TOWN OF HUDSON

Conservation Commission

William Collins, Chairman   David Morin, Selectmen Liaison

12 School Street • Hudson, New Hampshire 03051 • Tel: 603-886-6008 • Fax: 603-594-1142

CONSERVATION COMMISSION MEETING AGENDA
April 8, 2024

The Town of Hudson Conservation Commission will hold its next meeting on **April 8, 2024** at 7:00 p.m. in the Buxton Meeting Room, located in Town Hall 12 School Street, Hudson, NH.

- ✓ Call to Order
- ✓ Pledge of Allegiance
- ✓ Roll Call
- ✓ Alternates
- ✓ Public Input Related to Non-Agenda Items

I. **New Business:**

a. Welcome new member?

II. **Old Business:**

a. None

III. **Other Business:**

a: Robinson Pond- VHB Reports

b: Robinson Pond, Ottarnic Pond Long Term Management Plans

c: Musquash Pond Invasive Species Treatment Work

b: April Trail Workday

c: Open Space – letters sent

IV. **Financial Status:**

Current Report

V. **Correspondence**

Correspondence a: NH Lakes- Lake Host Impact Report

VI. **Approval of Minutes:**

a. Meeting Minutes – March 11, 2024

VII. **Commissioner's Comments:**

Next Regular Meeting: Monday May 13, 2024 at 7:00 p.m.

William Collins

William Collins, Chairman

Memorandum

To: Elvis Dhima , Town of Hudson Engineer
Date: January 15, 2024
VHB Project #: 53023.00 Robinson Pond
From: B. Arcieri and Garrison Beck
Re: DRAFT Robinson Pond Summary of Sediment Sampling Results

The memorandum provides a summary of the methods and results of the Robinson Pond sediment sampling effort and suggestions for next steps based on the study results described in greater detail in the attached report prepared by DK Water Resources Consulting LLC, who performed the sediment sampling in Robinson Pond as a subconsultant to VHB. The following identifies key factors that contribute to phosphorus (P) releases in the water column from bottom sediments as well as key aspects of the sampling approach and findings of the recent sampling.

Factors Affecting Phosphorus Availability in the Water Column

- As described in greater detail in the report, the amount of phosphorus in sediment potentially released into the water column depends on the relative availability of the phosphorus contained in the sediment (what it is bound to) and the extent and duration of anoxic conditions in the water column. As more of the lake area and water column becomes anoxic, the greater the risk for phosphorus releases.
- The relative availability of phosphorus depends largely on how it is contained or bound within the sediment. Typically, phosphorus in sediment is measured or classified into four major categories: that portion considered to be readily available or loosely-bound, that portion bound to organic matter (often referred to the labile portion), and then the portions that are bound to either iron or aluminum ions contained in the sediment, with the latter being the least available due to the greater binding strength with aluminum. Under anoxic conditions the loosely bound and iron bound phosphorus are readily released back to the water column.

Approach

- Bottom sediment samples were collected in six different locations across the main portions of the Pond in July 2023 and again in October 2023 for analysis for phosphorus and metal content, respectively.
- Sediment samples were generally collected from the upper 4 inches (10 cm) of the pond bottom.
- VHB conducted bi-weekly temperature/dissolved oxygen measurements from July to Oct, 2023 to get a better understanding of the duration and extent of low dissolved oxygen levels at depth during summer months.

Findings

- Based on an average concentration across six sampling locations, phosphorus bound to organic matter (i.e., labile portion or third most available category) comprised the largest fraction at approximately 35% of the measured total phosphorus in the Robinson Pond sediments.
- Aluminum-bound P was the second largest fraction at approximately 27% of the total average P concentration in the Robinson Pond sediments. The aluminum bound P is generally considered to be the least likely to be released from the sediments regardless of the oxygen content of the overlying water.

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vhb

Memorandum

- Approximately 51% of the phosphorus measured in the sediment was considered to be immediately available (loosely bound and iron bound) or after some decomposition (labile organic) forms. The combined average P concentration of phosphorus in the sediment was 0.462 mg/g.
- The amount of phosphorus measured within the various forms linked to bottom sediments was certainly not the highest nor the lowest observed in other NH lakes and is generally considered to be typical of that found in other lakes in and near New Hampshire (see Figures 5 and 6 in the Report). The more important factor may be the magnitude and duration of anoxia that was observed in 2023 which indicates a large portion of lake bottom is exposed to anoxic conditions enabling phosphorus to be released.
- The estimated duration of anoxia at various depths in the water column ranged from 19 days in the shallower depths of 3 to 4 meters (~9 to 12 ft) to 168 days in the deepest portion of more than 8 meters (~26 feet). Much of the pond area below 5 m (~15 feet) in depth was experiencing anoxic conditions for nearly 140 days, over 5 months, which is most of the summer period based on data collected in 2023. The 2023 summer may or may not have been typical given the prevailing warm temperatures and periodic intense rainfall events.
- Based on the estimated duration of anoxia at each of the depth intervals (see Table 5 in the Report) and the approximate area of sediment exposed to anoxia based on bathymetry data collected in 1988 by NHDES (formerly WSPCD), the total internal phosphorus load from bottom sediments is estimated to be as high as 26.3 kg (~58 lbs) over the course of the season, which is more than 10x greater than the 2.3 kg internal load estimate included in the 2011 TMDL Study (AECOM 2011).
- Assuming the overall watershed load of 115.2 kg/yr as estimated by the TMDL study has not changed dramatically since the time of the study, this revised internal load estimate represents approximately 23% of the total load compared to approximately 2% of the total phosphorus load presented in the TMDL Study.

Discussion

- The sediment sampling study results indicate that internal phosphorus loading from bottom sediments is likely much higher than previously estimated and may represent a major source of phosphorus affecting algal productivity and lake water quality.
- Internal loading of phosphorus from bottom sediments has the potential to worsen and have a greater impact if the duration of anoxia continues to expand at the shallower depths, which comprise a larger share of the overall pond area. Continued monitoring of dissolved oxygen data at depth will be critical to detect changes.
- Internal loading can also result in a self-fulfilling or worsening cycle if not curtailed or disrupted, especially if annual cyanobacteria blooms increase in area and duration and then subsequent die-offs cause more decomposition of organic matter at the pond bottom, which consumes oxygen and increases the anoxic area in the water column. This can then release even more phosphorus and fuel larger cyanobacteria blooms, creating a feedback loop of cyanobacteria blooms contributing to further anoxia and phosphorus release.

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- In addition to continuing to investigate and implement phosphorus control measures along shoreline properties and in the watershed, measures to reduce internal loading will be important considerations to improve the future lake water quality.
- In-lake management or control measures may include adding aeration devices to reduce or eliminate anoxic conditions or phosphorus inactivation with alum or alternative compounds, systematically dispersed over the lake to help bind phosphorus to the sediments even during anoxic periods.
- These in-lake management options are typically considered to provide relatively short-term relief, particularly if the phosphorus load from other sources is not curtailed as well. An alum treatment with watershed control of phosphorus might last 10-15 years or more depending on the lake conditions. Aeration would require installation of equipment and ongoing operation costs for the foreseeable future.
- NHDES has no formal guidance or a permitting process for in-lake control practices at this time and generally prefers various land-based source control and stormwater management measures as they generally have a more lasting effect. At a minimum, land control measures must be done in conjunction with in-lake measures.
- Given the level of anoxia observed in 2023, the relative contribution of phosphorus from bottom sediments compared to the overall load, and the general risk of conditions to worsen if the duration of anoxia expands in shallower depths, a reasonably strong case could be made to NHDES that Robinson Pond is a good candidate for alum treatments at least as an initial treatment option to restore water quality temporarily while additional phosphorus control measures are implemented in the watershed over the next decade or so.

Next Steps

- This revised internal load estimate relies heavily on older and uncertain bathymetry data developed back in 1988, and little is known about the methods and data resolution used to develop this data. A key step going forward would be to develop more accurate bathymetry data using the latest technology.
- Consult with NHDES and local VLAP coordinators about continuing to monitor temperature, dissolved oxygen, and hypolimnion total phosphorus levels at depth during summer months to detect any changes.
- List additional control measures and recommendations for next steps to address internal loading within the Technical Memorandum of recommended Best Management Practices (BMPs) being developed for NRPC for the Robinson Pond Water Quality Plan to NHDES and schedule a future meeting with NHDES to discuss the potential feasibility of an alum treatment as well as other phosphorus control measures and future data needs.
- Another next step involves updating the Town's Phosphorus Control Plan to include these bottom sediment findings and the pending recommendation for both structural and non-structural measures to be included in the Water Quality Protection Plan being completed by the Nashua Regional Planning Commission in June 2024 to effectively reduce phosphorus inputs from other sources within the watershed.

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Memorandum

- Establish a timeline and process to develop engineering plans and establish funding to implement at least 2 stormwater BMP projects in the watershed in the next 2 to 3 years to demonstrate a commitment and stimulate additional stakeholder interest in reducing phosphorus loads in the watershed.

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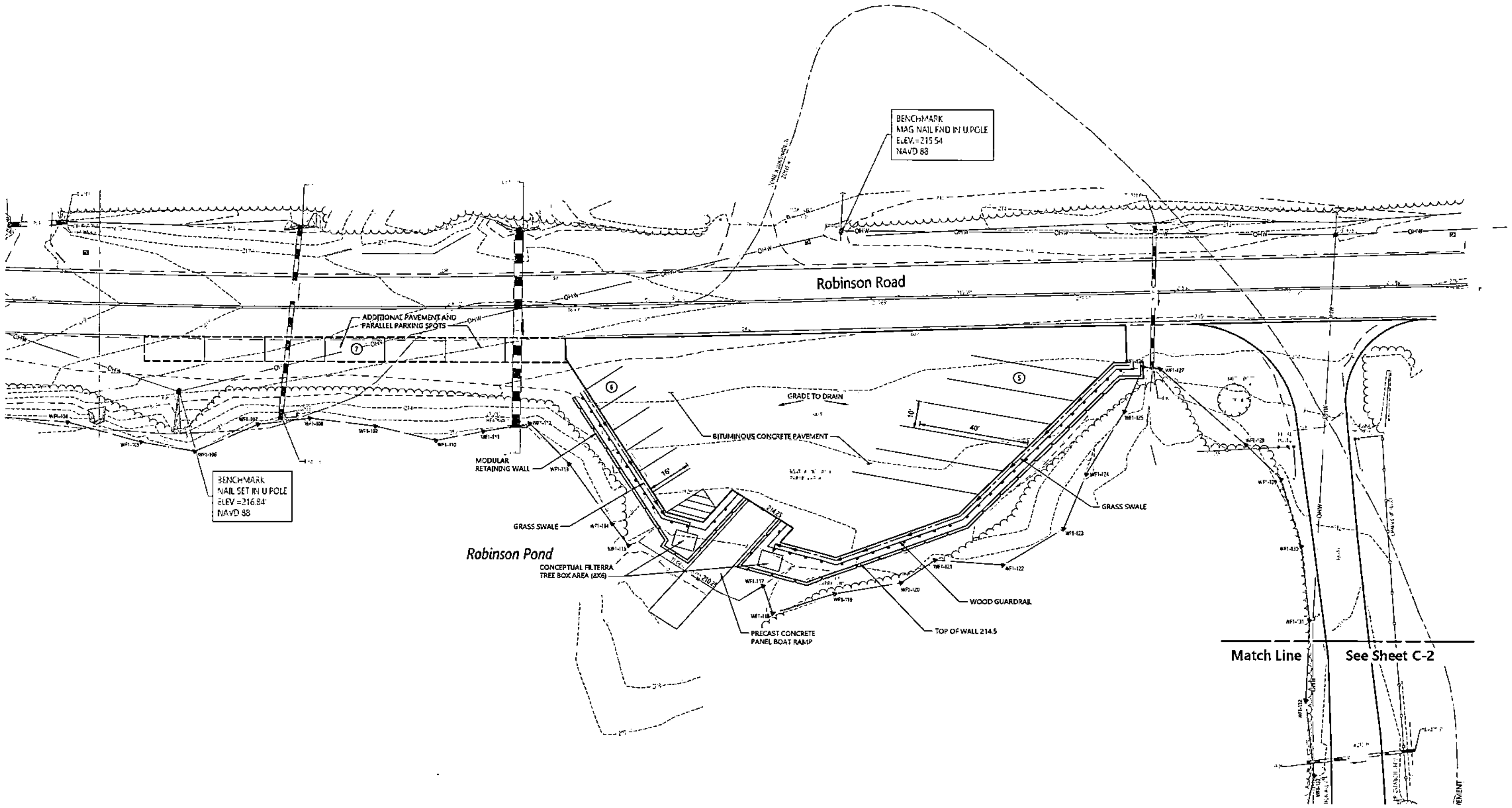

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603.391.3900

0 10 20 40 Feet

Robinson Pond

Robinson Road
Hudson, NH

No.	Revision	Date	Appvd

Designed by DJB Checked by MJV

Issued for Concept Date December 4, 2023

Conceptual Site Layout
Filterra

Drawing Number
C-1.1

Progress Print
For Review Only
December 4, 2023

Sheet 1 of 7

Project Number
53023.00

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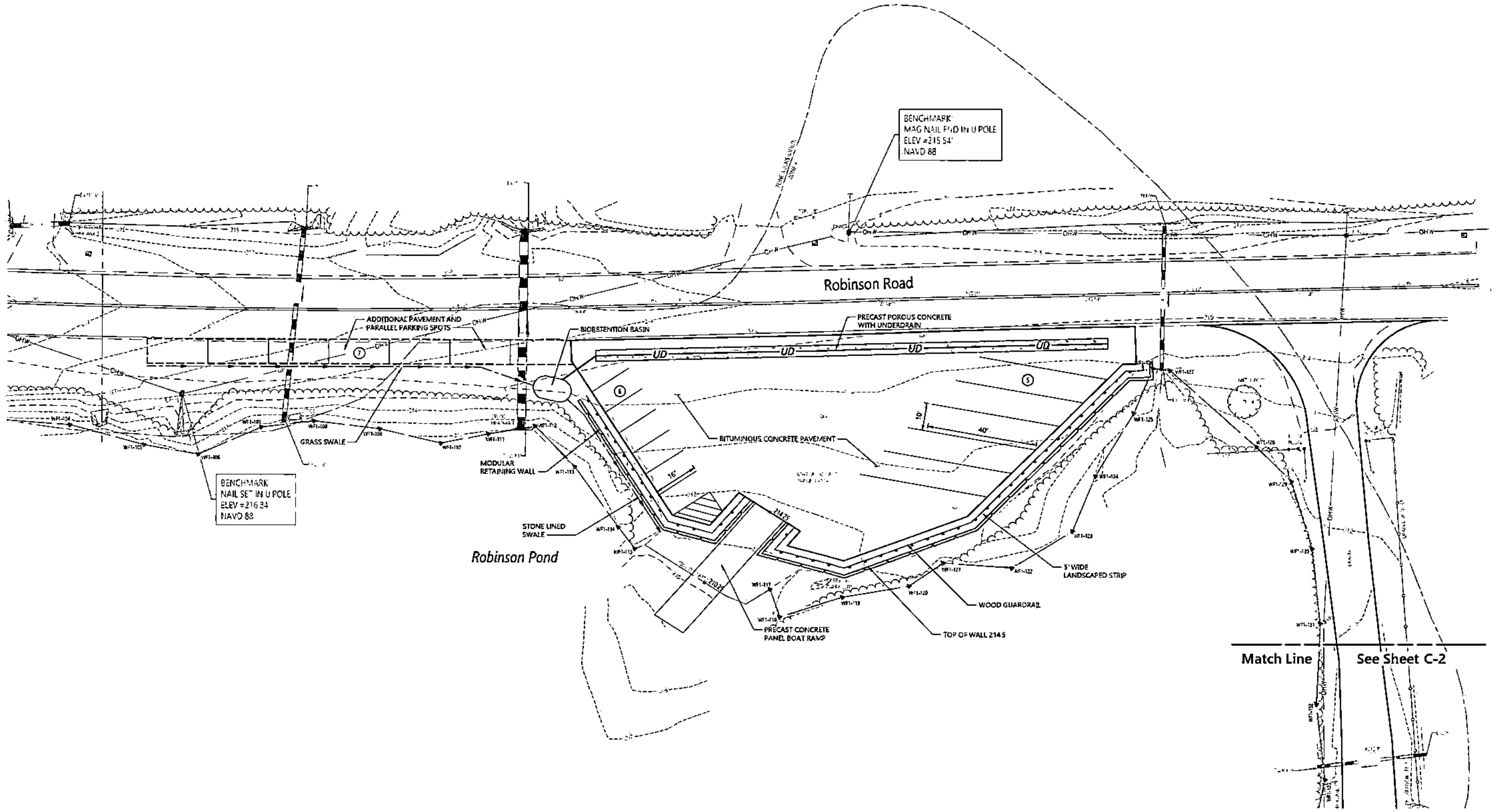

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Robinson Pond

Robinson Road
Hudson, NH

No.	Revision	Date	Appvd

Designed by DJB Checked by MJV

Issued for Date

Concept December 4, 2023

Drawing Title

Conceptual Site Layout
With Porous Concrete

Drawing Number

C-1.2

Progress Print
For Review Only
December 4, 2023

Sheet 2 of 7

Project Number
53023.00

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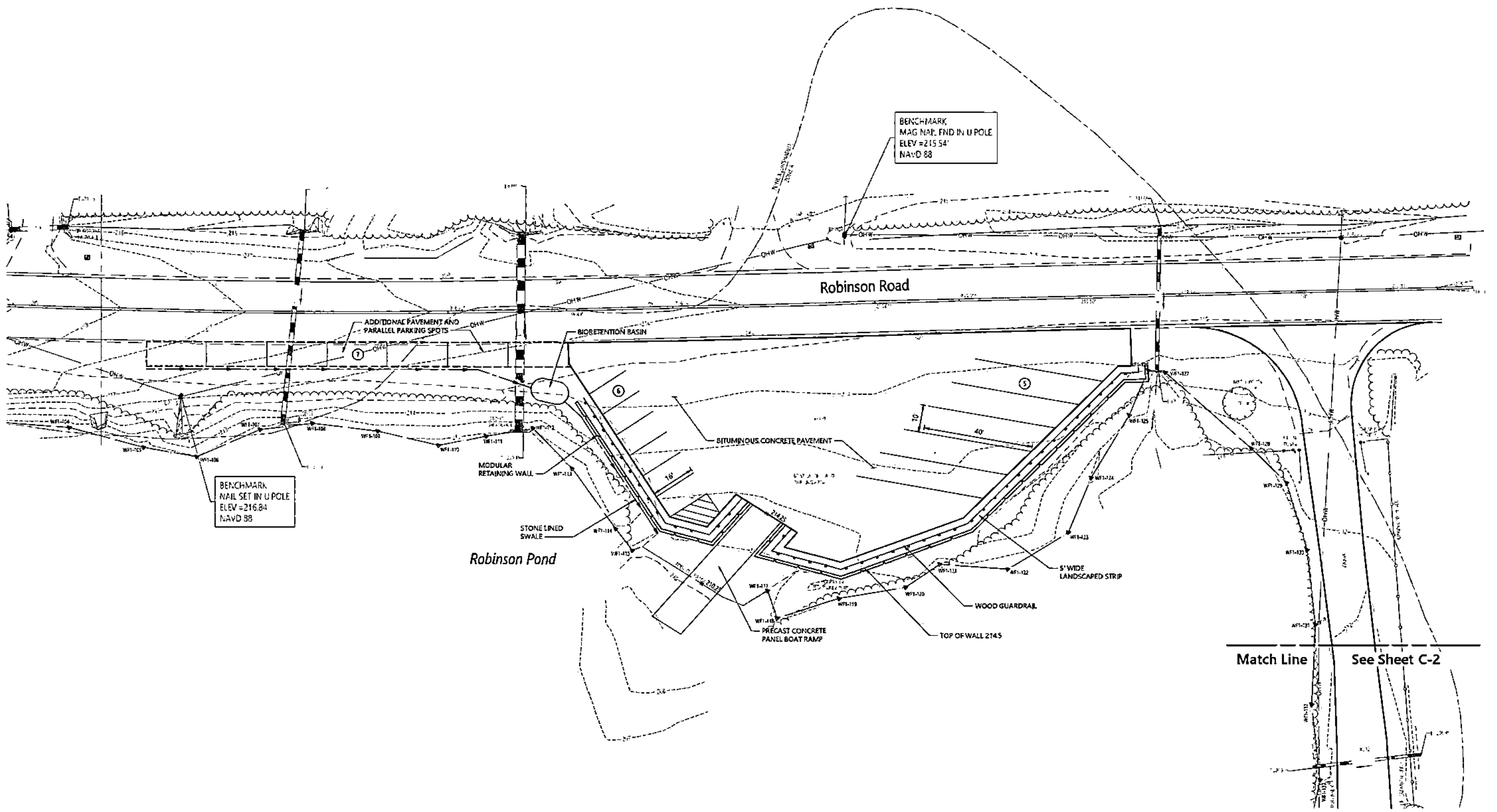

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Robinson Pond

Robinson Road
Hudson, NH

No.	Revision	Date	Appvd.

Designed by DJB — Checked by MJV

Issued for: Concept — Date: December 4, 2023

Conceptual Site Layout Stabilized

Drawing Number: C-1.3

Sheet 3 of 7

Project Number: 53023.00

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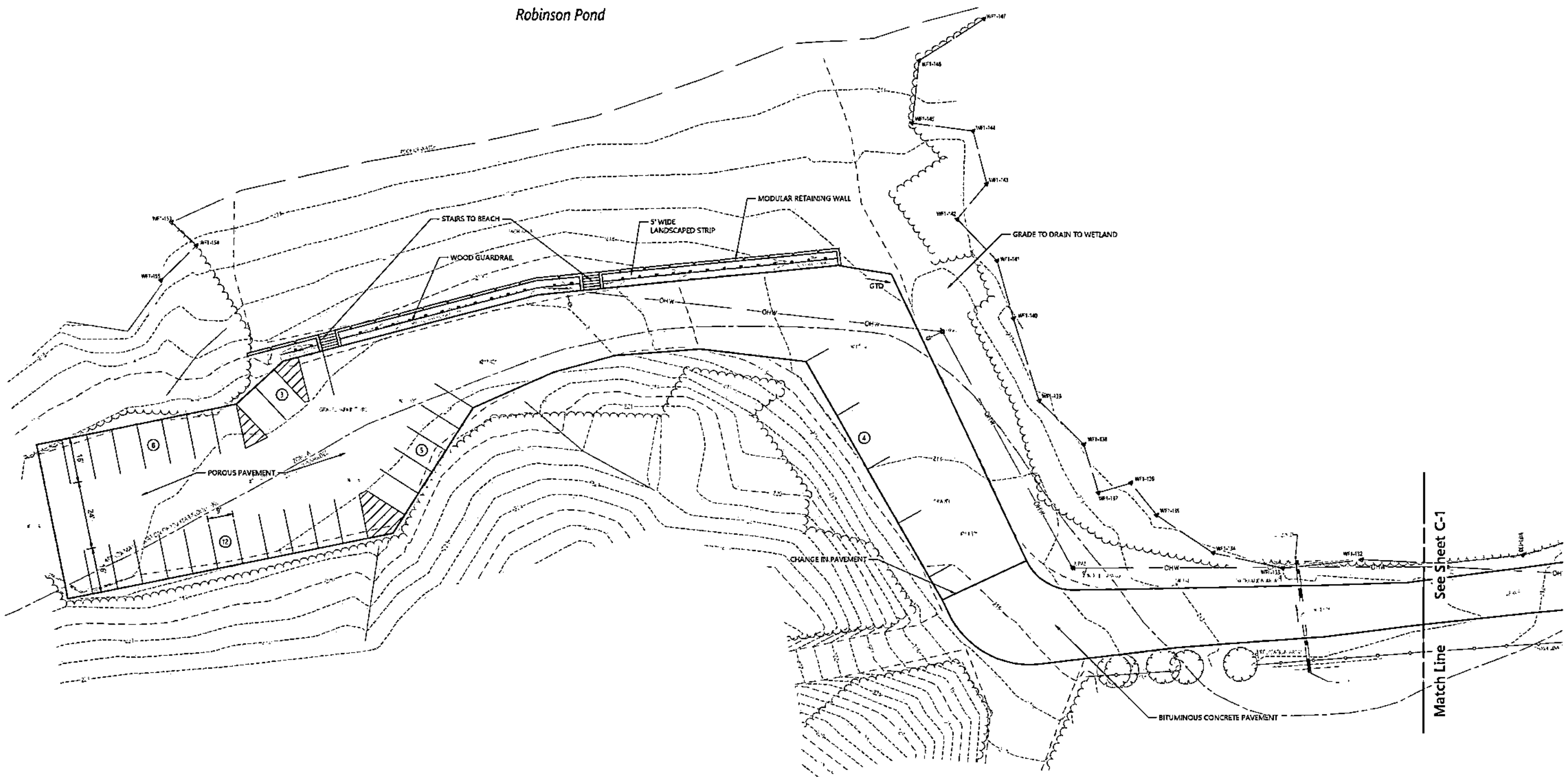

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0 10 20 40 Feet

Robinson Pond
Robinson Road
Hudson, NH

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Concept December 4, 2023

Conceptual Site Layout

Progress Print
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December 4, 2023

C-2

4 of 7

Project Number 53023.00

Saved Monday, December 4, 2023 1:51:41 PM DBOSWORTH Plotted Monday, December 4, 2023 1:55:25 PM Derek Bosworth

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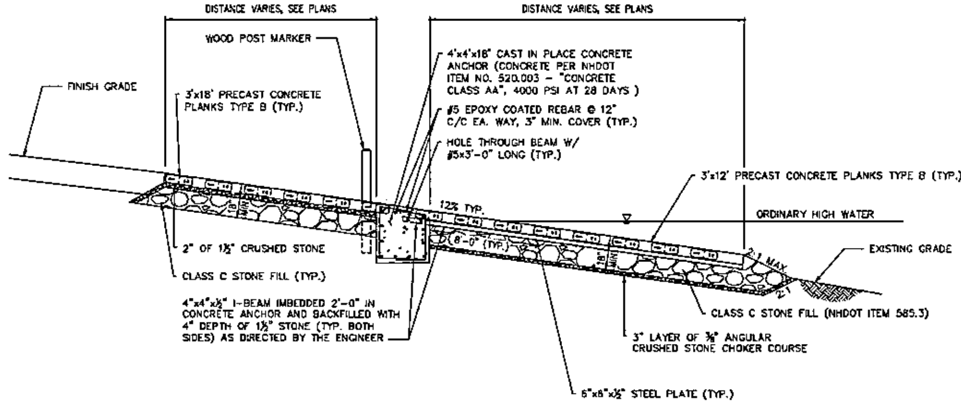
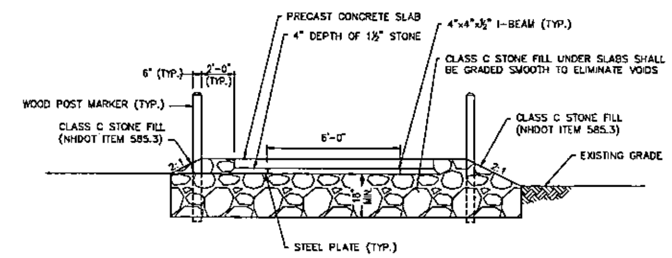


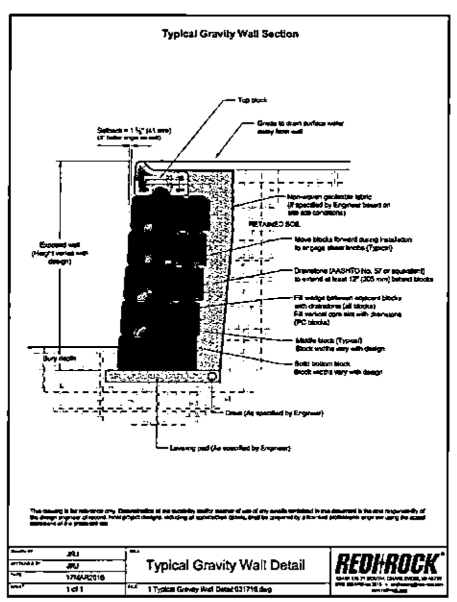
Precast Concrete Panel Boat Ramp Longitudinal Section 10/05

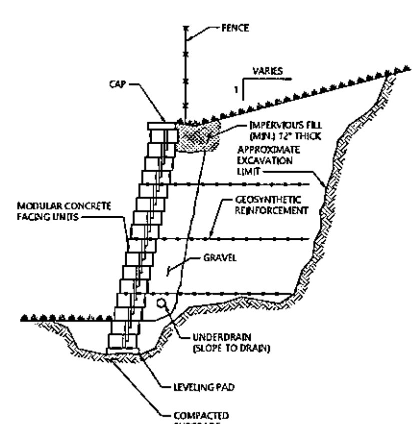
N.T.S. Source: NH Fish and Game Dept.



Precast Concrete Panel Boat Ramp Fill Section 10/05

N.T.S. Source: NH Fish and Game Dept.



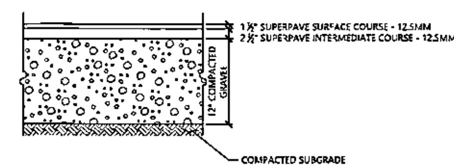


NOTES

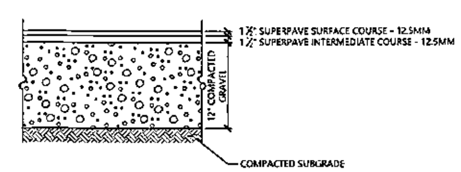
DETAIL PROVIDED FOR GENERAL INFORMATION ONLY. STAMPED FINAL DESIGN OF MODULAR WALL SYSTEM TO BE PROVIDED BY WALL MANUFACTURER BASED ON GEOTECHNICAL ENGINEERS RECOMMENDATIONS.

Modular Retaining Wall 1/16

N.T.S. Source: VHB LD_750



HEAVY DUTY FLEXIBLE PAVEMENT



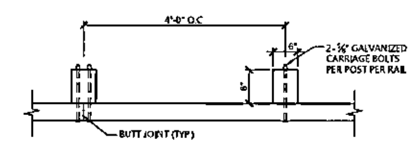
STANDARD DUTY FLEXIBLE PAVEMENT

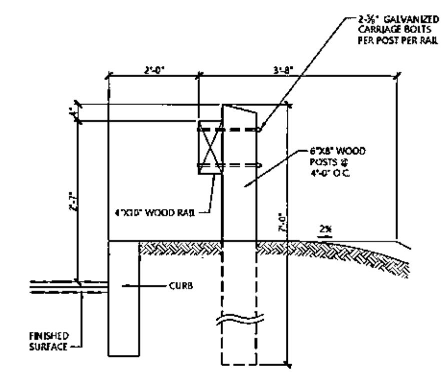
NOTES

PAVEMENT SECTIONS ARE SUBJECT TO CHANGE AND WILL BE BASED ON THE RESULTS OF FURTHER GEOTECHNICAL INVESTIGATIONS.

Bituminous Concrete Pavement Sections 7/22

N.T.S. Source: VHB REV LD_430





Wood Guardrail 10/20

N.T.S. Source: VHB REV LD_450

Robinson Pond

Robinson Pond
Hudson, NH

No.	Revision	Date	Appvd.

Designed by DJB Checked by MJV

Issued for Concept Date December 4, 2023

Drawing Title
Site Details

Drawing Number
C-3

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Sheet 5 of 7

Project Number 53023.00

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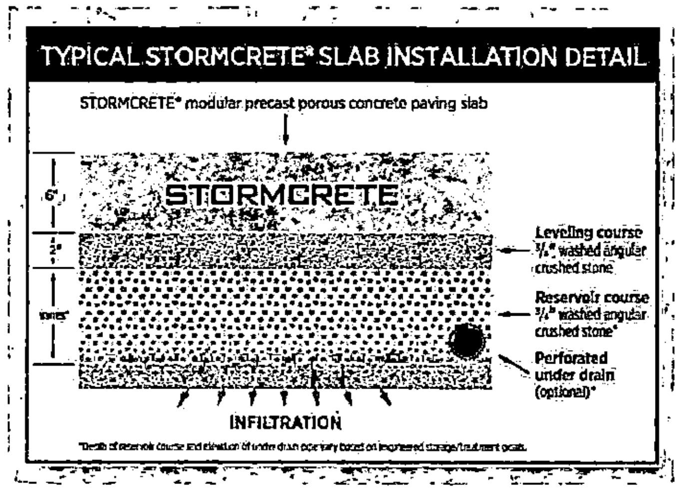
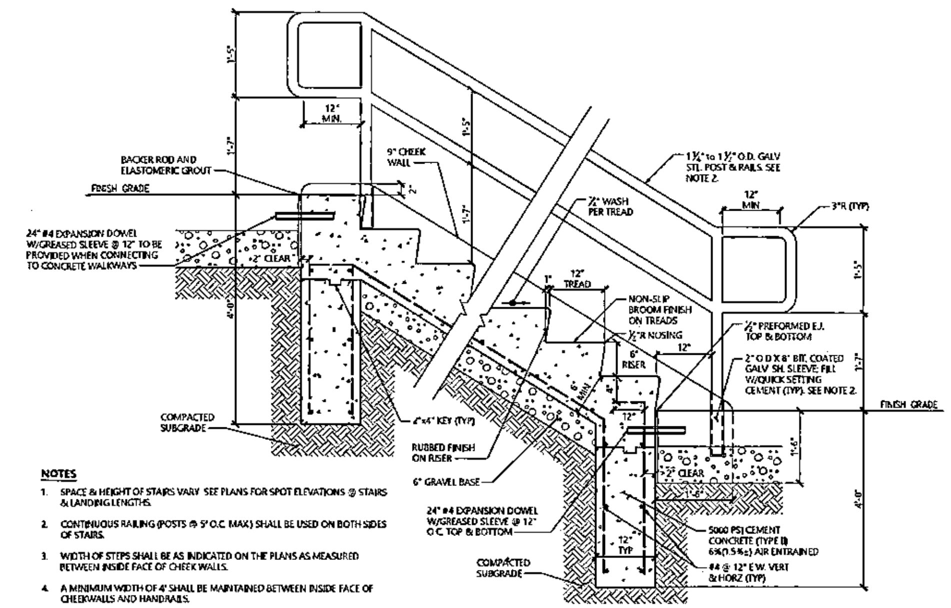
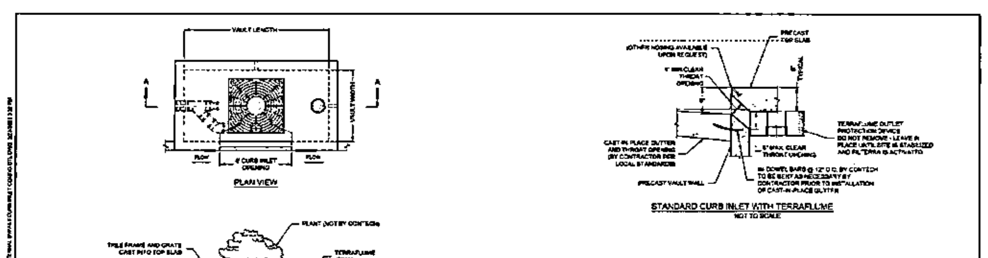


Precast Porous Concrete with Underdrain: Typical Stormcrete Precast Panel Section 10/05
N.T.S. Source: Porous Technologies, LLC



NOTES
1. SPACE & HEIGHT OF STAIRS VARY. SEE PLANS FOR SPOT ELEVATIONS @ STAIRS & LANDING LENGTHS.
2. CONTINUOUS RAILING (POSTS @ 5' O.C. MAX.) SHALL BE USED ON BOTH SIDES OF STAIRS.
3. WIDTH OF STEPS SHALL BE AS INDICATED ON THE PLANS AS MEASURED BETWEEN INSIDE FACE OF CHEEK WALLS.
4. A MINIMUM WIDTH OF 4' SHALL BE MAINTAINED BETWEEN INSIDE FACE OF CHEEKWALLS AND HANDRAILS.

Concrete Steps with Handrail 11/15
N.T.S. Source: VHB REV LD_765



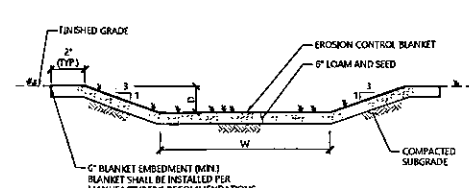
FTIBC CONFIGURATION								
VAULT SIZE (L x W)	MEDIA AREA (SF)	LONG SIDE INLET DESIG. / PART NO.	SHORT SIDE INLET DESIG. / PART NO.	AVAILABILITY	MAX. OUTLET/ BYPASS PIPE DIA.	MAX. BYPASS FLOW (CFS)	UNDER-DRAIN PIPE DIA. (PERF)	TREE GRATE QTY. & SIZE
4 x 4	[illegible]	[illegible]	[illegible]	ALL	6" SDR 35	[illegible]	4" SDR 35	(1) 3' x 3'
6 x 4	24	[illegible]	[illegible]	ALL	6" SDR 35	1.88	4" SDR 35	(1) 3' x 3'
8 x 4	32	[illegible]	[illegible]	ALL	6" SDR 35	[illegible]	4" SDR 35	(1) 3' x 3'
7.83 x 4.5	36	[illegible]	[illegible]	DE, MD, NJ, PA, VA, WV ONLY	6" SDR 35	[illegible]	4" SDR 35	(1) 3' x 3'
6 x 6	36	[illegible]	[illegible]	ALL	6" SDR 35	1.88	4" SDR 35	(1) 3' x 3'
8 x 6	48	[illegible]	[illegible]	ALL	10" SDR 35	2.57	4" SDR 35	(1) 4' x 4'
10 x 6	60	[illegible]	[illegible]	ALL	10" SDR 35	2.57	6" SDR 35	(1) 4' x 4'
6 x 8	[illegible]	[illegible]	[illegible]	CA, TX ONLY	10" SDR 35	2.57	6" SDR 35	(1) 4' x 4'
12 x 6	72	[illegible]	[illegible]	ALL	10" SDR 35	2.57	6" SDR 35	(2) 4' x 4'
10 x 8	80	[illegible]	[illegible]	CA, TX ONLY	10" SDR 35	2.57	6" SDR 35	(1) 4' x 4'
12 x 7	84	[illegible]	[illegible]	ALL	10" SDR 35	2.57	6" SDR 35	(2) 4' x 4'
12 x 8	96	[illegible]	[illegible]	CA, TX ONLY	10" SDR 35	2.57	6" SDR 35	(2) 4' x 4'
14 x 8	112	[illegible]	N/A	ALL	10" SDR 35	2.57	6" SDR 35	(2) 4' x 4'

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING ON VAULT SIZE

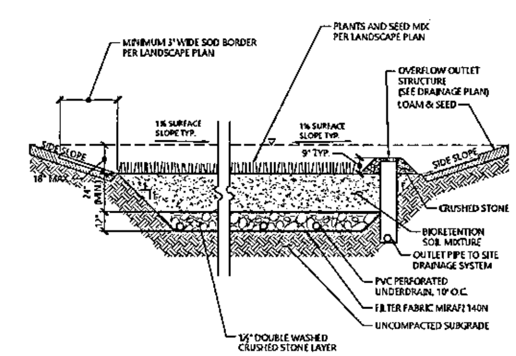
filterra
CONTECH ENGINEERED SOLUTIONS LLC
FILTERRA INTERNAL BYPASS CURB (FTIBC) CONFIGURATION DETAIL

SWALE TABLE

SWALE DESIGNATION	W	D
TBD	TBD	TBD



Grassed Swale 2/20
N.T.S. Source: VHB REV LD_171



NOTES
1. INSTALL UNDERDRAINS AT 10 FEET ON CENTER. CONNECT TO DRAINS PER PLAN
2. SIDE SLOPES SHALL BE 3:1 MAX 2% MIN

Bioretention Basin 3/20
N.T.S. Source: VHB REV LD_199

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Robinson Pond
Robinson Pond
Hudson, NH

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Concept December 4, 2023

Site Details

C-4

Sheet 6 of 7

Project Number 53023.00

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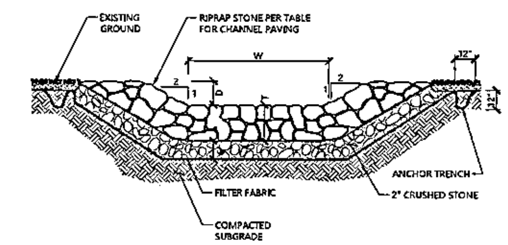
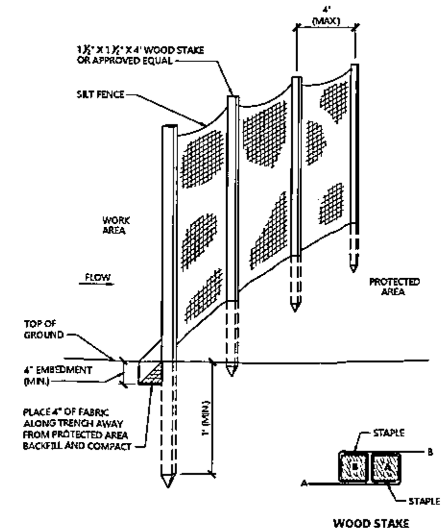
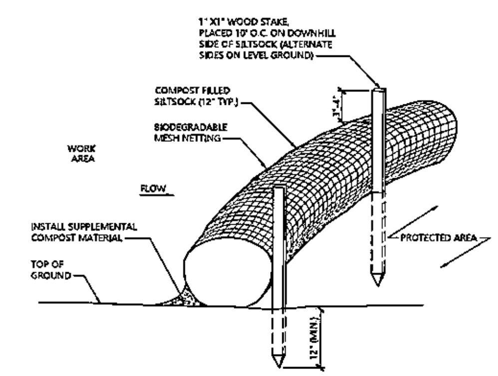
TABLE				
CHANNEL DESIGNATION	W	T	D	STONE DIA. (D50)
TBD	TBD	TBD	TBD	TBD



Stone Lined Swale 1/16
N.T.S. Source: VHB REV LD_170



Silt Fence Barrier 1/16
N.T.S. Source: VHB REV LD_650



NOTES

1. SILTSOCK SHALL BE FILTREXX SILTSOXX, OR APPROVED EQUAL.
2. SILTSOCKS SHALL OVERLAP A MINIMUM OF 12 INCHES.
3. SILTSOCK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS, AND REPAIR OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED
4. UPON SITE STABILIZATION, COMPOST MATERIAL SHALL BE DISPERSED ON SITE, AS DETERMINED BY THE ENGINEER.
5. IF NON BIODEGRADABLE NETTING IS USED THE NETTING SHALL BE COLLECTED AND DISPOSED OF OFFSITE.

Siltsock - Erosion Control Barrier 10/20
N.T.S. Source: VHB REV LD_658

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Robinson Pond

Robinson Pond
Hudson, NH

No.	Revision	Date	Appvd.

