HOP BROOK PROTECTION ASSOCIATION

Restoring and Preserving Sudbury's Ponds

Box 707, Sudbury, MA 01776

1/13/2020

Sudbury Conservation Commission
Department of Public Works Building
275 Old Lancaster Rd
Sudbury, MA 01776

Greetings! As Lori has discussed with you previously, our organization of abutters has been working hard these past months developing a solution to the decaying state of the 3 Hop Brook Ponds (Grist Mill, Stearns Mill, and Carding Mill). To that end, we have concluded that no matter what path we take, the first step must be the control and significant reduction of the water chestnut infestation.

After review of many different methods of achieving this goal, we have concluded that the best approach is herbicidal treatment using Clearcast. We have obtained a 3-year grant (subject to Town Meeting approval), from the CPC for herbicide treatment, and so we are hereby submitting a Notice of Intent for your approval. We have attached the below-listed documents for your review.

1) Notice of Intent.
2) Check for $762.50.
3) Signed forms from owners and abutters.
4) Checklists and documentation related to the signed forms.
5) Chemical/Safety review of Clearcast prepared by HBPA.
6) Answers to questions submitted by Lori with respect to 5).
7) Hop Brook Ponds Aquatic Management Program, prepared by SOLitude.
8) An evaluation of Clearcast from the MassDEP. (After a thorough review, the Mass DEP concluded that no additional restrictions on Clearcast use beyond those on the product label are necessary for safe use).
9) Experience reports from towns with similar issues and treatment methods, prepared by HBPA.
10) A brief history of the Hop Brook Protection Association.

Note that if our plans are approved, we must do the treatment in late June for it to be effective, and the permitting process can take a few months.

Last summer, the Hop Brook Protection Association embarked on an aggressive outreach effort to keep pond land owners and abutters informed. A Facebook group (called "Hop Brook Protection Association") was created, and flyers were put in every pond abutter's mailbox encouraging them to join. Many dozens did, along with additional dozens of interested residents from all over Sudbury. The group currently has over 120 members, all self-identified as Sudbury residents, with a significant proportion of pond owner/abutters. HBPA keeps this FB group updated with the latest information and responds to all queries. To date, there has been nothing but support for our plans from the group members.

In addition, as part of the preparation of the NOI, we had to reach out to every pond owner/abutter. Everyone we had contact with was supportive of our efforts.

We have also reached out to the Wayside Inn. According to Gary Christelis, President of the Board of the Wayside Inn Foundation, "*The problem with the water chestnuts in the Grist Mill Pond… [has] actually resulted in us being unable to operate the mill at several points during this [2019] season. So*

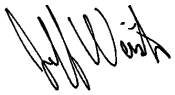
we see that as being a growing concern for us in terms of being able to operate the mill on a reliable basis". They are in strong support of our plans, and attend all hearings.

Finally, we are interacting with the Board of Selectpersons, the Ponds and Waterways Committee, and Sudbury Valley Trustees. We will meet with the BOS and PWC this week, but so far all are supportive of our efforts, and PWC and SVT plan to send representatives to your hearing.

We look forward to meeting with you on January 27th to present our plans.

Please contact me if you have any questions.

Best Regards



Jeff Winston, President, HBPA (*jeff@hopbrook.org*)

HOP BROOK PROTECTION ASSOCIATION

Restoring and Preserving Sudbury's Ponds

Box 707, Sudbury, MA 01776

A Brief History of the Hop Brook Protection Association
1/11/2020

The Hop Brook Protection Association was founded in 1987 because of the spread of invasive algae in the Hop Brook Ponds (Grist Mill Pond, Carding Mill Pond, and Stearns Mill Pond) caused by the effluent from the Marlboro Easterly Wastewater Treatment Facility. Up until 2016, HBPA focused on stopping the pollution coming into the ponds from Marlboro's effluent and insuring that the ponds and streams were mostly cleared of algae , and in this endeavor they were largely successful. The treatment plan was issued a more restrictive EPA permit and installed equipment that now reduces phosphorous output significantly below allowed levels.

However, in recent years, the Hop Brook has seen an increasing proliferation of water chestnut, which has since rapidly expanded to cover most of the ponds. Untreated, this invasive species will effectively kill all indigenous native plants in the ponds in only a few more years. One acre of water chestnut can produce enough seeds to cover 100 acres the following year, and produces over 40 cubic yards of additional undesirable biomass each year.

The Hop Brook Pond system is an essential part of Sudbury's character and a valuable town asset. Without control and eventual eradication of this invasive species, 80 acres of ponds and wetlands currently used for recreation and wildlife would be turned into a stagnant and unattractive bog. This will further decrease water quality, resulting in lower oxygen levels, shallower pond depth, a repugnant smell, poor fish and bird habitat, and reduced habitat for native macrophytes. A very significant concern, given the recent EEE outbreak, is that water chestnut infestations lead to higher levels of mosquitos, as they create optimal conditions for mosquito larvae.

HBPA originally tried to control the water chestnut through harvesting. However, like many other nearby towns, we concluded that harvesting by itself is ineffective and impractical, and may actually spread other invasives (such as Eurasian milfoil). Further, what beneficial effect it had typically lasted no more than several weeks.

Alternately, we have found that a very effective method of controlling water chestnut is use of environmentally-friendly chemical treatment, applied multiple times annually, in decreasing amounts over a number of years. This is being used successfully in Framingham, Wayland, Acton, and elsewhere. This treatment is be a key component of a comprehensive multi-modal pond management plan that could restore the ponds to class B recreational standards over time.

In December 2019, the Sudbury Community Preservation Committee granted our request for $180K over three years to treat the water chestnut with Clearcast, a low-risk, environmentally-friendly herbicide. We are currently working to gain Conservation Commission approval to start this treatment in the summer of 2020.

We have embarked on an aggressive outreach effort to keep abutters informed. A Facebook group (called "Hop Brook Protection Association") was created months ago, and flyers were put in every abutter's mailbox encouraging them to join. Many dozens did, along with additional dozens of interested residents from all over Sudbury. HBPA keeps this FB group updated with the latest information and responds to all queries. To date, there has been nothing but support for our plans from the group members.

We have also reached out to the Wayside Inn. According to Gary Christelis, President of the Board of the Wayside Inn Foundation, "The problem with the water chestnuts in the Grist Mill Pond… [has] actually resulted in us being unable to operate the mill at several points during this season. So we see that as being a growing concern for us in terms of being able to operate the mill on a reliable basis". They are in strong support of our plans, and attend all hearings.

We also have received supportive comments from Sudbury Valley Trustees, The Sudbury Ponds and Waterways Committee, and the Sudbury Board of Selectpersons. We will be meeting with the latter two in the near future to bring them up to speed on our plans.

Hop Brook Protection Association is a 501c3 non-profit corporation made up entirely of volunteer resident pond abutters, and supported entirely through CPC grants and charitable contributions. More information is available on our FB group and our website http://hopbrook.org, where you can also make contributions online via credit card or Paypal. We thank you for your support.

Hop Brook Ponds

2019 Aquatic Management Program

SOLITUDE LAKE MANAGEMENT

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2019 AQUATIC VEGETATION SURVEY REPORT & MANAGEMENT PLAN

Hop Brook Ponds
Sudbury, Massachusetts

Prepared On: December 2, 2019

Prepared by: SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

Prepared for: Jeff Winston
Hop Brook Protection Association
Sudbury, MA 01776

INTRODUCTION

The following report documents the observations and data gathered during our 2019 Pre-Management Survey conducted on the Hop Brook Ponds in Sudbury, MA. The objective of this survey was to determine the presence and extent of non-native, invasive aquatic vegetation for the purpose of developing a multi-year management plan focusing on the restoration of open water and suitable aquatic habitat. All work performed during the 2019 management season was conducted in accordance with the scope of work outlined in the 2019 Vegetation Management Plan Contract and the 2019 Vegetation Mapping Contract.

PRE-MANAGEMENT SURVEY RESULTS

On October 15th, a SOLitude Aquatic Specialist surveyed the plant community in all three Hop Brook Ponds (Grist Mill Pond, Carding Mill Pond, and Stearns Mill Pond - **See Figure 1**). These surveys involved traveling around the littoral zones of all three ponds in a 10-foot jon boat, noting the types of aquatic plants present and their relative cover and density. Vegetation data was collected using a combination of techniques: visual observation, as well as the use of a "throw-rake" and underwater camera. Special attention was given to the presence of potential non-native, invasive vegetation. Locations of various plant species and assemblages were recorded with a GPS unit and the data was then used to create dominant vegetation distribution maps for each pond.

At the time of the survey, aquatic vegetation had begun senescing for the season; therefore, depictions of overall density and distribution may not be fully representative of conditions during the peak of the growing season. With that being said, three invasive species were observed at the time of the survey, including water

chestnut (*Trapa natans*), Eurasian watermilfoil (*Myriophyllum spicatum*), and Curly-leaf pondweed (*Potamogeton crispus*). Native species observed include coontail (*Ceratophyllum demersum*), watermeal (*Wolffia sp.*), waterweed (*Elodea canadensis*), lesser duckweed (*Lemna*) white waterlily (*Nymphaea odorata*), yellow waterlily (*Nuphar variegata*), and water-shield (*Brasenia schreberi*).

TABLE 1: Vegetation species observed in each pond (Non-native species noted in RED)

Stearns Mill Pond	Carding Mill Pond	Grist Mill Pond
Water Chestnut	Water Chestnut	Water Chestnut
Elodea	White Waterlilies	White Waterlilies
Filamentous Algae	Yellow Waterlilies	Yellow Waterlilies
Duckweed	Duckweed	Duckweed
Watermeal	Watermeal	Watermeal
Eurasian Watermilfoil	Filamentous Algae	Filamentous Algae
Curly-leaf Pondweed	Elodea	-
	Coontail	-

Stearns Mill Pond - moderate to dense water chestnut growth was present on about 10 of the 19 acres of the pond surface (~55 percent). This plant growth was distributed primarily along the shorelines and in the northern and southern tips of the pond (**See Figure 2**). The water chestnut was also mixed with dense filamentous algae mats. Underneath these mats of filamentous algae and water chestnut was sparse-moderate amounts of invasive Eurasian watermilfoil, sparse amounts of invasive curly-leaf pondweed, and moderate density of Elodea. It is important to note that future management plans will need to consider the eventual expansion of both Eurasian watermilfoil and Curly-leaf pondweed. These invasive species can proliferate rapidly when conditions are suitable. The current water chestnut canopy is likely currently suppressing the density and distribution of these submersed species, so management and reduction of water chestnut will likely daylight these species causing an overall expansion of the assemblage

Carding Mill Pond - moderate-dense water chestnut was present on about 20 of the 41 acres of the pond surface (~50 percent). The growth was observed primarily along the shoreline of the waterbody, as well as patches scattered throughout more central areas and around the islands. Like Stearns Mill Pond, the water chestnut was mixed with filamentous algae, watermeal, and duckweed. Underneath the surface was moderate amounts of native species Elodea and coontail. Note that water chestnut was the only invasive species found at the time of the survey. (**See Figure 3**)

Grist Mill Pond - moderate to dense water chestnut was present on about 14.5 of the 18 acres of the pond surface (~80 percent). The greatest densities were observed in the northern basin and the southern cove, while moderate levels of growth were located in the middle. Mixed with the water chestnut were native duckweed and watermeal. (**See Figure 4**)

WATER CHESTNUT CHARACTERISTICS

Water Chestnut (*Trapa Natans*) is native to Eurasia, it was introduced intentionally to the U.S. in the late 1800's by a gardener at the Cambridge botanical garden, in Fresh Pond in Cambridge, MA. Water chestnut is an annual plant with a submerged stem 12-15 feet long that has fine roots that anchor it to the soil. Water chestnut impacts water bodies in several ways including increasing sedimentation and reducing oxygen. The fruits, which will always land spike-up, are viable for up to 10 years, although most germinate within two years. Once germinated, the water chestnut plantlet develops at a rapid rate. Each water chestnut seed can produce up to 15 to 20 new rosettes and each rosette can generate up to 20 seeds. One acre of water chestnut can produce enough seeds to cover 100 acres the following year. Water chestnuts form dense mats of rooted vegetation that can be very difficult to get though in a boat, kayak, canoe, or when swimming. These thick mats will shade out native aquatic plants that provide food and shelter to native fish, waterfowl, and insects. The images below show the water chestnut nutlet and rosettes starting to flower.

