

# Westbrook's Low Impact Development and Stormwater BMP Guide For Existing and New Development



Photo credit: Clarion Associates. USEPA.



Above: Porous paver parking spaces. Picture credit: Philadelphia Water Department.



Above: Stormwater planter (bioretention). Picture credit: USEPA.



## What is Low Impact Development?

**Low Impact Development, or LID, is a process of developing land in a way that minimizes negative impacts on water resources. It starts at the design stage and uses strategies, such as minimizing the footprint of impervious areas and utilizing on-site natural features to protect water quality.**

Impervious surfaces, such as asphalt and rooftops, prevent rainwater from infiltrating back into the soil. As we build more roads, buildings, and parking lots, we alter the natural landscape and change the hydrological cycle. Rainwater can no longer enter the ground and replenish our groundwater sources, but instead must be re-routed somewhere else. This not only increases the volume of water that accumulates in our storm drains, causing flooding, but also decreases the quality of the water. With nowhere to go, rainwater travels over the pavement, picking up trash and pollution. This dirty water is called runoff. The water quality of our watersheds gets worse as more impervious surfaces cover the land, because runoff enters our lakes and streams instead of being absorbed by plants or filtered through the earth. Traditional stormwater management infrastructure, or 'grey' infrastructure, tend to focus on water quantity management as a flood prevention technique, paying little attention to water quality management. Low Impact Development and Best Management Practices (BMPs) are alternative methods to managing stormwater using plants, soils, landscape design, and engineered techniques to retain, absorb and reduce runoff through biological processes.

This fact sheet explains the different types of stormwater Best Management Practices (BMPs), how and when to use them, and how to develop land using LID design principles.

## Why should I use Low Impact Development guidelines and stormwater BMPs?

The basic answer is that Low Impact Development and BMPs can benefit homeowners, developers and all the Westbrook community.

**Good for homeowners:** increased aesthetic value, fixes drainage issues.

**Good for developers:** reduced costs for land clearing and grading, stormwater infrastructure, and increased aesthetic value.

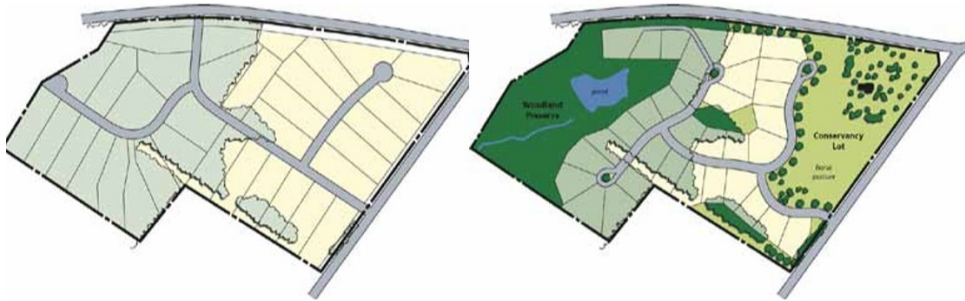
**Good for Westbrook:** reduced risk of flooding, better water quality, preservation of open space and natural resources.



Cluster Development works well as an LID technique

# Better Site Design

Conventional subdivision development (left) compared to LID (right)



## LID Design Principles

- Minimize impervious areas and conserve natural areas wherever possible
- Minimize areas of clearing and grading
- Minimize directly connected impervious areas
- Manage stormwater at the source
- Use scattered BMPs throughout the site to infiltrate, store, evaporate, and/or detain runoff close to the source

