NERRS Science Collaborative Progress Report

Reporting Period: September 1, 2013 – February 28, 2014
Project Title: Green Infrastructure for Sustainable Coastal Communities
Principal Investigator(s): James J. Houle
Project start date: September 1, 2012
Report compiled by: James J. Houle

Contributing team members and their role in the project:

- Project Coordination and Fiscal Agent: James J. Houle; University of New Hampshire Stormwater Center (UNHSC).
- Collaboration Lead: Julie LaBranche, Rockingham Planning Commission with James Gruber, Antioch University as the collaborative expert.
- Applied Science Investigator: Robert Roseen; Geosyntec Consultants
- End-user Representative: Alison Watts; Southeast Watershed Alliance
- Additional project team members:
- Tom Ballestero and Tim Puls; UNHSC
- Paul Stacy, Steve Miller and Chris Keeley; Great Bay NERR

A. Progress overview:

The goal of this project is to build municipal capacity in coastal watershed communities for Green Infrastructure by engaging local and regional stakeholders in a planning and implementation process that is supported by technical resources and current relevant information. The project integrates the collaborative process to build trust, legitimacy and relevance for the intended-users. The goal of creating a collaborative process is to build community resilience and improve capacity for managing water resources and related ecosystem services.

Activities during this reporting period include: proper administration of the grant, meetings and coordination with the project team, development of implementation elements with select communities, production of project materials and resources and the continuance of the project advisory board (AB).

The GISCC project team via the UNHSC entered into 3 contracts with select communities (Exeter, Portsmouth and Stratham) to implement localized GI projects and methods. One of those projects has been completed; see the final report to the town of Exeter added as an attachment to this progress report. Projects in Portsmouth and Stratham are still ongoing.

In addition to the three phase 1 projects the GISCC project team entered into 3 additional contracts with select phase 2 communities (Brentwood, Durham and Rochester).

Working with Intended Users:

During this six month period the project team continued a schedule of regular meetings and conference calls. The advisory board that has been guiding and grounding the project implementation has met 6 times and has directly led to changes in the approach the project team is currently using. The meetings have gone very well and are summarized briefly here, but for more detail, please see the complete meeting summaries posted on basecamp. Likewise on basecamp is the complete advisory board membership. In addition to base camp most project deliverables are also published on the projects new and evolving website hosted by the Southeast Watershed Alliance: http://southeastwatershedalliance.org/green-infrastructure/

Attendance at the AB meetings has been and remains strong. As mentioned in our previous report, the AB helped the project team identify a more focused approach to our implementation efforts, working in a smaller subset of municipalities (6) within the coastal watershed, as opposed to more broadly in 8-12 communities. The goal is to focus efforts and implement more in targeted communities which are motivated and prepared. As our AB meetings continued there arose some division over the communities that should be targeted for implementation. On the one hand it was agreed that many communities are keen to explore innovative water resource management strategies as there are emergent permits and new water quality thresholds currently in development. For these communities GI implementation and improved water resource management are imminent. It was recognized by some that focus on these early adopters was a good way to increase awareness and bring more communities into the project. On the other hand there is representation from smaller un-permitted municipalities can't be left out and should be given the opportunity to take advantage of program benefits. Some feared that there may be a rush to work with communities ready to move forward and those communities not as well staffed might not be considered. The AB challenged the project team to develop and apply a 2-phase approach to selecting implementation communities – phase 1, working with "low hanging fruit" communities with proven success and commitment, then phase 2, providing opportunities to communities who are inspired by the "early adopters that may not be shovel ready, but able to do a small demonstration project". From this input a clear, simple set of procedures, selection criteria and an implementation timeframe were prepared for the application and selection of implementation communities. This approach was not something included in the original proposal but was a modification that was directed by the AB and seemed to address some of the concerns.

C. Progress on project objectives for this reporting period:

Direction from the AB led directly to the initiation of an application process to select phase 1 implementation communities. The application and application criteria as well as the phase 1 results are all available on the GISCC basecamp site and on the project website. The second phase of implementation projects was started with the release of an application in September 2013. We received 4 well-rounded applications to our second request and three were selected as implementation projects. Phase 2 implementation communities and phase 2 project descriptions are provided as an appendix to this progress report. Procedurally the application process was a very different approach and led to a fundamentally different result than originally conceived. When we asked the communities to come to us with ideas, they came to us with full ownership of those ideas. For me personally, having been doing this for a long time, this was very refreshing because communities were already committed to their projects. The business of trying to convince people of the merits of an idea or a particular concept is a lot of work. When a community comes to the table with an idea, they come with the enthusiasm to complete and replicate that idea as well. The application process is not without limitations as it directly effects deliverables and some of the project team's (particularly the ASO) conception of specific project deliverables. The only downside to the application process is that some communities were not selected. One community in particular was denied funding twice.

Applied Science Objectives (ASO):

Task 1: Watershed Analysis: Land Use, Impervious Cover, and Pollutant Loading
These analyses will allow decision makers to visualize and assess a range of development scenarios so as to be able to adapt and plan for areas ranked and prioritized based on load per unit area and cumulative load to have the greatest impact. These deliverables are somewhat altered as we are now working at specific locations within the implementation communities and not necessarily for the communities at large. A subwatershed analysis has been completed for the Brickyard pond watershed area in Exeter. No action has begun for Portsmouth as the project site has already been identified. A general watershed analysis has been performed for the town of Stratham and will be used, if necessary, during deliberations with administrative staff and board members in considering regulation updates. A watershed analysis has also been commissioned for the town of Brentwood by their request. The analysis combines impervious cover (2012) from NH GRANIT, land use/land cover from Rockingham Planning Commission, soils from USDA-NRCS database, hydrography from NH Hydrography dataset and process data layer in an ArcGIS platform. Areas are ranked based on potential pollutant load, soil type, and proximity to major waterways. A high score indicates where potential hotspots for total suspended solids (TSS), total phosphorus (TP) and total nitrogen (TN) exist and where remediation efforts could have the maximum benefit.