IMAGE 1: Water Chestnut Nutlet

IMAGE 2: Water Chestnut Rosettes

EVALUATION OF MANAGEMENT OPTIONS

SŌLitude evaluated all available strategies for management of Hop Brook Ponds. Findings and recommendations are based on direct experience and discussions found in the *Eutrophication and Aquatic Plant Management in Massachusetts Final Generic Environmental Impact Review* (FGEIR, EOEA 2004).

The unbalanced growth of non-native aquatic vegetation within the Hop Brook Ponds are negatively impacting the ecological value of the system. Invasive non-native species such as water chestnut, Eurasian milfoil, and curly-leaf pondweed have the ability to outcompete native species and create dense monotypic stands. Therefore, when left unmanaged, the growth of these species result in loss of species richness and diversity, the degradation of water quality (dissolved oxygen fluctuations, increase phosphorus release from bottom sediments, etc.), reduction of open water habitat, and impairment of recreational accessibility. Therefore, in order to restore a balanced vegetation community and minimize spread of these invasive species within the pond's systems and neighboring waterbodies, we recommend implementing an aquatic vegetation management program.

By far water chestnut is the most abundant and problematic plant currently growing in the study areas. We, therefore, feel that the first phase of the management program should focus on the control of this species. Water chestnut is an annual seed producing plant that can be effectively managed through both mechanical and chemical strategies. Regardless of the management technique employed, long-term control of water chestnut requires a multi-year commitment, as the goal of active management is to

annually prevent viable seed production until the dormant seed-bank is depleted. Water chestnut seeds can remain dormant for as long as 10 years before germinating, although typically 3-5 years of large-scale annual management is sufficient to reduce the infestation to the point that the management effort can be reduced. Although there are many aquatic technologies and methods to removing invasive or nuisance vegetation, there are only a few that have been proven to have a profound effect on water chestnut.

Mechanical Harvesting

Mechanical harvesting is likely the most commonly used strategy to control water chestnut. It has been used successfully to control water chestnut infestations on the Charles River, the Mystic River, Lake Champlain, and many other sites around New England. Mechanical harvesters are paddle-wheel driven barges that cut and collect aquatic vegetation. The front cutting table can be adjusted to a maximum cutting depth of usually 5-7 feet. Hydraulically driven conveyors on these machines facilitate stockpiling and off-loading of the harvested material. By removing the water chestnut rosettes in mid to late summer before viable seed production occurs, the plants can be prevented from successfully reproducing and the infestation reduced over time. Due to the significant biomass associated with water chestnut the shore-based disposal operation is a critical component of an efficient and successful harvesting project.

Although harvesting is a viable management option for the control of the water chestnut in certain waterbodies, many of the site characteristics and constraints may make this a less desirable and more costly strategy in this case. Some of these specific issues are outlined below.

1. There are currently no access points to the ponds that would be suitable for launching equipment and staging the shore-based disposal operation. Although some small access points exist, they would require significant alterations/improvement (grading, brush & tree clearing, etc.) in order to make them usable for this purpose.
2. There are many shallow shoreline and backwater areas throughout the study area that support dense growth of water chestnut. Despite the fact that harvesters can effectively operate in shallow water (2-3 ft.), many of these areas are too shallow to be accessed by conventional harvesting equipment. Therefore, in order to remove all of the water chestnut growth a combination of manual hand-pulling and alternate mechanical equipment (hydro-rake & airboat cutter) will likely be required. The use of these other techniques will increase the complexity and cost of a harvesting project.
3. Given the presence of submersed non-native plant species (Eurasian milfoil) that reproduce through fragmentation (broken pieces of the plant develop new roots and create a new plant), harvesting may contribute to the proliferation of these plants within the ponds and potentially downstream. Additional measures would be necessary to prevent the migration of fragments downstream during a harvesting project.

All of these issues will increase the complexity and cost of a harvesting project and given the need for a multi-year commitment for long-term water chestnut control harvesting may not be a sustainable option.

Chemical Treatment

Treatment with USEPA/MA registered aquatic herbicides for the control of nuisance and non-native aquatic plant growth is often the most cost-effective and least disruptive management approach available. Historically chemical control of water chestnut has not been widely used due to the fact that most of the aquatic herbicides available have had fairly limited activity on this plant species. To date the bulk of

chemical water chestnut control has been performed using 2,4-D ester (Navigate) or the liquid 2,4-D amine formulation (Platoon, DMA-4, CleanAmine). These products have provided relatively good control; however, treatment timing and water flow can have significant influences on efficacy. Also, these products require an added level of scrutiny from regulatory agencies due to concerns over possible movement into groundwater. As a result, the use of 2,4-D products are prohibited in Zone II – wellhead protection areas. For these reasons, permits to use 2,4-D based products may be difficult.

Until recently 2,4-D based herbicides were all that were available for treatment of water chestnut in MA. In the spring of 2015, however, the aquatic herbicide Clearcast (active ingredient imazamox) was registered for use in MA by the Department of Agriculture. Clearcast has shown very good activity on water chestnut as a foliar spray elsewhere in the state and has a much more favorable toxicology profile than 2,4-D. In fact, Clearcast is labeled for direct application to drinking water reservoirs at low doses. Because of its favorable toxicology and its proven efficacy on water chestnut, we feel that it is the best chemical treatment option for these sites. Control of water chestnut with Clearcast is best achieved using a foliar application of the product to the floating rosettes of the plant at a rate of 0.5-1.0 gals per acre. Due to the nature of foliar treatment and the potential for plants to be missed, we recommend two treatments per season to achieve maximum control. Treatment with Clearcast carries very minimal post-treatment water-use restrictions, in fact there are no label required restrictions for swimming, boating, or fishing and only a 24-hour irrigation restriction when applied to still or quiescent waters.

PROPOPSED MANAGEMENT PLAN

Based on the results of the pre-management survey and the evaluation of management options discussed above, we recommend managing Hop Brook Ponds with EPA/MA registered aquatic herbicides. This approach is not only safe and effective, but also the most cost-effective solution.

Water Chestnut Management

Beginning in 2020, we recommend that Clearcast (Imazamox) herbicide be applied to the targeted areas of the Hop Brook ponds for the control of Water Chestnut. The foliar application of Clearcast will be administered along with a surfactant as required. An airboat equipped with the proper application equipment will be used for the treatment. A GPS system will also be used for real-time navigation during the treatment to ensure that the herbicide is accurately applied within the designated treatment areas.

As mentioned above, Clearcast has been used effectively in the treatment of Water Chestnut at dozens of regional waterbodies. We would recommend initiating treatment at the onset of active plant growth, probably mid-late June, if necessary. Multiple applications over the course of the year will be required to provide a desirable level of control due to staggered water chestnut germination. At least 3-5 years of herbicide treatment are recommended until the water chestnut population has been reduced to levels where hand-pulling may be feasible.

Other Invasive Species Management

The non-native aquatic vegetation within the subject area is negatively impacting the Hop Brook Ponds; therefore, some level of management is required to restore vegetative balance and ecological value. Given the non-native plant assemblage and the current extent of the growth it is our opinion that the management focus should initially be on the control of the extensive water chestnut infestation. Although the other non-native submersed species pose a threat to the aquatic ecology, the composition and distribution of these species will likely change in response to the removal of the expansive water chestnut canopy. The dense cover of water chestnut currently serves as a deterrent to the spread of these submersed species and therefore once removed will likely promote the spread of these invasive species. Once the non-native species assemblage becomes settled following the control of the water chestnut the appropriate management options can be better evaluated. Based off of prior experience and knowledge, both of these invasive species will proliferate once the current canopy is removed, and will require management in the future. Although it is difficult, if not impossible, to predict how these plants will behave following water chestnut management, long-term, low-low impact management plans for these species generally involve the application of USEPA herbicides. With that said, however, the actual management strategy employed would be commensurate with the specific composition and distribution of target plants.

Permitting

Proposed management activities at Hop Brook ponds will require appropriate State and local permit approvals. Obtaining an Order of Conditions from the Sudbury and Marlborough Conservation Commissions, as applicable, is planned for the initial year of the program and will be extended as needed over the duration of the project. Any required compliance tasks will be conducted annually as needed. To obtain Orders of Conditions, a Notice of Intent will need to be filed with the Conservation Commission(s). We anticipate a cost of $6,580 plus direct expenses for SOLitude to prepare and file the Notice of Intent. This cost also includes our attendance at one public hearing per town. Additional costs will apply for expenses such as abutter mailings, filing fees, additional required hearings, etc.

Herbicide treatments also require a License to Apply Chemicals (BRP WM04) which will be obtained from DEP on an annual basis, this cost is included in the management technique costs below (**table 2**).

Monitoring/Reporting

Routine monitoring is a critical component of all effective management programs. Both pre and post management surveys are included in the management plan, as well as any interim surveys that may be required to guide on-going management tasks. Annual year-end reports will be produced documenting the survey results and management actions conducted that year along with any adjustments recommended for subsequent years' program.

TABLE 2: Management Technique Costs

Management Technique	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	Total 5 Year Cost
Clearcast Treatment[1]	$56,500	$50,500	$42,950	$32,150	$32,150	$214,250

[1] – *These costs are based on three foliar herbicide applications in the initial (and possibly 2nd) year, and two foliar applications in each remaining year of the project, pre and post-treatment inspection, reporting and MA DEP pesticide use permitting. Note that mechanical harvesting would be 4-5 times the cost of Clearcast treatment, and is not recommended due to access issues and other logistics.*

Figure 1: Hop Brook Ponds Waterbody Location Map

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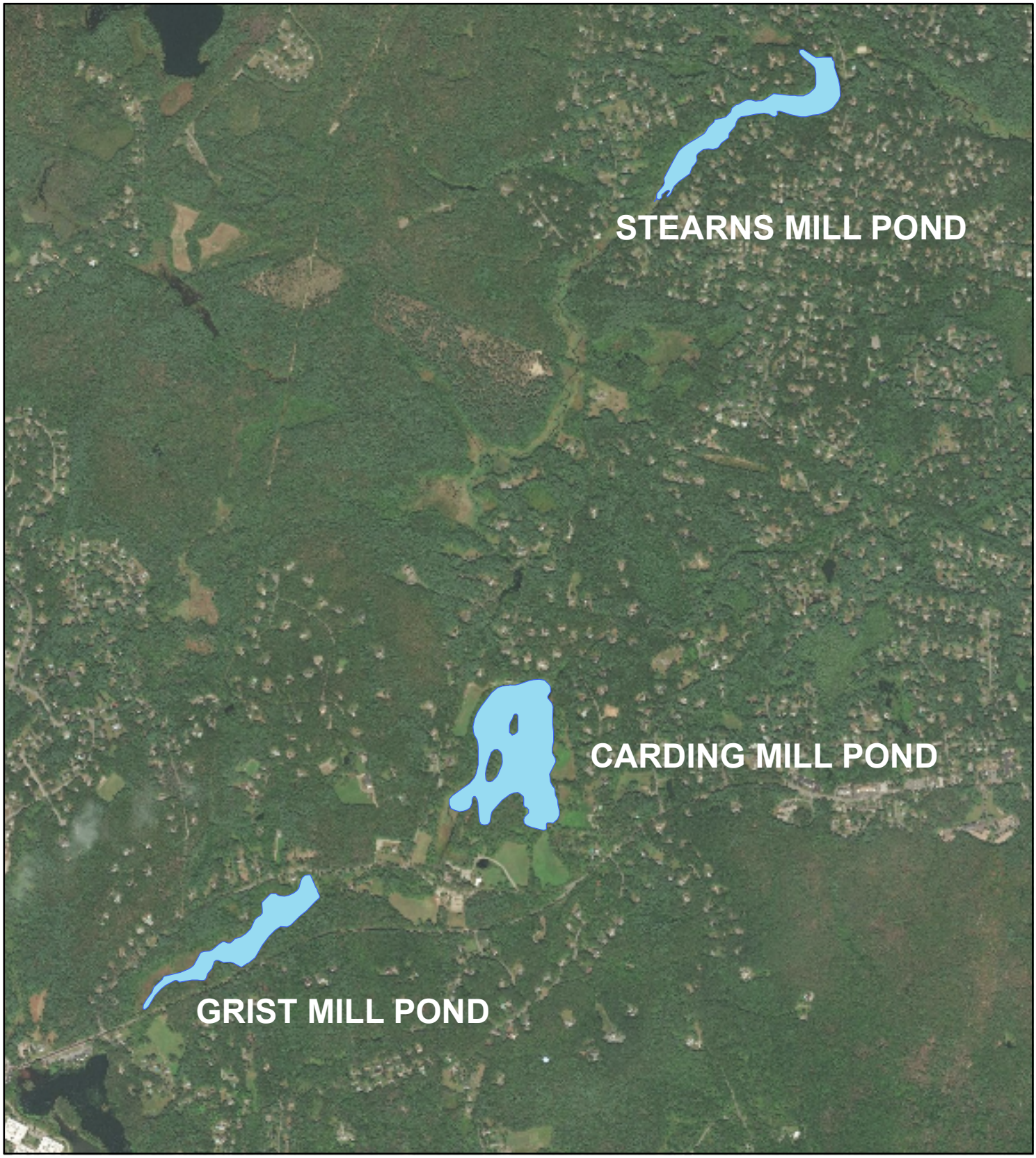

