THORP BROOK & KIMBALL BROOK WETLAND COMPLEX, LAKE CHAMPLAIN
Charlotte, Vermont

INVASIVE EXOTIC PLANT MANAGEMENT PLAN

December 2017

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With TECHNICAL ADVISORS Meg Modley and Tina Heath

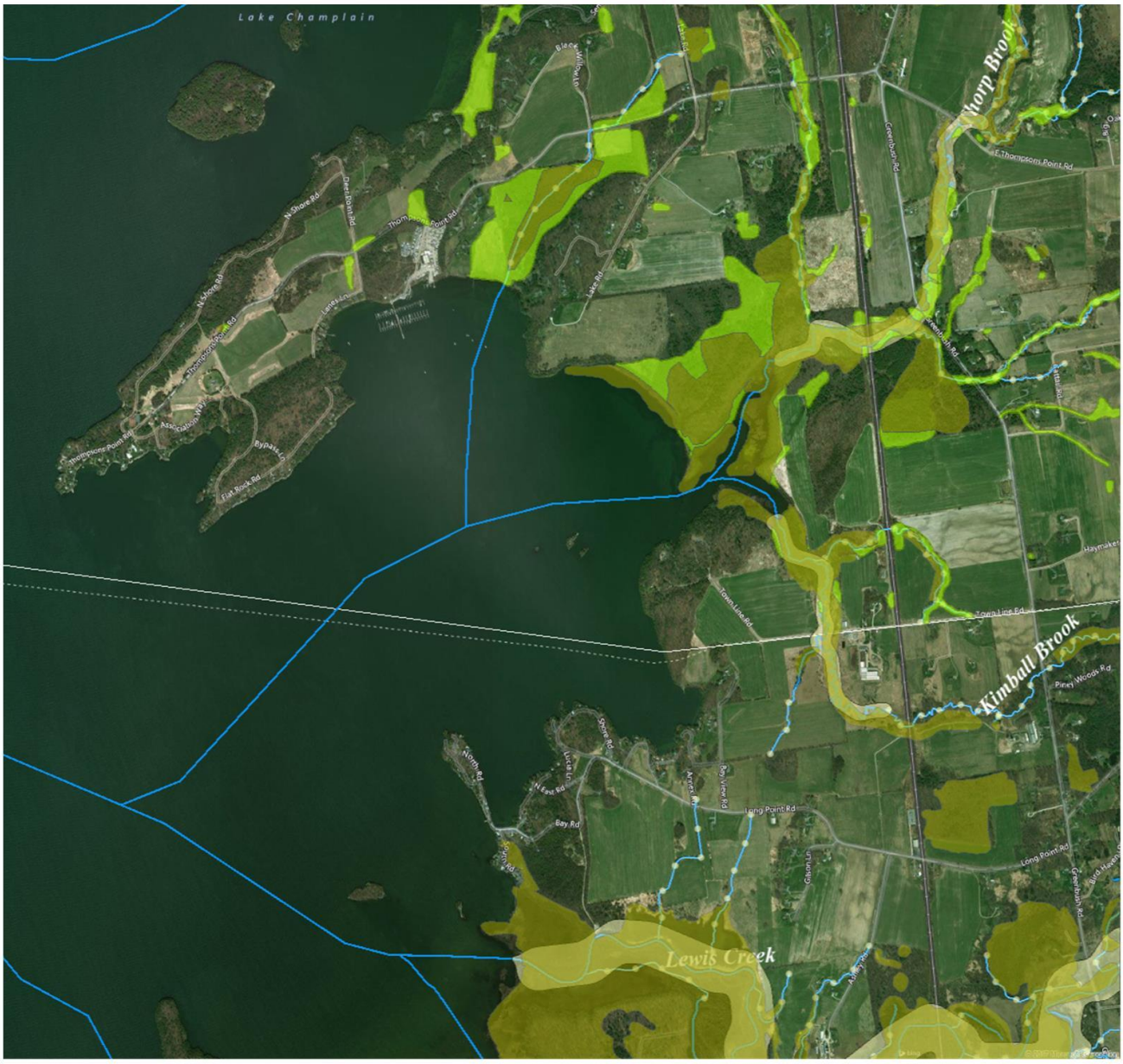
THE NATURE CONSERVANCY

VERMONT

Thorp/Kimabll Wetlands

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Wetland - VSWI
  - Class 1 Wetland
  - Class 2 Wetland
  - Buffer
- Wetlands Advisory Layer
- River Corridors (Jan 2, 2015)
- Small Streams - 50ft Setback
- Stream

NOTES

Map created using ANR GIS mapping techology on 11/29

1: 27,025

November 29, 2017

1,373.0 0 686.00 1,373.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

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1" = 2252 Ft. 1cm = 270 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

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1. INTRODUCTION

A. Description and purpose of the site

Town Farm Bay is located in the southwest corner of Charlotte. At the eastern edge of the bay Thorp and Kimball Brooks enter into Lake Champlain forming a large and diverse wetland complex. This wetland complex has been recognized by the state Agency of Natural Resources, the Town of Charlotte and ecologists as a premier wetland housing excellent examples of many natural communities.

