11. CPA Project Application Form

[CPC Use Only: Date Received 1/18/2018 By: Robin Eibye
Assigned CPC #2019 - 05]

If possible, use word processor to fill out form. Please answer all questions, use "N/A" if not applicable.

1. a.) Applicant Name and Organization: Last Luening First James
   Organization(s) (if appropriate) Great Ponds Advisory Com.

   b.) Regional Project: Yes_X_? or No?__ If Yes, Town/Organization: Groton Water Depart., Weed Harvest Com., Groton Lakes Association

2. Submission Date: 1/18/2018

3. Applicant Address: St. 711 Martins Pond Rd.
   City/ State: Groton, MA ZIP: 01450

4. Ph. # 585-545-8344 Email: luening11@gmail.com

5. CPA Purpose. Check all that apply:
   Community Housing___ (Affordable Housing: __) Historic Preservation:___. Open Space: : X .
   Recreation _X_

6. Town Committee or boards participating: Great Ponds Advisory Com., Groton Water Depart., Weed Harvest Com.,

7. Project Location/Address: Baddacook Pond, Groton MA

8. Project Name: Baddacook Pond Environmental Restoration – Year 3 (2019)

9. Additional Responsible Parties (If applicable):

Role (specify)	Name	Address	Ph. (w) (cell)	Email
Property/Site Owner	Town of Groton	173 Main St.		
Project Manager	James Luening	711 Martins Pond Rd.	585-545-8344	luening11@gmai.com
Lead Architect				
Project Contractor	Must be bid			
Project Consultants				
Other:				
Other				

10. As appropriate, indicate if proposal requires P&S agreement __ Deed__
    Option agreement ___ Other-describe: N/A

11. a.) Assessor info. (map/ block/ lot id.(s)): N/A b.) Tax classification type: N/A

12. Permits required: Zoning: N/A Historic Preservation: N/A Other :

13. Historic Commission Approval signoff (when required): N/A Date:

14. Funding: a.) Requested from CPC: $ 140,000 b.) Committed from other sources:$ 0

    c.) Annual anticipated total income :$ N/A d.) Annual anticipated total expense: $140,000

    d.) Anticipated net income (loss): $ 0.00 e.) Estimator name/company: Jim Luening

15. CCP Objectives - use codes from **Section 5** to indicate all that apply: 5.1.3, 5.3

16. Project Timelines: Proposed Start Date: 4/1/2019 Projected Complete Date: 12/31/2019

17. Estimated Delivery Date of Completion Report to CPC: 1/31/2020

18. Project description and explanation (attach additional sheets as needed): This is a funding for the third year of a 3 year environmental restoration program. Year 1 has already been successfully completed. Year 2 will be this summer (2018).
See Baddacook Pond Environmental Restoration – Year 3 description description.

19. Feasibility: Both Hydro-raking and weed harvesting are well vetted methods of lake of lake Management

20. List of attachments: 1) See Baddacook Environmental Restoration – Year 3 description
2) Solitude – Baddacook2017_FinalReport
3) Baddaook maps and images
4) Baddacook 2017_Final Report

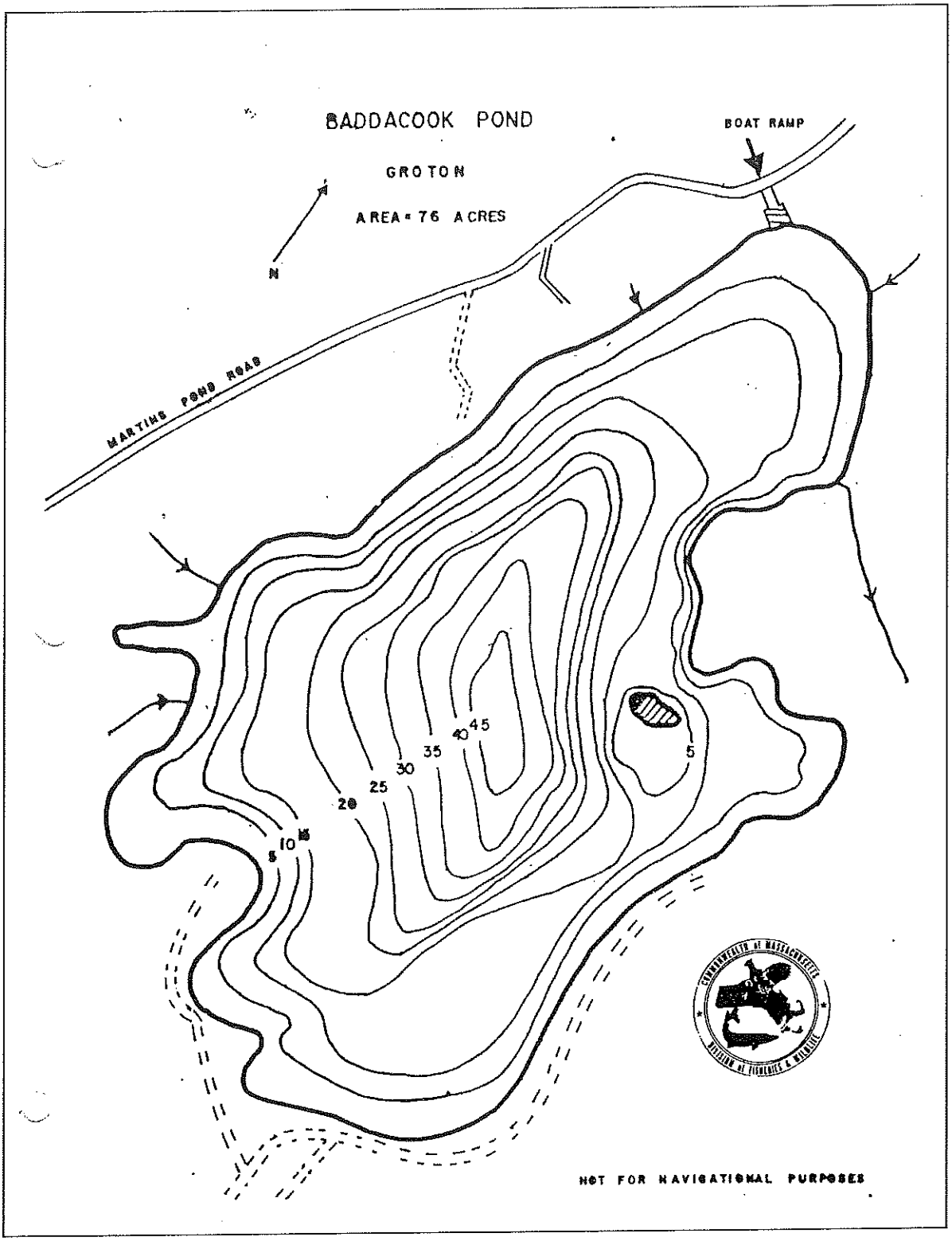
21. Additional Information: Debris from both Weed Harvesting and Hydro-raking will be brought to a shore transfer point. At the transfer point, debris will moved to a dumpster or trailer and transported to a composing location, outside the wet land area.