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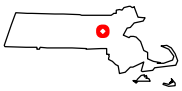
Sudbury, MA



Hop Brook Ponds

0 1,600 3,200 Feet

1:21,584

N

Prepared by: MD
Office: SHREWSBURY, MA

Figure 2: Hop Brook Ponds - Stearns Mill Pond

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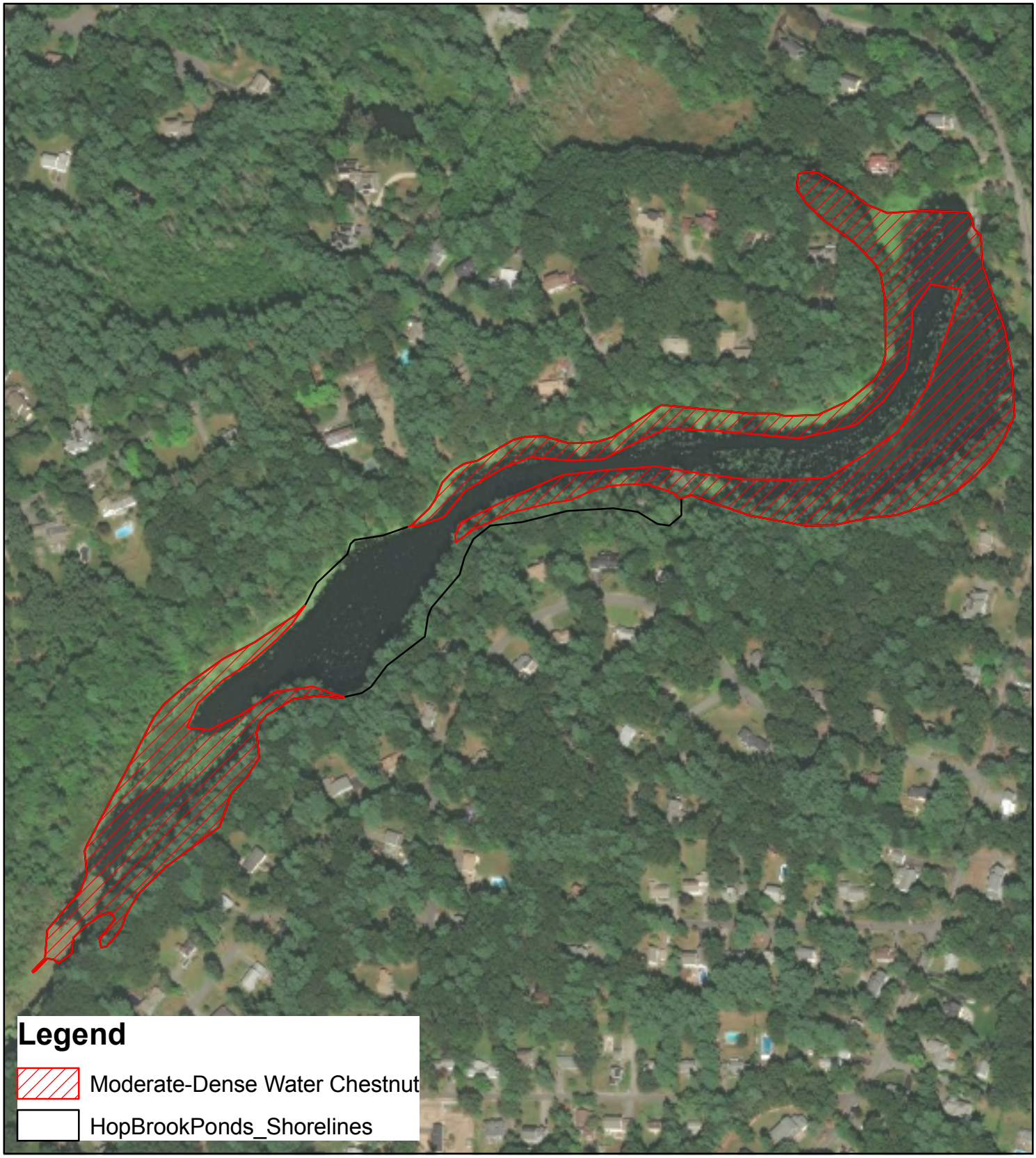
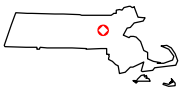


Hop Brook Ponds
Sudbury, MA



Stearns Mill Pond

0 340 680 Feet

N

1:4,104

Prepared by: MD
Office: SHREWSBURY, MA

Figure 3: Hop Brook Ponds - Carding Mill Pond

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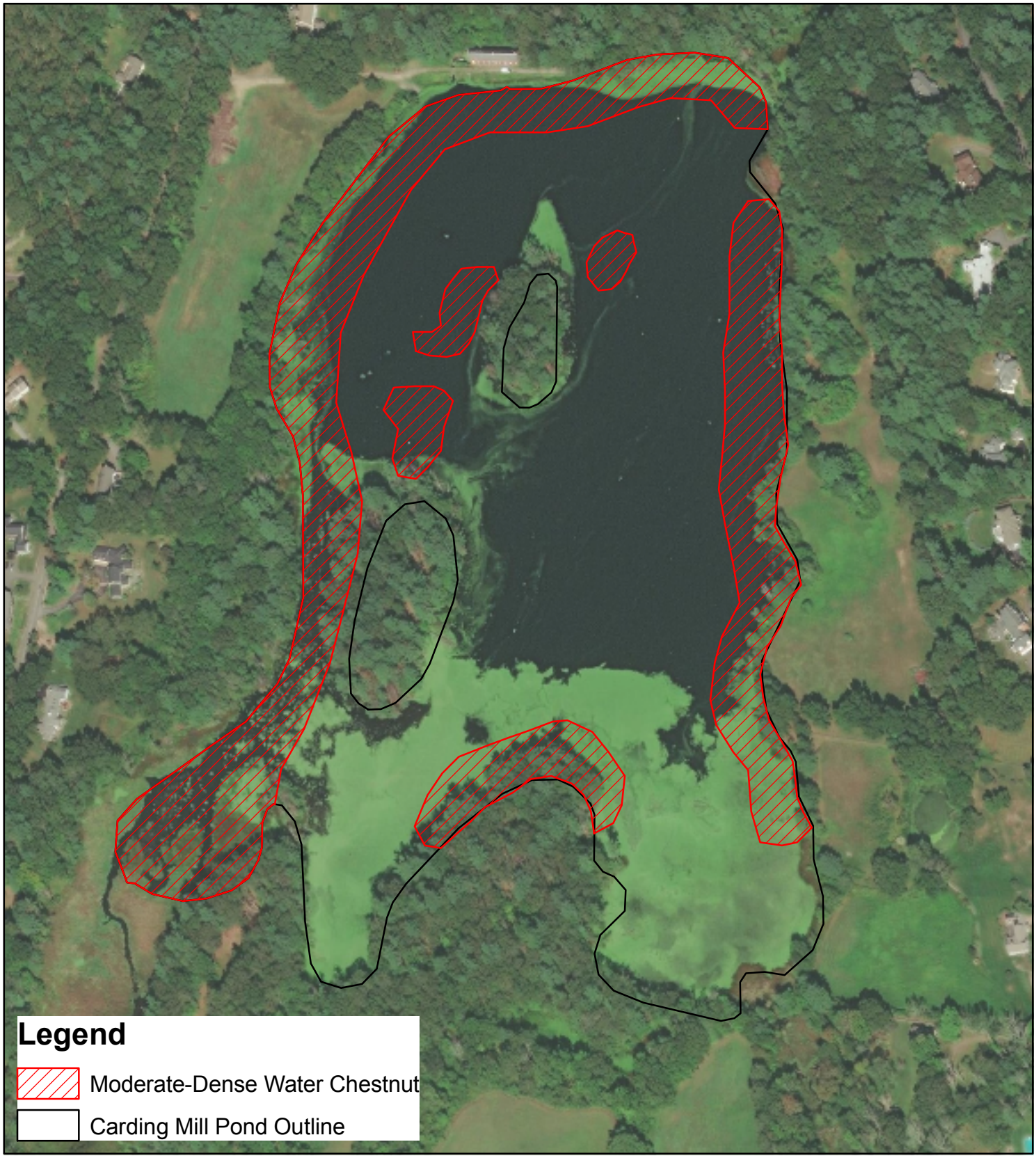
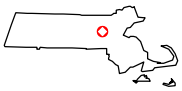


Hop Brook Ponds
Sudbury, MA



Carding Mill Pond

0 300 600 Feet

1:3,362

Prepared by: MD
Office: SHREWSBURY, MA

Figure 4: Hop Brook Ponds - Grist Mill Pond

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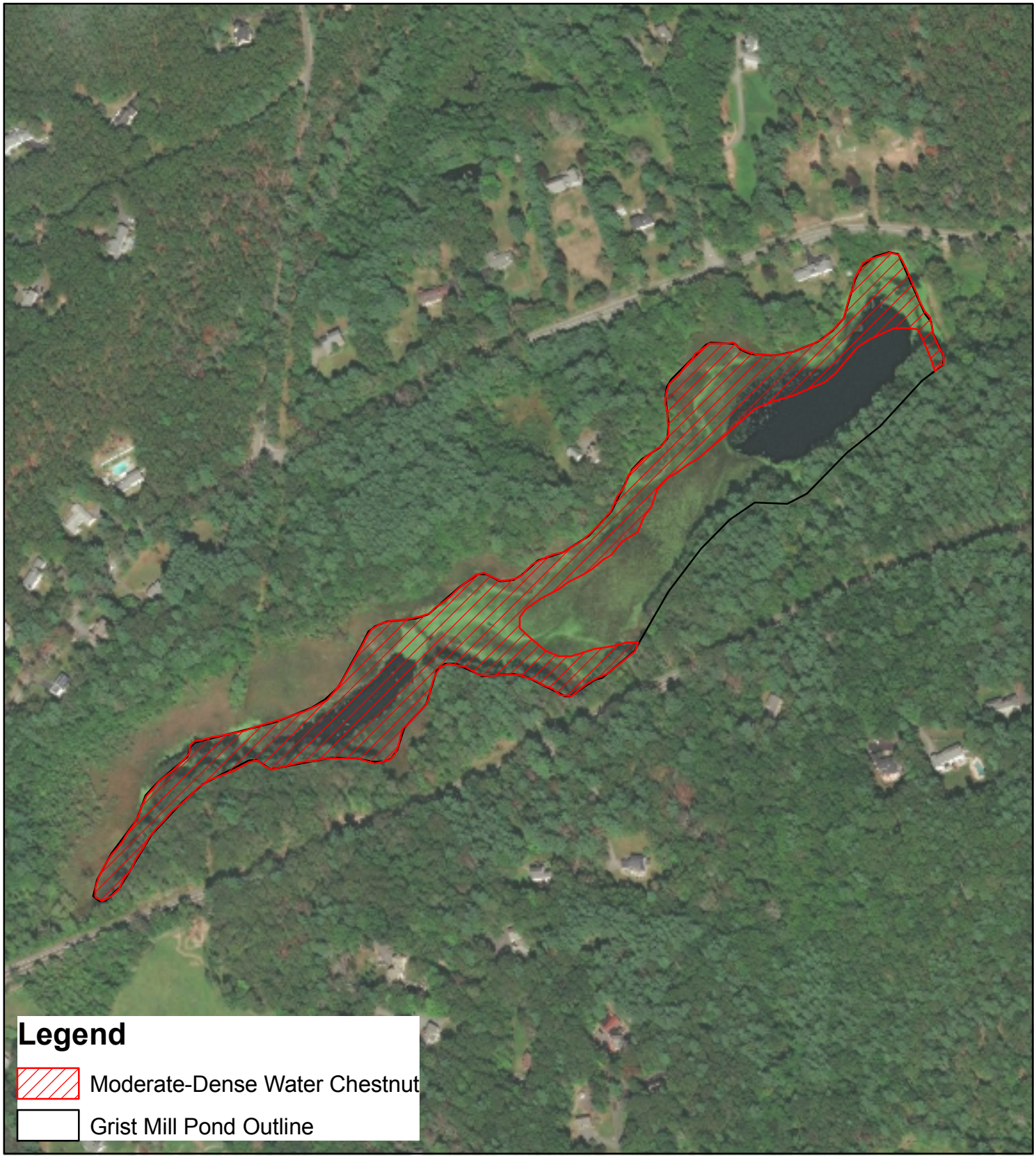

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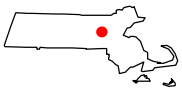

Grist Mill Pond

0 450 900 Feet

N

1:4,497

Prepared by: MD
Office: SHREWSBURY, MA

Clearcast® Herbicide Product Evaluation and Recommendation

This document is a review of the aquatic herbicide Clearcast® (EPA. Reg. No. 241-437-67690); (SEPRO, 2013). It contains product-specific aspects related to use characterization, inert formulation ingredients and adjuvants, and toxicity and effects of these ingredients to human health and non-target organisms. This document complements the MDAR/MassDEP review of the active ingredient imazamox (MDAR/MassDEP 2013).

