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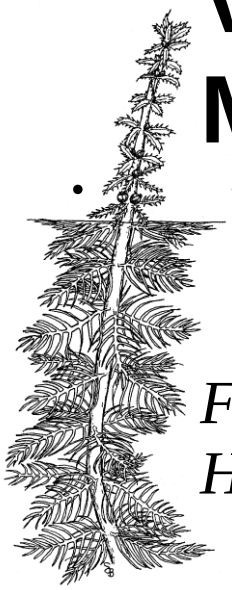
Long-Term Variable Milfoil Management Plan



Flints Pond
Hollis, New Hampshire

Contents

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 Flints Pond

Variable milfoil (*Myriophyllum heterophyllum*) has been documented in Flints Pond in Hollis, New Hampshire since the mid 1990s. Given the shallow depth and organic nature of the bottom substrate, variable milfoil came to dominate the macrophyte community in the pond.

Control efforts were delayed early on due to a plan to dredge Flints Pond to remove nutrient rich sediments and deepen the pond below the photic zone, per recommendations from a Section 314 Diagnostic Feasibility Study performed on the pond in the mid 1990s. Delays in the dredge, and ultimate decision not to dredge (due to project cost and arsenic contamination in sediments) led to a renewed interest in controlling the variable milfoil in the early 2000s. The project was delayed further by a desire to remove built-up organic matter in the pond, particularly at the outlet, by hydro-raking water-lily tubers in select areas, with the thought being that milfoil control for the whole pond would follow the completion of that project. The hydro-rake was completed in 2010, and milfoil control efforts became the focus for Flints Pond starting in 2011.

Figure 1 illustrates the milfoil population over time since digital mapping began on the pond (just recently), and the following table provides a summary of milfoil growth in the pond over time.

Location/Area Description	Year	Description of Growth
Whole pond	1990s	Variable milfoil growth began as small patches and expanded to larger areas, ultimately dominating whole pond by 2000.
	2011	Milfoil widespread across this shallow waterbody, covering 85-90% of the pond.
	2012	Milfoil populations greatly reduced by 2011 herbicide treatment, to levels that were less than 5% cover in the pond. Occasional regrowth of plants was easily controlled by diver hand removal activities on three separate occasions in 2012.
	2013	Stems of variable milfoil appeared in various locations during the summer, and were marked by DES and local Weed Watchers. Divers visited the lake several times during the summer, but by late summer some larger patches of variable milfoil appeared, mixed in with dense native vegetation, making them hard to hand remove. A September herbicide treatment reduced the milfoil by the end of the growing season.
	2014	Scattered stems around shore, easily managed by diving, marked by both NHDES and local lake residents who are volunteers.
	2015	Scattered stems around shore, easily managed by diving, marked by both NHDES and local lake residents who are volunteers.
	2016	Scattered stems around shore, easily managed by diving, marked by both NHDES and local lake residents who are volunteers.
	2017	Scattered stems around shore, easily managed by diving, marked by both NHDES and local lake residents who are volunteers.
	2018	Some areas of patchier growth and single scattered stems.
	2019	Patchier growth in shallows along developed shore, scattered elsewhere.
	2020	Some patchy growth around shore, expanded area of growth in shallows on developed shore, hard area to dive, recommend treatment of those areas.

In terms of the impacts of the variable milfoil in the system, there are several (26) houses around the shoreline of Flints Pond, with mostly seasonal cottages, though there are a few year-round dwellings. There are also >38 back lots with lake rights.

Lake residents have expressed frustration with the exotic plant growth for over a decade, citing fouling of their shorefront properties, difficulty in maneuvering boats and paddling through dense milfoil, and entanglement of fishing lures in the dense milfoil growth.

Milfoil Management Goals and Objectives

The goal for Flints Pond is the reduction of overall biomass, density and distribution of variable milfoil in the system, using an Integrated Pest Management Approach, to a level where the milfoil does not dominate the system or impede designated uses of the system. Eradication in this system is likely not feasible in the near future due to the very organic nature of the basin which would likely harbor seeds or seedlings and terrestrial/emergent forms of milfoil on the periphery of the pond outside of active treatment areas.

Local Support

Town or Municipality Support

The town of Hollis appreciates the importance of keeping the Flints Pond system usable and controlling the variable milfoil. The town has worked closely with the Flints Pond Improvement Association to secure funding and collaborate on management efforts related to the pond. A piece of town owned land abuts the lake on the north end of the basin, and it is in the town's interest to help maintain the ecological, aesthetic, and recreational values of Flints Pond since it is an abutter to the pond. The town authorized $106,000 for use in restoration efforts for Flints Pond during the town meeting on 3/12/10, for a combination of hydro-raking, herbicide treatment and diver work.

Flints Pond Improvement Association (FPIA)

Flints Pond has an active lake association that has long been involved in water quality monitoring, lake and watershed protection, and a variety of other activities. The lake association has individuals that are committed to performing follow-up monitoring for milfoil re-growth and doing what is needed to control the milfoil in the system, and prevent it from returning to the densities and coverage they currently experience in the pond (a Weed Watcher training was held in summer 2012). They are committed to expanding community outreach and volunteer involvement. Some local residents are interested in gaining a Weed Control Diver certification so as to help with diving activities for non-chemical management of milfoil in the pond when densities are reduced to a level where that approach would be feasible and practical.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of Flints Pond, including the 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).

Parameter/Measure	**Value/Description**
Lake area (acres)	48
Watershed area (acres)	691.6
Shoreline Uses (residential, forested, agriculture)	Medium density residential development along western shoreline. Forested to the north and east with fewer homes in the immediate vicinity of the pond. South end of the lake is forested/wetland habitat
Max Depth (ft)	8.91
Mean Depth (ft)	4.95
Trophic Status	Eutrophic
Color (CPU) in Epilimnion	95
Clarity (ft)	4.62
Flushing Rate (yr-1)	4.5 (DES estimate) and 14 (AECOM estimate)
Natural waterbody/Raised by Damming/Other	Natural
Invasive Plants (Latin name)	Variable milfoil *(Myriophyllum heterophyllum)*
Infested Area (acres)	See Figures for historic and current distributions
Distribution (ringing lake, patchy growth, etc)	See Figures for historic and current distributions
Sediment type in infested area (sand/silt/organic/rock)	Thick organic substrate overlying sandier soils
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Bureau (NHB) Inventory review)	<u>2019 Review:</u> Banded sunfish (*Enneacanthus obesus*) Swamp darter (*Etheostoma fusiforme*) Blandings turtle (*Emydoidea blandingii*) Wood turtle (*Glyptemys insculpta*) <u>Historic NHB Listings:</u> Marbled salamander (*Ambystoma opacum*)

A native aquatic vegetation map and key from a summer 2010 survey (field checked in 2010, 2011 and again in 2012) by the DES Biology Section is shown in Figure 3. A bathymetric map is shown in Figure 4.

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

According to the NH Fish and Game Department, Flints Pond is a warmwater fishery with largemouth bass, yellow perch, pickerel, horned pout, bluegill, pumpkinseed and golden shiner.

The Fish and Game Department lists the swamp darter (*Etheostoma fusiforme*) as present in the pond, it is listed in the Wildlife Action Plan (WAP) developed by the Fish and Game Department. The NHB record of this species is from one fish found in 2005. There are no designations for the swamp darter in New Hampshire or federally at this time, though they are listed as rare or uncommon in NH. This species needs good/dense mixed stands of aquatic vegetation for habitat. It is expected that diverse stands of native aquatic plants will remain following the recommended control efforts. Pondweed, bladderwort, water marigold, waterweed and grassy spike rush are all present in the pond and will provide similar submersed cover and habitat to the variable milfoil once the variable milfoil is reduced, and are expected to expand in cover once the milfoil is reduced. The herbicide of choice for this

control activity is 2,4-D, which has been shown by EPA to be non-toxic to aquatic life when used according to label restrictions.

The Fish and Game Department lists the banded sunfish as present in the pond, it is listed in the Wildlife Action Plan (WAP) developed by the Fish and Game Department. The NHB records for the banded sunfish (*Enneacanthus obesus*) are from 1986 and 2005. There are no designations for the banded sunfish in New Hampshire or federally at this time, though it is listed as rare or uncommon in NH. This species needs good/dense mixed stands of aquatic vegetation for habitat. Because there is good target specificity for variable milfoil with the herbicide of choice (2,4-D) it is expected that diverse stands of native aquatic plants will remain following the herbicide application, and that only the variable milfoil will be reduced. There are abundant pondweeds, bladderworts, water marigold, waterweed and grassy spike-rush species in the pond that will be unaffected by the herbicide treatment, thereby leaving native plant habitat intact. The herbicide is not toxic to this listed species at concentration, and does not bioaccumulate in fish tissue (the herbicide is excreted in the waste product of these organisms).

Wildlife Information

The Blanding's turtle (*Emydoidea blandingii*) is listed as endangered in New Hampshire, where it is rare or uncommon. It has no federal listing, and it is listed as globally secure, but a cause for concern. The NHB record is from 2008 when one adult turtle was observed to in a forested swampy area near the pond. Blanding's turtles are mostly aquatic and are found in the shallows of lakes and ponds, in marshes, bogs, and small streams. The turtles nest on land, but feed underwater on insects, tadpoles, crayfish, and snails, among other small aquatic organisms. It is not expected that habitat or food sources for the turtle will be affected by the recommended milfoil control practices. The herbicide of choice for this control activity is 2,4-D, which has been shown by EPA to be non-toxic to aquatic life when used according to label restrictions. No significant impacts to native habitat or food sources for the turtle are expected to be impacted as a result of the proposed control actions. Fish and Game requests that herbicide applicators avoid direct herbicide application in scrub shrub dominated wetland coves, in order to minimize impacts.

The wood turtle (*Glyptemys insculpta*) is not federally listed, but it is listed as a species of special concern in NH. According to information provided in the WAP prepared by the Fish and Game Department, wood turtles are often associated with stream and river habitat with sandy or gravely substrates in late April and May, and then migrate to upland terrestrial habitats for the summer months, returning to hibernate in the fall in the banks of rivers again. The wood turtle's diet consists of insects, earthworms, green leaves and fungi,

among other items. Main threats to this species appear to be from habitat loss and fragmentation, along with injury and mortality due to land use practices (mowing, mortality on roadways). The NHB review documented one adult wood turtle in 1993 in this area. The Fish and Game Department should comment on specific potential impacts of the proposed milfoil control activities on this species, and ways to mitigate these impacts during their review of the permit application.

The marbled salamander (*Ambystoma opacum*) is not federally listed, but it is listed as endangered in NH as it is at the northern extent of its range in this state and not commonly found. According to information provided in the Wildlife Action Plan (WAP) prepared by the Fish and Game Department, the marbled salamander breeds in seasonally flooded wetland habitats and lays its eggs along the margin of these wet areas, but the balance of its lifecycle is spent in forested upland areas near those wetlands. Historical records for this species exist for the Hollis area from 1965, but no detail or map was provided in the WAP. The WAP goes on to indicate that populations of this species are likely clustered in undisturbed forested areas with seasonal wetland habitats. The NHB documented an adult marbled salamander in 2008 on Pine Hill Rd. Population growth and expansion of developed areas are cited as threats to this species. Potential threats to this species would be during the breeding season and while eggs are developing. The Fish and Game Department should comment on specific potential impacts of the proposed milfoil control activities on this species, and ways to mitigate these impacts during their review of the permit application.

