Prepared by:
NH Department of
Environmental Services
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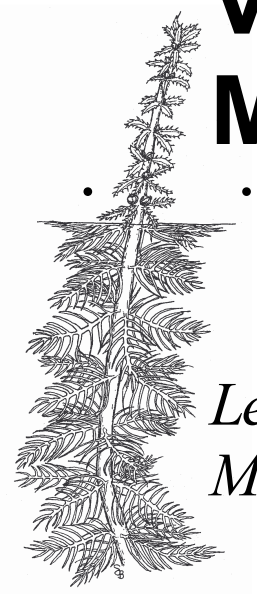
Long-Term Variable Milfoil Management Plan



Lees Pond
Moultonborough, New Hampshire

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Purpose

The purposes of this exotic aquatic plant management and control plan are:

1. To identify and describe the historic and current exotic aquatic infestation(s) in the waterbody;
2. To identify short-term and long-term exotic aquatic plant control goals;
3. To minimize any adverse effects of exotic aquatic plant management strategies on non-target species;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To evaluate control practices used in this waterbody over time to determine if they are meeting the goals outlined in this plan.

This plan also summarizes the current physical, biological, ecological, and chemical components of the subject waterbody as they may relate to both the exotic plant infestation and recommended control actions, and the potential social, recreational and ecological impacts of the exotic plant infestation.

The intent of this plan is to establish an adaptive management strategy for the long-term control of the target species (in this case variable milfoil) in the subject waterbody, using an integrated plant management approach.

Appendix A and Appendix B detail the general best management practices and strategies available for waterbodies with exotic species, and provide more information on each of the activities that are recommended within this plan.

Invasive Aquatic Plant Overview

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and ponds (Luken & Thieret, 1997, Halstead, 2000), primarily by forming dense growths or monocultures in critical areas of waterbodies that are important for aquatic habitat and/or recreational use. Under some circumstances, dense growths and near monotypic stands of invasive aquatic plants can result, having the potential to reduce overall species diversity in both plant and animal species, and can alter water chemistry and aquatic habitat structure that is native to the system.

Since January 1, 1998, the sale, distribution, importation, propagation, transportation, and introduction of key exotic aquatic plants have been prohibited (RSA 487:16-a) in New Hampshire. This law was designed as a tool for lake managers to help prevent the spread of nuisance aquatic plants.

New Hampshire lists 27 exotic aquatic plant species as prohibited in the state (per Env-Wq 1303.02) due to their documented and potential threat to surface waters of the state.

According to the federal Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM), "exotic macrophytes are non-native, fast growing aquatic plants, which can quickly dominate and choke out native aquatic plant growth in the surface water. Such infestations are in violation of New Hampshire regulation Env-Wq 1703.19, which states that surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region" (DES, 2006). In fact, waterbodies that contain even a single exotic aquatic plant do not attain water quality standards and are listed as impaired.

Variable Milfoil Infestation in Lees Pond

Variable milfoil (*Myriophyllum heterophyllum*) became established in Lees Pond in Moultonborough, New Hampshire in 1975. The plant quickly colonized this lake, forming dense stands of milfoil from near shore to depths of about 10 feet. Recent control measures have greatly reduced the overall infestation to only small patches of growth today.

Figure 1 illustrates the distribution of variable milfoil in Lees Pond in recent years (as far back as GIS data are available). The following table provides a summary of each area indicated in Figure 1, based on updated data from each year (as available). The area reference relates to the grid overlay on Figure 1.

Area	Location/Area Description	Year	Description of Variable Milfoil Growth	Variable Milfoil %Cover
C1	Northern-most cove. Silty/organic substrate with rocks mixed in. Wetland edge along north shore.	2001	No documented growth in this area	0%
		2002	Scattered patches and stems along shoreline of cove	20%
		2007	Scattered stems along shore, few plants in deeper water	10%
		2009	Regular growth along shore	60%
		2011	Few plants along shore	10%
		2012	Sparse growth, only a few stems found	<5%
D1, D2, D3	Eastern shoreline. Sandy substrates between large boulders and mixed	2001	Small patches of growth along shore	15%
		2002	No growth documented along this shoreline	0%

Area	Location/Area Description	Year	Description of Variable Milfoil Growth	Variable Milfoil %Cover
	rocks.	2007	Small to medium sized patches along shore and extending off shore to form medium sized patches	35%
		2009	Patches of growth in various shoreline section	40%
		2011	A couple of stems located in D1, otherwise no growth on this shoreline	<5%
		2012	Scattered patchy growth in coves along this shoreline	10%
B3, C3	Southern shorelines and coves. Sandy/silty substrates with mixed rocks/boulders.	2001	Growth documented in C3, not in B3	5%
		2002	Scattered patches in B2, not in C3	5%
		2007	Scattered patches of growth, more in cove in B3	10%
		2009	Small scattered patches of growth	10%
		2011	Thicker shoreline growth in B3 cove, a couple of patches in C3	5%
		2012	Scattered small patches of growth in B3, one small patch of growth in C3	10%
A2	Northwestern cove/inlet from Garland Pond. Silty/organic substrates, emergent wetland habitat. Inflow area pushes milfoil fragments from patches of growth out into lake with flow.	2001	Persistent growth in this area, regular trouble spot	30-40%
		2002	Persistent growth in this area, regular trouble spot	30-40%
		2007	Persistent growth in this area, regular trouble spot	30-40%
		2009	Persistent growth in this area, regular trouble spot	30-40%
		2011	Persistent growth in this area, regular trouble spot	30-40%
		2012	Persistent growth in this area, regular trouble spot	30-40%
B2	Northwestern shoreline. Silty/organic substrates, abuts expansive wetland.	2001	Milfoil plants scattered as patches along wetland edge	25%
		2002	Milfoil plants scattered as patches along wetland edge	25%
		2007	Milfoil plants scattered as patches along wetland edge	25%
		2009	Milfoil plants forming dense line of growth along wetland edge	70%
		2011	Milfoil plants forming dense line of growth along wetland edge	70%
		2012	Milfoil growth patchy along	30%

Area	Location/Area Description	Year	Description of Variable Milfoil Growth	Variable Milfoil %Cover
			wetland edge, reduced from previous two years.	
C2	Peninsula/Island on north-central shoreline. Rocky shallows with silty/sandy substrates.	2001	No growth observed along this section	0%
		2002	Scattered plants in western cove of peninsula/island	10%
		2007	Small to medium patches along western shoreline of this peninsula/island	40%
		2009	Small to medium patches along western shoreline of this peninsula/island	30%
		2011	A couple scattered plants along eastern shoreline of this peninsula/island	5%
		2012	Small patches along western shoreline of the pensinsula/island	10%

In terms of the impacts of the variable milfoil in the system, there are several houses around the shoreline of Lees Pond, with mostly seasonal cottages, though there are a few year-round dwellings. The variable milfoil in this system is a continuous source of fragments to Lake Winnipesaukee, where Lees Pond empties into that lake via a dam into Lees Mills.

Milfoil Management Goals and Objectives

The goal for Lees Pond is the reduction of overall biomass and distribution of variable milfoil in the system over time, with the eventual eradication (if feasible) using an Integrated Pest Management Approach.

Local Support

Town or Municipality Support

The Town of Moultonborough has generously supported variable milfoil control efforts in Lees Pond (and portions of Lake Winnipesaukee) for the past several years. The Town of Moultonborough also has a town milfoil committee, to coordinate milfoil control efforts on the local level, and to strategize timing, financial support, and other elements for larger-scale and more comprehensive prevention, early detection, and control efforts for town waterbodies.

Lake Resident Support

Lees Pond has an active lake association. They participate in the DES Volunteer Lake Assessment to monitor water quality and in the Weed Watcher program to track plant growth. The lake association also participated in the Lake Host Program to inspection boats as they enter and leave Lees Pond, but due to the low number of transient boaters visiting Lees Pond, the Lake Host Program was not as efficient for this waterbody, and therefore was discontinued. The lake association does still maintain signage regarding the infestation to warn boaters to be cautious and to clean their recreational gear.

In 2006, divers that live on the pond became trained in variable milfoil hand harvesting by experienced divers in this field, and have spent many hours performing hand-removal of variable milfoil in the lake. In 2007, the lake association coordinated and paid for diver-assisted suction harvesting work in the lake to reduce some of the smaller patches of variable milfoil.

The lake association has committed lake association funds to the milfoil control project for several years, providing matching funds for treatments and using their resources to perform monitoring and non-chemical control activities over the years.

The lake association is also committed to performing follow-up monitoring for milfoil re-growth, and working with DES to coordinate hand-removal and benthic barrier placement for further variable milfoil control.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of Lees Pond, including the variable milfoil infestation. Note that a current review of the Natural Heritage Bureau (NHB) database was requested and the results from that search are included in the table below, as well as in other key sections of this report as they may pertain to the type of species (fish, wildlife, habitat, or macrophyte).

General Lake Information	
Lake area (acres)	179.2
Watershed area (acres)	17,656.5
Shoreline Uses (residential, forested, agriculture)	Residential, forested
Max Depth (ft)	37.3
Mean Depth (ft)	12.2
Trophic Status	Mesotrophic
Color (CPU) in Epilimnion	43
Clarity (ft)	9.9
Flushing Rate (yr^{-1})	12.9

Natural waterbody/Raised by Damming/Other	Natural
Plant Community Information Relative to Management	
Invasive Plants (Latin name)	*Myriophyllum heterophyllum*
Infested Area (acres)	See maps showing progression over time
Distribution (ringing lake, patchy growth, etc)	See maps showing progression over time
Sediment type in infested area (sand/silt/organic/rock)	Silty/organic
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Inventory)	New England Bluet (Rare) Reversed Bladderwort (State Threatened) Common Loon (State Threatened) Purple Martin (State Endangered) Bridled shiner (State Threatened)

An aquatic vegetation map and key from a September 2011 survey by the DES Biology Section is shown in Figure 2. A bathymetric map is shown in Figure 3.

Beneficial (Designated) Uses of Waterbody

In New Hampshire, beneficial (designated) uses of our waterbodies are categorized into five general categories: Aquatic Life, Fish Consumption, Recreation, Drinking Water Supply, and Wildlife (CALM).

Of these, Aquatic Life, Wildlife and Recreation are the ones most often affected by the presence of invasive plants, though drinking water supplies can also be affected as well in a number of ways.

Following is a general discussion of the most potentially impacted designated uses, including water supplies and near shore wells, as they relate to this system and the actions proposed in this long-term plan.

The goal for aquatic life support is to provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region.

Aquatic Life

Fisheries Information

Lees Pond is dominated by warmwater species including largemouth and smallmouth bass, black crappie, chain pickerel, yellow perch, bluegill, pumpkinseed sunfish, and brown bullhead. The primary fishery is for

largemouth bass, crappie, and pickerel. Lees Pond is enjoyed by both transient and local fisherman.