1. Product Formulation

The product label indicates that Clearcast herbicide is a liquid formulation containing the ammonium salt of imazamox at a concentration of 12.1% by mass, which corresponds to 1 lb of acid equivalent per gallon of product (SEPRO, 2013).

The identity of the other ingredients (also referred to as inerts) in Clearcast herbicide is considered proprietary; therefore, the manufacturer does not identify the other ingredients on the general or supplemental product labels or material safety data sheets (MSDS). EPA requires labels of pesticide products to identify any inert ingredient that it has determined is of "toxicological concern." The Clearcast label does not identify inert ingredients of toxicological concern.

Proprietary information on the other formulation ingredients was obtained. The proprietary ingredients were evaluated as part of this review, but their identity cannot be disclosed here for reasons of confidentiality.

Foliar applications require the use of a spray adjuvant that is appropriate for aquatic sites.

2. Use Characterization

2.1 Use Sites

The product label for the imazamox-formulated Clearcast herbicide specifies that this product may be applied for the control of vegetation in and around aquatic sites and terrestrial non-crop sites. Clearcast is herbicidally active on many submerged, emergent, and floating broadleaf and monocot aquatic plants. The product may be applied directly to the water for control of submerged aquatic vegetation or a foliar spray for control of emergent and floating vegetation.

Aquatic uses of imazamox are for control of undesirable submerged, emergent and floating aquatic vegetation in and around standing and slow-moving water bodies. These include control of undesirable wetland, riparian and terrestrial vegetation growing in and around standing and flowing water.

Imazamox may also be applied terrestrially to non-crop sites for control of a number of weed species specified on the label.

2.2 Application Methods

Aquatic applications of imazamox herbicide products such as Clearcast are made as a liquid. Clearcast may be broadcast applied to the water surface or injected below the water surface as undiluted product or diluted with water. Application may be by directed application techniques or may be broadcast applied by using ground equipment or water craft. In addition, the products may also be used for cut stump, cut stem and frill and girdle treatments within aquatic sites to treat emergent vegetation. Clearcast may also be applied in a drawdown situation.

2.3 Use Rates

The label use rates per application of Clearcast Herbicide are:

- Subsurface rates that produce 50 to 500 ppb imazamox in the water column. The product label provides information on the amount of product required per surface acre and water depth to achieve the desired water concentration.
- Foliar broadcast application: 16 – 64 fl. oz. of product per acre (0.125 – 0.5 lb imazamox per acre)
- Foliar spot application: up to 5% Clearcast by volume.

2.4 Target Species

Clearcast Herbicide will control various submerged, floating, emerged and terrestrial/marginal weed species. It is effective against aquatic problem species such as Eurasian water milfoil, hydrilla, alligator weed, cattail, parrot feather, phragmites, purple loosestrife, water hyacinth, water primrose and pond weed. A complete list of weeds controlled can be found on the product label (SEPRO, 2013).

3. Human Health Effects of Other Ingredients

Both active and inert ingredients undergo scientific evaluation before approval by the USEPA. The agency must have sufficient data to make a safety determination regarding human health and the environment. For those inert ingredients applied to food, a tolerance or tolerance exemption is required. All food-use inert ingredients are also permitted for nonfood uses such as for ornamental plants, rights-of-way, aquatic use, structural use, etc.

Based on the information available on the USEPA website for pesticide inert ingredients[1], the inert ingredients in Clearcast Herbicide are approved for both nonfood and food uses.

The chemical-by-chemical approach in risk assessment does not address mixture toxicity and thereby adds uncertainty. EPA's approach with toxicity assessment of mixtures is based on grouping of chemicals that exhibit their effects through a common mechanism. However, this is only applied to the cumulative risk assessments of active ingredients.

[1] Pesticide Inert Ingredients: http://www.epa.gov/opprd001/inerts/

4. Ecological Effects of Other Formulation Ingredients

The "inert" or "other" ingredients in the product formulation were not considered in the ecological risk assessment conducted by EPA. As mentioned above, all inert ingredients in pesticide products undergo scientific evaluation before approval for use by the EPA. The Agency must have sufficient data to determine that the use of the product will not cause unreasonable adverse effects to the environment. The inert ingredients in Clearcast Herbicide have all been approved for application on nonfood and food sites.

For the purpose of the review presented here, the risks of the other formulation ingredients to aquatic non-target organisms were evaluated based on the consideration of toxicity information and concentrations in the formulation.

The combined effect of multiple substances was assessed by using the concentration additions approach. The combined effect of multiple compounds or substances is calculated by summation of the concentration of each compound divided by an effect concentration for that compound. This approach is considered to provide a conservative estimate of the mixture effect with relatively small likelihood of underestimating effects due to interactions (Lydy et al., 2004; Junghaus et al., 2006; Belden et al., 2007; Backhaus and Faust, 2012). The concentration addition approach is commonly applied by the use of toxic units (TU). The TU is defined as the quotient c_i/ECx_i which rescales the absolute concentrations of substances to individual potencies. The combined effect is estimated by the summation of TUs. This approach was used in the assessment of the combined effect of imazamox and other formulation ingredients. The assessment was based on the estimated environmental concentrations of imazamox and other formulation ingredients. Only acute effects were evaluated here.

The toxicity information for the other (inert) ingredients was obtained from the open literature and government review documents. Based on the limited availability of toxicity endpoint values, the quantitative analysis described above was only possible for one of the inert ingredients. Toxicity endpoints were not available for the other inert ingredients and therefore calculation of their contribution to the total of toxic units was not possible. The risk of these inert ingredients was qualitatively assessed based on their toxicity information. Such information included toxicity observations such as low toxicity at expected levels associated with the concentrations in the formulations and comparison to naturally occurring levels. It was concluded that these compounds are of a nature and/or present at levels in the product such that use of it as directed would not cause adverse aquatic ecological effects.

The results of the concentrations additions approach are shown in **Appendix 1**. These results indicate that imazamox dominates the combined chemical effects from the exposure to the mixture to fish and algae. If one applies the level-of-concern (LOC) thresholds as used in ecological risk assessment by EPA, the LOC for acute high risk of 0.5 is not exceeded for fish, invertebrates or algae. The LOC for endangered species of 0.05 is exceeded for algae.

The concentration addition approach is not recommended for assessment of chronic effects from exposure from mixtures (Backhaus and Faust, 2012). The differences in environmental fate, such as dissipation rates and partitioning behavior, also complicate the exposure assessment for longer

exposure times. The conclusions of a chronic risk evaluation are described in the imazamox review document (Section 3.3). Chronic risk to aquatic organisms is expected to be low.

5. Adjuvants

The application of Clearcast Herbicide to emergent and floating vegetation requires the addition of an adjuvant to the tank mix. Adjuvants are generally broadly defined as any substance separately added to a spray tank mixture that will improve the performance of the pesticide product. Since adjuvant products don't make pesticidal claims, they are not required to be registered. Where a product label directs the user to add a particular adjuvant before use, EPA will treat that adjuvant as an "other ingredient" in making the registration decision, and will assure that any necessary tolerances or exemptions from the requirement of a tolerance are established. It should be noted that residues of pesticide adjuvants in or on food commodities are subject to the requirements of the Federal Food, Drug and Cosmetic Act, which means that a food additive regulation or exemption from the requirement of a tolerance is needed for any substance used as a pesticide adjuvant that is applied to food crops.

Adjuvants that applicators in Massachusetts have reported using include Agri-Dex, Cide-Kick and Cygnet Plus are labeled for aquat`ic use.

A risk characterization of adjuvants that may be used with the application of this aquatic herbicide is found in **Appendix 2.** The assessment indicates that even at the high-end estimated spray volumes, the adjuvants commonly used with aquatic herbicides would not pose risk to aquatic organisms in general, but one could pose risk to endangered species. The adjuvants used by aquatic applicators operating in Massachusetts did not exceed LOCs and poses the lowest risk among the adjuvants that were evaluated.

6. Risk Mitigation

The potential movement from the application area and subsequent risk to non-target organisms is addressed by product label statements. Label statements for Clearcast Herbicide include the following advice:

Environmental Hazards
The herbicide may be hazardous to plants outside the treatment area. Do not apply to water except as specified on the label. Do not contaminate water when disposing of equipment washwaters or rinsate. Ensure that spray drift to non-target species does not occur.

Precautions for Potable Water Intakes
The product may be applied directly to water within one-quarter mile of an active potable water intake but concentrations of imazamox should not exceed 50 µg/L. *If concentrations of greater than 50 «g/L are required, the water intake must be turned off until the water concentration can be shown to be less than 50* µg/L. *The label also*

specifies that Clearcast may be applied to potable water sources at concentrations up to 500 «g/L to within a distance of ¼ mile from an active potable water intake.

Application to Waters used for Irrigation
To prevent adverse effects on crops, water treated with Clearcast Herbicide may not be used for irrigation purposes unless the concentration is below 50 «g/L. Water from still or quiescent water bodies that received foliar applications at rates of á 2 quarts per acre may be used for irrigation 24 hours after application. This requirement is related to treatment of emerged and floating vegetation in which >25% of the area has been treated and which is < 100 feet from an irrigation intake; and to treatment of submerged vegetation in an area that is < 100 feet from an irrigation intake. There are no irrigation restrictions for treated water from flowing waters with a depth of 4 feet or more that received foliar applications at rates á 2 quarts per acre.

Endangered Plant Species
To prevent impacts to endangered plant species, the product is not to be applied in a way that adversely affects federally or state listed endangered and threatened species.

Avoiding Injury to Non-Target Plants
When making applications along shorelines where desirable plants may be present, caution should be exercised to avoid spray contact with their foliage or spray application to the soil in which they are rooted. Shoreline plants that have roots that extend into the water in an area where the herbicide has been applied generally will not be adversely affected by uptake of the herbicide from the water.

Managing Off-Target Movement
To minimize spray drift, the label contains drift reduction advisory information addressing various equipment- and weather-related factors that determine the potential for spray drift. These factors include control of droplet size, application height, swath adjustment, wind, temperature and humidity, and temperature inversions.

Additional restrictions may be imposed on the use of these products in Massachusetts lakes and ponds within the permitting process, which can address project-specific situations.

7. Recommendations and Massachusetts Use Restrictions

No additional restrictions on the application of this product beyond those specified on the label are necessary.

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Appendix 1

Aquatic Toxicity Assessment of Clearcast Herbicide Formulation

In order to assess the toxicity of combined exposure of active and other formulation ingredients, the toxic unit approach was used to estimate combined toxicity. The toxic unit approach is based on concentration addition. The combined effect of multiple compounds or substances is calculated by summation of the concentration divided by an effect concentration. Only acute effects were evaluated. The concentration addition approach is not recommended for assessment of chronic effects from exposure from mixtures (Backhaus and Faust, 2012). The differences in environmental fate, such as dissipation rates and partitioning behavior, also complicate the exposure assessment for longer exposure times. The conclusions of a chronic risk evaluation are described in the imazamox review document (Section 3.3).

The concentration addition is commonly applied by the use of toxic units (TU). The TU is defined as the quotient c_i/ECx_i which rescales the absolute concentrations of substances to individual potencies. The combined effect is estimated by the summation of TUs.

Only one of the other ingredients included in TU calculations (indicated as 'Other ingredient 1'). Based on the limited availability of toxicity endpoint values, the quantitative analysis described above was only possible for one of the inert ingredients. Toxicity endpoints were not available for the other inert ingredients and therefore calculation of toxic units was not possible.

