2-24-2014

Final Report of the Residential Watershed Improvements Project for the Town of Exeter, NH

University of New Hampshire Stormwater Center (UNHSC)

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Project Background

In June of 2013 the Green Infrastructure for Sustainable Coastal Communities (GISCC) project authorized funding for the Town of Exeter proposed residential watershed improvements for the Brickyard Pond project.

Figure 1: Excess nutrients (phosphorus and nitrogen) causes algae growth in Brickyard Pond.

Brickyard pond, a small pond along Kingston Road in Exeter has long been a community icon. In the past there were maintained trails that encircled the perimeter, scouts used to hold an annual fishing derby there, and residents living nearby or using the adjacent park would enjoy the aesthetic and recreational opportunities that the pond provided. Over the past several years, the condition of the pond has significantly deteriorated (Figure 1). Now instead of a pleasant destination, each summer the pond is covered with excessive algae growth (Figure 1) and has an unpleasant odor. The residents of the Marshall Farms Crossing neighborhood, a 47 acre subdivision draining directly to the pond, expressed concerns about the ponds condition and were interested in knowing what they could do to determine the cause of the problem and improve the ponds condition. Upon inspection by town staff, it was evident that the nearby neighborhood has a variety of opportunities for implementation of Green Infrastructure that overtime could improve water quality. The neighborhood itself contains a number of stormdrains that drain directly to Brickyard Pond. In addition there are several areas where stormwater runs directly into the pond through a small neighborhood stream. Most homes in the area have long driveways and lawns. Several roof gutters drain to the driveways or other paved surfaces. The GISCC project initiated a neighborhood-wide stormwater education program followed by implementation of several green infrastructure installations. The intent was to share the message of how stormwater from homes, lawns and streets flows to stormdrains and pipes and ultimately the pond, all of which contribute to poor water quality. Through this project, the town of Exeter created a program that would help explain the benefits of a few simple changes that residents could make to improve water quality. Using Town staff and members from the GISCC project team, volunteer boards and the Exeter Think Blue “crew” and guidance from an experienced contractor, an “evaluation team” was established and work in the neighborhood commenced. Through site surveying, GIS analysis and a number of outreach events information and guidance on stormwater management opportunities were provided to the town and residents. This initial outreach was followed by implementation of a variety of green infrastructure projects with preference to those homes with a more direct stormwater connection to Brickyard Pond. Individual projects and outreach activities are described below:

• LAWN CARE - A Think Blue Exeter environmentally friendly lawn care program was established and information was distributed (see Appendix A). Soil analyses were conducted to determine fertilizer needs, and developed an outreach program to identify and sign up homeowners who were willing to commit to water quality friendly lawn care practices. Six soil samples were collected by three residents (several residents collected samples from different areas of their yards). The results indicated that phosphorus ranged from low (21 parts per million) to high (76 parts per million). The analysis did not include nitrogen, because nitrogen transforms rapidly, and is difficult to measure accurately. The UNH Cooperative Extension report with each analysis included recommended applications rates for nitrogen and other nutrients.

• RAIN BARRELS - A rainbarrel program was established with SkyJuice New England and rainbarrels were offered at discounted prices to residents. A total of 8 rainbarrels were sold, with 6 being placed within the Brickyard Pond watershed.

• RAINGARDEN INSTALLATION - Working with homeowner volunteers, two demonstration raingarden projects were designed and installed at key locations. The project team worked with Ironwood Design who designed the raingarden systems and Rye Beach Landscapers who installed the systems. Installation was performed by homeowners, neighbors and other interested volunteers, guided by the project team and contractors. The community installations provided a forum for interested residents to gain hands-on experience installing soil media, plants and other natural materials, which they can practice on their own properties.

Figure 2: Residents plant a newly installed raingarden

• WATER QUALITY MONITORING - The project team purchased and installed an AquaTroll water sensor at the downstream end of the drainage culvert off of Colonial Way in the Marshall Farms neighborhood. The device was installed to record water depth, temperature and conductivity which can be used as a surrogate measure for water quality. A summary of standard operation procedures are included in Appendix C. A spreadsheet was developed which can be used to calculate and track water volume and specific pollutants entering the pond and pollutant loads were modeled using a modification of the US Environmental Protection Agency Simple Method Approach (described in the excel worksheet and provided as a separate file). Results are summarized in the next section. In addition the GISCC project will gather water samples from 2-3 locations around the pond to establish an ongoing volunteer sampling program. An outline for a water quality monitoring program is provided in Appendix B. The project will fund the first year of water sample analyses which will include at minimum, total nitrogen, total phosphorus, total suspended sediments and chloride.

Community Outreach and Engagement

Through this project numerous outreach and engagement strategies have been implemented. Individual tasks and related outcomes are listed below:

• NEIGHBORHOOD OUTREACH - Residents were first engaged through two neighborhood informational "fairs" where, through the use of models, presentations and hands on demonstrations, they learned about water quality sensors, rain barrel installation, lawn and soil management, runoff management, and rain garden installation.

• TRAIN THE TRAINER – At the conclusion of the project a final training will be held with town staff and volunteers. Guidance will be provided by an experienced contractor to provide the Think Blue Exeter crew with hands on experience with site evaluation and implementation of green infrastructure practices.