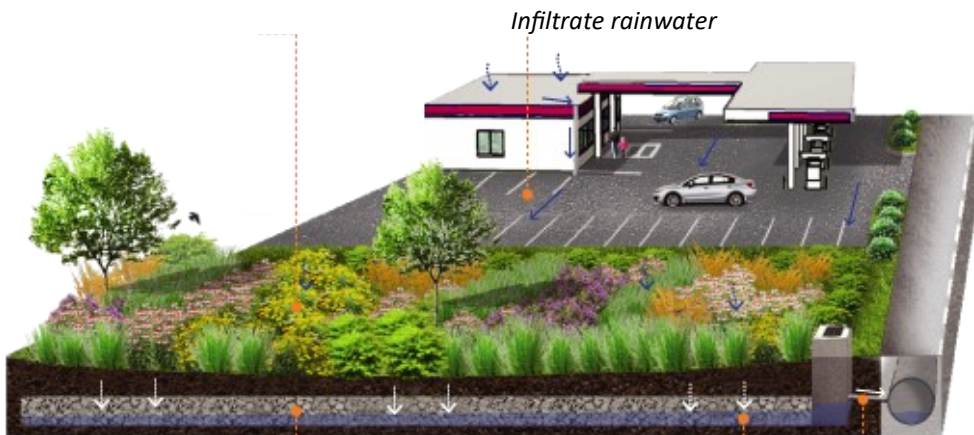


Image credit: Philadelphia Water Department

## LID Design Measures and Techniques

| LID Measure                                                                                                                       | Site Design Technique                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Protect as much undisturbed land as possible to maintain pre-development hydrology and allow rainfall infiltration                | Cluster development with protected remaining land by deed restriction<br>Maximum 1000 ft road per 10 lots or with buffers only                                                                 |
| Protect natural drainage systems, such as wetlands of special significance, streams, intermittent streams, ponds and vernal pools | No diversion of stormwater from its natural subwatershed<br>Include buffers on all water resources                                                                                             |
| Minimize land disturbance and soil compaction                                                                                     | Rototilling all compacted areas to be vegetated<br>Construction window no more than 25 ft around structures                                                                                    |
| Minimize lawns and maximize landscaping that encourages runoff detention                                                          | Low maintenance Maine native plants<br>Avoid using pesticides and fertilizers                                                                                                                  |
| Minimize impervious areas or the effect of impervious areas                                                                       | Go vertical with multi-story buildings and parking garages<br>Utilize pervious pavement or grass for parking lot overflow (25%)<br>Utilize pavers or pervious pavement for pedestrian walkways |
| Disconnect the flow of runoff over impervious surfaces to the extent practicable                                                  | Sheet flow over pavement that is less than 100 ft                                                                                                                                              |

Adapted from the Maine Stormwater Design Manual Volume 3, Table 10.2 LID Minimum Design Standards. For further information, refer to Chapter 4— Low Impact Development, Maine Stormwater Management Design Manual Volume 1, 2016



