City of Duvall
Washington

Homeowner's Guide to Low Impact Development Best Management Practices

A Guide to Design, Installation, and Maintenance

March 2015

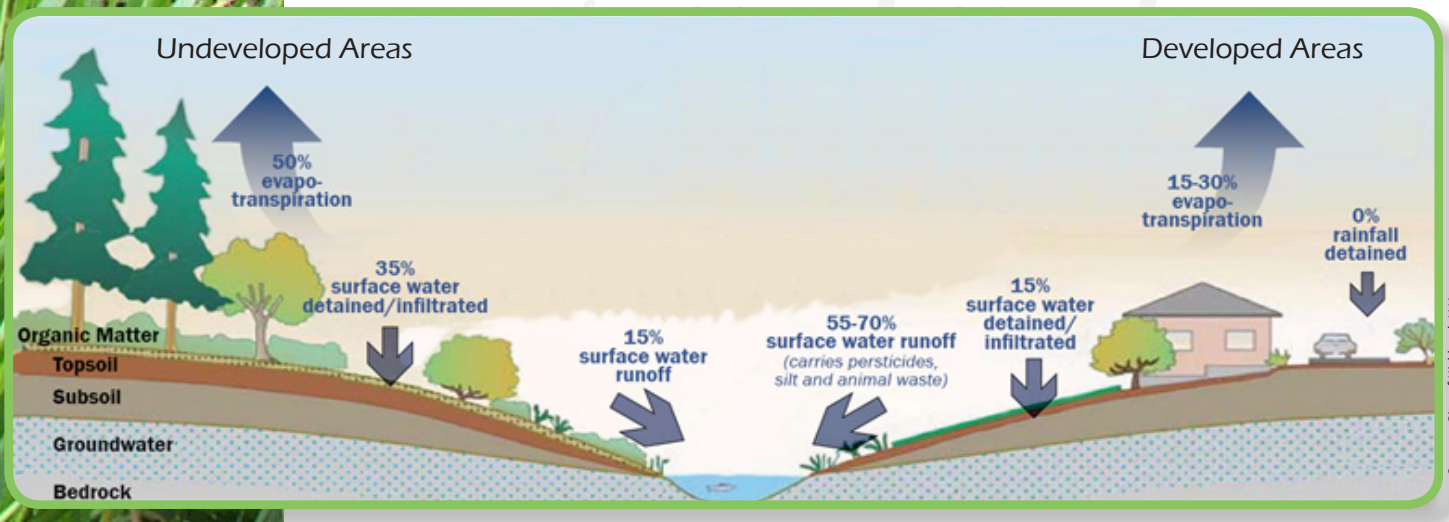
What is Low Impact Development?

Low Impact Development (LID) refers to stormwater and land use management practices that mimic natural hydrologic processes by promoting infiltration, evapotranspiration, water storage and filtration, and conservation of natural landscape features and vegetation. LID Best Management Practices (BMPs) manage and treat stormwater runoff close to its source to moderate the runoff volume reaching streams, prevent erosion, recharge groundwater aquifers, and maintain the health of stream, wetlands and other waterbodies.

Using LID BMPs on residential lots reduces the amount of precipitation running off as stormwater and improves water quality, which allows public stormwater facilities to work more effectively to protect streams and wetlands.

Why use Low Impact Development BMPs?

In developed areas like Duvall, hard (impervious) surfaces such as buildings, parking lots, and streets replace areas that historically stored and infiltrated precipitation. Precipitation runs off of impervious surfaces as storm water, gets collected in stormwater pipes, and is conveyed to detention facilities or discharged directly to a stream. Unless this stormwater is properly managed, it contributes to high flow rates in streams during storms. High flow rates increase flooding and destabilize stream banks, threatening homes, roads, utilities, and other important infrastructure. High flows also damage stream habitat, making conditions less suitable for fish spawning, rearing and migration. Additionally, stormwater runoff can pick up pollutants from impervious surfaces and carry them directly to the stream, degrading water quality.



Source: City of Kirkland, WA

Integrating LID BMPs into developed areas restores some of the natural hydrologic functions resulting in better water quality, reduced flooding, and reduced stream erosion.

Low Impact Development on Your Property

This booklet is organized into three basic steps intended to provide guidance for the use of LID BMPs on a residential lot.

