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Long-Term Invasive Plant Management Plan

Big Island Pond
Derry, 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 29 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.

Aquatic Invasive Plants in Big Island Pond

Big Island Pond has had a long history with fanwort (*Cabomba caroliniana*), an invasive aquatic plant, which dates back to the 1960s. Fanwort is widespread throughout the pond, and maintains a fairly consistent footprint from year to year, with plants reaching lengths of roughly 4-7 feet, but often not topping out and matting at the surface.

Variable milfoil (*Myriophyllum heterophyllum*) became established in Big Island Pond in 2003. In 2003, the variable milfoil was sparse and scattered as single stems or small patches in the northeastern end of the pond. In 2003 and 2004, DES divers conducted numerous site visits to perform hand-pulling activities in the area, but due to the density of fanwort, it was difficult to systematically remove the variable milfoil stems from the area. Since that time, variable milfoil has spread to various locations around the lake, albeit in low densities, and has been managed by contract divers.

During the summer of 2020, spiny naiad (*Najas minor*) was confirmed in Big Island Pond, first in Blueberry Cove, and then in other locations around the lake. Spiny naiad is locally abundant in some coves, and sparse in others.

At this point in time, it is hard to determine what impacts three aquatic invasive species will have on this system, particularly since fanwort is so widespread in the system, and has been for decades. Figure 1 illustrates the distribution of variable milfoil in this waterbody over time, as well as pioneering locations of spiny naiad. Fanwort is not shown on this map, and can be assumed to form a ring around much of the lake, to depths of approximately 10 feet.

Milfoil Management Goals and Objectives

The goal for Big Island Pond is the reduction of overall biomass and distribution of aquatic invasive species in the system, with the goal of containing and minimizing both variable milfoil and Spiny naiad, to prevent further spread.

Eradication of any one of these species is unlikely in this system, due to its size and the three different invasive plants growing in the system. It will take consistent commitment using appropriate integrated plant management strategies to contain and reduce growth.

Local Support

Town or Municipality Support
Unknown/TBD

Big Island Pond Corporation (BIPC) Support
Big Island Pond has a large and very active lake association. They maintain a network of Weed Watchers to look for and mark areas of aquatic invasive plant growth, and have trained some lake residents to serve as divers to help control some of the variable milfoil growth in the pond in the past. The lake association is also committed to performing follow-up monitoring for aquatic invasive plant growth, and working with DES to coordinate strategic control actions for targeted species. In addition to invasive species monitoring, the lake association is active in water quality monitoring and watershed monitoring.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of Big Island Pond, including the variable milfoil infestation.

General Lake Information	
Lake area (acres)	497.89
Watershed area (acres)	10,880.05
Shoreline Uses (residential, forested, agriculture)	Residential, fragmented forested areas
Max Depth (ft)	80.2
Mean Depth (ft)	17.8
Trophic Status	Eutrophic
Color (CPU) in Epilimnion	19
Clarity (ft)	16.5
Flushing Rate (yr^{-1})	1.80
Natural waterbody/Raised by Damming/Other	Natural with a dam
Plant Community Information Relative to Management	
Invasive Plants (Latin name)	*Myriophyllum heterophyllum, Najas minor* and *Cabomba caroliniana*
Infested Area (acres)	Ranges of small to large patches of growth as shown in Figure 1
Distribution (ringing lake, patchy growth, etc)	Variable milfoil growth is moderate to dense in the northern section of the pond. Fanwort is widespread throughout the waterbody (though not a problem to navigation/recreation). Spiny naiad is locally abundant in some coves/shoreline areas, sparse in others.
Sediment type in infested area (sand/silt/organic/rock)	Sandy, rocky, silty, organic
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Inventory)	<u>2023 Review</u> Blanding's Turtle (*Emydoidea blandingii*) Common Loon (*Gavia immer*) <u>Species Listed in Historical Reviews</u> Eastern Pond Mussel (*Ligumia nasuta*) Black gum-red maple swam basin American Eel (*Anguilla rostrata*) Spotted turtle (*Clemmys guttata*) Goshawk (north of lake) Lake whitefish (in Big Island Pond)

A native aquatic vegetation map and key s 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

Surveys and stocking records indicate that the following fish species are present: American eel, brook trout, brown bullhead, brown trout, chain pickerel, common shiner, common sunfish, golden shiner, largemouth bass, rainbow trout, smallmouth bass, white perch, white sucker and yellow perch. Historical stocking records indicate that both lake whitefish and rainbow trout were once stocked in Big Island Pond but the current status of these two species is unknown.

Wildlife Information

Historic NHB reviews for this site showed a review by the Natural Heritage Bureau (NHB) shows a record of lake whitefish (*Coregonus clupeaformis*) in Big Island Pond. This fish is listed as rare or uncommon in the state, but is not otherwise listed as threatened or endangered in the state or nationally. Global distribution of the species appears to be demonstrably widespread, abundant, and secure according to NHB records.

The lake whitefish is a reclusive fish that tends to spend most of its time in the deeper and colder waters of lakes. The whitefish does come into shallower waters to spawn in early winter. Spawning habitat is generally shallow rocky or sandy areas in waters that are less than 25 feet in depth.

The young of the year fish spend time in shallow waters early on, then migrate deeper as they mature. Lake whitefish feed on small organisms due to a small mouth size. Prey includes small fish in the water column, and benthic organisms such as insects. Based on the habitat types and habits of this fish, there are no anticipated impacts as a result of the proposed herbicide treatment. The treatment is set to take place in the shallow, silty north end of the lake. Small fish species and benthic organisms are not expected to be impacted by the treatment, and abundant habitat is present throughout other parts of Big Island Pond so that this fish species, as well as others, can seek refuge as needed.

The 2021 review has the Blanding's turtle (*Emydoidea blandingii*), the Eastern pond mussel (*Ligumia nasuta*) listed as concerns. Other wildlife species that are listed as concerns by NHB include the goshawk (*Accipiter gentiles*), spotted turtle (*Clemmys guttata*) and the common loon (*Gavia immer*)

Recreational Uses and Access Points

Big Island Pond is used for numerous recreational activities, including boating, fishing, swimming, and water skiing, among others, by both pond residents and visitors from the campground on the pond.

In terms of boat access, the BIPC maintains a boat launch on the southwestern side of the pond, however access to this launch is limited by a gate. Small motor boats, as well as kayaks and canoes can use this facility. While this boat ramp is owned by the BIPC, it is used as a public access for 12 state-sponsored fishing tournaments per year. There is secure parking for up to 18 vehicles with trailers. The public can have access to a boat launch key for a nominal fee for the purpose of fishing. There is another private boat launch area at the campground at the northern end of the lake. This launch is occasionally used for fishing tournaments, and the access is controlled by the campground and is generally restricted to campers. There are also at least three 'neighborhood' boat launches with access by 40 to 80 households each around the lake, and the recently renovated canoe launch in Atkinson now has parking for 5-6 vehicles.

There are generally 60 powerboats in use on a normal weekday, and 150-200 motorboats in use on weekend days, according to lake residents. There are also about 20-30 non-motorized watercraft on the pond at a given time.

There are seven designated beaches on the pond which are associated with the campground or towns. A designated beach is described in the CALM as an area on a waterbody that is operated for bathing, swimming, or other primary water contact by any municipality, governmental subdivision, public or private corporation, partnership, association, or educational institution, open to the public, members, guests, or students whether on a fee or free basis. Env-Wq 1102.14 further defines a designated beach as *"a public bathing place that comprises an area on a water body and associated buildings and equipment, intended or used for bathing, swimming, or other primary water contact purposes. The term includes, but is not limited to, beaches or other swimming areas at hotels, motels, health facilities, water parks, condominium complexes, apartment complexes, youth recreation camps, public parks, and recreational campgrounds or camping parks as defined in RSA 216-I:1, VII. The term does not include any area on a water body which serves 3 or fewer living units and which is used only by the residents of the living units and their guests.*

Figure 4 shows the locations commonly used for swimming, and the locations of swim platforms and docks (407) on Big Island Pond, as well as boat paths and public access locations.

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 Big Island Pond is characterized by a mix of native and non-native (variable milfoil and fanwort) plant growth (Figure 2).

Native species include a mix of floating plants (white lily, yellow water-lily, watershield), emergent plants (pickerelweed, spike rush, sedges, rushes, arrowhead, cattail, grassy arrowhead,), and submergent plants (bur-reed, grassy spike rush, various pondweed species, clasping-leaf pondweed, four bladderwort species, waterweed, quillwort, native milfoil, coontail, water marigold, water naiad). Native plant communities are mixed around the entire lake, and are characterized as 'common' by the DES, though growth in some of the coves approaches an abundant rating.

In addition to variable milfoil as an invasive non-native plant, fanwort is also present in the pond.

There are no records of state threatened or endangered plant species within the lake basin; however, a black gum (*Nyssa sylvatica*)-red maple basin swamp is located north of the lake according to an NHB review. The trees are in the nearshore area in the back (shoreward) edge of a wetland complex which is adjacent to the north end of Big Island Pond (the lakeward edge of the wetland is adjacent to a portion of the treatment area). It is not expected that the proposed 2,4-D treatment in the lake will have any effect at all on these tree species, particularly at the concentration that is proposed for variable milfoil control. Trees are more susceptible to 2,4-D through foliar applications of the herbicide. For milfoil control, 2,4-D granular applications will be made directly into the water.

