

Pine Meadow, Flannagan, and Sandy Ponds

Ayer, Massachusetts 2017 Year-End Report

Report Prepared for: Ayer Conservation Commission
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In accordance with the existing aquatic plant management contract between SOLitude Lake Management and the Ayer Conservation Commission for Pine Meadow, Flannagan, and Sandy Ponds, the following document serves to provide this year's treatment and survey results, as well as management recommendations for next season.

All management activities performed in 2017 were consistent with the Order of Conditions (DEP #100-0293), and the License's to Apply Chemicals issued by the MA DEP – Office of Watershed Management.

- Pine Meadow Pond: LTAC# - 17160
- Flannagan Pond: LTAC# - 17152
- Sandy Pond: LTAC# - 17163

Introduction

Over the years, Pine Meadow, Flannagan, and Sandy Ponds have been treated intermittently for the control of invasive aquatic vegetation, including fanwort (*Cabomba caroliniana*) and variable milfoil (*Myriophyllum heterophyllum*). These treatments also served to reduce the nuisance growth of native waterlilies (*Nuphar/Nymphaea*), which can become relatively dense in the ponds. The most recent prior treatment programs were conducted in 2011 for Pine Meadow and Sandy Pond, and in 2013 for Flannagan Pond.

In 2017, SOLitude Lake Management was contracted by the Ayer Conservation Commission to manage invasive and nuisance aquatic plant species in Pine Meadow, Flannagan, and Sandy Ponds in Ayer, Massachusetts. A unique management plan was devised for each pond, in order to achieve management goals. Elements of each plan included:

- Pre-treatment surveys to identify the distribution and abundance of target vegetation species, both invasive and nuisance, and to assess the best timing and range of treatment.
- Submission of Applications to Apply Herbicides to the Waters of the Commonwealth to the Massachusetts Department of Environmental Protection (MassDEP) and Division of Watershed Management (DWM), to permit the use of herbicides in each pond. These applications were submitted on April 12, 2017 and approved on May 12, 2017.
- Treatments to the defined areas of each pond to manage the target invasive and nuisance species.



Image 1: variable milfoil in
Flannagan Pond 4/18/17



- Notifications to the appropriate persons prior to any and all treatment events.
- Post-management surveys to identify the distribution and abundance of target vegetation species, and to evaluate the efficacy of the management program.

Early Season Survey

On April 18th, a pre-treatment survey of Pine Meadow, Flannagan, and Sandy Ponds was conducted by a SŌLitude biologist to assess the distribution and abundance of variable milfoil (**Figure 1**) and fanwort (**Figure 2**). Each pond was surveyed by following the entire littoral zone while documenting observed plant growth. The littoral zone is the area adjacent to the shore where sunlight penetrates to the sediment and allows aquatic vegetation to grow. The survey was completed using the following techniques: visual observation, use of a “throw rake” and underwater camera. A “throw-rake” was used to help locate any submersed vegetation where it was not visible from the surface. The plant composition was recorded using a handheld GPS to plot target plant locations and field notes to document the specific species present.

Pine Meadow Pond

During the survey, variable milfoil was observed scattered throughout the entire pond in sparse to moderate abundances. Fanwort was not observed at the time of the survey. There were dense patches of waterlilies with watershield (*Brasenia schreberi*) around the perimeter of the pond and, more sporadically, throughout the center. In addition, the native species muskgrass (*Chara* sp.) and stonewort (*Nitella* sp.) were present in the pond.

Flannagan Pond

During the survey, variable milfoil and fanwort were observed throughout the majority of the pond. Variable milfoil was present in the greatest abundance throughout the eastern basin, along the northern half of the western basin, and adjacent to the outflow. Fanwort was present in sparse to dense abundance scattered throughout the eastern basin, as well as along the northern half of the western basin down to the outflow cove. Moderate to dense patches of waterlilies with watershield were dispersed along the entire shoreline, most notably in the eastern basin.

Sandy Pond

During the survey, variable milfoil was observed in three isolated areas around the perimeter of the pond. These areas were located at two of the inlets and the outlet. Fanwort was not observed during the survey, however, a SŌLitude biologist surveyed the pond again on May 30th to reassess the distribution of invasive vegetation (**Figure 3**). During this survey, the distribution and abundance of variable milfoil had increased, as the species was then observed in six areas around the pond. Fanwort was observed at three areas around the perimeter of the pond, specifically at two of the inlets and on the northern shoreline at trace to sparse abundances. Sparse to moderate patches of waterlilies with watershield were observed at each of the inlets and sporadically along the shoreline.

A series of photographs were taken during the initial pre-treatment surveys at each pond in predetermined locations (**Figure 4**). The pre-treatment photos are shown in **Figure 5**. In April, most of the vegetation had not yet reached the surface of the water, due to this, the pictures of the pond surfaces were not representative of the amount of invasive vegetation present.

Herbicide Treatments

Over the course of the 2017 season, multiple treatment events were performed at each pond. The treatment approach differed for each waterbody based on the target species and distribution (**Table 1**).



Table 1

Pond	Target Plant(s)	Approach
Pine Meadow	Variable milfoil Waterlilies/watershield	Spot treatment with diquat herbicide for control of milfoil & with glyphosate for floating leaf plants
Flannagan	Variable milfoil Fanwort	Whole pond treatment with liquid and pellet formulations of Sonar (fluridone) herbicide for both target species & spot treatment with diquat herbicide for enhanced milfoil control.
Sandy	Variable milfoil Fanwort	Spot treatment with pelletized formulations of Sonar (fluridone) herbicide for fanwort control & spot treatment with diquat herbicide for milfoil control

Information pertaining to these treatment events including dates and herbicide product used is provided in **Table 2**.

Table 2:

Pond	Treatment Date	Herbicide Product (tradename)
Pine Meadow	June 12 th	Reward
	August 29 th	Aquapro
Flannagan	May 15 th	Sonar One & Sonar Genesis
	June 28 th	Sonar One, Sonar Genesis & Reward
	August 29 th	Sonar One & Sonar Genesis
Sandy	June 28 th	Sonar One & Reward
	August 29 th	Sonar One

The Town was notified well in advance of each event and, a week prior to each treatment event, the shoreline of each pond was thoroughly posted with caution signs in order to inform the residents of the upcoming treatment(s) and warn of the temporary water use restrictions. At no time during any of the treatments were fish mortalities or significant non-target impacts to other aquatic organisms or wildlife either observed or reported.

Pine Meadow Pond

The initial treatment, on June 12th, was performed using a 10-foot jon boat equipped with a low-pressure spray pump. The herbicide Reward (diquat) was mixed with pond water in an onboard tank and applied using a subsurface hose throughout the pond, with exception to the very northern region. The treatment targeted the invasive variable milfoil growth throughout the pond. The second treatment, on August 29th, was performed in a similar fashion to the initial treatment, however, the herbicide Aquapro (glyphosate) was used. Aquapro was applied to the floating leaves of the waterlily and watershield patches. An onboard GPS unit was used to provide real-time navigation and ensure an even application in the targeted treatment areas.



