SRWC who accompanied Bob Hartzel of Geosyntec during both the August 1, 2007 and June 19, 2008 field investigations. Betty Adelson of the Lynnfield Conservation Commission also participated in the June 2008 surveys. Anthony Guthro from the Massachusetts Department of Conservation and Recreation (DCR) provided background information and recommended sites to review at Breakheart Reservation.

Rick Dawe of the Lynn Water and Sewer Commission provided information about potential problem sites located within the City of Lynn's reservoir system. At each water body, aquatic vegetation was identified from the shoreline by visual inspection and by using an aquatic vegetation grappling hook to sample submersed vegetation. The survey of Flax Pond in June 2008 was conducted by Bob Hartzel and Joan LeBlanc via kayaks. The July 10, 2008 field investigation of the main stem of the Saugus River from the Lynn Water and Sewer Commission Dam to Kimball Lane was conducted by Joan LeBlanc and Chris Payne of SRWC by walking through the river in waders.

During 2009, less formal surveys were conducted to follow-up on water chestnut identification and removal projects implemented during 2008.

1.3 Vegetation Assessment Results

The macrophyte species observed at each water body during the 2007 and 2008 field investigations are listed on the following pages. These results are not intended to represent a comprehensive inventory of all macrophytes growing within the water bodies. In general, the lists represent the species observed from a limited number of shoreline locations. Non-native species are noted in each table with an asterisk and red text.

REEDY MEADOW LOWER POND (Lynnfield/Wakefield)

Plant Species	Common Name
<i>Lemna sp.</i>	Duckweed
<i>Potamogeton epiphydrus</i>	Ribbonleaf pondweed
<i>Ceratophyllum demersum</i>	Coontail
<i>Wolffia sp.</i>	Watermeal

Comments and Recommendations:

- No non-native species observed.

REEDY MEADOW UPPER POND (Lynnfield/Wakefield)

Plant Species	Common Name
<i>Lemna sp.</i>	Duckweed
<i>Wolffia sp.</i>	Watermeal
<i>Potamogeton epiphydrus</i>	Ribbonleaf pondweed
<i>Ceratophyllum demersum</i>	Coontail
<i>Nuphar sp.</i>	Yellow Water Lily
<i>Elodea canadensis</i>	Waterweed
* <i>Trapa natans</i>	Water Chestnut



Water Chestnut

Comments and Recommendations:

- A small infestation of water chestnut observed, with a small number of floating rosettes observed on both the 2007 and 2008 survey dates. Control of this infestation should be a high priority. The prospects for control of this highly invasive plant are good if an infestation is caught in its early stage. This annual plant tends to produce seeds in July or August, so an effort should be made early each summer to pull out any new plants before they propagate. Seeds can remain in the sediment for several years before sprouting, so multiple years of control efforts will be required before the "seed bank" (seeds that have accumulated in the bottom sediment) in each water body becomes depleted.

For relatively small areas of infestation, such as those observed in the Reedy Meadow area, hand pulling can be an effective and low-cost control technique. The roots of water chestnut plants are typically quite shallow, making it possible to pull the entire plant and root structure out in most cases. A slow and steady pulling motion yields the best results and limits the number of plants that break off, leaving the roots and seeds in the sediment.

All harvested plants should be disposed of or composted in an area well away from the water's edge.

Ongoing monitoring and harvesting (annually at a minimum) is strongly recommended for each infested area to prevent the water chestnut infestations from getting out of control.

LWSC DIVERSION CANAL (Lynnfield)

Plant Species	Common Name
<i>Sparganium sp.</i>	Bur-reed
<i>Typha latifolia</i>	Cattail
<i>Pontederia cordata</i>	Pickeralweed

Comments and Recommendations:

- No non-native species observed.

SAUGUS RIVER (downstream of LWSC Dam, Lynnfield/Wakefield)

Plant Species	Common Name
* <i>Trapa natans</i>	Water Chestnut

Comments and Recommendations:

- A small number of water chestnut rosettes were observed in the area immediately downstream of the LWSC dam during the 2007 survey. See Water Chestnut management recommendations above for Reedy Meadow Upper Pond.

SAUGUS RIVER (LWSC Dam to Kimball Lane, Lynnfield/Wakefield)

Plant Species	Common Name
<i>Elodea canadensis</i>	Waterweed
* <i>Cabomba caroliniana</i>	Fanwort
* <i>Myriophyllum heterophyllum</i>	Variable Milfoil
* <i>Trapa natans</i>	Water Chestnut



Water Chestnut

Comments and Recommendations:

- A small number of water chestnut rosettes were observed in the area between the LWSC dam and Route 128 overpass during the July 2008 survey. See Water Chestnut management recommendations above for Reedy Meadow Upper Pond.
- Fanwort and Variable Milfoil were identified downstream of Route 128 in the slower moving segments of the Saugus River.