The natural communities documented within the wetland complex are a large deep bulrush marsh, cattail marsh, a state-rare buttonbush swamp, and a shallow emergent marsh. There are several rare plants including the Handsome Sedge (*Carex formosa*), Loose Sedge (*Carex laxiculmis*), and the globally rare False Hop Sedge (*Carex lupuliformis*). Surrounding the wetland are in-tact floodplain forests that have been noted to contain mature silver maples as large as 25-inches in diameter. Further inland, state-rare Valley Clay-plain forests are found, including the 63-acre Williams Woods parcel owned and managed by The Nature Conservancy. This continuum of relatively undisturbed natural communities has led to Thorp / Kimball Brook wetland complex receiving recognition as "one of the finest wetland complexes on the shores of Lake Champlain" (Thompson & Perlow, 2005) and "a rare, intact cross-section of landscape from open water to bottomland forest." (Lapin, 1991). Furthermore, a study by Thompson and Perlow in 2005 suggested and provided documentation that these wetlands are worthy of Class One designation, which is reserved for the highest-quality wetlands in the state that "are exceptional or irreplaceable in their contribution to Vermont's natural heritage" and are therefore in need of the greatest legal protection (Vermont Wetland Rules, 2002).

The size and health of the Thorp / Kimball Brook wetland complex provides ample habitat for Vermont wildlife. Canada geese, least bittern, American bittern, common tern, wood duck, mallard duck, blue-winged teal, green-winged teal, osprey, kingfisher, and great blue heron are frequently seen in the wetland. Many species of migratory songbirds, including American redstart, yellow warbler, are found in surrounding forested areas. In a 2004 survey for the Vermont Breeding Bird Atlas, 41 species of bird were confirmed as breeding in the area and an additional 20 species were designated as "likely-breeding" but not confirmed. Additionally, the wetlands provide important breeding and feeding habitat for over 11 species of fish and 10 species of amphibians and reptiles. Many mammal species are also found along the drainage, including America otter, beaver, mink and bobcat, due to the rich mosaic of natural communities that provide important forested corridors for larger animals moving from upland to lowland areas (Thompson & Perlow, 2005).

B. History of activity and description of how invasive, exotic plants interfere with conservation goals

The Charlotte Conservation Commission hired wildlife biologists and botanists to study and map the natural communities along Thorp and Kimball Brooks in 2004. They have subsequently spent money and effort in publishing brochures and pamphlets noting the natural importance of the area and how residents can help protect the town's valuable assets. Thorp / Kimball Brook wetland complex is public access lands and therefore are unmanaged by any single entity. However, the importance of the wetland complex to the state and town makes it a key site to ensure that invasive plant species are managed.

The Thorp / Kimball wetland complex is particularly vulnerable to invasive plant introductions due to prevailing wind and wave action that may bring fragments of any nonnative or invasive species present in Lake Champlain to the mouth of the wetland, and the high number of recreational and fishing boats

that access the area, potentially transporting invasive plant seeds and viable root matter. Wetlands in general have been noted as highly susceptible to exotic plant invasions and many of these invaders form dense monotypic stands. Large infestations of invasive plants in wetlands have been linked to decreasing biodiversity, in both the actual number and "quality" of representative species, out-competing and pushing out many native species, disrupting nutrient cycling by discharging or collecting disproportionate amounts of nitrogen, oxygen or important nutrients, altering habitat structure via loss of plant diversity and thus loss of differing forms and types of vegetation, and modifying native food webs in areas (Zedler & Kercher, 2004).

A population of exotic, invasive plants in the wetland complex threatens to degrade the individual natural communities within the wetland complex and viability of the complex as a whole. The loss of the functional wetland would furthermore disrupt the integrity of the clay-plain and floodplain and decrease wildlife diversity within the town. If control options of certain aquatic and wetland invasive plants are addressed early by the town of Charlotte and its residents, the likelihood of maintaining this as a Class One-qualified wetland designation is high.

C. Inventory of plant species and Weed Management Plan goals

The following exotic, invasive plants have been observed in Thorp / Kimball Brook wetland complex: flowering rush (*Butomus umbellata*), European frogbit (*Hydrocharis morsus-ranae*), yellow-flag iris (*Iris pseudacorus*), purple loosestrife (*Lythrum salicaria*), Eurasian watermilfoil (*Myriophyllum spicatum*), water chestnut (*Trapa natans*), and Curly-leaved pondweed (*Potamogeton crispus*). Of these species, there is little management and control information known for European frogbit and flowering rush. This plan will outline all the exotic, invasive plant species currently found within the wetland and explore potential control efforts that could be undertaken. Actual management decisions will be dependent on the securing of funding for some efforts and amount of time and man-hour resources that town officials and residents deem appropriate. As part of this draft management plan, in 2007 town residents began to monitor the extent of the plant's infestation annually. Additionally, there was some small-scale removal of select species and the progress was monitored.

