Brentwood Goes Green

Background

In November of 2013, the Green Infrastructure for Sustainable Coastal Communities (GISCC) provided funding to the Town of Brentwood to assist with projects that apply green infrastructure (GI) and low impact development (LID) methods on municipally-owned lands, and would include various components, including an outreach and education campaign.

To identify these projects, the GISCC project team agreed to complete the following tasks:

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

This hands-on approach, including implementation of direct improvements and education in the understanding of LID, has led to increased awareness of LID strategies and how to incorporate them into development and redevelopment activities in the town.

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.

Project Results and Future Considerations

The project included optimization modeling of updated, watershed-wide impervious area data used to target pollution hotspots based on land use, zoning, soils, proximity to a water body, and other common GIS data layers.

Stormwater-derived loadings were modeled and classified to identify municipally-owned hotspot locations for installation of cost-effective stormwater solutions that maximize pollutant load reductions.

Attribute tables generated by the modeling effort were then used to sort and filter results based on specific town official interests. Municipally owned lands were ranked by final modeling point total and then in descending order according to total parcel acreage. Final points indicate the pollutant potential of any parcel area with higher numbers indicating larger pollution threats. Secondary sorting by parcel size indicates opportunities where more can be done, as larger parcels with higher potential for pollution indicate larger benefits from retrofit activities. This is a quick screening method to further investigate potential implementation sites.

LAND COVER	ACRES
Impervious	10,256
Pervious	607
Total	10,863
% IMPERVIOUS COVER	5.6%

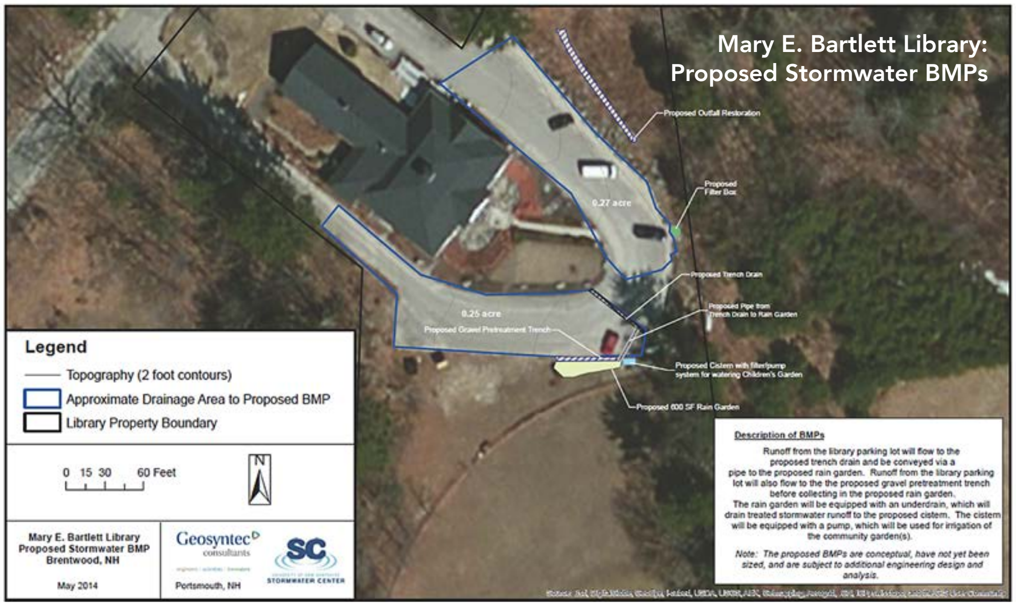
Impervious and pervious land cover statistics for the town of Brentwood.

RANK	LANDUSE DE	HSG	FINAL POINT	PARCEL ADDRESS	LOCATION	FINAL ACRES	NOTES
1	Government	A	1200	22 Dalton Rd	Brentwood Library	0.71	Managed through GISCC
2	Educational	B	1100	355 Middle Rd	Swasey School	3.02	Partially Managed Proposed
3	Government	B	1100	1 Dalton Rd	Town Hall	0.81	No Management Proposed
4	Government	C	1000	207 Middle Rd	Brentwood Highway Shed	0.76	No Management Proposed
					TOTAL	5.30	

Project Conditions

The selected property was the town-owned Mary E. Bartlett Library. The property consists of a 3.4-acre parcel with 0.71 acres of impervious cover.

