Project Final Report

Lake Attitash Watershed Restoration
Project Number 11-07/319

Dates: 2011-2014

Town of Amesbury, Massachusetts

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PREPARED FOR:

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF RESOURCE PROTECTION

AND

US ENVIRONMENTAL PROTECTION AGENCY
REGION 1

MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
Maeve Vallely Bartlett, Secretary

DEPARTMENT OF ENVIRONMENTAL PROTECTION
David W. Cash, Commissioner

BUREAU OF RESOURCE PROTECTION
Bethany A. Card, Assistant Commissioner

DIVISION OF MUNICIPAL SERVICES
Steven J. McCurdy, Director

A. Project Snapshot

Project Number and Title: 11-07/319 - Lake Attitash Watershed Restoration

A1. Project start date: April 26, 2011

A2. Date closed: June 30, 2014

A3. Basin and HUC 12 subwatershed: Merrimack Basin
Lake Attitash HUC ID: 010700061404

A4. Segment and/or waterbody number(s): 1) Lake Attitash - MA84002

A5. Status of waterbody (Category 5, etc.): 1) Category 5

A6. Priority Pollutant(s) targeted: Sediment, phosphorus, nitrogen, pathogens

A7. Estimated Annual Pollutant removal:
Sediment (TSS): 31,708 lbs/yr. (modeled)
Phosphorous: 10.6 lbs/yr. (modeled)
Nitrogen: 47.9 lbs/yr. (modeled)
Fecal Coliform: 742 billion colonies/yr
Method of Determination: Model (Desktop - developed under separate previous 319 grant). Model and tutorial attached to this final report.

A8. BMPs installed, number and type:

- West Shore Road
  - treatment train including:
    - one (1) sediment trap/plunge pool,
    - one (1) deep sump catch basin,
    - one (1) deep sump leaching catch basin,
  - remove 900 ft^2 of impervious material
  - wet pond/detention pond upgrade and retrofit;
- Ahern Circle: two (2) leaching catch basins;
- West Shore Road: three (3) leaching catch basins;
- Meadow Avenue:
  - one (1) deep sump catch basin,
  - one (1) deep sump leaching basin;
- Attitash Avenue treatment train including:
  - one (1) leaching catch basin
  - one (1) water quality vegetated swale;
- Attitash Avenue: one (1) leaching catch basin
- First Street: one (1) deep sump leaching catch basin – double structure
- Lake Avenue: one (1) raingarden
- Birchmeadow Road treatment train including:
  - one (1) vegetated filter strip
  - one (1) raingarden
- Merrill Avenue: one (1) raingarden
- Lake Shore Drive : one (1) leaching catch basin

Descriptive Project Summary

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

SECTION 319 NPS PROJECT 11-07/319

PROJECT TITLE:	Lake Attitash Watershed Restoration
NPS CATEGORY:	Urban Runoff
INVESTIGATOR:	Town of Amesbury
LOCATION:	Merrimack Watershed
TARGETED POLLUTANTS:	Total Suspended Solids (TSS), Pathogens, Nutrients (phosphorus, nitrogen)

DESCRIPTION:
Lake Attitash is a 360-acre natural lake located in the Towns of Amesbury and Merrimac, Massachusetts. With several public access points, parking and a number of sandy beaches along its shores, Lake Attitash is a popular recreational location for· activities such as boating, fishing and swimming. Listed as Category 5 on the 303(d) list of impaired waterbodies, Lake Attitash is a Class A Outstanding Resource Water which serves as the back-up water supply source for Amesbury, MA. A Watershed Management Plan was developed for Lake Attitash in 1999. The Town of Amesbury, with the help of volunteers from the Lake Attitash Association have addressed all of the specific recommendations in this plan including the installation of several stormwater BMPs by Amesbury as recommended in the plan under Recommendation #3. Despite these efforts, water quality within the lake remains low with significant nutrient issues resulting in algal blooms and season-wide beach closures due to cyanobacteria levels in 2009. The 2002-2007 EOEA Merrimack River 5-Year Watershed Action Plan states that 'high bacteria and nutrient levels in the Lake Attitash-Powow River Sub-Basin continue to be of concern'. The proposed project focuses on installing additional stormwater BMPs, this time on the Merrimac side of the watershed. Additionally, we would like to take advantage of the strong, well managed and dedicated leaders and volunteers at the Lake Attitash Association and launch a comprehensive Community Based Social Marketing education effort.

The goal of the current project is to improve the water quality of Lake Attitash through the implementation of LID based BMPs within the watershed. Previous grants have funded stormwater BMPs in Amesbury. This project includes the design and installation of BMPs within the watershed on the Merrimac side of the lake. Structural BMPs will be used to treat and infiltrate urban stormwater directly discharging to Lake Attitash.

Project tasks include:

1. Final designs, permits, and installation of BMPs;
2. Development and implementation of an Operation and Maintenance Plan for the BMPs;
3. Community-based Social Marketing (CBSM) outreach to supplement/better implement existing education efforts.
4. Reduction of nuisance aquatic weeds by significant volunteer effort.

BMPs installed consist of:

- 13 leaching and/or deep sump catch basins
- 3 raingardens
- Removal of 900ft^2 of impervious material
- Wet pond/detention pond upgrade and retrofit
- 3 treatment train areas

Results:	Sediment (TSS):	31,708 lbs/yr. (modeled)
	Phosphorous:	10.6 lbs/yr. (modeled)
	Nitrogen:	47.9 lbs/yr. (modeled)
	Fecal Coliform:	741 billion colonies/yr.

PROJECT COST: $ 243,322

FUNDING: $ 115,616 by the US EPA 48%
$ 127,704 by the Town of Amesbury/Merrimac 52%

PROJECT COMPLETE DURATION: 2011 – 2014

C. Financial Summary

The project came in under budget and on schedule with greater than the required 40% match minimum. An amendment was requested and granted for the following changes:

- additional BMPs were installed in place of the originally proposed pervious pavers,
- a private construction contractor was hired for a small portion of the work that required specialized equipment/expertise
- additional engineering funds were used for the design of BMPs at several new locations.

The amended work did not alter the final schedule or final budget.

Project expenditures included:

- design/engineering – DBE/WBE
- construction contractor for one BMP location
- materials for BMP construction
- materials and printing for public education and outreach CBSM program

Ultimately there was remaining budget in the category of construction/BMP materials.

The 40% match was met a number of different ways as outlined in the original grant application and below:

- Volunteer hours via the Lake Attitash Association – the majority of the match from volunteers came from the completion of the outreach and education tasks via the Community Based Social Marketing (CBSM) efforts - Task 4 Watershed CBSM Program and Task 5 Aquatic Weed Reduction Program.
- Town of Merrimac DPW – the Merrimac DPW installed the majority of the stormwater BMPs utilizing their current labor crew and DPW heavy equipment.
- Town of Amesbury DPW – the Amesbury DPW installed BMPs at two locations within town utilizing their current labor crew and DPW heavy equipment.

The efforts of the above stakeholders combined to well exceed the 40% match commitment.

Budget (Amended)
Lake Attitash Watershed Restoration
Project # 11-07/319

Expense Item	319 Amount	Non-Federal Match	Total
Salaries			
Town of Amesbury			
Salaries:			
DPW Director ($55-$70/hr)	**$0**	**$ 165.00**	**$ 165.00**
Town Engineer ($40-55/hr)	**$0**	**$ 50.00**	**$ 50.00**
Town of Merrimac			
DPW Director ($55-$70/hr)	**$0**	**$ 192.50**	**$ 192.50**
Sewer Supt. ($55-$70/hr)	**$0**	**$ 500.00**	**$ 500.00**
Foreman ($40-$50/hr)	**$0**	**$ 5,501.25**	**$ 5,501.25**
Laborers ($35-$45/hr)	**$0**	**$ 14,778.75**	**$ 14,778.75**
Town Staff ($25-$35/hr)	**$0**	**$ 1,055.00**	**$ 1,055.00**
Lake Attitash Volunteers ($25)	**$0**	**$ 88,907.50**	**$ 88,907.50**
Subtotal	**$ 0**	**$ 111,151.00**	**$ 111,151.00**
Subcontractual			
Construction services – pervious paver	$ $6,562.50	$ 0	$ 6,562.50
Engineering Services	$ 73,000	$ 0	$73,000
Subtotal Subcontractual	**$ 79,562.50**	**$ 0**	**$ 79,562.50**
Supplies & Misc			
Construction/BMP Materials	$ 31,053.74	$ 16,555.00	$ 47,608.74
Construction equipment rental	$ 0	$ 0	$ 0
Outreach materials	$ 5,000	$ 0	$ 5,000
Subtotal Supplies & Misc.	**$ 36,053.74**	**$ 16,555.00**	**$ 52,608.74**
Totals	**$ 115,616.24**	**$ 127,705**	**$ 243,322.24**
Percent	48% %	52%	100%

D. BMPs. Repeat this information as many times as required to report on each BMP implemented. Refer to the Key to learn more about the information that is required.

C1.	Type of BMP:	**West Shore Road Treatment Train** **one (1) sediment trap,** **one (1) Deep Sump Catch Basin,** **one (1) Deep Sump Leaching Catch Basin,** **Wet Pond/Detention Pond Upgrade and Retrofit**
C2.	Date of implementation:	May 2013
C3.	Size of treatment area:	2.5 ac.
C4.	Area land use:	Residential
C5.	Pollutant load removed:	TSS: 4,195 lbs./yr. P: 3.3 lbs./yr. N: 14.9 lbs./yr. Fecal Coliform: 189 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1.	Type of BMP:	**Ahern Circle** **two (2) Leaching Catch Basins**
C2.	Date of implementation:	June 2012
C3.	Size of treatment area:	2.6 ac.
C4.	Area land use:	Residential
C5.	Pollutant load removed:	TSS: 2,442 lbs./yr. P: 1.07 lbs./yr. N: 4.9 lbs./yr. Fecal Coliform: 118 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1.	Type of BMP:	**Lake Shore Drive** one (1) **Leaching Catch Basin**
C2.	Date of implementation:	November 2013
C3.	Size of treatment area:	2.5 ac.
C4.	Area land use:	Residential
C5.	Pollutant load removed:	TSS: 1,987 lbs./yr. P: 1.1 lbs./yr. N: 5.1 lbs./yr. Fecal Coliform: 94 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1. Type of BMP: **Merrill Avenue**
one (1) Rain Garden
C2. Date of implementation: July 2013
C3. Size of treatment area: 0.15 ac.
C4. Area land use: Residential
C5. Pollutant load removed: TSS: 199 lbs./yr.
P: 0.05 lbs./yr.
N: 0.20 lbs./yr.
Fecal Coliform: 0.003 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1. Type of BMP: **West Shore Road**
three (3) Leaching Catch Basins
C2. Date of implementation: August 2012
C3. Size of treatment area: 10.63 ac.
C4. Area land use: Residential
C5. Pollutant load removed: TSS: 8,130 lbs./yr.
P: 2.28 lbs./yr.
N: 10.3 lbs./yr.
Fecal Coliform: 170 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1. Type of BMP: **Meadow Avenue**
one (1) Deep Sump Catch Basin
one (1) Deep Sump Leaching Catch Basin
C2. Date of implementation: August 2013
C3. Size of treatment area: 1.86 ac.
C4. Area land use: Residential
C5. Pollutant load removed: TSS: 1,350 lbs./yr.
P: 0.4 lbs./yr.
N: 1.7 lbs./yr.
Fecal Coliform: 36 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1. Type of BMP: **Attitash Avenue Treatment Train**
one (1) Leaching Catch Basin
one (1) Water Quality Vegetated Swale
C2. Date of implementation: September 2013
C3. Size of treatment area: 2.21 ac.
C4. Area land use: Residential

C5. Pollutant load removed: TSS: 893 lbs./yr.
P: 0.8 lbs./yr.
N: 3.7 lbs./yr.
Fecal Coliform: 10 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1. Type of BMP: **Attitash Avenue**
one (1) Leaching Catch Basin
C2. Date of implementation: September 2013
C3. Size of treatment area: 0.16 ac.
C4. Area land use: Residential
C5. Pollutant load removed: TSS: 357 lbs./yr.
P: 0.2 lbs./yr.
N: 1.0 lbs./yr.
Fecal Coliform: 9.3 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1. Type of BMP: **First Street**
one (1) Double Deep Sump Leaching Catch Basin
C2. Date of implementation: September 2013
C3. Size of treatment area: 4.0 ac.
C4. Area land use: Residential
C5. Pollutant load removed: TSS: 2,890 lbs./yr.
P: 1.1 lbs./yr.
N:5.1 lbs./yr.
Fecal Coliform: 98.1 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1. Type of BMP: **Lake Avenue**
one (1) **Rain Garden**
C2. Date of implementation: June 2014
C3. Size of treatment area: 2.3 ac.
C4. Area land use: Residential
C5. Pollutant load removed: TSS: 1,794 lbs./yr.
P: 0.12 lbs./yr.
N: 0.3 lbs./yr.
Fecal Coliform: 8 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

C1.	Type of BMP:	**Birchmeadow Road** **one (1) Rain Garden** **one (1) Vegetated Filter Strip**
C2.	Date of implementation:	August 2014
C3.	Size of treatment area:	7.6 ac.
C4.	Area land use:	Residential
C5.	Pollutant load removed:	TSS: 7,471 lbs./yr. P: 0.1 lbs./yr. N: 0.6 lbs./yr. Fecal Coliform: 10.2 billion colonies/yr.

C6. Method of pollutant load removal determination: Modeling- A simple method was developed to calculate pollutant removal percentages for each BMP based on standard (published).

E. Lessons Learned

The Merrimac DPW performed most of the work to construct the stormwater BMPs. Combined with their other responsibilities, the staff had a very busy schedule during the grant period. Due to the multiple BMP locations, DPW crews were required to mobilize equipment between BMP locations and other ongoing Town projects. Fortunately a high level of commitment by the DPW and support from the Town's resources resulted in successful grant project.

Some of the proposed locations for leaching catch basins had unforeseen utility conflicts that required additional field investigations to find new locations. As a result, one deep sump leaching catch basin was located in the City of Amesbury. The flexibility of the Merrimac DPW was essential for keeping the project on schedule and on budget as well as the availability of the Amesbury DPW to commit to the relocated BMP. Applicants should be flexible to address mismarked utilities which can impact a project's schedule and coordination efforts. Design and coordination took place early in the grant process therefore location changes did not impact the final grant schedule.

The Lake Attitash Association made a very large time commitment to complete the CBSM program and weed reduction activities. A committed, reliable and sustainable watershed group is essential to the success of these types of hands-on programs that require local champions to mobilize volunteers and implement activities. One of the largest challenges is not only organizing and motivating an educated group like the LAA but to maintain the energy and motivation needed for long-term success. The LAA has accomplished this over the life of the grant.

F. Attachments/Deliverables

Task 1: Quality Assurance and Project Evaluation
Deliverable 1:

1. Modeled results of anticipated pollutant load reductions achieved by BMPs implemented under this project, produced by the project designer, engineer, or other qualified person.
   See Section D of this report and attached model tutorial.
2. Documentation of the BMP implementation work. Information to be supplied for each BMP includes BMP type, date of completed installation, targeted pollutant(s), size of targeted treatment area, and site maps.
   See Section D of this report and attached site map.

Task 2: Design and Construct Stormwater Management BMPs
Deliverables 2:

1. Final design and construction plans for the BMPs as described, submitted for review and comment to the MassDEP project officer prior to construction. Final plans must be reviewed and stamped by a professional engineer prior to review by the MassDEP project officer.
   Final plans attached.
2. Construction permits and approvals.
   Town of Merrimac Order of Conditions attached.
3. Final "as-built" drawings of the BMPs.
   Stamped 'as-built' drawings attached.
4. Certificate/letter from the designer or supplier stating the BMPs have been installed according to design specifications – see Additional Condition #8, below
   See attached letter of completion and request for certificate of compliance.
5. Vendor Information Forms from all bidders who respond to public bid opportunities for any aspects of the work
   N/A
6. Digital format photodocumentation of site, construction, and completed BMPs
   See attached BMP photographs.

Task 3: BMP Operation and Maintenance Plan
Deliverable 3:

1. A long-term operation and maintenance plan for the BMPs installed in Task 2, as described, submitted to the MassDEP Project Officer for review and approval before finalization of the plan.
   Merrimac O&M Plan attached.
   Amesbury O&M Plan attached.
   Lake Attitash Association O&M Plan attached.
2. A technical memo outlining operation and maintenance activities that have commenced since completion of BMP implementation.
   Only inspection has taken place to date.

Task 4: Watershed CBSM Program
Deliverables 5:

1. Copies of all educational and related materials
   CBSM summary of activities and related material attached.
2. A report describing how the project was carried out, with results, follow-up, and recommendations resulting from the task.
   CBSM summary of activities and related material attached.

Task 5: Aquatic Weed Reduction Program

Deliverables 5:

1. Field memo outlining actions/achievements at each volunteer weed removal event including training.

   2011, 2012, 2013 and 2014 weed reduction program memos attached.

   LAA Weed Watcher Handbook, February 2013 attached.

TUTORIAL

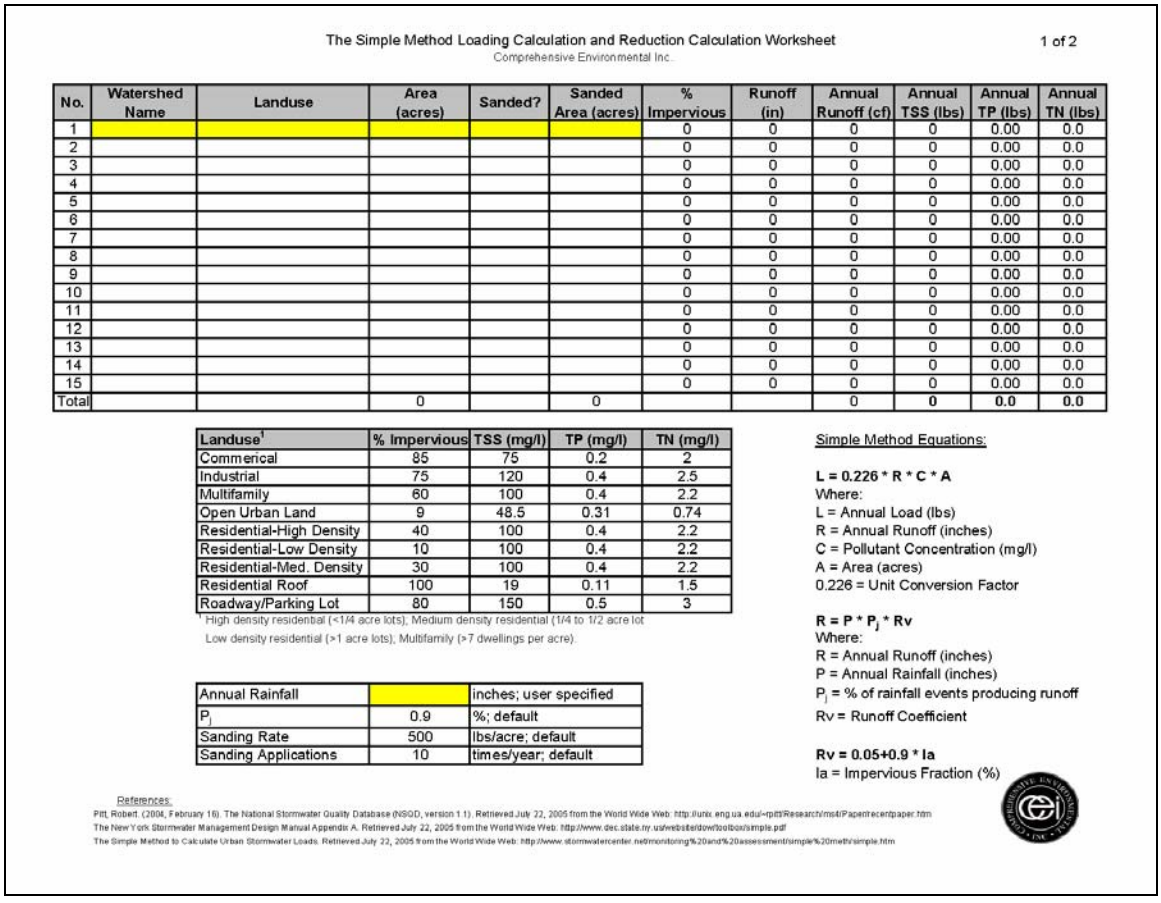
Entering Watershed Data – Enter data in the yellow areas shown in the figure below, proceed to subsequent rows for additional watersheds.

Watershed Name: Enter the Name of your watershed
Landuse: Select between 9 land uses
Area: Enter the total area of your watershed in acres
Sanded?: Select Yes or No if winter sanding occurs in your watershed
Sanded Area: Enter the total area in the watershed that is sanded. This value cannot exceed the **Area**.

Annual Rainfall: Enter the annual rainfall for the watershed. Annual rainfall for each town can be obtained from:

http://realestate.yahoo.com/re/neighborhood/massachusetts/

Note: If the impervious areas described in the landuse table are not representative for your watershed, subdivide your watershed into Open Urban land, Roadway/parking lot and Residential Roof landuses and enter them separately.



The Simple Method Loading Calculation and Reduction Calculation Worksheet 1 of 2
Comprehensive Environmental Inc.

No.	Watershed Name	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)
1						0	0	0	0	0.00	0.0
2						0	0	0	0	0.00	0.0
3						0	0	0	0	0.00	0.0
4						0	0	0	0	0.00	0.0
5						0	0	0	0	0.00	0.0
6						0	0	0	0	0.00	0.0
7						0	0	0	0	0.00	0.0
8						0	0	0	0	0.00	0.0
9						0	0	0	0	0.00	0.0
10						0	0	0	0	0.00	0.0
11						0	0	0	0	0.00	0.0
12						0	0	0	0	0.00	0.0
13						0	0	0	0	0.00	0.0
14						0	0	0	0	0.00	0.0
15						0	0	0	0	0.00	0.0
Total			0		0			0	0	0.0	0.0

Landuse[1]	% Impervious	TSS (mg/l)	TP (mg/l)	TN (mg/l)
Commerical	85	75	0.2	2
Industrial	75	120	0.4	2.5
Multifamily	60	100	0.4	2.2
Open Urban Land	9	48.5	0.31	0.74
Residential-High Density	40	100	0.4	2.2
Residential-Low Density	10	100	0.4	2.2
Residential-Med. Density	30	100	0.4	2.2
Residential Roof	100	19	0.11	1.5
Roadway/Parking Lot	80	150	0.5	3

[1] High density residential (<1/4 acre lots), Medium density residential (1/4 to 1/2 acre lot Low density residential (>1 acre lots), Multifamily (>7 dwellings per acre).

Annual Rainfall		inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

Simple Method Equations:

L = 0.226 * R * C * A
Where:
L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

$R = P * P_j * Rv$
Where:
R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient

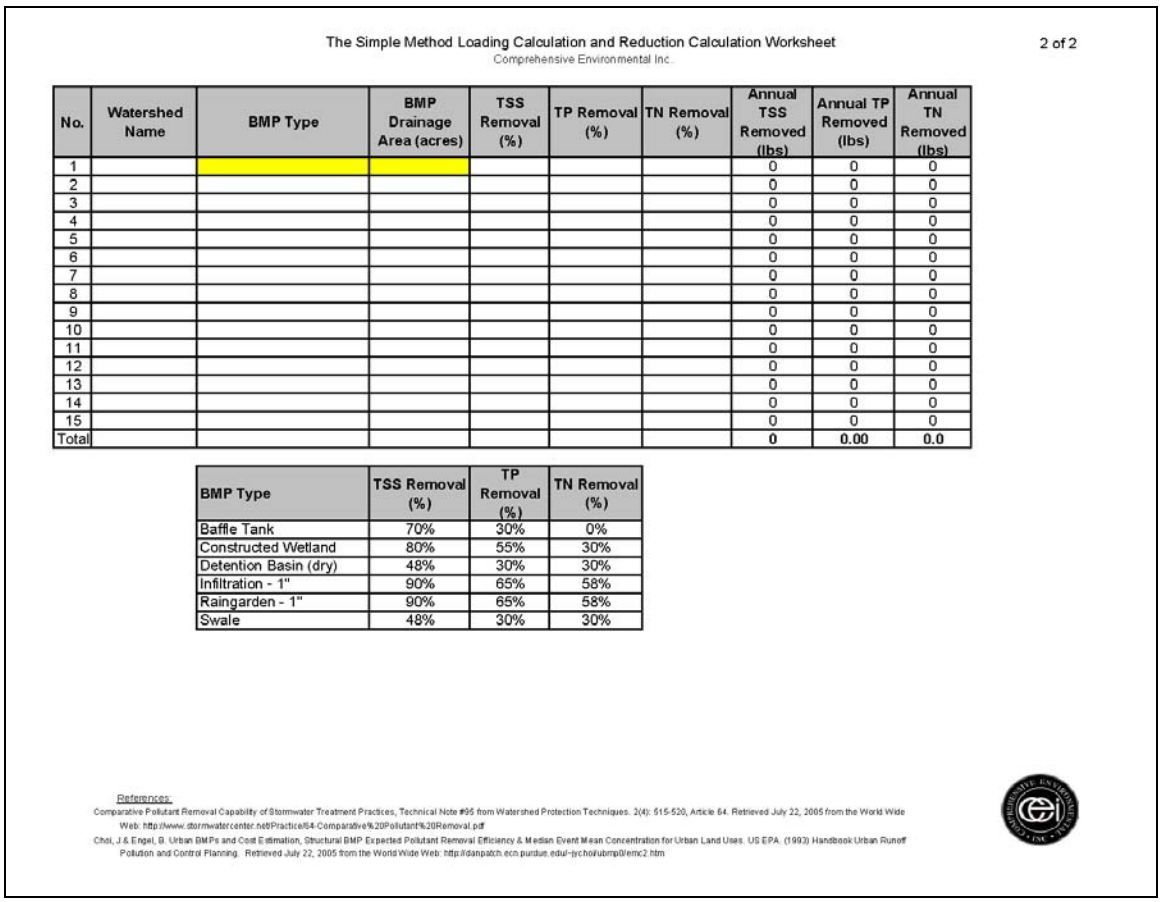
Rv = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paperrecentpaper.htm
The New York Stormwater Management Design Manual Appendix A. Retrieved July 22, 2005 from the World Wide Web: http://www.dec.state.ny.us/website/dow/toolbox/simple.pdf
The Simple Method to Calculate Urban Stormwater Loads. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

TUTORIAL

Entering BMP data – Enter data in the yellow areas shown in the figure below, proceed to subsequent rows for additional watersheds.

BMP Type: Select between the 6 types of BMPs listed
BMP Drainage Area: Enter total area to be treated by BMP within watershed (**BMP Drainage Area** cannot exceed the **Area**)



The Simple Method Loading Calculation and Reduction Calculation Worksheet
Comprehensive Environmental Inc.

2 of 2

No.	Watershed Name	BMP Type	BMP Drainage Area (acres)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)
1							0	0	0
2							0	0	0
3							0	0	0
4							0	0	0
5							0	0	0
6							0	0	0
7							0	0	0
8							0	0	0
9							0	0	0
10							0	0	0
11							0	0	0
12							0	0	0
13							0	0	0
14							0	0	0
15							0	0	0
Total							**0**	**0.00**	**0.0**

BMP Type	TSS Removal (%)	TP Removal (%)	TN Removal (%)
Baffle Tank	70%	30%	0%
Constructed Wetland	80%	55%	30%
Detention Basin (dry)	48%	30%	30%
Infiltration - 1"	90%	65%	58%
Raingarden - 1"	90%	65%	58%
Swale	48%	30%	30%

References:
Comparative Pollutant Removal Capability of Stormwater Treatment Practices, Technical Note #95 from Watershed Protection Techniques. 2(4): 515-520, Article 64. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/Practice/64-Comparative%20Pollutant%20Removal.pdf
Choi, J & Engel, B. Urban BMPs and Cost Estimation, Structural BMP Expected Pollutant Removal Efficiency & Median Event Mean Concentration for Urban Land Uses. US EPA. (1993) Handbook Urban Runoff Pollution and Control Planning. Retrieved July 22, 2005 from the World Wide Web: http://danpatch.ecn.purdue.edu/~jychoi/ubmp0/emc2.htm

Legend

- Deep Sump/Leaching Catch Basin Locations

0 250 500 1,000 1,500 Feet

Lake Attitash - S.319 GRANT

Stormwater BMP Locations

COMPREHENSIVE ENVIRONMENTAL INC.

Lake Attitash - S.319 GRANT

Stormwater BMP Locations

0 250 500 1,000 1,500 Feet

0 0.05 0.1 0.2 0.3 Miles

COMPREHENSIVE ENVIRONMENTAL INC.

Legend

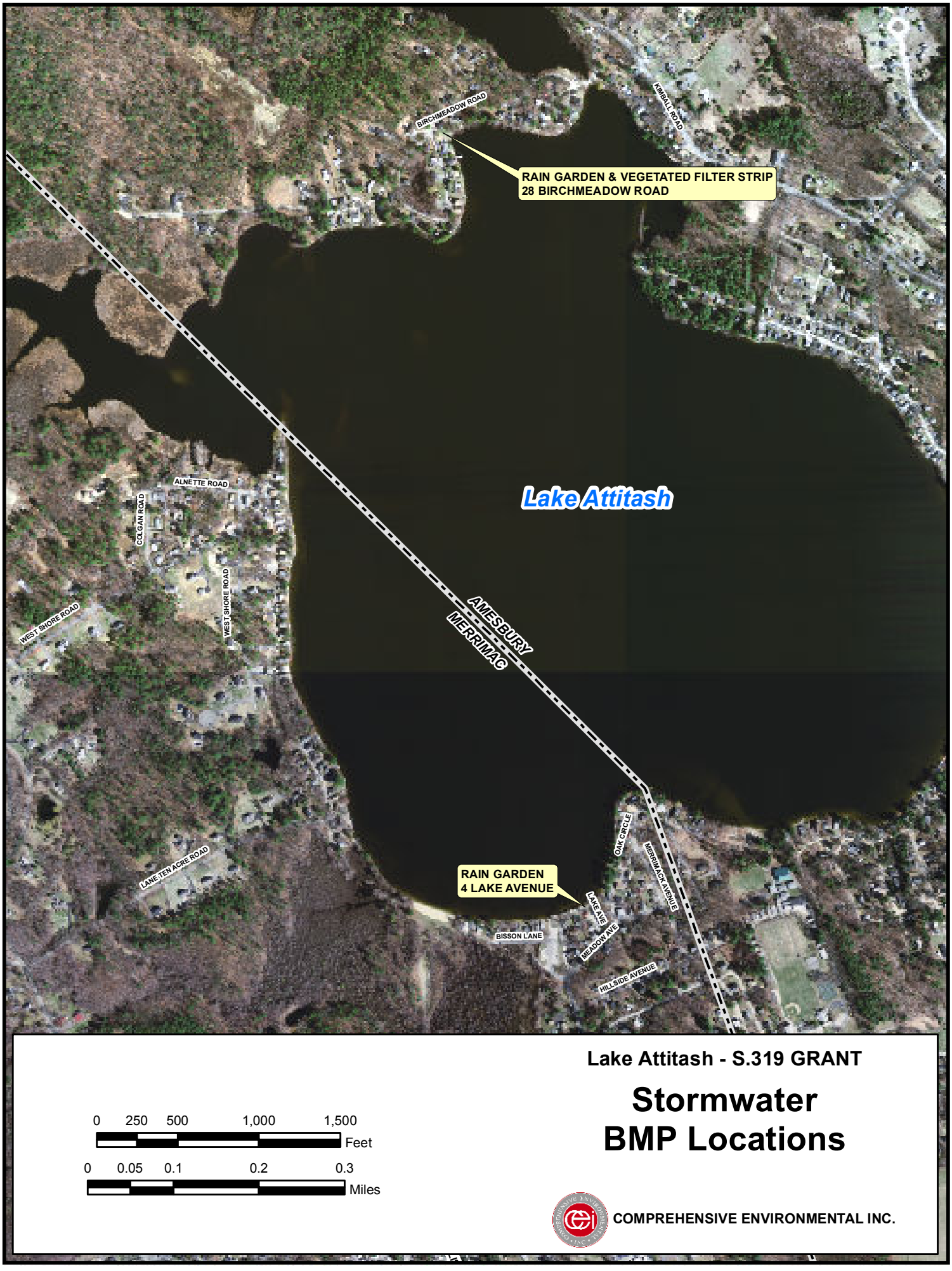
- Deep Sump/Leaching Catch Basin Locations

0 250 500 1,000 1,500 Feet

Lake Attitash - S.319 GRANT

Stormwater BMP Locations

COMPREHENSIVE ENVIRONMENTAL INC.



Lake Attitash - S.319 GRANT

Stormwater BMP Locations

0 250 500 1,000 1,500 Feet

0 0.05 0.1 0.2 0.3 Miles

COMPREHENSIVE ENVIRONMENTAL INC.

RECEIVED
APR 13 2012
BY:

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

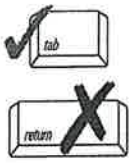
Provided by MassDEP:
45-250
MassDEP File #

eDEP Transaction #

Merrimac
City/Town

A. General Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. From: Merrimac
Conservation Commission

2. This issuance is for (check one): a. ☒ Order of Conditions b. ☐ Amended Order of Conditions

3. To: Applicant:

Tom
a. First Name

Barry
b. Last Name

Town of Merrimac
c. Organization

4 School St.
d. Mailing Address

Merrimac
e. City/Town

Mass
f. State

01860
g. Zip Code

4. Property Owner (if different from applicant):

same
a. First Name

b. Last Name

c. Organization

d. Mailing Address

e. City/Town

f. State

g. Zip Code

5. Project Location:

Various Locations
a. Street Address

Merrimac
b. City/Town

See plan information
c. Assessors Map/Plat Number

d. Parcel/Lot Number

Latitude and Longitude, if known: d m s
d. Latitude

d m s
e. Longitude

A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):

N/A Public Right of Way
a. County

b. Certificate Number (if registered land)

c. Book

d. Page

7. Dates: March, 2012 (a. Date Notice of Intent Filed) April 11, 2012 (b. Date Public Hearing Closed) April 12, 2012 (c. Date of Issuance)

8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):

Lake Attitash Watershead Restoration Project
a. Plan Title

Comprehensive Environmental
b. Prepared By

Mathew Lundiest
c. Signed and Stamped by

April 2012
d. Final Revision Date

30
e. Scale

Notice of Intent
f. Additional Plan or Document Title

g. Date

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:

Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:

a. ☒ Public Water Supply
b. ☒ Land Containing Shellfish
c. ☒ Prevention of Pollution
d. ☒ Private Water Supply
e. ☒ Fisheries
f. ☒ Protection of Wildlife
g. ☒ Groundwater Supply
h. ☒ Storm Damage Prevention
i. ☒ Flood Control

2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

a. ☒ the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

B. Findings (cont.)

Denied because:

b. ☐ the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

3. ☐ Buffer Zone Impacts: Shortest distance between limit of project disturbance and Bank or Bordering Vegetated Wetland boundary (if available) — a. linear feet

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☐ Bank	a. linear feet	b. linear feet	c. linear feet	d. linear feet
5. ☐ Bordering Vegetated Wetland	a. square feet	b. square feet	c. square feet	d. square feet
6. ☐ Land Under Waterbodies and Waterways	a. square feet	b. square feet	c. square feet	d. square feet
	e. c/y dredged	f. c/y dredged		
7. ☒ Bordering Land Subject to Flooding	1,375 a. square feet	1,375 b. square feet	1,375 c. square feet	1,375 d. square feet
Cubic Feet Flood Storage	e. cubic feet	f. cubic feet	350 g. cubic feet	350 h. cubic feet
8. ☐ Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet

B. Findings (cont.)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
9. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

10. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. ☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. ☐ Coastal Beaches	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
14. ☐ Coastal Dunes	a. square feet	b. square feet	c. nourishment cu yd	d. nourishment cu yd
15. ☐ Coastal Banks	a. linear feet	b. linear feet		
16. ☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17. ☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. ☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. ☐ Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. ☐ Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	a. c/y dredged	b. c/y dredged		
21. ☐ Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		

B. Findings (cont.)

22. ☐ Restoration/Enhancement:

a. square feet of BVW | b. square feet of salt marsh

23. ☐ Stream Crossing(s):

a. number of new stream crossings | b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. the work is a maintenance dredging project as provided for in the Act; or
   b. the time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order.
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.
8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.

10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

"Massachusetts Department of Environmental Protection" [or, "MassDEP"]

"File Number 45-250 "

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.

12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.

13. The work shall conform to the plans and special conditions referenced in this order.

14. Any change to the plans identified in Condition #12 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.

15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.

16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

NOTICE OF STORMWATER CONTROL AND MAINTENANCE REQUIREMENTS

19. **The work associated with this Order (the "Project") is** (1) ☒ **is not** (2) ☐ **subject to the Massachusetts Stormwater Standards. If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:**

a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
i. all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
ii. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
iii. any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;
iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;
v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement) for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following: *i.*) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and *ii.*) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):

See attached Standard conditions

The following Conditions are issued pursuant to Mass. General Laws c. 131 S40 and 301 CMR 10.00 et seq, and regulate those activities conducted in a Resource Area or Buffer Zone thereto.

STANDARD ORDER OF CONDITIONS

PROCEDURES:

1. All work must conform to the approved plans, approved documents submitted and to the Notice of Intent unless otherwise stipulated in the Order of Conditions or authorized by the Merrimac Conservation Commission (MCC).

2. This Order of Conditions must be recorded at the Registry of Deeds by the applicant, with the recording information submitted to this Commission, prior to the commencement of site work or construction, or within 60 days of the issuance of this Order if construction is not commenced.

3. Applicant shall provide the Commission, in writing, with the name and phone number of a contact person who will be responsible for supervision of all work on the project site and who can be contacted in case of problems during construction.

4. If the applicant is not the record owner of the property subject to this Order of Conditions, the applicant must, prior to the recording of this Order, provide to this Commission, a written, notarized statement, executed by the owner of the property approving the recording of the Order of Conditions at said Registry of Deeds.

5. These orders shall apply to any successor in interest or successor in control of the property. The MCC shall be notified in writing at the time of any transfer in the title to the property or any change in contractor/developer prior to the issuance of a Certificate of Compliance. A site visit with the MCC will be conducted prior to the transfer of the property.