Designed by [redacted] DJB [redacted] Checked by [redacted] MJV

Issued for: **Concept** Date: December 4, 2023

Drawing Title: **Site Details**

Drawing Number: **C-5**

Sheet 7 of 7

Project Number: 53023.00

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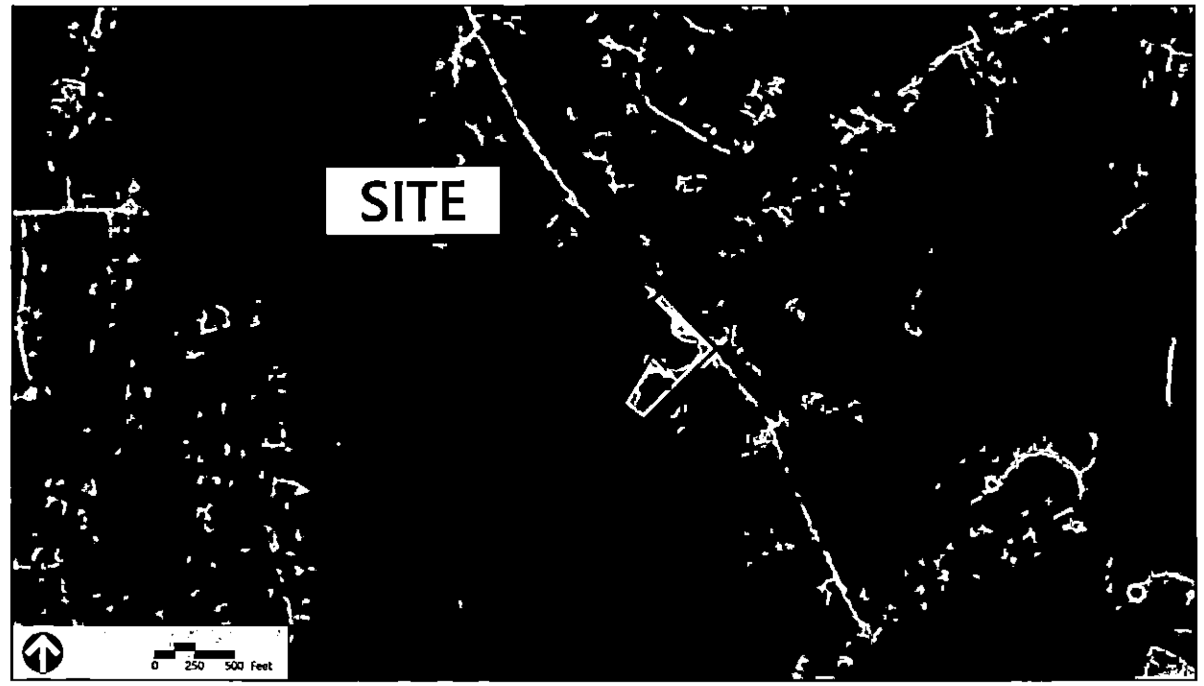
Saved Monday, December 4, 2023 2:05:06 PM DBOSWORTH Plotted Monday, December 4, 2023 2:14:18 PM Derek Bosworth

Site Plans

Issued for	Permitting
Date Issued	March 1, 2024
Latest Issue	March 1, 2024

Robinson Pond Public Access Improvements

Robinson Pond
Hudson, New Hampshire 03051



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101 Walnut Street
PO Box 9151
Watertown, MA 02471
617.924.1770

Applicant/Owner
Town of Hudson, NH
12 School Street
Hudson, New Hampshire 03051

Sheet Index

No.	Drawing Title	Latest Issue
C-1.01	Legend and General Notes	March 1, 2024
C-2.01	Layout and Materials Plan 1	March 1, 2024
C-2.02	Layout and Materials Plan 2	March 1, 2024
C-3.01	Grading, Drainage, and Erosion Control Plan 1	March 1, 2024
C-3.02	Grading, Drainage, and Erosion Control Plan 2	March 1, 2024
C-4.01	Site Details 1	March 1, 2024
C-4.02	Site Details 2	March 1, 2024
C-4.03	Site Details 3	March 1, 2024

Reference Drawings

No.	Drawing Title	Latest Issue
Sv-1-Sv-3	Existing Conditions Plan	October 26, 2023

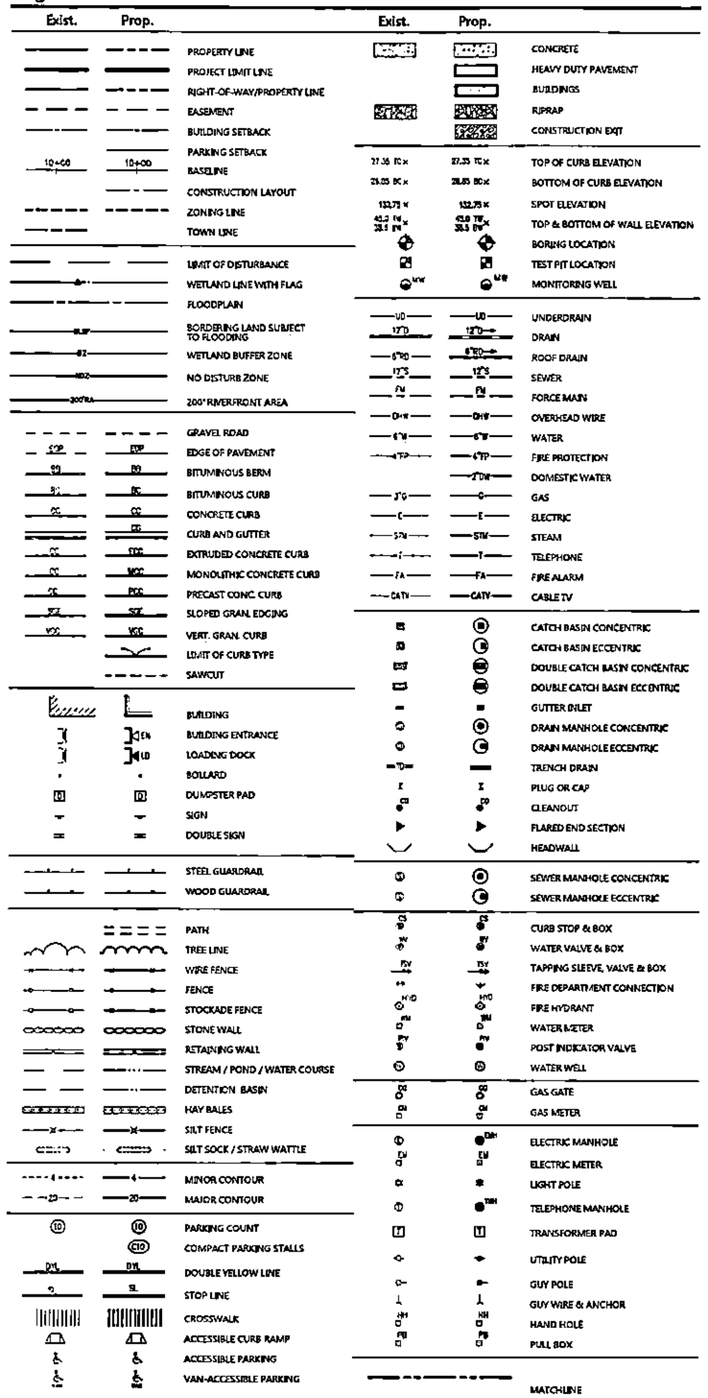
Assessor's Map: 135
Lot: 4

Progress Print
For Review Only
3/01/2024

VHB Project : 53023.00 Robinson Pond Public Access Improvements
Issued for : Permitting

\\VHB\GBL\PROJ\BEDFORD\53023.00 HUDSON ROBINSON POND\CAD\LD\PLANSET\53023.00-COV 29 February 2024

Legend



Abbreviations

General

ABAN	ABANDON
ACR	ACCESSIBLE CURB RAMP
ADJ	ADJUST
APPROX	APPROXIMATE
BIT	BITUMINOUS
BS	BOTTOM OF SLOPE
BWLL	BROKEN WHITE LANE LINE
CONC	CONCRETE
DYCL	DOUBLE YELLOW CENTER LINE
EL	ELEVATION
ELEV	ELEVATION
EX	EXISTING
FDN	FOUNDATION
FFE	FIRST FLOOR ELEVATION
GRAN	GRANITE
GTD	GRADE TO DRAIN
LA	LANDSCAPE AREA
LOD	LIMIT OF DISTURBANCE
MAX	MAXIMUM
MIN	MINIMUM
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
PERF	PERFORATED
PROP	PROPOSED
REM	REMOVE
RET	RETAIN
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
SWEL	SOLID WHITE EDGE LINE
SWLL	SOLID WHITE LANE LINE
TS	TOP OF SLOPE
TYP	TYPICAL

Utility

CB	CATCH BASIN
CMP	CORRUGATED METAL PIPE
CO	CLEANOUT
DCB	DOUBLE CATCH BASIN
DMH	DRAIN MANHOLE
CIP	CAST IRON PIPE
COND	CONDUIT
DIP	DUCTILE IRON PIPE
FES	FLARED END SECTION
FM	FORCE MAIN
F&G	FRAME AND GRATE
F&C	FRAME AND COVER
GI	GUTTER INLET
GT	GREASE TRAP
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HH	HANDHOLE
HW	HEADWALL
HYD	HYDRANT
INV	INVERT ELEVATION
I=	INVERT ELEVATION
LP	LIGHT POLE
MES	METAL END SECTION
PIV	POST INDICATOR VALVE
PWW	PAVED WATER WAY
PVC	POLYVINYLCHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
R=	RIM ELEVATION
RIM=	RIM ELEVATION
SMH	SEWER MANHOLE
TSV	TAPPING SLEEVE, VALVE AND BOX
UG	UNDERGROUND
UP	UTILITY POLE

Notes

General

1. THE PURPOSE OF THESE SITE PLANS IS FOR THE PERMITTING OF SITE IMPROVEMENTS TO THE EXISTING ROBINSON POND BEACH AND BOAT LAUNCH AREA.
2. CONTRACTOR SHALL NOTIFY "DIG-SAFE" (1-888-344-7233) AT LEAST 72 HOURS BEFORE EXCAVATING.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SITE SECURITY AND JOB SAFETY. CONSTRUCTION ACTIVITIES SHALL BE IN ACCORDANCE WITH OSHA STANDARDS AND LOCAL REQUIREMENTS.
4. ACCESSIBLE ROUTES, PARKING SPACES, RAMPS, SIDEWALKS AND WALKWAYS SHALL BE CONSTRUCTED IN CONFORMANCE WITH THE FEDERAL AMERICANS WITH DISABILITIES ACT AND WITH STATE AND LOCAL LAWS AND REGULATIONS (WHICHEVER ARE MORE STRINGENT).
5. AREAS DISTURBED DURING CONSTRUCTION AND NOT RESTORED WITH IMPERVIOUS SURFACES (BUILDINGS, PAVEMENTS, WALKS, ETC) SHALL RECEIVE 6 INCHES LOAM AND SEED.
6. WITHIN THE LIMITS OF THE BUILDING FOOTPRINT, THE SITE CONTRACTOR SHALL PERFORM EARTHWORK OPERATIONS REQUIRED UP TO SUBGRADE ELEVATIONS.
7. WORK WITHIN THE LOCAL RIGHTS-OF-WAY SHALL CONFORM TO LOCAL MUNICIPAL STANDARDS. WORK WITHIN STATE RIGHTS-OF-WAY SHALL CONFORM TO THE LATEST EDITION OF THE STATE HIGHWAY DEPARTMENTS STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES.
8. UPON AWARD OF CONTRACT, CONTRACTOR SHALL MAKE NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN NECESSARY PERMITS, PAY FEES, AND POST BONDS ASSOCIATED WITH THE WORK INDICATED ON THE DRAWINGS, IN THE SPECIFICATIONS, AND IN THE CONTRACT DOCUMENTS. DO NOT CLOSE OR OBSTRUCT ROADWAYS, SIDEWALKS, AND FIRE HYDRANTS, WITHOUT APPROPRIATE PERMITS.
9. TRAFFIC SIGNAGE AND PAVEMENT MARKINGS SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
10. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
11. IN THE EVENT THAT SUSPECTED CONTAMINATED SOIL, GROUNDWATER, AND OTHER MEDIA ARE ENCOUNTERED DURING EXCAVATION AND CONSTRUCTION ACTIVITIES BASED ON VISUAL, OLFACTORY, OR OTHER EVIDENCE, THE CONTRACTOR SHALL STOP WORK IN THE VICINITY OF THE SUSPECT MATERIAL TO AVOID FURTHER SPREADING OF THE MATERIAL, AND SHALL NOTIFY THE OWNER IMMEDIATELY SO THAT THE APPROPRIATE TESTING AND SUBSEQUENT ACTION CAN BE TAKEN.
12. CONTRACTOR SHALL PREVENT DUST, SEDIMENT, AND DEBRIS FROM EXITING THE SITE AND SHALL BE RESPONSIBLE FOR CLEANUP, REPAIRS AND CORRECTIVE ACTION IF SUCH OCCURS.
13. DAMAGE RESULTING FROM CONSTRUCTION LOADS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO OWNER.
14. CONTRACTOR SHALL CONTROL STORMWATER RUNOFF DURING CONSTRUCTION TO PREVENT ADVERSE IMPACTS TO OFF SITE AREAS, AND SHALL BE RESPONSIBLE TO REPAIR RESULTING DAMAGES, IF ANY, AT NO COST TO OWNER.
15. THIS PROJECT DISTURBS MORE THAN ONE ACRE OF LAND AND FALLS WITHIN THE NPDES CONSTRUCTION GENERAL PERMIT (CGP) PROGRAM AND EPA JURISDICTION. PRIOR TO THE START OF CONSTRUCTION CONTRACTOR IS TO FILE A CGP NOTICE OF INTENT WITH THE EPA AND PREPARE A STORMWATER POLLUTION PREVENTION PLAN IN ACCORDANCE WITH THE NPDES REGULATIONS. CONTRACTOR SHALL CONFIRM THE OWNER HAS ALSO FILED A NOTICE OF INTENT WITH THE EPA.

Utilities

1. THE UTILITY COMPANIES SERVICING THE PROJECT AREA ARE:
   A. WATER: N/A
   B. SEWER: N/A
   C. ELECTRIC: N/A
   D. TELEPHONE: N/A
   E. CABLE TV: N/A
   F. GAS: N/A
2. THE LOCATIONS, SIZES, AND TYPES OF EXISTING UTILITIES ARE SHOWN AS AN APPROXIMATE REPRESENTATION ONLY. THE OWNER OR IT'S REPRESENTATIVE(S) HAVE NOT INDEPENDENTLY VERIFIED THIS INFORMATION AS SHOWN ON THE PLANS. THE UTILITY INFORMATION SHOWN DOES NOT GUARANTEE THE ACTUAL EXISTENCE, SERVICEABILITY, OR OTHER DATA CONCERNING THE UTILITIES, NOR DOES IT GUARANTEE AGAINST THE POSSIBILITY THAT ADDITIONAL UTILITIES MAY BE PRESENT THAT ARE NOT SHOWN ON THE PLANS. PRIOR TO ORDERING MATERIALS AND BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY AND DETERMINE THE EXACT LOCATIONS, SIZES, AND ELEVATIONS OF THE POINTS OF CONNECTIONS TO EXISTING UTILITIES AND, SHALL CONFIRM THAT THERE ARE NO INTERFERENCES WITH EXISTING UTILITIES AND THE PROPOSED UTILITY ROUTES, INCLUDING ROUTES WITHIN THE PUBLIC RIGHTS OF WAY.
3. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, OR EXISTING CONDITIONS DIFFER FROM THOSE SHOWN SUCH THAT THE WORK CANNOT BE COMPLETED AS INTENDED, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED IN WRITING TO THE OWNER'S REPRESENTATIVE FOR THE RESOLUTION OF THE CONFLICT AND CONTRACTOR'S FAILURE TO NOTIFY PRIOR TO PERFORMING ADDITIONAL WORK RELEASES OWNER FROM OBLIGATIONS FOR ADDITIONAL PAYMENTS WHICH OTHERWISE MAY BE WARRANTED TO RESOLVE THE CONFLICT.
4. SET CATCH BASIN RIMS, AND INVERTS OF SEWERS, DRAINS, AND DITCHES IN ACCORDANCE WITH ELEVATIONS ON THE GRADING AND UTILITY PLANS.
5. RIM ELEVATIONS FOR DRAIN AND SEWER MANHOLES, WATER VALVE COVERS, GAS GATES, ELECTRIC AND TELEPHONE PULL BOXES, AND MANHOLES, AND OTHER SUCH ITEMS, ARE APPROXIMATE AND SHALL BE SET/RESET AS FOLLOWS:
   A. PAVEMENTS AND CONCRETE SURFACES: FLUSH
   B. ALL SURFACES ALONG ACCESSIBLE ROUTES: FLUSH
   C. LANDSCAPE, LOAM AND SEED, AND OTHER EARTH SURFACE AREAS: ONE INCH ABOVE SURROUNDING AREA AND TAPER EARTH TO THE RIM ELEVATION.
5. THE LOCATION, SIZE, DEPTH, AND SPECIFICATIONS FOR CONSTRUCTION OF PROPOSED PRIVATE UTILITY SERVICES SHALL BE INSTALLED ACCORDING TO THE REQUIREMENTS PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (GAS, TELEPHONE, ELECTRIC, FIRE ALARM, ETC.) FINAL DESIGN LOADS AND LOCATIONS TO BE COORDINATED WITH OWNER AND ARCHITECT.
6. CONTRACTOR SHALL MAKE ARRANGEMENTS FOR AND SHALL BE RESPONSIBLE FOR PAYING FEES FOR POLE RELOCATION AND FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE, FIRE ALARM, AND ANY OTHER PRIVATE UTILITIES, WHETHER WORK IS PERFORMED BY CONTRACTOR OR BY THE UTILITIES COMPANY.
7. UTILITY PIPE MATERIALS SHALL BE AS FOLLOWS, UNLESS OTHERWISE NOTED ON THE PLAN:
   A. STORM DRAINAGE PIPES SHALL BE DUAL WALL SMOOTH INTERIOR HIGH DENSITY POLYETHYLENE (HDPE)
8. CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR AND SHALL FURNISH EXCAVATION, INSTALLATION, AND BACKFILL OF ELECTRICAL FURNISHED SITEWORK RELATED ITEMS SUCH AS PULL BOXES, CONDUITS, DUCT BANKS, LIGHT POLE BASES, AND CONCRETE PADS. SITE CONTRACTOR SHALL FURNISH CONCRETE ENCASEMENT OF DUCT BANKS IF REQUIRED BY THE UTILITY COMPANY AND AS INDICATED ON THE DRAWINGS.
9. ALL DRAINAGE AND SANITARY STRUCTURE INTERIOR DIAMETERS (4' MIN.) SHALL BE DETERMINED BY THE MANUFACTURER BASED ON THE PIPE CONFIGURATIONS SHOWN ON THESE PLANS AND LOCAL MUNICIPAL STANDARDS. FOR MANHOLES THAT ARE 20 FEET IN DEPTH AND GREATER, THE MINIMUM DIAMETER SHALL BE 5 FEET.

Layout and Materials

1. DIMENSIONS ARE FROM THE FACE OF CURB, FACE OF BUILDING, FACE OF WALL, AND CENTER LINE OF PAVEMENT MARKINGS, UNLESS OTHERWISE NOTED.
2. CURB RADII ARE 5 FEET UNLESS OTHERWISE NOTED.
3. CURBING SHALL BE VGC WITHIN THE SITE UNLESS OTHERWISE INDICATED ON THE PLANS.
4. SEE ARCHITECTURAL DRAWINGS FOR EXACT BUILDING DIMENSIONS AND DETAILS CONTIGUOUS TO THE BUILDING, INCLUDING SIDEWALKS, RAMPS, BUILDING ENTRANCES, STAIRWAYS, UTILITY PENETRATIONS, CONCRETE DOOR PADS, COMPACTOR PAD, LOADING DOCKS, BOLLARDS, ETC.
5. PROPOSED BOUNDS AND ANY EXISTING PROPERTY LINE MONUMENTATION DISTURBED DURING CONSTRUCTION SHALL BE SET OR RESET BY A LICENSED LAND SURVEYOR (LLS).
6. PRIOR TO START OF CONSTRUCTION, CONTRACTOR SHALL VERIFY EXISTING PAVEMENT ELEVATIONS AT INTERFACE WITH PROPOSED PAVEMENTS, AND EXISTING GROUND ELEVATIONS ADJACENT TO DRAINAGE OUTLETS TO ASSURE PROPER TRANSITIONS BETWEEN EXISTING AND PROPOSED FACILITIES.

Demolition

1. CONTRACTOR SHALL REMOVE AND DISPOSE OF EXISTING MANMADE SURFACE FEATURES WITHIN THE LIMIT OF WORK INCLUDING BUILDINGS, STRUCTURES, PAVEMENTS, SLABS, CURBING, FENCES, UTILITY POLES, SIGNS, ETC. UNLESS INDICATED OTHERWISE ON THE DRAWINGS. REMOVE AND DISPOSE OF EXISTING UTILITIES, FOUNDATIONS AND UNSUITABLE MATERIAL BENEATH AND FOR A DISTANCE OF 10 FEET BEYOND THE PROPOSED BUILDING FOOTPRINT INCLUDING EXTERIOR COLUMNS.
2. EXISTING UTILITIES SHALL BE TERMINATED, UNLESS OTHERWISE NOTED, IN CONFORMANCE WITH LOCAL, STATE AND INDIVIDUAL UTILITY COMPANY STANDARD SPECIFICATIONS AND DETAILS. THE CONTRACTOR SHALL COORDINATE UTILITY SERVICE DISCONNECTS WITH THE UTILITY REPRESENTATIVES.
3. CONTRACTOR SHALL DISPOSE OF DEMOLITION DEBRIS IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS, ORDINANCES AND STATUTES.
4. THE DEMOLITION LIMITS DEPICTED IN THE PLANS IS INTENDED TO AID THE CONTRACTOR DURING THE BIDDING AND CONSTRUCTION PROCESS AND IS NOT INTENDED TO DEPICT EACH AND EVERY ELEMENT OF DEMOLITION. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING THE DETAILED SCOPE OF DEMOLITION BEFORE SUBMITTING ITS BID/PROPOSAL TO PERFORM THE WORK AND SHALL MAKE NO CLAIMS AND SEEK NO ADDITIONAL COMPENSATION FOR CHANGED CONDITIONS OR UNFORESEEN OR LATENT SITE CONDITIONS DISCOVERED DURING EXECUTION OF THE WORK.
5. UNLESS OTHERWISE SPECIFICALLY PROVIDED ON THE PLANS OR IN THE SPECIFICATIONS, THE ENGINEER HAS NOT PREPARED DESIGNS FOR AND SHALL HAVE NO RESPONSIBILITY FOR THE PRESENCE, DISCOVERY, REMOVAL, ABATEMENT OR DISPOSAL OF HAZARDOUS MATERIALS, TOXIC WASTES OR POLLUTANTS AT THE PROJECT SITE. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR ANY CLAIMS OF LOSS, DAMAGE, EXPENSE, DELAY, INJURY OR DEATH ARISING FROM THE PRESENCE OF HAZARDOUS MATERIAL AND CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE ENGINEER FROM ANY CLAIMS MADE IN CONNECTION THEREWITH. MOREOVER, THE ENGINEER SHALL HAVE NO ADMINISTRATIVE OBLIGATIONS OF ANY TYPE WITH REGARD TO ANY CONTRACTOR AMENDMENT INVOLVING THE ISSUES OF PRESENCE, DISCOVERY, REMOVAL, ABATEMENT OR DISPOSAL OF ASBESTOS OR OTHER HAZARDOUS MATERIALS.

Erosion Control

1. PRIOR TO STARTING ANY OTHER WORK ON THE SITE, THE CONTRACTOR SHALL NOTIFY APPROPRIATE AGENCIES AND SHALL INSTALL EROSION CONTROL MEASURES AS SHOWN ON THE PLANS AND AS IDENTIFIED IN FEDERAL, STATE, AND LOCAL APPROVAL DOCUMENTS PERTAINING TO THIS PROJECT.
2. CONTRACTOR SHALL INSPECT AND MAINTAIN EROSION CONTROL MEASURES ON A WEEKLY BASIS (MINIMUM) OR AS REQUIRED PER THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP). THE CONTRACTOR SHALL ADDRESS DEFICIENCIES AND MAINTENANCE ITEMS WITHIN TWENTY-FOUR HOURS OF INSPECTION. CONTRACTOR SHALL PROPERLY DISPOSE OF SEDIMENT SUCH THAT IT DOES NOT ENCUMBER OTHER DRAINAGE STRUCTURES AND PROTECTED AREAS.
3. CONTRACTOR SHALL BE FULLY RESPONSIBLE TO CONTROL CONSTRUCTION SUCH THAT SEDIMENTATION SHALL NOT AFFECT REGULATORY PROTECTED AREAS, WHETHER SUCH SEDIMENTATION IS CAUSED BY WATER, WIND, OR DIRECT DEPOSIT.
4. CONTRACTOR SHALL PERFORM CONSTRUCTION SEQUENCING SUCH THAT EARTH MATERIALS ARE EXPOSED FOR A MINIMUM OF TIME BEFORE THEY ARE COVERED, SEEDED, OR OTHERWISE STABILIZED TO PREVENT EROSION.
5. UPON COMPLETION OF CONSTRUCTION AND ESTABLISHMENT OF PERMANENT GROUND COVER, CONTRACTOR SHALL REMOVE AND DISPOSE OF EROSION CONTROL MEASURES AND CLEAN SEDIMENT AND DEBRIS FROM ENTIRE DRAINAGE AND SEWER SYSTEMS.

Existing Conditions Information

1. BASE PLAN: THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE BASED UPON AN ACTUAL ON-THE-GROUND INSTRUMENT SURVEY PERFORMED BY VHB IN SEPTEMBER AND OCTOBER 2023.
   A. DELINEATION OF THE WETLANDS AND PLACEMENT OF THE FLAGS WAS PERFORMED BY VHB IN SEPTEMBER, 2023
   B. FLAGS MARKING THE WETLANDS WERE LOCATED BY FIELD SURVEY BY VHB IN SEPTEMBER, 2023
2. TOPOGRAPHY: ELEVATIONS ARE BASED ON NAVD88.

State Permits

1. NHDES WETLAND DREDGE AND FILL PERMIT - PENDING
2. NHDES SHORELAND PERMIT - PENDING

Document Use

1. THESE PLANS AND CORRESPONDING CADD DOCUMENTS ARE INSTRUMENTS OF PROFESSIONAL SERVICE, AND SHALL NOT BE USED, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN FOR WHICH IT WAS CREATED WITHOUT THE EXPRESSED, WRITTEN CONSENT OF VHB. ANY UNAUTHORIZED USE, REUSE, MODIFICATION OR ALTERATION, INCLUDING AUTOMATED CONVERSION OF THIS DOCUMENT SHALL BE AT THE USER'S SOLE RISK WITHOUT LIABILITY OR LEGAL EXPOSURE TO VHB.
2. CONTRACTOR SHALL NOT RELY SOLELY ON ELECTRONIC VERSIONS OF PLANS, SPECIFICATIONS, AND DATA FILES THAT ARE OBTAINED FROM THE DESIGNERS, BUT SHALL VERIFY LOCATION OF PROJECT FEATURES IN ACCORDANCE WITH THE PAPER COPIES OF THE PLANS AND SPECIFICATIONS THAT ARE SUPPLIED AS PART OF THE CONTRACT DOCUMENTS.
3. SYMBOLS AND LEGENDS OF PROJECT FEATURES ARE GRAPHIC REPRESENTATIONS AND ARE NOT NECESSARILY SCALED TO THEIR ACTUAL DIMENSIONS OR LOCATIONS ON THE DRAWINGS. THE CONTRACTOR SHALL REFER TO THE DETAIL SHEET DIMENSIONS, MANUFACTURERS' LITERATURE, SHOP DRAWINGS AND FIELD MEASUREMENTS OF SUPPLIED PRODUCTS FOR LAYOUT OF THE PROJECT FEATURES.

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Robinson Pond Public Access Improvements

Robinson Pond
Hudson, NH

No.	Revision	Date	Appvd.

Designed by DJB   Checked by MJV

Issued for: Permitting   Date: March 1, 2024

Legend and General Notes

Drawing Number: C-1.01

Progress Print For Review Only 3/01/2024

Sheet 1 of 8

Project Number: 53023.00

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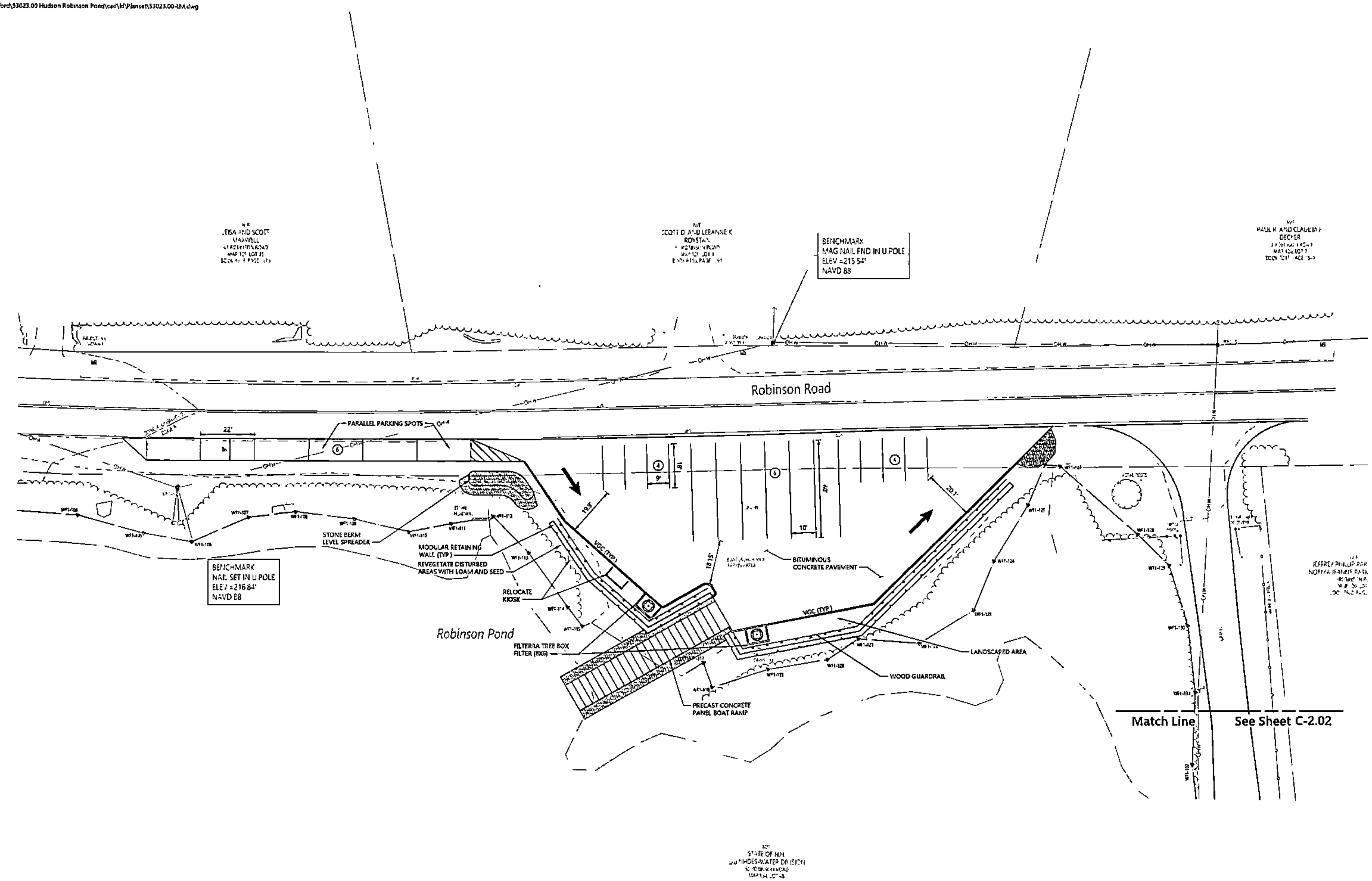

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Issued for Permitting Date March 1, 2024

Layout and Materials Plan 1

Drawing Number

C-2.01

Sheet 2 of 8

Project Number 53023.00

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Saved Thursday, February 29, 2024 1:50:55 PM DBOSWORTH Plotted Friday, March 1, 2024 2:49:59 PM Derek Bosworth

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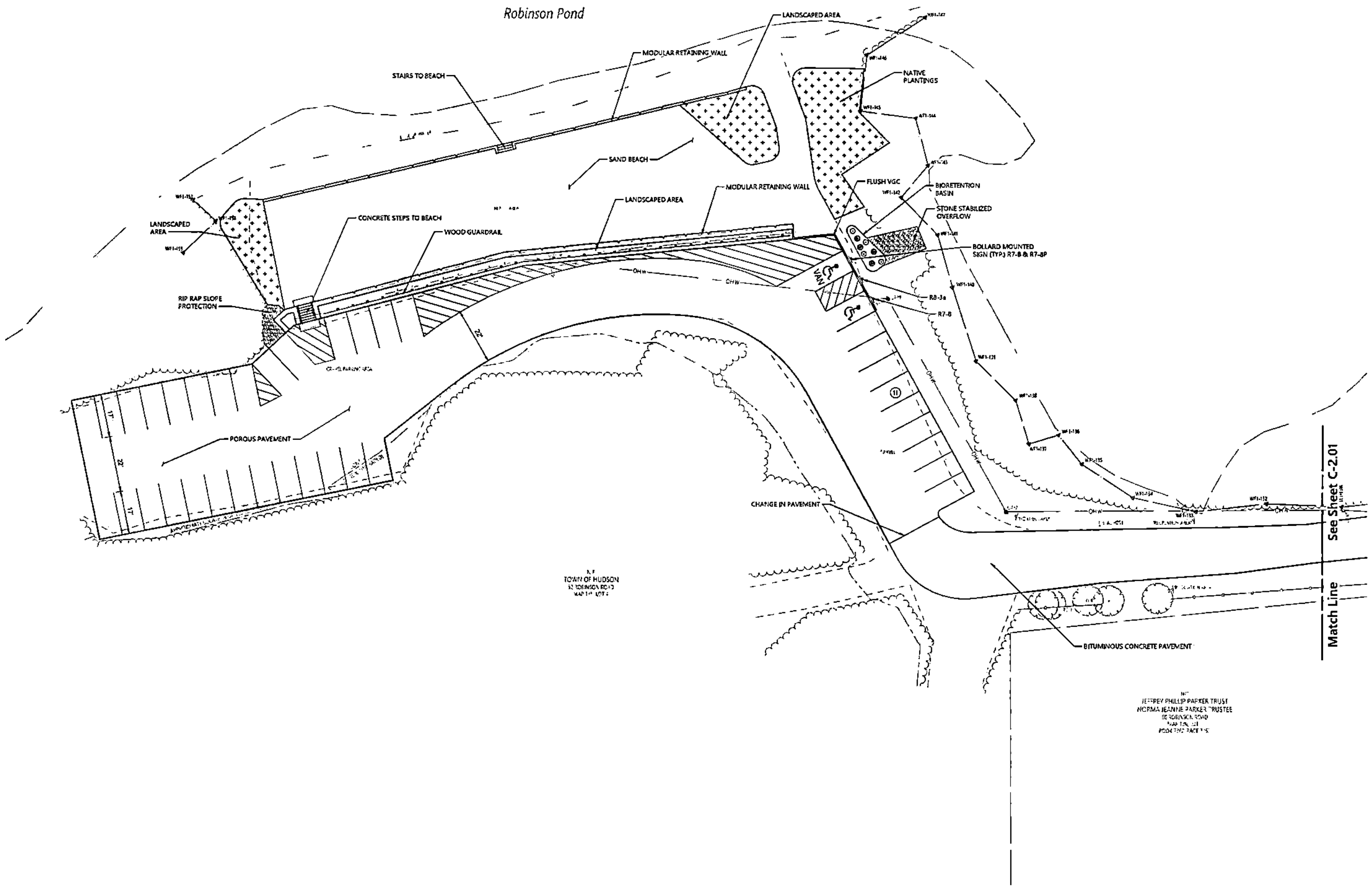

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Layout and Materials Plan 2

Drawing Number
C-2.02

Sheet 3 of 8

Project Number
53023.00

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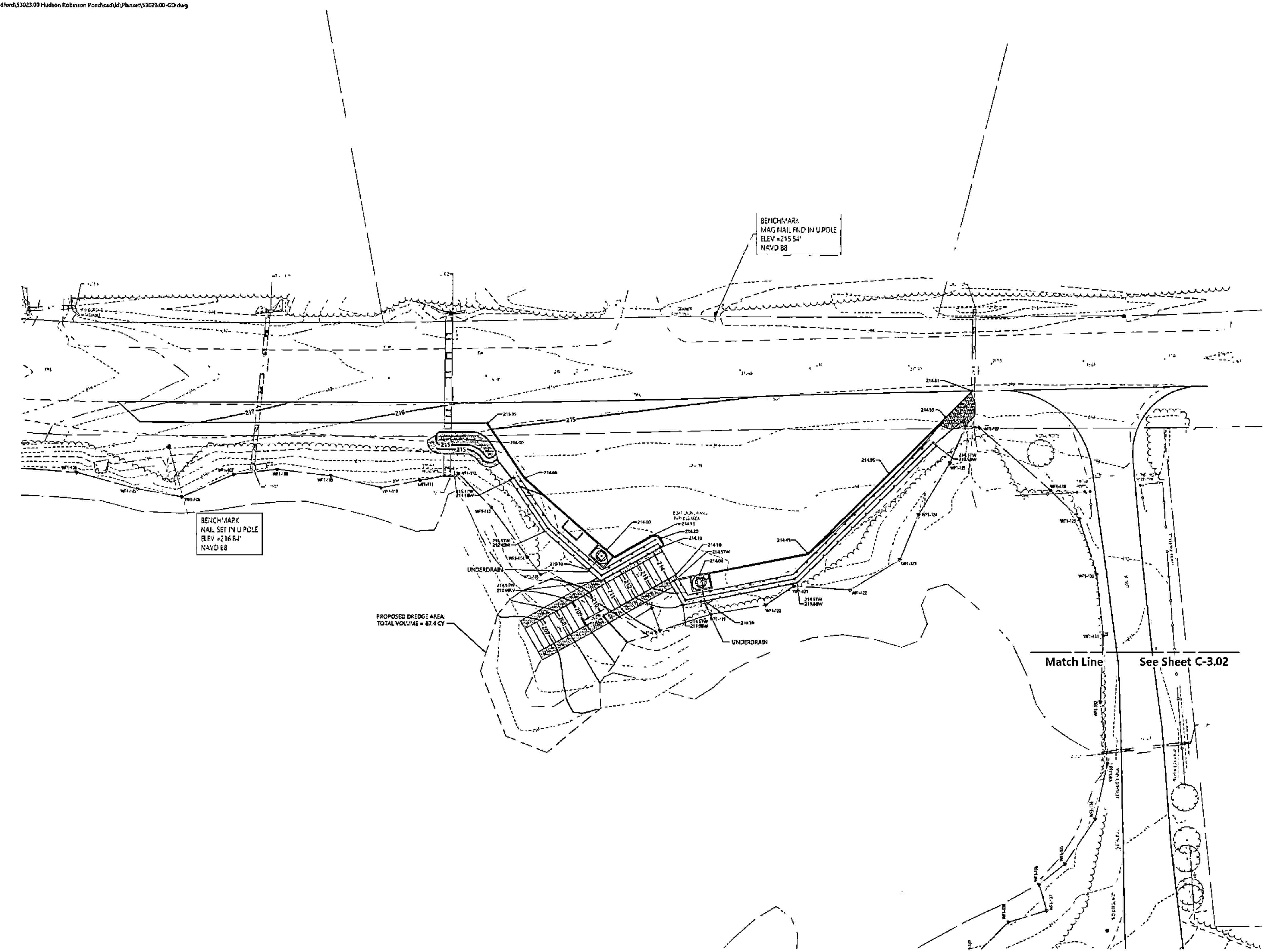

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Issued for: Permitting
Date: March 1, 2024

Drawing Title: Grading, Drainage and Erosion Control Plan 1

Drawing Number: C-3.01

Sheet 4 of 8

Project Number: 53023.00

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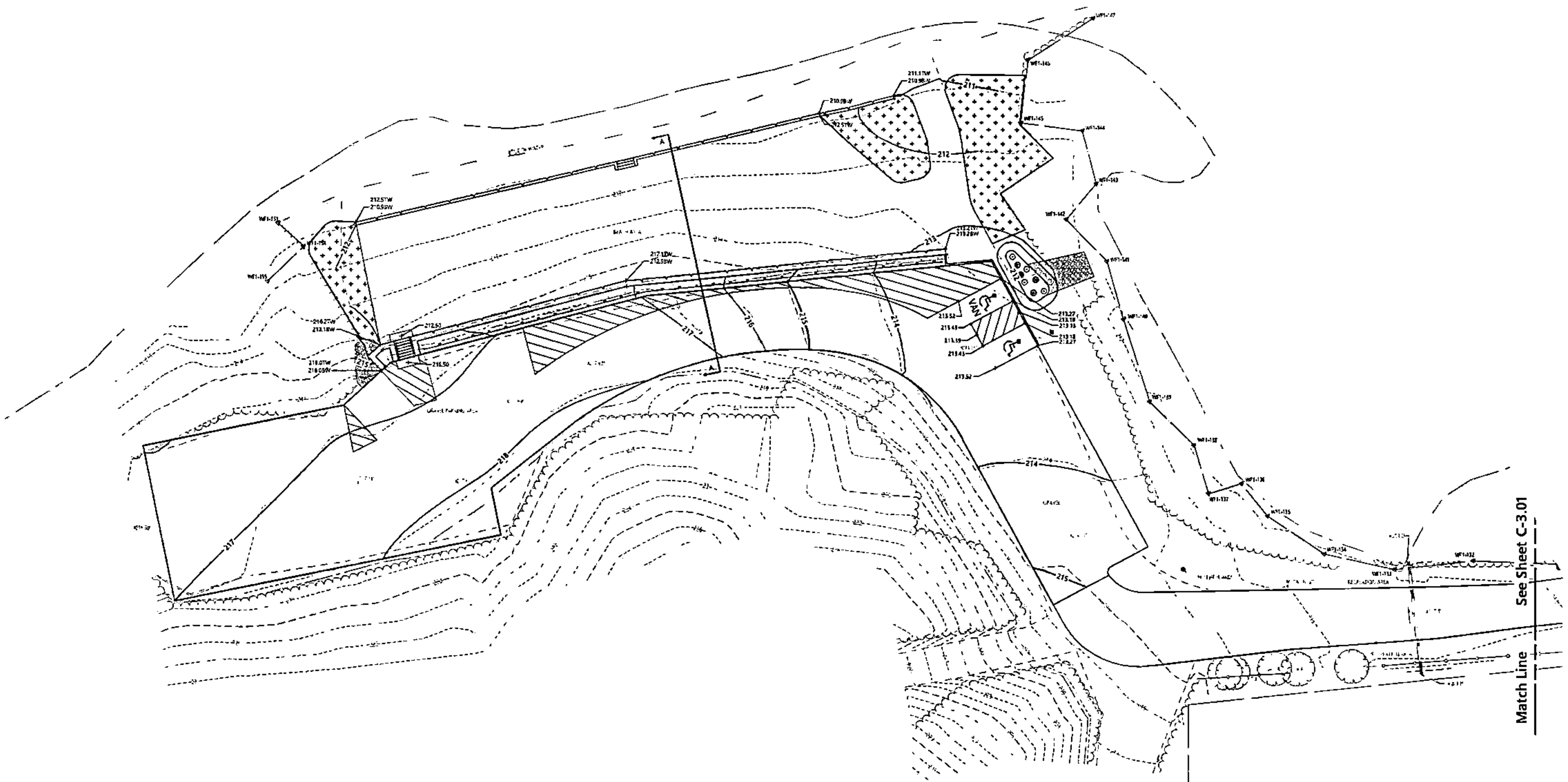

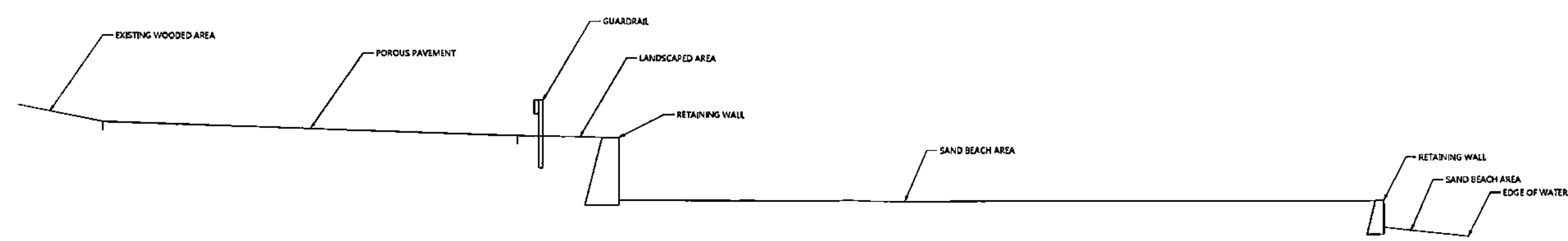

SECTION A-A
HORIZONTAL SCALE 1" = 4'
VERTICAL SCALE 1" = 1'

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Grading, Drainage and Erosion Control Plan 2

Drawing Number
C-3.02

Sheet 5 of 8

Project Number
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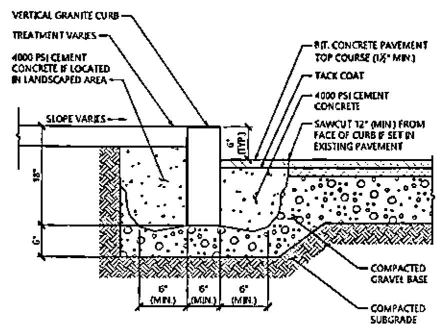
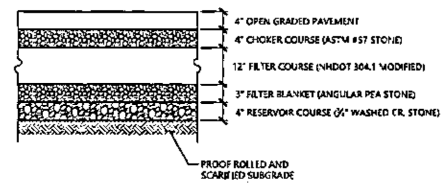


Vertical Granite Curb (VGC) 3/20
N.T.S. Source: VHB REV LD_402

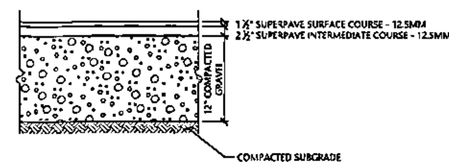


POROUS PAVEMENT

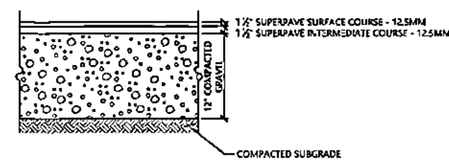
NOTES

1. THE PRACTICE SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH UNHSC DESIGN SPECIFICATIONS FOR POROUS ASPHALT PAVEMENT AND INFILTRATION BEDS, FEBRUARY 2014, REVISED SEPTEMBER 2016, PUBLISHED BY THE UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER
2. ANY ORGANIC MATERIAL BELOW THE PROPOSED POROUS PAVEMENT SHALL BE REMOVED DOWN TO NATURAL PARENT MATERIAL AND REPLACED WITH SUITABLE GRANULAR MATERIAL UP TO SUBGRADE ELEVATION PER THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.

Porous Pavement Section 1/16
N.T.S. Source: VHB REV LD_430P



HEAVY DUTY FLEXIBLE PAVEMENT

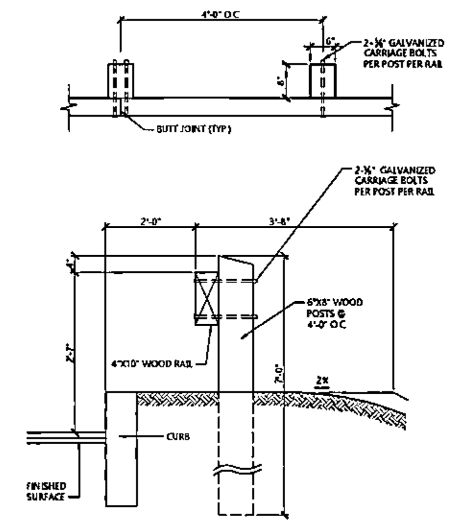


STANDARD DUTY FLEXIBLE PAVEMENT

NOTES

PAVEMENT SECTIONS ARE SUBJECT TO CHANGE AND WILL BE BASED ON THE RESULTS OF FURTHER GEOTECHNICAL INVESTIGATIONS

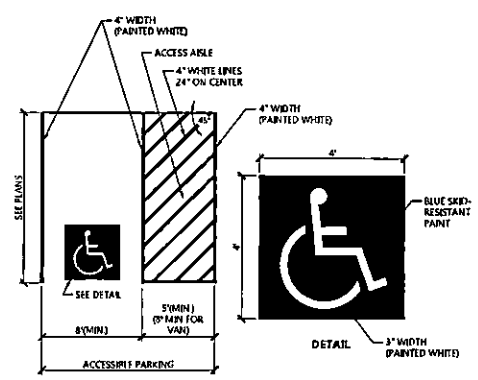
Bituminous Concrete Pavement Sections 7/22
N.T.S. Source: VHB REV LD_430



Wood Guardrail 10/20
N.T.S. Source: VHB REV LD_450

Sign Summary

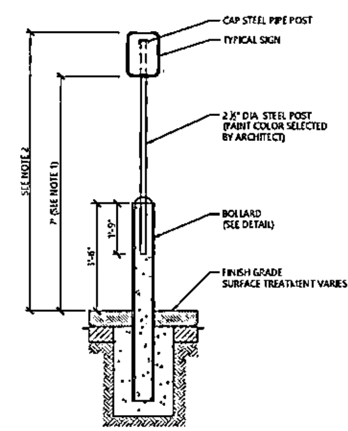
M.U.T.C.D. Number	Specification Width	Specification Height	Desc.
R7-8	12"	18"	RESERVED PARKING
R7-8P	12"	6"	VAN ACCESSIBLE
R8-3a	12"	6"	NO PARKING



NOTES

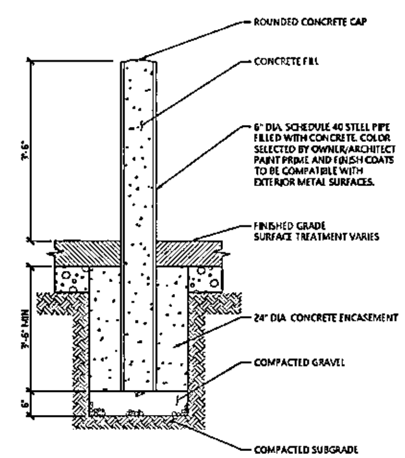
1. ALL DIMENSIONS TO EDGES OF 4" PAVEMENT STRIPING
2. 8' STALL WIDTH REFERS TO 8' CLEAR BETWEEN INSIDE EDGES OF PAVEMENT MARKINGS.
3. ALL SLOPES THROUGHOUT THE ACCESSIBLE PARKING AND AISLE AREAS SHALL NOT EXCEED 1.5%

Accessible Parking Space 1/16
N.T.S. Source: VHB REV LD_552W-NH



1. THIS DIMENSION SHALL BE A MINIMUM OF 5' FOR ACCESSIBLE SIGNAGE.
2. THIS DIMENSION SHALL BE A MAXIMUM OF 8' FOR ACCESSIBLE SIGNAGE

Bollard Mounted Sign 2/20
N.T.S. Source: VHB REV LD_703



Bollard 12/19
N.T.S. Source: VHB REV LD_700

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Issued for: Permitting — Date: March 1, 2024

Drawing Title: **Site Details 1**

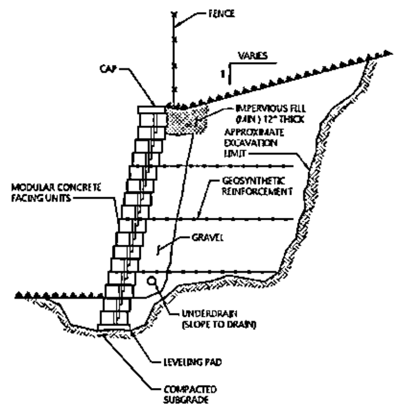
Drawing Number: **C-4.01**

Progress Print For Review Only 3/01/2024

Sheet 6 of 8

Project Number 53023.00

\\vhb\gbl\proj\Bedford\53023.00 Hudson Robinson Pond\cad\ld\Planset\53023.00-DT.dwg



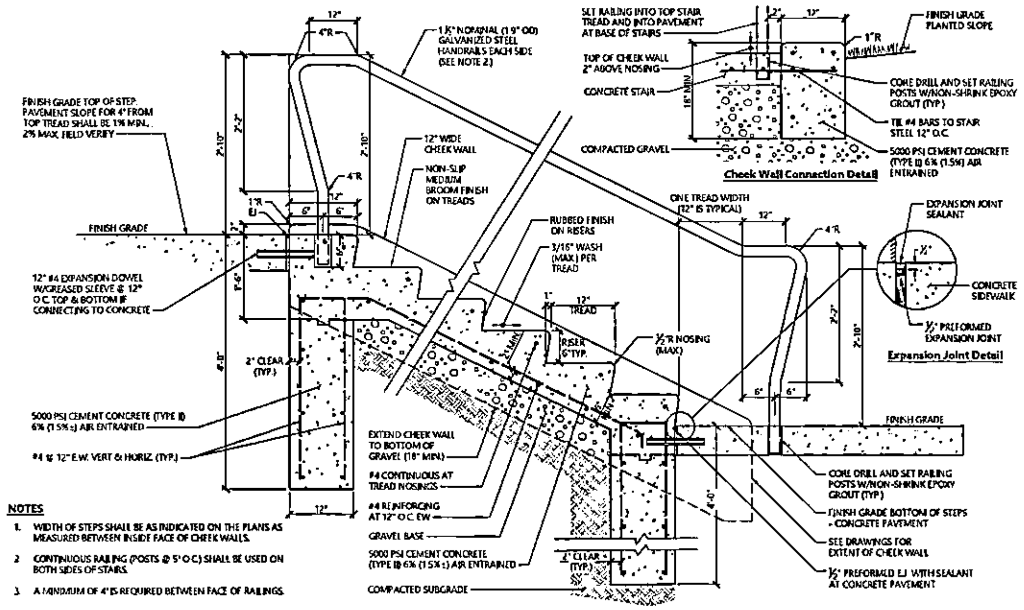
NOTES

DETAIL PROVIDED FOR GENERAL INFORMATION ONLY. STAMPED FINAL DESIGN OF MODULAR WALL SYSTEM TO BE PROVIDED BY WALL MANUFACTURER BASED ON GEOTECHNICAL ENGINEERS RECOMMENDATIONS.