PILLINGS POND (Lynnfield)

Plant Species	Common Name
<i>Lemna sp.</i>	Duckweed
<i>Potamogeton pectinatus</i>	Sago pondweed
<i>Nuphar sp.</i>	Yellow Water Lily
* <i>Potamogeton crispus</i>	Curlyleaf Pondweed
* <i>Najas minor</i>	European Naiad

Comments and Recommendations:

- Small amounts of Curlyleaf Pondweed and European Naiad were observed along the pond’s southern shoreline. No management of these species is recommended at this time. Macrophyte growth in general appears to be limited by poor water clarity and sediment substrate alterations due to the prior dredging project.
- Very turbid conditions were observed during both the 2007 and 2008 surveys, with high algal productivity. An apparent blue-green algae bloom was observed on the 2007 survey date. Abundant blue-green algae and filamentous green algae were noted during the 2008 survey.
- Water Chestnut was observed in Pillings Pond during a 2005 survey. See recommendations for Reedy Meadow Upper Pond.
- Lynnfield Conservation Commission recommended adding native plantings along the banks of the pond to reduce runoff.



European Naiad



Curlyleaf Pondweed

HAWKES POND (Lynnfield/Saugus)

Plant Species	Common Name
<i>Lemna minor</i>	Lesser Duckweed
<i>Spirodela polyrhiza</i>	Big Duckweed
<i>Elodea canadensis</i>	Waterweed
<i>Ceratophyllum demersum</i>	Coontail
<i>Utricularia sp.</i>	Bladderwort
<i>Nuphar sp.</i>	Yellow Water Lily
* <i>Potamogeton crispus</i>	Curlyleaf Pondweed
* <i>Najas minor</i>	European Naiad

Comments and Recommendations:

- Small amounts of Curlyleaf Pondweed and European Naiad were observed at shoreline sampling locations. No management of these species is recommended at this time.

GRISWOLD POND (Saugus)

Plant Species	Common Name
<i>Lemna minor</i>	Lesser Duckweed
<i>Utricularia vulgaris</i>	Common Bladderwort
<i>Elodea canadensis</i>	Waterweed
* <i>Cabomba caroliniana</i>	Fanwort
* <i>Myriophyllum heterophyllum</i>	Variable Milfoil

Comments and Recommendations:

- Very dense Fanwort with dense patches of Variable Milfoil observed.
- The options for effective control of both Fanwort and Variable Milfoil are quite limited. Mechanical control (e.g. mechanical cutting/harvesting) is not recommended because these species propagate by vegetative fragments. Although very short term control can be achieved, fragments created by mechanical harvesting tend to spread the infestations and result in a higher plant density when the plant grows back.
- Herbicides can provide control of these species for a relatively short duration. Fanwort is usually best controlled with fluridone, a systemic herbicide that will typically provide a season or two of control. However, fluridone is not effective at treating Variable Milfoil. Variable milfoil is usually best controlled with diquat dibromide, a broad-spectrum contact herbicide that works quickly on a wide range of submerged plants, but also typically has a short duration of effectiveness. Regrowth of some species has been rapid after treatment with diquat in many cases, often within the same year. (Massachusetts Final GEIR on Eutrophication and Aquatic Plant Management, 2004).



Variable milfoil



Fanwort

UNNAMED POND, SOUTH OF GRISWOLD POND (Saugus)

Plant Species	Common Name
<i>Elodea canadensis</i>	Waterweed
<i>Najas flexilis</i>	Bushy Pondweed
<i>Utricularia vulgaris</i>	Common Bladderwort
<i>Nymphaea odorata</i>	White Water Lily
* <i>Marsilea quadrifolia</i>	Water Clover
* <i>Potamogeton crispus</i>	Curlyleaf Pondweed
* <i>Najas minor</i>	European Naiad



Water Clover

Comments and Recommendations:

- A relatively small patch of Water Clover was observed from one of the shoreline monitoring locations. This plant uncommon in Massachusetts, but it is reported to have the potential for nuisance growth. This growth of this plant should be tracked carefully in future years, to determine whether or not it is spreading and if it appears to be outcompeting native species.
- Small quantities of European Naiad and Curlyleaf Pondweed were observed. No management of these species is recommended at this time.

SILVER LAKE (Saugus)

Plant Species	Common Name
<i>Utricularia radiata</i>	Little Floating Bladderwort

Comments and Recommendations:

- No non-native species observed. Very scant overall growth observed.