6. In conjunction with the sale of any lot with a resource area under an Order of Conditions, the applicant shall submit to the MCC a signed statement by the buyer that he is aware of an outstanding Order of Conditions on the property.

7. The applicant or his successor shall notify the MCC, in writing, and before site work begins, of the name, address business and home phone numbers of the project supervisor responsible for compliance with this Order.

8. This Order shall be made part of all general and subcontractors' (responsible for site work) written contract.

9. Any modifications or revisions to the referenced plans and/or Notice of Intent shall be submitted to the MCC for review and to determine if a new Notice of Intent is required. The MCC reserves the right to require the applicant to file a new Notice of intent for any appropriate plan changes or submittals.

10. No additional new construction or disturbance of the wetlands, or the 100ft. buffer zone around the wetlands not shown on the approved plans, shall be permitted on this site until the applicant has filed a request for a modification or revision with the MCC and the Commission has made a determination on the request.

11. Issuance of these conditions does not in any way imply or certify that the site or downstream areas will not be subject to flooding, storm damage, or any other form of damage due to wetness.

12. Members and agents of the MCC shall have the right to enter and inspect the premises to evaluate compliance with the conditions stated in this Order.

13. Upon completion of work, and in order to receive a Certificate of Compliance, the applicant may be required to submit an as-built plan of all areas within jurisdiction of the Wetlands Protection Act. A professional engineer, certifying compliance with this Order of Conditions, shall sign the plan. The plan shall include:
    a. As-built elevations of all drainage ways constructed within 100ft. of any wetland resource area.
    b. As-built elevations and grades of all filled or altered wetland resource areas, buffer zones and replicated wetland areas.
    c. Distances to all structures within 100ft. of any wetland resource area.

14. A Certificate of Compliance or Partial Certificate of Compliance shall be issued by the CC before any Occupancy Permits are requested.

SITE WORK

15. Prior to the start of work, the edge of wetlands of all work areas shall be clearly marked with flags or stakes. These markers shall be maintained in place until construction has been completed.

16. Erosion and siltation prevention measures must be properly installed before construction. Securely installed silt fence backed with doubly staked hay bales, both embedded a minimum of 6" into existing grade, shall be placed between construction areas and wetland areas. Unless otherwise specified. Prior to installation of these devices, the Conservation Agent shall be contacted for instruction as to proper installation. The Commission will be provided a minimum of one-week notice in advance of the start of construction to perform this inspection.

17. Both hay bales and silt fence shall be maintained throughout the project until all disturbed areas have been mulched, seeded and stabilized to prevent erosion.

18. The CC reserves the right to require additional or modified erosion/siltation controls during construction if deemed that site conditions warrant such measures.

19. All trees to be cleared within the wetlands buffer zones, as shown on the approved plans, shall be felled in a direction opposite the wetland resource. Trees or shrubs of comparable species and size shall replace any trees or shrubs removed beyond the approved limits of clearing.

20. No slash or wood chips from tree clearing activities shall be placed within wetlands or the wetlands buffer zone.

21. Any de-watering efforts, if required, will be conducted using de-watering filters, stilling basins and or similar devices to remove sediment. At no time shall unfiltered water be allowed to discharge to any wetland resource area. Any accumulated sediment within the 100' wetlands buffer zones shall be removed.

22. There shall be no disturbance of the wetland past the hay bale and silt fence line. The demarcated wetland line shall indicate the limit of construction.

23. If during the course of construction, it is found that further erosion or siltation preventative measures are needed, the MCC shall direct the applicant upon its placement.

24. Upon completion of construction and grading, all disturbed areas located outside resource areas shall be stabilized permanently against erosion. This shall be done either by sodding, or by loaming, seeding, and mulching according to Natural Resources Conservation Service standards. If the latter course is chosen, stabilization will be complete when the surface shows complete vegetative cover.

25. Before hay bales or silt fences are removed, after all disturbed areas have been stabilized by revegetation or at the completion of a project all accumulated silt behind the fences shall be carefully removed and placed sufficiently far from the wetland area that it cannot wash into the wetlands.

26. The erosion control shall be removed once areas have become stable and been inspected by the Conservation Agent. Upon removal of erosion control, soil surfaces, which were disturbed by the fencing, shall be immediately raked and loamed (if necessary) by hand, and seeded. Hay bales shall either be removed or may be cut up and used as mulch.

27. Check dams and/or sediment traps shall be installed at 100' intervals on un-protected swales.

28. At no time during construction shall fill or other materials be placed, slump into or fall beyond the approved limits of work. The applicant shall be responsible for inspecting and maintaining all disturbed areas, and shall notify the Commission if any encroachment, erosion, slumping or other disturbance occurs to designated non-disturbance areas.
29. Any stormwater detention basin and the roads shall be constructed concurrently.

30. Stormwater treatment systems serving any roadway shall be completely constructed and functioning prior to the start of earth moving for construction of buildings.

31. No earthen embankment in any buffer zone area shall have a slope steeper than 2:1.

32. The contractor shall take all necessary steps to control dust on site to prevent its spread to abutting properties and habitats.

33. Dust control, if required, shall be limited to water; no salts or other wetting agents shall be used.

34. No dirt stockpiles, construction materials, spoils of construction, or equipment shall be stored, placed or operated in the wetland areas, unless specifically allowed by the Order of Conditions.

35. Fill stored within 100ft. of the wetland of the must have adequate erosion control measures surrounding it.

36. Only clean fill shall be used on this site, as indicated in General Condition #6.

37. No construction site bury holes shall be located within 100ft. of the wetland.

38. Any on-site dumpster shall not be located within 100ft. of the wetland.

39. During and after work on this project, there shall be no discharge or spillage of fuel, oil, construction debris, or other pollutants into any wetland area.

40. Petroleum products, toxic materials, and construction debris shall be disposed of off site.

41. Since the underground storage of petroleum products cannot be effectively monitored for loss, and presents a hazard to ground water and wetland resources, such storage is prohibited. This condition shall be included with the Certificate of Compliance so as to run with the land.

42. If the project requires a replication area then that area shall be constructed at the same time as work is being done on the wetland crossing. Any other impacted areas that need replication shall be done concurrently or the replication done before commencement begins.

43. Stormwater structures must be inspected and cleaned at least twice a year and after any major storm events.

- End of Conditions-

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☐ Yes ☒ No

2. The _____ hereby finds (check one that applies):
   Conservation Commission

   a. ☐ that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

   _____ _____
   1. Municipal Ordinance or Bylaw 2. Citation

   Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

   b. ☐ that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

   _____ _____
   1. Municipal Ordinance or Bylaw 2. Citation

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.
   The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):

Lake

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 – Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
45-250
MassDEP File #

eDEP Transaction #

Merrimac
City/Town

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

4/12/2012
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

Seven
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

Signatures

☒ by hand delivery on
4/12/2012
Date

☐ by certified mail, return receipt requested, on
Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request of Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

G. Recording Information

This Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Merrimac
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Merrimac
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Various Locations
Project Location

45-250
MassDEP File Number

Has been recorded at the Registry of Deeds of:

County | Book | Page

for: Town of Merrimac
Property Owner

and has been noted in the chain of title of the affected property in:

Book | Page

In accordance with the Order of Conditions issued on:

4/12/12
Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

TOWN OF MERRIMAC AND CITY OF AMESBURY, MASSACHUSETTS

LAKE ATTITASH
WATERSHED RESTORATION PROJECT

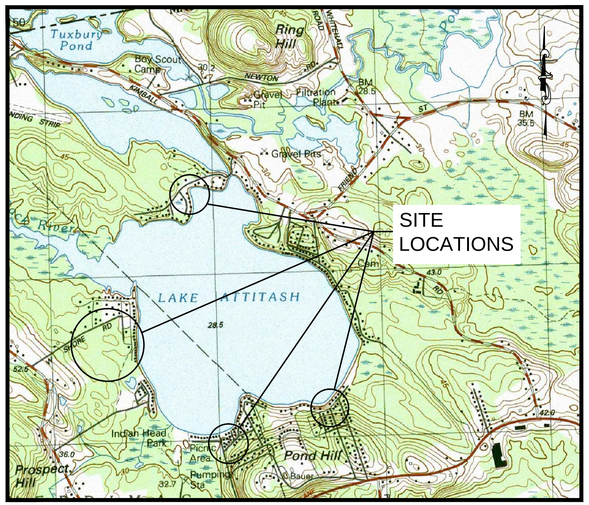
STORMWATER BMP LOCATIONS

JUNE 2014

PROJECT FUNDED THROUGH THE
U.S. EPA / MASSDEP s.319 NONPOINT
SOURCE POLLUTION GRANT PROGRAM

IN COORDINATION WITH

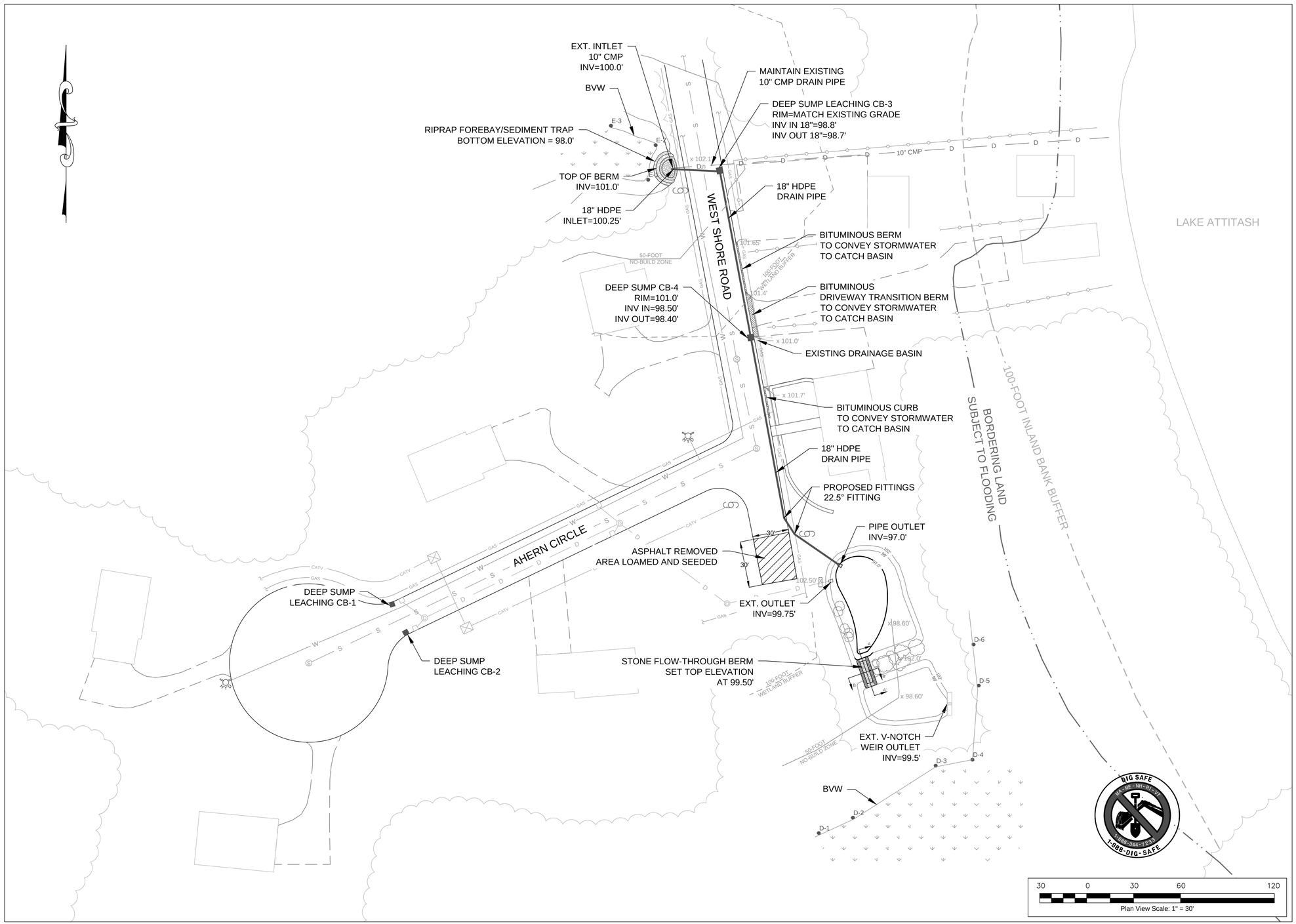
TOWN OF MERRIMAC
CITY OF AMESBURY
LAKE ATTITASH ASSOCIATION



LOCUS SCALE 1" =1500'

SHEET	TITLE
C-1	WEST SHORE ROAD/ AHERN CIRCLE OVERVIEW
C-2	LEACHING CATCH BASINS WEST SHORE ROAD, FIRST STREET AND LAKE SHORE ROAD
C-3	STORMWATER BMPs ATTITASH AVENUE, MEADOW AVENUE LAKE AVENUE AND MERRILL AVENUE
C-4	WEST SHORE ROAD / AHERN CIRCLE DETAILS
C-5	TYPICAL DETAILS

COMPREHENSIVE ENVIRONMENTAL INCORPORATED • MARLBOROUGH, MASSACHUSETTS



PROJECT OVERVIEW

General Notes

1. ELEVATIONS ARE BASED ON AN ASSUMED DATUM.

2. RIGHT-OF-WAY AND PROPERTY LOCATIONS NOT SURVEYED.

3. SOME SITE DETAILS DEPICTED ON THIS PLAN ARE SHOWN IN APPROXIMATE LOCATIONS BASED ON INTERPRETATION OF AERIAL PHOTOGRAPHY AND MAY NOT BE ACCURATE.

4. WETLANDS FLAGGED BY CEI ON 11/15/11

5. 100-YEAR FLOOD ZONE IS BASED ON FLOOD INSURANCE RATE MAPS (FIRM) PRODUCED BY FEMA. PANEL NUMBERS 250092 002 B AND 250092 004 B.

COMMONWEALTH OF MASSACHUSETTS
Matthew L. Lundeen
No. 40894
REGISTERED PROFESSIONAL ENGINEER

LEGEND

- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING DRAIN MANHOLE
- EXISTING SEWER MANHOLE
- EXISTING PULL BOX
- UTILITY POLE
- FIRE HYDRANT
- DRAIN PIPE
- SEWER PIPE
- FENCELINE
- x 100.00' EXISTING GROUND ELEVATION
- EDGE OF TREELINE
- WETLAND AREA
- D-1 WETLAND FLAG

No.	Revision/Issue	Date

COMPREHENSIVE ENVIRONMENTAL INCORPORATED

225 CEDAR HILL STREET
MARLBOROUGH, MA 01752

WEST SHORE ROAD/
AHERN CIRCLE
OVERVIEW

TOWN OF MERRIMAC
2 SCHOOL STREET
MERRIMAC, MA 01860

Project: NO. 175-10 Date: June 2014	Sheet: C-1
Designed by: CLB Checked by: MLL	
Scale: As Shown	

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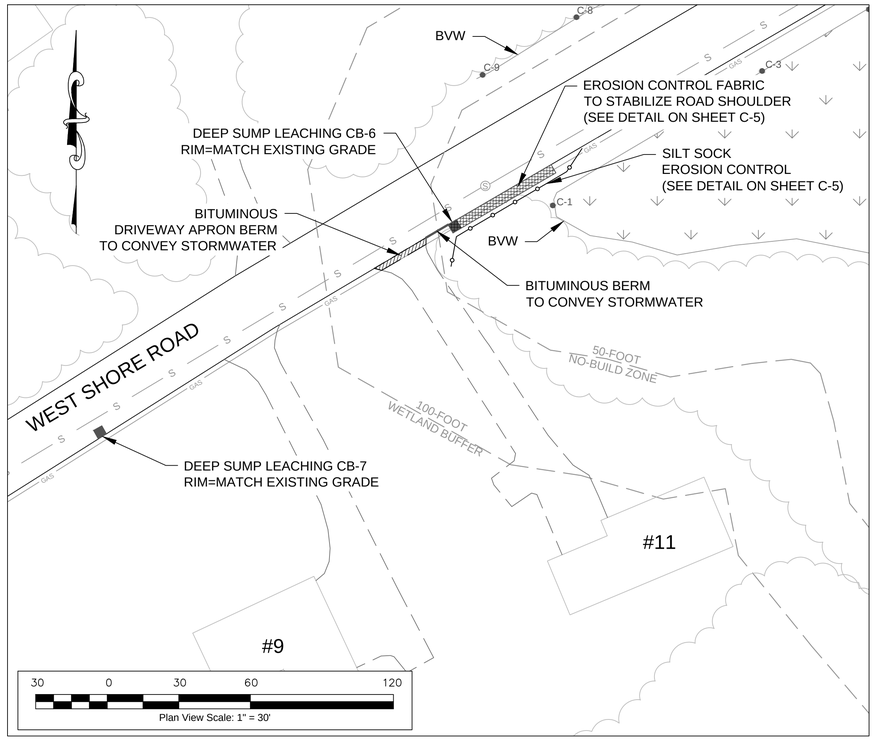
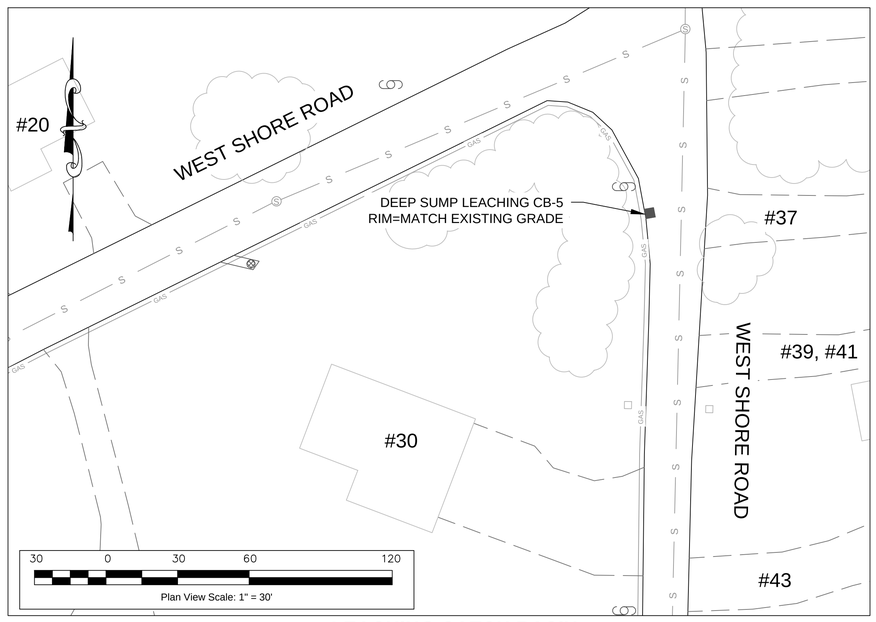
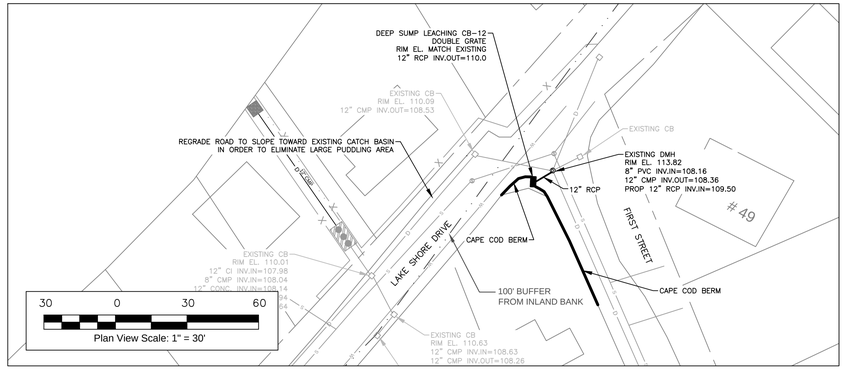
MA-ME-NH-RI-VT
1-888-344-7233
1-888-DIG-SAFE



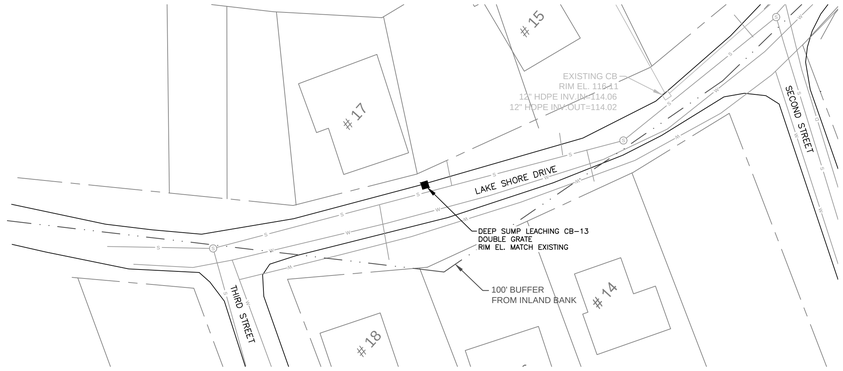
LEACHING CATCH BASIN AND SHOULDER STABILIZATION
WEST SHORE ROAD



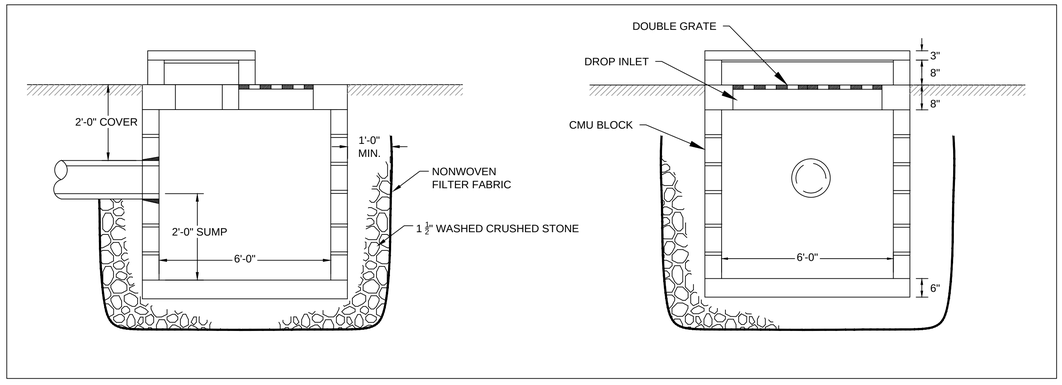
LEACHING CATCH BASIN
WEST SHORE ROAD



FIRST STREET
DEEP SUMP & LEACHING CATCH BASIN



LAKE SHORE DRIVE
DEEP SUMP & LEACHING CATCH BASIN



FIRST STREET & LAKE SHORE DRIVE
DEEP SUMP LEACHING CATCH BASIN
TYPICAL DETAIL

NOT TO SCALE

General Notes

COMMONWEALTH OF MASSACHUSETTS
Matthew L. Lundeen
No. 40894
REGISTERED PROFESSIONAL ENGINEER

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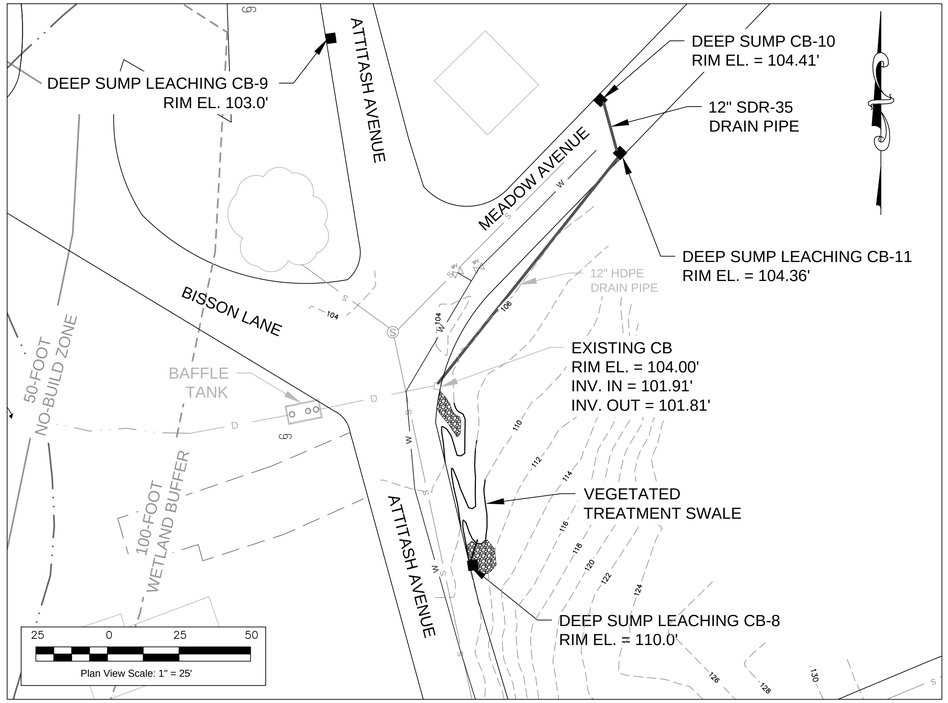
No.	Revision/Issue	Date

COMPREHENSIVE ENVIRONMENTAL INCORPORATED
225 CEDAR HILL STREET
MARLBOROUGH, MA 01752

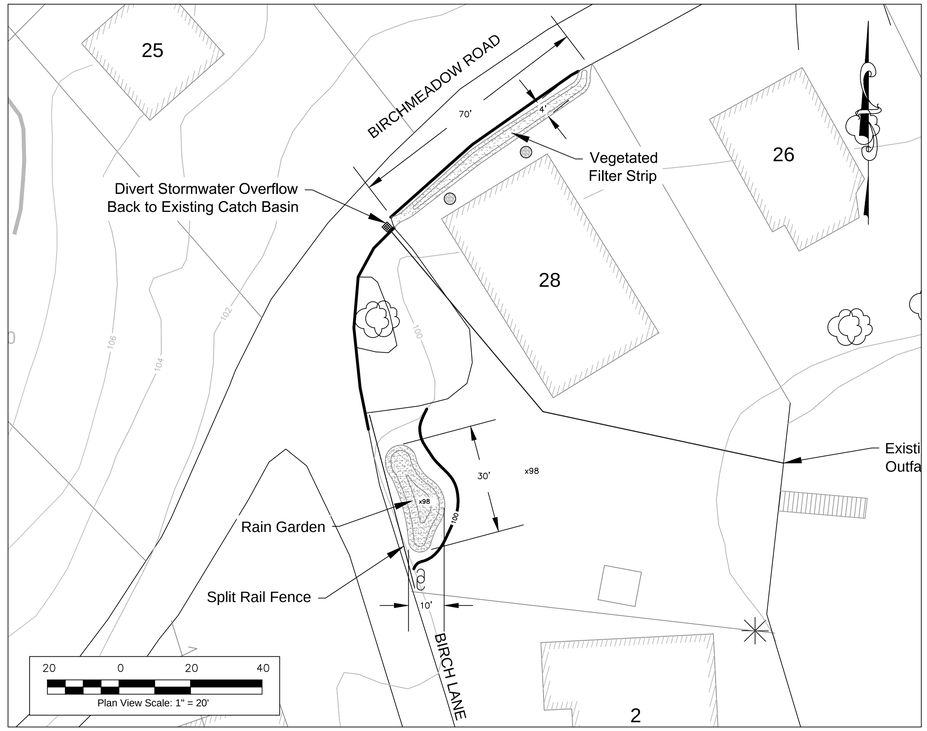
LEACHING CATCH BASINS
WEST SHORE ROAD, FIRST
STREET AND LAKE SHORE ROAD

TOWN OF MERRIMAC
2 SCHOOL STREET
MERRIMAC, MA 01860

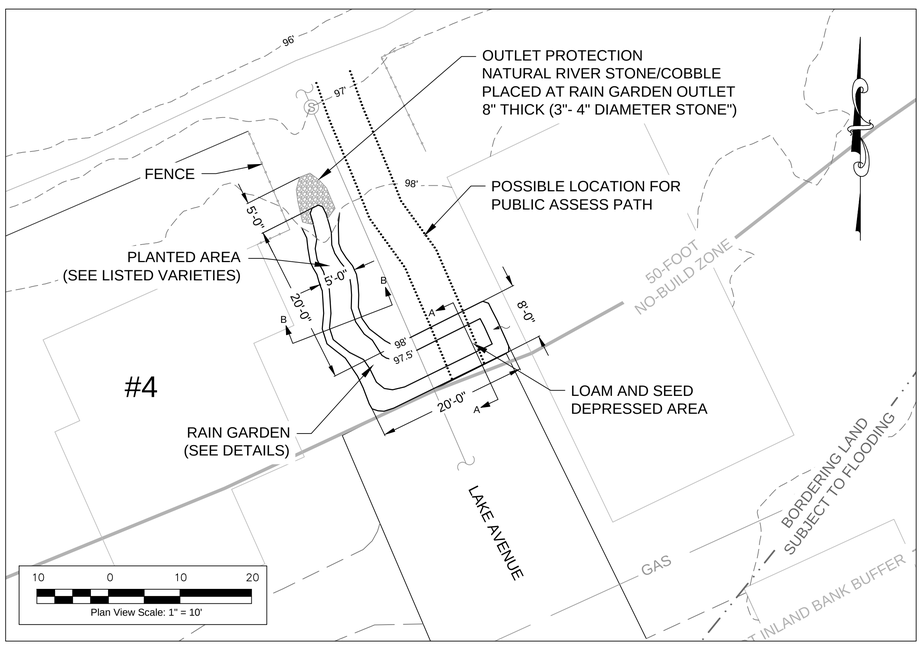
Project: NO. 175-10 Date: June 2014	Sheet: C-2
Designed by: CLB Checked by: MLL	
Scale: As Shown	



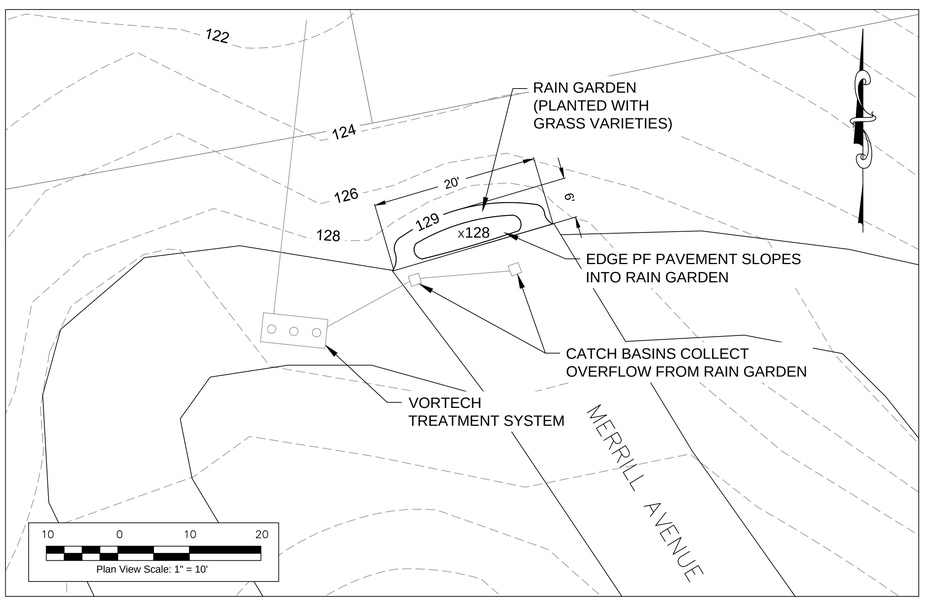
LEACHING CATCH BASIS AND VEGETATED SWALE
ATTITASH AVENUE & MEADOW AVENUE



BIRCHMEADOW ROAD & VEGETATED FILTER STRIP



LAKE AVENUE RAIN GARDEN



MERRILL AVENUE RAIN GARDEN

General Notes

COMMONWEALTH OF MASSACHUSETTS
Matthew L. Lundgren
No. 40894
PROFESSIONAL ENGINEER

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1-888-DIG-SAFE

No.	Revision/Issue	Date

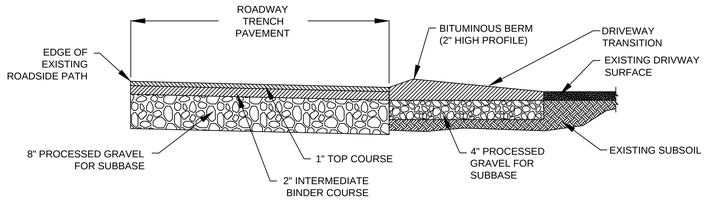
COMPREHENSIVE ENVIRONMENTAL INCORPORATED
225 CEDAR HILL STREET
MARLBOROUGH, MA 01752

STORMWATER BMPs

ATTITASH AVENUE, MEADOW AVENUE
LAKE AVENUE AND MERRILL AVENUE

TOWN OF MERRIMAC
2 SCHOOL STREET
MERRIMAC, MA 01860

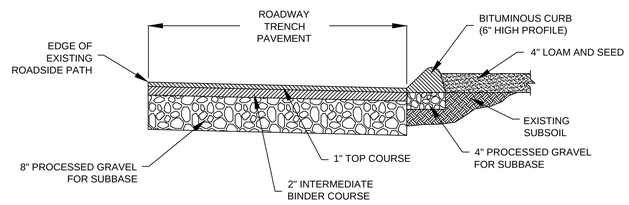
Project: NO. 175-10 Date: June 2014	Sheet: C-3
Designed by: CLB Checked by: MLL	
Scale: As Shown	



NOTES:

- IF SURFACE OF EXISTING ROADSIDE PATH IS WITHIN TWO INCHES OF FINISHED GRADE, THE EXISTING PATH WILL BE OVERLAYED (WITH TACK COAT) INSTEAD OF RE-CONSTRUCTED.
- IF LEVELING COURSE IS NEEDED IN ADDITION TO A ONE INCH OVERLAY (ITEM 14), LEVELING COURSE SHALL BE PAID FOR AS AN ADDITIONAL ONE INCH OVERLAY (ITEM 14).

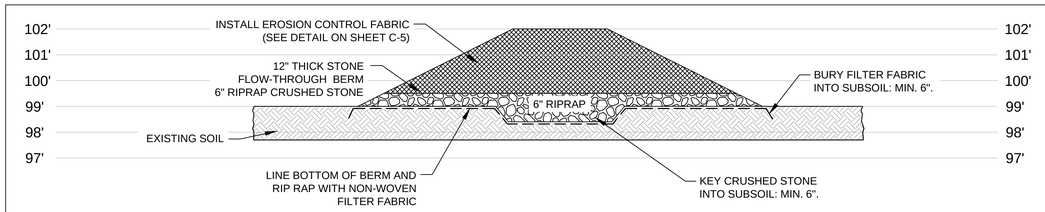
TRENCH PATCH WITH DRIVEWAY TRANSITION
NOT TO SCALE



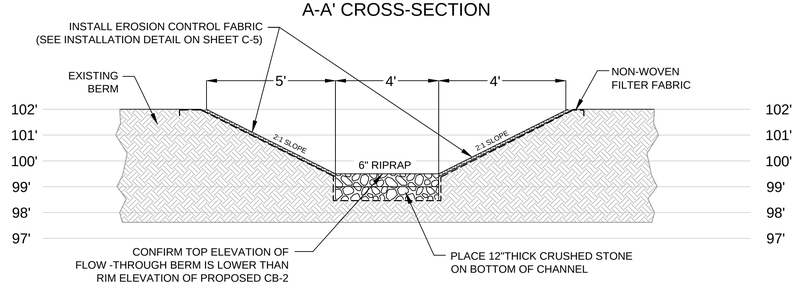
NOTES:

- IF SURFACE OF EXISTING ROADSIDE PATH IS WITHIN TWO INCHES OF FINISHED GRADE, THE EXISTING PATH WILL BE OVERLAYED (WITH TACK COAT) INSTEAD OF RE-CONSTRUCTED.
- IF LEVELING COURSE IS NEEDED IN ADDITION TO A ONE INCH OVERLAY (ITEM 14), LEVELING COURSE SHALL BE PAID FOR AS AN ADDITIONAL ONE INCH OVERLAY (ITEM 14).