22. Management Plan: The project will be managed by Jim Luening, GPAC Chairman. He will over see the project and ensure that objectives and target dates are met. Based on the legal bidding process, the contract shall be awarded to the best qualified contractor to perform the work. The contractor shall conduct day to day operations. They will be required to conduct pre and post surveys to determine the effectivity of these methods which will be included in a year end report.

23. Applicant Signature: Jim Luening Date: 1/17/2018

Co Applicant Signature: _____ Date: _____

Co Applicant Signature: _____ Date: _____

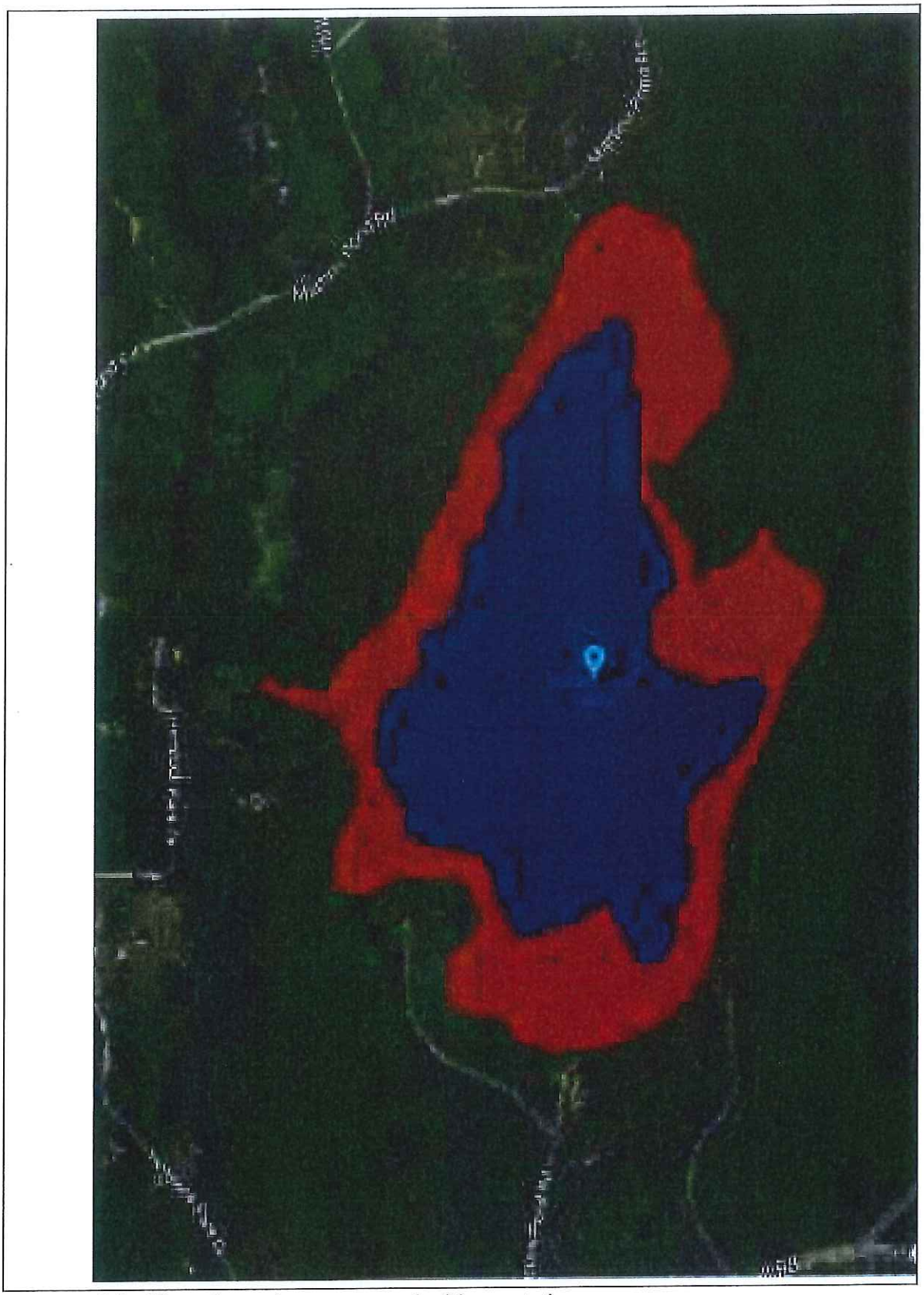


2-1 Baddacook Pond Depths

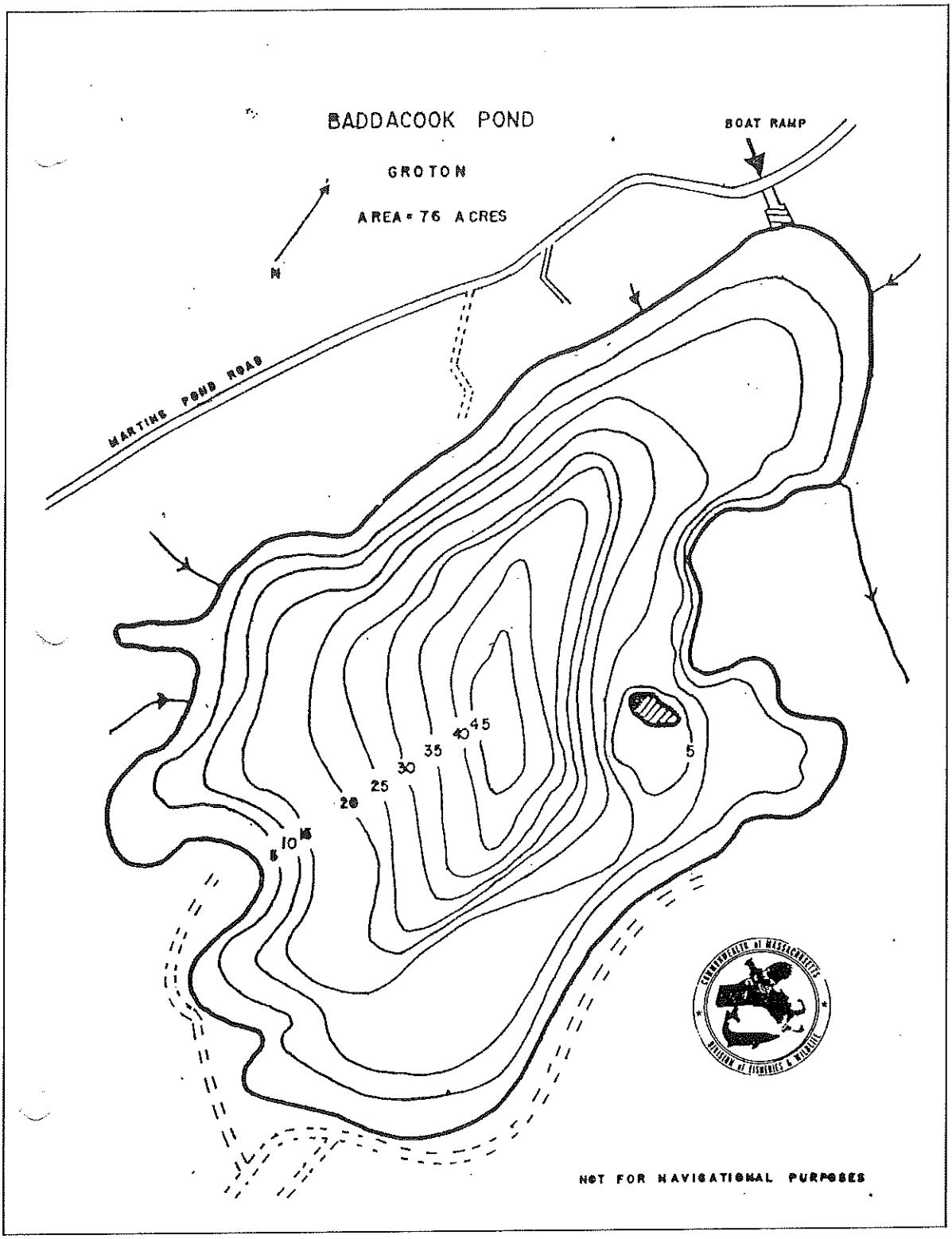
2-2 Baddacook Pond from Google earth showing weed growth 8-24-2015