• TOWN-WIDE – The Think Blue Crew having hands-on experience with a variety of methods for management of stormwater will serve as a local resource for identification of stormwater management opportunities for other homeowners/landowners in town. The installation projects serve as easily accessible and functional demonstrations of successful green infrastructure applications. Overall the project provides a learning opportunity and raises awareness in the neighborhood and in town about the importance of water quality.

Project Results and Future Considerations

As part of the project a pollutant load tracking spreadsheet was developed to highlight and track current and future project deliverables (provided as a separate file, a summary can be seen in Appendix B). In general Marshall Farms Crossing is a 46.9 acre watershed draining to

Brickyard Pond. The predominant land use is ¼ acre residential lots and consists of two subwatershed areas; Heritage Way (18 acres) and Colonial Way and Liberty Lane (28.9). Additional subwatershed characteristics and pollutant load estimates are provided in Table 1.

Table 1: Pollutant load estimates based on the USEPA Simple Method for the Brickyard Pond Watershed.

Watershed	Cover Area AC	% IC	TSS Annual Load 'L' #/year	TP Annual Load 'L' #/year	TN Annual Load 'L' #/year
Heritage Way	18.0	0.17	3,567	14	78
Colonial Way & Liberty Lane	28.9	0.19	6,236	21	185
Total		0.18	9,803	35	264
Reduction Target		0.10	3,393	14	75
Achieved		0.004	203	0.8	0
Percentage of Target		4%	6%	6%	0%

The State of New Hampshire has no numeric criteria for phosphorus in lakes and ponds. Consequently, the New Hampshire Department of Environmental Services (NH DES) has derived a numeric TP target of 12 ug/L. The target is recommended and based on an analysis of phosphorus conditions in both impaired and unimpaired lakes in the state, and is supported by additional analyses of nutrient levels for commonly recognized trophic levels, and by the use of probabilistic equations to establish targets that minimize the risk of impaired conditions. Loading estimates in Table 1 are derived from EPA published pollutant export rates from specific land uses and may vary from location to location. Verification of model results with actual data will be critical for long term accuracy and representativeness. Upon completion of the first year of volunteer monitoring specific reduction targets can be developed to more effectively track progress.

As a result of this project a majority of the Marshall Farms Crossing neighborhood residents have received information on how they can reduce nutrients to Brickyard Pond, six rain barrels have been installed and 3 residents have pledged to not use lawn fertilizer. In addition, two raingardens have been installed that treat 0.4 acres of drainage area and annually reduce 203 lbs of TSS and 0.8 lbs of phosphorus from entering the pond.

Optimization

A pollutant load analysis was developed for the Marshall Farms Crossing watershed. Areas were ranked based on potential pollutant load, soil type, and proximity to major waterways. A high score indicates where potential hotspots for TSS, TP and TN exist and where remediation efforts could have the maximum benefit (see Figure 3). The model showed that of the two distinct subwatershed areas, The Colonial Way and Liberty Lane drainage area is larger in size and larger in overall impervious cover resulting in higher contributions in pollutant load and larger potential impact to the pond. If the Marshal Farms Crossing project continued to reduce EIC by 0.21 acres per year than EIC reduction targets could be met in 19 years.