TRENCH PATCH WITH CURB
NOT TO SCALE

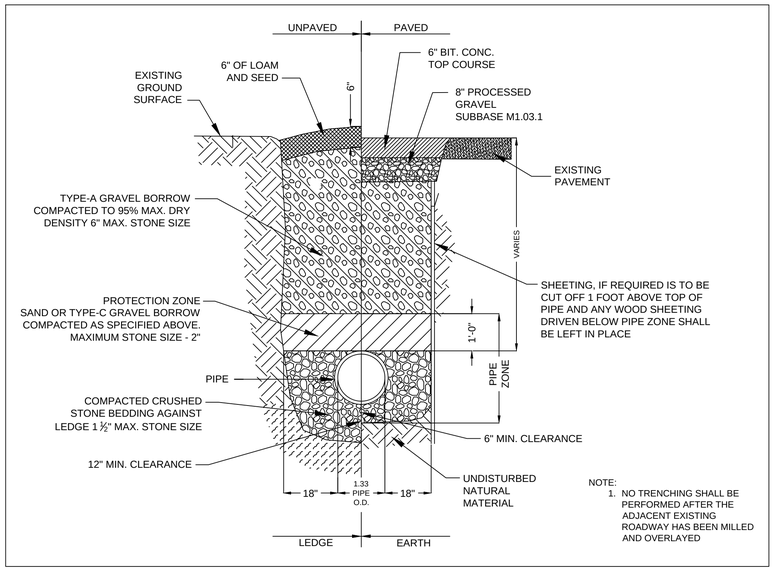


A-A' CROSS-SECTION



B-B' CROSS-SECTION

DETENTION POND BERM PROFILES
NOT TO SCALE



NOTE:
1. NO TRENCHING SHALL BE PERFORMED AFTER THE ADJACENT EXISTING ROADWAY HAS BEEN MILLED AND OVERLAYED

TYPICAL PIPE TRENCH DETAIL
NOT TO SCALE

General Notes

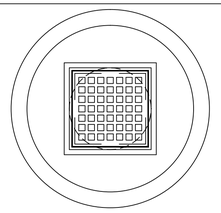
No.	Revision/Issue	Date

COMPREHENSIVE ENVIRONMENTAL INCORPORATED
225 CEDAR HILL STREET
MARLBOROUGH, MA 01752

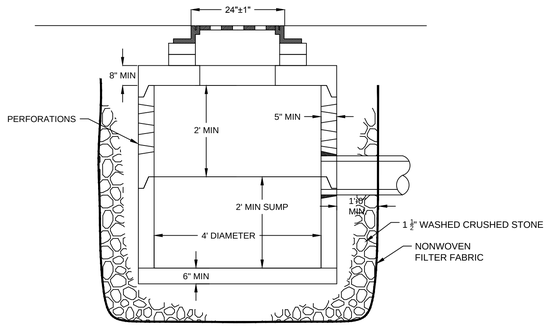
WEST SHORE ROAD/
AHERN CIRCLE
DETAILS

TOWN OF MERRIMAC
2 SCHOOL STREET
MERRIMAC, MA 01860

Project: NO. 175-10 Date: June 2014	Sheet: C-4
Designed by: CLB Checked by: MLL	
Scale: As Shown	

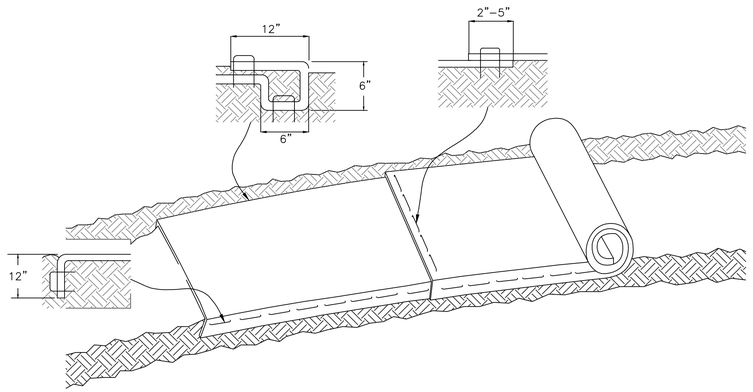


PLAN VIEW



SECTION VIEW

TYPICAL DEEP SUMP LEACHING CATCH BASIN
NOT TO SCALE

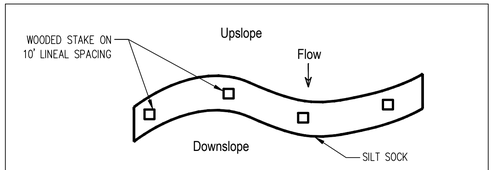


1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED NOTE: WHEN USING CELL–O–SEED, DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
3. ROLL BLANKETS HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE.
4. THE EDGES OF ALL HORIZONTAL AND VERTICAL BLANKET SEAMS MUST BE STAPLED WITH APPROXIMATELY 2"–5" OVERLAP. TO ENSURE PROPER SEAM ALIGNMENT BETWEEN ADJACENT BLANKETS, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE PREVIOUSLY INSTALLED BLANKET. SECURE ALL OVERLAPS WITH STAPLES SPACED 12" APART.

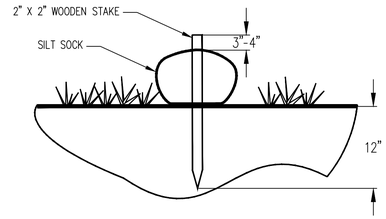
NOTE:
* SEAM OVERLAP SHOULD BE SHINGLED ACCORDING TO PREDOMINANT EROSIVE ACTION.

* IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.

EROSION CONTROL FABRIC TYP. DETAILS
NOT TO SCALE



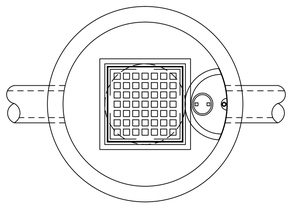
Plan View



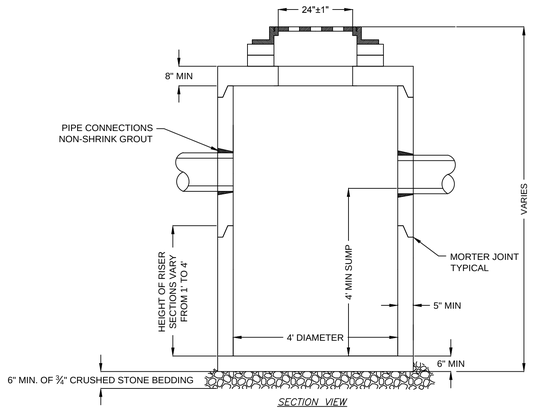
Section View

Notes:
1. All material to meet silt sock specifications.
2. Compost/soil/rock/seed fill to meet application requirements.
3. Compost material to be dispersed on site, as determined by Engineer.

SILT SOCK EROSION CONTROL
NOT TO SCALE



PLAN VIEW



SECTION VIEW

TYPICAL DEEP SUMP CATCH BASIN
NOT TO SCALE

VEGETATIVE SUPPORT MATERIAL

Vegetative Support Material shall be reasonably free of stumps, roots, and heavy or stiff clay, stones larger than 2-inches in diameter, LUMPS, COARSE SAND, NOXIOUS WEEDS, STICKS, BRUSH OR OTHER LITTER. IT SHALL BE COMPOSED OF THE FOLLOWING PERCENTAGES OF MATERIALS:

LOAM	30%
SAND	50%
COMPOST OR PEAT	20%

LOAM
LOAM SHALL CONSIST OF LOOSE FRIABLE TOPSOIL WITH NO ADMIXTURE OF REFUSE OR MATERIAL TOXIC TO PLANT GROWTH. LOAM SHALL BE GENERALLY FREE FROM STONES, LUMPS, STUMPS, OR SIMILAR OBJECTS LARGER THAN 50 MM (2 IN) IN GREATEST DIAMETER, SUBSOIL, ROOTS, AND WEEDS. THE TERM AS USED HEREIN SHALL MEAN THAT PORTION OF THE SOIL PROFILE DEFINED TECHNICALLY AS THE "A" HORIZON BY THE SOIL SCIENCE SOCIETY OF AMERICA. THE MINIMUM AND MAXIMUM PH VALUE SHALL BE FROM 5.5 TO 7.6. LOAM SHALL CONTAIN A MINIMUM OF 3 PERCENT AND A MAXIMUM OF 10 PERCENT OF ORGANIC MATTER AS DETERMINED BY LOSS BY IGNITION. NOT MORE THAN 65 PERCENT SHALL PASS A 0.075 MM (NO. 200) SIEVE AS DETERMINED BY THE WASH TEST IN ACCORDANCE WITH ASTM D 1140. IN NO INSTANCE SHALL MORE THAN 20% OF THAT MATERIAL PASSING THE 4.75 MM (NO. 4) SIEVE CONSIST OF CLAY SIZE PARTICLES.

SAND
SAND SHALL CONSIST OF BANK RUN SAND CONFORMING TO THE FOLLOWING REQUIREMENTS DETERMINED BY ASTM D422:

SIEVE OPENING	PERCENT PASSING WEIGHT
1-INCH	100
1/2-INCH	50-100
NO.20	20-95
NO.50	10-60
NO.200	0-8

COMPOST
COMPOST SHALL BE A STABLE, HUMUS-LIKE ORGANIC MATERIAL PRODUCED BY THE BIOLOGICAL AND BIOCHEMICAL DECOMPOSITION OF SOURCE SEPARATED COMPOSTABLE MATERIALS, SEPARATED AT THE POINT OF GENERATION, THAT MAY INCLUDE, BUT ARE NOT LIMITED TO, LEAVES AND YARD TRIMMINGS, FOOD SCRAPS, FOOD PROCESSING RESIDUALS, MANURE AND/OR OTHER AGRICULTURAL RESIDUALS, FOREST RESIDUES AND BARK, AND SOILED OR NON-RECYCLABLE PAPER. COMPOST SHALL NOT BE ALTERED BY THE ADDITION OF MATERIALS SUCH AS SAND, SOIL OR GLASS. COMPOST SHALL CONTAIN NO SUBSTANCES TOXIC TO PLANTS AND SHALL NOT CONTAIN MORE THAN 0.1 PERCENT BY DRY MASS OF MAN-MADE FOREIGN MATTER. COMPOST SHALL POSE NO OBJECTIONABLE ODOR AND SHALL NOT CLOSELY RESEMBLE THE RAW MATERIAL FROM WHICH IT WAS DERIVED. COMPOST SHALL HAVE A MINIMUM ORGANIC MATTER CONTENT OF 30 PERCENT DRY UNIT WEIGHT BASIS AS DETERMINED BY LOSS ON IGNITION IN ACCORDANCE WITH ASTM D 2974. COMPOST SHALL BE LOOSE AND FRIABLE, NOT DUSTY, HAVE NO VISIBLE FREE WATER AND HAVE A MOISTURE CONTENT OF 35 - 60 PERCENT IN ACCORDANCE WITH ASTM D 2974. THE PARTICLE SIZE OF COMPOST SHALL BE 100 PERCENT LESS THAN 25 MM IN ACCORDANCE WITH AASHTO T27 AND SHALL BE FREE OF STICKS, STONES, ROOTS OR OTHER OBJECTIONABLE ELONGATED MATERIAL LARGER THAN 50 MM IN GREATEST DIMENSION. THE PH OF COMPOST SHALL BE IN THE RANGE OF 5.5 - 8.0. THE MATURITY OF THE COMPOST SHALL BE TESTED AND REPORTED USING THE SOLVITA COMPOST MATURITY TEST AND MUST SCORE 6 OR HIGHER TO BE ACCEPTABLE. THE SOLUBLE SALT CONTENT OF COMPOST SHALL NOT EXCEED 4.0 MMHOS/CM AS DETERMINED BY USING A DILUTION OF 1 PART COMPOST TO 1 PART DISTILLED WATER.

PEAT
PEAT SHALL HAVE AN ASH CONTENT OF LESS THAN 15%, A PH RANGE OF 4.9 TO 5.2, AND A LOOSE BULK DENSITY OF 0.12 TO 0.15 G/CC. PEAT SHALL BE FREE OF FOREIGN OBJECTS AND SHALL HAVE NO PARTICLES GREATER THAN 1 INCH IN DIAMETER. THE MATERIAL MUST BE REED-SEDGE HEMIC PEAT , SHREDDED, UNCOMPACTED, UNIFORM AND CLEAN.

INSTALLATION

A. THE VEGETATIVE SUPPORT MATERIAL SHALL BE MIXED, HAULED, DEPOSITED, SPREAD, COMPACTED AND RAKED TO A TOTAL DEPTH AND TO THE LINES AND GRADES SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER. THE VEGETATIVE SUPPORT MATERIAL SHALL BE PLACED IN 6" LIFTS.

B. ALL DEPRESSIONS CAUSED BY SETTLEMENT SHALL BE FILLED WITH ADDITIONAL MATERIALS AND THE SURFACES SHALL BE REGRADED UNTIL IT PRESENTS A REASONABLY SMOOTH AND EVEN FINISH AND IS UP TO THE REQUIRED GRADE.

C. DURING HAULING OPERATIONS, ALL PUBLIC AND PRIVATE ROADWAY SURFACES SHALL BE KEPT CLEAN AND ANY TOPSOIL OR OTHER DIRT, WHICH MAY BE BROUGHT UPON THE SURFACE, SHALL BE REMOVED PROMPTLY AND THOROUGHLY BEFORE IT BECOMES COMPACTED BY TRAFFIC. IF NECESSARY, THE WHEELS OF ALL VEHICLES USED FOR HAULING SHALL BE CLEANED FREQUENTLY AND KEPT CLEAN TO AVOID BRINING ANY DIRT UPON THE SURFACE.

General Notes

1. CONCRETE: 4,000 PSI MINIMUM AFTER 28 DAYS.
2. REINFORCED STEEL CONFORMS TO LATEST ASTM A185 SPEC. 0.12 SQ. IN./LINEAL FT. AND 0.12 SQ. IN. (BOTH WAYS) BASE BOTTOM.
3. H-20 DESIGN LOADING PER AASHTO HS-20-44; ASTM C478 SPEC FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS."

COMMONWEALTH OF MASSACHUSETTS
Matthew H. Lundgren
Civil
No. 40894
REGISTERED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

COMPREHENSIVE ENVIRONMENTAL INCORPORATED
225 CEDAR HILL STREET
MARLBOROUGH, MA 01752

TYPICAL DETAILS

TOWN OF MERRIMAC
2 SCHOOL STREET
MERRIMAC, MA 01860

Project: NO. 175-10 Date: June 2014	Sheet: C-5
Designed by: CLB Checked by: MLL	
Scale: As Shown	

COMPREHENSIVE
ENVIRONMENTAL
INCORPORATED

- Engineering
- Design
- Construction
- Inspection

Responsive service, cost-effective solutions, technical excellence

- Drainage & Flooding
- Energy & Sustainability
- Hazardous Waste
- Permitting & NEPA
- Stormwater & LID
- Transportation
- Water & Wastewater
- Watershed Restoration

September 15, 2014

Merrimac Conservation Commission
2 School Street
Merrimac, MA 01860

RE: LAKE ATTITASH STORMWATER BMPS
CONSTRUCTION COMPLETION

Dear Commission Members:

The Merrimac Conservation Commission on April 12, 2012 (DEP File #45-250) issued an Order of Conditions for the installation of several stormwater Best Management Practices (BMPs) to help improve the water quality of Lake Attitash.

The purpose of this letter is to provide documentation that the Lake Attitash Watershed Restoration Project BMPs, funded by the U.S. EPA and MassDEP s.319 NPS Grant Program were constructed in accordance with the project goal and in conformance with the design intent to reduce nonpoint source pollution entering Lake Attitash and help improve water quality.

If you have any questions or comments, please feel free to contact me at 800.725.2550 or at mlundsted@ceiengineers.com.

Sincerely,

COMPREHENSIVE ENVIRONMENTAL, INC.

Matthew Lundsted, P.E., CFM
Principal Engineer

225 Cedar Hill Street, Marlborough, Massachusetts 01752 508-281-5160 Fax: 508-281-5136
21 Depot Street, Merrimack, New Hampshire 03054 603-424-8444 Fax: 603-424-8441
Gateway Crossing, 1 Hartford Square-East, New Britain, Connecticut 06052 860-224-0442
www.ceiengineers.com

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 8A – Request for Certificate of Compliance

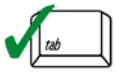
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

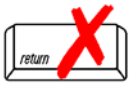
DEP File Number:

45-250
Provided by DEP

A. Project Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.





1. This request is being made by:

Tom Barry
Name

4 School Street
Mailing Address

Merrimac | MA | 01860
City/Town | State | Zip Code

978.346.8939
Phone Number

2. This request is in reference to work regulated by a final Order of Conditions issued to:

Town of Merrimac
Applicant

4.12.2012 | 45-250
Dated | DEP File Number

Upon completion of the work authorized in an Order of Conditions, the property owner must request a Certificate of Compliance from the issuing authority stating that the work or portion of the work has been satisfactorily completed.

3. The project site is located at:

Various Locations | Merrimac
Street Address | City/Town

See plan information on NOI |
Assessors Map/Plat Number | Parcel/Lot Number

4. The final Order of Conditions was recorded at the Registry of Deeds for:

Property Owner (if different)

County | Book | Page

Certificate (if registered land)

5. This request is for certification that (check one):

☒ the work regulated by the above-referenced Order of Conditions has been satisfactorily completed.

☐ the following portions of the work regulated by the above-referenced Order of Conditions have been satisfactorily completed (use additional paper if necessary).

☐ the above-referenced Order of Conditions has lapsed and is therefore no longer valid, and the work regulated by it was never started.

A. Project Information (cont.)

6. Did the Order of Conditions for this project, or the portion of the project subject to this request, contain an approval of any plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor?

☒ Yes — If yes, attach a written statement by such a professional certifying substantial compliance with the plans and describing what deviation, if any, exists from the plans approved in the Order.

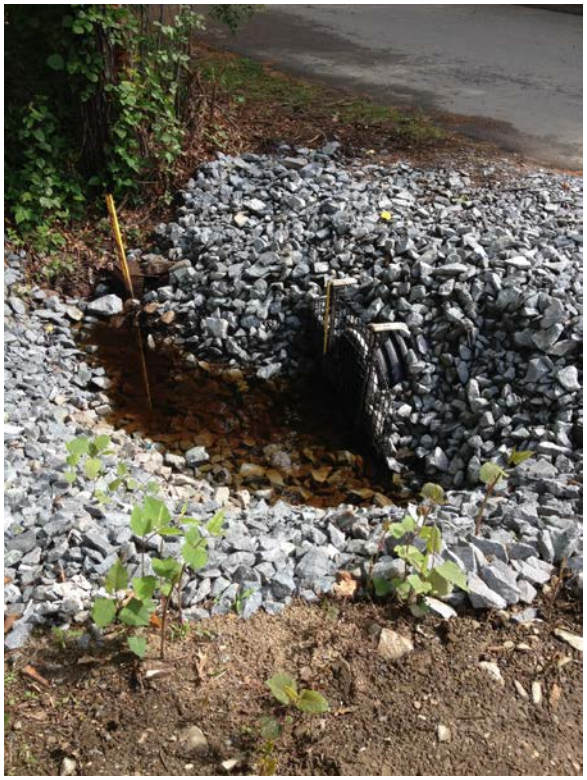
☐ No

B. Submittal Requirements

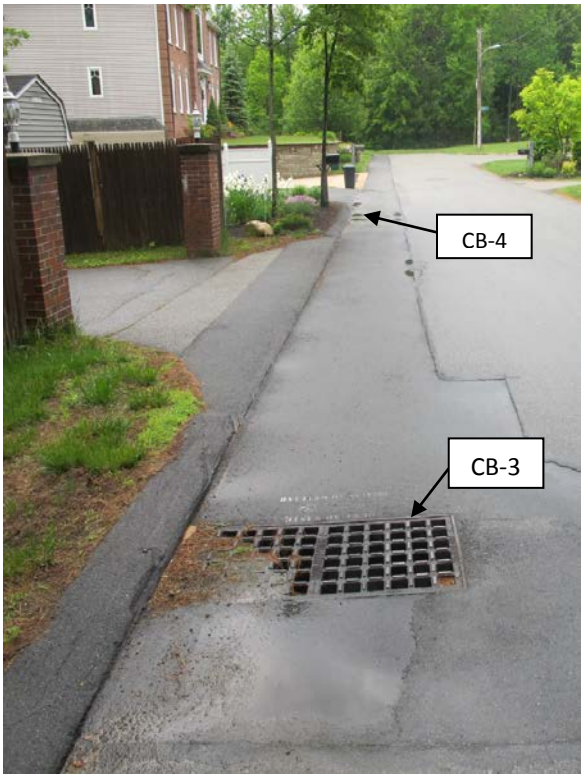
Requests for Certificates of Compliance should be directed to the issuing authority that issued the final Order of Conditions (OOC). If the project received an OOC from the Conservation Commission, submit this request to that Commission. If the project was issued a Superseding Order of Conditions or was the subject of an Adjudicatory Hearing Final Decision, submit this request to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html).

Ahern Circle
Deep Sump Leaching CB-1

Ahern Circle
Deep Sump Leaching CB-2



West Shore Road
Forebay (part of treatment train)



West Shore Road
Deep Sump Leaching CB-3
& Deep Sump CB-4
(part of treatment train)

West Shore Road
Detention Basin Outfall/Restoration
(part of treatment train)

West Shore Road
Berm Restoration
(part of treatment train)

West Shore Road
Area where Pavement was replaced with grass
(part of treatment train)

West Shore Road
Deep Sump Leaching CB-5

West Shore Road
Deep Sump Leaching CB-6

West Shore Road
Deep Sump Leaching CB-6

West Shore Road
Deep Sump Leaching CB-7

Attitash Street
Deep Sump Leaching CB-8 and Water Quality Swale

Attitash Street
Deep Sump Leaching CB-9

Meadow Avenue
Deep Sump CB-10

Meadow Avenue
Deep Sump Leaching CB-11

First Street
Deep Sump Leaching CB-12

First Street
Deep Sump Leaching CB-12

Lake Shore Drive
Deep Sump Leaching CB-13

Merrill Ave
Rain Garden

Birchmeadow Road
Rain Garden

Birchmeadow Road
Vegetated Filter Strip

Lake Avenue
Rain Garden

Lake Avenue
Rain Garden

Lake Avenue
Rain Garden

Lake Attitash Watershed Restoration

Stormwater BMP Implementation Project
Operations & Maintenance Plan

Town of Merrimac, MA

June, 2014

Prepared by

Comprehensive Environmental, Inc.

The Town of Merrimac, MA is a small Merrimack Valley community in the state's northernmost corner, which is bounded by the City of Amesbury on the east, Haverhill on the west, the Merrimack River to the south and the New Hampshire border to the North.

Lake Attitash is a Class A Outstanding Resource Water which serves as the back-up water supply source for Amesbury. Water quality within the lake remains low with significant nutrient issues resulting in algal blooms and season-wide beach closures due to cyanobacteria levels in 2009. Lake Attitash is listed as Category 5 on the 303(d) list of impaired waterbodies. The watershed project focuses on installing stormwater BMPs on both the Merrimac and Amesbury side of the lake.

The goal of the Lake Attitash Watershed Restoration Project is to improve water quality through the implementation of stormwater Best Management Practices (BMPs). The BMPs are designed to treat runoff and restore some of the watershed's pre-development hydrology. This project is part of a DEP s.319 Nonpoint Source Pollution Grant to retrofit several residential drainage systems and construct new stormwater BMPs in the Lake Attitash watershed.

BMPs to be utilized include:

- leaching catch basins
- deep sump catch basins
- sediment forebay
- vegetated water quality swale
- raingarden

BMP Owner:

Town of Merrimac

O&M Responsible Party:

Town of Merrimac Department of Public Works

Schedule for Inspection & Maintenance:

See attached O&M procedures for each specific BMP.

List of O&M Tasks:

See attached O&M procedures for each specific BMP.

Source of Long-Term O&M Funding:

The Department of Public Works is committed to maintaining all public stormwater BMPs and drainage conveyances. BMPs will be maintained at a minimum of 7-years as part of the annual department budget.

BMP Locations:

See attached map.

Plan Elements:

1. O&M Plan procedures
2. BMP maintenance logs
3. Site Map

Legend

- Deep Sump/Leaching Catch Basin Locations

0 250 500 1,000 1,500 Feet

Lake Attitash - S.319 GRANT

Stormwater BMP Locations

COMPREHENSIVE ENVIRONMENTAL INC.

Leaching Catch Basin		
Procedure	**Objective**	**Frequency**
Surface Inspection	Remove sediment and debris from the surface grate to prevent street flooding.	Quarterly
Interior and Sump Sediment Removal	Maintain flow capacity. Measure and remove sediment when the basin is 50% filled.	Quarterly
Outlet Hood Inspections	Visually inspect condition of outlet hood (i.e. cracks, missing bolts, and debris.) If debris is present, remove and discard approrpiately offsite.	Quarterly
Pipe Inspection	Measure and remove accumulated sediment >2" to maintain flow capacity through inlet and outlet pipes.	Quarterly

Locations: West Shore Road, Ahern Circle, Attitash Street, Meadow Avenue

Notes:
Inlets will be kept free of snow and ice during the winter months as necessary.

The accumulated sediment, leaves, and debris from the surface grate are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Leaching Catch Basin						
Maintenance Record						
Location (Road Name)	Date	Condition of BMP	Maintenance Performed, Material Removed	Maintenance Personnel	Volume of Sediment Removed (cf)	Comments

Deep Sump Catch Basin		
Procedure	**Objective**	**Frequency**
Surface Inspection	Remove sediment and debris from the surface grate to prevent street flooding.	Quarterly
Interior and Sump Sediment Removal	Maintain flow capacity. Measure and remove sediments four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.	Quarterly
Outlet Hood Inspections	Visually inspect condition of outlet hood (i.e. cracks, missing bolts, and debris.) If debris is present, remove and discard approrpiately offsite.	Quarterly
Pipe Inspection	Measure and remove accumulated sediment >2" to maintain flow capacity through inlet and outlet pipes.	Quarterly

Locations: West Shore Road, Meadow Avenue

Notes:
Deep sump catch basins should be maintained on quarterly basis and kept clear of winter snow and icing where possible.

The accumulated sediment, leaves, and debris from the surface grate are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Deep Sump Catch Basin						
Maintenance Record						
Location (Road Name)	Date	Condition of BMP	Maintenance Performed, Material Removed	Maintenance Personnel	Volume of Sediment Removed (cf)	Comments

Sediment Forebay/Trap		
Procedure	**Objective**	**Frequency**
Sediment Removal	Remove sediment >2" and debris from the plunge pool to prevent it from entering waterbody.	Quarterly
Structural Inspection	Visually inspect slope of bank and check for soil erosion. Visually inspect plunge pool stones to make sure they are not being undermined or displaced.	Quarterly
Pipe Inspection	Remove accumulated sediment >2" to maintain flow capacity through inlet and outlet.	Quarterly

Locations: West Shore Road

Notes:

The accumulated sediment, leaves, and debris from the forebay/trap are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Sediment Forebay/Trap						
Maintenance Record						
Location (Road Name)	Date	Condition of BMP	Maintenance Performed, Material Removed	Maintenance Personnel	Volume of Sediment Removed (cf)	Comments

Vegetated Swale		
Procedure	**Objective**	**Frequency**
Debris and Litter Removal	Remove litter and debris from the vegetated swale to prevent it from entering nearby the waterbody and inhibiting BMP capacity.	Monthly
Sediment removal	Remove sediment >2" from the vegetated swale to prevent it from entering the nearby waterbody and inhibiting BMP capacity.	Quarterly
Mowing and Vegetation	Minimize erosion and channelization of stormwater. Inspect swale for signs of scouring, particularly near high velocity areas. Regrade as needed (e.g. pipe discharge, check dam). Replace vegetation as needed to maintain 75% coverage.	Quarterly

Locations: Attitash Street

Notes:
The accumulated sediment, leaves, and debris from the swale are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Vegetated Swale

Maintenance Record

Location (Road Name)	Date	Condition of BMP	Maintenance Performed, Material Removed, & Quantity	Maintenance Personnel	Comments

Raingardens		
Procedure	**Objective**	**Frequency**
Debris and Litter Removal	Remove litter and debris from the vegetated swale to prevent it from entering the nearby waterbody and inhibiting BMP capacity	Monthly
Sediment removal	Remove sediment >2" from the raingarden to prevent it from entering the nearby waterbody and inhibiting BMP capacity.	Quarterly
Plantings & Mulch Care	Maintain healthy vegetation. Prune plants and remove weeds as required. Replace mulch and regrade as necessary. Replace unhealthy plants with new healthy plantings.	Spring and Fall or as necessary.

Locations: Lake Avenue

Notes:
The accumulated sediment, leaves, and debris from the raingarden are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Raingardens

Maintenance Record

Location (Road Name)	Date	Condition of BMP	Maintenance Performed, Material Removed, & Quantity	Maintenance Personnel	Comments

Lake Attitash Watershed Restoration

Stormwater BMP Implementation Project
Operations & Maintenance Plan

City of Amesbury, MA

June, 2014

Prepared by

Comprehensive Environmental, Inc.

The City of Amesbury, MA is a Merrimack Valley community Situated along the waters of the Powow River and Merrimack River in the state's northernmost corner. The City is bounded by the Town of Merrimac to the west and Salisbury on the east, the Merrimack River to the south and the New Hampshire border to the North.

Lake Attitash is a Class A Outstanding Resource Water which serves as the back-up water supply source for Amesbury. Water quality within the lake remains low with significant nutrient issues resulting in algal blooms and season-wide beach closures due to cyanobacteria levels in 2009. Lake Attitash is listed as Category 5 on the 303(d) list of impaired waterbodies. The watershed project focuses on installing stormwater BMPs on both the Merrimac and Amesbury side of the lake.

The goal of the Lake Attitash Watershed Restoration Project is to improve water quality through the implementation of stormwater Best Management Practices (BMPs). The BMPs are designed to treat runoff and restore some of the watershed's pre-development hydrology. This project is part of a DEP s.319 Nonpoint Source Pollution Grant to retrofit several residential drainage systems and construct new stormwater BMPs in the Lake Attitash watershed.

BMPs to be utilized include in the City of Amesbury:

- Deep sump/leaching catch basins
- Rain Garden

BMP Owner:

City of Amesbury

O&M Responsible Parties:

City if Amesbury Department of Public Works

Schedule for Inspection & Maintenance:

See attached O&M procedures for each specific BMP.

List of O&M Tasks:

See attached O&M procedures for a leaching catch basin.

Source of Long-Term O&M Funding:

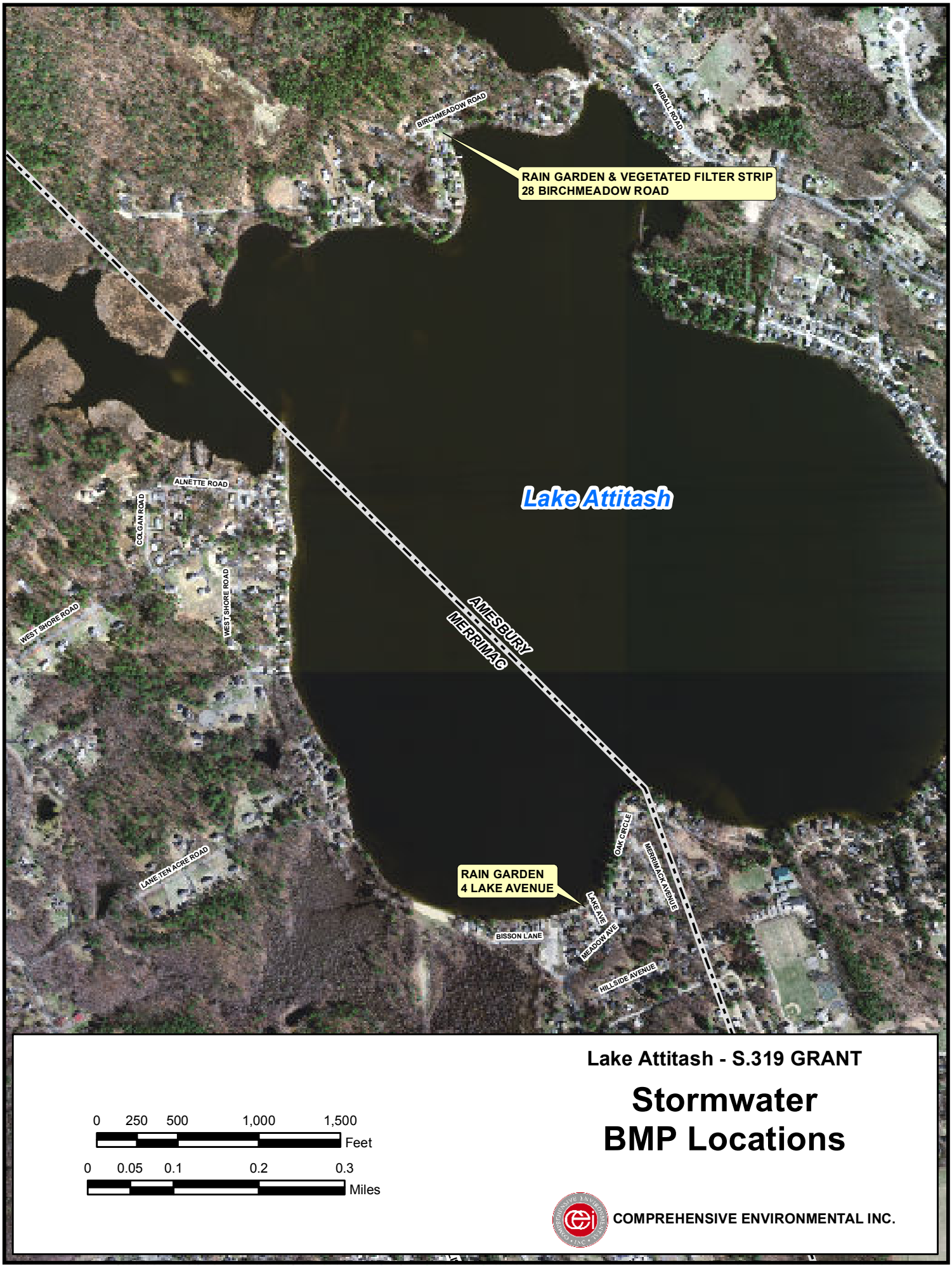
The Department of Public Works is committed to maintaining all public stormwater BMPs and drainage conveyances. BMPs will be maintained at a minimum of 7-years as part of the annual department budget.

BMP Locations:

See attached maps.

Plan Elements:

1. O&M Plan procedures
2. BMP maintenance logs
3. Site Maps



Lake Attitash - S.319 GRANT

Stormwater BMP Locations

0 250 500 1,000 1,500 Feet

0 0.05 0.1 0.2 0.3 Miles

COMPREHENSIVE ENVIRONMENTAL INC.

Leaching Catch Basin		
Procedure	**Objective**	**Frequency**
Surface Inspection	Remove sediment and debris from the surface grate to prevent street flooding.	Quarterly
Interior and Sump Sediment Removal	Maintain flow capacity. Measure and remove sediment when the basin is 50% filled.	Quarterly
Outlet Hood Inspections	Visually inspect condition of outlet hood (i.e. cracks, missing bolts, and debris.) If debris is present, remove and discard.	Quarterly
Pipe Inspection	Measure and remove accumulated sediment >2" to maintain flow capacity through inlet and outlet pipes.	Quarterly

Locations: First Street, Lake Shore Drive

Notes:
Inlets will be kept free of snow and ice during the winter months as necessary.

The accumulated sediment, leaves, and debris from the surface grate are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Leaching Catch Basin						
Maintenance Record						
Location (Road Name)	Date	Condition of BMP	Maintenance Performed, Material Removed	Maintenance Personnel	Volume of Sediment Removed (cf)	Comments

Raingardens		
Procedure	**Objective**	**Frequency**
Debris and Litter Removal	Remove litter and debris from the vegetated swale to prevent it from entering the nearby waterbody and inhibiting BMP capacity	Monthly
Sediment removal	Remove sediment >2" from the raingarden to prevent it from entering the nearby waterbody and inhibiting BMP capacity.	Quarterly
Plantings & Mulch Care	Maintain healthy vegetation. Prune plants and remove weeds as required. Replace mulch and regrade as necessary. Replace unhealthy plants with new healthy plantings.	Spring and Fall or as necessary.

Locations: Merrill Avenue

Notes:
The accumulated sediment, leaves, and debris from the raingarden are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Rain Garden

Maintenance Record

Location (Road Name)	Date	Condition of BMP	Maintenance Performed, Material Removed, & Quantity	Maintenance Personnel	Comments

Lake Attitash Watershed Restoration

Stormwater BMP Implementation Project
Operations & Maintenance Plan

Lake Attitash Association
Amesbury, MA

June, 2014

Lake Attitash is a Class A Outstanding Resource Water which serves as the back-up water supply source for Amesbury. Water quality within the lake remains low with significant nutrient issues resulting in algal blooms and season-wide beach closures due to cyanobacteria levels in 2009. Lake Attitash is listed as Category 5 on the 303(d) list of impaired waterbodies. The watershed project focuses on installing stormwater BMPs on both the Merrimac and Amesbury side of the lake.

The goal of the Lake Attitash Watershed Restoration Project is to improve water quality through the implementation of stormwater Best Management Practices (BMPs). The BMPs are designed to treat runoff and restore some of the watershed's pre-development hydrology. This project is part of a DEP s.319 Nonpoint Source Pollution Grant to retrofit several residential drainage systems and construct new stormwater BMPs in the Lake Attitash watershed.

As part of the work completed under the grant, the Lake Attitash Association has built two rain gardens and a vegetated filter strip. The rain gardens and vegetated filter strip are designed to collect stormwater runoff from adjacent road surfaces and provide pollutant removal through vegetative treatment and infiltration.

BMP Owner:

Lake Attitash Association/home owners

O&M Responsible Parties:

Lake Attitash Association/home owners

Schedule for Inspection & Maintenance:

See attached O&M procedures for rain garden and vegetated filter strip maintenance.

List of O&M Tasks:

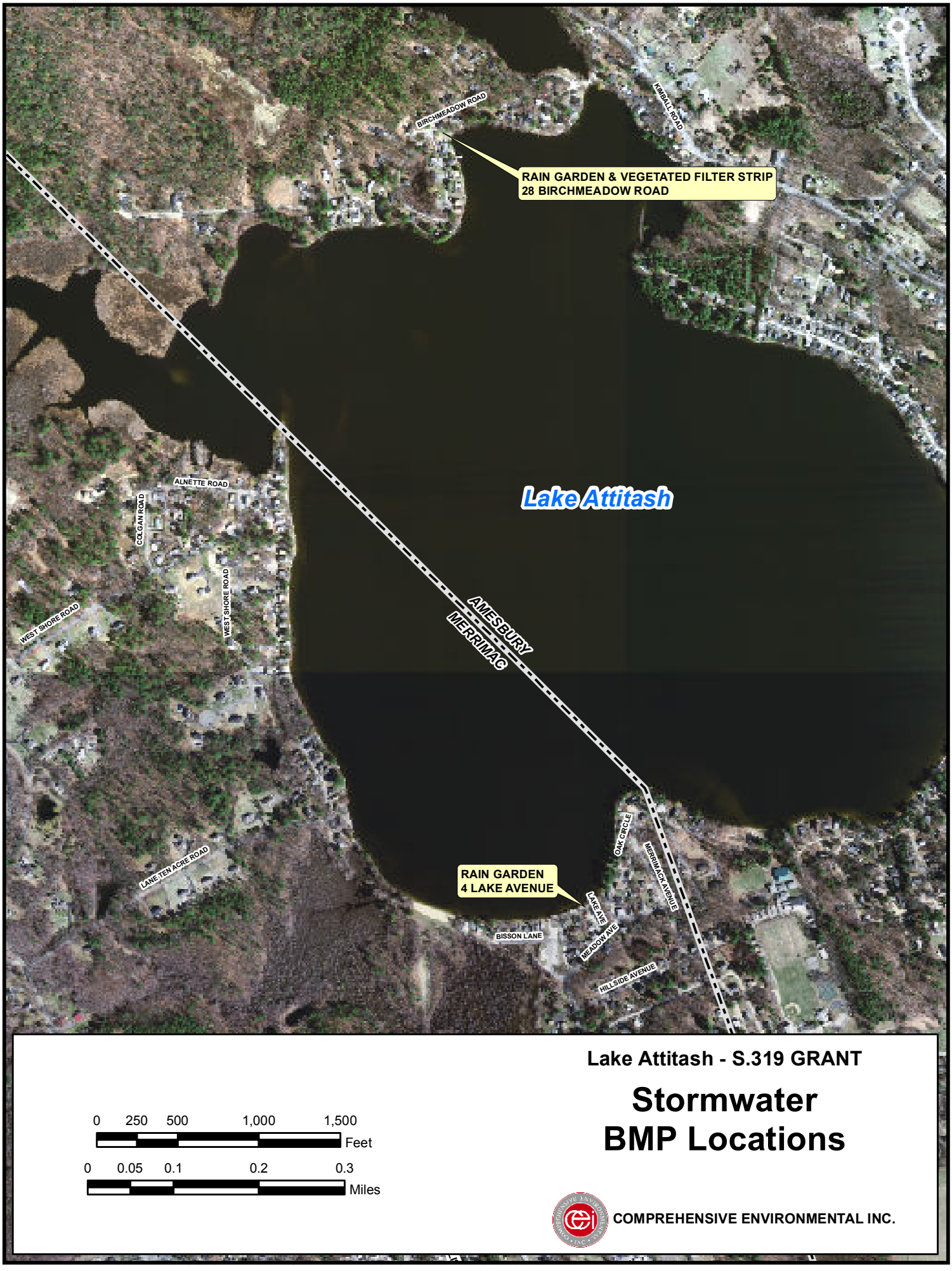
See attached O&M procedures for rain garden and vegetated filter strip maintenance.