A Natural Heritage Inventory review showed one fish species of interest or concern in the general area: bridled shiner.

The bridled shiner habitat was identified by Fish and Game biologists in 2010. The area where they were observed is shown in Figure 5. This habitat area coincides with areas of known variable milfoil growth. The Fish and Game Department has requested that no herbicide treatment an no non-chemical control treatments be performed prior to July 15th. Optimal treatment time for this area of the lake would be in June to reduce the density of the variable milfoil so that it is not pushed into the lake through the growing season from inflowing water from Garland Pond upstream; however we understand the importance in protecting this fish species. As an alternate timeframe, a mid-July (after July 15) start time for control actions (herbicide and/or non-chemical control) is possible, with control activities continuing through the remainder of the growing season.

Information provided by the Fish and Game Department suggests that bridled shiners find their habitat in dense structures of submersed aquatic plants, like milfoil and similar plants. In Lees Pond, there are numerous submersed plant species that are native, that can provide alternate habitat for the bridled shiner because the plants persist through treatment. These plants included water marigold, bladderwort, a variety of pondweed species and coontail. They each provide similar structure and cover as the variable milfoil.

Wildlife Information

A Natural Heritage Inventory review showed three wildlife species of interest or concern in the general area: the New England bluet, common loon, and purple martin.

The New England bluet was documented downstream of Lees Pond in Lake Winnipesaukee. The record was from 2002. General comments about the bluet indicate that the population appears to be widespread in the vicinity, and secure. Because only a small amount of herbicide will be used upstream in Lees Pond, it is expected that the herbicide concentration will be diluted to a point where it will not be a concern downstream. Lees Mills has done numerous historical herbicide treatments, apparently with no detriment to this damselfly population. By the time of the treatment (late May or early June), the bluets are already airborne, and out of the water. Egg laying is likely in July, and by that point the herbicide concentration will likely be below detection limits, particularly in this flow-through area. Other non-chemical approaches will not impact or target this species.

The common loon is a regular visitor to Lees Pond. Only small areas of variable milfoil growth around the pond will be targeted for control, and the balance of the pond will not be targeted for herbicide treatment. Native plants abound in Lees Pond, providing suitable habitat for the fish species which are they prey of the common loon. Other non-chemical approaches will not impact or target this species. The Fish and Game Department recommends that control actions (both herbicide and non-chemical) not take place within 100 meters of any known or suspected active nests between May 15 and July 15th, to avoid "take" under RSA 212-Aof the Endangered Species Conservation Act.

The record for the state threatened purple martin was within the watershed of Lees Pond, and not directly tied to the waterbody (found near an apple orchard). We do not anticipate the herbicide treatment or non-chemical controls of variable milfoil in Lees Pond will affect this avian species.

Recreational Uses and Access Points

Lees Pond is used for numerous recreational activities, including boating, fishing, swimming, and sail boating by both pond residents and transient boaters. Figure 6 illustrates the location of the public access site. There is one designated public access for boats on the northeastern side of the pond. Small motor boats, as well as kayaks and canoes can use this facility. Generally 1-2 transient boaters can be found visiting the lake each day during the summer months. There is limited parking for vehicles with trailers. There are generally a handful of small resident owned powerboats on the lake each year, and numerous canoes, kayaks, and row boats.

There are a few small private swim beaches located on private properties around the pond. There are 10 floating docks and swim platforms around the pond as well, and roughly 19 docks around the pond. Figure 6 shows the locations commonly used for swimming, and the locations of docks on Lees Pond.

Macrophyte Community Evaluation

The littoral zone is defined as the nearshore areas of a waterbody where sunlight penetrates to the bottom sediments. The littoral zone is typically the zone of rooted macrophyte growth in a waterbody.

The littoral zone of Lees Pond is characterized by a mix of native and non-native (variable milfoil) plant growth (Figure 2). Native species include a mix of floating plants (yellow and white water-lilies, watershield, floating heart),

emergent plants (bur-reed, pickerelweed, cattail), and submergent plants (pondweed, bladderwort, water marigold, coontail, mermaid-weed). Native plant communities are mixed around the entire lake, and are characterized as 'common/abundant' by the DES.

Native plant growth is relatively unchanged since milfoil control activities began, though an increase in water marigold (*Bidens beckii*) was noted just outside of the northwestern inlet of the pond where some variable milfoil growth has been reduced.

A New Hampshire Natural Heritage Bureau did not list any plant species of concern in the 2013 survey. Historical listings did include reversed bladderwort, which is listed as state threatened, and the record for this plant was upstream of Lees Pond. DES has conducted several plant mapping activities in this area, and this particular plant species has not been observed in Lees Pond, though other bladderwort species are fairly common in the pond. DES will conduct a site inspection in the general vicinity of the bladderwort sighting before a control practice is conducted, to verify if it is present or not. If the bladderwort is present, but in an upstream location, it will not be impacted by milfoil control activities in Lees Pond.

Wells and Water Supplies

Figure 7 shows the location of wells, water supplies, well-head protection areas, and drinking water protection areas around the subject waterbody, based on information in the DES geographic information system records. Note that it is likely that Figure 7 does not show the location of all private wells.

Note that the map in Figure 7 cannot be provided on a finer scale than 1:48,000. Due to public water system security concerns, a large-scale map may be made available upon agreement with DES' data security policy. Visit DES' OneStop Web GIS, http://www2.des.state.nh.us/gis/onestop/ and register to Access Public Water Supply Data Layers. Registration includes agreement with general security provisions associated with public water supply data. Paper maps that include public water supply data may be provided at a larger-scale by DES' Exotic Species Program after completing the registration process.

In the event that an herbicide treatment is needed for this waterbody, the applicator/contractor will provide more detailed information on the wells and water supplies within proximity to the treatment areas as required in the permit application process with the Division of Pesticide Control at the Department of Agriculture. It is beyond the scope of this plan to maintain

updated well and water supply information other than that provided in Figure 7.

Historical Control Activities and Progress Yield

DATE	ACTION	ACRES	DOSE (HERBICIDE) OR MATERIAL REMOVED (DIVER/DASH)	CONTRACTOR/ ENTITY
04-Jun-03	DIQUAT	35	1.5 gal/ac	ACT
07-Jun-05	2,4-D	30	100 lbs/ac	ACT
07-Jun-06	2,4-D	10	100 lbs/ac	ACT
04-Jun-08	2,4-D	10	100 lbs/ac	ACT
29-Jun-10	2,4-D	16.6	100 lbs/ac	ACT
6/14/2010	DASH	VARIOUS	6 hours, 20 minutes, 185 gallons removed	AB AQUATICS
6/15/2010	DASH	VARIOUS	4 hours 48 minutes, 68 gallons	AB AQUATICS
6/16/2010	DASH	VARIOUS	8 hours, 30 minutes, 117 gallons removed	AB AQUATICS
6/18/2010	DASH	VARIOUS	4.5 hours, 100 gallons	AB AQUATICS
7/10-10/10	FRAGMENT BARRIER	ACROSS NORTHWEST COVE	N/A	DES
8/9/2010	RECON	<1/2 acre	No dive time, no material removed	DES DIVERS
8/16/2010	HAND PULL	<1/2 acre	5 hours dive time, 400 gallons removed	DES DIVERS
10/8/2010	HAND PULL	<1/2 acre	4 hours dive time, 300 gallons removed	DES DIVERS
Summer 2011	DASH	VARIOUS	TBD (NO REPORTS SUBMITTED AS OF YET)	AB AQUATICS
5/11-10/11	FRAGMENT BARRIER	ACROSS NORTHWEST COVE	N/A	DES
17-Jul-12	2,4-D (G)	13.14	100 lbs/ac	ACT
SUMMER AND FALL 2012	DIVER/DASH	Lees Pond, Anita's Cove	37 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lees Pond (Anitas-Island cove)	15 GALLONS	AB AQUATICS
FALL 2012	DIVER/DASH	Lees pond	40 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lee's Pond, Island shoreline	45 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lees Pond, launch area	48 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lees Pond (Launch to inlet)	20 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lee's Pond (DASH Launch)	15 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lees Pond, NW	560 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lees Pond, NW	1180 GALLONS	AB AQUATICS
SUMMER AND FALL 2012	DIVER/DASH	Lee's Pond, outlet & east of Island	20 GALLONS	AB AQUATICS

Aquatic Invasive Plant Management Options

The control practices used should be as specific to the target species as feasible. No control of native aquatic plants is intended.

Exotic aquatic plant management relies on a combination of proven methods that control exotic plant infestations, including physical control, chemical control, biological controls (where they exist), and habitat manipulation.

Integrated Pest Management Strategies (IPM) are typically implemented using Best Management Practices (BMPs) based on site-specific conditions so as to maximize the long-term effectiveness of control strategies. Descriptions for the control activities are closely modeled after those prescribed by the Aquatic Ecosystem Restoration Foundation (AERF) (2004). This publication can be found online at http://www.aquatics.org/bmp.htm. Additional information can be obtained from a document prepared for the State of Massachusetts called the Generic Environmental Impact Report for Lakes and Ponds, available at http://www.mass.gov/dcr/watersupply/lakepond/geir.htm.

Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices currently used by the State of New Hampshire.

Feasibility Evaluation of Control Options in this Waterbody

DES has evaluated the feasibility of potential control practices on the subject waterbody. The following table summarizes DES' control strategy recommendations for the subject waterbody:

Control Method	Use on Lees Pond
Restricted Use Areas (RUAs) and/or Fragment Barriers	The purpose of RUAs and fragment barriers is to contain small areas of exotic aquatic plant growth to prevent them from spreading further in a system. A fragment barrier has been in place in the northwestern inlet of the pond for the few years to keep milfoil plants from that area from spreading back into the lake.
Hand-pulling	It is recommended that the lake association plan to keep a diver on retainer through the growing season for the next several years, until the variable milfoil is in good control. Diving should be performed a few days a month,

Control Method	Use on Lees Pond
	guided by Weed Watcher activity that marks milfoil growth, to guide divers. DES will continue to perform surveys to map the milfoil, but more stepped up and routine monitoring will be needed if the variable milfoil is the be greatly reduced in this system. There are over 100 certified Weed Control Divers in New Hampshire, and 4-5 Diver Assisted Suction Harvester operations, so ample divers are available to contract with, and bids should be sought to find a reasonably priced diver for hire. It is understood that the Lees Pond Association will continue to work with the town of Moultonborough and partake in diver services contract by the town.
Mechanical Harvesting/Removal	Not recommended due to the risk of fragmentation and drift, and subsequent further spread of the invasive plant.
Benthic Barriers	Recommended for small patches that are 20' x 20' in size or less, and where practical.
Herbicides	Herbicide treatment is recommended as a primary means of control only where infestations of the exotic plant are too widespread and/or dense for non-chemical means of control to be effective, or where non-chemical means of control (diver/etc) are infeasible due to environmental (depth/flow) constraints.
Extended Drawdown	Not feasible or practical for this waterbody due to lack of an impoundment structure that would allow for significant water level fluctuation.
Dredge	Cost prohibitive and not often effective for controlling invasive aquatic plants.
Biological Control	No biological controls are yet approved for use on variable milfoil.
No Control	The variable milfoil infestation in Lees Pond is much reduced as compared to prior years. A no control option would only allow milfoil to expand in the lake again, obviating the value of all of the hard work and dollars spent on this project.