There are no NH F&G Wildlife Management Areas within a mile of this waterbody. The Hall, and Flints Brook–Bowman lots encompass more than 50 acres of conservation land abutting this waterbody. No species are being managed in this area currently.

Recreational Uses and Access Points

Flints Pond is used for boating (note that petroleum motors are banned) and fishing by both pond residents and transient boaters in the summer, and in winter it is used for ice fishing and ice skating.

A public access site is located at the north end of the pond. However, because of dense milfoil growth over time, access, boating, and fishing on the pond have been difficult.

In terms of boating activity, lake residents indicate that there are 1-2 visiting boaters throughout the week and 5-6 visitors on weekends. Local residents use rowboats, canoes and kayaks on the pond.

The town owns a parcel of land at the north end of the pond, as does Fish and Game.

There are no designated beaches on Flints Pond and swimming has not been advisable due to very dense milfoil growth and potential threats to swimmers from entanglement, particularly near shore.

There are two small private swim beaches located on private properties around the pond. There are few floating docks or swim platforms around the pond. Figure 6 shows the locations of the private beaches, and the locations of swim platforms and docks on Flints Pond, as well as the location of the access site.

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 Flints Pond is characterized by a mix of native and non-native (variable milfoil, and some purple loosestrife) plant growth (Figure 3). Native species include a mix of floating plants (white and yellow water-lilies, watershield), emergent plants (cattail, bur-reed, pipewort, iris, spike rush, pickerelweed, and arrow arum), and submergent plants (various pondweeds, bladderwort, coontail, mermaid-weed, waterweed, grassy spike rush). Native plant communities are mixed around the entire lake, and are characterized as 'common/abundant' by the DES.

A full report outlining aquatic plant growth before and after the herbicide treatment is available from DES upon request. As part of the 2011 herbicide treatment, the contractor was required to conduct point-intercept sampling in Flints Pond and collect data on plant populations before and after the herbicide treatment. Much detail on the plant communities can be found in that report.

In addition to the variable milfoil in the pond, the only other invasive aquatic plant that was observed was purple loosestrife, which was scattered in small areas around the shoreline of the ponds (see Figure 3 for locations). DES recommends that the FPIA work with property owners to physically remove these plants before they spread.

There are no records of state threatened or endangered plant species in Flints 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

MANAGEMENT ACTION	DATE	ACRES	CONTRACTOR	EFFORT
MAX G (TRICLOPYR/2,4-D COMBINATION AT A RATE OF 94.5 LBS/AC	9-May-11	29.6	ACT	
DIVER HAND PULLING	7/21 & 8/19 2012	8 GALLONS REMOVED	BOB PATTERSON	
DIVER HAND PULLING	9/9 & 10/5 2012	23 GALLONS REMOVED	BOB PATTERSON	
DIVER HAND PULLING	12/5/2012	24 GALLONS REMOVED	BOB PATTERSON	
DIVER HAND PULLING	6/3/2013	20 GALLONS REMOVED	AB AQUATICS	

MANAGEMENT ACTION	DATE	ACRES	CONTRACTOR	EFFORT
DIVER HAND PULLING	7/19/2013	15 GALLONS REMOVED	AB AQUATICS	
RENOVATE MAX G (2,4-D & TRICLOPYR)	9/18/2013	5.6 ACRES	ACT	
DIVER HAND PULLING	9/11/2014	40	NH DES DIVERS	
DIVER HAND PULLING	9/23/2014	2	NH DES DIVERS	
DIVER HAND PULLING	6/12/2015	10	NH DES DIVERS	
DIVER HAND PULLING	6/30/2015	5	NH DES DIVERS	
DIVER HAND PULLING	8/19/2015	40	NH DES DIVERS	
DIVER HAND PULLING	9/3/2015	30	NH DES DIVERS	
DASH	6/1/2016	20	AQUALOGIC	
DASH	6/2/2016	10	AQUALOGIC	
DASH	7/12/2016	45	AQUALOGIC	
DASH	9/16/2016	10	AQUALOGIC	
DASH	9/22/2016	30	AQUALOGIC	
DASH	7/2/2018	120 GALLONS	AQUALOGIC	
DASH	7/3/2018	15 GALLONS	AQUALOGIC	
DASH	7/10/2018	40 GALLONS	AQUALOGIC	
DASH	7/11/2018	70 GALLONS	AQUALOGIC	
DASH	6/27/2019	60 GALLONS	AQUALOGIC	
DASH	6/28/2019	60 GALLONS	AQUALOGIC	
DASH	7/1/2019	20 GALLONS	AQUALOGIC	
DIVERS	6/8/2020	10 GALLONS	BEN JONES	3 HOURS
DIVERS	N/A	79 GALLONS	BEN JONES	21 HOURS
DIVERS	6/12/2020	20 GALLONS	BEN JONES	4 HOURS
DIVERS	6/19/2020	22 GALLONS	BEN JONES	5 HOURS
DIVERS	6/23/2020	15 GALLONS	BEN JONES	4 HOURS
DIVERS	7/2/2020	18 GALLONS	BEN JONES	4.5 HOURS

MANAGEMENT ACTION	DATE	ACRES	CONTRACTOR	EFFORT
DIVERS	7/9/2020	27 GALLONS	BEN JONES	7.5 HOURS
DIVERS	8/3/2020	45 GALLONS	AQUALOGIC	6.0 HOURS
DIVERS	8/5/2020	75 GALLONS	AQUALOGIC	6.0 HOURS
DIVERS	8/6/2020	60 GALLONS	AQUALOGIC	6.0 HOURS
DIVERS	9/29/2020	135 GALLONS	AQUALOGIC	8.5 HOURS

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 Flints 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. If variable milfoil is reduced by other integrated approaches outlined in this plan, then RUAs and fragment barriers may be a future consideration based on the size, configuration and location of remaining areas of growth.
Hand-pulling	Recommended as a primary means of control for milfoil regrowth as it occurs. It is recommended that a diver for hire be on retainer through each growing season for the next several years to hand remove milfoil as/if it sprouts, to prevent expansion of the milfoil population in the lake once again.
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.
Extended Drawdown	Not feasible or practical for this waterbody due to lack of an impoundment structure.
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	A no control option would result in Flints Pond being dominated by variable milfoil growth, and it is not recommended.

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
2020	Weed Watching training followed by regular 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
	Diver/DASH work as needed and recommended (areas to be determined based on updated spring survey)	Contract Diver	June-September as needed
	Survey waterbody and planning for next season's control actions	DES	September
2021	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
	Diver/DASH work as needed and recommended (areas to be determined based on need)	Contract Diver	June-September as needed
	Herbicide treatment, if needed, based on diver progress as monitored by DES (areas to be determined based on need)	SOLitude Lake Management	Spring or Fall
	Survey and planning for next season's control actions	DES	September
2022	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
	Diver/DASH work as needed and recommended (areas to be determined based on need)	Contract Diver	June-September as needed

Year	Action	Responsible Party	Schedule
	Survey and planning for next season's control actions	DES	September
2023	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
	Diver/DASH work as needed and recommended (areas to be determined based on need)	Contract Diver	June-September as needed
	Survey and planning for next season's control actions	DES	September
2024	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
	Diver/DASH work as needed and recommended (areas to be determined based on need and updated survey)	Contract Diver	June-September as needed
	Survey and planning for next season's control actions	DES	September
2025	Update and revise Long-Term Variable Milfoil Control Plan	DES and Interested Parties	Fall/ Winter

Notes

Target Specificity

It is important to realize 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 invasive aquatic plant management in the subject waterbody.