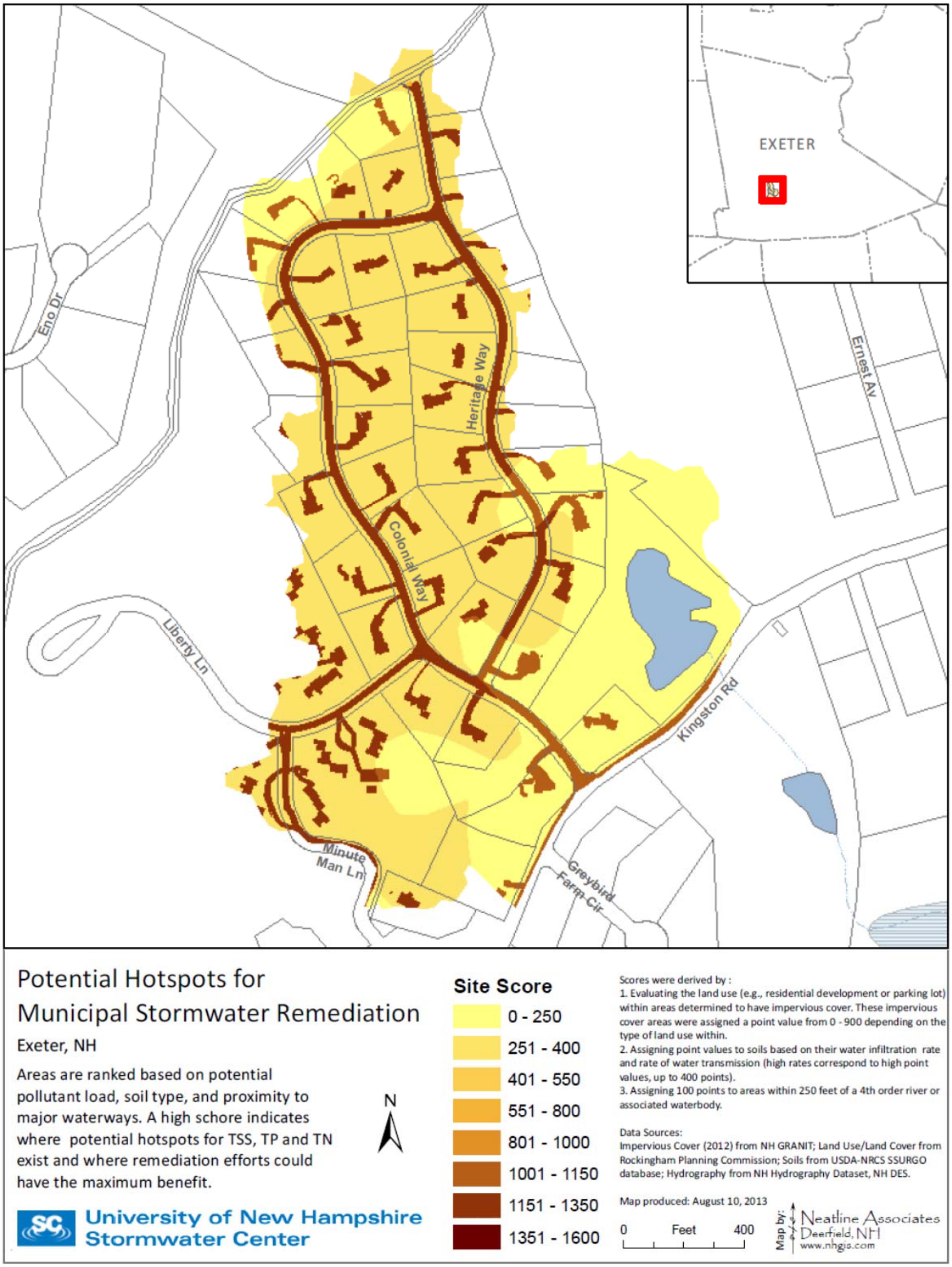

Figure 3: Hotspot modeling for the Marshall Farms Crossing Watershed.

The Impervious Cover Model (ICM) was first proposed in 1994 by Tom Schueler and the Center for Watershed Protection. It was first introduced as a management tool to diagnose the severity of future stream problems in urban and urbanizing watersheds. Since its introduction the ICM has been adapted as a surrogate for impaired water attainment. Numerous watershed studies throughout the country have correlated the percentage of IC to the overall health of a watershed and its ability to meet designated uses. According to studies, it is reasonable to rely on the surrogate measure of percent IC to represent the combination of pollutants that can contribute to aquatic life impacts. Without a total maximum daily load assessment for a watershed a general target related to the ICM is 10 % Effective Impervious Cover (EIC). That is if IC in a watershed can be disconnected through treatment through an appropriately sized BMP it can be removed from the EIC.

Based on the implementation within Brickyard Pond Watersheds for 2013 an IC disconnection rate of 0.72% was achieved for 0.21 acres of drainage area within the Colonial Way & Liberty Lane Watersheds (0.45% reduction for the entire Marshall Farms watershed). At this rate of implementation, and barring any other IC increase in the watershed, an EIC target of 10% could be achieved by the year 2032 (see Figure 4). Costs associated with raingarden design and construction were $11,000, or $5,500 per raingarden. Cost typically will come down over time as familiarity and experience with these systems increases. The cost per acre disconnected in this project was $52,000. This is higher than the average cost of $30,000 that has been tracked by the UNHSC over the past 10 years of work in the field.