Modular Retaining Wall

1/16

N.T.S. Source: VHB LD_750



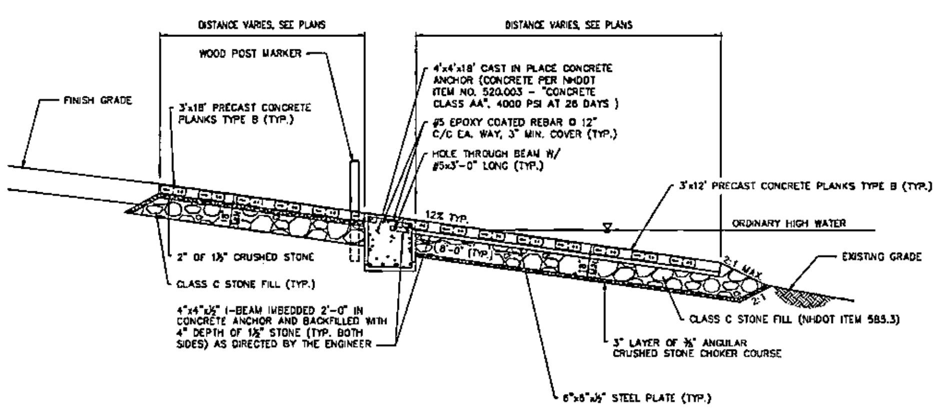
NOTES

1. WIDTH OF STEPS SHALL BE AS INDICATED ON THE PLANS AS MEASURED BETWEEN INSIDE FACE OF CHEEK WALLS.
2. CONTINUOUS RAILING (POSTS @ 5' O.C.) SHALL BE USED ON BOTH SIDES OF STAIRS.
3. A MINIMUM OF 4' IS REQUIRED BETWEEN FACE OF RAILINGS.

Concrete Steps with Handrails

2/20

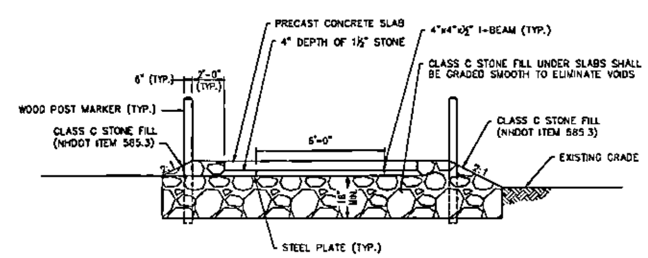
N.T.S. Source: VHB LD_765_MA



Precast Concrete Panel Boat Ramp Longitudinal Section

10/05

N.T.S. Source: NH Fish and Game Dept.



Precast Concrete Panel Boat Ramp Fill Section

10/05

N.T.S. Source: NH Fish and Game Dept.

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vhb

2 Bedford Farms Drive
Suite 200
Bedford, NH 03110
603.391.3900

Robinson Pond Public Access Improvements

Robinson Pond
Hudson, NH

Designed by DJB Checked by MJV

Issued for: Permitting Date: March 1, 2024

Site Details 2

C-4.02

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Sheet 7 of 8

Project Number 53023.00

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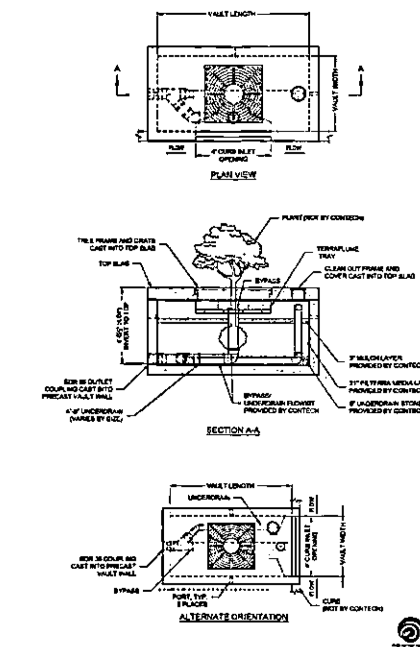
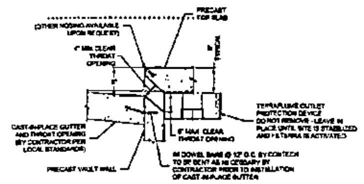




FTIBC CONFIGURATION								
VAULT SIZE (L x W)	MEDIA AREA (SF)	LONG SIDE INLET DESIG. / PART NO.	SHORT SIDE INLET DESIG. / PART NO.	AVAILABILITY	MAX. OUTLET/ BYPASS PIPE DIA.	MAX BYPASS FLOW (CFS)	UNDER-DRAIN PIPE DIA. (PERF)	TREE GRATE QTY. & SIZE
4 x 4	16	FTIBC0404	FTIBC0404	ALL	6" SDR 35	1.43	4" SDR 35	(1) 3' x 3'
6 x 4	24	FTIBC0604	FTIBC0406	ALL	8" SDR 35	1.90	4" SDR 35	(1) 3' x 3'
8 x 4	32	FTIBC0804	FTIBC0408	ALL [illegible]	8" SDR 35	1.90	4" SDR 35	(1) 3' x 3'
7.83 x 4.5	35	FTIBC07804	FTIBC04078	DE, MD, NJ, PA, VA, WV ONLY	8" SDR 35	1.90	4" SDR 35	(1) 3' x 3'
6 x 6	36	FTIBC0606	FTIBC0606	ALL [illegible]	8" SDR 35	1.90	4" SDR 35	(1) 3' x 3'
8 x 6	48	FTIBC0806	FTIBC0608	ALL	10" SDR 35	3.37	4" SDR 35	(1) 4' x 4'
10 x 6	60	FTIBC1006	FTIBC0610	ALL [illegible]	10" SDR 35	3.37	6" SDR 35	(1) 4' x 4'
8 x 8	64	FTIBC0808	FTIBC0808	CA, TX ONLY	10" SDR 35	3.37	6" SDR 35	(1) 4' x 4'
12 x 6	72	FTIBC1206	FTIBC0612	ALL [illegible]	10" SDR 35	3.37	6" SDR 35	(2) 4' x 4'
10 x 8	80	FTIBC1008	FTIBC0810	CA, TX ONLY	10" SDR 35	3.37	6" SDR 35	(1) 4' x 4'
13 x 7	91	FTIBC1307	FTIBC0713	ALL [illegible]	10" SDR 35	3.37	6" SDR 35	(2) 4' x 4'
12 x 8	96	FTIBC1208	FTIBC0812	CA, TX ONLY	10" SDR 35	3.37	6" SDR 35	(2) 4' x 4'
14 x 8	112	FTIBC1408	N/A	ALL	10" SDR 35	3.37	6" SDR 35	(2) 4' x 4'

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING ON VAULT SIZE

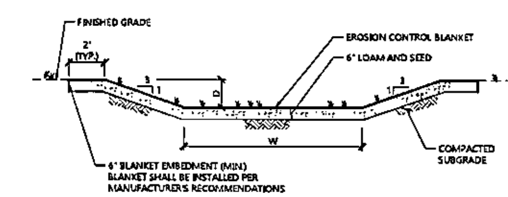
filterra

CONTECH
ENGINEERED SOLUTIONS LLC

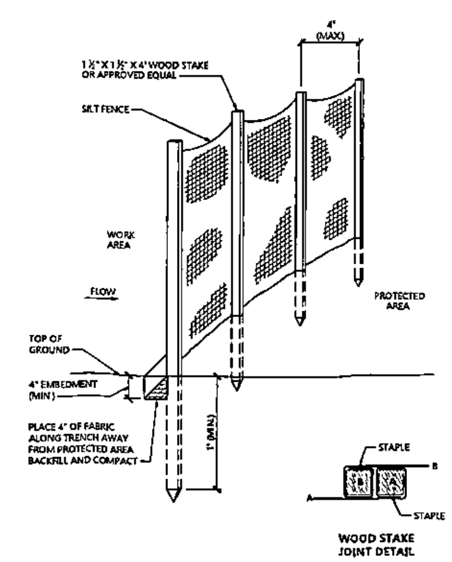
FILTERRA INTERNAL BYPASS CURB (FTIBC) CONFIGURATION DETAIL

SWALE TABLE

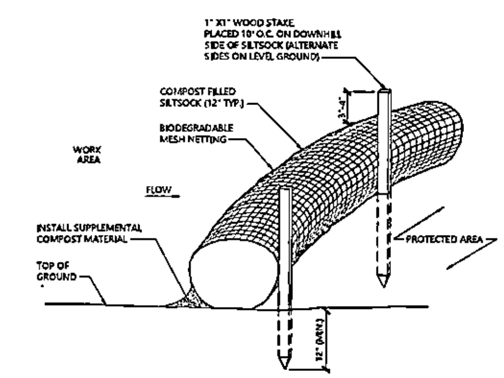
SWALE DESIGNATION	W	D
TBD	TBD	TBD



Grassed Swale 2/20
N.T.S. Source: VHB REV LD_171



Silt Fence Barrier 1/16
N.T.S. Source: VHB REV LD_650



NOTES

1. SILTSOCK SHALL BE FILTREXX SILTSOXX, OR APPROVED EQUAL.
2. SILTSOCKS SHALL OVERLAP A MINIMUM OF 12 INCHES.
3. SILTSOCK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS, AND REPAIR OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED.
4. UPON SITE STABILIZATION, COMPOST MATERIAL SHALL BE DISPERSED ON SITE, AS DETERMINED BY THE ENGINEER.
5. IF NON BIODEGRADABLE NETTING IS USED THE NETTING SHALL BE COLLECTED AND DISPOSED OF OFFSITE.

Siltsock - Erosion Control Barrier 10/20
N.T.S. Source: VHB REV LD_658

vhb.com

2 Bedford Farms Drive
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Robinson Pond Public Access Improvements

Robinson Pond
Hudson, NH

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Drawing Title
Site Details 3

Drawing Number
C-4.03

Sheet 8 of 8

Project Number 53023.00

Progress Print For Review Only 3/01/2024

Saved Friday, January 26, 2024 3:44:18 PM DBOSWORTH Plotted Thursday, February 29, 2024 11:41:13 AM Derek Bosworth

Robinson Pond Sediment Analysis

Technical Memorandum

Prepared By: Don Kretchmer, DK Water Resource Consulting LLC
January 10, 2024

Contents

1.0 Background

This document characterizes the phosphorus content of the surficial sediments of Robinson Pond (approximately the upper 10 cm) at a variety of depths and locations in the pond as well as a summary of the related water quality and sediment data that will be used to help evaluate the potential internal load of phosphorus (P) from the sediments to Robinson Pond.

Robinson Pond is in the Merrimack River Basin within the town of Hudson, New Hampshire. The 52-hectare (128 acres) pond has a maximum depth of 9.0 m (29.5 feet) and a mean depth of 2.4 m (7.9 feet) (Figure 1). The pond volume is 1,249,302 cubic meters with an estimated flushing rate of approximately 2.7 times per year (AECOM 2011). More recent bathymetry is available from NH GRANIT (2016) however, these data are believed to be unreliable, showing large areas with water depths much greater than has ever been reported for Robinson Pond (NHDES 2022). As a result, bathymetric data from 1988 were used to estimate sediment release (Figure 1). These estimates can be updated if recent accurate bathymetric data are obtained.

In recent years, Robinson Pond in Hudson, NH has experienced low dissolved oxygen in the deepest sections. The AECOM (2011) suggested that dissolved oxygen was reduced below 6 m in the pond in the summer. Recent data suggests that dissolved oxygen is reduced below 3 m (VHB2023). Localized cyanobacteria blooms and related water quality impairments including contact recreation restrictions have been prevalent in recent years. In response to these episodes of poorer water quality, sediment sampling was conducted in July and October 2023 to assess the phosphorus concentration of the sediments of the pond and the likelihood that these phosphorus stores could be released back to the water column.

A comprehensive discussion of Robinson Pond water quality and watershed issues can be found in the TMDL for Robinson Pond (AECOM 2011), Volunteer Lake Assessment Program (VLAP) for Robinson Pond (NHDES 2021) and recent work by VHB (VHB 2023). Robinson Pond water quality varies from good to poor generally and is representative of a highly nutrient rich system with high productivity (eutrophic) system. Recent water quality shows evidence of even higher nutrient concentrations and associated increases in productivity suggesting that in recent years the pond is more eutrophic than in the past. Specifically, cyanobacteria have been observed more frequently and in greater density in recent years. The degree of anoxia in the deeper sections of the pond in the summer is high. It is likely that increased phosphorus concentrations in the water column from a combination of watershed loading and loading from the sediments are a contributing factor.

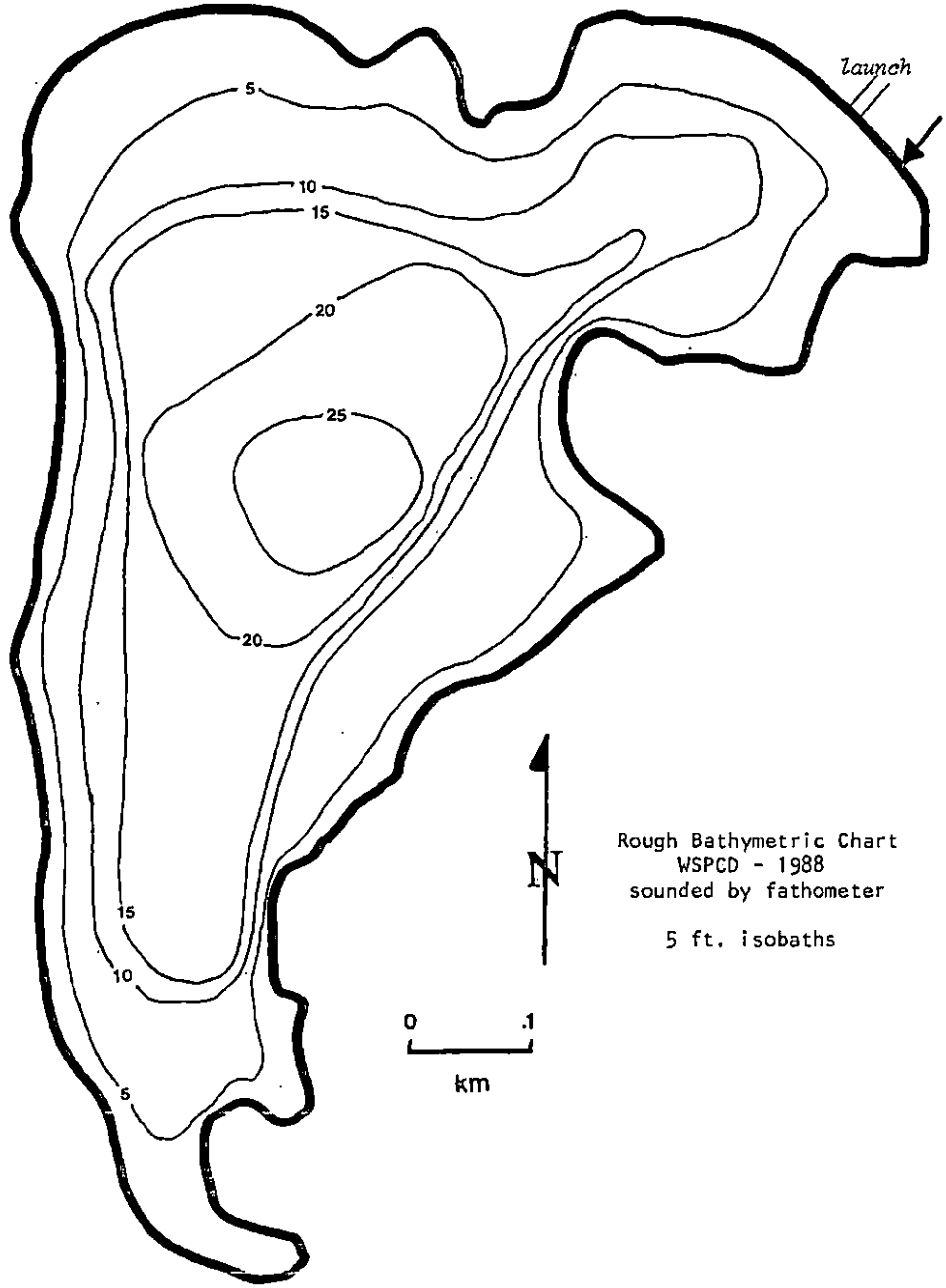

Figure 1: Robinson Pond bathymetry. (NH WSPCD 1988).

Water quality data have been collected regularly by volunteers under the NH VLAP since 2000. These data allow a look at changes in pond water quality over time as well as a comprehensive look at current water quality. Selected data from this record are presented in Figure 2 and Table 1 below.

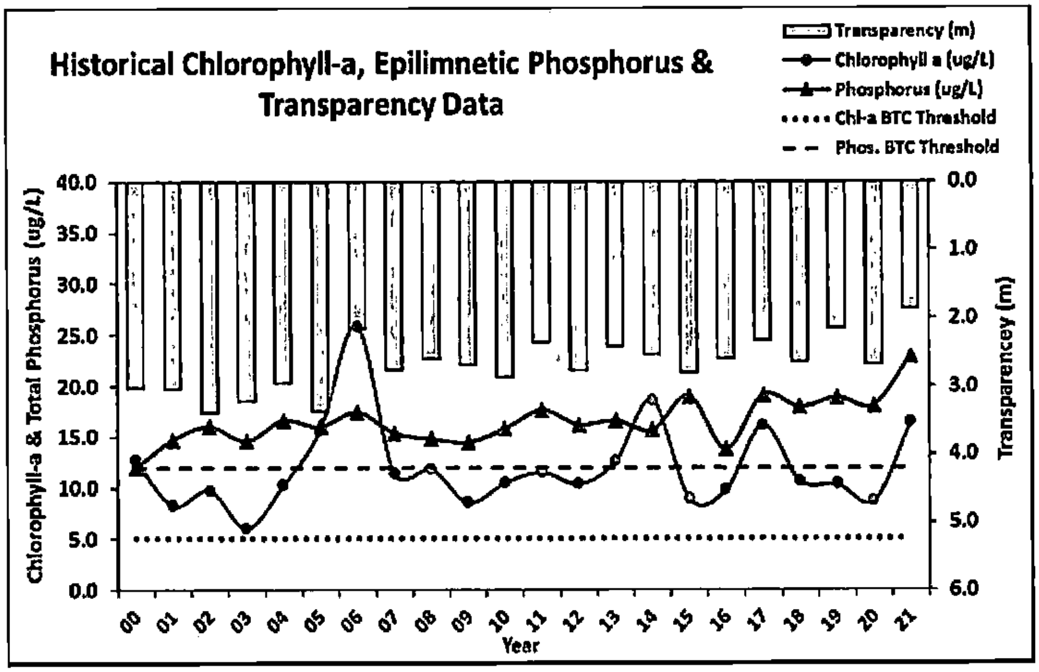

Figure 2: Historic Water Quality data for Robinson Pond, Hudson, NH (NHDES 2021).

Table 1: 2021 Water Quality data for Robinson Pond, Hudson, NH (NHDES 2021).

Station Name	2021 Average Water Quality Data for ROBINSON POND - HUDSON										
	Alk. (mg/L)	Chlor-a (ug/L)	Chloride (mg/L)	Color (pcu)	Cond. (us/cm)	E. coli (mpn/100mL)	Total P (ug/L)	Trans. (m)		Turb. (ntu)	pH
								NVS	VS		
Epilimnion	14.5	16.38	50	108	195.8		23	1.88	2.17	1.78	6.17
Metalimnion					207.2		29			3.63	6.20
Hypolimnion					225.5		128			12.40	6.32
Sta. 2 Launch Brook			57		221.5	348	35			1.01	6.72
Sta. 3 Howard Brook			17		89.4	1126	62			2.01	5.92
Sta. 4 Juniper Brook			48		210.3	232	26			8.43	5.90
Sta. 5 Stoney Lane Drainage			43		199.8	486	45			8.80	6.32
Sta. 6 Woodcrest Brook			82		292.5	1168	181			9.58	6.10
Sta. 7 Row			85		309.2	834	120			5.57	6.14

Phosphorus concentrations in the surface layers of the lake are currently high enough to support a trophic classification of eutrophic or highly nutrient rich. Robinson Pond thermally stratifies in the deep zone of the pond in the summer and during that stratification period, dissolved oxygen is depressed in the deeper waters below 3 m (10 ft). The anoxic conditions facilitate release of phosphorus from the sediments to the water column. Phosphorus concentrations in the deeper strata of the pond are much higher (Table 1) than those observed in the surface layers suggesting substantial phosphorus release from the sediments. Results from the summer of 2023 were used to estimate internal release of phosphorus.

2.0 Sediment Sampling

2.1 Approach

There are several central questions that drive the sediment assessment presented in this summary:

1. How much phosphorus is in the sediments of Robinson Pond?
2. How much of this phosphorus (internal load) could be released under low oxygen conditions?
3. How much of this phosphorus is essentially permanently bound in the sediments?
4. Is internal loading of phosphorus currently a driving factor in Robinson Pond?

These questions can be largely answered using the sediment data however, future water quality monitoring and the ongoing watershed planning projects will put these results in context with other sources.

2.2 Field Program.

The sediment sampling program was developed through collaboration between DK Water Resource Consulting LLC and VHB. The monitoring program generally follows the protocols developed as a part of the sediment sampling Quality Assurance Project Plan (QAPP) prepared for Nippo Lake in Barrington, NH (DKWRC and NHDES 2018). The only deviation from these protocols was that samples to be analyzed for metals were collected with an Eckman dredge in October of 2023 rather than the core sampler utilized in July. This technique captures approximately 4 inches (10cm) of sediment in typical lake sediments. This change in protocol was necessitated by the shipping loss of July 2023 metals samples taken from the cores. In general, only the P in the upper 4 to 10 cm (1.6 - 4 inches) of sediment interacts with the water column (Cooke et al. 2005). Both the core samples and Eckman dredge samples were representative of the upper 4 inches (10cm) of sediment.

Sediment sampling was conducted on July 26, 2023 and October 19, 2023. Field personnel for the July event included Don Kretchmer from DK Water Resource Consulting LLC (DKWRC), Garrison Beck from VHB and Savia Berlucchi from VHB. Six samples were collected at various depths and locations across the pond along with one duplicate sample (Station Center N). The October event was conducted by Don Kretchmer from DKWRC and Garrison Beck from VHB. Sampling locations are depicted in Figure 3. Coordinates for these stations are presented in Table 2. Stations were chosen to provide a representation of sediment conditions in both the deep open water areas and shallow areas or embayments.

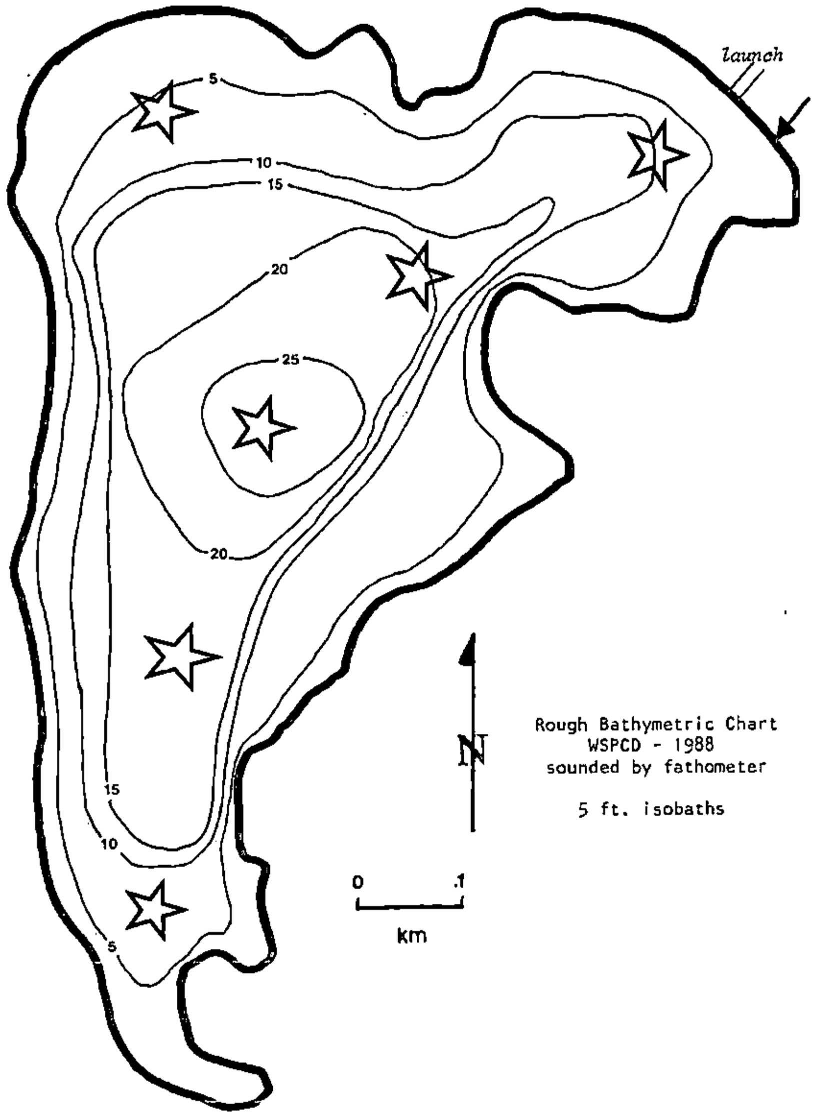

Figure 3: Sampling Locations, Robinson Pond Sediment Monitoring, July 26, 2023, and October 19, 2023.

Table 2. Sampling Coordinates, Robinson Pond Sediment Monitoring, Hudson, NH.

	Water Depth ft)	Latitude (degrees)	Longitude (degrees)
NE	15	42° 48' 2.01"	71° 22' 59.45"
NW	12	42° 48' 3.37"	71° 23' 19.28"
Center N	20	42° 48' 0.41"	71° 23' 7.19"
Center	30	42° 47' 58.56"	71° 23' 12.56"
Center S	26	42° 47' 50.23"	71° 23' 14.12"
South	10	42° 47' 39.62"	71° 23' 16.34"

2.3 Sampling Results

Phosphorus (P) in sediment originates from historic loading and, to a lesser degree, the native soils beneath a lake. In Robinson Pond, the watershed soils and settling of organic matter from plants and animals growing in the pond are likely to be more important to the phosphorus resources than native soils as the pond was formed during the last glaciation and deposits of sediments since glaciation in the pond likely bury the native soils.

The sediment P in samples was split into fractions by sequential lab extractions and reported in four categories depending on how tightly the P is bound in the sediments and under what conditions P might be released back to the water column. Loosely bound P is the most readily available fraction for uptake by algae. Iron bound P can be released from sediments under low oxygen conditions and be available to algae. Labile organic P is bound in organic matter and is slowly released as the organic matter decays and is then available for binding to iron or aluminum or release to the water column and subsequent uptake by algae. Aluminum bound P is largely permanently bound to aluminum and typically remains in the sediments regardless of the oxygen status of the overlying water or the sediment pore water. In addition to aluminum bound P there are other forms of permanently bound P including calcium bound mineral P and organic forms of P that are resistant to bacterial breakdown. These other forms are included in sediment total P but are generally not considered mobile. The physical characteristics of the sediments of Robinson Pond were typical for lake sediments in New England below the wave zone and exposed to low oxygen concentrations. At all sampling sites the sediments were gray-brown and had the consistency of mayonnaise (Photo 1).

Photo 1: Typical lake sediments from New Hampshire.

Sediment samples collected on July 26, 2023, were stored, shipped, and analyzed at University of Wisconsin-Stout (phosphorus by sequential extraction). Metal samples collected on October 19, 2023, were hand delivered to Eastern Analytical (metals) according to procedures in the QAPP document (DKWRC and NHDES 2018) used for reference in this project. Results of the analyses are presented in Table 3. These values are important to understand the likelihood of P release from the sediments of Robinson Pond under anoxia. Quality assurance data are provided in Appendix Table 1.

In Robinson Pond, sediments, concentrations of the most readily released forms of P (loosely bound P and iron bound P) are low relative to other forms of P (Table 3, Figure 4) but still sufficient to result in internal loading of phosphorus under low oxygen conditions as has been observed. A substantial amount of phosphorus in the sediment of Robinson Pond is bound to organic matter (labile organic P, Table 3, Figure 4). Much of this organic matter is likely slow to decay resulting in low release rates of P. Much of the P released by the organic matter would be expected to subsequently bind to aluminum or iron. The iron bound phosphorus may then be released to the water column under the anoxic conditions that currently exist.

Labile organic P the largest fraction of phosphorus in the sediments of Robinson Pond. Aluminum -bound P is the second largest fraction in Robinson Pond. The aluminum bound P is unlikely to be released from the sediments regardless of the oxygen content of the overlying water. The fact that most of the sediment P is bound to either aluminum or organic compounds suggests that the anoxia driven internal load would be modest however, the low oxygen status of the water column and the fact that this area appears to be expanding over time has led to a substantial internal load of P to the water column. All forms of P are near the average of other lakes in and near New Hampshire (Figures 5 and 6).

Table 3: 2023 Upper 10 cm Sediment Data for Robinson Pond, Hudson, NH

Station	Depth of Sample	Depth of Sample	Moisture content	Organic Content (LOI)	Wet bulk density	Dry bulk density	Loosely-bound P	Iron-bound P	Labile organic P	Aluminum-bound P	Total P	Total Iron	Total Aluminum	Sum of mobile P [1]	Redox P
	feet	meters	(%)	(%)	(g/cm^3)	(g/cm^3)	(mg/g)	(mg/g)	(mg/g)	(mg/g)	(mg/g)	(mg/g)	(mg/g)	mg/g or g/kg	mg/g or g/kg
NE	13.0	4.0	91.8	32.7	1.035	0.086	0.026	0.076	0.295	0.200	0.826	11.0	9.9	0.397	0.102
NW	12.0	3.7	95.4	42.9	1.017	0.047	0.036	0.087	0.301	0.171	1.033	11.0	7.0	0.424	0.123
CENTER N	20.0	6.1	93.8	37.6	1.025	0.065	0.026	0.108	0.331	0.205	0.989	11.0	9.0	0.465	0.134
CENTER	30.0	9.1	94.3	37.6	1.022	0.059	0.032	0.144	0.306	0.251	0.991	10.0	9.2	0.482	0.176
CENTER S	26.0	7.9	93.7	37.3	1.025	0.065	0.026	0.110	0.359	0.267	0.834	12.0	9.3	0.495	0.136
S	10.0	3.0	92.5	38.1	1.029	0.078	0.026	0.120	0.267	0.199	0.806	12.0	7.4	0.413	0.146
DUP [2]	20.0	6.1	92.4	38.8	1.029	0.079	0.024	0.090	0.238	0.223	0.810	11.0	10.0	0.352	0.114
Center N Ave	20.0	6.1	93.1	38.2	1.0	0.1	0.025	0.099	0.285	0.214	0.900			0.409	0.124
NE Ave												11.0	10.0		
Mean at > 4m depth	25.3	7.7	93.7	37.7	1.025	0.065	0.028	0.118	0.317	0.244	0.908	11.000	9.167	0.462	0.145
Whole Lake mean	18.500	5.639	93.470	37.794	1.026	0.068	0.029	0.106	0.302	0.217	0.898	11.200	8.560	0.437	0.136

[1]Sum of mobile P includes loosely-bound P, iron-bound-P and labile organic P

[2] Dupe for all parameters except Fe and Al was at Station Center N. Dupe for Al and Fe was at Station NE

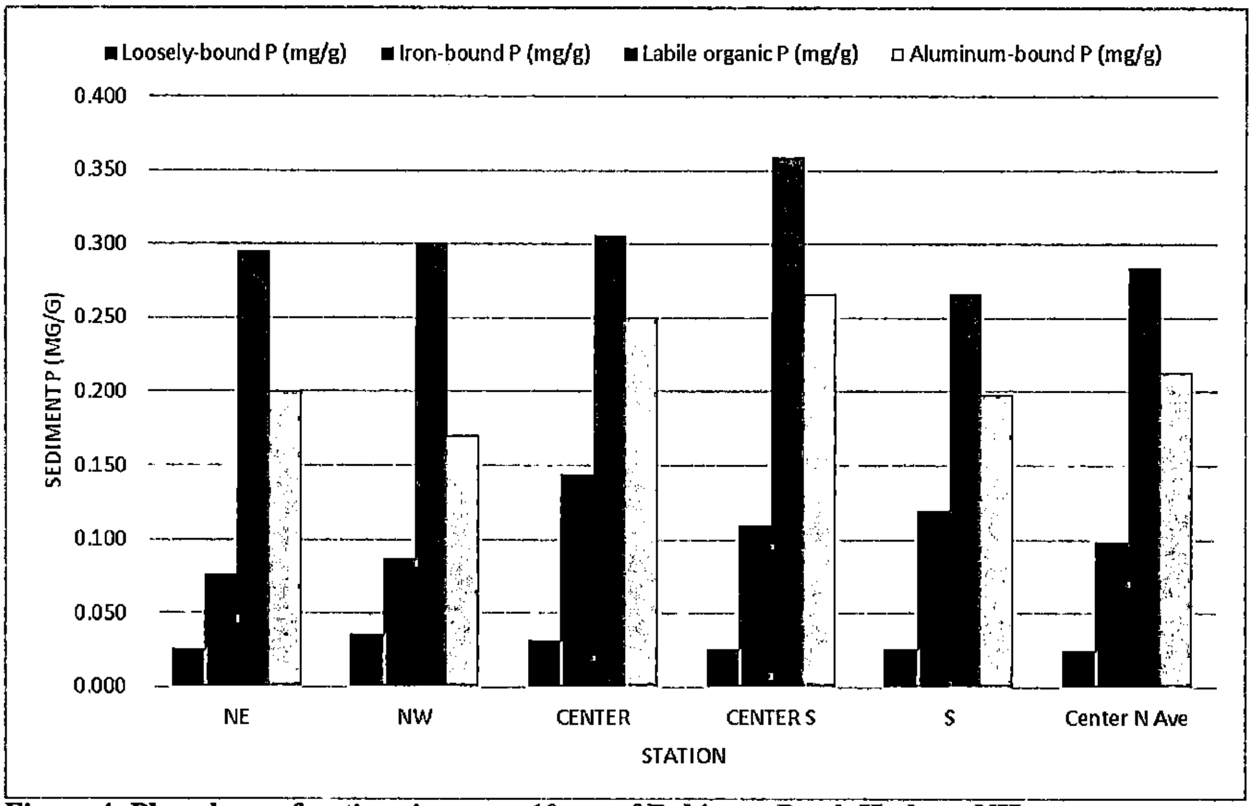

Figure 4: Phosphorus fractions in upper 10 cm of Robinson Pond, Hudson, NH sediments, 2023.

Phosphorus fractions by water depth are presented in Figure 7. In most lakes, sediments and associated phosphorus are focused to the deeper sectional of the lake by gravity. This is the case for mobile forms of P but not for total P in Robinson Pond. This is likely attributable to the proliferation of aquatic plants and plant roots in the shallow zones of the pond which trap and hold sediments before they migrate to the deep section of the pond. Although the relationships are not particularly strong, the mobile and potentially mobile fractions show an increase with water depth in Robinson Pond. This migration of mobile fractions results in a larger pool of releasable P in the deeper anoxic zones.

Iron and aluminum concentrations in conjunction with P concentrations in sediment (Table 4) can also help inform an assessment of the likelihood of release of P from the sediments to the water column. Concentrations of aluminum are low when compared to other NH lakes while iron concentrations are somewhat low. Molar ratios of aluminum to phosphorus more than 25 in the sediment indicate that available aluminum is sufficient to keep phosphorus bound in the sediments regardless of the oxygen status of the overlying water or sediment pore water (Norton et al 2008). Al/P ratios in Robinson Pond were all well below 25 suggesting that aluminum may not be sufficient to lock up phosphorus in the sediment and avoid release back to the water column (Table 4). A molar ratio of aluminum to iron in the sediments more than 3 (Kopacek et al 2007) suggests that that there is sufficient aluminum to react with phosphorus that may be released from iron under low oxygen conditions. In Robinson Pond, aluminum to iron rations were less than 3 in all samples (Table 4) suggesting that the lake may be susceptible to phosphorus release when the sediments are exposed to anoxic conditions.

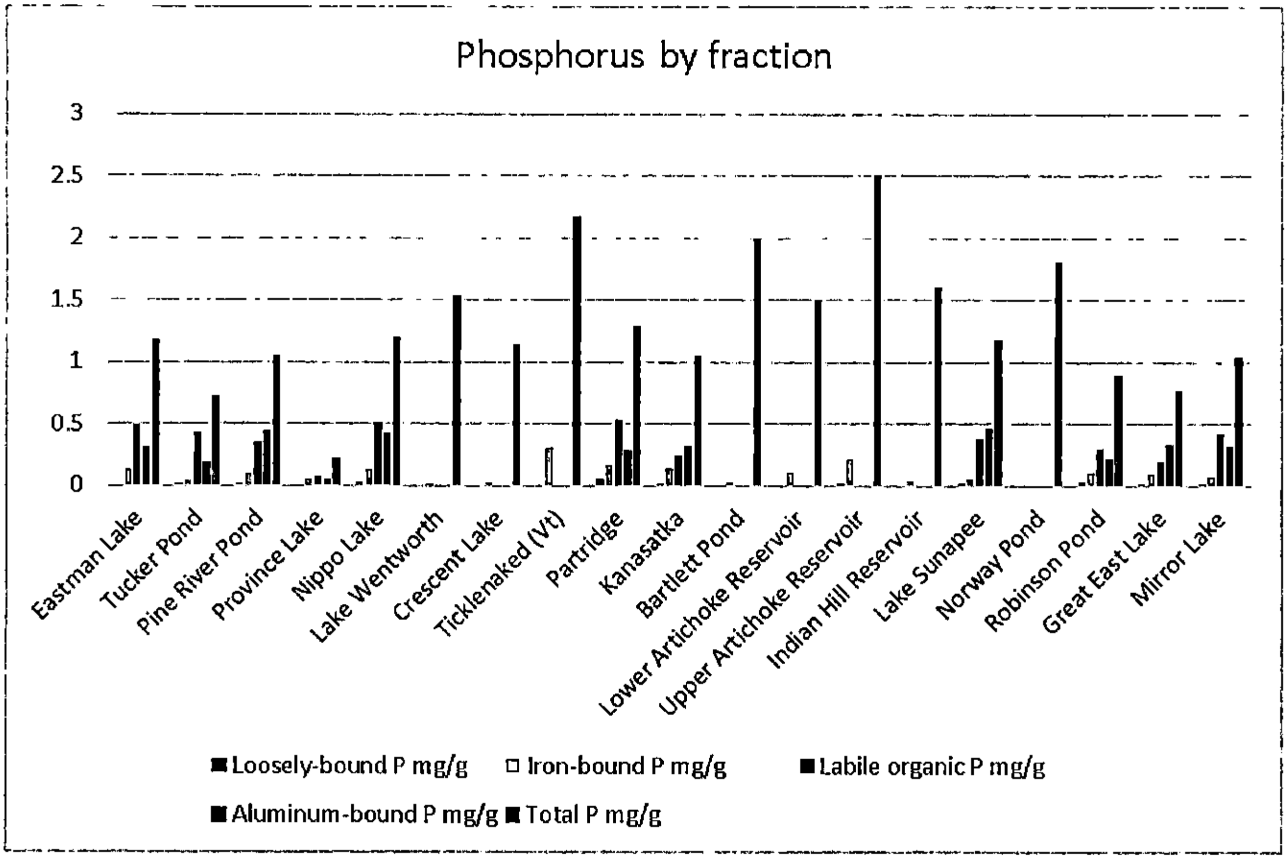

Figure 5: Sediment phosphorus fractions across selected New Hampshire and nearby lakes.

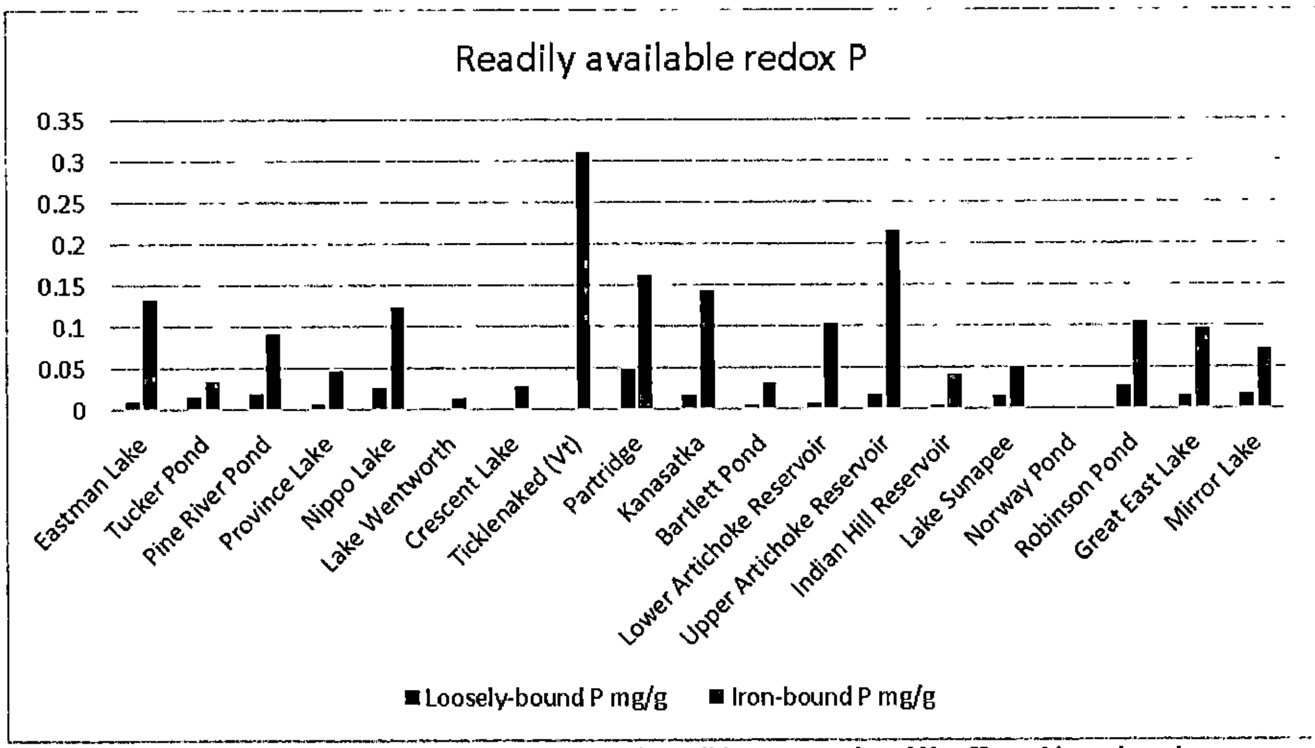

Figure 6: Phosphorus fractions likely to be released under anoxic conditions across selected New Hampshire and nearby lakes.

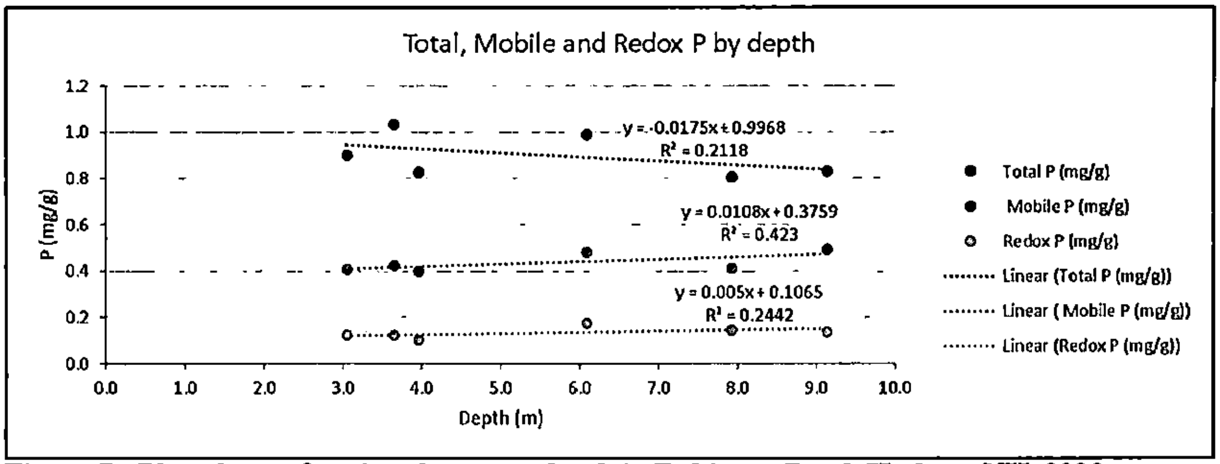

Figure 7: Phosphorus fractions by water depth in Robinson Pond, Hudson, NH, 2023.

Table 4: Sediment metals ratios for upper 10 cm of sediment in Robinson Pond, Hudson, NH, 2023.

Station	Total Phosphorus mg/g	Atomic weight P	Total Iron mg/g	Atomic weight Fe	Total Aluminum mg/g	Atomic weight Al	molar ratios Al/Fe	Al/P
NE	0.826	30.97	11	55.84	9.9	26.98	1.9	13.8
NW	1.033	30.97	11	55.84	7	26.98	1.3	7.8
CENTER N	0.989	30.97	11	55.84	9	26.98	1.7	10.4
CENTER	0.991	30.97	10	55.84	9.2	26.98	1.9	10.7
CENTER S	0.834	30.97	12	55.84	9.3	26.98	1.6	12.8
S	0.806	30.97	12	55.84	7.4	26.98	1.3	10.5
DUP 2	0.810	30.97	11	55.84	10	26.98	1.9	14.2
Center N Ave	0.900	30.97		55.84		26.98		
NE Ave		30.97	11	55.84	10.0	26.98	1.9	
Whole Lake mean	0.898	30.97	11.2	55.84	8.6	26.98	1.6	10.9

The estimated annual mass of potentially mobile sediment P in the upper 10 cm of the sediment layer was estimated using the empirical relationship developed by Nurnberg (1988) where the release rate per unit area exposed to anoxia can be calculated from the amount of redox P in the upper 10cm of sediment. The equation is:

$$\text{Release rate (mg/m}^2\text{ d)} = (13.66 * \text{Redox P in mg/g dry weight}) - 0.47$$

For Robinson Pond, the sediments deeper than 3m are estimated to release phosphorus at a rate of 1.52 mg/m^2 d for a total of 19-168 days based on 2023 water quality data. Deeper sediments are exposed to anoxia for longer periods of time (Table 5). As a result of the anoxia and available phosphorus in the sediments, Robinson Pond sediments below 3 meters were estimated to release 26.3 kg of phosphorus over the course of the summer. This internal load is approximately 23% of the non-internal load estimated from the TMDL study

(AECOM 2011). The TMDL study estimated the internal load based on 2009 data at 2.3 kg or approximately 2% of the watershed load.

Table 5: Estimated annual internal load of phosphorus in Robinson Pond 2023.

Interval (m)	Area between Contours (ha)	Release Rate (mg/m2 d)	Number of Days of Anoxia	Season Release (kg)
3 to 4	2.86	1.52	19	0.8
4 to 5	4.39	1.52	63	4.2
5 to 6	3.42	1.52	139	7.2
6 to 7	3.48	1.52	156	8.3
7 to 8	1.82	1.52	156	4.3
>8	0.59	1.52	168	1.5
Total	**16.56**			**26.3**

Robinson Pond has a modest amount of potentially available phosphorus in the sediments that is being released under severe anoxic conditions. The degree of anoxia and overall phosphorus concentrations in Robinson Pond appear to be getting larger over time despite efforts in nutrient reduction in the watershed. This increase is likely attributable, in part, to a large increase in the internal load.

The results of the sediment testing program in conjunction with a review of water quality results suggest that there is currently anoxic migration of phosphorus from the sediments to the water column. Much of the phosphorus in the sediment is currently bound to aluminum and organic compounds however there is sufficient redox P to fuel releases from the sediments deeper than 3m. It is also certainly possible that cyanobacteria cells on the pond bottom or at the thermocline pick up phosphorus directly from the sediments in shallow water or the hypolimnion, respectively, and then rise into the water column. This could be an important mechanism for the perpetuation of blooms throughout the summer.

2.4 Next Steps

The information obtained from the sediment sampling program confirms the presence of available sediment phosphorus in Robinson Pond. Because the sediment data show a reservoir of potentially mobile P in the deeper sections of the pond, continued dissolved oxygen monitoring in the deeper sections of the pond coupled with water column P measurements in the hypolimnion are suggested to confirm the persistence of the internal load. These data will be used to document changes in the current sediment release rates to overlying waters. Specific attention should be paid to periods of stratification (June through

September). The water quality data regularly collected should be sufficient to do at least preliminary design on sediment phosphorus inactivation, a hypolimnetic aeration or oxygenation project should one of these be desired in the future. Because recent bathymetric data appear to be unreliable, a resurvey of the pond is advisable. The bathymetry is an integral part of the calculation of the internal release of phosphorus and evaluation of treatment alternatives.

Continued watershed management that results in phosphorus load reduction will decrease the likelihood that internal load driven by anoxia get worse, however, inactivation of redox phosphorus in the sediments or addition of oxygen to the deep sections of the pond through aeration or oxygen injection may be needed to address the internal load. Phosphorus inactivation using aluminum is expected to cost $150,000 to $300,000 including permitting, monitoring and treatment costs. Unknowns in this estimate are the permitting requirements which have not been formalized in New Hampshire or the price of aluminum which fluctuates greatly in the market. There are numerous technologies in the market to reduce hypolimnetic anoxia by increasing oxygen through mixing or injection. Depending on the technology chosen, costs may be comparable to sediment phosphorus inactivation however, there would be an ongoing operations cost.