Flannagan & Sandy Pond

In Flannagan Pond, the goal of treatment was to maintain a target concentration of fluridone throughout the entire pond for a sufficient amount of time to control fanwort and milfoil and reduce the density of floating leaf waterlilies. To accomplish this, multiple applications of both the granular (slow-release) and liquid formulations of the herbicide were utilized. Following the initial treatment, periodic inspections and herbicide testing were used to help determine the timing and dose for follow-up, “booster” applications. Application of Reward (diquat) was used during the second treatment event to reduce milfoil biomass in the eastern basin.

In Sandy Pond, the fanwort and milfoil distribution was much more scattered and maintaining a lake wide concentration was not advisable from either an ecological or a cost perspective. Targeted applications of granular Sonar herbicide were used to treat areas of fanwort, while similar treatments with Reward (diquat) were used for control of milfoil. As with the application of Sonar in Flannagan Pond, an extended contact time was needed and multiple applications were performed.

Each treatment was conducted using an airboat equipped with a high-volume spray pump and mechanical spreader. The pelletized herbicide Sonar One (fluridone) was dispersed using the mechanical spreader mounted to the bow of the airboat. The liquid herbicides, Sonar Genesis (fluridone) and Reward, were combined with pond water in an onboard mixing tank and applied subsurface using weighted hoses. An onboard GPS unit was used to provide real-time navigation and ensure an even application in the targeted treatment areas.

Throughout the season, water samples were collected to monitor the levels of the herbicide Sonar (fluridone) in the water and ensure the appropriate concentration was maintained. Details from these water samples are provided in **Table 3**.

Table 3:

Pond	Sample Date	Sample Location	Sonar/fluridone Concentration (ug/L)
Flannagan	June 12 th	East (Sandy Inlet)	3.3
		West (Outlet)	6
	July 28 th	East (Sandy Inlet)	12
		Middle	10.7
		Northwest (Pine Meadow Inlet)	11.1
		West (Outlet)	10.8
Sandy	July 28 th	Northwest Inlet	1.1
		Southeast Inlet	<1

Post-Treatment Survey

On September 14th, a SÖLitude biologist conducted a post-treatment survey of Pine Meadow, Flannagan, and Sandy Pond to assess the overall effectiveness of the 2017 management program. The surveys were performed with the same techniques as the pre-treatment surveys. The post-treatment surveys revealed a significant overall reduction in the target species, variable milfoil (**Figure 6**) and fanwort (**Figure 7**), throughout each pond.

Pine Meadow Pond

During the survey, variable milfoil was observed in only trace to sparse abundance in the mid-western cove and along the southern shoreline. Fanwort was not found at the time of the survey. A healthy assemblage of native vegetation was also observed throughout the pond (**Figure 8**). Along the perimeter of the pond, moderate to dense patches of waterlilies and watershield were observed, with the herbicide treated portions beginning to degrade. Water primrose (*Ludwigia palustris*) and coontail (*Ceratophyllum demersum*) were present at trace densities in isolated locations. A sparse abundance of common bladderwort (*Utricularia vulgaris*), purple bladderwort (*Utricularia purpurea*), and muskgrass was observed throughout the entire pond.



Flannagan Pond

During the survey, variable milfoil was observed only in trace to sparse abundance, primarily at the Sandy Pond inlet and at the southeast region of the western basin. The only remaining growth of fanwort was observed at the Sandy Pond inlet in a moderate density. In addition, there was a healthy assemblage of native vegetation around the perimeter of the pond (**Figure 9**). The waterlily and water shield growth was reduced to a moderate patch of watershield adjacent to the Sandy Pond inlet. The floating mats of dead waterlily rhizomes will eventually break down and fall to the bottom of the pond. Robins' pondweed (*Potamogeton robbinsii*), common bladderwort, and purple bladderwort were observed sporadically around the perimeter of the pond.

Sandy Pond

During the survey, variable milfoil was observed only in trace abundance at the southeast inlet. The only remaining growth of fanwort was observed in a moderate density at the southeast inlet, however after the treatments were conducted, additional growth of fanwort occurred in non-treatment targeted areas. The additional growth occurred in trace to sparse abundance in locations along the southern, northeast, and western shoreline. Additionally, there was a healthy assemblage of native vegetation in the littoral zone of the pond (**Figure 10**). The native vegetation included: waterlilies, watershield, common bladderwort, purple bladderwort, Robbins' pondweed, tape grass, and ribbon-leaf pondweed (*Potamogeton epihydrus*).

Ongoing Management Recommendations

Based on the results of the surveys, the 2017 management program successfully controlled >95% of the pre-management growth of the target species, variable milfoil and fanwort, and suppressed the nuisance growth of waterlilies in Pine Meadow, Flannagan, and Sandy Pond. Based on the characteristics of the species within these waterbodies, however, and their recent history, it is likely that ongoing management will continue to be required in order to maintain a balanced aquatic ecosystem. Below are management recommendations for each pond for the 2018 season.

Pine Meadow Pond

Over the course of the 2017 season, the distribution and abundance of variable milfoil and waterlilies in Pine Meadow Pond was significantly reduced and the presence of fanwort was not observed. Due to the shallowness of the pond and the aggressive re-growth expected, SŌLitude recommends continuing with a similar program for the 2018 season, including early/late season monitoring and separate herbicide treatments for milfoil and waterlily regrowth. In particular, waterlily growth can take several years to push back effectively given the inherent challenges associated with foliar treatment approaches.

Flannagan Pond

Over the course of the 2017 season, the distribution and abundance of both target species, variable milfoil and fanwort, was substantially reduced throughout the entirety of Flannagan Pond. The nuisance growth of waterlilies was also successfully suppressed. With the inflow from the Sandy Pond inlet creating high levels of dilution, some minor growth is likely to remain there next season while the remainder of the pond should see good carryover control.

SŌLitude recommends a management program including early/late season monitoring, an early season Sonar pellet treatment to proactively address fanwort regrowth (likely only in the vicinity of the Sandy Pond inlet for 2018), and spot treatments with Reward to control any variable milfoil regrowth. As a result of the many years of increased biomass in the east and west basins of Flannagan Pond, areas of the waterbody are becoming increasingly shallow. SŌLitude recommends targeted hydroraking of the shoreline in these areas to remove a portion of the built up sediment and restore some depth to these areas.