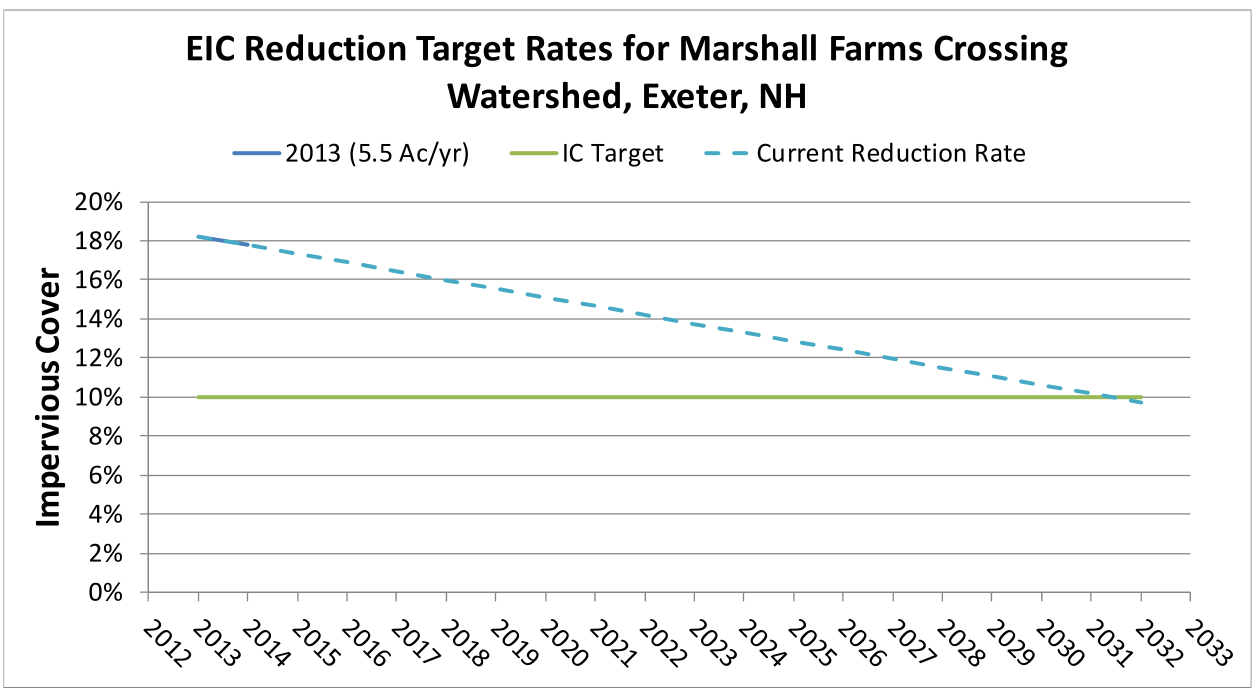

Figure 4: EIC Reduction Target Rates for Colonial Way & Liberty Lane, Exeter, NH

APPENDIX A – LAWN CARE

Green Grass & Clear Water

Environmentally friendly lawn care recommendations for northern New England

According to a recent survey, it's likely that you and your neighbors believe having a lawn that is safe for the environment is very important.* However, some lawn care practices can create water quality problems. Excess nutrients (including nitrogen and phosphorous found in fertilizers) that run off our properties into local waterbodies can trigger algal blooms that cloud water and rob it of oxygen.

Many of us enjoy the time we spend working on our lawns and are willing to try new practices as long as our lawns continue to look good.* Here are some easy practices for creating and maintaining a truly healthy lawn – attractive and safer for the environment.

For additional resources, please visit:

www.extension.unh.edu/Sustainable-Landscapes-and-Turf

Simple Recommendations for Every Lawn



1. Choose the Right Grass Seed

- Consider limiting lawn area to locations where grass will grow easily and will actually be used for outdoor activities.
- Choose grass varieties that require less maintenance. For northern New England, choose seed mixes with higher percentages of turf-type tall fescues, compact-type fall fescues and/or fine fescues. Choose mixes with smaller percentages of Kentucky bluegrass and/or perennial ryegrass.
- In shaded areas, select shade-tolerant turf grasses like fine-leaf and tall fescues.
- Up to 10% of total seed mix can be white clover to help fix nitrogen in soil naturally. Avoid clover if anyone in the household is allergic to bee stings.

2. Don't Overwater

- If irrigating, one inch of water per week is typically enough. Overwatering can lead to runoff and leaching of contaminants into groundwater.

3. Test Your Soil

- Sometimes adjusting the soil pH or organic matter are the only treatments needed to improve a lawn. If the soil test results come back as acceptable but your lawn is not, then check for other problems like pest infestations.

4. Mow Smart

- Mow grass 3" or higher. Cut no more than 1/3 of the blade to encourage longer, stronger turf grass roots. Leave the clippings after mowing to provide a source of low release nutrients.

Recommendations for Lawns that Need Fertilizer

1. Determine How Much to Apply

- Measure the dimensions of the area where you plan to apply. The square footage of the area will determine how much fertilizer to purchase and use.

- Only use what you need. Nearly half of homeowners mistakenly use the entire bag whether it is needed or not.* Seal and store opened fertilizer bags in an airtight container or share excess with others.

- Lawns older than 10 years usually need less nitrogen than newer lawns, especially if the clippings are left, so apply only half of the amount directed on the bag. Only apply more if there's no improvement over time in turf color and density. Staying under four applications per season at this reduced rate helps keep the overall application at the recommended level† for water friendly practices.

- Lawns less than 10 years old may need the full amount of nitrogen as indicated on the fertilizer instructions. Apply less than four times per year.

2. Know When & Where to Apply

- Avoid applying fertilizers mid-summer when turf growth naturally subsides or before a big rain when it can run off into nearby waterways or leach into ground water.

- In northern New England, apply no earlier than spring green-up and no later than mid-September to ensure the proper soil temperature for grass to take up the nutrients.

- Know your local and state laws related to fertilizer application. For example, do not apply any fertilizers within 25 feet of water bodies in New Hampshire.

3. Choose the Right Fertilizer

- Avoid combination products that include both pesticide and fertilizer unless confident you need both. Unnecessary applications of fertilizers and pesticides can lead to soil and water contamination.

- Select lawn fertilizers with low or no phosphorus unless your soil test indicates otherwise. The fertilizer formula (e.g., 20-0-15) tells the relative percentages of nitrogen (N), phosphorous (P) and potassium (K).

3. Choose the Right Fertilizer, cont.

- Slow release formulations (>50% water insoluble nitrogen – WIN) are generally preferable. Only use quick release products when there is a need to grow turf very quickly, for example to prevent erosion of bare soil during a new seeding. Check the product label to see what type of nitrogen it contains.

- Organic fertilizers are typically slow release and contain micronutrients that are beneficial to soil. They are not petroleum-based like most synthetic fertilizers. Overapplying any type of fertilizer or over-irrigating fertilized turf can lead to water quality problems.

For more information:

www.extension.unh.edu/Sustainable-Landscapes-and-Turf

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†Recommendations adapted from:
New England Regional Nitrogen and Phosphorus Fertilizer and Associated Management Practice Recommendations for Lawns Based on Water Quality Considerations. 2008. Karl Guillard (ed.). *Turfgrass Nutrient Management Bulletin 0100*. College of Agriculture and Natural Resources, University of Connecticut. USDA CSREES project # 2006-51130-03656.