Figure 1: Map of Variable Milfoil Infestations Over Time

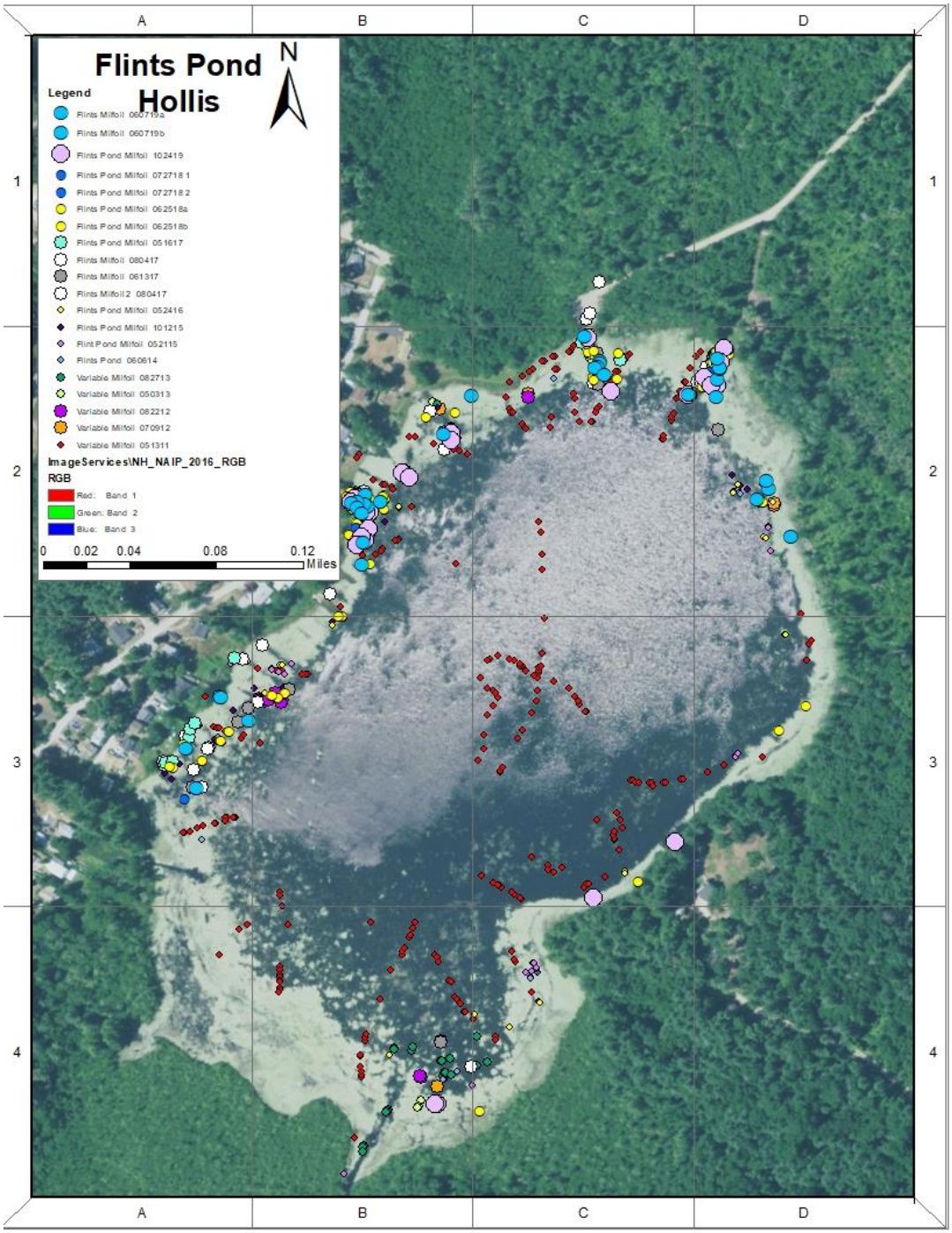
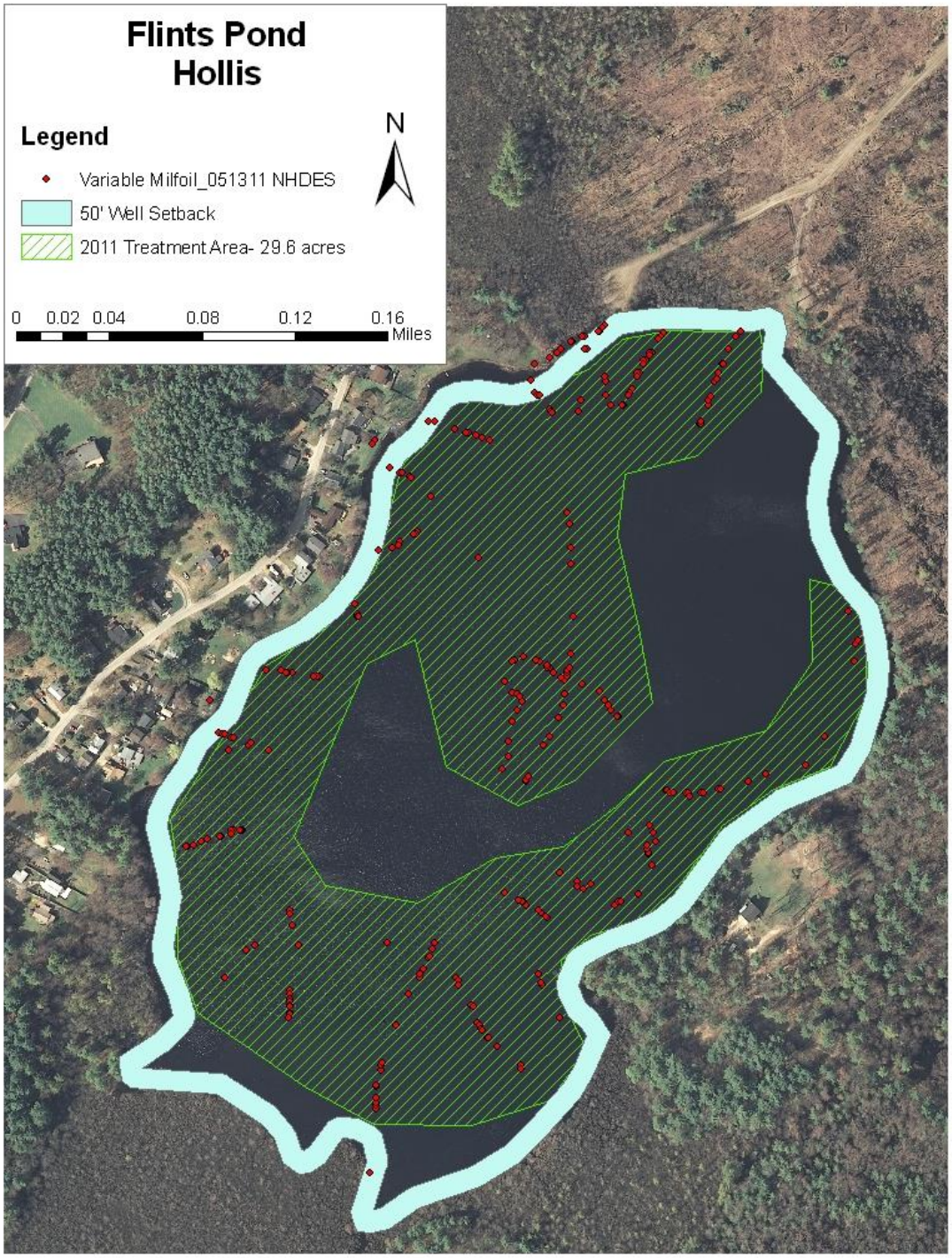
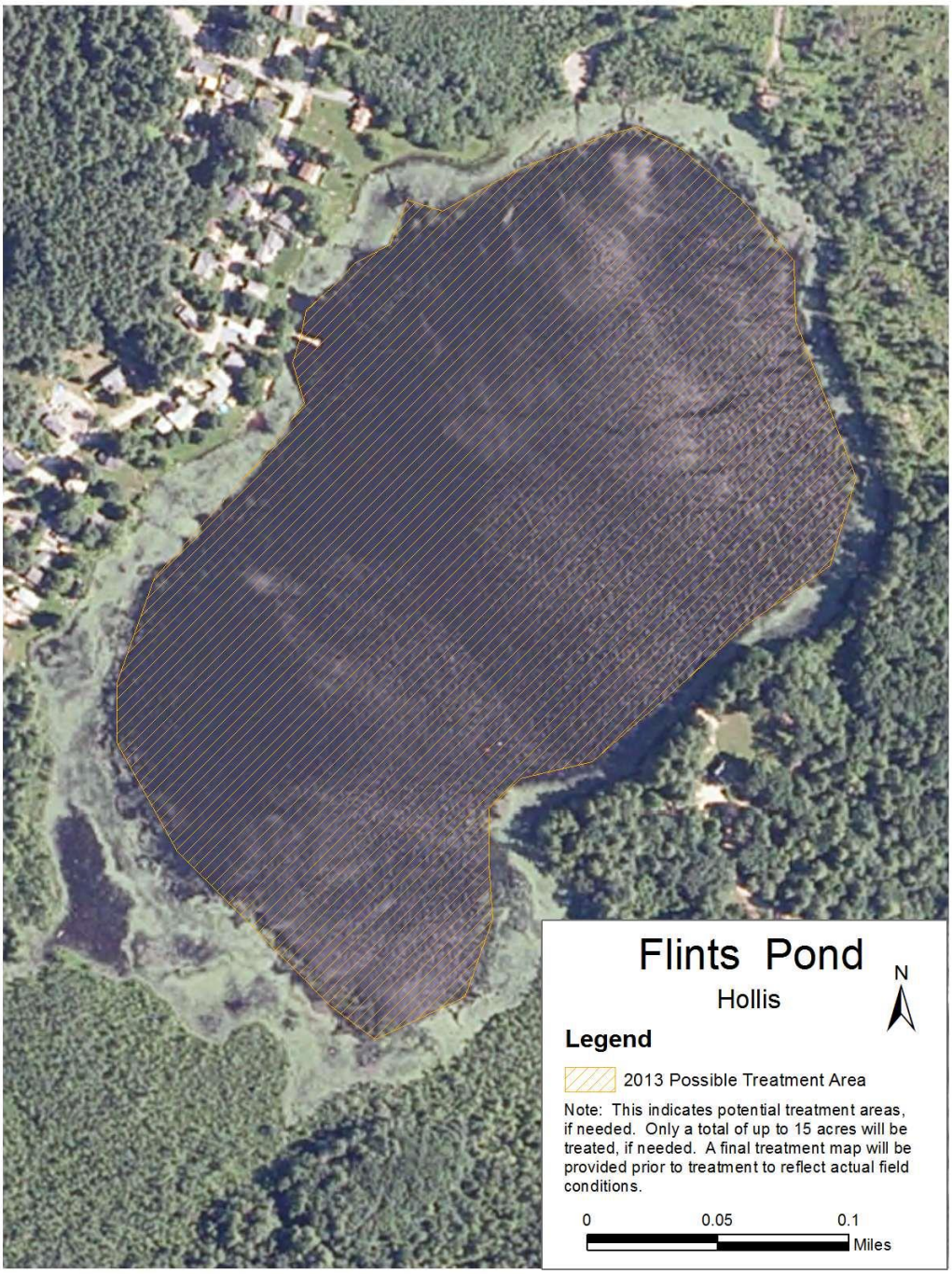


