Guidance
Low Impact Development (LID)

LID is a process of developing land that mimics the natural hydrologic regime. LID begins at the design phase of a new development or redevelopment, incorporating planning techniques that minimize site clearing and impervious surfaces to reduce impact and stormwater runoff generated from the site. By reducing the volume of water leaving a site, the pollutant loading is also reduced. Other techniques that will reduce the volume and peak flow rates of runoff from the development are then incorporated throughout the site. LID is an effective tool that reduces pollutant loading, thermal impacts, stream flows, and minimizes stream channel erosion.

LID is not a rigid set of standards, or a one size fits all approach and has many benefits:

- **Benefits to the Developer:** The owner and developer will see reduced costs for land clearing and grading, infrastructure, and stormwater management while seeing an increased aesthetic value in the development.
- **Benefits to the Municipality:** The local government and community will benefit from reduced infrastructure maintenance costs and reductions in property damage from flooding, while having more green space, protected natural resources, and increased water quality.
- **Benefits to the Environment:** The hydrologic cycle is preserved; streams are less prone to erosion, and stream flows are maintained which benefits fish and wildlife.

LID goals and objectives shall be incorporated into the site planning process as early as possible. The following steps serve as a guideline to use in the planning stage:

- Identify and preserve areas that will affect the hydrology of the site. Features that should be protected are sensitive areas and natural resources including down gradient waterways.
- Minimize site disturbance and impervious areas with an alternative layout for the development within the constraints of local development criteria.
- Minimize the impervious surfaces directly connected to drainage conveyance systems to reduce the time of concentration.
- Break the site into smaller drainage areas that can be handled using basic LID techniques.

PLANNING FOR LID

Minimize Site Clearing: Development typically involves new impervious surfaces such as roads and buildings, and landscaped areas for lawns. Avoid developing soils with high permeability where possible. Protect areas that are sensitive to disturbance and that will sustain groundwater recharge and reduce runoff. For example, developing a vegetated, tight clay soil area will have less impact on stormwater runoff than developing a forested area on sandy soils. Once the sensitive areas have been identified, the layout of the development should be aligned with the conservation of these areas.

Minimize Impervious Areas: The traffic distribution network (roadways, sidewalks, driveways, and parking areas) is generally the greatest source of site imperviousness and should be the focus for reducing impervious area. The following techniques may be considered, where appropriate and permitted by local land use codes and/or ordinances:

Alternative Roadway Layout: Alternative roadway layouts can be used to reduce total pavement, while allowing for the same amount of development. Cluster development, in accordance with and as allowed by local ordinances can decrease imperviousness.

- *Narrow Road Sections:* The width of pavement can be reduced by including the primary driving surface, a pervious base for the shoulders, and ditch drainage swale in place of curb and gutter as deemed appropriate. Use of this technique should be evaluated in accordance with site-specific conditions.
- *Sidewalks:* Sidewalks can be reduced to one side of the road or eliminated. The use of pervious materials can reduce runoff.
- *On-Street Parking:* Reduction to one side or elimination of on-street parking has significant potential to reduce overall site imperviousness. On- street parking may be a desirable practice in highly urbanized areas to reduce on-site disturbance.
- *Rooftops:* The number and size of buildings dictates the impervious area associated with rooftops. Vertical construction and/or the use of green roofs can minimize imperviousness.
- *Driveways:* Minimizing paved or impervious driveway area can be accomplished through the design of narrower driveways or by reducing the length of driveways. Shared driveways can also reduce imperviousness, where appropriate. In addition, the use of pervious materials can minimize runoff.

Minimize Connected Impervious Areas: The impacts from impervious surfaces can be minimized by disconnecting these areas from piped drainage networks and by managing runoff at the source.

- Paved driveways and roads can be directed to stabilized, vegetated areas.
- Flows from large, paved surfaces can be broken up to facilitate on-site management of smaller flows. Breaking flows up allows the flows to be directed to vegetation as sheet flow.
- LID techniques can be dispersed throughout the development, such as at individual houselots to obtain the most benefit. They can be incorporated into the landscaping of the property to provide a natural treatment system.

Maintain Time of Concentration: When development occurs, the time of concentration (Tc) is often shortened due to the impervious area, causing greater flows over a shorter period of time. LID practices can maintain the pre-development Tc by:

- Minimizing land disturbance,
- Detaining flows on site,
- Increasing the flow length,
- Increasing the surface roughness of the flow path,
- Creating flatter slopes, and/or
- Disconnecting impervious areas, which will decrease their travel rates.

Manage Stormwater at the Source: The impact from a development can be mitigated atthe source by reestablishing a more natural hydrologic cycle that sustains a clean stream base flow. Typically, the most economical and simplistic stormwater management strategy is achieved by controlling runoff at the source with a variety of small treatment structures that will result in the reduction of stormwater discharge and more flexibility in the site design.

