



Update of the Freeman Lake Diagnostic and Management Assessment

Key Findings and Next Steps

02.13.2025



Presentation Overview



UPDATE OF THE FREEMAN LAKE DIAGNOSTIC & MANAGEMENT ASSESSMENT

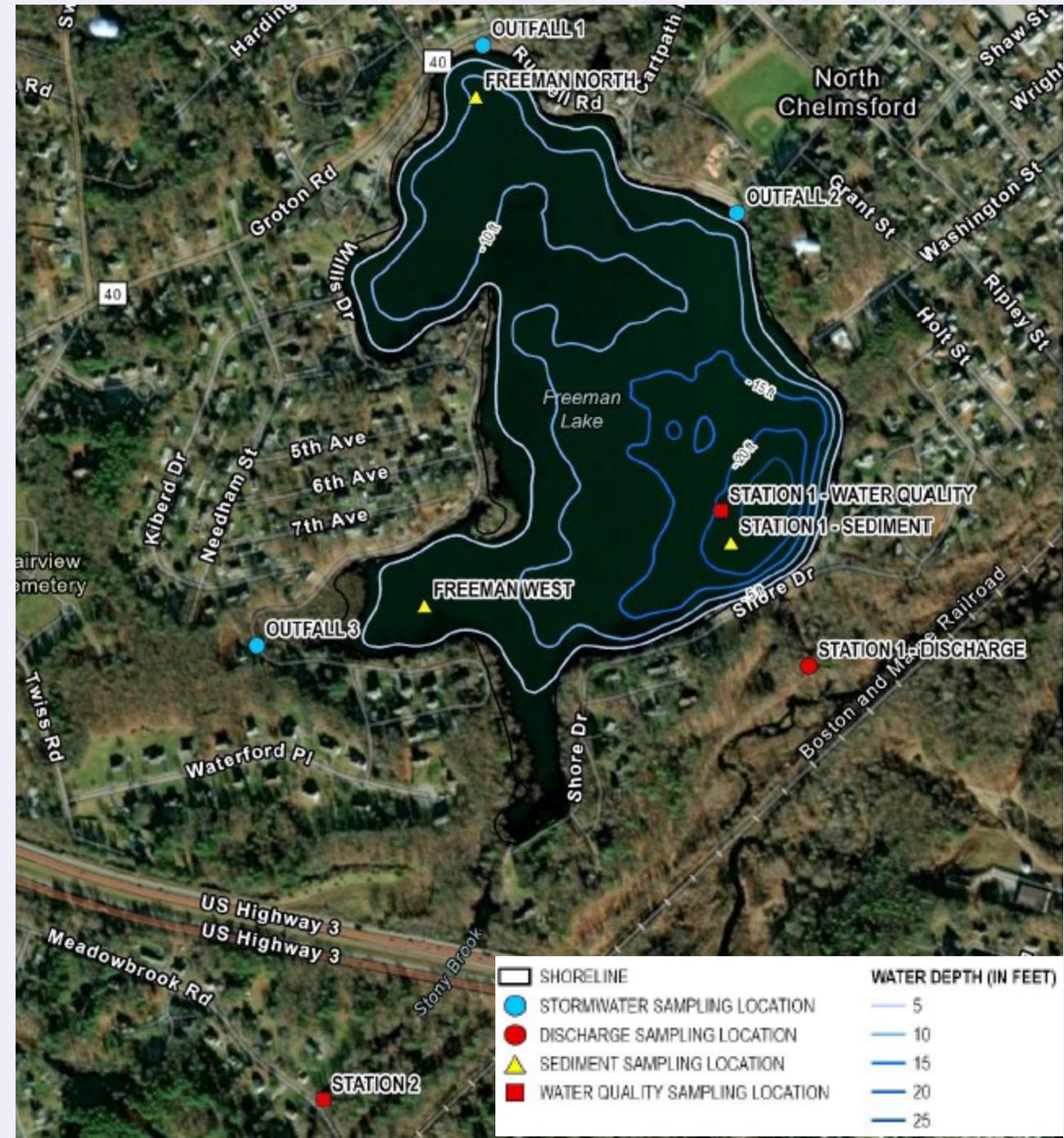
- Introduction
- Key Findings
 - Water quality
 - Aquatic plants
 - Nutrient budget
- Recommendations
 - Long-term options
 - Near-term priorities
 - What can you do?
 - Funding



