

**Long-Term Variable Milfoil Management and Control Plan for
MEREDITH BAY (NORTH END)
Meredith, New Hampshire
Belknap County**

Prepared by: New Hampshire Department of Environmental Services (DES),
February 2010

PROBLEM STATEMENT

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and ponds (Luken & Thieret, 1997, Halstead, 2000). According to the 2006 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 Env-Ws 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).

Though exotic aquatic plants can negatively impact an aquatic system, native aquatic plants are beneficial to the aquatic ecology of waterbodies, and are thus not a focus of management efforts in this waterbody. Diverse assemblages of native aquatic plants are a source of oxygen to the system, they provide stabilizing root systems to minimize erosion and turbidity, and they provide food and habitat for aquatic life.

Variable milfoil (*Myriophyllum heterophyllum*) became established in Lake Winnepesaukee in 1965 in Moultonborough Bay. From that location it has spread to most bays and coves around Lake Winnepesaukee, including Meredith Bay. With increases in disturbance to the bottom sediments and additions of silt and nutrients from the watershed runoff, variable milfoil has ample habitat to thrive in some key areas of Meredith Bay.

Figure 1 illustrates the distribution of variable milfoil in the northern tip of Meredith Bay, which is the focus of this plan. In general, variable milfoil infestations have been increasing in density over the last several years, to the point where there are inter-tangled mats of milfoil canopied on the water’s surface by mid-summer, throughout many of the shallow areas of the bay. Many of these areas serve as public or private boat launching or docking facilities, and recreational boating activities through these areas routinely fragment the milfoil and cause further spread of the plants, particularly in this high-use northern end of the bay. Hawkins Brook, which flows into Meredith Bay from the north, has also been included in this plan. The presence and density of variable milfoil within Hawkins Brook is uncertain though local reports indicate growths of this plant within the brook. A field inspection in spring 2010 will determine if management actions are needed within the brook.

In terms of the impacts of the variable milfoil in the bay area that is the focus of this management plan, there are few (ten) houses around this commercialized portion of shoreline, two hotels, three restaurants, and one private yacht club. There are roughly 15 back lots with

waterfront access. Meredith Bay is used by hundreds of boaters on a daily basis, and attracts numerous visitors by land to the water's edge. Residents, business owners and lake users have expressed concerns and complaints about floating fragments and masses of milfoil in the bay throughout the growing season, in addition to fouling of recreational gear.

PURPOSE

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

1. To identify the waterbody's beneficial use areas, including essential aquatic habitat, designated conservation zones, swimming areas, boat access sites, and boating use areas;
2. To present the aquatic macrophyte distribution map, including both native and exotic species;
3. To identify short-term and long-term exotic aquatic plant control goals that protect and conserve the lake's beneficial uses;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To recommend monitoring strategies to determine the success of the control practices over time in meeting the goals.

This plan also summarizes the current physical, biological, ecological, and chemical components of Meredith Bay and the social and ecological impacts of the milfoil infestation.

GOALS/OBJECTIVES OF MILFOIL CONTROL ACTIONS

The aquatic plant management plan for the northern end of Meredith Bay outlines actions to reduce growths of variable milfoil (*Myriophyllum heterophyllum*) while maintaining native plant communities whenever variable milfoil control actions are being implemented.

The intent of this strategic plan is to outline steps to greatly reduce variable milfoil growth in the north end of Meredith Bay over time through the use of Integrated Pest Management Strategies (IPM). Appendix A details the strategies available for waterbodies with exotic species, and provides more information on each of the activities that are recommended within this plan. Due to the widespread nature of variable milfoil within the Lake Winnepesaukee system eradication is not a reasonable goal; however, reduction of milfoil and implementation of strategies to maintain it at lower levels is reasonable.

Town Support

The Town of Meredith has been working with a number of entities to monitor and protect the bay and its watershed, and activities have included water quality sampling, invasive species monitoring, and watershed planning.

The Town of Meredith has been very supportive of variable milfoil control efforts in Meredith Bay and is working to establish a town-wide invasive species plan to both protect waters that are currently uninfested, and to control growths of exotic plants in infested waterbodies.

The town has provided matching funds to other waterbodies in town with exotic plant infestations (Lake Winnisquam in 2008), and plans to provide matching funds for a control project in the north end of Meredith Bay in 2010, and beyond if funding is available.

The Town of Meredith has an employee who holds a Weed Control Diver certification. This employee may be available to perform some follow up work involving hand removal and/or diver assisted suction harvesting and benthic barrier placement.

Lake Association Support

While Meredith Bay does not have one individual lake association to assist with control efforts, there are numerous small cove and community associations and garden clubs around the bay that are active in tracking milfoil growth and in educating their members about early detection and prevention activities. There is a good support network from these small local groups.

WATERBODY CHARACTERISTICS

The following table summarizes basic physical and biological characteristics of Meredith Bay.

General Lake Information	
Shoreline Uses (residential, forested, agriculture)	Commercial, residential, forested
Area of Meredith Bay (acres)	2,627.9
Max Depth (ft)	100.7
Mean Depth (ft)	41.3
Trophic Status	Oligotrophic
Color (CPU) in Epilimnion	7.5
Clarity (ft)	26.4
Natural waterbody/Raised by Damming/Other	Natural
Plant Community Information Relative to Management	
Invasive Plants (Latin name)	<i>Myriophyllum heterophyllum</i>
Infested Area (acres)	19.2 acres (note that infestation within Meredith Bay is larger than this, but this 19.2 acres is current focus in the northern tip of the bay)
Distribution (ringing lake, patchy growth, etc)	Areas of dense growth in cove, particularly in shallows, around docking structures, and near areas of high use. Plants growing from shore to maximum depths of 15 +/- feet. Figure 1 illustrates focus area(s) for this plan.
Sediment type in infested area (sand/silt/organic/rock)	Sandy/rocky/silty
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Inventory)	Common loon (<i>Gavia immer</i>)

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

BENEFICIAL (DESIGNATED) USES

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 and Recreation are the ones affected by the presence of invasive plants like variable milfoil.