Sandy Pond

Over the course of the 2017 season, the distribution and abundance of variable milfoil was greatly reduced. Due to the late season emergence of fanwort in non-treatment areas and survival of some growth in the eastern inlet area, additional management will be required next year. SŌLitude recommends continuing with a similar management program in 2018, including: early/late season monitoring and targeted Sonar pellet/diquat



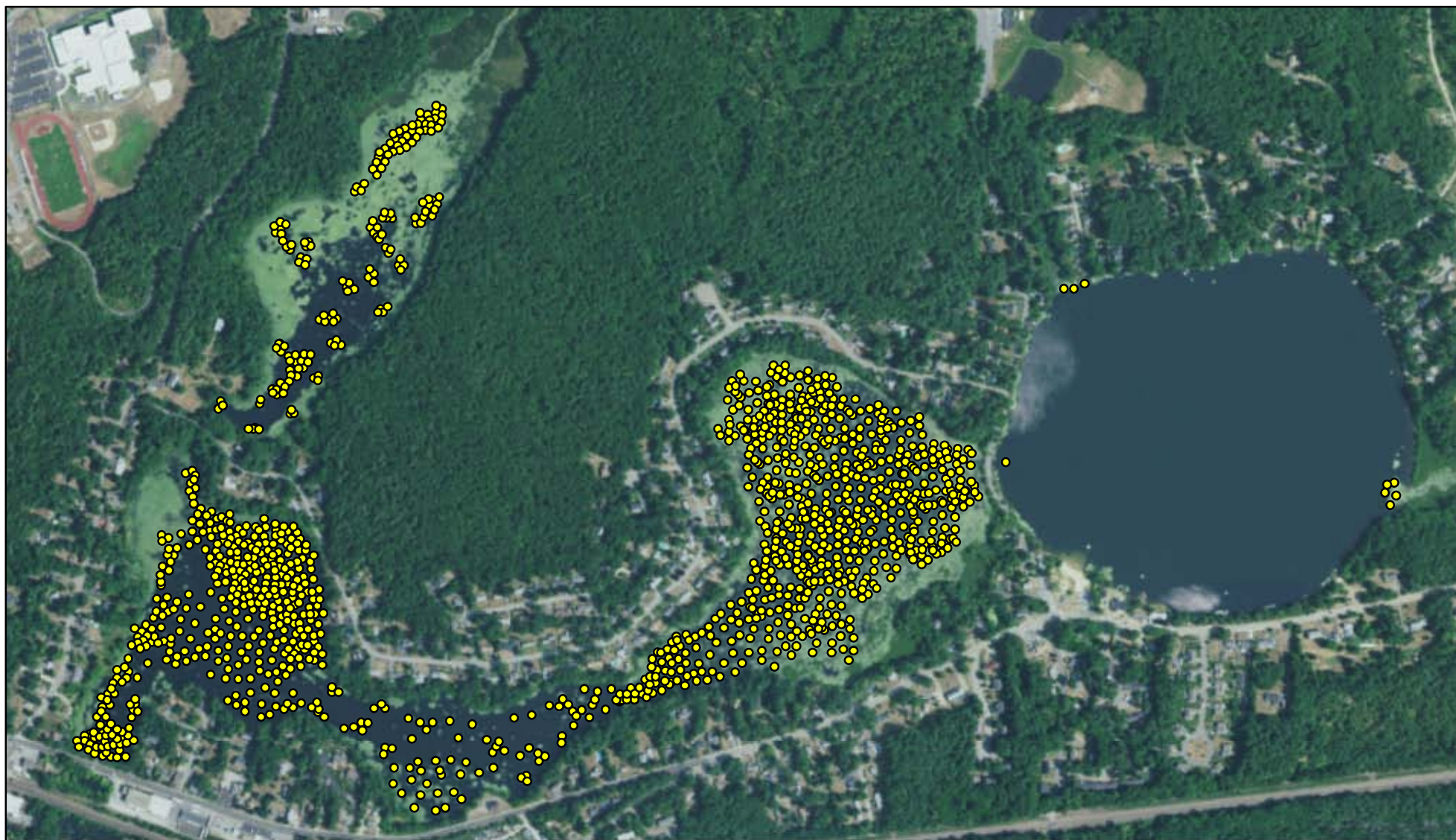
treatments to continue reducing the distribution of the invasive vegetation. In addition, SŌLitude recommends discussing the feasibility of adding Clipper (flumioxazin) herbicide to the program, as it will provide a more efficient method of treating small, scattered areas of fanwort growth in Sandy Pond and may also assist in managing re-growth in Flannagan Pond. Doing so is likely to require approval from the National Heritage & Endangered Species Program (NHESP), as we understand there are listed species within or near the pond.

Overall, we recommend instituting on-going, annual programs at these ponds to monitor vegetation conditions and conduct management of invasive plants and other nuisance vegetation as needed. This is preferable to allowing the ponds to return to pre-management conditions that will require large scale management efforts and may actually reduce costs and herbicide usage over the long term. In terms of budget for 2018, we suggest the following ranges (**Table 3**), but would be happy to work with the Commission to develop more definitive, detailed costs based on the Town's goals.

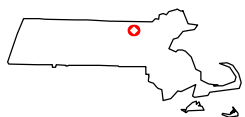
Table 3

Pond	2018 Management Actions	Budget
Pine Meadow	<ul style="list-style-type: none"> • Monitor early and late season vegetation. • Manage variable milfoil with spot treatments using diquat herbicides. • Continue to thin out floating leaf plants using glyphosate herbicide. 	\$5,000-\$7,500
Flannagan	<ul style="list-style-type: none"> • Monitor early and late season vegetation. • Conduct spot treatment with Sonar (fluridone) to any remaining areas or re-growth of fanwort. • Manage variable milfoil with spot treatments using diquat herbicides. • Maintain levels of floating leaf plants using glyphosate herbicide. 	\$10,000-\$15,000
Sandy	<ul style="list-style-type: none"> • Monitor early and late season vegetation. • Conduct spot treatment with Sonar (fluridone) to any remaining areas or re-growth of fanwort. • If possible, manage scattered, shoreline fanwort growth with Clipper (flumioxazin) herbicide. • Manage variable milfoil with spot treatments using diquat herbicides. 	\$10,000-\$20,000

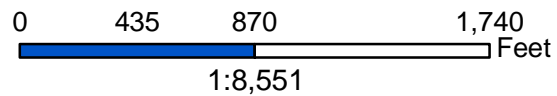
FIGURE 1: Pre-Treatment Variable Milfoil Distribution