2-3 Fanwort invasive taking over noninvasive floating heart

2-4 Floating Island



2-5 Baddacook pond areas covered with vegetation



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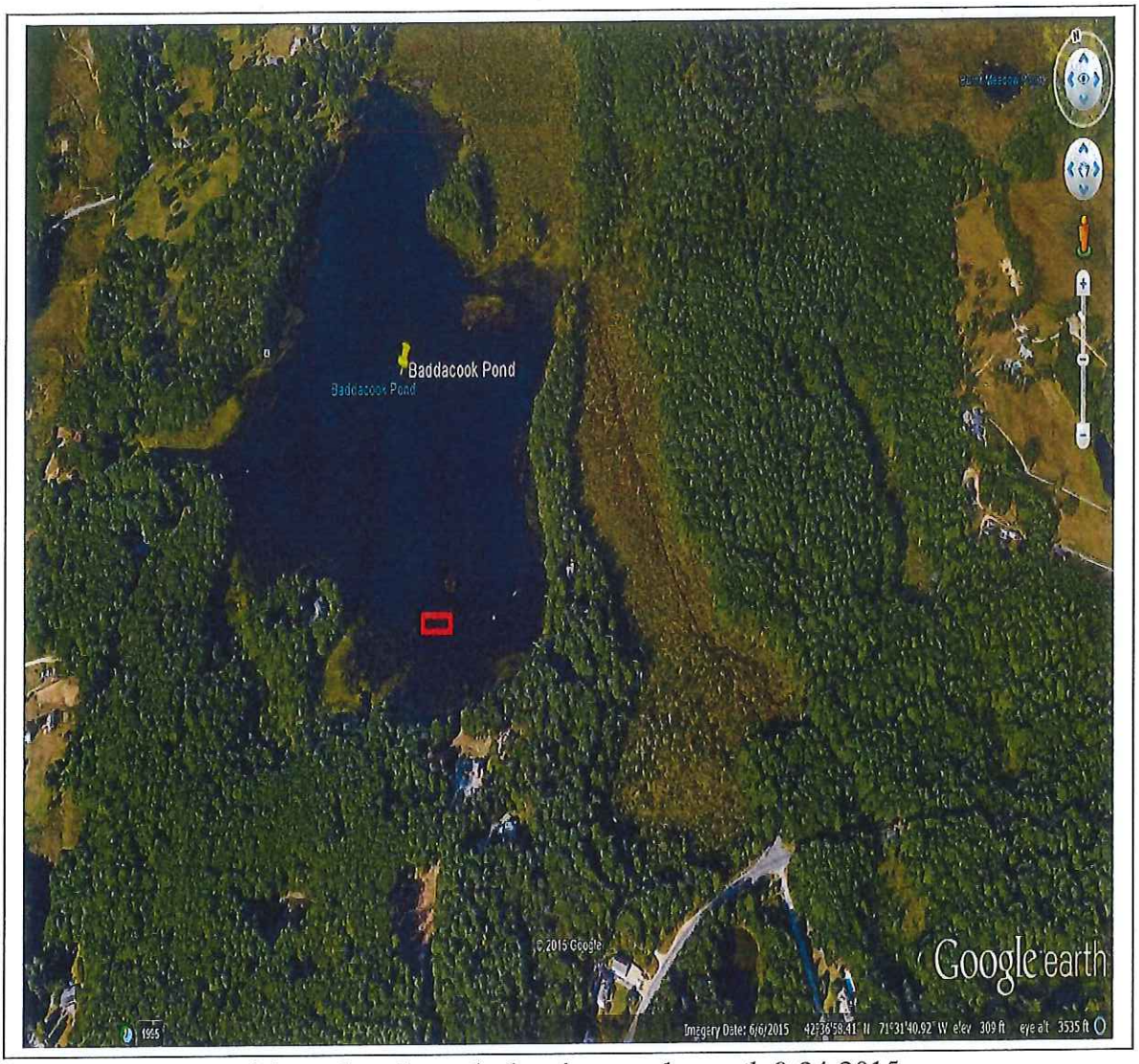