Subtasks include:

a. Watershed wide pollutant load analyses: started and preliminary results complete for phase 1 implementation communities if applicable.
b. Identification of target hot spot locations for retrofit within the region of interest or subwatershed. This analysis is largely based on impervious area and land use classification.
c. Development of a Stormwater Assessment Report and Fact Sheet to support proposed municipal MS4 permit requirements for tracking IC. This task will be discussed with phase 1 implementation community representatives and its utility assessed prior to production. The ASO team is considering this as part of the

overall deliverables but currently efforts are more focused on the targeted implementation activities included in successful community applications. See the final report for the Exeter Project for an example of the deliverable (Appendix A).

Task 2: Collaborative Planning and Demonstration Project Implementation

While numerous high-impact high-visibility demonstration locations are planned they are largely directed by successful implementation community applicants. Applicants are encouraged to consider other strategies from the GI Toolbox and final determinations of GI implementation strategies is a collaborative decision between the project team and municipal partner representatives.

Additional subtasks include:

a. Potential host communities contacted and planning sessions conducted
b. Identification of GI Strategies to be incorporated
c. Implementation plan developed and executed
d. Educational signage

Task 3: Performance Monitoring

Verification of success will include assessment of volume reduction and monitoring for pollutant load reduction (Nitrogen, Phosphorus, or other water quality parameters) and calculation of decreased IC for all installations or project watershed areas. To date monitoring strategies vary with respect to implementation strategies selected. For the Brickyard Pond project with the town of Exeter a real-time water quality sensor has been purchased and installed at one of the major outfalls. Local staff and volunteers have been trained on the operation and data collection methods associated with the sensor and are incorporating operations with ongoing grab sampling and spot monitoring ongoing in the watershed. While watershed scale improvements may take longer than the timeframe of this project the local “think blue crew” is developing additional skill sets and equipment to use in their ongoing monitoring efforts. In addition a water sampling program has been established to gather water samples from 2-3 locations around brickyard pond to establish an ongoing volunteer sampling program. 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.

For the Peirce Island Municipal Snow Dump in Portsmouth NH, Monitoring of the snow pile has continued throughout the 2013-2014 winter and will be used to estimate pollutant load potential from this type of land use and potential for load reductions through treatment. This information will be useful as there are few local empirical studies quantifying pollutant load export rates from municipal snow dump facilities. Pre and post monitoring efforts will develop pollutant load export rates by which GI intervention activities can be accurately quantified.

For the stormwater management ordinance and land use regulation update projects in Stratham and Rochester no monitoring is expected.

For the Durham subsurface gravel wetland project monitoring is expected pre and post construction and should begin in the spring of 2014.

Task 4: Web Resource Framework Development

A web resource is currently being developed to communicate information and transfer resources for GI planning and design to installation. The website is being hosted and maintained by the southeast watershed alliance and can be accessed through the following url: http://southeastwatershedalliance.org/green-infrastructure/

The web resource concept is currently still in development with ongoing feedback from the project AB. A web designer has been selected to help with the final stages of the site development.

Task 5: Green Infrastructure Training and Municipal Capacity Building

Technical assistance is currently being provided successful implementation communities in the watershed. Training and capacity building projects vary and are commensurate with projects that are proposed by the applicant municipalities. Additional training will be provided under the collaborative science objectives but will largely focus on highlighting local initiatives and success stories.

Collaborative Science Objectives (CSO):

Task 1: Project Team kickoff. Set schedule and invite Advisory Board (AB) participants, invitations went out to 42 municipalities and 7 Rivers Advisory Committees – (Salmon Falls/Piscataqua, Cocheco, Isinglass, Oyster/Bellamy, Lamprey, Exeter/Squamscott, Winnicut). The AB has been established and is actively assisting with project implementation.

Task 2: Initial meeting with Project Team and Advisory Board. Completed and ongoing.

Task 3: Focused Sub-watershed Methods Workshops. Hold a workshop in each of the coastal sub-watersheds (four or five) to introduce GI concepts in more detail, get watershed specific feedback on requested tools, type of information. A draft of the meeting agenda has been developed. With guidance from the AB this task has been modified. The project team and AB have developed a draft collaborative outreach plan and are currently finalizing the approach. The draft plan proposes to offer a Workshop Series hosted by the River Advisory Committees and Watershed Associations in the coastal watershed. The goal of the workshops will be to deliver information to municipal decision makers, staff, and land use boards and commissions from each watershed.

Additional sub-tasks include:

- ☐ Fact sheet development (examples include: development of local case studies from a local community identifying the situation, action taken, outcomes, and lessons learned; barriers to implementation in individual communities; power point slides; general overview information; specific information on technical areas of interest). This sub-task has been initiated and has been completed by Christos Tsiamis, the TIDES intern to the project. The fact sheets are in the process of being edited and a graphic design template unique to the project is under development. Once completed the fact sheets will be made available in collaborative outreach activities and on the project website.

Task 4: Project Team and Advisory Board meet and discuss results from workshops, finalize priorities for selecting communities, craft the invitation to participate, design of training or working sessions, and discuss communications methods. No workshops have yet been held although a collaborative outreach plan has been developed and is currently being finalized. Workshops will be scheduled during the next reporting period April –July 2014.

Task 5: Identify and start collaborations with selected implementation communities. This task overlaps with ASO task 2.