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

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
East of Governors Island	5/13/2014	CS Dash	Variable milfoil	80	AB AQUATICS
East of Governors Island	5/14/2014	CS Dash	Variable milfoil	50	AB AQUATICS
WEST SIDE OF CHANNEL	5/16/2014	CS Dash	Variable milfoil	180	AB AQUATICS
VARIOUS	5/19/2014	ABA DASH	Variable milfoil	95	AB AQUATICS
VARIOUS	5/19/2014	CS DASH	Variable milfoil	260	AB AQUATICS
VARIOUS	5/20/2014	ABA DASH	Variable milfoil	160	AB AQUATICS
VARIOUS	5/20/2014	CS Dash	Variable milfoil	260	AB AQUATICS
VARIOUS	5/21/2014	ABA DASH	Variable milfoil	30	AB AQUATICS
NORTH COVE ACROSS FROM GOVERNORS ISLAND	5/21/2014	ABA DASH	Variable milfoil	60	AB AQUATICS
VARIOUS	5/22/2014	CS Dash	Variable milfoil	160	AB AQUATICS
VARIOUS	5/23/2014	ABA DASH	Variable milfoil	55	AB AQUATICS
VARIOUS	5/23/2014	ABA DASH	Variable milfoil	5	AB AQUATICS
VARIOUS	5/23/2014	CS Dash	Variable milfoil	190	AB AQUATICS
VARIOUS	5/29/2014	ABA DASH	Variable milfoil	270	AB AQUATICS
VARIOUS	6/2/2014	ABA DASH	Variable milfoil	80	AB AQUATICS
MIDDLE OF CHANNEL 2 BARRIER SITE	6/2/2014	CS Dash	Variable milfoil	170	AB AQUATICS
N C SEM'S LAUNCH	6/3/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
SOUTH OF RIVER BY CAMPGROUND	6/3/2014	ABA DASH	Variable milfoil	40	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
COVE W X C SEM'S LAUNCH	6/3/2014	ABA DASH	Variable milfoil	80	AB AQUATICS
CHANNEL C SEM'S 2 OPEN WATER	6/3/2014	CS Dash	Variable milfoil	188	AB AQUATICS
COVE X C SEM'S BEFORE CHANNEL ON NORTH SIDE	6/3/2014	CS Dash	Variable milfoil	42	AB AQUATICS
COVE WEST OF C SEM'S LAUNCH	6/4/2014	ABA DASH	Variable milfoil	75	AB AQUATICS
NW SHORELINE GOVERNOR I.	6/4/2014	ABA DASH	Variable milfoil	5	AB AQUATICS
JOHNSON COVE ALONG BACKSIDE	6/4/2014	CS Dash	Variable milfoil	120	AB AQUATICS
NW SHORELINE GOVERNORS	6/5/2014	ABA DASH	Variable milfoil	55	AB AQUATICS
VARIOUS	6/5/2014	ABA DASH	Variable milfoil	5	AB AQUATICS
JOHNSONS COVE FAR SIDE FROM REEDS	6/5/2014	CS Dash	Variable milfoil	20	AB AQUATICS
COAST LAST I. JOHNSON'S COVE	6/5/2014	CS Dash	Variable milfoil	20	AB AQUATICS
THREE ISLANDS NEAR BOULDER COVE	6/5/2014	CS Dash	Variable milfoil	10	AB AQUATICS
SOUTH OF SANDBAR NEAR D PERKINS DOCK	6/6/2014	ABA DASH	Variable milfoil	15	AB AQUATICS
RED MARKER X SANDBAR	6/6/2014	ABA DASH	Variable milfoil	15	AB AQUATICS
WEST SHORELINE GOVERNORS I.	6/6/2014	ABA DASH	Variable milfoil	0	AB AQUATICS
BOULDER COVE AROUND ISLANDS	6/6/2014	ABA DASH	Variable milfoil	300	AB AQUATICS
BOULDER COVE	6/7/2014	CS Dash	Variable milfoil	40	AB AQUATICS
BOULDER COVE	6/9/2014	CS Dash	Variable milfoil	44	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
CONLEYS COVE WEST SHORE	6/9/2014	SURVEY	Variable milfoil	10	AB AQUATICS
TAYLOR BROOK	6/10/2014	CS Dash	Variable milfoil	4	AB AQUATICS
CAMPGROUND & C SEMS	6/10/2014	SURVEY	Variable milfoil	2	AB AQUATICS
CAMPGROUND & C SEMS	6/10/2014	CS Dash	Variable milfoil	30	AB AQUATICS
GOVERNORS I. BRIDGE	6/10/2014	ABA DASH	Variable milfoil	80	AB AQUATICS
COVE NE GOVERNORS I.	6/11/2014	CS Dash	Variable milfoil	14	AB AQUATICS
G I. EAST SIDE, BRIDGE NORTH	6/11/2014	CS Dash	Variable milfoil	106	AB AQUATICS
SOUTH SIDE G I. BRIDGE	6/11/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
CHANNEL BOTH SIDE INTO COVE	6/11/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
NARROW EAST SIDE (MAINLAND)	6/12/2014	CS Dash	Variable milfoil	100	AB AQUATICS
WEST SIDE OF GOVERNORS I. OFF SHORE	6/12/2014	ABA DASH	Variable milfoil	20	AB AQUATICS
SE GOVERNORS I. SHALLOWS	6/12/2014	ABA DASH	Variable milfoil	30	AB AQUATICS
SW GOVERNORS I. SHORE OUT TO DEEP	6/12/2014	ABA DASH	Variable milfoil	20	AB AQUATICS
EAST SIDE NARROWS HEADING NORTH	6/13/2014	CS Dash	Variable milfoil	94	AB AQUATICS
WEST SHORELINE OF NARROWS	6/13/2014	ABA DASH	Variable milfoil	240	AB AQUATICS
EAST SIDE NARROWS HEADING NORTH	6/14/2014	CS Dash	Variable milfoil	80	AB AQUATICS
LOBSTER COVE SOUTH OF CHASE ISLAND	6/17/2014	CS Dash	Variable milfoil	2	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
LOBSTER COVE NORTH OF CHASE ISLAND	6/17/2014	CS Dash	Variable milfoil	48	AB AQUATICS
NE GOVERNORS ISLAND B4 CHANNEL	7/25/2014	ABA DASH	Variable milfoil	120	AB AQUATICS
N OF NARROWS, E SHORE	7/29/2014	ABA DASH	Variable milfoil	50	AB AQUATICS
N OF GOVERNORS ISLAND AND NARROWS	7/29/2014	ABA DASH	Variable milfoil	44	AB AQUATICS
N OF GEORGES ISLAND NE TIP GOVERNORS	7/30/2014	ABA DASH	Variable milfoil	200	AB AQUATICS
N OF GOVERNORS AND W OF GEORGES	7/31/2014	ABA DASH	Variable milfoil	100	AB AQUATICS
GEORGES ALONG SHORE GOVERNORS	7/31/2014	ABA DASH	Variable milfoil	60	AB AQUATICS
NNE GEORGES ISLAND	8/1/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
W OF GEORGES ISLAND INTO CHANNEL	8/1/2014	ABA DASH	Variable milfoil	90	AB AQUATICS
NE TO NW GEORGES ISLAND	8/4/2014	ABA DASH	Variable milfoil	10	AB AQUATICS
NE TO NW GEORGES ISLAND	8/5/2014	ABA DASH	Variable milfoil	10	AB AQUATICS
N OF GOVERNORS ISLAND E OF CHANNEL	8/5/2014	ABA DASH	Variable milfoil	70	AB AQUATICS
LOBSTER COVE SURROUND 3 ISLAND	8/6/2014	ABA DASH	Variable milfoil	50	AB AQUATICS
LOBSTER COVE SURROUND 3 ISLAND	8/7/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
LOBSTER COVE SURROUND 3	8/8/2014	ABA DASH	Variable milfoil	4	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
ISLAND					
N OF CHANNEL INTO CONLEYS GROVE	8/8/2014	ABA DASH	Variable milfoil	26	AB AQUATICS
CHANNEL ENTER AND INTO Conley's grove	8/11/2014	ABA DASH	Variable milfoil	32	AB AQUATICS
PTS W OF LOON ISLAND	8/11/2014	ABA DASH	Variable milfoil	22	AB AQUATICS
NORTHERN CHANNEL	8/11/2014	ABA DASH	Variable milfoil	120	AB AQUATICS
SW SHORE CONLEY'S COVE, S MOST PTS	8/12/2014	ABA DASH	Variable milfoil	4	AB AQUATICS
BOULDER COVE	8/12/2014	ABA DASH	Variable milfoil	106	AB AQUATICS
NORTHERN CHANNEL	8/12/2014	ABA DASH	Variable milfoil	70	AB AQUATICS
BOULDER COVE	8/13/2014	ABA DASH	Variable milfoil	100	AB AQUATICS
NORTHERN CHANNEL	8/13/2014	ABA DASH	Variable milfoil	60	AB AQUATICS
BOULDER COVE	8/14/2014	ABA DASH	Variable milfoil	30	AB AQUATICS
NORTHERN CHANNEL	8/14/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
BOULDER COVE	8/15/2014	ABA DASH	Variable milfoil	80	AB AQUATICS
NORTHERN CHANNEL	8/15/2014	ABA DASH	Variable milfoil	70	AB AQUATICS
SE PENINSULA OF THE NARROWS	8/18/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
SW SHORE OF THE NARROWS	8/18/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
BOULDER COVE	8/18/2014	CS Dash	Variable milfoil	30	AB AQUATICS
S END OF THE NARROWS	8/19/2014	HAND PULL	Variable milfoil	2	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
SE SHORE OF NARROWS, S OF S MOST C	8/19/2014	ABA DASH	Variable milfoil	60	AB AQUATICS
S OF SOUTHERN C IN NARROWS E SHORE	8/19/2014	ABA DASH	Variable milfoil	40	AB AQUATICS
BOULDER COVE	8/19/2014	HAND PULL	Variable milfoil	1	AB AQUATICS
NE SIDE OF CHANNEL UP AND INCAMPGROUND COVE	8/19/2014	CS Dash	Variable milfoil	49	AB AQUATICS
SE COVE OF THE NARROWS	8/20/2014	ABA DASH AND HAND PULL	Variable milfoil	105	AB AQUATICS
CAMPGROUND COVE	8/20/2014	CS Dash	Variable milfoil	60	AB AQUATICS
NW COVER CAMPGROUND COVE AND INLET FROM SHOP POND STREAM	8/21/2014	ABA DASH	Variable milfoil	10	AB AQUATICS
SE SIDE GEORGE'S ISLAND INTO NARROWS	8/21/2014	ABA DASH	Variable milfoil	50	AB AQUATICS
NE OF NARROWS ALONG E SHORE	8/21/2014	CS Dash	Variable milfoil	20	AB AQUATICS
WESTERN SHORE OF NARROWS	8/21/2014	CS DASH	Variable milfoil	50	AB AQUATICS
WESTERN SHORE OF NARROWS	8/22/2014	ABA DASH	Variable milfoil	120	AB AQUATICS
CAMPGROUND COVE, S INTO CHANNEL	8/22/2014	CS Dash	Variable milfoil	8	AB AQUATICS
PENINSULA, E OF JOHNSON C. AND W SHORELINE OF JOHNSON C.	8/26/2014	ABA DASH	Variable milfoil	90	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
N SHORELINE JOHNSON C., BRIDGE TO MARSH IN NE CORNER	8/27/2014	ABA DASH/HAND PULL	Variable milfoil	80	AB AQUATICS
JOHNSON COVE	8/28/2014	ABA DASH/HAND PULL	Variable milfoil	60	AB AQUATICS
JOHNSON COVE	8/29/2014	HAND PULL	Variable milfoil	10	AB AQUATICS
BETWEEN TWO RED BOUYS	8/29/2014	HAND PULL/CS DASH	Variable milfoil	34	AB AQUATICS
TUNE BALL ACROSS FROM COLLEST BEACH AND COLLEST BEACH SHORE	8/30/2014	CS Dash	Variable milfoil	40	AB AQUATICS
W OF GOVERNORS ISLAND BY R/W SPAR	9/3/2014	CS Dash	Variable milfoil	20	AB AQUATICS
COLETTE'S BEACH	9/3/2014	CS Dash	Variable milfoil	10	AB AQUATICS
W OF GOVERNORS ISLAND BY R/W SPAR	9/4/2014	CS DASH	Variable milfoil	110	AB AQUATICS
E OF GOVERNOR'S ISLAND BY SAND BAR	9/4/2014	CS DASH	Variable milfoil	40	AB AQUATICS
N COLLETE'S BEACH, W SHORE	9/5/2014	SURVEY	Variable milfoil	0	AB AQUATICS
OFF COLLETE'S BEACH	9/5/2014	SURVEY	Variable milfoil	0	AB AQUATICS
COVE, N END GOVERNORS ISLAND	9/5/2014	HAND PULL	Variable milfoil	5	AB AQUATICS
W OF GOVERNORS ISLAND. 75 YDS NE R/W SPAR	9/6/2014	ABA DASH	Variable milfoil	4	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
COLLETE'S BEACH, SAND BAR 150 YDS N AND 10 YDS OFF MAINLAND	9/6/2014	ABA DASH	Variable milfoil	50	AB AQUATICS
E SANDBAR W EDGE OF LAKE 150 YDS N COLLETE'S BEACH	9/7/2014	ABA DASH	Variable milfoil	5	AB AQUATICS
COLLETE'S BEACH AND DOCKS	9/7/2014	ABA DASH	Variable milfoil	5	AB AQUATICS
W SHORE, 150 YDS S COLLETTE'S BEACH	9/7/2014	ABA DASH	Variable milfoil	5	AB AQUATICS
W SHORE GOVERNORS ISLAND OUTSIDE COVE, 100 YDS S OF MILFOIL BARRIER	9/7/2014	ABA DASH	Variable milfoil	25	AB AQUATICS
HOT DOG COVE, 150 YDS N BARRIERS	9/9/2014	ABA DASH	Variable milfoil	20	AB AQUATICS
GOVERNORS ISLAND W SIDE 100 YDS S BARRIER	9/9/2014	ABA DASH	Variable milfoil	5	AB AQUATICS
GOVERNOR'S ISLAND W SIDE 100 YDS S BARRIER	9/10/2014	ABA DASH	Variable milfoil	50	AB AQUATICS
W GOVERNOR'S ISLAND, E COLLETTE'S BEACH	9/10/2014	ABA DASH	Variable milfoil	30	AB AQUATICS
W GOVERNOR'S ISLAND, E COLLETTE'S BEACH	9/11/2014	ABA DASH	Variable milfoil	14	AB AQUATICS
W GOVERNOR'S ISLAND, E COLLETTE'S BEACH	9/12/2014	ABA DASH	Variable milfoil	90	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
COLLETE'S BEACH W GOVERNOR'S ISLAND 200 FT N OF BUOY	9/13/2014	ABA DASH AND HAND PULL	Variable milfoil	40	AB AQUATICS
W GOVERNORS ISLAND NEAR TO SPAR	9/15/2014	ABA DASH	Variable milfoil	60	AB AQUATICS
W GOVERNOR I COVE 200 YDS N SPAR	9/23/2014	ABA DASH	Variable milfoil	100	AB AQUATICS
E SPAR COLLETTES BEACH WEST GOVERNORS I SHORELINE	9/24/2014	ABA DASH	Variable milfoil	30	AB AQUATICS
GOVERNORS ISLAND BY BARRIER TO TURTLES ISLAND	9/25/2014	ABA DASH	Variable milfoil	30	AB AQUATICS
GOVERNORS ISLAND BY BARRIER TO TURTLES ISLAND AND NEAR GEORGES ISLAND	9/26/2014	ABA DASH	Variable milfoil	20	AB AQUATICS
Blueberry Circle	5/26/2015	ABA DASH	Variable milfoil	30	AB AQUATICS
Blueberry Circle	5/27/2015	ABA DASH	Variable milfoil	44	AB AQUATICS
Boulder Cove	5/28/2015	ABA DASH	Variable milfoil	50	AB AQUATICS
Boulder Cove	5/29/2015	ABA DASH	Variable milfoil	25	AB AQUATICS
Governors Island	6/1/2015	ABA DASH	Variable milfoil	21	AB AQUATICS
Northern Coast and Chase Island	6/2/2015	ABA DASH	Variable milfoil	25	AB AQUATICS
13a, 13b, 14b	6/3/2015	ABA DASH	Variable milfoil	40	AB AQUATICS
13a, 14b	6/4/2015	ABA DASH	Variable milfoil	26	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Northwest coast, Blueberry circle	6/5/2015	ABA DASH	Variable milfoil	10	AB AQUATICS
NE EDGE OF CAMPGROUND COVE	6/8/2015	ABA DASH	Variable milfoil	14	AB AQUATICS
W OF GOVERNOR'S ISLAND	6/9/2015	ABA DASH	Variable milfoil	45	AB AQUATICS
W OF GOVERNOR'S ISLAND	6/10/2015	ABA DASH	Variable milfoil	160	AB AQUATICS
W OF GOVERNOR'S ISLAND	6/11/2015	ABA DASH	Variable milfoil	50	AB AQUATICS
W OF GOVERNOR'S ISLAND	6/12/2015	ABA DASH	Variable milfoil	70	AB AQUATICS
Northern Shore of 12/11a	6/22/2015	ABA DASH	Variable milfoil	23	AB AQUATICS
Northern point of cove	6/23/2015	ABA DASH	Variable milfoil	8	AB AQUATICS
NE side of Island	6/24/2015	ABA DASH	Variable milfoil	20	AB AQUATICS
Governor's Island	6/25/2015	ABA DASH	Variable milfoil	2	AB AQUATICS
NE side of narrows	6/26/2015	ABA DASH	Variable milfoil	23	AB AQUATICS
E of Narrows	6/30/2015	ABA DASH	Variable milfoil	26	AB AQUATICS
Area Surrounding Bridge	7/2/2015	ABA DASH	Variable milfoil	4	AB AQUATICS
Lobster Cove	7/3/2015	ABA DASH	Variable milfoil	0	AB AQUATICS
CANAL BY CAMPGROUND	7/20/2015	ABA DASH	Variable milfoil	8	AB AQUATICS
BOULDER COVE	7/21/2015	ABA DASH	Variable milfoil	10	AB AQUATICS
MOUTH OF CANAL BY CAMPGROUND	7/22/2015	ABA DASH	Variable milfoil	4	AB AQUATICS
WESTERN SHORE/16F	7/23/2015	ABA DASH	Variable milfoil	8	AB AQUATICS
GOVERNOR'S ISLAND	7/24/2015	ABA DASH	Variable milfoil	30	AB AQUATICS
BOULDER COVE	7/27/2015	ABA DASH	Variable	6	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
			milfoil		
LOBSTER COVE	7/28/2015	ABA DASH	Variable milfoil	4	AB AQUATICS
LOBSTER COVE/JOHNSONS COVE	7/29/2015	ABA DASH	Variable milfoil	22	AB AQUATICS
NARROWS	7/30/2015	ABA DASH	Variable milfoil	20	AB AQUATICS
Blueberry Circle	8/12/2015	ABA DASH	Variable milfoil	20	AB AQUATICS
TAYLOR BROOK	8/13/2015	ABA DASH	Variable milfoil	14	AB AQUATICS
Zone 12	8/14/2015	ABA DASH	Variable milfoil	40	AB AQUATICS
S of Red Buoy in Zone 16e	8/17/2015	ABA DASH	Variable milfoil	40	AB AQUATICS
Boulder Cove	8/18/2015	ABA DASH	Variable milfoil	24	AB AQUATICS
Blueberry Circle	8/19/2015	ABA DASH	Variable milfoil	16	AB AQUATICS
Zone 16h	8/20/2015	ABA DASH	Variable milfoil	16	AB AQUATICS
Governors Island, Zone 16i	8/21/2015	ABA DASH	Variable milfoil	8	AB AQUATICS
Zone 10A heading N towards channel	9/8/2015	ABA DASH	Variable milfoil	90	AB AQUATICS
Zone 16J	9/9/2015	ABA DASH	Variable milfoil	30	AB AQUATICS
Zone 5B	9/16/2015	ABA DASH	Variable milfoil	30	AB AQUATICS
Eastern Shoreline at Zone 14B	9/17/2015	ABA DASH	Variable milfoil	50	AB AQUATICS
Zone 4A	9/18/2015	ABA DASH	Variable milfoil	30	AB AQUATICS
Boulder Cove	9/21/2015	ABA DASH	Variable milfoil	20	AB AQUATICS
Zone 16I	9/22/2015	ABA DASH	Variable milfoil	30	AB AQUATICS
Zone 14A	9/23/2015	ABA DASH	Variable milfoil	20	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Zone 16E	9/24/2015	ABA DASH	Variable milfoil	4	AB AQUATICS
Area 12, 13A, 13B (Back shore of lake)	9/28/2015	ABA DASH	Variable milfoil	32	AB AQUATICS
Area 16A (eastern side of island)	9/29/2015	ABA DASH	Variable milfoil	4	AB AQUATICS
Area 16A, 1A (Eastern side of island, and lobster cove)	10/1/2015	ABA DASH	Variable milfoil	8.6	AB AQUATICS
Channel	5/16/2016	DASH	Variable milfoil	5	AB AQUATICS
N side Governer's Island	5/16/2016	DASH	Variable milfoil	20	AB AQUATICS
George's Island	5/16/2016	DASH	Variable milfoil	5	AB AQUATICS
NW Cove of Channel	5/17/2016	DASH	Variable milfoil	40	AB AQUATICS
Narrows	5/18/2016	DASH	Variable milfoil	60	AB AQUATICS
W side of cove, S of public beach	6/1/2016	DASH	Variable milfoil	32	AB AQUATICS
E shore Lobster C. to S most island	6/1/2016	DASH	Variable milfoil	5	AB AQUATICS
Launch C. Pt. E to Boulder C.	6/1/2016	DASH	Variable milfoil	12	AB AQUATICS
W inlet of Boulder Cove	6/2/2016	DASH	Variable milfoil	60	AB AQUATICS
Boulder Cove	6/3/2016	DASH	Variable milfoil	10	AB AQUATICS
SE shore of Governers Island x from Lobster C.	6/3/2016	DASH	Variable milfoil	2	AB AQUATICS
Channel, N shoreline Governors Island	6/20/2016	DASH	Variable milfoil	55	AB AQUATICS
W shoreline Governors Island	6/21/2016	DASH	Variable milfoil	50	AB AQUATICS
W shoreline opposite of	6/22/2016	DASH	Variable milfoil	38	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Governors Island					
Mainland shore N of bridge @ Governors Island	6/22/2016	DASH	Variable milfoil	5	AB AQUATICS
E side of Narrows	6/23/2016	DASH	Variable milfoil	40	AB AQUATICS
The narrows	6/27/2016	DASH	Variable milfoil	30	AB AQUATICS
N shoreline Campground Cove to sm' inlet N	6/28/2016	DASH	Variable milfoil	28	AB AQUATICS
N m'land shore channel W to Blueberry Cle	6/29/2016	DASH	Variable milfoil	8	AB AQUATICS
N end Lobster C. to islands to boulders	6/30/2016	DASH	Variable milfoil	17	AB AQUATICS
Loon Island	7/11/2016	DASH	Variable milfoil	116	AB AQUATICS
Taylor Brook	7/12/2016	DASH	Variable milfoil	5	AB AQUATICS
Chases Grove Inlet	7/12/2016	DASH	Variable milfoil	1	AB AQUATICS
Channel Inlet/Blueberry Cove	7/12/2016	DASH	Variable milfoil	10	AB AQUATICS
Narrows	7/13/2016	DASH	Variable milfoil	18	AB AQUATICS
N tip Governor's Island to Narrows	7/14/2016	DASH	Variable milfoil	68	AB AQUATICS
Johnson's Cove	7/15/2016	DASH	Variable milfoil	20	AB AQUATICS
Whole-Lake Survey/Dive	8/8/2016	DASH	Variable milfoil	132.2	AB AQUATICS
Lobster cove	8/15/2016	Survey	Variable milfoil	10	AB AQUATICS
Narrows	8/16/2016	DASH	Variable milfoil	12	AB AQUATICS
Boulder Cove	8/17/2016	DASH	Variable milfoil	56	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Boulder Cove	8/18/2016	DASH	Variable milfoil	34	AB AQUATICS
Johnson's Cove	8/19/2016	Survey	Variable milfoil	20	AB AQUATICS
The Channel, W shore Governor's Island center channel	8/22/2016	DASH	Variable milfoil	10	AB AQUATICS
E shore Governor's Island in Johnson's cove	8/23/2016	DASH	Variable milfoil	10	AB AQUATICS
W shore Governor's Island	8/24/2016	DASH	Variable milfoil	15	AB AQUATICS
Boulder Cove, BE Shore Governor's Island, Campground Cove, Narrows	8/31/2016	DASH	Variable milfoil	25	AB AQUATICS
Collette's Grove and Johnson's Cove	9/1/2016	DASH	Variable milfoil	5	AB AQUATICS
The Channel, George's Island, Narrows	10/3/2016	DASH	Variable milfoil	10	AB AQUATICS
Johnsons Cove	10/4/2016	DASH	Variable milfoil	3	AB AQUATICS
Boulder Cove	10/4/2016	DASH	Variable milfoil	3	AB AQUATICS
W shore Governors Island Near Red Marker	10/4/2016	DASH	Variable milfoil	14	AB AQUATICS
West and East side of the narrows	10/5/2016	DASH	Variable milfoil	10	AB AQUATICS
Campground Cove	10/5/2016	DASH	Variable milfoil	2	AB AQUATICS
The Channel, Blueberry Circle and Goc Island	5/17/2017	DASH	variable milfoil	40	AB AQUATICS
W shore of Narrow	5/18/2017	DASH	Variable milfoil	20	AB AQUATICS
W shore of Narrow	5/19/2017	DASH	Variable	26	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
			milfoil		
Gov Island; E Shore over N end to W shore	5/22/2017	DASH	Variable milfoil	20	AB AQUATICS
Gov Island; W shore head S towards red spar	5/23/2017	DASH	Variable milfoil	24	AB AQUATICS
Johnson's Cove	5/24/2017	DASH	Variable milfoil	28	AB AQUATICS
E SHORE OF THE NARROWS	5/25/2017	DASH	Variable milfoil	16	AB AQUATICS
NARROWS W SHORE	5/30/2017	DASH	Variable milfoil	20	AB AQUATICS
START IN BOULDER COVE WORKING THROUGH AREA	5/31/2017	DASH	Variable milfoil	20	AB AQUATICS
BOULDER COVE, LOBSTER COVE, BRIDGE AREA	6/1/2017	DASH	Variable milfoil	20	AB AQUATICS
Campground cove and inlet	6/12/2017	DASH	Variable milfoil	10	AB AQUATICS
Cove E Channel and tween George's Gov	6/13/2017	DASH	Variable milfoil	10	AB AQUATICS
Lobster Cove	6/14/2017	dash	Variable milfoil	4	AB AQUATICS
Loon Island; Escumbuit I; Chase's Grove	6/14/2017	DASH	Variable milfoil	40	AB AQUATICS
Loon I; E. Sh' Chase's Grove; Benthic Barr'	6/15/2017	DASH	Variable milfoil	4	AB AQUATICS
Chase's G; Taylor's Br'; SW corner Brook	6/16/2017	DASH	Variable milfoil	0	AB AQUATICS
Entered Dam C; behind sheep island; near Johnson's Cove	8/8/2017	DASH	Variable milfoil	10	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
North shore Johnson's cove; East shore Governor's Island	8/8/2017	DASH	Variable milfoil	4	AB AQUATICS
Various reported spots and cove North of channel	8/9/2017	DASH	Variable milfoil	10	AB AQUATICS
Transition from channel to NW shore of Governor's Island	8/9/2017	DASH	Variable milfoil	2	AB AQUATICS
Vein channel and campground, markers of South dam C, small coe near George's Island	8/10/2017	DASH	Variable milfoil	8	AB AQUATICS
West shore Campground C heading into channel	8/10/2017	DASH	Variable milfoil	4	AB AQUATICS
Boulder cove	8/14/2017	DASH	Variable milfoil	18	AB AQUATICS
West shore of Narrows and George's Island	8/15/2017	DASH	Variable milfoil	8	AB AQUATICS
Conley's Cove	8/16/2017	DASH	Variable milfoil	5	AB AQUATICS
Taylor's Brook, Germantown Inlet	8/16/2017	DASH	Variable milfoil	0	AB AQUATICS
SE cove of Johnson's Cove, Lobster Cove, Boulder Cove	8/17/2017	DASH	Variable milfoil	4	AB AQUATICS
East shore of Campground Cove and South into East shore of Narrows	8/18/2017	DASH	Variable milfoil	16	AB AQUATICS
Narrows	8/21/2017	DASH	Variable milfoil	12	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Boulder Cove & Johnson's Cove	8/22/2017	DASH	Variable milfoil	6	AB AQUATICS
Cove within channel and West shore of Governor's Island	8/22/2017	DASH	Variable milfoil	2	AB AQUATICS
West Shore of Govenor's Island	8/23/2017	DASH	Variable milfoil	8.4	AB AQUATICS
VARIOUS	8/23/2017	DASH	Variable Milfoil and Fanwort	200	AB AQUATICS
West Shore of Govenor's Island	8/24/2017	DASH	Variable milfoil	6	AB AQUATICS
16 E, F, & G NE end Governors Island	6/4/2018	DASH	Variable milfoil	0	AB AQUATICS
13 b Campground Cove	6/5/2018	DASH	Variable milfoil	10	AB AQUATICS
14 B NW coast Governors Island	6/5/2018	DASH	Variable milfoil	0	AB AQUATICS
13B SE Corner	6/6/2018	DASH	Variable milfoil	10	AB AQUATICS
14 B Islands of SE corner of Governors Island	6/6/2018	DASH	Variable milfoil	0	AB AQUATICS
15 A, B, &1B ESE Governors I. into E cove	6/7/2018	DASH	Variable milfoil	10	AB AQUATICS
16 A E of Escumbuit Island	6/7/2018	DASH	Variable milfoil	0	AB AQUATICS
Site 2 North end	8/20/2018	DASH	variable milfoil	20	AB AQUATICS
Site 2 North end	8/20/2018	DASH	variable milfoil	20	AB AQUATICS
Site 1 NE end	8/21/2018	DASH	Variable milfoil	20	AB AQUATICS
Site 1 NH end	8/21/2018	DASH	Variable milfoil	20	AB AQUATICS
Boulder cove	8/22/2018	DASH	Variable milfoil	20	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Island in front of Conley's Grove Road	8/22/2018	DASH	Variable milfoil	80	AB AQUATICS
Escumbuit Island	8/23/2018	DASH	Variable milfoil	50	AB AQUATICS
Boulder Cove	8/23/2018	DASH	Variable milfoil	10	AB AQUATICS
Campground Cove	8/24/2018	DASH	Variable milfoil	20	AB AQUATICS
Mills Shore Road Cove	8/24/2018	DASH	Variable milfoil	5	AB AQUATICS
lobster cove	8/28/2018	DASH	Variable milfoil	20	AB AQUATICS
boulder cove	8/28/2018	DASH	Variable milfoil	10	AB AQUATICS
boulder cove	8/29/2018	DASH	Variable milfoil	20	AB AQUATICS
stickney road cove	8/30/2018	DASH	Variable milfoil	10	AB AQUATICS
taylor brook	8/30/2018	DASH	Variable milfoil	0.01	AB AQUATICS
island pond stream	8/30/2018	DASH	Variable milfoil	0.01	AB AQUATICS
sand bar area	8/31/2018	DASH	Variable milfoil	10	AB AQUATICS
Northeast lily pad area	8/31/2018	DASH	Variable milfoil	0	AB AQUATICS
Campground cove and narrows	8/31/2018	DASH	Variable milfoil	0	AB AQUATICS
Western shore of Narrows	9/25/2018	DASH	Variable milfoil	20	AB AQUATICS
Western shore of Narrows	9/26/2018	DASH	Variable milfoil	20	AB AQUATICS
Western shore of Narrows	9/27/2018	DASH	Variable milfoil	20	AB AQUATICS
NNW side Governor's Island	9/28/2018	DASH	Variable milfoil	20	AB AQUATICS
WNW side Governor's Island	9/29/2018	DASH	Variable milfoil	15	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
"Channel" area, Blueberry Circle, Governor's Island E shoreline	5/28-31/2019	DASH	Variable milfoil	60	AB AQUATICS
15B North of bridge	6/3/2019	DASH	Variable milfoil	5	AB AQUATICS
14B South of Campground Cove	6/3/2019	DASH	Variable milfoil	5	AB AQUATICS
Campground Cove	6/4/2019	DASH	Variable milfoil	5	AB AQUATICS
E most shore of cove, S of canal	6/4/2019	DASH	Variable milfoil	0	AB AQUATICS
Sand bar cove	6/4/2019	DASH	Variable milfoil	0	AB AQUATICS
16A Beginning of Johnson Cove E side of Big Island	6/5/2019	DASH	Variable milfoil	0	AB AQUATICS
Near bridge, N shore of cove	6/5/2019	DASH	Variable milfoil	5	AB AQUATICS
15B S shore of Johnson Cove	6/6/2019	DASH	Variable milfoil	0	AB AQUATICS
2B-3 N most area of Boulder Cove	6/6/2019	DASH	Variable milfoil	0	AB AQUATICS
Around outside of Boulder Cove, around island	6/6/2019	DASH	Variable milfoil	0.2	AB AQUATICS
Spars, entrance to Boulder Cove	6/7/2019	DASH	Variable milfoil	2	AB AQUATICS
10B channel, shallow channel to W main island	6/7/2019	DASH	Variable milfoil	0	AB AQUATICS
8 channel	6/7/2019	DASH	Variable milfoil	0	AB AQUATICS
Escumbit I., 4 spars SE of island	6/7/2019	DASH	Variable milfoil	30	AB AQUATICS
Channel	8/19/2019	DASH	Variable milfoil	40	AB AQUATICS
Channel	8/20/2019	DASH	Variable milfoil	100	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Channel	8/20/2019	DASH	Variable milfoil	20	AB AQUATICS
Johnson's Cove	8/21/2019	DASH	Variable milfoil	20	AB AQUATICS
Johnson's Cove	8/21/2019	DASH	Variable milfoil	15	AB AQUATICS
Northeast of Governor's Island	8/22/2019	DASH	Variable milfoil	40	AB AQUATICS
Narrows, Campground Cove, Johnson's Cove	8/22/2019	DASH	Variable milfoil	20	AB AQUATICS
Narrows, Campground Cove	8/22/2019	DASH	Variable milfoil	20	AB AQUATICS
Boulder Cove	8/23/2019	DASH	Variable milfoil	10	AB AQUATICS
Loon Island and Escumbuit Island	8/23/2019	DASH	Variable milfoil	15	AB AQUATICS
SE of Escumbuit Island	9/30/2019	DASH	Variable milfoil	20	AB AQUATICS
NW tip of Governor's Island	10/1/2019	DASH	Variable milfoil	10	AB AQUATICS
NW tip of Governor's Island, Campground Cove & Channel	10/2/2019	DASH	Variable milfoil	10	AB AQUATICS
Johnson's Cove	10/3/2019	DASH	Variable milfoil	30	AB AQUATICS
Blueberry Cove	10/3/2019	DASH	Spiny Naiad	130	AB AQUATICS
Blueberry Cove	10/4/2019	DASH	Spiny Naiad	380	AB AQUATICS
Sections 11A, 16G, 16F, Section 16F	6/10/2020	DASH	Variable milfoil	10	AB AQUATICS
Section 11A	6/11/2020	DASH	Variable milfoil	0	AB AQUATICS
Sections 16H and 16F, Section 16I	6/12/2020	DASH	Variable milfoil	70	AB AQUATICS
Sections 16J and 16K	6/16/2020	DASH	Variable milfoil	25	AB AQUATICS
Sections 16K and 15C	6/16/2020	DASH	Variable milfoil	15	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Sections 15C and 14A	6/17/2020	DASH	Variable milfoil	0	AB AQUATICS
Sections 14A and 14B	6/17/2020	DASH	Variable milfoil	30	AB AQUATICS
Sections 14C, 13A, 13B, 12	6/18/2020	DASH	Variable milfoil	5	AB AQUATICS
Section 12	6/18/2020	DASH	Variable milfoil	15	AB AQUATICS
Section 16A	6/19/2020	DASH	Variable milfoil	5	AB AQUATICS
Zone between 16A and 15A	6/19/2020	DASH	Variable milfoil	15	AB AQUATICS
Section 15A	6/22/2020	DASH	Variable milfoil	20	AB AQUATICS
Sections 1B & 2A	6/22/2020	DASH	Variable milfoil	0	AB AQUATICS
Section 17	6/23/2020	DASH	Variable milfoil	10	AB AQUATICS
Zone between 2A and 4A, next to 4B	6/23/2020	DASH	Variable milfoil	5	AB AQUATICS
Zone next to 4B and Section 4B	6/25/2020	DASH	Variable milfoil	5	AB AQUATICS
Sections 4B, 4A & 5C	6/25/2020	DASH	Variable milfoil	5	AB AQUATICS
Zone next to 5C	6/26/2020	DASH	Variable milfoil	15	AB AQUATICS
Section 8	6/26/2020	DASH	Variable milfoil	0	AB AQUATICS
Sectors 10B & 16E	6/30/2020	DASH	Variable milfoil	20	AB AQUATICS
Narrows	8/10/2020	DASH	Variable milfoil	15	AB AQUATICS
Narrows	8/11/2020	DASH	Variable milfoil	12	AB AQUATICS
Narrows	8/12/2020	DASH	Variable milfoil	40	AB AQUATICS
Narrows	8/13/2020	DASH	Variable milfoil	64	AB AQUATICS
Narrows	8/14/2020	DASH	Variable milfoil	22	AB AQUATICS
Zones 12, 13 A & B	8/18/2020	DASH	Variable	30	AB AQUATICS