2. OVERVIEW OF WEED MANAGEMENT PLAN

A. General Management Philosophy

Invasive, exotic plant control is part of the overall site management and restoration program. We focus on the species and communities we want in place of the invasive exotic species, rather than on simply eliminating plants. Preventative programs have been implemented to keep the site free of species that are not yet established, but which are known to be pests elsewhere in the region. Priorities have been set for the control or elimination of invasive exotic species that have already established on the site, according to their actual and potential impacts on native species and communities. Action is taken only when careful consideration indicates that leaving the invasive species unchecked will result in more damage than controlling it with available methods.

We use an adaptive management strategy. First, we establish and record the goals for the site. Second, we identify species that block us from reaching these goals and assign them priorities based on the of their impacts. One shortcoming of this step is monitoring and observations are arbitrary, and are affected by the observer, water levels, and seasons. Third, we consider methods for controlling them or otherwise diminishing their impacts and, if necessary, re-order priorities based on likely impacts on target and non-

target species. Fourth, we develop control plans based on this information. Fifth, the plan is implemented, and results of our management actions monitored. Sixth, we evaluate the effectiveness of our methods in light of the site goals, and use this information to modify and improve control priorities, methods and plans. Finally, we start the cycle again by establishing new/modified goals.

We set priorities in the hope of minimizing the total, long-term workload. Therefore, we act to prevent new infestations and assign highest priority to existing infestations that are the fastest growing, most disruptive, and affect the most highly valued area(s) of the site. We also consider the difficulty of control, giving higher priority to infestations we think we are most likely to be controlled with available technology and resources.

B. Summary of Specific Actions Planned

In the spring of 2007 Charlotte residents Dianne Leary and Susan Smith noticed four undocumented exotic invasive plant species in the Thorp / Kimball Brook wetland complex: yellow-flag iris, curly-leaf pondweed, Eurasian water milfoil, and European frogbit. After receiving confirmation from the Vermont Department of Environmental Conservation that these plants were exotics, Leary and Smith began to explore the best ways to monitor and control the populations.

The issue was brought forth at an initial meeting of interested parties including The Nature Conservancy, Lake Champlain Basin Program, Lewis Creek Association, and the Charlotte Conservation Commission. With the help of TNC and LCBP, this management plan is a guiding document for the town to use in determining management options for exotic invasive plants. Smith and Leary, with the help of volunteers, began hand pulling areas with European frogbit to reduce its density in the bay in 2009. Currently, LCA coordinates volunteers every summer to hand pull frogbit. A small patch of water chestnut was spotted in 2013 (early detection), and LCA got advice from DEC on how to remove and record it. Each year that it is spotted, it is removed with rosettes that are submerged in the soft sediment substrate, and plants are counted and disposed of off-site.

As more information is collected about the extent of the infestations and the ability of the town to locate and provide resources towards control efforts, this document has become more defined and exact in its specific recommended actions.

3. SPECIFIC CONTROL PLANS FOR PRESENT WEED SPECIES

Species #1
Scientific name: *Butomus umbellata*
Common name**:** flowering rush
Updated _November 2017_____

A. PRIORITY __High___

B. DESCRIPTION
Flowering rush is an aquatic perennial that grows along freshwater shorelines and in wetland areas with water as deep as 3 feet. Its leaves are three-angled, a unique distinguishing feature. Flowering rush is most conspicuous in later summer and early fall when its large, umbellate pink flowers are visible on tall stalks that can reach over 3 feet in height. Flowers produce dark brown beaked fruit that split open to release many seeds.

C. CURRENT DISTRIBUTION ON THE SITE
Flowering rush is currently found in sparse, scattered populations among the deep bulrush marsh. It is typically found in small clusters of 5-10 stems interspersed with bulrush (*Scirpus* spp.), broad-leaved arrowhead (*Sagittaria latifolia*) and the pickerelweed (*Pontederia cordata*). In Fall 2017, a large patch of the species was observed (over 100 plants) on the west side of Thorp Brook upstream from the floating skiff.

D. DAMAGE & THREATS
Flowering rush has been observed displacing native species and sometimes is found in populations so thick that boat access is limited. Furthermore, this rush spreads by seed and rhizome fragments and has been noted to appear in floodplain forests. The rush found in Thorp Brook Mouth has the potential of being dispersed by seeds attached to mobile birds or mammals or by broken rhizome fragments floating along the water. However, a recent study by Bemidji State University and Queens University reports that some North American populations do not produce viable seeds; this suggests that rush will most likely spread by human activity or animals like the muskrat that typically dig and disrupt wetland bottoms, dislodging and moving rhizomes.