Figure 2: Map of Control Actions Over Time

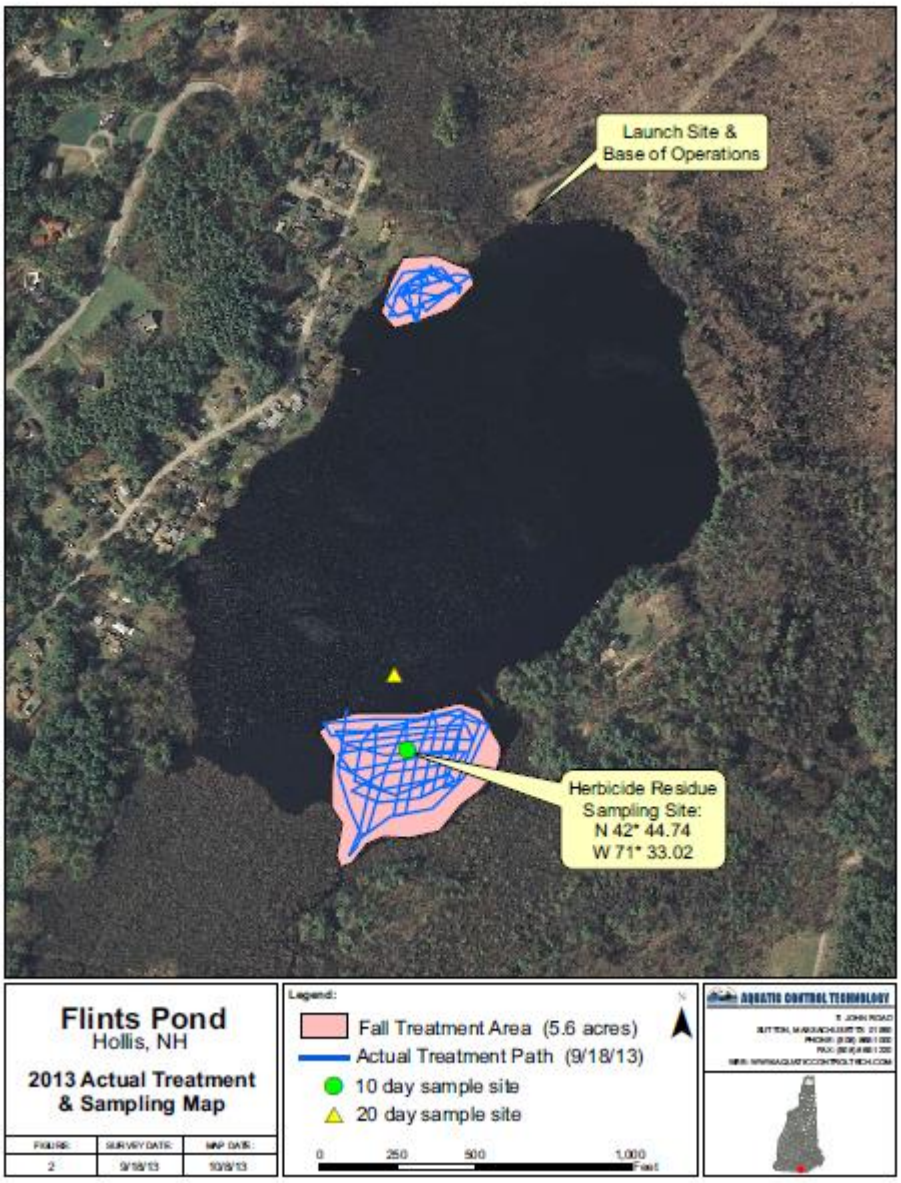
2011



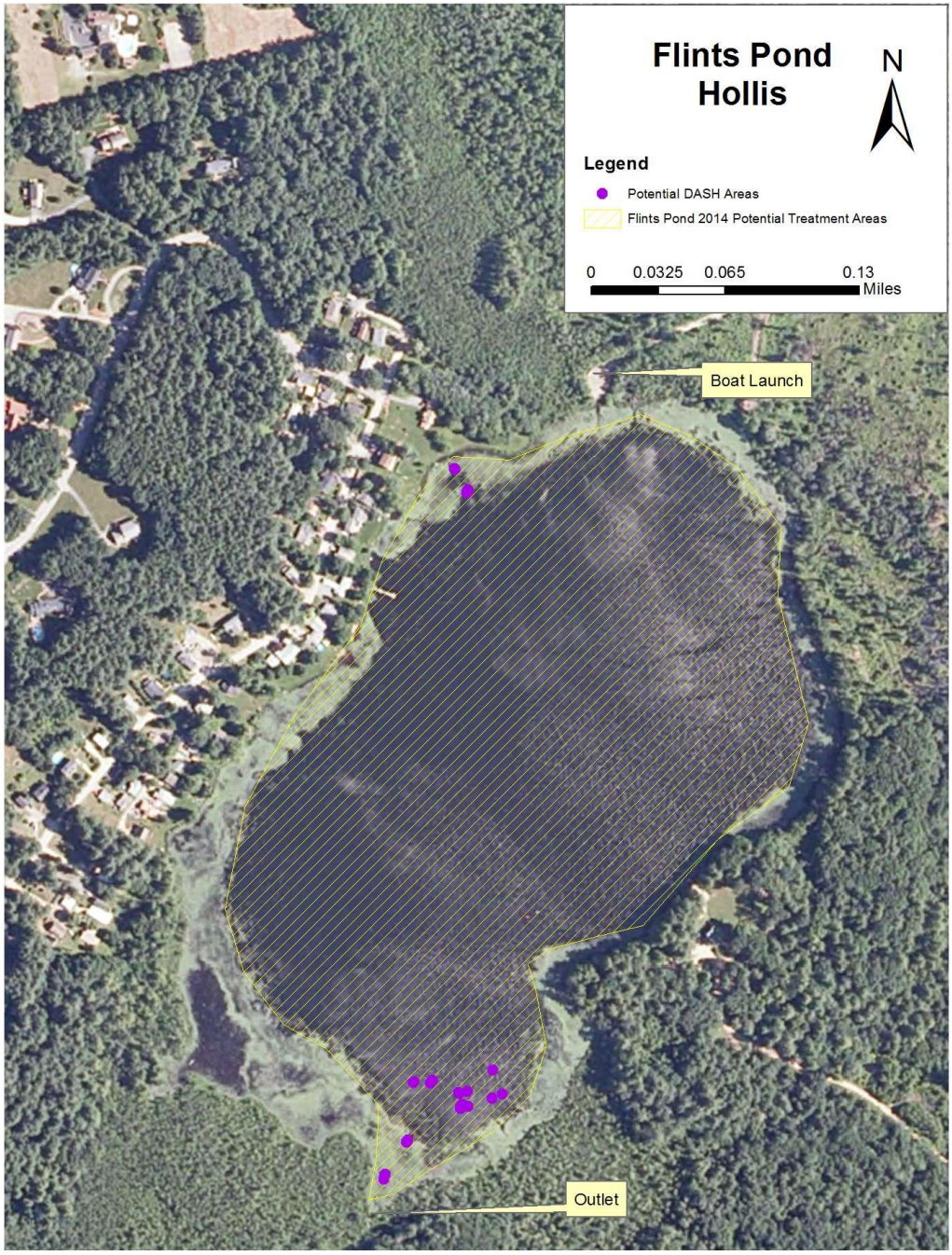
2013 (proposed)



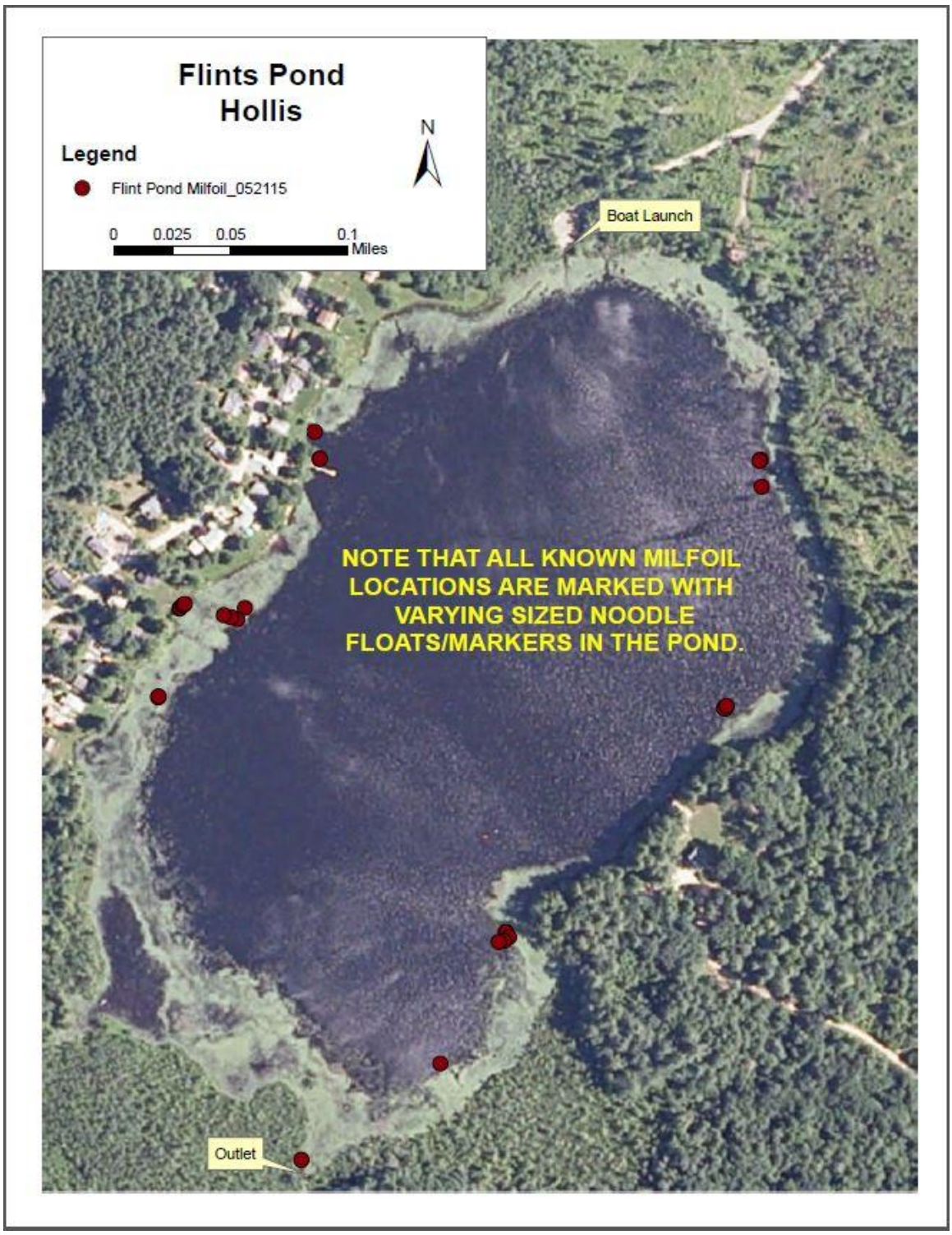
2013 (actual)


Launch Site &
Base of Operations
Herbicide Residue
Sampling Site:
N 42° 44.74
W 71° 33.02
Flints Pond
Hollis, NH
2013 Actual Treatment
& Sampling Map
FIGURE:
SURVEY DATE:
MAP DATE:
2
9/18/13
10/8/13
Legend:
Fall Treatment Area (5.6 acres)
Actual Treatment Path (9/18/13)
10 day sample site
20 day sample site
0
250
500
1,000
Feet
AQUATIC CONTROL TECHNOLOGY

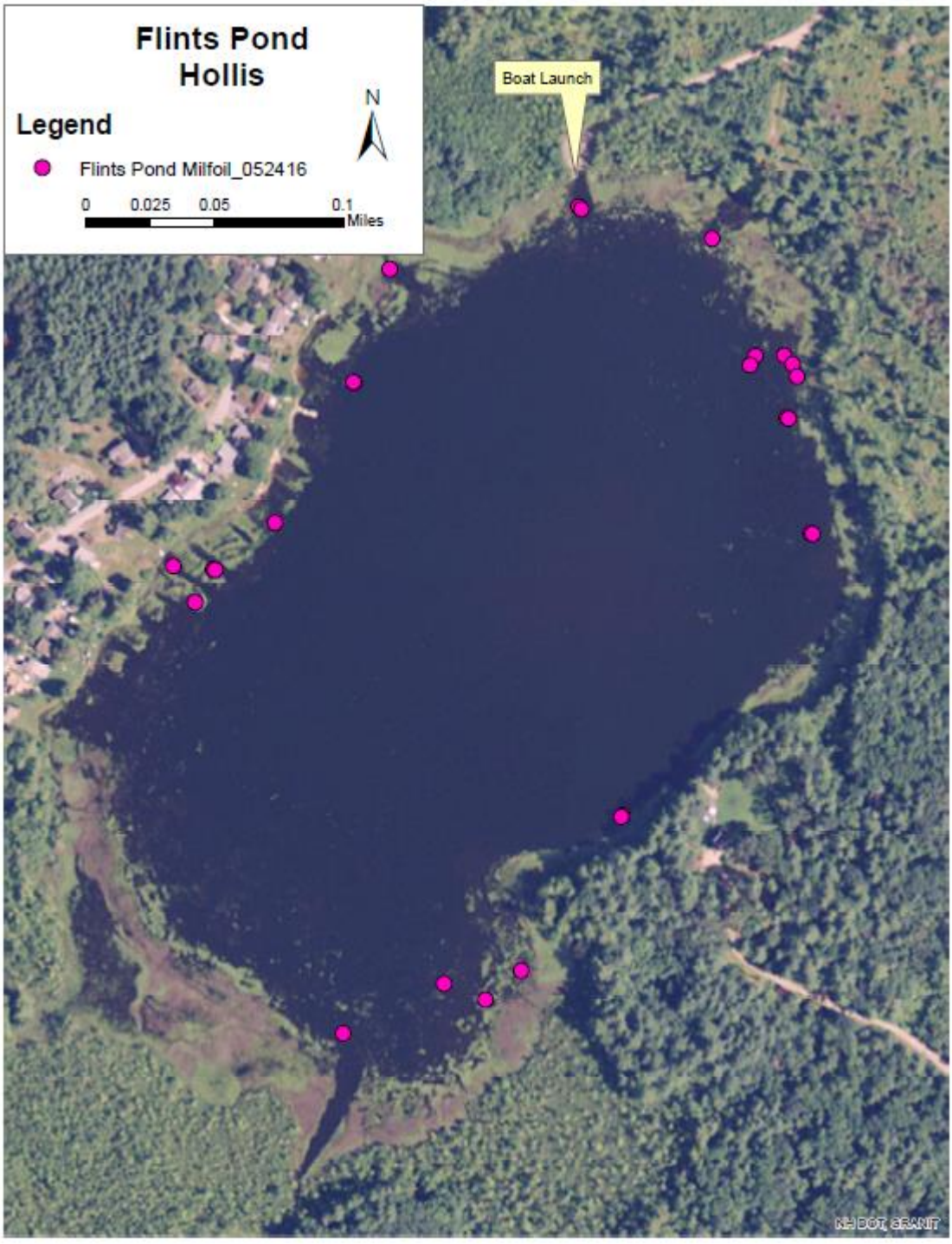
2014 (proposed)



