

# Black's Nook In-Pond Restoration Project



Cambridge Water Board  
9 February 2021





# AGENDA

1. Review of Work to Date and Key Findings
2. Rehabilitation Alternatives and Costs
3. Decision Matrix
4. Discussion
5. Next Steps



# OUR TEAM

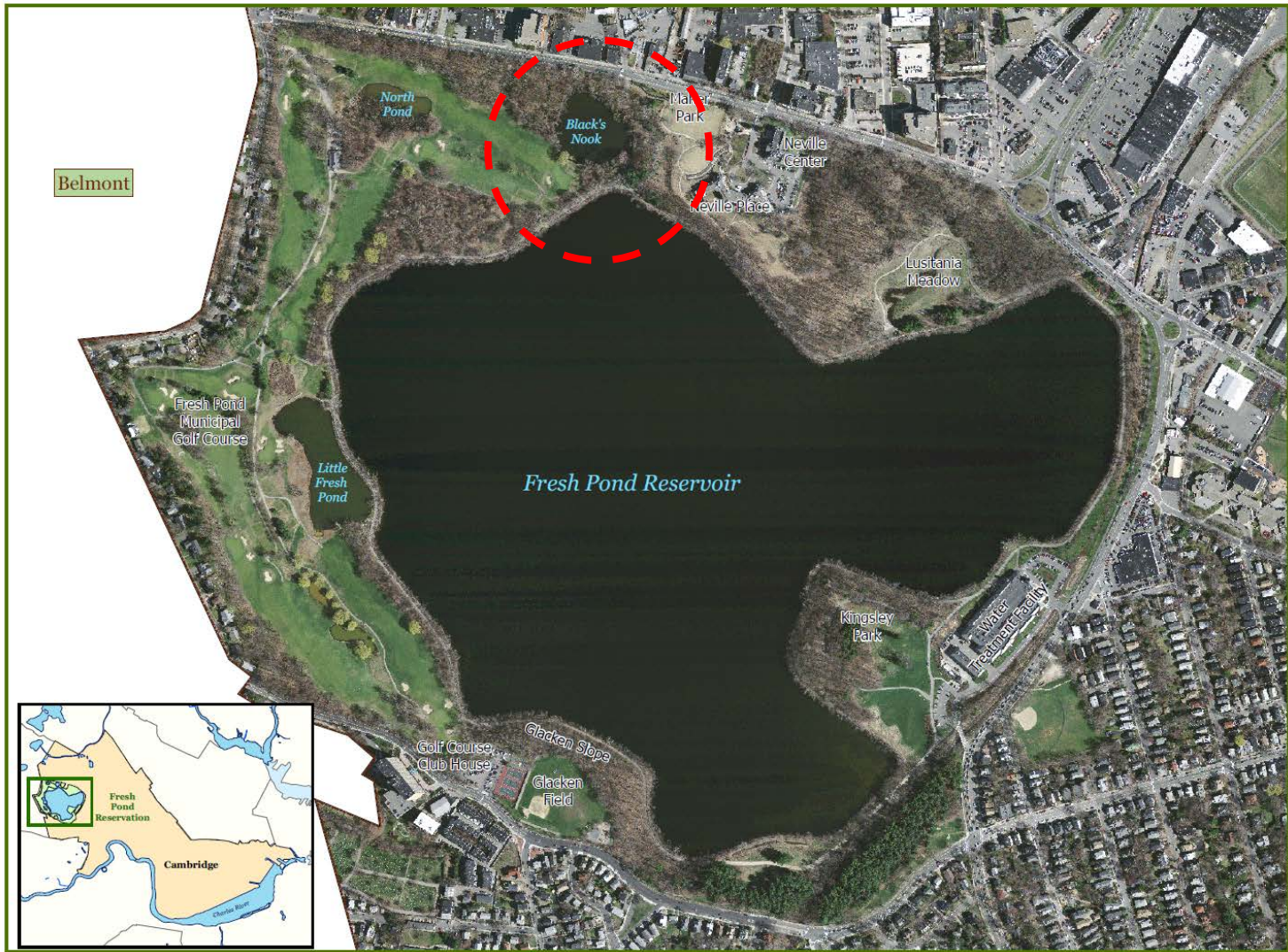
**WATER QUALITY EXPERT** – Ken Wagner, Ph.D., Limnologist, Certified Pond Manager, WATER RESOURCE SERVICES