PEARCE LAKE (Saugus)

Plant Species	Common Name
<i>Utricularia radiata</i>	Little Floating Bladderwort
<i>Nuphar sp.</i>	Yellow Water Lily
* <i>Myriophyllum heterophyllum</i>	Variable Milfoil

Comments and Recommendations:

- Patchy growth of Variable Milfoil was observed at the northern tip of the lake during the 2007 survey. Spot treatment with diquat dibromide could be considered if the infestation appears to be spreading to beyond the lake's northern tip.

WALDEN POND (Lynn/Saugus)

Plant Species	Common Name
<i>Elodea canadensis</i>	Waterweed
<i>Potamogeton perfoliatus</i>	Claspingleaf Pondweed
<i>Potamogeton gramineus</i>	Variable Pondweed

Comments and Recommendations:

- No non-native species observed.

FLAX POND (Lynn)

Plant Species	Common Name
<i>Nymphaea odorata</i>	White Water Lily
<i>Ceratophyllum demersum</i>	Coontail
<i>Decodon verticillatus</i>	Swamp Loosestrife
* <i>Potamogeton crispus</i>	Curlyleaf Pondweed

Comments and Recommendations:

- Very scant overall growth observed, with the exception of dense beds of white water lily.
- A small amount of Curlyleaf Pondweed fragments were observed at several locations. No management of this species is recommended at this time.

SLUICE POND (Lynn)

Plant Species	Common Name
<i>Nuphar sp.</i>	Yellow Water Lily

Comments and Recommendations:

- No non-native species observed.



Yellow Water Lily

SECTION 2: ASSESSMENT OF ALGAE IN LAKE QUANNAPOWITT, WAKEFIELD

2.1 Introduction

During 2008, MDPH finalized its guidelines for blue-green algae known as *Microcystis aeruginosa* in Massachusetts lakes. The agency recognizes that certain strains of *Microcystis* and *Anabaena* make toxins called microcystin and anatoxin that can affect the health of people, especially children, and pets if concentrations exceed a threshold of 14 parts per billion (ppb) or a cell count of 70,000 per milliliter (ml). If toxic algae is swallowed, it can cause an array of symptoms such as diarrhea, nausea and cramps. Skin contact can cause rashes or irritation. Also, if the algae collects as a visible mat or scum, MDPH recommends that immediate warnings be posted by the Board of Health to advise against contact with the water.

Following observations of a significant algal bloom in Lake Quannapowitt, SRWC initiated a sampling program to determine the potential toxicity of algae in the lake.

2.2 Methodology



Fieldwork was collected by SRWC Vice President Doug Heath, a scientist at the U.S. Environmental Protection Agency. All samples were collected and handled in accordance with Massachusetts Department of Environmental Protection protocols for cyanobacteria toxin characterization, and frozen and thawed three times to adequately lyse the cells, according to ELISA analysis (Enviroligix ET022 Qualitubes).

The conductivity meter was calibrated immediately before field measurements with a 1,500 $\mu\text{S}/\text{cm}$ standard conductivity solution, and checked with a 100 $\mu\text{S}/\text{cm}$ standard. The dissolved oxygen sensor for the YSI 85 field meter was calibrated onsite. Samples were conducted once per month from January through April, and every two weeks from May through December.

All samples were taken from Lake Quannapowitt near the outfall to the Saugus River (Latitude: 42.522415683 DEG.N, Longitude: -71.077472880 DEG.W). Water quality and field observations for dissolved oxygen, pH, conductivity, temperature, flow, depth, and transparency were also recorded.



Samples were evaluated to determine whether cyanobacteria toxin and cell counts were below the Massachusetts Department of Public Health recreational water thresholds of 14 ppb and 70,000 cells/ml. MDPH protocol for cyanobacteria is available at:

http://www.mass.gov/Eeohhs2/docs/dph/environmental/exposure/protocol_cyanobacteria.pdf.

2.3 Results

2008 and 2009 sampling results for cyanobacteria are summarized in the table on the following page. Additional monitoring results and field data for all of the sampling parameters are

available by contacting the Saugus River Watershed Council at srw@shore.net.

Add Bacteria Sampling Data Table Here

Comments and Recommendations:

An extensive algae bloom of *Microcystis aeruginosa* developed in the lake in early May 2008. Toxin concentrations exceeded 20 ppb and cells were almost too numerous to count. A MADEP biologist checked the sample and found over 675,800 cells per ml, or more than nine times the health threshold.