2015


Flints Pond
Hollis
Legend
Flint Pond Milfoil_052115
0 0.025 0.05 0.1
Miles
N
Boat Launch
NOTE THAT ALL KNOWN MILFOIL LOCATIONS ARE MARKED WITH VARYING SIZED NOODLE FLOATS/MARKERS IN THE POND.
Outlet

2016


Flints Pond
Hollis
Legend
Flints Pond Milfoil_052416
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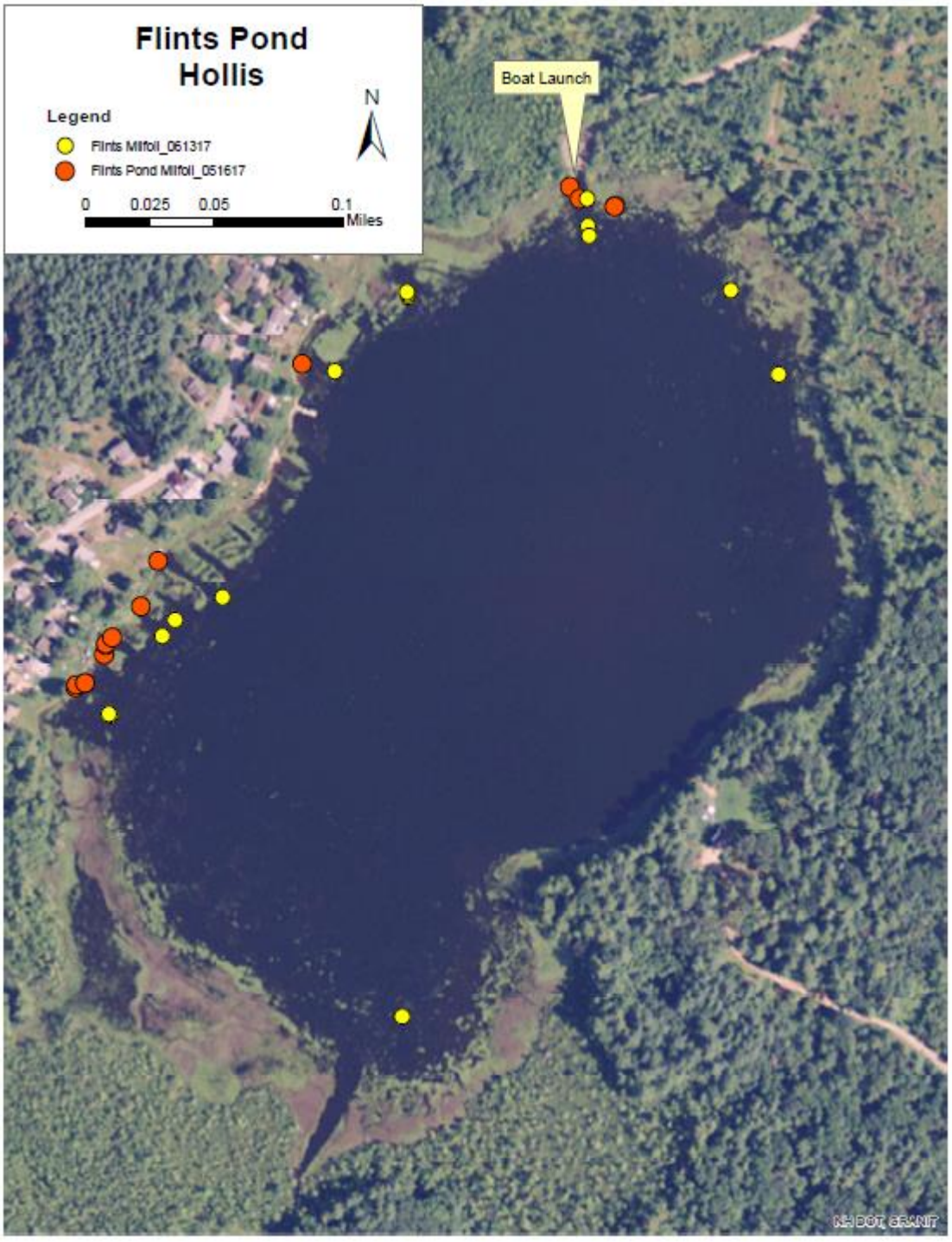
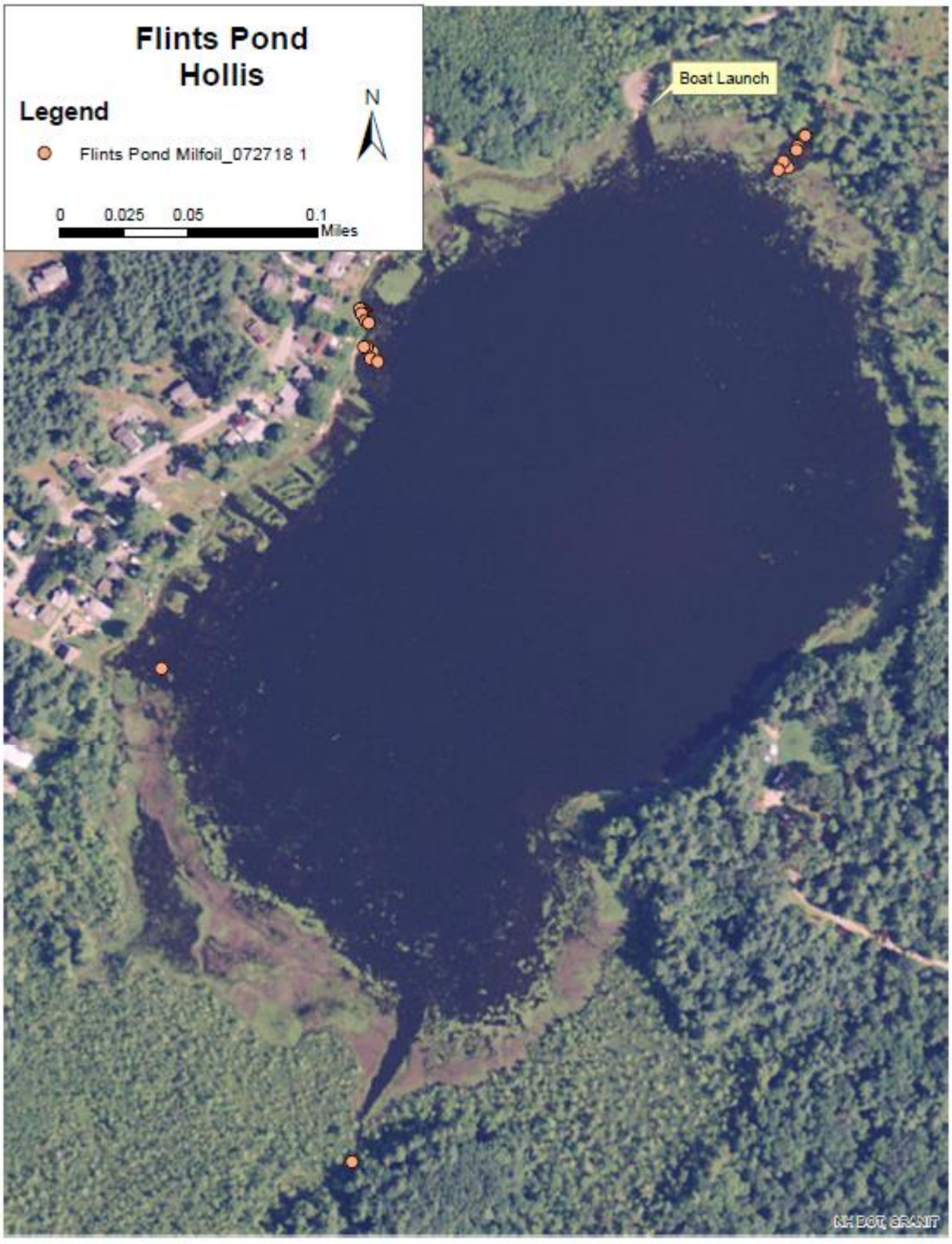
Miles
N
Boat Launch
NH DOT, GRANIT

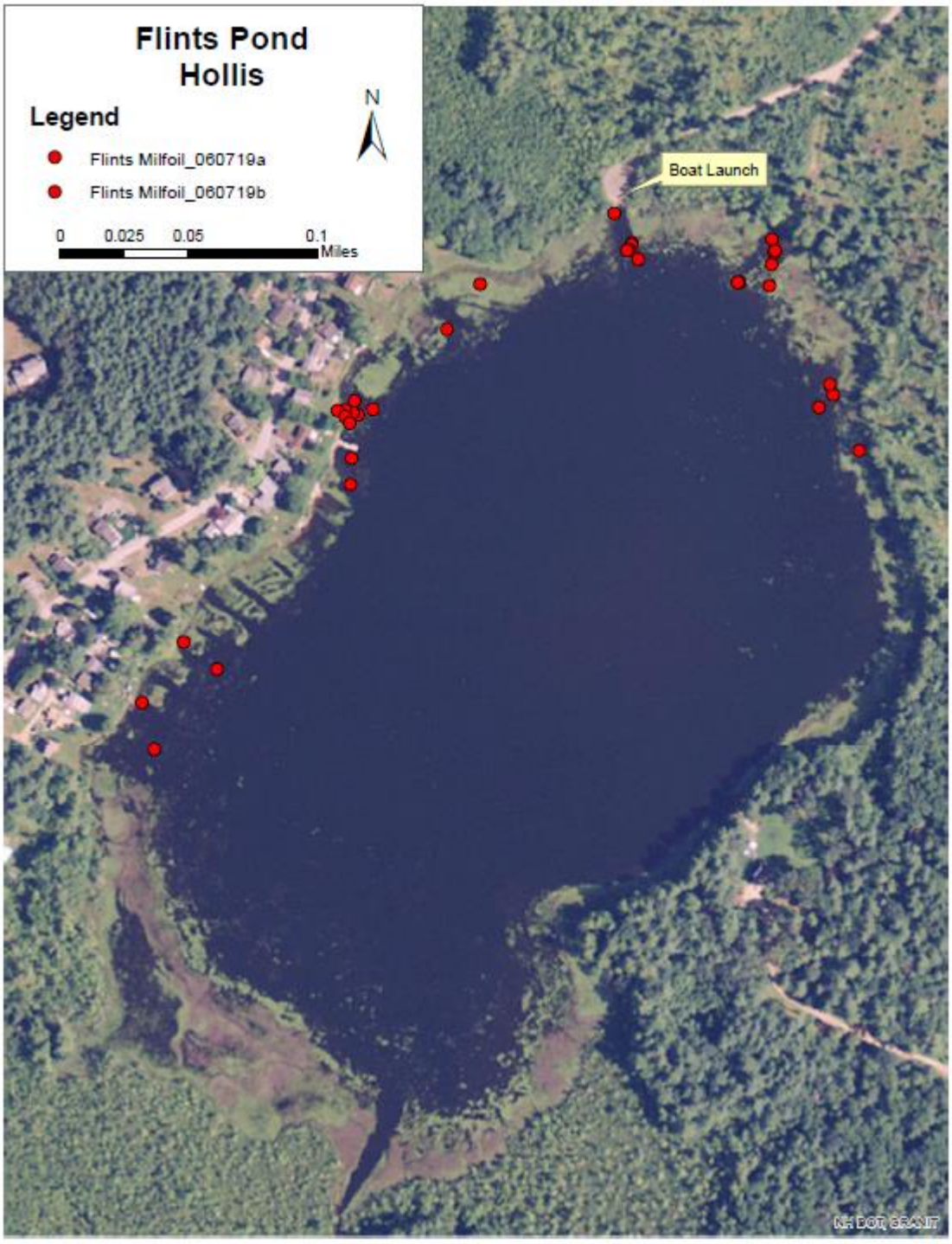
2017


Flints Pond
Hollis
Legend
Flints Milfoil_061317
Flints Pond Milfoil_051617
0 0.025 0.05 0.1
Miles
N
Boat Launch
NH DOT, GRANIT