Introduction

SCOPE OF WORK

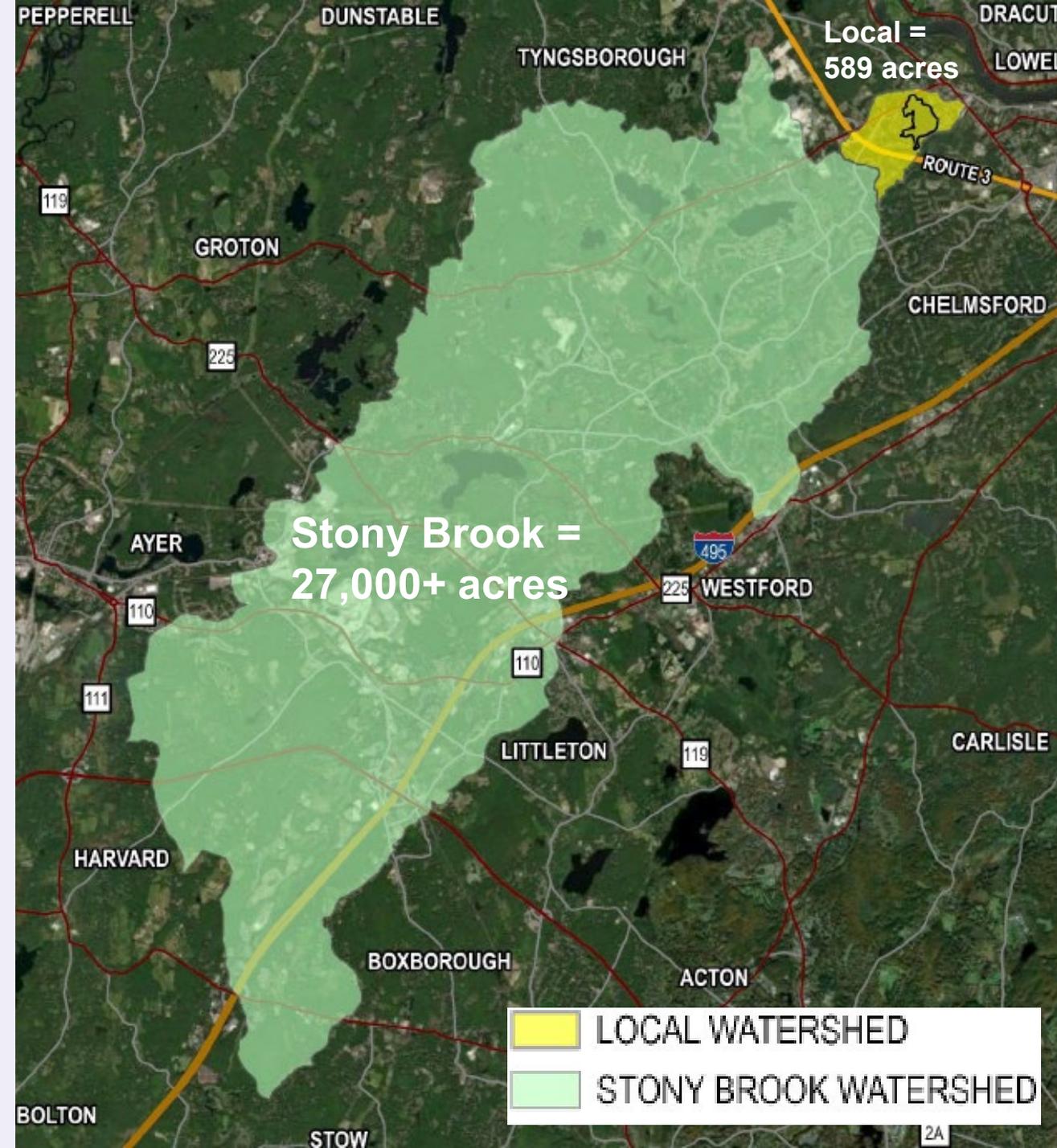
- Review and incorporate existing data and prior reports
- Update watershed delineation and land use map
- Update bathymetry map
- Collection of new data Oct '23 – Oct '24
 - Water quality from Freeman Lake and its inflows
 - Streamflow at Stony Brook diversion and Freeman Lake outlet
 - Sediment core samples from Freeman Lake
 - Plankton samples from Freeman Lake
 - Aquatic plant mapping