BMP Locations:

See attached map.

Plan Elements:

1. O&M Plan procedures.
2. BMP maintenance log.
3. Site Map



Lake Attitash - S.319 GRANT

Stormwater BMP Locations

0 250 500 1,000 1,500 Feet

0 0.05 0.1 0.2 0.3 Miles

COMPREHENSIVE ENVIRONMENTAL INC.

Vegetated Filter Strip		
Procedure	**Objective**	**Frequency**
Debris and Litter Removal	Remove litter and debris from the vegetated swale to prevent it from entering nearby the waterbody and inhibiting BMP capacity.	Monthly
Sediment removal	Remove sediment >2" from the vegetated swale to prevent it from entering the nearby waterbody and inhibiting BMP capacity.	Quarterly
Mowing and Vegetation	Minimize erosion and channelization of stormwater. Inspect swale for signs of scouring, particularly near high velocity areas. Regrade as needed. Replace vegetation as needed to maintain 75% coverage.	Quarterly

Locations: 28 Birchmeadow Road, Amesbury, MA

Notes:
The accumulated sediment, leaves, and debris from the swale are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Vegetated Filter Strip

Maintenance Log

Date	Condition of BMP	Maintenance Performed, Material Removed, & Quantity	Person Performing Maintenance	Comments

Raingardens		
Procedure	**Objective**	**Frequency**
Debris and Litter Removal	Remove litter and debris from the vegetated swale to prevent it from entering the nearby waterbody and inhibiting BMP capacity	Monthly
Sediment removal	Remove sediment >2" from the raingarden to prevent it from entering the nearby waterbody and inhibiting BMP capacity.	Quarterly
Plantings & Mulch Care	Maintain healthy vegetation. Prune plants and remove weeds as required. Replace mulch and regrade as necessary. Replace unhealthy plants with new healthy plantings.	Spring and Fall or as necessary.

Locations: 28 Birchmeadow Road, Amesbury, MA
4 Lake Avenue, Merrimac, MA

Notes:
The accumulated sediment, leaves, and debris from the raingarden are to be removed and disposed of in an approved manner and in such a way as to not cause harm to the environment.

Rain Garden

Maintenance Log

Date	Condition of BMP	Maintenance Performed, Material Removed, & Quantity	Person Performing Maintenance	Comments

Lake Attitash Association CBSM Activity Summary

July 11, 2011 Initial education and outreach volunteer meeting with CEI presentation on CBSM

- Agenda
- CBSM Overview Handout
- CEI Presentation

August 2011 CBSM survey development and pilot

- LAA CBSM project objectives

September 2011 Announce survey and encourage watershed participation via website

- Survey announcement postcard

Sept/Oct 2011 Launch CBSM survey

- CBSM survey distributed via mail, email and surveymonkey.com

November 15, 2011 CBSM volunteer meeting with CEI to provide update on survey results and next steps.

- LAA presentation of survey results
- LAA Program Story (summary to date)

January-February CBSM Program Development

- CBSM campaign elements & plan overview (graphic)
- Proposed timeline and expenses

March-April 2012 CBSM volunteers develop material for campaign

- CBSM 'be a sponge' logo development (see right)
- Program pamphlet
- Workshop announcement postcard
- Lawn sign for residents
- Magnet
- Press release
- Garden center sign
- Watershed Signs

April 2012 Be a Sponge Workshop on Raingardens

- Presentation by CEI

April-October 2012 – Implementation of CBSM program elements

Results, Follow-Up and Future Recommendations

CEI Meeting Agenda

Lake Attitash s.319 Grant

CBSM Meeting Agenda

Monday July 11, 2011

- **Introductions**
- **Grant Overview**
- **Task Summary**

Task 4: Watershed CBSM Program

The Lake Attitash Association has made significant efforts over the past few years to educate their members and watershed residents on how to be better stewards of Lake Attitash. This effort has resulted in the development of an impressive website, active volunteers, and the publication of several brochures specific to Lake Attitash. With this task, the Grantee will work with LAA volunteers and a consultant to implement a community-based social marketing program to focus watershed education efforts on several specific areas, to address high phosphorus levels in the Lake: fertilizer use, pet waste and nuisance aquatic weeds. Implementation activities may include:

- Watershed survey to identify resident actions and barriers
- Development of program slogan/logo
- Selection of vivid messages -material will be based on existing material (with permission)
- Identify social norms, incentives, reminders and commitments

Deliverables 4:

1. Copies of all educational and related materials
2. A report describing how the project was carried out, with results, follow-up, and recommendations resulting from the task.

- **CBSM Presentation – Concepts of CBSM vs. traditional education efforts**
- **Lake Attitash Issues/Goals**
- **Next Steps/To Do List/Schedule**

Public Education Considerations

Community Based Social Marketing (CBSM) is a new, more scientific approach to public education where specific behaviors are promoted, and where barriers to these specific behaviors are eliminated. This approach involves the community and direct contact with people as opposed to conventional public education – the advertising approach. Media and advertising can be successful at raising public awareness and providing education on a particular issue (such as educating residents on why protecting the watershed is important) but these approaches have not worked well for environmental issues. This is because most environmental issues, for example, composting yard waste instead of dumping it in waterbodies, requires a greater level of commitment and time than changing from one product to another. CEI's approach uses the latest methods found effective at actually changing behavior. Key steps in our approach include:

☑ ID Problem Areas

This includes determining the initial problem area. One example is dumping of yard waste in and around waterbodies that results in clogged pipes, flooding and excessive nutrient input. How much of a problem is it and are there other targeted problem areas that should be identified?

☑ Determine Target Behaviors

Based on the yard waste example above, ideal behaviors would be encouraging residents to home compost or utilize a local/town Recycling Center that accepts yard waste. This step involves identifying the target behaviors to address the problem area: what behavior do you want to change and how?

☑ Develop Survey

A survey can be an ideal tool to determine why residents DO NOT recycle or compost yard waste but will also tell us why people DO recycle and compost yard waste. Are there model citizens in the watershed that do it right? What barriers are stopping people from doing the right thing? Lack of awareness? Time constraints? Other barriers?

☑ Pilot and Distribute Survey

No matter how large or small the survey, it should be piloted to a small group of the target audience to ensure all questions are understandable and desired results are obtained. This group of say 12 people, will be individually contacted to make sure the questions made sense to them and to gauge the usefulness of the results that will be tabulated when it is done on a larger scale.

☑ Identify Barriers & Competing Behaviors

Through the above survey and statistical analysis, we can identify barriers and benefits people perceive in the desired behavior. Some residents of the watershed likely already compost: why? The survey will also tell us what barriers prevent others from doing this (don't know how: don't have a vehicle to transport yard waste to the facility, don't care, can't make it during open hours, too time consuming, concerns about odors, etc.).

☑ Develop An Action List on How To Tip the Scale

Once barriers and competing behaviors have been recognized within a target group, we can then determine how to change the ratio of benefits and barriers so that the target behavior(s) becomes more attractive. CEI will develop an action list to accomplish this.

Comprehensive Environmental Inc.
603-424-8444

Public Education Plan Implementation

Here are a few examples of what this action list can include.

☑ Commitment

Studies show that if people actively make a commitment to do a certain activity they are not only more likely to perform a certain action but maintain that action for a longer period of time.

☑ Reminders and Prompts

Simply put, we all need reminders. Prompts are essential in not only getting people to choose a particular behavior but also maintaining that favorable action. For example, a sign on a trash bin that promotes recycling may encourage use of the container for recycling. Prompts may also be used to dissuade people from choosing a competing behavior. For example, “No Dumping” signs along the waterbody.

☑ Establish a Norm

Social norms are a big part of sustainable behavior. An example would be promoting the fact that residents recycle over 50% of their residential waste stream – this will likely nudge others to do the same. Would you want to be left out if all your neighbors are doing it? Establishing and promoting a social norm can do wonders to get people to choose a certain behavior.

☑ Create a Vivid Message

Communicating an effective message is essential in changing a person’s behavior. For example, ‘after a survey of X stream, it was determined that enough yard waste was illegally dumped within the watershed area to fill a football field XX feet deep’. This or a similar comparison that people are familiar with will surely get their attention.

☑ Develop Goals & Feedback

Studies have shown that people respond positively when goals are established and are more likely to continue an action when they receive feedback. Those little thermometers with $$$ raised in red are good examples.

☑ Encourage Personal Contact

For the most part the media does not influence what actions and behaviors we take, the network of people around us do. Watershed and block leaders can have a significant impact on what behaviors people choose through personal contact.

☑ Provide Incentives for the Preferred Behavior

If possible, an incentive for maintaining a positive behavior can often help extend the preferred action. Public recognition can go a long way and also help establish social norms (see above).

☑ Finally, Evaluate the Program’s Success

Determining a method for evaluating the program is essential in determining the success of the program. This data can often be used for future projects and in obtaining future funding such as state and federal grants.

Community Based Social Marketing Techniques: Measurements & Marketing of Protections

Presented by:
Stephanie Hanson
Comprehensive Environmental Inc.

What is CBSM/Social Marketing

- A pragmatic approach focusing on behavior change.
- Use of marketing principles to influence human behavior.
- Draws on the full range of social sciences and marketing techniques.
- Not to be confused with social media marketing.

Presented by Stephanie Hanson, Comprehensive Environmental Inc
Telephone (800)725-2550 or see www.ceiengineers.com

Traditional Public Education

May focus on:

- Issue awareness
- Shifting attitudes
- Knowledge/Facts
- List of positive/negative behaviors

However, awareness & knowledge do not always lead to behavior change!

Presented by Stephanie Hanson, Comprehensive Environmental Inc
Telephone (800)725-2550 or see www.ceiengineers.com

How is CBSM Different?

- Based on formative research - occurs before a program is designed and implemented
- Identifies barriers that prevent change.
- Develops a program to remove these barriers using proven tools of change.
- Implements a program community-wide.
- Develops a method to evaluate program effectiveness.

Presented by Stephanie Hanson, Comprehensive Environmental Inc
Telephone (800)725-2550 or see www.ceiengineers.com

History of CBSM

- 1971 article by marketing experts Kotler & Zaltman "Social Marketing: An Approach to Planned Social Change" in the Journal of Marketing.
- Kotler & Roberto later defined 'social change campaigns' as "an organized effort conducted by one group (the change agent) which attempts to persuade others (the target adopters) to accept, modify, or abandon certain ideas, attitudes, practices or behavior."
- Has been widely used for over 30 years in public health campaigns.

Basic Principles

- Understand your Audience
- Decisions center around Action
- There must be an Exchange
- Know your Competition
- What is current Policy

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4 P's of Marketing

- Product represents the desired behavior
- Price is the cost ($$, emotional, time) of the change
- Place where the target audience will encounter your program
- Promotion stands for the messages that will reach the target audience.

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Social Marketing IS:

- A social or behavior change strategy
- Most effective when it activates people
- Targeted to those who have reason to care and who are ready for change
- Strategic, and requires efficient use of resources
- Integrated, and works in stages

Social Marketing IS NOT:

- Just advertising
- Just a slogan
- A media blitz
- An image campaign
- Done in a vacuum
- A quick process

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Oversights of Traditional Efforts

- Awareness not leading to behavior change.
  - Example: this is your watershed
- Knowledge not leading to behavior change.
  - Example: smoking
- Misdiagnosis of the problem.
  - Example: recycling
- Failing to remove barriers to behavior change.
  - Example: recycling

Elements of CBSM

Identify Problem Areas

Determine Target Behaviors

Elements of CBSM

Develop Survey & Focus Group

Pilot & Distribute Survey

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Elements of CBSM

ID Barriers/Competing Behaviors

Develop an Action List to Tip the Scale

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Elements of CBSM

Commitments

Reminders/Prompts

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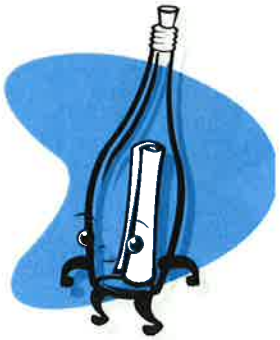
Elements of CBSM

Establish a Norm

Create Vivid Messages



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Elements of CBSM

Develop Goals & Feedback

Personal Contact

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Elements of CBSM

Provide Incentives

Evaluate Program Success

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Stump Pond CBSM Program

- Funded by NH DES Source Water Protection Program
- Source water supply for Pennichuck

Advantages/Challenges

- ✓ Small area with ~600 homes
- ✓ 2002 Stump Pond Brook Subwatershed Plan
- ✓ 1998/2008 Watershed Restoration Plans
- ✓ 1 of 24 subwatershed – can be used as pilot
- ✖ Include 2 communities (Amherst & Merrimack)
- ✖ Not Pennichuck customers – most have private wells
- ✖ No existing watershed group or neighborhood champion

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Initial Focus Areas

- Fertilizer Use & Management
- Lawn & Yard Waste Disposal
- Pet Waste

Working Group

- Town of Amherst – DPW & ConCom
- Town of Merrimack – DPW & ConCom
- Pennichuck Water Works
- CEI

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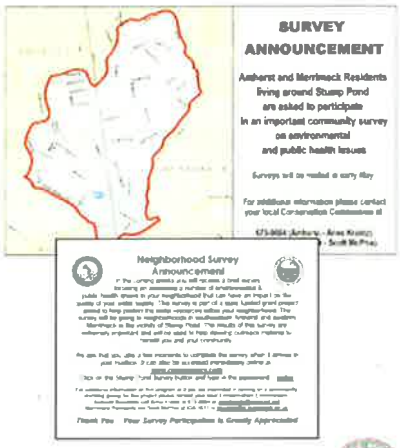
Challenge #1 – Survey Approach

- Pre-Survey Media Blitz
  - Cable announcements
  - Postcard
  - Website
  - Newsletter/newspaper
- Internet capable
- Town letter



Initial Survey Results

- 39% Response Rate
- 84% Hard Copy/16% Electronic

Felt most significant activities contributing to water pollution were:

1. Improper/overeuse of lawn products
2. Failing septic systems
3. Littering
4. Dog droppings

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Fertilizer Use & Management

- 22% felt improper/overuse of lawn products was a contributing factor to water pollution.
- 75% used fertilizer with the majority applying at least 2 times per year.
- 73% had never done a soil test.
- 20% used organic/low nutrient fertilizers while many did not know what they were using.

Preferred Behaviors

- Decrease lawn fertilizer use.
- Proper application of fertilizer when needed to sustain healthy plant growth.
- Use of organic/low nutrient/slow release fertilizers when needed.
- Annual soil testing.
- Understanding of what products are being applied.
- Acceptance of natural landscapes (lawns go dormant as part of natural process).

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Non-Preferred Behaviors/Barriers

- Improper application of lawn fertilizer (timing, amount, dilution, method of application).
- Application of wrong fertilizer formulation.
- Lack of understanding of what they are applying.
- Lack of information on conducting soil tests.

Plan Development

- Based on CBSM techniques:

  Commitments, Reminders/Prompts, Norms, Vivid Messages, Goals & Feedback, Incentives, Personal Contact
- Survey identified individuals willing to help with implementation.
- UNH Cooperative Extension - great technical resource and gave program credibility.

Plan Implementation

- Kick-off meeting with working group members.
- Shift from municipal to community
- Integrate timeline
- Make adjustments/be flexible
- Identify talents of group

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Date	Action/Activity
May	Postcard announcement of free soil test.
May	Distribution of free soil test kits with cover letter from Towns.
June	Postcard announcement of Free Lawn & Garden Event including Q&A with Master Gardeners.
July	Master Gardener Lawn & Garden event at High School
July	Lawn & Garden Tip Postcard #1
July	Vivid Message Postcard.
July	Lawn & Garden Tip Postcard #2
July	Distribution of 'Put Your Lawn on a Diet' Lawn Flags – 2 designs.
August	Lawn & Garden Tip Postcard #3
August	Distribution of UNH Cooperative Extension magnet & cover letter from Towns.
August	Farmer's Market table with outreach material.
September	Survey announcement postcard with pledge and incentive offer
October	Distribution of the 'Put Your Lawn on a Diet: The 5-Minute Survey'

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Slogan/Logo Development

- Placed on all material
- Unified the program
- Vivid Message/Reminder & Prompt
- 88% of final survey respondents were familiar with this logo.

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Free Soil Test

- Mailed to each watershed resident with return postage
- 11% completed tests – 73% had never completed a soil test
- Mailed out in mid-spring
- Sent to UNH Lab

Free Soil Test

As part of a state funded grant educational outreach effort aimed to help protect the water resources within your neighborhood you will be receiving a free home soil test kit and test analysis. We hope you will take advantage of this free offer to obtain useful and valuable information about your soil. A comprehensive soil test kit will be arriving in your mail within the next few weeks. Tests will be conducted through the UNH Cooperative Extension Program and will be analyzed free of charge through the middle of July.

Put Your Lawn on a Diet – Buy Less & Use Less Fertilizer

Testing your soil can have the following benefits:

- Unlock nutrients already in the soil
- Identify nutrients that are lacking in soil
- Save $$$ by only applying type & amount of fertilizer needed
- Reduce chances of nutrients leaching or running off into drinking water sources

Thank You – We Hope You Will Consider Testing Your Soil To Reduce Fertilizer Use, Protect Water Quality & Save $$$

For additional information on this program or if you are interested in serving on a [illegible] working group for this project please contact [illegible]

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Free Soil Test

- When asked why they were testing their soil:
  - 35% protect groundwater/surface water
  - 25% test is free
  - 24% save money (only apply what soil needs)
  - 16% save time (only apply what soil needs)
- Ranked 1st for behavior change in final survey
- Reminder/prompt
- Incentive to save $$

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Postcard Tips

- Send to each household over approximately 6 weeks.
- Easy to convert to handouts
- Healthy Soil – Healthy Lawn – Healthy Pond

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Postcard Tips

- Final survey ranked this effort the highest as far as promoting program awareness and second behind the free soil test regarding impact on behavior.
- Reminder/Prompt
- Vivid Message

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Vivid Message Postcard

- Part of larger campaign that began several years ago – used with permission
- Reminder/Prompt
- Vivid Message/Image

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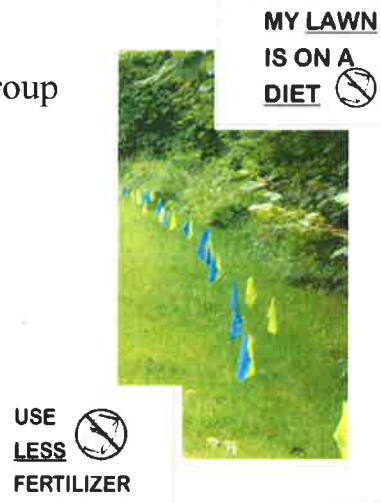
Lawn Flags

- Distributed by working group members and available at Town Hall
- Low effort/cost
- Commitment
- Norm
- Reminder/Prompt
- Personal Contact



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UNH Magnet

- UNH Cooperative Extension
- Paired with cover letter from each town
- Survey indicated many remembered the magnet but did not lead to direct behavior change
- Reminder/Prompt
- Pledge

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Events

- Lawn & Garden Event
  - Local school
  - Drop-in
  - Master Gardeners on hand to answer questions and review soil test results
  - Personal Contact
  - Norm
  - Reminder/Prompt
  - Incentive (raffle)
- Farmer's Market
  - Handout material
  - Lawn flags
  - Magnets
  - Program posters

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Pledge/Commitment

- Included with final survey
- Make a pledge to:
  - Test soil
  - Reduce # of applications
  - Use organic, slow release or low phosphorus fertilizer
  - Apply half the labeled rate
- Free book offer

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Final Survey Results

- 18% response rate
- 88% familiar with logo/slogan
- 75% became familiar with postcard mailings
- 65% familiar with free soil test program
- 89% have/will use less fertilizer
- 11% will use the same amount
- 90% have/will start using organic/slow release or low phosphorus fertilizer

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LAA CBSM Effort

- ✓Establish a committed group of CBSM leaders.
- ✓Truly understand CBSM and stick to methods.
- ✓ID several issues to initially discuss & survey.
- ✓ID target audience, barriers and behaviors.
- ✓Develop and scrutinize survey distribution methods/set return goal.
- ✓Draft and pilot survey.
- ✓Finalize, announce and distribute survey/set return deadline.

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LAA CBSM Effort cont.

- ✓Review survey results and identify barriers to behavior change.
- ✓ID methods that will remove barriers and change behaviors.
- ✓Cost and prioritize implementation activities.
- ✓Ensure activities touch upon CBSM elements.
- ✓Finalize list of activities to be funded by grant and develop detailed schedule & resources.

Words of Advice

- ✓Maintain momentum – active email communication is low effort but keeps it current.
- ✓Plan ahead – everyone has other commitments and things always take longer than expected.
- ✓Stay on schedule but remain flexible.
- ✓Survey participation and feedback is critical.

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References/Resources

CBSM

- www.toolsofchange.com
- www.cbsm.com
- www.turningpointprogram.org

Nonpoint Source Pollution

- http://cfpub.epa.gov/npstbx/index.html

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Project Objectives

The purpose of this project is to assess why residents are choosing certain behaviors that may contribute to specific sources of nonpoint source pollution and to identify barriers and competing behaviors. Identifying certain resident behaviors associated with non-point source pollution will provide a basis for developing an education action plan for the public (e.g. watershed residents) that will help to minimize behaviors that result in greater non-point source pollution. Based on the fact that Lake Attitash has been struggling with an overload of nutrients, frequent algae blooms and water contact advisories due to high counts of cyanobacteria, we have decided to focus on the following areas of behavior that result in nonpoint source pollution:

1. Misuse of Fertilizer, Weed Killer & Pesticide Use & Management (nutrients, pesticides) by homeowners.
    - Find out why people fertilize and educate them on the impact of fertilizers and find alternatives. (Take what we learn and present education, tools and incentives for using alternatives)
2. Lack of natural landscaping in the watershed that could help control run-off from rain into the lake and absorb nutrients at the shoreline
    - Find out why people choose to have their lawn right up to the waterfront and educate them on creating vegetative barriers/natural buffers that are both good looking and benefit the water quality. (Take what we learn and develop solutions and incentives that support their desire to have nice landscaping, a view and good water quality)

3. Poor management of pet waste (bacteria, nutrients)

- *Find out how people are handling their pet waste and use this information to decide if we should address this issue at a later date. (We do not anticipate developing solutions for pet waste management as part of this grant, but as a future activity)*

Although there are a number of other issues related to commercial land use practices that could also contribute to nonpoint source pollution and impact water

quality, the focus of this project is to identify resident behaviors and suggest a plan of action to reduce residential land use impacts.

Note:

Other topics of interest that we want to investigate at a later date:

1. *Inappropriate Lawn & Yard Waste Disposal (nutrients, sedimentation/TSS, color/odor)*

Neighborhood Survey Announcement

In the coming weeks you will receive a brief survey focusing on assessing a number of environmental issues in your neighborhood that can have an impact on the water quality of Lake Attitash. We have been awarded a state-funded grant aimed at protecting the water quality of our lake. The survey will go out to the Lake Attitash watershed neighborhoods in Amesbury and Merrimac. The results of this survey are extremely important and will be used to help develop outreach material and actions that will benefit the quality of our lake.

Thank you in advance – your survey participation is greatly appreciated and will assist us in developing a successful program to help preserve and protect Lake Attitash.

We ask that you take a few moments to complete the survey when it arrives in your mailbox. Once it arrives it will also be available online at: www.lakeattitash.org. Click the **Neighborhood Survey** link.

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Lake Attitash Association
P O Box 503
Amesbury MA 01913
RETURN SERVICE REQUESTED

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Amesbury MA 01913
RETURN SERVICE REQUESTED

Lake Attitash Association
P O Box 503
Amesbury MA 01913
RETURN SERVICE REQUESTED

Lake Attitash Association
P O Box 503
Amesbury MA 01913
RETURN SERVICE REQUESTED

'Living Lake Smart' - The 10 Minute Survey

Thank you for taking the time to complete the Lake Attitash Watershed survey. This survey is an important part of a public education grant supported by the Towns of Amesbury and Merrimac and funded by a s.319 Grant awarded to the Lake Attitash Association.

This survey will assess a number of environmental and public health issues involving Lake Attitash that can have an impact on the quality of the Lake's water. Among many, these issues include cyanobacteria blooms that restrict usage and present potential health related affects. This problem not only has an impact on recreational use of Lake Attitash but also could affect drinking water quality.

Your answers will assist us in developing a successful program to help preserve and protect Lake Attitash. Please try to complete the survey by September 30th.

This survey should take no longer than 10 minutes. Please answer as many questions as possible to the best of your knowledge. This information is anonymous. We appreciate your time and look forward to hearing your opinion.

Part 1~ General Information

1. Are you a resident of:
    - ☐ Amesbury
    - ☐ Merrimac
    - ☐ Newton, NH
2. Do you own or rent your home?
    - ☐ Own

☐ Rent

3. What type of activities do you believe contribute to water pollution in your neighborhood? (Please pick 3) And which activities have you observed?

	I believe contribute to water pollution	**I've observed in my neighborhood**
People not picking up/properly disposing of dog droppings	☐	☐
Dumping into storm drains (trash, pet waste, other)	☐	☐
Improper/overuse of lawn products (fertilizers, pesticides and/or weed killers)	☐	☐
Failing septic systems	☐	☐
Improper disposal of yard waste	☐	☐
Improper manure storage	☐	☐
Feeding ducks/waterfowl	☐	☐
Littering	☐	☐
Bathing in the lake (self and/or pets)	☐	☐
Dumping aquariums into the lake	☐	☐
Lack of waterfront buffers/native vegetation (to absorb runoff from rain)	☐	☐
Storm-water runoff from impervious surfaces (a surface that does not absorb rain water such as asphalt)	☐	☐
Lack of natural landscaping	☐	☐
None of the above	☐	☐

Part 2 ~ Fertilizer, Weed Killer & Pesticide Use & Management

4. Who maintains your lawn?
    - ☐ Homeowner
    - ☐ Landscape Service Company
      Name_____
    - ☐ Landlord/owner
    - ☐ Other _____

5. How often are fertilizers, weed killers and pesticides applied to your lawn?

	Fertilizers	**Weed Killers**	**Pesticides**
Once a week	☐	☐	☐
Every other week	☐	☐	☐
Monthly	☐	☐	☐
Once per year	☐	☐	☐
Twice per year	☐	☐	☐
Don't know	☐	☐	☐
Not used	☐	☐	☐

Other (please specify)_____

6. If you or your lawn care service applies fertilizer, is it an "organic", "low nutrient" or a "slow release" formula?
    - ☐ Yes, I only use organic/low nutrient/slow release fertilizers
    - ☐ Yes, I sometimes use an organic/low nutrient/slow release fertilizer,
    - ☐ No, tried it once, but did not like the results
    - ☐ No, too expensive
    - ☐ No, it's not available at my garden supply store
    - ☐ No, I understand they are not effective
    - ☐ No, never thought of it/don't have enough information on it
    - ☐ Not sure if the fertilizer I use is organic, low nutrient, or slow release.
    - ☐ I do not apply fertilizer
    - ☐ Other (please specify)_____

7. Do you conduct a soil test on your lawn?
    - ☐ One, at the start of the growing season
    - ☐ Several during the growing season
    - ☐ No, never considered doing one
    - ☐ No, what is a soil test?
    - ☐ No, I've considered doing one, but not yet
    - ☐ No, it seems too difficult/don't know how

8. How important is having a lush, green lawn to you?
    - ☐ Very important, I like a bright green, thick, weed free lawn.
    - ☐ Somewhat important, I prefer a green lawn with minimal weeds.
    - ☐ Not that important, I cut it regularly but don't mind a few weeds.
    - ☐ Not important, I'd rather spend my time doing other things.
    - ☐ Other: _____

Part 3 ~ Management of Pet Waste

9. Are you a dog owner?
    - ☐ Yes
    - ☐ No

10. How many dogs do you own?

- ☐ One
- ☐ Two
- ☐ Three
- ☐ If more than 3, how many? _____

11. DOG OWNERS ~ How do you dispose of dog waste that you have collected?
    NOT A DOG OWNER ~ How do you observe dog owners in your neighborhood disposing of dog waste?

	Always	**Sometimes**	**Never**
Toss in garbage	☐	☐	☐
Flush down toilet	☐	☐	☐
Bury in ground	☐	☐	☐
Throw in woods	☐	☐	☐
Put in storm drain	☐	☐	☐
Don't pick it up	☐	☐	☐

12. In your opinion, what are the top two reasons why people don't pick up after their dog? (Check up to 2 choices)
    - ☐ They forget
    - ☐ Think rain will wash it away
    - ☐ Forgot to bring bag or gloves for disposal
    - ☐ Don't want to take the time/effort (Don't care)
    - ☐ No convenient disposal area/trash
    - ☐ Don't know
    - ☐ Other (please specify) _____
13. What do you think would motivate people to pick up after their dog? (Check up to 2 choices)
    - ☐ Pressure from neighbors
    - ☐ Nearby bag dispenser
    - ☐ Material on how to properly dispose of pet waste
    - ☐ Signs/reminders
    - ☐ Not sure/don't know
    - ☐ Other (please specify) _____

Part 4 ~ Natural Landscaping in the Watershed

14. Are you aware that runoff from rainwater enters the lake directly through the storm drains?
    - ☐ Yes
    - ☐ No
15. Are you aware that runoff from rainwater exists when grass meets the waters edge?
    - ☐ Yes, I understand
    - ☐ No, I didn't know
16. Are you aware that runoff from rainwater contains nutrients that can negatively affect the water quality in the lake?
    - ☐ Yes
    - ☐ No
17. Have you heard of barrier gardens, buffer gardens and/or rain gardens?
    - ☐ Yes
    - ☐ No
18. Do you have a garden(s) on your property that absorbs runoff from rain?
    - ☐ Yes
    - ☐ No
    - ☐ I don't know
19. Are you aware of the connection between buffer gardens and the quality of the water in the lake?
    - ☐ Yes
    - ☐ No
20. If you thought the quality of the lake water could be improved by adding a garden to your landscape, how likely are you to add one?
    - ☐ Extremely likely
    - ☐ Somewhat likely
    - ☐ Not likely, if not why _____
21. If you are not likely (or somewhat likely) what would prevent you from adding a garden to your landscape?
    - ☐ I don't like to garden
    - ☐ Too expensive
    - ☐ I don't know enough about which plants to use
    - ☐ I don't know where to put it

- ☐ I don't know how to create a rain garden
- ☐ I don't want to limit my lawn area
- ☐ It's too much work/too much maintenance

22. Would you like more information on the benefits of barrier gardens and how to create one?
    - ☐ Yes
    - ☐ No, If not, why _____
23. How would you like to receive this information?
    - ☐ Workshops
    - ☐ E-mail
    - ☐ Flyer/pamphlet
    - ☐ Consultation with a landscaper

Part 5 ~ Neighborhood Information

The following information will help us develop an effective outreach program to meet your neighborhood needs. We ask that you answer as many questions as you feel comfortable with, and simply skip those you may not want to answer. If you are interested in obtaining more information about participating in this neighborhood working group, please provide your contact information where indicated at the bottom of this survey and you will be contacted. You can also contact the Lake Attitash Association directly for more information at **www.lakeattitash.org.**

24. Are you:
    - ☐ Male
    - ☐ Female

25. Your age group is:
    - ☐ 65+
    - ☐ 55-64
    - ☐ 45-54
    - ☐ 35-44
    - ☐ 25-34
    - ☐ 18-24
26. How many people in your house hold? _____
27. How often do the following serve as a main source of local news, daily information, and current town-wide issues?

	Often	Sometimes	Never
☐ Internet	☐	☐	☐
☐ Newspaper	☐	☐	☐
☐ Daily Newspaper	☐	☐	☐
☐ Amesbury Newspaper	☐	☐	☐
☐ Haverhill Gazette	☐	☐	☐
☐ Eagle Tribune	☐	☐	☐
☐ Television	☐	☐	☐
☐ Town Meetings	☐	☐	☐
☐ Flyers/brochures	☐	☐	☐
☐ Radio	☐	☐	☐
☐ Word of mouth	☐	☐	☐
☐ www.lakeattitash.org	☐	☐	☐
☐ e-mail from Lake Attitash Association	☐	☐	☐
☐ Other (please specify)_____	☐	☐	☐

If you are interested in learning more about the LAA education grant or would like to be part of the working group in your neighborhood, please provide the following contact information. This information is confidential and will only be used for matters relating to this project. . You can also contact the Lake Attitash Association directly for more information at **www.lakeattitash.org.**

Name: _____

Address:_____

City/Town:_____

Zip/Postal Code:_____

Email Address:_____

Phone Number:_____

Thank you for taking time to complete this survey!

Please return the completed survey in the enclosed envelope or mail directly to:

Lake Attitash Association

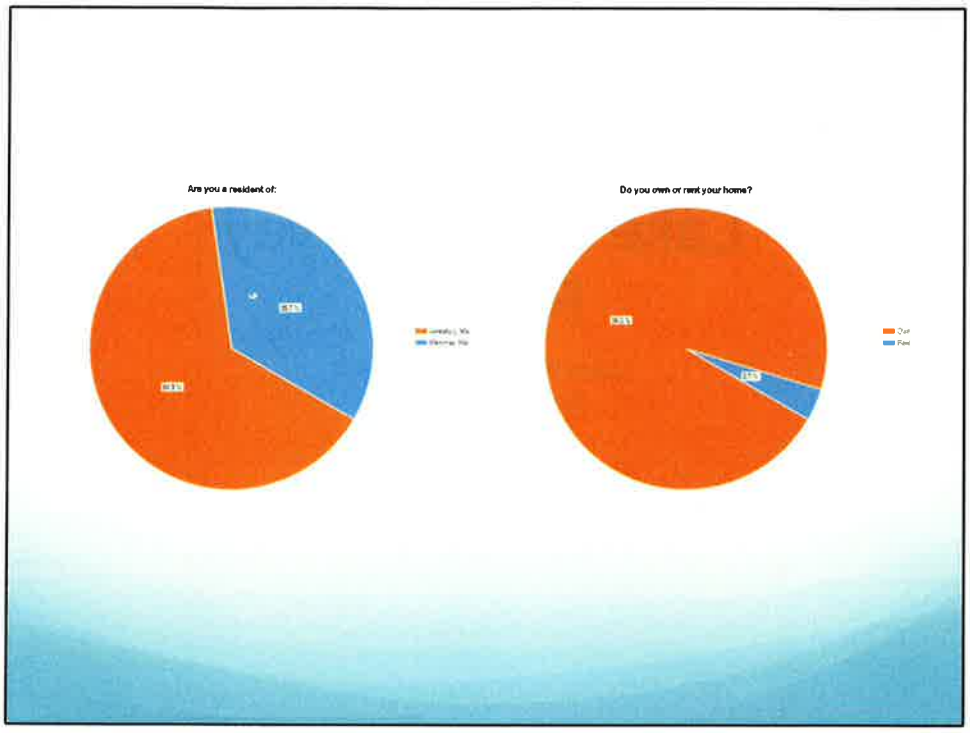
PO Box 503

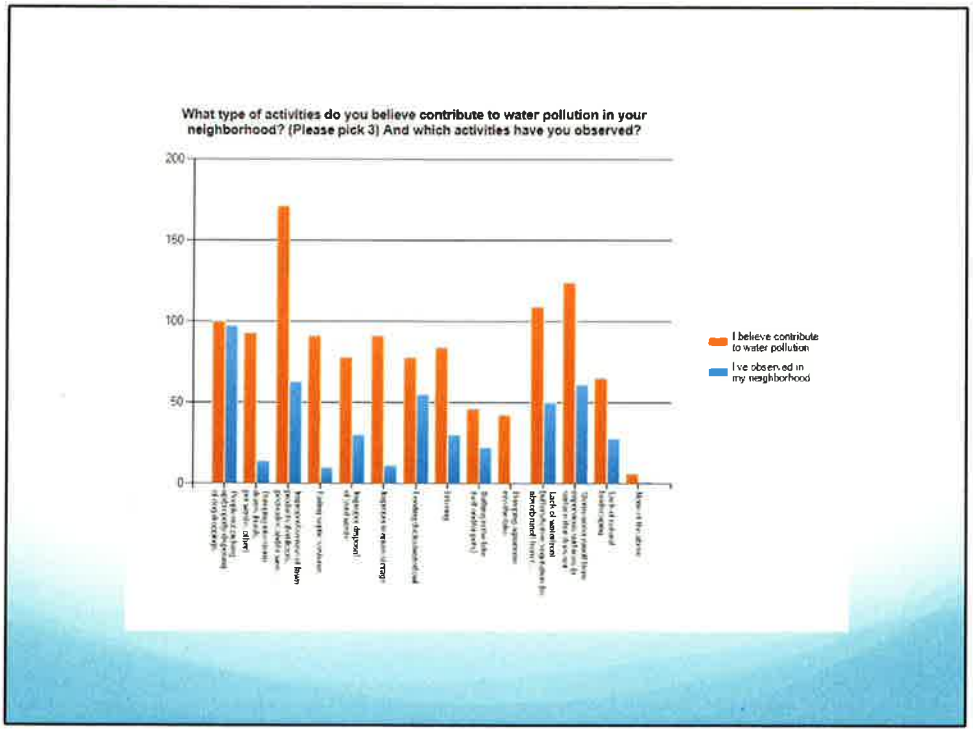
Amesbury, MA 01913

Lake Smart Survey Results

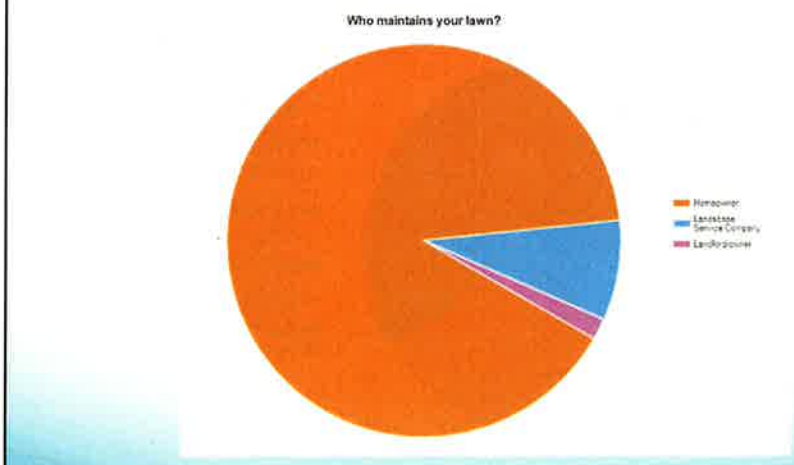
Lake Attitash CBSM Project
November 14, 2011

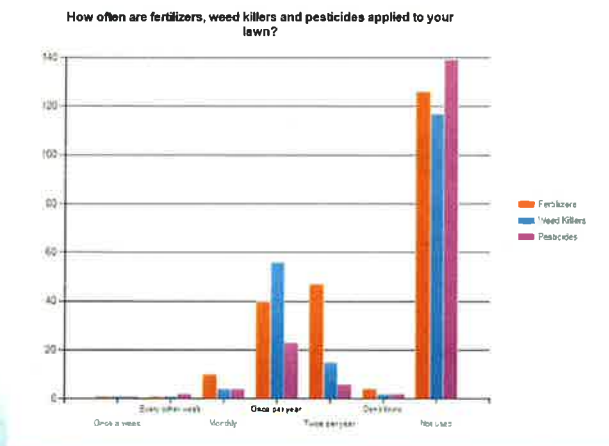
Part 1
General Information

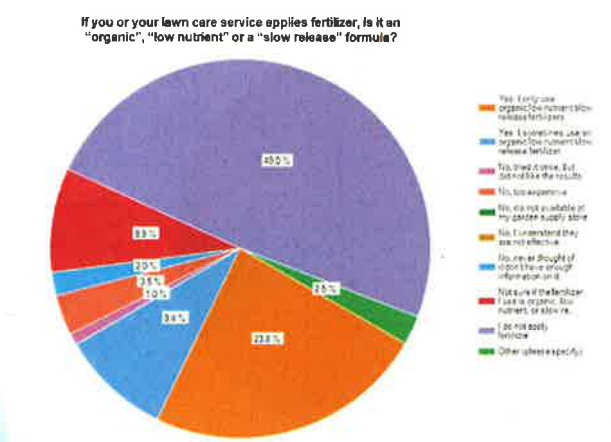

Are you a resident of:
Do you own or rent your home?

