"Water Chestnut Management Guidance & Five-Year Management Plan for the Sudbury, Assabet, and Concord River Watershed"

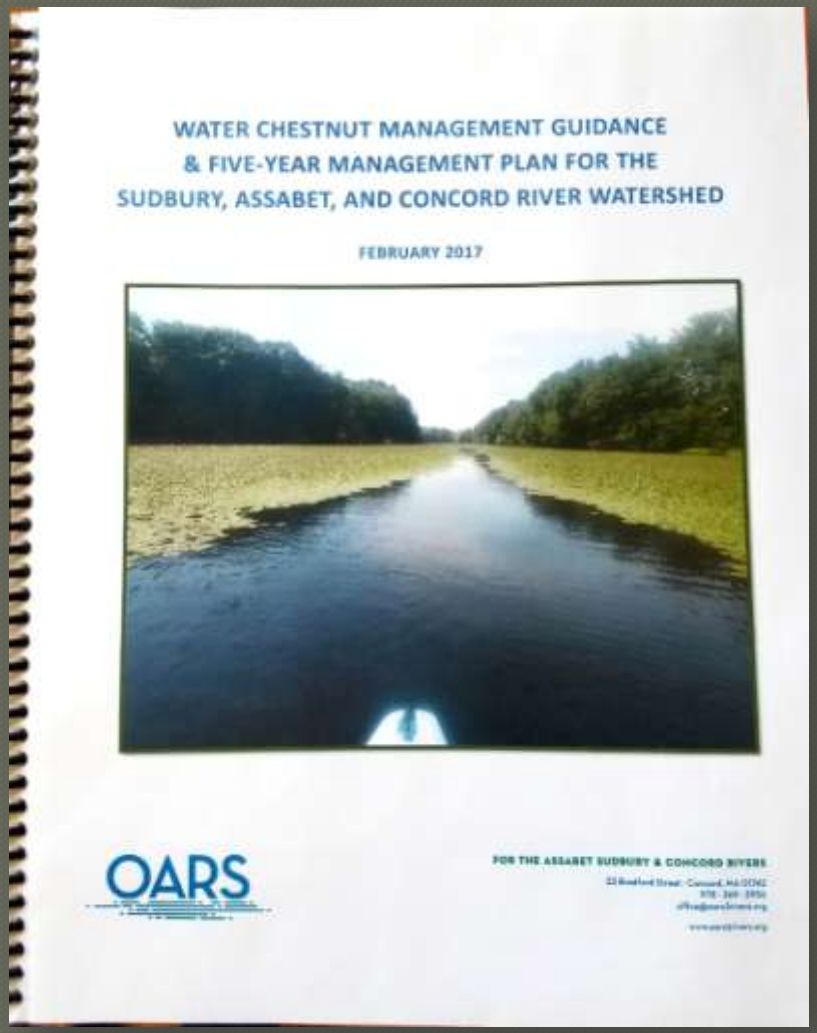
Presented SuAsCoShaw Network Meeting: 11/27/2018

Sue Flint, Staff Scientist, OARS

Barriers to Effective Management

- Invasive & persistent plant (10- 15 year seed viability)
- High cost of management
- Lack of life-cycle information
- Diverse approaches to permitting
- Evolving control methods

Guidance Document

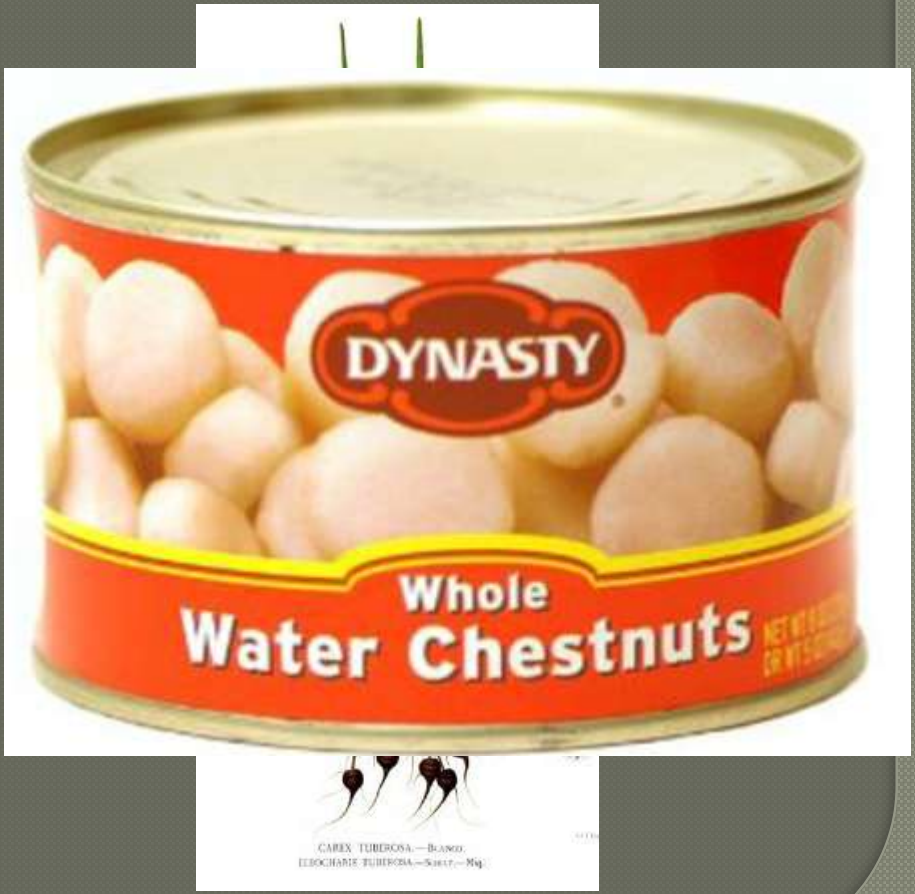


- Biology
- Management Options
- Permitting
- Management Plan for the SuAsCo
- Appendices
  - Maps of WC in the Sudbury, Assabet & Concord
  - Model Permitting Documents