Ayer Ponds
Ayer, MA

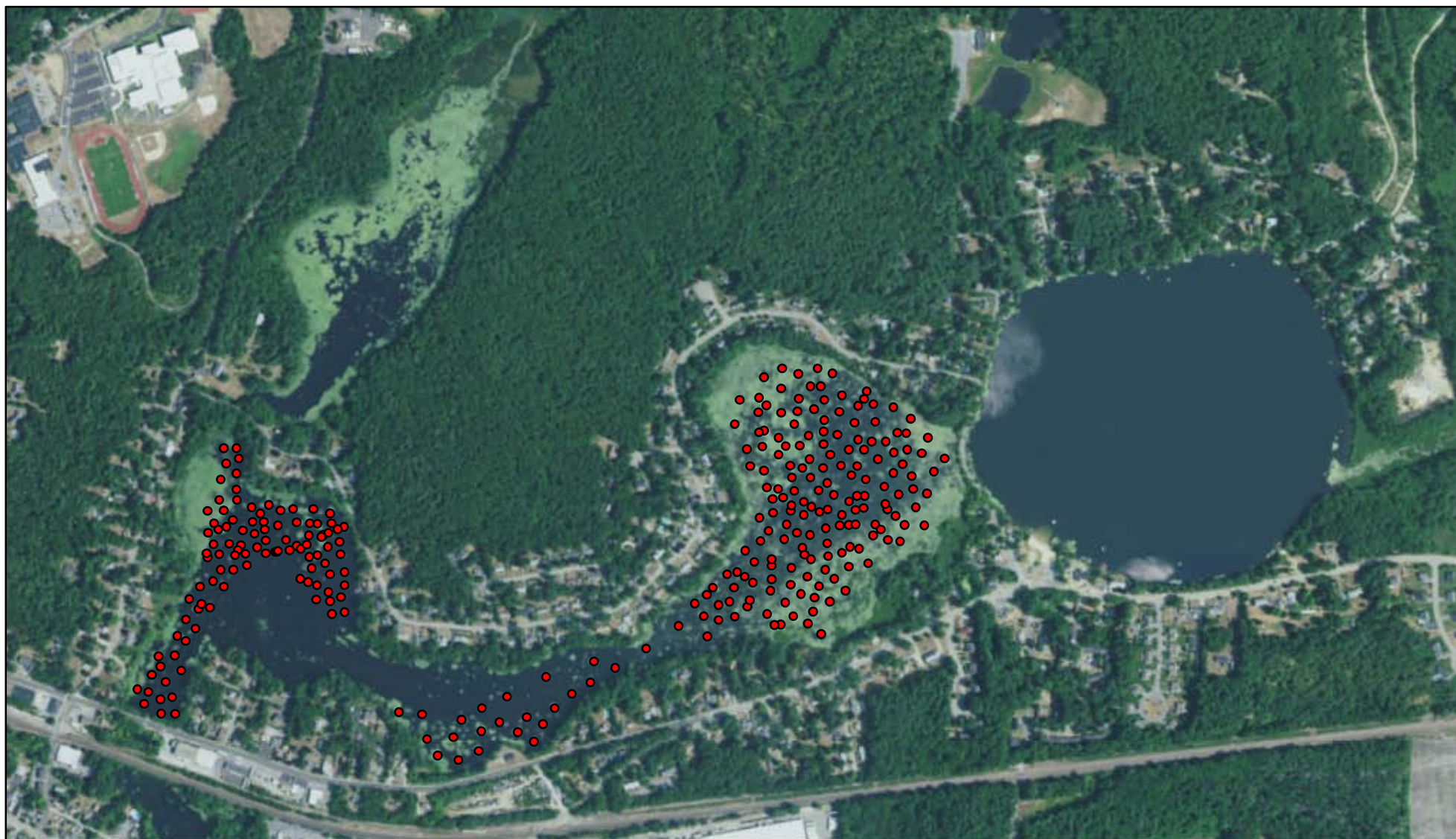


Ayer Ponds

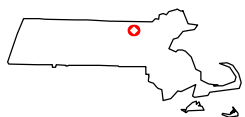


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Prepared by: MH
Office: Shrewsbury, MA

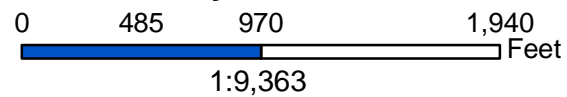
FIGURE 2: Pre-Treatment Fanwort Distribution