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
			milfoil		
Zone 16 H & I	8/19/2020	DASH	Variable milfoil	10	AB AQUATICS
Zone 16 I	8/19/2020	DASH	Variable milfoil	20	AB AQUATICS
Zone 13A & 14B	8/20/2020	DASH	Variable milfoil	0	AB AQUATICS
Z0ne 14B & 14A	8/20/2020	DASH	Variable milfoil	10	AB AQUATICS
Zone 12A, 11A, 16G	8/21/2020	DASH	Variable milfoil	40	AB AQUATICS
NE of Boulder Cove	10/13/2020	DASH	Variable milfoil	40	AB AQUATICS
Taylor Brook	10/14/2020	DASH	Variable milfoil	40	AB AQUATICS
East side of Governors Island	10/15/2020	DASH	Variable milfoil	20	AB AQUATICS
Johnson's Cove	10/20/2020	DASH	Variable milfoil	20	AB AQUATICS
See 2021 map	8/9/2021	Tribune (Diquat)	Spiny Naiad	45.3 acres	SOLitude Lake Management
Zone 1	9/28/2021	DASH	Variable milfoil	1	AE Commercial Diving Services
Zone 2	9/29/2021	DASH	Variable milfoil	1	AE Commercial Diving Services
Zone 3	9/30/2021	DASH	Variable milfoil	5	AE Commercial Diving Services
Zone 4	10/1/2021	DASH	Variable milfoil	20	AE Commercial Diving Services
Zone 4	10/4/2021	DASH	Variable milfoil	10	AE Commercial Diving Services
Zone 4	10/5/2021	DASH	Variable milfoil	10	AE Commercial Diving Services
Zone 5	10/6/2021	DASH	Variable milfoil	8	AE Commercial Diving Services
Zone 6	10/7/2021	DASH	Variable milfoil	5	AE Commercial Diving Services
Zone 7	10/8/2021	DASH	Variable milfoil	1	AE Commercial Diving Services