The TU values were calculated for fish, aquatic invertebrates and algae. The results are shown in Fig. A1-1, below. These results indicate that for fish and algae the combined effect is dominated by the effect of imazamox, with very small contributions from effects of the other ingredient included in the analysis. The toxicity endpoint of Other Ingredient 1 for invertebrates was not available. The Sum of TU could not be calculated and therefore is not shown in Fig. A1-1.

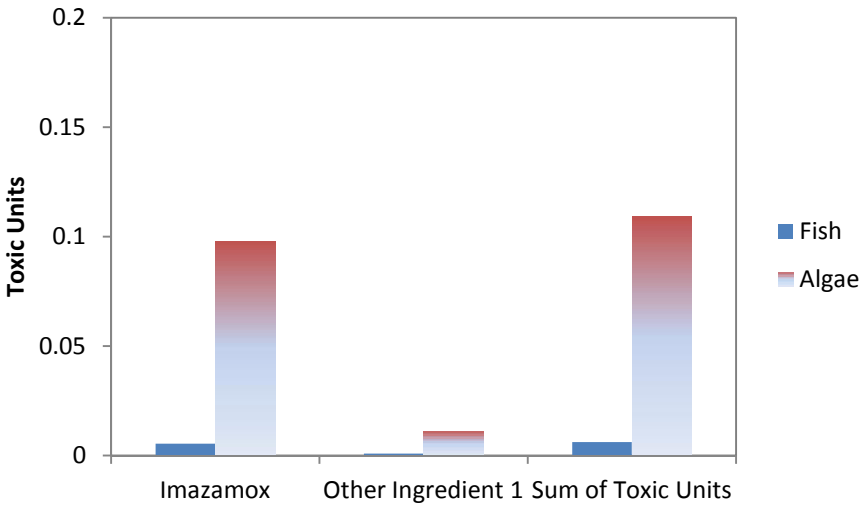

Figure A2-1 Toxic Units of formulation ingredients for acute effects to fish and algae. The TU value for invertebrates is not shown because the toxicity endpoint for inert ingredient was not available.

Toxic Unit (TU) calculations

Toxic Unit calculations for acute effects from exposure to Clearcast Herbicide formulation ingredients illustrated in Fig. A1-1 are shown below. Information on the EECs and EC_{50}/LC_{50} for imazamox can be found in the review document for flumioxazin (MDAR/MassDEP, 2013, Section 3.1 and 3.2). Toxicological endpoints were only available for one other ingredient.

Ingredient	EEC	EC50/LC50	TU	EC50	TU	EC50	TU
	mg/L	Fish mg/L		Aq. Invert. mg/L		Algae mg/L	
Imazamox	0.500	94.2	0.00531	115	0.004348	5.1	0.0980
Other Ingredient 1	0.0041	5.0	0.00082	--	--	0.37	0.0111
Sum of TU:			0.006128		0.004348		0.1091

Appendix 2

Risk Assessment of Adjuvants Used with Aquatic Herbicides

The Clearcast Herbicide label indicates that treatment of emergent or floating vegetation requires the addition of an adjuvant in the tank mix. The label suggests the use of methylated seed oils or nonionic surfactants at recommended manufacturer's rates.

The risk assessment of several adjuvant products that are commonly used with the application of aquatic herbicides is presented below.

Toxicity Characterization

The toxicity of adjuvants was considered in risk assessments of herbicide applications in estuaries in Washington State (Entrix, 2003) and San Francisco (Pless, 2005). Commonly used adjuvants included non-ionic alkylphenol ethoxylates and/or fatty acids (e.g., R-11®, X-77®), and crop-oil based concentrates (e.g., Agri-Dex®, Hasten®). On the basis of EPA toxicity criteria, the non-ionic alkylphenol ethoxylates (e.g., R-11®, X-77®) are moderately acutely toxic to aquatic species. The crop-oil based surfactants would be considered practically non-toxic. Smith et al. (2004) characterized the toxicity of four surfactants to juvenile rainbow trout and implications for their use over water. The 96-h LC_{50} values were 6.0 mg/L for R-11®, 17 mg/L for LI 700®, 74 mg/L for Hasten, and 271 mg/L for Agri-Dex®. The 96-h EC_{50}s (on-bottom gilling behavior) were 4.4 mg/L for R-11® and 17 mg/L for LI 700®.

Curran (2003) determined the toxicity of formulated herbicide product Arsenal Herbicide (a.i., imazapyr) with and without the adjuvants Agri-Dex® and Hasten® using juvenile rainbow trout. The 96-h LC_{50} value for Arsenal Herbicide without adjuvant was 77,716 mg/L. In systems containing Arsenal plus adjuvant, the 96-h LC_{50} was expressed as mg/L surfactant and were reported to be 113 mg/L for Hasten® and 479 mg/L for Agri-Dex®. These values were compared with the LC_{50} values for the surfactants alone which were 74 mg/L for Hasten® and 271 mg/L for Agri-Dex®. Since this source of information was a meeting abstract, no further evaluation of data was possible for the review presented here. The authors concluded that the data suggest that the Arsenal Herbicide formulation has low toxicity to juvenile rainbow trout, the toxicity of the tank mixes is driven by the surfactants, and depending on the type of surfactant and its percentage in the tank mix, surfactants may pose greater hazard to non-target species than Arsenal Herbicide.

Adjuvants and surfactants were also considered in human health and ecological effects risk assessments of imazapyr use for controlling vegetation in riparian corridors (AMEC, 2009). The most frequently used adjuvants were identified to be Agri-Dex®, Dyne-Amic®, Class-Act® and R-11®. It should be noted that the assessment did not consider direct applications to water. Reference was made to a study by Smith et al. (2004), which was cited above. While toxicity data

were reviewed, the document did not include a formal exposure and risk assessment for the adjuvants.

Additional adjuvants that applicators in Massachusetts have reported using include Cide-Kick and Cygnet Plus. These adjuvants contain *d*-limonene as the major surfactant. Limonene is slightly toxic to fish and aquatic invertebrates with LC_{50} values of 80 mg/L and 39 mg/L, respectively (USEPA, 1994).

Exposure Assessment

Pless (2005) considered several adjuvants as used in tank mixes in the ecological risk assessment. The environmental properties and toxicity of adjuvants were also considered with the assessment of imazapyr herbicide use in estuaries in Washington State (Entrix, 2003). Both reviews estimated adjuvant concentration in water in an estuary scenario. For the purpose of this special review presented here, the environmental concentrations of two adjuvants Agri-Dex® and Hasten® were estimated in a pond application scenario as described below.

It was assumed that the adjuvant was used in a 1% v/v concentration in the tank mix (the label requires >0.25%). It was further assumed that the application volume was 50 gallons per acre (label requirement is >5 gal for ground applications). A 1% v/v adjuvant concentration in the 50 gal spray volume would correspond to a 1.89 L adjuvant volume per acre. Based on the density of Agri-Dex (0.879 kg/L, Agri-Dex MSDS), this volume corresponds to 1.66 kg Agri-Dex adjuvant per acre. The peak concentration of Agri-Dex® in a 1-acre water body with a 1-foot depth can be calculated as follows: 1.66×10^6 mg / ($4047\ m^2 \times 0.3048$ m $\times$ 1000 L/m^3) = 1.35 mg/L. For the 6.56-feet (2-meter) and 3-feet depths the concentrations are 0.21 mg/L(mg/L) and 0.45 mg/L(mg/L), respectively. The values for the adjuvants Hasten®, Cide-Kick and Cygnet Plus are very similar for the same adjuvant concentration given that the densities of these adjuvants are very similar to Agri-Dex (0.87-0.9 kg/L). It should be noted that these calculations assumed no interception by target vegetation and no sorption to sediment. The adjuvant concentrations calculated above are slightly lower than the values for adjuvant concentrations that were reported in Entrix (2003). Those calculations assumed a density of 1 kg/L, whereas the actual density of the adjuvant products Agri-Dex® and Hasten® is less than 1 kg/L.

The Clearcast Herbicide label does not specify spray volumes for foliar treatments other than 10 gallons or more. A reasonable high-end estimate for spray volume could be 100 gallons per acre. Consequently, to calculate the highest level, the concentration of 1.35 mg/L in a 1-ft deep pond would have to be multiplied by 2 in this case: 2.70 mg/L in a 1-ft deep pond.

Risk Assessment

As pointed out in the review by Pless (2005), the toxicity of the herbicide/adjuvant mixture is driven by the surfactant. The risk quotients presented by Pless (2005), based on environmental concentrations in an estuary scenario, were in the range of 0.13-0.051. The higher value was determined in association with the adjuvant Hasten®. That value marginally exceeded the level of concern (LOC) of 0.05 for endangered fish. It was pointed out that the highest measured exposure

was extremely conservative in that the pesticide was applied directly to the estuary sediment (mud flat) without interception by vegetation and measured in the 3 hours later in the first overflow.

For the consideration of the application in a pond, the estimated environmental concentrations (EECs) of the Agri-Dex® and Hasten® adjuvants were calculated above. These two adjuvants were selected based on the availability of toxicity data for product with adjuvant (Curran et al., 2003). The highest estimated concentration in a water body with 1-foot depth was 1.35 mg/L. Based on the 96-hr LC_{50} of 479 mg/L expressed as adjuvant (Curran et al., 2003) for the product plus adjuvant mixture, the risk quotient is 0.0028. For the Hasten® adjuvant, the risk quotient would be 0.012. For the limonene-based adjuvants Cide-Kick and Cygnet Plus, the risk quotient would be 0.016. These values are below levels of concern for aquatic species as established by USEPA (2011), the most sensitive for endangered species acute risk being 0.05.

Entrix (2003) conducted a risk assessment of four adjuvants that have uses with glyphosate- and imazapyr-based aquatic herbicides. In addition to Hasten® and Agri-Dex®, the LI 700® and R-11® were included in the exposure and risk assessment. Since the spray-volume requirements for glyphosate-based herbicide are higher compared to imazapyr-based herbicides, the risk quotients were evaluated as a function of spray volume. The risk quotients were based on the LC_{50} values for juvenile rainbow trout as reported by Smith et al. (2004). The same procedure was used here for the concentrations developed for a pond scenario as described in Section 3.2 of the imazapyr review document. Figure A2-1 shows that the R-11 adjuvant exceeds the most sensitive Level of Concern (LOC) over the entire application volume range considered, while the Hasten® and Agri-Dex® adjuvants do not exceed the most sensitive LOC even at the highest application volume. In the review by Entrix (2003), it is pointed out that glyphosate-based herbicides require large application volumes (up to 100 gal/acre for efficacy), while 5 to 20 gal/acre can be used for imazapyr-based herbicides to yield equivalent results. Consequently, imazapyr-based herbicide applications are associated with lower adjuvant exposures compared to glyphosate-based herbicides.

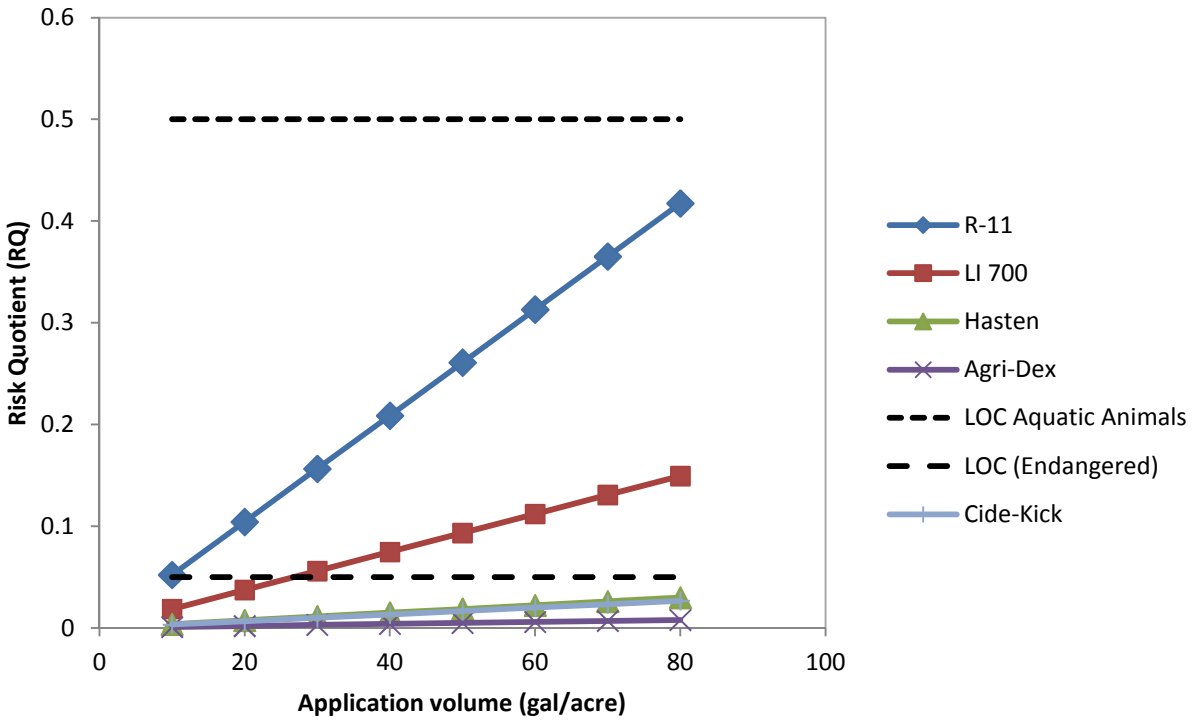

Figure A2-1. Risk quotient (RQ) of four spray adjuvants based on adjuvant concentrations associated with applications to a 1-foot deep water body. The adjuvant concentration was 1% v/v. The risk quotient was calculated based on the 96-h LC50 values for rainbow trout as reported by Smith et al. (2004) and USEPA (1994). The RQ values are compared with the Levels of Concern (LOC) for acute risk as developed by US EPA (2011). Adjuvants used by applicators operating in Massachusetts include Agri-Dex and Cide-Kick.