Introduction

SCOPE OF WORK

- Develop updated nutrient budget for Freeman Lake
- Compare results to those obtained by past studies, esp. Worden (1995)
- Identify management issues
- Assess management options
- Develop recommendations for future management

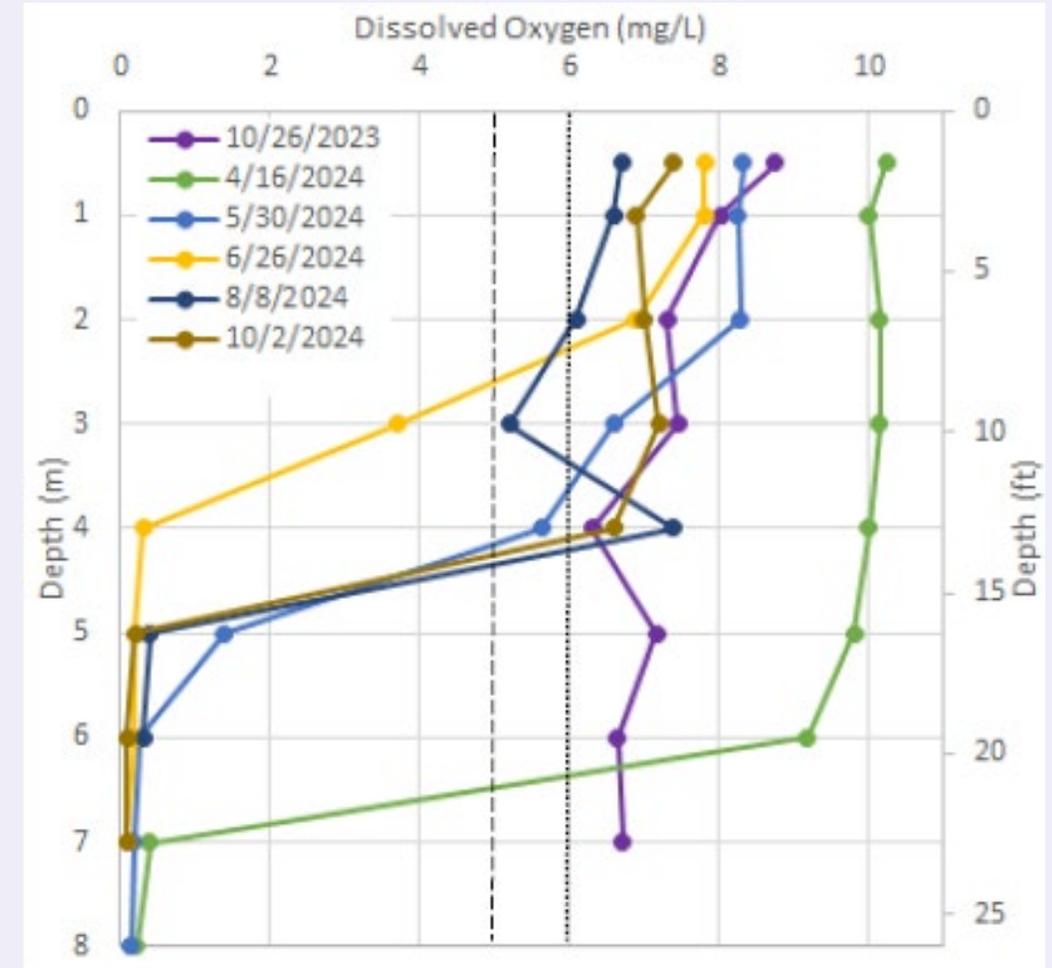


Key Findings



WATER QUALITY

- Freeman Lake is oxygen-stressed from May to September/October
 - No dissolved oxygen in bottom waters
 - Not good for aquatic life
- Low water clarity - < 6 ft on average
- Elevated nutrient concentrations
 - Leads to excessive algae and plant growth
- Elevated algal productivity
 - No action-level blooms observed but cyanobacteria present and plentiful every month but April
 - Some of the species observed are known to produce cyanotoxins



Key Findings

AQUATIC PLANTS

- Aquatic plants ring most of the lake
- Very dense in areas
- Multiple invasive species present
 - Eurasian milfoil
 - Fanwort
 - Water chestnut (new)
 - Curly-leaf pondweed and brittle naiad also reported in past



