



Tour of Low-Impact Development Demonstration Projects

Ipswich and Wilmington



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Co-sponsored by:
U.S. Environmental Protection Agency
Massachusetts Department of Conservation and Recreation
Ipswich River Watershed Association

LID in the Ipswich River Watershed: Tour Overview

June 9, 2009: Welcome to this presentation and tour of low-impact development (LID) projects in the Ipswich River watershed. The projects were funded by the United States Environmental Protection Agency (EPA) and implemented by the Massachusetts Department of Conservation and Recreation (DCR) in collaboration with the Ipswich River Watershed Association (IRWA), the U.S Geological Survey (USGS), and the towns and project partners described in this guide.



The Ipswich River suffers from excessive water withdrawals that can cause sections of the river to completely dry up. Assessing whether LID and improved water conservation can help solve this problem was the goal of the Ipswich River Targeted Watershed Grant.

The Ipswich River Targeted Watershed Grant (TWG) is piloting four innovative LID projects and five water conservation projects to help reduce severe low-flow problems and polluted runoff in the Ipswich River watershed. These projects are of particular interest in the Ipswich River watershed where there is pollution from runoff and a high demand on surface and groundwater resources; LID practices allow water to soak into the ground to be naturally filtered and replenish groundwater, and water conservation techniques reduce demand on water supplies, especially during dry months.

The purposes of the pilot projects were to assess the effectiveness, quantify the benefits, and provide local demonstrations of LID and water conservation practices. The U.S. Geological Survey used a computer model, with data either collected from these sites or documented in the scientific literature, to evaluate how LID and water conservation techniques would affect river flows if they were used throughout the watershed.

The tour will visit four LID projects: a green roof (Ipswich); an LID subdivision (Ipswich); a permeable-paving parking lot (Wilmington); and a retrofit of a stormwater system in a residential neighborhood (Wilmington). For more information on the Ipswich River Targeted Watershed Grant, please visit: <http://www.mass.gov/dcr/waterSupply/ipswichRiver/index.htm>. This five-year grant is expected to be completed by fall of 2009 and all results will be available on the website.

Tour Schedule

Ipswich Town Hall
9:30 – 11:00 Overview Presentation, with Q&A
11:00 – 11:30 Green Roof viewing
11:30 – 11:45 Pick-up box lunch and board buses

Tour A:
12:00 – 12:45 Partridgeberry Place (Ipswich)
1:30 – 2:15 Silver Lake Permeable Parking Lot (Wilmington)
2:30 – 3:00 LID Neighborhood Retrofit (Wilmington)
4:00 Drop-off Ipswich Town Hall

Tour B:
12:45 – 1:30 Silver Lake Permeable Parking Lot (Wilmington)
1:45 – 2:15 LID Neighborhood Retrofit (Wilmington)
3:00 – 3:45 Partridgeberry Place (Ipswich)
4:00 Drop-off Ipswich Town Hall



Green Roof: Whipple Riverview Place, Ipswich

What is a Green Roof?

A green roof is a rooftop that is covered with plants. A waterproof membrane is applied and covered with a specialized drainage matrix and a lightweight soil or planting medium, and then planted with suitable plants. Green roofs absorb rain and release water slowly, reduce pollution and erosion caused by stormwater, and can also act as an insulating blanket, thus reducing heating and cooling costs.

There are different types of green roof installations, depending on the steepness of the roof, and whether the plantings will be actively managed or left to grow with little regular maintenance. On flat roofs, plantings can include trees and shrubs, creating a rooftop garden. On pitched roofs, low-maintenance plants are usually selected. Plants like sedums are often chosen because they are drought tolerant and do well in a sunny location; however, other plants, including grasses and mosses, may be suitable.