In well-establish wetlands, rush has not been observed as problematic. Changes in water lever or minor disruptions, however, could change site conditions and allow for rush to spread quickly in disturbed areas. If wind storms or disturbance events decrease native plant numbers or water levels fluctuate frequently, flowering rush could potentially spread throughout Thorp Brook and Kimball wetlands.

E. GOALS
The population of flowering rush should be monitored annually, especially in nearby forests and upstream of the mouths of Thorp and Kimball Brooks. If the population continues to expand or begins to displace current native flora, control efforts should be considered.

F. OBJECTIVES
Annually monitor the flowering rush population; manage the population if it spreads or becomes more dense. Technical Advisor Meg Modley considers this to be a high priority for species management based on the number and distribution of plants observed in Fall 2017. It is found throughout the floodplain, with a dense stand at the upper reaches of the Thorp floodplain west branch.

G. MANAGEMENT OPTIONS

(a) No Treatment

(b) Mechanical

(i) Stem cutting

Flowering rush has been successfully controlled when stems are cut, sometimes multiple times a season, below the water surface. This method will not kill the plant but will prevent seed production and decrease overall plant abundance. Plants should be cut while flowering and all cut parts should be bagged and removed from the area. Removed parts should be dried thoroughly and may be composted away from wetland areas.

(ii) Hand digging

Small patches of rush in shallow water may be dug out. Extreme care must be taken to remove all parts of the root system – even small bits of roots or rhizomes can resprout and grow, especially in a disturbed area. This method is only recommended for small patches of plants in drier areas where root fragments are less likely to be spread by moving water.

(c) Chemical

Herbicide is not a recommended technique for control of rush found in deep waters but can be selectively used for plants found on dry banks or shallow waters. The narrow leaves and sleek surface of flowering rush make it difficult to effectively "paint" the plant with herbicide and the typical location of the plant in wetland areas prohibits the use of herbicides with added surfactants that increase the herbicides' absorption into the plant's leaves. Currently, there are no herbicides that are selective for flowering rush so when treating with herbicide extra care should be taken to prevent contact with other wetland plants. *Herbicide treatment may be considered an allowed use under VWE 6.18, upon approval of a written plan from the Wetlands Program. Herbicide treatment within / near waters also requires an Aquatic Nuisance Control Permit from the Lakes Program.*

Species #2
Scientific name: *Hydrocharis morsus-ranae*
Common name**:** European frogbit
Updated ___November 2017_____

A. PRIORITY __HIGH___

B. DESCRIPTION

European frogbit is a free-floating aquatic plant that resembles other aquatic water lilies. Frogbit leaves are leathery, round, heart-shaped and range in size from 0.5 – 2.25 inches (typically smaller than other aquatic lily leaves). It reproduces sexually by its small, three-petal white flowers with a yellow spot in the center or asexually by the production of stolons. Frogbit survives winter by producing turions, small buds that break off of the plant and sink to the substrate, which rise in the spring to form new plants.

C. CURRENT DISTRIBUTION ON THE SITE

Frogbit is currently distributed in dense patches throughout the entire wetland complex, and extends into the cattail marsh areas and seasonal standing waters upstream of the main open water marsh. Because it is free-floating it does not appear in the open channels with faster moving water, but instead congregates

in sheltered niches created by bulrushes, cattails and other emergent vegetation. In the back areas of the bay near the mouth of Thorp Brook, the population of frogbit is denser and covers a greater area.

D. DAMAGE & THREATS

The ability of frogbit to form long stolons allows it to spread rapidly and cover a large area. The formation of dense mats will decrease light penetration to a wetland's benthic layer and negatively affect aquatic life. In shallow water areas, decomposition of frogbit mats decrease dissolved oxygen levels and further disrupt native vegetation and animals. Dense patches of frogbit will also inhibit boat traffic and waterfowl use.

E. GOALS

Reduce dense growth of European frogbit to annual hand harvest maintenance level (<10% coverage).

F. OBJECTIVES

Annually monitor and control the frogbit population.

G. MANAGEMENT OPTIONS

(a) No treatment

(b) Mechanical

(i) Hand pulling

Currently, the only control option for frogbit control is hand harvesting the plant during the growing season. This has been reported as only providing temporary and limited relief for small populations. If new frogbit populations are caught during their first year of infestation, before over-wintering turions are formed, frogbit may be eliminated from an area. All parts of harvested plants should be removed from the water body and should be dried or composted in a site away from wetland areas.

(ii) Shading

Shading has been proven to be an effective management tool in reducing European frogbit populations. Percent shade coverage of 70-100% has the greatest results at reducing to eliminating European frogbit growth (Zhu et al., 2014).

(c) Chemical

European frogbit has been successfully managed using endothall or diquat herbicides. This method is not species selective and non-target impacts are possible. *Herbicide treatment may be considered an allowed use under VWE 6.18, upon approval of a written plan from the Wetlands Program. Herbicide treatment within / near waters also requires an Aquatic Nuisance Control Permit from the Lakes Program.*

H. SPECIFIC ACTIONS PLANNED (Treatments and monitoring)

Volunteers go out in kayaks and canoes annually between June and August to hand-pick frogbit. By the end of the August, frogbit levels should be reduced to 5% cover.