Task 6: Individual community applied science implementation. Meet with selected individual demonstration communities to develop scope of work. Project team and community agree on scope of work, budget, implementation timeline, etc. With input from the AB a phased application and implementation approach has been adopted. The phase 1 application process has been completed and implementation is either complete or underway. The phase 2 application process has been completed and implementation is now underway. Results are all available on the GISCC basecamp site or on the project website. The complete description of phase 1 and phase 2 projects are provided in Appendix B

Task 7: Ongoing Assistance and Training. Workshops and training/field trips will be offered as identified by Advisory Board and in detailed in the Applied Science Methods. This ongoing contact provides opportunities for both demonstration and stakeholder communities to increase capacity and raise awareness through participation in watershed-based training events with other communities. Training and ongoing technical assistance is being provided to implementation communities on as needed basis. Project staff has trained Exeter participants on the operation and data gathering methods associated with the real-time water quality sensor purchased for the project. Other training and assistance will be provided as the need arises.

Task 8: Ongoing communication. Electronic and printed newsletter, webpages photo-logs, project management website etc. A website has been developed and is being hosted and maintained by the southeast watershed alliance. The web resource concept is currently still in development with feedback from the project AB. A web designer has been selected to help with the next stages of development.

Task 9: Final Workshop. Format of the workshop will be based on feedback throughout the project, but a suggested model is a full Saturday, with a morning session of information and lectures, including presentations by demonstration communities; lunch for networking and discussion of the most effective ways to further the institutionalizing GI, an afternoon site tour of demonstration projects; and final evaluation/assessment of collaborative component. No progress on this task has occurred to date.

Task 10: Collaboration Assessment

A draft of the collaborative assessment methods has been created and is being refined by the CSO team. Once finalized the assessment methodology will be reviewed and commented on by the AB.

D. Benefit to NERRS and NOAA

Preliminary discussions have taken place with at least two other reserves and NSC projects regarding regularities associated with implementation of green infrastructure. Discussions will continue laying the groundwork for future collaborations or information sharing between the projects and the larger NERRs community that may be interested in similar stormwater implementation projects. The project coordinator has also participated in a transfer situation analysis of all Science Collaborative funded stormwater projects.

E. Additional activities, products, accomplishments, or obstacles

Project implementation timeframes continue to be the largest obstacle. Admittedly this work is inherently slow and takes longer than expected as it is important that all project partners are brought along. There have been dividends however, the implementation projects are progressing well and the communities are enthusiastic and in the driver's seat because they initiated the project and developed the concept. The project team adds technical expertise and knowledge of how to get the project done, but the energy comes from the community. In the end the product doesn't look like anything any one person envisioned because it is truly a collaboration of efforts. I think that is a mark of success.

The modification of the ASO and CSO objectives through the project AB have led to substantial project benefits. While implementation efforts have changed they are more focused on municipalities that the project is working with and more focused on transfer of implementation of green infrastructure concepts. Transfer of GI implementation concepts is more difficult than it may appear to be on the surface. In the past the UNHSC used to develop GI implementation concepts and bring them to communities. UNHSC has a long and successful track record implementing in this manner. In this project municipalities bring their project ideas to the team. If selected the project team then works with the community to refine and advance implementation efforts. A result of this approach is that much of the motivation to complete the project is transferred from the project team to the communities we work in. This offers a tremendous opportunity to really partner with practitioners in the field. The approach is not without its difficulties however. I look at them at the next phase of implementation barriers. New barriers present themselves when a technology, in this case GI progress from demonstration project to mainstream. In some cases communities have wanted to work with partners outside the project team who they commonly work with and trust. This has raised the cost of some implementation efforts as well as opening the project to different designs that were not necessarily consistent with the latest science. In other cases communities have worked very hard to maintain control of the implementation process and preserve their right to come up with potentially different solutions than experts on the project team may have suggested. For the most part we have viewed these instances as opportunities for collaboration. This is an interesting finding however it creates some challenges as to how to measure success. One of the outcomes of this project's work with the AB that I am most proud of is the development of the complete community approach. It started as an attempt to answer a rather simple question from one of the members of the AB, "what would it look like if a community were to successfully incorporate a GI approach into their water resource management efforts". The complete community approach is the project team and the AB's best and most current answer to that question.

In natural landscapes like forests, wetlands, or fields, rainwater falling to the earth tends to quickly absorb into the ground and underlying soils. But when landscapes are developed, adding impervious area (IA) such as roads, sidewalks, buildings, and parking lots, rainwater is prevented from filtering into the ground and instead flows across these hard surfaces. This unabsorbed water – called stormwater runoff – becomes polluted as it encounters toxins and sediments and can cause substantial water quality impacts when entering into waterways.

Evidence clearly shows that in rapidly developing areas, greater amounts of IA and resulting stormwater runoff cause higher levels of watershed degradation, leading to significant costs to local communities. Green infrastructure, which reduces stormwater runoff by promoting natural infiltration of rainwater, represents an effective solution to this problem.

This project advocates a "green infrastructure community approach" for mitigating the negative effects associated with increasing IA, thus protecting ecosystems from stormwater pollution and minimizing water quality impacts. The following measures outline a comprehensive municipal strategy towards achieving these goals:

1) Adopt ordinances and regulations with new development that mandate the use of stormwater filtration and infiltration practices for reducing runoff

2) Require improved stormwater controls for reducing runoff with redevelopment or other significant improvements such as repaving or building renovations

3) Employ conservation strategies such as protecting naturally vegetated buffers and limiting the size or percentage of allowable impervious area

4) Reduce existing impervious area through targeted stormwater retrofits in high impact locations.

5) Make a long-term commitment to fund and maintain stormwater controls along with an accounting mechanism to track long-term benefits. Consider innovative funding mechanisms such as impact fees or stormwater utilities.

6) Provide opportunities for outreach by sharing plans and progress with citizens through community newsletters, cable access, and on-site signs that explain what steps are being taken to protect or improve the community's waterways.

Appendix A: Exeter Report

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

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 sytems. 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 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. The 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 will 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 lot residential and consist 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 xx number of 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 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 results 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.