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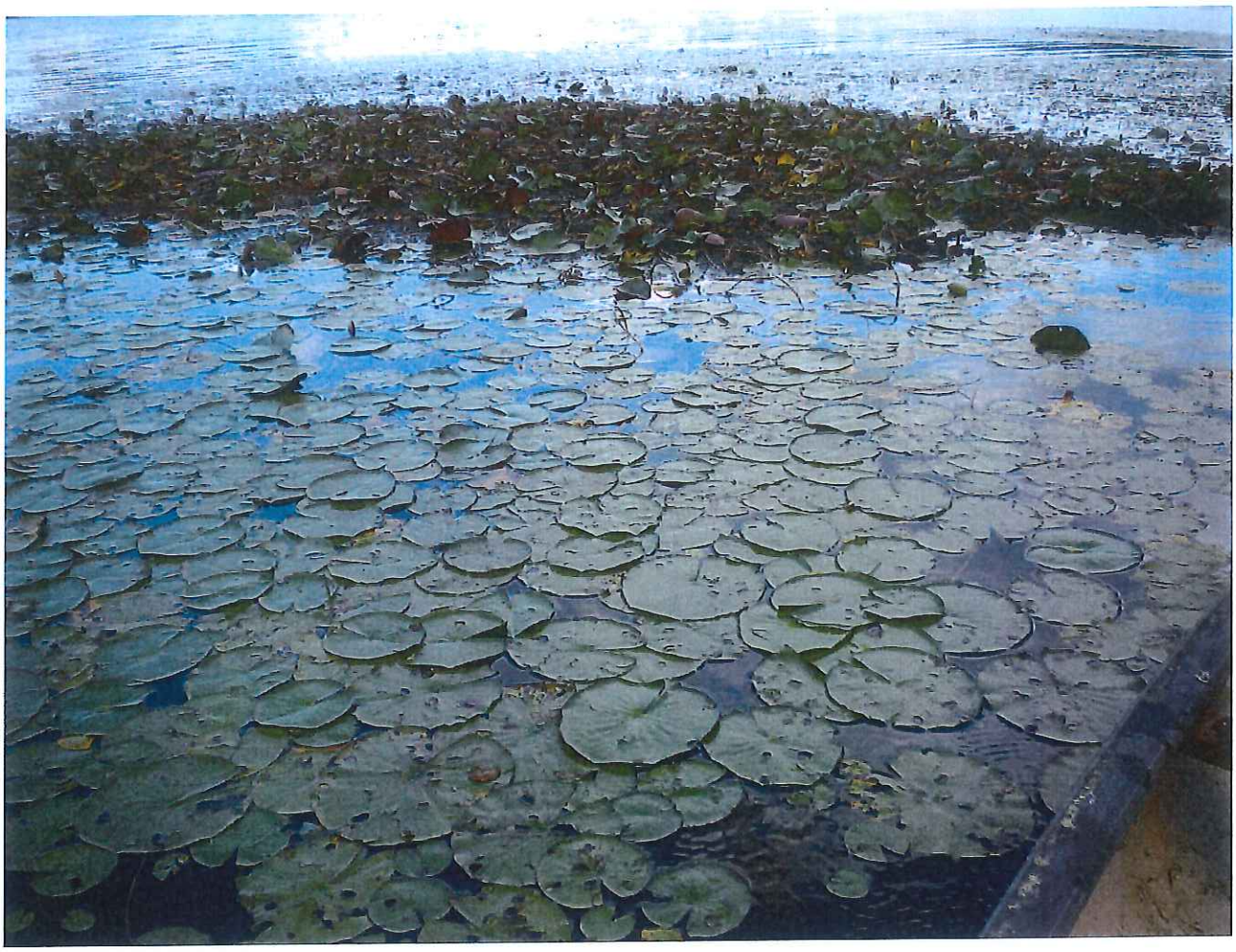

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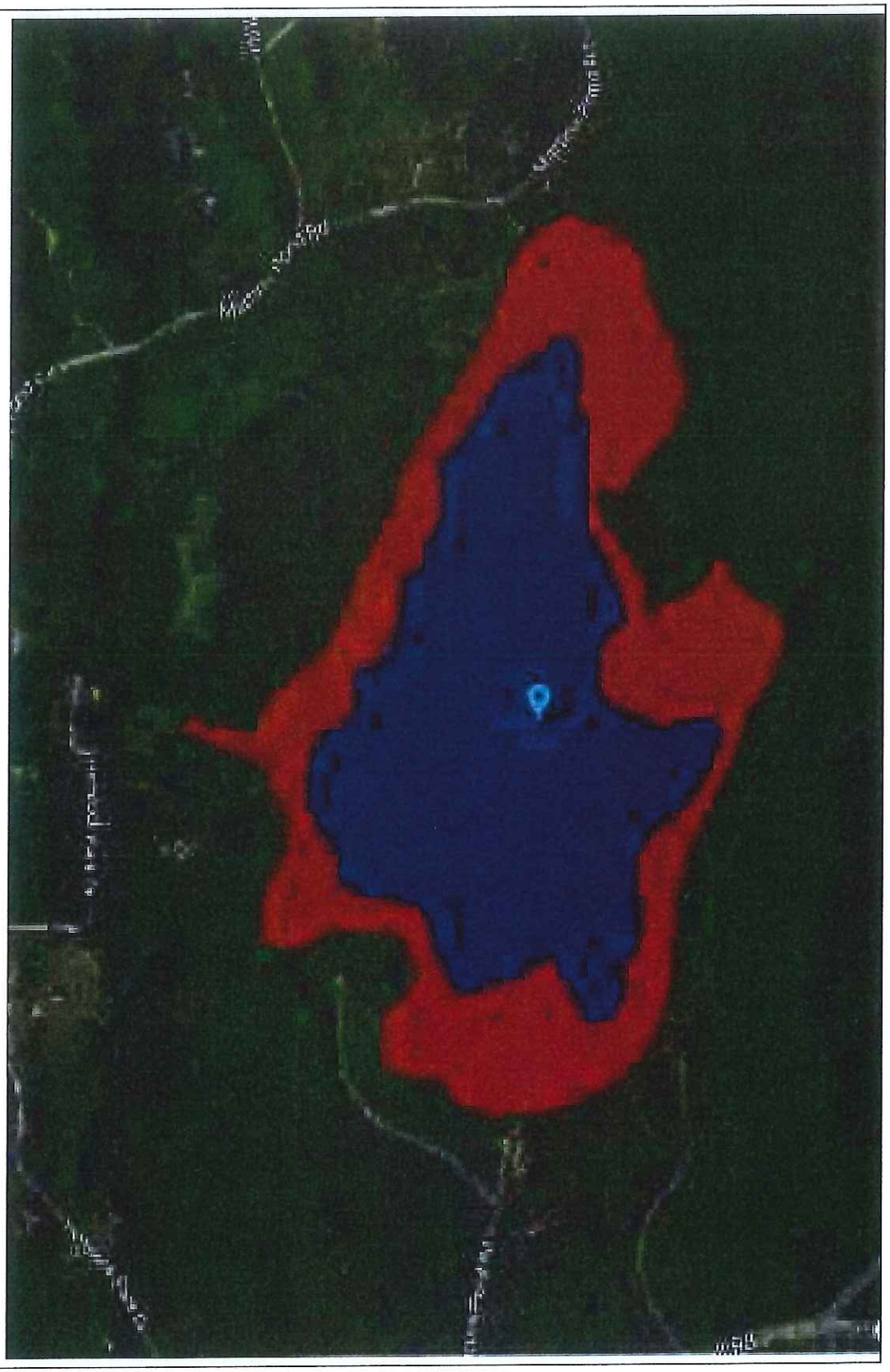

2-5 Baddacook pond areas covered with vegetation

CPC Project and Description

This is CPC funding to environmentally restore the littoral the areas (shallow shoreline areas) of Baddacook Pond and to test management of invasive weeds, using mechanical methods. This funding will be for the third and final year of the pilot program. The Selectmen and Water Department have agreed to consider funding the on going maintenance if this pilot is successful.