Trapa natans ≠ *Eleocharis dulcis*

- *Trapa natans*

- *Eleocharis dulcis*



Origins: Eurasia and Africa

- Native to temperate Europe, Asia & Africa
- Several species: T. *natans*, T. *bicornis*, and T. *rossica*
- *T. natans* and *T. bicornis* valued as a food-plant in Europe until the early 1900s
- Current status:
  - Cultivated in Asia
  - Endangered in Europe
  - Invasive in North America and Australia

Trapa natans harvest in Taiwan

Introduction & Spread in N. America

- **1874**: introduced at Harvard's botanical gardens
- **1879**: Intentionally introduced to a pond near Sudbury River other ponds including Fresh Pond in Cambridge.
- **1884**: Introduced to Sanders Lake near Schenectady, NY
- **1920**: reached western Mass
- **1923**: two-acre patch on the Potomac near Washington D.C.
- **2017**: Listed as a noxious weed in AL, AZ, CT, ID, IN, MA, ME, MI, MN, OR, SC, VT, WA.

"but that so fine a plant as this, with its handsome leafy rosettes, and edible nuts, which would, if common, be as attractive to boys as hickory nuts now are, can ever become a 'nuisance' I can scarcely believe" (Davenport, 1879)

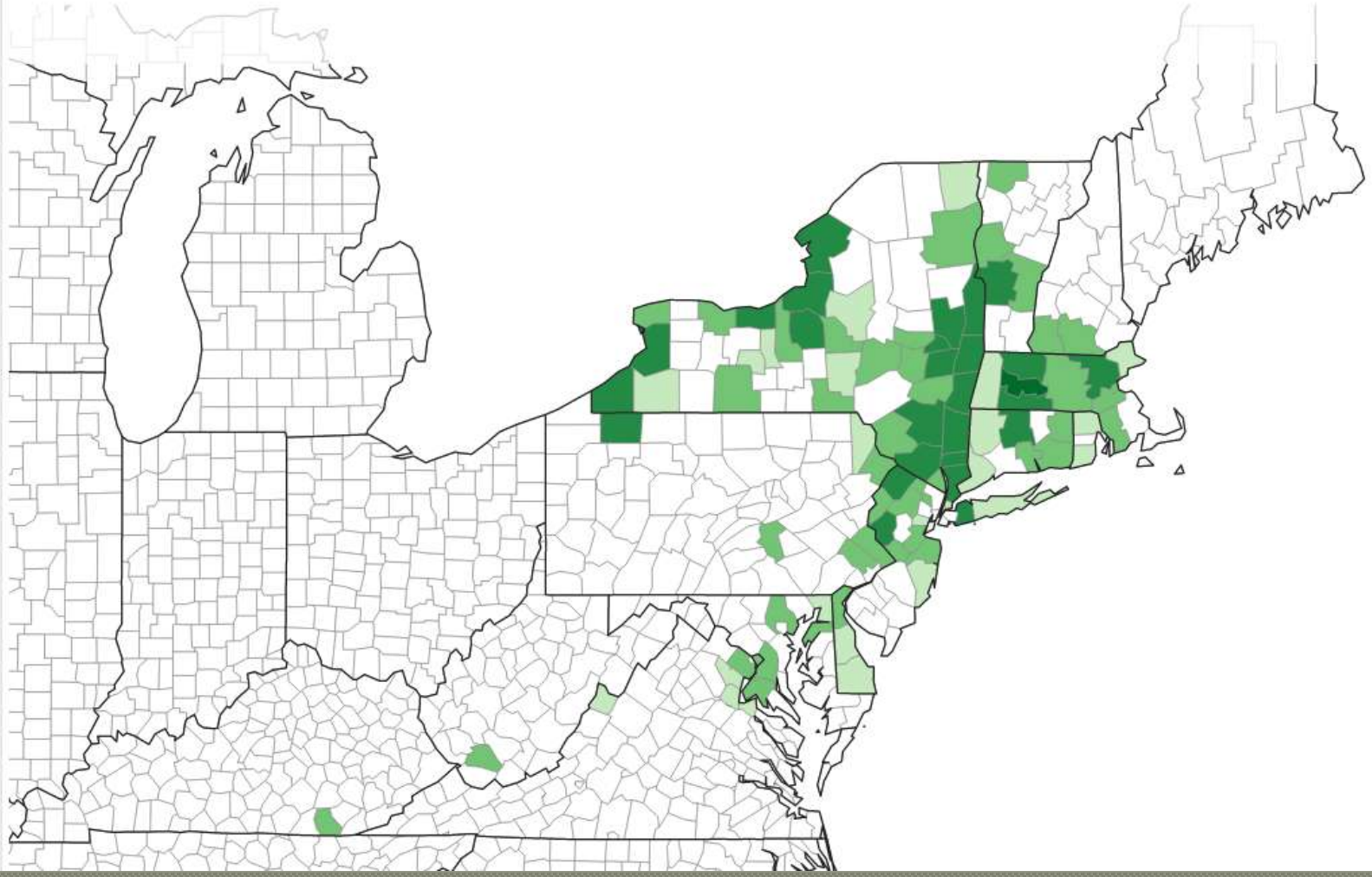
European water chestnut
***Trapa natans* L.**

