

**2015 Annual Summary Report
Aquatic Management Program
East Monponsett Pond
Halifax, MA**

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A herbicide treatment program was conducted at East Monponsett Pond during the summer of 2015 to control invasive non-native aquatic vegetation. The 2015 treatment program focused on the control of a variety of non-native species that included fanwort (*Cabomba caroliniana*), Eurasian watermilfoil (*Myriophyllum spicatum*), and variable watermilfoil (*Myriophyllum heterophyllum*). The herbicide treatment program consisted of the application of various formulations of the USEPA/MA registered herbicide Sonar (active ingredient fluridone). Three treatments were performed in order to maintain a target herbicide concentration in the range of 10 ppb until effective plant control was achieved. An outline of the 2015 program along with our recommendations for ongoing management follow.

2015 MANAGEMENT PROGRAM CHRONOLOGY

Project Task	Date Performed
Performed pre-treatment vegetation survey	May 11 th
Received approved MA DEP permit	May 13 th
Conducted initial herbicide treatment with Sonar Genesis and Sonar AS	May 28 th
Conducted Sonar Genesis and Sonar AS booster treatment	June 30 th
Performed interim vegetation inspection	August 3 rd
Conducted final Sonar AS booster treatment	August 24 th
Final post-treatment inspection	October 7 th

PRE-TREATMENT VEGETATION SURVEY

The pre—treatment survey was conducted on May 11th to document the extent of the target plant growth, dominant native plant assemblages, flow conditions, and other site conditions important to scheduling the initial

herbicide treatment. The general plant growth characteristics and other notable site conditions noted are outlined below.

- The observed fanwort, which was most abundant in the northern section of the pond, was actively growing and was in the range of 6-10 inches tall.
- Eurasian watermilfoil growth was widely scattered at the time of the survey with the greatest frequency of occurrence noted along the western and northern shoreline of the pond. The observed plants ranged from immature plants (1 ft. – 2 ft. tall) to larger more mature growth just 12 inches below the water’s surface.
- Variable watermilfoil growth was moderate in nature, occurring in scattered patches along the southern and western shorelines with the most abundant growth in the northern end of the pond. The maturity of these plants also varied, but the majority of the growth was near the water surface.
- The native plant assemblage was dominated by waterlily (*Nuphar variegatum* and *Nymphaea odorata*), floating-leaf pondweed (*Potamogeton natans*), tape grass (*Vallisneria americana*), quillwort (*Isoetes*), bladderwort (*Utricularia sp.*), along with an abundance of emergent cattails (*Typha latifolia*) and common reed (*Phragmites australis*) along the shoreline.
- As expected during the early stages of the growing season the water transparency was high, with a recorded Secchi depth of approximately 10 ft. The dissolved oxygen concentrations throughout the water column were normal for the depth, temperature, and time of year. No thermal stratification was observed.

Based on the maturity of the target plant growth, it was determined that the initial treatment should be scheduled before the end of May.

HERBICIDE TREATMENT PROGRAM SUMMARY

The initial Sonar herbicide treatment was performed on May 28th. A combination of Sonar Genesis and Sonar AS (liquid formulations) was applied at a pond-wide dose of approximately 15 ppb. Due to anticipated migration of water toward the pond outlet, a sizeable no-treatment buffer was maintained immediately up gradient of the spillway. Leaving this area untreated provides additional herbicide resonance time and improved herbicide contact time. The Sonar Genesis was injected below the water surface throughout the northern half of the pond, while the Sonar AS was applied using the same method throughout the southern portion of the pond. The herbicide treatment was performed using a shallow draft Panther airboat equipped with WAAS enabled GPS for accurate and even placement of the herbicide.

An inspection and FasTEST sample collection was performed approximately two weeks following the initial application in order to document fluridone concentrations and target plant response. At the time of the inspection (6/10/15) the target invasive plants displayed highly chlorotic (bleached plant tissue) growing tips and a complete lack of additional growth/maturation. These are all typical and desirable plant responses resulting from exposure to the Sonar herbicide. In fact, the level of impact observed was greater than what would ordinarily be expected just two weeks after the initial application.

FasTEST Collection Date	Mean Fluridone Concentration (ppb)
6/10/15	8.5
7/13/15	12.0
8/3/15	7.2

Three FasTEST samples were collected during the course of the inspection. A single sample was collected from the northern section, a second sample was collected from the mid pond section, and one additional sample was collected from the southern section in the main pond basin. The sample analysis indicated an average fluridone concentration of roughly 8.5 ppb, with the highest individual concentration recorded in the northern section (8.7 ppb). These fluridone concentrations coupled with the observed impacts on the target plants indicated that the treatment program was progressing well but that a booster treatment would be required soon.