Key Findings



AQUATIC PLANTS

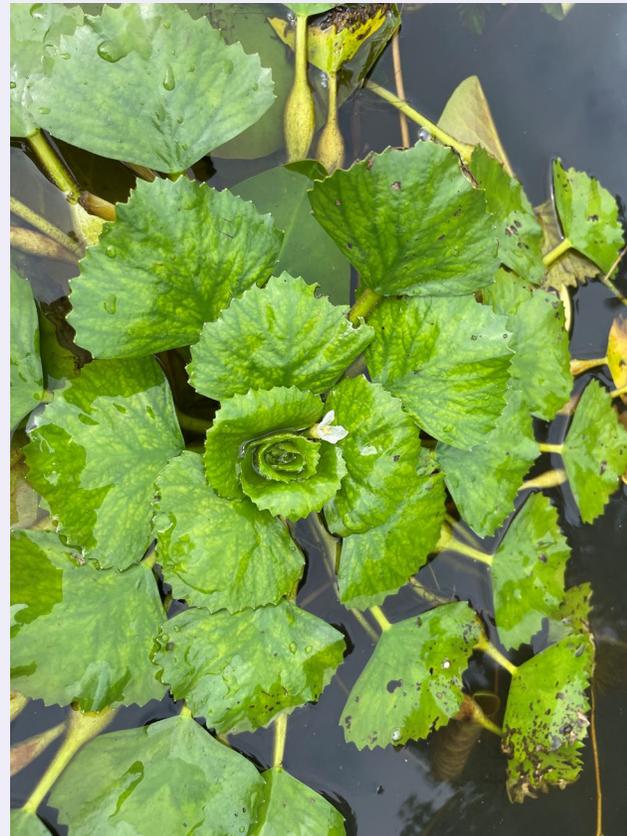
- Eurasian Milfoil & Fanwort
 - Submerged growth but tops out at the surface in shallow water
 - High biomass – crowds out other species
 - Perennial species – reproduce by fragmentation



Key Findings

AQUATIC PLANTS

- Water Chestnut
 - Floating leaves cover surface of water by July
 - Extremely aggressive
 - Annual species – reproduces by seed