Background

The aggressive growth of non-native, invasive weeds has negatively impacted Baddacook ecologically and dramatically diminished its recreational use (fishing, boating, swimming). As of August 2013, the weeds covered 35 acres or 45% of the total surface of the pond, including the entire littoral zone which impedes pond access.

Baddacook Pond is a natural pond of glacier origin. It is surrounded by mostly town owned conservation land and water department property which leads to its character as a ecologically diverse open space. The water rights are also owned by the town (held by the Water Department) and Baddacook is identified as a zone 2 recharge source for town water. There are also a few sparse residential properties. For well over 100 years, the lake has been a popular recreational resource, for boating, fishing and swimming. Baddacook has a public boat ramp which is the property of Division of Fisheries & Wildlife. It is a very popular fishing destination and is stocked several times a year by the state. Motor boats, canoes and kayaks can be seen in the summer. Ice fisherman and ice skaters use the pond in the winter. Swimmers use the lake however these weeds do present a danger of drowning by weed entanglement.

Baddacook Pond is 76 acres with a maximum depth of 45 ft (14 meters) however significant portions of the pond are quite shallow. These shallow areas provide an optimal environment for non-native invasive weeds to quickly spread and fill in.

Cabomba caroliniana (Fanwort) and myrophyllum heterophyllum (variable milfoil) are the two invasive aquatic species which have spread to the point of impacting the current health and long term viability of Baddacook. For boaters, the weeds are navigational impediment and fowl their propellers. For fishermen, the weeds destroy the fish habitat and snag their lines. For swimmers, the weeds over grow access areas and present a risk of drowning, especially for young children. For the town and home owners, the value of the abutting property drops as the lake deteriorates.

Project

The goal of this 3 year project would be two fold. 1) To restore portions of Baddacook Pond that have filled with biomass by using hydro-raking. 2) To implement aggressive mechanical weed harvesting to reduce available plant starch which will help control invasive weed infestation. And, test year over year harvesting to see if it effectively controls the weeds.

Hydro-Raking

Hydro-Raking is basically a back hoe on a barge. Biomass is dredged up and placed onto a support barge which runs the debris back to shore. At the shore, debris is transferred to an appropriate composting location. In this case, the composting location is the town transfer station.

Many areas of Baddacook's littoral zone have filled in with debris from internal as well as external sources. Internal sources include weeds, root mass and floating islands. External sources include branches and leaves. The hydro-rake will address all areas that are too dense for the weed harvester to manage. After initially clearing the areas with the hydro-rake, the weed harvester will be used to maintain them, year after year.

Weed Harvesting

Weed Harvesting is accomplished using a Weed Harvester. A weed harvester is essentially a lawn mower. However does nothing to eradicate the weeds. The machine has three cutting blades, right, left and bottom, on the bow. These blades cut weeds onto a conveyor where they are move back, until the harvester is full. When full, the harvester transports the weeds to shore. The weeds are off loaded and moved to a composting location, the Groton transfer station.

This would be a three year program which would include an evaluation of the effectiveness each year. If deemed successful weed harvesting will have to be continued by the town indefinitely.

Other alternatives

Other methods of weed control are not applicable at this time. Many, such as benthic barriers and diver assisted suction harvesting (DASH) are not effective for a infestation of this magnitude. Draw down has been effectively used for weed control in man-made lakes however Baddacook is natural with no way to control the lake level. Herbicide treatment would be very effective. However, the Water Department has not approved the use of herbicides in Baddacook Pond.

Financial Estimate

Description	Hours	Unit Price	Extension
Weed Harvesting	170	$174	$29,538
Harvesting equipment Mobilization / Demobilization	1	$3,180	$3,180
Repairs	1	$5,300	$5,300
Hydro-raking	141.9	$571	$81,060
Hydro-raking equipment mobilization	1	$7,950	$7,950
Permitting help and final report	1	$7,950	$7,950
	Year 3 funding required....		**$134,978**

SOLITUDE
LAKE MANAGEMENT

Year-End Report for the 2017 Management of:
Baddacook Pond

Groton, MA

Submitted: December 15, 2017

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545
Phone: (508) 480-5253
FAX: (888) 358-0088
info@solitudelake.com
www.solitudelakemanagement.com

Table of Contents

INTRODUCTION

Below is a summation of the Baddacook Pond 2017 aquatic management project. This report details all aspects of this program including: surveys, harvesting/hydro-raking data, and ArcGIS mapping of the management areas. This project was performed for and funded by the Town of Groton, with the objective of reducing plant biomass and restoring open-water areas throughout the littoral zone of Baddacook Pond.

PRE-MANAGEMENT ASSESSMENT

The Pre-Management Assessment was performed on May 24, 2017 by a SŌLitude Aquatic Specialist. The waterbody's littoral zone was surveyed using two techniques: throw-rake tosses and hydro-acoustic sonar. Throw-rake tosses were performed periodically to assess the distribution and density of the aquatic vegetation assemblage. Hydro-acoustic sonar provides the ability to determine the extent of growth within the pond. Approximately 36% of the waterbody exhibited some degree of vegetation growth, mostly found in water depths less than 10-feet. The submersed macrophyte community was co-dominated by two invasive species, variable water milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba carolinana*). Other beneficial native species included large-leaf pondweed (*Potamogeton amplifolius*), with stonewort (*Nitella sp.*) and other pondweed species (*Potamogeton sp.*) less frequently encountered. Shallow areas of the pond, with water depths less than 4-feet, and a mucky substrate were densely populated with white waterlily (*Nymphaea odorata*), yellow waterlily (*Nuphar variagata*), and watershield (*Brasenia schreberi*) that were beginning to have surface leaves. Please refer to **Figure 1**, for a map of the Pre-management acoustic sonar map, exhibiting the biovolume data within Baddacook Pond.

MECHANICAL HARVESTING PLAN AND OPERATIONS

Prior to harvesting operations, SOLitude Lake Management (SOLitude) applied for a Special Use Permit to use the boat launch during operations. Once this was obtained (Permit #10990), it was determined that mechanical harvesting would begin the week of July 31, 2017. To that end, on July 31st, the container service and loader rental were prepared at the Baddacook Pond Boat Launch and operations commenced utilizing the town's aquatic weed harvester.

Seventeen (17) days of mechanical harvesting ensued, concluding on August 29. During operations, all collected material was off-loaded into a skid steer loader at the designated off-loading area. The plant material was then placed into a container to properly de-water **(Image 1)**. Once full the containers were transported to the local landfill/composting site. During operations the harvester operator started south and then proceeded around the pond in a counter clockwise fashion, focusing on invasive species removal and recouping open water space. Please refer to **Figure 2** for a map of the harvested areas during this management period.

Image 1: Photo of the dumpster at the off-loading area

In sum, the 2017 harvesting effort totaled 136 hours and collected a total of 6 containers, equating to 180 cubic yards of plant material. This comprised of a combination of invasive aquatic vegetation including Fanwort and Variable Milfoil.