Recommended Actions, Timeframes and Responsible Parties

An evaluation of the size, location, and type of variable milfoil infestation, as well as the waterbody uses was conducted at the end of the last growing

season (see attached figures for findings). Based on this survey the following recommendations are made for variable milfoil control in the system:

Year	Action	Responsible Party	Schedule
2012	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June and August
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	DES	May through October
	Herbicide treatment, if needed, based on diver progress as monitored by DES (areas to be determined based on updated spring survey)	Aquatic Control Technology, Inc.	After July 15
	Survey waterbody and planning for next season's control actions	DES	September
2013	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June and August

Year	Action	Responsible Party	Schedule
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	DES and/or contract diver	May through October in most places, after July 15 for loon/ bridled shiner habitats
	Herbicide treatment, if needed, based on diver progress as monitored by DES (areas to be determined based on need)	Aquatic Control Technology	After July 15
	Survey and planning for next season's control actions	DES	September
2014	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June and August
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Contract diver	May through October in most places, after July 15 for loon/ bridled shiner habitats
	Herbicide treatment, if needed	TBD	June or September
	Survey and planning for next season's control actions	DES	September

Year	Action	Responsible Party	Schedule
2015	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June and August
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Contract diver	May through October in most places, after July 15 for loon/ bridled shiner habitats
	Survey and planning for next season's control actions	DES	September
2016	Weed Watching and marking/reporting of milfoil growth	Local Weed Watchers	Once a month from May through September
	Survey and planning for summer/fall milfoil control actions	DES	May/June and August
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Contract diver	May through October in most places, after July 15 for loon/ bridled shiner habitats

Year	Action	Responsible Party	Schedule
	Survey and planning for next season's control actions	DES	September
2017	Update and revise Long-Term Variable Milfoil Control Plan	DES and Interested Parties	Fall/ Winter

Notes

Target Specificity

It is important to note that aquatic herbicide applications are conducted in a specific and scientific manner. To the extent feasible, the permitting authority favors the use of selective herbicides that, where used appropriately, will control the target plant with little or no impact to non-target species, such that the ecological functions of native plants for habitat, lake ecology, and chemistry/biology will be maintained. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

Adaptive Management

Because this is a natural system that is being evaluated for management, it is impossible to accurately predict a management course over five years that could be heavily dependent on uncontrolled natural circumstances (weather patterns, temperature, adaptability of invasive species, etc).

This long-term plan is therefore based on the concept of adaptive management, where current field data (from field survey work using DES established field survey standard operating procedures) drive decision making, which may result in modifications to the recommended control actions and timeframes for control. As such, this management plan should be considered a dynamic document that is geared to the actual field conditions that present themselves in this waterbody.

If circumstances arise that require the modification of part or all of the recommendations herein, interested parties will be consulted for their input on revisions that may be needed to further the goal of variable milfoil management in the subject waterbody.

Figure 1: Map of Variable Milfoil Infestations Over Time

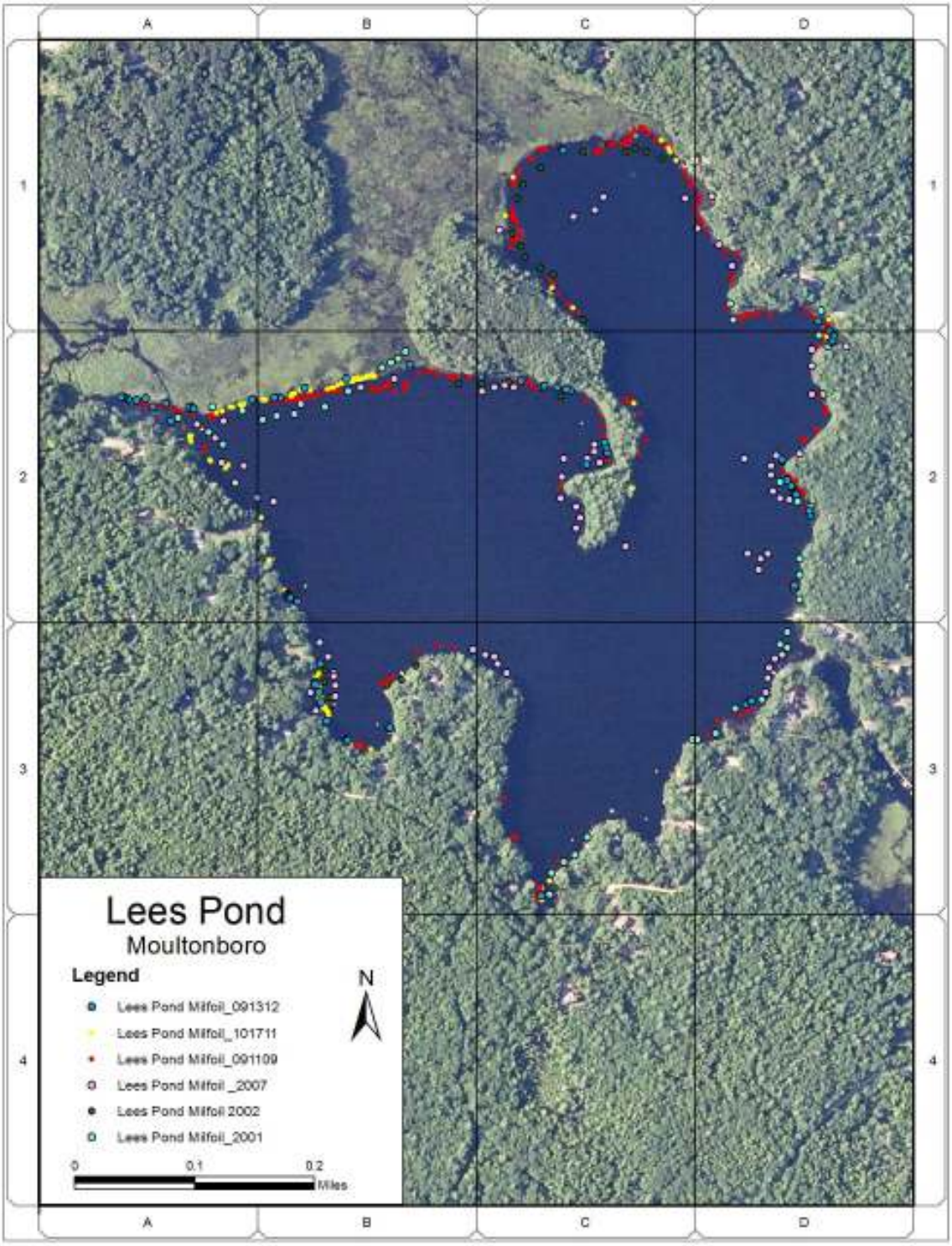
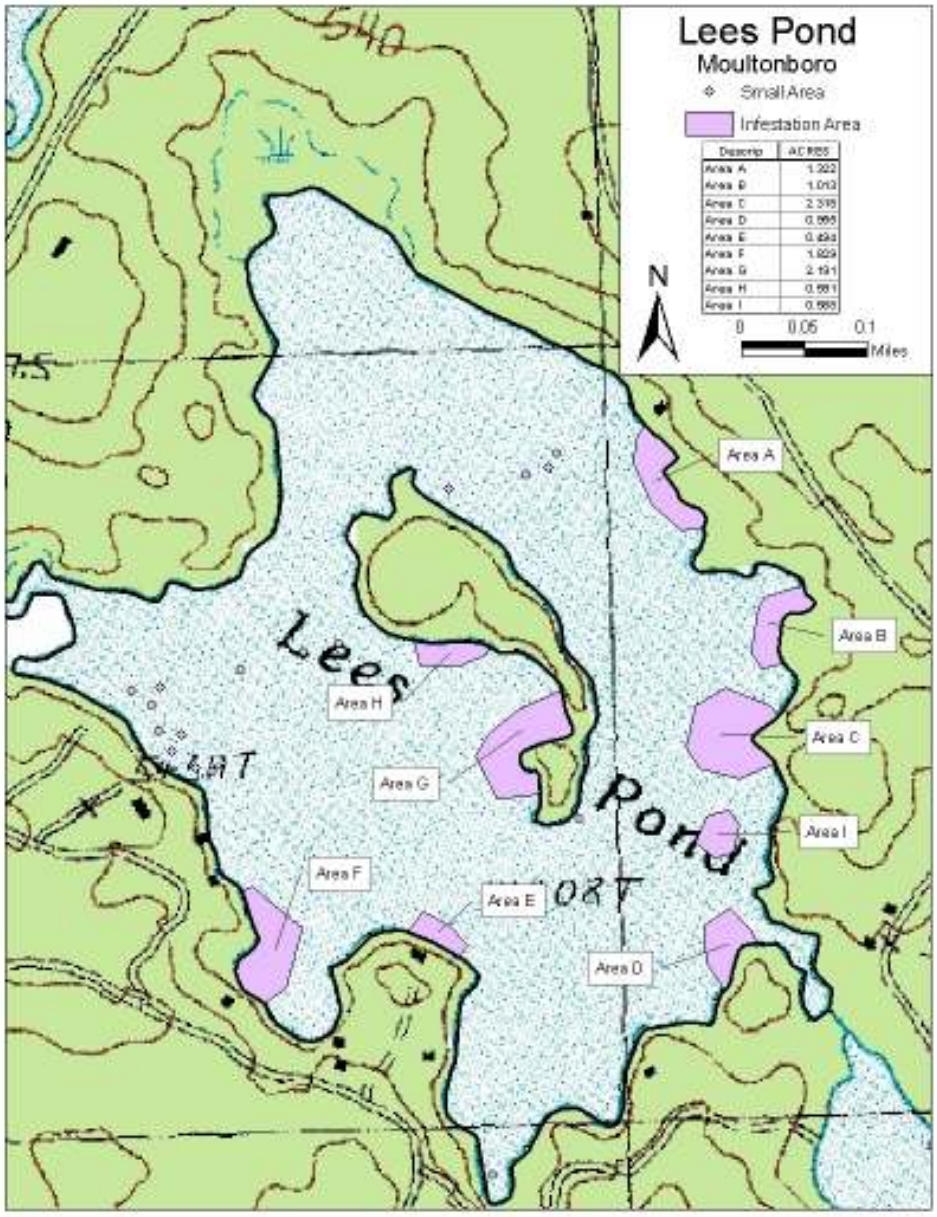
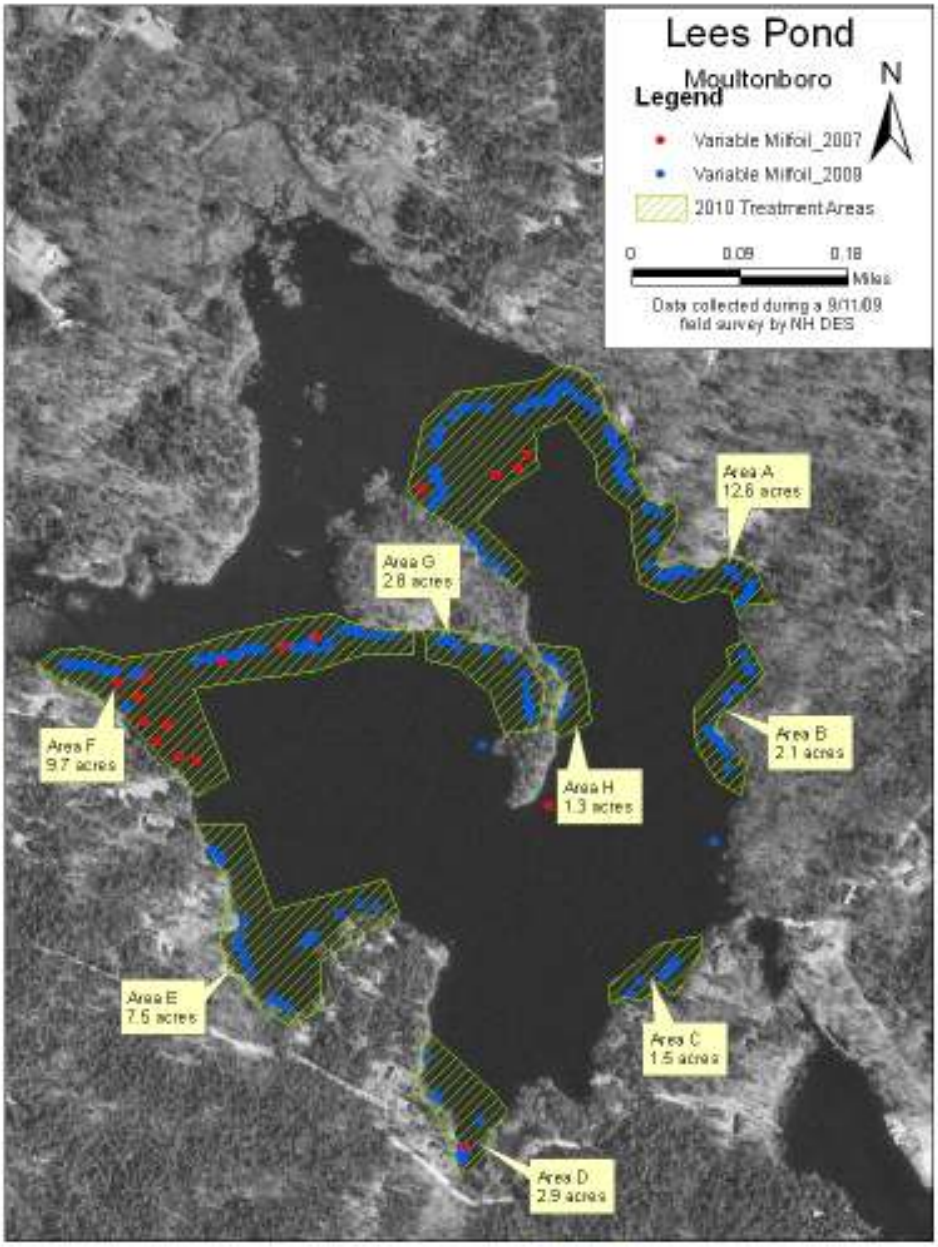