LOCATION	DATE	ACTION	TARGET	ACTION (acr) or AMOUNT (GAL)	CONTRACTOR
Various	7/15/1905	DASH/diving	Variable milfoil and spiny naiad	12 days DASH and 5 days dive survey/hand harvesting	AE Commercial Diving and Sarah Patey/Jamie Burleigh

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.

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 Big Island Pond
Restricted Use Areas	Challenging due to the large amount of boating traffic and the need for ease of ingress and egress for residents within the aquatic invasive plant infested areas. Multiple areas would need to be erected and maintained.

Control Method	Use on Big Island Pond
Fragment Barrier	Challenging due to the large amount of boating traffic and the need for ease of ingress and egress for residents within the aquatic invasive plant infested areas. Multiple areas would need to be erected and maintained.
Hand-pulling	DES recommends that the individual stems or small patches of aquatic invasive plants be hand pulled when encountered, especially those encroaching on new areas. Particular emphasis should be placed on small colonies or individual stems that begin to grow outside of established areas of growth. Local Weed Control Divers should work with Weed Watchers on the pond to delineate areas that are most suitable for hand-removal of these smaller patches.
Diver-Assisted Suction Harvesting	Diver Assisted Suction Harvesting is recommended for larger patches of target aquatic invasive plants, as feasible and reasonable.
Benthic Barriers	Benthic barriers are appropriate for areas of variable milfoil growth that are less than 20' x 20' in size. It is recommended that benthic barrier use be restricted to appropriate areas where it is reasonable and feasible to use, and that the barrier not be used on a wide-scale basis in the pond to avoid problems with buoyancy and uplifting of large amounts of barrier.
Herbicides	An herbicide treatment is recommended to reduce the overall biomass of Spiny naiad, as this is new to the lake and containment and management is critical to reduce further spread. Variable milfoil growth could be managed chemically if densities reach levels where diver removal is impractical. Fanwort treatment would require nearly lakewide treatment, for likely long (2-3 month) exposure times. Widespread fanwort growth is not recommended at this time.
Extended Drawdown	Drawdown is not an effective control method for control of the aquatic invasive plants in Big Island Pond. Big Island Pond does annual deep drawdowns that expose large areas of shallows in the lake. These species are not controlled by drawdown/exposure.
Dredge	Not recommended due to nature of exotic plant distribution, the cost, and the ancillary ecological impacts that the dredge could have.
Biological Control	There are no approved biological controls for these species at this time.
No Control	The future expansion of these aquatic invasive plants is likely if no management is performed. Fanwort is already widespread and covering much of the likely available habitat. Both variable milfoil and Spiny naiad have the capacity to continue to expand in coming

Control Method	Use on Big Island Pond
	years, if no control occurs, or if inadequate controls are implemented.

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	Management Strategy	Responsible Party	Schedule
2021	Weed Watching	BIPC Weed Watchers	May through September
	Survey to guide summer control actions	NHDES	June/July
	Weed Control Diver (WCD) milfoil removal of small patches/single stems	BIPC Weed Control Divers	June through September
	Benthic barrier placement, as appropriate	BIPC/contractor	July through September
	Fragment barrier placement where/if needed	BIPC	TBD
	Herbicide treatment targeting Spiny naiad (location and timing to be determined based on germination and growth)	SOLitude Lake Management	July/August
	Late season survey for next growing season planning	NHDES	September/October
2022	Weed Watching	BIPC Weed Watchers	May through September
	Survey to guide summer control actions	NHDES	June/July
	Benthic barrier placement, as appropriate	BIPC/contractor	July through September
	Fragment barrier placement where/if needed	BIPC	TBD

Year	Management Strategy	Responsible Party	Schedule
	Herbicide treatment targeting Spiny naiad (location and timing to be determined based on germination and growth)	SOLitude Lake Management	July/August
	Late season survey for next growing season planning	NHDES	September/October
2023	Weed Watching	BIPC Weed Watchers	May through September
	Survey to guide summer control actions	NHDES	June/July
	Weed Control Diver (WCD) milfoil removal of small patches/single stems	BIPC Weed Control Divers	June through September
	Benthic barrier placement, as appropriate	BIPC/contractor	July through September
	Fragment barrier placement where/if needed	BIPC	TBD
	Herbicide treatment targeting Spiny naiad (location and timing to be determined based on germination and growth)	SOLitude Lake Management	July/August
	Late season survey for next growing season planning	NHDES	September/October
2024	Weed Watching	BIPC Weed Watchers	May through September
	Survey to guide summer control actions	NHDES	June/July
	Weed Control Diver (WCD) milfoil removal of small patches/single stems	BIPC Weed Control Divers	June through September
	Benthic barrier placement, as appropriate	BIPC/contractor	July through September
	Fragment barrier placement where/if needed	BIPC	TBD
	Herbicide treatment targeting Spiny naiad (location and timing to be determined based on germination and growth)	SOLitude Lake Management	July/August

Year	Management Strategy	Responsible Party	Schedule
	Late season survey for next growing season planning	NHDES	September/October
2025	Weed Watching	BIPC Weed Watchers	May through September
	Survey to guide summer control actions	NHDES	June/July
	Weed Control Diver (WCD) milfoil removal of small patches/single stems	BIPC Weed Control Divers	June through September
	Benthic barrier placement, as appropriate	BIPC/contractor	July through September
	Fragment barrier placement where/if needed	BIPC	TBD
	Herbicide treatment targeting Spiny naiad (location and timing to be determined based on germination and growth)	SOLitude Lake Management	July/August
	Late season survey for next growing season planning	NHDES	September/October
2026	Update and revise Long-Term Variable Milfoil Control Plan	NH DES and interested parties	Spring 2012

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 aquatic invasive plant management in this waterbody.