Smith et al. (2004) estimated the water depth at which the 96-h LC_{50} value for juvenile trout would be reached with an application volume of 20 gal/acre and labeled tank mix concentration (0.5 – 5%). When used at the minimum recommended percentage of adjuvant in the tank mix the LC_{50} depth was <16 mm for R-11 and < 5 mm for the Agri-Dex®, Hasten® and LI 700®. At the maximum label recommended percentages of adjuvant in the tank mix, the LC_{50} depth for Agri-Dex would remain <5 mm, for Hasten it would be 10 mm and for LI 700 it would be 43 mm. It was concluded that Agri-Dex posed the lowest hazards to fish among the surfactants evaluated.

In the case of Clearcast Herbicide, a high-end estimate of spray volume is 100 gal per acre. From the graph depicted in Fig. 1 above, it can be concluded that at that spray volume, the R-11 adjuvant would approach the LOC for aquatic animals. The LI700 adjuvant would not exceed the LOC for aquatic animals, but would exceed the LOC for endangered species. The Hasten, Agri-Dex and Cide-Kick adjuvants would not exceed the LOC for aquatic animals or endangered species.

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HOP BROOK PROTECTION ASSOCIATION

Restoring and Preserving Sudbury's Ponds

Box 707, Sudbury, MA 01776

Results of our research on Clearcast (Imazamox)

Hop Brook Protection Association, 12/6/19, Rev 1.01

Chemistry

This information is prepared by the Hop Brook Protection Association, based on a review in November 2019 by Glenn Pransky MD, MOccH, of several State and Federal reference documents, factsheets prepared by State and Federal agencies, several original studies, and documentation of proposed water treatment plans and follow-up surveys, as listed in the footnotes. A brief description of Clearcast (Imazamox formulated for aquatic use) is provided, along with information about safety, efficacy, and environmental impact with the intended use in the Hop Brook watershed.

Description

Imazamox is an imizoladimine compound that is absorbed by leaves and stems, is transported to roots of plants, and inhibits a specific enzyme system that synthesizes essential amino acids in plants. Susceptible plants immediately stop growing and die in 4 – 12 weeks.

Imazamox was developed in 1969, and first registered for use with soybeans in 1997 for weed control (trade name Raptor), and since then has been approved for use on 12 more crops. It has been extensively used in the Midwest since that time for field application. Since it degrades rapidly on exposure to air or light, and does not accumulate in animal tissues, the EPA classified it as non-bioaccumulative and waived food residue tolerance requirements. After extensive research documenting low toxicity to animals, and absence of any reports of adverse human health effects, the EPA exempted it in 2003 from any requirements regarding residues in food. Testing its use for aquatic macrophyte management began in 2004, eventually expanding to registered use in 16 states. Clearcast received full EPA approval for this use in 2008.[1]

- **What are the by-products (daughter molecules) that it breaks down to?**
  When light is present, the half life is 6 hours, with degradation to different imidazole compounds, nicotinic and carboxylic acids, that are metabolized as a food source by microbes into carbon dioxide.[2] Breakdown of Clearcast requires light or oxygen, and in a dark, oxygen-poor environment, there is very little breakdown of this chemical, and the same is assumed to be true for its primary breakdown products, if they settle to the bottom of a pond with low oxygen levels. Half-lives in this situation may be around 2 years.[3] As soon as exposure to light or oxygen occurs, the breakdown process restarts. The breakdown products don't have any herbicidal effects,[4] and are regarded as same or lower toxicity than Clearcast itself – as they are similar in structure. Although the toxicity of these breakdown products has not been specifically tested, there is no evidence of adverse effects on plants or animals.[5]

[1] "Use of Aquatic Herbicide Imazamoz in NY State: Supplemental Environmental Impact Statement." (NY-SEIS) Final. AECOM Inc, Sept 2009.
[2] NY SEIS p42
[3] Imazamox Factsheet WI Dept of Natural Resources, 2002
[4] Imazamox Factsheet WI Dept of Natural Resources, 2002
[5] MA Dept of Agriculture (MA-DOA) Imazamox (2014) p 2

Both plants and animals break down ingested Clearcast into similar ring compounds that lack one or more of the parent's methyl groups. Rat studies show that most of the dose is rapidly excreted unchanged, some demethylated, with a half-life less than 7 hours.[6]

- **Why is it potentially lower risk than other initially-considered-safe products like Roundup?** A recent review on Clearcast found no evidence of animal toxicity at concentrations and durations of exposure much higher than those encountered in terrestrial or aquatic application.[7] There has been over 50 years of testing in the lab, and on land, and over 20 years extensive water use of Clearcast without reported adverse health effects on animals or humans. Conversely, Roundup is associated with potential toxicity to a wider variety of plants than Clearcast, as it is a less selective herbicide, and there is more documentation of possible animal and human toxicity.[8] Both glyphosphate (Roundup) and Clearcast require mixture with an adjuvant (soap-like) compound to facilitate dispersion and adherence to leaves in an aquatic application, and these compounds are potentially toxic for aquatic animals. However, the amounts of adjuvants required for Clearcast surface (foliar) water application are well below the thresholds for toxicity of these adjuvant compounds in aquatic use.[9] And, the adjuvant and inert compounds in the Clearcast formulation are sufficiently safe that they have been approved by EPA for application on food and non-food use.[10]

- **Are there reactants that might be found in the pond that would combine with the chemical to produce something undesired or dangerous?** There is limited research on interactions with Clearcast or its breakdown products with naturally occurring or man-made substances in the environment. Testing in typical field and aquatic situations hasn't found evidence of any such interactions.[11] Also, we have prior sediment analyses from our ponds that do not indicate the presence of anything unusual that would be a concern. The primary issues for our ponds' water quality are high concentrations of phosphorus and low amount of oxygen. The low oxygen would slow Clearcast biodegradation but would not affect degradation pathways.

- **Why is this the best choice of chemical?**
  Other herbicides are not as effective in controlling water chestnut[12], and have greater toxicity to other plant and animal species, and some are more persistent in the environment. Glyphosphate is probably the most effective alternative herbicide for water chestnut control[13], but there have been concerns about human health effects with this compound. In New York State, Clearcast was much more effective than other herbicides in several water chestnut-infested areas, and was successfully used to reduce water chestnut populations to a level that could be managed by harvesting and very selective herbicide application.[14]

  With respect to foliar (spraying on leaves) application, even the highest recommended level of spraying (2 quarts concentrate/acre) results in water concentrations of less than 50ppb, which is not enough to affect submerged plant species or water quality. Imazapyr is another similar compound that does not have any effect on submerged species, but is less well tested and has not been used as extensively as Clearcast.[15]

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[6] 052-24-02a-Imazamox (USFS risk assessment), 2010, page10-12
[7] 052-24-02a-Imazamox (USFS risk assessment), 2010, page x.
[8] Glyphosphate SERA (USFS) 2010
[9] 052-24-02a-Imazamox (USFS risk assessment), 2010, page 50
[10] State of MA review of Clearcast, page 3
[11] 052-24-02a-Imazamox (USFS risk assessment), 2010, page 20
[12] NY SEIS, p73 (Table 7-3)
[13] NY SEIS, p82
[14] OARS, Water Chestnut Management Guidance and 5-Year Management Plan, page 19 (numbered page 19)
[15] MA DOA Imazamox (2014) p 2

Other municipalities have developed management plans that begin with Clearcast treatment to reduce the amount of water chestnut to levels that can be managed with hand-pulling and spot herbicide treatment. HBPA plans to go a similar route. Clearcast application is only the first step in a long term pond management plan, which must include transition to other methods once the current large infestation has been brought under control. [16] HBPA is developing this plan now.

Health:

- **What is the short/long term effect on human health?** In multiple mammalian studies there are no short or long-term effects of Clearcast even at doses many times higher than would be encountered in a pond or even commercial agricultural application. One rat study showed some acute liver toxicity, at dosage levels over 10,000 times greater than what might be encountered in water application.[17] MA Dept of Agricultural Resources and US EPA conclusions about absence of significant human health toxicity are based on multiple mammalian studies using short and long-term oral, dermal, intravenous and ocular exposures.[18] These studies were reviewed in detail by the EPA and judged to be of good quality, as they were conducted based on rigorous standards and requirements. Although some are not in the public domain, the EPA review and detailed risk assessments are publicly available. [19] [20] Based on available research and the lack of bioaccumulation in mammalian and vertebrate tissue studies, there doesn't seem to be concern about bioaccumulation and cumulative or synergistic toxicity.[21] The actual applied solution (mixture of Clearcast with an adjuvant) can cause temporary skin and eye irritation of those who are applying it, if high-level exposure occurs.[22]

- A comprehensive review by the European Union Food Safety Authority in 2016 did not identify any significant toxicologic effects, and supported conclusions by US experts about the safety of food residues, but raised concerns that the data on potential toxicity of metabolites and degradation products is incomplete.[23]

- It is important to recognize significant differences between imidazole herbicides such as Clearcast, and other chemicals (such as PFAS or TCE) that have been identified as critical water contaminants, with potential negative effects on human health. These polychlorinated or polyfluorinated compounds are biopersistent and bioconcentrated in some plants and most animals, can cause significant metabolic changes, and have evidence of mutagenic and carcinogenic effects in laboratory studies – unlike Clearcast.

- **Is there any mutagenesis, carcinogenesis?** None observed in any study examining these effects – primarily short term reproduction studies in mammals.[24] The EPA classifies this compound as unlikely to be a human carcinogen.

- **What is the effect on wildlife, fish, insects, birds, aquatic plants, mosquitos?** This compound has been tested in short-term studies with birds and amphibians, and in longer-term

[16] NY SEIS p35
[17] Sevim, Comakli et al, An imazamox-based herbicide causes apoptotic changes in rat liver and pancreas. Toxicol Reports, 11/2018, 6: 42-50.
[18] 052-24-02a-Imazamox (USFS risk assessment), 2010, page 9
[19] www.regulations.gov , in Docket ID: EPA-HQ-OP
[20] 052-24-02a-Imazamox (USFS risk assessment), 2010, page 9
[21] 052-24-02a-Imazamox (USFS risk assessment), 2010, page 40
[22] Imazamox Factsheet, WI Dept of Natural Resources, 2002
[23] European Food Safety Authority, Peer review of the pesticide risk assessment of the active substance imazamox, 2016. P18
[24] 052-24-02a-Imazamox (USFS risk assessment), 2010, page 16-17

studies with fish,[25] and the MA Dept of Agricultural Resources and USFS conclusions are that it's essentially nontoxic to aquatic animals, and does not concentrate or persist in animals.[26] Limited invertebrate studies show similar results.[27] One study showed no toxicity to honeybees.[28] Removing water chestnut infestations early in the season may be an important strategy to reduce mosquito populations, as the leaves serve as a breeding area for mosquito larvae.[29] Clearcast has little direct effect on mosquito larvae.[30]

Fairly rapid die-off of a large population of plants will result in decaying matter reaching the lake bottom, and this will temporarily lower oxygen levels, a potential threat to fish and other aquatic animals. With water chestnut, this happens naturally at the end of the growing season with the fall die-off, so treatment with a herbicide results in the same impact – only somewhat earlier in the year.[31]

- **What is the likelihood of it entering the water supply. Is that a problem?** With a standard application at the recommended concentration, the half-life in the water is less than 20 days, based on tests in 11 ponds. Since it's highly water soluble, it tends to stay in solution, and any compound that settles to the bottom can move through ground water, and would persist at low levels in this anaerobic, dark environment. [32] But some studies with agricultural applications (at a much higher level than encountered in aquatic foliar application) suggest that there is very little transport through soil into groundwater.[33] A conservative analysis by the Mass Dept of Agriculture concluded that even if drinking water was drawn directly from a treated pond, the levels of Clearcast in the water would be far lower than the EPA guidelines for allowed concentrations in drinking water.[34] One of the advantages of foliar (leaf / surface) application is that it does not develop significant concentrations of herbicide in the water column itself, and thus would not affect shoreline or submerged plants. The pond water concentration in one study with foliar application was 46ppb after foliar application.[35] At low levels (< 50 micrograms per liter in drinking water), there is no evidence of health concerns.[36] There is no information on interaction between Clearcast or its breakdown products and chlorination or other water treatment chemicals[37], but there have been no reports of adverse health effects from drinking water that may contain trace amounts of Clearcast or its breakdown products.