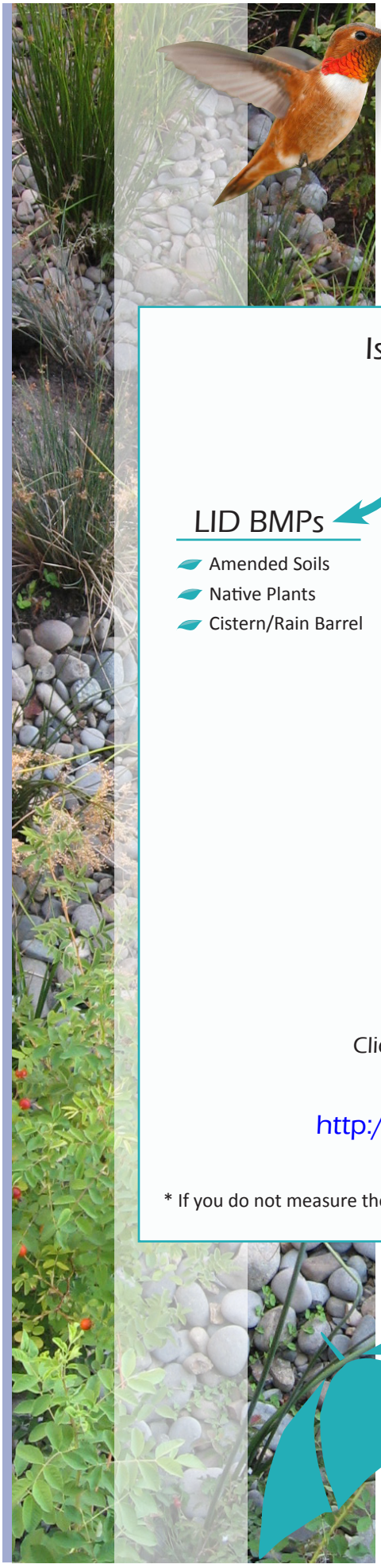
1. **Assess your property**
2. **Select an LID BMP**
3. **Design, install, and maintain your LID BMP**

1) Assess Your Property

Site planning is an integral part of implementing LID BMPs. To identify the approrpiate BMPs for your property, it is important to assess natural characteristics and built infrastructure. The first step is to draw a map of the existing features on your property. Common site characteristics to consider are described in the table below.

PROPERTY ASSESSMENT

Characterize Soils	Identify locations where soils may be contaminated by past activities such as oil or lead paint. Areas with contaminated soils are not suitable for LID BMPs. Identify locations with high groundwater. Avoid areas where winter ponding occurs.
Locate Existing Trees	Locate mature trees. Consult an arborist if the LID BMP will be located within the drip line of an existing tree to determine if the LID BMP will destabilize or otherwise adversely affect the health of the tree.
Streams and Wetlands	Construction near streams and wetlands may require additional considerations and permits. Consult a natural resource scientist if you think you will need to do work within or adjacent to a stream or wetland.
Identify Stormwater Flow Patterns and Impervious Areas	Draw a diagram of flow directions. Identify locations where surface runoff leaves your property.
Map Setbacks	LID BMPs should be at least 10 feet from structures and 5 feet from property lines where the adjacent property is down slope.
Locate Utilities	Locate existing utilities such as electric, water, sewer, and gas lines that run underground. Call 811 to have utilities located with spray paint on your site.



2) Select an LID BMP

Once you have completed your property assessment, follow the flow diagram to determine which LID BMPs are suitable on your property.

Is your property located in a steep slope hazard area?

Yes

LID BMPs

- Amended Soils
- Native Plants
- Cistern/Rain Barrel

No

Is the infiltration rate at least 0.5 inch per hour?* (infiltration test on next page)

No

LID BMPs

- Amended Soils
- Native Plants
- Cistern/Rain Barrel
- Rain Garden
- Dispersion

Yes

LID BMPs

- Amended Soils
- Native Plants
- Cistern/Rain Barrel
- Rain Garden
- Dispersion
- Pervious Pavement/Pavers
- Gravel Trench

Click here for a Landslide and Erosion Hazard Area Map to determine whether your home is in a hazard area:

http://www.duvallwa.gov/DocumentCenter/View/110

* If you do not measure the infiltration rate, assume soil will not infiltrate 0.5 inch/hour.

SOIL INFILTRATION TEST

The next step to selecting appropriate LID BMPs is to determine your soil infiltration rate. You can measure the soil infiltration rate using an Open Pit Infiltration Test.