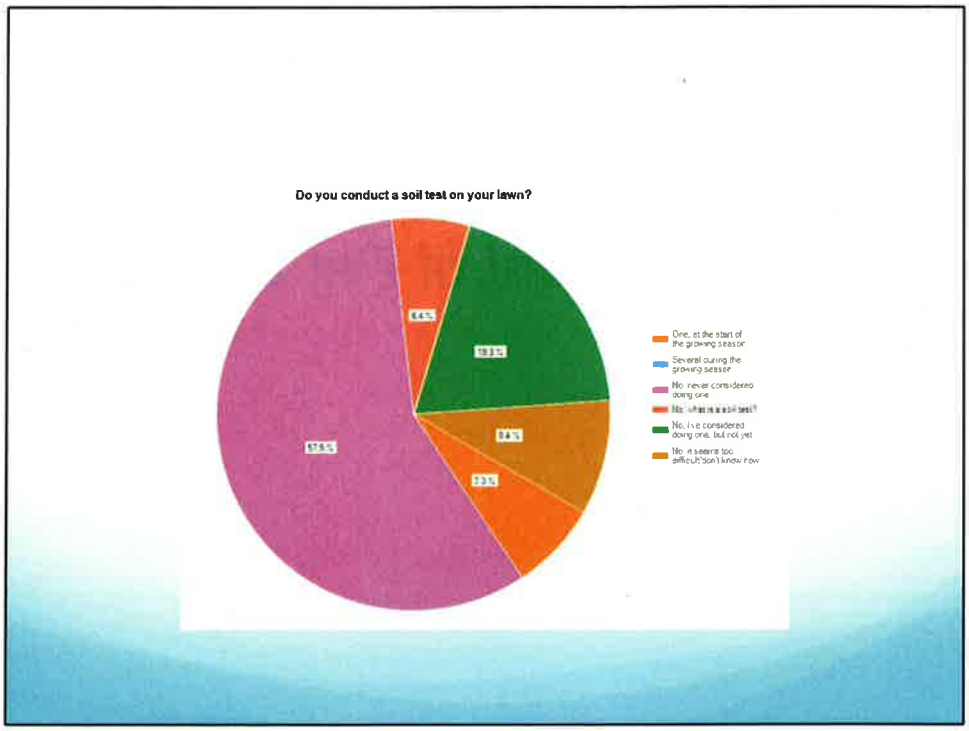

What type of activities do you believe contribute to water pollution in your neighborhood? (Please pick 3) And which activities have you observed?
200
150
100
50
0
I believe contribute to water pollution
I've observed in my neighborhood

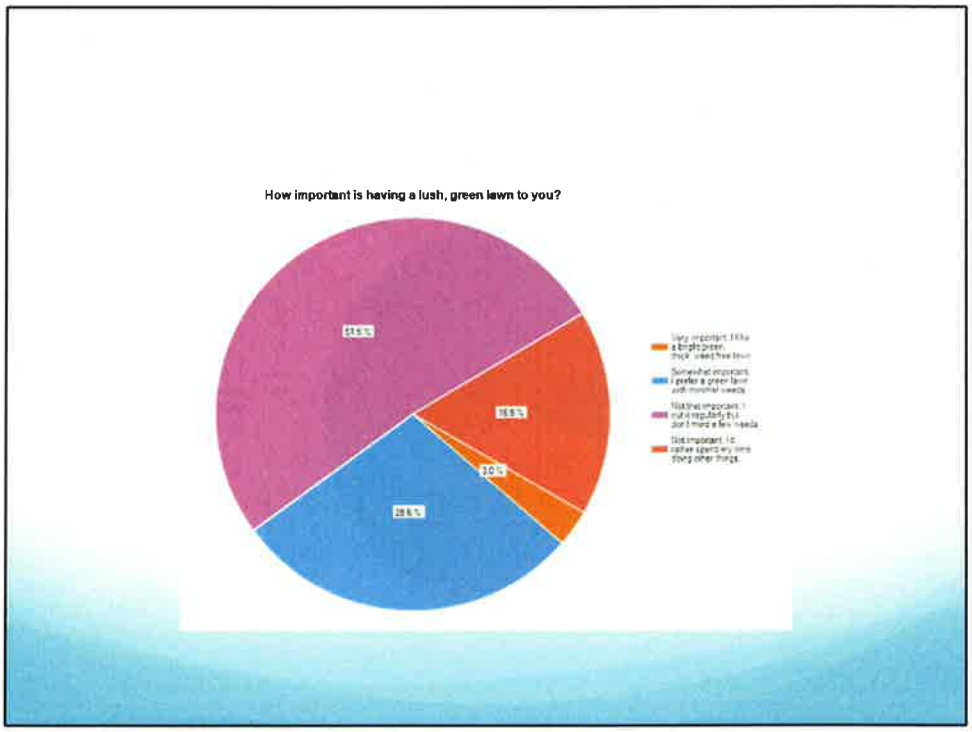
Part 2
Fertilizer, Weed Killer & Pesticide Use & Management



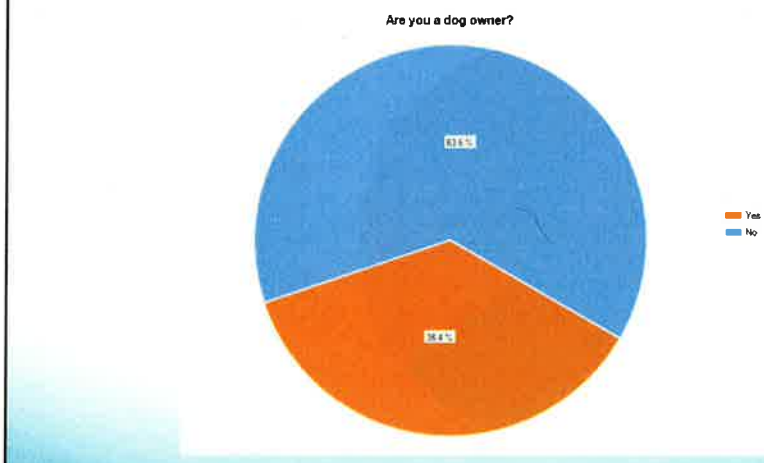

How often are fertilizers, weed killers and pesticides applied to your lawn?
140
120
100
80
60
40
20
0
Once a week
Every other week
Monthly
Once per year
Twice per year
Don't know
Not used
Fertilizers
Weed Killers
Pesticides

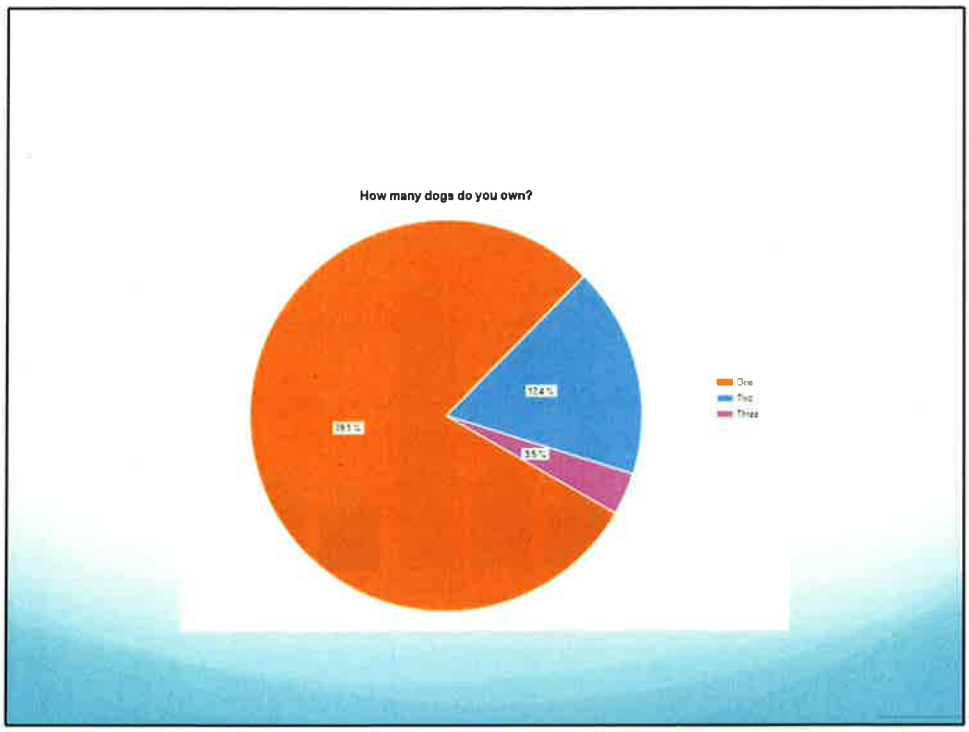

If you or your lawn care service applies fertilizer, is it an "organic", "low nutrient" or a "slow release" formula?
45.0 %
33 %
20 %
3.5 %
10 %
3.4 %
2.5 %
23.8 %

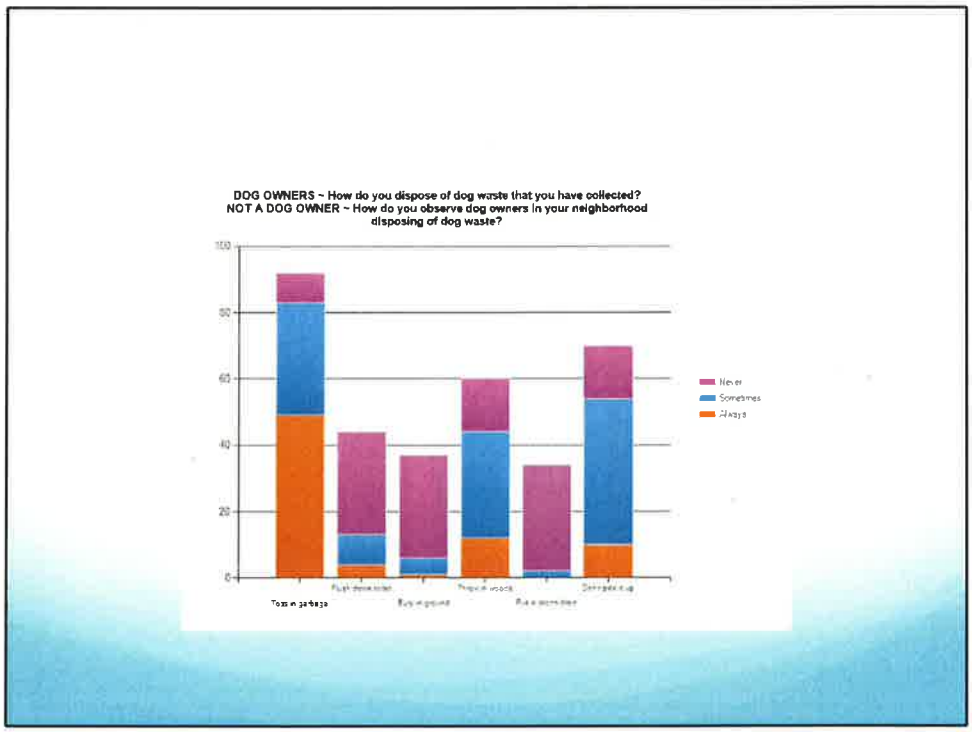

Do you conduct a soil test on your lawn?
6.4%
19.3%
9.4%
12.3%
52.6%
One, at the start of the growing season
Several during the growing season
No, never considered doing one
No, what is a soil test?
No, I've considered doing one, but not yet
No, it seems too difficult/don't know how

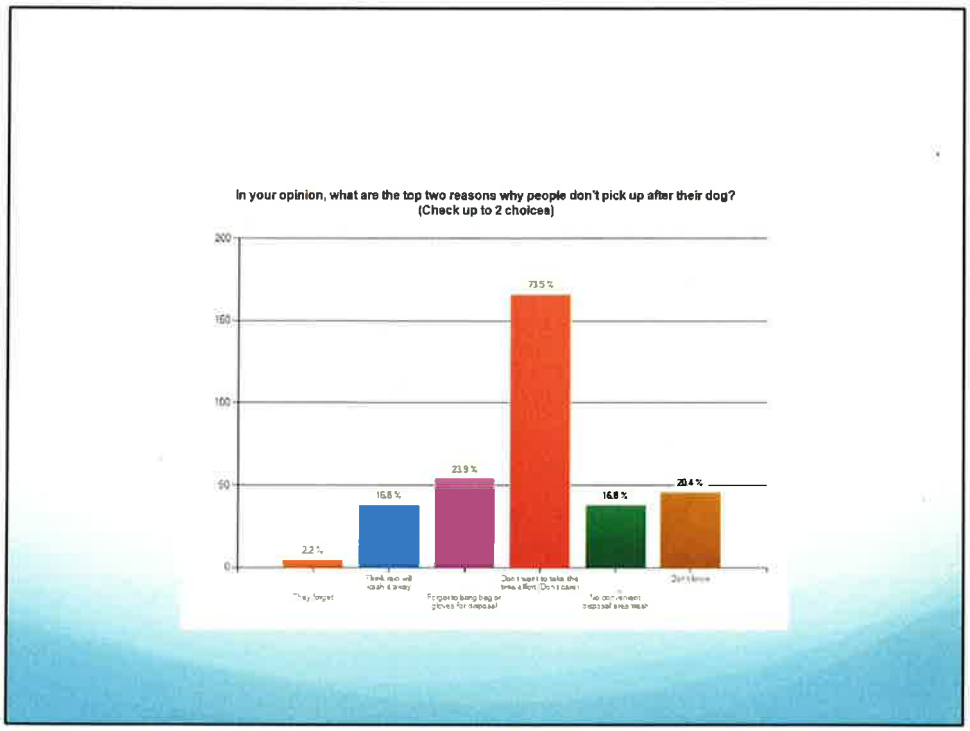

How important is having a lush, green lawn to you?
35.5%
16.5%
3.0%
28.6%

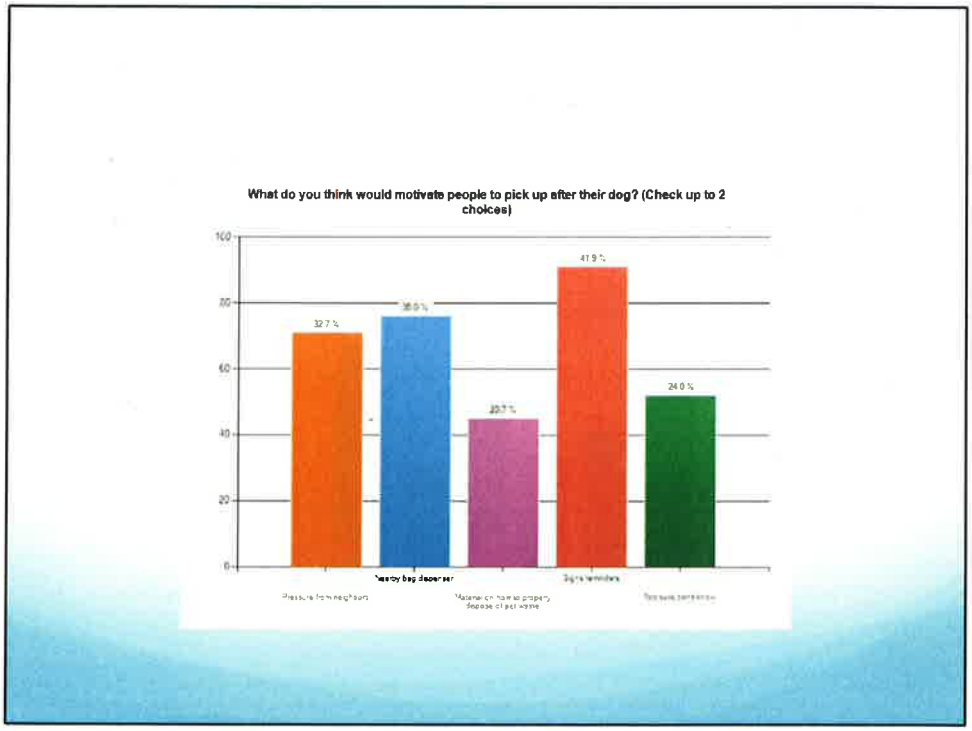
Part 3
Management of Pet Waste



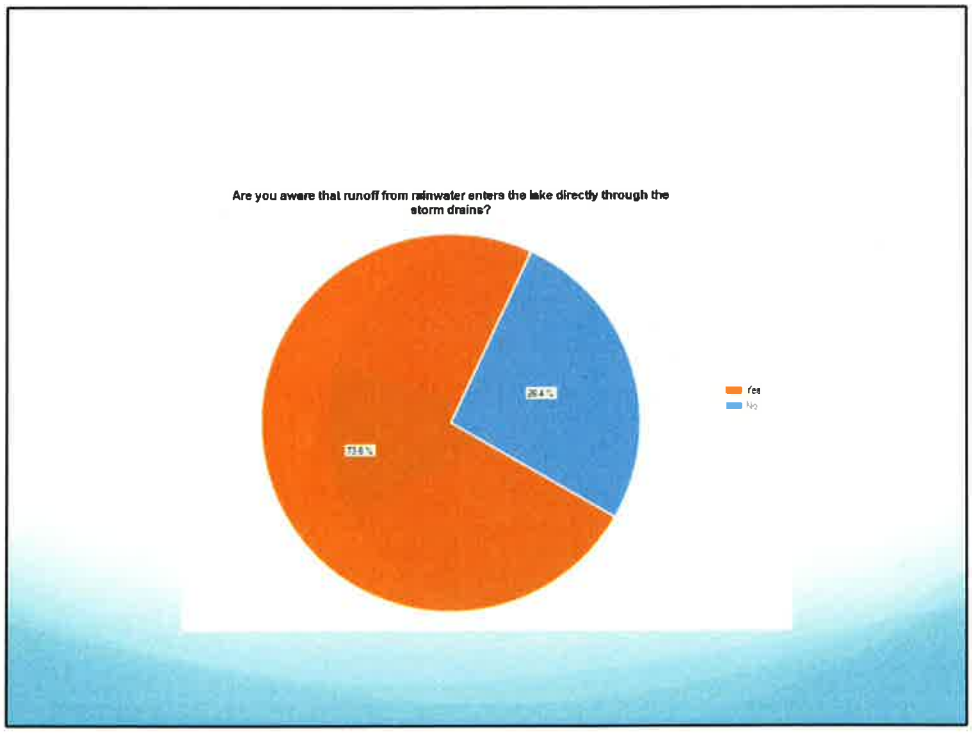

How many dogs do you own?
One
Two
Three

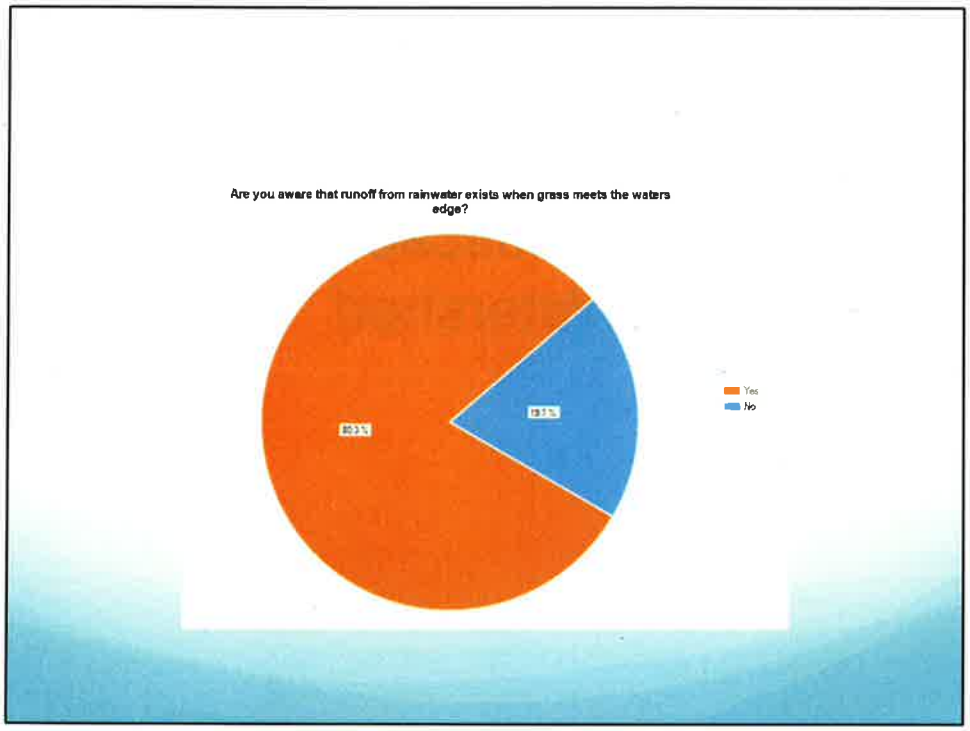

DOG OWNERS ~ How do you dispose of dog waste that you have collected?
NOT A DOG OWNER ~ How do you observe dog owners in your neighborhood disposing of dog waste?
Never
Sometimes
Always

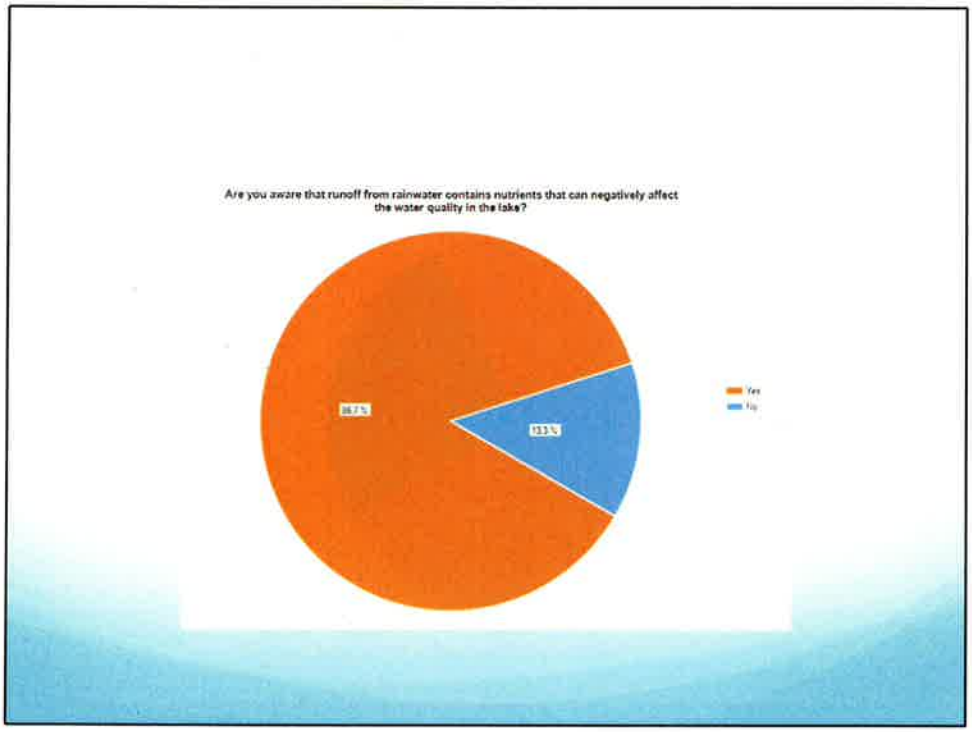

In your opinion, what are the top two reasons why people don't pick up after their dog? (Check up to 2 choices)
200
150
100
50
0
2.2 %
16.8 %
23.9 %
73.5 %
16.8 %
20.4 %

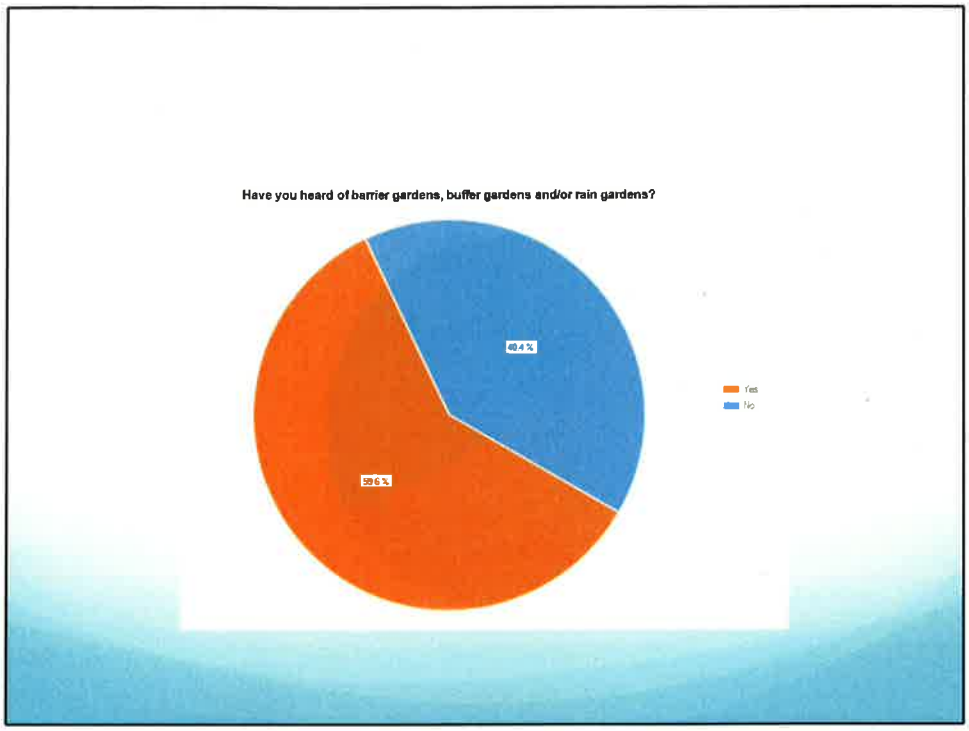

What do you think would motivate people to pick up after their dog? (Check up to 2 choices)
100
80
60
40
20
0
32.7 %
41.9 %
24.0 %

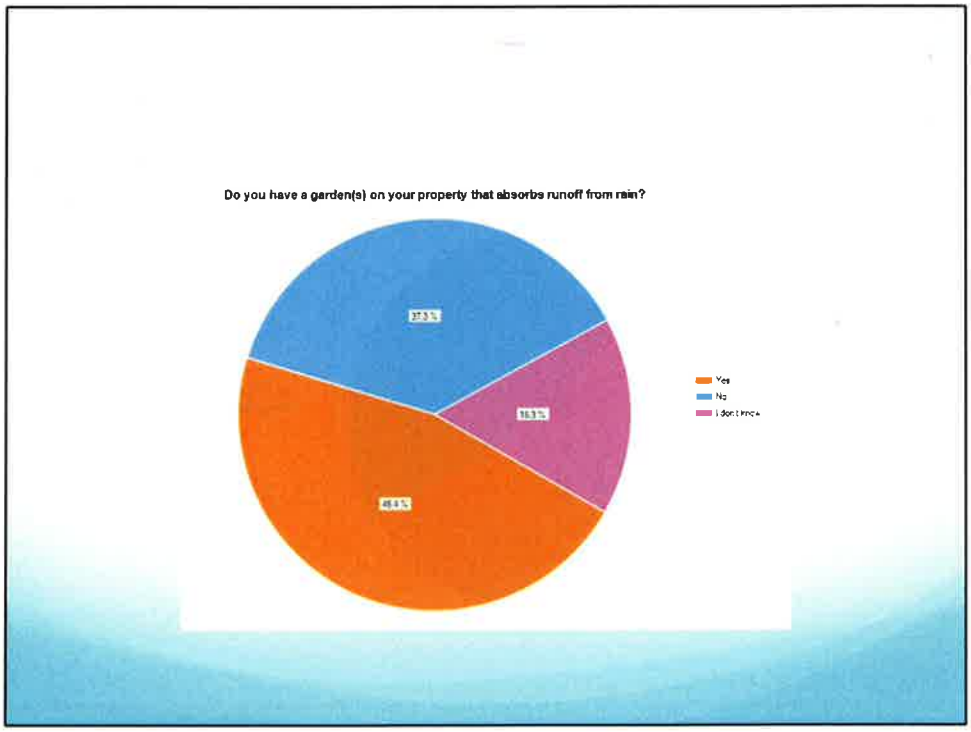
Part 4
Natural Landscaping in the Watershed

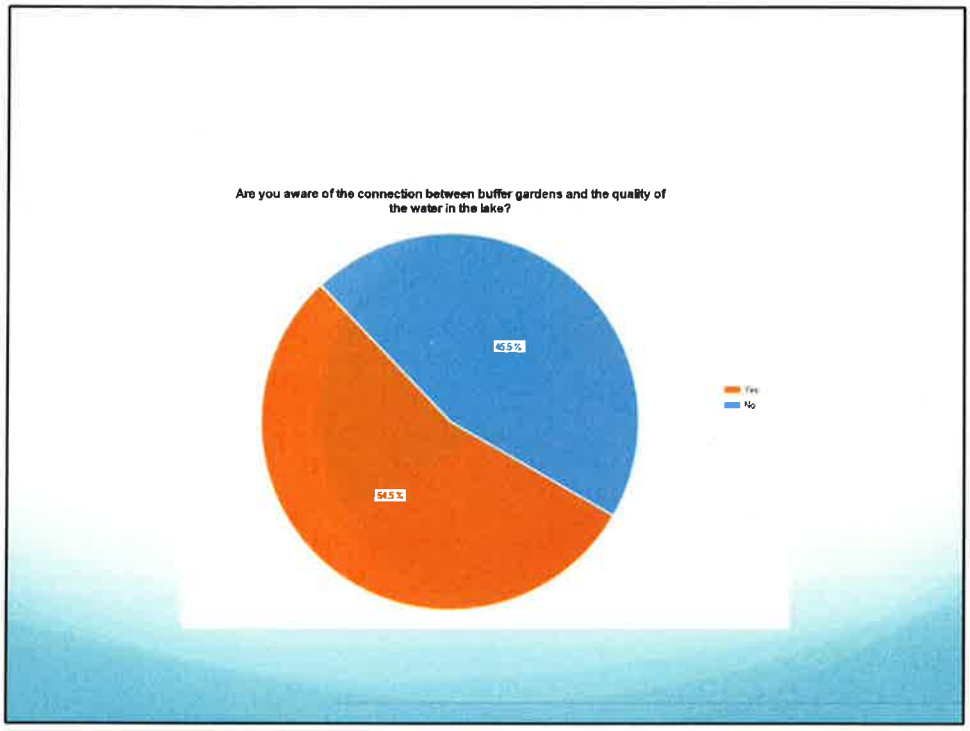


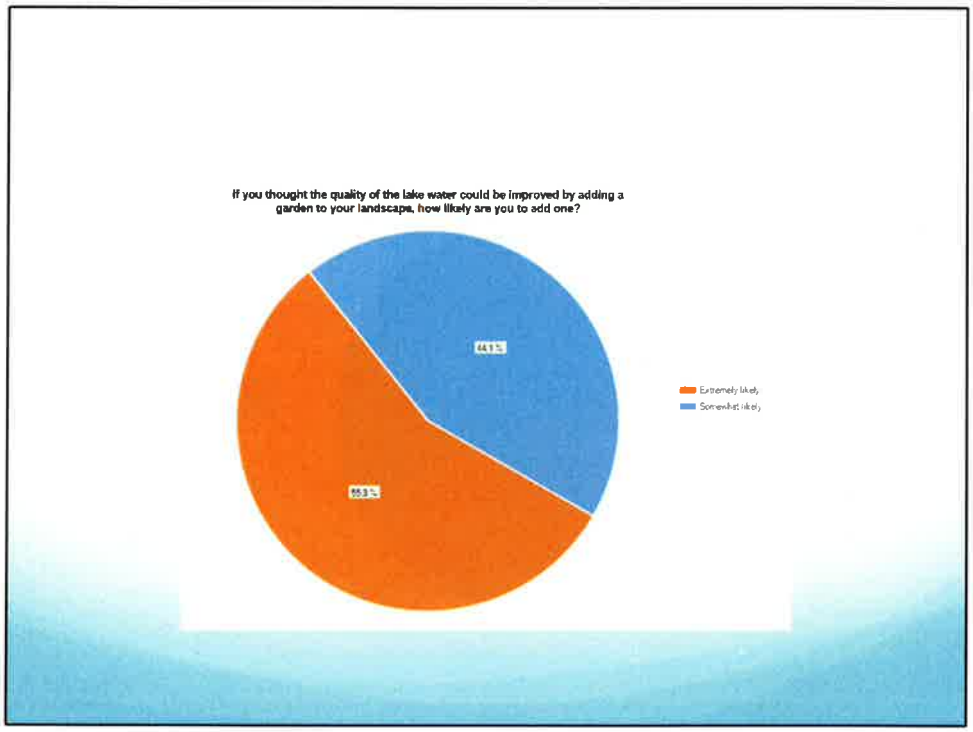

Are you aware that runoff from rainwater exists when grass meets the waters edge?
Yes
No

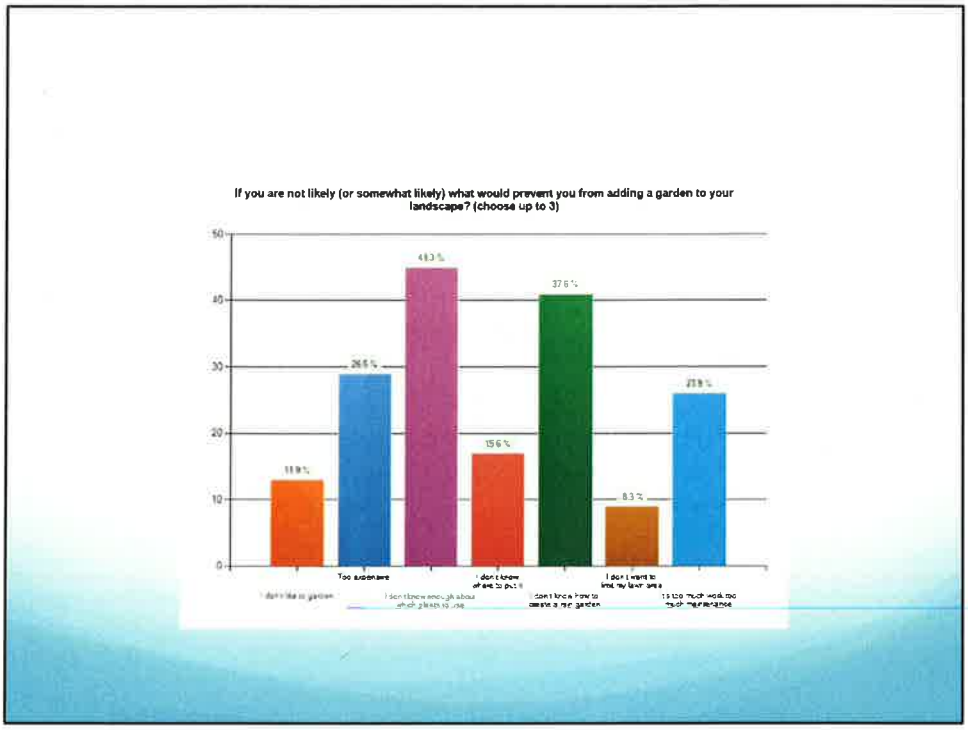

Are you aware that runoff from rainwater contains nutrients that can negatively affect the water quality in the lake?
Yes
No