AQUATIC LIFE

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.

FISHERIES AND WILDLIFE

The principal fisheries of Lake Winnepesaukee include both warm and coldwater species. Coldwater species of primary interest are; landlocked Atlantic salmon, lake trout, and rainbow trout; coldwater species of less interest are lake whitefish, round whitefish (species of concern in Wildlife Action Plan), burbot, brook trout, and rainbow smelt.

Warmwater species of primary interest are; largemouth bass, smallmouth bass, white perch, yellow perch, chain pickerel, black crappie, brown bullhead, and bluegill. The bass fishery is extremely popular with anglers as numerous fishing tournaments are held on the lake each year.

Numerous warmwater species are present in littoral areas of the lake and constitute the prey fish sought by larger gamefish (warmwater). These species include; banded killifish, common shiner, common white sucker, creek chubsucker, bridge shiner (species of concern in Wildlife Action Plan), fallfish, golden shiner, pumpkinseed, redbreast sunfish, rock bass, slimy sculpin, and yellow bullhead.

The American eel, a catadromous species, resides up to 4-9 years in our inland lakes, such as Lake Winnepesaukee, where they reach sexual maturity and migrate down the rivers and outlets of our large lakes to the Atlantic Ocean.

A Natural Heritage Inventory review yielded one record of sensitive wildlife in this area. The common loon (*Gavia immer*) has been documented in and near the proposed treatment area. Loons are common on Lake Winnepesaukee, and the NHB review did not provide information on the location of nesting pairs within the treatment area. Due to the high use of this end of Meredith Bay it is unlikely that there would be an active loon nest in the area covered by this plan. In any event, DES recommends that the Town of Meredith make contact with the Loon Preservation Society and notify them of the proposed treatment. In the past, a Loon Preservation Society representative has been on site to observe treatments in and near loon habitat on other waterbodies. These representatives carry handheld radios to communicate with the applicator

during the treatment of the subject areas. The loon staff member monitors the behavior of the loons (if they are in the area), and directs the actions of the applicator so as to minimize any stress on the loons. The herbicides that are used are not toxic to the loons at the dose used to control milfoil, so toxicity effects are not an issue. Information from other waterbodies where treatments have been done when loons have been nesting suggests that if the treatment is performed in a manner that does not disturb the loons, there should be no negative impact on the loons.

RECREATION USES AND ACCESS POINTS

Lake Winnepesaukee and Meredith Bay proper are used for numerous recreational activities, including motor boating, canoeing, kayaking, fishing, swimming, sailing, and water skiing by both residents and transient boaters. There are numerous commercial establishments around the edge of Meredith Bay that provide services for boaters and on-land visitors alike.

There is one designated public access for boats on the western shoreline of Meredith Bay. Motor boats, as well as kayaks and canoes can use this facility. There is limited parking for vehicles with trailers at a separate parking area down the street from the launch.

The Town of Meredith maintains several town docking structures along the waterfront on the eastern shoreline of the bay. There is a private yacht club on the western shoreline.

There are five public beaches in this area of the bay (also called “designated beach”). 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.*

MACROPHYTE 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 Meredith Bay is characterized by a mix of native and non-native (variable milfoil) plant growth (Figure 2). Native species include a mix of floating plants (yellow water-lilies), emergent plants (pipewort, bur-reed), and submergent plants (bladderwort, pondweed). Native plant communities are scattered around the shoreline areas, and are characterized as ‘sparse’ by the DES.

Patches of filamentous green algal growth were documented in various locations in shallow water around the bay, forming cloud-like underwater masses.

The only other invasive species documented during the survey was purple loosestrife, located in sparse patches on the shoreline.

There are no records of state threatened or endangered plant species in Meredith Bay.

HISTORICAL CONTROL ACTIVITIES ON THIS WATERBODY:

SITE	DATE	ACTION	AREA (ac)	APPLICATOR
MEREDITH YACHT CLUB	07-Jun-94	2,4-D (G)	3	ACT
MEREDITH YACHT CLUB	05-Jun-96	2,4-D (G)	4	ACT
MEREDITH YACHT CLUB	09-Jun-99	2,4-D (G)	4	ACT
MEREDITH YACHT CLUB	12-Jun-01	DIQUAT	4	LYCOTT
MEREDITH YACHT CLUB	11-Jun-02	DIQUAT	4	ACT
MEREDITH YACHT CLUB	11-Jun-03	DIQUAT	4	ACT
MEREDITH YACHT CLUB	09-Jun-04	DIQUAT	4	ACT
MEREDITH YACHT CLUB	09-Jun-05	2,4-D	4	ACT
MEREDITH YACHT CLUB	20-Jun-06	2,4-D	4	ACT
MEREDITH YACHT CLUB	06-Jun-07	2,4-D	4	ACT
MEREDITH DOCKS	02-Jun-97	DIQUAT	12	LYCOTT
TIP OF MEREDITH BAY	09-Jun-05	2,4-D	10	ACT
TIP OF MEREDITH BAY	06-Jun-00	DIQUAT	0.5	ACT
TOWN DOCKS/YACHT CLUB	06-Jun-00	2,4-D (G)	14.2	ACT

MILFOIL MANAGEMENT OPTIONS

The control practices used should be as specific to milfoil 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/aquatic_bmp.pdf.

Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices used by the State of New Hampshire. DES has evaluated the feasibility of potential control practices on Meredith Bay. The following table summarizes DES’ control strategy recommendations for Meredith Bay.

FEASIBILITY EVALUATION FOR CONTROL ALTERNATIVES

Control Method	Use on Meredith Bay
Restricted Use Areas	Due to both the widespread distribution of variable milfoil and the popularity of the area for boaters and other water users, not to mention the commercial values along the waterfront, restricting access or uses in this area is not feasible.
Hand-pulling	<p>DES recommends that the individual stems or small patches of variable milfoil be hand pulled when encountered. Hand-pulling could be done by a town employee holding a WCD certification, by DES, or by a contracted diver.</p> <p>DES also recommends that both lake residents and trained town officials perform routine monitoring through the Weed Watcher Program to follow up the herbicide application and identify locations of persistent growth or re-growth following the herbicide treatment with hand-pulling of re-growth, if that re-growth is small and scattered.</p>
Mechanical Harvesting/Removal	Mechanical harvesting is not recommended due to the threat of spreading variable milfoil to uninfested areas of the lake through the generation of fragments. While variable milfoil is widespread in Meredith Bay there is still some uninfested habitat, and the generation of fragments that may not be well-contained in a harvesting project could drift. Also, this is not a permanent solution and harvesting would become a routine activity due to re-growth.
Benthic Barriers	Benthic barriers are recommended for areas where small growths are persistent.
Herbicides	To reduce the overall distribution and density of variable milfoil in the town docks area of Meredith Bay herbicides are recommended. Specifically, 2,4-D is recommended for use in summer 2010, and as a follow up in 2011 or 2012 if adequate control is not achieved in 2010. The milfoil plants are very mature in Meredith Bay and it is expected that the root crowns are also mature and likely will be harder to control with a single application of the herbicide.
Extended Drawdown	Drawdown is not an effective control method for variable milfoil and is not feasible in this location of the lake.
Dredge	Not recommended due to nature of exotic plant distribution, the cost, or the ancillary ecological impacts that the dredge could have.
Biological Control	There are no approved biological controls for variable milfoil at this time in New Hampshire.
No Control	Meredith Bay is a very high use portion of Lake Winnepesaukee. The variable milfoil population continues to expand annually, and recreational and aesthetic impairments exist as a result of dense growths of milfoil. The plants have been going to seed annually

Control Method	Use on Meredith Bay
	which could further expand the infestation and provide longevity of the infestation through an established seed bank. A no control option would only allow the milfoil to expand further.

EXOTIC AQUATIC PLANT CONTROL PLAN

An evaluation of the size, location, and type of variable milfoil infestation, as well as the waterbody uses was conducted by DES during August and September 2009. Based on the evaluation, the following control actions are recommended:

Year	Action	Responsible Party	Recommended Schedule
2010	2,4-D treatment of 19.2 acres of Meredith Bay, as shown in Figure 1	Aquatic Control Technology, Inc.	May/June
	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Local WCD, contracted divers, and/or DES	July through September
	Installation of benthic barriers, as may be appropriate	Local WCD, contracted divers, and/or DES	August/September
	Weed Watching and Lake Hosting	Local Volunteers	May through September
	Site assessment and remapping of variable milfoil infestation	DES	September/October
2011	2,4-D treatment (if needed) based on fall 2010 survey.	TBD	Spring or Fall
	Weed Watching and Lake Hosting	Local Volunteers	May through September
	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Local WCD, contracted divers, and/or DES	July through September
2012	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Local WCD, contracted divers, and/or DES	July through September

Year	Action	Responsible Party	Recommended Schedule
	Installation of benthic barriers, as may be appropriate	Local WCD, contracted divers, and/or DES	August/September
	Weed Watching and Lake Hosting	Local Volunteers	May through September
	DES Site Inspection	DES	Late Summer/Fall
2013	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Local WCD, contracted divers, and/or DES	July through September
	Installation of benthic barriers, as may be appropriate	Local WCD, contracted divers, and/or DES	August/September
	Weed Watching and Lake Hosting	Local Volunteers	May through September
2014	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	Local WCD, contracted divers, and/or DES	July through September
	Installation of benthic barriers, as may be appropriate	Local WCD, contracted divers, and/or DES	August/September
	Weed Watching and Lake Hosting	Local Volunteers	May through September
	DES Site Inspection	DES	Late Summer/Fall
2015	Update and revise Long-Term Variable Milfoil Control Plan	NH DES and interested parties	Fall/Winter

- Based on the types of native plants that are mixed in with the stands of variable milfoil (Figure 2) where herbicide application is recommended there are no significant impacts to native plant communities expected as a result of this treatment. It is expected that a well distributed stand of native aquatic plants will remain following herbicide application.
- It is important to realize that aquatic herbicide applications are conducted in a specific and scientific manner, and that the herbicides that are used can be target-specific when used at appropriate doses/concentrations: this means that the invasive plant can be removed and native plants favored in this type of control practice. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

- 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, etc). 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 outline herein, all interested parties will be consulted for their input on revisions that may be needed to further the goal of variable milfoil and fanwort management in the subject waterbody.