As a result of this project, 90% of the Mary E. Bartlett Library impervious cover has been disconnected via treatment through green infrastructure practices. Two GI stormwater control measures have been installed that treat 0.64 acres of drainage area and annually reduce 413 lbs of TSS, 1.6 lbs of phosphorus and 9.1 lbs of nitrogen on an annual basis.



A. Western perimeter drive and parking area; B: re-graded site; C: excavated hole for cistern; D: installed cistern; E: excavated bioretention area; F: placed stone; G: backfilled with BSM; H: finished grade; I: installed cistern pump.

2014 BMPS	ANNUAL LOAD 'L$_I$' #/YEAR	EFFLUENT LOAD 'L$_E$' #/YEAR	ANNUAL PL REMOVED #/YEAR
TSS #/year	456	42	413
TP #/year	1.95	0.35	1.61
TN #/year	17.6	8.5	9.1

Summary of annual pollutant load reductions estimated for the retrofits at the Library.

The Impervious Cover Model and Future Permit Compliance

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.

This approach can serve as a surrogate for water quality criteria in the absence of any other governing regulatory limits.

The analyses performed in this project constitute major elements of any required WQRP and include the following elements:

1. Preliminary source assessment with respect to potential stormwater sources
2. Implementation of programs leading to the disconnection of DCIA
3. Structural BMP retrofits

While additional analyses and comprehensive assessment of illicit discharge detection and elimination (IDDE) programs and revision of good housekeeping and pollution practices (such as catch basin cleaning frequency and leaf litter collection programs) may be required, the analyses and action items embodied in this report represent a major contribution to any future WQRP or SWMP permit submission.

This project is funded by the **NERRs Science Collaborative** to a project team led by the **University of New Hampshire Stormwater Center** and the **Great Bay National Estuarine Research Reserve.** It supports Green Infrastructure implementation with local municipal, non-profit and private sector partners.

For more information please visit **southeastwatershedalliance.org/green-infrastructure**

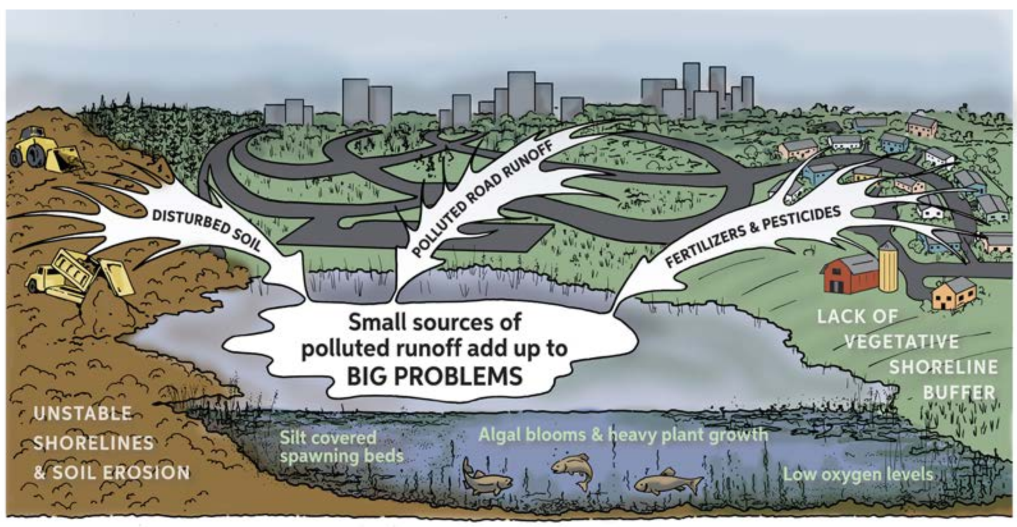
A Community Approach to Green Infrastructure for New Hampshire's Coastal Watershed


SNOW MELT/ RUNOFF


STORMWATER RUNOFF

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 hard surfaces (called *impervious cover*) 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, collects pollutants and carries them into waterways, causing substantial water quality problems.



Research and monitoring clearly shows that in rapidly developing areas, greater amounts of impervious cover result in stormwater runoff that causes higher levels of water pollution. This can lead to significant financial costs to local communities. Green infrastructure can provide effective solutions to this problem by reducing stormwater runoff and filtering harmful pollutants from stormwater runoff.

The Green Infrastructure project advocates a "complete community approach" for mitigating the negative effects associated with increasing impervious cover and stormwater runoff, thus minimizing impacts to water quality and protecting ecosystems and water resources.