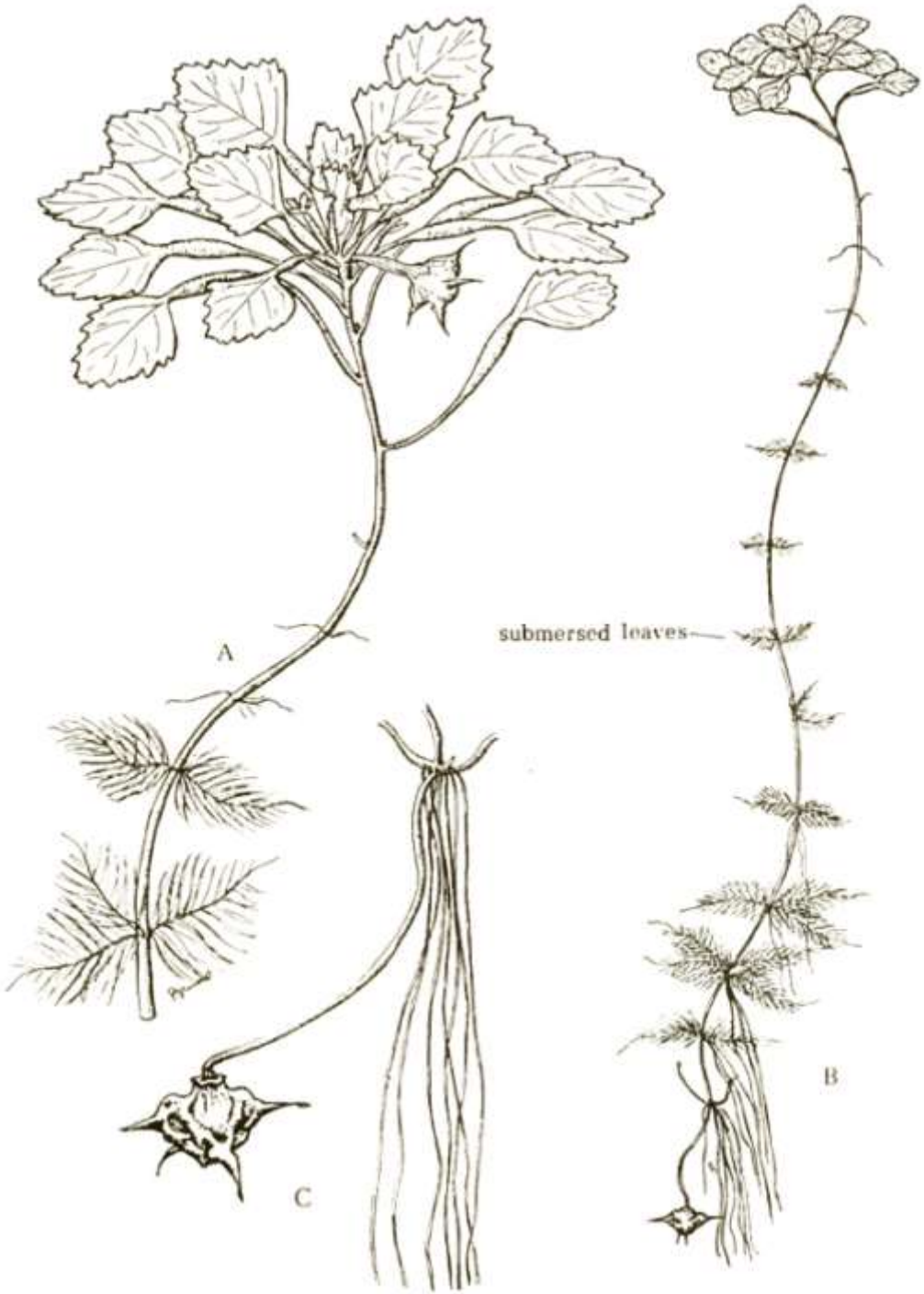
Current distribution of Trapa natans in the US from EDD Maps

States | **Counties** | Points | List

Distribution | **Record Density** | **Literature vs Observation**

Share





Biology

- Easily identified
- Glossy, green leaves form distinctive floating rosette
- Annual, grows from seed each year
- Dies back in the fall

Trapa natans (from Crow & Hellquist, 1983, Used with permission by Milne Special Collections and Archives Dept, University of New Hampshire, Durham, NH).

Life Cycle: Early spring

- Nuts overwinter in the soft sediments
- Need a period of dormancy < 8°C to germinate
- Germinate when water temps reach ~ 12°C (early May in NE)
- Germinate at a range of temps but fastest at 17 to 19°C
- Rosettes reach the surface by early to mid-June

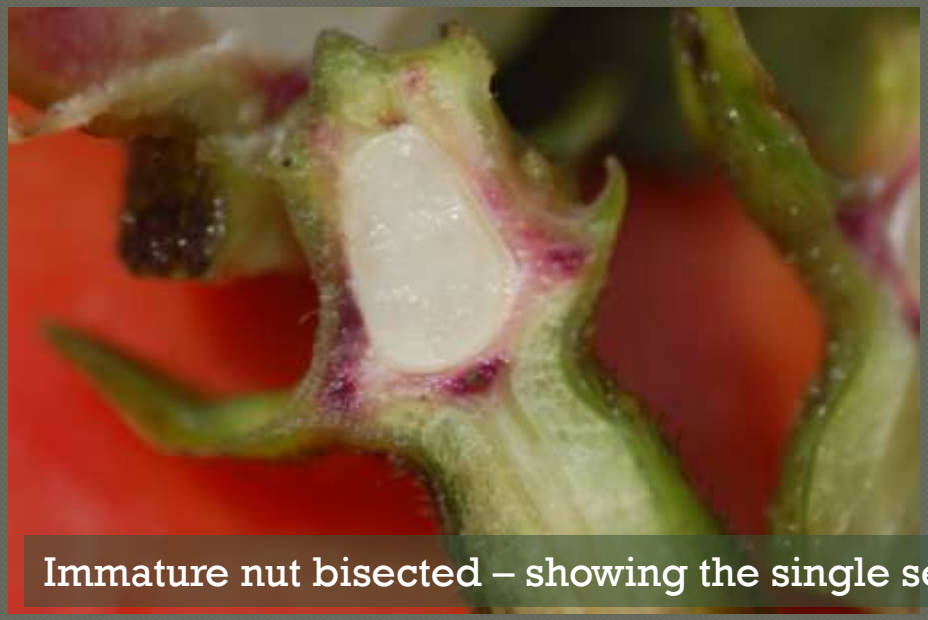
Early summer

Underwater leaves/adventitious roots

- Stems elongate adding leaves at the growing tip
- Submerged leaves drop off and are replaced by pairs of fine, dissected leaves along the stem
- LATE JUNE: Small white, single, flowers form at axil of leaves
- Pollinated by insects, cross-pollination, or self-pollination (June through Sept)