Figure 1- Map of Milfoil Infestation

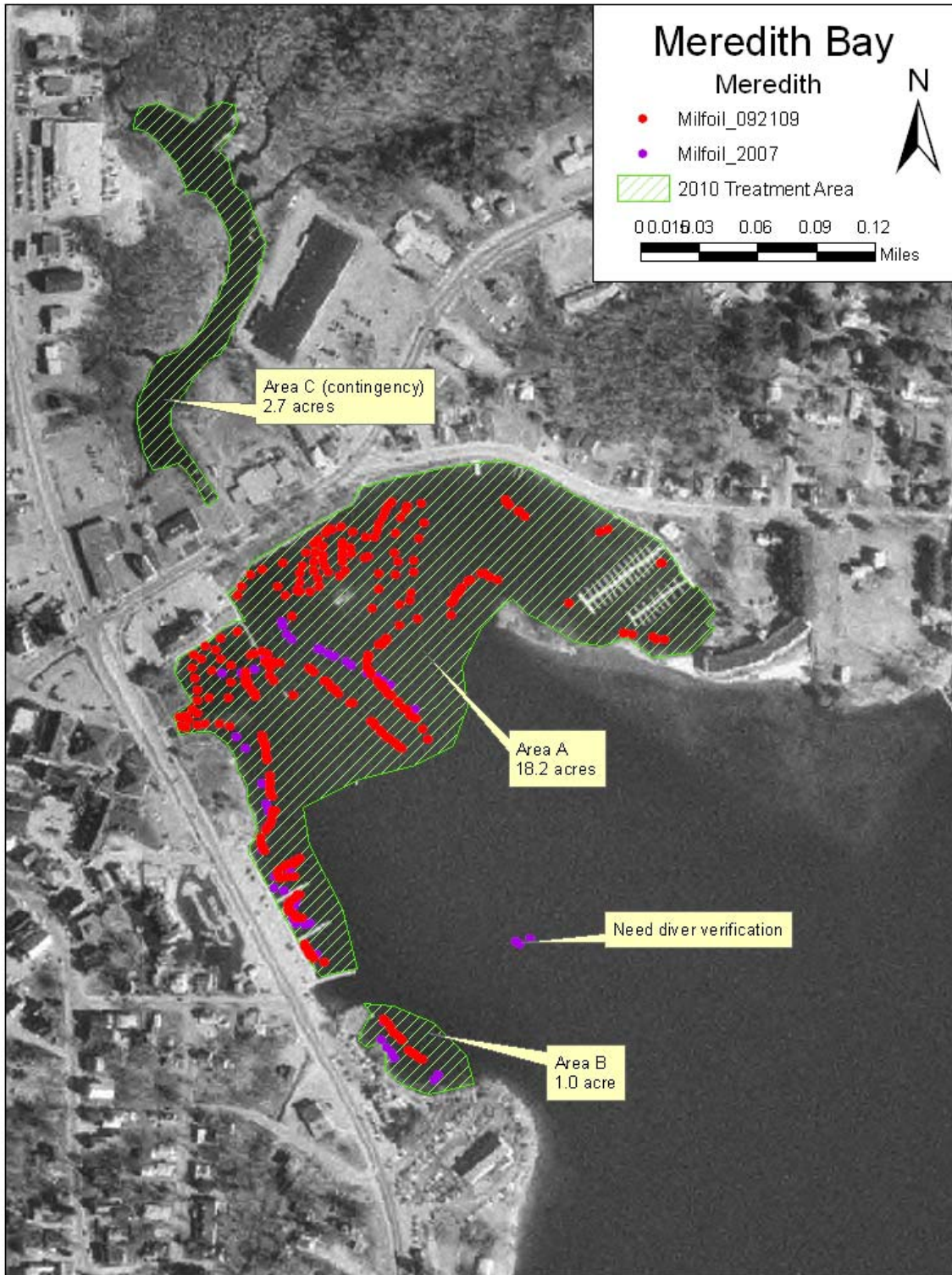
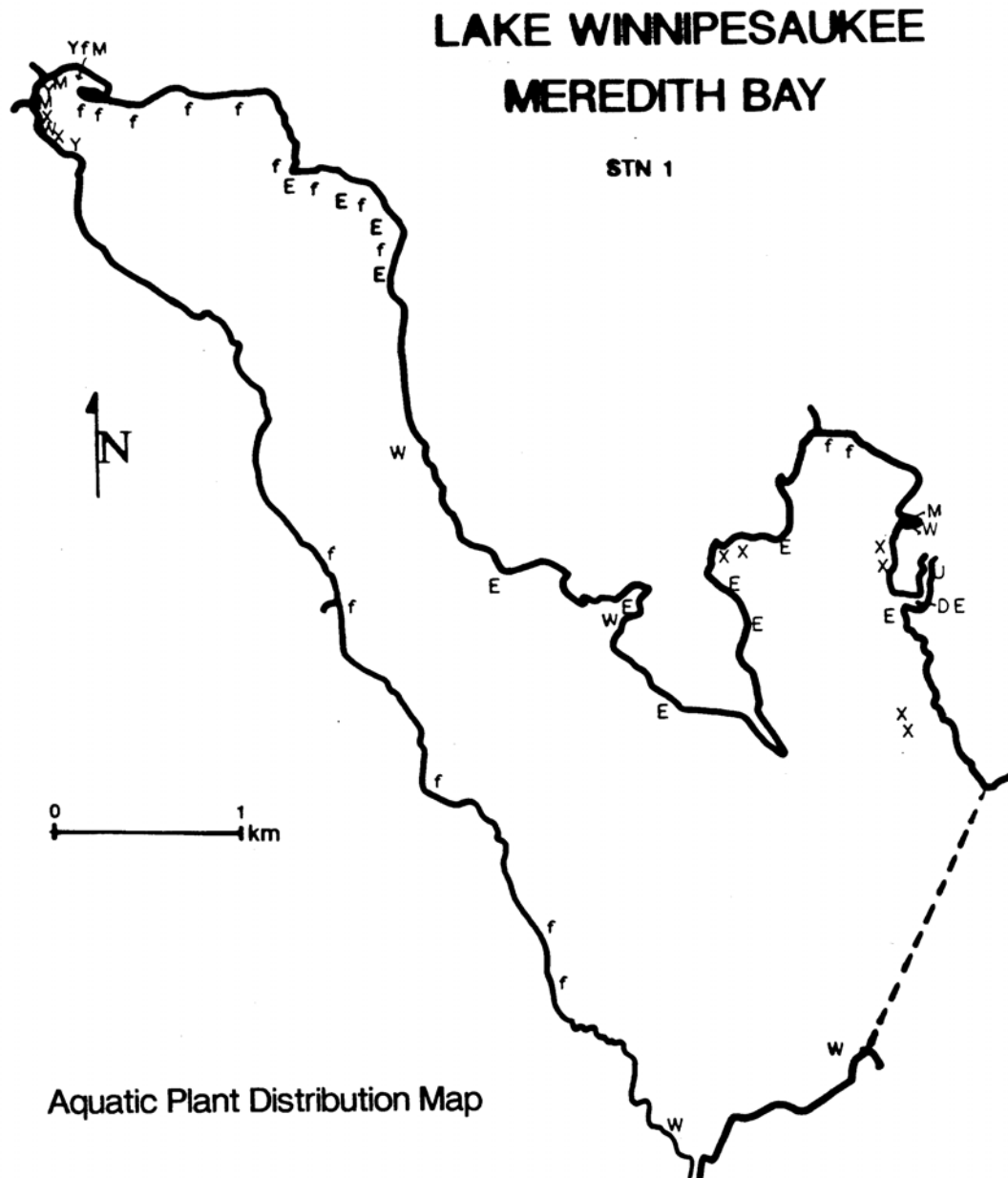