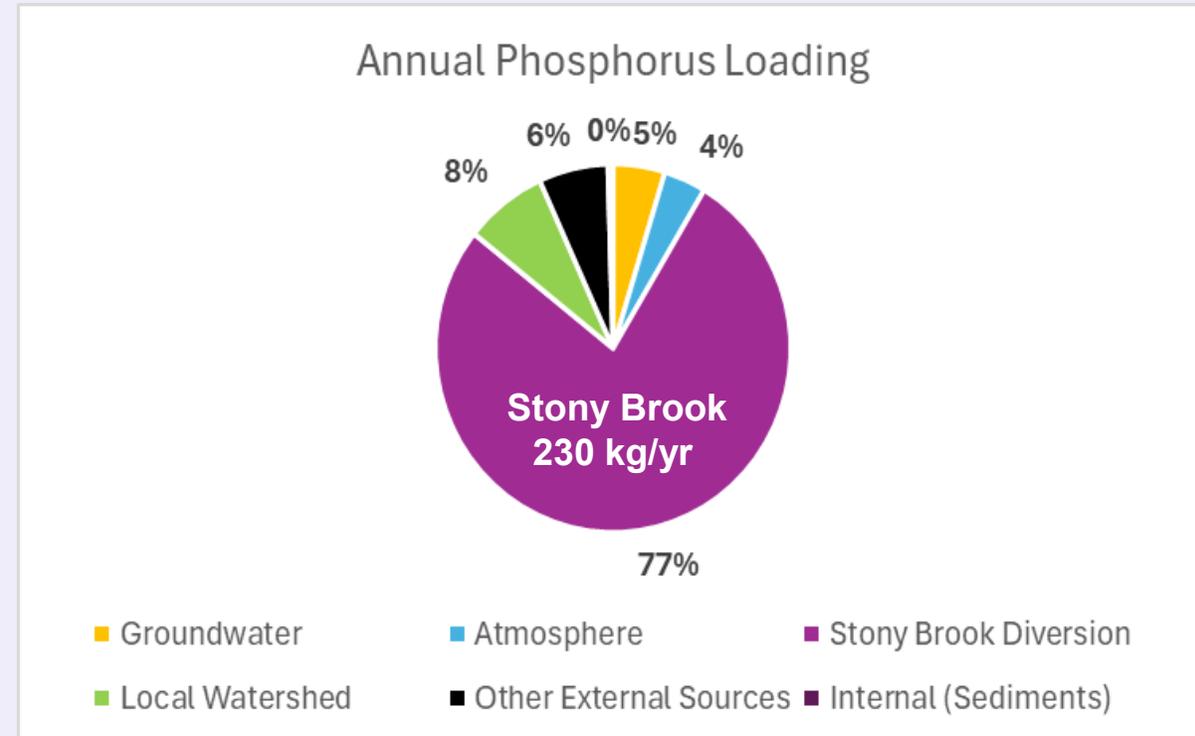




Key Findings

NUTRIENT BUDGET

- Freeman Lake is a eutrophic water body
 - Plentiful nutrients
 - Supports excessive growth of algae and plants
 - Declining water clarity
- Nutrients can come from outside the lake (external loading) or from within (internal loading)
- At Freeman Lake, most come from external sources, mainly the Stony Brook Diversion
- Annual load of phosphorus ~300 kg
- Ideally would like to be <160 kg to avoid water quality problems

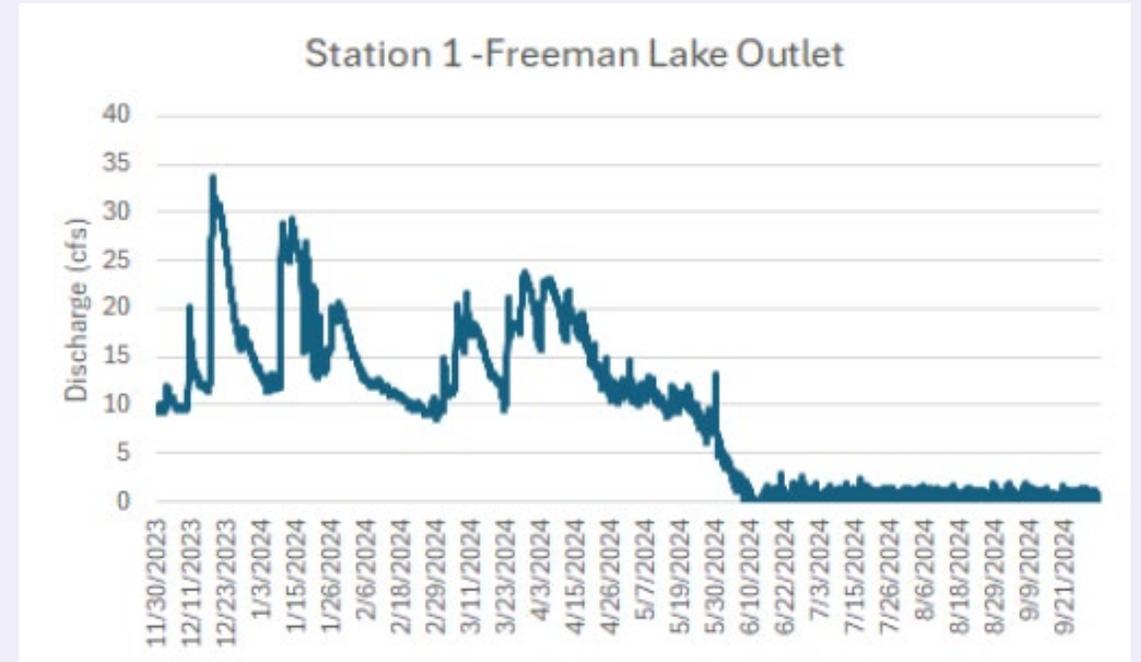
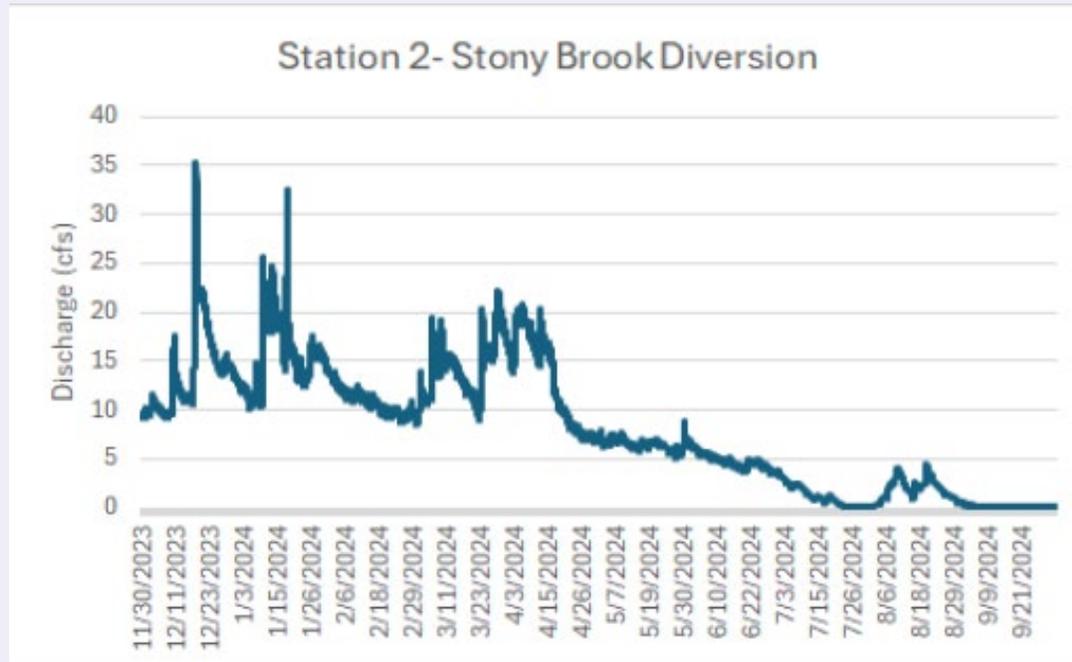