I. HOW ACTIONS WILL BE EVALUATED (Criteria for success)

The remaining frogbit population at the end of the picking season should be around 5% cover, give or take depending on starting conditions, weather, and water levels.

J. RESOURCE NEEDS

Tools: kayaks and canoes (at least 5), weed rakes, baskets, buckets, paddles, PFDs
Estimated Costs: $1.5k

K. RESULTS OF EVALUATION

Hand-picking seems to be an effective management strategy. Initially, grant money was awarded to remove frogbit from Town Farm Bay in Charlotte at 50% cover. Each year picking took place, cover was drastically reduced. For the last several years, frogbit management has solely been a volunteer effort with one paid manager. Since 2009 when volunteers first began picking frogbit, cover has been reduced from 50% to 5-10%.

Species #3
Scientific name: *Iris pseudacorus*
Common name**:** yellow-flag iris
Updated __November 2017_____

A. **PRIORITY __HIGH___**

B. **DESCRIPTION**

Yellow-flag iris is an obligate wetland herbaceous perennial that grows 3-4 feet in height. Specimens in Lewis Creek have exceeded 6 foot clumps, and have been observed in floodplain to cover 40 square feet. Its flower blooms yellow (sometimes a light cream variation appears) which distinguishes it from its native counterpart, blue-flag iris (*Iris versicolor*). Its flowers appear from April to June and form 6-angled fruit capsules that hang from a long stipe. Yellow-flag iris spreads primarily thorough rhizome growth and plants will easily contaminate a new area when bits of rhizome are moved in water or soil. Yellow-flag iris tends to form dense masses of plants, excluding typical native wetland plants like cattail (*Typha* spp.) from growing.

C. CURRENT DISTRIBUTION ON THE SITE

Yellow-flag iris is currently found in limited patches in emergent vegetation, in smaller clumps along the wetland's shoreline, and in large clumps in the upstream floodplain.

D. DAMAGE & THREATS

In large numbers, yellow-flag iris will form a dense colony that prevents the growth of other native wetland plants. As plants extend rhizomes and create denser mats of roots, local conditions become more favorable for iris, further increasing its population size and decreasing regeneration of native plants. The dense mats formed by yellow-flag iris have been documented as preventing waterfowl from breeding.

E. GOALS

Obtain permission from neighboring landowners to remove yellow flag iris and remove or treat small populations before they spread and become problematic.

F. OBJECTIVES

Remove all yellow-flag iris from the lower Thorp Brook wetland's edge and monitor the area annually to insure new plants do not arise.

G. MANAGEMENT OPTIONS

(a) No treatment

(b) Mechanical

(i) Hand digging

Single plants and small clumps (<5 plants) may be removed from an area by hand digging out all roots and rhizomes. Rhizomes, seed pods, and flowers must be removed from the area and allowed to decompose thoroughly before disposal. Plant parts should not be composted. Any digging or excavating will cause soil disturbance to the area and may promote growth of iris root fragments or seeds found in the soil. Replanting an area after iris removal with wetland grass or fast-growing cattails may prevent the regrowth of iris.

(ii) Dead-heading

For areas that cannot be dug, iris flowers may be "dead-headed" by cutting blooms before fruit appears. Cut flower heads should be bagged and allowed to decompose thoroughly before disposal. This method will prevent the spread of iris through seed production but will not contain or decrease a populations' size as iris will continue to spread through rhizome growth.

(c) Chemical

Herbicide may be selectively used for plants in small patches or numbers. Leaves should be wiped using a sponge with a 17.9% glyphosate solution during the plant's growing season, post-bloom. Rodeo, a glyphosate product manufactured by Dow Chemical, is labeled as safe for use in aquatic environments. A fall (late September early October) foliar application of 5% Rodeo with surfactant has proven very effective at eliminating iris clumps. *Herbicide treatment may be considered an allowed use under VWE 6.18, upon approval of a written plan from the Wetlands Program. Herbicide treatment within / near waters also requires an Aquatic Nuisance Control Permit from the Lakes Program.*

H. SPECIFIC ACTIONS PLANNED (Treatments and monitoring)

Charlotte residents or Conservation Commission members will begin to contact nearby landowners to receive permission to remove yellow-flag iris from the wetland's properties. Once permission has been obtained, control options can proceed.

May – June: Residents will paddle the wetland and mark, with GPS unit, topographic map or flagging tape location of irises in bloom. This will ensure that only yellow-flag iris individuals are removed from the area. After plants have been located and marked, residents will chemically treat plants. Yearly monitoring of wetland should continue to control new iris that may appear.

I. HOW ACTIONS WILL BE EVALUATED (Criteria for success)

Because the population of yellow-flag iris is limited in the wetland complete eradication of the species is possible, pending landowner permission. Because of high boat traffic in the area and the presence of iris along the shores of Lake Champlain, yearly monitoring for new iris plants is critical.