Watershed management should be continued regardless of the treatment of the internal load. A reduction in the external load will decrease the likelihood that internal load driven by anoxia will get worse without treatment, improve the likelihood that treatment of the internal load will succeed and increase the longevity of an internal load treatment.

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Appendix Table 1: QA data for Robinson Pond sediment sampling program 2023

	Duplicates[1]	Split[2]	Moisture content (%)	Organic content (LOI, %)	Wet bulk density (g/cm³)	Dry bulk density (g/cm³)	Loosely-bound P P (mg/g)	Iron-bound P P (mg/g)	Labile organic P P (mg/g)	Aluminum-bound P P (mg/g)	Total P (mg/g)	Total Al (mg/g)	Total Fe (mg/g)
			QA Data										
Field Replicate													
Center N	1		93.8	37.6	1.025	0.065	0.026	0.108	0.331	0.205	0.989		
Center N (DUP)	1		92.4	38.8	1.029	0.079	0.024	0.090	0.238	0.223	0.810		
NE												9.9	11.0
NE(DUP)												10.0	11.0
Relative Percent Difference (%)			1.47	3.04	0.48	18.44	8.33	20.00	39.08	8.07	22.19	1.00	0.00

[1]Duplicates represent two separate subsamples withdrawn from the same sample

Prepared by:
NH Department of
Environmental Services
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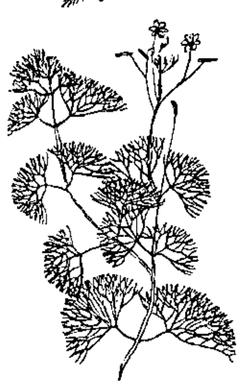
Long-Term Variable Milfoil & Fanwort Management Plan

Robinson Pond
Hudson, New Hampshire



Contents

Purpose

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

1. To identify and describe the historic and current exotic aquatic infestation(s) in the waterbody;
2. To identify short-term and long-term exotic aquatic plant control goals;
3. To minimize any adverse effects of exotic aquatic plant management strategies on non-target species;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To evaluate control practices used in this waterbody over time to determine if they are meeting the goals outlined in this plan.

This plan also summarizes the current physical, biological, ecological, and chemical components of the subject waterbody as they may relate to both the exotic plant infestation and recommended control actions, and the potential social, recreational and ecological impacts of the exotic plant infestation.

The intent of this plan is to establish an adaptive management strategy for the long-term control of the target species (in this case variable milfoil) in the subject waterbody, using an integrated plant management approach.

Appendix A and Appendix B detail the general best management practices and strategies available for waterbodies with exotic species, and provide more information on each of the activities that are recommended within this plan.

Invasive Aquatic Plant Overview

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and Lakes (Luken & Thieret, 1997, Halstead, 2000), primarily by forming dense growths or monocultures in critical areas of waterbodies that are important for aquatic habitat and/or recreational use. Under some circumstances, dense growths and near monotypic stands of invasive aquatic plants can result, having the potential to reduce overall species diversity in both plant and animal species, and can alter water chemistry and aquatic habitat structure that is native to the system.

Since January 1, 1998, the sale, distribution, importation, propagation, transportation, and introduction of key exotic aquatic plants have been prohibited (RSA 487:16-a) in New Hampshire. This law was designed as a tool for lake managers to help prevent the spread of nuisance aquatic plants.

New Hampshire lists 27 exotic aquatic plant species as prohibited in the state (per Env-Wq 1303.02) due to their documented and potential threat to surface waters of the state.

According to the federal 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 New Hampshire regulation Env-Wq 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). In fact, waterbodies that contain even a single exotic aquatic plant do not attain water quality standards and are listed as impaired.

Variable Milfoil and Fanwort Infestation in Robinson Pond

Variable milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*) became established in Robinson Pond in Hudson, New Hampshire in the 1990s. Over the years the plant dominance has oscillated between fanwort and variable milfoil, usually with fanwort becoming most dominant over the milfoil over time.

Robinson Pond is relatively shallow with organic substrates, essentially creating prime fanwort and variable milfoil habitat across much of the pond where depth permits. Both plants have flowered and contributed to the seed stock in the substrates.

Figure 1 illustrates the distribution of the variable milfoil and fanwort infestation in this waterbody over time, since regular monitoring began. The following table provides a summary of variable milfoil and fanwort growth as shown in Figure 1 (area name reference in table below is relative to grid overlay on Figure 1).

Area	Location/Area Description	Year	Description of Growth
A1, B1	North end wetland complex. Shallow organic flocculent substrates, hummocky wetland growth. Water depths <2 feet.	2010 and earlier	Patchy fanwort growth and scattered milfoil stems in this wetland complex, reduced but still remaining post herbicide treatment in 2010
		2011	Patchy growth managed by divers
		2012	Patchy growth managed by divers
		2013	Scattered fanwort growth along wetland edge. No milfoil observed in this area in fall.
		2014	Fanwort and variable milfoil reduced by treatment and diving along wetland edge and in wetland, though single stems do remain
		2015	Sparse milfoil. Fanwort growth early season was slow and low density, and increased as the summer progressed.
		2016	Early season scattered milfoil plants, with fanwort increasing mid-summer, though not dense.
		2017	Early season growth was sparse (May) but as water temperatures warmed through the summer fanwort growth and milfoil growth increased.
		2018	Scattered milfoil and fanwort stems
		2019	A couple of scattered stems of variable milfoil and fanwort patchy along shore in mid-June. Increased fanwort density around shoreline in mid-August, due to diver delays in hand harvesting, and milfoil is present at about the same density as June survey. In October fanwort was reduced from a fall treatment, but variable milfoil persisted in similar abundance to that observed in other surveys during the growing season.
		2020	Patchy growth along wetland edge and inlet channel
		2021	Scattered small clusters of plants along wetland edge
		2022	Scattered areas of milfoil and fanwort growth
		2023	Common milfoil and fanwort patches
A2, A3	Western shoreline. Silty/sandy substrates with areas of rock and organic substrates mixed in. Depths of milfoil/fanwort growth range from 3-6 feet.	2010 and earlier	Dense and increasing growths of fanwort around the pond, with scattered milfoil growth. 2010 control activities greatly reduced the growth of the invasives, but gradual regrowth occurred as 2010 control practice did not work as well as expected.
		2011	Scattered fanwort and few variable milfoil stems along shore, managed by divers
		2012	Consistent dive efforts but fanwort spreading

Area	Location/Area Description	Year	Description of Growth
			and fragmenting quickly. Variable milfoil low density, fanwort dominant.
		2013	Sparse fanwort growth, single stems or small patches
		2014	Fanwort and milfoil reduced in these zones as a result of summer management activities
		2015	Shoreline area showing much reduced growth of both fanwort and milfoil, reduced to single stems or small clumps.
		2016	Fairly invasive free through 2016
		2017	Sparse growth this season for both species along this shoreline.
		2018	Scattered milfoil occasional fanwort stems, low density
		2019	A couple of scattered stems of variable milfoil and fanwort patchy along shore in mid-June. Increased fanwort density around shoreline in mid-August, due to diver delays in hand harvesting, and milfoil is present at about the same density as June survey. In October fanwort was reduced from a fall treatment, but variable milfoil persisted in similar abundance to that observed in other surveys during the growing season.
		2020	No growth documented in this area
		2021	No growth documented in this area
		2022	Low density milfoil and fanwort
		2023	Low density milfoil stems and a couple of fanwort stems
B3	South basin/end of lake. Organic/silty sustrates. Milfoil growth in 2-8 feet of water.	2010 and earlier	Dense and increasing growths of fanwort around the pond, with scattered milfoil growth. 2010 control activities greatly reduced the growth of the invasives, but gradual regrowth occurred as 2010 control practice did not work as well as expected.
		2011	Patchy milfoil at mouth of wetland area at south end of lake.
		2012	Patchy area of growth becoming denser despite diver activity
		2013	Sparse fanwort (single stems), patchy milfoil growth in coves
		2014	Milfoil and fanwort reduced to all but a couple single stems of fanwort
		2015	Western shoreline areas looking good, only single stems of either plant. Eastern shoreline showing patchy growth, mostly fanwort, but scattered stems of milfoil mixed in.

Area	Location/Area Description	Year	Description of Growth
		2016	Sparse scattered stems of milfoil and fanwort
		2017	Patchy growth of both milfoil and fanwort in cove areas and in the narrows exiting the lake to the wetland complex
		2018	Patchy fanwort in July and sparse in August.
		2019	A couple of scattered stems of variable milfoil and fanwort patchy along shore in mid-June. Increased fanwort density around shoreline in mid-August, due to diver delays in hand harvesting, and milfoil is present at about the same density as June survey. In October fanwort was reduced from a fall treatment, but variable milfoil persisted in similar abundance to that observed in other surveys during the growing season.
		2020	Patchy growth close to shore, scattered single stems
		2021	Patchy growth close to shore
		2022	Patchy milfoil and sparse fanwort
		2023	Patchy milfoil and scattered fanwort
C1, C2,	Eastern shoreline/northeastern cove. Gravelly/organic substrate. Location of public access site and town swim beach.	2010 and earlier	Dense and increasing growths of fanwort around the pond, with scattered milfoil growth. 2010 control activities greatly reduced the growth of the invasives, but gradual regrowth occurred as 2010 control practice did not work as well as expected.
		2011	Patchy growth of fanwort and some stems of variable milfoil. Hand removed by diver.
		2012	Rapidly growing fanwort, sparse variable milfoil
		2013	Patchy milfoil and fanwort in shoreline areas and coves
		2014	Fanwort and milfoil reduced compared to 2013 growths, though a single stem of each remain.
		2015	Most of the growth in the main body of the cove has been reduced, now growth is confined to small shallow shelves and coves around outside edge of main cove, tucked into wetland fringe.
		2016	Patchy growth of both milfoil and fanwort associated with shallow shoreline wetland complexes, locally dense in small patches. Shallow water.
		2017	Patchy growth near shore and in deeper cove areas
		2018	Scattered stems of each plant, low density
		2019	A couple of scattered stems of variable milfoil

Area	Location/Area Description	Year	Description of Growth
			and fanwort patchy along shore in mid-June. Increased fanwort density around shoreline in mid-August, due to diver delays in hand harvesting, and milfoil is present at about the same density as June survey. In October fanwort was reduced from a fall treatment, but variable milfoil persisted in similar abundance to that observed in other surveys during the growing season.
		2020	Scattered stems and patchy growth
		2021	Clusters of milfoil growth, scattered fanwort stems
		2022	Scattered patches of milfoil with fanwort mixed in
		2023	Common patches of milfoil, scattered fanwort mixed in
B4, C4	Southern wetland complex/outlet end. Silty/organic substrates with woody debris mixed in. Water depths three feet or less.	2010 and earlier	Dense and increasing growths of fanwort around the pond, with scattered milfoil growth. 2010 control activities greatly reduced the growth of the invasives, but gradual regrowth occurred as 2010 control practice did not work as well as expected.
		2011	Patchy growth of fanwort, little variable milfoil observed
		2012	Increasing coverage of fanwort, scattered milfoil
		2013	Patchy fanwort and milfoil among native plants, water depths very shallow during survey, so could not get all the way into outlet end
		2014	A few scattered stems of variable milfoil, some scattered patches of fanwort. Emphasis should shift to this wetland as the lake infestation is reduced.
		2015	Reduced growth in outlet wetland, scattered single stem plants, or clusters of a few stems.
		2016	Not surveyed
		2017	Not surveyed
		2018	Increased density by mid summer, necessitating a fall treatment
		2019	Not surveyed
		2020	Scattered patches of plants in channels through wetland complex
		2021	Not surveyed
		2022	Not surveyed
		2023	Milfoil and fanwort patches in navigable channel of this zone

In terms of the impacts of the variable milfoil and fanwort in the system, there are several (33) houses around the shoreline of Robinson Pond with unobstructed water access, with additional properties (17) abutting more of the wetland-type habitats around the pond or positioned as back lots with water access. There is a mix of year-round and seasonal dwellings around the pond. Most of these abut areas of dense fanwort and/or variable milfoil growth.

Lake residents have cited fouling of their swim beaches, swim impairments, and concerns about the whole pond being choked with the invasive plants.

Additionally, the invasive plant infestation in this waterbody is a continuous threat to other nearby waterbodies. Robinson Pond is used by many recreational transient boaters, as evidenced by data collected through the Lake Host Program implemented through the NH Lakes Association. Each year hundreds of fragments of fanwort and milfoil are found attached to boats, trailers, and other recreational gear leaving Robinson Pond, suggesting that this pond could be an important source of plants for the further advancement of invasive aquatic plants in nearby waterbodies.

Milfoil and Fanwort Management Goals and Objectives

The aquatic plant management plan outlines actions to manage the infestation of variable milfoil and fanwort in Robinson Pond while maintaining native plant communities whenever control actions are being implemented.

The goal for Robinson Pond is to greatly reduce the overall distribution and density of variable milfoil and fanwort within the system using an Integrated Pest Management Approach. Figure 2 (over several maps) shows both historical and proposed control actions for Robinson Pond milfoil and fanwort.

Local Support

Town or Municipality Support

The Town of Hudson has been very supportive of prevention and control efforts in waterbodies within town boundaries. For the last several years the town has made financial allocations to support the Lake Host Program which is operated on lakes in town to help inspect boats to prevent further spread of fragments (Robinson Pond has ranked 1st for number of fragments of exotic aquatic plants leaving the lake through the Lake Host Program, which is a program that performs courtesy boat inspections provides education and outreach to the boating community).

Lake Resident Support

Robinson Pond has an active lake association. They have a very strong prevention program in place through the Lake Host Program, which they have participated in since 2002. This allows them to protect Robinson Pond from new invasives, but also protects other nearby waterbodies from fragments that could be coming out of Robinson Pond. The lake association also participates in the Weed Watcher Program, and volunteers routinely monitor for an mark exotic plant growth as it is found. their efforts have also greatly aided in the dive work on the lake, as volunteers place markers to help guide divers to areas that need work.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of Robinson Pond, including the milfoil and fanwort infestations. Note that a current review of the Natural Heritage Bureau (NHB) database was requested and the results from that search are included in the table below, as well as in other relevant sections of this plan. Species and/or communities of concern from historic NHB reviews may also be included in this plan, even if they are not listed in the most current NHB review.

General Lake Information	
Lake area (acres)	87.9
Watershed area (acres)	831.6
Shoreline Uses (residential, forested, agriculture)	Residential, wetland, forested
Max Depth (ft)	29.7
Mean Depth (ft)	10.89
Trophic Status	Mesotrophic
Color (CPU) in Epilimnion	31
Clarity (ft)	11.22
Flushing Rate (yr^{-1})	1.3
Natural waterbody/Raised by Damming/Other	Natural w/dam
Invasive Plants (Latin name)	*Cabomba caroliniana (fanwort)* *Myriophyllum heterophyllum (variable milfoil)*
Infested Area (acres)	See figures
Distribution (ringing lake, patchy growth, etc)	See figures
Sediment type in infested area (sand/silt/organic/rock)	Silty/organic

Rare, Threatened, or Endangered Species in Waterbody (according to historic NH Natural Heritage Inventory)	2024 Review American eel (*Anguilla rostrata*) Blanding's turtle (*Emydoidea blandingii*) Brook floater (*Alasmidonta varicosa*) Wood turtle (*Glyptemys insculpata*)

A native aquatic vegetation map and key by the DES Biology Section is shown in Figure 3. A bathymetric map is shown in Figure 4.

Beneficial (Designated) Uses of Waterbody

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, Wildlife and Recreation are the ones most often affected by the presence of invasive plants, though drinking water supplies can also be affected as well in a number of ways.

Following is a general discussion of the most potentially impacted designated uses, including water supplies and near shore wells, as they relate to this system and the actions proposed in this long-term plan.
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.

Aquatic Life

Fisheries Information
Robinson Pond in Hudson is managed as a warmwater fishery. The most recent survey was an electrofishing survey in 1981. Primary gamefish sampled were largemouth bass, smallmouth bass, and chain pickerel. Other species of interest to anglers that were sampled included common sunfish and yellow perch. Hornpout were not sampled but are another species targeted by anglers. Golden shiners were the only baitfish sampled. White perch, fallfish, minnows, and the common white sucker are also found in the pond.

Lake residents report a steady flow of transient fishermen to the pond, as evidenced also by the records of the Lake Host Program.

Wildlife Information

An historic Natural Heritage Inventory review yielded four records of sensitive wildlife species in this area, including the American eel, brook floater, Blanding's turtle and wood turtle (Figure 5). Only the Blanding's Turtle was referenced in the 2019 NHB review.

The American eel was not document in the pond itself, but in a nearby river system. There is not likely to be an impact to this species as a result of control practices performed in Robinson Pond.

The brook floater mussel is listed as endangered in NH due to rarity or vulnerability, but has no federal listing at this time. Globally the species is listed as rare or uncommon. The NHB record for this species in this area dates to 1994 in Beaver Brook, upstream of Route 111, nearer to Cobbetts Pond in Windham. As brook floaters are strictly riverine species they are not expected to be affected by this in-lake management action. If the species is present within the Robinson Pond system, there are no expected impacts to this species as a result of the fanwort and milfoil control activities in Robinson Pond. It is not expected that habitat or food sources for the mussel will be affected either.

The Blanding's turtle is listed as endangered in New Hampshire, where it is rare or uncommon. It has no federal listing, and it is listed as globally secure, but a cause for concern. The NHB record is from 1999, when the specimen was observed to be crossing Robinson Pond Road, just north of the intersection with Griffin Road. The map locus indicates the location is about ½ mile east of Robinson Pond. Blanding's Turtles are mostly aquatic and are found in the shallows of lakes and ponds, in marshes, bogs, and small streams. The turtles nest on land, but feed underwater on insects, tadpoles, crayfish, and snails, among other small aquatic organisms. If the species is present within the Robinson Pond system, there are no expected impacts to this species as a result of the fanwort and milfoil control activities in Robinson Pond. The Fish and Game Department requests that contractors avoid direct herbicide application in scrub-shrub dominated wetland coves, in order to minimize any potential impacts.

The wood turtle was not documented in Robinson Pond, but rather in a stream nearby the pond that may eventually receive outflow from Robinson Pond. There is no impact to this species expected as a result of management efforts in Robinson Pond.

Recreational Uses and Access Points

Robinson Pond is used for numerous recreational activities, including boating, fishing, swimming, and water skiing by both pond residents and transient boaters. There is one designated public access for boats on the northeastern end of the lake. Small motor boats, as well as kayaks and canoes can use this facility (the gravel launch is relatively shallow for launching boats). There is limited parking for about three to five vehicles with trailers. There are generally 5-15 boats on the lake on weekdays and 15-20 on weekends. Numerous canoes, kayaks, and row boats are also seen on the lake. Figure 6 shows a map of the access site, swim beaches and docks and swim platforms on the lake.

There is one public (town) beach on the pond (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 Community 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 Robinson Pond is characterized by a mix of native and non-native (variable milfoil and fanwort) plant growth (Figure 2). Native species include a mix of floating plants (white water-lily, watershield, bladderwort, yellow water-lily, floating heart), emergent plants (swamp loosestrife, pickerelweed, cattail, bur-reed, arrow arum, pipewort, button bush, sweet gale), and submergent plants (water naiad, pondweeds, grassy arrowhead, grassy spike rush). Native plant communities are diverse around the entire waterbody, and are characterized as 'common' by the DES. Extensive wetland complexes are found at both the north and south ends of the lake though the vegetation in these areas was not surveyed as part of this plan preparation.

There are no historic records of state threatened or endangered plant species in Robinson Pond at this time.

Other invasive plants besides fanwort and variable milfoil that were documented in this system include purple loosestrife, which was found in isolated patches around the shoreline of the pond.

Wells and Water Supplies

Figure 7 shows the location of wells, water supplies, well-head protection areas, and drinking water protection areas around the subject waterbody, based on information in the DES geographic information system records. Note that it is likely that Figure 7 does not show the location of all private wells.

Note that the map in Figure 7 cannot be provided on a finer scale than 1:48,000. Due to public water system security concerns, a large-scale map may be made available upon agreement with DES' data security policy. Visit DES' OneStop Web GIS, http://www2.des.state.nh.us/gis/onestop/ and register to Access Public Water Supply Data Layers. Registration includes agreement with general security provisions associated with public water supply data. Paper maps that include public water supply data may be provided at a larger-scale by DES' Exotic Species Program after completing the registration process.

In the event that an herbicide treatment is needed for this waterbody, the applicator/contractor will provide more detailed information on the wells and water supplies within proximity to the treatment areas as required in the permit application process with the Division of Pesticide Control at the Department of Agriculture. It is beyond the scope of this plan to maintain updated well and water supply information other than that provided in Figure 7.

Historical Control Activities

DATE	ACTION	ACRES	NOTES	CONTRACTOR/ENTITY
6/11/2002	FLURIDONE	97	WHOLE POND TREATMENT, LIQUID	LYCOTT
5/18/10 (initial), 6/14/10 (bump), 7/19/10 (bump)	FLURIDONE	52.8	MIX OF GRANULAR AND LIQUID FORMULATIONS	ACT
6/21/12 to 6/22/12	DIVER/DASH	VARIED	8.25 HOURS, 12 GALLONS OF FANWORT/MILFOIL REMOVED	AB AQUATICS
LATE APRIL/EARLY MAY 2012	DIVER/DASH	VARIED	8 DAYS, 1,432 GALLONS	AB AQUATICS
LATE MAY 2012	DIVER/DASH	VARIED	4 DAYS, 380 GALLONS	AB AQUATICS
JULY THROUGH MID AUGUST 2012	DIVER/DASH	VARIED	6,785 GALLONS	AB AQUATICS
EARLY OCTOBER 2012	DIVER/DASH	VARIED	22.75 HOURS, 1120 GALLONS	AB AQUATICS
6/27/2013	CLIPPER (FLUMIOXAZIN)	38.14 ACRES	4.2 LBS/AC TARGET 200 PPB	ACT
WEEK ENDING 10/5/13	DIVER/DASH	VARIED	500 GALLONS REMOVED (VARIABLE MILFOIL & FANWORT)	AB AQUATICS
WEEKS ENDING 9/21 & 9/28/13	DIVER/DASH	VARIED	1160 GALLONS (VARIABLE MILFOIL & FANWORT)	AB AQUATICS
6/30/2014	CLIPPER AND DIQUAT	38.14 ACRES	38.14 ACRES	ACT
10/28/2014	DIVER HAND PULL	NE SHORELINE	NONE FOUND	AB AQUATICS
10/28/2014	DIVER HAND PULL	N COVE	NON FOUND	AB AQUATICS

DATE	ACTION	ACRES	NOTES	CONTRACTOR/ENTITY
10/28/2014	DIVER HAND PULL	NW SHORELINE	3 GALLONS	AB AQUATICS
10/29/2014	DIVER HAND PULL	NW SHORELINE	NONE FOUND	AB AQUATICS
10/29/2014	DIVER HAND PULL	E COVE	NONE FOUND	AB AQUATICS
10/29/2014	DIVER HAND PULL	SE COVE	NONE FOUND	AB AQUATICS
10/29/2014	DIVER HAND PULL	S RIVER	5 GALLONS	AB AQUATICS
6/25/2015	DIQUAT & FLUMIOXAZIN	VARIED	8.8 ACRES	ACT
8/31/2015	DIVER HAND PULL	N COVE	510 GALLONS	AB AQUATICS
9/1/2015	DIVER HAND PULL	N COVE	390 GALLONS	AB AQUATICS
9/2/2015	DIVER HAND PULL	S COVE	330 GALLONS	AB AQUATICS
10/13/2015	DASH	S OF BEACH	60 GALLONS	AQUALOGIC
10/14/2015	DASH	CENTER COVE	90 GALLONS	AQUALOGIC
10/15/2015	HAND	COVE S OF LAUNCH	90 GALLONS	AQUALOGIC
10/16/2015	HAND	COVES ON E SHORE	45 GALLONS	AQUALOGIC
11/10/2015	HAND AND DASH	NW COVE	75 GALLONS	AQUALOGIC
6/1/2016	DASH	Each side of boat launch	140 GALLONS	AB AQUATICS
6/2/2016	DASH	N of boat launch moving along N shore	215 GALLONS	AB AQUATICS
6/3/2016	DASH	N shore, working E to W	25 GALLONS	AB AQUATICS
7/28/2016	DIQUAT & FLUMIOXAZIN	VARIED	16.2 ACRES	SOLITUDE LAKE MANAGEMENT
8/17/2017	DASH	Near public boat launch	345 GALLONS	AQUALOGIC
8/18/2017	DASH	East shore cove	150 GALLONS	AQUALOGIC
summer 2017	Herbicide		72.64 GALLONS FOR 12 ACRES	SOLITUDE LAKE MANAGEMENT
7/16/2018	DASH	Around launch	20 gallons	AQUALOGIC

DATE	ACTION	ACRES	NOTES	CONTRACTOR/ENTITY
7/17/2018	DASH	inlet across from launch	45 gallons	AQUALOGIC
7/18/2018	DASH	coves at far end	70 gallons	AQUALOGIC
9/24/2018	DEPTH CHARGE FLUMIOXAZIN & 2,4-D	5.2 ACRES	33.5 GALLONS	SOLITUDE LAKE MANAGEMENT
7/24/2019	DASH	Boat launch	260 GALLONS	AQUALOGIC
7/26/2019	DASH	Boat launch	300 GALLONS	AQUALOGIC
7/29/2019	DASH	Boat launch and shore towards public beach	260 GALLONS	AQUALOGIC
7/30/2019	DASH	Small southeastern cove	180 GALLONS	AQUALOGIC
7/31/2019	DASH	Small northern cove	160 GALLONS	AQUALOGIC
8/1/2019	DASH	Northern shore	40 GALLONS	AQUALOGIC
8/2/2019	DASH	Near stream in southern end	215 GALLONS	AQUALOGIC
8/5/2019	DASH	Near stream in southern end	80 GALLONS	AQUALOGIC
8/6/2019	DASH	Northern shore	200 GALLONS	AQUALOGIC
8/7/2019	DASH	Small northern cove	150 GALLONS	AQUALOGIC
8/8/2019	DASH	Northern shore	140 GALLONS	AQUALOGIC
8/9/2019	DASH	Boat launch, cove near public beach	100 GALLONS	AQUALOGIC
8/12/2019	DASH	Northern shore	140 GALLONS	AQUALOGIC
9/9/2019	Flumioxazin 51% WDG-NonCrop	VARIED	15 acres	SOLITUDE LAKE MANAGEMENT
6/1/2020	DASH	DES marked southern end	20 GALLONS	AQUALOGIC
6/2/2020	DASH	Boat Launch, South of Beach	30 GALLONS	AQUALOGIC
6/3/2020	DASH	Small bay at end of pond	10 GALLONS	AQUALOGIC
6/4/2020	DASH	Boat Launch	30 GALLONS	AQUALOGIC

DATE	ACTION	ACRES	NOTES	CONTRACTOR/ENTITY
6/5/2020	DASH	SEE MAP FOR THIS YEAR	15 GALLONS	AQUALOGIC
7/27/2020	DASH	SEE MAP FOR THIS YEAR	30 GALLONS	AQUALOGIC
7/28/2020	DASH	SEE MAP FOR THIS YEAR	30 GALLONS	AQUALOGIC
7/29/2020	DASH	SEE MAP FOR THIS YEAR	30 GALLONS	AQUALOGIC
7/30/2020	DASH	SEE MAP FOR THIS YEAR	30 GALLONS	AQUALOGIC
8/13/2020	DEPTH CHARGE	SEE MAP FOR THIS YEAR	3.93 ACRES	SOLITUDE LAKE MANAGEMENT
6/15/2021	DASH	DES Marked Areas	100 GALLONS	AE COMMERCIAL DIVING
6/16/2021	DASH	DES Marked Areas	180 GALLONS	AE COMMERCIAL DIVING
6/17/2021	DASH	DES Marked Areas	400 GALLONS	AE COMMERCIAL DIVING
6/21/2021	DASH	DES Marked Areas	100 GALLONS	AE COMMERCIAL DIVING
10/22-28/2021	DASH	DES Marked Areas	660 GALLONS	AE COMMERCIAL DIVING
6/22/2022	PROCELLACOR EC	SEE 2022 TREATMENT MAP	24.4 ACRES	SOLITUDE LAKE MANAGEMENT
7/21/2022	FLUMIGARD SC	SEE 2022 TREATMENT MAP	19.3 ACRES	SOLITUDE LAKE MANAGEMENT

Aquatic Invasive Plant Management Options

The control practices used should be as specific to the target species 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/bmp.html.

Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices currently used by the State of New Hampshire.

Feasibility Evaluation of Control Options in this Waterbody

DES has evaluated the feasibility of potential control practices on the subject waterbody. The following table summarizes DES' control strategy recommendations for the subject waterbody:

Control Method	Use on Robinson Pond
Restricted Use Areas	Not recommended as fanwort and variable milfoil growth ring the pond in the shallows, and there is no way to restrict access to these areas unless access to the entire pond is restricted.
Hand-pulling	DES recommends that the individual stems or small patches of fanwort and variable milfoil should be hand pulled when encountered; however, prior to hand-removal activities being successful, the majority of the fanwort and milfoil biomass must be controlled chemically, otherwise the hand-pull effort will be futile. DES recommends that the lake residents follow up the herbicide application with hand-pulling of re-growth, if that re-growth is small and scattered. This can be accomplished only if there is a good

Control Method	Use on Robinson Pond
	monitoring program in place, such as the Weed Watcher Program, where local residents regularly inspect and mark re-growth following treatment. That re-growth can be targeted by Weed Control Divers.
Mechanical Harvesting/Removal	For Robinson Pond, mechanical harvesting is not recommended due to concerns about plant fragmentation and further spread. This technique also does not target root systems, so re-growth will likely be rapid.
Benthic Barriers	For Robinson Pond, DES recommends installing small benthic barriers in key areas of re-growth if small patches of variable milfoil and/or fanwort re-grow and can adequately be contained by benthic barriers.
Herbicides	For Robinson Pond, herbicide use is recommended as primary treatment due to extent of infestation.
Extended Drawdown	Drawdown is not an effective control method for variable milfoil or fanwort, nor is it a reasonable or feasible action on this 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 fanwort or variable milfoil at this time in New Hampshire.
No Control	In order to allow for a healthy stand of mixed native aquatic vegetation, as well as open areas in the shallows, a 'No Control' option is not recommended. Fanwort, and to a lesser extent, variable milfoil, have been showing exponential growth in Robinson Pond, therefore actions to manage the plants are needed. Evidence from the Lake Host Program shows that fragments of these invasive plants repeatedly leave Robinson Pond on transient recreational gear, thereby making the lake a threat to other nearby

Control Method	Use on Robinson Pond
	waterbodies.

Recommended Actions, Timeframes and Responsible Parties

An evaluation of the size, location, and type of variable milfoil and fanwort infestations, as well as the waterbody uses was conducted at the end of the last growing season (see attached figures for findings). Based on this survey the following recommendations are made for variable milfoil and fanwort control in the system:

Year	Action	Responsible Party	Schedule
2024	Field survey and mapping of milfoil and fanwort populations	NHDES	Spring/Fall
	Weed Watcher and Lake Hosting Activities	Lake Residents	May through September
	Herbicide treatment (see map for current year proposals)	SOLitude Lake Management	May/June
	Diver/DASH Activities	Contract Divers	July through September
	Mapping for year end summary and next year's management planning	NHDES	September/ October
2025	Field survey and mapping of milfoil and fanwort populations	NHDES	Spring/Fall
	Weed Watcher and Lake Hosting Activities	Lake Residents	May through September
	Diver/DASH Activities	Contract Divers	July through September
	Mapping for year end summary and next year's management planning	NHDES	September/ October

Year	Action	Responsible Party	Schedule
2026	Field survey and mapping of milfoil and fanwort populations	NHDES	Spring/Fall
	Weed Watcher and Lake Hosting Activities	Lake Residents	May through September
	Diver/DASH Activities	Contract Divers	July through September
	Mapping for year end summary and next year's management planning	NHDES	September/ October
2027	Field survey and mapping of milfoil and fanwort populations	NHDES	Spring/Fall
	Weed Watcher and Lake Hosting Activities	Lake Residents	May through September
	Diver/DASH Activities	Contract Divers	July through September
	Mapping for year end summary and next year's management planning	NHDES	September/ October
2028	Field survey and mapping of milfoil and fanwort populations	NHDES	Spring/Fall
	Weed Watcher and Lake Hosting Activities	Lake Residents	May through September
	Diver/DASH Activities	Contract Divers	July through September
	Mapping for year end summary and next year's management planning	NHDES	September/ October
2029	Update and revise Long-Term Variable Milfoil and Fanwort Control Plan	NH DES and interested parties	Winter

Notes

Target Specificity
It is important to realize that aquatic herbicide applications are conducted in a specific and scientific manner. To the extent feasible, the permitting authority favors the use of selective herbicides that, where used appropriately, will control the target plant with little or no impact to non-target species, such that the ecological functions of native plants for habitat, lake ecology, and chemistry/biology will be maintained. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

Adaptive Management
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, adaptability of invasive species, etc).

This long-term plan is therefore based on the concept of adaptive management, where current field data (from field survey work using DES established field survey standard operating procedures) drive decision making, which may result in modifications to the recommended control actions and timeframes for control. As such, 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 herein, 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 Variable Milfoil and Fanwort Infestations Over Time

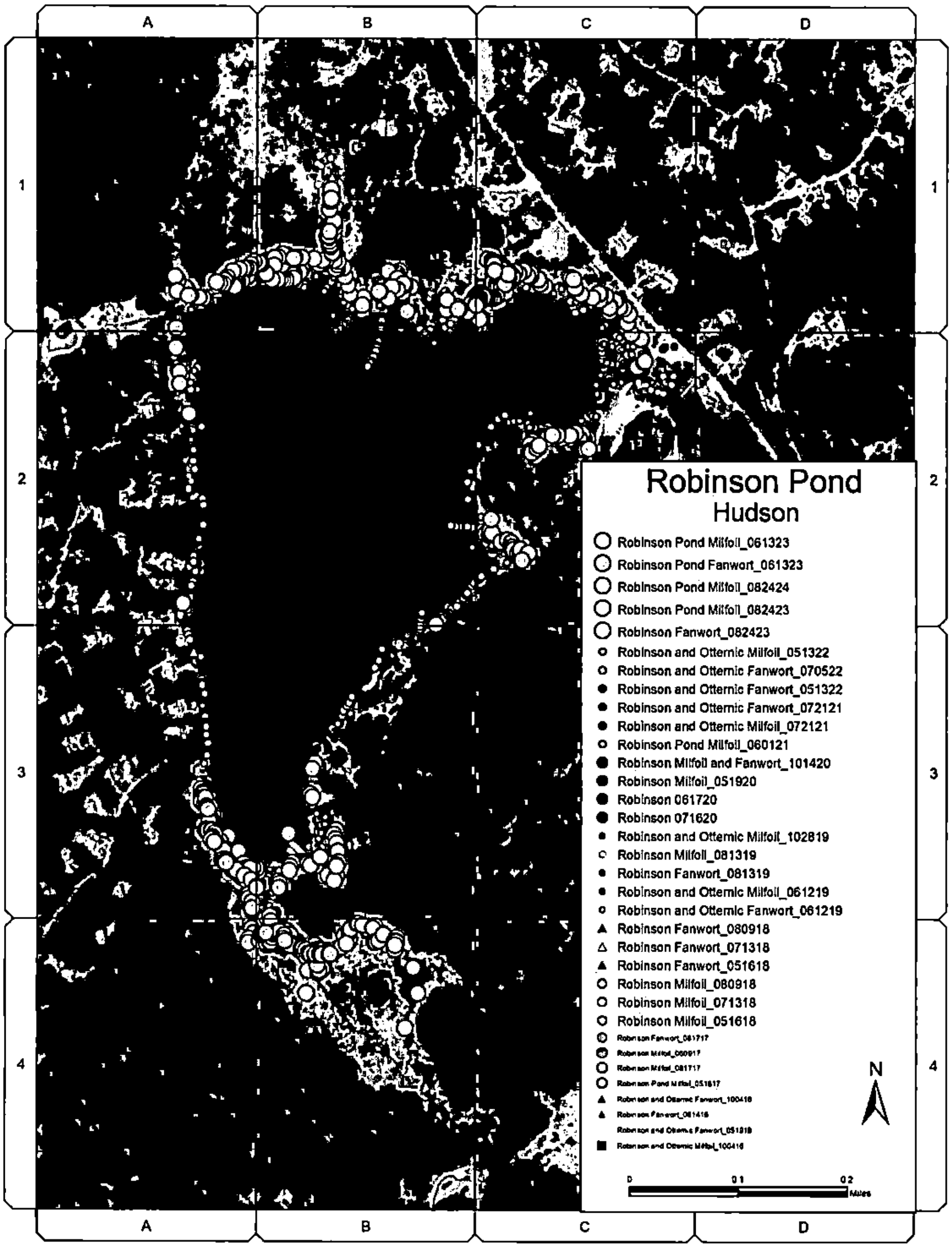
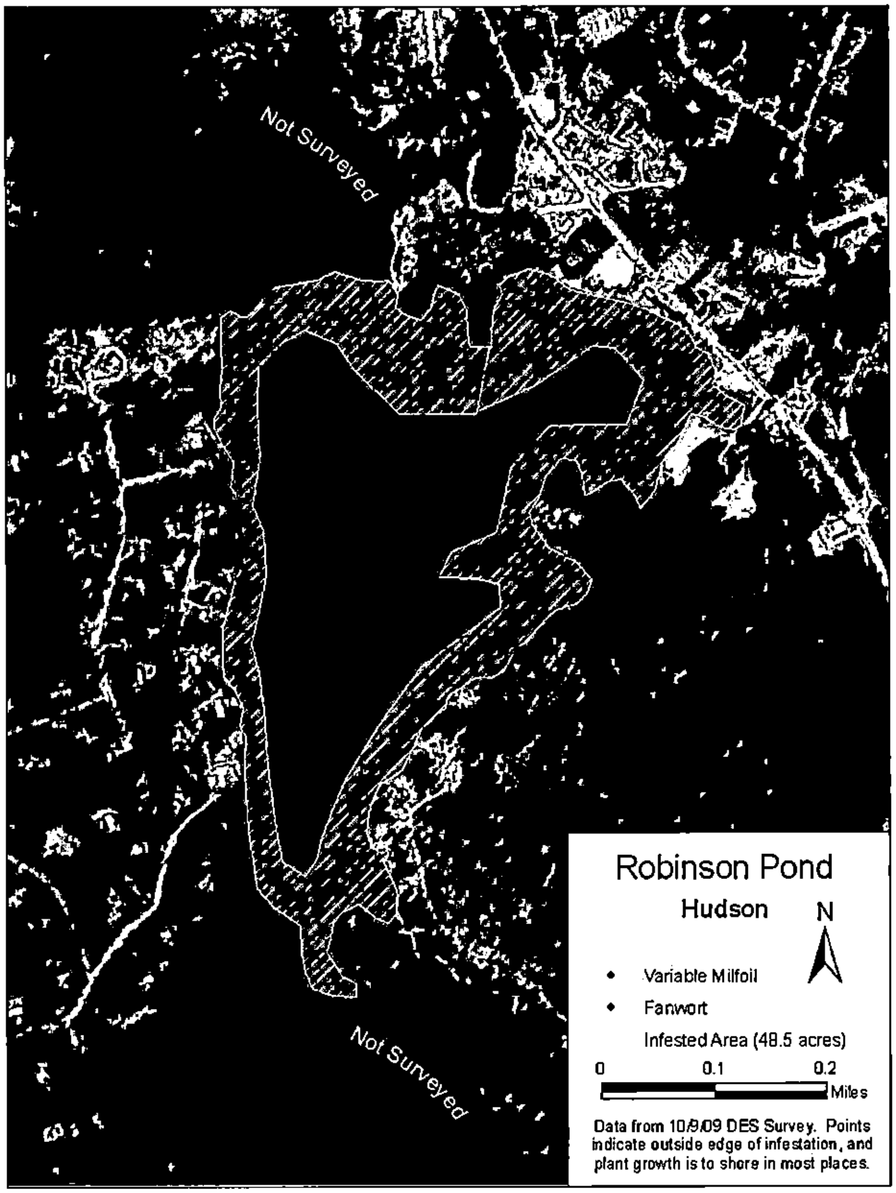
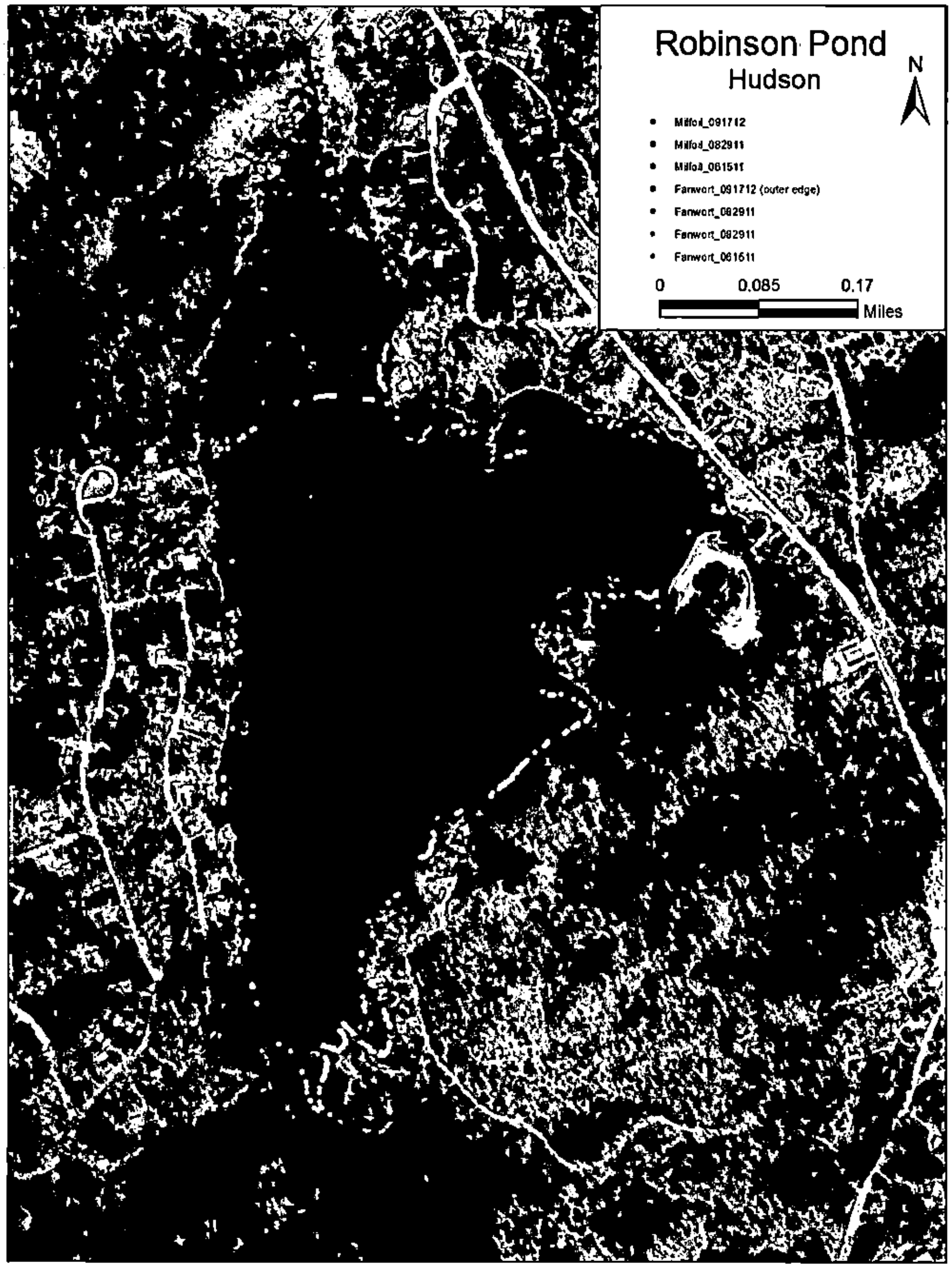


Figure 2: Map of Control Actions

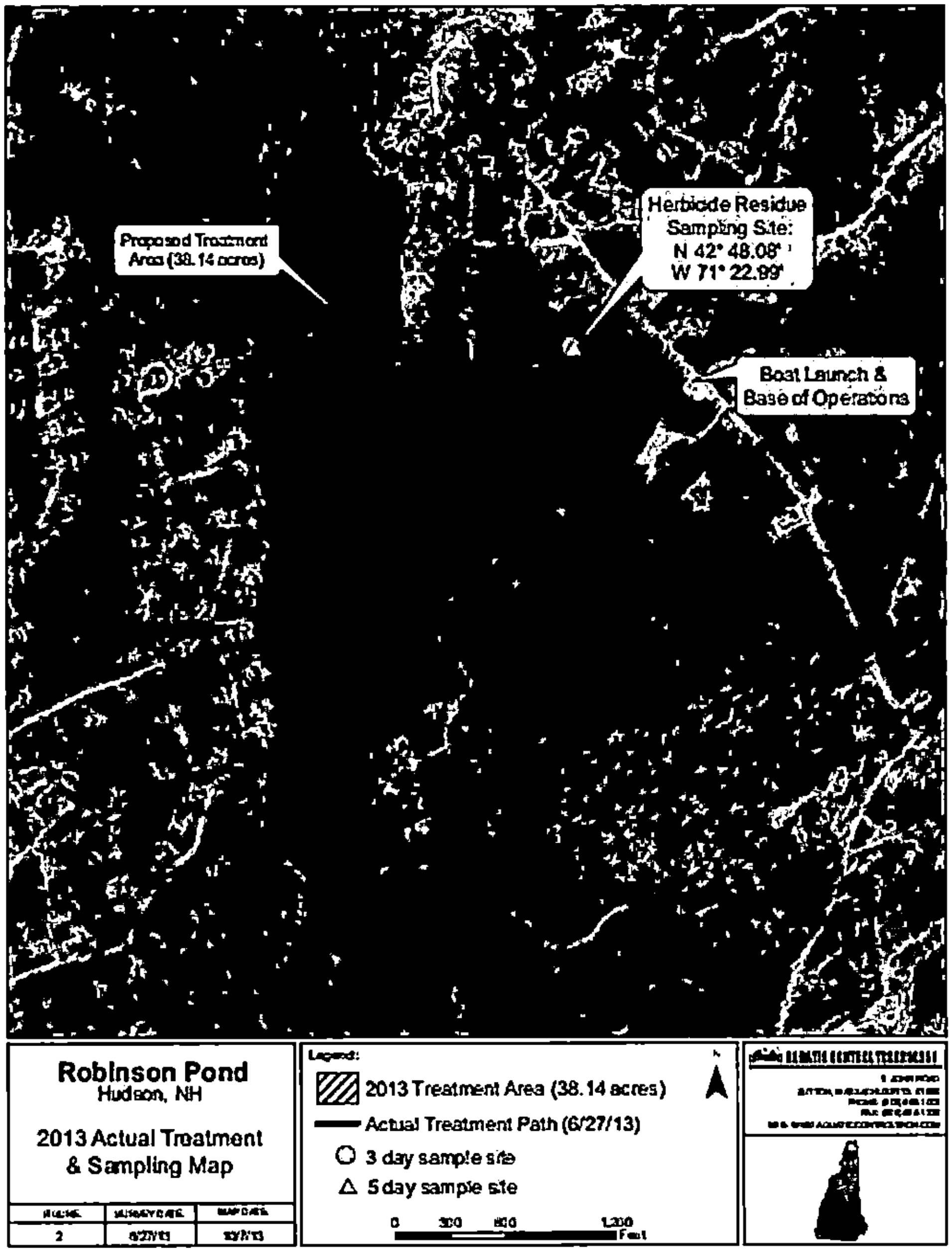
2010



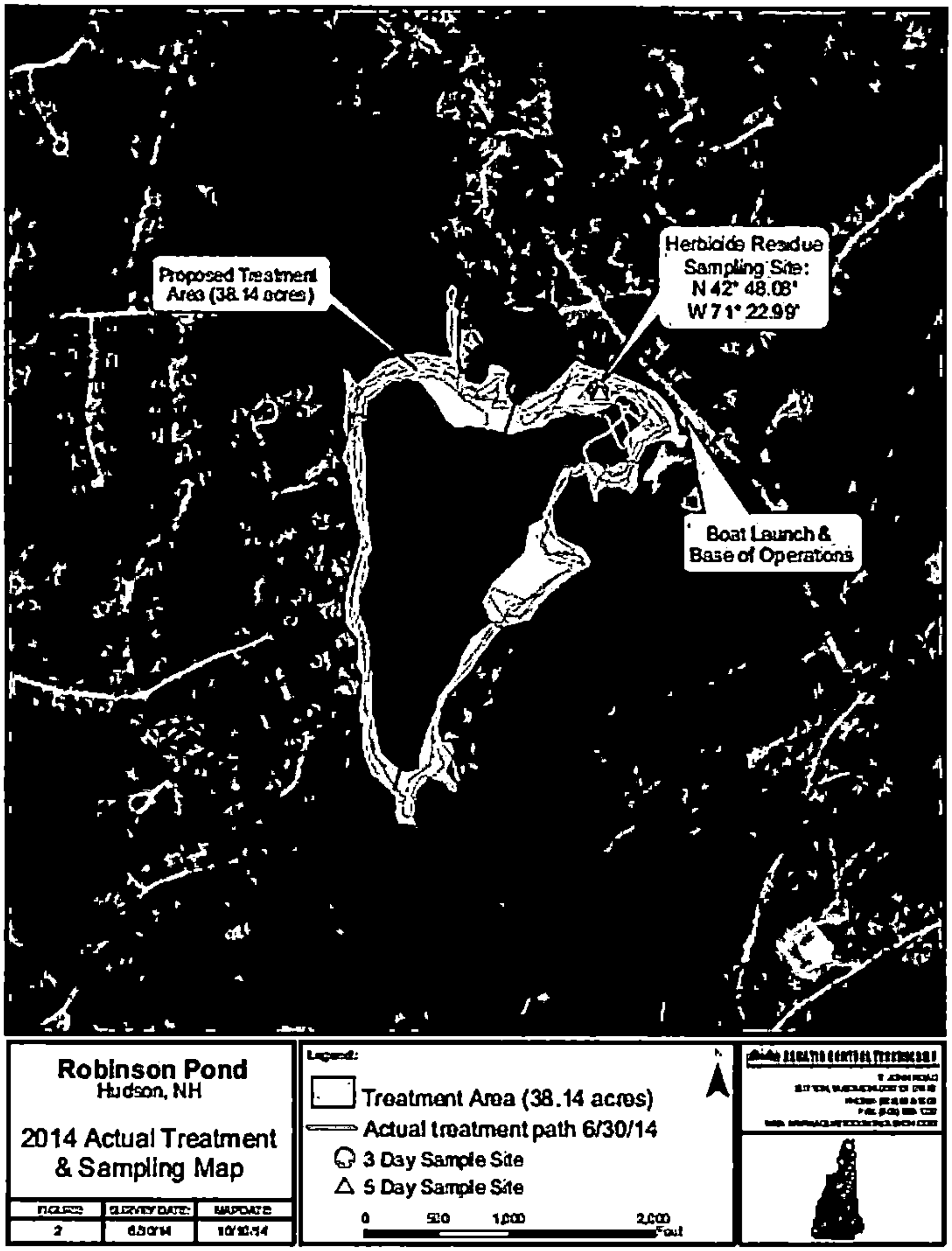
2011-2012 Diver/DASH Activity



2013 (Actual- map from Aquatic Control Technology, LLC)