Key Findings



NUTRIENT BUDGET

- In summer, flows from Stony Brook continue to enter Freeman Lake, especially during wet weather (also stormwater flows from local watershed)
- At the same time, flows out of Freeman Lake are minimal
- As a result, nutrients are not flushed out and can be used to fuel growth of algae in the lake



Recommendations



LONG TERM OPTIONS – IN-LAKE (PART 1)

Approach	Action	Order of Magnitude Cost Estimate*
Aeration or Circulation	Undertake feasibility study.	\$30,000 to \$60,000
	Design, permit, and install unit(s).	\$100,000+
	Operate and maintain system.	\$10,000+ (annual)
Algaecides	Permit treatments.	\$10,000 to \$15,000
	Treat if/when needed.	\$5,000 to \$10,000 (annual)
Benthic Barriers	Permit and install benthic barriers as part of a pilot study.	\$15,000 to \$20,000
Dilution or Flushing: Investigate Alteration of the Stony Brook Diversion Structure	Undertake feasibility study.	\$70,000 to \$100,000+
	Design, permit, and construct project.	Highly variable costs – will depend on findings of feasibility study.
	Operate and maintain new system.	Dependent on alternative selected for implementation.
Fragment Barriers	Permit and install fragment barriers on inlet from Stony Brook diversion.	\$10,000 to \$15,000
	Maintain fragment barriers.	\$5,000 (annual)
Harvesting – Hand	Permit harvesting program with a focus on water chestnut.	\$10,000 to \$15,000
	Harvest and dispose of biomass.	\$10,000 to \$25,000 (annual)

Recommendations



LONG TERM OPTIONS – IN-LAKE (PART 2)

Approach	Action	Order of Magnitude Cost Estimate*
Harvesting – DASH	Permit DASH program with a focus on fanwort and Eurasian milfoil. Harvest and dispose of biomass.	\$15,000 to \$20,000 \$28,000 to \$48,000 per acre (annual) or \$350,000+ (annual) to address entire area of target species growth.
Herbicides	Permit treatments. Treat target species beds.	\$10,000 to \$15,000 \$300 to \$1,200 per acre, depending on product used. \$80,000+ for a lakewide systemic treatment (i.e., Sonar[fluridone]). \$20,000 to \$30,000 (annual) for spot treatments of existing beds
Hydroraking	Permit hydroraking program with a focus on key recreational shorelines. Implement hydroraking.	\$15,000 to \$20,000 \$15,000+ (annual)
Nutrient Inactivation	Permit low-dose nutrient inactivation program. Apply low-dose treatment.	\$10,000 to \$15,000 \$50,000+ (annual) for partial lake treatment
Oxygenation	Undertake feasibility study. Design, permit, and install unit(s). Operate and maintain system.	\$30,000 to \$60,000 \$350,000+ \$10,000+ (annual)