**WILDLIFE SCIENTISTS** – Ben Griffith and others, NORMANDEAU ASSOCIATES

**RESTORATION ECOLOGISTS/  
LANDSCAPE ARCHITECTS,  
SITE CIVILS** Duke Bitsko,  
HATCH



# BLACK'S NOOK PROJECT AREA



# PREVIOUS PROJECTS – PHASES 1 & 2

- Inventory and Analysis
- Concept Designs
- Contract Documents
- Permitting
- Construction Oversight
- Vegetation Management Plan
- Phased Implementation







# WORK TO DATE – PHASE 3

1. FPAB Presentation #1 - Intro, Sept 2019
2. Field Work for Water Quality and Habitat Assessment, 2020
3. FPAB Presentation #2 – Findings, Oct 2020
4. Submitted BN Restoration Opportunities Report, Jan 2021
5. FPAB Presentation #3, Jan 2021





# BLACK'S NOOK IN-POND GOAL SETTING

## 1. Fresh Pond Reservation Master Plan Vision

- Preserve water quality, natural green spaces, wildlife habitat and refuge from hectic urban life

## 2. Black's Nook Pond – Water Quality Goals

- Slow cultural eutrophication;
- Keep Black's Nook an open water body; and
- Address Category 5 impaired water body status on the State's 303(d) list.
- Meet Class B Water Quality standards.



# KEY FINDINGS - SEDIMENT CHARACTERIZATION

1. Marked change in physical features with sediment depth.
2. Nearly all contaminants below standard or below detection limits.
3. Lead (Pb) in upper foot of 2 Stations exceeds most stringent standards.
4. Available phosphorus (P) is substantial, even in upper 2' of sediment (high organic content).

Loose Organic Muck  
(0-12" Layer)



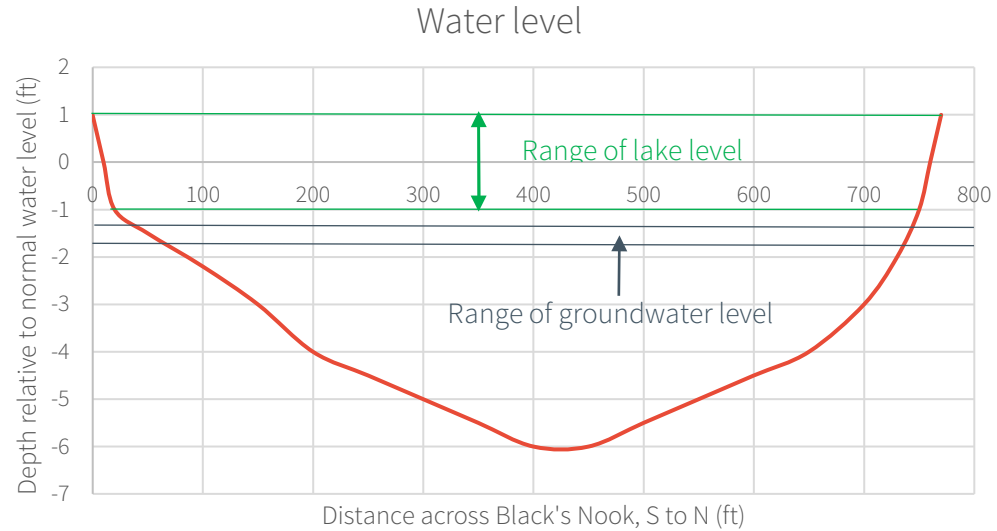
Mixture of Organic  
Muck and Pure Peat  
(12"-24" Layer)



Pure Peat –  
24"-36" Layer

# KEY FINDINGS - WATERSHED & GROUNDWATER INPUTS

1. Pond fluctuates 1' above and below normal water level (0).
2. Groundwater level less than normal pond elevation.
3. Existing peat layer restricts lateral groundwater flow.
4. Pond hydrology mainly impacted by precipitation (limited surface runoff; little groundwater input; and rare Stream A inflow).