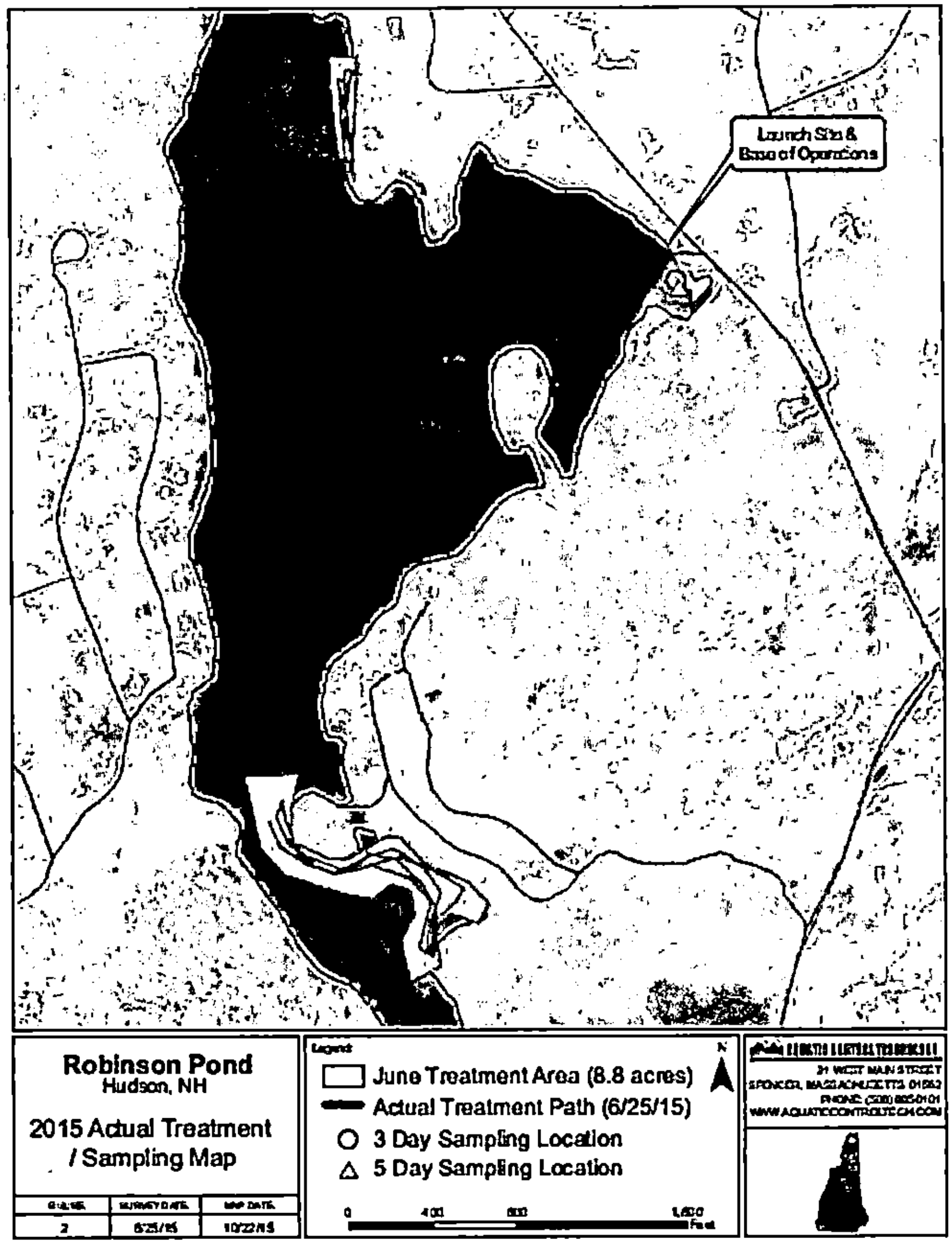


2014 (Actual)

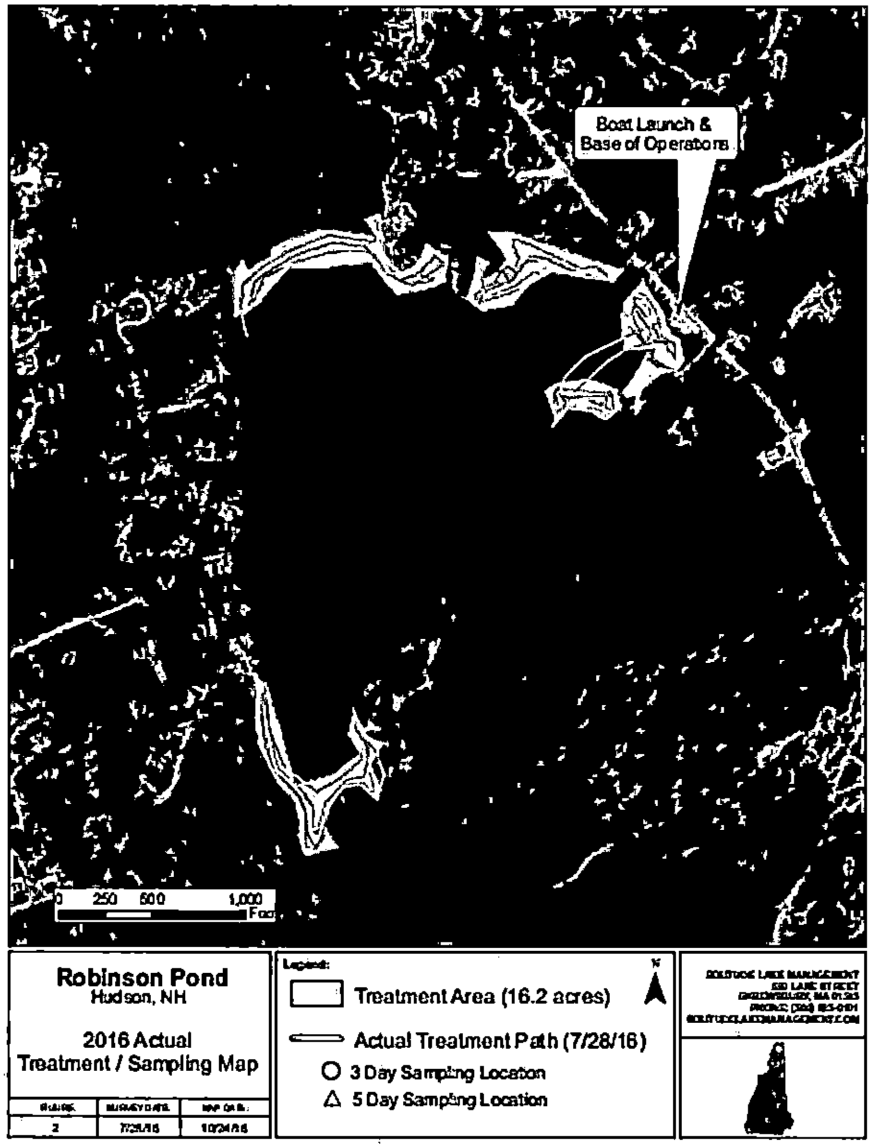


Proposed Treatment Area (38.14 acres)
Herbicide Residue Sampling Site: N 42° 48.08' W 71° 22.99'
Boat Launch & Base of Operations
Robinson Pond
Hudson, NH
2014 Actual Treatment & Sampling Map
Legend:
Treatment Area (38.14 acres)
Actual treatment path 6/30/14
3 Day Sample Site
5 Day Sample Site
0 500 1,000 2,000 Feet

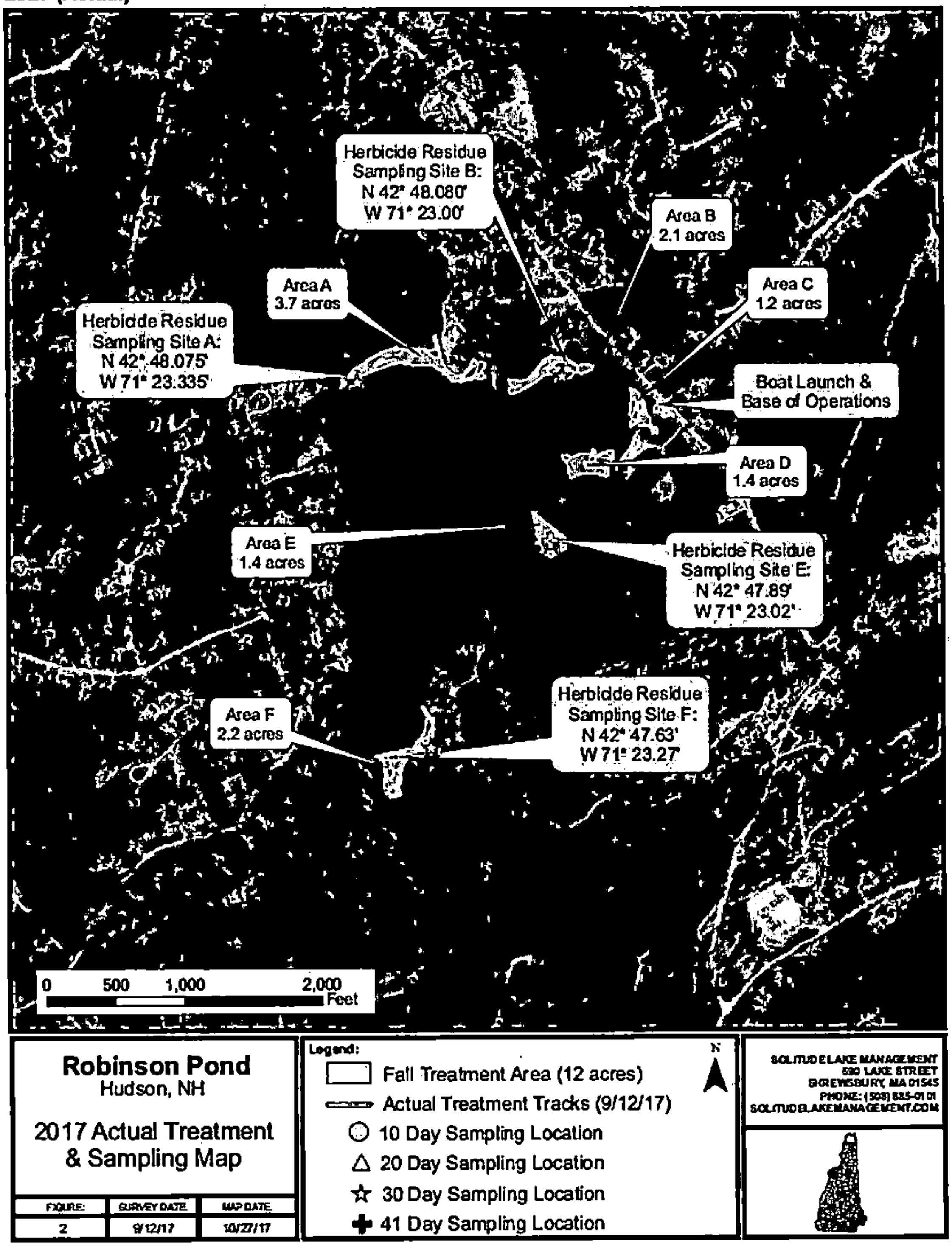
2015 (Actual)


Launch Site &
Base of Operations
Robinson Pond
Hudson, NH
2015 Actual Treatment / Sampling Map
June Treatment Area (8.8 acres)
Actual Treatment Path (6/25/15)
3 Day Sampling Location
5 Day Sampling Location
N
0
400
1,600
Feet

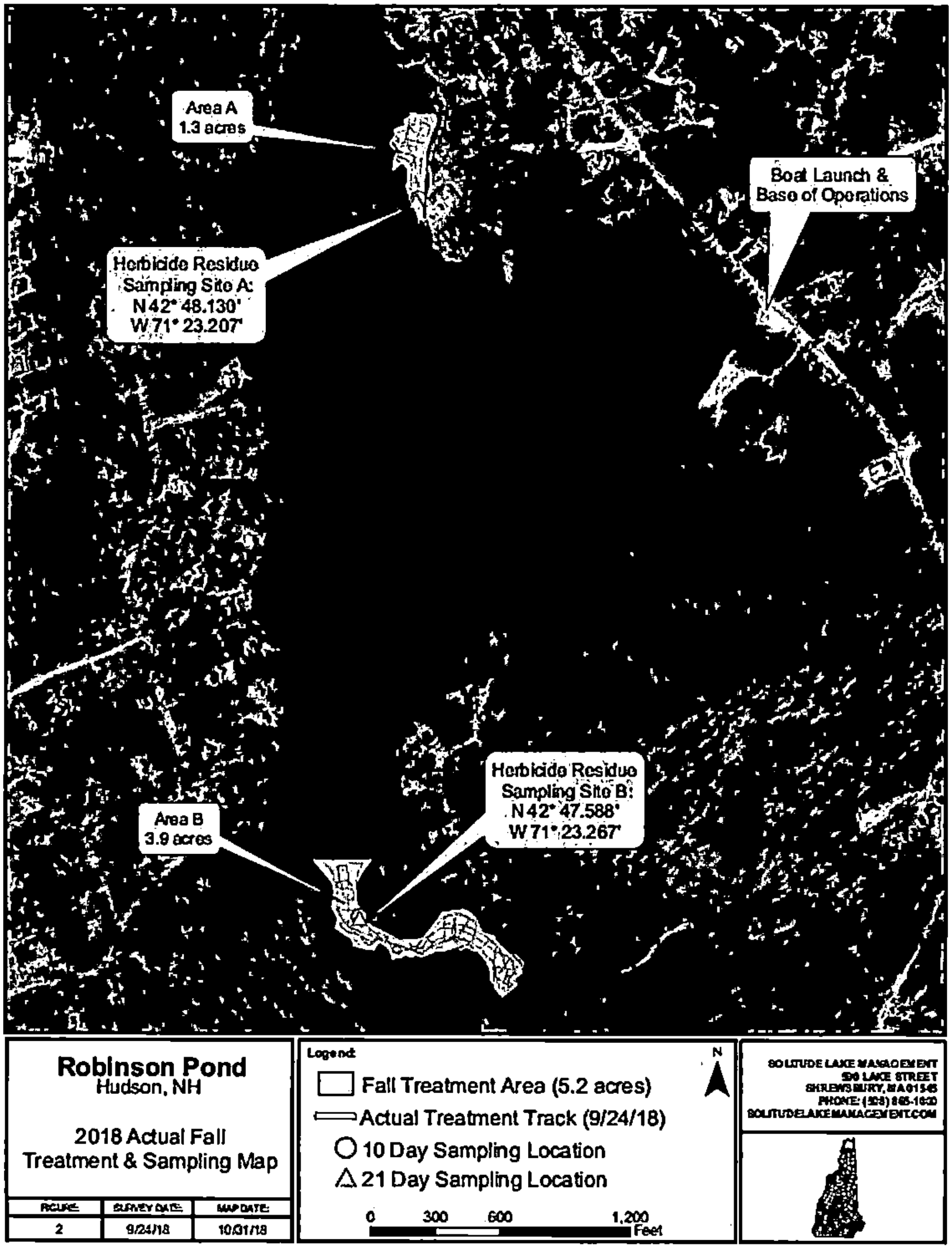
2016 (Actual)


Boat Launch &
Base of Operations
0 250 500 1,000
Feet
Robinson Pond
Hudson, NH
2016 Actual
Treatment / Sampling Map
Treatment Area (16.2 acres)
Actual Treatment Path (7/28/16)
3 Day Sampling Location
5 Day Sampling Location

2017 (Actual)

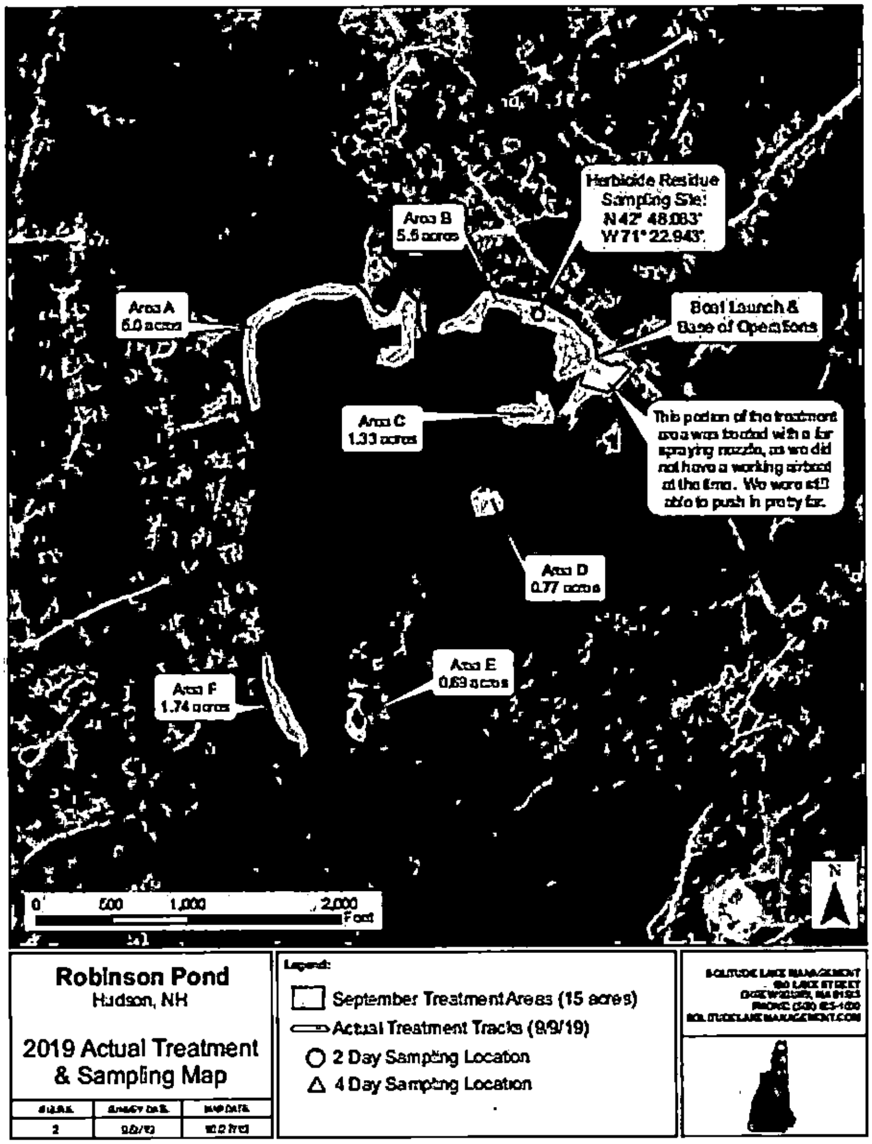

Herbicide Residue
Sampling Site B:
N 42° 48.080'
W 71° 23.00'
Area B
2.1 acres
Area A
3.7 acres
Area C
1.2 acres
Herbicide Residue
Sampling Site A:
N 42° 48.075'
W 71° 23.335'
Boat Launch &
Base of Operations
Area D
1.4 acres
Area E
1.4 acres
Herbicide Residue
Sampling Site E:
N 42° 47.89'
W 71° 23.02'
Area F
2.2 acres
Herbicide Residue
Sampling Site F:
N 42° 47.63'
W 71° 23.27'
0
500
1,000
2,000
Feet
Robinson Pond
Hudson, NH
2017 Actual Treatment
& Sampling Map
FIGURE:
2
SURVEY DATE
9/12/17
MAP DATE
10/27/17
Legend:
Fall Treatment Area (12 acres)
Actual Treatment Tracks (9/12/17)
10 Day Sampling Location
20 Day Sampling Location
30 Day Sampling Location
41 Day Sampling Location
N
SOLITUDE LAKE MANAGEMENT
SOLITUDELAKEMANAGEMENT.COM

2018 (Actual)

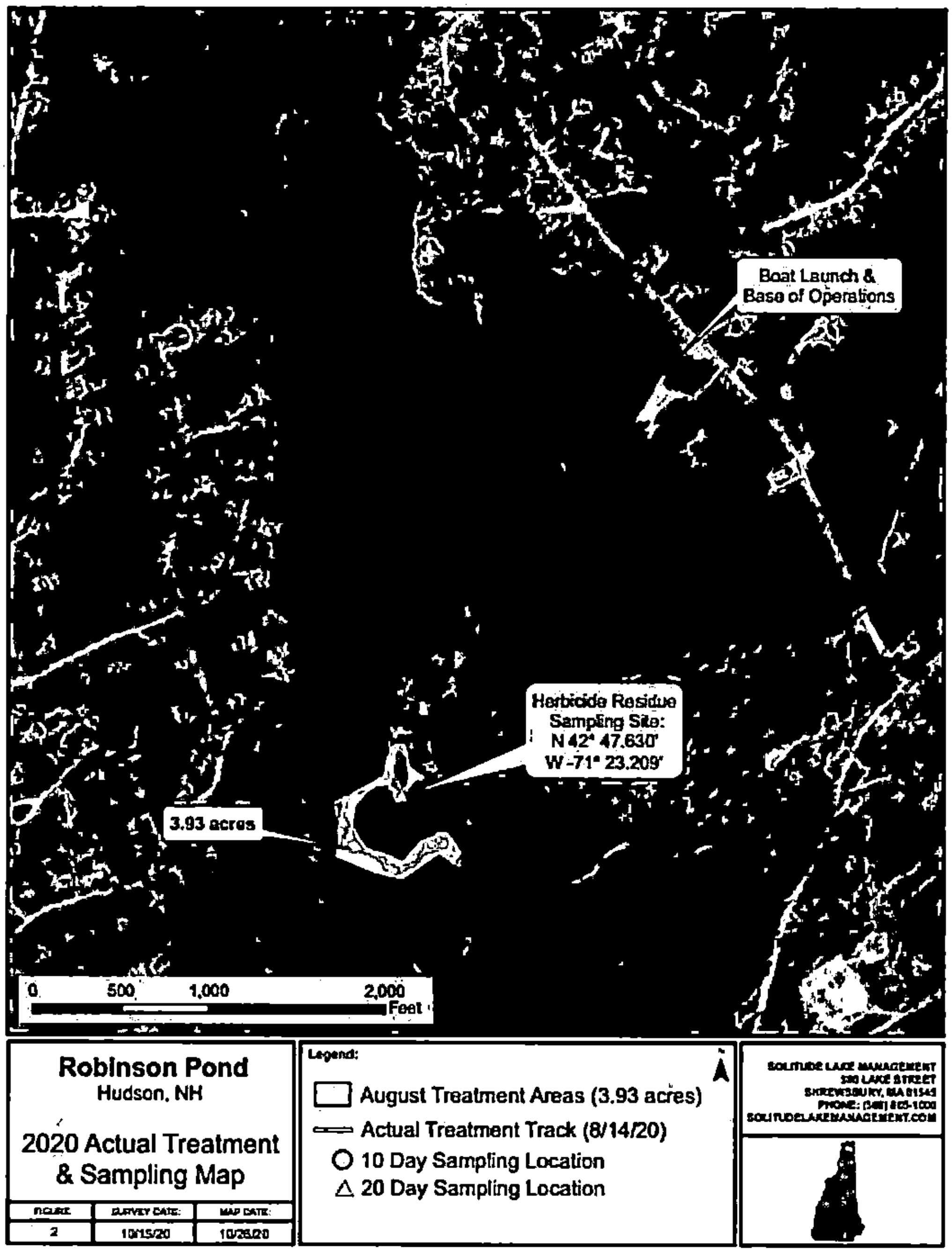


Area A
1.3 acres
Herbicide Residue
Sampling Site A:
N 42° 48.130'
W 71° 23.207'
Boat Launch &
Base of Operations
Herbicide Residue
Sampling Site B:
N 42° 47.588'
W 71° 23.267'
Area B
3.9 acres
Robinson Pond
Hudson, NH
2018 Actual Fall
Treatment & Sampling Map
FIGURE: 2
SURVEY DATE: 9/24/18
MAP DATE: 10/31/18
Legend
Fall Treatment Area (5.2 acres)
Actual Treatment Track (9/24/18)
10 Day Sampling Location
21 Day Sampling Location
0 300 600 1,200 Feet
N
SOLITUDE LAKE MANAGEMENT
SOLITUDELAKEMANAGEMENT.COM

2019 (Actual)

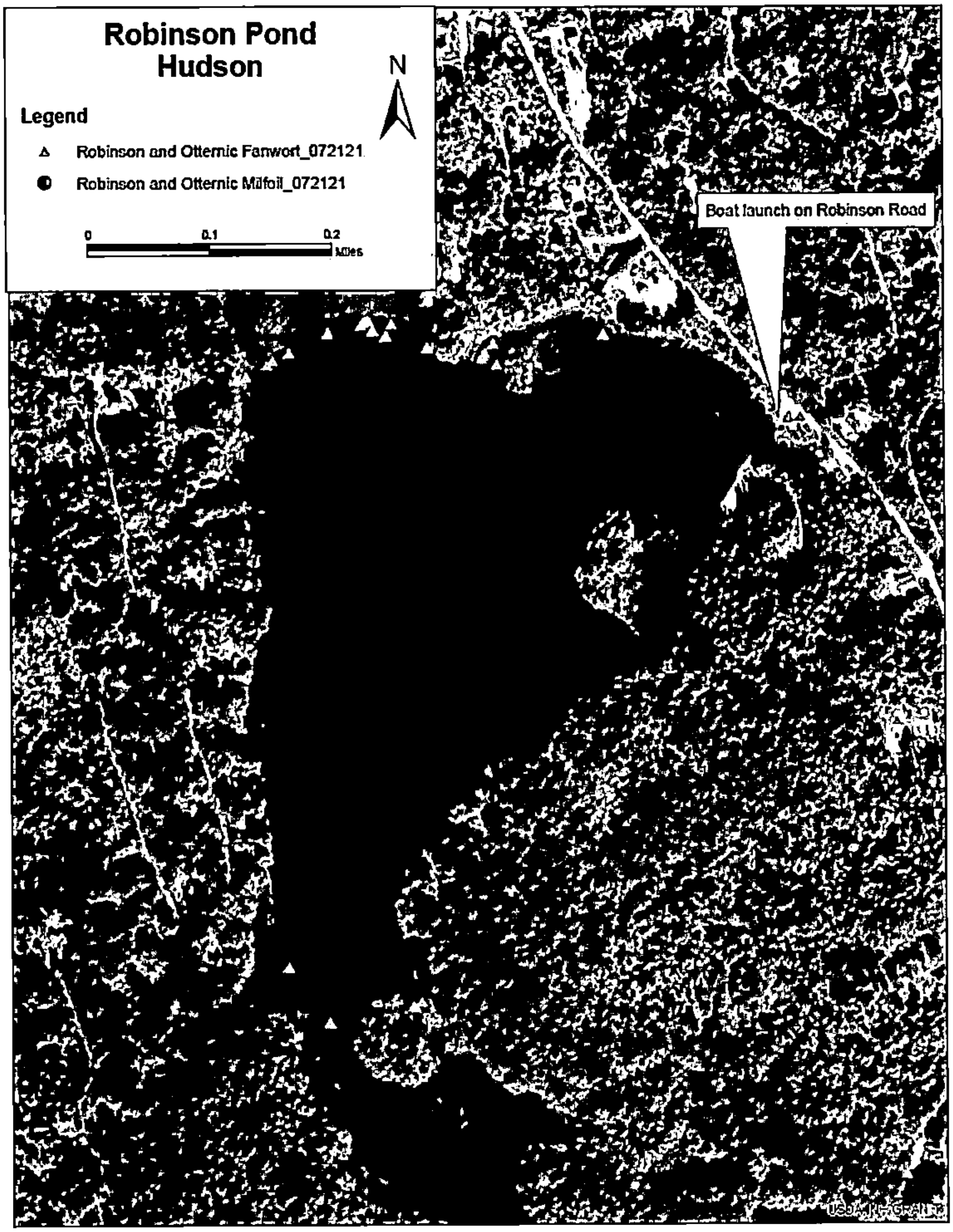

Herbicide Residue
Sampling Site:
N 42° 48.083'
W 71° 22.943'
Area B
5.5 acres
Area A
6.0 acres
Boat Launch &
Base of Operations
Area C
1.33 acres
This portion of the treatment area was treated with a far spraying nozzle, as we did not have a working airboat at the time. We were still able to push in pretty far.
Area D
0.77 acres
Area E
0.69 acres
Area F
1.74 acres
0
500
1,000
2,000
Feet
N
Robinson Pond
Hudson, NH
2019 Actual Treatment
& Sampling Map
Legend:
September Treatment Areas (15 acres)
Actual Treatment Tracks (9/9/19)
2 Day Sampling Location
4 Day Sampling Location

2020 Actual

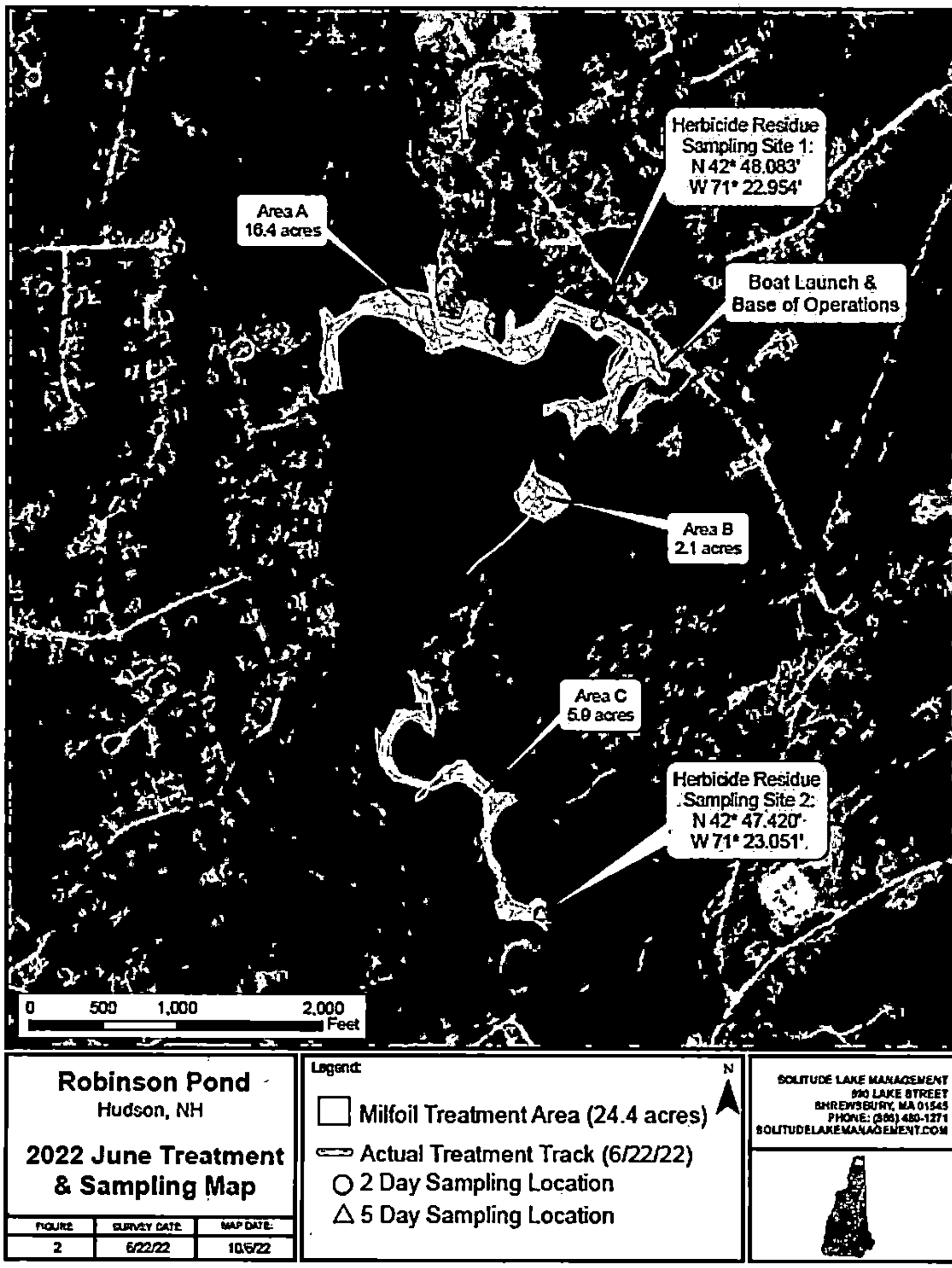


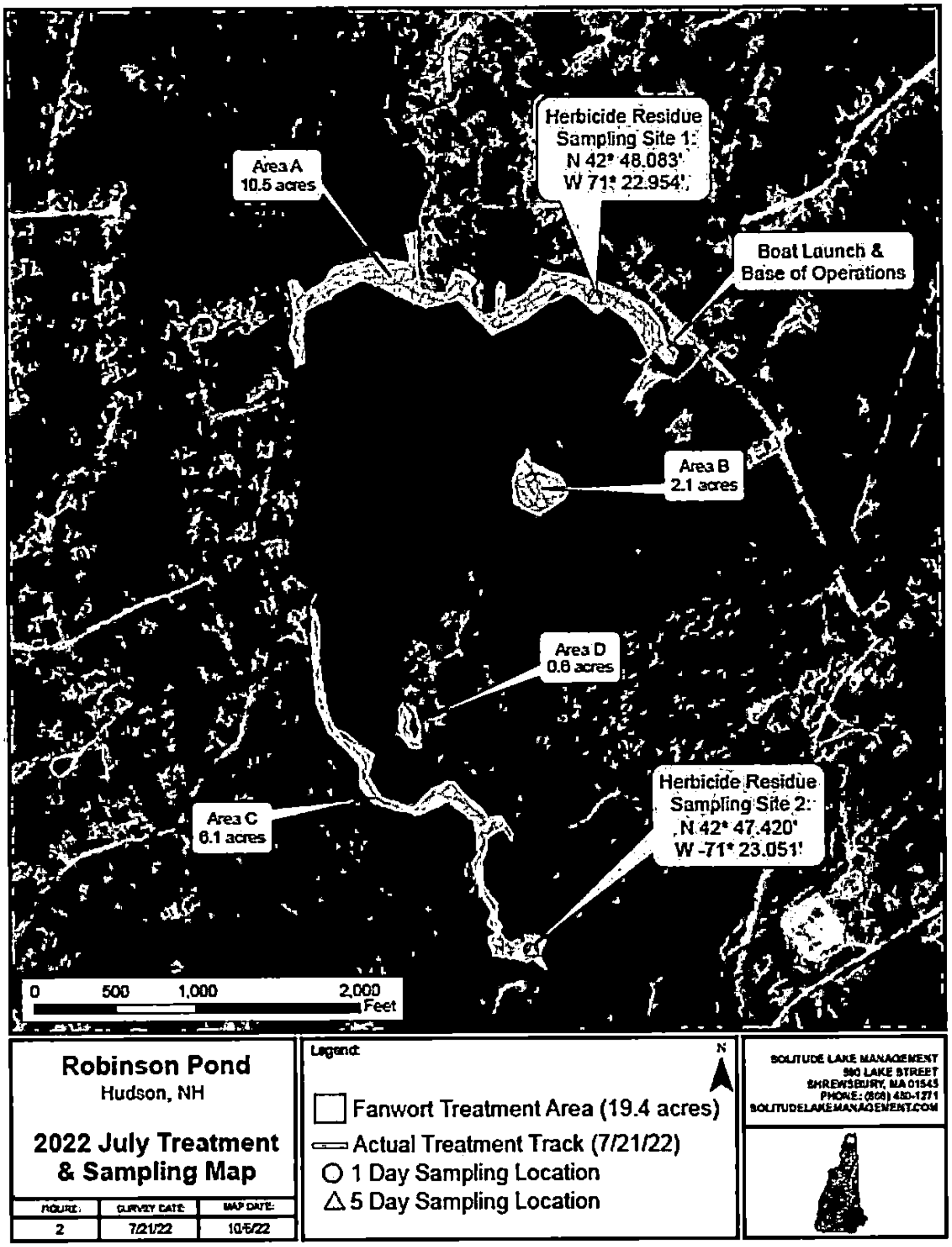
Boat Launch & Base of Operations
Herbicide Residue Sampling Site: N 42° 47.630' W -71° 23.209'
3.93 acres
0 500 1,000 2,000 Feet
Robinson Pond
Hudson, NH
2020 Actual Treatment & Sampling Map
FIGURE: 2
SURVEY DATE: 10/15/20
MAP DATE: 10/26/20
Legend:
August Treatment Areas (3.93 acres)
Actual Treatment Track (8/14/20)
10 Day Sampling Location
20 Day Sampling Location
SOLITUDE LAKE MANAGEMENT

2021 Actual


Robinson Pond
Hudson
N
Legend
Robinson and Otternic Fanwort_072121
Robinson and Otternic Milfoil_072121
0
0.1
0.2
Miles
Boat launch on Robinson Road

2022 Actual


Herbicide Residue Sampling Site 1: N 42° 48.083' W 71° 22.954'
Area A 16.4 acres
Boat Launch & Base of Operations
Area B 2.1 acres
Area C 5.9 acres
Herbicide Residue Sampling Site 2: N 42° 47.420' W 71° 23.051'
0 500 1,000 2,000 Feet
Robinson Pond
Hudson, NH
2022 June Treatment & Sampling Map
FIGURE: 2
SURVEY DATE: 6/22/22
MAP DATE: 10/6/22
Legend:
Milfoil Treatment Area (24.4 acres)
Actual Treatment Track (6/22/22)
2 Day Sampling Location
5 Day Sampling Location
N
SOLITUDE LAKE MANAGEMENT
SHREWSBURY, MA 01545
SOLITUDELAKEMANAGEMENT.COM



Herbicide Residue Sampling Site 1: N 42° 48.083' W 71° 22.954'
Area A 10.5 acres
Boat Launch & Base of Operations
Area B 2.1 acres
Area D 0.8 acres
Area C 6.1 acres
Herbicide Residue Sampling Site 2: N 42° 47.420' W -71° 23.051'
0 500 1,000 2,000 Feet
Robinson Pond
Hudson, NH
2022 July Treatment & Sampling Map
FIGURE: 2
SURVEY DATE: 7/21/22
MAP DATE: 10/6/22
Legend
N
Fanwort Treatment Area (19.4 acres)
Actual Treatment Track (7/21/22)
1 Day Sampling Location
5 Day Sampling Location
SOLITUDE LAKE MANAGEMENT
SHREWSBURY, MA 01545
SOLITUDELAKEMANAGEMENT.COM

2024 Proposed

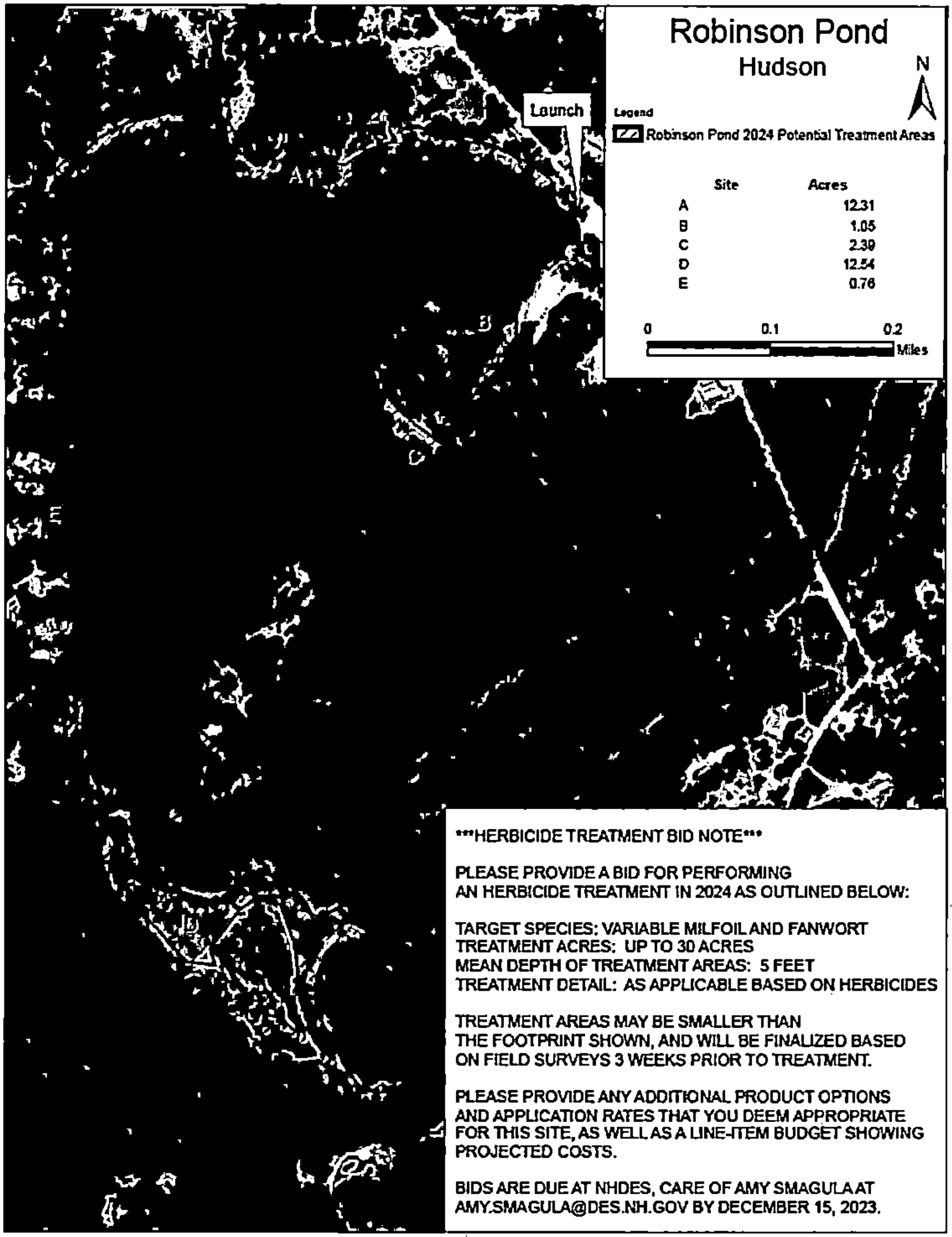
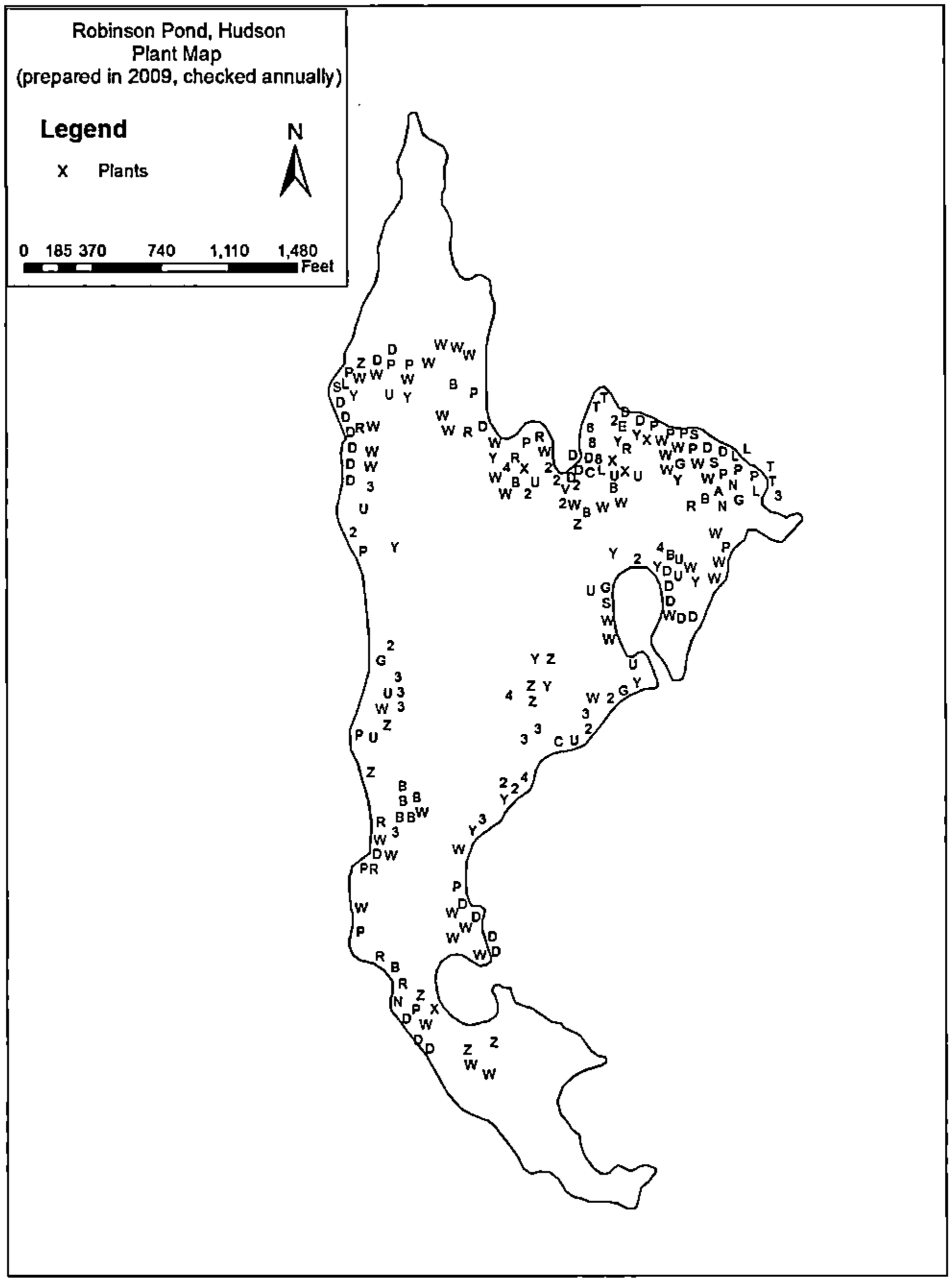


Figure 3: Map of Native Aquatic Macrophytes



Key to Macrophyte Map

Symbol	Common Name	Latin Name
D	Swamp loosestrife	*Decodon verticillata*
N	Water naiad	*Najas*
W	White water-lily	*Nymphaea*
P	Pickerelweed	*Pontedaria cordata*
T	Cattail	*Typha*
L	Purple loosestrife	*Lythrum salicaria*
S	Bur-reed	*Sparganium*
X	Pondweed	*Potamogeton*
R	Robbin's Pondweed	*Potamogeton robbinsii*
G	Grassy arrowhead	*Sagittaria*
A	Arrow arum	*Peltandra virginica*
B	Watershield	*Brasenia schreberi*
4	Tape-like bur-reed	*Sparganium*
U	Bladderwort	*Utricularia*
Y	Yellow water-lily	*Nuphar*
Z	Bassweed	*Potamogeton amplifolius*
E	Pipewort	*Eriocaulon*
2	Grassy spike rush	*Eleocharis*
C	Buttonbush	*Cephalanthus occidentalis*
8	Sweet gale	*Myrica gale*
3	Floating heart	*Nymphoides cordata*