Figure 2: Map of Control Actions Over Time

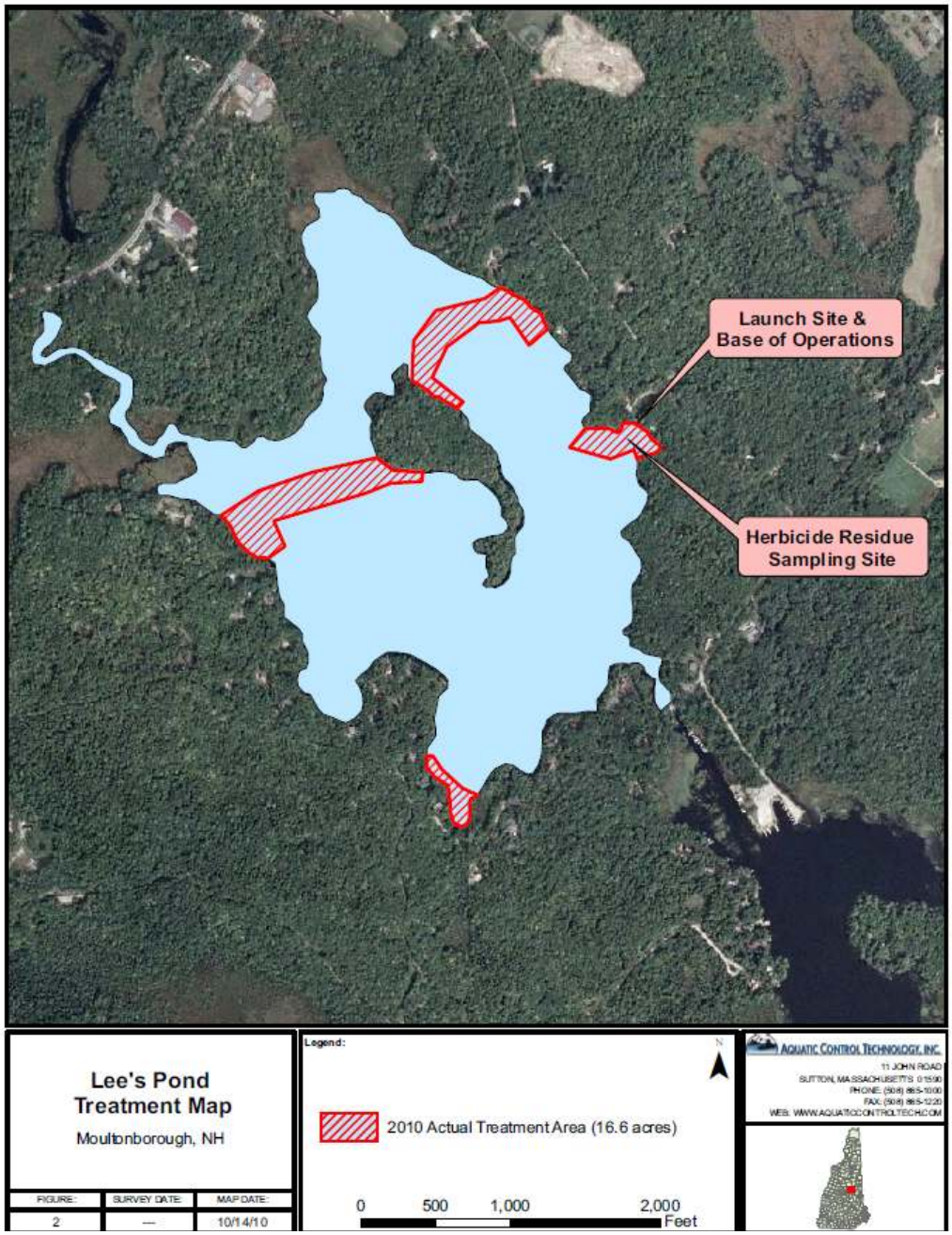
2007



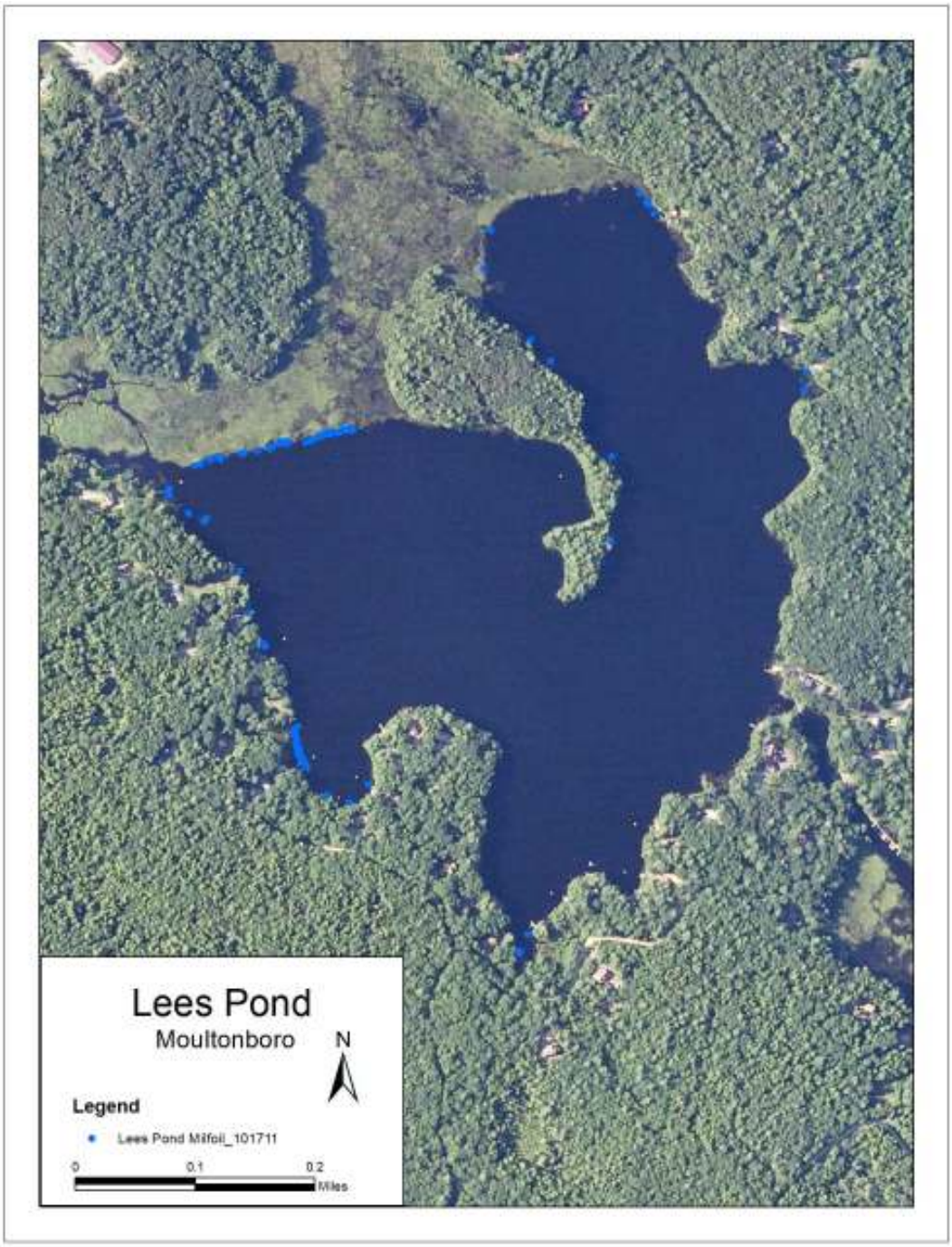
2009


Lees Pond
Moultonboro
N
Legend
Variable Milfoil_2007
Variable Milfoil_2009
2010 Treatment Areas
0
0.09
0.18
Miles
Data collected during a 9/11/09
field survey by NH DES
Area A
12.6 acres
Area G
2.8 acres
Area F
9.7 acres
Area B
2.1 acres
Area H
1.3 acres
Area E
7.5 acres
Area C
1.5 acres
Area D
2.9 acres