MECHANICAL HYDRO-RAKING PLAN AND OPERATIONS

Prior to mechanical hydro-raking services the loader and container service were placed at the Baddacook Boat Launch. Once complete, mechanical hydro-raking services commenced on September 22, 2017. Nineteen (19) days of mechanical hydro-raking ensued, concluding on October 18, 2017. During operations, the hydro-rake off-loaded the collected organic material onto the harvester conveyor. Once full the harvester operator transported the material to the designated off-loading site. From there, the same process took place as the previous harvesting operation.

Hydro-raking services were performed on select areas of Baddacook Pond, including both common areas as well as private shoreline areas. Please refer to **Figure 3** for a map of the designated hydro-raking areas, as well as **Appendix A** for a chart of the areas Hydro-raked each day. The collected organic material comprised of a combination of accumulated organic matter, floating islands, emergent vegetation, floating-leaf vegetation, and submersed vegetation.

In sum, the 2017 hydro-raking effort totaled 160 hours and collected a total of 52 containers, equating to 780 cubic yards of plant material, root systems and organic

matter. Please refer to **Image 1** and **2** for photos of before and after hydro-raking around the boat launch.

Image 1: Photo of the Baddacook Pond boat launch before the hydro-raking operation

Image 2: Photo of the Baddacook Pond boat launch after the hydro-raking operation

POST MANGMENT SURVEY SUMMARY

The Post-Management Survey was performed by a SŌLitude Aquatic Specialist on October 25, 2017. A similar survey methodology to the Pre-Management Assessment was performed utilizing throw-rake tosses and hydro-acoustic sonar. While variable watermilfoil and fanwort continued to be the co-dominant vegetation observed in the waterbody, neither species were topped-out; both were commonly observed 1-2 feet below the water's surface. The most prevalent areas of their growth were just south of the boat ramp on the western shoreline and the two southern-most coves. Again, large-leaf pondweed was the most common

native species, growing along the western shoreline. Other species observed in trace and sparse densities included stonewort, coontail (*Ceratophyllum demersum*), and other pondweed species. Floating-leaf species growth was senescing, but significant reductions were observed along the portions of the shoreline and high-use areas of the pond. Please refer to **Figure 4** for a map of the collected hydro-acoustic data. As shown, the majority of hydro-raked areas showed a large decrease in collected biovolume in the post management survey. The most prominent reductions were shown in the northern cove area as well as the western cove. These areas contained 80-90% biovolume in the pre-management survey which reduced to about 40-50% in the post management survey.

SUMMARY AND ONGOING MANAGEMENT RECOMMENDATIONS

Overall, the 2017 program ran smoothly, effectively maintaining Baddacook Pond and reducing a total of 960 cubic yards of plant biomass within the open water space. The harvesting effort successfully controlled the variable watermilfoil and fanwort infestation for two months, with the plants still shown 1 to 2 feet under the water's surface in the post management survey at the end of October. The hydro-raking effort also showed positive results as shown in the attached biovolume maps. Our objective of reducing plant biomass and restoring open-water areas throughout the littoral zone of Baddacook Pond was achieved.

Keeping the objectives of this project in mind, SOLitude is recommending the same management approach next year encompassing both mechanical harvesting and hydro-raking methods. Based on next year's results, we will be able to precisely examine the success of these two management techniques. Looking ahead to 2018, SOLitude recommends coordinating the pre-management survey in close proximity to the commencement of the mechanical harvesting efforts; this will enhance the accuracy of the data regarding the success of the harvesting efforts.

Appendix A:

A chronology of this past year's management events follows:

Date	Area Hydro-raked
9/22/2017	Area 1
9/25/2017	Area 1
9/26/2017	Area 1
9/27/2017	Area 1 & 2
9/28/2017	Area 4
9/29/2017	Area 5
10/2/2017	Area 5
10/3/2017	Area 5
10/4/2017	Area 6
10/5/2017	Area 6
10/6/2017	Area 7
10/9/2017	Area 8
10/10/2017	Area 8
10/11/2017	Area 8 & 9
10/12/2017	Area 9
10/13/2017	Area 2
10/16/2017	Area 2
10/17/2018	Area 2
10/18/2017	Area 2

FIGURE 1: Pre-management Biovolume (May 2017)

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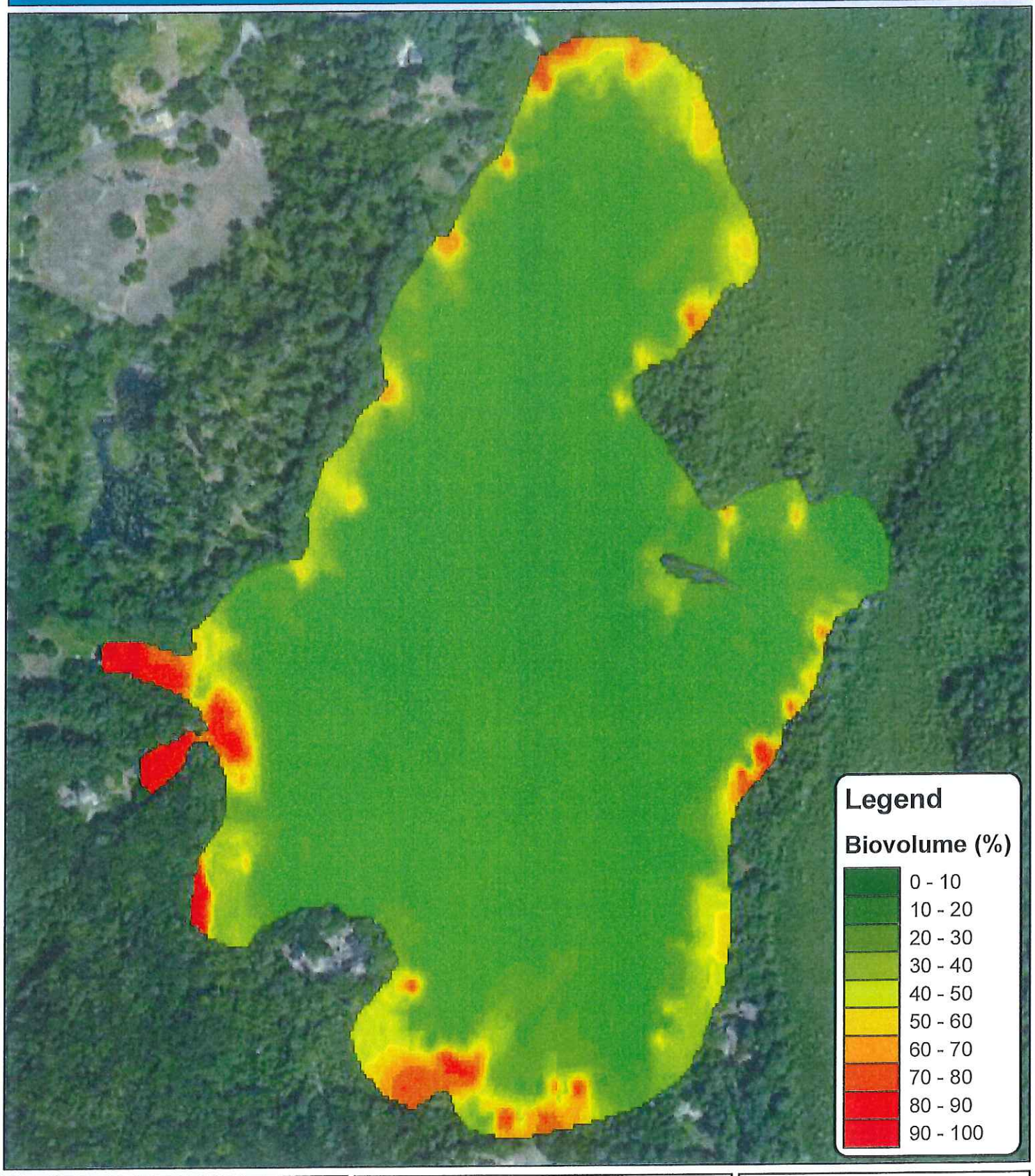
solitudelakemanagement.com