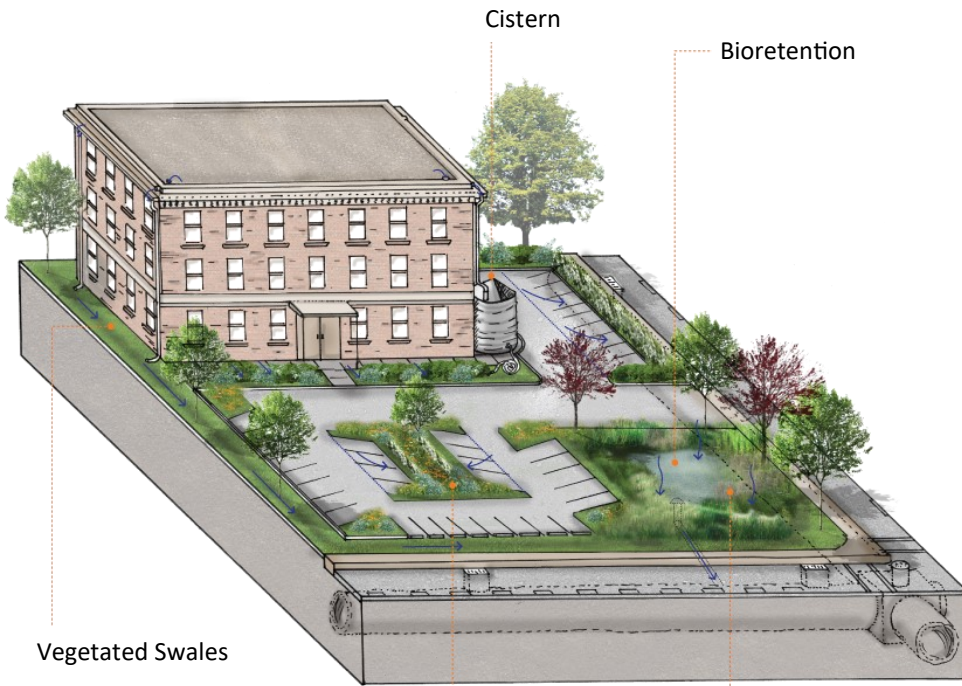


Image credit: Philadelphia Water Department

## WHEN TO USE STORMWATER BMPs?

After reducing the potential amount of stormwater by applying LID design principles, the remaining stormwater can often be addressed with the use of green-infrastructure or LID BMPs. Many of which are low cost, or costs less than traditional underground filtration BMPs.

Factors that determine whether a BMP is suitable for the development include: soils types (well-draining versus poor draining); BMP size; available space; and stormwater volume. In addition, most stormwater BMPs must be located downhill to receive stormwater from impervious surfaces.

All new development must meet Westbrook's Code of Ordinances. The suggestions in this guide are aimed for projects that do not trigger DEP oversight (Chapter 500 review under the Maine Stormwater Management Law). Staff at the City of Westbrook's Planning and Code Enforcement or the city engineer can help you determine what is appropriate for your development.

## DEVELOPMENT SELECTION MATRIX

| LID BMP                                       | COST        | SINGLE FAMILY RESIDENTIAL LOT | SMALL NON-RESIDENTIAL OR MULTI-FAMILY LOT | EXISTING DEVELOPMENT OR REDEVELOPMENT |
|-----------------------------------------------|-------------|-------------------------------|-------------------------------------------|---------------------------------------|
| Vegetated Buffer or Filter Strip              | 0 - \$      | ●                             | ●                                         | ●                                     |
| Infiltration Trench and Dry-wells             | \$\$        | ●                             | ●                                         | ●                                     |
| Vegetated Swales                              | \$          | ●                             | ●                                         | ○                                     |
| Raingardens                                   | \$\$        | ●                             | ○                                         | ○                                     |
| Rainwater Harvesting (cistern or rain barrel) | \$          | ●                             | ●                                         | ○                                     |
| Stormwater Planter                            | \$ - \$\$\$ | ∅                             | ●                                         | ●                                     |
| Tree Well/ Box Filter                         | \$\$        | ∅                             | ●                                         | ●                                     |
| Bioretention                                  | \$ - \$\$\$ | ∅                             | ●                                         | ○                                     |
| Permeable or Porous Pavement                  | \$ - \$\$\$ | ●                             | ●                                         | ○                                     |
| Eco Roofs                                     | \$\$\$      | ○                             | ●                                         | ∅                                     |

KEY: ● = Suitable ○ = Sometimes Suitable ∅ = Rarely Suitable

\* Table organization: lower maintenance BMPs from top to higher maintenance BMPs at the bottom.

Source: Adapted from: Horsley Witten Group. 2007. *LID Guidance Manual for Maine Communities: Approaches for Implementation of Low Impact Development Practices at the Local Level*. Adapted from Selection Matrix 1. *Selecting Appropriate Practices for Different Land Use Types*.



Picture credit: The Ohio State University, Filter Strips/Grassed Riparian Buffers.

## Vegetated Buffer or Filter Strips

### Description

Vegetated buffers consist of undisturbed natural forest/vegetated areas and trees. Vegetated filter strips are gently sloped areas designed to capture and infiltrate stormwater.

### Conditions Suited For

Should have a slight depression to allow directing and be large enough to infiltrate drainage from impervious area.

Filter strips are typically linear and designed to accommodate runoff from sidewalks and driveways.

Appropriate for all soils

### Additional Information

Maine Stormwater BMP Manual Volume III, Section 5 Vegetated Buffers



Picture credit: City of Portland, Oregon 2016.