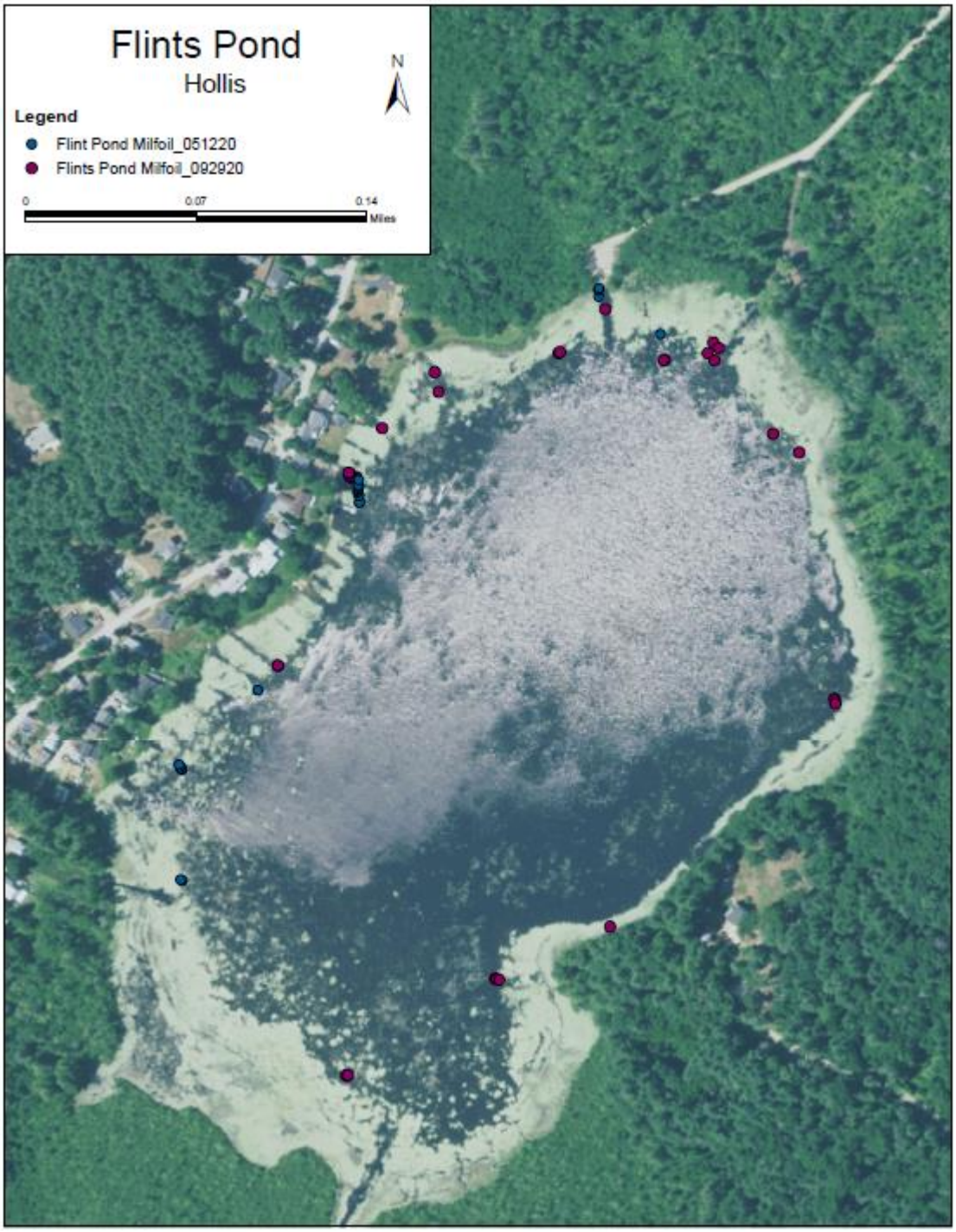
2018


Flints Pond
Hollis
Legend
Flints Pond Milfoil_072718 1
N
0 0.025 0.05 0.1
Miles
Boat Launch
NH DOT, GRANIT

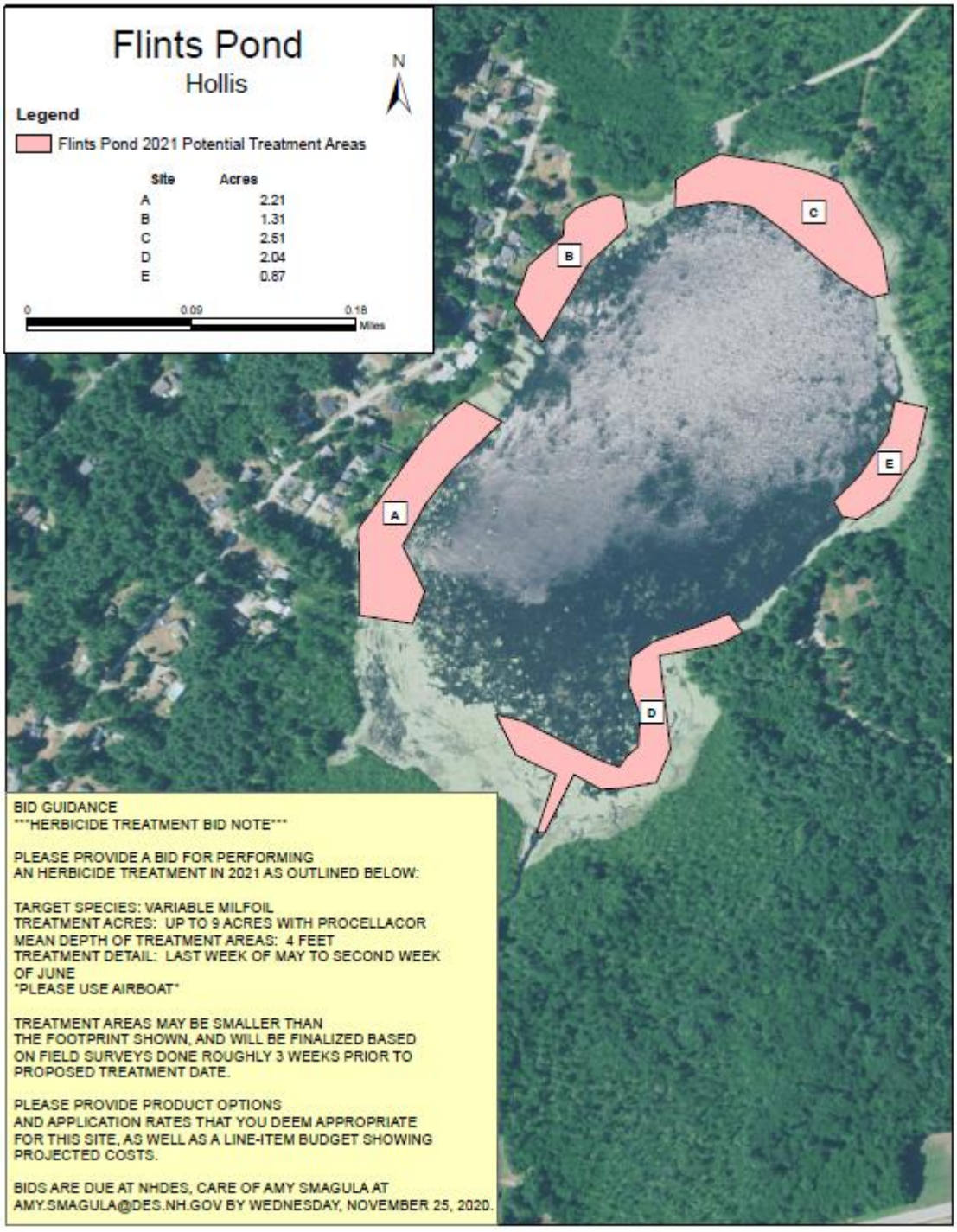
2019

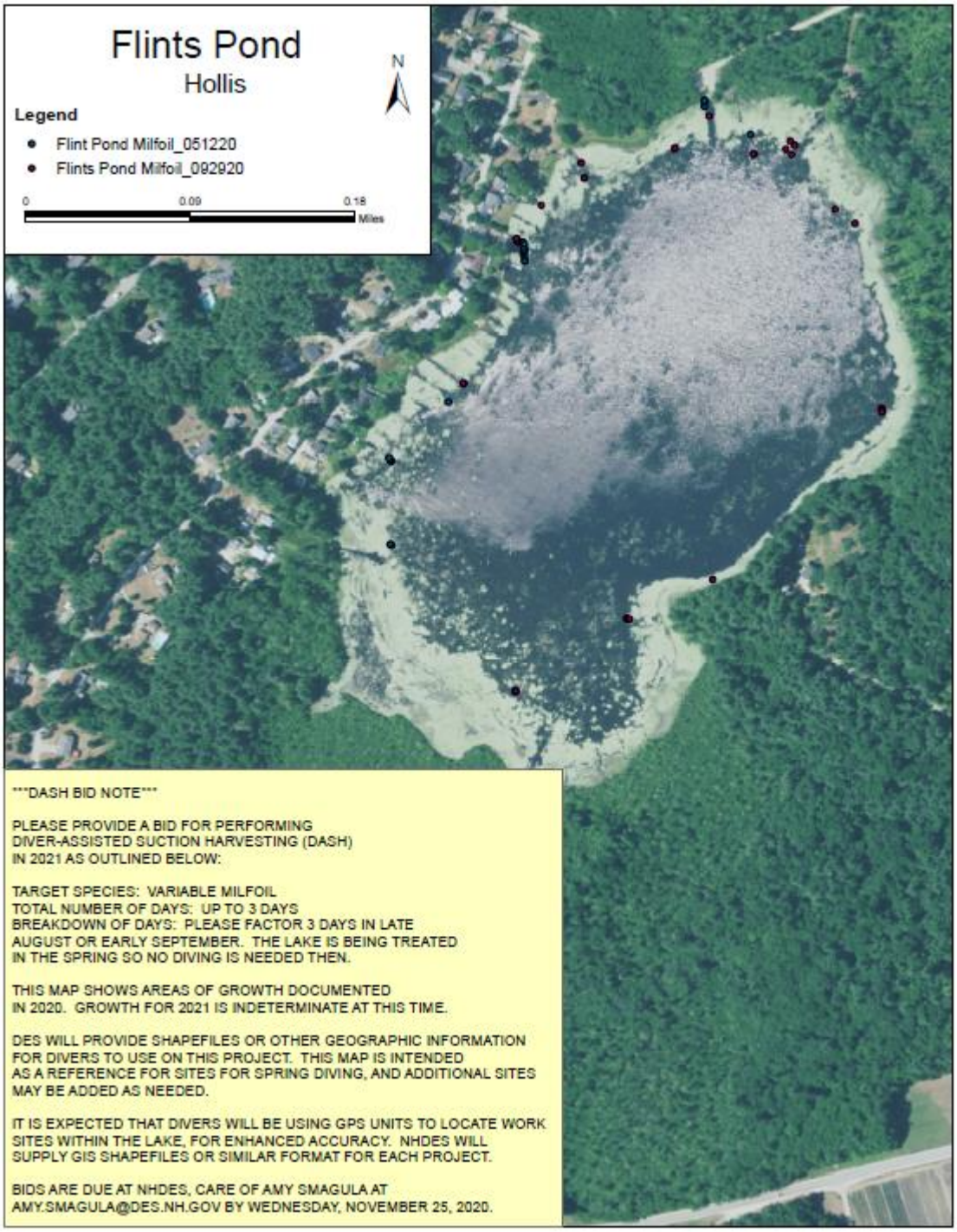

Flints Pond
Hollis
Legend
Flints Milfoil_060719a
Flints Milfoil_060719b
N
0
0.025
0.05
0.1
Miles
Boat Launch
NH DOT, GRANIT