# KEY FINDINGS - WATER QUALITY

1. WQ data fairly consistent with 20-year historical CWD data.
2. Low dissolved oxygen (bottom) and high pH (surface) caused by excessive plant growth.
3. Large temperature gradient caused by high plant density restricting mixing and sunlight penetration.
4. Most water quality features are within normal ranges for ponds in acceptable condition.



# KEY FINDINGS - WATER QUALITY (contd.)

5. Secchi transparency not measured due to density of aquatic plants.
6. High Ammonium levels cause potential for toxicity during summer months (elevated temperatures and pH).
7. Nitrate concentrations are low; Total Kjeldahl N levels are moderate.
8. Total Phosphorus levels elevated; very high at bottom; indicates internal loading from pond sediments.



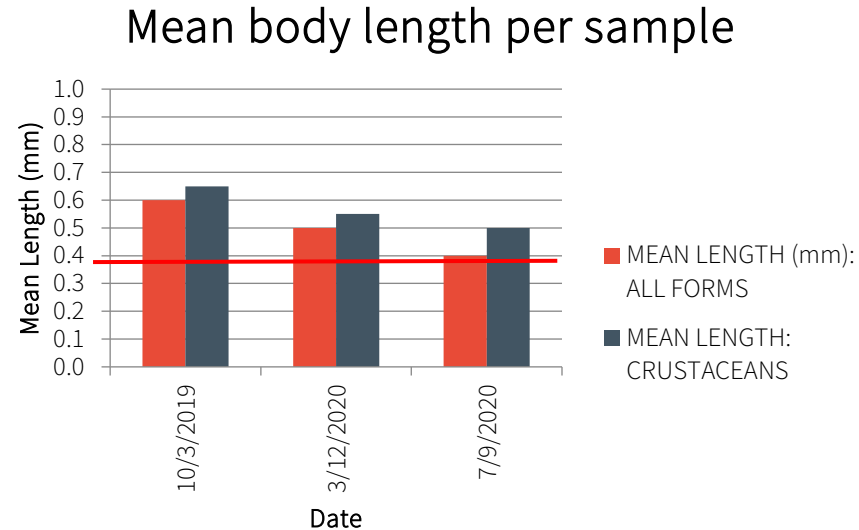
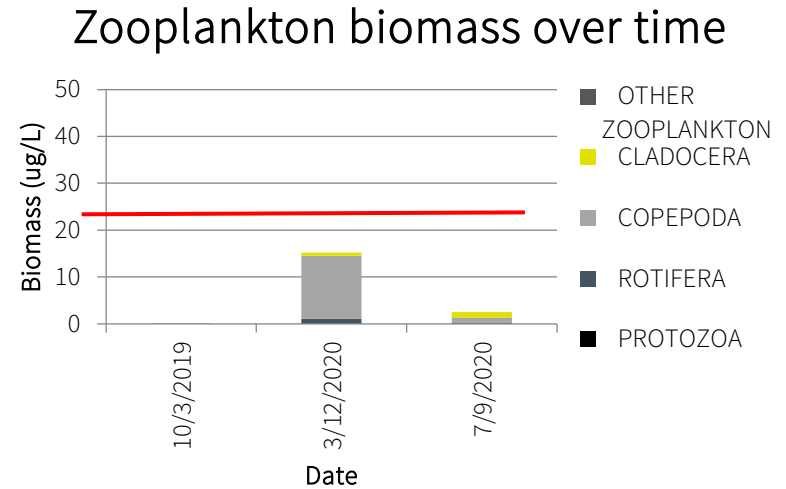
# KEY FINDINGS - AQUATIC VEGETATION

1. Aquatic plants not diverse but excessively abundant, filling entire water column.
2. Plant density is higher than desirable.
3. Dominant species include: water smartweed, coontail, and Indian lotus.
4. Indian lotus spread quickly in 2020; estimate 80-90% coverage in < 10 years.
5. Submergent species are gradually being eliminated due to floating leaves.
6. Indian lotus and water chestnut are only non-native species.