Summer

- Nuts form on the underside of the rosette
- Nuts mature by late-July, early-August & drop to the sediments
- Each rosette can produce 10 – 15 nuts



Immature nut bisected – showing the single seed

Summer

- Rosettes reach full size by late June 12 - 14" diameter
- Secondary branches and rosettes appear from the time the first leaves reach the surface until the first nuts are set
- Plants in initially low-density plots (5–15 rosettes/square meter) are larger, more productive, and longer-lived than plants in high density plots (>100 rosettes/square meter)
- Plants in low-density plots can produce up to ~ 27 secondary rosettes, each of which produces 10- 15 nuts
- … which helps explain why water chestnut can take over so rapidly

Fall

- Plants die back by Sept – October
- Nuts in the sediments lose the green outer layer, leaving the sharp barbed nut

Management Options

Water Chestnut Control Options			
Type	Mode of action	Advantages	Disadvantages
Hand-pulling	Physical removal of plants before seeds drop; hand-pulling from small boats	highly selective control; limited impact to non-target organisms; good for shallow sites; removes plants from water column; can involve volunteers (lower cost)	Not good for large, dense infestations; labor intensive
Mechanical Harvesting	Physical removal of plants before seeds drop; requires mechanical harvester, conveyor, and truck	Capable of removing large/dense infestations; removes plants from water column	Minimally selective; not useable in shallow sites; fragmentation may spread other invasives; may impact aquatic fauna; requires larger access or use of crane; higher cost
Hydroraking	Physical removal of plants before seeds drop; requires hydrorake, barge, and truck	Capable of operating in shallower areas than mechanical harvester, removes stump and debris	Minimally selective; very disruptive in areas applied; may generate high turbidity; fragmentation may spread other plants; requires larger access or crane
Drawdown	Winter drawdown to kill seeds by freezing; summer drawdown to kill emerging vegetation before seeds set; timing duration are critical	Low cost; opportunity for shoreline cleanup or structure repair; needs outlet control	Non-selective; very disruptive; alteration of flows downstream during drawdown & refill periods; more information needed on effectiveness of summer drawdown
Dredging	Sediment removal to reduce seed bank, reduce nutrient recycling, increase water depth	Removes the soft sediments, deepens the waterbody, effective on all rooted plants	Non-selective; very disruptive; alteration of flows during management; potential release of sediment; high cost
Bethic Barriers	Placement of barrier or bottom cover to prevent growth of rooted plants	Effective on growth of rooted plants in limited areas or create access lanes; complete elimination of plants in area	Non-selective; High cost of installation and maintenance; not suitable for large areas; difficult to install
Herbicides	absorbed or membrane-active chemicals that disrupt plant metabolism	Limited toxicity; rapid action; can be selectively applied	Potential toxicity to aquatic fauna; water use restrictions for varying time after application; increased oxygen demand from decaying vegetation
Biological Control: Herbivorous insects	Introduction of insects that feed selectively on target	Research on *Galerucella birmanica* ongoing; potentially very selective control; lower cost of application and potentially long-term control achieved	Involves introduction of non-native species; more research needed

Management Options

- Most frequently used:
  - Hand pulling
  - Mechanical harvesting
  - Chemical application
  - Dredging

Developments in Management

- Clearcast (imazamox) approved for control of water chestnut in Mass. in 2015
- Foliar application
- Used effectively in NY
  - 24 year history of other control methods (chemical and mechanical) on the Oswego & Seneca Rivers

David Lassman / The Post-Standard

An air boat from Allied Biological piloted by Steve Wilson sprays water chestnut growth along the Oswego River near Battle Island State Park last year.

- 2012–2016: large patches of water chestnut were treated using Clearcast
- 2016: the over-220 acres of water chestnut were reduced to about 20 acres
- A combination of Clearcast and Rodeo was used on the Seneca River

Developments

- *Galerucella birmanica* (beetle) being studied at Cornell (Dr. Blossey)
- Host-specific
- Likely able to survive NE winters
- Dr. Blossey hopes to have USDA approval for use in the US by 2018

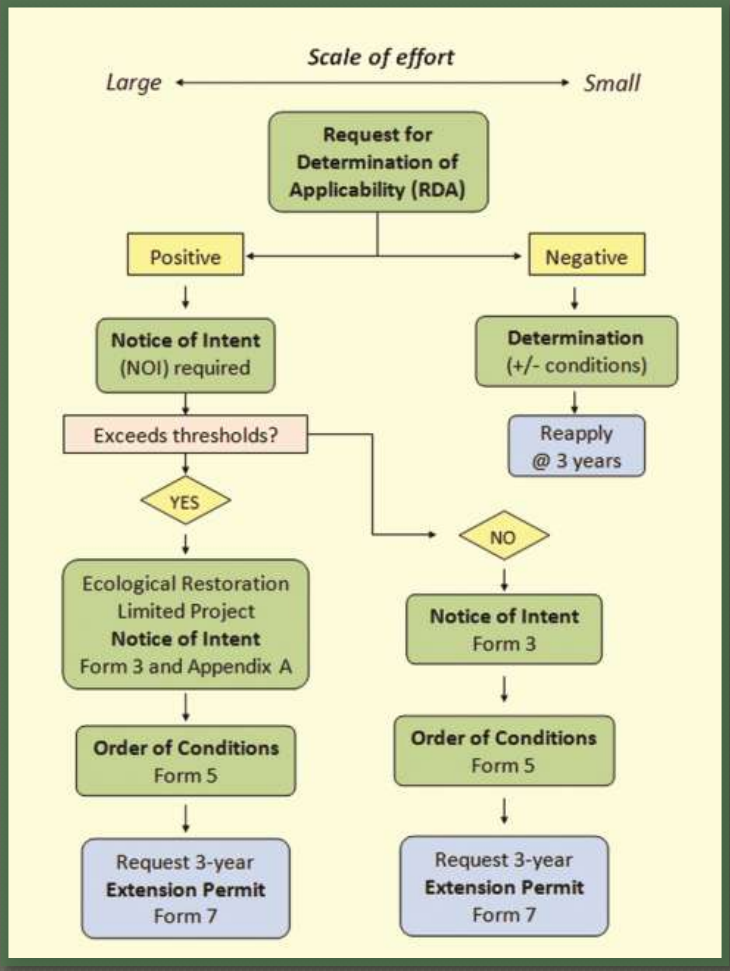
Permitting

All water chestnut control projects fall under permitting requirements of the Mass. Wetlands Protection Act because they may **alter** a "**resource area**" (land under water, banks, bordering wetlands & riverfront areas). Alterations include:

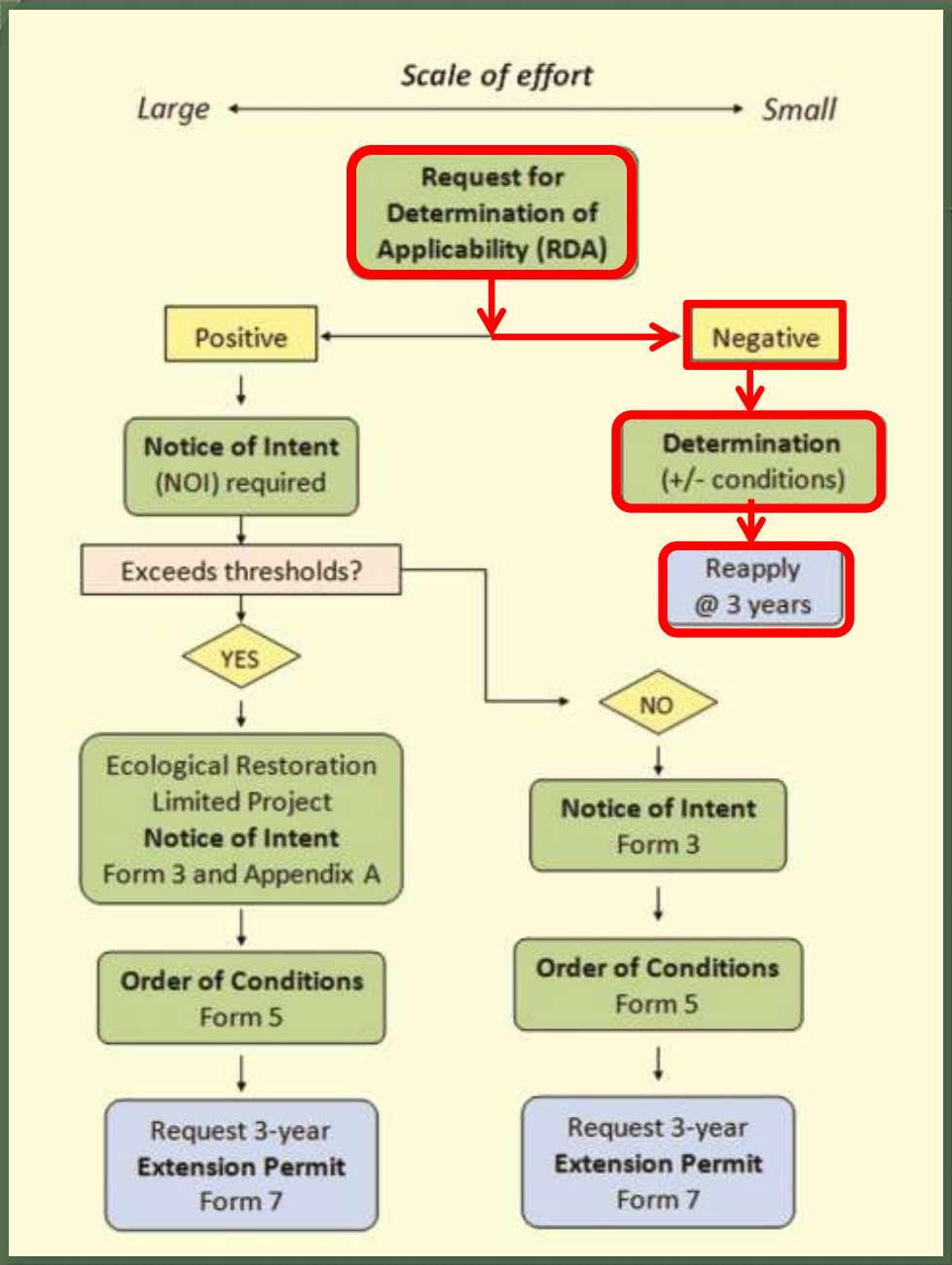
-- Sedimentation
-- Flow patterns
-- Vegetation
-- Physical, biological or chemical condition of the water

The level of WPA permitting will depend on the **scale** of the project and the **likelihood of alteration**. Additional permitting under other regulations or local bylaws may be needed depending on the type, complexity, and location of the work.

Wetlands Protection Act terms:

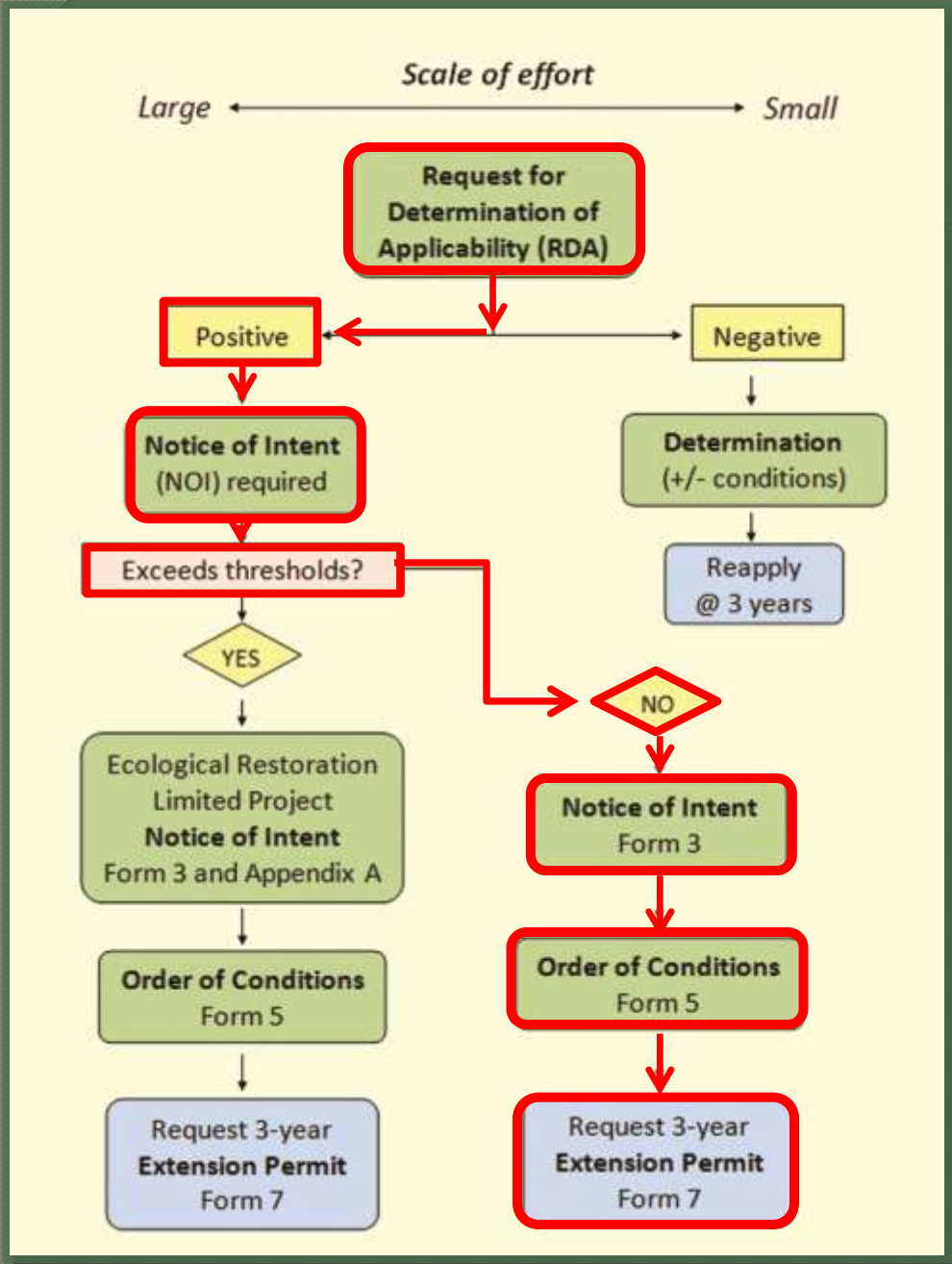


- Request for Determination of Applicability (RDA)
- Notice of Intent (NOI)
- Order of Conditions
- Ecological Restoration Limited Project
- Resource Area (land under water, bank, riverfront area, bordering vegetated wetland)



Handpulling

- Small-scale hand-pulling efforts **may** not need formal approval, at the discretion of the Commission– however, it's preferable to have something in writing with DEP
- Meet with your Conservation Agent well in advance of project!
- Organized larger-scale hand-pulling may need to be reviewed through a Request for Determination of Applicability (RDA)
- RDA is submitted to the ConsCom
- The Commission may issue **negative Determination** with the provision that DCR's SOPs are used
- OR issue a positive Determination, then a Notice of Intent must be submitted



Larger Projects

- E.g. harvesters, hydrorakes, use of chemicals, dredging
- Require permitting through a WPA Order of Conditions
- File: NOI that specifies:
  - scale
  - scope of the project
  - location(s)
  - equipment
  - disposal methods
- Can file electronically
- Does not need publication in the Environmental Monitor
- Does require abutter notification.

Large/Complex Projects

Ecological Restoration Project

"a project whose primary purpose is to restore or otherwise improve the natural capacity of a Resource Area(s) to protect and maintain the interests identified in M.G.L. c.131 § 40, when such interests have been degraded or destroyed by anthropogenic influences."

- Ecological Restoration Projects
- Designed for more complex projects such as dam removal, day-lighting a stream, or culvert restoration
- Permitting is expected to be complex and would benefit standardized conditions and pre-NOI reviews such as Natural Heritage or Fish & Wildlife

Ecological Restoration Limited Project

CMR 10.04 (definition) Ecological Restoration Project means a project whose primary purpose is to restore or otherwise improve the natural capacity of a Resource Area(s) to protect and sustain the interests …