Based on the known degradation rate of the Sonar active ingredient, a follow-up booster treatment was performed on June 30th. The focus of this treatment was to augment existing Sonar herbicide concentrations in order to maintain a lethal concentration for 40-60 days or until target plant control is achieved. As with the initial treatment a combination of Sonar Genesis and Sonar AS liquids were applied to the majority of the pond at a pond-wide dose of approximately 10 ppb. In the 20 days since the previous inspection the target plants were noticeably more impacted, with a higher degree of chlorosis and even some loss in stem rigidity observable.

Two additional inspections were performed following the second Sonar application, one at approximately 30 days after the initial treatment (DAT) and the second roughly 90 DAT. FasTEST samples collection replicating the initial sampling round was performed at each of the inspections. The fluridone concentrations at the time of the 30 DAT collection round averaged 12 ppb. This indicates a pond-wide concentration above the desired 10 ppb. We therefore feel that these results along with the advancing target plant impacts, indicated that the Sonar concentrations present in the pond were having lethal impacts on the target plants.

At the time of the 90 DAT inspection the Sonar concentrations had fallen significantly and averaged roughly 7.2 ppb. Despite the fact that the herbicide concentrations had fallen below 10 ppb at this stage of the program, the vast majority of the target plant growth had fallen out of the water column and begun decomposing on the bottom. Only a few small patches of variable watermilfoil growth along the western shoreline and at the northern end of the pond remained in the water column. These plants displayed significant herbicide impacts, however. The plants showed a high level of chlorosis and foliage loss along the lower sections of the stem. Based on these observations it was determined that one additional treatment would be required to achieve maximum long-term control of the target plants. As a result, a final booster treatment was performed on August 24th where an additional 5 ppb of Sonar was applied.

In advance of all treatments the Town of Halifax was notified of the scheduled treatment date. Also the pond shoreline was posted with signs warning of the scheduled treatment and post-treatment water-use restrictions in advance of each treatment. All treatments were conducted by ACT's MA licensed applicators in compliance with the product label, the MA DEP permit, and the Order of Conditions. ACT did not observe or receive any reports of adverse conditions developing following any of the treatments.

POST-TREATMENT VEGETATION SURVEY

The final post-treatment survey was conducted on October 7th to assess the efficacy of the treatment program on the target plant growth, identify impacts on non-target species, and collect other data pertinent to evaluating future management needs. An outline of the conditions observed at the time of the survey are listed below.

- The survey was performed by traversing all littoral areas (area of the pond that is capable of supporting rooted plant growth) visually assessing plant growth and by randomly collecting plant samples using a throw-rake.
- At the time of the survey the vegetation growth was dominated by yellow water lily (*Nuphar variegatum*), tape grass (*Vallisneria americana*), floating-leaf pondweed (*Potamogeton natans*), bladderwort (*Utricularia spp*), and cattails (*Typha latifolia*).
- The native plant assemblage appeared, for the most part, unimpacted by the treatment program. Areas of submersed pondweed growth were fully mature and showed evidence of seed production, which is indicative of an uninterrupted or affected life cycle. The only observed non-target/native plant impact was that some of the white waterlily growth in the northern area and western shoreline had been reduced. This is not uncommon during the year of a Sonar treatment as a result of the required extended herbicide exposure; however, the doses maintained are generally insufficient to have a lasting impact on waterlily growth. Therefore, it is likely that the waterlily canopy will rebound to near pre-treatment conditions next season.
- No viable fanwort growth was observed anywhere in the pond at the time of survey. The plants that were observed were raked up from the pond bottom using a throw rake. The plants consisted of dark colored