# KEY FINDINGS - ZOOPLANKTON

1. Zooplankton not abundant (under 25 ug/L); preferred values of 100 ug/L or greater.
2. Lack of Open Water limits zooplankton habitat.
3. Average zooplankton size is moderate but desirable.
4. Larger-bodied species preferred by fish not abundant.



# KEY FINDINGS - BENTHIC COMMUNITY

## 1. Kick Net Sampling:

- 51 Species
- Diversity Index 2.39 (Moderate)

## 2. Ponar Sampling:

- 30 Species
- Diversity Index 2.57 (High)

## 3. Most Species Tolerant of Poor Water Quality/Low Oxygen Levels.

### Most Abundant Species - Kick Net Sampling

Taxon	Common Name	Tolerance
Dero nivea	naiad worm	High
Caenis sp.	mayfly	High
Corynoneura sp	midge	Moderate
Enallagma sp.	damselfly	High

### Most Abundant Species – Ponar Sampling

Taxon	Common Name	Tolerance
Chironomus sp.	midge	High
Dero sp.	naiad worm	High
Dero nivea	naiad worm	High
Dicrotendipes sp.	midge	Moderate
Paranytarsus sp.	midge	Moderate

# KEY FINDINGS - FISH SURVEY

1. Four Species Detected.
2. Tolerant of Degraded Habitat.
3. Primarily Young Fish – Low Survivorship/High Reproduction.



Species	Native Distribution (in relation to Northeast)	Occurrence in Northeast (common to rare)	Water Class (General Habitat preference)	Water temperature preference	Trophic Class	Tolerance to degraded habitat
Spottail Shiner	Native/Introduced <sup>1</sup>	common	Rivers to Lakes	warmwater	Water Column	Intermediate
Golden Shiner	Native	common	Streams to Lakes	warmwater	Generalist Feeder	Tolerant
Goldfish	introduced	common	Rivers to Lakes	warmwater	Generalist Feeder	Tolerant
Pumpkinseed	Native	common	Streams to Lakes	warmwater	Generalist Feeder	Intermediate



# KEY FINDINGS - HERPTILE SURVEY

1. 3 Species Detected.
2. Only Bullfrog presently abundant.
3. Peepers may be the result of reintroduction effort.



Species	Scientific Name	Black's Nook (N)	Black's Nook (S)	Fresh Pond	Little Fresh Pond
Bullfrog	<i>Lithobates catesbeianus</i>	Abundant	Abundant	0	Abundant
Green Frog	<i>Lithobates clamitans</i>	Uncommon	Uncommon	0	0
Spring Peeper	<i>Pseudacris crucifer</i>	Common	0	0	0

# KEY FINDINGS - BREEDING BIRDS

1. 34 Species Detected.
2. 9 Species Confirmed Nesting, 7 Probable.
3. Aquatic Insects and Riparian Vegetation Important Contributors of Pond to Bird Community.



Orchard Oriole



Gray Catbird

## Pond Use by Bird Species at Black's Nook

Diet: Aquatic Insects	Diet: Aquatic Vertebrates	Diet: Aquatic Vegetation	Breeding Habitat
American Redstart	Black-crowned Night-Heron	Canada Goose	Common Grackle
Cedar Waxwing	Green Heron	Mallard	Eastern Kingbird
Chimney Swift	Great Blue Heron		Great Crested Flycatcher
Common Grackle			Orchard Oriole
Eastern Kingbird			Baltimore Oriole
Gray Catbird			Red-winged Blackbird
Great Crested Flycatcher			Warbling Vireo
Red-winged Blackbird			Yellow Warbler
Tree Swallow			

# KEY FINDINGS - BAT SURVEY

1. 6 Species Detected (9 Total in MA).
2. Two Listed Species – Both Rare at the Site.
3. Potentially Significant Bat Foraging Habitat.