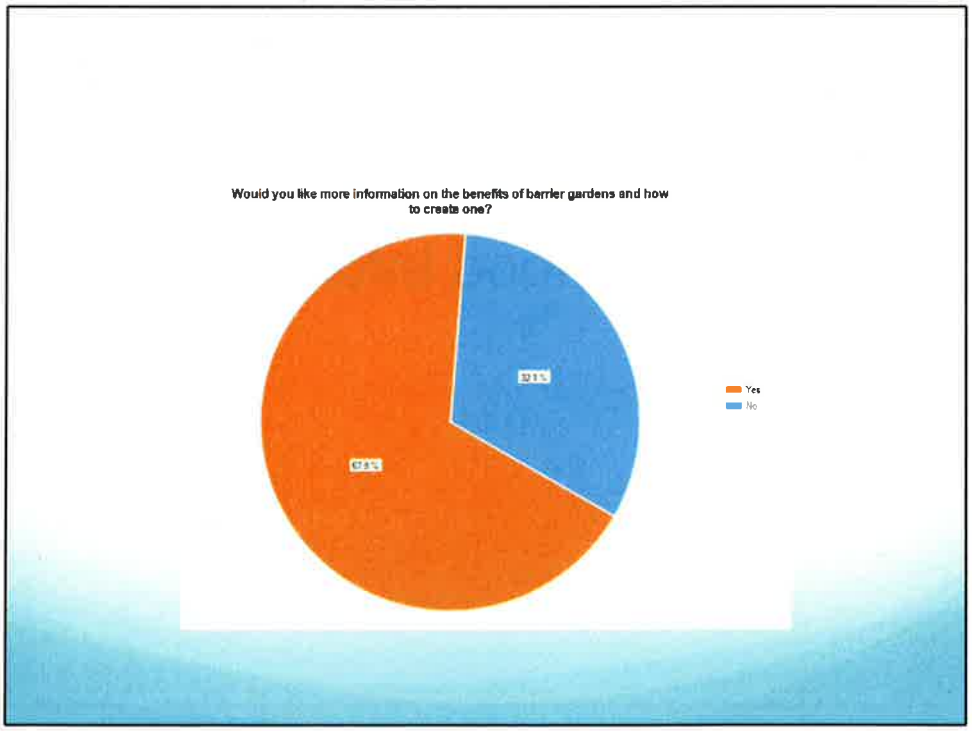

Have you heard of barrier gardens, buffer gardens and/or rain gardens?
40.4 %
59.6 %
Yes
No

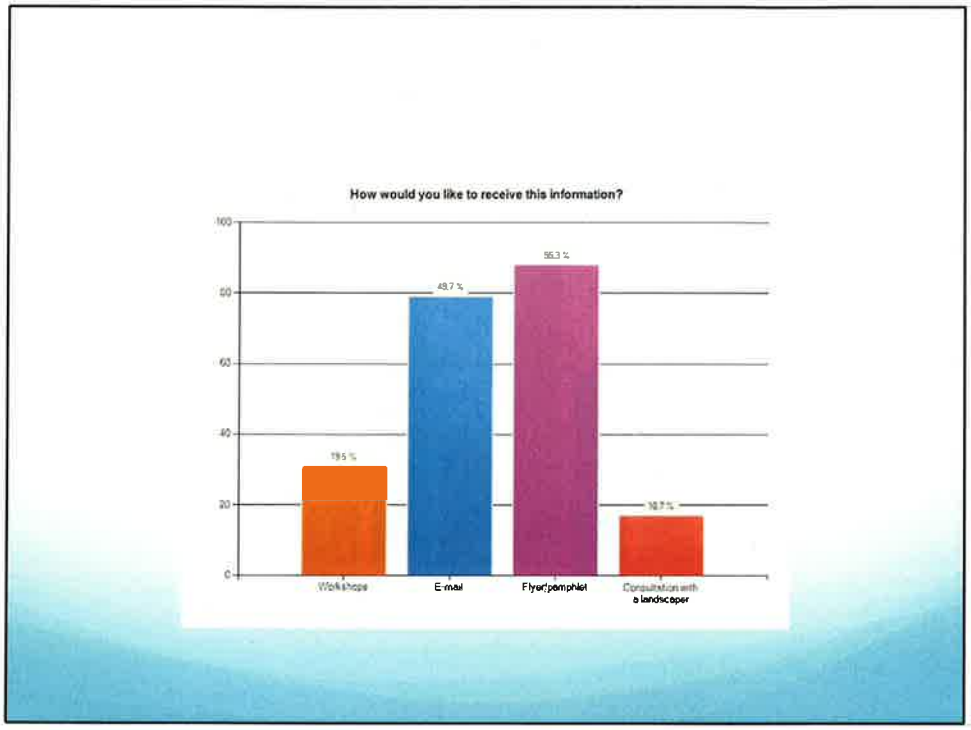

Do you have a garden(s) on your property that absorbs runoff from rain?
37.3 %
16.3 %
46.4 %
Yes
No


Are you aware of the connection between buffer gardens and the quality of the water in the lake?
45.5%
54.5%
Yes
No

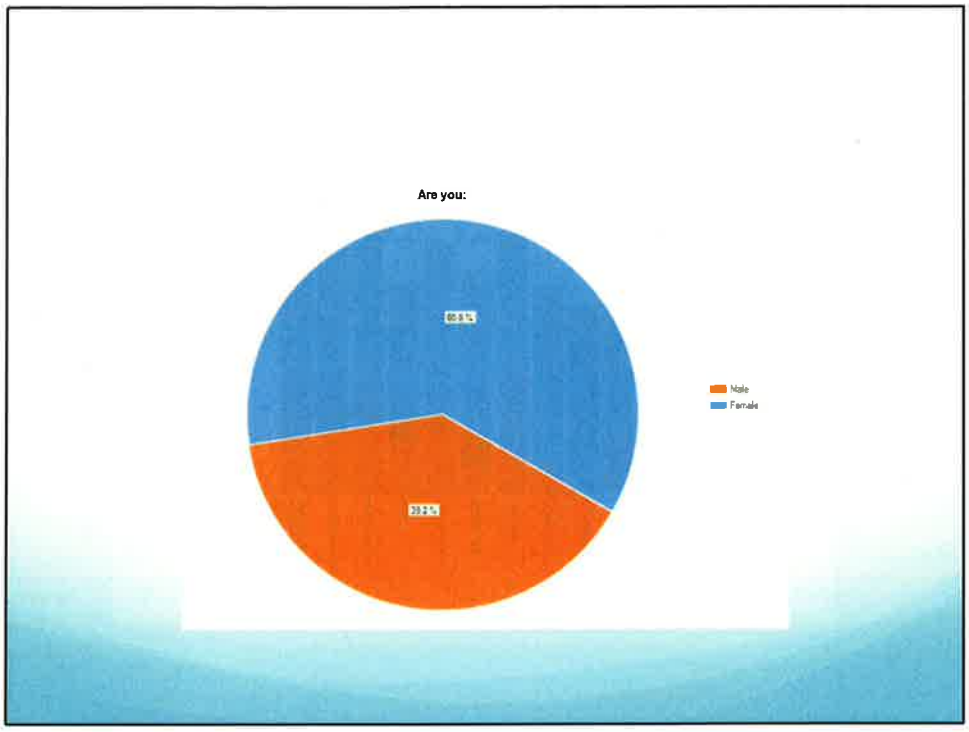

If you thought the quality of the lake water could be improved by adding a garden to your landscape, how likely are you to add one?
44.1%
55.9%
Extremely likely
Somewhat likely

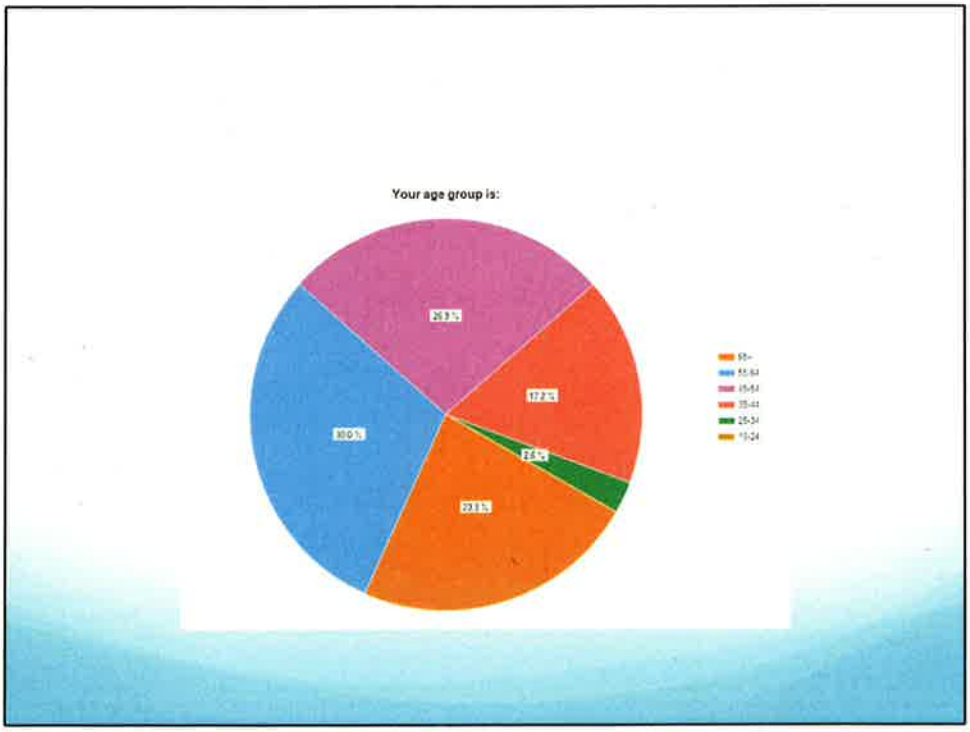

If you are not likely (or somewhat likely) what would prevent you from adding a garden to your landscape? (choose up to 3)
50
40
30
20
10
0
11.9 %
26.6 %
48.3 %
15.6 %
37.6 %
8.3 %
27.9 %
Too expensive
I don't know where to put it
I don't know how to create a rain garden
I don't want to limit my lawn area

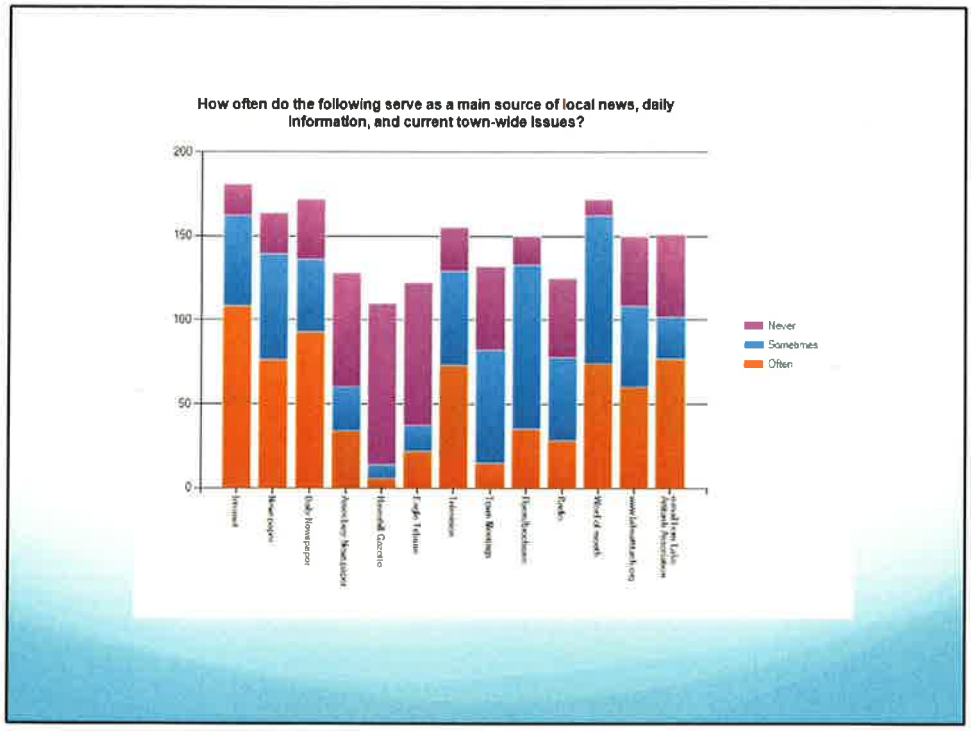

Would you like more information on the benefits of berrier gardens and how to create one?
32.1 %
67.9 %
Yes
No



Part 5
Neighborhood Information


Are you:
Male
Female


Your age group is:
26.9 %
17.2 %
2.6 %
29.8 %
30.0 %


How often do the following serve as a main source of local news, daily information, and current town-wide issues?
200
150
100
50
0
Never
Sometimes
Often

LAA CBSM Program Story
Katie Karatzas

As part of the s.319 grant awarded to the Lake Attitash Association and supported by the towns of Merrimac and Amesbury, we received $5000 for Community Based Social Marketing program in our watershed.

In June, once the grant was officially received, the LAA board members asked for volunteers to take on this CBSM project. Four board members and one community member stepped up and formed the LAA CBSM team. Early in July, Stephanie Hanson of CEI, met with the team to kick-off the project. She explained CBSM, presented a case study, discussed lessons learned, and reviewed the project flow (steps in the process).

The LAA team then met to discuss the survey development, distribution plan, and project timeline. As a team, we talked about what we thought the environmental and public health issues were in the context of the issues that we know the lake is facing e.g. invasive weeds, and cyanobacteria. The following topics were determined to be our problem areas and the topics that we wanted to learn more about:

- Fertilizer, weed killers, pesticide use and management
- Management of pet waste
- Natural Landscaping in the Watershed

There was another topic of interest, invasive weeds entering the lake via the public boat ramp that we felt was important. We will keep it on our list as 'problem area' but, for the purposes of this survey, we decided to leave it out and remain focused.

Throughout August we developed the survey and materials for generating interest and awareness of the survey:

- Developed the survey questions both online, using Surveymonkey.com and a hard copy version
- Designed and printed a postcard to generate awareness of the survey
- Wrote a press release and announcement for the website
- Wrote and ad for the local cable television station

In September we implemented the "advertising" and mailed the printed surveys:

- Printed, labeled, stamped and mailed the postcard to the entire watershed (~675 homes) September 6th
- Posted announcement on the website (week of September 6th)
- Announcement aired on the local cable TV station (Week of September 6th)
- Press release was printed in the newspaper (Week of September 6th)
- Posted a sign at the Family Fun Day to generate interest (September 10)
- Surveys were printed, envelopes labeled, stuffed, stamped and mailed to 675 homes in the watershed (mailed on September 15th) we did included a self addressed stamped envelope to encourage people to mail them back.

In October we collected the completed surveys. The return was excellent. Out of 675 surveys that were mailed, 249 were completed. That's over 1/3 returned! (61 surveys were entered online and the remaining 188 were hard copies returned in the mail.) We entered the hard copy data into the online tool as a way to keep all data in one place. This was a manual process and somewhat time consuming but worth the effort as we have all results tallied for us by the surveymonkey.com tool. It took about 5 minutes to enter one survey, so in an hour we could enter about 12 surveys.

In November we are looking at the survey results, identifying barriers and competing behaviors. We met with Stephanie Hanson on November 15th to go over the results. After an initial look at the data we have determined that the primary focus be on natural landscaping in the watershed including education on natural buffers, rain gardens and how they work, impervious/pervious surfaces, and how storm water works. We will have a secondary focus on management of pet waste, but only implement low cost solutions for now.

Overview

Our survey revealed behaviors and barriers that we want to address and overcome with our CBSM educational/awareness campaign. We learned that homeowners believe that the top three reasons for water pollution are:

1. Improper/overuse of fertilizer
2. Storm water runoff from impervious surfaces,
3. Lack of waterfront buffers/native vegetation to absorb runoff

Most people said that they had heard of rain gardens and buffer gardens and over half of the respondents (55.9%) said that they would be "extremely likely" to add a garden to their landscape. However, when asked if they were "not likely" or "somewhat likely" (44.1%) to add a garden to their landscape, they identified the following barriers:

1. I don't know enough about what plants to use/or how to create it
2. Too much work
3. Too expensive

We want to overcome these barriers by helping people in the watershed to understand that natural buffers and rain gardens don't have to be expensive and can be very low maintenance. Therefore, the goals of the LAA CBSM Project are:

• To Improve watershed awareness: Communicate what it means to live in a watershed, explain where storm water goes & how our behavior impacts local waterways

• To reduce pollution from runoff: Provide education about techniques and benefits of effective rain-scaping, absorbing stormwater versus shedding it off property

• Restore natural landscape in the watershed and on the waters edge: Communicate the benefits to property owners as well as waterways & wildlife

• Increase the number of rain gardens, buffer gardens, green roofs, & rainbarrels used within our watershed

Pamphlet or Postcard/Invitation to workshop

The first piece of the campaign will be an informational piece that introduces the "Be a Sponge!" concept. The primary message is about the benefits to the land owner and the secondary message is that it will protect the lakes and rivers. It should include the following:

A vivid message

- Some image or fact that will make people really think about using rain water
    - Amount of money saved each year
    - Money pouring out of the hose or sprinkler, or going down the stormdrain?
    - Other ideas?

Primary Message –

- What it means to "Be a Sponge"
- How it saves you money
- How it improves the property value

Secondary Message

- How it protects the lakes and rivers (preventing storm water runoff from going directly into the lake)

Techniques & how to get more info

- A bit about the techniques used and encourage people to the website and/or attend a workshop for more information:
    - Rain barrels
    - Rain gardens

- Buffer gardens
- Green roofs

An invitation to a workshop with a landscape architect should be included either as part of the pamphlet or a separate piece. This can target people who are planning to do work this spring in their yards. (patio's, walkways, decks, gardens, driveways, etc.)

Magnet

A magnet should be included as a reminder/prompt. It should include the slogan and logo, key benefits, website address. Magnets could be handed out at the workshop and annual meeting, and might be used on the bill board.

Watershed and other campaign signs

We would like to install watershed signs at highly visible areas where the people enter the watershed. It should let them know that they are in a watershed and that it's a protected area. It also serves as a reminder.

Workshop with Landscaper

This would be a free workshop for residents of the watershed to learn how to implement the different techniques for capturing and absorbing rainwater. We should also address how to deal with a slope since much of our watershed has them. We would like to offer a free rain barrel either as a raffle or to someone who volunteers to be a demonstration home. We will also offer a free consultation with the landscape architect. We can introduce the Rain garden Task Force, and plant donation. This workshop may be where we can get a commitment from residents?

- We can collect e-mail addresses for a digital newsletter.
- Get people to sign up for plant donation, rain garden task force
- Sign up for help with installing a rain or buffer garden
- Sign up to be a demonstration home?
- Inform them about town rain barrel programs
- Give away free soil tests
- Give away rain barrel?
- Address flooding issues???

LAA Website – "Be a Sponge!" Section

There will be a new section on the website and it will provide more detail and links to more information regarding watershed education and how to be a sponge. This might include things like:

- How to create a rain garden
- How to create a buffer garden
- How to install a green roof
- What a rain barrel can do, How to install one, Info on where to get one
- Status on local rain garden and buffer garden construction (task force)
- Demonstration home?
- Conservation contact information?
- Ask for and encourage volunteering

- Provide surveys to learn more about visitors
- Report on the progress we are making

LAA Annual Meeting

It would be good if our annual meeting could focus on this topic of watershed education and how to "Be a Sponge!" We could possibly offer another rain barrel, or free consultation. We could introduce our interactive billboard, the Garden Task Force, the plant donation, show case studies, follow progress of the rain gardens being installed on West Shore and Bisson Lane.

Rain/Buffer Garden Task Force

Volunteer group who helps install rain gardens and buffer gardens around the watershed. This is especially helpful to our older residents.

Interactive Billboard

This is based on an idea from the AIDS campaign where the word AIDS was on a board constructed of bright yellow condom packages. People were encouraged to walk up and take one and as they did, the word AIDS began to disappear. Our board will be a map of the lake that is painted a pretty blue color and covered up by green packets (maybe seeds and rain garden education, maybe the magnet) but as people take them off the lake starts to turn blue. The message being that if you plant a rain garden, the lake water will get better. It should be big enough to make a visual impact but small enough to move from event to event and be stored easily.

E-mail Newsletter

A newsletter could be sent electronically to the membership and others who provide their e-mail address.There could be information about what each element is (rain garden, buffer garden, green roof, rain barrel, etc.) and provide links to LAA website where they can get info on how to create/install them on their property. It could report on the status of the "Be a Sponge!" Campaign. Maybe showcase a demonstration home, tell stories from the garden task force, show status of the rain gardens on West Shore and Bisson lane. And it could include a small digital survey aimed at finding out how effective the campaign has been.

Kiosk

The kiosk at the boat ramp could include some watershed education, and house pamphlets and magnets for people to take home.

Resources & Incentives:

Some things we might be able to offer are:

- Free Rainbarrel (raffle or incentive to become a demonstration home)
- Free plants (from a local plant donation program or swap)
- Free consultation with landscape architect
- Discounts a local garden centers
- Garden installation by volunteer task force
- Rain barrel purchase program through the town
- Local plant donation program
- Town support for easy conservation approval
-

Other slogan ideas:

Be a Sponge, Not a Shed!
Don't be a Shed!
Be a Sponge in the Water Shed!
Storm water smart - Treat storm water as a resource not a waste product
Waterwise
Water Wise Homes - Getting Smart about Runoff
Be Water Wise - Slow it down, Spread it out, Soak it in
Living Lake Smart
Lake Smart Homes - Getting Smart about Runoff
Restoring the watershed - beautify and restore environmental quality
Reduce Runoff: Slow it down, Spread it out, Soak it in
Healthy Watershed Initiative
WE – Watershed Education
Water Wise in the Watershed
Nice Save! Treat storm water as a resource not a waste product

After the Storm
Let it Rain!
Rain, Rain, Don't go away!
Save Rain, Support Clean Water
Absorb Storm Water,
One Drop at a Time
Good to the last Drop!
Good to the last Raindrop!
It's ok to be greedy - Collect Stormwater: Slow it down, Spread it out, Soak it in
Soak it up! Harvest Rain Water, Save Money, Reduce pollution in the Water Shed

CBSM Public Education Plan Overview - Proposed Message and Components

Be a sponge!

Treat rainwater as a resource, not a waste product

Save money
Increase property value
Protect our lakes and rivers

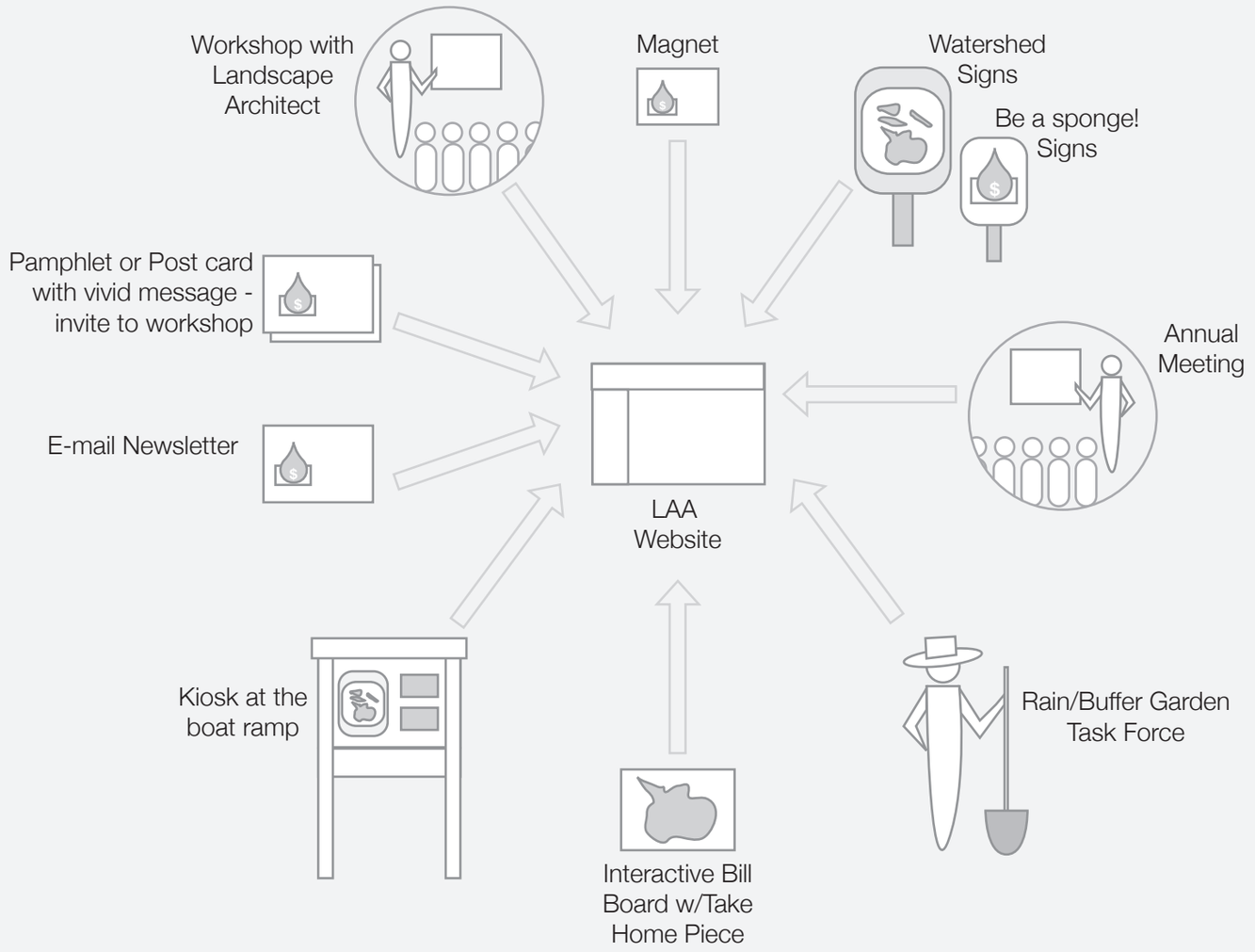
Goals:

- Watershed awareness: Communicate what it means to live in a watershed, explain where storm water goes & how our behavior impacts local waterways
- Reduce pollution from runoff: Provide education about technques and benefits of effective rainscaping, absorbing stormwater versus shedding it off property
- Restore natural landscape in the water shed and on the waters edge: Communicate the benefits to property owners as well as waterways & wildlife
- Increase # of rain gardens, buffer gardens, green roofs, & rainbarrels in our watershed

Resources & Incentives:

- Free Rainbarrel
- Free plants
- Free consultation with landscape architect
- Discount a local garden centers
- Garden installation by volunteer task force
- Rainbarrel purchase program through the town
- Local plant donation program
- Town support for easy conservation approval

The following are proposed elements in the Be a Sponge! campaign. Each component will be branded and designed with a consistent look and feel to make each point of contact a memorable one, ultimately increasing effectiveness of the program.



Prepared by Lake Attitash Association, January 10, 2012

CBSM Public Education Plan - **Proposed Timeline & Estimated Expenses**

FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER

E-mail and press release to kick-off the campaign!

LAA Website - Be a Sponge! Section available

Ongoing updates →

Pamphlet w/vivid message

Magnet

Invitation to workshop

Mailed to entire watershed

Workshop with Landscape Architect

Watershed Signs & other campaign signs

Annual Meeting

Interactive Bill Board w/Take Home Piece

Workshop with Landscape Architect

Rain/Buffer Garden Task Force

Installations over the summer into the fall →

Kiosk at the boat ramp

Ongoing updates →

E-mail Newsletter

ESTIMATED EXPENSES

Inital Survey	*$1000.00*
Logo Design	$?
Pamphlet	
- Design	$?
- Printing	$?
- Postage	$?
Magnets (500?)	
- Printing	$?
Bill Board	$?
Workshop	$?
Watershed Signs	$?
Campaign Signs	$?
Rainbarrels	$?
Newsletter	$?
Follow-up Survey	$?
Total	$5000.00

Prepared by Lake Attitash Association, January 11, 2012

Rain Barrels

http://www.nerainbarrel.com/

https://www.greatamericanrainbarrel.com:444/

http://www.woodlanddirect.com/Outdoor/Rain-Barrels

Amesbury Chamber of Commerce Community Rain Barrel Program
5 Market Square, Amesbury MA 01913
978-388-3178

Rain gardens

https://www.raingardens.org/

http://www.skyjuice.us/html/rain_gardens.html

http://appliedeco.com/Projects/Rain%20Garden.pdf

http://www.lowimpactdevelopment.org/raingarden_design/whatisaraingarden.htm

http://www.uri.edu/ce/healthylandscapes/raingarden.htm

Buffer gardens

http://www.lynnhavenrivernow.org/buffer-garden.aspx

http://www.businessevision.info/parker_river/BufferGardens.pdf

http://www.hvatoday.org/publications/bufferbrochure.pdf

Pervious Surfaces

http://www.oregonmetro.gov/index.cfm/go/by.web/id=25101

http://www.recycleworks.org/greenbuilding/sus_impervious surfaces.html

Green Roof

http://www.delafleur.com/168_Elm/index.htm

Pet waste

http://www.mass.gov/dep/water/resources/petwaste.htm

Lake Attitash was awarded a state grant to help educate the community about reducing storm water runoff that pollutes local waterways. The campaign **"Be a Sponge in the Watershed"** was developed as part of this grant. The goals of the campaign are:

- Watershed awareness
- Reduce pollution from runoff
- Restore natural landscape in the watershed and on the waters' edge
- Increase the number of rain gardens, buffer gardens, green roofs, and rain barrels in our watershed

The grant also supports local storm water management with the installation of rain gardens and updating catch basins in the area that collect storm water runoff.

This project has been financed with Federal Funds from the Environmental Protection Agency (EPA) to the Massachusetts Department of Environmental Protection (the Department) under an s.319 competitive grant. The contents do not necessarily reflect the views and policies of EPA or of the Department, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

LAKE ATTITASH ASSOCIATION

To learn more or join the "Be A Sponge" team, visit www.lakeattitash.org!

BE A SPONGE

BE A SPONGE

A beautiful solution to water pollution!

If you allow storm water to soak into the landscape instead of running off roofs and pavement into the storm drains you can....

> Save Money
You could potentially save up to $320 per year by collecting and using storm water for lawns and gardens!

> Increase Property Value
Gardens and porous surfaces add diversity and beauty to your property, while serving as sponges for storm water runoff!

> Reduce pollution in your watershed
The biggest cause of pollution in our lakes and rivers is runoff from streets and lawns that carry pesticides, fertilizers, and oil into the storm drains that empty directly into Lake Attitash and other nearby waterways.

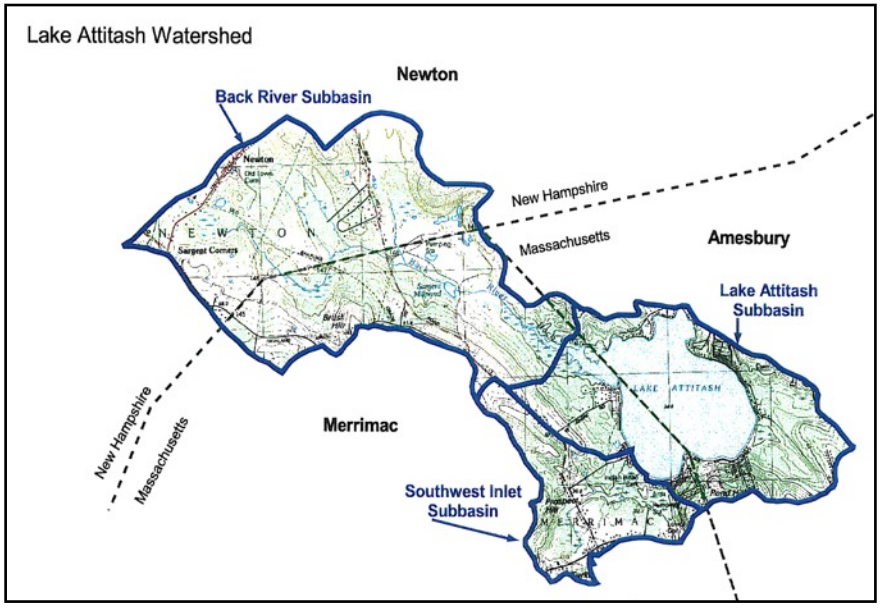
Join the Cause and Be A Sponge in the watershed!

What it means to live in a Watershed

We all live in a watershed!

A watershed is an area that drains to a common waterway, such as a stream, lake, estuary, wetland, aquifer, or even the ocean. Watersheds provide our drinking water, habitat for wildlife, soil in which to grow our food, and the streams, rivers and lakes we use for fishing, boating and swimming. We all share a common interest in having a healthy watershed.

This is our watershed …



Storm water management and why it's so important

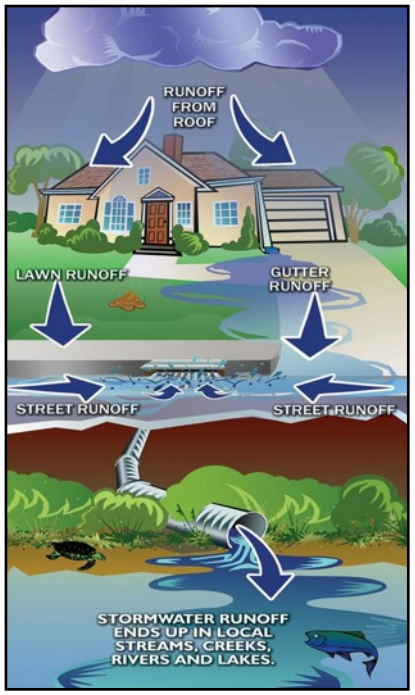
Large impervious surfaces such as roofs, driveways and parking areas prevent rain from being absorbed into the earth.

As rainwater passes over these surfaces, it picks up sediment and other particles, nutrients, pathogens and chemical pollutants before it enters the storm drain.

Anything that enters a storm sewer system or that flows from your residence directly to a nearby stream or lake is left untreated. **Many of our local storm drains empty this polluted runoff directly into Lake Attitash.**

Although it seems like a small thing when considering one individual house or lot, polluted storm water runoff from all of our residential areas collectively poses a great threat to our waters. You can make a difference!

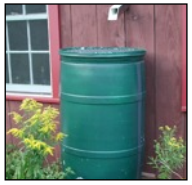
Image courtesy NCDENR



What you can do…

There are many things that we as individual land-owners can do to manage storm water runoff in our neighborhoods and improve the quality of water in our lakes, streams, and rivers.

Even if you don't live at the water's edge, reducing storm water volumes and helping storm water to seep into the ground benefits the whole watershed.



Rain Barrels

Rain barrels collect runoff from the roof and funnel it into a barrel. The water can later be used for gardening or your land-scaping. Rain barrels conserve water and help lower costs (a rain barrel can save approximately 1300 gallons of water during peak summer months)

Rain Gardens

A "Rain Garden" is simply a shallow depression in your yard that's planted with native wetland plants, wildflowers, shrubs or grasses. They can be low cost and low maintenance, and add beauty to your landscape.

Buffer Gardens

A buffer garden is planted on the water's edge and serves as a "living filter," because they capture many of the pollutants that travel through them. The extensive root systems hold the soil in place, prevent erosion, and provide color and interest all summer long!

Porous Surfaces

Porous surfaces, like pervious pavement or pavers, allow rainwater to pass through them and soak into the ground instead of flowing into storm drains resulting in healthier waterways. If you are planning a patio, walkway, or driveway project, keep this in mind!

Green Roofs

A green roof or "living roof" is a roof of a building that is partially or completely covered with plants. Green roofs absorb rainwater & provide valuable insulation.

FREE Workshop:
How to "Be a Sponge in the Watershed"

Sponsored by a state grant and the Lake Attitash Association, you are invited to drop in and learn about techniques for handling storm water runoff on your property.

You will learn how to:

Save money, increase your property value, make your spring project the best it can be, and reduce pollution in the watershed.

Topics will include:

Collecting & reusing storm water with rain barrels; Rain & buffer gardens; Planting a green roof; Using porous surfaces for walkways, driveways and patios.

Speaker: Peter Phippen of Greenscapes North Shore Coalition

Date & Time: **Saturday, April 28th from 10:00 am – 11:30 am**

Location: Merrimac Senior Center, 100 E. Main Street, Rte 110, Merrimac

Win a **FREE** rain barrel!
Win a **FREE** consultation with a landscape architect!
Learn about **discounts** at your local garden centers!
A professional landscape architect will be on hand to answer questions.

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Lake Attitash Association
www.lakeattitash.org

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Lake Attitash Association
www.lakeattitash.org

This garden is a sponge!

Learn more at www.lakeattitash.org

I'm a sponge!

www.lakeattitash.org

BE A SPONGE

This garden was installed to soak up storm water runoff and prevent pollution from entering Lake Attitash, local streams and rivers!

www.lakeattitash.org

Magnet - Option 1

Magnet - Option 2

Magnet - Option 3

Press Release announcing the workshop:

The Lake Attitash Association is offering a FREE Workshop on Saturday April 28th from 10:00-11:30 am at the Merrimac Senior Center. The workshop is part of the "Be a Sponge in the watershed" educational campaign. This grant supported program will educate the community about techniques for handling storm water runoff on your property.

Peter Phippen of Greenscapes Northshore Coallition will provide information about:

- Collecting and reusing storm water with rain barrels
- Installing Rain and Buffer Gardens
- Planting a Green Roof
- Using porous surfaces for walkways, driveways, and patio's

Using these techniques, homeowners will:

> Save money
> Increase your property value
> Make your spring project the best it can be
> Reduce pollution in the watershed

A FREE Rain barrel and a FREE Consultation with a Landscape Architect will be raffled off during the workshop.

Residents will also learn about discounts at local garden centers.