Figure 4: **Bathymetric Map**

Figure 5: Species and/or Habitats of Concern

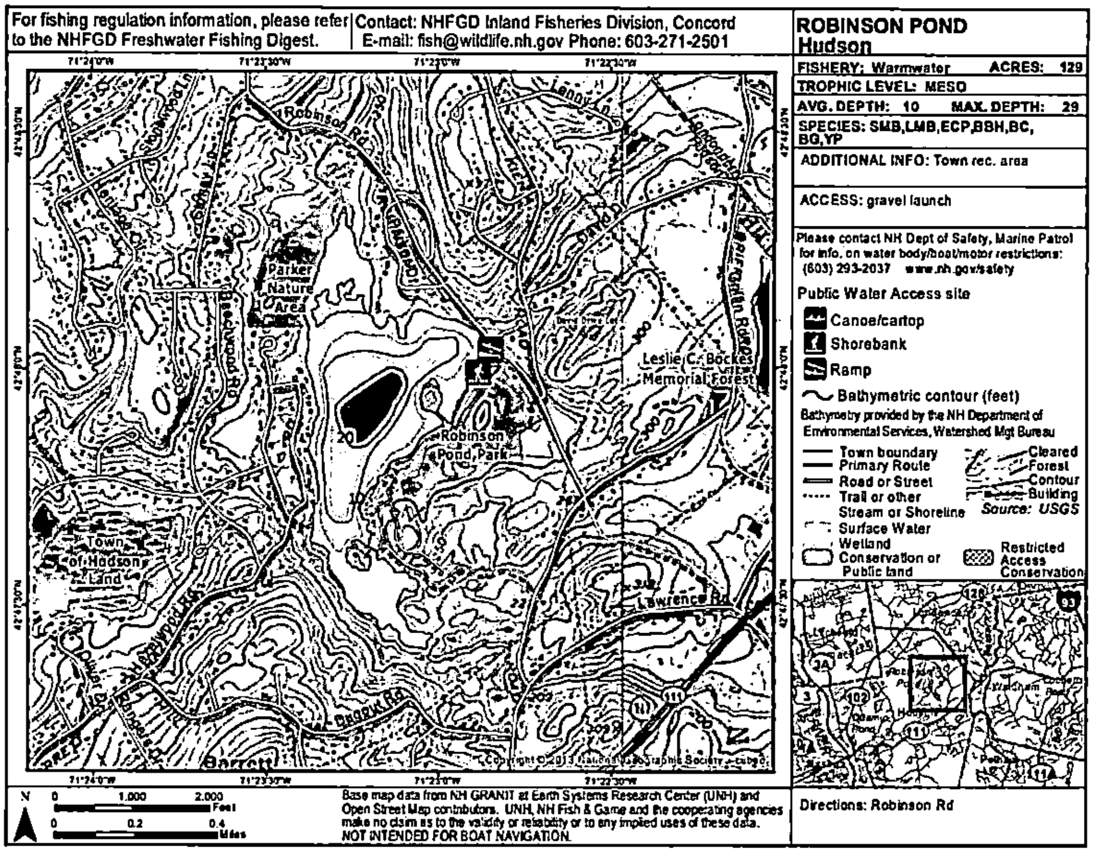


Figure 6: Access Areas

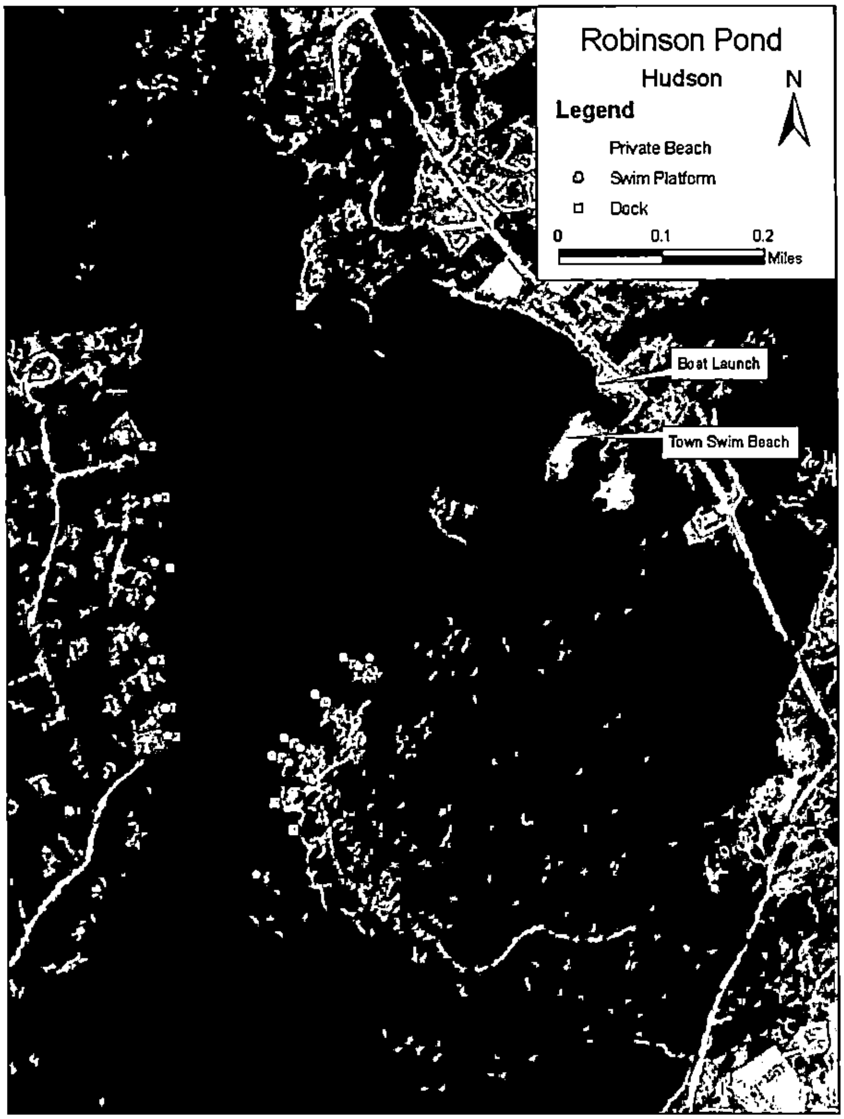
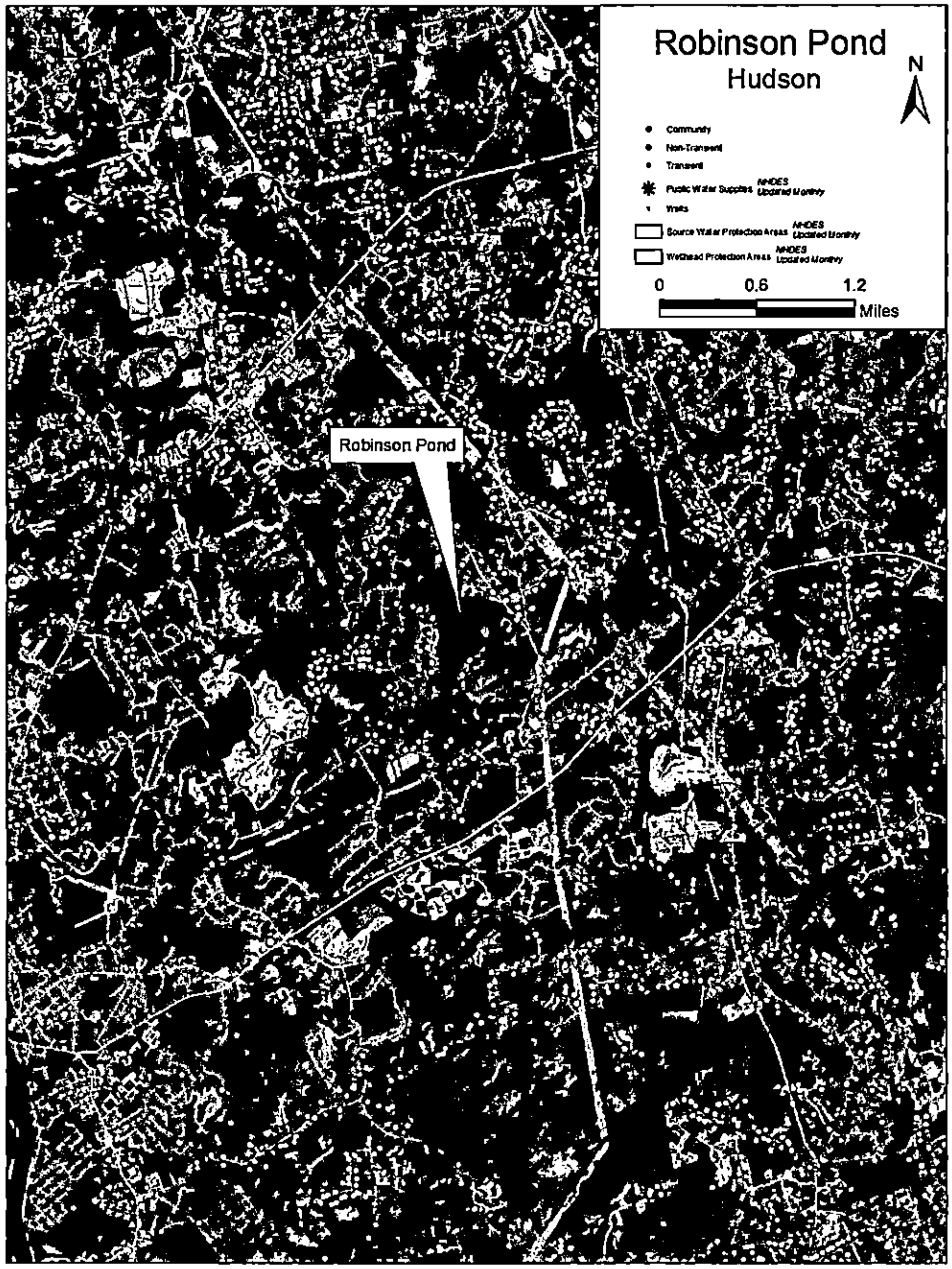


Figure 7: Wells and Water Supplies, 1:48,000 scale



Appendix A 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 exotic aquatic 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 (provide updated native plant map after review of milfoil and fanwort in the Fall or after treatment)

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 threat to downstream waterbodies from the exotic aquatic plant based on limnological characteristics (water chemistry, quantity, quality as they relate to movement or support of exotic plant growth).

Overall Control Options

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

1) Eradication: The goal is to completely remove the exotic plant infestation over time. In some situations this may be a rapid response that results in an eradication event in a single season (such as for a new infestation), in other situations a longer-term approach may be warranted given the age and distribution of the infestation. Eradication is more feasible in smaller systems without extensive expanded growth (for example, Lake Winnipesaukee is unlikely to achieve eradication of its variable milfoil), or without

upstream sources of infestation in other connected systems that continually feed the lake.

2) Maintenance: Waterbodies where maintenance is specified as a goal are generally those with expansive infestations, that are larger systems, that have complications of extensive wetland complexes on their periphery, or that have upstream sources of the invasive plant precluding the possibility for eradication. For waterbodies where maintenance is the goal, control activities will be performed on the waterbody to keep an infestation below a desirable threshold. For maintenance projects, thresholds of percent cover or other measurable classification will be indicated, and action will occur when exotic plant growth exceeds the threshold.

3) Containment: The aim of this approach is to limit the size and extent of the existing infestation within an infested waterbody if it is localized in one portion of that waterbody (such as in a cove or embayment), or if a whole lake is infested action may be taken to prevent the downstream migration of fragments or propagules. This could be achieved through the use of fragment barriers and/or Restricted Use Areas or other such physical means of containment. Other control activities may also be used to reduce the infestation within the containment area.

4) 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. Feasibility of control or control options may be revisited if new information, technologies, etc., develop.

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

Guidelines and requirements of each control practice are suggested and detailed below each alternative, but note that site specific conditions will be factored into the evaluation and recommendation of use on each individual waterbody with an infestation.

A. Hand-Pulling and Diver-Assisted Suction Harvesting

- Hand-pulling 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'). For larger areas Diver-Assisted Suction Harvesting (DASH) may be more appropriate.

- 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 or DASH
- 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).
- If a waterbody is fully infested and no other control options are effective, mechanical harvesting can be used to open navigation channel(s) through dense plant growth.

C. Herbicide Treatment

- Can be used if application of herbicide is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or density and 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
- 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 herbicide treatment as compared with other treatments.

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

- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other transient 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 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.
- Use must be in compliance with the Wetlands Bureau rules.

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 habits 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 RSA 211:11 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 as they are illegal in New Hampshire.
- <u>Exotic</u> controls, such as insects, cannot be introduced to control a nuisance plant

unless approved by Department of Agriculture.

- Research should be conducted on a potential biological control prior to use to determine the extent of target specificity.

Restricted Use Areas and Fragment Barrier:
Restricted Use Areas (RUAs) are a tool that can be use to quarantine a portion of a waterbody if an infestation of exotic aquatic plants is isolated to a small cove, embayment, or section of a waterbody. RUAs generally consist of a series of buoys and ropes or nets connecting the buoys to establish an enclosure (or exclosure) to protect an infested area from disturbance. RUAs can be used to prevent access to these infested areas while control practices are being done, and provide the benefit of restricting boating, fishing, and other recreational activities within these areas, so as to prevent fragmentation and spread of the plants outside of the RUA.

Hand-pulling:
Hand-pulling exotic aquatic plants is a technique used on both new and existing infestations, as circumstances allow. For this technique divers carefully hand-remove the shoots and roots of plants from infested areas and place the plant material in mesh dive bags for collect and disposal. This technique is suited to small patches or areas of low density exotic plant coverage.

For a new infestation, hand-pulling activities are typically conducted several times during the first season, with follow-up inspections for the next 1-2 years or until no re-growth is observed. For existing infestations, hand-pulling may be done to slow the expansion of plant establishment in a new area or where new stems are removed in a section that may have previously been uninfested. It is often a follow-up technique that is included in most management plans.

In 2007 a new program was created through a cooperative between a volunteer monitor that is a certified dive instructor, and the DES Exotic Species Program. A Weed Control Diver Course (WCD) was developed and approved through the Professional Association of Dive Instructors (PADI) to expand the number of certified divers available to assist with hand-pulling activities. DES has only four certified divers in the Limnology Center to handle problems with aquatic plants, and more help was needed. There is a unique skill involved with hand-removing plants from the lake bottom. If the process is not conducted correctly, fragments could spread to other waterbody locations. For this reason, training and certification are needed to help ensure success. Roughly 100 divers were certified through this program through the 2010 season. DES maintains a list of WCD divers and shares them with waterbody groups and municipalities that seek diver assistance for controlling exotic aquatic plants. Classes are offered two to three times per summer.

Diver Assisted Suction Harvesting

Diver Assisted Suction Harvesting (DASH) is an emerging and evolving control technique in New Hampshire. The technique employs divers that perform hand removal actions as described above, however, instead of using a dive bag a mechanical suction device is used to entrain the plants and bring them topside where a tender accumulates and bags the material for disposal. Because of this variation divers are able to work in moderately dense stands of plants that cover more bottom area, with increased efficiency and accuracy.

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:

Benthic barriers are fiberglass coated screening material that can be applied directly to the lake bottom to cover and compress aquatic plant growth. Screening is staked or weighted to the bottom to prevent it from becoming buoyant or drifting with current. The barriers also serve to block sunlight and prevent photosynthesis by the plants, thereby killing the plants with time. While a reliable method for small areas of plants (roughly 100 sq. ft. or less), larger areas are not reasonably controlled with this method due to a variety of factors (labor intensive installation, cost, and gas accumulation and bubbling beneath the barrier).

Targeted Application of Herbicides:

Application of aquatic herbicides is another tool employed for controlling exotic aquatic plants. Generally, herbicides are used when infestations are too large to be controlled using other alternative non-chemical controls, or if other techniques have been tried and have proven unsuccessful. Each aquatic plant reacts differently to different herbicides and concentrations of herbicides, but research performed by the Army Corps of Engineers has isolated target specificity of a variety of aquatic herbicides for different species.

Generally, 2,4-D (Navigate formulation) is the herbicide that is recommended for control of variable milfoil. Based on laboratory data this is the most effective herbicide in selectively controlling variable milfoil in New Hampshire's waterbodies.

A field trial was performed during the 2008 summer using the herbicide Renovate to control variable milfoil. Renovate is a systemic aquatic herbicide that targets both the shoots and the roots of the target plant for complete control. In this application it was dispersed as a granular formulation that sank quickly to the bottom to areas of active uptake of the milfoil plants. A small (<5 acre) area of Captains Lake in Salem was treated with this systemic herbicide. The herbicide was applied in pellet form to the infested area in May 2008, and showed good control by the end of the growing season. Renovate works a little more slowly to control aquatic plants than 2,4-D and it is a little more expensive, but presents DES with another alternative that could be used in future treatments.

During the summer of 2010, DES worked with other researchers to perform field trials of three different formulations of 2,4-D in Lake Winnisquam, to determine which product was most target-specific to the variable milfoil. Navigate formulation was used, as were a 2,4-D amine formulation, and a 2,4-D amine and triclopyr formulation (MaxG). Although the final report has not been completed for this study, preliminary results suggest that all three products worked well, but that Navigate formation may be the most target specific of all three.

Another herbicide, Fluridone, is sometimes also used in New Hampshire, mainly to control growths of fanwort (*Cabomba caroliniana*). Fluridone is a systemic aquatic herbicide that inhibits the formation of carotenoids in plants. Reduced carotenoids pigment ultimately results in the breakdown of chlorophyll and subsequent loss of photosynthetic function of the plants.

Other aquatic herbicides are also used in New Hampshire when appropriate (glyphosate, copper compounds, etc). The product of choice will be recommended based on what the target species is, and other waterbody-specific characteristics that are important to consider when selecting a product.

In 2018, a new aquatic formulation of an herbicide was labeled and licensed for use. ProcellaCOR is a reduced-risk liquid formulation herbicide that is a systemic. Based on New Hampshire field data, it works well on variable milfoil, it is taken up very quickly following treatment (hours) and it degrades quickly in the water column, with typical non-detect readings within 24-48 hours post treatment.

Extended Drawdown

Extended drawdown serves to expose submersed aquatic plants to dessication and scouring from ice (if in winter), physically breaking down plant tissue. Some species can resLake well to drawdown and plant density can be reduced, but for invasive species drawdown tends to yield more disturbance to bottom sediments, something to which exotic plants are most adapted. In waterbodies where drawdown is conducted exotic plants can often outcompete native plants for habitat and come to dominate the system.

Some waterbodies that are heavily infested with exotic plants do conduct drawdowns to reduce some of the invasive aquatic plant density. During this reporting period both Northwood Lake (Northwood) and Jones Lake (New Durham) coordinated deep winter drawdowns to reduce growths of variable milfoil (the drawdown on Northwood Lake is primarily for flood control purposes, but they do see some ancillary benefits from the technique for variable milfoil control).

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 lakes 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 to fashion, 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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NH Department of
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Long-Term Variable Milfoil & Fanwort Management Plan

Otternic Pond
Hudson, New Hampshire

Contents

Purpose

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

1. To identify and describe the historic and current exotic aquatic infestation(s) in the waterbody;
2. To identify short-term and long-term exotic aquatic plant control goals;
3. To minimize any adverse effects of exotic aquatic plant management strategies on non-target species;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To evaluate control practices used in this waterbody over time to determine if they are meeting the goals outlined in this plan.

This plan also summarizes the current physical, biological, ecological, and chemical components of the subject waterbody as they may relate to both the exotic plant infestation and recommended control actions, and the potential social, recreational and ecological impacts of the exotic plant infestation.

The intent of this plan is to establish an adaptive management strategy for the long-term control of the target species (in this case variable milfoil) in the subject waterbody, using an integrated plant management approach.

Appendix A and Appendix B detail the general best management practices and strategies available for waterbodies with exotic species, and provide more information on each of the activities that are recommended within this plan.

Invasive Aquatic Plant Overview

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and Lakes (Luken & Thieret, 1997, Halstead, 2000), primarily by forming dense growths or monocultures in critical areas of waterbodies that are important for aquatic habitat and/or recreational use. Under some circumstances, dense growths and near monotypic stands of invasive aquatic plants can result, having the potential to reduce overall species diversity in both plant and animal species, and can alter water chemistry and aquatic habitat structure that is native to the system.

Since January 1, 1998, the sale, distribution, importation, propagation, transportation, and introduction of key exotic aquatic plants have been prohibited (RSA 487:16-a) in New Hampshire. This law was designed as a tool for lake managers to help prevent the spread of nuisance aquatic plants.

New Hampshire lists 27 exotic aquatic plant species as prohibited in the state (per Env-Wq 1303.02) due to their documented and potential threat to surface waters of the state.

According to the federal 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 New Hampshire regulation Env-Wq 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). In fact, waterbodies that contain even a single exotic aquatic plant do not attain water quality standards and are listed as impaired.

Variable Milfoil and Fanwort Infestation in Otternic Pond

Otternic Pond (also known as Ottarnic or Otternick Pond, among other various spellings) was first documented to support growths of an exotic aquatic plant in 2002, when a variable milfoil (*Myriophyllum heterophyllum*) infestation was reported by local residents. It is believed that the plant was introduced sometime between 1999 and 2001. During an herbicide application in summer of 2005 to control the variable milfoil, small patches of fanwort (*Cabomba caroliniana*) were observed around the shoreline of the pond. By the following year, with the variable milfoil controlled by the herbicide treatment of 2005, fanwort quickly started to colonize the lake, and by a survey in summer 2007, a population explosion had occurred, and the fanwort covered nearly 100% of the pond. Variable milfoil was seen persisting in small patches or as scattered stems in the stands of fanwort. In less than 7 years Otternic Pond has become nearly 100% infested with invasive aquatic plants. Since then management efforts have been irregular, mostly due to the lack of consistent local match dollars for appropriate management efforts. In recent years the town and lake residents have renewed their efforts to reduce growths of invasive aquatic plants in Otternic Pond. In 2021, patchy areas of curly-leaf pondweed (*Potamogeton crispus*) growth was also documented in the pond. Divers worked to harvest the plants before they set seed, hopefully reducing that infestation.

Figure 1 illustrates the distribution of variable milfoil, fanwort and curly-leaf pondweed infestation in this waterbody over time, since regular monitoring began. The following table provides a summary of variable milfoil and fanwort growth as shown in Figure 1 (area name reference in table below is relative to grid overlay on Figure 1).

Area	Location/Area Description	Year	Description of Growth
A1, B1, C1, D1	Northern shoreline	2009	Scattered patches of both milfoil and fanwort growth at end of 2009 growing season, but much reduced to prior year's level of growth
		2010	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse
		2011	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse. Some fanwort rebounding.
		2012	Fanwort and variable milfoil growing quickly and footprint of growth expanding. No local funds for control, other than some limited diving.
		2013	Fanwort and variable milfoil dominating growth.
		2014	Post-treatment regrowth of variable milfoil and fanwort. Densities less than pre-treatment levels, but developing good stands by end of season.
		2015	Milfoil and fanwort growths being reduced through management, present as small patches of growth along northern shoreline
		2016	Milfoil growth expanding
		2017	Milfoil growth expanding, no treatment this year
		2018	Abundant variable milfoil and fanwort early season, reduced but still present in late season. Herbicide ratios may need to be adjusted for 2019.
		2019	Variable milfoil growth very sparse in June, however fanwort was very common. Fanwort appeared controlled by herbicide treatment in the summer, but new growth was forming in many areas by the late October survey. Milfoil populations expanded some over the summer.
		2020	Patchy milfoil and fanwort growth, controlled by treatment
		2021	Scattered fanwort stems, scattered milfoil

Area	Location/Area Description	Year	Description of Growth
			clusters, scattered curly-leaf pondweed plants
		2022	Milfoil and fanwort patchy along shoreline
		2023	Increased density of milfoil and fanwort around shoreline
A2, A3	Western shoreline	2009	Scattered patches of both milfoil and fanwort growth at end of 2009 growing season, but much reduced to prior year's level of growth
		2010	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse
		2011	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse
		2012	Fanwort and variable milfoil growing quickly and footprint of growth expanding. No local funds for control, other than some limited diving.
		2013	Fanwort and variable milfoil dominating growth.
		2014	Post-treatment regrowth of variable milfoil and fanwort. Densities less than pre-treatment levels, but developing good stands by end of season.
		2015	Variable milfoil and fanwort reduced compared to previous year, present as small patches or clumps of growth
		2016	Increased growth
		2017	Increased growth, no treatment year
		2018	Abundant variable milfoil and fanwort early season, reduced but still present in late season. Herbicide ratios may need to be adjusted for 2019.
		2019	Variable milfoil growth very sparse in June, however fanwort was very common. Fanwort appeared controlled by herbicide treatment in the summer, but new growth was forming in many areas by the late October survey. Milfoil populations expanded some over the summer.
		2020	Patchy milfoil and fanwort, controlled by treatment
		2021	Scattered milfoil clusters, scattered curly-leaf pondweed plants
		2022	Milfoil and fanwort patchy along shoreline
		2023	Increased density of milfoil and fanwort around shoreline
D2, D3	Eastern shoreline	2009	Scattered patches of both milfoil and fanwort growth at end of 2009 growing season, but much reduced to prior year's level of growth
		2010	Primarily patchy and scattered milfoil growth

Area	Location/Area Description	Year	Description of Growth
			in the lake, mostly near shore and sparse
		2011	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse. Some fanwort rebounding.
		2012	Fanwort and variable milfoil growing quickly and footprint of growth expanding. No local funds for control, other than some limited diving.
		2013	Fanwort and variable milfoil dominating growth.
		2014	Post-treatment regrowth of variable milfoil and fanwort. Densities less than pre-treatment levels, but developing good stands by end of season.
		2015	Patchy fanwort growth through area, only scattered milfoil
		2016	Increased growth
		2017	Increased growth, no treatment year
		2018	Abundant variable milfoil and fanwort early season, reduced but still present in late season. Herbicide ratios may need to be adjusted for 2019.
		2019	Variable milfoil growth very sparse in June, however fanwort was very common. Fanwort appeared controlled by herbicide treatment in the summer, but new growth was forming in many areas by the late October survey. Milfoil populations expanded some over the summer.
		2020	Patchy milfoil and fanwort, controlled by treatment
		2021	Scattered milfoil clusters, scattered curly-leaf pondweed plants
		2022	Milfoil and fanwort patchy along shoreline
		2023	Increased density of milfoil and fanwort around shoreline
B4	Outlet	2009	Scattered patches of both milfoil and fanwort growth at end of 2009 growing season, but much reduced to prior year's level of growth
		2010	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse
		2011	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse
		2012	Fanwort and variable milfoil growing quickly and footprint of growth expanding. No local funds for control, other than some limited diving.
		2013	Fanwort and variable milfoil dominating

Area	Location/Area Description	Year	Description of Growth
			growth.
		2014	Post-treatment regrowth of variable milfoil and fanwort. Densities less than pre-treatment levels, but developing good stands by end of season.
		2015	Common growths of variable milfoil and fanwort in this area, though reduced compared to previous years
		2016	Increased growth
		2017	Increased growth, no treatment year
		2018	Abundant variable milfoil and fanwort early season, reduced but still present in late season. Herbicide ratios may need to be adjusted for 2019.
		2019	Variable milfoil growth very sparse in June, however fanwort was very common. Fanwort appeared controlled by herbicide treatment in the summer, but new growth was forming in many areas by the late October survey. Milfoil populations expanded some over the summer.
		2020	Patchy milfoil and fanwort, controlled by treatment
		2021	Scattered milfoil clusters, scattered curly-leaf pondweed plants
		2022	Milfoil and fanwort patchy along shoreline
		2023	Increased density of milfoil and fanwort around shoreline
C3	Southeastern shoreline	2009	Scattered patches of both milfoil and fanwort growth at end of 2009 growing season, but much reduced to prior year's level of growth
		2010	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse
		2011	Primarily patchy and scattered milfoil growth in the lake, mostly near shore and sparse
		2012	Fanwort and variable milfoil growing quickly and footprint of growth expanding. No local funds for control, other than some limited diving.
		2013	Fanwort and variable milfoil dominating growth.
		2014	Post-treatment regrowth of variable milfoil in this area. Densities less than pre-treatment levels, but developing good stands by end of season.
		2015	Sparse growth
		2016	Increased growth
		2017	Increased growth, no treatment year

Area	Location/Area Description	Year	Description of Growth
		2018	Abundant variable milfoil and fanwort early season, reduced but still present in late season. Herbicide ratios may need to be adjusted for 2019.
		2019	Variable milfoil growth very sparse in June, however fanwort was very common. Fanwort appeared controlled by herbicide treatment in the summer, but new growth was forming in many areas by the late October survey. Milfoil populations expanded some over the summer.
		2020	Patchy milfoil and fanwort, controlled by treatment
		2021	Scattered milfoil clusters, scattered curly-leaf pondweed plants
		2022	Milfoil and fanwort patchy along shoreline
		2023	Increased density of milfoil and fanwort around shoreline
B2, C2, B3	Open water area of lake	2009	No growth observed in main open water area of lake
		2010	No growth observed in main open water area of lake
		2011	No growth observed in main open water area of lake
		2012	Fanwort and variable milfoil growing quickly and footprint of growth expanding. No local funds for control, other than some limited diving.
		2013	Fanwort and variable milfoil dominating growth.
		2014	Some limited regrowth of mostly variable milfoil in this portion of the waterbody, though a few fanwort stems do mix in.
		2015	Open water areas continue to show reduced variable milfoil and fanwort growth
		2016	Not much growth observed in open water area of pond
		2017	Not much growth observed in open water area of pond
		2018	Abundant variable milfoil and fanwort early season, reduced but still present in late season. Herbicide ratios may need to be adjusted for 2019.
		2019	Some fanwort was present mid-pond in the June survey, reduced by fall, but still coming off shore a fair distance around the pond. No milfoil mid-lake this year.
		2020	Minimal growth in open water areas

Area	Location/Area Description	Year	Description of Growth
		2021	Minimal invasive plant growth in open water areas in the middle of the pond
		2022	Milfoil and fanwort patchy along shoreline
		2023	Increased density of milfoil and fanwort around shoreline

In terms of the impacts of the variable milfoil and fanwort in the system, there are several (19) houses around the shoreline of Otternic Pond, with mostly year-round houses, and only one or two seasonal cottages. There are no back lots with lake rights.

Lake residents have expressed frustration with the exotic plant growth, citing an inability to motor or paddle across the lake without becoming entangled in the thick exotic plant growth. There are additional concerns that transient boaters that use the waterbody will transport fragments to other nearby waterbodies in town, or abutting towns.

The invasive plant infestation in this pond has increased exponentially over the last couple of years. Otternic Pond is shallow, with organic substrates, essentially creating prime variable milfoil and fanwort habitat across the entire pond the whole pond.

Milfoil, Fanwort and Curly-leaf Pondweed Management Goals and Objectives

The aquatic plant management plan outlines actions to manage the infestation of variable milfoil and fanwort in Otternic Pond while maintaining native plant communities whenever control actions are being implemented.

The goal for Otternic Pond is to greatly reduce the overall distribution and density of variable milfoil, fanwort and curly-leaf pondweed within the system using an Integrated Pest Management Approach, and maintain the population at a low level so as not to impact the designated uses of the waterbody. Eradication of the invasive plant in this system is likely infeasible, due to migration of the plant into the wetland fringe surrounding the lake, making complete management or eradication quite a challenge.

Figure 2 shows both historical and proposed control actions for Otternic Pond milfoil and fanwort.

Local Support

Town or Municipality Support

The Town of Hudson has been very supportive of variable milfoil and fanwort control efforts in Otternic Pond. This is one of two infested waterbody in the town at this point (Robinson Pond is also infested with fanwort and variable milfoil), and the town officials recognize the need to protect other nearby waterbodies.

The town has been supportive financially by offering matching funds for various management practices through funds from the Conservation Commission.

Lake Resident Support

Local residents around Otternic Pond have formed an advocates group for working with state and local officials for managing Otternic Pond. Their activities have included monitoring the pond and developing informational kiosks at the public access site.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of Otternic Pond, including the milfoil and fanwort infestations. Note that a current review of the Natural Heritage Bureau (NHB) database was requested and the results from that search are included below, as well as in other relevant portions of the plan. Note also that historically identified species are included here, even though they may not appear in the current NHB review.

Lake area (acres)	34.0
Watershed area (acres)	2 752.0
Shoreline Uses (residential, forested, agriculture)	Residential, forested, wetland
Max Depth (ft)	12.2
Mean Depth (ft)	6.3
Trophic Status	Eutrophic
Color (CPU) in Epilimnion	37
Clarity (ft)	8.5
Flushing Rate (yr^{-1})	20.5
Natural waterbody/Raised by Damming/Other	Natural w/ dam

Plant Community Information Relative to Management	
Invasive Plants (Latin name)	*Myriophyllum heterophyllum* *Cabomba caroliniana* *Potamogeton crispus*
Infested Area (acres)	See Figures
Distribution (ringing lake, patchy growth, etc)	See Figures
Sediment type in infested area (sand/silt/organic/rock)	Organic, silty, peaty
Rare, Threatened, or Endangered Species in Waterbody (according to historic NH Natural Heritage Inventory)	2024 Review Blanding's Turtle (*Emydoidea blandingii*) Spotted Turtle (*Clemmys guttata*) Historic Reviews Eastern Box Turtle (*Terrapene carolina)* Geometrid Moth (*Metarranthis apiciaria*) Cobweb Skipper (*Hesperia metea*)

A native aquatic vegetation map and key by the DES Biology Section is shown in Figure 3. A bathymetric map is shown in Figure 4.

Beneficial (Designated) Uses of Waterbody

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, Wildlife and Recreation are the ones most often affected by the presence of invasive plants, though drinking water supplies can also be affected as well in a number of ways.

Following is a general discussion of the most potentially impacted designated uses, including water supplies and near shore wells, as they relate to this system and the actions proposed in this long-term plan.

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.

Aquatic Life

Fisheries Information

Surveys indicate that the following fish species are present in Otternic Pond: black crappie, bluegill, brown bullhead, chain pickerel, common sunfish, golden shiner, largemouth bass, yellow bullhead, and yellow perch.

Wildlife Information

The current NHB review for the project showed only the Blanding's turtle as a species of concern within or adjacent to Otternic Pond; however, historic Natural Heritage Bureau reviews determined that there are species of concern in the general area of Otternic Pond; Blandings turtle, spotted turtle, geometric moth and the cobweb skipper. These species will be included in this plan as reference.

The Blanding's turtle is listed as endangered in New Hampshire, where it is rare or uncommon. It has no federal listing, and it is listed as globally secure, but a cause for concern. Blanding's Turtles are mostly aquatic and are found in the shallows of lakes and ponds, in marshes, bogs, and small streams. The turtles nest on land, but feed underwater on insects, tadpoles, crayfish, and snails, among other small aquatic organisms. If the species is present within the Otternic Pond system, there are no expected impacts to this species as a result of the fanwort and milfoil control activities in Otternic Pond. The Fish and Game Department requests that contractors avoid direct herbicide application in scrub-shrub dominated wetland coves, in order to minimize any potential impacts.

The spotted turtle was documented at sites outside and a little distance from Otternic Pond. As such, control practices in Otternic Pond are unlikely to impact this species.

The geometrid moth, (*Metarranthis apiciaria*) is neither state nor federally listed as threatened or endangered, but it is listed as critically imperiled in NH and globally due to the rarity or vulnerability of the species. A 1973 record from NHB for the moth indicates it was found in an upland area to the northwest of the pond, towards Nashua, NH, in scrub oak thickets near a bog, and along powerlines. This moth is found throughout New England (CT, MA, ME, NH) and in other parts of the Northeast. The habitat of this moth is not well understood at this time. In most of New England it is found in pitch pine and/or scrub oak barrens. In other areas it was found in dry rocky woods, rich dry forests and dry oak woodlands. The larvae of this species usually attach to a host plant. The proposed herbicide application is not expected to affect this species due to the distance between the pond and the upland site, and the fact that this is an aquatic based herbicide application and herbicide drift is not anticipated.

The cobweb skipper (*Hesperia metea*) is neither state nor federally listed as threatened or endangered. It is listed as rare or uncommon in New Hampshire, but its global rating is apparently secure but with cause for concern. The cobweb skipper is found in more than half of the states within the United States. This species is often found in grassy openings in many sorts of dry woodlands or shrub lands, including pine and oak barrens. They are also often found in meadow habitats. The record from NHB indicates that the cobweb skipper was found in an area to the west of Otternic Pond, in the vicinity of Little Otternic Pond/Bog. The record is from 1986. The bog would be an inlet channel to Otternic Pond, and not likely affected by the proposed herbicide treatment since Otternic Pond is down-gradient of the bog and back-flow is not expected due to a rapid flushing rate of the pond.

Eastern box turtle (*Terrapene carolina*) was last documented by the NHB in 2021. There was a young adult female observed as well as a male documented close-by.

Recreational Uses and Access Points

Otternic Pond is used for various recreational activities, including boating and fishing. Swimming and water skiing are limited due to the small area, shallow depths, and degree of invasive aquatic plant cover in the waterbody.

There is one designated public access for boats on the northern side of the pond (Figure 6). Small motor boats, as well as kayaks and canoes can use this facility. There is limited parking for about two to four vehicles with trailers. There are generally less than 10 resident owned powerboats on the lake each year, and numerous canoes, kayaks, and row boats.

There are no public beaches on the pond, though there are a few small private swim beaches located on private properties around the pond. There are 8 floating docks and swim platforms around the pond as well. Figure 6 shows the locations commonly used for swimming, and the locations of swim platforms and docks on Otternic Pond.

Macrophyte Community Evaluation

The littoral zone is defined as the nearshore area 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 Otternic Pond is characterized by a mix of native and non-native (variable milfoil, fanwort, purple loosestrife, common reed) plant growth (Figure 2). Native species include a mix of floating plants (yellow and white lilies, watershield, watermeal), emergent plants (swamp loosestrife, arrowhead, pickerelweed, cattail, bur-reed, bulrush, iris, smartweeds, button bush, sweet gale), and submergent plants (bladderwort, pondweed, coontail, Robbins pondweed). Native plant communities are mixed around the entire lake, and are characterized as 'very abundant' by the DES, with coontail and the pond lilies as most abundant.

There are no records of state threatened or endangered plant species in Otternic Pond at this time.

Other invasive plants besides fanwort and variable milfoil that were documented in this system include purple loosestrife and common reed, which were found in isolated patches around the shoreline of the pond.

Wells and Water Supplies

Figure 7 shows the location of wells, water supplies, well-head protection areas, and drinking water protection areas around the subject waterbody, based on information in the DES geographic information system records. Note that it is likely that Figure 7 does not show the location of all private wells.

Note that the map in Figure 7 cannot be provided on a finer scale than 1:48,000. Due to public water system security concerns, a large-scale map may be made available upon agreement with DES' data security policy. Visit DES' OneStop Web GIS, http://www2.des.state.nh.us/gis/onestop/ and register to Access Public Water Supply Data Layers. Registration includes agreement with general security provisions associated with public water supply data. Paper maps that include public water supply data may be provided at a larger-scale by DES' Exotic Species Program after completing the registration process.

In the event that an herbicide treatment is needed for this waterbody, the applicator/contractor will provide more detailed information on the wells and water supplies within proximity to the treatment areas as required in the permit application process with the Division of Pesticide Control at the Department of Agriculture. It is beyond the scope of this plan to maintain updated well and water supply information other than that provided in Figure 7.

Historical Control Activities

DATE	ACTION	DIVER (GALLONS) OR TREATMENT (ACRES)	CONTRACTOR/ ENTITY	TARGET
06/01/05	2,4-D TREATMENT	25 ACRES	AQUATIC CONTROL TECHNOLOGY	VARIABLE MILFOIL
JUNE 1, 2009 (BUMP TREATMENTS ON JUNE 22 AND JULY 20, 2009)	FLURIDONE TREATMENT	34 ACRES	AQUATIC CONTROL TECHNOLOGY	VARIABLE MILFOIL
SUMMER 2011	HAND PULLING/ DASH	SCATTERED PATCHES AROUND SHORE	AB Aquatics	VARIABLE MILFOIL & FANWORT
MAY 4-8 2012	HAND PULLING/ DASH	412 GALLONS REMOVED (MILFOIL & FANWORT)	BOB PATTERSON	VARIABLE MILFOIL & FANWORT
JUNE 5-7 & 10-11 2013	HAND PULLING/ DASH	1950 GALLONS REMOVED (FANWORT)	AB Aquatics	VARIABLE MILFOIL & FANWORT
06/30/14	DIQUAT AND FLUMIOXAZIN	17 ACRES	ACT	VARIABLE MILFOIL & FANWORT
10/29/14	HAND PULLING	5 GALLONS	AB Aquatics	VARIABLE MILFOIL & FANWORT
06/25/15	2,4-D (L) & FLUMIOXAZIN	18.5 ACRES	ACT	VARIABLE MILFOIL & FANWORT
07/15/15	2,4-D BEE (G)	5 ACRES	ACT	VARIABLE MILFOIL & FANWORT
08/18/15	DASH	90 GALLONS	AB Aquatics	VARIABLE MILFOIL & FANWORT
08/19/15	DASH	90 GALLONS	AB Aquatics	VARIABLE MILFOIL & FANWORT

DATE	ACTION	DIVER (GALLONS) OR TREATMENT (ACRES)	CONTRACTOR/ ENTITY	TARGET
08/20/15	DASH	90 GALLONS	AB Aquatics	VARIABLE MILFOIL & FANWORT
08/25/15	DASH	30 GALLONS	AB Aquatics	VARIABLE MILFOIL & FANWORT
10/20/15	DASH	60 GALLONS	AQUALOGIC	VARIABLE MILFOIL & FANWORT
10/21/15	DASH	120 GALLONS	AQUALOGIC	VARIABLE MILFOIL & FANWORT
10/22/15	DASH	120 GALLONS	AQUALOGIC	VARIABLE MILFOIL & FANWORT
10/23/15	HAND	100 GALLONS	AQUALOGIC	VARIABLE MILFOIL & FANWORT
10/26/15	DASH	90 GALLONS	AQUALOGIC	VARIABLE MILFOIL & FANWORT
10/27/15	HAND	30 GALLONS	AQUALOGIC	VARIABLE MILFOIL & FANWORT
11/03/15	HAND	120 GALLONS	AQUALOGIC	VARIABLE MILFOIL & FANWORT
07/28/16	2,4-D (AMINE) & FLUMIOXAZIN	17.3 ACRES	SOLitude LAKE MANAGEMENT	VARIABLE MILFOIL & FANWORT
06/19/18	FLUMIOXAZIN & 2,4-D	16.6 ACRES	SOLitude LAKE MANAGEMENT	VARIABLE MILFOIL, FANWORT
07/11/19	Sonar AS (fluridone)	34 acres (whole pond)	SOLitude LAKE MANAGEMENT	VARIABLE MILFOIL, FANWORT
08/01/19	Sonar AS (fluridone)	34 acres (whole pond)	SOLitude LAKE MANAGEMENT	VARIABLE MILFOIL, FANWORT
06/29/20	FLURIDONE AND FLUMIOXAZIN	12 ACRES	SOLitude LAKE MANAGEMENT	VARIABLE MILFOIL AND FANWORT
06/15/21	DASH	40 GALLONS	AE COMMERCIAL DIVERS	Variable Milfoil
06/16/21	DASH	60 GALLONS	AE COMMERCIAL DIVERS	Variable Milfoil
06/17/21	DASH	120 GALLONS	AE COMMERCIAL DIVERS	Variable Milfoil
06/18/21	DASH	60 GALLONS	AE COMMERCIAL DIVERS	Variable Milfoil
06/21/21	DASH	180 GALLONS	AE COMMERCIAL DIVERS	Variable Milfoil
06/22/21	DASH	80 GALLONS	AE COMMERCIAL DIVERS	Variable Milfoil

DATE	ACTION	DIVER (GALLONS) OR TREATMENT (ACRES)	CONTRACTOR/ ENTITY	TARGET
06/15-21/2021	DASH	620 GALLONS	AE COMMERCIAL DIVERS	Variable Milfoil
06/22/22	PROCELLACOR	20 ACRES	SOLitude LAKE MANAGEMENT	VARIABLE MILFOIL
07/21/22	FLUMIGARD SC	16.3 ACRES	SOLitude LAKE MANAGEMENT	FANWORT

Aquatic Invasive Plant Management Options

The control practices used should be as specific to the target species 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/bmp.html.

Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices currently used by the State of New Hampshire.

Feasibility Evaluation of Control Options in this Waterbody

DES has evaluated the feasibility of potential control practices on the subject waterbody. The following table summarizes DES' control strategy recommendations for the subject waterbody:

Control Method	Use on Otternic Pond
Restricted Use Areas	Not recommended as variable milfoil and fanwort growth is too widely distributed throughout pond.
Hand-pulling/Suction Harvesting	DES recommends that the individual stems or small patches of variable milfoil and fanwort be hand pulled when encountered, particularly following

Control Method	Use on Otternic Pond
	herbicide treatment.
Mechanical Harvesting/Removal	Because fanwort and variable milfoil cover nearly the entire lake area, mechanical harvesting may be a reasonable non-chemical approach to open up boating lanes in the lake in the future, if herbicides do not seem to effectively reduce the overall growth of these invasive plants, noting that this is not the most desirable technique for long-term control.
Benthic Barriers	For Otternic Pond, DES recommends installing small benthic barriers in areas of re-growth if small patches of variable milfoil and fanwort re-grow and can adequately be contained by benthic barriers. We do not recommend installing benthic barriers throughout the lake, however.
Herbicides	For Otternic Pond, herbicide use is recommended as primary treatment due to extent of infestation.
Extended Drawdown	Drawdown is not an effective control method for variable milfoil and fanwort.
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 or fanwort at this time in New Hampshire.
No Control	In order to allow for a healthy stand of mixed native aquatic vegetation, as well as areas of bare substrate in the shallows, a 'No Control' option is not recommended. Without control, variable milfoil and fanwort will eventually take over 100% of the littoral zone of Otternic Pond, and could extend into slightly deeper waters. Fanwort and milfoil has been showing exponential growth in Otternic Pond, therefore action to manage the plants in needed to prevent the exotic aquatic plants from further impacting the remaining native species.

Recommended Actions, Timeframes and Responsible Parties

An evaluation of the size, location, and type of variable milfoil and fanwort infestations, as well as the waterbody uses was conducted at the end of the last growing season (see attached figures for findings). Based on this survey the following recommendations are made for variable milfoil and fanwort control in the system:

Year	Action	Responsible Party	Schedule
2024	Weed Watching and reporting of growth to DES, Lake Host	Local Weed Watchers and Lake Hosts	May through September
	Diver and DASH work as appropriate	Contract divers	Growing season
	Herbicide Treatment for variable milfoil and fanwort control	SOLitude Lake Management	June or September
	Follow up surveys to guide diving and plan for next growing season	NHDES	September/October
2025	Weed Watching and reporting of growth to DES, Lake Host	Local Weed Watchers and Lake Hosts	May through September
	Diver and DASH work as appropriate	Contract divers	Growing season
	Herbicide Treatment for variable milfoil and fanwort control	SOLitude Lake Management	June/July
	Follow up surveys to guide diving and plan for next growing season	NHDES	September/October
2026	Weed Watching and reporting of growth to DES, Lake Host	Local Weed Watchers and Lake Hosts	May through September
	Diver and DASH work as appropriate	Contract divers	Growing season
	Follow up surveys to guide diving and plan for next growing season	NHDES	September/October
2027	Weed Watching and reporting of growth to DES, Lake Host	Local Weed Watchers and Lake Hosts	May through September
	Diver and DASH work as appropriate	Contract divers	Growing season

Year	Action	Responsible Party	Schedule
	Herbicide Treatment for variable milfoil and fanwort control	SŌLitude Lake Management, LLC	Growing season, as appropriate for each species
	Follow up surveys to guide diving and plan for next growing season	NHDES	September/October
2028	Weed Watching and reporting of growth to DES, Lake Host	Local Weed Watchers and Lake Hosts	May through September
	Diver and DASH work as appropriate	Contract divers	Growing season
	Herbicide Treatment for variable milfoil and fanwort control	SŌLitude Lake Management, LLC	Growing season, as appropriate for each species
	Follow up surveys to guide diving and plan for next growing season	NHDES	September/October
2029	Update and revise Long-Term Variable Milfoil and Fanwort Control Plan	NH DES and interested parties	Winter

Notes

Target Specificity

It is important to realize that aquatic herbicide applications are conducted in a specific and scientific manner. To the extent feasible, the permitting authority favors the use of selective herbicides that, where used appropriately, will control the target plant with little or no impact to non-target species, such that the ecological functions of native plants for habitat, lake ecology, and chemistry/biology will be maintained. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

Adaptive Management

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, adaptability of invasive species, etc).