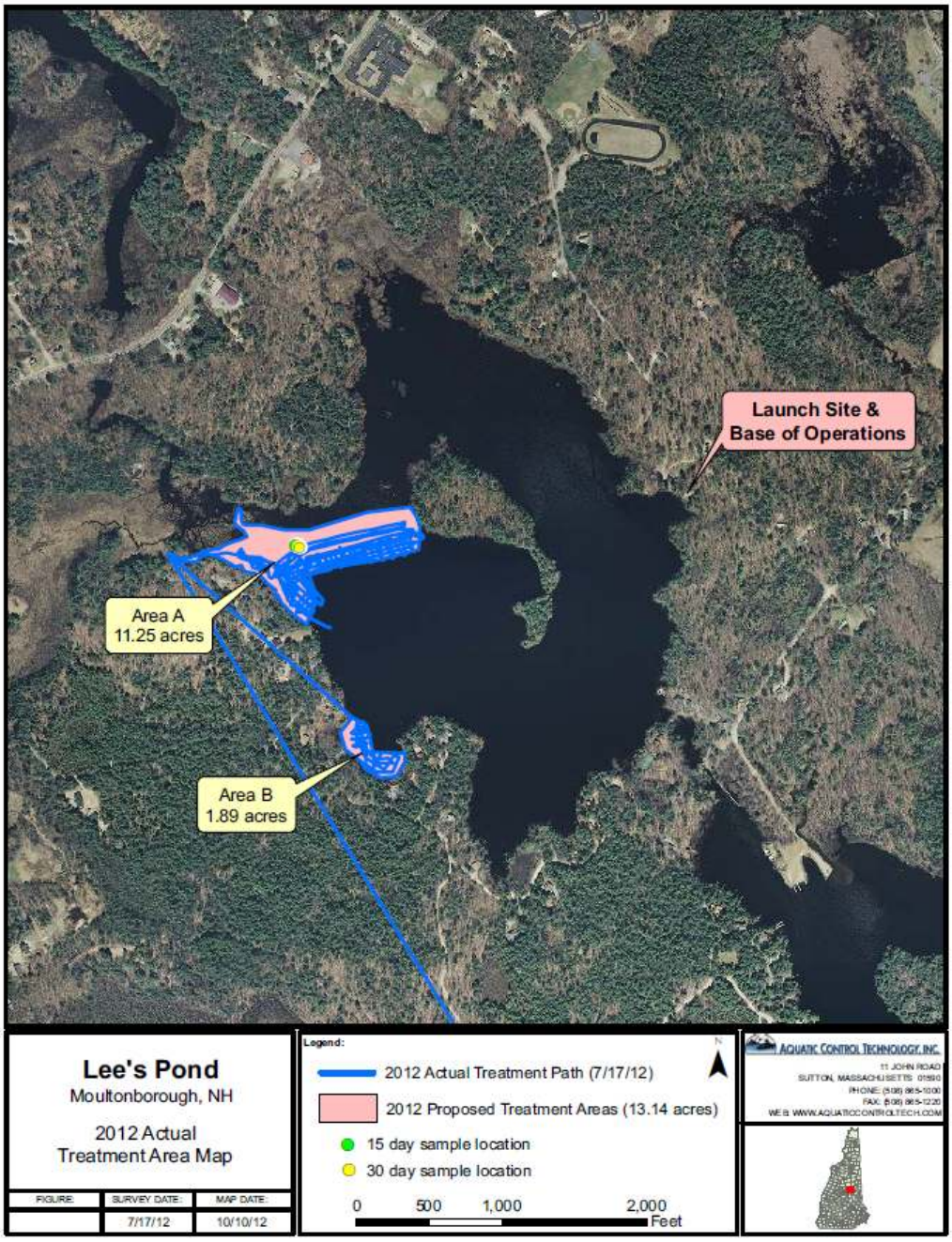
2010 (map prepared by Aquatic Control Technology)



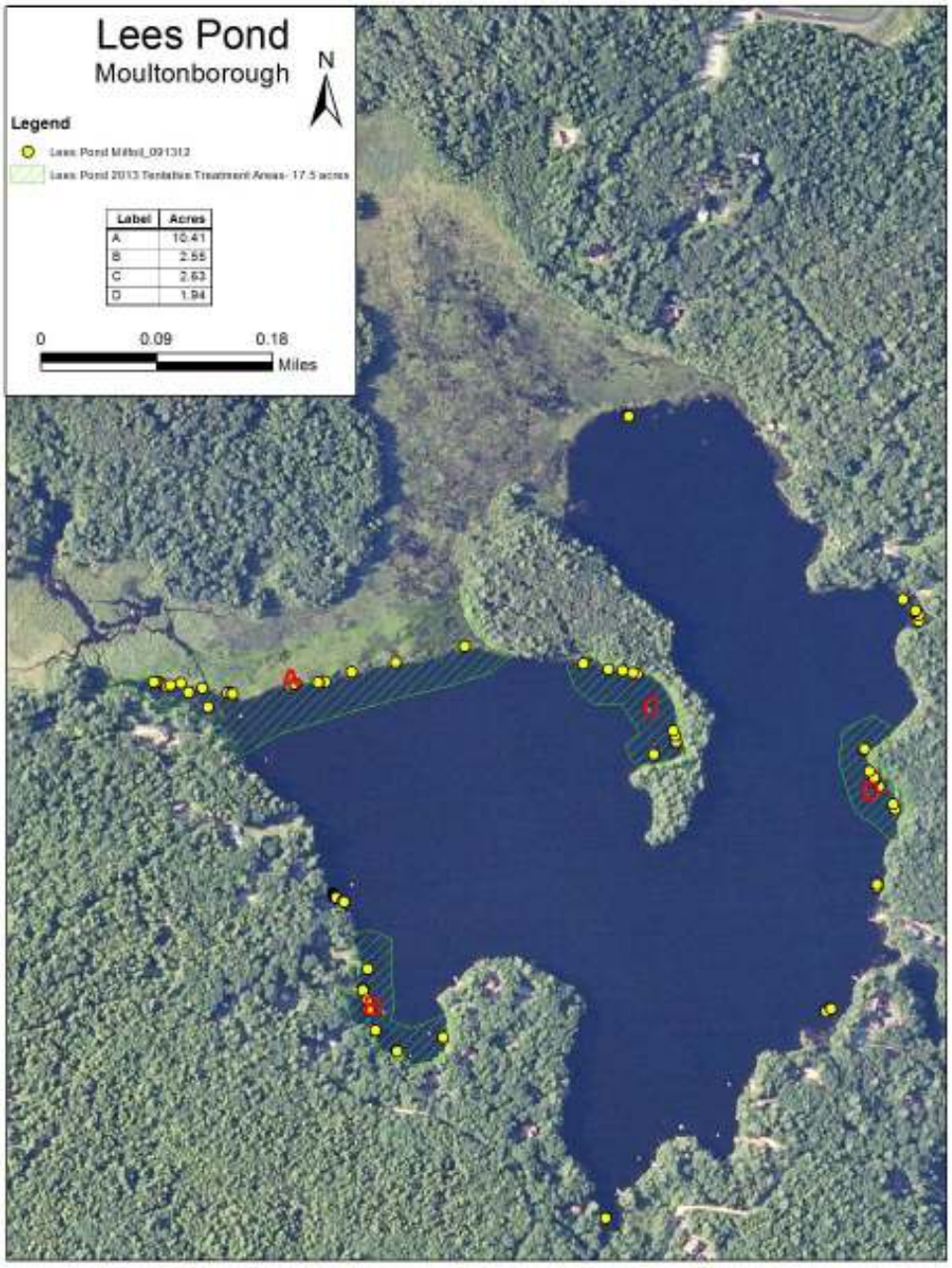
2011 (hand pull/DASH sites)