Recommendations



LONG TERM OPTIONS – WATERSHED

Approach	Action	Order of Magnitude Cost Estimate*
Nutrient Inactivation (Dosing Station)	Undertake feasibility study. Design, permit, and construct station. Operate and maintain system.	\$40,000 to \$60,000 Variable but anticipate minimum of \$350,000. Variable but anticipate minimum of \$50,000+ (annual)
Public Education and Outreach	Identify additional public education and outreach needs	Varies but minimal additional costs anticipated.
Resident Waterfowl Control	Continue active goose harassment program on Town recreational area parcels near the lake. Consider addition of passive measures, if needed.	Varies but minimal additional costs anticipated. Some passive measures can reduce operations and maintenance costs.
Shoreline Road Maintenance	Continue to address with good housekeeping measures.	Negligible to minimal additional costs beyond what is required for compliance with Small MS4 General Permit.
Stormwater Controls	Additional investigation of high priority outfalls/sources and development of concept designs. Design, permit, and construct high priority controls. Operate and maintain controls.	\$75,000 to \$100,000 Highly variable costs – will depend on findings of additional studies and the designs developed in response. Dependent on designs selected for implementation.

Recommendations

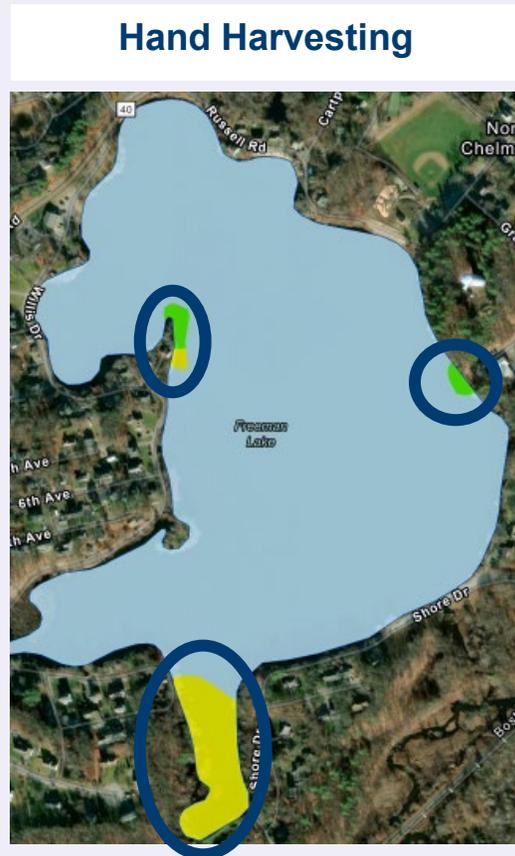


PRIORITY ACTIONS FOR NEAR TERM

1. Initiate a water chestnut hand harvesting program
2. Use targeted herbicide treatments in key recreational areas
3. Undertake a pilot study with benthic barriers



Possible Locations
for Priority Action



Near-Term Recommendations

1. WATER CHESTNUT HAND HARVESTING

- Water chestnut is the most potent aquatic invasive species present
- The infestation is spreading but not yet established throughout
- May avoid the need for more serious intervention (mechanical harvesting or herbicides)



Near-Term Recommendations

2. TARGETED HERBICIDE TREATMENTS

- Spot treatments of fast-acting herbicides
- Provides immediate control of nuisance plants in key recreational areas
 - Improve safety for swimmers
 - Clear channels for watercraft to navigate from shore to deeper waters



Near-Term Recommendations

3. BENTHIC BARRIER PILOT STUDY

- Provides immediate control of all plant growth over very small, discrete areas
- Best near key recreational areas but not directly where boats or wading will occur
- Pilot study in one or two locations will help determine feasibility for broader use