Figure 2- Aquatic Vegetation Map and Key



Symbol	Common Name	Latin Name
W	Pondweed	<i>Potamogeton sp.</i>
Y	Yellow water-lily	<i>Nuphar</i>
F	Filamentous green algae	<i>n/a</i>
M	Variable milfoil	<i>Myriophyllum heterophyllum</i>
E	Pipewort	<i>Eriocaulon</i>
S	Bur-reed	<i>Sparganium</i>
U	Bladderwort	<i>Utricularia</i>
D	Swamp loosestrife	<i>Decodon verticillatus</i>

Figure 3- Bathymetric Map

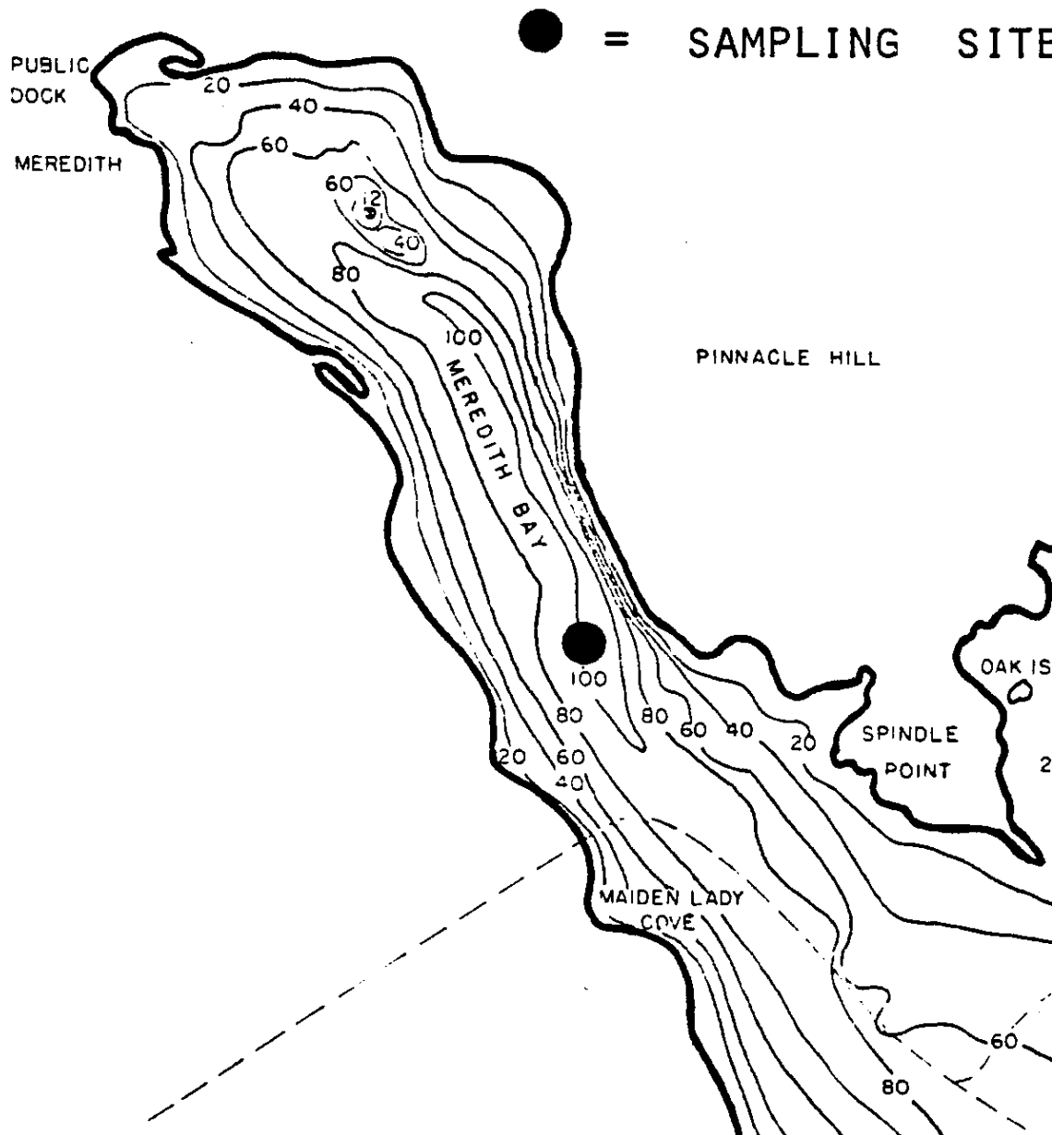
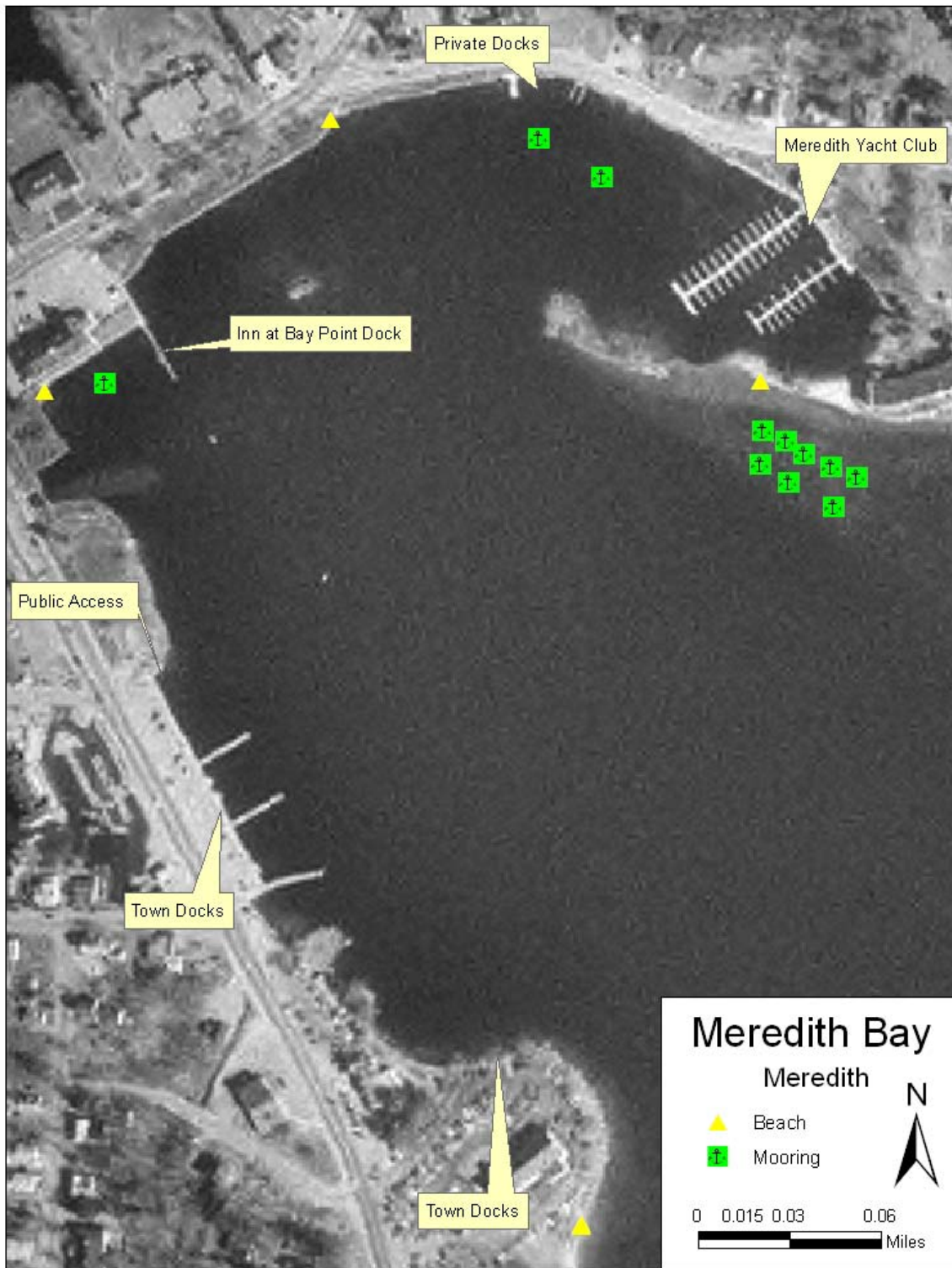


Figure 4- Beaches, Docks, and Public Access Points



APPENDIX A

CRITERIA TO EVALUATE THE 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 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.