*Survey references from:
Eisenhauer, B.W. and B. Gagnon. 2008. "Changing homeowner's lawn care behavior to reduce nutrient losses in New England's urbanizing watersheds: the report of findings from social science research." USDA CSREES project # 2006-51130-03656.

This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under Agreement No. 2006-51130-03656. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

Designed by: Rebecca Zeiber, NHSG science writer. Publication #: UNHMP-IS-SG-13-27

Appendix B

Brickyard Pond Pollutant Load Calculation per BMP											
		Upper Berry Brook Subwatershed parameters				TSS			TP		
Location (Land Use)	BMP Description	Drainage Area 'A' Acre	Impervious Area 'Ia' %	Runoff Coefficient 'Rv'	Annual Runoff 'R' inches	Annual Load 'L_i' #/year	Effluent Load 'L_e" #/year	Annual PL Removed #/year	Annual Load 'L_i' #/year	Effluent Load 'L_e" #/year	Annual PL Removed #/year
Baseline											
Heritage Way		18.00	0.17	0.203	8.77	3567			14.27		
Colonial Way & Liberty Lane		28.90	0.19	0.221	9.55	6236			24.94		
Baseline at 10% EIC											
Heritage Way		18.00	0.10	0.140	6.05	2460			9.84		
Colonial Way & Liberty Lane		28.90	0.10	0.140	6.05	3950			15.80		
Target Reductions						**3393**			**14**		
2013 Installs											
9 Colonial Way - Residential	Raingarden	0.088	0.95	0.905	39.10	77.7	0.51	77.2	0.31	0.01	0.30
10 Colonial Way - Residential	Raingarden	0.319	0.39	0.405	17.48	126.2	0.82	125.4	0.50	0.02	0.49
Treated drainage area total		**0.407**	**2013 BMP Annual Load totals**			**203.9**	**1.3**	**202.6**	**0.82**	**0.03**	**0.79**
Percent of reduction target								**6%**			**6%**
2014 Installs											

APPENDIX C

Sampling Methods

RE: Standard of practice (SOP) for data management and data interpretation of the In-Situ Aqua TROLL 200 (AT200) water monitoring device

The AT200 is installed at the downstream end of the drainage culvert off of Colonial Way in Exeter, NH. The device is installed to record water depth, temperature and specific conductivity of stormwater runoff from the Colonial Way & Liberty Lane subwatershed areas as it drains to Brickyard Pond in the Marshall Farms Crossing neighborhood. This data is being collected in conjunction with the Green Infrastructure for Sustainable Coastal Communities project. This document includes methods developed and utilized by University of New Hampshire Stormwater Center (UNHSC) staff for management and interpretation of data generated by AT200s. Also included are suggestions for sampling methodology and a breakdown of expected costs for sample analyses.

Data Management

- If using a laptop, download the Win-Situ® 5 Software from the In-Situ website at http://www.in-situ.com/win_situ5 . This is a free download.
- Download data from sensor using a TROLL Com communication cable. In-Situ sells cables that connect a laptop to the AT200 without removing the sensor from its monitoring location. The following is a list of steps in downloading AT200 data with Win-Situ 5.
    1. Remove the desiccant container that is connected to the end of the AT200 cable.
    2. Connect the TROLL Com Communications cable to the same end of the instrument cable that the desiccant was connected to. Be sure to fully connect the cable with the use of the twist-lock connector.
    3. Connect the TROLL Com Communications cable to the laptop USB port.
    4. Open Win-Situ 5 software.
    5. When prompted to "Connect to device now?" select "Yes".
        1) If this prompt does not come up you can connect to the AT200 by selecting the on-screen button in the lower right corner of the opening page of the Win-Situ 5 software. The button looks like an extension cord and plug.
        2) The connection can also be made by going to the "File" drop down menu and selecting 'Connect'.
        3) If you cannot connect check to see that the software is looking for the correct "COM" port. A "COM" port number is assigned to each USB port on your device. To check go to your computer's Control Panel > Device

Manager > Ports (COM & LPT). Under this menu the computer should recognize the device and have an assigned "COM #" for the cable.

    4) Reconnect

6. Once connected look for a row of 4 icons across the top left of the Win-Situ page under the menu bar. Select the icon in the top left that looks like a clipboard.
7. This brings up a page of pre-programmed logs that are stored on the connected AT200. Select the log that you are currently using to gather data.
8. A series of buttons along the bottom of the screen will become active. Select the downward pointing arrow, which will display "download data" when you hover over the icon.
9. A window will come up with three options:
    1) Download All Data – select if this is the first time that you are downloading data from this AT200 to this computer.
    2) Download New Data – use this if there is already data from this site on the computer and you just want the data since the last download.
    3) Download Data in Time Range – use this if a specific range of data is desired.
10. This may take several minutes depending on amount of data being downloaded.
11. Once the download is finished you will be prompted "Download Successful". Select "Ok"
12. Next prompt is "Want to view your data?"
13. If you select "Yes" it will bring you to a screen where you can see the data in either tabular or graphical formats.
14. From here you can "Export" the data to a .csv file. This file extension is supported by Microsoft Excel. There are two ways to export data:
    1) Go to the "File" menu and select "Download to CSV"
    2) Find the AT200 site name under "Site Data", right-click on the file name and select "Export to CSV"
15. Once in .csv form the file can be opened and saved into excel format.
16. More information can be found in the AquaTROLL 200 Operator's Manual. Go to http://www.in-situ.com/manuals and download "Aqua TROLL 100 and 200 Operator's Manual".