Figure 1: Map of Infestations

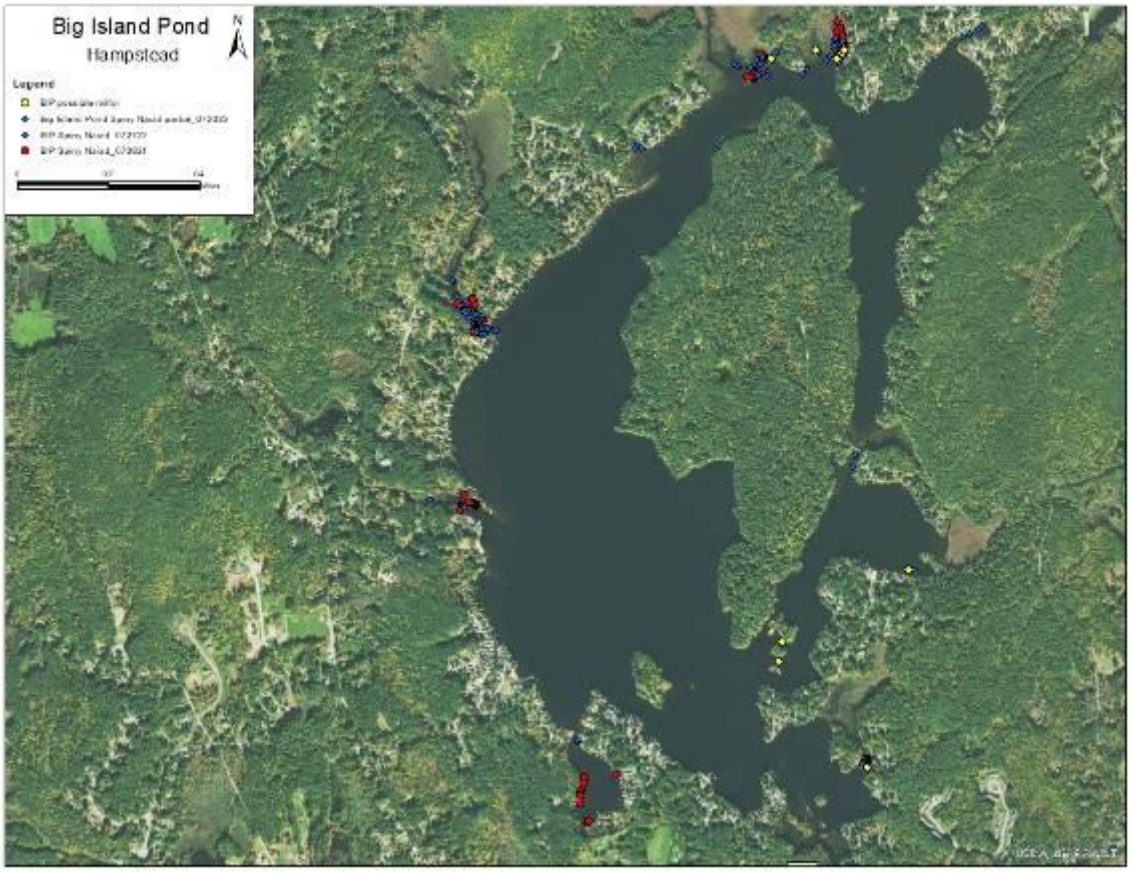
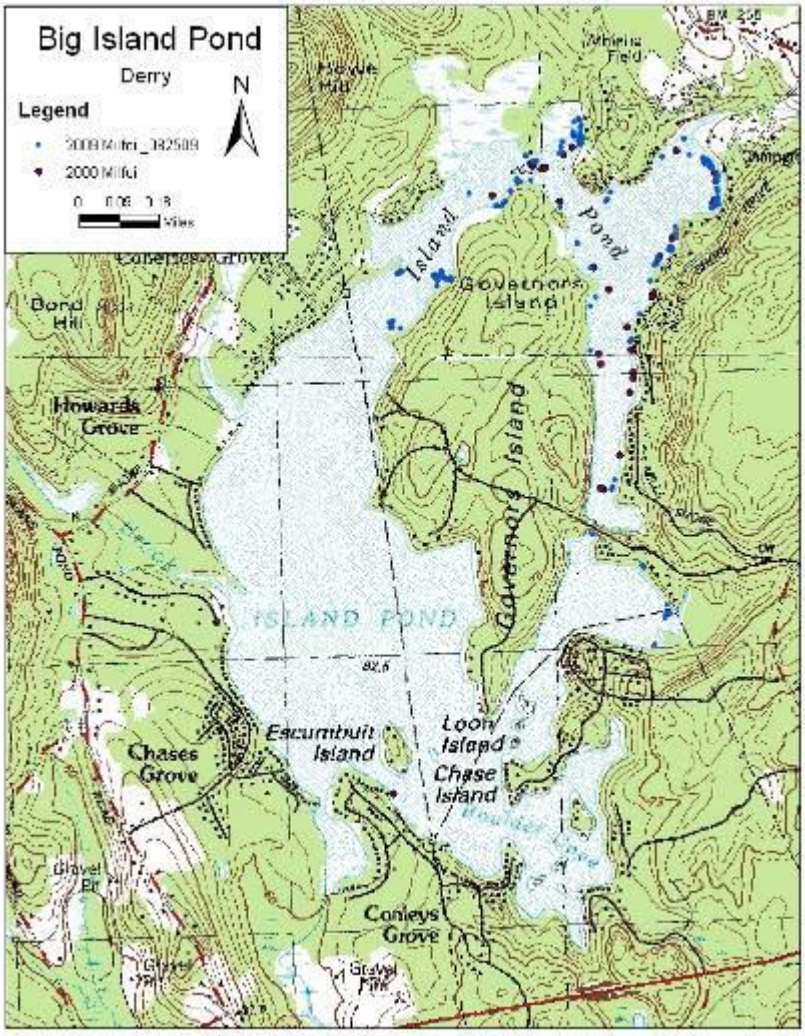
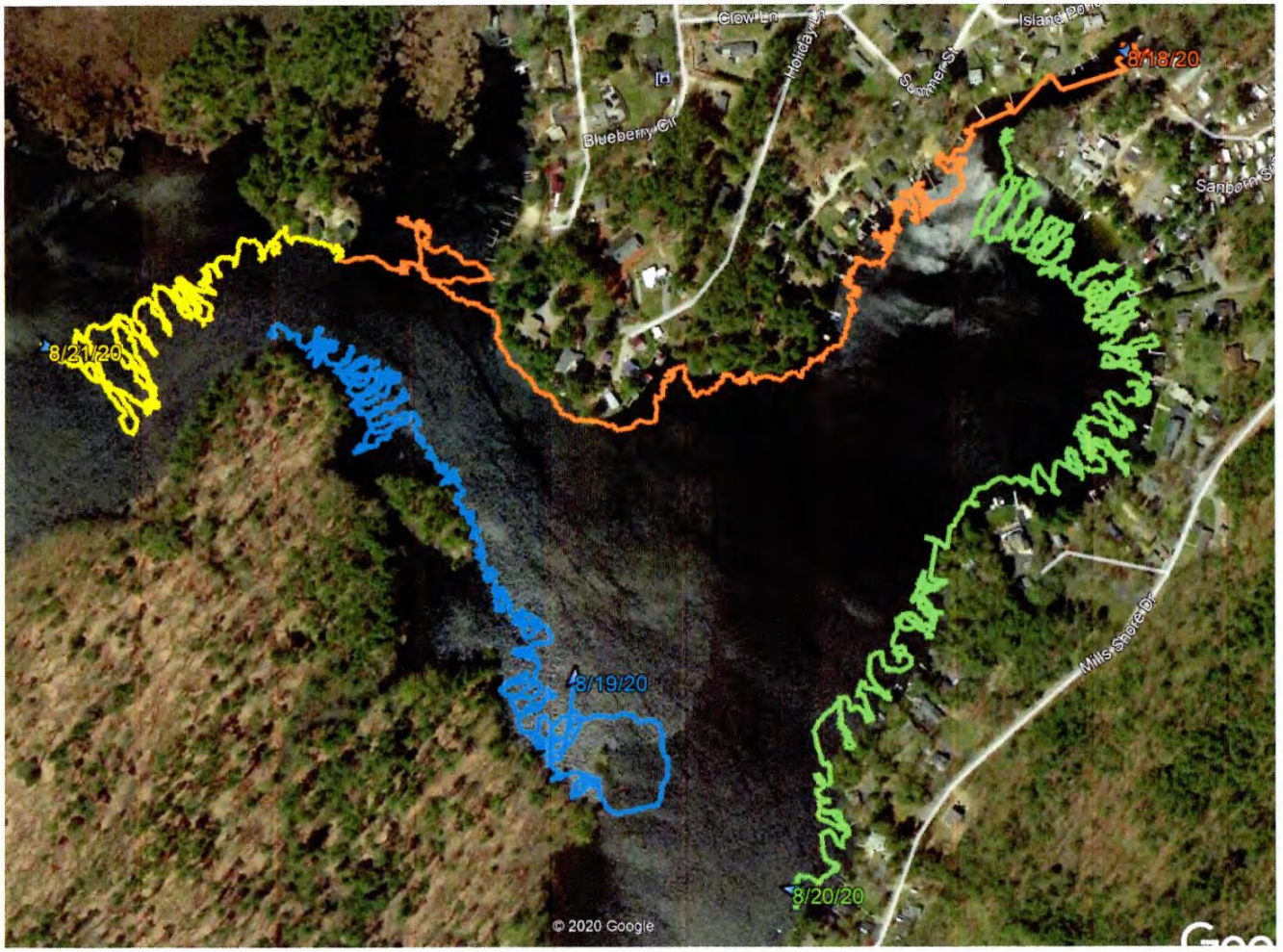


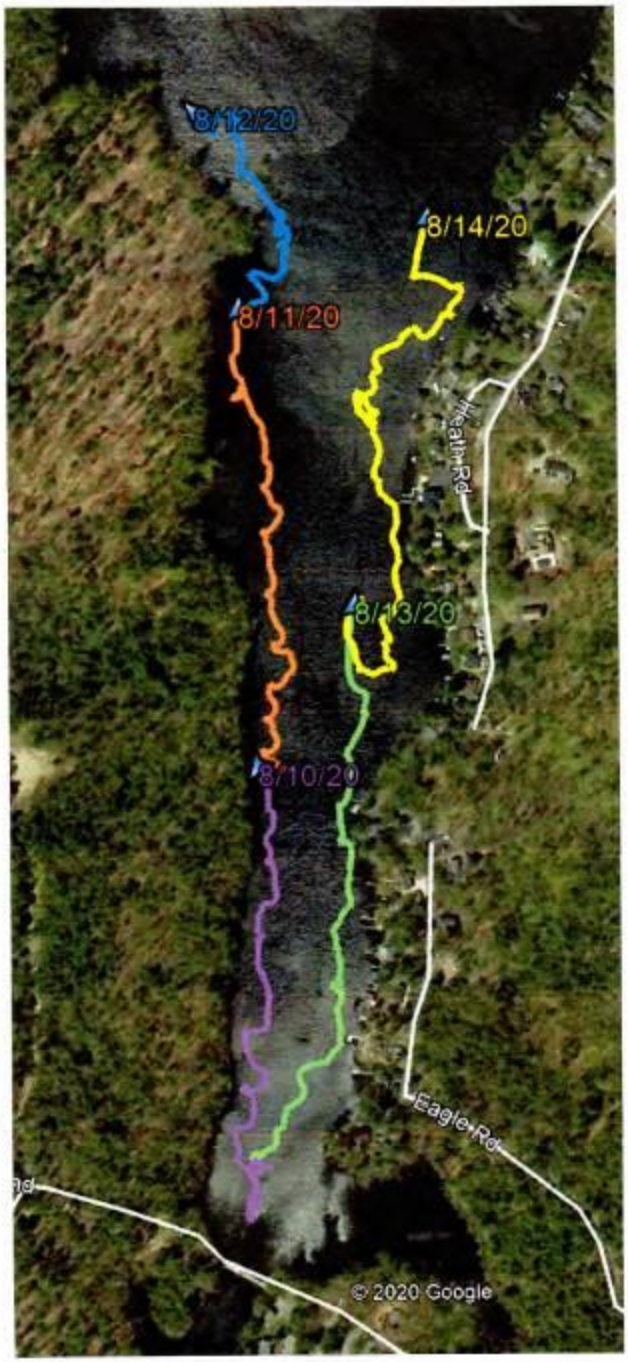
Figure 2: Map of Control Actions Over Time

2003-2021 Dive Locations (variable milfoil)

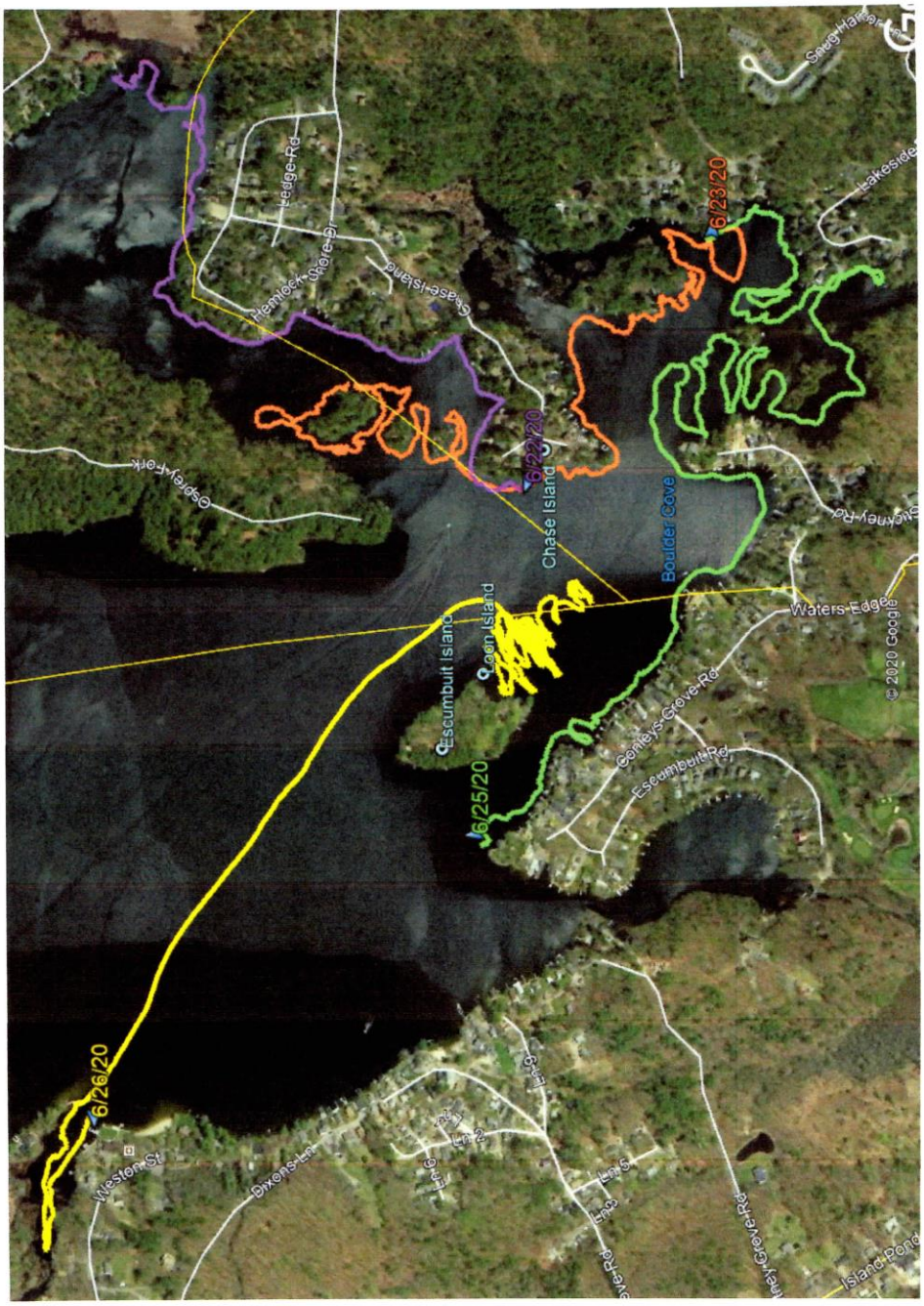


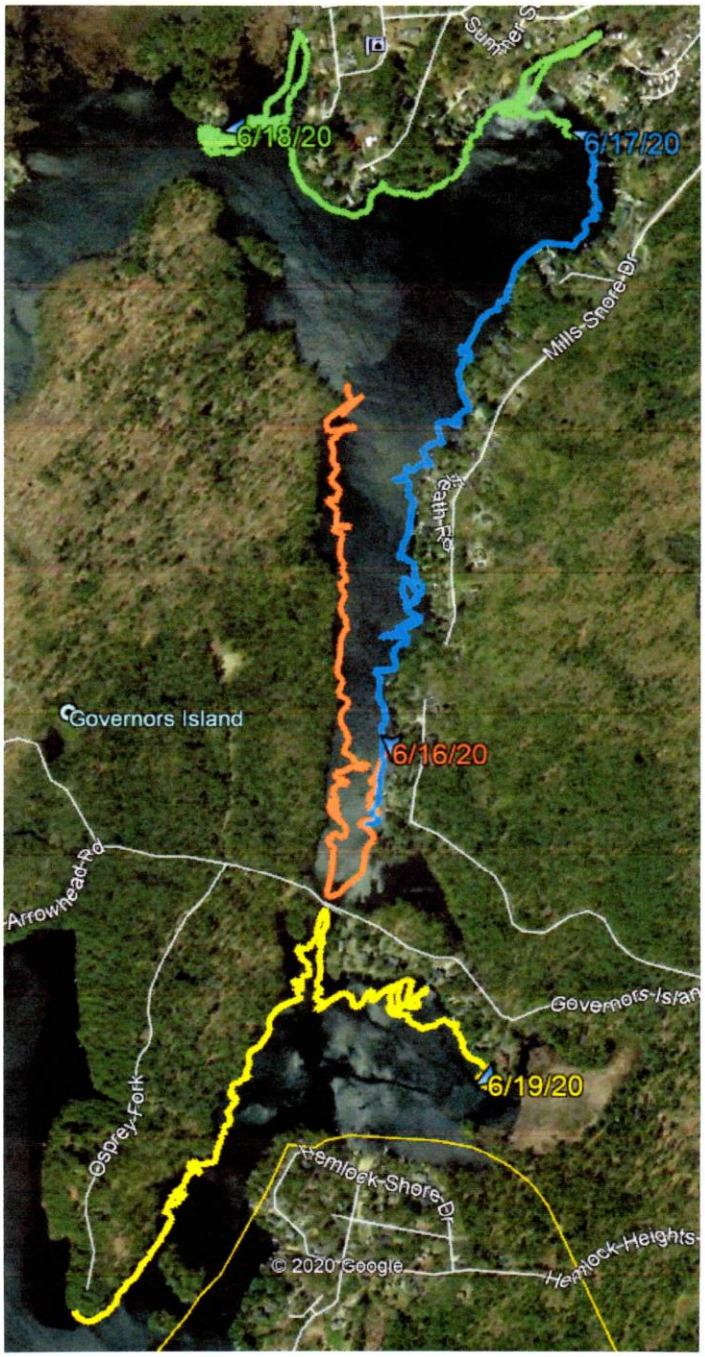
2020 Dive Maps (courtesy of AB Aquatics)