This long-term plan is therefore based on the concept of adaptive management, where current field data (from field survey work using DES established field survey standard operating procedures) drive decision making, which may result in modifications to the recommended control actions and timeframes for control. As such, 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 herein, 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 Variable Milfoil and Fanwort Infestations Over Time

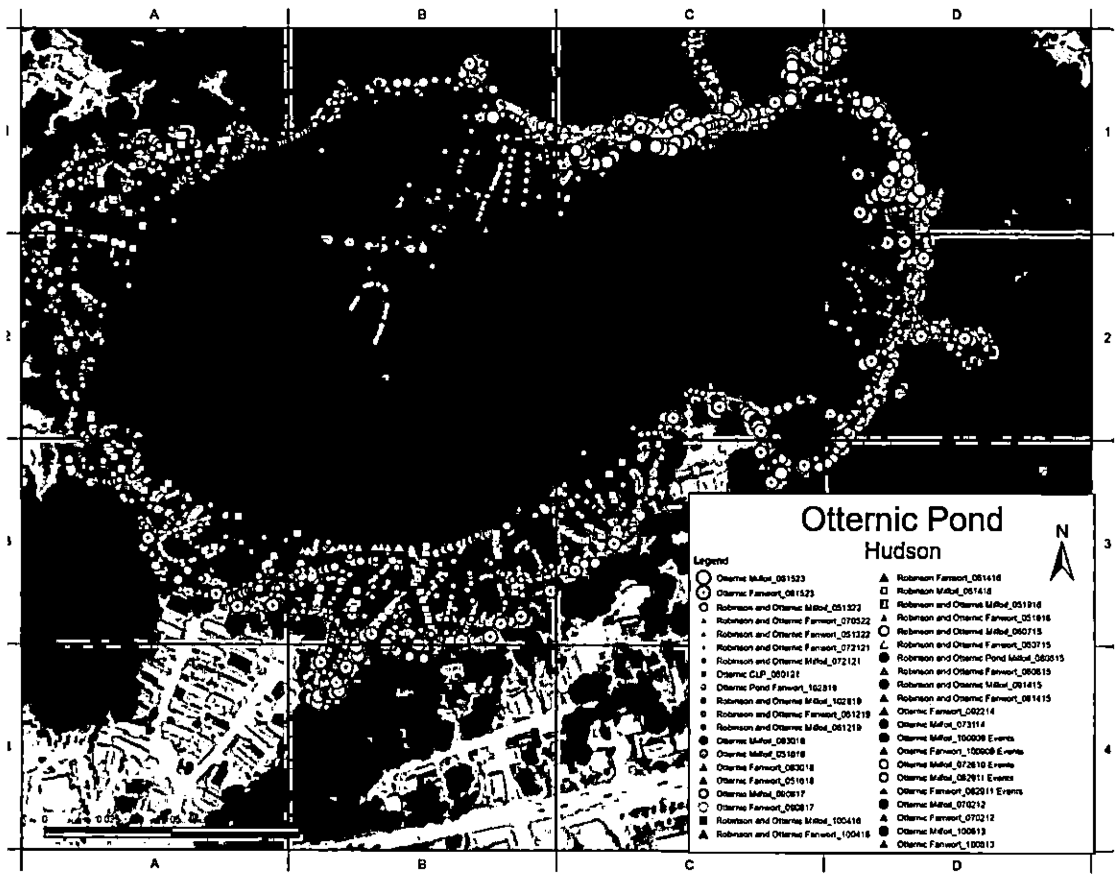
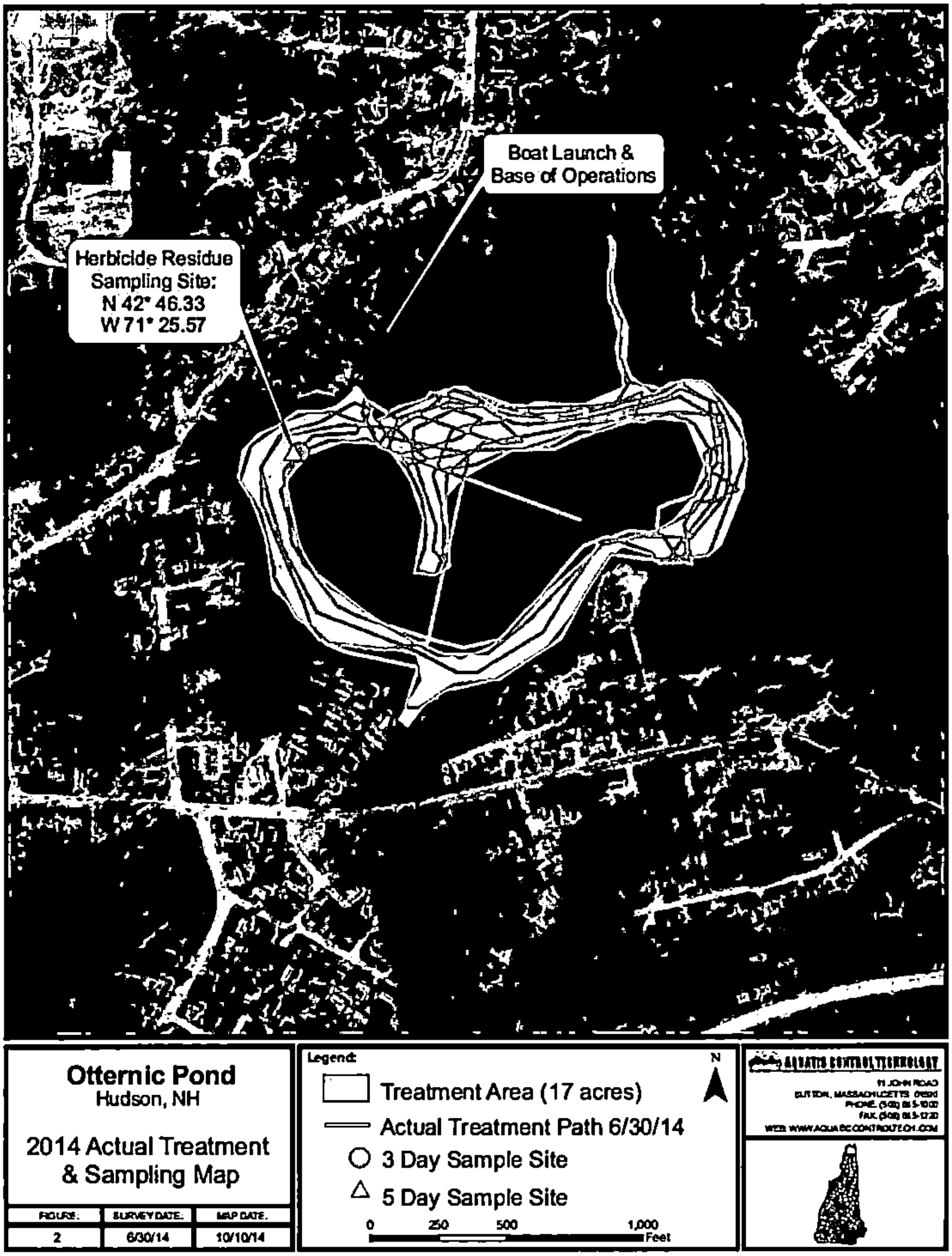
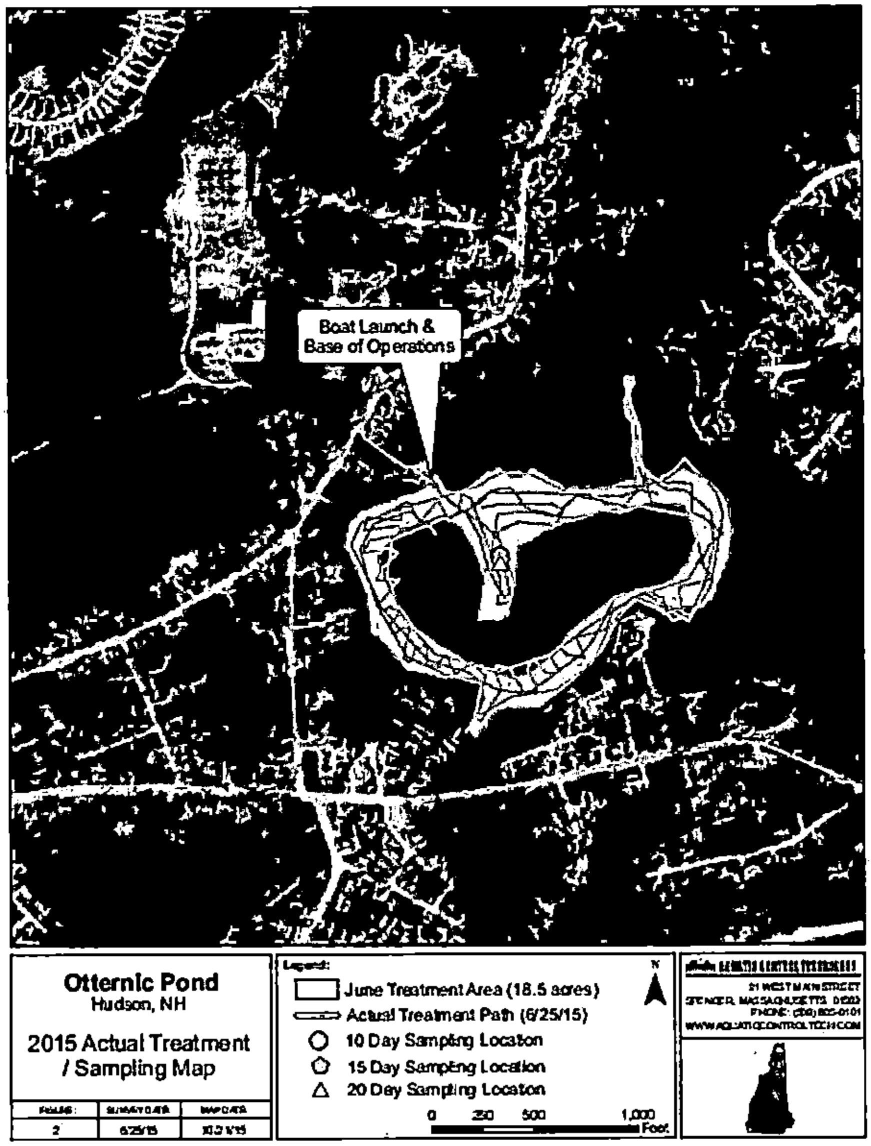


Figure 2: Map of Control Actions

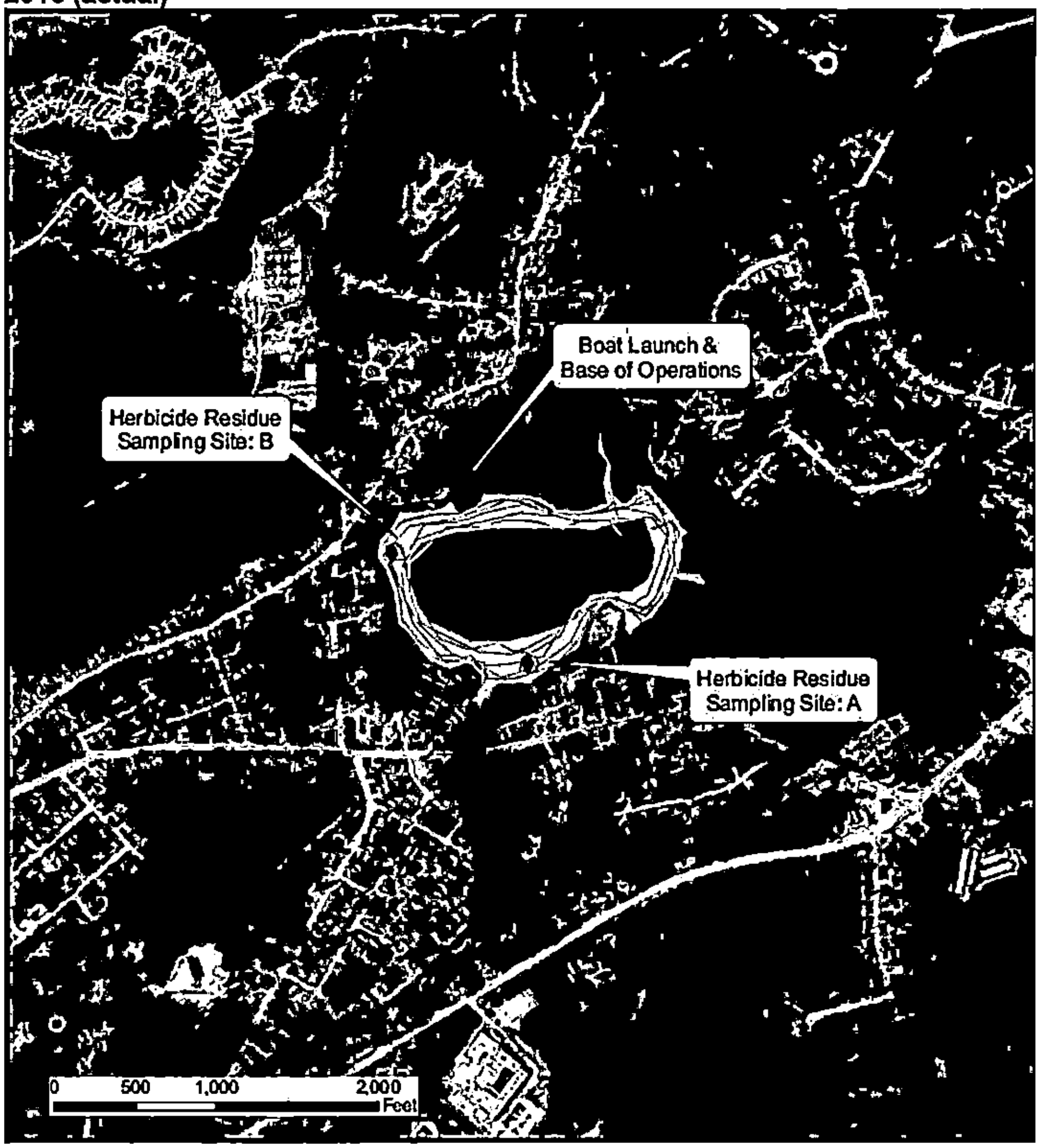
2014 (actual)



2015 (actual)


Boat Launch &
Base of Operations
Otternic Pond
Hudson, NH
2015 Actual Treatment
/ Sampling Map
2
6/25/15
June Treatment Area (18.5 acres)
Actual Treatment Path (6/25/15)
10 Day Sampling Location
15 Day Sampling Location
20 Day Sampling Location
0 250 500 1,000
Feet
N
21 WEST MAIN STREET
SPENCER, MASSACHUSETTS
PHONE: (508) 885-0101
WWW.AQUATICCONTROLTECH.COM

2016 (actual)



Otternic Pond
Hudson, NH

2016 Actual
Treatment / Sampling Map

FIGURE:	SURVEY DATE:	MAP DATE:
2	7/28/16	10/24/16

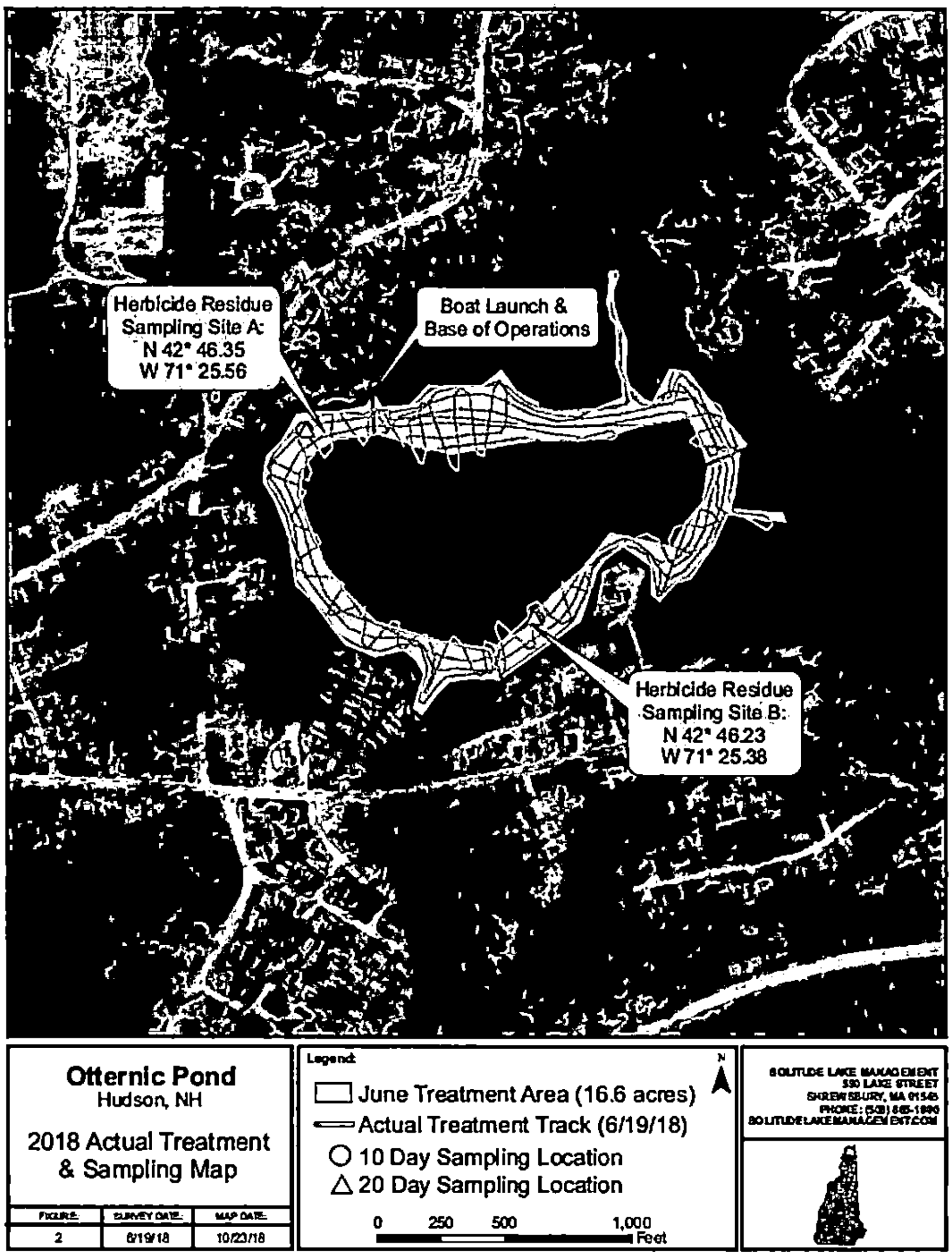
Legend:

- Treatment Area (17.3 acres)
- Actual Treatment Path (7/28/16)
- ○ 5 Day Sampling Location
- △ 10 Day Sampling Location
- ♦ 20 Day Sampling Location

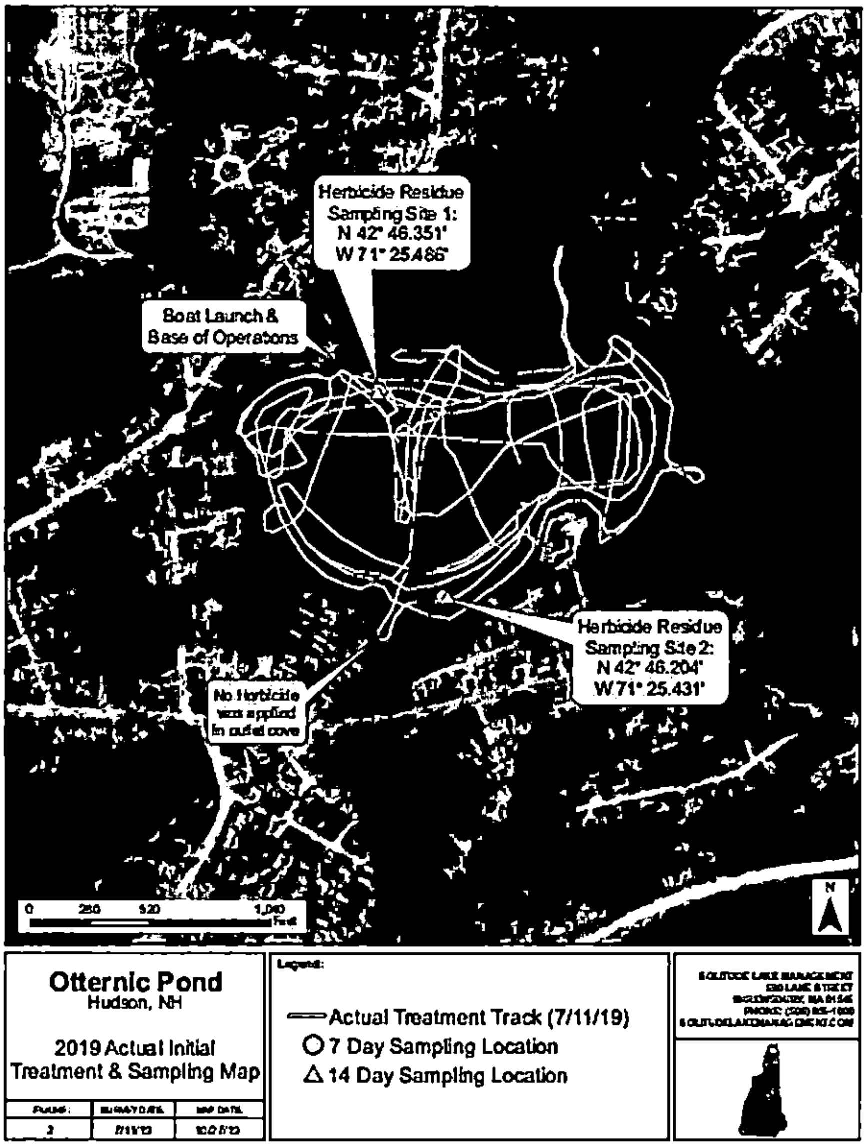
N

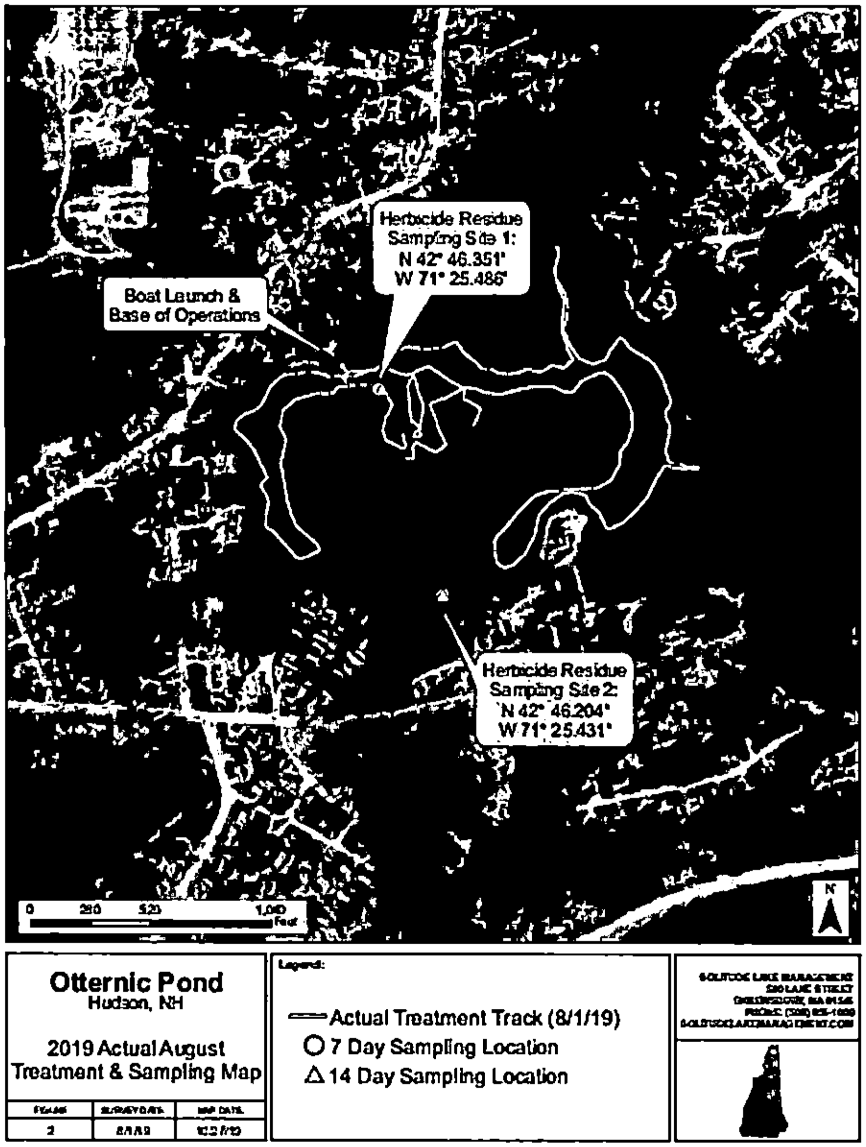
SOLITUDE LAKE MANAGEMENT
590 LAKE STREET
SHREWSBURY, MA 01545
SOLITUDELAKEMANAGEMENT.COM

2018 Actual

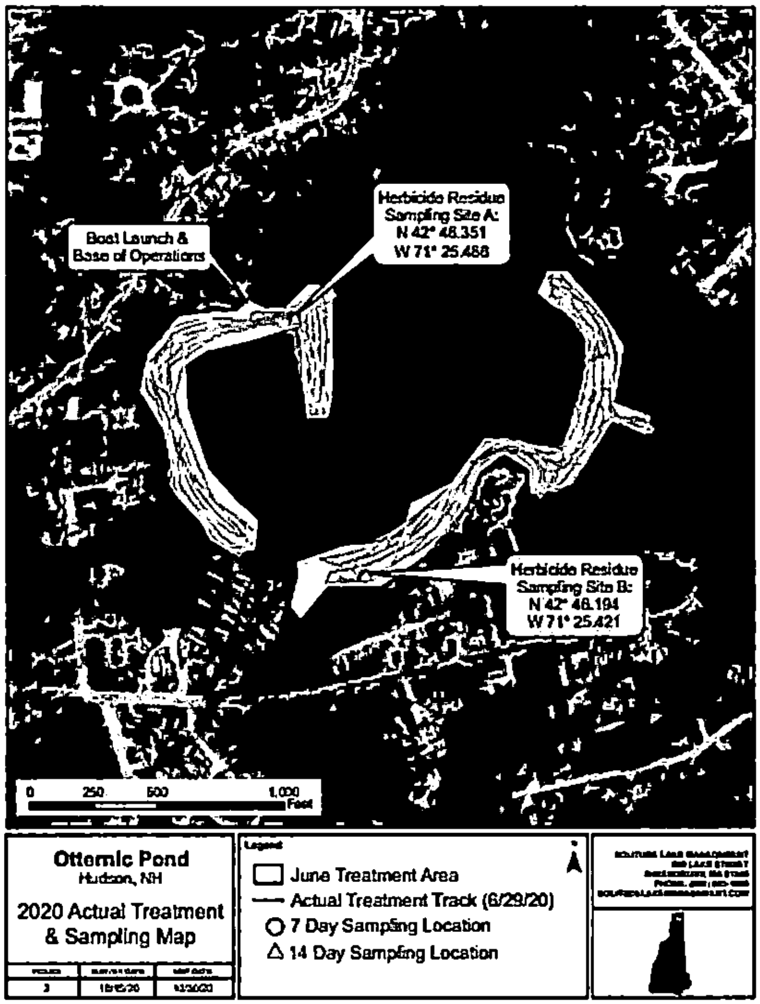

Herbicide Residue
Sampling Site A:
N 42° 46.35
W 71° 25.56
Boat Launch &
Base of Operations
Herbicide Residue
Sampling Site B:
N 42° 46.23
W 71° 25.38
Otternic Pond
Hudson, NH
2018 Actual Treatment
& Sampling Map
FIGURE: 2
SURVEY DATE: 6/19/18
MAP DATE: 10/23/18
Legend
June Treatment Area (16.6 acres)
Actual Treatment Track (6/19/18)
10 Day Sampling Location
20 Day Sampling Location
0 250 500 1,000
Feet
N
SOLITUDE LAKE MANAGEMENT
590 LAKE STREET
SHREWSBURY, MA 01545

2019 Actual


Herbicide Residue
Sampling Site 1:
N 42° 46.351'
W 71° 25.486'
Boat Launch &
Base of Operations
Herbicide Residue
Sampling Site 2:
N 42° 46.204'
W 71° 25.431'
No Herbicide
was applied
in outlet cove
0
250
520
1,040
Feet
N
Otternic Pond
Hudson, NH
2019 Actual Initial
Treatment & Sampling Map
Legend:
Actual Treatment Track (7/11/19)
7 Day Sampling Location
14 Day Sampling Location


Herbicide Residue
Sampling Site 1:
N 42° 46.351'
W 71° 25.486'
Boat Launch &
Base of Operations
Herbicide Residue
Sampling Site 2:
N 42° 46.204'
W 71° 25.431'
0 250 500 1,000
Feet
N
Otternic Pond
Hudson, NH
2019 Actual August
Treatment & Sampling Map
Legend:
Actual Treatment Track (8/1/19)
O 7 Day Sampling Location
Δ 14 Day Sampling Location

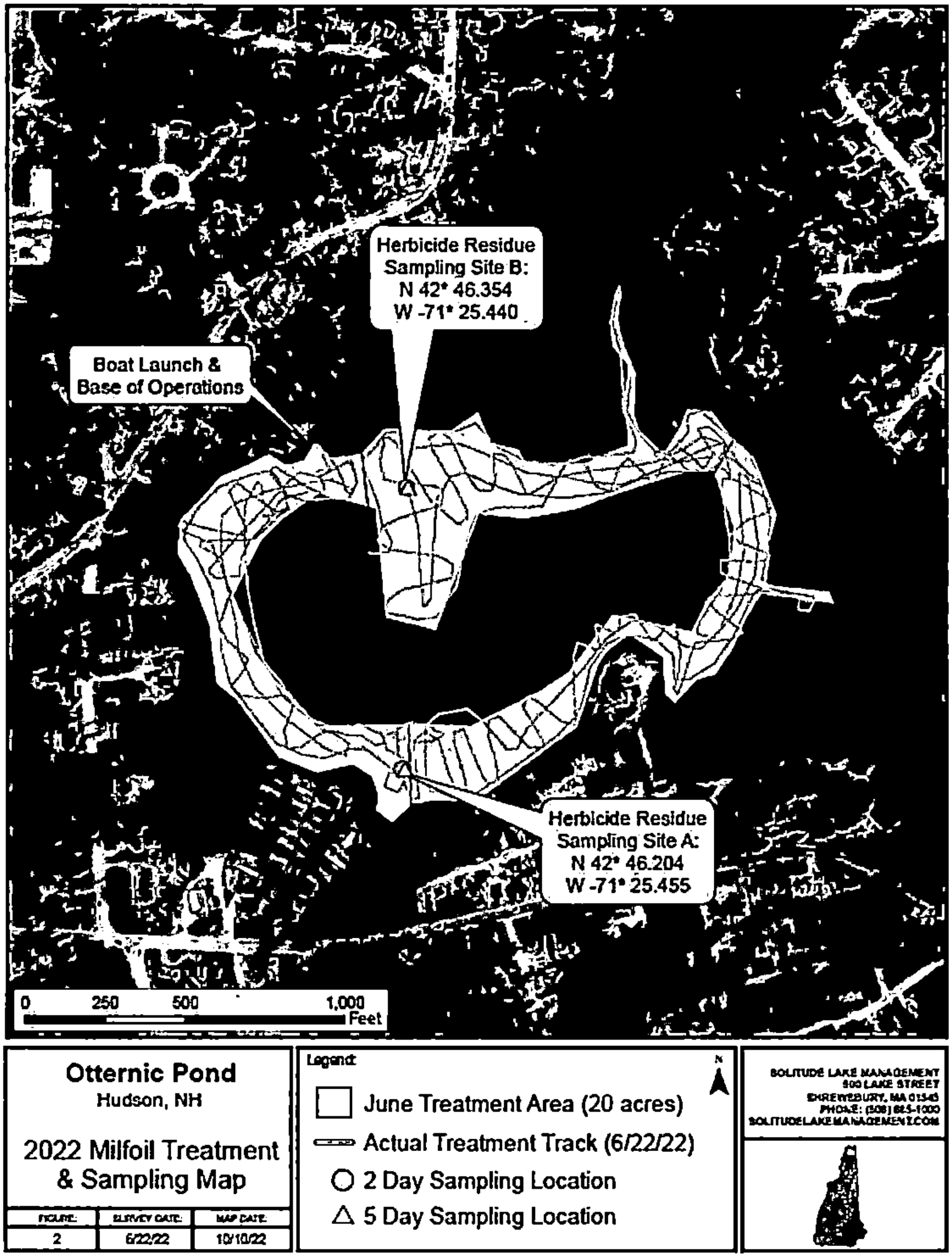
2020 Actual



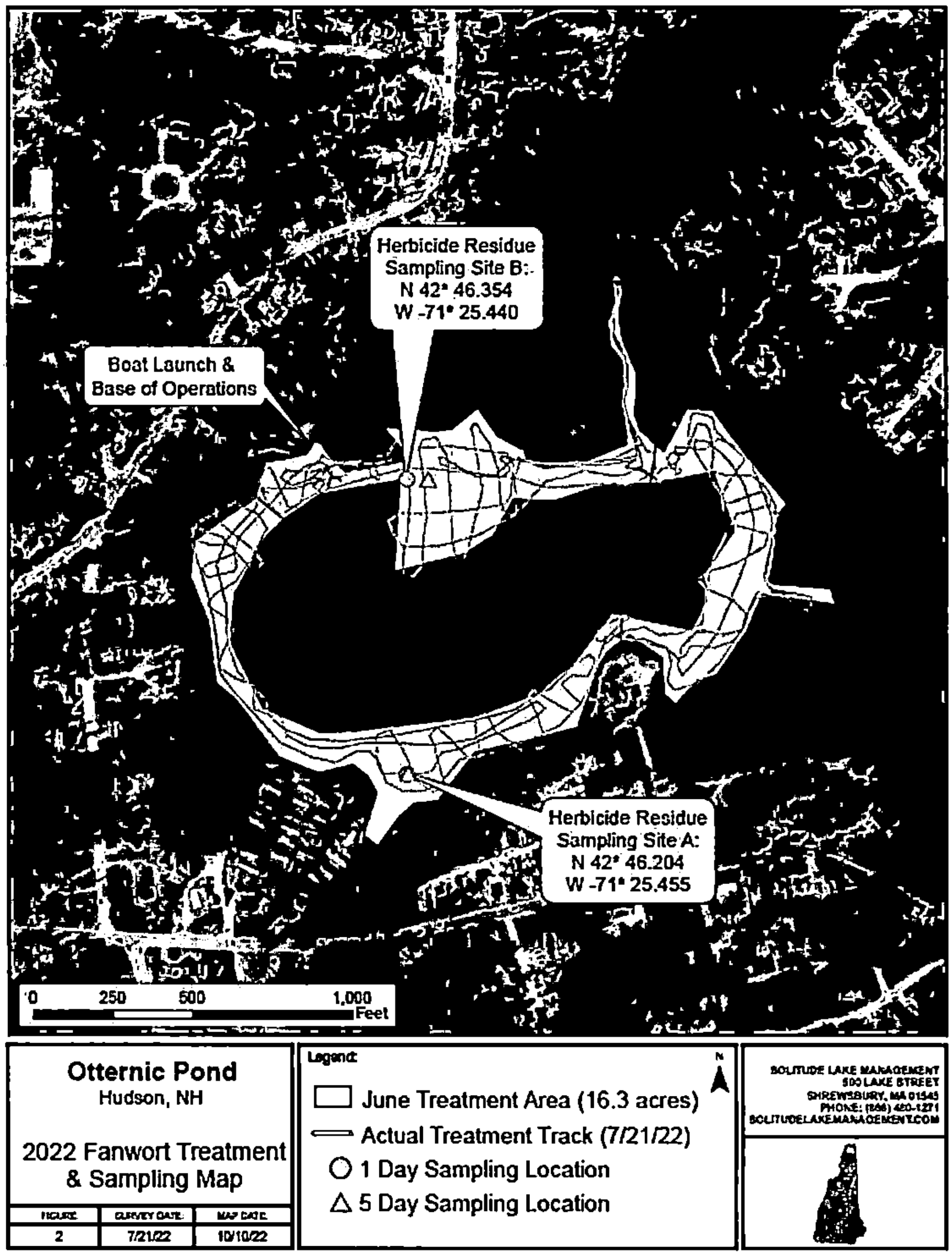
Herbicide Residue
Sampling Site A:
N 42° 46.351
W 71° 25.488
Boat Launch &
Base of Operations
Herbicide Residue
Sampling Site B:
N 42° 46.194
W 71° 25.421
0
250
500
1,000
Feet
Ottarnic Pond
Hudson, NH
2020 Actual Treatment
& Sampling Map
Legend
June Treatment Area
Actual Treatment Track (6/29/20)
7 Day Sampling Location
14 Day Sampling Location

2021 Actual- Diving Locations

2022 Actual



Herbicide Residue Sampling Site B: N 42° 46.354 W -71° 25.440
Boat Launch & Base of Operations
Herbicide Residue Sampling Site A: N 42° 46.204 W -71° 25.455
0 250 500 1,000 Feet
Otternic Pond
Hudson, NH
2022 Milfoil Treatment & Sampling Map
FIGURE: 2
SURVEY DATE: 6/22/22
MAP DATE: 10/10/22
Legend
N
June Treatment Area (20 acres)
Actual Treatment Track (6/22/22)
2 Day Sampling Location
5 Day Sampling Location


Herbicide Residue
Sampling Site B:
N 42° 46.354
W -71° 25.440
Boat Launch &
Base of Operations
Herbicide Residue
Sampling Site A:
N 42° 46.204
W -71° 25.455
0 250 500 1,000
Feet
Otternic Pond
Hudson, NH
2022 Fanwort Treatment
& Sampling Map
FIGURE 2
SURVEY DATE: 7/21/22
MAP DATE: 10/10/22
Legend:
N
June Treatment Area (16.3 acres)
Actual Treatment Track (7/21/22)
1 Day Sampling Location
5 Day Sampling Location
SOLITUDE LAKE MANAGEMENT
590 LAKE STREET
SHREWSBURY, MA 01545
PHONE: (866) 460-1271
SOLITUDELAKEMANAGEMENT.COM

2023 Actual

No control actions- growth was too dense for diving.

2024 Proposed

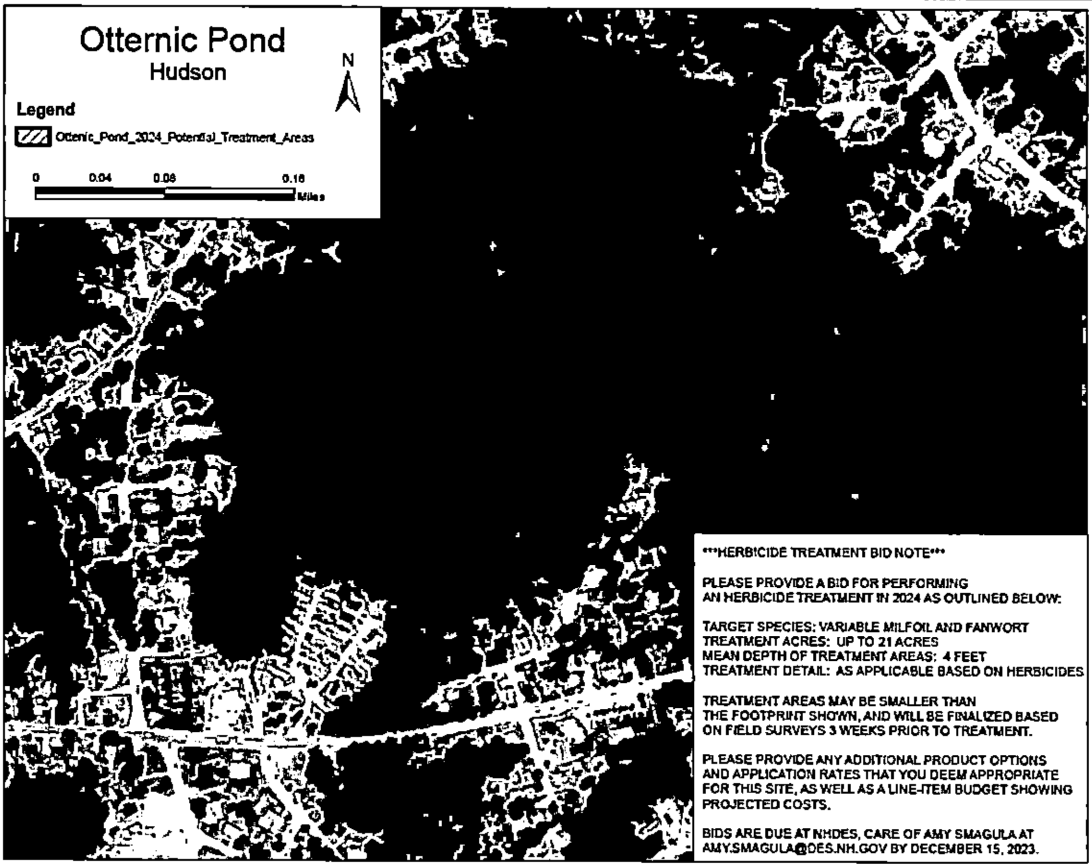
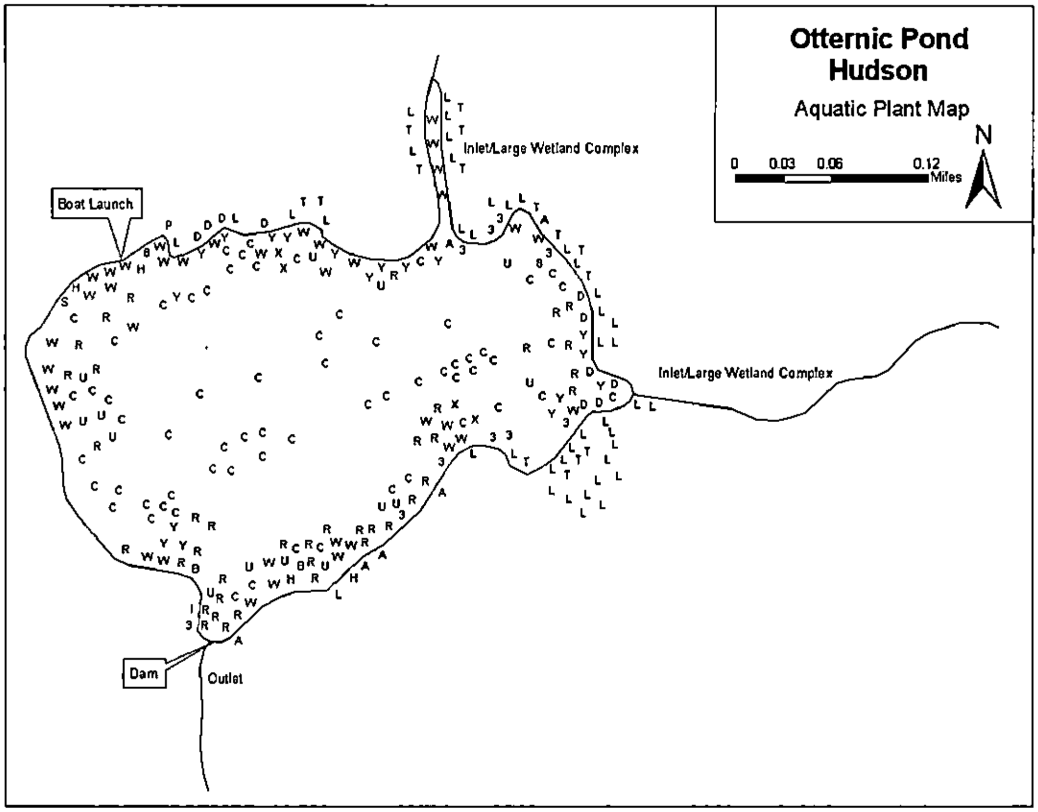


Figure 3: Map of Native Aquatic Macrophytes



Key to Macrophyte Map

Symbol	Common Name	Latin Name
W	White water-lily	*Nymphaea*
D	Swamp loosestrife	*Decodon verticillatus*
H	Smartweed	*Polygonum sp.*
S	Bur-reed	*Sparganium*
I	Iris	*Iris versicolor*
L	Purple loosestrife	*Lythrum salicaria*
P	Common reed	*Phragmites*
C	Coontail	*Ceratophyllum sp.*
R	Robbins pondweed	*Potamogeton robbinsii*
9	Buttonbush	*Cephalanthus occidentalis*
U	Bladderwort	*Utricularia*
Y	Yellow water-lily	*Nuphar*
B	Watershield	*Brasenia schreberi*
3	Pickerelweed	*Pontedaria cordata*
A	Arrowhead	*Sagittaria sp.*
X	Bassweed	*Potamogeton amplifolius*
T	Cattail	*Typha*
6	Bulrush	*Scirpus*
8	Watermeal	*Wolffia*