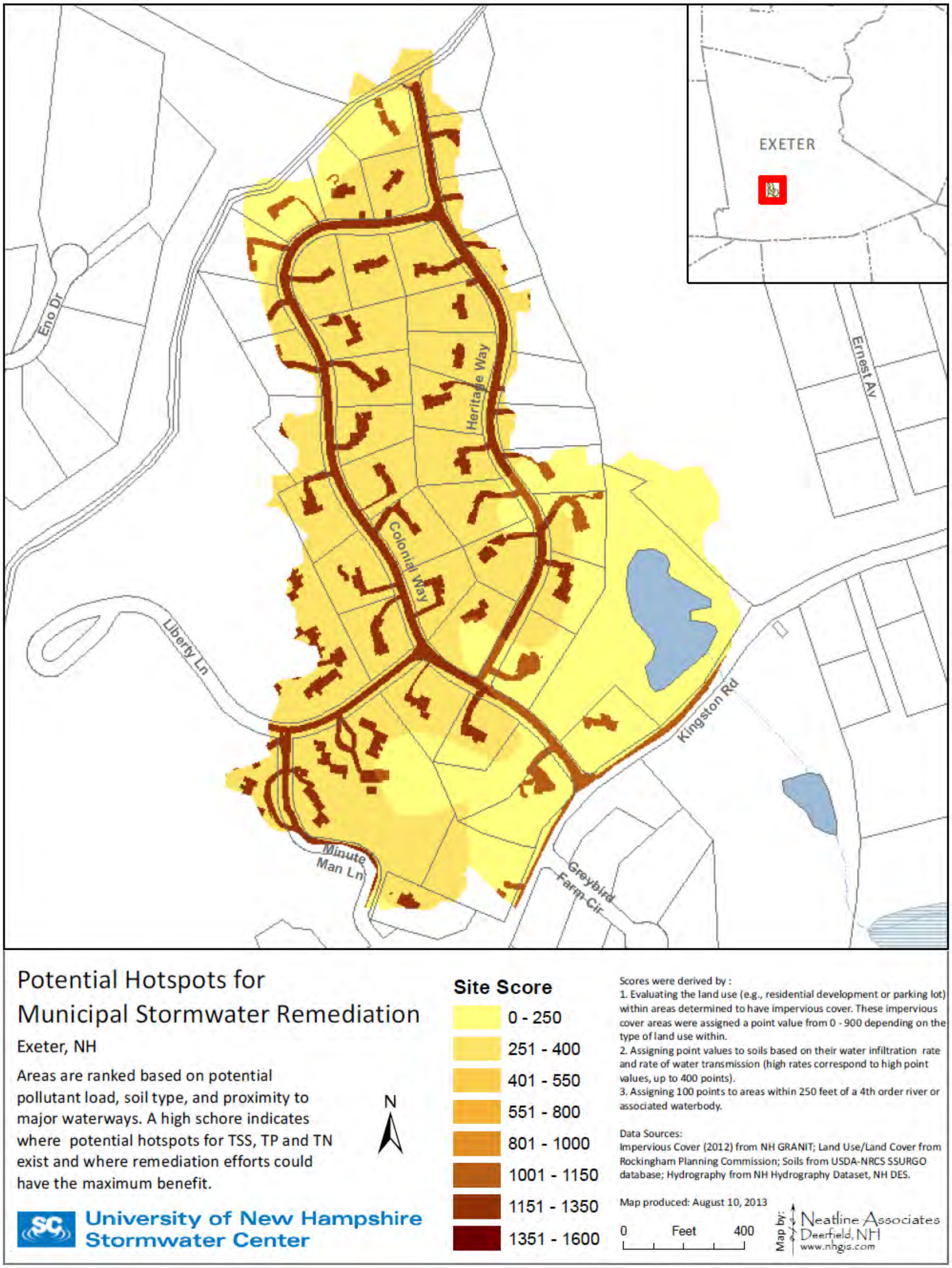

Figure 3 Hotspot modeling for the Municipal Farms Crossing Watershed.

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 0.45% was achieved for 0.21 acres of drainage area within the Colonial Way & Liberty Lane Watersheds. 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 (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.