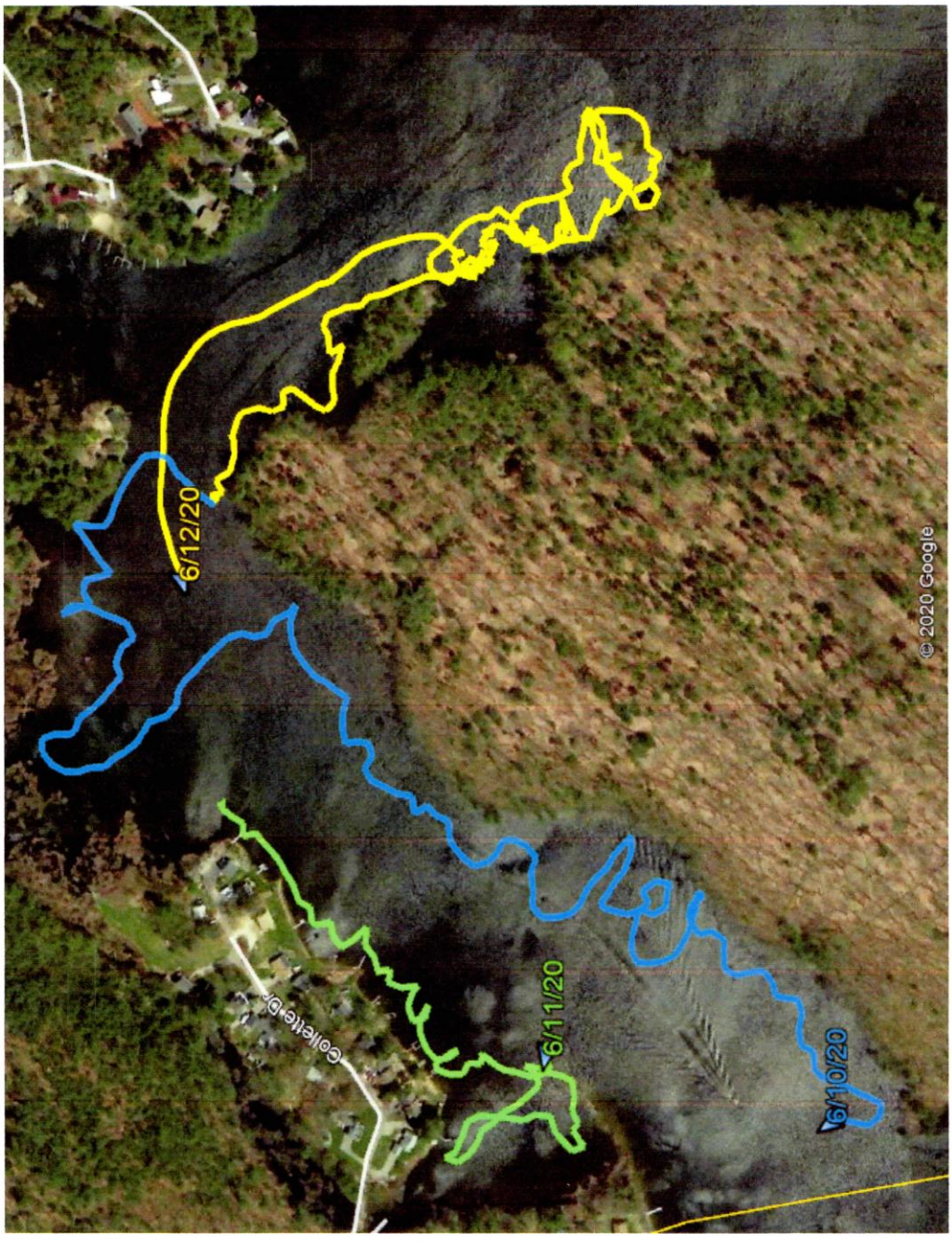

8/18/20
8/21/20
8/19/20
8/20/20
Clow Ln
Blueberry Cir
Holiday Dr
Summer St
Island Pond
Sanborn St
Mills Shore Dr
© 2020 Google


8/12/20
8/14/20
8/11/20
Heath Rd
8/13/20
8/10/20
Eagle Rd
© 2020 Google

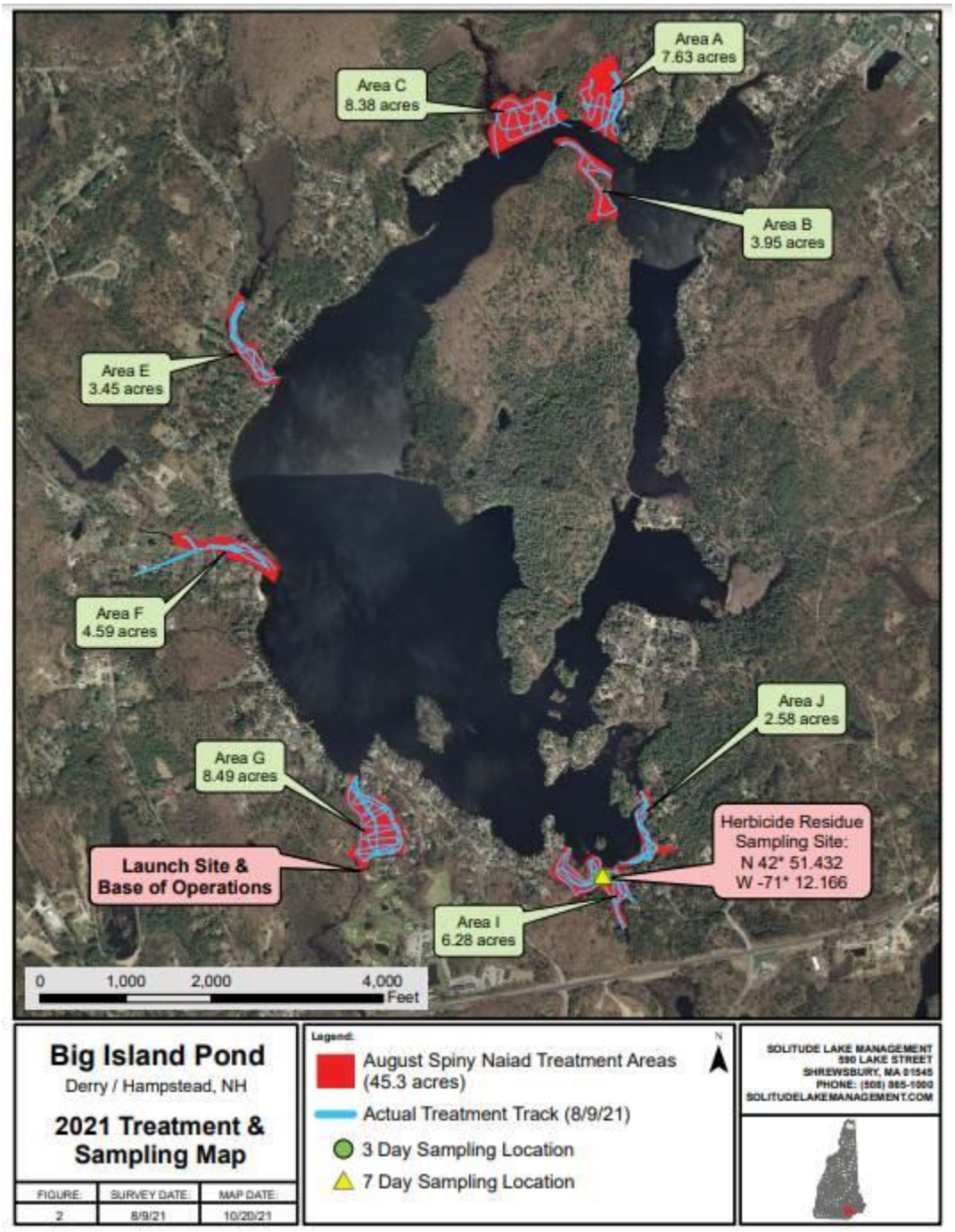
Germantown Rd
6/30/20
Governors Island
Grove Rd


6/23/20
6/22/20
6/25/20
6/26/20
Chase Island
Boulder Cove
Escumbuit Island
Loon Island
Waters Edge
Osprey Fork
Hemlock Grove Dr
Edge Rd
Chase Island
Escumbuit Rd
Gonleys Grove Rd
Weston St
Dixons Ln
Island Pond
© 2020 Google

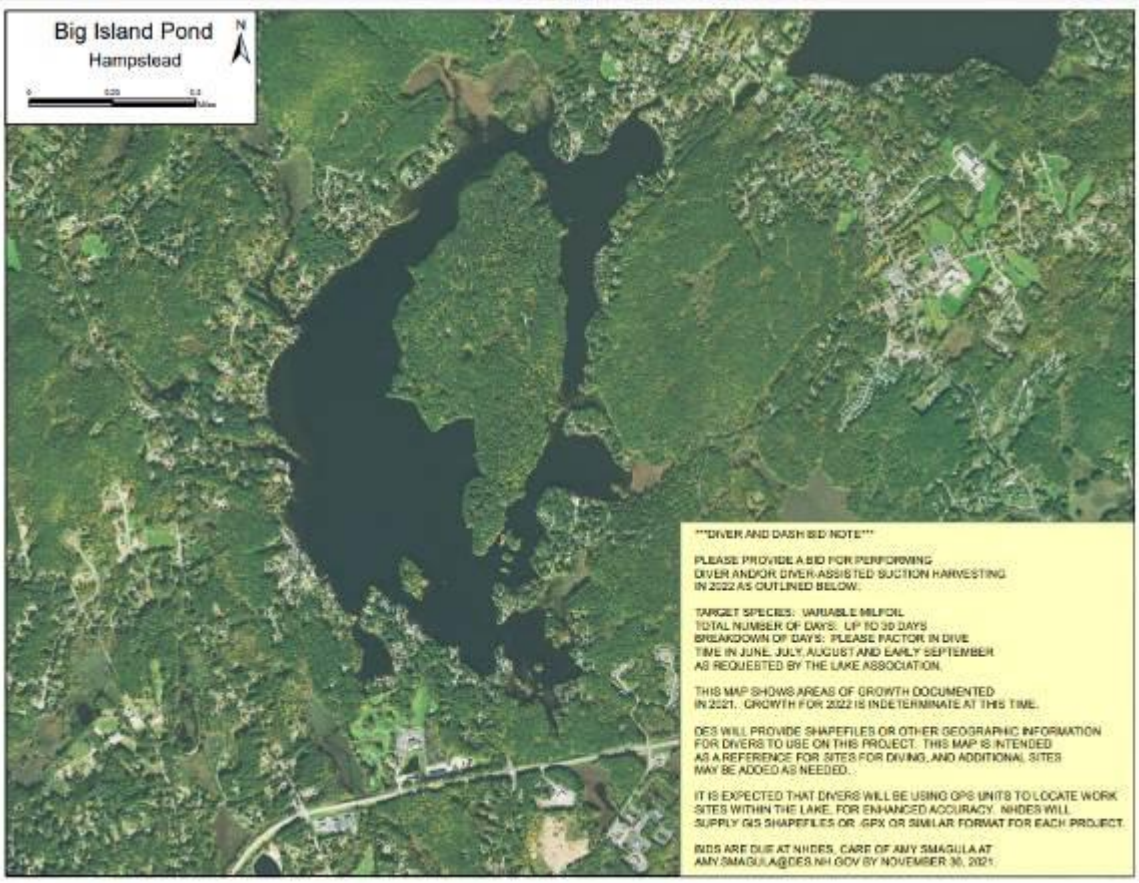

6/18/20
6/17/20
Mills Shore Dr
6/16/20
Governors Island
Arrowhead Rd
Osprey Fork
6/19/20
Hemlock Shore Dr
© 2020 Google