Figure 4: Bathymetric Map

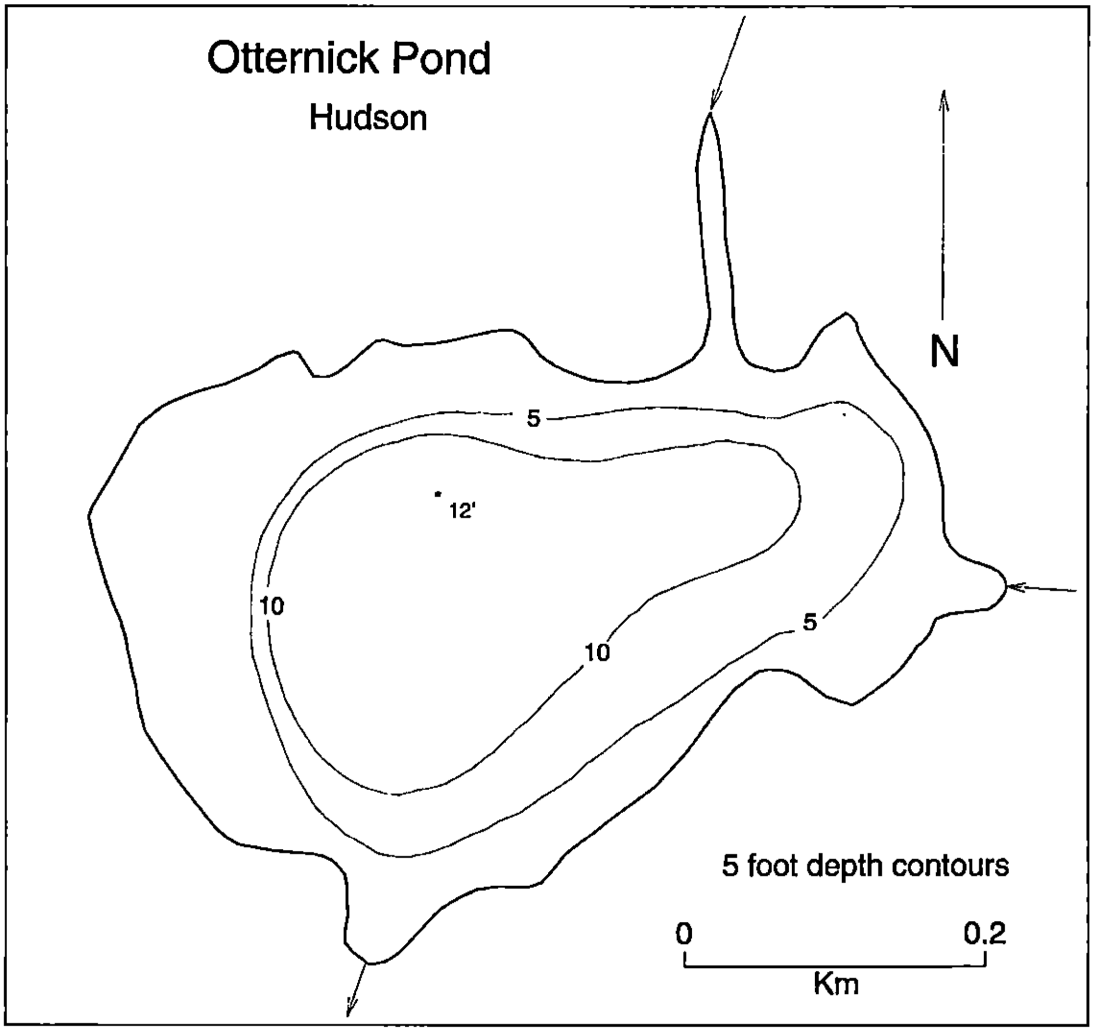


Figure 5: Critical Habitats or Conservation Areas

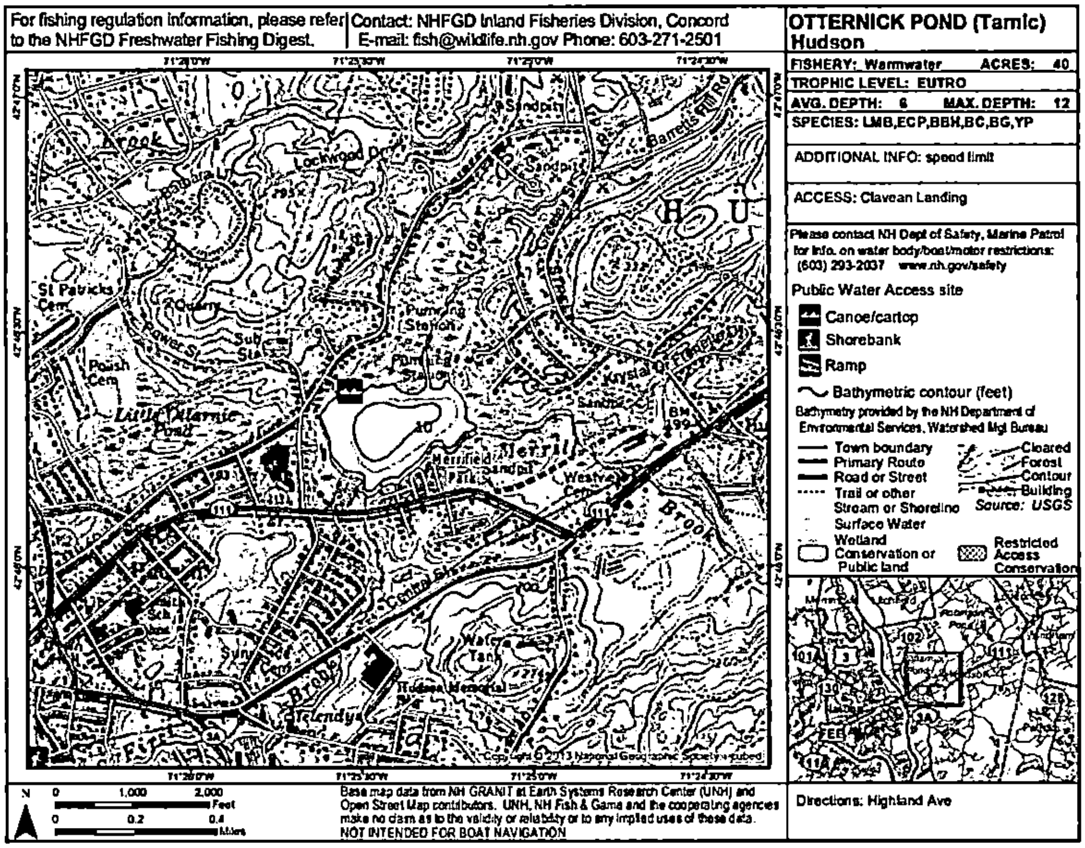


Figure 6: Access and Uses

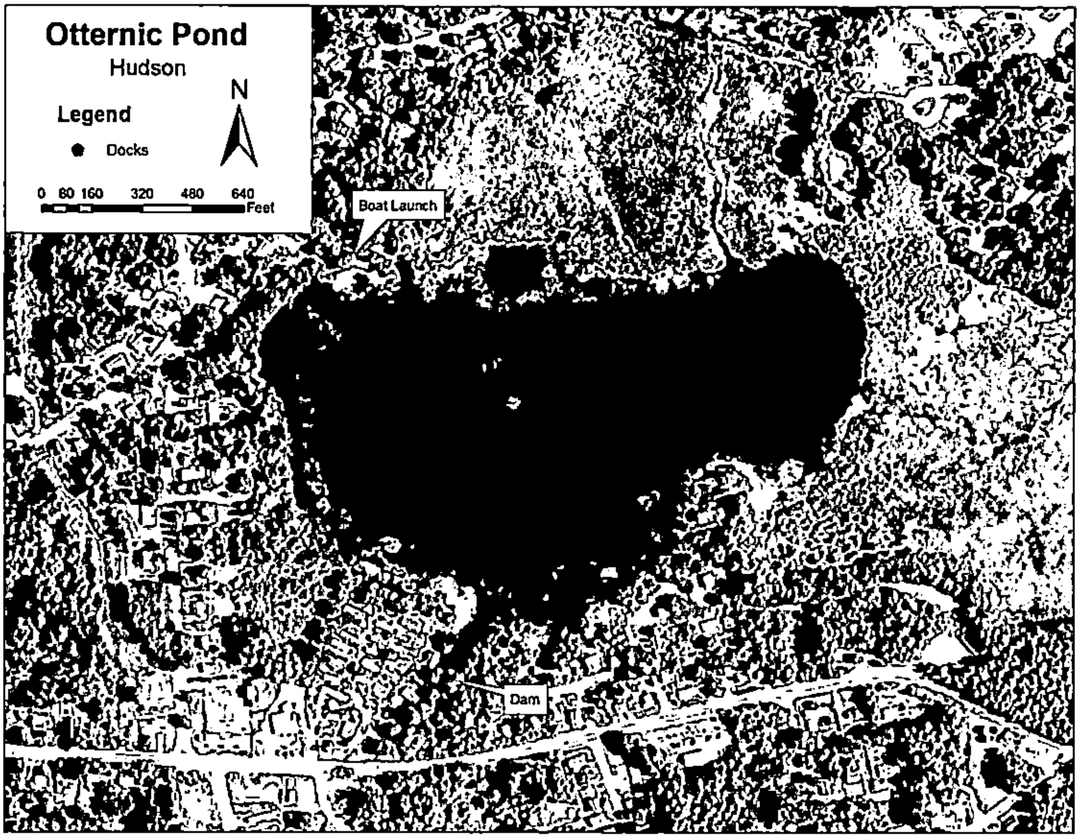
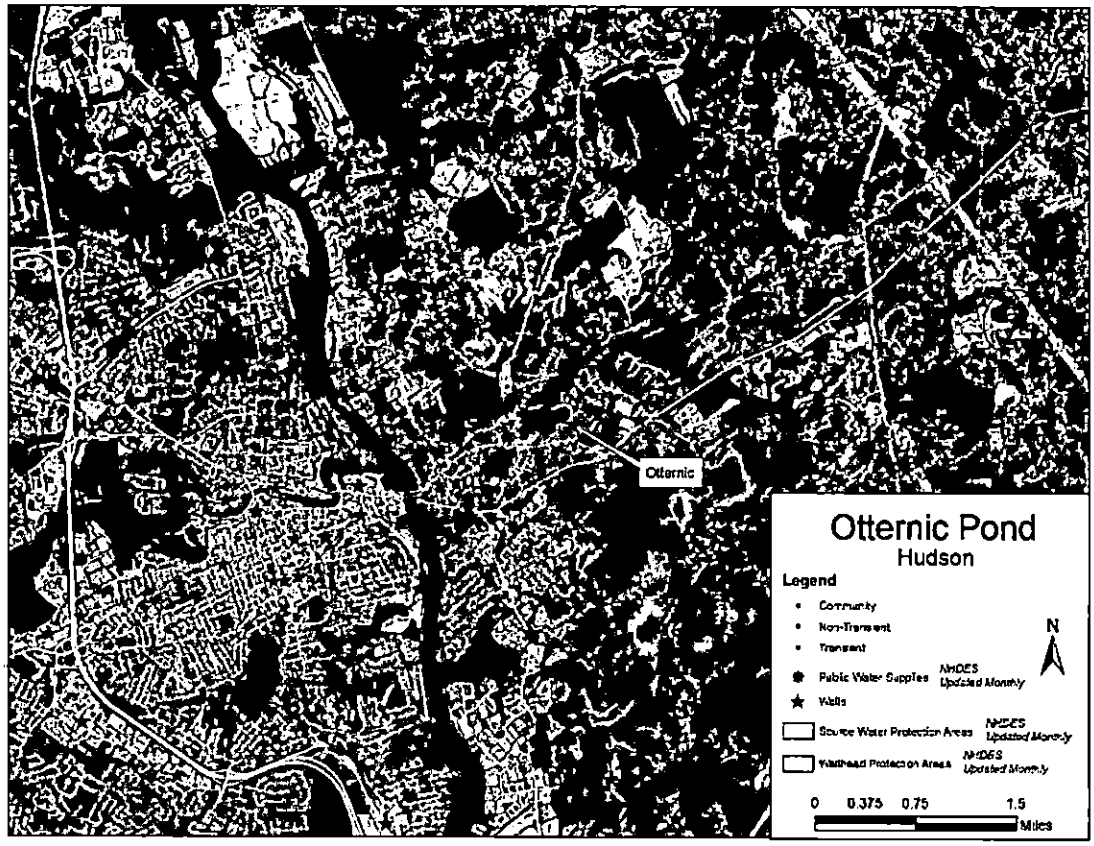


Figure 7: Wells and Water Supplies, 1:48,000 scale



Appendix A 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 exotic aquatic 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 (provide updated native plant map after review of milfoil and fanwort in the Fall or after treatment)

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 threat to downstream waterbodies from the exotic aquatic plant based on limnological characteristics (water chemistry, quantity, quality as they relate to movement or support of exotic plant growth).

Overall Control Options

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

1) Eradication: The goal is to completely remove the exotic plant infestation over time. In some situations this may be a rapid response that results in an eradication event in a single season (such as for a new infestation), in other situations a longer-term approach may be warranted given the age and distribution of the infestation. Eradication is more feasible in smaller systems without extensive expanded growth (for example, Lake Winnipesaukee is unlikely to achieve eradication of its variable milfoil), or without

upstream sources of infestation in other connected systems that continually feed the lake.

2) Maintenance: Waterbodies where maintenance is specified as a goal are generally those with expansive infestations, that are larger systems, that have complications of extensive wetland complexes on their periphery, or that have upstream sources of the invasive plant precluding the possibility for eradication. For waterbodies where maintenance is the goal, control activities will be performed on the waterbody to keep an infestation below a desirable threshold. For maintenance projects, thresholds of percent cover or other measurable classification will be indicated, and action will occur when exotic plant growth exceeds the threshold.

3) Containment: The aim of this approach is to limit the size and extent of the existing infestation within an infested waterbody if it is localized in one portion of that waterbody (such as in a cove or embayment), or if a whole lake is infested action may be taken to prevent the downstream migration of fragments or propagules. This could be achieved through the use of fragment barriers and/or Restricted Use Areas or other such physical means of containment. Other control activities may also be used to reduce the infestation within the containment area.

4) 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. Feasibility of control or control options may be revisited if new information, technologies, etc., develop.

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

Guidelines and requirements of each control practice are suggested and detailed below each alternative, but note that site specific conditions will be factored into the evaluation and recommendation of use on each individual waterbody with an infestation.

A. Hand-Pulling and Diver-Assisted Suction Harvesting

- Hand-pulling 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'). For larger areas Diver-Assisted Suction Harvesting (DASH) may be more appropriate.

- 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 or DASH
- 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).
- If a waterbody is fully infested and no other control options are effective, mechanical harvesting can be used to open navigation channel(s) through dense plant growth.

C. Herbicide Treatment

- Can be used if application of herbicide is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or density and 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
- 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 herbicide treatment as compared with other treatments.

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

- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other transient activities may cause fragmentation to occur.
- Can <u>not</u> 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 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.
- Use must be in compliance with the Wetlands Bureau rules.

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 habits 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 RSA 211:11 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 as they are illegal in New Hampshire.
- <u>Exotic</u> controls, such as insects, cannot be introduced to control a nuisance plant

unless approved by Department of Agriculture.

- Research should be conducted on a potential biological control prior to use to determine the extent of target specificity.

Appendix B Summary of Control Practices

Restricted Use Areas and Fragment Barrier:

Restricted Use Areas (RUAs) are a tool that can be use to quarantine a portion of a waterbody if an infestation of exotic aquatic plants is isolated to a small cove, embayment, or section of a waterbody. RUAs generally consist of a series of buoys and ropes or nets connecting the buoys to establish an enclosure (or exclosure) to protect an infested area from disturbance. RUAs can be used to prevent access to these infested areas while control practices are being done, and provide the benefit of restricting boating, fishing, and other recreational activities within these areas, so as to prevent fragmentation and spread of the plants outside of the RUA.

Hand-pulling:

Hand-pulling exotic aquatic plants is a technique used on both new and existing infestations, as circumstances allow. For this technique divers carefully hand-remove the shoots and roots of plants from infested areas and place the plant material in mesh dive bags for collect and disposal. This technique is suited to small patches or areas of low density exotic plant coverage.

For a new infestation, hand-pulling activities are typically conducted several times during the first season, with follow-up inspections for the next 1-2 years or until no re-growth is observed. For existing infestations, hand-pulling may be done to slow the expansion of plant establishment in a new area or where new stems are removed in a section that may have previously been uninfested. It is often a follow-up technique that is included in most management plans.

In 2007 a new program was created through a cooperative between a volunteer monitor that is a certified dive instructor, and the DES Exotic Species Program. A Weed Control Diver Course (WCD) was developed and approved through the Professional Association of Dive Instructors (PADI) to expand the number of certified divers available to assist with hand-pulling activities. DES has only four certified divers in the Limnology Center to handle problems with aquatic plants, and more help was needed. There is a unique skill involved with hand-removing plants from the lake bottom. If the process is not conducted correctly, fragments could spread to other waterbody locations. For this reason, training and certification are needed to help ensure success. Roughly 100 divers were certified through this program through the 2010 season. DES maintains a list of WCD divers and shares them with waterbody groups and municipalities that seek diver assistance for controlling exotic aquatic plants. Classes are offered two to three times per summer.

Diver Assisted Suction Harvesting

Diver Assisted Suction Harvesting (DASH) is an emerging and evolving control technique in New Hampshire. The technique employs divers that perform hand removal actions as described above, however, instead of using a dive bag a mechanical suction device is used to entrain the plants and bring them topside where a tender accumulates and bags the material for disposal. Because of this variation divers are able to work in moderately dense stands of plants that cover more bottom area, with increased efficiency and accuracy.

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:

Benthic barriers are fiberglass coated screening material that can be applied directly to the lake bottom to cover and compress aquatic plant growth. Screening is staked or weighted to the bottom to prevent it from becoming buoyant or drifting with current. The barriers also serve to block sunlight and prevent photosynthesis by the plants, thereby killing the plants with time. While a reliable method for small areas of plants (roughly 100 sq. ft. or less), larger areas are not reasonably controlled with this method due to a variety of factors (labor intensive installation, cost, and gas accumulation and bubbling beneath the barrier).

Targeted Application of Herbicides:

Application of aquatic herbicides is another tool employed for controlling exotic aquatic plants. Generally, herbicides are used when infestations are too large to be controlled using other alternative non-chemical controls, or if other techniques have been tried and have proven unsuccessful. Each aquatic plant resLakes differently to different herbicides and concentrations of herbicides, but research performed by the Army Corps of Engineers has isolated target specificity of a variety of aquatic herbicides for different species.

Generally, 2,4-D (Navigate formulation) is the herbicide that is recommended for control of variable milfoil. Based on laboratory data this is the most effective herbicide in selectively controlling variable milfoil in New Hampshire's waterbodies.

A field trial was performed during the 2008 summer using the herbicide Renovate to control variable milfoil. Renovate is a systemic aquatic herbicide that targets both the shoots and the roots of the target plant for complete control. In this application it was dispersed as a granular formulation that sank quickly to the bottom to areas of active uptake of the milfoil plants. A small (<5 acre) area of Captains Lake in Salem was treated with this systemic herbicide. The herbicide was applied in pellet form to the infested area in May 2008, and showed good control by the end of the growing season. Renovate works a little more slowly to control aquatic plants than 2,4-D and it is a little more expensive, but presents DES with another alternative that could be used in future treatments.

During the summer of 2010, DES worked with other researchers to perform field trials of three different formulations of 2,4-D in Lake Winnisquam, to determine which product was most target-specific to the variable milfoil. Navigate formulation was used, as were a 2,4-D amine formulation, and a 2,4-D amine and triclopyr formulation (MaxG). Although the final report has not been completed for this study, preliminary results suggest that all three products worked well, but that Navigate formation may be the most target specific of all three.

Another herbicide, Fluridone, is sometimes also used in New Hampshire, mainly to control growths of fanwort (*Cabomba caroliniana*). Fluridone is a systemic aquatic herbicide that inhibits the formation of carotenoids in plants. Reduced carotenoids pigment ultimately results in the breakdown of chlorophyll and subsequent loss of photosynthetic function of the plants.

Other aquatic herbicides are also used in New Hampshire when appropriate (glyphosate, copper compounds, etc). The product of choice will be recommended based on what the target species is, and other waterbody-specific characteristics that are important to consider when selecting a product.

In 2018, a new aquatic formulation of an herbicide was labeled and licensed for use. ProcellaCOR is a reduced-risk liquid formulation herbicide that is a systemic. Based on New Hampshire field data, it works well on variable milfoil, it is taken up very quickly following treatment (hours) and it degrades quickly in the water column, with typical non-detect readings within 24-48 hours post treatment.

Extended Drawdown

Extended drawdown serves to expose submersed aquatic plants to dessication and scouring from ice (if in winter), physically breaking down plant tissue. Some species can resLake well to drawdown and plant density can be reduced, but for invasive species drawdown tends to yield more disturbance to bottom sediments, something to which exotic plants are most adapted. In waterbodies where drawdown is conducted exotic plants can often outcompete native plants for habitat and come to dominate the system.

Some waterbodies that are heavily infested with exotic plants do conduct drawdowns to reduce some of the invasive aquatic plant density. During this reporting period both Northwood Lake (Northwood) and Jones Lake (New Durham) coordinated deep winter drawdowns to reduce growths of variable milfoil (the drawdown on Northwood Lake is primarily for flood control purposes, but they do see some ancillary benefits from the technique for variable milfoil control).

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 lakes 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 to fashion, 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.

References

Department of Environmental Services. 2006: 2006 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology. November 2005. New Hampshire Department of Environmental Services. NHDES-R-WD-05-29. Available at http://des.nh.gov/WMB/swqa/calm.html

Halstead, J.M., J. Michaud, S. Hallas-Burt, and J.P. Gibbs. 2003. "An Hedonic Analysis of Effects of a Nonative Invader (*Myriophyllum heterophyllum*) on New Hampshire (USA) Lakefront Properties." Environmental Management. 32 (3): 391 – 398

Luken, J.O. and J.W. Thieret. 1997. Assessment and Management of Plant Invasions. Springer-Verlag, New York. 324 pages.

WORK ORDER
EVR248

25 March 2024

Doreena Stickney
12 School Street
Town of Hudson Engineering Department
Hudson, NH 03051

Re: Musquash Conservation Area Invasive Plant Treatment in Hudson, NH

Sign, date, and return a copy back to the below address. Retain a copy for your records.

I/We agree to hire Full Circle Forestry, LLC to treat invasive plant species on said property in Hudson, NH as shown by Ken Dickenson (HCC) to Eric Radlof (FCF, LLC) on 8/3/2023 and further noted by the scope of work provided 8/10/23. Areas to be treated include the Primary Area and Secondary Area as noted in the scope of work. Treatments will be conducted by licensed NH pesticide applicators at $125.00/hr with a not to exceed rate of $3,000.00 through foliar or cut stump herbicide treatments.

The Knotweed Control Area will be treated in conjunction with the previously stated areas. Treatment will be conducted by licensed NH pesticide applicators at $125.00/hr with a not to exceed rate of $1,250.00 through foliar or cut stump herbicide treatments. Treatment is contingent upon the knotweed being cut down by July 1. If the knotweed has not been cut down by the stated date, FCF,LLC will conduct this work at $125.00/hr with a not to exceed rate of $625.00.

All treatments are contingent upon access granted for ATV usage to transport supplies and the approval of a Right-of -Way/Watershed Permit with the NH Division of Pesticide Control. The permits will be completed at a flat rate of $250.00.

Additional meetings with the town, abutters, etc. will be at a fee of $85.00/hr. including travel.

Foliar herbicide treatments will be conducted from late August to mid-October as long as weather allows for the 2024 season.

ERIC RADLOF
113 Old Pound Road, Antrim, NH 03440
eradlof.fcf@gmail.com
603-321-3482

FULL CIRCLE FORESTRY, LLC

Payment is due upon completion of the individual treatments. Invoice to be provided.

Signatures:

Submitted by: ______________________ Date: 25 March 2024
Eric V. Radlof

Acceptance by: ______________________ Date: ______________
Signature(s)

ERIC RADLOF
113 Old Pound Road, Antrim, NH 03440
eradlof.fcf@gmail.com
603-321-3482

Musquash Conservation Area - Invasive Plant Control (Herbicide Treatment) - Scope of Work 2023:

Submitted by: Ken Dickinson, Hudson Conservation Commission member on August 10, 2023

Summary:

Treat invasive plants and shrubs within a range of 2-3' of trail edges with a focus on Poison Ivy and Honeysuckle Vines in effort to keep trails open and safe for hiking. Other invasive species present: Multiflora Rose, Burning Bush, Autumn Olive, Glossy Buckthorn, Bittersweet, Garlic Mustard

<u>Primary Area (early October 2023):</u>

Nash/Hamblett Trail - from parking area kiosk to Meetinghouse Trail southern junction (1st junction).

Colburn Trail - within 200 ft of parking area

Meetinghouse Trail - full length

<u>Secondary Area (early October 2023):</u>

Whispering Pines Trail – short loop trail located off of Nash/Hamblett Trail

Colburn Trail – both segments within the Powerline Corridor Easement

Nash-Hamblett Trail – segments within the Powerline Corridor Easement

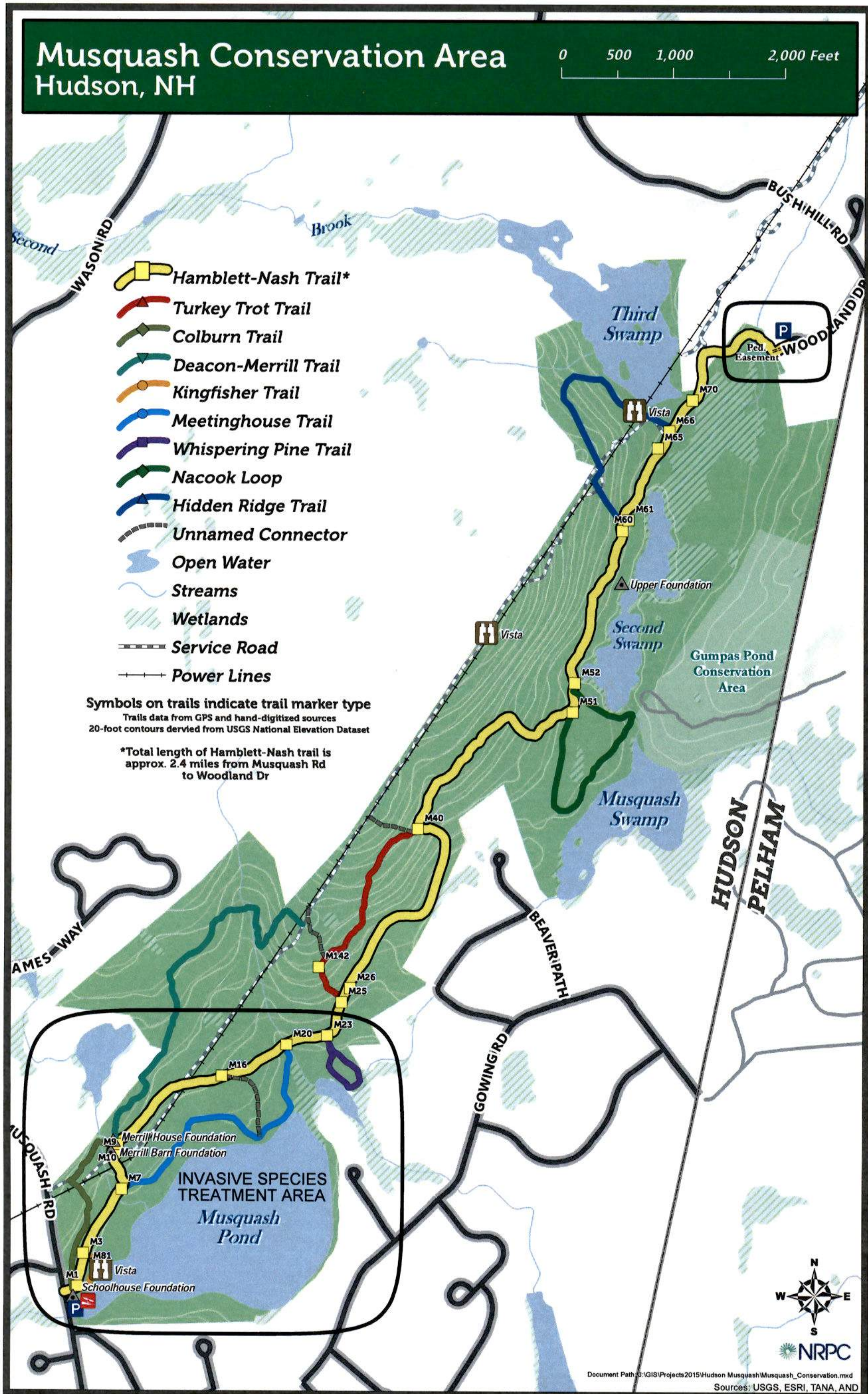
Nash-Hamblett Trail – northern end of trail (first 200 ft) from Woodland Drive entrance

Bonus: first 25 ft of trail located across from Copper Hill Road (along Musquash Road embankment)

<u>Knotweed Control Area (spring 2024):</u>

Merrill Barn Foundation (located at intersection of Nash-Hamblett and Colburn Trails)

Treatment Area = 105' x 70' (3700 SF) triangular area



Musquash Conservation Area
Hudson, NH
0 500 1,000 2,000 Feet
Hamblett-Nash Trail*
Turkey Trot Trail
Colburn Trail
Deacon-Merrill Trail
Kingfisher Trail
Meetinghouse Trail
Whispering Pine Trail
Nacook Loop
Hidden Ridge Trail
Unnamed Connector
Open Water
Streams
Wetlands
Service Road
Power Lines
Symbols on trails indicate trail marker type
Trails data from GPS and hand-digitized sources
20-foot contours dervied from USGS National Elevation Dataset
*Total length of Hamblett-Nash trail is approx. 2.4 miles from Musquash Rd to Woodland Dr
Second Brook
WASON RD
BUSH HILL RD
WOODLAND DR
Ped. Easement
Third Swamp
Vista
M70
M66
M65
M61
M60
Upper Foundation
Second Swamp
Gumpas Pond Conservation Area
M52
M51
Musquash Swamp
M40
HUDSON
PELHAM
BEAVER PATH
AMES WAY
M142
M26
M25
M23
M20
M16
GOWING RD
MUSQUASH RD
M9
Merrill House Foundation
M10
Merrill Barn Foundation
M7
INVASIVE SPECIES TREATMENT AREA
Musquash Pond
M3
M81
M1
Schoolhouse Foundation
N
E
S
W
NRPC
Document Path: J:\GIS\Projects2015\Hudson Musquash\Musquash_Conservation.mxd
Sources: USGS, ESRI, TANA, AND

TOWN OF HUDSON

Conservation Commission

William Collins, Chairman   David Morin, Selectmen Liaison

12 School Street · Hudson, New Hampshire 03051 · Tel: 603-886-6008 · Fax: 603-594-1142

March 29, 2024

Mr. Frank Bogan and Mrs. Florence Bogan
116 Robinson Road
Hudson, NH 03051

Dear Mr. and Mrs. Bogan,

I hope this letter finds you in good health and spirits. Allow me to introduce myself as Bill Collins, Chairman of the Hudson Conservation Commission, Hudson, NH.

I understand that you may be surprised to receive a letter from our board, but please rest assured that our intentions are sincere. After conducting extensive research and analysis, the Conservation Commission has identified your properties at **114 Robinson Road and 18R Stoney Lane** as assets that align with our long-term goals and interests of land preservation in our community.

The Conservation Commission prides itself on being transparent and respectful in all our dealings and would appreciate the opportunity to sit down with you to discuss the possibility of purchasing these properties with our goal being to increase the inventory of undisturbed open space in the town of Hudson and further protect the Robinson Pond watershed from continued development we believe that purchase of your properties would help achieve these intentions.

Land preservation plays an important role in protecting our watersheds and wetlands, aides in reducing air and water pollution and improves the overall ecological health any community. Hudson is currently undergoing a hefty development phase and now it's more important than ever to permanently preserve some of the remaining undeveloped tracks of land for future generations to enjoy.
Should you have any questions or wish to discuss this matter further, please do not hesitate to contact me personally at (603) 247-8600 or through my personal email listed below. You can also feel free to reach out to the Conservation Commission town liaison office via edhima@hudsonnh.gov, dstickney@hudsonnh.gov or dkirkland@hudsonnh.gov.

Thank you for your time and consideration. I look forward to hearing from you.

Yours sincerely,

Bill Collins, Chairman
Hudson Conservation Commission
wcoll66956@gmail.com
cell: (603) 247-8600

Expenditure Report - Including Carry Forward Activity
Conservation Committee
Town of Hudson, NH
As Of: March 2024, GL Year 2024

Account Number	Budget	Prior Year Encumbered	Budget & PY Adjustments	Net Budget	MTD Exp	YTD Exp	Encumbered	Balance Available	%Used
Conservation Fund									
06-0000-6500-000-000 Purchase Property	0.00	0.00	0.00	0.00	0.00	328,452.00	0.00	-328,452.00	0.000
06-4619-5586-202-000 Conserv Comm, Sm. Equipment Mtce	2,300.00	0.00	0.00	2,300.00	0.00	183.80	0.00	2,116.20	7.991
06-4619-5586-217-000 Conserv Comm, Assoc Dues/Fees	1,327.00	0.00	0.00	1,327.00	100.00	1,225.00	0.00	102.00	92.313
06-4619-5586-235-000 Conserv Comm, Registration Fees	500.00	0.00	0.00	500.00	0.00	0.00	0.00	500.00	0.000
06-4619-5586-252-000 Conserv Comm, Prof Services	48,626.00	28,000.00	0.00	76,626.00	0.00	6,040.00	96,460.00	-25,874.00	133.767
Total Conservation Fund									
Selected Year	**52,753.00**	**0.00**	**0.00**	**52,753.00**	**100.00**	**331,100.80**	**73,260.00**	**-351,607.80**	**766.517**
Prior Year	**0.00**	**28,000.00**	**0.00**	**28,000.00**	**0.00**	**4,800.00**	**23,200.00**	**0.00**	**100.000**
Sort Total	**52,753.00**	**28,000.00**	**0.00**	**80,753.00**	**100.00**	**335,900.80**	**96,460.00**	**-351,607.80**	**535.411**

Expenditure Report - Including Carry Forward Activity
Conservation Committee
Town of Hudson, NH
As Of: March 2024, GL Year 2024

Account Number	Budget	Prior Year Encumbered	Budget & PY Adjustments	Net Budget	MTD Exp	YTD Exp	Encumbered	Balance Available	%Used
Selected Year	52,753.00	0.00	0.00	52,753.00	100.00	331,100.80	73,260.00	-351,607.80	766.517
Prior Year	0.00	28,000.00	0.00	28,000.00	0.00	4,800.00	23,200.00	0.00	100.000
Grand Total	52,753.00	28,000.00	0.00	80,753.00	100.00	335,900.80	96,460.00	-351,607.80	535.411

Town of Hudson, NH
Conservation Cash Flow
Fiscal Year 2024

Conservation	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Beginning Bal.	764,609.09	766,596.24	768,588.55	770,603.72	772,691.53	774,717.46	776,816.41	778,915.30	780,884.08	-	-	-
Income												
Deposits	-	-	-	-	-	-	-	-	-	-	-	-
Interest	1,987.15	1,992.31	2,015.17	2,087.81	2,025.93	2,098.95	2,098.89	1,968.78	2,109.88	-	-	-
Total Income	1,987.15	1,992.31	2,015.17	2,087.81	2,025.93	2,098.95	2,098.89	1,968.78	2,109.88	-	-	-
Expenditures												
Expenditures	-	-	-	-	-	-	-	-	-	-	-	-
Bank Charges	-	-	-	-	-	-	-	-	-	-	-	-
Total Expend.	-	-	-	-	-	-	-	-	-	-	-	-
Ending Balance	766,596.24	768,588.55	770,603.72	772,691.53	774,717.46	776,816.41	778,915.30	780,884.08	782,993.96	-	-	-

TOWN OF HUDSON

Conservation Commission

William Collins, Chairman Dave Morin, Selectmen Liaison

12 School Street · Hudson, New Hampshire 03051 · Tel: 603-886-6008 · Fax: 603-816-1291

DATE: March 11, 2024

MEETING MINUTES: Below is a listing of minutes for the Hudson Conservation Commission. Minutes are not a verbatim record of each meeting, but rather represent a summary of the discussion and actions taken at the meeting. All Conservation Commission meetings are televised live and repeated during the following week on HCTV, cable television channel 22. Official copies of the minutes are available to read and copy at the Town Engineer's Office during regular business hours (Monday through Friday, 8:00 A.M. to 4:30 P.M.).

Should you have any questions concerning these minutes or wish to see the original recording, please contact the Town Engineer's Office at 603-886-6008.

In attendance = X Alternates Seated = S Partial Attendance = P Excused Absence = E

William Collins Chairman _X_	Carl Murphy Vice-Chair _X_	Ken Dickinson Clerk _X_	Brian Pinsonneault Member _E_
Linda Krisciunas Alternate _S_	David Morin Selectman Rep _X_	Elvis Dhima Town Engineer _E_	

CALL TO ORDER BY CHAIRPERSON AT 07:02 P.M.

PLEDGE OF ALLEGIANCE

ROLL CALL

SEATING OF ALTERNATES:

Public Input Related to Non-Agenda Items: none

I. New Business: none

II. Old Business: none

III. Other Business

a. Forestry Income:
Chairman Collins reviewed final income received from the Rangers Town Forest Timber Harvest. Rangers Town Forest Stumpage Summary = $28,185.45 total harvest value will be added into the Forestry Account. Approximately half of the harvest income was from White Pine. The highest value/MBF was from Red Oak (12 MBF) and Black Oak (14 MBF); however their volume was of lesser quantity than White Pine (74 MBF).

b. April Trail Work Day: Sunday, April 14th, 9 AM-12 PM. Meet at location (TBD). Chariman Collins looks forward to installing timber steps at the Woodland Dr. trail entrance.

c. Open Space Continued Discussion:

Chairman Collins asked Mr. Dickinson if he had performed any research last month. Mr. Dickinson noted that he looked further at the list regarding parcels in the northern portion of Hudson. There are at least five contingous parcels that are over 15 acres in size each. These parcels are located in the vicinity of Robinson Pond and Boyd Road. Some parcels are landlocked, contain substantial wetlands, or have access issues due to steep slopes or another reason. This is in effort to inquire about their long term plans for their property and have them understand the value of a potential group effort to preserve open space and protect the Robinson Pond watershed area. Mr. Dickinson mentioned that it might be a good idea to invite these landowners to a meeting in effort to discuss this opportunity. Mr. Collins noted that the Commission has done a good job of preserving land along the southern portion of Robinson Pond and he would be in favor to concentrate efforts to preserve land in the northern of Robinson Pond. After further discussion, Mr. Collins agreed to draft a letter to each large parcel land owner that is listed on pg. 17 of the 2012 Open Space Master Plan. Mr. Dickinson noted these parcels as the Commission had not recently considered them. Preservation opportunities should be evaluated throughout Town as part of the Open Space Master Plan update. Mr. Collins stated that he would focus on land parcels that are near either Robinson Pond or Musquash Conservation Area. Mr. Dickinson will begin working on updating an excel spreadsheet as time allows including merging Mr. Collins database with the other databases that were included in the 2012 Open Space Master Plan.

d. Newspaper Article:

Chairman Collins submitted a news article that was published in February's local newspaper. It included Mr. Pinsonneault's wood duck box project and our recent trail work day. Mr. Collins asked if it was acceptable to submit future articles and all members determined it to be generally acceptable.

e. Pond Treatments:

Chairman Collins noted that grant contracts/paperwork had been received from NHDES recently regarding Milfoil and Fanwort herbicide treatments at both Robinson and Ottarnic Ponds. Solitude anticipates performing treatments in June and July. Town of Hudson contribution for professional services is approx. $36,000. Mr. Collins noted that he had extreme difficulty paddling at Ottarnic

Pond last summer due to the extreme level of invasive weed growth. Mr. Dickinson noted that he spoke with a landowner who lives on Robinson Pond while hiking around it. They are actively using Robinson Pond throughout the year and care about its water quality. Mr. Dickinson expressed that it would be a good year to perform treatments early in the season as it has been generally warmer and wetter than usual. Although the cost is higher now, it has been at least two years since any herbicide treatment has been performed. Mr. Collins noted that plans and maps for both ponds are forthcoming.

IV. Financial Status:

Conservation Fund Balance = $780,884. Forestry Fund Balance = approx. $44,000.

V. Correspondence:

Chairman Collins reviewed our monthly correspondence which included the following:

a) NHACC Saving Special Places =4/6/2024
b) How to Follow a State Bill
c) Carbon Harvesting Commodities (general discussion)
d) Hudson Chamber of Commerce = NH Business Review Article
e) Letter of Acknowledgement from SPNHF for our recent donation
f) Notice of Maintenance (moving activities) along gas line corridor for 70 Rangers Drive and Windham Rd. scheduled for March and April.
g) NH Lakes Program annual contribution request:
Motion by Ms. Krisciunas to contribute $100.00 from our "Associaton Dues and Fees" budget line item, seconded by Mr. Murphy.

Motion Carried 4/0/0

VI. Approval of Minutes:

Ms. Krisciunas moved to accept the February 12, 2024 regular meeting minutes, seconded by Mr. Murphy.

Motion Carried 4/0/0

VII. Commissioner's Comments:

Selectman Morin reminded everyone of the importance of our Town voting day tomorrow.

Ms. Krisciunas inquired if we had enough money in our professional services line item to pay for the proposed herbicide treatments at both ponds and the herbicide treatment at Musquash Conservation Area. Mr. Collins responded that the Town is committed to the pond treatment work and has a 50/50 split with the State for these services. The HCC is not currently committed to the treatments at Musquash Conservation Area. The HCC will most likely carry a negative balance for a short period of time for the pond treatment work; however that is a regular occurrence as the work carries over to the next fiscal year. Ms. Krisciunas reminded everyone that we need to contact Full Circle Forestry soon to schedule work at Musquash Conservation Area. Chairman Collins also noted that maintenance can also be paid for using our Conservation Fund account if needed.

Mr. Dickinson asked if Ms. Smagula had provided any grant updates for the NHDES Aquatics Invasive Species program. Chairman Collins noted that NHDES is currently working on invasive species treatment plans for both Robinson and Ottarnic Ponds. 50% grant award for this work will be forthcoming for review in March.

Mr. Dickinson noted that Ottarnic Pond is also a Great Pond. Although it is smaller in size, it is an equally important resource as Robinson Pond.

Chairman Collins noted that we may have a new member in April. Ticks are out and check your pets.

VIII. Motion to adjourn:

Mr. Murphy moved to adjourn our regular meeting at 8:09 PM; seconded by Ms. Krisciunas.

Motion Carried 4/0/0

Ken Dickinson

Ken Dickinson, Clerk

emailed to cc
3/22/24 258

NH LAKES

March 21, 2024

Dear Members of the Town of Hudson Conservation Commission,

Looking at some of the factors that most affected lake health in 2023, it's hard not to feel a little hopeless. What can any of us do to prevent another warm winter or more record-setting flooding?

But, please take heart. The actions of the NH LAKES community over the past year, as in previous years, offered so many reasons for optimism. It is a testament to NH LAKES supporters, staff, volunteers, and partners that there is so much positive impact to report.

Communities at eight lakes are grateful for the Lake Hosts who prevented costly infestations of invasive species in their lake. Neighbors worked with neighbors to learn new ways to live lake -friendly. And, many people became the voice New Hampshire's lakes needed at the State House advocating for lake-friendly legislation .

Our lakes are showing obvious signs of trouble–another record-setting year of cyanobacteria advisories and the alarming discovery of the invasive spiny water flea in two of our largest lakes. These warning signs have served as a wake -up call for many and have fueled a response like I have never seen before.

There is still so much work to do and it will take everyone working together to make it happen.

NH LAKES has a bold vision. Our vision is a state where all lakes are clean and healthy and caring for them is a way of living, doing business, and governing.

I am pleased to provide you with this copy of our 2023 impact report. In it, you will see how the NH LAKES community, instead of feeling hopeless, is taking bold action for the lakes we all love.

Committed to healthy lakes,

Andrea

Andrea LaMoreaux, President and Policy Advocate

NH LAKES

2023 IMPACT REPORT

Working together for the lakes we all love.

Lake-Friendly Living Becomes a Way of Life for Many

As our lakes show obvious signs of stress, more and more property owners are recognizing the role they play in lake health. They are learning about what they can do to help—they are becoming LakeSmart. Now in its fifth year in New Hampshire, LakeSmart is inspiring entire communities to embrace lake-friendly living as a way of life.

In 2023, the first LakeSmart Community Award was presented to the Kezar Lake Protective Association in North Sutton. The beauty of Kezar Lake and its past struggles with serious water quality problems inspired over 50% of the property owners around the lake to participate in the LakeSmart program. Together, neighbor inspiring neighbor, they are working to reduce the polluted runoff water entering their fragile lake.

Delivering the NH LAKES LakeSmart Program statewide received some help this year with two new partnerships: Newfound Lake Region Association and Squam Lakes Association. They join the Lake Winnipesaukee Association in helping NH LAKES deliver the tools and resources of the LakeSmart Lake-Friendly Living Program in their watersheds.

Cover: Mary Ropka and John Philbrick of Little Lake Sunapee proudly show off their LakeSmart Award, along with their dog, Scarlett!

Top Right: Members of the Kezar Lake Protective Association accept the first LakeSmart Community Award in New Hampshire!

Right: Chip and Gail Bull of Monomonac Lake were one of 50 property owners to receive the LakeSmart Award in 2023.

LakeSmart 2023: By the Numbers

316	CUSTOMIZED LAKE-FRIENDLY LIVING REPORTS CREATED	1,044 SINCE 2019
167	SITE VISITS PROVIDING CUSTOM LAKE-FRIENDLY IDEAS	553 SINCE 2019
49	LAKES VISITED THROUGHOUT NEW HAMPSHIRE	163 SINCE 2019
50	LAKESMART AWARDS PRESENTED TO PROPERTY OWNERS	180 SINCE 2019

Thank you to our LakeSmart Partner Organizations!

LAKE WINNIPESAUKEE ASSOCIATION
Keep Winni Blue

NEWFOUND LAKE REGION ASSOCIATION

SQUAM LAKES ASSOCIATION

Lake Hosts SAVE the Day

Since 2002, boaters at popular boat ramps throughout the state have been greeted by Lake Hosts. And, every summer, these Lake Hosts remain vigilant as they do their part to prevent invasive hitchhiking plants and animals from making their home in lakes where they don't belong.

While 2023 will be remembered for some heroic saves at pristine lakes, it will also be remembered as the summer the invasive spiny water flea found its way to New Hampshire. This invasive species was found in Lake Winnipesaukee and Lake Winnisquam. Looking ahead, your NH LAKES Conservation Team is working with the state and other partners to develop new resources to prevent the spread of the spiny water flea to other lakes in the state.

2023 SAVES

In 2023, 33% of the boats met by a Lake Host were last used in a waterbody infested with invasive species.

Lake Hosts—our heroes! Lake Hosts saw and removed these invasive species from boats headed into uninfested lakes—saving these communities from the costly burden of managing the inevitable infestations.

Conway Lake, Conway (Eurasian Water Milfoil)

Lake Potanipo, Brookline (Variable Milfoil)

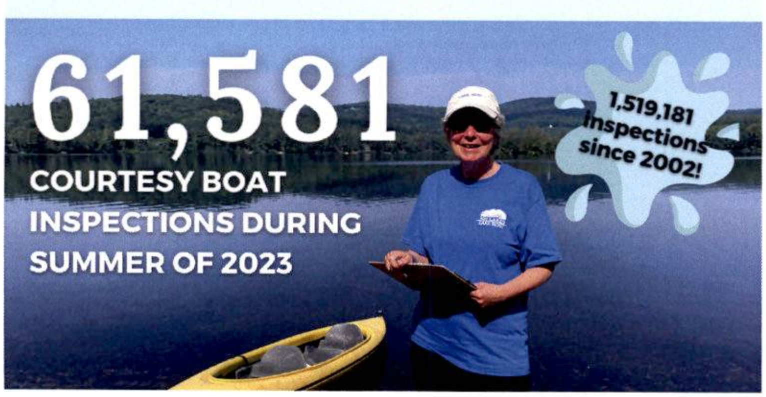
Lake Winnisquam, Laconia (Water Chestnut Seed)

Laurel Lake, Fitzwilliam (Eurasian Water Milfoil

Newfound Lake, Bristol (Eurasian Water Milfoil)

Nubanusit Lake, Hancock/Nelson (Variable Milfoil)

Pleasant Pond, Francestown (Variable Milfoil)



2023 Lake Host Season Data

Boat Ramps Covered

2002 45

2023 102

Lake Hosts

2002 161

2023 754

Partner Groups

2002 38

2023 76

1,665 'Saves' at 61 Waterbodies Since 2002

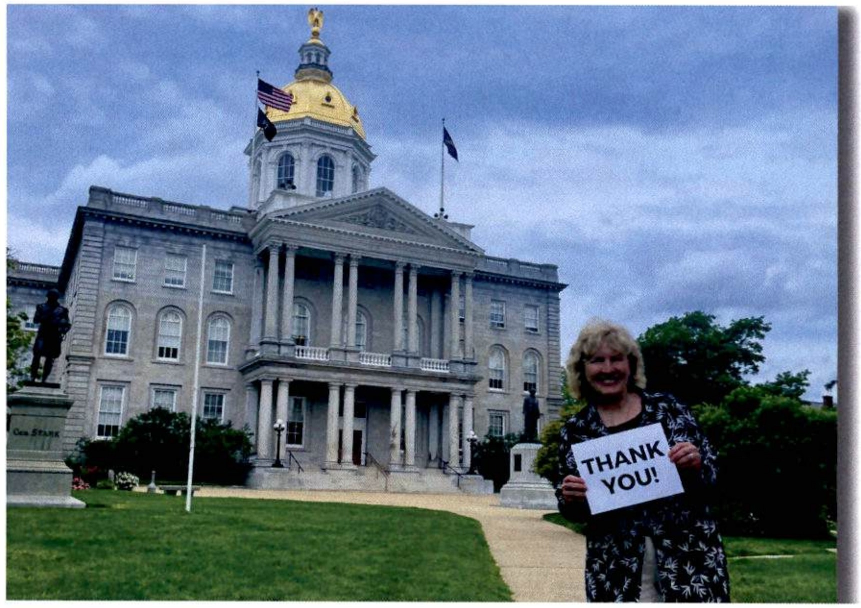
Ten different invasive species have been stopped from entering pristine lakes since 2002.

Fanwort (814)
Variable Milfoil (664)
Eurasian Milfoil (101)
European Naiad (24)
Mystery Snail (23)
Water Chestnut (20)
Curly Leaf Pondweed (16)
Zebra Mussel (1)
Common Reed (1)
Purple Loosestrife (1)

A Million Thanks: Lake Advocates Make Waves for Lake Health

The NH LAKES Lake Advocates Network is a vital force in preserving New Hampshire's lakes. Composed of passionate individuals from lake-minded organizations, they stay current on the advocacy issues affecting our lakes and mobilize their communities to reach out to legislators.

Thanks to your support, the Lake Advocates Network rallied during a critical time for our lakes. Hundreds of supporters just like you advocated for a cyanobacteria mitigation fund to provide lake associations, municipalities, and water suppliers with grants to manage and prevent cyanobacteria. Your impact is evident—the motion passed, creating a $1 million Cyanobacteria Mitigation Fund for our lakes!



Rep. Rosemarie Rung extends her heartfelt gratitude in front of the State House, thanking the incredible support that helped rally lawmakers and secure a $1 million Cyanobacteria Mitigation Grant Fund to rejuvenate our precious lakes. Together, we're making a real difference for our environment and our communities. Thank you!

As a results of the bold actions of NH LAKES partners and supporters, NH LAKES was named the 2023 Champion in Action for Environmental Sustainability by Citizens and the New Hampshire Union Leader. This recognition gave NH LAKES a megaphone to help raise awareness of the statewide threats our lakes face.

CHAMPIONS IN ACTION
BE INSPIRED

Citizens

The Cyanobacteria Plan: A Coordinated Statewide Response

Thanks to your backing of House Bill 1066 last year, the Cyanobacteria Advisory Committee was established, with NH LAKES President and Policy Advocate, Andrea LaMoreaux, among its members.

This November, guided by the committee's insights, the New Hampshire Department of Environmental Services unveiled a strategy to combat cyanobacteria blooms in our cherished lakes and ponds, including:

- **Reducing Polluted Runoff**
- **Enhanced Monitoring**
- **Education & Outreach**
- **Drinking Water Safety**

Mark Your Calendar: Learn to Protect Our Lakes on June 6

Learn about our annual Lakes Congress conference at **nhlakes.org/lakes-congress.** Registration opens in April!

"Great to see and meet people from all over the state interested in protecting our lakes."

—2023 Lakes Congress attendee

SCAN HERE TO SEE THE FULL 2023 IMPACT REPORT!