Little Brown Bat



N. Long-eared Bat



Species	Scientific Name	Total Calls	State Status	Federal Status
Big Brown Bat	Eptesicus fuscus	566	-	-
Eastern Red Bat	Lasiurus borealis	4	-	-
Hoary Bat	Lasiurus cinereus	483	-	-
Silver-haired Bat	Lasionycterus noctivagans	650	-	-
Little Brown Bat	Myotis lucifugus	3	Endangered	-
Northern Long-eared Bat	Myotis septentrionalis	10	Endangered	Threatened



# REHABILITATION ALTERNATIVES

1. Do Nothing.
- 2A. Manage Aquatic Vegetation – Benthic Barriers
- 2B. Manage Aquatic Vegetation – Mechanically (Hydro-rake)
- 2C. Manage Aquatic Vegetation – Chemical Treatment
3. Phosphorus Inactivation
- 4A. Shallow Dredging – 2' Depth
- 4B. Deeper Dredging – 4' Depth





# ALTERNATIVE 1 – DO NOTHING

## Pros:

1. Zero Costs (Volunteer Invasive Removal).

## Cons:

1. Does Not Meet any Water Quality Goals:
  - A. Maintain Open Water Body;
  - B. Meet Class B Water Quality Standards;
  - C. Address Impaired Water Status.
2. No Change to Benthic and Wildlife Habitats.





# ALTERNATIVE 2A – MANAGE AQUATIC VEGETATION W/ BENTHIC BARRIERS

## Pros:

1. Returns Black's Nook to Open Water Body (Portions).
2. Partial Improvements to Fish, Bird, and Amphibian Habitats.

## Cons:

1. Won't Meet Class B WQ Standards or Address Impaired Category 5 Water Body Status.
2. Plant Removal Limited to Barrier Placement.
3. No Improvements to Benthic Community and Bat Habitats.
4. Requires Other Alternatives at Additional Costs.
5. Requires Maintenance.

Cost per 20 Years: \$100,000 (50% of Pond)



**Benthic Barriers**

# ALTERNATIVE 2B – MANAGE AQUATIC VEGETATION MECHANICALLY (HYDRO-RAKE)

## Pros:

1. Returns Black's Nook to Open Water Body.
2. Eliminates Emergent and Floating-Leaved Species.
3. Partially Meets Class B WQ Standards and Addressing Impaired Water Body Status.
4. Partial Improvements to Benthic and Wildlife Communities.

## Cons:

1. Can Disturb Benthic Community.
2. Allows other Species like Coontail to Expand.
3. Does not Operate in Less Than 12" of Water.
4. Control only Lasts 3 – 5 Years.
5. Requires Shoreline Access.

Cost per 20 Years: \$70,000.



# ALTERNATIVE 2C – MANAGE AQUATIC VEGETATION CHEMICALLY

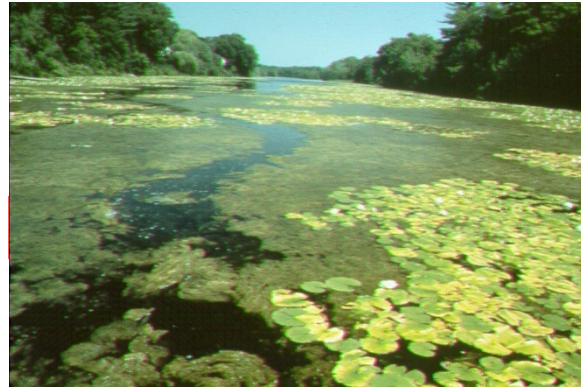
## Pros:

1. Returns Black's Nook to Open Water Body.
2. Eliminates Emergent and Floating-Leaved Species.
3. Partially Meets Class B WQ Standards and Addressing Impaired Water Body Status.
4. Partial Improvements to Benthic and Wildlife Communities.

## Cons:

1. Requires Use of Multiple Herbicides based on Species.
2. Control only Lasts 1-3 Years.
3. Requires Shoreline Access for Boat.

Cost per 20 Years: \$60,000.



Ware's Cove,  
Charles River





# ALTERNATIVE 3 – PHOSPHORUS INACTIVATION TREATMENT

## Pros:

1. Enhances Water Quality and Limits Algal Blooms.
2. Partially Meets Class B WQ Standards and Addressing Impaired Water Body Status.
3. Partial Improvements to Benthic and Wildlife Communities.