Baddacook Pond
Groton, MA
Middlesex County
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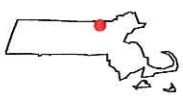


Baddacook Pond

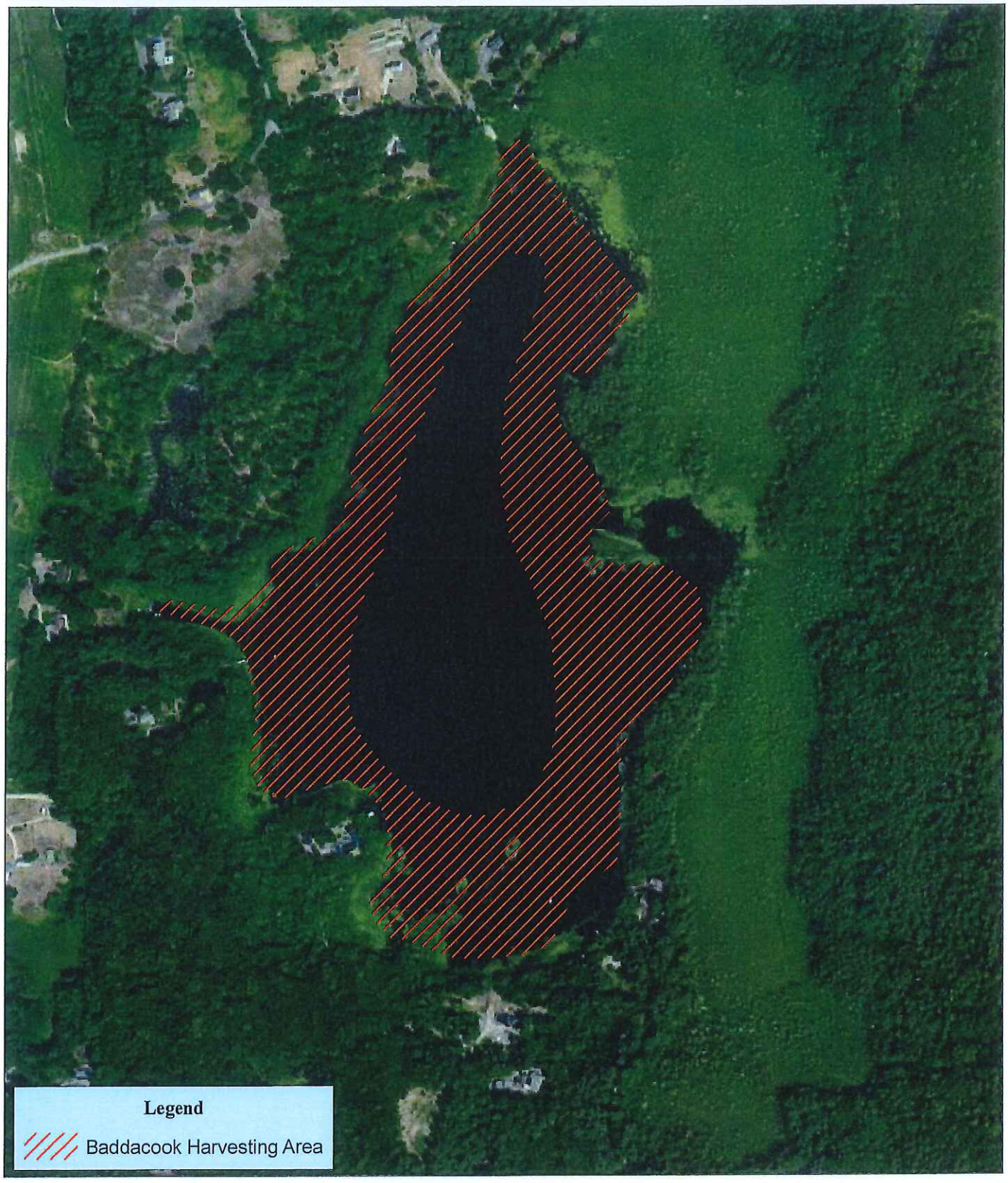
0 250 500 Feet

1:4,500

N

Map Date: 12/4/17
Prepared by: MS
Office: SHREWSBURY, MA

Figure 2: 2017 Harvested Areas



Baddacook Pond
Groton
Massachusetts

Map Prepared:08/23/17
Basemap © 2013 Esri

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1:6,050 Feet

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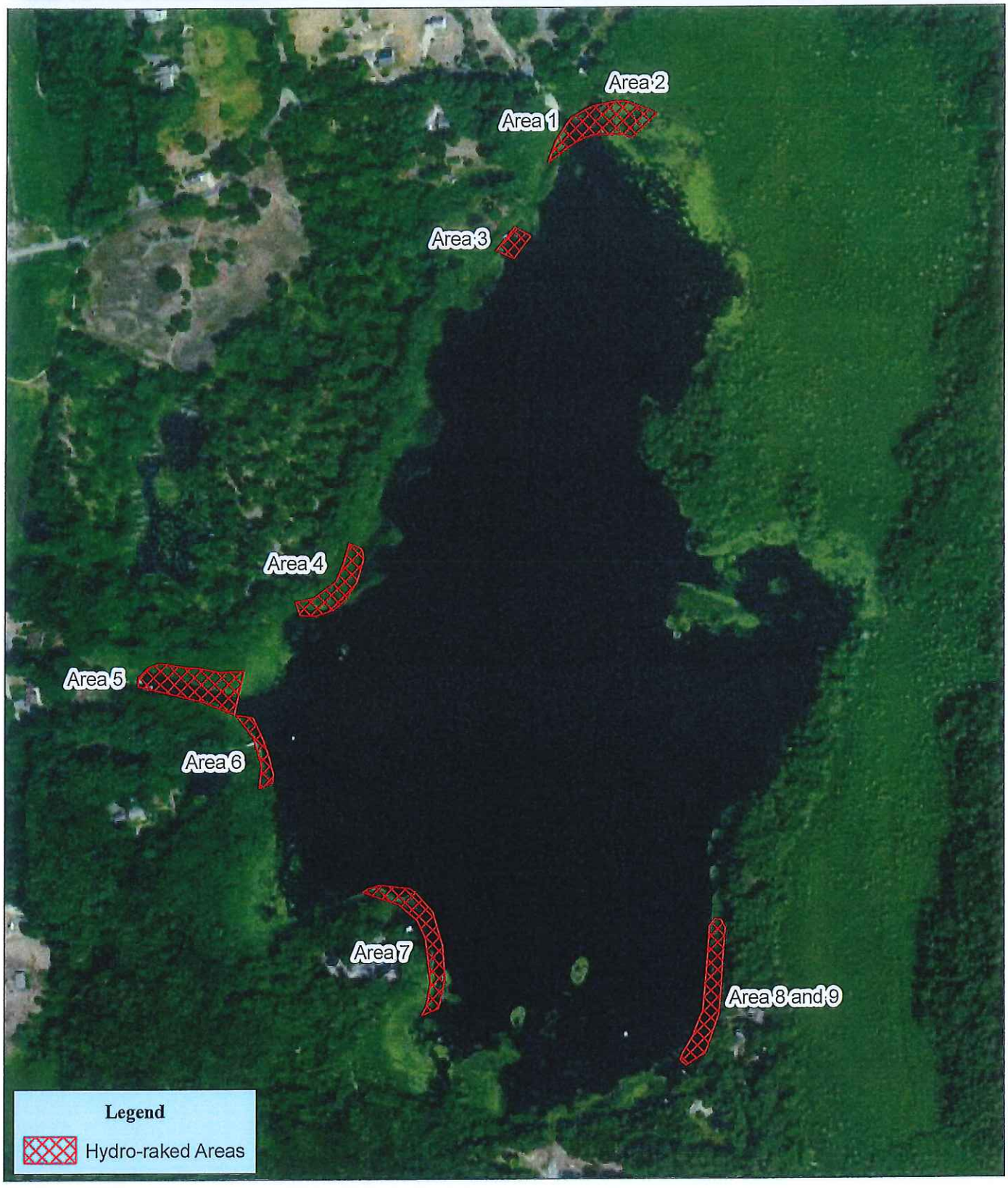
SOLITUDE
LAKE MANAGEMENT