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 impacts to downstream waterbodies based on limnological characteristics (water chemistry, quantity, quality).

Overall Control Options

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

- 1) **Eradication:** Herbicide application targeted at exotic aquatic plant to be eradicated, to either eradicate the plant or to reduce overall biomass to a point where alternative non-chemical strategies may be used. This action will be followed by thorough annual monitoring for regrowth and the use of non-chemical actions to achieve the eradication.
- 2) **Containment:** The aim of this approach is to limit the size and extent of the existing infestation. An herbicide application may be used to reduce specified areas down to a percent cover of the exotic species so that it can be maintained or contained with alternative management strategies, including Restricted Use Areas, benthic barriers, and others. Subsequent herbicide applications may be necessary if the target species shows exponential growth and further spread.

- 3) 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. All efforts will instead be made towards containment of the target species to that specific waterbody, so that downstream migration of the plant can be prevented.

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

Guidelines and requirements of each control practice are detailed below each alternative.

A. Hand-Pulling

- Can be used for exotic or native species.
- 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').
- 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 a few scattered plants.
- 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).
- Funds are available for repeated harvesting activities in that season.
- A navigation channel is required through dense plant growth.

C. Chemical Treatment

- Can be used if application of chemical is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or 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 (rare or endangered that will not be impacted by chemical treatment).
- 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 chemical treatment as compared with

other treatments.

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

- Can be used for exotic species only.
- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other 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 for exotic or native species.
- 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.

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 habitats 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 RSA211:11 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.
- Exotic controls, such as insects, cannot be introduced to control a nuisance plant.
- Research should be conducted on a potential biological control prior to use to determine the extent of host specificity.

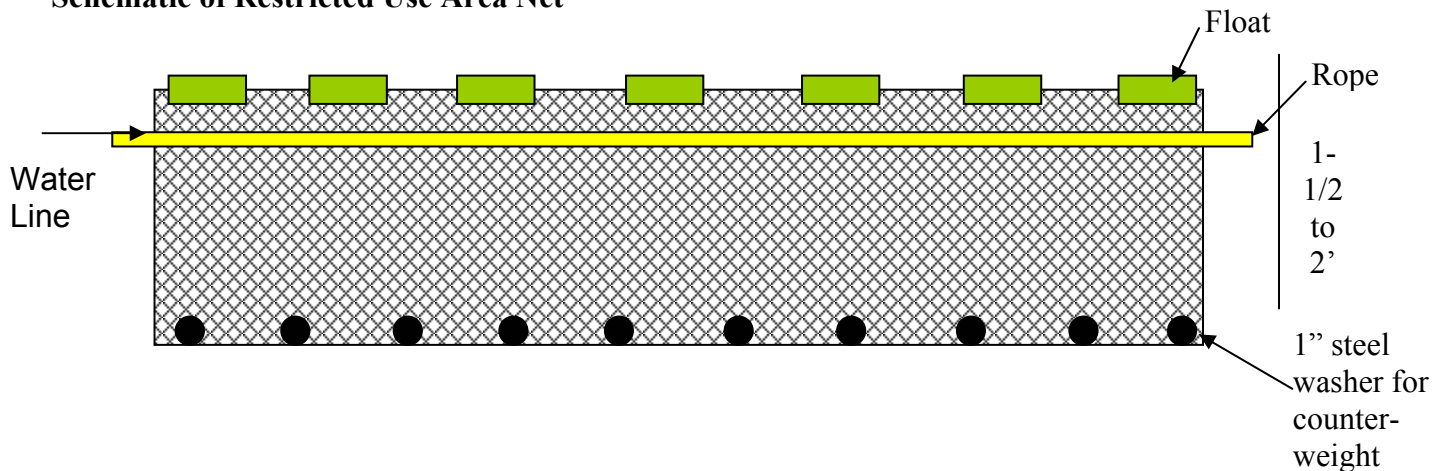
APPENDIX B

SUMMARY OF CONTROL PRACTICES USED IN THE STATE OF NEW HAMPSHIRE FOR EXOTIC AQUATIC PLANTS

Restricted Use Areas:

Restricted Use Areas (RUAs) are a regular control option for lakes with small, contained infestations of exotic plants, limited to small patches or embayments. This is often the case in waterbodies with newly-discovered infestations. RUAs restrict access to all recreational activities in a delineated area to minimize plant fragmentation and thereby reduce the spread of milfoil. As an additional method of protection from fragment migration, RUAs are encircled with a shallow net that is suspended vertically in the water column. The net is approximately 1.5-2.0 feet in height. The top of the net is set to extend four inches above the surface of the water, while the remainder is positioned below the surface of the water (see figure below). This configuration prevents the movement of fragments from infested areas to uninfested areas. Due to the size and nature of net construction, there is no impediment to fish migratory patterns or spawning activities.

Schematic of Restricted Use Area Net



Hand-pulling:

When infestations of exotic aquatic plants begin as single scattered stems or small patches, DES biologists SCUBA dive to hand-pull the plants (and DES can train other certified divers to also perform this management practice). Guidelines for determining feasibility and effectiveness for hand-removal are site specific, but generally sparsely populated patches of up to 5' X 5', single stems, or dense small patch up to 2' X 2' are reasonable.