## Cons:

1. Does not Control Rooted Plants.
2. Does not Achieve Open Water without Herbicide Treatment.

Cost per 20 Years: \$20,000. (does not include Herbicide Treatment Costs).



# ALTERNATIVE 4A – SHALLOW DREDGING (2')

## Pros:

1. Returns Black's Nook to Open Water Body.
2. Meets Class B WQ Standards and Addresses Impaired Water Body Status.
3. Improves Benthic and Wildlife Communities.
4. Limited Future Maintenance.

## Cons:

1. Temporary Disruption to Pond's Ecology.
2. Management of Surface Sediments may be Required (Algal Blooms).
3. Dredged Material may need to be Disposed of Off-site.
4. Higher Permitting Costs.

Cost per 20 Years: >\$300,000.



# Black's Nook Water Depth (ft) and Proposed Dredge Area\*

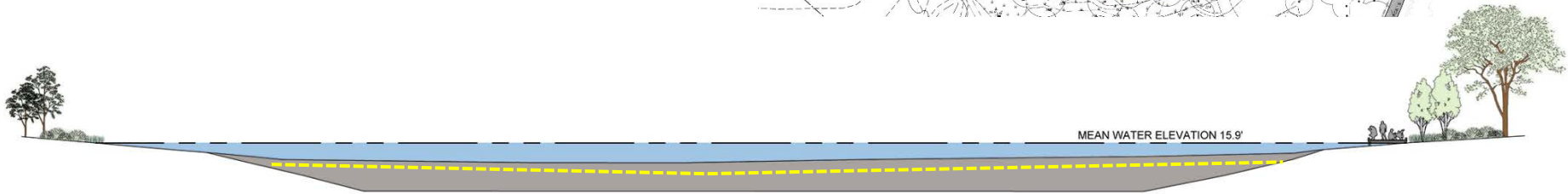
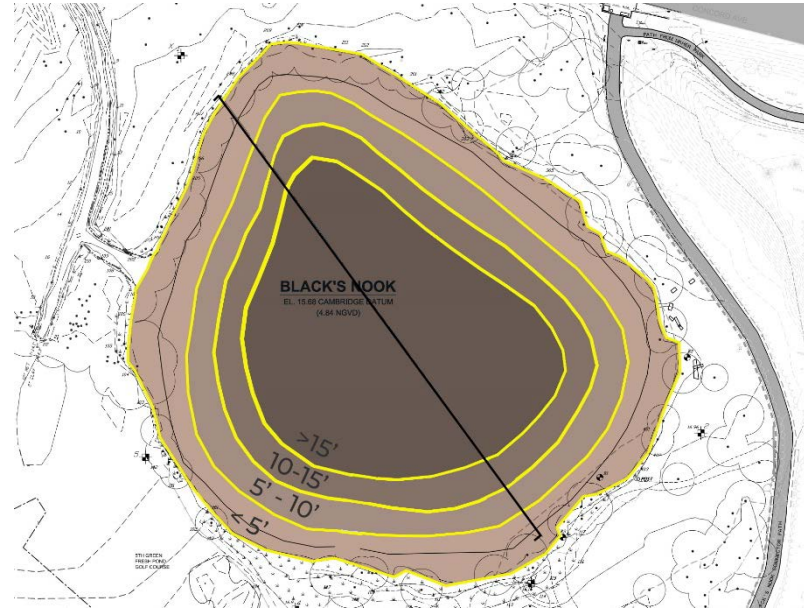
\*Proposed Dredge  
Area Starts  
approximately 20 ft  
off of Existing  
Shoreline



# SEDIMENT CHARACTERIZATION

## Field Survey and Metrics:

1. Bathymetric Survey.
2. Sediment Characterization.



Soft Sediment Section A-A'

# ALTERNATIVE 4A – DEEPER DREDGING (4')

## Pros:

1. Returns Black's Nook to Open Water Body.
2. Meets Class B WQ Standards and Addresses Impaired Water Body Status.
3. Improves Benthic and Wildlife Communities.
4. Expanded Habitat and Limited Growth Based on Species.
5. Longer-term Benefits and Limited Maintenance.