2020


Flints Pond
Hollis
N
Legend
Flint Pond Milfoil_051220
Flints Pond Milfoil_092920
0
0.07
0.14
Miles

2021 Proposed





DASH BID NOTE

PLEASE PROVIDE A BID FOR PERFORMING
DIVER-ASSISTED SUCTION HARVESTING (DASH)
IN 2021 AS OUTLINED BELOW:

TARGET SPECIES: VARIABLE MILFOIL
TOTAL NUMBER OF DAYS: UP TO 3 DAYS
BREAKDOWN OF DAYS: PLEASE FACTOR 3 DAYS IN LATE AUGUST OR EARLY SEPTEMBER. THE LAKE IS BEING TREATED IN THE SPRING SO NO DIVING IS NEEDED THEN.

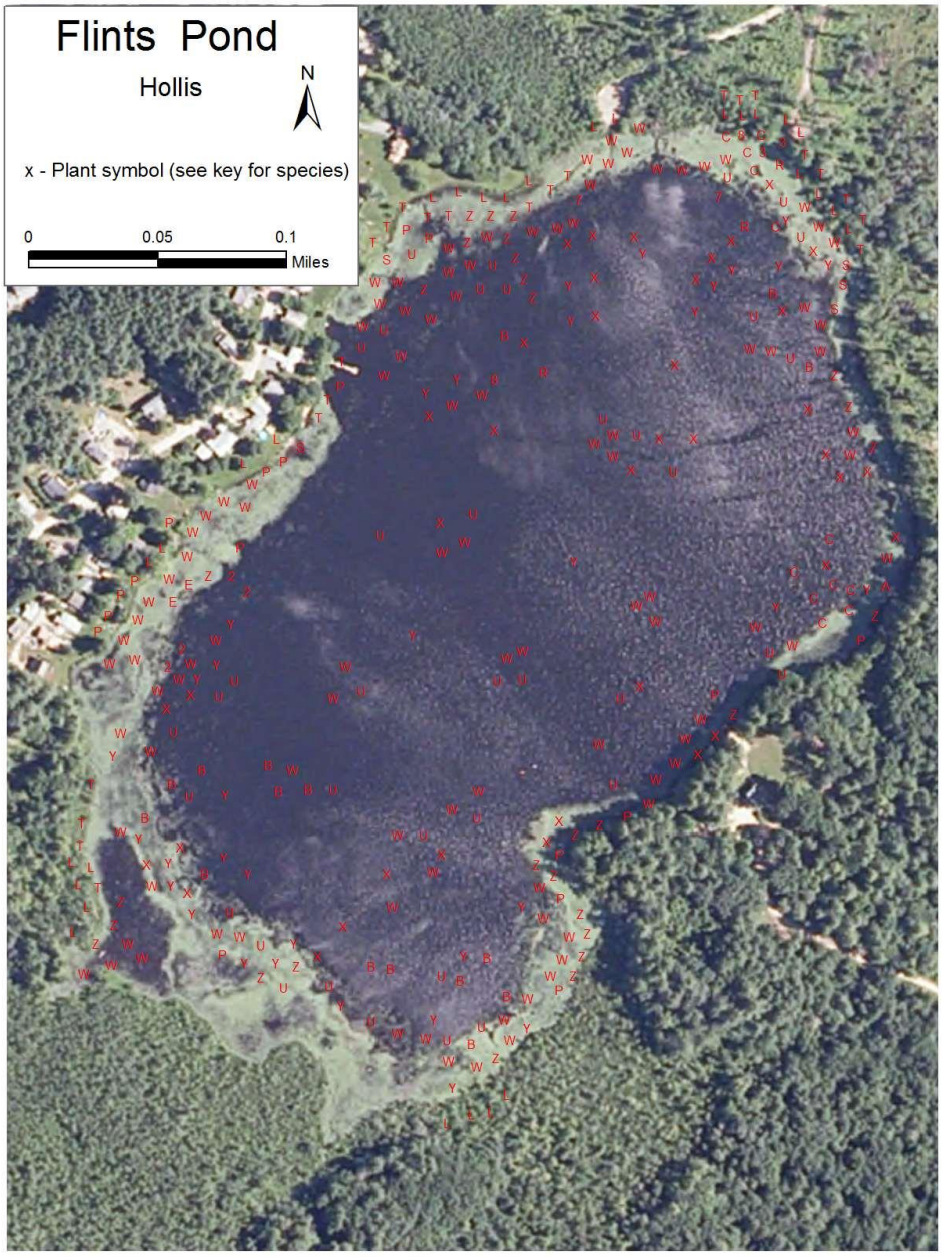
THIS MAP SHOWS AREAS OF GROWTH DOCUMENTED IN 2020. GROWTH FOR 2021 IS INDETERMINATE AT THIS TIME.

DES WILL PROVIDE SHAPEFILES OR OTHER GEOGRAPHIC INFORMATION FOR DIVERS TO USE ON THIS PROJECT. THIS MAP IS INTENDED AS A REFERENCE FOR SITES FOR SPRING DIVING, AND ADDITIONAL SITES MAY BE ADDED AS NEEDED.

IT IS EXPECTED THAT DIVERS WILL BE USING GPS UNITS TO LOCATE WORK SITES WITHIN THE LAKE, FOR ENHANCED ACCURACY. NHDES WILL SUPPLY GIS SHAPEFILES OR SIMILAR FORMAT FOR EACH PROJECT.

BIDS ARE DUE AT NHDES, CARE OF AMY SMAGULA AT AMY.SMAGULA@DES.NH.GOV BY WEDNESDAY, NOVEMBER 25, 2020.

Figure 3: Map of Native Aquatic Macrophytes



Key to Macrophyte Map

Symbol	Common Name	Latin Name
Y	Yellow water-lily	*Nuphar*
W	White water-lily	*Nymphaea*
C	Coontail	*Ceratophyllum*
U	Bladderwort	*Utricularia*
8	Mermaid-weed	*Proserpinaca*
3	Water marigold	*Megalodonta beckii*
L	Purple loosestrife	*Lythrum salicaria*
T	Cattail	*Typha*
R	Robbins Pondweed	*Potamogeton robbinsii*
X	Pondweed species	*Potamogeton spp.*
E	Grassy spike rush	*Eleocharis sp.*
B	Watershield	*Brasenia schreberi*
S	Erect bur-reed	*Sparganium sp.*
Z	Spike rush (erect)	*Eleocharis sp.*
A	Arrow arum	*Peltandra virginica*
P	Pickerelweed	*Pontedaria cordata*
I	Iris	*Iris*
7	Waterweed	*Elodea sp.*
2	Pipewort	*Eriocaulon*

Notes:

Plants throughout pond were very abundant, even in slightly deeper portion in the middle on the pond. White water-lily, waterweed and pondweeds were the most abundant species though many other species present in mixed stands around waterbody.