Ayer Ponds
Ayer, MA

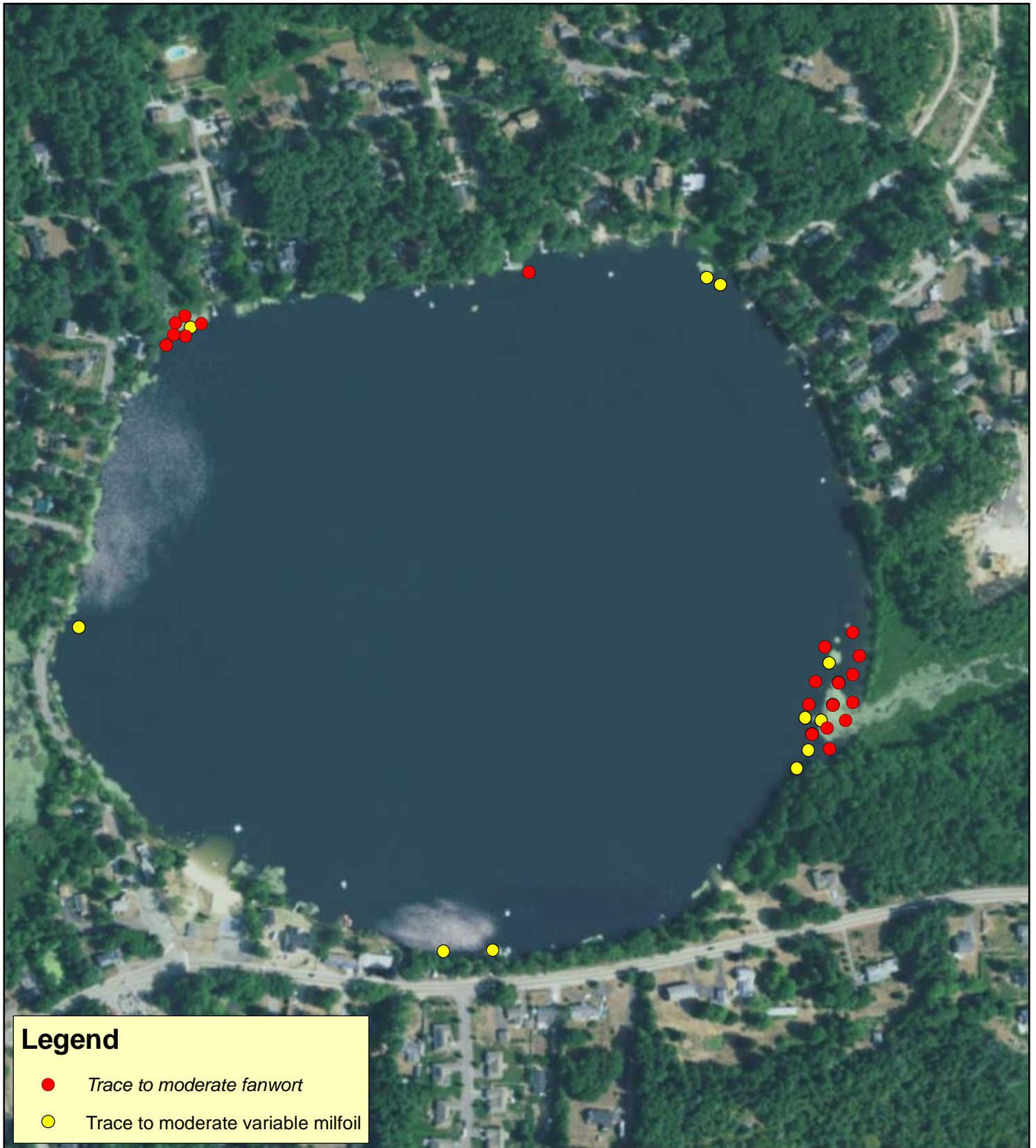


Ayer Ponds

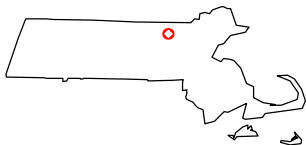


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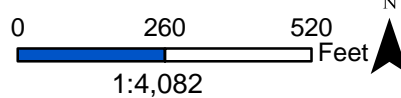
FIGURE 3: Pre-treatment Invasive Aquatic Vegetation Distribution
May 30, 2017



Sandy Pond
Ayer, MA

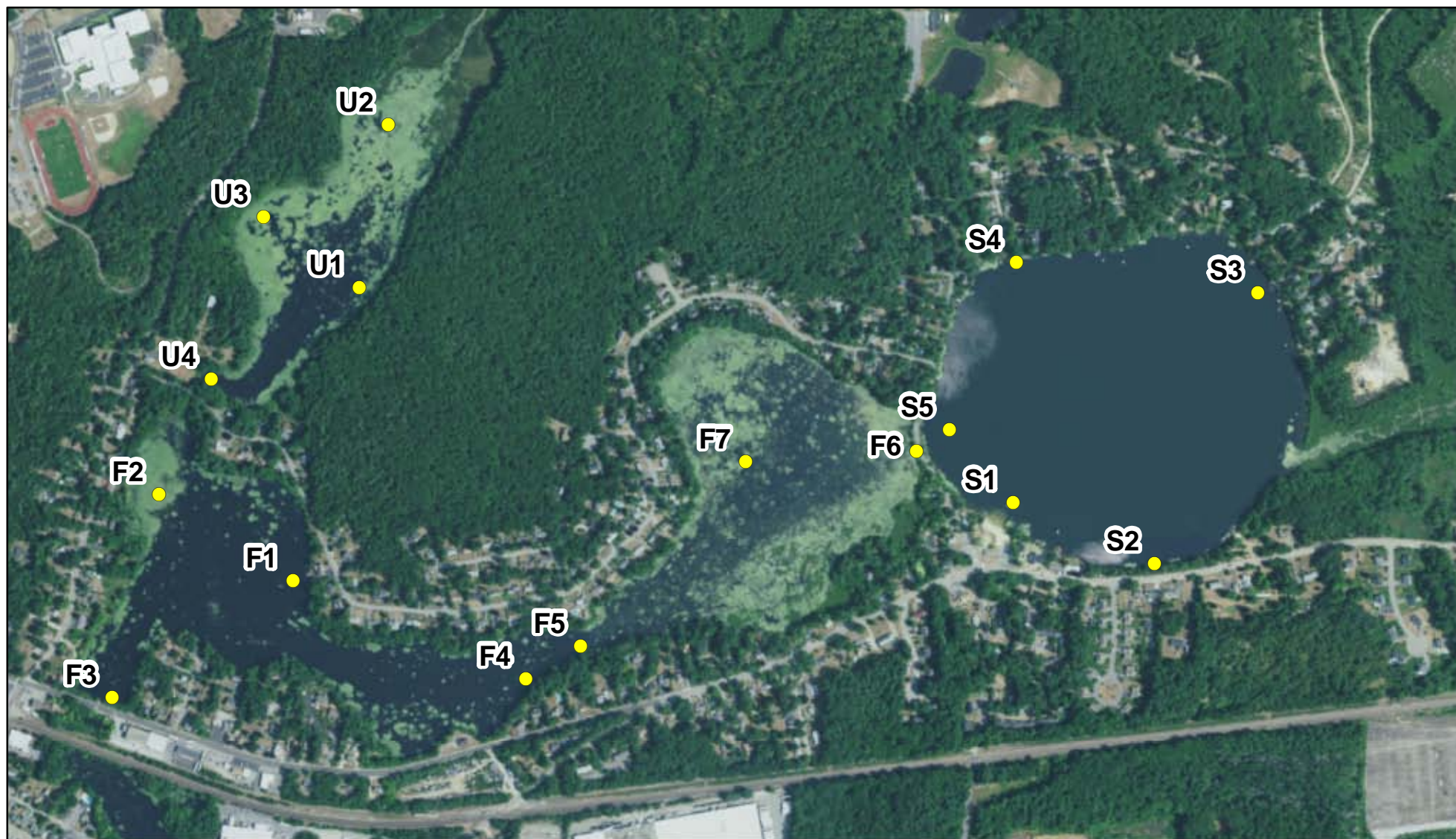


Sandy Pond

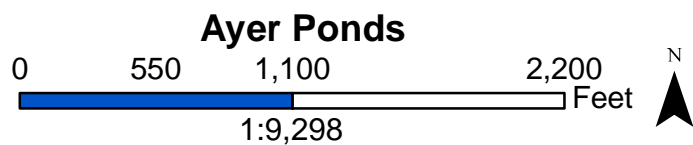
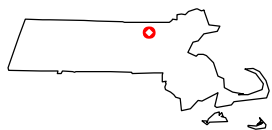


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FIGURE 4: Vegetation Survey Photograph Locations