Because the May 2008 sample exceeded the state health guidelines for *Microcystis*, health advisories were posted at the lake's three information stations warning people about swimming in the lake or allowing their pets to go in the water. Within two weeks, the cell counts had dropped enough to lift the advisory. Except for the first appearance of *Anabaena* in mid-July, toxin levels and cell counts remained generally low for the rest of the 2008 due to high rainfall, which averaged about 12 inches above normal. At the end of May 2009, cell counts exceeded the MDPH advisory levels. Although concentration advisory levels were not exceeded in May 2009, public health advisories were posted as a precautionary measure (as recommended by the Massachusetts Department of Public Health).

- Monitoring of Lake Quannapowitt should continue to determine if and / or when toxic algal bloom pose a public health problem.
- Continue working with state and local departments of public health to post public health advisory in cases where toxin levels exceed thresholds for freshwater.
- Continue working with state and local environmental agencies to determine the causes of toxic algae and determine appropriate actions for addressing toxic algae.
- Occasional monitoring should be conducted at other site such as Pillings Pond in Lynnfield if warranted by the presence of algal blooms.



SECTION 3: ADDITIONAL ASSESSMENT AND RECOMMENDATIONS

3.1 PROBLEMS IN THE ESTUARY

Although a full evaluation of invasive aquatic plants in the estuarine portion of the Saugus River watershed is beyond the scope of this project, SRWC pursued the strategies outlined below to evaluate and work to eradicate phragmites and pepperweed.

Phragmites



The presence of phragmites has been long-documented in the Saugus River watershed. SRWC participated in the advisory group that developed and published the 2002 Rumney Marshes ACEC Salt Marsh Restoration Plan. Because that plan identified and recommended comprehensive restoration projects for phragmites beds located within the Rumney Marshes ACEC, the geographic focus on mapping phragmites for purposes of this project covers the Saugus River from the Saugus Iron Works downstream to the Boston Street Bridge (the upper boundary of the Rumney Marshes ACEC).

From 2007 through 2009 SRWC has worked with the National Park Service to help facilitate removal of phragmites from a three-acre site along the Saugus River adjacent to the Saugus Iron Works Historic Site. In the fall of 2008, the National Park Service completed a major capital project to excavate and remove phragmites from this site. Photo above shows the site during high tide conditions following phragmites removal, winter 2009. SRWC staff and volunteers are working with National Park Service staff to assist with replanting native intertidal vegetation along the Saugus River bank. SRWC is also working with National Park Service staff to map phragmites beds downstream of the Saugus Iron Works. Recommendations for the future:

- Finish assessment of phragmites beds between the Saugus Iron Works and Boston Street.
- Continue native plantings and monitoring of phragmites removal adjacent to Saugus Iron Works.
- Continue advocating for implementation of salt marsh restoration projects to remove phragmites throughout the Rumney Marshes ACEC and other southern portions of the watershed.

Pepperweed

Pepperweed (*Lepidium latifolium* L.) is an invasive herb that is especially well adapted to coastal wetlands. During 2008 and 2009, pepperweed was identified at several locations in the Saugus River estuary, with the most extensive beds located along the coastal areas of Point of Pines in Revere (shown in photo at right). A pilot project, initiated during the spring of 2009 to begin hand-pulling pepperweed, will be conducted throughout the summer months and re-evaluated in the spring of



2010.

Recommendations for the future:

- Conduct a comprehensive evaluation to identify locations and extent of pepperweed throughout the watershed.
- Continue and assess the success of pilot project to remove pepperweed. Conduct additional removal projects at pilot site as needed.
- Conduct additional projects to remove pepperweed from other sites.

3.2 EDUCATION AND OUTREACH

Educating and involving the public in efforts to evaluate and remove aquatic invasive species is essential to address this environmental problem. The following short and longer-term actions should be implemented:

- Develop website featuring educational resources about aquatic invasives in the Saugus River Watershed
- Create and distribute educational brochures about aquatic invasive vegetation
- Promote simple steps that individuals can take to prevent the spread of aquatic invasive plants
- Incorporate information about aquatic invasive plants into the Saugus River Watershed Council's watershed education program which reaches approximately 1,000 students each year
- Develop tools to engage volunteers in identifying aquatic invasive species in the Saugus River watershed
- Involve volunteers in hands-on projects to remove aquatic invasive species throughout the watershed
- Develop volunteer network to monitor potential recurrence of aquatic invasive vegetation following removal projects
- Develop strategies for educating the broader public at large about aquatic invasive vegetation in the watershed
- Conduct outreach to engage local businesses, boaters and waterfront residents in efforts prevent and remove aquatic invasive species
- Host educational workshops promoting use of native plants and landscaping techniques
- Conduct outreach to yacht clubs, marinas and other local boating groups to promote safe boating techniques aimed at preventing the spread of aquatic invasives
- Continue ongoing collaboration with community based organizations and environmental agencies to ensure coordination of efforts to address aquatic invasives