Data Interpretation

The AT200 records data at a preprogrammed time interval and stores it into its internal memory storage. The AT200 will continually record and store data until it runs out of battery life or memory space. Remaining battery life and storage capacity can be checked when the device is connected to Win-Situ 5 software. Once connected look at the top right for two green

/ yellow bars. One is for battery and the other is for memory. Move the mouse cursor over each bar to see which is which and how much power or space remains. The more green on the bar the more battery or memory are left on the device.

The device installed off of Colonial Way is programmed to record data values every 15 minutes. This interval was chosen to preserve battery life and storage capacity as well as provide adequate resolution of the drainage flows. There are two types of readings that the AT200 records and reports in the data files: direct readings and calculated readings. The direct readings are recorded with the use of specified instrumentation that gathers the information. The calculated readings are calculated from the direct readings. The parameters currently being recorded with this device are:

- Direct Readings
    - Date and Time
    - Pressure (PSI)
    - Temperature (°F)
    - Actual Conductivity (µS)
- Calculations
    - Depth (ft)
    - Specific Conductivity (µS)
    - Salinity (PSU)
    - Total Dissolved Solids (ppt)
    - Resistivity (ohm-cm)
    - Water Density (g/cm^3)

For more information on the measurement methodology and calculations used to generate these readings go to http://www.in-situ.com/technical_notes and download "Aqua TROLL 200 Measurement Methodology"

Once the data is exported to excel spreadsheet format, or other graphing software, graphs can be made to assist in visualizing the changes in parameters due to drainage flows. The real-time data provides an in depth look at the changes in water quality and water quantity throughout a storm event, season, and/or year. Figures C1 -C3 are examples of graphs created in Microsoft Excel comparing different parameters over the course of a 1.57 inch rain event in August of 2013.

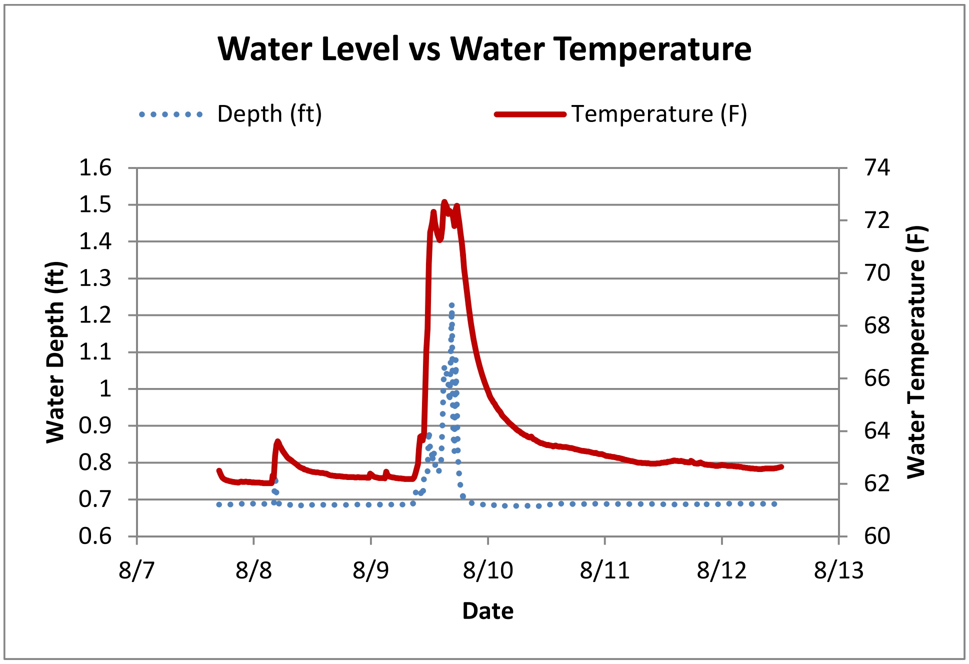

Figure C1: Graph displaying the change in water depth and water temperature at the outfall of the Colonial Way & Liberty Lane drainage areas. Notice that the temperature of the runoff is 10°F warmer than the water in the channel between storm events.