## Infiltration Trench and Drywell

### Description

A soakage or infiltration trench is a shallow trench that is filled with drain rock and may be covered with vegetation, while dry wells are typically a 5 foot perforated concrete ring that is set underground with crushed stone. Both systems are very low maintenance.

### Conditions Suited For

Dry wells must be placed at least 5 feet above the water table and require soils suitable for infiltration. Both systems work very well for gutter infiltration (rooftop runoff).

### Additional Information

Maine Stormwater Management Design Manual Volume III Chapter 6.2 Dry Well, Chapter 6.3 Infiltration Trench and Chapter 7.5 Roof Dripline Filters





Picture credit: City of Portland, Oregon, 2016.

## Grassy Swales and Vegetated Swales (Bioswales)

### Description

Gently sloping vegetated channels/depressions that convey stormwater and remove pollutants by sedimentation and infiltration through the soil. Maintenance requirements include litter removal and landscaping.

Vegetated swales with native or non-invasive plants are preferable to grassy swales, which function primarily as a stormwater conveyance system.

### Conditions Suited For

Swales require shallow slopes, well-draining soils, and a minimal width of 3 feet. They are typically long channels placed at the side of a road or parking lots. Where soils don't drain well, swales can overflow to an approved discharge location (typically, another BMP).

### Additional Information

Maine Stormwater Management Design Manual Vol III Chapter 8.1. Vegetated Swale



Picture credit: Joy Stewart, USEPA.

## Raingardens

### Description

Landscaped depressions that collect runoff in a vegetated soil medium, where water infiltrates back into the ground, is absorbed by plants, evapotranspirates, or is redirected. Raingardens require some maintenance, such as watering during extreme droughts, and general landscaping. Raingardens should be planted with native or non-invasive plant species

### Suitable for

Can be used in small residential installations to capture driveway or roof runoff, or to complement other BMPs in larger developments. Plants must be able to tolerate both dry and wet conditions.

### Additional Information

Vermont Rain Garden Manual

Native Plants for New England Rain Gardens

New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself Stormwater Solutions





Picture credit: Philadelphia Water Department

## Rainwater Harvesting

### Description

Cisterns or rain barrels capture rainwater from a roof and stores the water for re-use for non-potable water. The water can then be used for irrigation or oth-

### Conditions Suited For

Used in both small residential and larger buildings. Rooftop downspouts are redirected to a storage tank, usually a plastic barrel for small residential applications. Cisterns range in size and can be used above ground or underground for year-round use.

### Additional Information

City of South Portland Stormwater Manual Rainwater Storage

EPA's Municipal Handbook: Managing Wet Weather with Green Infrastructure



Picture credit: Eric Vance, USEPA.

## Stormwater Planters

### Description

Small strip planter box (structural facility) with bioretention systems typically enclosed by curb edges. May be designed for a specific site, or be a proprietary system, such as FocalPoint. Maintenance requirements include litter removal, landscaping and routine cleaning of inlets and pipes. Stormwater planters should be planted with native or non-invasive plant species

### Suitable for

Suitable for small compact spaces, where other bioretention BMPs won't fit. Can be used to infiltrate or to overflow to an approved discharge location.

### Additional Information

Maine LID Guidance Manual, Page 5I-1 Stormwater Planters





## Tree Wells or Tree Boxes

### Description

A stormwater tree pit, box, filter, or well, typically involves a tree planted in gravel and soil medium on an open-bottomed concrete barrel with an under-drain. Designs vary. Examples: Silva Cells, Filterra, and StormTrees. Maintenance depends on system design and routine cleaning of inlets and pipes may be required.

### Conditions Suited For

Usually sited in tight spaces, such as streets, sidewalks, and parking lots.

### Additional Information

See stormwater planters



Picture credit: Alisha Goldstein, EPA

## Bioretention

### Description

Landscaped depressions that collect runoff in a vegetated soil medium, where water infiltrates back into the ground, is absorbed by plants, evapotranspires, or is redirected. Bioretention systems are larger than raingardens, contain a drain pipe and use engineered soils/planting media. Bioretention systems are sometimes lined and may use underdrains to control overflow. Maintenance requirements include litter removal, landscaping and depending on the design, routine cleaning of inlets and pipes. Should be planted with na-

### Conditions Suited For

Usually consist of large installations, suitable for parking lots, roof runoff, or driveways. Where soils don't drain well, bioretention systems can overflow to an approved discharge location (typically, another BMP).