A professional Landscape Architect will be available for questions
Light refreshments will be served

Speaker: Peter Phippen of Greenscapes Northshore Coallition
Date: Saturday April 28th
Time: 10:00-11:30 am
Location: Merrimac Senior Center, , 100 East Main St. Merrimac, MA 01860

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BE A SPONGE

Install a rain or buffer garden with native plants!

Reduce pollution from storm water runoff and restore our natural landscape.

www.lakeattitash.org

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Entering

Lake Attitash Watershed

Use care with

Fertilizer
Salt
Pet waste
Yard waste
Car washing

Lake Attitash Association
www.lakeattitash.org

Stormwater Management Through Creative Landscaping for the Homeowner

Rain Gardens, Vegetated Buffers, Green Roofs and Rainwater Harvesting

Presented by Comprehensive Environmental Inc
Massachusetts Rhode Island New Hampshire
call (800)725-2550 or see www.ceiengineers.com

Rain Gardens

Source: RainGardens of West Michigan, CEI

Rain Garden Themes

Shrub Garden

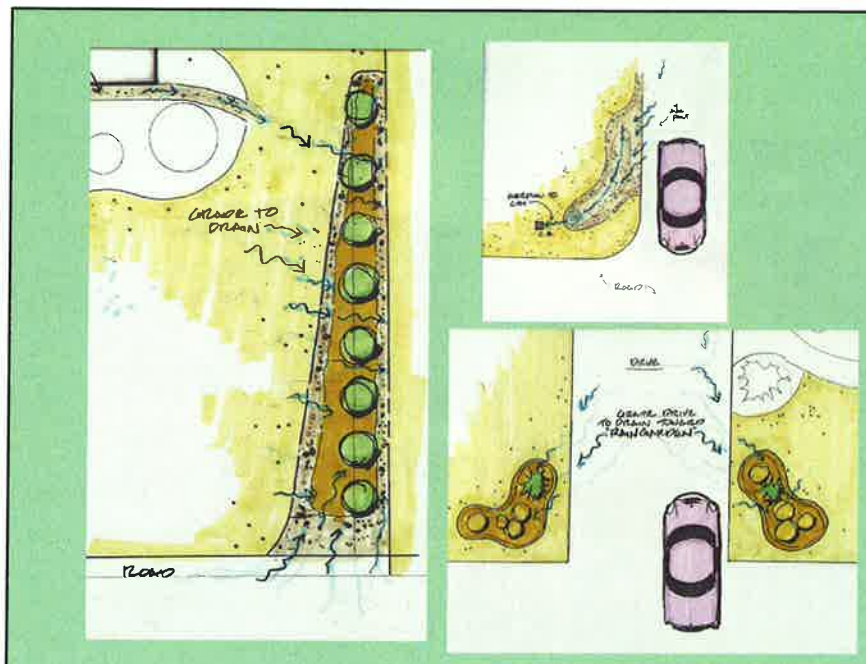
Shady Garden

Butterfly Garden

Sun Garden

Daylily Garden

Grass/Prairie Garden



Location

- Look/observe - during a storm.
- Where does the stormwater go?
- Where does your roof leader flow?
- Where does your driveway runoff go?
- Are there any other impervious areas?
- Keep away from septic system leachfields.
- Keep at least 10 feet from structural foundations.
- What type of soils do you have? NEsoil.com
- Separation to Groundwater

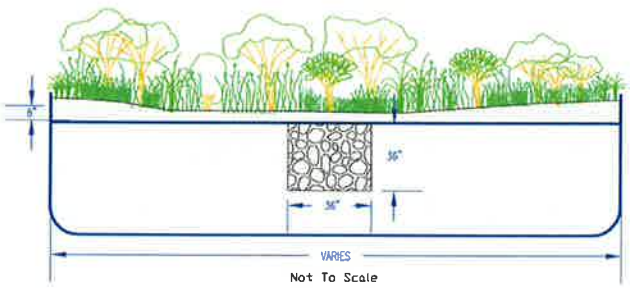
Sizing

- How much area do you have?
- Do you enjoy gardening
- How much time do you have – now for installation and later for maintenance?
- How much help will you have for the installation?
- Are you going to get a combination of flows (ie: roof leaders and driveway runoff)?
- Budget

Rain Garden Types

- Sun/shade
- Birds/butterflies
- High/low maintenance
- Budget
- 4 season or 3 season blooming
- Color scheme
- Your idea of aesthetic beauty

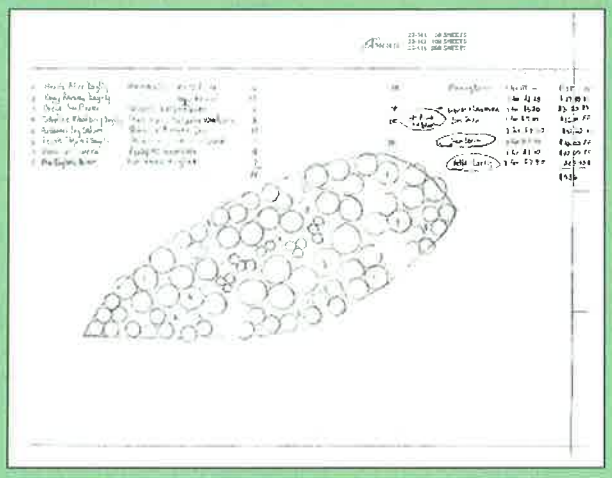
Rain Garden Detail

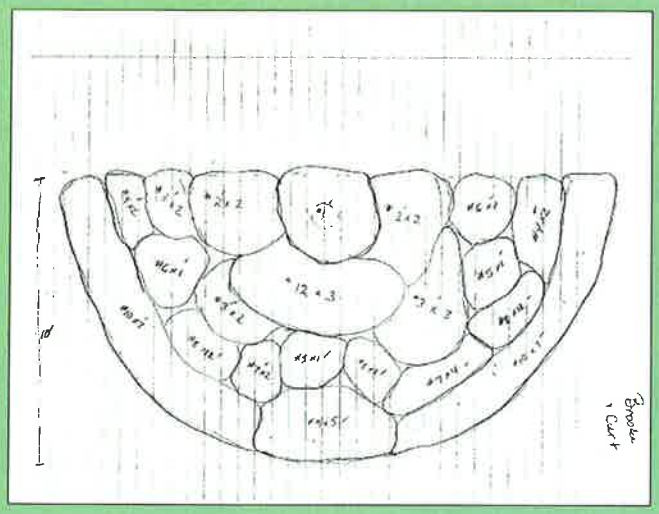


Typical Rain Garden

Sketch a Design

- Take measurements/stake or flag area
- Sketch out your design
- Include the following in your sketch:
  - Approximate size/shape to scale
  - Existing features
  - Direction of flow
  - Plant placement with appropriate spacing





Plant Selection

- Plants that can tolerate being wet and also survive dryer periods.
- Native plants recommended; also check list of invasive and prohibited plants
  - http://www.mass.gov/agr/farmproducts/prohibitedplantlist.htm
- Select plants appropriate for sun/shade at site.
- Are you patient? Buy smaller plants for varieties that grow and spread quickly.
- Are you not so patient or need instant aesthetic beauty? Invest in larger more mature plants for an established look.

Materials

- Shovels, rakes, backhoe optional
- Stone or PVC piping
- Filter fabric/burlap/grain bags
- Stakes/tape measure
- Compost
- Mulch
- Plants
- Typical gardening supplies for planting

Cost $$$

- Depends on size, free materials, type of plants, etc…
- Average size of example sites range from 60 sq. ft. – 300+ sq. ft.
- Average cost ranges from $150-$600.

Working With a Budget

- Free stuff is easy on the budget!
- Compost
  - transfer station, DPW or your own compost bin
- Stone
  - nearby construction site possible source
- Plants
  - friends/neighbors may be dividing existing plants or take cuttings
- Neighborhood Rain Garden project = free labor

Before You Begin

- Contact Dig-Safe (1-888-DIG-SAFE) and any other local utilities to ID underground wires, pipes, etc…
- Talk with local Engineering or DPW Department for permission if near road/within right of way.
- Contact Local Conservation Commission if near wetlands or buffer zone.

Main Elements

- Slight depression of garden to hold/retain water for infiltration
- 3'x3'x3' or trench (if narrow garden) filled with crushed stone wrapped in fabric to provide storage volume
  - Larger stone bed will collect, treat and infiltrate more stormwater runoff
- 8" sand/topsoil/compost mix
  - 50% sand, 25% topsoil, 25% compost
- High organic content – no need to fertilize
- Wet/dry tolerant plants

Construction Sequence

- After contacting Dig-Safe and others (see before you begin slide)
- Remove existing aboveground material (grass/weeds/impervious area, etc…)
- Excavate top 8" of material – removing stones.
- Dig storage pit/trench and install filter fabric and stone
- Cover with 50/50 soil/compost mix
- Rake and level out area leaving depression
- Install plants
- Cover with of mulch
- Wait for rain!

Rain Garden Planning/Prep

Rain Garden Excavation

Stone/Loam Installation

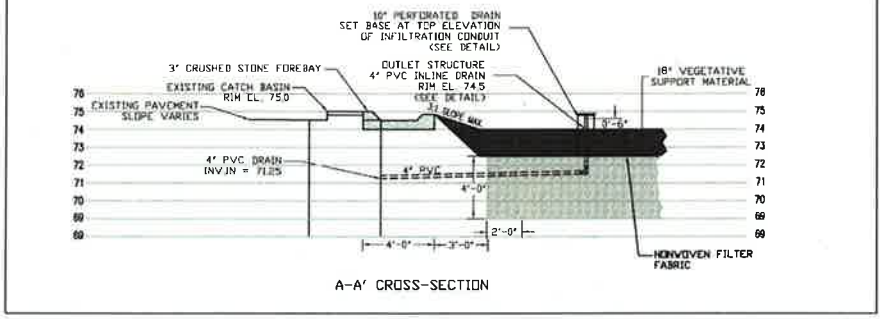
Plantings, Mulch and Runoff

Roof Leader Collection

Bioretention Area

- Larger scale holds more stormwater volume
- Application for larger impervious areas
  - Parking lot and road runoff

Bioretention Area



PROFILE BIO-RETENTION INFILTRATION AREA

Shrub Garden

- Winterberry Holly
- Fothergilla
- Highbush Cranberry
- Highbush Blueberry
- Golden Alexander
- Lilac

Sun Garden

- Witchhazel
- Sedum
- Salvia
- Coreopsis
- Sweetspire

Daylily and Hosta Garden

Butterfly Garden

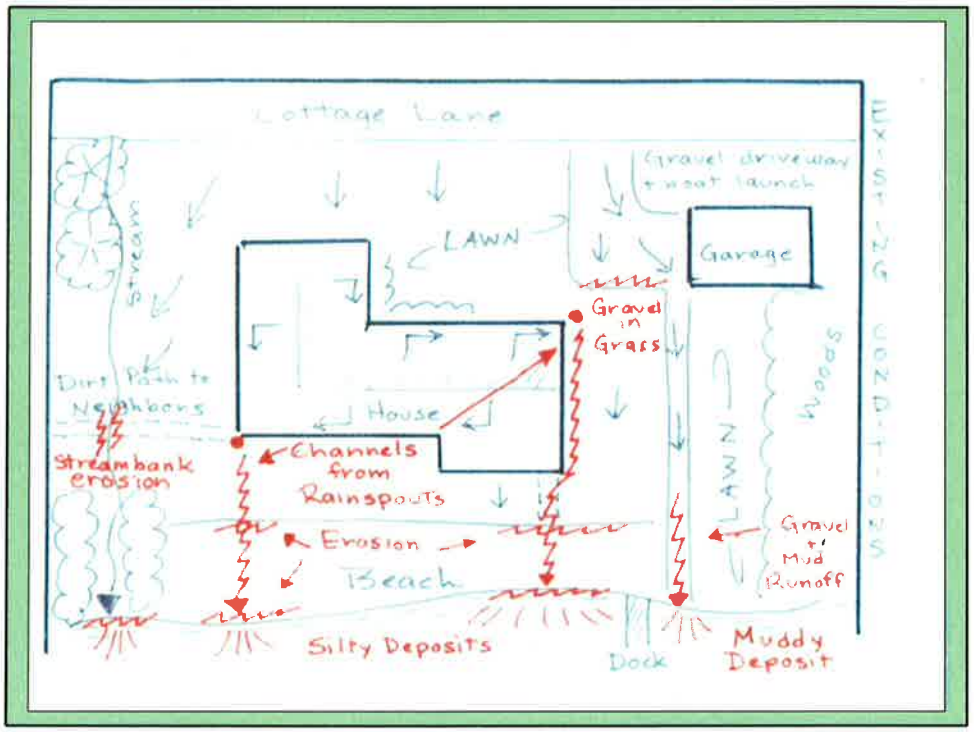
- Bee Balm
- Blazing Star
- Black-eyed Susan
- Butterfly Milkweed
- New England Aster

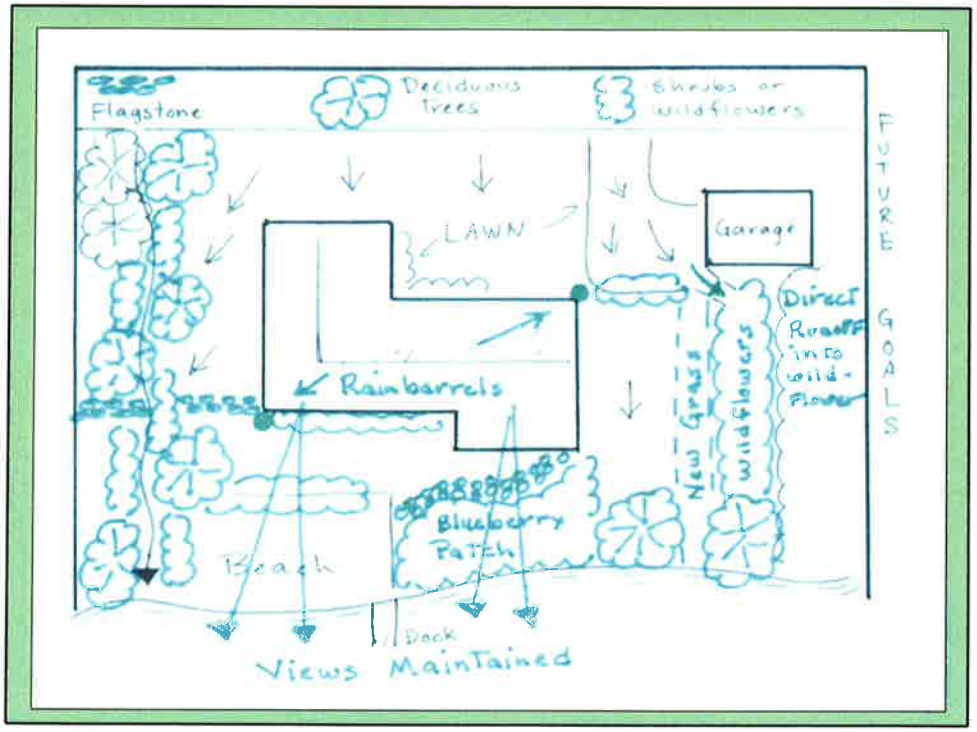
Sedge and Grass Garden

Vegetative Buffers

- Reduce stormwater runoff into adjacent waterbodies and promote infiltration
- Promote nutrient uptake/filter pollutants
- Deter Canada Geese
- Wildlife habitat/corridors/food source
- Flood and erosion control
- Can provide privacy and increase property value

Buffer Strips


Cottage Lane
Gravel driveway + boat launch
Stream
LAWN
Garage
Gravel in Grass
Dirt Path to Neighbours
House
Woods
EXISTING CONDITIONS
Streambank erosion
Channels from Rainspouts
Erosion
Beach
LAWN
Gravel + Mud Runoff
Silty Deposits
Dock
Muddy Deposit


Flagstone
Deciduous Trees
Shrubs or wildflowers
LAWN
Garage
Direct Runoff into wild-flower
Rainbarrels
New Grass
Wildflowers
Blueberry Patch
Beach
Dock
Views Maintained
FUTURE GOALS

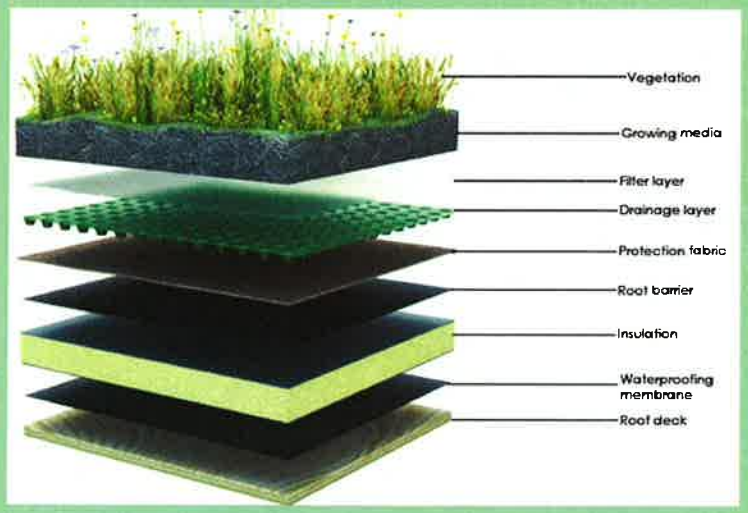
Green Roofs

Green Roof Benefits

- Reduce heat loss in winter and cooling loads in the summer
  - 10-30% energy cost savings
- Reduce heat island effect
- Reduce stormwater runoff
  - 70-90% in summer
  - 25-40% in winter
- Filter pollutants in rain and air
- Sound dampener

Source: D.C. Greenworks

Green Roof Cross Section



Basic Types of Greenroofs

- Extensive
  - 3-4 inches deep
  - 15-30 lbs/sf
  - Supports sedum or similar
- Semi-Intensive
  - 4-8 inches deep
  - Supports wildflowers/herbaceous perennials
- Intensive
  - 8-12 inches or more
  - 30-150 lbs/sf
  - Can support shrubs, trees, fountains and ponds

Source: DC Greenworks

GreenRoof Retrofitting

- <30 degree pitch
- Access to roof/deck
- Structure built after 1960's or addition of structural reinforcing
- Use addition, garage or out-building built within the last 15 years
- Sunny roof area with few above growing trees
- $8-12 sf + $5-10 sf for specialized waterproofing

Source: D.C. Greenworks

Techniques for Stormwater Collection and Reuse

- Rain Barrels
  - ¼ inch of runoff from average roof will fill a rain barrel
  - 1 inch of rain on a 1,000 sq. ft. roof yields 623 gallons of water.
- Cisterns
  - Larger volume
  - Extended use during dry summer months
- Dry Wells
  - Groundwater recharge

Rainbarrels

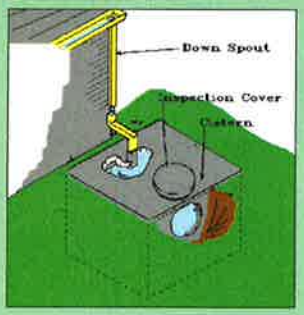
Source: CEI

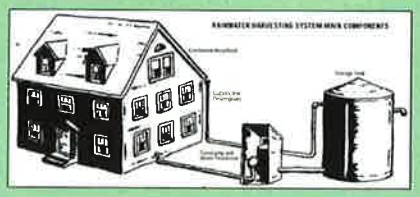
Source: New England Rainbarrel

Source: New England Rainbarrel

Source: New England Rainbarrel

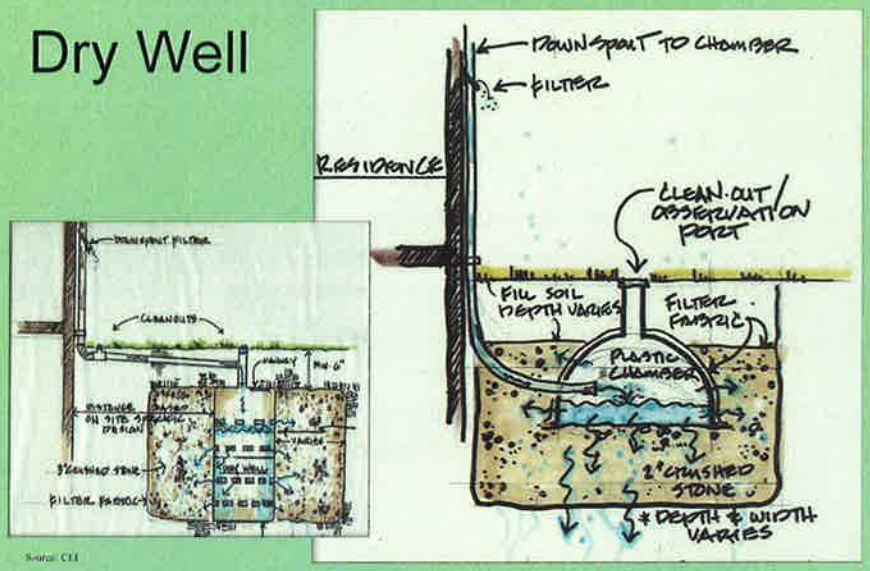
Cisterns





Source: LID Center

Dry Well



Source: CEI

Uses for Collected Water

- General outdoor non-potable use
- Landscape/lawn irrigation
- Garden irrigation
- Landscape or interior water features
- Vehicle washing

Costs & Maintenance

- Rainbarrels - $100-$120 (55 gallon)
- Cisterns – vary in size and material
  - Polyethylene $250 for 300 gal.
- Dry Wells – vary based on size
- Periodic inspection of rainbarrel or cistern for leaks
- Make sure overflow is not blocked and drain is not causing erosion
- Ensure lids are on securely for safety and for the prevention of insect breeding

2011 Weed Management Plan for large event* hand pulling of water chestnuts, milfoil

The LAA Board of Directors (BOD) has a weed management committee of 4 Board members who take responsibility for training, organizing and coordinating LAA members and other volunteers to conduct a minimum of 4 large scale weed pulling days during the weed growing season. The weed pulling events will be held in June, July and August.

Training of volunteers:

All volunteers will be trained in a basic safety protocol that requires them to sign in and sign out with the identified leader for each weed pulling event. All volunteers will be reminded to bring adequate sun protection.

Milfoil

The LAA BOD will be trained in how to remove milfoil with and without the use of certified divers during 2010. 2 members of the LAA BOD are certified divers. Certified divers are need for removal of plants in deep water.

In June 2011 LAA will conduct a Eurasian and Variable milfoil identification and removal training for LAA members and other volunteers. All volunteers who will directly handle the plant will receive specialized training in how to remove milfoil without fragmenting the plant and in the use of any special vacuuming / suctioning equipment that may be available. BOD members will contribute pontoon boats to provide the needed platforms and support for small boats and divers. Other training sessions (individual or group) will be organized for new volunteers as they are recruited during the season.

Water Chestnuts

Training is provided to the volunteers on the morning of each weed pulling event. Leaders will show samples of the plant and demonstrate careful pulling techniques. All kayakers will be instructed to have gloves and containers strapped to the top of their boats (laundry baskets or milk crates) for collecting the weeds.

Setting the Dates:

The dates are set by the LAA Weed Committee with alternative dates for bad weather.
Public Notice / request for volunteers is sent out via

- LAA member group e-mail notices
- announcements in the local newspapers
- LAA website.

Volunteers:
Based on current experience we expect 20-25 volunteers at each event. We will require that all volunteers sign up in advance so that we can plan for adequate leadership and support for the event.

Notification / approval - Amesbury and Merrimac Conservation Commissions
LAA BOD members advise each Conservation Commission prior to the season's hand pulling events and obtain approval for proper disposal of gathered weeds at the Merrimac Town brush disposal site.

Disposal of milfoil and water chestnut plants:
Weeds are placed on a party boat platform for drainage, and then put in plastic trash bags for transfer to pick-up trucks provided by volunteers who take them to the designated town disposal site.

Safety Protocol:
All volunteers must sign in with the event leader (LAA BOD member) prior to being included in any weed pulling event and must sign out with the leader at the close of their volunteer activity.

Weed Pulling Event Organization:

- Time: 9:30 am until 4:00 pm
- Meeting Point: Public Boat launching ramp of Rte. 110 in Merrimac
- 9:30 am - Sign in with event leaders
- Event leaders will check that all volunteers are properly equipped with life jackets, cell phones, sun screen, bottled water and equipment needed for their role.
- All volunteers will identify a weed pulling partner and be in sight of that partner throughout the day.
- Event leaders will review training protocols and expectations of the day and organize volunteers into appropriate roles based on their interest and training-
    - direct collection of plants
    - support on large pontoon platform boats to receive plants from kayakers and other small craft and put drained plants into large trash bags
    - Trucking bags of weeds to approved site during the event
- At the close of the day leaders will be responsible for ensuring that the area used for transferring the plants from the boats to the truck is clean of any remaining weed fragments or other trash.

***NOTE**
In addition to large scale weed pulling events, key LAA members, volunteers and BOD members routinely monitor weed growth and conduct small scale weed pulling activities throughout the season. Example: 2 BOD members contribute 6 hours a month on average for water chestnut pulling from June through September.

MEMO

TO:	Field Memo
FROM:	Lake Attitash Association Correspondence
SUBJECT:	Lake Attitash s.319 Grant Task 5 Deliverable
JOB NUMBER:	175-10
FIELD MEMO:	2011

The purpose of this memo is to document the training and weed reduction activities that took place during 2011 by the Lake Attitash Association (LAA) and its volunteers.

The LAA held 1½ hour training sessions for volunteers on June 18, 2011, July 12, 2011, and July 22, 2011 at the Merrimac boat ramp for those interested in boat ramp monitoring.

The LAA has a volunteer boat monitoring program to help reduce weeds. Residents are asked to contribute 4 hours over the summer to help monitor boats at the public boat ramp in Merrimac. This program places volunteers at the ramp during busy periods to show boaters how to inspect their boats and trailers for weeds that can invade and take over the lake.

The following is a summary of weed reduction activity dates for 2011:

6/18/2011	Boat Ramp Monitor Training
7/12/2011	Boat Ramp Monitor Training
7/22/2011	Boat Ramp Monitor Training
8/6/2011	Water Chestnut Pulling
8/14/2011	Water Chestnut Pulling
8/26/2011	Water Chestnut Pulling
9/23/2011	Water Chestnut Pulling

Additionally, consistent weed monitoring at the boat ramp occurred throughout the summer and early fall.

MEMO

TO:	Field Memo
FROM:	Lake Attitash Association Correspondence
SUBJECT:	Lake Attitash s.319 Grant Task 5 Deliverable
JOB NUMBER:	175-10
FIELD MEMO:	2012

The purpose of this memo is to document the training and weed removal activities that took place during 2012 by the Lake Attitash Association (LAA) and its volunteers.

The LAA held a 2-hour training session for approximately two dozen volunteers in 2012.

The aquatic weed reduction program includes mobilization of 12 teams of volunteers who monitor 12 specific areas of the lake on a monthly basis. The reduction program activities include:

- Utilization of view tubes;
- Use of weed rakes for weed removal;
- Photographic evidence of each area and suspect weeds and in certain circumstances sending photos to the program coordinator for expert weed identification.

The program also includes the hand pulling of water chestnuts by 3 volunteers doing regular tours of the Back River. This is a continuous effort but every year the volume of plants has decreased.

Finally, the LAA has a volunteer boat monitoring program to help reduce weeds. Residents are asked to contribute 4 hours over the summer to help monitor boats at the public boat ramp in Merrimac. This program places volunteers at the ramp during busy periods to show boaters how to inspect their boats and trailers for weeds that can invade and take over the lake.

The following is a summary of weed reduction activity dates for 2012:

5/12/2012	Weed Watchers - Milfoil, pond weed & water chestnuts
5/12/2012	Weed Watchers - Milfoil, pond weed & water chestnuts
5/25/2012	Water Chestnut Pulling
5/26/2012	Weed Watchers - Milfoil, pond weed & water chestnuts
6/8/2012	Water Chestnut Pulling
6/22/2012	Weed Watchers - Milfoil, pond weed & water chestnuts
6/25/2012	Weed Watchers - Milfoil, pond weed & water chestnuts
6/30/2012	Boat Ramp Monitoring
7/2/2012	Weed Watchers - Milfoil, pond weed & water chestnuts
7/5/2012	Weed Watchers - Milfoil, pond weed & water chestnuts
7/15/2012	Water Chestnut Pulling

MEMO

7/26/2012	Water Chestnut Pulling
7/31/2012	Boat Ramp Monitoring
8/8/2012	Water Chestnut Pulling
8/12/2012	Water Chestnut Pulling
8/19/2012	Water Chestnut Pulling
8/31/2012	Boat Ramp Monitoring
9/8/2012	Water Chestnut Pulling
9/25/2012	Water Chestnut Pulling
9/30/2012	Boat Ramp Monitoring
10/15/2012	Boat Ramp Monitoring
11/20/2012	Weed Monitor Meeting
12/9/2012	Weed Monitor Meeting

MEMO

TO:	Field Memo
FROM:	Lake Attitash Association Correspondence
SUBJECT:	Lake Attitash s.319 Grant Task 5 Deliverable
JOB NUMBER:	175-10
FIELD MEMO:	2013

The purpose of this memo is to document the training and weed removal activities that took place during 2013 by the Lake Attitash Association (LAA) and its volunteers.

The LAA held a 2-hour training session for approximately two dozen volunteers on Saturday May 18, 2013 hosted at the residence of one of the LAA Board of Directors. Training was provided by ACT and included:

- Identifying milfoil, curly pondweed, fanwort and native look-alikes.
- How to systematically monitor an area.
- How to report volunteer surveys
- How to photograph suspicious weeds for identification.

The aquatic weed reduction program includes the mobilization of 12 teams of volunteers who monitor 12 specific areas of the lake on a monthly basis. The reduction program activities include:

- Utilization of view tubes;
- Use of weed rakes for weed removal;
- Photographic evidence of each area and suspect weeds and in certain circumstances sending photos to the program coordinator for expert weed identification.

The program also includes the hand pulling of water chestnuts by 3 volunteers doing regular tours of the Back River. This is a continuous effort but every year the volume of plants has decreased.

Careful hand pulling in 2013 of milfoil took place once it was spotted in Turtle Cove. This was followed by hand removal by professional divers (Aqualogic). In 2013 curly pondweed was also spotted.

In February 2013 the LAA developed a Weed Watcher Handbook. The handbook is available online at http://www.lakeattitash.org/weedwatcher.htm and contains the following information for weed reduction volunteers:

- How to conduct a weed reduction survey including materials needed, monitoring, collection and reporting;
- Mapping;
- Plant identification; and
- Management techniques

MEMO

Finally, the LAA has a volunteer boat monitoring program to help reduce weeds. Residents are asked to contribute 4 hours over the summer to help monitor boats at the public boat ramp in Merrimac. This program places volunteers at the ramp during busy periods to show boaters how to inspect their boats and trailers for weeds that can invade and take over the lake.

The following is a summary of weed reduction activity dates for 2013:

1/10/2013	Weed Monitoring Development
1/14/2013	Weed Monitoring Development
4/19/2013	Weed Watch at lake
4/21/2013	Weed Monitoring Planning Meeting
5/18/2013	Weed Identification Training
6/9/2013	Boat Ramp Monitoring
6/15/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
6/16/2013	Boat Ramp Monitoring
6/22/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
6/23/2013	Boat Ramp Monitoring
6/25/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
6/30/2013	Boat Ramp Monitoring
7/8/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
7/17/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
7/26/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
8/3/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
8/11/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
8/27/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
8/28/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
9/5/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
9/16/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
9/22/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
10/2/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
10/5/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
10/17/2013	Weed Watchers - Milfoil, pond weed & water chestnuts
10/22/2013	Weed Watchers - Milfoil, pond weed & water chestnuts

MEMO

TO:	Field Memo
FROM:	Lake Attitash Association Correspondence
SUBJECT:	Lake Attitash s.319 Grant Task 5 Deliverable
JOB NUMBER:	175-10
FIELD MEMO:	2014

The purpose of this memo is to document the training and weed removal activities that took place during 2014 by the Lake Attitash Association (LAA) and its volunteers.

The LAA held a 2-hour training session for approximately two dozen volunteers in the Spring of 2014.

The aquatic weed reduction program includes mobilization of 12 teams of volunteers who monitor 12 specific areas of the lake on a monthly basis. The reduction program activities include:

- Utilization of view tubes;
- Use of weed rakes for weed removal;
- Photographic evidence of each area and suspect weeds and in certain circumstances sending photos to the program coordinator for expert weed identification.

The program also includes the hand pulling of water chestnuts by 3 volunteers during regular tours of the Back River. This is a continuous effort but every year the volume of plants has decreased.

The above text summarizes the events of the meeting at the above date and time.
If this information is not correct, please contact me as soon as possible.

weed watcher handbook

LA E ATT TAS ASS C AT N

P o 03, Amesbury, MA 01913

www.lakeattitash.org

February, 2013

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WEED WATCHER HANDBOOK

INTRODUCTION

Thank you for taking an interest in the Lake Attitash Association volunteer weed watching program! Your efforts to monitor Lake Attitash and report any new invasive or suspicious weeds are greatly appreciated. The information that you gather will enable us to identify any threat to Lake Attitash from invasive weeds and take prompt and appropriate action to remove them.

Lake Attitash has had a problem with invasive plants in the past (water chestnut, Eurasian water-milfoil, variable milfoil, curly-leaf pondweed and European naiad). The Association, with the support of our members and the towns of Amesbury and Merrimac, successfully raised the funds needed to treat the lake in 2012. A follow-up weed survey conducted in the fall of 2012 showed no evidence of invasive weeds.

To continue to build on the progress we have made, and to protect the lake for the future, we need to be vigilant for any new growth of these invasive plants. It is possible that the roots of some particularly sturdy plants may have survived the herbicide treatment and will re-emerge at some point. It is almost certain that boaters will bring in fragments of these plants on their boats from other lakes and new growth will appear in the future. Invasive weeds such as milfoil are a very serious problem in most New England lakes.

To demonstrate how important and effective volunteer weed watchers are, several volunteers have managed over the past 4 years to effectively control an infestation of water chestnuts (a particularly invasive and fast-spreading plant) in the Back River section of Lake Attitash. This is an ongoing effort but each year the number of plants found and removed from the lake has decreased significantly.

Unfortunately, the term eradication is not usually applicable to invasive plants. Usually, when an invasive plant enters a water body it is there to stay. Ongoing management is the key. You CAN help prevent the spread of invasive plants.

This manual will provide you with all the information you will need to conduct a weed survey. It includes a list of materials needed, instructions on how to conduct a weed survey, how and where to report your findings, maps of Lake Attitash with sections assigned to specific teams of weed watchers and descriptions of invasive weeds, including reference pictures.

MATERIALS NEEDED

- Boat (any type works, like a pontoon boat, ski boat, fishing boat, canoe, kayak, or row boat)
- If using a motor boat, one person to drive the boat, and one or more weed watchers
- Plant identification pictures & information – included in this manual
- A map of the lake broken into sections that are assigned to volunteers - included in this manual.
- Note pad, pens/pencils or other waterproof markers.
- Small rake with a long handle and/or two iron rake bottoms tied together and attached to a long rope (provided by the Association)
- Zip-lock bags and paper towels for collecting samples
- Polarized sunglasses (recommended)
- A view scope (provided by the Association)
- GPS unit (optional)
- A marker buoy system (as simple as a brick connected by rope to a 6" section of swim noodle or other floating marker)
- Access to a digital camera – to photograph plants for identification

CONDUCTING THE SURVEY

Sections & Teams

Lake Attitash has been divided up into twelve sections, (see map on page 10) with each section assigned to a team of volunteer weed watchers. Sections are usually assigned to volunteers that live along that section of the lake. One person, designated as the project coordinator, receives reports from each team. The project coordinator needs to know when surveys have been conducted and is the person to receive photographs of any suspicious plants that were found. The project coordinator will make sure that each shoreline section is monitored each month during the growing season.

Frequency of Monitoring

Conduct a weed survey at least monthly from May through September. It is important to know that many invasive plants can grow up to an inch per day under optimum summer temperature, light, and nutrient conditions, so regular monitoring is the key to finding plants early.

Using a Weed Watcher Map to Show Weed Locations

It is important to map the location of any newly identified invasive weeds that you find.

Included in this manual you will find a map of Lake Attitash divided into twelve sections. Please take the laminated map found at the end of this manual with you when you do your survey and write on the map (front and back as needed using a waterproof marker or grease pencil) what invasive weeds (also referred to as "exotic weeds" in this manual) you have found, what you think they are and where you found them. Please be as specific as possible and follow the detailed instruction in the monitoring section below.

Monitoring

1. Once you begin monitoring, move slowly from the shore line outward in a weaving or zigzag pattern. (See diagram on page 12). You can either follow the shoreline along your section and when you reach your end point on shore, turn around, go out a little deeper, and go back to the start point. Continue to do these parallel tracks to shore until you are sure there are no weeds to be found at that depth. Alternatively, start at one end of your shoreline section and paddle out into the lake until you are at a depth where there are no weeds. Turn around and paddle back to shore, aiming for a spot a little over from where you started, zigzagging until you get to the end of your shoreline section. Both of these methods will enable you to systematically cover a large area, including deeper waters. Since Lake Attitash is a shallow lake with an average depth of less than fifteen to twenty feet, weeds may extend quite a ways beyond the near shore area, and search of the entire section may be necessary. Using a "view scope" can help see further down, but in murky water you may need to use a long handled rake or rake system on a rope to gather samples to check. Plan your weed watching days (or time periods) when there are calm winds. Weed surveys are best conducted when conditions are calm. Ripples and small waves may prevent you from seeing below the surface of the water.

1. Observe the plants as you travel through your section of the lake. Be sure to scan the surface of the water for floating pieces of plants (many of the submersed invasives tend to break off and drift as small pieces on the surface) and look below the surface for rooted submersed species. Also, scan the shoreline to see what plants have washed up, as this can indicate an infestation. Generally lakes with infestations have pieces of the invasive plants washing up on shore.

   For the submersed species, carefully pull up a small piece of the plant, with a rake if necessary, to get a piece in hand to aid in identification (being careful not to disturb the lake bottom or to create fragments of the plant).

3. We are using an alphabetic system where each plant is given code letters as an effective way to mark the location of the plants on a map (see list and example on page 9). You may find it helpful to use a bigger outline map of your section to make notes on as you move around your section. There is no need to document every plant, but if an area of plants is particularly dense, you should indicate that by placing letters closer together and noting it in your written reporting. This is an excellent way to document the location and abundance of a plant, both for current use, and for historical reference in the future. You do not have to map native plants. You can simply search for anything that is suspicious or obviously invasive. If you're not sure whether a plant is an invasive species, collect a sample for later identification as described in "Collection" below. Use the descriptions and pictures included in this manual to help with the identification process.