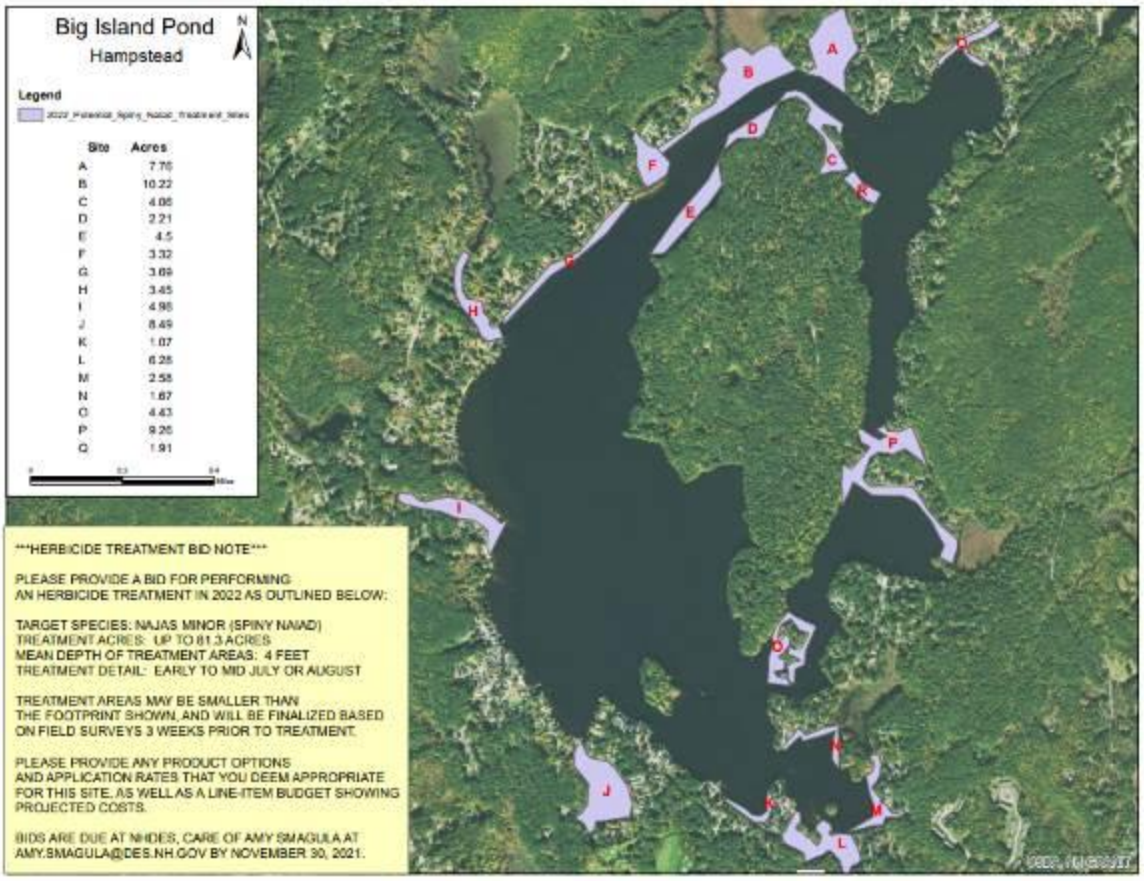

6/12/20
6/11/20
6/10/20
Collierb
© 2020 Google

2021 Actual

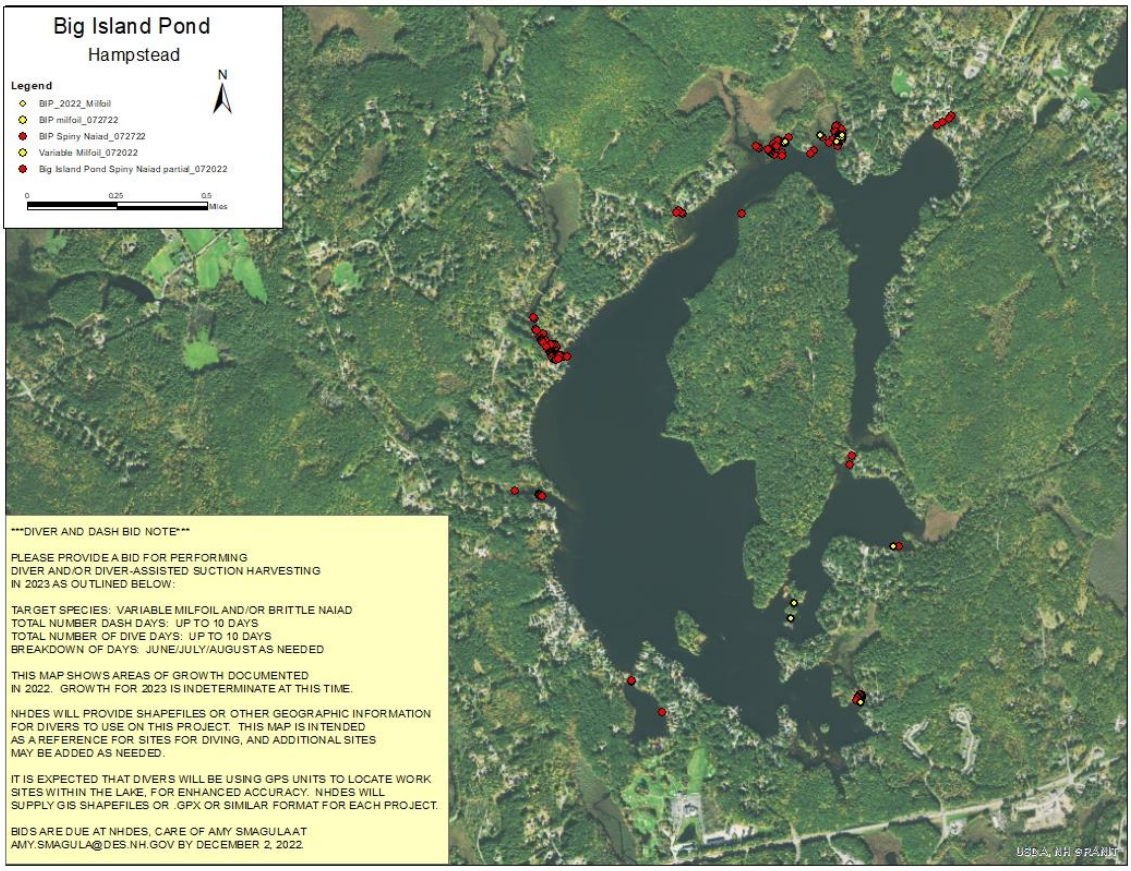

Area A
7.63 acres
Area C
8.38 acres
Area B
3.95 acres
Area E
3.45 acres
Area F
4.59 acres
Area J
2.58 acres
Area G
8.49 acres
Herbicide Residue
Sampling Site:
N 42° 51.432
W -71° 12.166
Launch Site &
Base of Operations
Area I
6.28 acres
0
1,000
2,000
4,000
Feet
Big Island Pond
Derry / Hampstead, NH
2021 Treatment &
Sampling Map
FIGURE:
2
SURVEY DATE:
8/9/21
MAP DATE:
10/20/21
Legend:
August Spiny Naiad Treatment Areas
(45.3 acres)
Actual Treatment Track (8/9/21)
3 Day Sampling Location
7 Day Sampling Location
N
SOLITUDE LAKE MANAGEMENT
590 LAKE STREET
SHREWSBURY, MA 01545
PHONE: (508) 865-1000
SOLITUDELAKEMANAGEMENT.COM

2022 Proposed





2023 Proposed


Big Island Pond
Hampstead
Legend
BIP_2022_Milfoil
BIP milfoil_072722
BIP Spiny Naiad_072722
Variable Milfoil_072022
Big Island Pond Spiny Naiad partial_072022
N
0
0.25
0.5
Miles
DIVER AND DASH BID NOTE
PLEASE PROVIDE A BID FOR PERFORMING
DIVER AND/OR DIVER-ASSISTED SUCTION HARVESTING
IN 2023 AS OUTLINED BELOW:
TARGET SPECIES: VARIABLE MILFOIL AND/OR BRITTLE NAIAD
TOTAL NUMBER DASH DAYS: UP TO 10 DAYS
TOTAL NUMBER OF DIVE DAYS: UP TO 10 DAYS
BREAKDOWN OF DAYS: JUNE/JULY/AUGUST AS NEEDED
THIS MAP SHOWS AREAS OF GROWTH DOCUMENTED
IN 2022. GROWTH FOR 2023 IS INDETERMINATE AT THIS TIME.
NHDES WILL PROVIDE SHAPEFILES OR OTHER GEOGRAPHIC INFORMATION
FOR DIVERS TO USE ON THIS PROJECT. THIS MAP IS INTENDED
AS A REFERENCE FOR SITES FOR 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 .GPX OR SIMILAR FORMAT FOR EACH PROJECT.
BIDS ARE DUE AT NHDES, CARE OF AMY SMAGULA AT
AMY.SMAGULA@DES.NH.GOV BY DECEMBER 2, 2022.
USDA, NH OF&NT

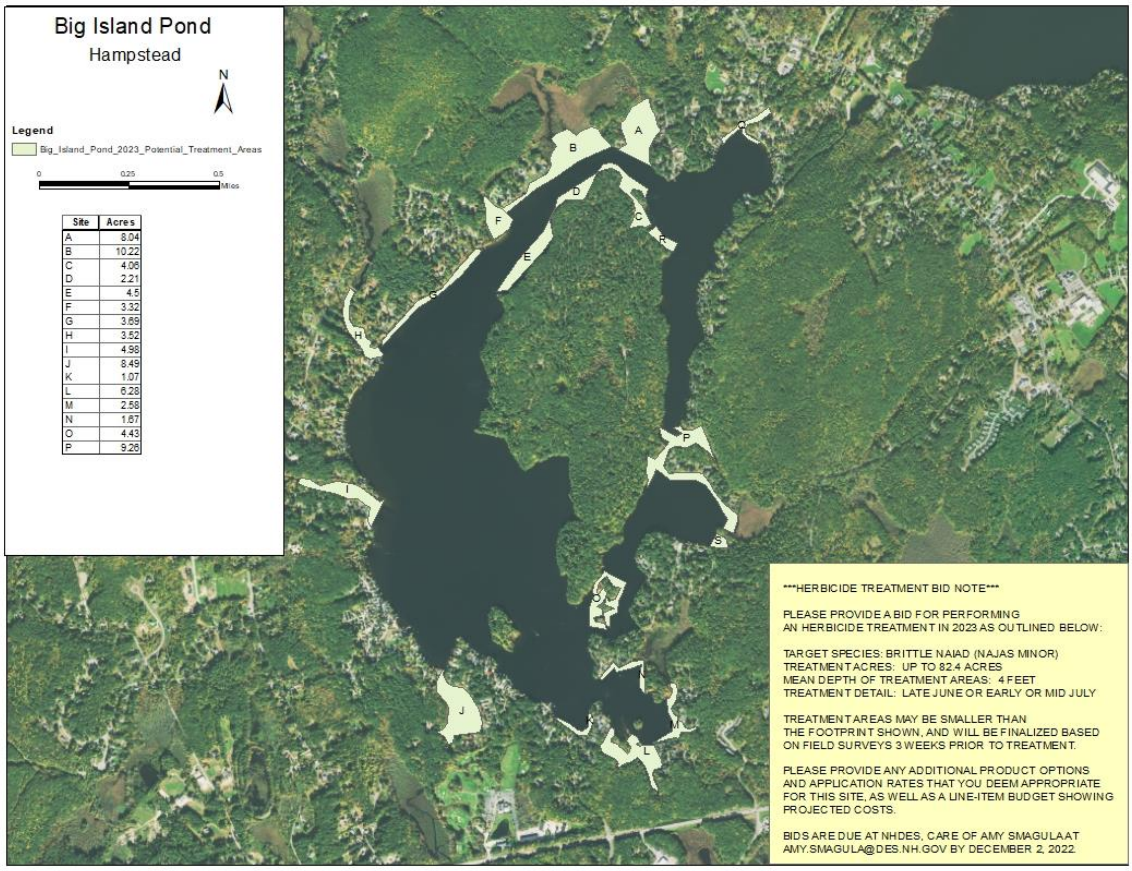
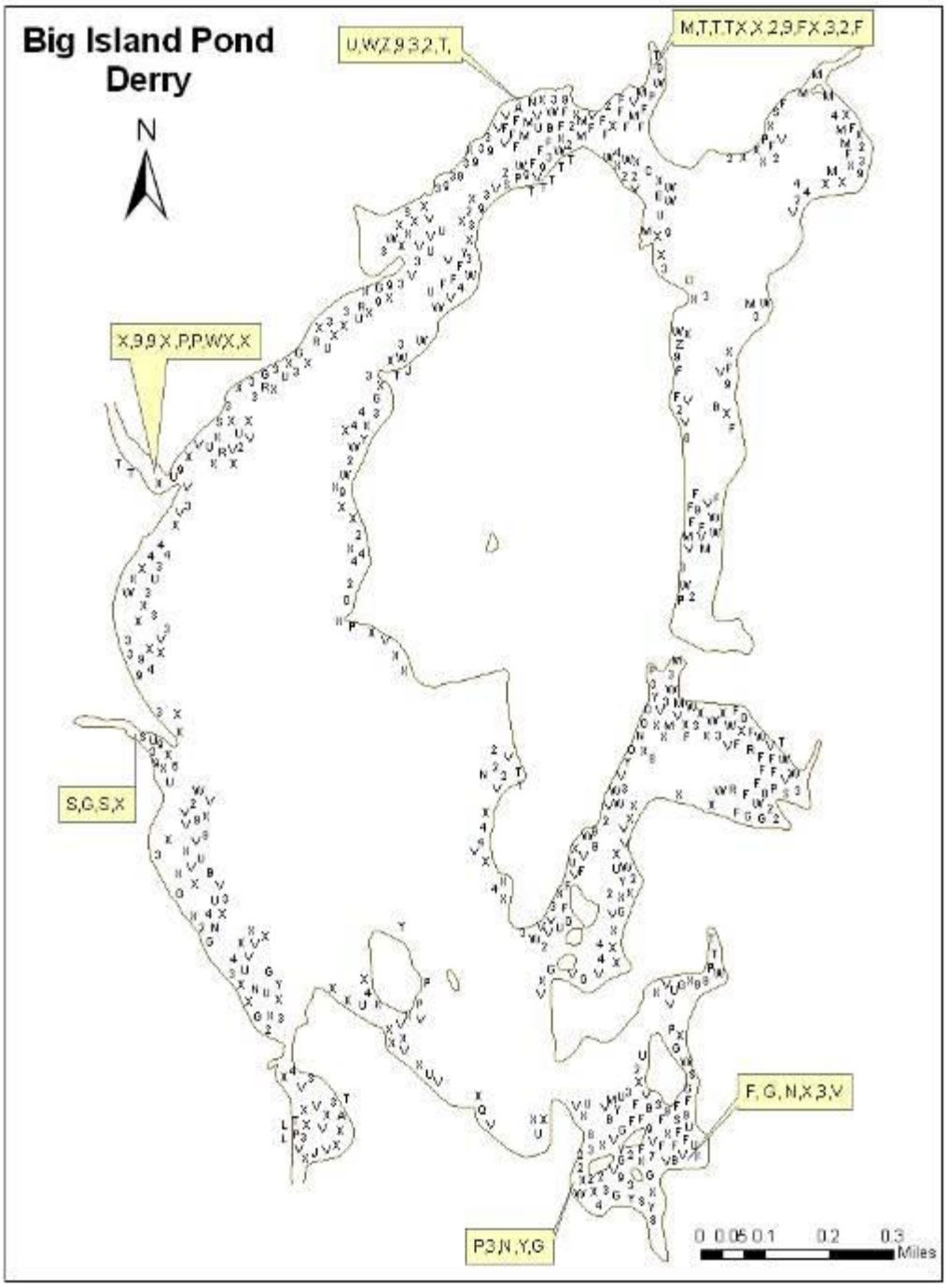

Big Island Pond
Hampstead
N
Legend
Big_Island_Pond_2023_Potential_Treatment_Areas
0
0.25
0.5
Miles
Site | Acres
A | 8.04
B | 10.22
C | 4.06
D | 2.21
E | 4.5
F | 3.32
G | 3.89
H | 3.52
I | 4.98
J | 8.49
K | 1.07
L | 6.28
M | 2.58
N | 1.67
O | 4.43
P | 9.26
HERBICIDE TREATMENT BID NOTE
PLEASE PROVIDE A BID FOR PERFORMING AN HERBICIDE TREATMENT IN 2023 AS OUTLINED BELOW:
TARGET SPECIES: BRITTLE NAIAD (NAJAS MINOR)
TREATMENT ACRES: UP TO 82.4 ACRES
MEAN DEPTH OF TREATMENT AREAS: 4 FEET
TREATMENT DETAIL: LATE JUNE OR EARLY OR MID JULY
TREATMENT AREAS MAY BE SMALLER THAN THE FOOTPRINT SHOWN, AND WILL BE FINALIZED BASED ON FIELD SURVEYS 3 WEEKS PRIOR TO TREATMENT.
PLEASE PROVIDE ANY ADDITIONAL PRODUCT OPTIONS AND APPLICATION RATES THAT YOU DEEM APPROPRIATE FOR THIS SITE, AS WELL AS A LINE-ITEM BUDGET SHOWING PROJECTED COSTS.
BIDS ARE DUE AT NHDES, CARE OF AMY SMAGULA AT AMY.SMAGULA@DES.NH.GOV BY DECEMBER 2, 2022.