## Cons:

1. Temporary Disruption to Pond's Ecology.
2. Management of Surface Sediments may be Required (Algal Blooms).
3. Dredge Material may need to be Disposed of Off-site.
4. Higher Permitting Costs.

Cost per 20 Years: \$600,000.

City Hall Pond,  
Newton



Dunn's Pond,  
Athol



# DREDGING EXAMPLE (HILLS POND, ARLINGTON MA)



Hills Pond was drained and excavated by long-reach equipment, but a treaded tractor was used to “plow” soft sediment in harder to reach areas to the edge for removal.



# DREDGING EXAMPLE (HILLS POND, ARLINGTON MA)



The containment area for dredged material was filled and allowed to stand for some months before final cover, grading and seeding. The pond was restored to an open water habitat with parkland surrounding it.



# REGULATORY PERMIT REQUIREMENTS

## Alternative 1 – Do Nothing

- ✓ None Required.

## Alternatives 2A and 2B – Benthic Barriers and Hydro-Rake

- ✓ Notice of Intent (Cambridge).

## Alternatives 2C and 3 – Chemical Treatment and Phosphorus Inactivation

- ✓ Notice of Intent (Cambridge); WM04 Herbicide Application (DEP).

## Alternatives 4A and 4B– Dredging

- ✓ Notice of Intent (Cambridge); 401 Water Quality Certification (DEP); CWA Section 404 (USACE); Chapter 91 License.



# DECISION MATRIX FOR ALTERNATIVES

No.	ALTERNATIVE	WATER QUALITY IMPROVEMENTS			HABITAT IMPROVEMENTS					Special Considerations	20-Year Life Cycle Cost
		Returns BN to Open Water Body	Meet Class B Water Quality Standards	Address Category 5 Impaired Water Body Status	Benthic Community	Fishery	(Avian) Birds	(Anuran) Amphibians	Bats		
1	Do Nothing	N	N	N	NC	NC	NC	NC	NC	No cost but meets no goals.	0
2A	Manage Aquatic Vegetation - Benthic Barriers	Y	N	N	N	P	P	P	N	Will limit plants where applied but would not cover whole pond due to impacts on benthic community; requires some maintenance.	\$100,000
2B	Manage Aquatic Vegetation - Mechanically (Hydro-rake)	Y	P	P	P	P	P	P	P	Could limit emergent and floating leaved species for up to 5 years, but other species like coontail will expand.	\$70,000
2C	Manage Aquatic Vegetation - Chemical Treatment	Y	P	P	P	P	P	P	P	Would need more than one herbicide for range of species present.	\$60,000
3	Phosphorus Inactivation	N	P	P	P	P	P	P	P	Will enhance water quality and limit algae blooms but will not affect rooted plants.	\$20,000
4A	Shallow Dredging (2')	Y	Y	Y	Y	Y	Y	Y	Y	Affects all aspects of the pond, allows for overall restoration and enhancement.	>\$300,000
4B	Deeper Dredging (4')	Y	Y	Y	Y	Y	Y	Y	Y	Same as for shallow dredging but provides longer benefits and will expand habitat for some species and limit regrowth of plants.	>\$600,000

## KEY

	N = NO
	Y = YES
	P = PARTIAL
	NC = NO CHANGE



# NEXT STEPS

## 2021 and 2022:

1. Provide Case Studies and Recommend Preferred Alternative.
2. Resource Area Delineation and Permit Agency Coordination, as Necessary.
3. Develop 35% DD Drawings and Cost Estimate.
4. FPAB Meeting (April 2021).
5. Develop Phased Approach.



# QUESTIONS & INPUT





# ASSESSMENT APPROACH

## Slow Cultural Eutrophication:

1. Determine the source(s) and magnitude of nutrient loading.
2. Engage FPGC as long-term partner and steward.
3. Improve water quality within Black's Nook Pond.



# ASSESSMENT APPROACH

## Riparian Buffer:

- FP Golf Course runoff.
- Mowing of pond buffer plantings.
- Changing maintenance crews.
- Geese.