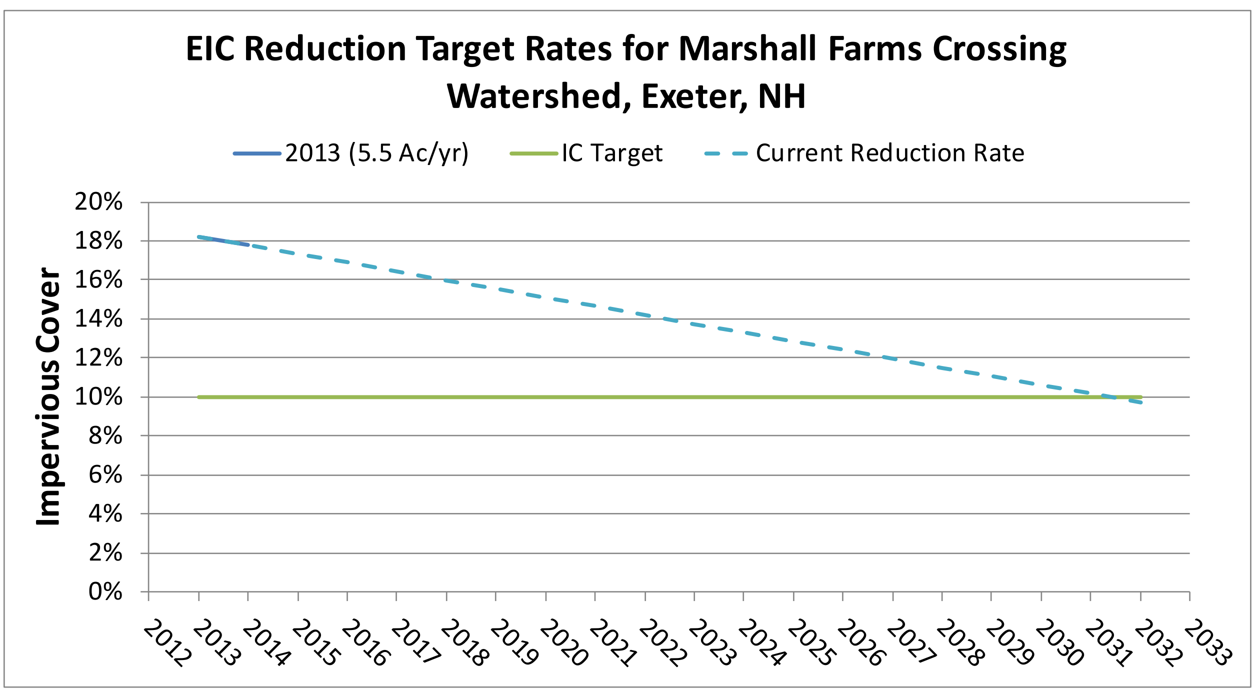

Figure 4 EIC Reduction Target Rates for Colonial Way & Liberty Lane, Exeter, NH

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.

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

Appendix B

Brickyard Pond Pollutant Load Calculation per BMP

Location (Land Use)	BMP Description	Upper Berry Brook Subwatershed parameters				TSS			TP		
		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 the 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 drainage area 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".
        - 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.
        - The connection can also be made by going to the "File" drop down menu and selecting 'Connect'.
        - 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.

    - 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:
    - Download All Data – select if this is the first time that you are downloading data from this AT200 to this computer.
    - 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.
    - 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 .csv or .xls files. Both of these file extensions are supported by Microsoft Excel. There are two ways to export data:
    - Go to the "File" menu and select "Download to CSV"
    - 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 pointer 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 B1 -B3 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.

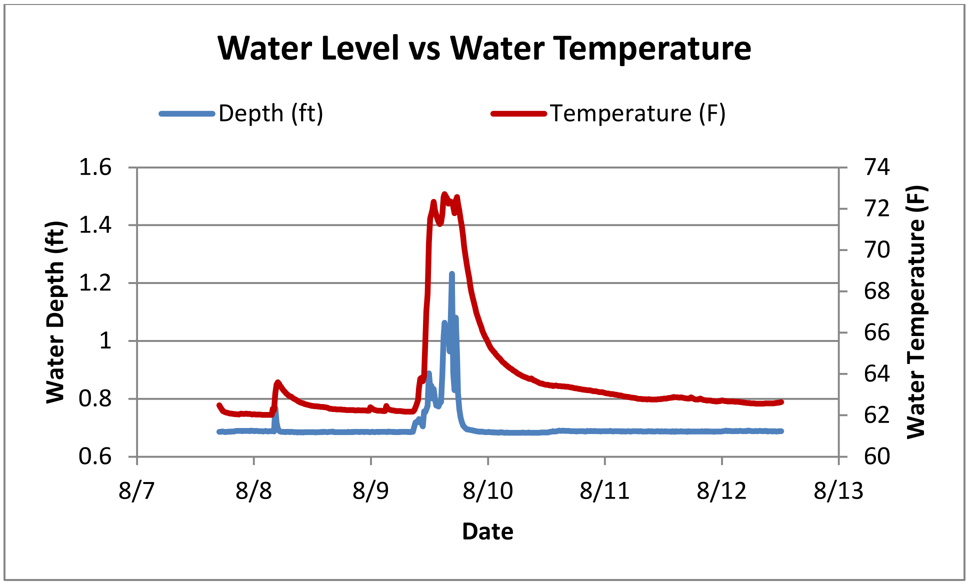

Figure B1: Graph displaying the change in water depth and water temperature at the outfall of the Colonial Way drainage area. Notice that the temperature of the runoff is 10°F warmer than the water in the channel between storm events.

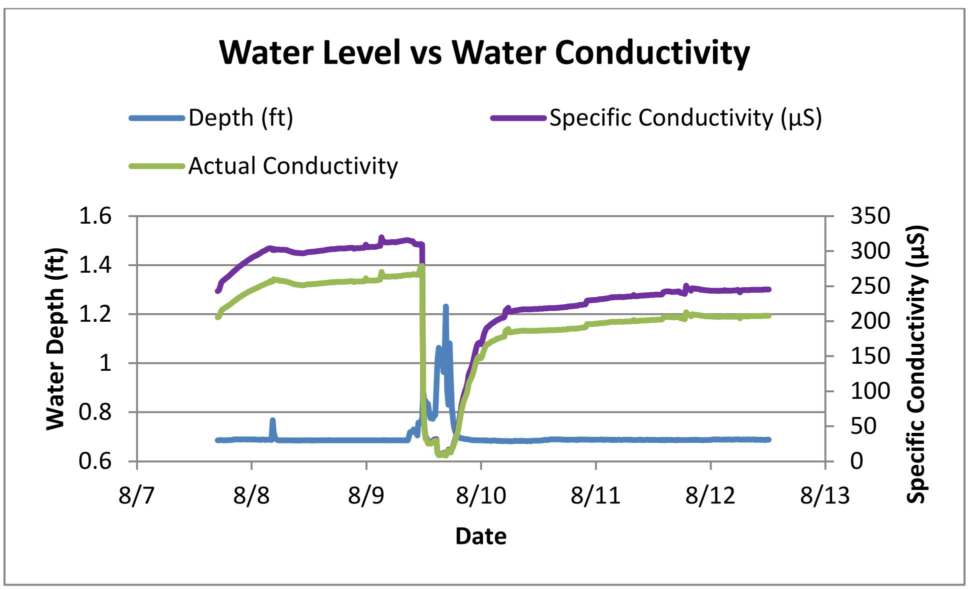

Figure B5: Graph displaying the change in water depth and water conductivity at the outfall of the Colonial Way drainage area. Both actual and specific conductivity are graphed here. Actual is a direct reading by the AT200 and specific is a calculated reading. See "Aqua TROLL 200 Measurement Methodology" for more information regarding these calculations.