Figure 3: Map of Native Aquatic Macrophytes



Key to Macrophyte Map

Symbol	Common Name	Latin Name
X	Pondweed sp.	*Potamogeton sp.*
E	Waterweed	*Elodea canadensis*
V	Tapegrass	*Vallisneria americana*
e	Pipewort	*Eriocaulon*
3	Clasping-leaf pondweed	*Potamogeton perfoliatus*
L	Purple loosestrife (non native)	*Lythrum salicaria*
4	Spotted pondweed	*Potamogeton pulcher*
N	Water naiad	*Najas sp.*
I	Iris	*Iris versicolor*
C	Musk grass	*Chara*
R	Robbins pondweed	*Potamogeton robbinssi*
T	Cattail	*Typha sp.*
W	White water-lily	*Nymphaea*
Y	Yellow water-lily	*Nuphar*
P	Pickerelweed	*Pontedaria cordata*
S	Grassy arrowhead	*Sagittaria graminea*

Figure 4: Bathymetric Map

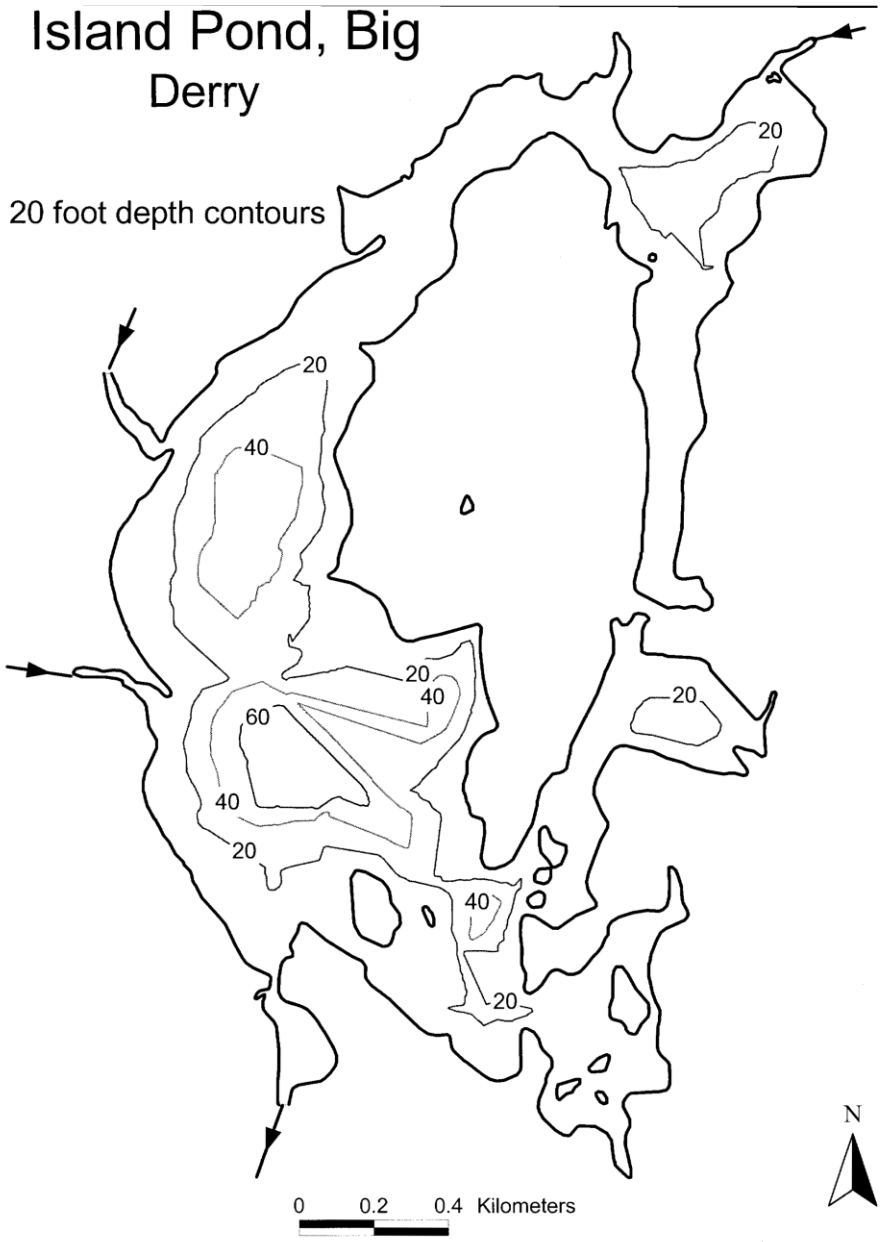


Figure 5: Critical Habitats and Conservation Areas

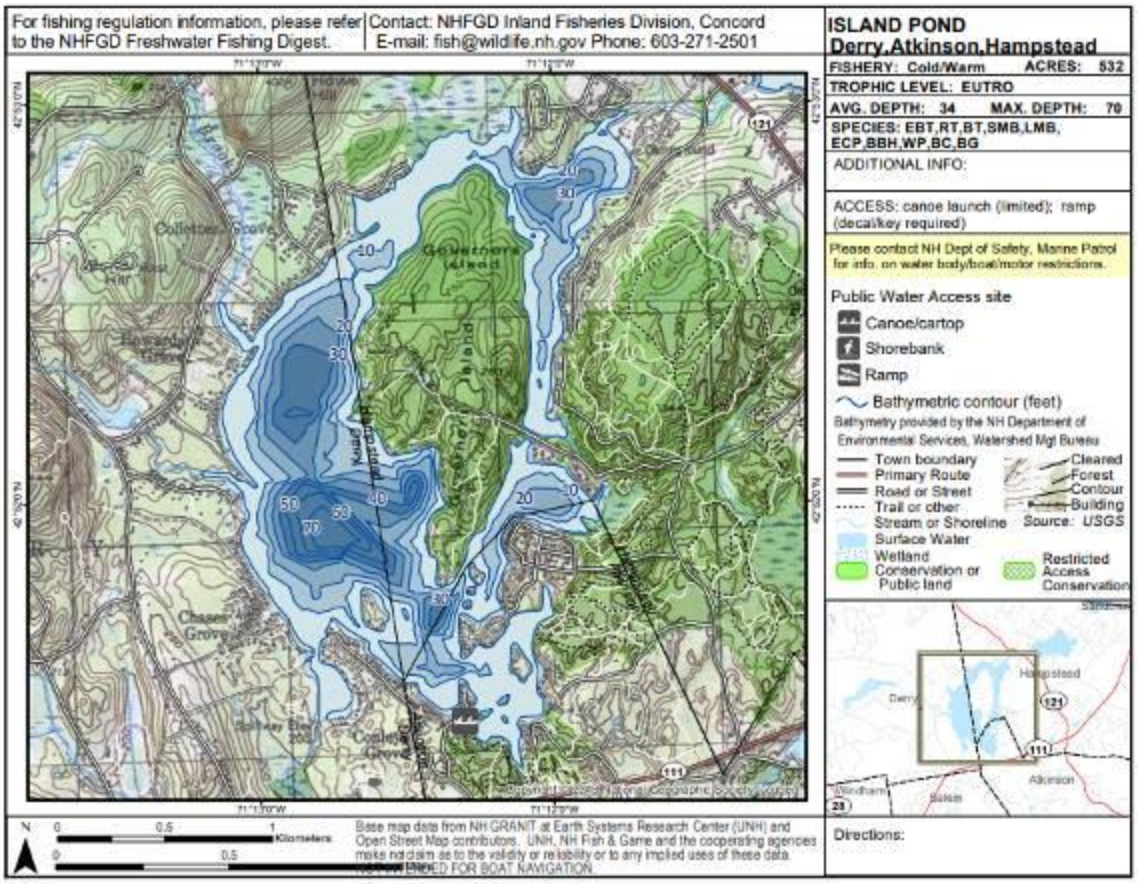


Figure 6: Public Access Site, Swim Areas

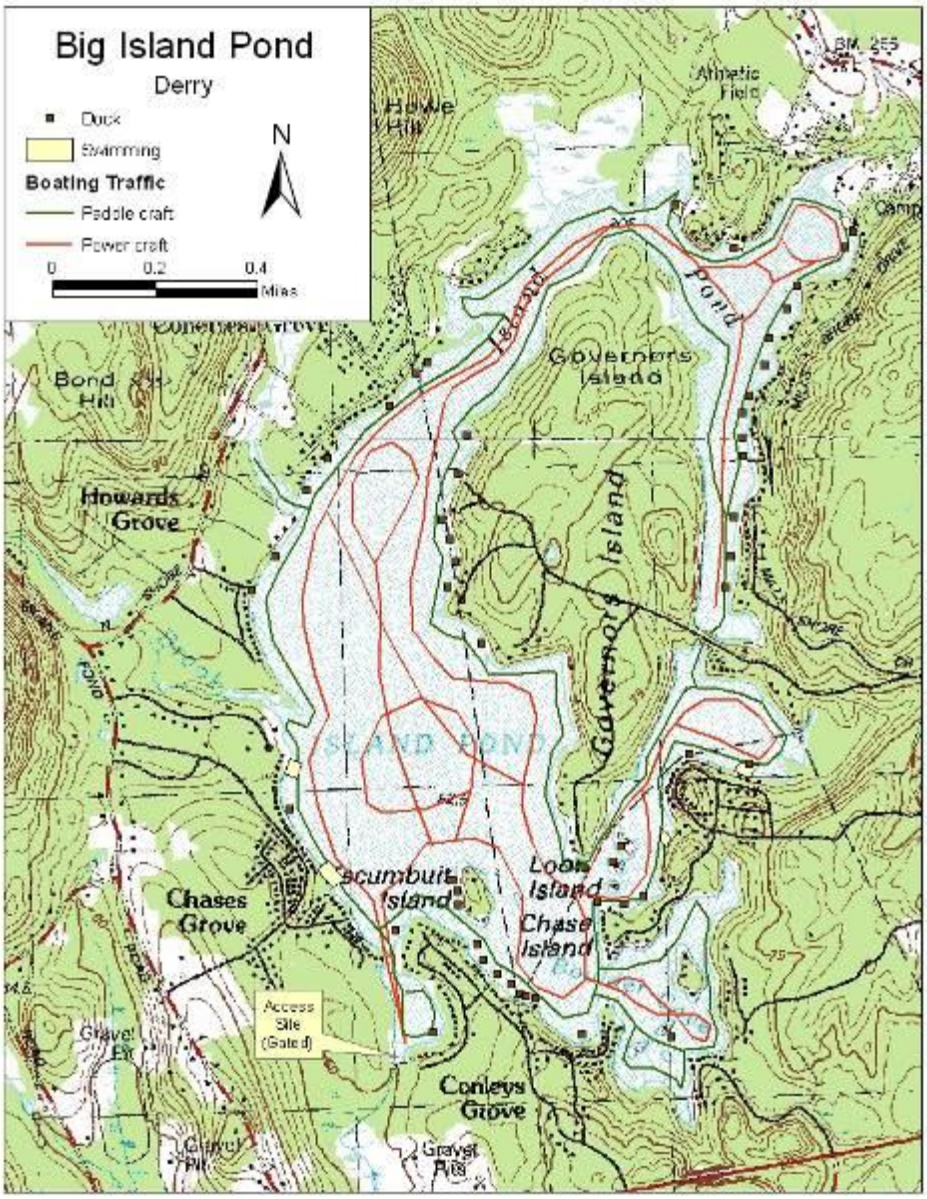
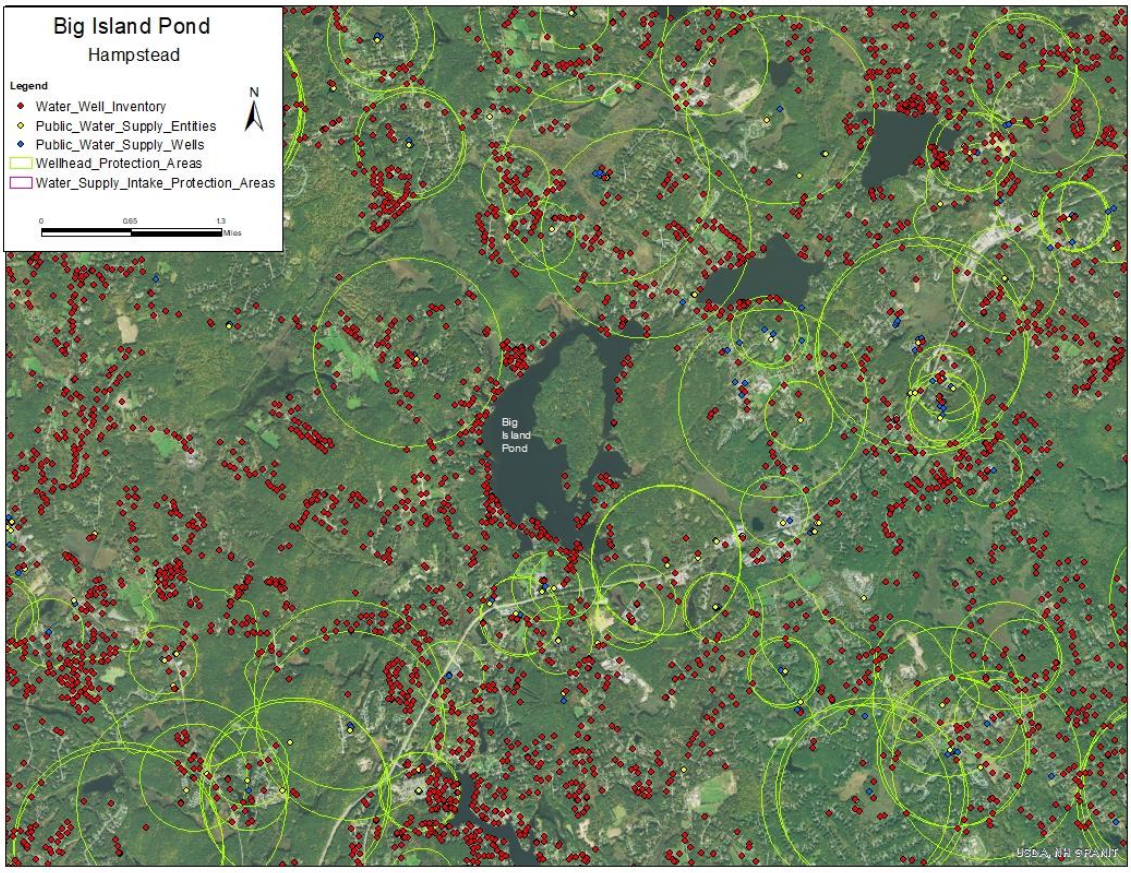


Figure 7: Wells and Water Supplies



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 Control Practices Used New Hampshire

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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