  The Sudbury municipal wells around Hop Brook (north of Pratt's Mill Rd) draw from a large aquifer where the Hop Brook itself is only a minor contributor, so the amount of Clearcast that ends up in town water may be very low, possibly undetectable even with sensitive assays. Given the depth of town wells and the aquifer, our Water Department does not have concerns about the

[25] NY SEIS p47 (table)
[26] 052-24-02a-Imazamox (USFS risk assessment), 2010, page 41
[27] MA DOA Imazamox (2014) p8
[28] MA DOA Imazamox (2014) p9
[29] Kelly and Henley, Water chestnut and culex mosquitos, E Middlesex Mosquito Control Project, 1996.
[30] Morris, Murrell et al, Effect of two commercial herbicides on life history traits of a human disease vector, Aedes Egyptii, in the laboratory setting. Ecotoxicology, Jul 2016, 25:863-70.
[31] NY SEIS p52
[32] MA DOA Imazamox (2014) p11
[33] Cessna, Elliott and Bailey. Leaching of three imidazole herbicides during sprinkler irrigation. J Environ Quality. May 2012, 41:882-92
[34] MA DOA Imazamox (2014) p6
[35] NY SEIS, p39.
[36] WA State aquatic herbicide evaluation, p44
[37] European Food Safety Authority, Peer review of the pesticide risk assessment of the active substance imazamox, 2016. P18

proposed herbicide applications.[38] At low levels (<50 micrograms per liter in drinking water), there is no evidence of health concerns.

We talked to the Executive Director of the Sudbury Water Department (Vincent Roy), and he said the wells near Hop Brook were so deep that he was unconcerned about any herbicide making its way into the town water supply.

- **How much falls to the bottom of the pond? Does it stay there forever?** (see prior answer)

- **Can water chestnut become resistant to Clearcast?** Some plants can develop less sensitive forms of the acetolactate synthase enzyme, and thus become resistant to Clearcast, but that has not been reported for water chestnut.

- **What happens where the Clearcast misses its target (i.e., lands outside the pond).** Spray that falls on surrounding plants could kill them if concentrations are high enough, but this has not been reported in MA DEP applications on the Nashua or Sudbury rivers.[39]

- **What if it's a windy day? Is it dangerous for the chemical to become airborne?** This situation is probably non-optimal for application, as spray is more likely to miss its target, potentially affecting shoreline plants, and wave action can wash the Clearcast off the leaves.[40] The product label includes detailed instructions to control spray drift, and applications are prohibited if wind speeds are over 10 MPH. Our vendor has extensive experience with application in all weather, and follows strict protocols with respect to weather conditions. They routinely reschedule treatment if the proper conditions are not present.

- **What happens to other life in the pond when the shade provided by the water chestnuts is removed?** We should see a rapid increase in fish, waterfowl, and a rise in oxygen levels, as has occurred in other ponds once water chestnut was controlled. Other subsurface invasives, such as milfoil, are more likely to become prominent, especially in ponds with high nutrient loads like ours. Fortunately, there are available strategies (such as draw-downs) that can effectively manage this species.[41] HBPA will develop a long-term comprehensive management plan that will address water quality once water chestnut is controlled.

- **What have been the results of use in other towns?** For initial treatment Clearcast is extremely effective in managing water chestnut. This recent follow-up report documents the effect in the Nashua River just south of the Pepperell dam. An infestation with water chestnut covering 90% of the surface area was reduced to less than 10% coverage. [42] Similar results over a three-year period of Clearcast treatment were observed in Franklin at the Del Carte ponds, with a return of native macrophyte species.[43]

- **What have been the unintended effects in other towns?** Have not identified any so far.

- **What are the alternatives?** The NY State SEIS document has a table that compares alternative methods of invasive macrophyte control, with strengths and weaknesses of each approach (Table 7-1).[44] Other towns with similar ponds and water chestnut infestations have considered

[38] Communication from Sudbury Water District
[39] NashuaRiver18_YER_V2_Final_Combined.pdf
[40] NY SEIS, p50.
[41] Eutrophication and Aquatic Plant Management in Massachusetts, Executive Office of Environmental Affairs, 2004, p169, 183, 341
[42] NashuaRiver18_YER_V2_Final_Combined.pdf
[43] ESS Group. Del Carte Ponds 2019 year-end report
[44] NY SEIS, p62

mechanical harvesting, but have also concluded that it's not likely to be successful in shallow ponds with extensive inaccessible shoreline areas, and have also concluded that using a herbicide is the best approach. Sudbury's situation is particularly unsuitable for mechanical harvesting because the most upstream pond (Grist Mill Pond) is shallow with a very rocky bottom, so standard harvesting equipment cannot be used. Drawdowns are ineffective, and dredging is too expensive.[45]

- **What happens if we use only harvesting?** One of the problems of mechanical harvesting is fragmentation and dispersion of Eurasian milfoil, a problematic invasive species that inhabits our lakes.[46] Fragmentation and dispersion is the primary means of spread for this species.[47] Once the water chestnut population is essentially eradicated, hand harvesting is preferred to manage small persistent areas.[48]

- **What happens if we use only hand-pulling?** Infeasible for such a large area of infestation, but might be an effective control strategy for small remaining infestations.

- **What happens if we do nothing?** Water chestnut will continue to spread over 80% or more of the ponds' surface areas each year. Each acre of infestation will contribute as much as 20 cubic yards of organic matter, all setting to the pond bottom. This will further decrease water quality, resulting in lower oxygen levels, shallower pond depth, a repugnant smell, poor fish and bird habitat, and reduced habitat for native macrophytes.[49] A very significant concern, given the recent EEE outbreak, is that water chestnut infestations lead to higher levels of mosquitos, as they create optimal conditions for mosquito larvae. This does not seem to occur with other surface plant species (such as water lilies). [50]

- **What happens if it succeeds? What replaces the water chestnuts?** Once more light is available in the water column, previously suppressed invasive plants such as milfoil are likely to become dominant. As noted above, HBPA intends to develop a long-term management strategy to address this concern.

- **Is our contractor the most experienced in applications in our situation?** Solitude has many years of experience using Clearcast in many ponds in adjoining towns and around the state. Attached [TBD] are references we obtained from several other municipalities in the immediate area.

- **Do we have a water management plan?** A comprehensive long-term integrated plant management plan, using a variety of different strategies as needed (hand-pulling, draw-downs,[51] etc) is being developed by HBPA, which we will review with the Conservation Commission.

- **What is the long-term plan?** HBPA is developing a long term plan for the ponds. Our desire is to move to a sustainable paradigm where herbicidal treatments are no longer needed, but which might include some adjustments to the characteristics (size, water level, flow, etc.) of the ponds. We have much to research and learn here, but what we have discovered is that no matter what path we take, they all start with controlling and significantly eradicating the water chestnut.

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[45] ESS Group. Ecological and Management Study of the Del Carte Ponds, Franklin MA. 2016
[46] Sudbury River NOI package, p 42
[47] NY-SEIS Page 27
[48] NY-SEIS . Page 36
[49] Sudbury River NOI pages 44-45
[50] "Water Chestnut: An Exotic Invasive Plant" MA DCR, 2002 and Kelly and Henley, Water chestnut and culex mosquitos, E Middlesex Mosquito Control Project, 1996.
[51] bare hill pond harvard strategy

Prepared by: Glenn Pransky MD MOccH FACOEM. Visiting Scientist, Harvard School of Public Health. Associate Professor, Univ of MA Medical School, Depts of Family and Community Health and Quantitative Health Sciences.

Reviewed by: Hotze Wijnja, Chief Agricultural Chemist for the Mass Department of Agricultural Resources

HOP BROOK PROTECTION ASSOCIATION

Restoring and Preserving Sudbury's Ponds

Box 707, Sudbury, MA 01776

Experience of Nearby Towns with Clearcast (Imazamox)

Hop Brook Protection Association, 12/7/19, Rev 1.00

[Hyperlinks are listed at the end of the document]

1) Framingham had a study performed for them for the Sudbury River, recommending Clearcast.
   https://www.framinghamma.gov/DocumentCenter/View/24290/Notice-of-Intent-Application---Sudbury-River-Aquatic-Management-Program

   We subsequently obtained feedback from Tom Flannery, MA department of conservation and recreation lakes and ponds program:

   > *"This past summer was our first experience using it on chestnut. We did two large projects, the biggest being the Nashua River at approximately 100 acres of chestnut give or take. Where the product was applied we saw 100% control. Drawback was that the "rows" the boat drove over during application need to be treated on follow up treatments as the product must stay on the dry plants. We had to do numerous treatments and although a success overall, we did not get probably 25% of the plants."*

   Also, the 2018 City of Framingham Annual Report (page 84) noted:

   > *"In 2018, the Conservation Division continued its fiveyear program to manage nuisance aquatic vegetation in the impounded section of the Sudbury River. In the month of June, the Division's lake management contractor completed two treatments of the river using the herbicide Clearcast and achieved approximately 70 percent control of invasive water chestnut (Trapa natans) at the surface."*

   Finally, the *friendsofsaxonville.org* group noted:

   > *"The Conservation Commission worked thoughtfully to create a five-year plan to help remediate this crisis on the river. The first year is now complete. Solitude Lake Management implemented a three-part application of the state and regionally approved herbicide "Clearcast", during the summer of 2017. The result looks promising. Waterfowl presence has increased and recreational use has improved."*

2) ESS corporation prepared a study of the DelCarte Ponds in Franklin MA. Their situation was similar to ours, and the recommendations section is worth review. The initial study and progress report are below.

   https://www.franklinma.gov/sites/franklinma/files/pages/delcarte_ponds_ecological_and_management_study.pdf

   https://drive.google.com/file/d/0B4vYtFIqWbqGTFlHbmNZQWV1WVE3LTRhY3lzUDQ1aC1XS19N

According to the progress report:

"*The results indicate that SLM's treatment of water chestnut in Del Carte Ponds is effectively decreasing the extent and density of this aquatic invasive species in the system."*

3) In Littleton, Clearcast was used on Doleful Pond. Littleton's overall plan and analysis are below.

https://www.littletonma.org/sites/littletonma/files/uploads/littletonpds_project_descriptions_1-22-18.pdf

According to Corey Godfrey, Environmental Analyst, Littleton Water Department:

"Clearcast has been very effective at controlling the Water Chestnut in Doleful Pond. We have also been happy with Solitude's performance over the many years we have been working with them."