J. RESOURCE NEEDS

Tools: Shovel, spade, work gloves, black construction garbage bags, herbicide applicator license, herbicide and associated treatment equipment

Estimated Costs: $5k

K. RESULTS OF EVALUATION
(This section is to be filled in later, preferably within 1 year, when monitoring data has been taken and evaluated, at least preliminarily. The evaluation should be used to determine whether any of the sections B-K above should be modified.)

Species #4
Scientific name: *Lythrum salicaria*
Common name**:** purple loosestrife
Updated _November 2017_____

A. PRIORITY _MEDIUM____

B. DESCRIPTION
Purple loosestrife is an herbaceous perennial introduced from Europe in the early 1800s and now occurs widely in wetland areas in the northeastern United States. Prominent features include a stiff four-sided stem and showy spikes of numerous magenta flowers. Reproduction occurs by seed and rhizome growth that spread at a rate of about one foot per year. Purple loosestrife can be found in a variety of wetland habitats including freshwater and tidal marshes, riverbanks, ditches, wet meadows, and edges of ponds and reservoirs. It prefers moist, highly organic soils in open areas, but can tolerate a wide range of substrate material, flooding depths, and light levels.

C. CURRENT DISTRIBUTION ON THE SITE
Loosestrife is found in sparse, scattered populations within the wetland. It is not present in the deeper areas of water and is more prevalent near the eastern edge of the wetland where Thorp and Kimball Brook enter the bay.

D. DAMAGE & THREATS
In spite of its spectacular beauty, loosestrife often covers acres of wetland areas, preventing the growth of native wetland plants and providing little wildlife value. Purple loosestrife has been found to increase tannic acid levels in wetlands that is toxic to American toad (*Bufo americanus*) tadpoles by inhibiting their respiratory development. Purple loosestrife can produce up to 2.5 million seeds per plant and these seeds remain viable in the soil for years.

E. GOALS
Annually monitor and map loosestrife population in the wetland, especially taking note of beetle damage to leaves. If population increases in density or number, proactive control measures should be taken.

F. OBJECTIVES
Annually monitor and map the purple loosestrife population and allow no-net increase in loosestrife cover.

G. MANAGEMENT OPTIONS
(a) No treatment

(b) Mechanical

(i) Hand digging
Single plants may be had dug or pulled from the soil. All plant parts should be bagged and removed from an area and allowed to decompose thoroughly before disposal. No plant parts should be composted. Digging or pulling of plants is generally a secondary option as these methods increase soil disturbance and may encourage the growth of loosestrife seeds found within the soil.

(ii) Dead-heading
Flower heads of loosestrife may be cut before flowers set seed. Flowers should be bagged, removed from area, and allowed to decompose thoroughly before disposal. They should not be composted. This method will not kill plants but will prevent seed production and decrease risk of further infestation.

(c) Chemical
Herbicide may be selectively used for plants in small patches or numbers in the late summer or early fall, before plants have set seed. Prior to herbicide application flower heads should be removed from plant. Leaves should be wiped with a sponge and a 17.9% glyphosate solution. Rodeo, a glyphosate product manufactured by Dow Chemical, is labeled as safe for use in aquatic environments. *Herbicide treatment may be considered an allowed use under VWE 6.18, upon approval of a written plan from the Wetlands Program. Herbicide treatment within / near waters also requires an Aquatic Nuisance Control Permit from the Lakes Program.*

(d) Biological
In 1995, the United States Fish and Wildlife Service began releasing 3 insect species [a root-mining weevil (*Hylobius transversovittatus*) and two leaf-eating beetles (*Galerucella calmariensis* and *Galerucella pusilla*)] as biological control agents for purple loosestrife in Vermont. These releases followed extensive trial periods where entomologists and biologists insured that released beetles would not harm agricultural or native wetland plant species. In 1996, The Vermont Department of Environmental Conservation took over the beetle release program, focusing on the two *Galerucella* beetle species. State DEC biologists visited purple loosestrife infestation patches and prescribed beetle release when site conditions were appropriate. In the summer of 2016, Charlotte Invasives Collaborative (CHIC) worked with USFWS and released beetles in the upper wetland (east of the RXR) of Thorp Brook on TNC land. In the summer of 2017, there has been a great resurgence of purple loosestrife in Charlotte. USFWS has agreed to raise some of the beetles for us to release in Charlotte in 2017. The beetle releases are very effective and do not disturb the surrounding native plants. The beetles do not eliminate the plants, but by the larva feeding on the leaves and flowers, control them. Larva damage can be physically seen on the underside of leaves in the summer. Beetles overwinter in the soil, but if conditions are not right (too wet), they die.