Building Green Infrastructure Through a Complete Community Approach

The following measures outline a comprehensive strategy towards achieving the complete community approach:

- **Adopt ordinances and regulations for new development** that mandate the use of stormwater filtration to clean runoff, and infiltration practices to reduce runoff.
- **Require improved stormwater controls for reducing runoff** for redevelopment projects or other significant construction, and for site improvements such as repaving or building renovations.
- **Apply conservation strategies** such as protecting naturally vegetated areas near water bodies and wetlands, and limiting the size or percentage of allowable impervious cover in high value natural resource areas.
- **Reduce existing impervious cover** through targeted site improvements and stormwater management changes in high impact locations (i.e. locations that contribute high amounts of polluted runoff).

BIORETENTION SYSTEM

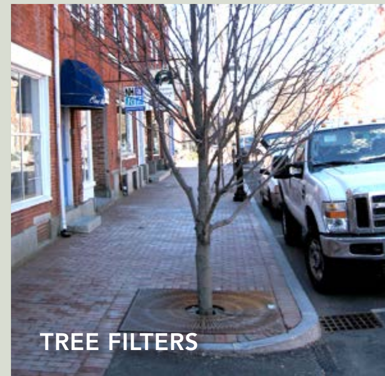
POROUS PAVEMENT

- **Make a long-term commitment to fund and maintain stormwater controls** along with an accounting mechanism to track long-term benefits of strategies. Consider innovative funding mechanisms such as impacts fees, exaction fees and stormwater utilities.

RAIN GARDEN SIGNAGE

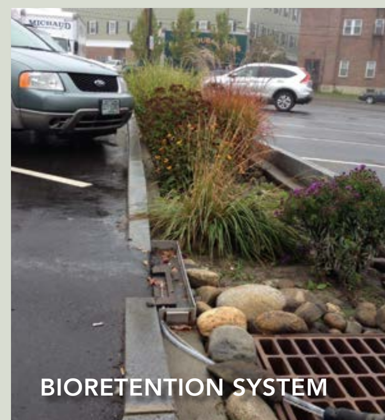
- **Provide opportunities for outreach** by sharing plans and progress with citizens and business owners through community newsletters, cable access, and on-site signs that explain what steps are being taken to protect waterways or improve stormwater management.

FILTRATION SYSTEMS



TREE FILTERS

BIORETENTION SYSTEM



BIORETENTION SYSTEM

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Green Infrastructure

for New Hampshire Coastal Watershed Communities

what is Green Infrastructure

Green Infrastructure is a programmatic use of Low Impact Development (LID) and other management measures to control drainage and pollution in a watershed or municipal setting. LID techniques mimic natural processes to capture and treat stormwater close to its source and enhance overall environmental quality. As a general principal, green infrastructure engineered systems use soils and vegetation to infiltrate and/or treat runoff. Structural examples include bioretention systems and rain gardens; permeable pavements; tree filters and stormwater planters; and vegetated roofs. Non-structural elements may include incorporating best practices into site design; regulations requiring better infrastructure performance; and incentives or education to encourage property owners to protect water quality.

THE VALUE OF GREEN INFRASTRUCTURE

INVESTING IN GREEN INFRASTRUCTURE CAN PROVIDE MUNICIPALITIES WITH A RANGE OF LONG-TERM ECONOMIC, ENVIRONMENTAL, AND SOCIAL BENEFITS INCLUDING:

- The potential to reduce municipal costs for stormwater management by decreasing a reliance on costly grey infrastructure
- Reducing stress to aging municipal grey infrastructure and minimizing the need for capacity increases (i.e., gutters, storm sewers)
- Improving water quality in our streams, rivers, ponds, and estuaries
- Increasing groundwater aquifer recharge to support drinking water and stream baseflow
- Minimizing flooding and building resiliency to extreme storm events
- Increasing the usage of green spaces for water management and improving community aesthetics
- Cultivating public education opportunities by connecting people more directly with natural resources

the Green Infrastructure PROJECT

Researchers from the University of New Hampshire, and Geosyntec, as well as staff from the Southeast Watershed Alliance, Strafford Regional Planning Commission, Rockingham Planning Commission, Antioch University, and the Great Bay National Estuarine Research Reserve partnered to deliver customized technical assistance and educational resources focused on stormwater management in the coastal watershed. One of the primary goals of this project was to communicate with municipalities on the values of green infrastructure in order to assist them in deciding where, when, and to what extent green infrastructure practices should become part of future planning, development, and redevelopment efforts.