4) In Norton, Clearcast was used in Chartley Pond and Barrowsville Pond. See Figures 7 & 19 and Figures 10 & 23 respectively for their results in their report below.

https://www.nortonma.org/sites/nortonma/files/uploads/norton_ponds_-_2017_annual_report_reduced_103017.pdf

According to the above report:

"The treatment appeared to result in very good control of water chestnut growth and seed set." (p. 43)

5) The Nashua River Watershed Association is also using Clearcast. See their current report below. Comparing figures 1 and 3 provides a good example of treatment results.

https://drive.google.com/open?id=1gip9xs4MLV1Jv14IQZAMOSeSNC-pt2jx

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

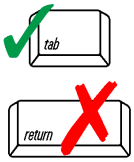
Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Sudbury
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Grist Mill, Carding Mill and Stearns Mill Ponds — a. Street Address
Sudbury — b. City/Town
01776 — c. Zip Code

Latitude and Longitude: 42.35488; 42.36215; 42.38666 — -71.48000; -71.46472; -71.44944

N/A — f. Assessors Map/Plat Number
N/A — g. Parcel /Lot Number

2. Applicant:

Jeff — a. First Name
Winston — b. Last Name
Hop Brook Protection Association — c. Organization
118 Barton Drive — d. Street Address
Sudbury — e. City/Town
MA — f. State
01776 — g. Zip Code
978-443-2589 — h. Phone Number
978-443-8518 — i. Fax Number
jeff@hopbrook.org — j. Email Address

3. Property owner (required if different from applicant): ☒ Check if more than one owner

See Attached — a. First Name
b. Last Name
c. Organization
d. Street Address
e. City/Town
f. State
g. Zip Code
h. Phone Number
i. Fax Number
j. Email address

4. Representative (if any):

a. First Name
b. Last Name
c. Company
d. Street Address
e. City/Town
f. State
g. Zip Code
h. Phone Number
i. Fax Number
j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

$1,500 — a. Total Fee Paid
$737.50 — b. State Fee Paid
$762.50 — c. City/Town Fee Paid

A. General Information (continued)

6. General Project Description:

Herbicide Treatment (Clearcast) to manage water chestnut in Grist Mill, Carding Mill, and Stearns Mill Ponds.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☐ Transportation
9. ☒ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☐ Yes ☒ No

If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

a. County

b. Certificate # (if registered land)

c. Book

d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☐ Bordering Vegetated Wetland	1. square feet	2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet 3. cubic yards dredged	2. square feet

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☐ Bordering Land Subject to Flooding	1. square feet 3. cubic feet of flood storage lost	2. square feet 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet 2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☐ Riverfront Area	1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

   ☐ 25 ft. - Designated Densely Developed Areas only

   ☐ 100 ft. - New agricultural projects only

   ☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: _____ square feet

4. Proposed alteration of the Riverfront Area:

   a. total square feet _____ b. square feet within 100 ft. _____ c. square feet between 100 ft. and 200 ft. _____

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement
If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW | b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings | b. number of replacement stream crossings

C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

   a. ☐ Yes ☒ No

   If yes, include proof of mailing or hand delivery of NOI to:

   Natural Heritage and Endangered Species Program
   Division of Fisheries and Wildlife
   1 Rabbit Hill Road
   Westborough, MA 01581

   August 1, 2017
   b. Date of map

   If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

   c. Submit Supplemental Information for Endangered Species Review*

      1. ☐ Percentage/acreage of property to be altered:

         (a) within wetland Resource Area _____ percentage/acreage

         (b) outside Resource Area _____ percentage/acreage

      2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

   (a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

   (b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_fee_schedule.htm). Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_exemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing.
a. NHESP Tracking # _____ b. Date submitted to NHESP _____

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: DMF.EnvReview-South@state.ma.us

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: DMF.EnvReview-North@state.ma.us

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☐ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
      2. ☐ A portion of the site constitutes redevelopment
      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

   b. ☒ No. Check why the project is exempt:
      1. ☐ Single-family house
      2. ☐ Emergency road repair
      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

D. Additional Information (cont'd)

3. ☐ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

Figures 2-4 Hop Brook Ponds - Stearns Mill Pond, Carding Mill Pond, Grist Mill Pond
a. Plan Title

Solitude Lake Management
b. Prepared By

c. Signed and Stamped by

d. Final Revision Date

varies
e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☐ Attach Stormwater Report, if needed.

E. Fees

1. ☐ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date
N/A

Hop Brook Protection Association
6. Payor name on check: First Name

7. Payor name on check: Last Name

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Sudbury
City/Town

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant	2. Date: 1/13/2020
3. Signature of Property Owner (if different): See Attached	4. Date
5. Signature of Representative (if any)	6. Date

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

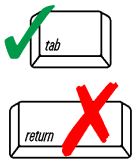
The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Applicant Information

1. Location of Project:

Grist Mill, Carding Mill, and Stearns Mill Ponds	Sudbury
a. Street Address	b. City/Town
c. Check number	d. Fee amount

2. Applicant Mailing Address:

Jeff	Winston
a. First Name	b. Last Name

Hop Brook Protection Association
c. Organization

118 Barton Drive
d. Mailing Address

Sudbury	MA	01776
e. City/Town	f. State	g. Zip Code

978 443 2589	978 443 8518	jeff@hopbrook.org
h. Phone Number	i. Fax Number	j. Email Address

3. Property Owner (if different):

a. First Name	b. Last Name

c. Organization

d. Mailing Address

e. City/Town	f. State	g. Zip Code

h. Phone Number	i. Fax Number	j. Email Address

B. Fees

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Category 2j	3	$500.00	$1,500.00

Step 5/Total Project Fee: $1,500.00

Step 6/Fee Payments:

Total Project Fee:	$1,500.00 (a. Total Fee from Step 5)
State share of filing Fee:	$737.50 (b. 1/2 Total Fee **less $**12.50)
City/Town share of filling Fee:	$762.50 (c. 1/2 Total Fee **plus** $12.50)

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

HOP BROOK PROTECTION ASSOCIATION

Restoring and Preserving Sudbury's Ponds

Box 707, Sudbury, MA 01776

Answers to questions from Lori Capone, Sudbury Conservation Coordinator, by Hop Brook Protection Association, 12/23/19

1. I didn't see any information on what the Hop Brook Association has done in the past regarding water chestnut besides mentioning the harvester. I think informing the Commission on how many years you have tried the harvester and/or supplemented with hand pulling would be helpful. How many years this was done, how much material was removed, and how successful or not it was will help inform that as to why you are proposing chemicals.

HBPA: We have been targeting water chestnut with harvesting for decades (my original info was incorrect). However, we weren't particularly successful. Harvesting has also become somewhat of a non-starter since

a) you can't use a harvester in Grist Mill Pond
b) we no longer have access to the danger-loving small-boat people who did it in the past
c) we now know it spreads other invasives.

Also, in the past, the other two ponds were harvested by borrowing equipment and using volunteers, neither of which are available to us anymore. Harvesting using proper channels is very expensive if you can find someone to do it (DPW's RFQ in 2019 went unanswered). Hand pulling can help, and it was used to a limited degree in conjunction with harvesting in the past, but you would need an army of hand-pullers to have an impact now.

It's also possible that HBPA used this inadequate solution for so long because until recently, safer herbicides like Clearcast were neither available nor proven.

It's useful to note this answer from the attached 2018 report *"It is clear that a more permanent solution is necessary at all of the ponds or we will eventually lose the ponds and their surrounding ecosystems."*

2. Your cover letter states that the treatment must be done in May or early June to be effective, but as they are proposing the areal spray the plants, they will not be at the water surface by then and then you would be treating the water column, not the plants. The initial treatment would likely occur in late June/early July, you may want to confirm with Solitude and revise your cover letter and/or provide information on treatment of submerged plants, if that is what is being proposed.

HBPA: You're correct. I was trying to build in some margin.

3. Would you consider sequencing where you treat the upper pond and make your way done to the other ponds in subsequent years as the upstream water chestnut are brought under control?

HBPA: The goal is to kill as much as possible in order to deplete the seed bank. So, if you eradicate water chestnut in Grist Mill Pond and then begin to treat Carding Mill Pond, you'll extend the treatment for a decade or more, as the downstream seeds last for up to a decade. The downstream ponds will also get much worse during the delay.

4. Is there any treatment of the Hop Brook itself or just the ponds, and if so, how would that effect the success of your program?

HBPA: Just the ponds. Wherever the water moves quickly and/or the channel is deep there isn't a problem. This was observed in Heard Pond in Wayland

5. You mention that Clearcast is being used in Concord. There may some private landowners using clearcast, but the Town is not using herbicides to manage water chestnut so I wasn't sure what this reference related to.

HBPA: That was incorrect and the document is updated. Please see our document " HBPA Experience of Nearby Towns" for correct data.

6. In the list of experience from nearby town, your citation for Framingham is the Notice of Intent application, this is not a study.

HBPA: That's true. We're looking for followup information. However, there's a great series of photos that tell a good story and a nice summary here: http://friendsofsaxonville.org/initiatives/river-stewards/

7. I think the Commission may have concerns with the fact that the inert product information and MSDS sheets are not available, as a proprietary product. And that the toxicity of breakdown products has not been specifically tested but relies on antidotal evidence of no adverse impacts on plants or animals.

HBPA: The MSDS sheet is quite similar to the detailed product information, but neither lists the exact formulation of the inert ingredients and adjuvants used for water surface application. That was the reason that a detailed risk review of the actual inert and adjuvant ingredients was conducted by the Mass Dept of Agricultural Resources (State of MA Clearcast.pdf). They concluded that the recommendations and restrictions on the product label were sufficient to insure safety of its use.

Actually, some toxicity studies have been done. All of the field studies using imazamox and Clearcast would have also included exposure to the breakdown products, the same breakdown products that we would see in Hop Brook. That's why the lack of any observed toxicity in real-life use is directly relevant to both the compound itself and the breakdown products.

8. I think the Commission will also have concerns with the likelihood of the product not breaking down due to the shallow, oxygen-poor environment in the ponds. It would be good to have some comparative information of how these ponds are similar or dissimilar in depth to the other area ponds that were treated with Clearcast to compare apples to apples.

HBPA: The ponds listed in our "HBPA Experience of Nearby Towns" document are similar. For example, look at Del Carte in Franklin – size in the 20 - 40 acre range, shallow (< 5 ft), mucky bottom, and they all drain into the Charles River watershed, which is a water supply for several towns. There is a similar situation in Littleton as well. Given the very low amounts of Clearcast being used, and the slow nature of transport through muck, there haven't been such concerns in these towns.

9. Also concerning is that only acute effects were evaluated and not chronic, which is normal for this type of product, but the Commission is concerns with the potential long-term impacts of introducing a chemical into the environment, as well as the short-term impacts and benefits.

HBPA: Some of the imazamox studies were long-term chronic studies that evaluated carcinogenesis and mutagenesis. The results are described in detail in the NY State document. Given all this data, it seems unlikely

that a serious problem is going to emerge with the proposed low-level use. Remember that this herbicide has been used at far greater concentrations in soybean production, for decades, without any reports of adverse health effects.

On the other hand, inaction in dealing with the water chestnut problem contributes to a favorable environment for mosquito larvae, and thus higher risk of EEE virus transmission. We already have a significant problem with EEE in Sudbury.

10. Permitting herbicide treatment to remove one invasive, just for a second invasive, milfoil, to fill that void, and how that will be managed will cause concern. I know you say that a plan will be developed to address this, but with milfoil, chemical treatment is again the primary management tool. Particularly as Carding and Grist Mill ponds don't presently have milfoil, according to Solitude Vegetation Survey. Was Hop Brook, in between the three ponds evaluated as part of this vegetation survey?

HBPA: It's likely that milfoil or something else will take the place of water chestnut. The water is shallow, the sediment loaded with phosphorus and nitrogen, so it's an ideal environment for plant overgrowth. Chemical treatment has been one of the main approaches used for milfoil, but other approaches may be effective, including draw-downs, pond size reduction, limited dredging, and focused aeration. In actuality, we need to take care of the water chestnuts and then see where we are.

11. You state that an Order will be needed from Marlborough. I recently talked to the Conservation Director in Marlboro and she said that water chestnut is not a problem in Haggar Pond anymore. Is there other work in Marlboro that would require permitting.

HBPA: We think part of Grist Mill pond is in Marlboro

12. How do you address to concerns about impact on nontarget macrophytes?

HBPA: SOLitude tells us: "The first thing to think about when discussing non-target impacts is herbicide choice. Through the foliar application of Clearcast we don't have to worry about impact to any native pondweeds or submersed species as it won't be effective on those. Clearcast through foliar application is however effective on other floating leafed species such as waterlilies, and emergent species such as cattails for instance. A few things to think about with these types of species: 1) our biologists are educated in recognizing the target species and can try to be somewhat selective. By choosing a non-windy day without precipitation, we can fairly easily avoid the herbicide contacting emergent species. If an area is solely lilies for instance we can minimize any non-target impact there by simply not treating that area. If lilies (for example) are completely mixed in with water chestnut I'd expect they'll be impacted. With this specific example it's important to note that water chestnut is so aggressive that the Hop Brook Ponds are virtually already taken over by water chestnut and b) if there were any remaining lilies co-mingled with water chestnut, they'll be outcompeted by the water chestnut soon; therefore managing the water chestnut is the best thing you can do. Once the water chestnut densities decline it allows both submersed and native floating leafed species to recolonize; this is when we can look to smaller scale strategies such as hand-pulling."

We would add that there is extensive research showing no effect on submerged plants, insects or animals, and many floating plants are not susceptible to this compound either. The NY SEIS has an extensive list of susceptible and non-susceptible water plants.