Steps for an Open Pit Infiltration Test:

1. Dig a hole to the depth where the bottom of the LID BMP will be located. This can be done by hand using a shovel, auger or post-hole digger. Ideally this should be done when groundwater levels may be high (such as spring).

2. Fill the hole with water to a height of about six inches from the bottom of the hole or to one-half the maximum depth of the proposed facility (whichever is greater), and record the exact time.

3. Check the water level at regular intervals (at least 4 times) until all the water has infiltrated. Record the distance the water has dropped from the top edge of the hole for each time interval.

4. Calculate time interval, drop in water level and infiltration rate for each interval. The infiltration rate for the hole is the average of all individual infiltration rates.

$$\text{Infiltration rate} = \frac{\text{drop in water level}}{\text{time interval}} \times \text{time conversion}$$

$$\textit{for example:} \quad \frac{0.6 \text{ in}}{20 \text{ min}} \times \frac{60 \text{ min}}{\text{hr}} = 1.8 \text{ in/hr}$$

5. Repeat this process two more times, for a total of three rounds of testing. These tests should be performed as close together as possible to assess the soils ability to infiltrate while saturated.

STEP 1. Dig a hole

STEP 2. Fill the hole with water

STEP 3. Record the water level at regular time intervals

Robert Emanuel

LID BMP Options for Residential Development

Once you have determined which LID BMPs are suitable for your property, select the LID BMP(s) that best meet your personal aesthetic, budget, and environmental stewardship goals.

LID BMP	Description	Photo
Amended Soils	Amending soil restores the health and function of disturbed soils. Amending soils reduces the amount of runoff from landscaped areas. Two common materials for amending soil are: 1) Native topsoils, stockpiled and reapplied (amendment with some imported topsoil may be necessary) 2) Imported topsoil (Pacific Topsoils, Topsoils Northwest, or other approved source)	 *ESA*
Native Plants	Native plants intercept and transpire precipitation. They are adapted to the northwest climate thus often reduce the need for summer irrigation and use of fertilizer, pesticides, and herbicides. Some common and useful native plants for Duvall include vine maple, Pacific Dogwood, bitter cherry, oceanspray, tall Oregon Grape, bald hip rose and snowberry. Extensive plant lists are available in the Rain Garden Handbook for Western WA.	 *King County*
Cistern/Rain Barrel	Rain barrels and cisterns collect runoff and store it for re-use. They reduce peak runoff rates and can be used to offset summer irrigation needs. *Capacity - limited.	 *SPU*
Rain Garden	Rain gardens store and filter runoff from adjacent developed surface areas; this improves water quality and also reduces peak runoff rates.	 *ESA*

LID BMP	Description	Photo
Dispersion	Dispersing runoff from roofs or adjacent impervious areas; improves water quality and reduces peak runoff rates. *Cost effective if you have a small impervious area and a large greenspace that infiltrates.	 *Clark County*
Pervious Pavement / Pavers	Pervious pavements and pavers allow precipitation to soak into the ground. This improves water quality and reduces peak runoff rates. *Appropriate where infiltration rates are high enough that ponding does not occur.	 *SPU*
Gravel Trench	Gravel trenches allow precipitation to soak into the ground. This improves water quality and reduces peak runoff rates. *Appropriate where infiltration rates are high enough that ponding does not occur.	 *SPU*

3) Design, install, and maintain your LID BMP

Specific detailed information about proper design, installation and maintenance of the LID BMPs recommended in this booklet can be found in the attached fact sheets or the Rain Garden Handbook. The Rain Garden Handbook for Western Washington can be obtained from the Department of Ecology's website at: https://fortress.wa.gov/ecy/publications/publications/1310027.pdf. The fact sheets are also available online or for pick up at city hall.

Additional Resources

King County's Native Plant Guide Website– includes lookup tools, customizable plant lists, sample landscaping plans and more resources to "create your own native plant landscape". Available at: https://green2.kingcounty.gov/gonative/Index.aspx.

12,000 Rain Gardens in the Puget Sound – a collaboration between Stewardship Partners and WSU to provide free rain garden education workshops to homeowners, as well as other resources. Available at: http://www.12000raingardens.org/.

RainWise Program Website – Seattle Public Utilities resources for managing rainwater at your home. Available at: http://www.seattle.gov/util/MyServices/DrainageSewer/Projects/GreenStormwaterInfrastructure/RainWise/index.htm.

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The City of Duvall is committed to Low Impact Development.