Ayer Ponds
Ayer, MA



Map Date: 12/7/2017
Prepared by: MH
Office: Shrewsbury, MA

Figure 5: Survey photos









	U1	U2	U3	U4
Pre-treatment 4/18/17				
Post-treatment 9/14/17				

Figure 5: Survey photos









	F1	F2	F3	F4
Pre-treatment 4/18/17				
Post-treatment 9/14/17				

Figure 5: Survey photos









	F5	F6	F7	S1
Pre-treatment 4/18/17				
Post-treatment 9/14/17				

Figure 5: Survey photos









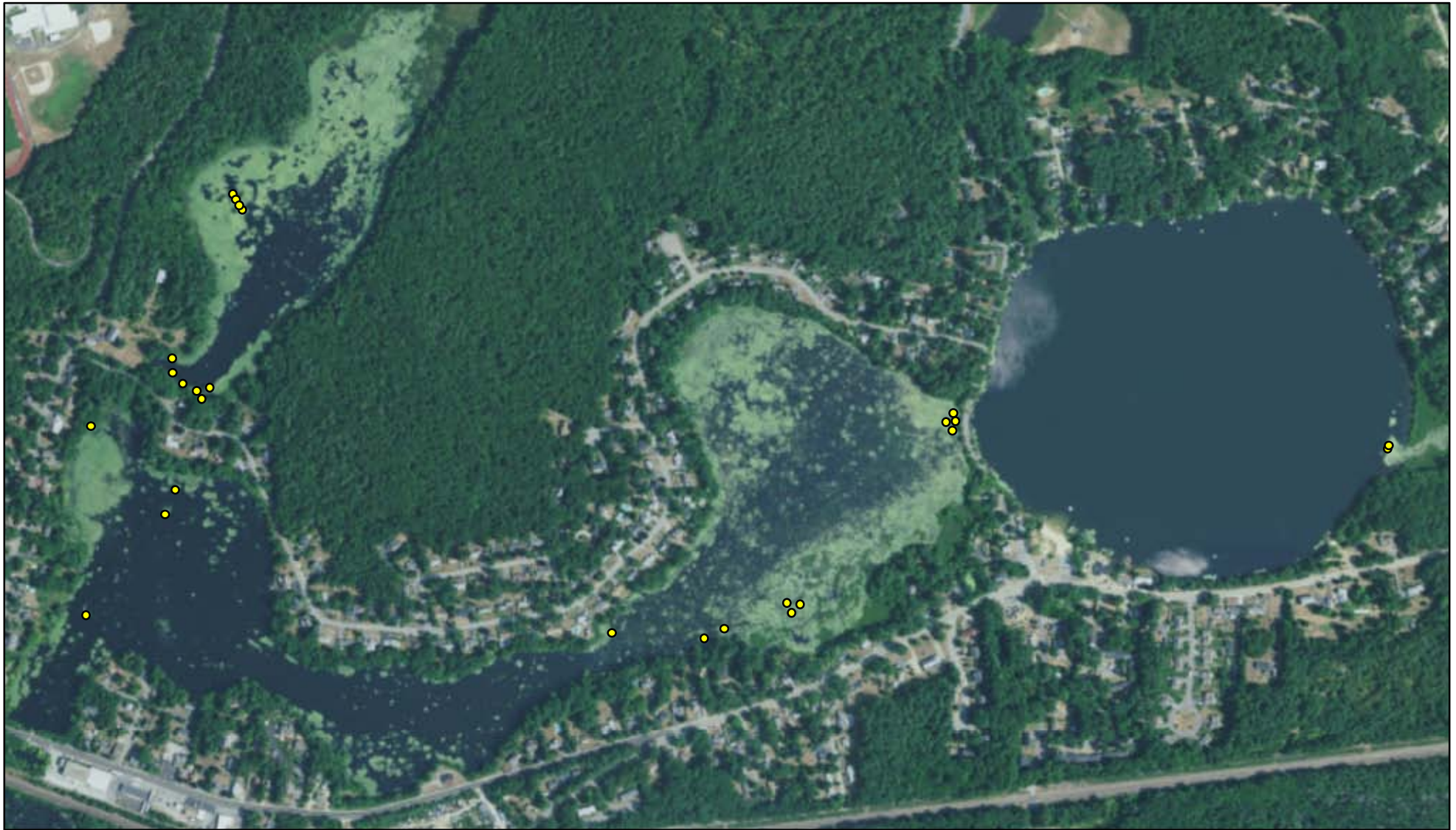
	S2	S3	S4	S5
Pre-treatment 4/18/17				
Post-treatment 9/14/17				

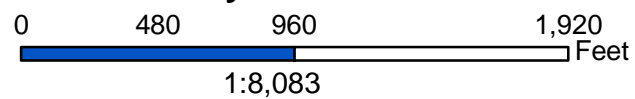
FIGURE 6: Post-Treatment Variable Milfoil Distribution



Ayer Ponds
Ayer, MA

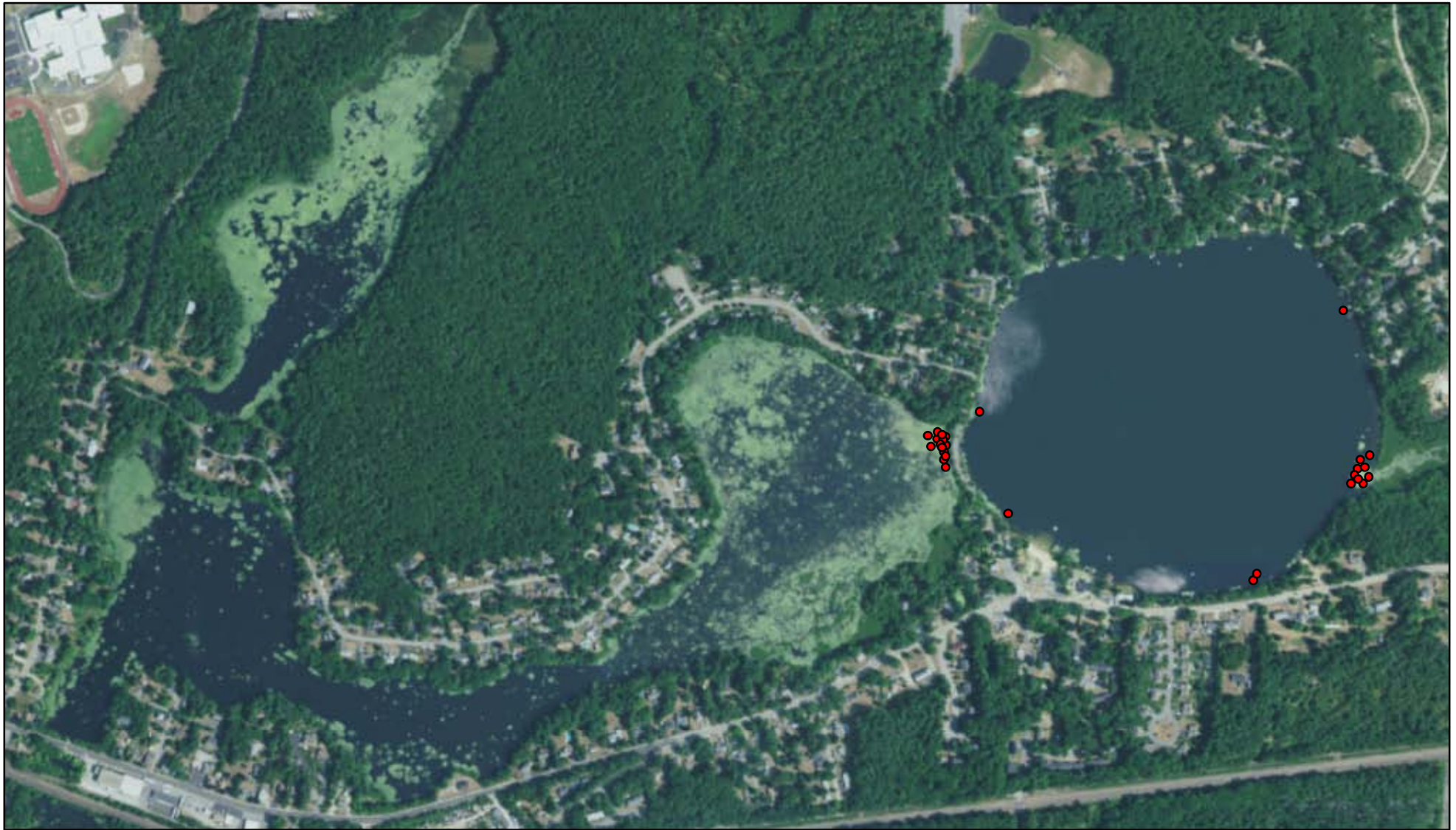


Ayer Ponds



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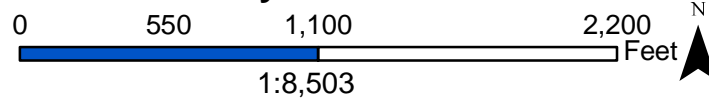
FIGURE 7: Post-Treatment Fanwort Distribution