2012 (map prepared by Aquatic Control Technology

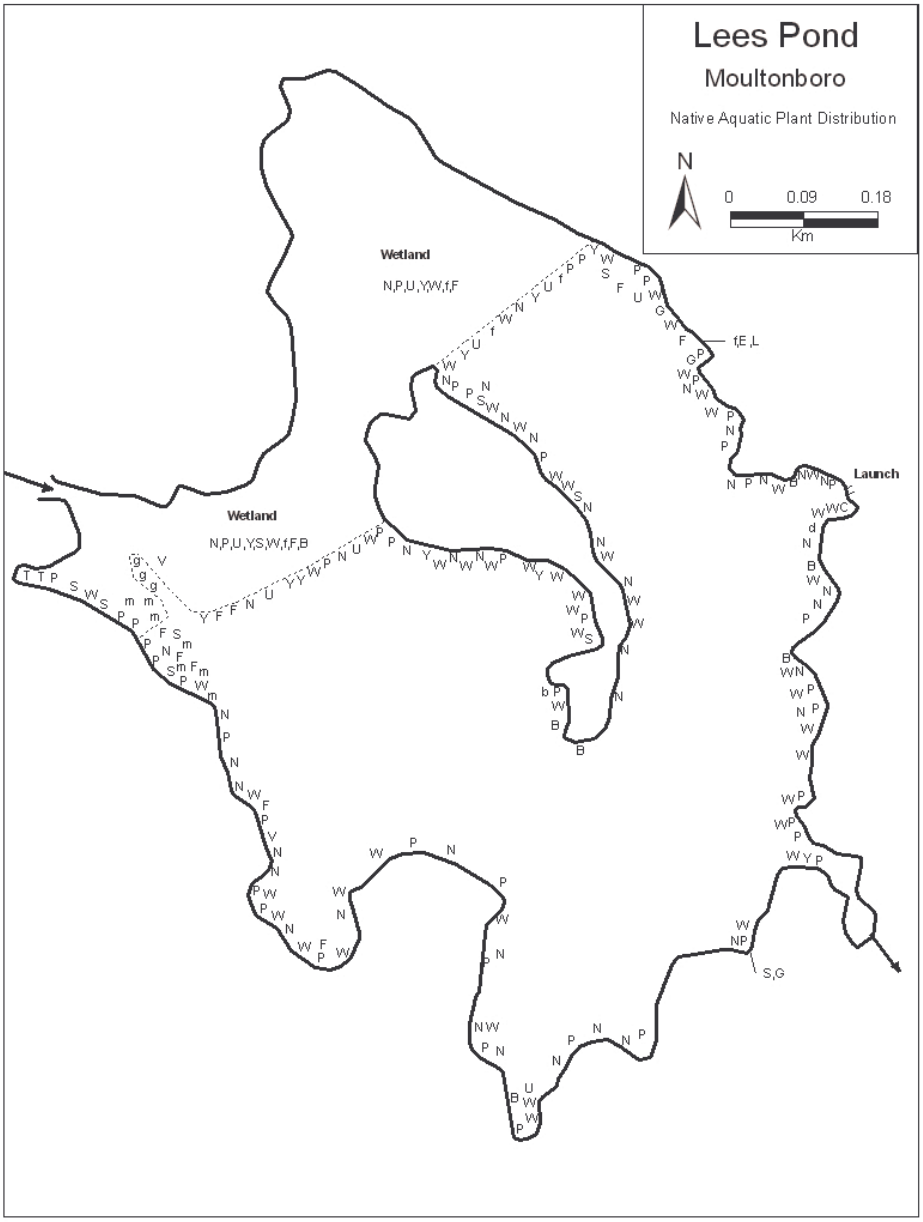


2013 (proposed)



Note: Points outside of polygons to be hand removed.

Figure 3: Map of Native Aquatic Macrophytes



Key to Plant Map

Symbol	Common Name	Latin Name
S	Bur-reed	*Sparganium*
Y	Yellow water-lily	*Nuphar*
N	White water-lily	*Nymphea*
m	Water marigold	*Bidens beckii*
P	Pickerelweed	*Pontedaria cordata*
W	Pondweed	*Potamogeton sp.*
B	Watershield	*Brasenia schreberi*
F	Floating heart	*Nymphoides cordata*
T	Cattail	*Typha*
U	Bladderwort	*Utricularia*
C	Coontail	*Ceratophyllum*
R	Mermaid-weed	*Proserpinaca palustris*

