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

Photo credit: Clarion Associates. USEPA.

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

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 Measures and Techniques

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

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

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
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

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

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

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

**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

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**Infiltration Trench and Drywell**

**Description**
A soaking 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
**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**

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**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
# 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 other applications.

**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

# 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

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Bioretention

**Description**
Landscaped depressions that collect runoff in a vegetated soil medium, where water infiltrates back into the ground, is absorbed by plants, evaporates, 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 native vegetation.

**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
<table>
<thead>
<tr>
<th>Permeable/Porous Pavement and Pervious Pavers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Permeable/porous pavement is a special asphalt or concrete that allows water to permeate through it.</td>
</tr>
<tr>
<td>Pervious pavers are paving blocks with space between the blocks to allow stormwater infiltration into the ground.</td>
</tr>
<tr>
<td><strong>Conditions Suited For</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>Additional Information</strong></td>
</tr>
<tr>
<td>Maine Stormwater Management Design Manual Chapter 7.7 Manmade Pervious Surfaces</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eco-Roofs or Green Roofs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Roofs that are partially or completely covered with vegetation and soil. Can be intensive or extensive.</td>
</tr>
<tr>
<td><strong>Conditions Suited For</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>Additional Information</strong></td>
</tr>
<tr>
<td>Maine Stormwater Management Design Manual Chapter 7.6 Vegetated Roofs</td>
</tr>
</tbody>
</table>
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
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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


Information for Homeowners


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