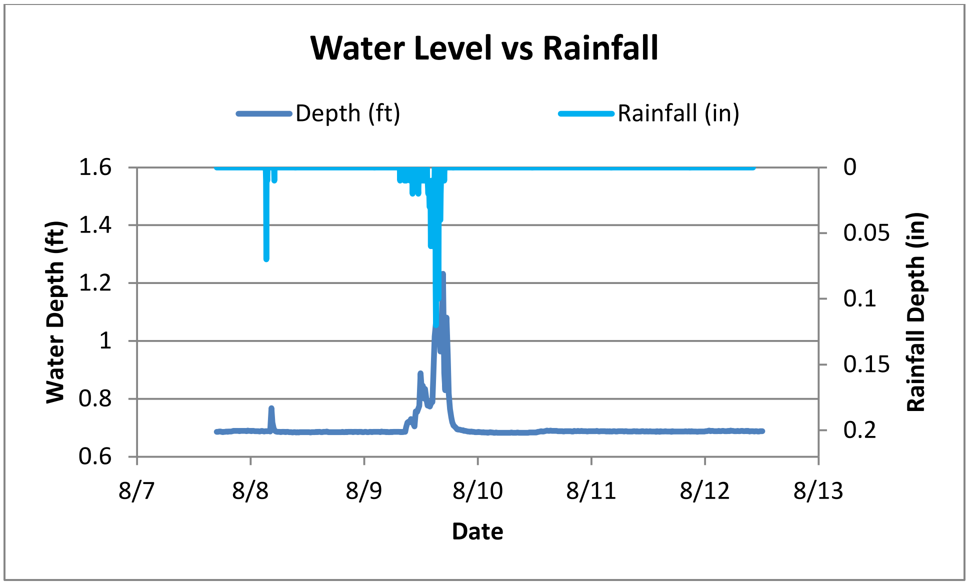

Figure B6: Graph displaying the change in water depth and rainfall at the outfall of the Colonial Way drainage area. The rainfall data here is recorded by a rain gauge at a different location in Hampton Falls that is maintained by UNHSC.

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 throughout the runoff event. As can be seen from figure B2, 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 B4 for suggested sampling locations and Table 1 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 funding available various combinations of the suggested sites can determined 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 2 for lab analyses and associated costs)
- 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.
- 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
- Preserve, process, and deliver sample as required to ensure integrity of sample. Once water sample is removed from drainage flow changes happen quickly through temperature, agitation, and time.

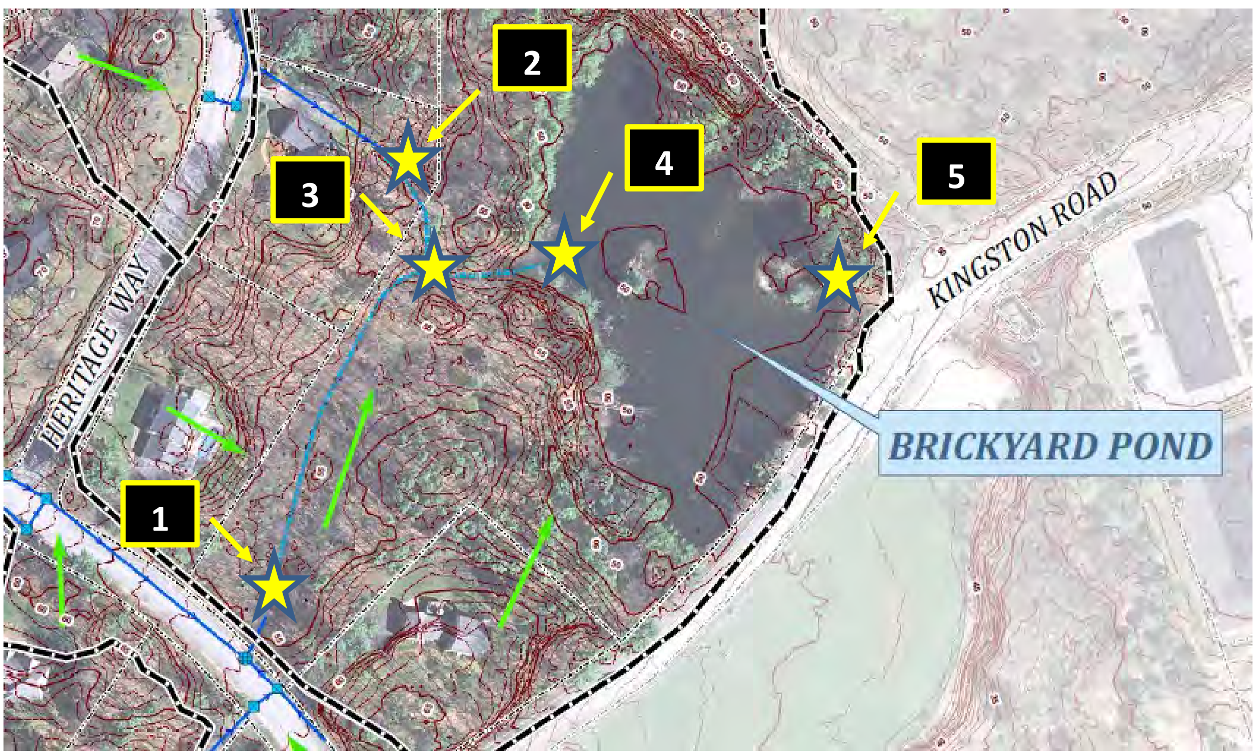

Figure B7: Aerial view of Brickyard Pond in Exeter, NH. There are two culverts draining to Brickyard Pond: One from Heritage Way and the other from Colonial Way. The stars indicate suggested sampling locations.