Rain Garden, Public Library, Durham, NH

Durham Department of Public Works

Bioretention Retrofit, UNH Campus, Durham, NH

UNH Stormwater Center

BECOMING AN IMPLEMENTATION COMMUNITY

The Green Infrastructure project advocates that municipalities take a Complete Community Approach to mitigate the negative effects associated with increasing impervious cover and stormwater runoff, thus minimizing impacts to water quality and protecting ecosystems and water resources.

A Complete Community Approach uses green infrastructure throughout all aspects of community planning. This approach includes: ordinances and regulations; stormwater controls; conservation strategies; reduced impervious cover; long-term commitments to fund and maintain stormwater controls; opportunities for outreach.

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LOCAL PLANNING: TOWN OF DURHAM

DESIGN AND CONSTRUCTION OF A STORMWATER RETROFIT AT THE INTERSECTION OF OYSTER RIVER ROAD AND GARDEN LANE

GOAL

THE GOAL OF THIS PUBLIC INFRASTRUCTURE REPAIR AND IMPROVEMENT PROJECT WAS TO DISCONNECT THE STORMWATER RUNOFF GENERATED FROM THE NEIGHBORHOOD AND REDUCE NON-POINT SOURCE POLLUTION ON THE OYSTER RIVER. THE UNH STORMWATER CENTER ASSISTED BY DEVELOPING DESIGN PLANS AND PROVIDED BUILDING OVERSIGHT FOR THE PROJECT. THE TOWN OF DURHAM AND THEIR SELECTED CONTRACTORS FINALIZED THE CONSTRUCTION IN THE SPRING OF 2015.

IDENTIFIED NEED

The Town of Durham's Department of Public Works recognized that a stormwater outfall in a residential neighborhood had fallen into serious disrepair and was discharging directly into the Oyster River. The existing drainage structure and outlet pipe were under capacity and severely degraded. The site contained a highly eroded trench that had undermined a 20' section of corrugated metal pipe (see picture, middle left), which according to the UNH Stormwater Center, was responsible for releasing approximately 30 dump truck loads of fine sediment per year into the river. The undercutting from the existing pipe resulted in massive erosion, slope instability, and water quality issues. Due to these factors, staff from the Durham Public Works Department submitted a grant application to evaluate the contributing drainage area and existing stormwater management infrastructure, design an engineered green solution, and install a control measure.

"A WIN-WIN-WIN"

This subsurface gravel wetland installation created an eventual win-win-win, where we reduced dissolved nutrient contributions from yard waste, prevented localized soil erosion, and improved water quality control of a 10-acre residential area discharging directly to the Oyster River.

JAMIE HOULE,
PROGRAM MANAGER, UNH STORMWATER CENTER

SPECIFIC RESULTS OF THIS PROJECT

- *Stabilization of 50 feet of heavily eroded and entrenched gully discharging directly to the Oyster River*
- *Installation of a subsurface gravel wetland system at the outfall to slow flow and provide water quality treatment from 6 acres of untreated residential land uses*
- *Employ a regenerative stormwater conveyance approach that will use the existing eroded gully as the excavation for the treatment area and will result in less than 750 square feet of temporary disturbance associated with an access for construction; no additional impervious area is proposed*
- *Overall improvement to the aesthetics of the site, which in its former condition had become a dumping ground for nutrient laden lawn and leaf debris from local yards*

DURHAM'S COMMITMENT TO GREEN INFRASTRUCTURE

2010 INCORPORATED STORMWATER REGULATIONS WITH LOW IMPACT DEVELOPMENT INCENTIVES IN SITE PLAN REVIEW AND SUBDIVISION REGULATIONS

2011 PARTNERED WITH THE UNH STORMWATER CENTER TO RETROFIT A CUSTOM DESIGNED STATE OF THE ART NITROGEN TREATMENT BIORENTION STRUCTURE IN A BUSY DOWNTOWN PARKING LOT

2012 TOWN PARTNERED WITH THE OYSTER RIVER HIGH SCHOOL TO DESIGN AND CONSTRUCT A 1,000 SQUARE-FOOT RAIN GARDEN TO DISCONNECT AND TREAT STORMWATER RUNOFF FROM 10,000 SQUARE FEET OF THE HIGH SCHOOL MAIN PARKING LOT

2013 ADOPTED A NEW WATER ORDINANCE, WHICH INCLUDES PROTECTION OF ALL THE TOWN'S WATER RESOURCES FROM DISCHARGES OF POLLUTED STORMWATER RUNOFF AND ILLICIT DISCHARGES