Species #5
Scientific name: *Myriophyllum spicatum*
Common name**:** Eurasian watermilfoil
Updated __November 2017_____

A. PRIORITY __LOW___

B. DESCRIPTION

Eurasian watermilfoil is an aquatic plant found in fresh or brackish ponds, lakes, slow-moving streams or shallow water bodies. The plant typically roots in the mud substrate and grows stems ranging from 3 to 33 feet in length towards the water's surface. Leaves are olive green in color and found in whorls of four around the stem. Eurasian watermilfoil may be distinguished from native milfoils by the number of leaflets on each leaf (12 to 16) and its soft, feather like texture. Plants may reproduce from any node along the stem or from small yellow flowers that emerge from the water surface. Native milfoils have less than 12 leaflets per leaf. Eurasian watermilfoil also has a much longer internodal spacing along the stem between whorls than native milfoils. Eurasian watermilfoil stes and leaf tips may also be reddish in color.

C. CURRENT DISTRIBUTION ON THE SITE

Eurasian watermilfoil is found throughout Lake Champlain and is scattered widely in small patches within the Thorp Brook wetland. Most of the patches observed in Fall 2017 were found at the mouth of the wetland complex and within the deeper channels of Thorp and Kimball wetlands. Presence was relatively sparse. Native baldderwart dominated the vegetation growth along with native waterweed (*Elodea canadensis*).

D. DAMAGE & THREATS

Eurasian watermilfoil is extremely tolerant of a wide range of water and soil conditions and will form dense mats in waters up to 20 feet deep. These mats have been noted as affecting the temperature, light, and oxygen levels within a water body and because of their density are poor spawning areas for fish. Furthermore, the non-native milfoil is rarely used by waterfowl, fish or aquatic insects as a food source and impede recreational traffic when dense. Because milfoil may sprout from any plant fragment it is easily spread to new areas by wind and wave action, boat traffic, and water currents.

E. GOALS

Educate boaters and recreational users of the wetland to prevent the spread of Eurasian watermilfoil by encouraging them to clean, drain and dry boating equipment, anchors, and ropes before and after visiting the wetland area and avoiding navigation through dense patches of aquatic vegetation.

F. OBJECTIVES

Annually monitor and map known populations of Eurasian watermilfoil in the wetlands and consider limited hand harvest if populations grow.

G. MANAGEMENT OPTIONS

(a) No treatment

(b) Mechanical

(i) Hand pulling

For small, new milfoil populations snorkelers/divers may hand pull plants at their base, ensuring to remove all parts of the root and stem of the plant. All plant parts should be removed from the lake and allowed to dry or compost in non-wetland areas. If no milfoil fragments are left, this can be a highly successful control method. Typically, it is a very labor and cost intensive control method for large milfoil populations.

(ii) Mechanical harvesting

The state of Vermont and other lake and bay associations operate large mechanical aquatic plant (weed) harvesters that mow all aquatic vegetation stems from the water's surface to allow user

access. These harvesters are not species selective and do not remove watermilfoil roots and thus do not control the populations. Due to the high biodiversity in Thorp Brook Mouth this control method is not recommended.

(iii) Bottom barriers

Bottom barriers are mats that block light penetration and are typically made of rubber or fabric that have been used to successfully prevent water milfoil growth in lakes and around docks and along boat lanes. These barriers are anchored to the bottom and prevent light from reaching the substrate, preventing the growth of all plant species. Barriers may be expensive to deloy, maintain, and remove after treatment, but are highly successful at controlling dense populations of Eurasian watermilfoil.

(c) Chemical

Some herbicides have been federally registered for use in aquatic ecosystems that can adequately control large watermilfoil infestations. Some herbicides, such as 2,4-D (Trade names AquaKleen® and Navigate®) and triclopyr (Trade name Renovate3®) are selective for Eurasian watermilfoil when used at their labeled rates and leave most species of native aquatic species unaffected. Other herbicides such as fluridone (Trade names Sonar® and Avast!®) are less selective and may negatively affect other wetland plants. These herbicides come in a variety of forms (i.e. pellets, liquid, spray) and typically require multiple applications followed by selective hand pulling to be completely effective. Because of the Thorp Brook wetland's high-quality, biodiversity, and the high ecological and economic costs associated with chemical control, implementation of this option would be high-risk and potentially more damaging than helpful. *Herbicide treatment may be considered an allowed use under VWE 6.18, upon approval of a written plan from the Wetlands Program. Herbicide treatment within / near waters also requires an Aquatic Nuisance Control Permit from the Lakes Program.*

(d) Biological

Due to the widespread problem of Eurasian watermilfoil in the United States and its large economic and environmental impacts there are many forms of biological control agents under study. Many insects, bacteria and fungi are currently in experimental stages and are not close to receiving approval for release. Some states have introduced a plant-eating fish, the Chinese grass carp (*Ctenopharyngodon idella*) to combat watermilfoil but this method is illegal in Vermont waters. Since 1989, the Vermont Department of Environmental Conservation has been working with a native aquatic insect, the watermilfoil weevil (*Euhrychiopsis lecontei*) as a possible biological control agent. The weevil has been successful in decreasing Eurasian milfoil in Brownington Pond and other selective ponds, but not as successful in others, and the state intends to continue researching the weevil's biology. This weevil may become available as a future control method.