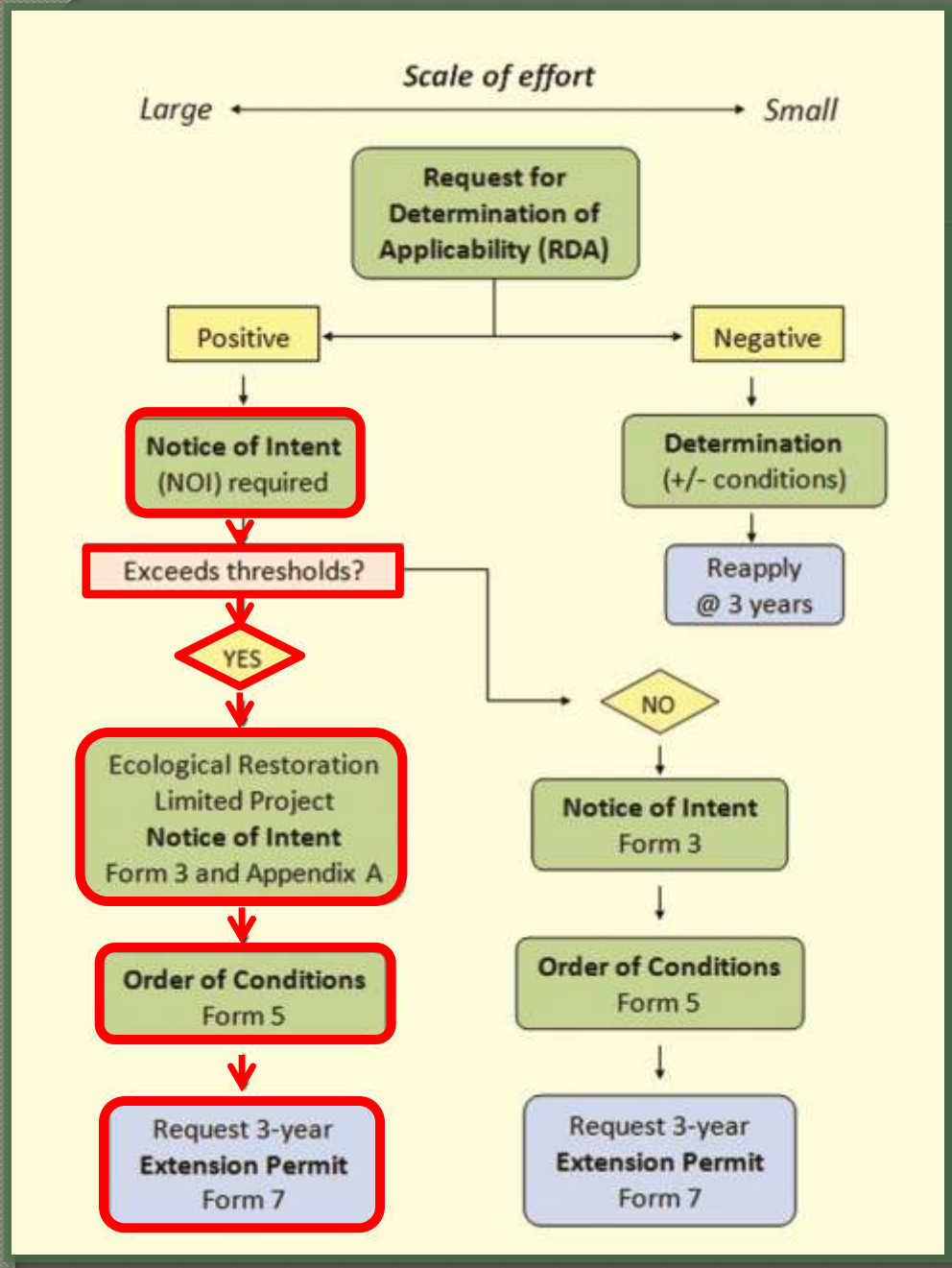
CMR 10.53(4)(e)5. Other Restoration Projects. An Ecological Restoration Project that is not listed in 310 CMR 10.54(4)(e)2. through 4., that will improve the natural capacity of a Resource Area(s) to protect the interests identified in M.G.L. c. 131, § 40, may be permitted as an Ecological Restoration Limited Project …

Such projects include, but are not limited to…the removal of aquatic nuisance vegetation to retard pond and lake eutrophication, the thinning or planting of vegetation to improve habitat value, riparian corridor re-naturalization, river floodplain reconnection, in-stream habitat enhancement, fill removal and regrading, flow restoration, and the installation of fish passage structures.

Ecological Restoration "Limited" Project

Thresholds for Filing as a "Limited Project"	
Resource Area	**Threshold in Inland Resource Areas**
Bank	>50 linear feet or 10% of Bank on the property, whichever is less (310 *CMR* 10.54(4)(a)(5))
Land Under Waterbodies and Waterways (LUW)	>5,000 square feet or 10% of LUW on the property, whichever is less (310 CMR 10.56(4)(a)(4))
Bordering Land Subject to Flooding (BLSF)	>5,000 square feet or 10% of BLSF presumed significant for wildlife habitat, whichever is less (310 CMR 10.57(4)(a)(3))

- If a project EXCEEDS thresholds, it can be permitted as a "Limited" Project
- Ecological Restoration Projects that **don't** exceed the thresholds can be permitted under a Ecological Restoration Project General Permit (WPA Form 3A and Appendix A)
- …but most WC management projects will be easier to permit as a regular project using WPA Form 3 (Notice of Intent).



Ecological Restoration "Limited" Project Permitting

Other permitting

CHEMICAL APPLICATION

- Notice of Intent required
- Must be applied by a licensed applicator. Herbicide licenses issued by the MassDEP (Form BRP WM 04)
- No herbicide license is required for treating a privately-owned pond with a single owner from which there are no flowing outlets

DREDGING & DRAWDOWN

- Notice of Intent
- Order of Conditions (restrictions may limit the extent of the project)
- Fish & Game assessment of native species
- Clean Water Act Section 404 permit before dredged material may be discharged
- Section 401 Water Quality Certificate from MADEP may also be required (depending on the amount of material dredged)

Other considerations

DURATION

- Successful control requires long-term management. So, seek permitting for the maximum duration (5 years)
- RDA is good for 3 years, then *reapply*
- Order of Conditions can be for 5 years and may be *renewed*

GENERIC ORDER OF CONDITIONS

- Can cover similar efforts elsewhere in the municipality
- Designate a single town entity or person as coordinator to maintain accountability and compliance
  - E.g. the town DPW could oversee handpulling efforts at waterbodies throughout town

ADAPTIVE MANAGEMENT

- Can write the original permit to cover a suite of treatment options
- NOI should list the various control methods expected
  - e.g. starting with mechanical harvesting or chemical application and going to hand-pulling as water chestnut population densities are reduced
  - provide for annual monitoring and reporting to the Conservation Commission
- Commission should review the project annually and approve any adjustments of the control methods

…. Got all that?