Table B1: Description and rationale for suggested sampling locations displayed in Figure B1.

Location Number	Location Description	Rationale for Sample Location
1	Outfall from Colonial Way	Provide water quality of direct runoff from Colonial Way 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 B2: 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 the costs when there are more than 20 samples.

Appendix B Phase 1 and Phase 2 Project Destriptions

MUNICIPALITY: TOWN OF EXETER
Address: 10 Front Street, Exeter NH
Primary Contact - Name: Kristen Murphy, Environmental Planner
Primary Contact – Phone and Email: (603) 418-6452, kmurphy@exeternh.gov

Proposed Project Description: Residential watershed improvements for 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. Now instead of a pleasant destination, each summer the pond is covered with excessive algae growth and has an unpleasant odor. In June 2012 the residents of the Marshall Farms Crossing neighborhood 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, it was evident that the nearby neighborhood has a variety of opportunities for implementation of Green Infrastructure that would directly contribute to a tangible result for water quality improvement. The neighborhood itself contains a number of storm drains that outfall 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 large lush lawns. Several roof gutters drain to the driveways or other paved surfaces.

The town proposes to initiate a neighborhood-wide stormwater education program followed by implementation of several green infrastructure "toolbox" items. The intent is to share the message of how stormwater runoff across our homes, lawns and streets and into storm drains and pipes and ultimately their receiving water body all connects and contributes to local water quality. Through this process we will explain the benefits of a few simple changes we all can make to improve water quality. Using staff and members from volunteer boards and the local Think Blue "crew" with guidance from the GISCC team, the Town will establish an "evaluation team" to visit willing homeowner's properties in this neighborhood and provide guidance on what stormwater management opportunities may be appropriate for their individual circumstances. This would be followed by implementation of a variety of green infrastructure practices with preference to those homes with a more direct connection to Brickyard Pond.

• LAWN CARE - We would establish a Think Blue Exeter environmentally friendly lawn care sign such as Green Lawns-Blue Waters where owners who have committed to adopt water quality friendly lawn care practices can display small signs in their yards as a testament to this commitment.

• RAIN BARRELS - We would offer residents the opportunity to purchase rain barrels at reduced rates and demonstrate their installation at one or two residence.

• DOWNSPOUT REDIRECTION - We would demonstrate simple changes such as how to re-direct downspouts to vegetated areas and away from driveways or other impervious surfaces.

• RAINGARDEN INSTALLATION - Lastly we would install two demonstration rain gardens at key locations with willing homeowners. Design will be lead by the GISCC team and the Think Blue Exeter team. Prior to installation we will provide an overview of the design process. This would be followed by installation with guidance from this team, neighbors and other interested volunteers designed as a way for others to gain hands-on experience installing similar infiltration measures on their properties.

• WATER QUALITY MONITORING - This series of educational and implementation events would be dovetailed with a water quality monitoring program that monitors the water quality (turbidity, nitrogen, phosphorus, and chloride, chlorophyll-a) of Brickyard Pond itself before implementation during the Spring of 2013 and after implementation in the Fall of 2013 and spring of 2014 as a way to document the effectiveness of the program.

Community Outreach and Engagement

Through this project we envision four opportunities for community outreach and engagement.

• NEIGHBORHOOD - Initially the neighborhood would be engaged through the education presentation and hands on demonstration workshops for rain barrel installation, downspout redirection, and rain garden installation.

• TRAIN THE TRAINER - This program would provide a good opportunity to serve as a “train the trainer” type educational opportunity. 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 - This crew would then have hands-on experience with a variety of methods for management of stormwater and could then serve as a local resource for identification of stormwater management opportunities for other homeowner in town.

Next Steps: The GISCC project team will engage with the City of Exeter and work collaboratively to develop an implementation plan supported by the technical resources of the project partners to help build capacity at the municipal level and support sustainable and timely management strategies in the Brickyard pond watershed.

MUNICIPALITY: CITY OF PORTSMOUTH
Address: 1 Junkins Avenue Portsmouth, NH 03801
Primary Contact - Name: Peter Britz, Environmental Planner
Primary Contact – Phone and Email: 610-7215 plbritz@cityofportsmouth.com

Proposed Project Description: BMP Installation at Peirce Island Municipal Snow Dump

The proposed project will implement a Low Impact Development/Green Infrastructure project to mitigate water quality impacts from a municipal snow dump site on Peirce Island, a known high load contribution site or pollution “hot spots”. The Peirce Island snow dump is filled with silt, debris and salt accumulated from years of stockpiling snow during the winter months. While efforts are made to try and filter the water using silt fence and hay bales there is large quantity of material that remains. Installation of a more effective best management practice at the site would do a better job of improving water quality before it outlets to the Piscataqua River. Initial discussions over what could be done on the site include the installation of some type of settling unit which would drain to a rain garden or bioretention area. It appears there is adequate space for that type of configuration however only conceptual discussions have taken place so we anticipate working with the GISCC team to prepare a more detailed final design. This project would provide an excellent opportunity for water quality improvements and an ideal area for a highly visible LID demonstration project. The project is proposed to begin this summer work could begin in the fall of 2013.

Community Outreach and Engagement

The City of Portsmouth is interested in developing outreach materials or signage to describe the project and explain how it fits into citywide improvements that are being put in place to protect water quality. The City will continue to participate with the GISCC and will develop and post information to its website regarding this project.