H. SPECIFIC ACTIONS PLANNED (Treatments and monitoring)

The Eurasian milfoil infestation in Thorp Brook mouth may be selectively managed by hand harvesting or benthic barrier mats. The town of Charlotte should be aware of future control options, such as the release of native biological insects, and consider these options at that time. Due to the high quality biodiversity of the wetlands, less selective herbicides are not recommended as a control method. The populations of Eurasian watermilfoil should be annually monitored and mapped to track the species possible expansion.

Species #6
Scientific name: *Potamogeton crispus*
Common name**:** curly-leaved pondweed
Updated __November 2017_____

A. PRIORITY __LOW___

B. DESCRIPTION
Curly-leaved pondweed is a submersed aquatic perennial found in 0.3 to 4 meter-deep brackish or fresh water wetlands. Its leaves are long, waxy, and reddish-green in color with a slightly toothed margin. The plant produces small, inconspicuous flowers and fruits, but the seed viability in the United States in questionable. Reproduction is primarily through turion production, similar to European frogbit. Turions are produced mid-summer and fall to the wetland substrate for the season. In late fall the turions germinate and adult plants persist through the winter, even under ice. This unusual life cycle allows this pondweed to be the first plant in the spring to begin growing.

C. CURRENT DISTRIBUTION ON THE SITE
Curly-leaved pondweed has been found in small dense patches throughout the wetland but further assessment of its population is necessary.

D. DAMAGE & THREATS
Like many other aquatic plants, curly-leaved pondweed creates dense vegetative mats that outcompete native vegetation and impede recreational use of waterways. Because plants are the first to emerge in the spring this pondweed has a competitive edge over native vegetation that begins its growing season later in the year.

E. GOALS
Annually monitor and map infestations of pondweed in wetlands and determine management options after infestation assessment.

F. OBJECTIVES
Determine pondweed infestation levels.

H. MANAGEMENT OPTIONS

(a) No treatment

(b) Mechanical

(i) Hand pulling
For small curly leaved populations snorkelers/divers may hand pull plants at their base, ensuring to remove all parts of the root and stem of the plant. All plant parts should be removed from the lake and allowed to dry or compost in non-wetland areas. If no plant fragments are left, this can be a highly successful control method. Typically, it is a very labor and cost intensive control method for large populations.

(ii) Mechanical harvest
Curly-leaved pondweed can be hand cut in the early spring after plants begin emerging. This

method will provide immediate relief to infestation levels and some evidence suggests that early cuts can prevent the production of turions and disrupt reproductive life cycles. Repeat cutting each spring may effectively control smaller populations of pondweed.

(c) Chemical

Because of this pondweed's distinctive life cycle, chemical control of this plant could be a viable option. Treating water bodies in the early spring, after curly-leaved pondweed emergence but prior to other aquatic plant growth, could allow for more selective herbicide use. Endothall based herbicides such as Aquathol or Hydrothol 191 are effective on pondweed in cooler water temperatures. Any decisions to apply herbicides in water should follow strict label guidelines and effects of endothal herbicides on emerged wetland vegetation also needs to be addressed. *Herbicide treatment may be considered an allowed use under VWE 6.18, upon approval of a written plan from the Wetlands Program. Herbicide treatment within / near waters also requires an Aquatic Nuisance Control Permit from the Lakes Program.*

4. SPECIFIC ACTIONS PLANNED

Since the initial assessment of the Thorp Brook Mouth wetland by TNC, LCBP, and LCA in 2007, more ecological surveys were completed to further understand the wetland and the potential impacts aquatic, invasive plants will have on its health. These further steps are recommended by the aforementioned group to insure the most time and resource efficient methods are used in any invasive exotic management at the site:

- Ecological Assessment of bay/wetland area. Potential funding sources for this EA are:
  - *Lake Champlain Basin Program's Local Implementation Grants*
  - *Vermont Department of Environmental Conservation's Grant-In-Aid program*
  - *Vermont Department of Fish & Wildlife's Landowner Incentive Program*
- Broader-scale management plan of the Thorp Brook Mouth including:
  - *Assessment of all species of "conservation significance" and further protection methods (including invasive plant control)*
- Development of an aquatic, invasive exotic plant monitoring program for species such as flowering rush, curly-leaved pondweed, European frogbit, purple loosestrife, water chestnut and Yellow iris. This sampling protocol will allow for:
  - *Determining the effectiveness of frogbit removal efforts in the bay*
  - *Monitoring of invasive plant populations found in sparse numbers in the wetland that can be quantitatively tracked*
  - *Determine effectiveness of controlling yellow iris populations with herbicide*
  - *Determine effectiveness of controlling loosestrife with beetles*

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