Ayer Ponds
Ayer, MA

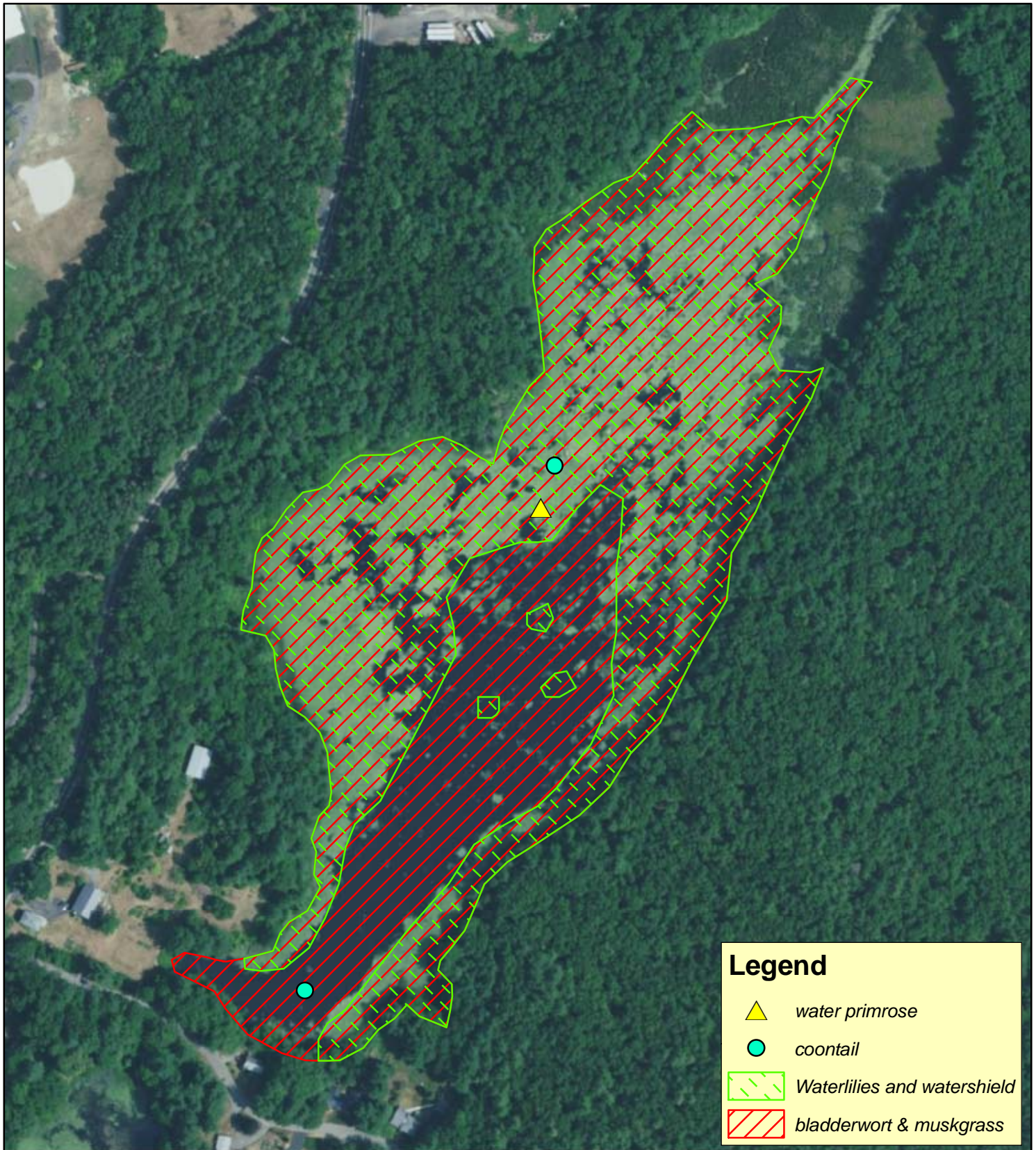


Ayer Ponds

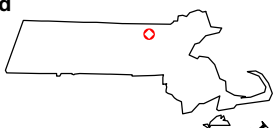


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FIGURE 8: Post-treatment Native Aquatic Vegetation Distribution