Near-Term Recommendations

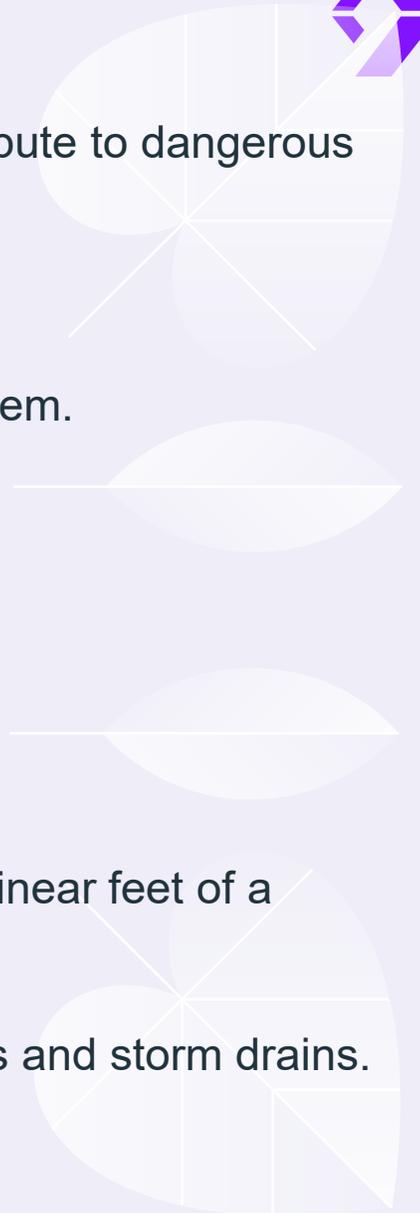


TIMING

Action	Jun	Jul	Aug	Sep	Oct
1. Hand Harvesting of Water Chestnut		●	●		
2. Herbicide Spot Treatments	●				
3. Benthic Barrier Pilot Study	●	●	●	●	●

What can YOU do?

- Increased input of nutrients into a lake can accelerate the growth of aquatic plants and contribute to dangerous algal blooms
- Fertilizers, leaves, and pet waste are common, high nutrient stormwater pollutants
- If you fertilize lawn and gardens, avoid fertilizers and cleaning products with phosphorus in them.
- If you hire a lawn care contractor, speak with them about using phosphorus-free fertilizers.
- Introduce more native plants - they require no fertilizer and minimal watering.
- Pick-up after pets and dispose in trash. Never dump pet waste into storm drain.
- Do not feed waterfowl.
- Never dump, store, or stockpile yard waste, including grass clippings and leaves, within 100 linear feet of a waterbody or wetlands.
- Dispose of yard waste properly at a commercial waste facility or compost away from wetlands and storm drains.
 - Chelmsford offers free curbside leaf pick-up events for residents
- Keep paved areas and storm drains clear of leaves.



Healthy Lawns – Healthy Water

Use Zero-Phosphorus Lawn Fertilizer! It's the Law!

Phosphorus runoff poses a threat to water quality. Therefore, under Massachusetts Law, phosphorus-containing fertilizer may only be applied to lawn or non-agricultural turf when:

- a soil test indicates that additional phosphorus is needed for the growth of that lawn or non-agricultural turf; or
- is used for newly established lawn or non-agricultural turf during the first growing season.

Most lawns in Massachusetts do not need additional phosphorus for healthy growth.

Look for the “Zero” to Protect Our Waters



Check the fertilizer bag for a set of three numbers representing the percentage of nitrogen (N), phosphorus (P) and potassium (K).

Buy the bag with a “0” in the middle: Zero Phosphorus!

Visit www.mass.gov/agr for more information and resources on plant nutrient management.

Please... don't feed waterfowl.



REGULAR FEEDING CAN CAUSE:

- Poor nutrition
- Spread of disease
- Unnatural behavior
- Pollution
- Overcrowding
- Delayed migration

Many people enjoy feeding waterfowl, but the effects of this seemingly generous act can be harmful. If you care about waterfowl, please stop feeding them, allow them to return to their natural habits.

If your yard requires fertilizer, you can still help reduce water pollution by:

- Using phosphorus-free and/or slow-release fertilizers
- Spot treatment; only apply fertilizer to problem areas, rather than entire yard
- Do not apply before a rain event
- Do not over apply – follow instructions on the bag
- Never store or dump yard waste in or around waterways, wetlands, or storm drains
- Leave grass clippings in your yard as natural fertilizer or compost yard waste in an area away from storm drains and wetlands (minimum 100 ft)



Recommendations



FUNDING & OTHER ASSISTANCE

- Local
 - Community Preservation Act Funds – Preservation of Open Space/Recreation
- State
 - DCR Weed Watcher Program – Training on Aquatic Invasive Plants
 - Municipal Vulnerability Preparedness (MVP) Action Grants – Climate Resilience
 - Stormwater MS4 Municipal Assistance Grants – Funding to Support Intermunicipal Coordination
 - Water Quality Monitoring Grants – Funding to Support Monitoring by Non-Profits
- Federal (may be administered through state or other entities)
 - CWA 604(b) Water Quality Planning Grants – Watershed Assessment and Planning
 - CWA Section 319 Nonpoint Source Management Grants – Project Permitting and Implementation
 - New England Water Infrastructure Network (NEWIN) – Technical Assistance to Municipalities

Thanks!

Questions?



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