### Additional Information

Maine Stormwater Management Design Manual Chapter 7.2. Bioretention Filters





Picture credit: Alisha Goldstein, EPA

## Permeable/Porous Pavement and Pervious Pavers

### Description

Permeable/porous pavement is a special asphalt or concrete that allows water to permeate through it.

Pervious pavers are paving blocks with space between the blocks to allow stormwater infiltration into the ground.

### Conditions Suited For

Permeable/porous pavement is suitable for low-traffic areas, such as parking and sidewalks. While there are maintenance requirements (needs to be vacuumed 3-4 times annually to prevent clogging), permeable/porous pavement reduces retains 70 to 80% of annual rainfall and does not require salt or sand.

### Additional Information

Maine Stormwater Management Design Manual Chapter 7.7 Manmade Pervious Surfaces



## Eco-Roofs or Green Roofs

### Description

Roofs that are partially or completely covered with vegetation and soil. Can be intensive or extensive.

### Conditions Suited For

Intensive green roofs usually have 6" or more of soil depth to support larger vegetation. This type of facility is only suitable for large buildings that are engineered to withstand the added weight of vegetation medium and temporary water storage( multi-family or commercial) with flat roofs. Intensive green roofs are usually built for use by people.

Extensive: are lightweight, use low-maintenance small plants and not suited for foot traffic. Can be used in any building, including single family residences. Extensive green roofs generally have 3" to 6" soil depth and can increase the roof load by 20-35 lbs per sq ft.

### Additional Information

Maine Stormwater Management Design Manual Chapter 7.6 Vegetated Roofs



## Who to Contact

### Westbrook Staff:

#### Public Services—(207) 854-0660

Lynn Leavitt, Sustainability Coordinator, lleavitt@westbrook.me.us

Eric Dudley, City Engineer, edudley@westbrook.me.us

Katherine Kelley, Assistant City Engineer, kkelley@westbrook.me.us

#### Planning & Code Enforcement—(207) 854-0638

Jennie Franceschi, City Planner, jfranceschi@westbrook.me.us

Rebecca Spitella, Assistant City Planner, rspitella@westbrook.me.us



Bioretention. Image credit: Philadelphia Water Department

## Information for Developers

### United States Environmental Protection Agency (EPA) website:

<https://www.epa.gov/green-infrastructure>

### City of Portland, Oregon Stormwater Management Manual 2016:

<https://www.portlandoregon.gov/bes/64040>

### Maine Stormwater Management Manual Volume 3 BMP Technical Design Manual and Chapter 10 Low Impact Development Practices:

<https://www.maine.gov/dep/land/stormwater/stormwaterbmps/vol3/chapter10.pdf>

Horsley Witten Group. 2007. **LID Guidance Manual for Maine Communities: Approaches for Implementation of Low Impact Development Practices at the Local Level:** [https://www.maine.gov/dmr/mcp/downloads/nonpoint/MaineLID\\_Guidance\\_Manual\\_RevisedJune2011.pdf](https://www.maine.gov/dmr/mcp/downloads/nonpoint/MaineLID_Guidance_Manual_RevisedJune2011.pdf)

## Information for Homeowners

McCarthy, Jillian, and Lisa Loosigian. 2016. **"New Hampshire Homeowner's Guide to Stormwater Management Do-It-Yourself Stormwater Solutions."** Manual, New Hampshire Department of Environmental Services.

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[https://extension.unh.edu/resources/files/Resource005899\\_Rep8265.pdf](https://extension.unh.edu/resources/files/Resource005899_Rep8265.pdf)

University of Vermont Extension. n.d. **"The Vermont Rain Garden Manual"** "Gardening to Absorb the Storm".

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