Figure 4: Bathymetric Map

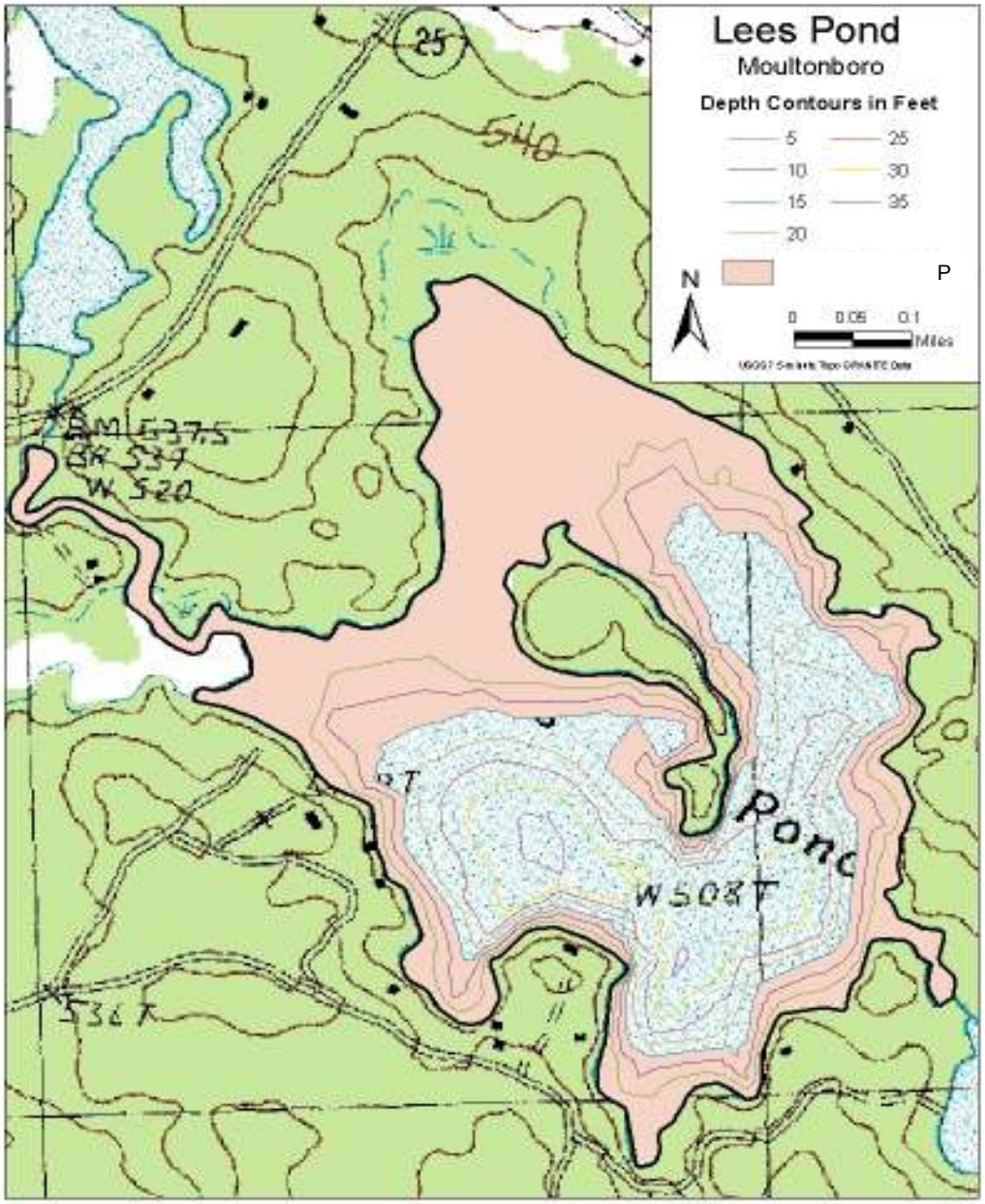


Figure 5: Critical Habitats or Conservation Areas

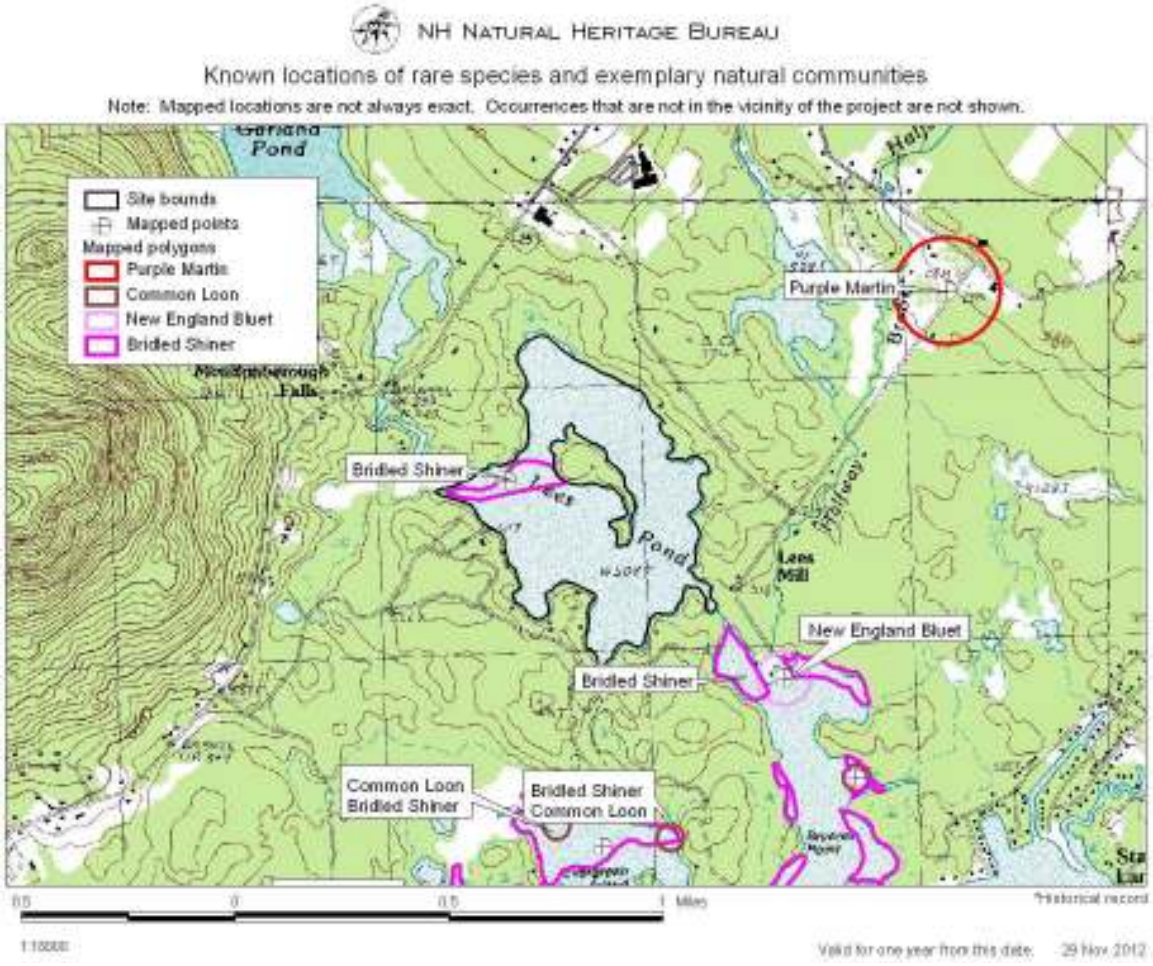


Figure 6: Public Access Sites, Swim Areas, Docks and Swim Platforms

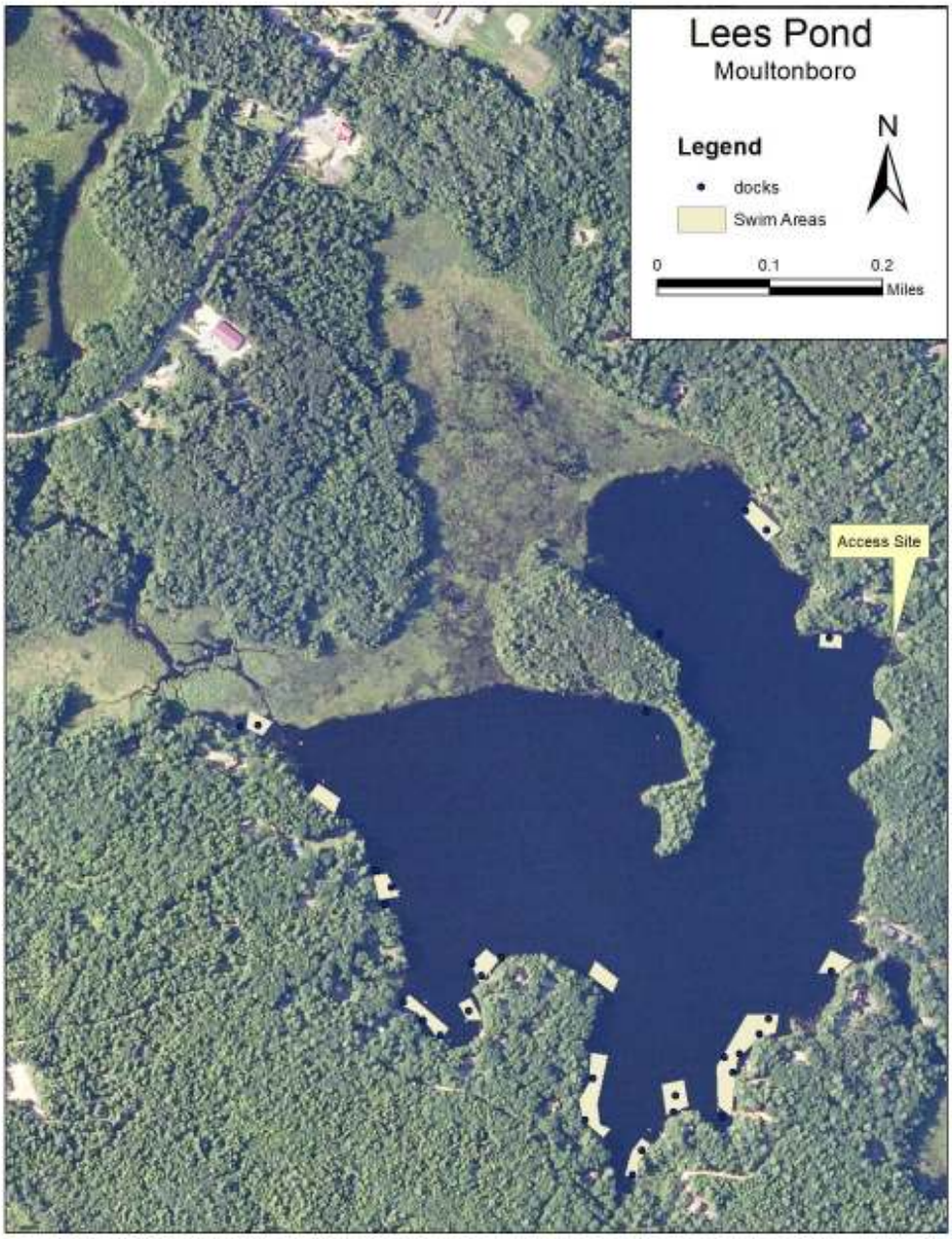
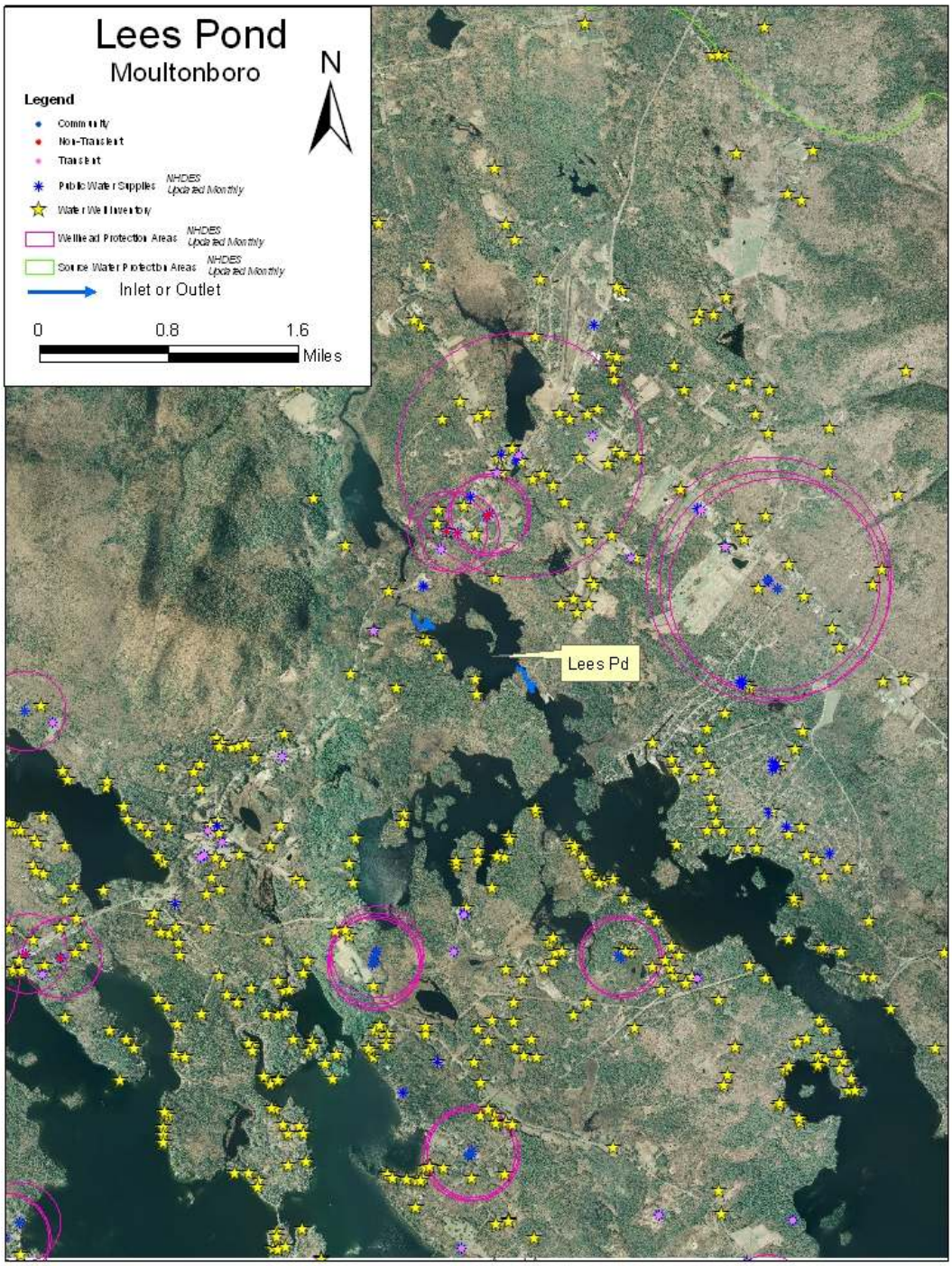


Figure 7: Wells and Water Supplies, 1:48,000 scale



Appendix A Aquatic Plant Control Techniques

Preliminary Investigations

I. Field Site Inspection

- Verify genus and species of the plant.
- Determine if the plant is a native or exotic species per RSA 487:16, II.
- Map extent of the exotic aquatic plant infestation (area, water depth, height of the plant, density of the population).
- Document any native plant abundances and community structure around and dispersed within the exotic/nuisance plant population (provide updated native plant map after review of milfoil in the Fall or after treatment)

II. Office/Laboratory Research of Waterbody Characteristics

- Contact the appropriate agencies to determine the presence of rare or endangered species in the waterbody or its prime wetlands.
- Determine the basic relevant limnological characteristics of the waterbody (size, bathymetry, flushing rate, nutrient levels, trophic status, and type and extent of adjacent wetlands).
- Determine the potential threat to downstream waterbodies from the exotic aquatic plant based on limnological characteristics (water chemistry, quantity, quality as they relate to movement or support of exotic plant growth).

Overall Control Options

For any given waterbody that has an infestation of exotic plants, one of four options will be selected, based on the status of the infestation, the available management options, and the technical knowledge of the DES Limnologists and other key resource managers who have conducted the field work and who are preparing or contributing to this plan. The options are as follows:

1) Eradication: The goal is to completely remove the exotic plant infestation over time. In some situations this may be a rapid response that results in an eradication event in a single season (such as for a new infestation), in other situations a longer-term approach may be warranted given the age and distribution of the infestation. Eradication is more feasible in smaller systems without extensive expanded growth (for example, Lake Winnipesaukee is unlikely to achieve eradication of its variable milfoil), or without upstream sources of infestation in other connected systems that continually feed the lake.

2) Maintenance: Waterbodies where maintenance is specified as a goal are generally those with expansive infestations, that are larger systems, that have complications of extensive wetland complexes on their periphery, or that have upstream sources of the invasive plant

precluding the possibility for eradication. For waterbodies where maintenance is the goal, control activities will be performed on the waterbody to keep an infestation below a desirable threshold. For maintenance projects, thresholds of percent cover or other measurable classification will be indicated, and action will occur when exotic plant growth exceeds the threshold.

3) Containment: The aim of this approach is to limit the size and extent of the existing infestation within an infested waterbody if it is localized in one portion of that waterbody (such as in a cove or embayment), or if a whole lake is infested action may be taken to prevent the downstream migration of fragments or propagules. This could be achieved through the use of fragment barriers and/or Restricted Use Areas or other such physical means of containment. Other control activities may also be used to reduce the infestation within the containment area.

4) No action. If the infestation is too large, spreading too quickly, and past management strategies have proven ineffective at controlling the target exotic aquatic plant, DES, in consultation with others, may elect to recommend 'no action' at a particular site. Feasibility of control or control options may be revisited if new information, technologies, etc., develop.

If eradication, maintenance or containment is the recommended option to pursue, the following series of control techniques may be employed. The most appropriate technique(s) based on the determinations of the preliminary investigation will be selected.

Guidelines and requirements of each control practice are suggested and detailed below each alternative, but note that site specific conditions will be factored into the evaluation and recommendation of use on each individual waterbody with an infestation.