4. Pay extra attention to boat launch areas and swampy protected coves of the lake or pond, and areas where the wind usually pushes things that drift in the lake. These are areas that may provide good habitat for invasive plants due to high use or higher nutrients. Invasive species in particular usually take root near boat launch sites.

5. BEWARE OF THE LOOK-ALIKES! A number of plants may resemble exotic species. Bladderwort, waterweed (Elodea), coontail, water marigold, and others can easily be confused with invasive species like milfoil and fanwort. The look-alikes have distinctive variations, however. Use your laminated weed identification sheets to help distinguish between similar types of plants. Share your photograph with the project coordinator and other weed watchers.

6. Keep an eye out for other invasives like zebra mussels. Massachusetts, Vermont and Connecticut are so far the only New England states that have documented infestations of these invasive mussels. Zebra mussels have also recently been found in Lake George in New York. A description of zebra mussels is included in this manual. These invasives are usually found on hard submerged objects like boat hulls, buoys, docks, and rocks. The mussels are small, usually less than one inch in length. They are distinctive in that they have alternating brownish and white stripes, and have a sticky secretion from their shells that allows them to stick to hard objects.

7. Be aware of what washes up on the shore during high winds and storms. Invasive plants often fragment, or break apart during disturbances to the water. These pieces wash up on shore in mats of intertwined plant material. Be sure to check these mats or piles of plants from time to time to be sure that the plants are all natives and not invasives.

Collection

1. Note the location of the plant in the lake on your map by finding reference points on shore. You can also throw a marker buoy into the lake to mark the exact spot of the specimen that is in question if there is likely to be prompt removal action. If you have a GPS unit you can note the latitude and longitude of the location.

2. Collect a representative specimen of the plant you think is invasive (a length of the stem with leaves is necessary, as well as any flowers or fruits if they are present).

3. Wrap the collected specimen in a moist (not dripping) paper towel and place it in a re-sealable plastic bag. Photograph the specimen as soon as possible, carefully spreading it out on a flat white background. We will need to see small details such as how the leaves attach to the stem. Place a pen or coin next to the plant to provide some sense of scale. Save the pictures as .jpg, .bmp, or .tif files.

Reporting

1. Report the date of your regular monitoring to the project coordinator each month by e-mail. Let the coordinator know that you have conducted your survey regardless of whether you did or did not note any suspicious plants.

2. If you find a plant or mussel species that looks suspicious, contact the project coordinator immediately with all the relevant information. E-mail the photographs you have taken, along with information about the location in the lake where the sample was found to the project coordinator.

   For people comfortable with computer applications, a map of the lake been placed on a Google web site. Use this map to report the type and location of weeds found. Instructions for use of this web site can be found at the end of this section.

3. The coordinator will confirm the identity of the plant, with assistance from experts as necessary, and notify you of its identification. Appropriate management strategies can then be taken if it is an invasive plant.

Google Web Map

1. A map of the lake for Lake Attitash weed watchers use has been placed on a Google web site for use by teams to show where weeds have been found including as much supporting information as possible. You can enter information onto the Google map from your laminated paper map when you return from your survey.

    - The map can be accessed by logging into www.google.com
    - Click on the "sign in" section in the upper right hand corner of the page
    - Sign in using the email address of "**attitashlake**"
    - The password is "**merrimac**"
    - Click on "**Maps**" in the upper left hand section of the page that opens
    - Click on "**My Places**" in the upper left hand section of the page that opens
    - Click on "**Lake Attitash Weed Watch**" about half way down the left section of the page

    ** If you are new to Google Maps, please acquaint yourself with the features using the "Test/Learning Map" before using the "Lake Attitash Weed Watch" map.

    - You should see an aerial view of Lake Attitash on the right of the page including street names.
    - You can zoom in and out using the symbols and line at the top-left of the map.

    - You can also pan around to different areas of the lake map by holding down your left mouse button and dragging your mouse around.

2. You can add a point on the map where you found weeds -
    - Click the orange "EDIT".
    - Click on the "add a place mark" symbol on the upper left of the screen.

Then move the symbol by holding the left section of your mouse down and dragging it using your mouse to the location of the weeds you found and identified. Releasing the left side of the mouse places the symbol where you want it.

- Clicking on the symbol you placed brings up a dialogue box where you can write any information you want that helps locate the weeds and helps identify them.
  - Examples of useful information:
    - Type of weed, if known.
    - Estimated distance from shore of spotted weeds.
    - Color/other features of house weeds were spotted in front of.
    - Overall area affected by weeds (i.e., 3 feet, a single weed, etc.)
- When finished editing the map, click the "DONE" button and Sign Out via the down-arrow at the very top-right of the screen.

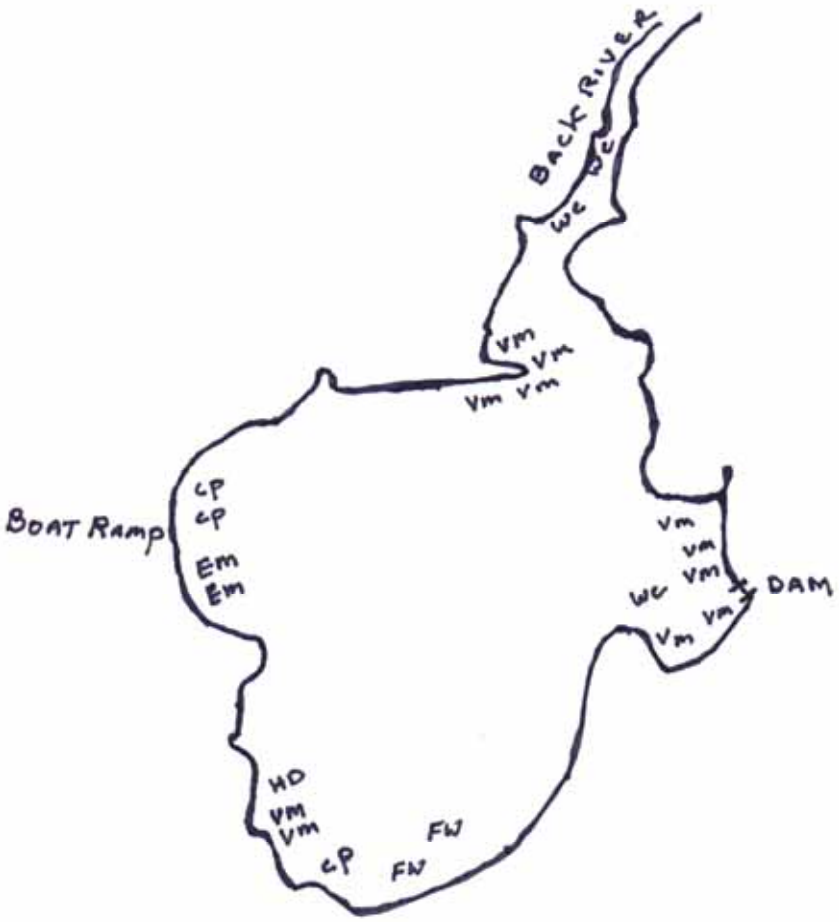
A FINAL COMMENT

Please remember that native aquatic plants are important in the ecological balance of any lake or pond. Native plants provide shade, food, fish and invertebrate habitat, and diversity in the aquatic environment. It is a natural progression for lakes to gradually become more nutrient rich over time and to have a greater abundance of native plants. This process is taking place in lakes and ponds all over the world, and may occur faster in some lakes than in others.

Establishing a Weed Watcher program on Lake Attitash is one way to document these changes and find problems early. It's also a great way to get out and enjoy nature!

PLEASE NOTE - Thank you to Amy Smagula from the New Hampshire Dept. of Environmental Services for providing much of the material included in this manual.

Example of Lake Outline Map with Plant Symbols

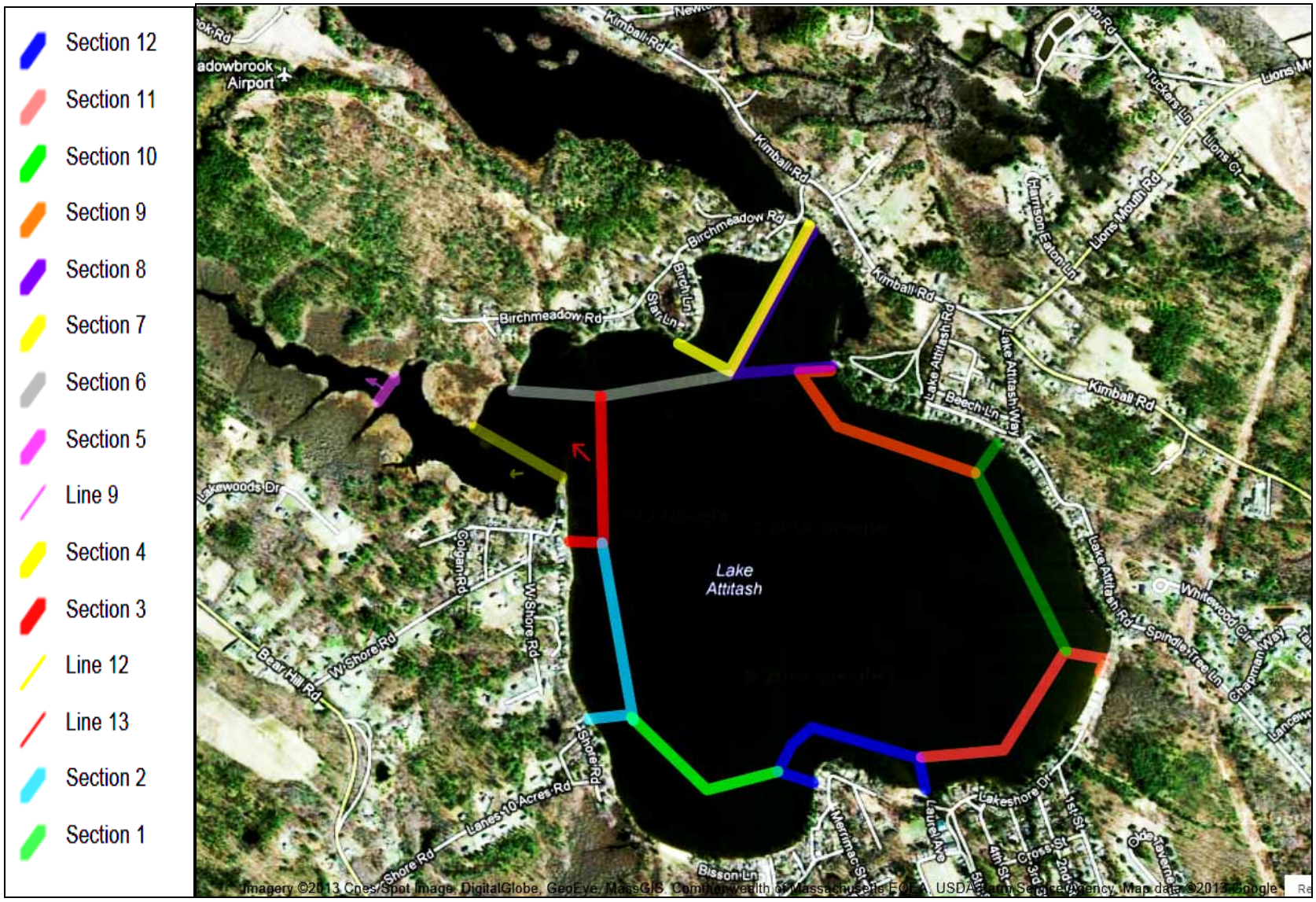


Key to Plant Symbols

FW	=	**Fanwort**
VM	=	**Variable Milfoil**
EM	=	**Eurasian Milfoil**
HD	=	**Hydrilla**
BE	=	**Brazilian Elodea**
WC	=	**Water Chestnut**
CP	=	**Curly Pondweed**
ZM	=	**Zebra Mussels**

9

LAKE ATTITASH SECTION NUMBERS

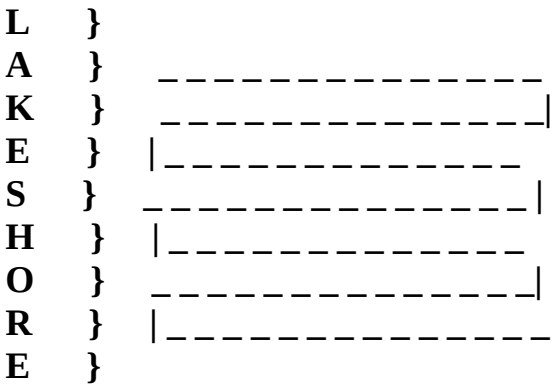


Detailed boundaries for each section will be provided separately

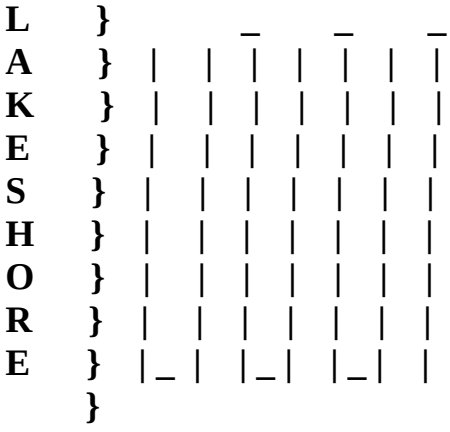
MONITORING ZIG ZAG INSTRUCTIONS / DIAGRAM

Once you begin monitoring, move slowly from the shore line outward in a weaving or zigzag pattern. You can either follow the shoreline along your section and when you reach your end point on shore, turn around, go out a little deeper, and go back to the start point. Continue to do these parallel tracks to shore until you are sure there are no weeds to be found at that depth. Alternatively, start at one end of your shoreline section and paddle out into the lake until you at a depth where there are no weeds. Turn around and paddle back to shore, aiming for a spot a little over from where you started, zigzagging until you get to the end of your shoreline section. Both of these methods will enable you to systematically cover a large area, including deeper water

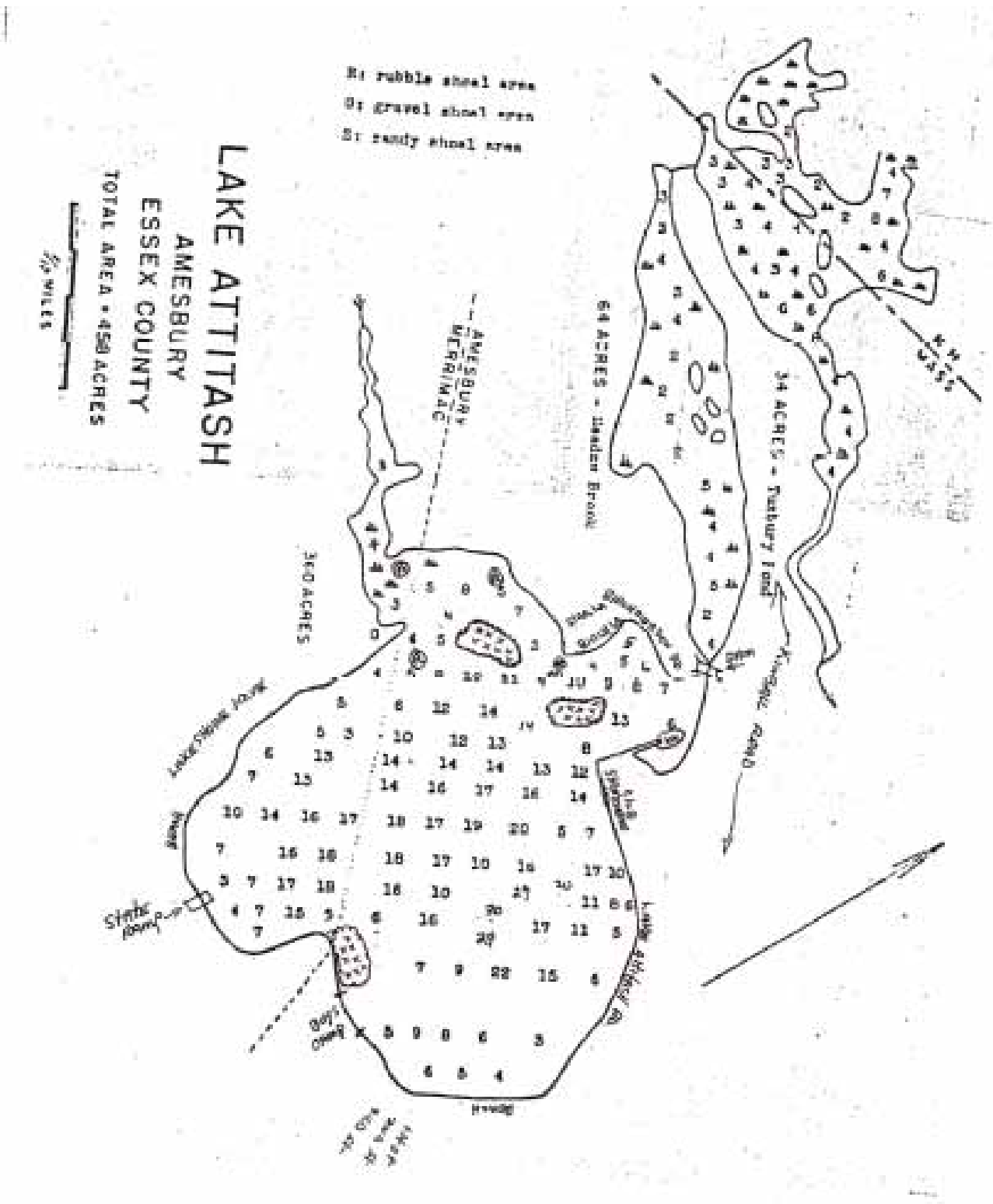
ZIG ZAG PATTERN FOR MONITORING



OR



LAKE ATTITASH DEPTH MAP



UNWANTED

==========

THE FRIGHTFUL FOURTEEN

These 14 exotic invasive aquatic plants will choke surface water, harm native vegetation and wildlife, impact recreation and lower property values. Only you can prevent their spread.

Characteristics of the Frightful Fourteen

Habit	Common Name	Leaves/Stems	Flower	Native Range
Floating Leaved Plants	Yellow Floating Heart	Small heart-shaped leaves	Showy yellow flowers June through September	Eurasia
	Frogbit	Round thick leaves	White flowers with three petals	Europe
	Water Chestnut	Triangular toothed leaves, forming rosettes	Small whitish to green flower from June through September, forming spiny fruit	Europe and Asia
Submerged Plants (underwater)	Variable Milfoil	Feather-like leaves, whorled along main stem	Emergent flower stalk, green flowers with football shaped bracts	Southern and Midwestern United States
	Eurasian Milfoil	Feather-like leaves, whorled around main stem	Emergent flower stalk, green flowers, with bracts smaller than flowers	Europe and Asia
	Parrot Feather	Very small, compact feather-like leaves, whorled around stem, emergent and submersed leaves similar	Flowers opposite, emergent	Southern North America
	Curly-leaf Pondweed	Oblong leaves with very curly edges, leaf margins are finely toothed	Winter buds generally present	Europe
	Brazilian Elodea	Leaves are finely toothed along margin, in whorls of 5 around stem	White flowers that stay at water surface	South America
	Fanwort	Branching leaves forming fan shape, opposite on stem	Flowers white, with small lily pad-like structure from July through September	Southern United States and Latin America
	European Naiad	Narrow leaves toothed, recurved back toward stem, appearing whorled	Does not produce showy flowers	Europe
	Hydrilla	Leaves are toothed along margin, leaf whorls of 4-6 along main stem	White flowers near surface of water	Africa, Australia, Asia
Emergent Plants (growing out of water)	Common Reed	Stems 3-14 feet tall, leaves alternate along stem	Reddish to silver flowering head, forming large tuft	Europe
	Purple Loosestrife	Stems woody and square, 1-7 feet tall, leaves opposite or whorled along stem	Magenta purple spike of flowers from July to September	Europe
	Flowering Rush	Stems erect when emergent, tape-like when submergent	Showy clusters of large pink to whitish flowers, July through August	Europe and Asia

STOP the spread of exotic aquatic invasive plants. Always inspect your boat, motor, trailer and recreational equipment for tag-along plants before launching and after exiting a water body. Remove all tag-along material and dispose of it away from the water body.

PLEASE HELP US STOP THE SPREAD OF THESE NINE EXOTIC AQUATIC PLANTS ALREADY IN NH WATERBODIES!

Variable Milfoil
Myriophyllum heterophyllum

Fanwort
Cabomba caroliniana

Eurasian Water-Milfoil
Myriophyllum spicatum

Brazilian Elodea
Egeria densa

Curly-leaf Pondweed
Potamogeton crispus

European Naiad
Najas minor

Water Chestnut
Trapa natans

Purple Loosestrife
Lythrum salicaria

Common Reed
Phragmites australis

PLEASE HELP US PREVENT THE INTRODUCTION OF THESE FIVE EXOTIC AQUATIC PLANTS NOT YET IN NEW HAMPSHIRE!

Parrot Feather
Myriophyllum aquaticum

Yellow Floating Heart
Nymphoides peltata

Hydrilla
Hydrilla verticillata

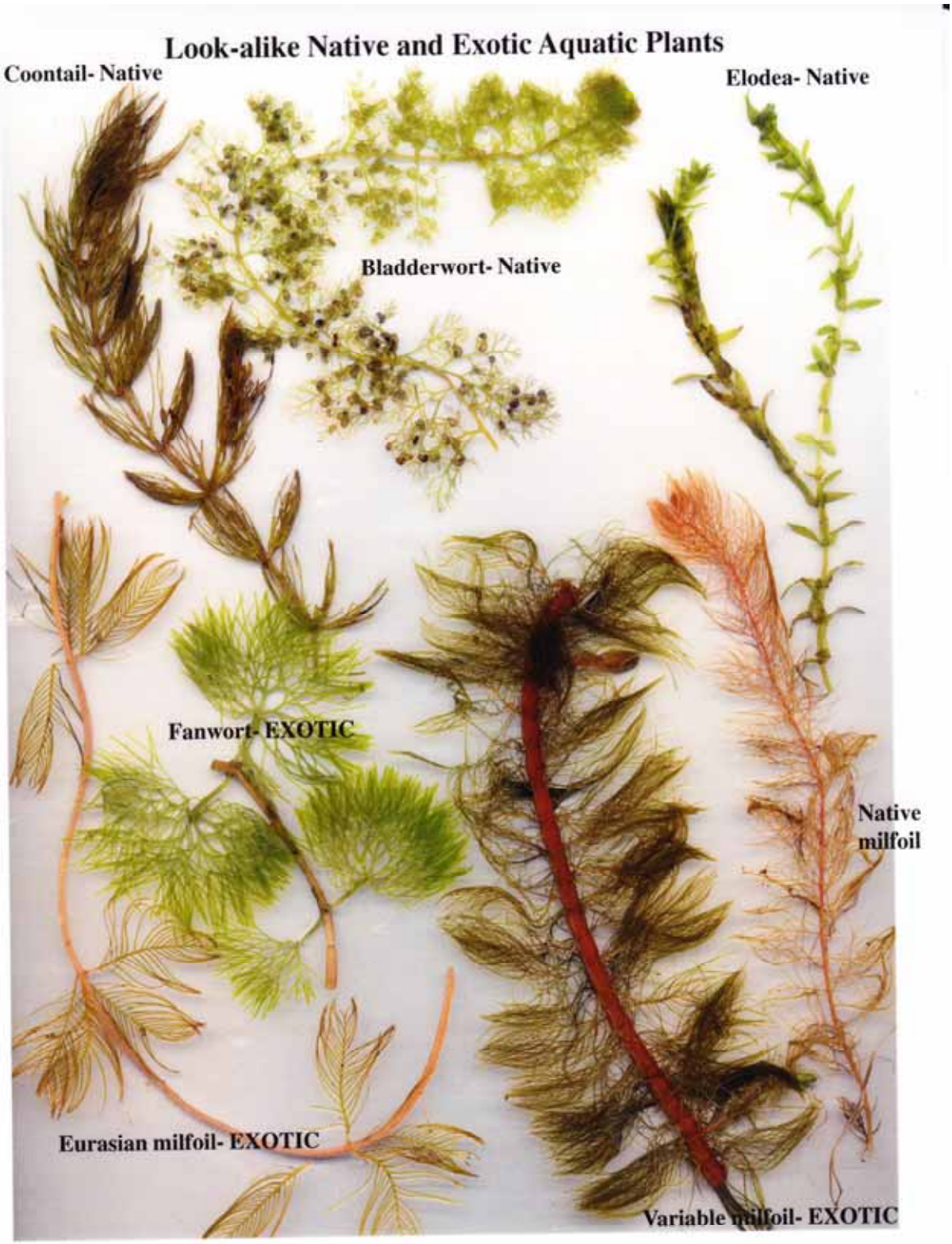
Flowering Rush
Butomus umbellatus

NH Department of Environmental Services
Biology Section
29 Hazen Drive, Concord, NH 03301
(603) 271-2248
www.des.nh.gov

European Frogbit
Hydrocharis morsus-ranae

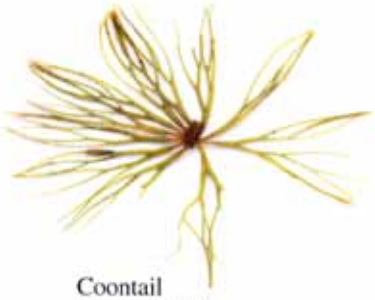
Cover photo by Amy Smagula and Jason Smith

Plant Identification Pictures & Information



Look-Alike Submerged Plants with Feathery Leaves

Fanwort
Cabomba caroliniana
EXOTIC!



Coontail
Ceratophyllum
Native

Eurasian milfoil
Myriophyllum spicatum
EXOTIC!

Bladderwort
Utricularia
Native

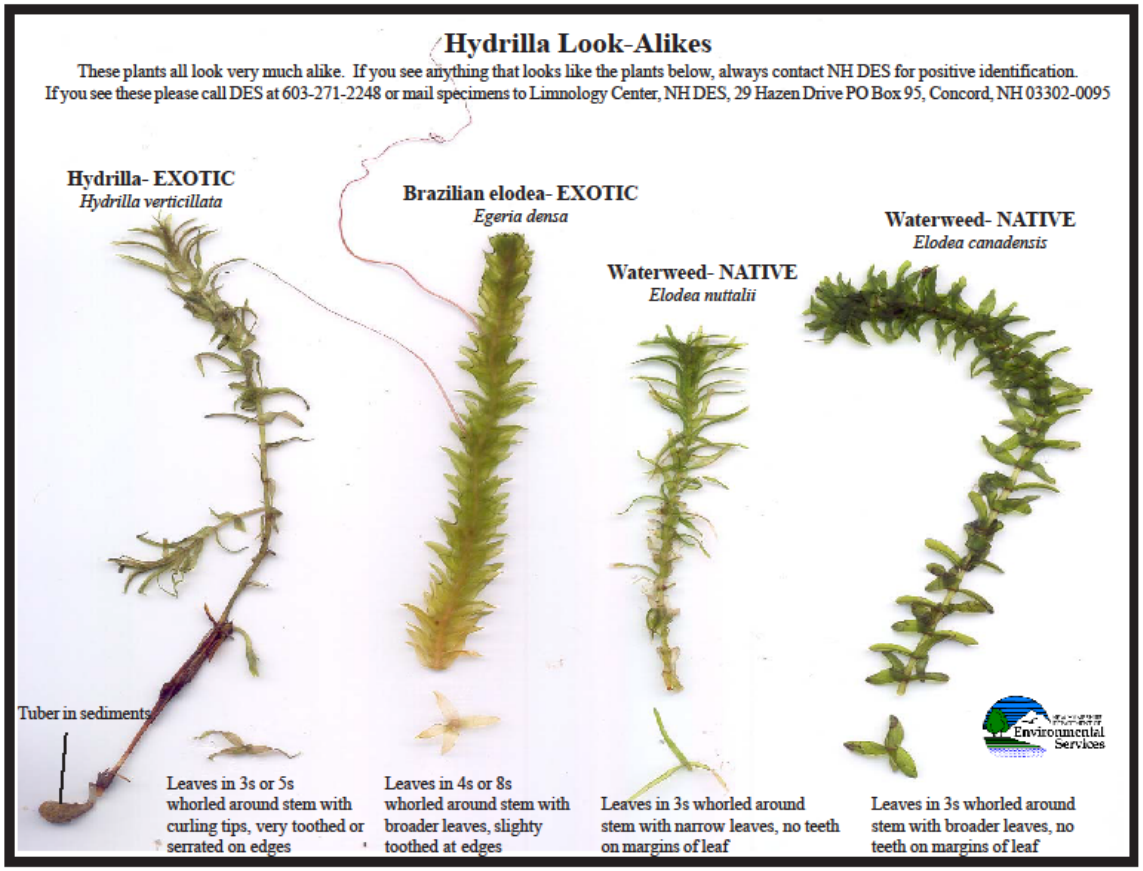
Variable milfoil
Myriophyllum heterophyllum
EXOTIC!

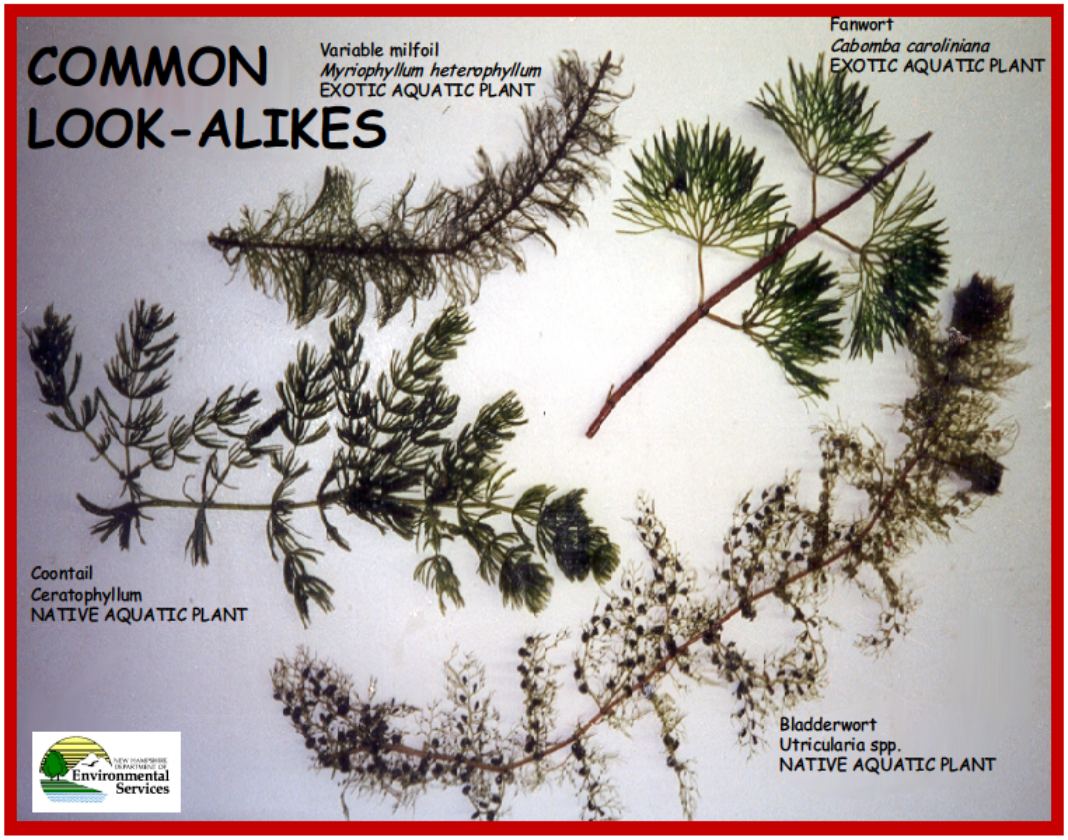
Waterweed
Elodea
Native

Native milfoil
Myriophyllum humile
Native

Environmental Services

Exotic Species Program
603-271-2248


Hydrilla Look-Alikes
These plants all look very much alike. If you see anything that looks like the plants below, always contact NH DES for positive identification.
If you see these please call DES at 603-271-2248 or mail specimens to Limnology Center, NH DES, 29 Hazen Drive PO Box 95, Concord, NH 03302-0095
Hydrilla- EXOTIC
Hydrilla verticillata
Tuber in sediments
Leaves in 3s or 5s whorled around stem with curling tips, very toothed or serrated on edges
Brazilian elodea- EXOTIC
Egeria densa
Leaves in 4s or 8s whorled around stem with broader leaves, slighty toothed at edges
Waterweed- NATIVE
Elodea nuttalii
Leaves in 3s whorled around stem with narrow leaves, no teeth on margins of leaf
Waterweed- NATIVE
Elodea canadensis
Leaves in 3s whorled around stem with broader leaves, no teeth on margins of leaf
Environmental Services


COMMON
LOOK-ALIKES
Variable milfoil
Myriophyllum heterophyllum
EXOTIC AQUATIC PLANT
Fanwort
Cabomba caroliniana
EXOTIC AQUATIC PLANT
Coontail
Ceratophyllum
NATIVE AQUATIC PLANT
Bladderwort
Utricularia spp.
NATIVE AQUATIC PLANT
Environmental Services

ZEBRA MUSSELS

Zebra mussels can be found in many New England waters. It is critical that they don't get a chance to gain a foothold in Lake Attitash.

Zebra mussels are filter feeders. When in the water, they open their shells to admit detritus. As their shells are very sharp, they are known for cutting people's feet, resulting in the need to wear water shoes wherever they are prevalent.

Since their colonization of the Great Lakes they have moved across the country. They have covered the undersides of docks, boats, and anchors. They have also spread into streams and rivers nationwide. In some areas they completely cover the substrate, sometimes covering other freshwater mussels. They can grow so densely that they block pipelines, clogging water intakes of municipal water supplies and hydroelectric companies.

Zebra mussels are believed to be the source of deadly avian botulism poisoning that has killed tens of thousands of birds in the Great Lakes since the late 1990s. Because they are so efficient at filtering water, they tend to accumulate pollutants and toxins. For this reason, although they are edible, most experts recommend against consuming zebra mussels.

They are also responsible for the near extinction of many species in the Great Lake system by out-competing native species for food and by growing on top of and suffocating the native clams and mussels. It is important that they not be given the chance of doing the same thing in our local lakes and streams.

Monitoring of the lake and checking boats and trailers for these mussels must be a priority if Lake Attitash is to be kept free of them.

Aquatic Exotic Plant Management Techniques

Method	Effectiveness	Specificity to Target	Advantages	Disadvantages	Cost*
Hand Pulling (Physical)	Effective in removing a few individual plants at a time.	ery specific	Good for locali ed areas few plants. Plants physically removed from water body.	Labor intensive Good for small infestations only. Not practical when plant growth is dense.	1 0 diver hour
Diver Assisted Suction Harvesting (DASH)	Effective in controlling e otic plants distributed in low to moderate density over a large area, or larger more dense patches in a small area	ery specific	Plants and roots physically removed from system, speeds up hand removal (but is only as good as diver)	Moderately e pensive, hard to do in cobble rocky bottom area.	900 ,000 for a team of two divers and one or two topside support staff (includes equipment use and disposal)
Mechanical Harvesting (Physical)	Effective in removing large amounts of vegetation at a time.	Not specific	Rapidly removes vegetation from area. Plants physically removed from water body.	Fragments plants which could cause regrowth. Removes native vegetation. Could increase turbidity, ultimately affecting other aquatic life. Does not remove rooting system.	Ranges widely depending on plant density, location, disposal, etc. Generally 3 0 1 00 per acre.
Hydro-Raking (Physical)	Effective in removing large amounts of vegetation at a time.	Not specific	Rapidly removes vegetation. Removes rooting systems to prevent rapid regrowth. Plants removed from water body.	Fragments plants which could cause regrowth. Removes native vegetation. Could increase turbidity.	Ranges widely depending on plant density, location, disposal, etc. Generally 3 0 00 per acre.

Method	Effectiveness	Specificity to Target	Advantages	Disadvantages	Cost*
Benthic Barrier: Permeable or Non-Permeable (Physical)	Effective for very small areas.	Specific to areas where barrier is located mpacts all plants under barrier	Compresses plants to sediments and prevents likelihood of fragmentation by wind, wave, or anthropogenic means.	Labor intensive. Must be frequently cleaned re staked. Plants not physically removed from water body. May cause sediment water ano ia. May impact non target species such as fish, invertebrates, and others.	0. 0 1. per sq. foot (,000 0,000 per acre).
Chemical Treatment	Systemic herbicides more effective than contact herbicides.	Most chemicals have target species for which they are most effective arying application rates can increase target specificity	Chemical has potential to eliminate e otic plant infestation if done at correct time and correct concentration is used.Relatively rapid effect.Longer time span of control than other types of control techniques.	Addition of chemical to water body.May impact non target species if not applied according to label restrictions.Could be environmentally damaging if not applied to label restrictions.	aries with chemical and si e of treatment area.Could range from 00 1300 per acre.
Drawdown (Habitat manipulation)	Somewhat effective if repeated frequently. More effective if drawdown maintained for a long time period.	Not specific	Could control density of vegetation due to plant die off from desiccation or free ing. inter drawdowns favorable.	mpacts non target species (plants, fish, amphibians, etc.). Devastating to entire water body ecology.	Low cost if dam or other means of drawing down water is available.

Method	Effectiveness	Specificity to Target	Advantages	Disadvantages	Cost*
Dredging (Habitat manipulation)	Effective in removing plants from a locali ed area where dredge takes place.	Not specific	Completely removes plant material. Removes nutrient laden sediments. Removes seed bank.	Devastating to entire system impacts non target plants and animals. Could cause e cessive turbidity. Must wait for water body to be filled again.	1 ,000 3 ,000 per acre. Previously used and successful in Milville Lake, New ampshire.
Biological Controls	Effective against target plants.	Specific	nsects, bacteria, or viruses used in this method are typically specific to target plant. Their life cycles revolve around particular plant species. Does not affect non target species.	May cause decline in o ygen as plant material decays. Many biological controls are themselves e otic. Still e perimental.	Cost of insects. igh monitoring cost.

NOTES