Pine Meadow Pond
Ayer, MA



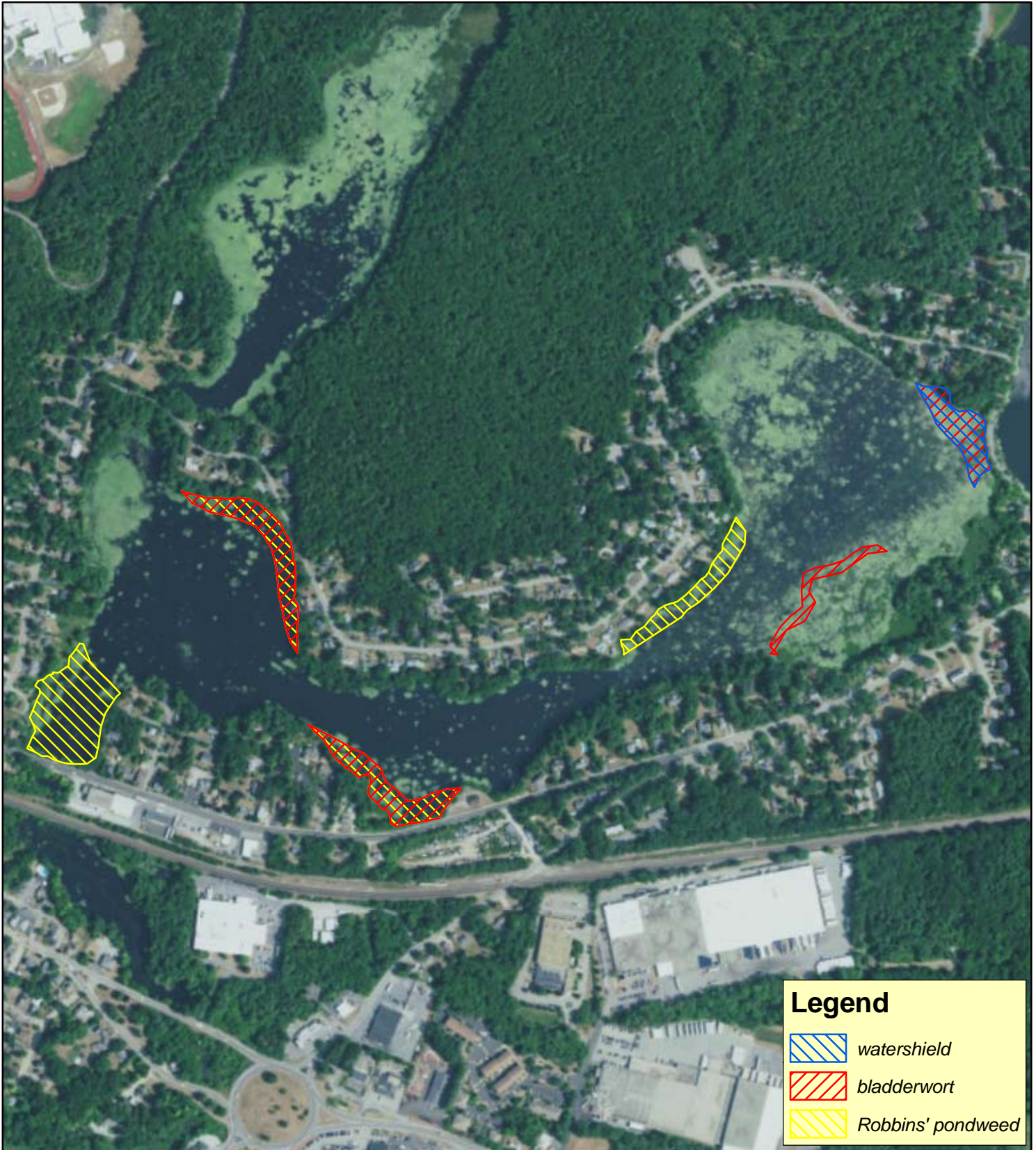
Pine Meadow Pond

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1:3,228

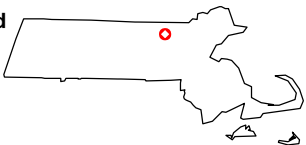


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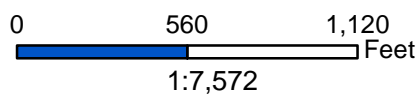
FIGURE 9: Post-treatment Native Aquatic Vegetation Distribution



Flannagan Pond
Ayer, MA

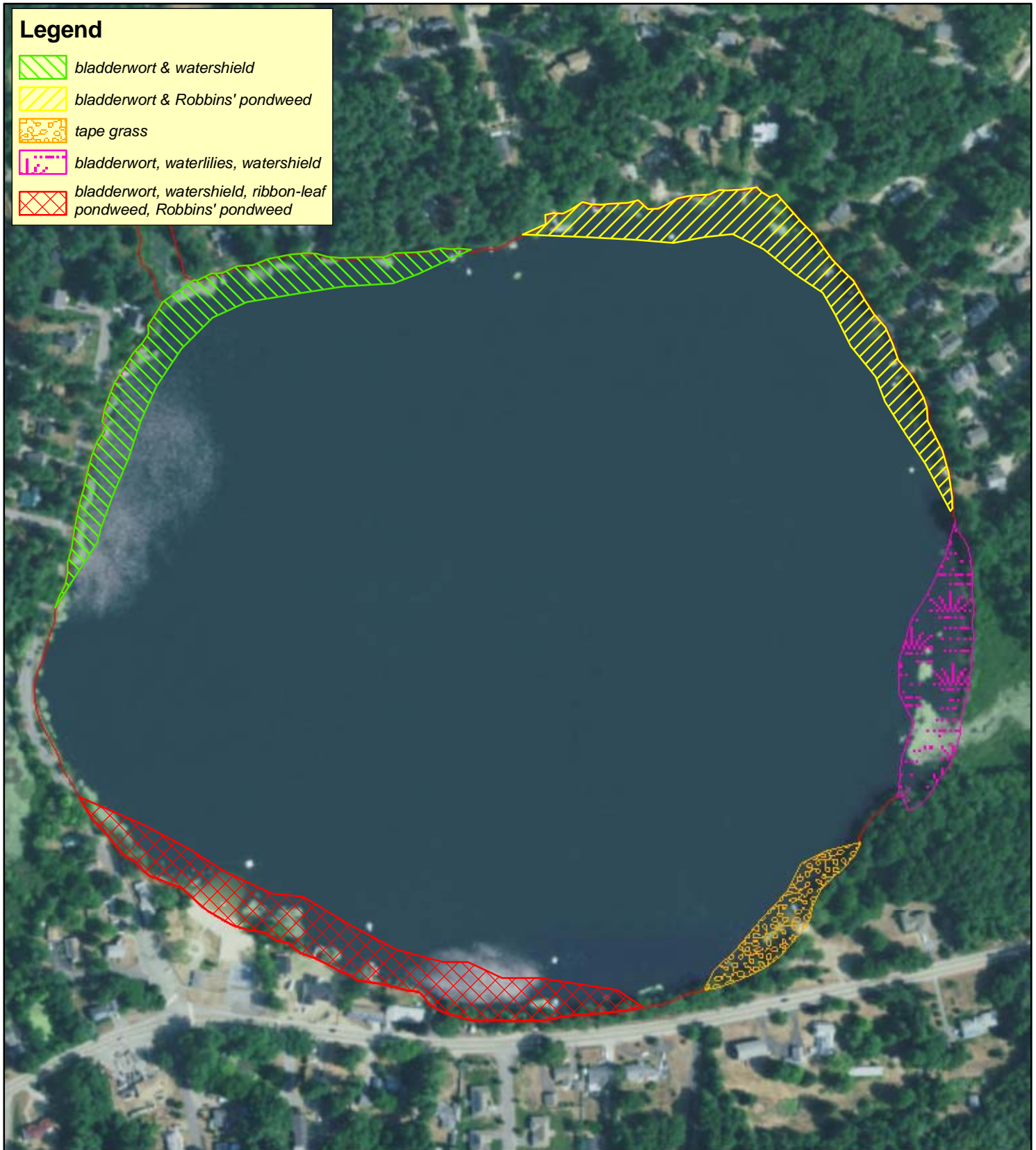


Flannagan Pond

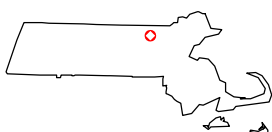


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FIGURE 10: Post-treatment Native Aquatic Vegetation Distribution



Sandy Pond
Ayer, MA



Sandy Pond

0 230 460
Feet
1:3,613



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