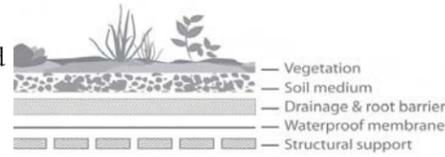
Featured Green Roof

This green roof was planted with 3-4 inches of soil medium and 10 varieties of low-growing, drought-tolerant plantings, including 8 varieties of sedum (*Sedum spp.*), and accented by chive (*Allium schoenoprasum*) and fume flower (*Talinum calycinum*).

The building was formerly a factory and a school and was redeveloped as affordable senior housing by the North Shore Housing Trust. The design, engineering, installation, and first two years of maintenance for the green roof cost approximately \$100,000.

USGS monitored runoff quantity and quality from the green roof and from the adjacent conventional roof on the Ipswich Town Hall. Researchers were interested in the answers to the following questions:

- To what extent is roof runoff volume reduced relative to a conventional roof?
- To what extent are concentrations of pollutants reduced, relative to a conventional roof?



Dominated by succulent Sedums, green roofs need very little water or fertilizer and can survive temperature extremes.



The green roof was constructed in September 2006 on an existing roof (top) and is home to at least 10 species of flowering plants (bottom). The roof area is 3,000 ft² and the weight is 20 lbs. per ft² (saturated).

Photo courtesy of Kate Day

Project Proponent: North Shore Housing Trust
 Engineering/Design: K. J. Savoie Architecture
 Consultation/Construction: Magco, Inc.
 Maintenance: Apex Green Roofs
 Monitoring: USGS

LID Subdivision: Partridgeberry Place, Ipswich

What is Low-Impact Development (LID)?

LID principles focus on restoring or retaining the natural drainage patterns of a site by: 1) minimizing land disturbance and the installation of pavement and other hard surfaces; 2) using natural vegetation, natural site grading, and open space to allow rain to soak into the ground throughout the site; and 3) minimizing centralized drainage structures.

LID aims to preserve (or restore) a property's natural areas, vegetation, and drainage with features such as rain gardens, open swales, bioretention areas, vegetated buffers, porous paving materials, and green roofs. While green roofs do not replenish groundwater, they do help minimize erosion and reduce polluted runoff.

Featured Subdivision

In order to evaluate the benefits of LID in a subdivision setting, DCR worked with a developer to enhance the cluster design for a residential subdivision in Ipswich, MA by incorporating additional LID stormwater features. Under an open-space residential design (OSRD) bylaw, Partridgeberry Place's design already demonstrated the key LID principles of minimizing land disturbance and impervious areas by protecting 75% of the area as open space, using narrower roadways, small lots, and shorter driveways. The design also includes drywells to allow all runoff from roofs to soak into the ground. The additional LID stormwater features incorporated under the grant include a grass-pave swale, a large rain garden to serve as pre-treatment for the detention pond, and four additional rain gardens throughout the property. The design and installation of these additional features cost \$90,000.

Using data collected from the site, researchers examined the following:

- How do runoff patterns at this site compare to a (modeled) conventional 20-house subdivision on the same property?
- How do runoff patterns at this site compare to a (modeled) clustered subdivision without any additional LID stormwater enhancements, on the same property?
- How do runoff patterns at this site compare to the pre-development forested condition?
- What aspects of the project are contributing most to the differences observed?



Lots in Partridgeberry Place are placed to maximize open space (top), and some include rain gardens to collect and absorb rain falling on the driveway (bottom).

Concept Design and OSRD Layout: Randall Arendt
 Developer/Construction: The Martins Companies
 Engineering/Design: Meridian Associates
 Monitoring: GeoSyntec Consultants
 Town Partner: Ipswich

Permeable Parking Lot: Silver Lake, Wilmington

In response to closures at the Silver Lake Town Beach in Wilmington due to bacterial contamination, the Ipswich River Targeted Watershed Grant helped fund an LID retrofit of the beach parking lot. The goal of the retrofit was to increase the amount of water that soaks into the ground so that pollutants will be removed before the water enters the lake.