Figure 4: Bathymetric Map

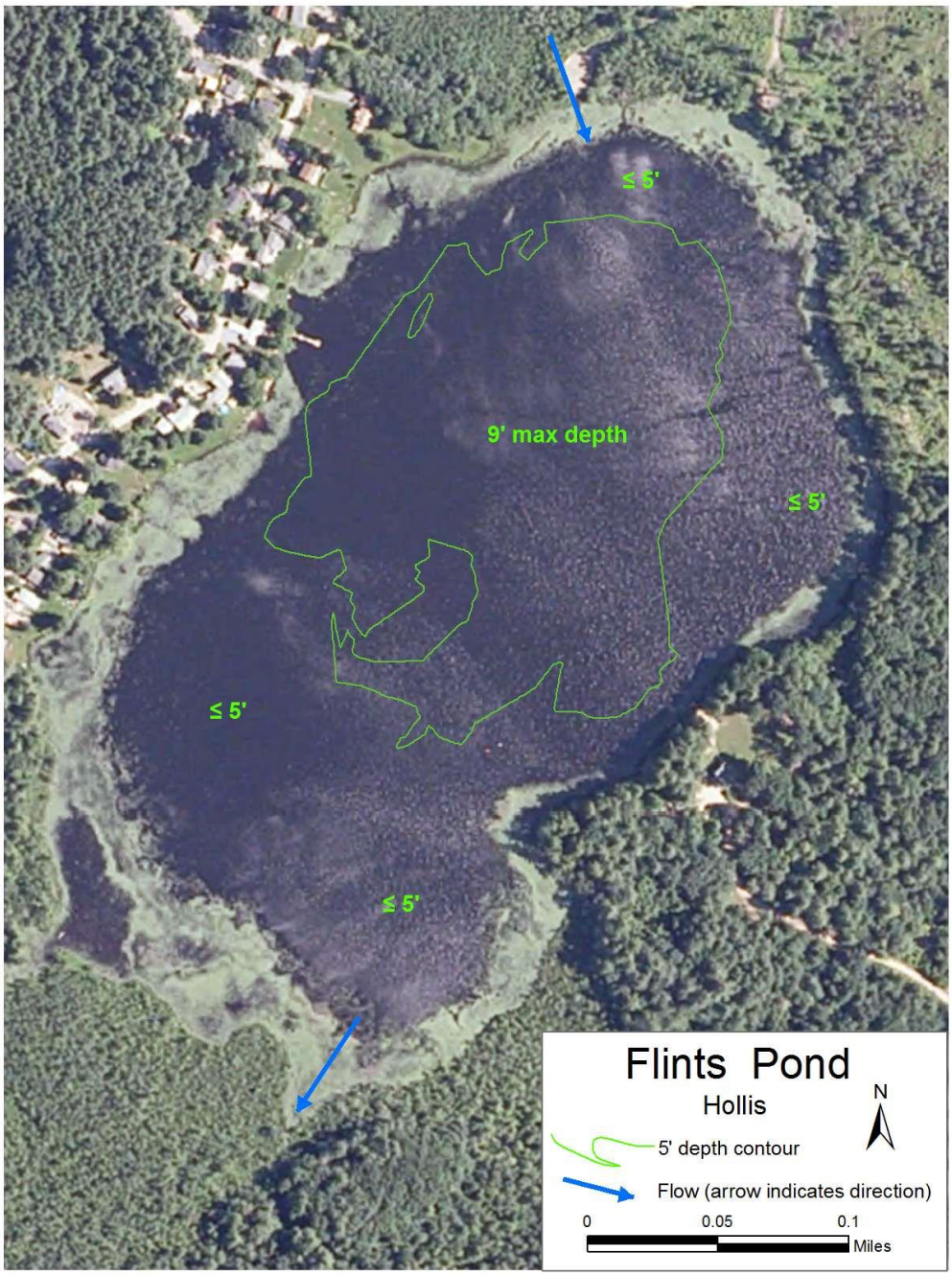


Figure 5: Critical Habitats or Conservation Areas

NHB19-0096

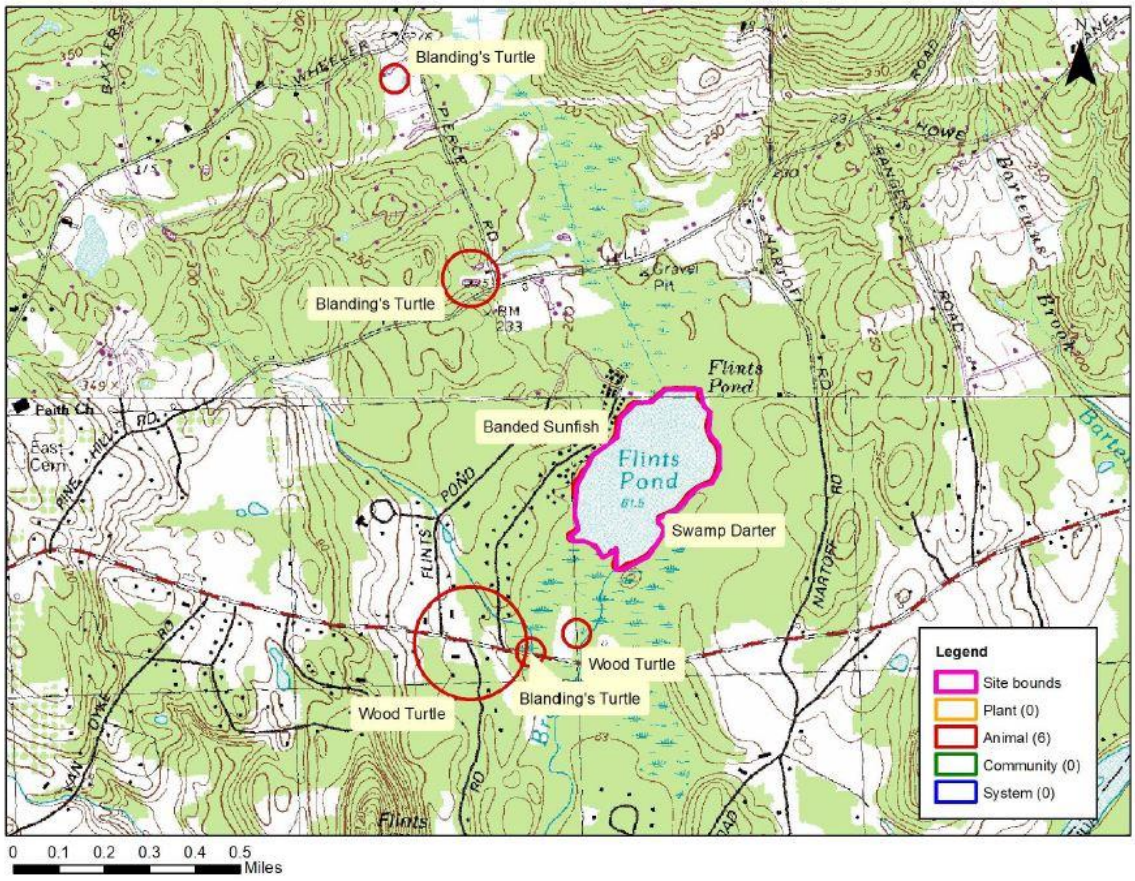


Figure 6: Public Access, Swim Areas, Docks

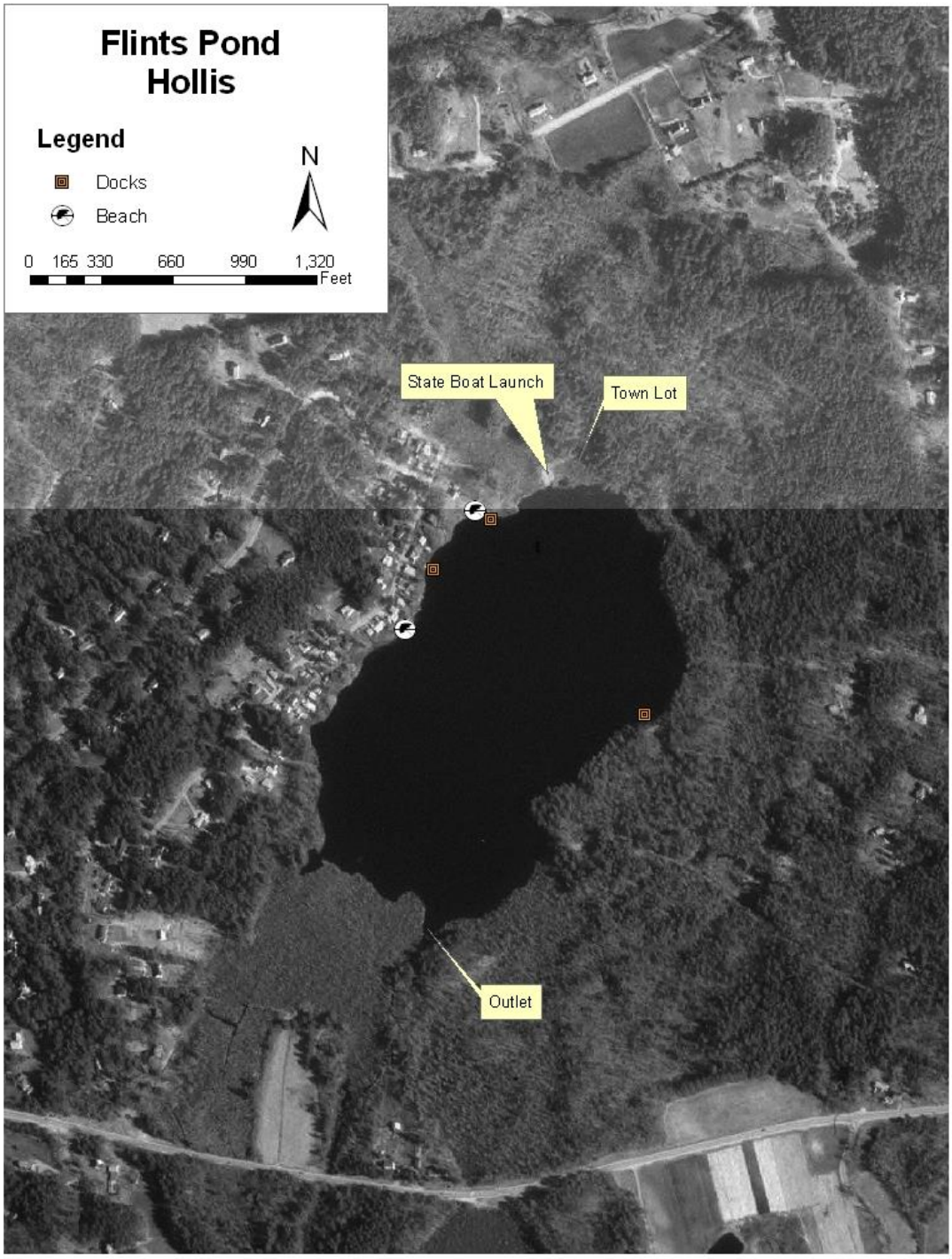
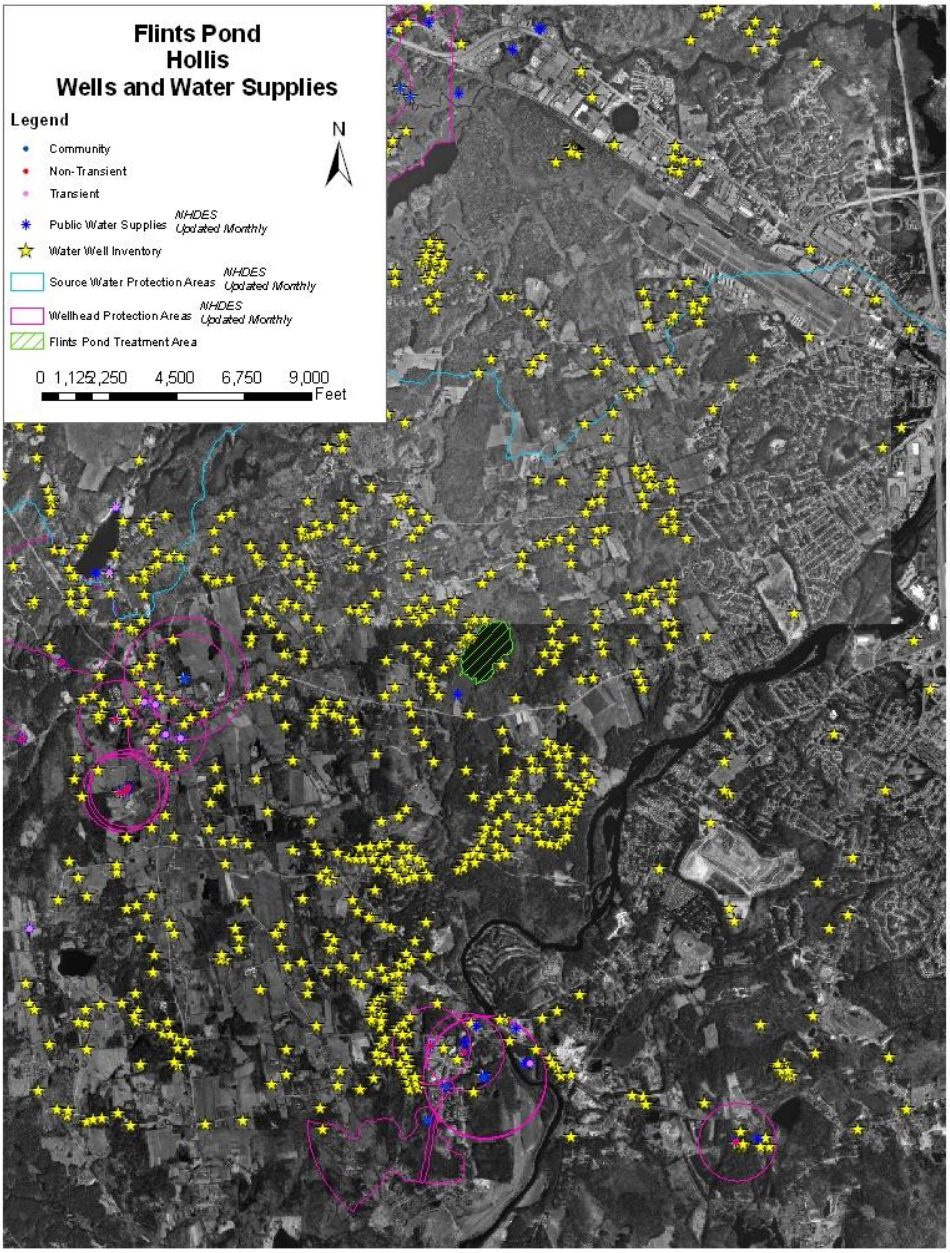


Figure 7: Wells and Water Supplies, 1:48,000 scale



Appendix A Selection of 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 not 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 Used in NH

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). Although the final report has not been completed for this study, preliminary results suggest that all three products worked well, but that Navigate formation may be the most target specific of all three.

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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