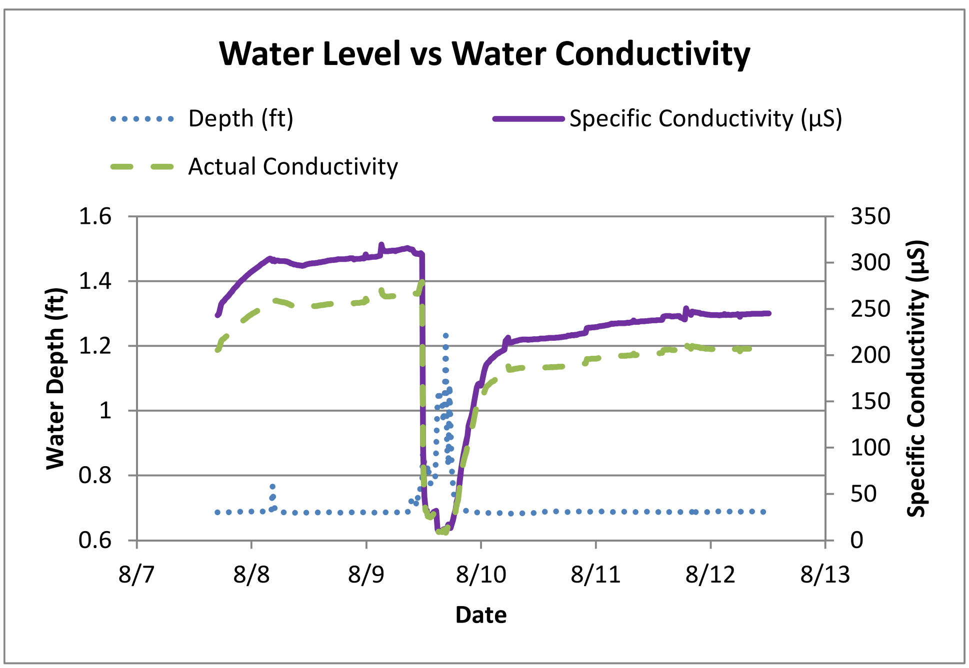

Figure C2: Graph displaying the change in water depth and water conductivity at the outfall of the Colonial Way & Liberty Lane drainage areas. Both actual and specific conductivity are graphed here. Actual is a direct reading by the AT200 and specific is a calculated reading. See "Aqua TROLL 200 Measurement Methodology" for more information regarding these calculations.

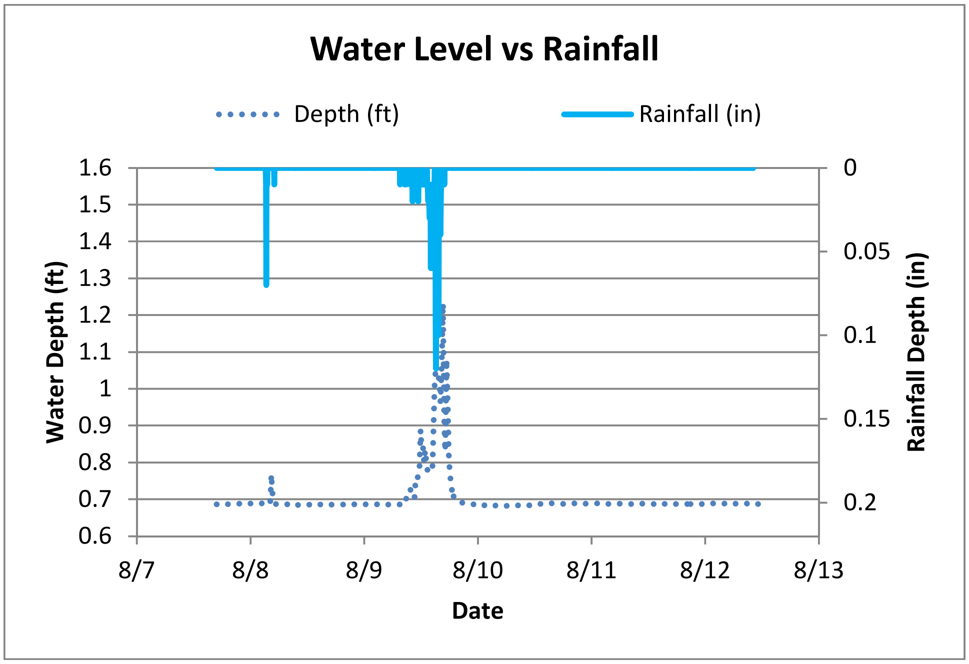

Figure C3: Graph displaying the change in water depth and rainfall at the outfall of the Colonial Way & Liberty Lane drainage areas. The rainfall data here is recorded by a rain gauge at a location in Hampton Falls that is maintained by UNHSC.

Water Quality Sampling

Water samples can be taken at many locations and analyzed for a wide-range of pollutants. The focus of this water sampling effort should be on the water quality of the runoff entering Brickyard Pond as well as the changes in water quality of Brickyard Pond. The primary pollutants of concern for this study are nitrogen and phosphorous. A target of 10 to 12 storms is a good start to assess the current conditions of roadway runoff and of Brickyard Pond. Samples can be taken either through the use of automated sampling equipment or through the use of grab samples. Automated equipment is more expensive due to initial equipment costs and the time involved in operation and maintenance. Grab samples can be collected by Town staff and/or volunteers and can be an effective approach if managed appropriately, however grab samples may not accurately reflect pollutant runoff unless they are collected in a consistent manner throughout the runoff event. As can be seen from figure C2, the changes to water quality can be dramatic, and occur within just a few hours.

Samples should be taken during both wet and dry weather conditions to ensure a full characterization of water quality. See Figure C4 for suggested sampling locations and Table C1 for sample descriptions. Sampling from each of these sites would help to develop an understanding of existing water quality, changes in water quality, and begin to identify pollution sources. Depending on the amount of available funding various combinations of the suggested sites can be formulated to achieve monitoring objectives.

Key factors in developing a data set to characterize water quality of storm water flows are:

- Develop a sampling plan
- Train Town staff and volunteers as needed
- Determine amount of funds allocated for sample analyses and develop a budget. (See Table C2 for lab analyses and associated costs)
- Choose sampling locations that are accessible year round
- Take samples from the same locations for each sample event throughout monitoring period
- Establish consistent and repeatable methods
- Document and record information needed to identify each sample: date, time, sample location, initials of technician, current weather, air and water temperature, depth of water (use yard stick or tape measure), include any other discernible information needed to document each sample.
- Preserve, process, and deliver sample as required ensuring integrity of sample. Once water sample is removed from drainage flow changes happen quickly through the effects temperature, agitation, and time.