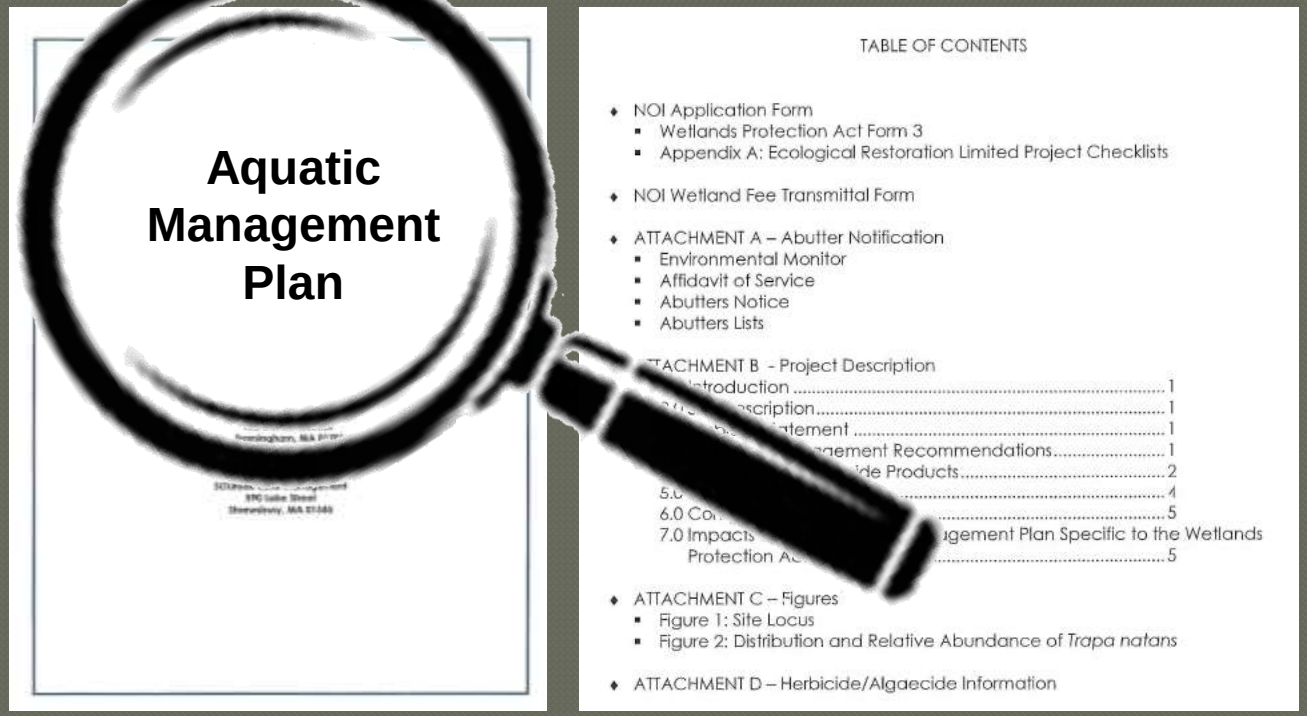
Framingham Example

SAXONVILLE IMPOUNDMENT of the Sudbury River, Framingham

- Starting some time after about 2010 overgrown with water chestnut
- OARS mapping in 2013 showed almost complete coverage of the lower sections
- Local involvement critical to getting remediation started
- First hand-pulling event in 2013 helped raise awareness
- Residents and OARS worked with Framingham Conservation Commission to get started
- Framingham hired SOLitude Lake Management in 2015

Permitting

- Filed NOI as a Ecological Restoration Limited Project in September 2016
- Requesting a 5-year approval and adaptive management provisions



Appendix B: Project Description

- Adaptive management provisions:
  - Provisions for pre- and post-management surveys
  - "A combination of management techniques including but limited to chemical, mechanical, or manual removal may be employed." Also included: Hand-harvesting, DASH, and benthic barriers as options.
  - Alternatives Analysis included: mechanical harvester, sediment excavation, drawdowns, biological, and no-action.
  - Factors to be considered in selecting the management strategy:
    - distribution & density of target plant
    - existence and distribution of native species
    - likelihood of successful seasonal removal
    - potential for success with (alternative) physical removal
    - Likelihood of fragmentation of other (non-target) invasive species
- Other permitting: DEP License to Apply Chemicals

Distribution and Relative Abundance of *Trapa natans*

Sudbury River
Framingham, MA

Data Collected: 08/28/2015
Map Prepared: 11/11/15
For: Audubon Society
Basemap © 2013 Esri

0 500 1,000 1,500 2,000
1:10,000 Feet

N

AQUATIC CONTROL TECHNOLOGY
21 West Main Street • Spencer, MA
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508-885-0101

Sudbury River, Saxonville, June 2016 (BEFORE)

Treatment

2017 (cost $30K)

- Three applications of Clearcast
  - June 21 (coverage dense)
  - July 19
  - August 29 (a little late)
- Significant reductions in water chestnut (but many nuts still dropped)
- Recommended a second year of treatment with Clearcast

2018 (cost $30K)

- Four applications of Clearcast starting June 12th and continuing every 2 weeks
- Drone survey on August 8th showed significant reductions

Sudbury River, Saxonville, August 2018

Framingham Reservoir #1, August 2018

Management Plan for the SuAsCo

OBJECTIVES

- ✓ Establish a watershed-wide water chestnut task force (formed as a sub-committee of CISMA)
- Establish watershed-wide monitoring & reporting
- Outreach & local participation
- Consistent wetland permitting of control efforts
- Prevent & control new infestations
- Contribute to research
- Support control measures

Next Steps?

- Watershed- or state-wide generic Order of Conditions for hand-pulling of water chestnut?
- Town-by-town generic OOCs for hand-pulling
- Development of drone survey methodology for wider use?
- State-wide database of invasives?

Thank you to our Technical Advisory Committee:

Amber Carr (SuAsCo CISMA, Jeff Castellani (SOLitude, Inc.) Ron Chick (Friends of Saxonville), Tom Flannery (MassDCR Lakes and Ponds), Michele Girard (MACC), Delia Kaye (Concord Natural Resources), Tom Largy (Wayland SWQ Committee), Lealdon Langley (Wetlands Program, MassDEP), Frank Lyons (Hop Brook Protection Association), Eileen McGourty (Eastern Mass. NWR, U.S. F&WS), Dave McKinnon (Lincoln Conservation Dept.), Judy Schmitz (Mass DEP Wetlands Circuit Rider), and Michael Stroman (Mass DEP Wetlands Program)

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DISCOVERY 158