Figure 3: 2017 Hydro-raked Areas



Baddacook Pond
Groton
Massachusetts

Map Prepared:10/8/17
Basemap © 2013 Esri

0 250 500
1:5,000 Feet

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SOLITUDE LAKE MANAGEMENT

FIGURE 4: Post-management Biovolume (October 2017)

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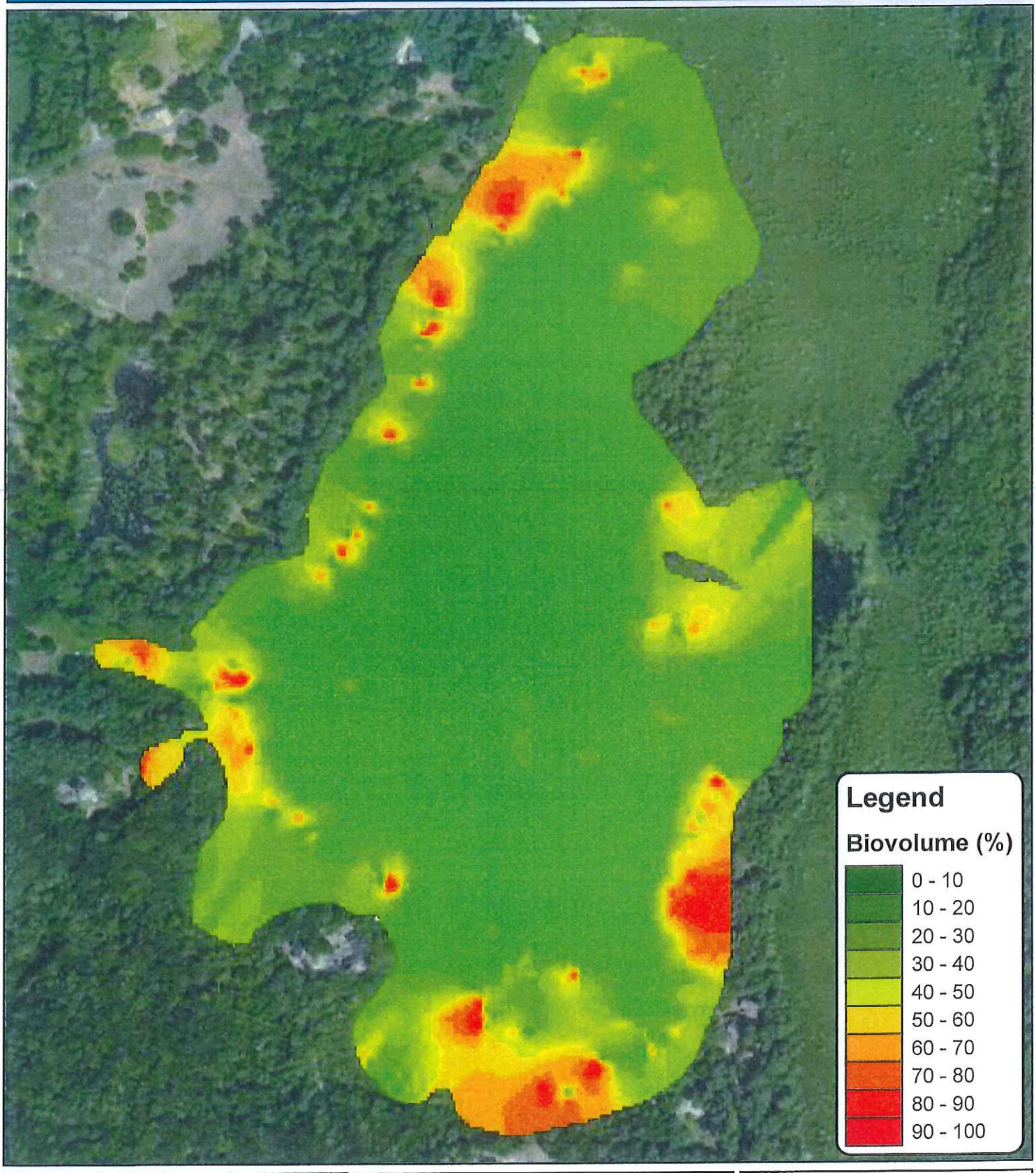

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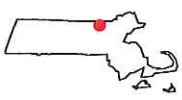

Baddacook Pond

0 240 480 Feet

1:4,500

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Map Date: 12/12/17
Prepared by: MS
Office: SHREWSBURY, MA