The whole plant including the roots should be removed in this process, while leaving the beneficial native species intact. This technique works best in softer sediments, with shallow rooted species and for smaller, scattered infestation areas. When hand pulling nuisance species, the entire root system and all fragments of the plants must be collected since small root or stem fragments could result in additional growth of the species. The process must be repeated often to control re-growth of the exotic plants. For a new infestation, hand-pulling activities are typically

conducted several times during the first season, with follow-up inspections for the next 2-5 years or until no re-growth is observed. This control practice has proven successful in many waterbodies.

Diver Assisted Suction Harvesting

Diver Assisted Suction Harvesting (DASH) is a method whereby a diver works to hand remove exotic plants from the bottom sediments, and rather than depositing them into a dive bag for containment, they are fed into a suction tube that brings the materials topside for containment, de-watering, and disposal. This method can allow for larger-scale removal projects and potentially lower turbidity than simple diving and hand-removal with a dive bag.

Generally, the DASH unit is comprised of a floating platform that is set up with a suction pump and associated hoses, and some type of catchment basin that is lined with fine mesh net to entrain the plants and to filter the water through and back into the lake.

A team comprised of one or two divers and one or two topside tenders are needed to operate the DASH unit.

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 (a.k.a. bottom barriers):

When a small infestation of exotic aquatic plants occurs in clusters of growth (generally areas >5 sq. ft.), as opposed to scattered stems, a permeable fiberglass screen can be placed over the area of infested lake sediments. The permeable fabric screening allows for gas release from the sediments while effectively blocking sunlight and compressing the plants into the sediment, inhibiting photosynthesis and eventually killing the plant. Occasionally, in some lakes, gas release from the sediments or boating activity cause the uplifting of screening. Benthic barriers can effectively control small infestations of less than approximately 10,000 square feet.

Benthic barriers have two basic applications. These practices are used to cover pioneering infestations and prevent the spread of the plant. Bottom barriers are installed across small portions of lake bottoms infested with invasive aquatic plants. The disadvantage of benthic barriers is their non-selectivity and limitation of cover to less than 10,000 square feet. Additionally, these physical barriers prevent the growth of all vegetation, which is a necessary component of fish and wildlife habitat.

Bottom barriers are attached to the bottom of a water body by re-bar attached to the edges and across the middle of the material. Bottom barriers are transported to the shoreline adjacent to where installation is to occur. They are then cut to fit the treatment site and rolled onto a length of pipe. Divers carry the roll into the water at the start of the treatment site and secure one edge of the material to the lake bottom. The divers then roll out the remainder of the material and continue to secure it to the bottom sediments. This process is repeated until the plants in the treatment are covered.

Bottom barriers are generally considered for small localized areas rather than lakewide application. Bottom barriers provide 100% control of this weed in areas where they are installed. They also provide long-term control. An ongoing maintenance operation is required to inspect the bottom barrier and clear the mats of sediment buildup.

Benthic barriers are not recommended for application in river systems, as flow can easily uplift the barrier.

Targeted Application of Herbicides:

The use of chemicals, such as herbicides, for the control of noxious and nuisance plant species represents one of the most widely known and effective management options available. Herbicide control of invasive aquatic plants is often the first step in a long-term integrated control program. In the last 15 to 20 years the use and review of herbicides has changed significantly in order to accommodate safety, health, and environmental concerns. Currently no herbicide product can be labeled for aquatic use if it has more than a one in a million chance of causing significant harmful effects to human health, wildlife, or the environment. Because of this, the number of effective and U.S. Environmental Protection Agency (EPA) approved herbicides for aquatic weeds are limited. In most cases the cost and time of testing and registration, rather than environmental issues, limits the number of potentially effective compounds.

All herbicide applications in New Hampshire are performed under permits issued by the New Hampshire Department of Agriculture, Division of Markets and Food, Bureau of Pesticide Control.

Two herbicides have been used in New Hampshire for the control of milfoil. Diquat (trade name Reward), the most often-used herbicide, is a contact herbicide that can generally provide one season of control for milfoil. Because this herbicide does not target the root systems, the plants eventually re-grow from established roots.

The second herbicide, 2, 4-D (trade name Navigate or Aqua Kleen), is a systemic herbicide. It is absorbed into the sediments and taken up through the root system, killing both the

roots and the plant biomass above the sediments. Label restrictions for aquatic application currently limit its use in New Hampshire to waterbodies with no water intakes, and with no wells adjacent to the shoreline.

The aquatic herbicide SONAR has been used in New Hampshire to control growths of fanwort. The chemical acts by limiting photosynthesis when chlorophyll-a is affected by the active ingredient of the herbicide.

Extended Drawdown

Water drawdown is used for control of some species of aquatic macrophytes. Drawdown requires some type of mechanism to lower water levels, such as dams or water control structures and use is thus limited. It is most effective when the drawdown depth exceeds the depth or invasion level of the target plant species.

In northern areas, drawdown will result in plant and root freezing during the winter for an added degree of control. Drawdown is typically inexpensive and has intermediate effects (2 or more years). However, drawdown can have other environmental effects and interfere with other functions of the water body (e.g. drinking water, recreation, or aesthetics). Drawdown can result in the rapid spread of highly opportunistic annual weed species, which in most cases is the plant that is targeted for control.

Drawdowns have been used in the past for plant control. In theory, the drying of the plants in the summer, or the freezing of the plants in the winter, will eliminate or limit plant growth. However, milfoil often forms a more succulent terrestrial form during drawdown conditions and the succulent form of the plant can remain viable for long periods of time without submergence, making the practice ineffective. This strategy can be used for control of some native plant species.

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 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 two fashions, 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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