A. Hand-Pulling and Diver-Assisted Suction Harvesting

- Hand-pulling can be used if infestation is in a small localized area (sparsely populated patch of up to 5' X 5', single stems, or dense small patch up to 2' X 2'). For larger areas Diver-Assisted Suction Harvesting (DASH) may be more appropriate.
- Can be used if plant density is low, or if target plant is scattered and not dense.
- Can be used if the plant could effectively be managed or eradicated by hand-pulling or DASH
- Use must be in compliance with the Wetlands Bureau rules.

B. Mechanically Harvest or Hydro-Rake

- Can not be used on plants which reproduce vegetatively by fragmentation (e.g., milfoil, fanwort, etc.) unless containment can be ensured.
- Can be used only if the waterbody is accessible to machinery.

- Can be used if there is a disposal location available for harvested plant materials.
- Can be used if plant depth is conducive to harvesting capabilities (~ <7 ft. for mower, ~ <12 ft. for hydro-rake).
- If a waterbody is fully infested and no other control options are effective, mechanical harvesting can be used to open navigation channel(s) through dense plant growth.

C. Herbicide Treatment

- Can be used if application of herbicide is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or density and type of plant.
- Can be used for treatment of exotic plants where fragmentation is a high concern.
- Can be used where species specific treatment is necessary due to the need to manage other plants
- Can be used if other methods used as first choices in the past have not been effective.
- A licensed applicator should be contacted to inspect the site and make recommendations about the effectiveness of herbicide treatment as compared with other treatments.

D. Restricted Use Areas (per RSA 487:17, II (d))

- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other transient activities may cause fragmentation to occur.
- Can <u>not</u> be used when there are several "patches" of an infestation of exotic aquatic plants throughout a waterbody.
- Can be used as a temporary means of control.

E. Bottom Barrier

- Can be used in small areas, preferably less than 10,000 sq. ft.
- Can be used in an area where the current is not likely to cause the displacement of the barrier.
- Can be used early in the season before the plant reaches the surface of the water.
- Can be used in an area to compress plants to allow for clear passage of boat traffic.
- Can be used in an area to compress plants to allow for a clear swimming area.
- Use must be in compliance with the Wetlands Bureau rules.

F. Drawdown

- Can be used if the target plant(s) are susceptible to drawdown control.

- Can be used in an area where bathymetry of the waterbody would be conducive to an adequate level of drawdown to control plant growth, but where extensive deep habits exist for the maintenance of aquatic life such as fish and amphibians.
- Can be used where plants are growing exclusively in shallow waters where a drawdown would leave this area "in the dry" for a suitable period of time (over winter months) to control plant growth.
- Can be used in winter months to avoid encroachment of terrestrial plants into the aquatic system.
- Can be used if it will not significantly impact adjacent or downstream wetland habitats.
- Can be used if spring recharge is sufficient to refill the lake in the spring.
- Can be used in an area where shallow wells would not be significantly impacted.
- Reference RSA 211:11 with regards to drawdown statutes.

G. Dredge

- Can be used in conjunction with a scheduled drawdown.
- Can be used if a drawdown is not scheduled, though a hydraulic pumping dredge should be used.
- Can only be used as a last alternative due to the detrimental impacts to environmental and aesthetic values of the waterbody.

H. Biological Control

- Grass carp cannot be used as they are illegal in New Hampshire.
- Exotic controls, such as insects, cannot be introduced to control a nuisance plant unless approved by Department of Agriculture.
- Research should be conducted on a potential biological control prior to use to determine the extent of target specificity.

Appendix B Summary of Control Practices

Restricted Use Areas and Fragment Barrier:

Restricted Use Areas (RUAs) are a tool that can be use to quarantine a portion of a waterbody if an infestation of exotic aquatic plants is isolated to a small cove, embayment, or section of a waterbody. RUAs generally consist of a series of buoys and ropes or nets connecting the buoys to establish an enclosure (or exclosure) to protect an infested area from disturbance. RUAs can be used to prevent access to these infested areas while control practices are being done, and provide the benefit of restricting boating, fishing, and other recreational activities within these areas, so as to prevent fragmentation and spread of the plants outside of the RUA.

Hand-pulling:

Hand-pulling exotic aquatic plants is a technique used on both new and existing infestations, as circumstances allow. For this technique divers carefully hand-remove the shoots and roots of plants from infested areas and place the plant material in mesh dive bags for collect and disposal. This technique is suited to small patches or areas of low density exotic plant coverage.

For a new infestation, hand-pulling activities are typically conducted several times during the first season, with follow-up inspections for the next 1-2 years or until no re-growth is observed. For existing infestations, hand-pulling may be done to slow the expansion of plant establishment in a new area or where new stems are removed in a section that may have previously been uninfested. It is often a follow-up technique that is included in most management plans.

In 2007 a new program was created through a cooperative between a volunteer monitor that is a certified dive instructor, and the DES Exotic Species Program. A Weed Control Diver Course (WCD) was developed and approved through the Professional Association of Dive Instructors (PADI) to expand the number of certified divers available to assist with hand-pulling activities. DES has only four certified divers in the Limnology Center to handle problems with aquatic plants, and more help was needed. There is a unique skill involved with hand-removing plants from the lake bottom. If the process is not conducted correctly, fragments could spread to other waterbody locations. For this reason, training and certification are needed to help ensure success. Roughly 100 divers were certified through this program through the 2010 season. DES maintains a list of WCD divers and shares them with waterbody groups and municipalities that seek diver assistance for controlling exotic aquatic plants. Classes are offered two to three times per summer.

Diver Assisted Suction Harvesting

Diver Assisted Suction Harvesting (DASH) is an emerging and evolving control technique in New Hampshire. The technique employs divers that perform hand removal actions as described above, however, instead of using a dive bag a mechanical suction device is used to entrain the plants and bring them topside where a tender accumulates and bags the material for disposal. Because of this variation divers are able to work in moderately dense stands of plants that cover more bottom area, with increased efficiency and accuracy.

Mechanical Harvesting

The process of mechanical harvesting is conducted by using machines which cut and collect aquatic plants. These machines can cut the plants up to twelve feet below the water surface. The weeds are cut and then collected by the harvester or other separate conveyer-belt driven device where they are stored in the harvester or barge, and then transferred to an upland site.

The advantages of this type of weed control are that cutting and harvesting immediately opens an area such as boat lanes, and it removes the upper portion of the plants. Due to the size of the equipment, mechanical harvesting is limited to water areas of sufficient size and depth. It is important to remember that mechanical harvesting can leave plant fragments in the water, which if not collected, may spread the plant to new areas. Additionally harvesters may impact fish and insect populations in the area by removing them in harvested material. Cutting plant stems too close to the bottom can result in re-suspension of bottom sediments and nutrients. This management option is only recommended when nearly the entire waterbody is infested, and harvesting is needed to open navigation channels through the infested areas.

Benthic Barriers:

Benthic barriers are fiberglass coated screening material that can be applied directly to the lake bottom to cover and compress aquatic plant growth. Screening is staked or weighted to the bottom to prevent it from becoming buoyant or drifting with current. The barriers also serve to block sunlight and prevent photosynthesis by the plants, thereby killing the plants with time. While a reliable method for small areas of plants (roughly 100 sq. ft. or less), larger areas are not reasonably controlled with this method due to a variety of factors (labor intensive installation, cost, and gas accumulation and bubbling beneath the barrier).

Targeted Application of Herbicides:

Application of aquatic herbicides is another tool employed for controlling exotic aquatic plants. Generally, herbicides are used when infestations are too

large to be controlled using other alternative non-chemical controls, or if other techniques have been tried and have proven unsuccessful. Each aquatic plant responds differently to different herbicides and concentrations of herbicides, but research performed by the Army Corps of Engineers has isolated target specificity of a variety of aquatic herbicides for different species.

Generally, 2,4-D (Navigate formulation) is the herbicide that is recommended for control of variable milfoil. Based on laboratory data this is the most effective herbicide in selectively controlling variable milfoil in New Hampshire's waterbodies.

A field trial was performed during the 2008 summer using the herbicide Renovate to control variable milfoil. Renovate is a systemic aquatic herbicide that targets both the shoots and the roots of the target plant for complete control. In this application it was dispersed as a granular formulation that sank quickly to the bottom to areas of active uptake of the milfoil plants. A small (<5 acre) area of Captains Pond in Salem was treated with this systemic herbicide. The herbicide was applied in pellet form to the infested area in May 2008, and showed good control by the end of the growing season. Renovate works a little more slowly to control aquatic plants than 2,4-D and it is a little more expensive, but presents DES with another alternative that could be used in future treatments.

During the summer of 2010, DES worked with other researchers to perform field trials of three different formulations of 2,4-D in Lake Winnisquam, to determine which product was most target-specific to the variable milfoil. Navigate formulation was used, as were a 2,4-D amine formulation, and a 2,4-D amine and triclopyr formulation (MaxG). Each product effectively controlled variable milfoil.

Another herbicide, Fluridone, is sometimes also used in New Hampshire, mainly to control growths of fanwort (*Cabomba caroliniana*). Fluridone is a systemic aquatic herbicide that inhibits the formation of carotenoids in plants. Reduced carotenoids pigment ultimately results in the breakdown of chlorophyll and subsequent loss of photosynthetic function of the plants.

Other aquatic herbicides are also used in New Hampshire when appropriate (glyphosate, copper compounds, etc). The product of choice will be recommended based on what the target species is, and other waterbody-specific characteristics that are important to consider when selecting a product.

Extended Drawdown

Extended drawdown serves to expose submersed aquatic plants to dessication and scouring from ice (if in winter), physically breaking down plant tissue. Some species can respond well to drawdown and plant density can be reduced, but for invasive species drawdown tends to yield more disturbance to bottom sediments, something to which exotic plants are most adapted. In waterbodies where drawdown is conducted exotic plants can often outcompete native plants for habitat and come to dominate the system.

Some waterbodies that are heavily infested with exotic plants do conduct drawdowns to reduce some of the invasive aquatic plant density. During this reporting period both Northwood Lake (Northwood) and Jones Pond (New Durham) coordinated deep winter drawdowns to reduce growths of variable milfoil (the drawdown on Northwood Lake is primarily for flood control purposes, but they do see some ancillary benefits from the technique for variable milfoil control).

Dredging

Dredging is a means of physical removal of aquatic plants from the bottom sediments using a floating or land-based dredge. Dredging can create a variety of depth gradients creating multiple plant environments allowing for greater diversity in lakes plant, fish, and wildlife communities. However due to the cost, potential environmental effects, and the problem of sediment disposal, dredging is rarely used for control of aquatic vegetation alone.

Dredging can take place in to fashion, including drawdown followed by mechanical dredging using an excavator, or using a diver-operated suction dredge while the water level remains up.

Biological Control

There are no approved biological controls for submersed exotic aquatic plant at this time in New Hampshire.

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