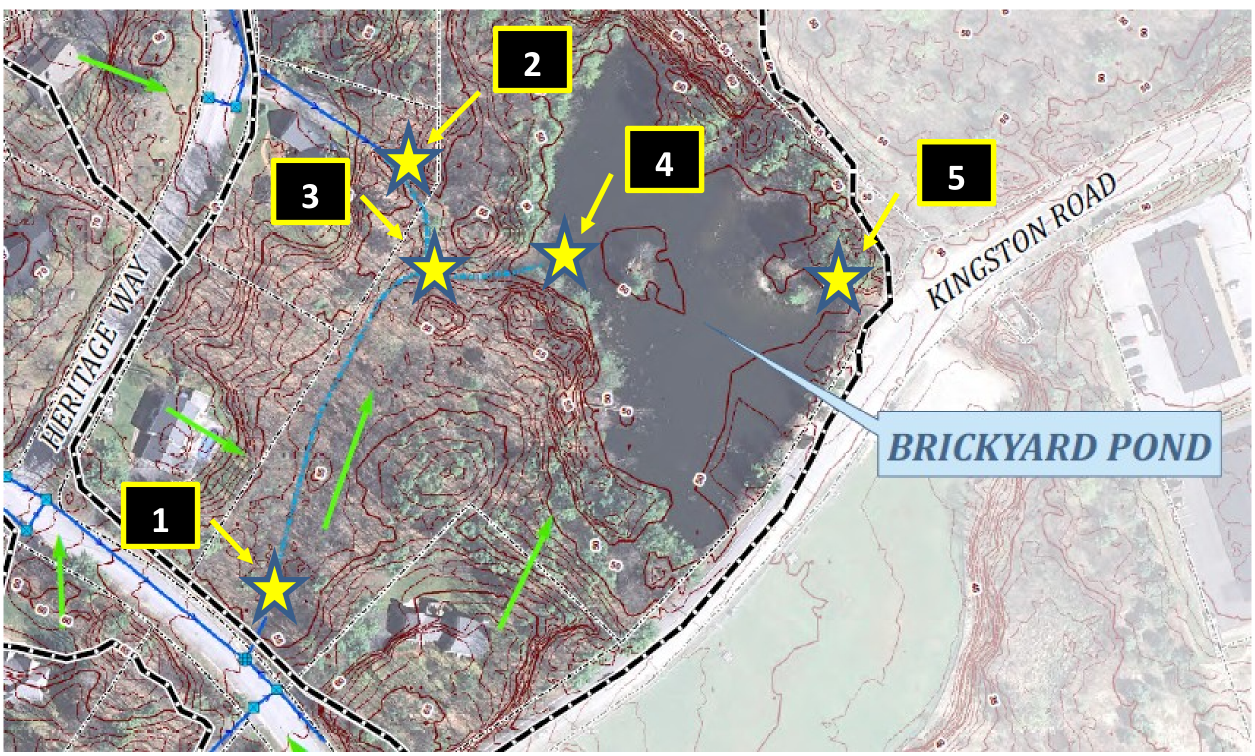

Figure C4: Aerial view of Brickyard Pond in Exeter, NH. There are two culverts draining to Brickyard Pond: One from Heritage Way and the other from Colonial Way & Liberty Lane. The stars indicate suggested sampling locations.

Table C1: Description and rationale for suggested sampling locations displayed in Figure C4.

Location Number	Location Description	Rationale for Sample Location
1	Outfall from Colonial Way & Liberty Lane	Provide water quality of direct runoff from Colonial Way & Liberty Lane drainage area
2	Outfall from Heritage Way	Provide water quality of direct runoff from Heritage Way drainage area
3	Confluence of Colonial Way and Heritage Way	Sample mixed runoff from both outfalls providing what is ultimately entering Brickyard Pond from neighborhood roads
4	Confluence of neighborhood road runoff and Brickyard Pond	Sample mixed runoff where it enters Brickyard Pond. Provides water quality of road runoff as it mixes with waters in Brickyard Pond
5	Brickyard Pond	Provide background information for the quality of water in Brickyard Pond

Table C2: List of suggested water quality analyses, methods and costs that UNHSC has received from two analytical labs. To note the WRRC costs per analysis go down after the 20th sample is sent in.

Sample Analysis	Short	Method Reference	ARA* Cost ($)	WRRC* Cost ($)
Nitrate	NO_3	E300.0A	6	10 (6)
Nitrite	NO_2	SM4500NO2B	6	Mixed w/ NO_3
Ammonia as N	NH3	SM4500NH3-D	20	10 (6)
Total Kjeldahl Nitrogen	TKN	ASTM359002A	20	21 (7)
Total Nitrogen	TN	NO_3+NO_2+NH3+TKN	No Cost	Mixed w/ TP
Phosphate	PO_4	E365.1	20	10 (6)
Total Phosphorous	TP	E365.3	18	43 (14)
Total Suspended Solids	TSS	SM2540D	12	
TOTAL			112	94 (46)

*ARA is Absolute Resource Associates in Portsmouth, NH

** WRRC is NH Water Resource Research Center located on UNH-Durham campus. Numbers in parenthesis are reduced costs when there are more than 20 samples.