MUNICIPALITY: TOWN OF STRATHAM
Address: 10 Bunker Hill Avenue, Stratham NH 03885
Primary Contact Name: Lincoln Daley, Town Planner
Primary Contact - Phone: (603) 772-7691 ext. 147 Email: Ldaley@strathamnh.gov

Proposed Project Description: Incorporate Updates to Stormwater Management in Zoning Ordinance and Land Use Regulations

The Town of Stratham seeks technical assistance to strengthen the Town's local regulations to incorporate up-to-date stormwater management controls and address their new MS4 permit requirements. The goal of the project will be to develop site plan regulations, subdivision regulations, or a zoning ordinance that provides the Town with the regulatory tools needed to mitigate the impacts of stormwater runoff from impervious surfaces in Stratham's residential, commercial, and industrial zones and the incorporation of standards, techniques, and designs of Low Impact Development and Green Infrastructure (both structural and non-structural). The regulations shall address both new development and redevelopment of properties that require site plan and/or subdivision approval from the Planning Board.

Community Outreach and Engagement

Stratham is fully committed and available to share the Town's experiences with other watershed communities through assistance with the development of case-studies, interviews, participation in future outreach activities and willingness to continue work with the GISCC project team. The Town recently updated its website which will be featured as a primary tool to provide outreach about the proposed project.

MUNICIPALITY: TOWN OF BRENTWOOD
Address: 1 Dalton Road, Brentwood, NH 03833
Primary Contact - Name: Robert Wofchuck

Proposed Project Description: Assistance with projects that apply low impact development (LID) methods

The goals of this project are to:
1) Increase the awareness and understanding of the town boards and highway department on the benefits of low impact development strategies.
2) Implement LID strategies at municipal buildings to reduce the storm water run-off into the Exeter River which is in close proximity.

To accomplish these goals, we propose developing storm water management plans for various municipal sites that incorporate LID strategies and then implement some of those strategies.

Specifically, the project team would:

1) Evaluate municipal sites including the town shed, town office, library and school.
2) Develop a storm water management plan for each site that incorporates LID projects.
3) Make presentations to town boards of these storm water management plans to educate and improve understanding and benefits of LID. This would include the Selectboard, Highway Department, Planning Board and Conservation Commission.
4) Representatives from town boards meet and pick two to three projects to implement.
5) Implement projects by September 2014
6) Follow-up meetings with town boards after completion.

This hands-on-approach to education and understanding of LID will lead to increased awareness of incorporating LID strategies into development and redevelopment activities in town. Furthermore, having the town lead by example and having more actual examples of LID strategies in a small town will hopefully lead to increased utilization of LID strategies in other towns. Lastly, the management plans will provide an invaluable resource and roadmap for the town for future implementation of LID strategies at municipal sites which will lead to continued improvement in the water quality in the Exeter River.

MUNICIPALITY: CITY OF DURHAM
Address: Dept. of Public Works 100 Stone Quarry Drive
Primary Contact - Name: David Cedarholm, Town Engineer

Proposed Project Description: Proposed Bioretention Structure Project

The proposed project involves the design and construction of a green bioretention structure to be located near the intersection of Oyster River Road and Garden Lane in Durham, NH. The purpose of this proposed structure is to disconnect the stormwater runoff generated from a residential neighborhood to reduce the impacts of non-point source pollution on the Oyster River.

Stormwater runoff generated from this "hot spot" neighborhood contributes a significant load of sediments and nutrients (i.e. phosphorus and nitrogen) from extensive lawns and impervious surfaces directly to the Oyster River. Currently at this location, stormwater runoff from more than 600 feet of Town road and 5 acres of densely settled residential properties drains directly to an existing set of weather beaten catch basins and corroded drain pipes, which all discharges directly to a seriously degraded outfall along the banks of the Oyster River. The proposed project includes an evaluation of the contributing drainage area and existing stormwater management infrastructure, design of an engineered green solution, which is expected to include a combination raingarden forebay, a gravel wetland, and a much needed improved outfall.

MUNICIPALITY: CITY OF ROCHESTER
Address: 31 Wakefield Street, Rochester, NH 03867
Primary Contact Name: Elena V. Engle

Proposed Project Description: Incorporate Updates to Stormwater Management in Zoning Ordinance and Land Use Regulations

Rochester is one of the fastest developing communities in the NH Seacoast. With this evolution, it is essential for Rochester to implement the Zoning and Land Development Regulations and Planning approaches outlined in the Green Infrastructure Toolbox.

Zoning and Land Development Regulations: The City of Rochester currently addresses stormwater mitigation practices in several documents and regulations including the Site Plan Regulations, Subdivision Regulations, Public Works Infrastructure Design Standards, and Chapter 50 of the City Ordinances. We are finding that these documents are outdated; the adopted/recommended Best Management Practices are no longer the best options for sizing and treating stormwater runoff, resulting in the approval of subpar stormwater systems that are stressing the existing public drainage systems and degrading wetlands, rivers, and aquifers – all of which increase economic and health related costs.

Additionally, these documents were not all created simultaneously and as a result there are inconsistencies and outdated references between the documents. As the City continues to experience growth and development (*in 2012 there were approvals for 19 Site Plans and 7 Subdivision Plans through the Planning Board)* staff must spend considerable amounts of time with developers to explain which development rules to follow and which to forgo, and with changes in staff come changes in interpretation….the result is a collection of stormwater and development designs, some good, some bad, yet all approved, and this inconsistency confuses both citizens and development professionals.

As part of the current Site Plan and Subdivision approval process, the City collects and reviews the long-term operations and maintenance plans for each development, however, the city does not have any formal way of tracking continued adherence to these plans. As part of the Planning approach, the City wishes to identify existing "hot spots" throughout the city and identify what long-term operation and maintenance procedures are required, and ultimately verify/enforce compliance with these required practices. The City is currently in the process of creating and populating a GIS website, this would be an ideal way of organizing a "hot spot" inventory.

The goals of this proposed project are to improve the quality-of-life of Rochester's citizens and visitors, protecting natural resources, and reducing municipal costs through the incorporation of Green Infrastructure, by:

1) Creating a means with which the city can require, with consistency, the implementation of the best and most current Low Impact Development and Green Infrastructure stormwater mitigation practices.
2) Establishing baseline data and/or methodology for tracking and monitoring the ongoing maintenance of these systems.