Parking lot post-construction

The town replaced a conventionally paved parking lot in need of resurfacing with a combination of permeable pavers, porous asphalt, and conventional asphalt. Bioretention cells were installed adjacent to the parking lot to filter surface runoff from the conventional asphalt and any excess runoff from the permeable surfaces. In an overflow parking area, two additional permeable paving technologies were installed: GravelPave™, which utilizes a plastic matrix for structural support within a gravel bed; and Flexi-Pave™, which is a permeable and flexible surface made from crushed recycled tires. Additionally, the town built two vegetated swales to daylight stormwater outfalls to the lake. The swales were designed to increase absorption into the ground and to improve the quality of the discharging stormwater runoff before it reaches the lake.



This demonstration project and the Neighborhood Retrofit demonstration described on the following page were engineered and contracted jointly. The combined cost of these two projects was approximately \$445,000, including design, engineering, construction, and three years of maintenance. Pre- and post-construction groundwater quality measurements were collected under the permeable portion of the parking lot. Additionally, beach closure records from before and after project implementation were obtained from the town Board of Health. Researchers were specifically interested in assessing:



Vegetated swale under construction

- Is groundwater quality negatively impacted under the permeable paving?
- Are beach closures due to fecal bacteria reduced (or eliminated)?

Design/Engineering: GeoSyntec Consultants
 Construction: Cali Corporation
 Monitoring: USGS
 Town Partner: Wilmington DPW

LID Retrofits: Silver Lake Ave./Dexter St. , Wilmington

The residential neighborhood at the intersection of Silver Lake Avenue and Dexter Street was suspected of being the source of polluted runoff into Silver Lake through the storm sewers that drain directly into the lake via a catch-basin stormwater system. In an effort to reduce the amount of runoff entering the lake, the Ipswich River Targeted Watershed Grant helped fund a retrofit that: 1) replaced existing compacted road-edge dirt with permeable pavers and underlying stone beds; 2) constructed twelve rain gardens in the public right-of-way contiguous with residential properties; 3) replaced several catch basins with new deep-sump catch basins; and, 4) restored the stormwater outfall entering Silver Lake.

The combined cost of this demonstration project and the Permeable Parking Lot was approximately \$445,000, including design, engineering, construction, and three years of maintenance.

Pre- and post-construction runoff volume and water quality measurements were collected to evaluate:

- To what extent is surface runoff reduced in the retrofit neighborhood relative to pre-installation?
- To what extent are pollutant concentrations and loads reduced in the retrofit neighborhood, relative to pre-installation?



Permeable pavers along the street sit on top of stone beds that capture and filter runoff and allow it to soak into the ground.



Rain gardens on Silver Lake Ave. and Dexter St. collect rainwater that flows off the street and allow it to slowly soak into the ground.



Engineering/Design: GeoSyntec Consultants
 Construction: Cali Corporation
 Monitoring: USGS
 Town Partner: Wilmington DPW

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Catering: Ipswich River General Store

Targeted Watershed Grant Partners and Participants:

U.S. Environmental Protection Agency	Town of Wilmington
Mass. Department of Conservation and Recreation	AquaSave, LLC
U.S. Geological Survey: MA – RI Water Science Center	Rainwater Recovery, Inc.
Ipswich River Watershed Association	North Shore Housing Trust
Town of Hamilton	The Martins Companies
Town of Ipswich	Magco, Inc.
Town of Middleton	GeoSyntec Consultants
Town of North Reading	Meridian Associates
City of Peabody	K. J. Savoie Architecture
Town of Reading	Cali Corporation
Town of Topsfield	Apex Green Roofs

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, and dams, whose mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources. To learn more about DCR, our facilities, and our programs, please visit www.mass.gov/dcr. Contact us at mass.parks@state.ma.us.

Commonwealth of Massachusetts
Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Executive Office of Energy and Environmental Affairs
Ian A. Bowles, Secretary
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Notes