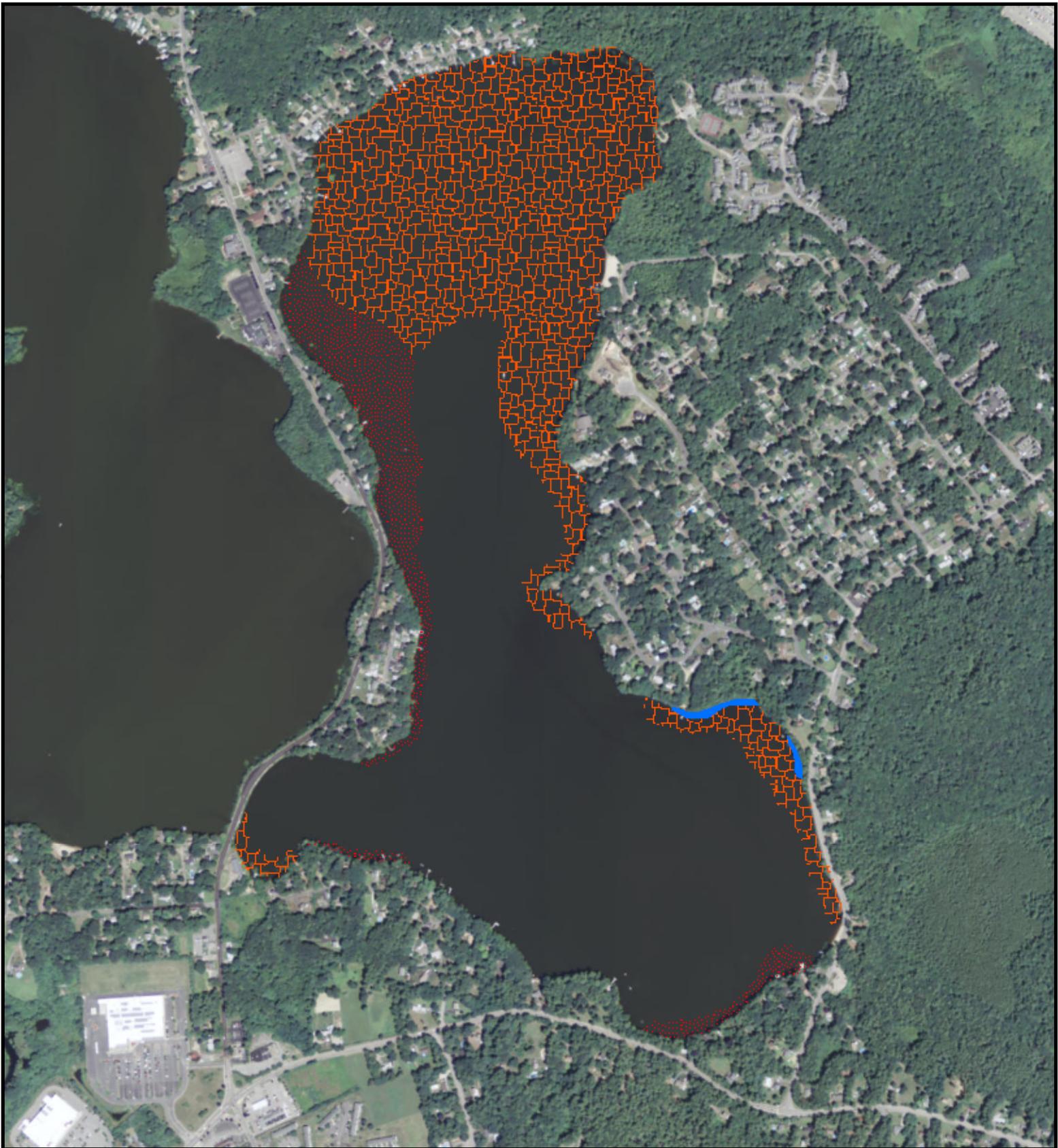
partially decayed leafless stem fragments. None of these collected plant stems showed any evidence of viability.

- No evidence of any growth of the other target plants (Eurasian watermilfoil and variable watermilfoil) was observed during the survey.
- Water quality conditions appeared favorable with a Secchi depth of approximately 10 ft. The dissolved oxygen concentrations were at or near the saturation point for the water temperature and fairly uniform throughout the water column. Near anoxic conditions occurred just above the sediment that was representative of normal biological oxygen demand.

MANAGEMENT RECOMMENDATIONS FOR 2016

Based on the level of control observed during the post-treatment inspection, we expect to see excellent carry-over control throughout 2016. As a result, we do not anticipate that any additional active management of the non-native plant assemblage will be required next year. We do, however, feel that the Town should budget for a late season (August) vegetation survey in order establish a baseline post-treatment vegetation assemblage and identify the extent of target plant growth, if any.

We feel that continued monitoring and early detection of non-native plant regrowth is an important component of the East Monponsett Pond long-term management program. Early detection of invasive species and rapid management response is the most cost effective and least disruptive way to sustain a desirable vegetative balance in the pond over the long term. We appreciate your business and look forward to working with you again in 2016. If you have any questions about the 2015 program or our 2016 management recommendations please do not hesitate to contact our office.



East Monponsett Pond

2015 Pre-Treatment Invasive Plant Map

Halifax, MA

Legend:



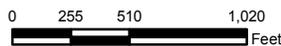
Area dominated by moderate to dense fanwort growth with lesser amount of variable watermilfoil, Eurasian watermilfoil, floating-leaf pondweed, waterlily and bladderwort - average plant cover 50%-75%



Area dominated by variable watermilfoil with lesser amounts of Eurasian watermilfoil, bladderwort, and waterlily - average plant cover 25%-50%



Dense shoreline growth of common reed - 100% cover



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FIGURE:	SURVEY DATE:	MAP DATE:
1	5/11/15	11/11/15



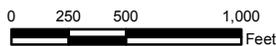
East Monponsett Pond

2015 Post-Treatment Invasive Plant Map

Halifax, MA

Legend:

-  Sparse to moderate growth of floating-leaf pondweed with scattered occurrences of bladderwort, yellow water lily, and benthic filamentous algae - Average plant cover 25-30%
-  Sparse canopy of yellow water lily with sparse understory of bladderwort - average plant cover 10%-20%
-  Sparse to moderate growth of bladderwort - average plant cover 10%-20%
-  Sparse growth of floating-leaf pondweed and bladderwort - average plant cover <10%



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FIGURE:	SURVEY DATE:	MAP DATE:
2	10/7/15	11/11/15