6 Integrated Management Practices

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Specifications for:
- Bioretention areas
- Amending construction site soils
- Permeable paving
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- Minimal excavation foundations
- Roof rainwater collection systems

Integrated management practices (IMPs) are the tools used in a low impact development (LID) project for water quality treatment and flow control. The term IMP is used instead of best management practice or BMP (used in a conventional development) because the controls are integrated throughout the project and provide a landscape amenity in the LID design.

6.1 Bioretention Areas

The bioretention concept originated in Prince George’s County, Maryland in the early 1990s and is a principal tool for applying the LID design approach. The term bioretention was created to describe an integrated stormwater management practice that uses the chemical, biological, and physical properties of plants, microbes, and soils to remove, or retain, pollutants from stormwater runoff. Numerous designs have evolved from the original application; however, there are fundamental design characteristics that define bioretention across various settings.

Bioretention areas (also known as rain gardens) are:
- Shallow landscaped depressions with a designed soil mix and plants adapted to the local climate and soil moisture conditions that receive stormwater from a small contributing area.
- Facilities designed to more closely mimic natural conditions, where healthy soil structure and vegetation promote the infiltration, storage, and slow release of stormwater flows.
- Small-scale, dispersed facilities that are integrated into the site as a landscape amenity.
- An IMP designed as part of a larger LID approach. Bioretention can be used as a stand-alone practice on an individual lot, for example; however, best performance is achieved when integrated with other LID practices.

The term bioretention is used to describe various designs using soil and plant complexes to manage stormwater. The following terminology is used in this manual:
- Bioretention cells: Shallow depressions with a designed planting soil mix and a variety of plant material, including trees, shrubs, grasses, and/or other herbaceous plants. Bioretention cells may or may not have an under-drain and are not designed as a conveyance system.
• Catch basin: Catch basins can be used to slowly release water to the bioretention area through a grate for filtering coarse material.

Woody plants can restrict or concentrate flows and can be damaged by erosion around the root ball and should not be placed directly in the entrance flow path (Prince George’s County, 2002).

Ponding area

The ponding area provides surface storage for storm flows, particulate settling, and the first stages of pollutant treatment within the cell. Pool depth and draw-down rate are recommended to provide surface storage, adequate infiltration capability, and soil moisture conditions that allow for a range of appropriate plant species (Prince George’s County, 2002).

• Maximum ponding depth: 12 inches recommended.
• Surface pool drawdown time: 24 hours recommended.
• Soils must be allowed to dry out periodically in order to:
  o Restore hydraulic capacity to receive flows from subsequent storms.
  o Maintain infiltration rates.
  o Maintain adequate soil oxygen levels for healthy soil biota and vegetation.
  o Provide proper soil conditions for biodegradation and retention of pollutants. (Ecology, 2001)

Under-drain

The area above an under-drain pipe in a bioretention area provides detention and pollutant filtering; however, only the area below the under-drain invert and the bottom of the bioretention facility can be used in the WWHM for flow control benefit (see Chapter 7 for bioretention area flow control credits). Under-drain systems (see Figure 6.1.12) should be installed only when the bioretention area is:

• Located near sensitive infrastructure (e.g., unsealed basements) and potential for flooding is likely.
• Used for filtering storm flows from gas stations or other pollutant hotspots (requires impermeable liner).
• In soils with infiltration rates that are not adequate to meet maximum pool and system dewater rates.

The under-drain can be connected to a downstream open conveyance (bioretention swale), to another bioretention cell as part of a connected treatment system, daylight to a dispersion area using an effective flow dispersion practice, or to a storm drain.
Filter materials

Gravel blankets and filter fabrics buffer the under-drain system from sediment input and clogging. Properly selected for the soil gradation, geosynthetic filter fabrics can provide adequate protection from the migration of fines. Aggregate filter blankets, with proper gradations, provide a larger surface area for protecting under-drains and are preferred.

Suggested specifications for filter materials include:

1. For use with heavy walled slotted pipe (see under-drain specification above):
   - Type 26 mineral aggregate (gravel backfill for drains, city of Seattle)

<table>
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<tr>
<th>Sieve size</th>
<th>Percent Passing</th>
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<tbody>
<tr>
<td>¾ inch</td>
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<tr>
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</tbody>
</table>

   - Place under-drain on a 3-foot wide bed of the Type 26 aggregate at a minimum thickness of 6 inches and cover with Type 26 aggregate to provide a 1-foot minimum depth around the top and sides of the slotted pipe.

2. If proper gradation and/or slotted pipe are not available and perforated PVC or flexible HDPE pipe is used:
   - The under-drain pipe should be placed on a 3-foot wide bed of ½ to 1½-inch drain rock (ASTM No. 57 aggregate or equivalent) at a minimum thickness of 3 inches, and covered with 6 inches of No. 57 aggregate.