Soil Considerations:

Minimize Compaction: Compaction reduces the natural infiltrating ability of soils; thus, avoiding disturbance by heavy equipment can benefit infiltration. Designing development to situate impervious surfaces and development disturbances on the more impermeable soils of a site can leave more pervious soils to continue infiltrating runoff.

Increase Organic Content of Soils: When constructing many of the LID vegetated techniques, such as filtration Best Management Practices (BMP), a quality topsoil can optimize pollutant removal. In this case, the soil bed should consist of organic content as described in the relevant filtration BMP. This highly organic layer traps contaminants, absorbs more runoff and provides a medium for biological activity that helps break down pollutants. Planting soil provides a healthy growing medium for vegetation by encouraging strong root growth. In addition, microbes found in healthy soils transform nutrients for plant growth. Compost or other organic amendments can be added at the site preparation level, typically by the truckload. It is also available for little or no cost from many community leaf compost programs. For rain gardens and bioretention areas, organic content can also be valuable in absorbing and retaining moisture for plant life, filtering pollutants, and providing an active layer for microorganisms to reside and reproduce. A healthy microorganism population is key to the decomposition of many pollutants, whether in the home rain garden or in a parking lot.

- *Avoid Pesticides/Herbicides:* Healthy soil is alive with microorganisms that decompose and inactivate pollutants, but these may be killed by excessive chemicals. Although the soil microorganisms are not typically the target of these chemicals, many of them may fall victim to the use of pesticides. Additionally, insect species that prey on pests are also killed by pesticides. Since the predatory species tend to have slower reproduction than the pest species, a natural defense against insect pests may be lost.

LID TECHNIQUES

Many LID techniques rely on infiltration, retention, and evapotranspiration of stormwater to reduce runoff. When infiltration is not a possibility, the initial planning techniques described above should be the primary focus, followed by the use of small disconnected underdrained systems that rely on soil and vegetation to retain runoff. Examples of LID measures and techniques are shown on Table 1.

- *Filters (Bioretention Cells and Rain gardens):* Bioretention areas or rain gardens are built with a specific soil filter media (containing organic material and planted with vegetation that can handle wet and dry conditions) that will reduce the volume of runoff through absorption and evapotranspiration. A slight depression allows the ponding of stormwater as it filtrates through the soil media and into the groundwater or to an underdrain for surface discharge.
- *Infiltration:* Infiltration reduces runoff and mimics the natural hydrologic cycle by redirecting water into the ground rather than to a piped system. Runoff can be reduced by using smaller infiltration basins that fit into the natural landscape.
- *Buffers:* Vegetated buffers use soils and vegetation to remove pollutants from stormwater. Buffers can be used as a stormwater BMP for small developments by minimizing the amount of runoff generated through infiltration and evapotranspiration. Filter strips are typically used as pretreatment devices for bioretention cells and other infiltration practices.
- *Collection Cisterns:* In a commercial setting, the collection of rain runoff can be put to use in the building to off-set the cost of water supply. Cisterns can be located either above or below ground, and in out-of-the-way places that can easily be incorporated into a site design. Commercially available systems are typically constructed of high-density plastics and can include pumps and filtration devices. Rain barrels are inexpensive, effective, and easily maintainable when used in residential applications to capture roof runoff for later watering of lawns and gardens.
- *Vegetated Rooftops:* Vegetated rooftops provide three primary benefits: attenuation of stormwater runoff and peak flows, reductions of the heat island effects with an increase in building insulation, and a longer life expectancy for the base roof material. The stormwater benefit is that the smaller more common storm events are absorbed, which minimizes peak runoff and the net volume of runoff typically produced by roofs.

- *Porous Pavement:* Porous pavement is a permeable surface (pervious asphalt, concrete or pavers), a granular base, and subbase materials which allow the penetration of runoff into the underlying soils. The efficiency of pavement alternative systems depends on whether the pavement is designed to store and infiltrate most runoff, or only limited volumes of runoff (e.g., "first-flush") with the remainder discharged to a storm drainage system or overland flow. Maintenance is essential for long-term use and effectiveness. Pavement alternatives vary in load bearing capacities but generally can be designed for low traffic areas such as sidewalks, parking lots, overflowparking and residential roads. It is important to choose a material appropriate for the desired use (light, moderate or heavy use).
- *Other Techniques:* LID is about creativity. Multiple practices can be implemented and adapted into various sites and situations. However, they are mostly dependent upon the layout of the development and the disconnection of its individual elements.

<table>
<tr><th colspan="3">Table 1 – LID Measures and Techniques*</th></tr>
<tr><th>LID Measure</th><th>Example Technique</th><th>Design</th></tr>
<tr><td>Minimize site clearing</td><td>• Promote compact development on the site
• Place parking underneath or inside structures
• Avoid developing in areas with high-permeable soils to retain natural infiltration
• Align development layout with conservation of sensitive areas</td><td></td></tr>
<tr><td>Protect natural drainage system</td><td>• Maintain a minimum 25 foot buffer on all natural water resources including intermittent channels
• Do not divert stormwater from its natural sub-watershed</td><td rowspan="3">Design practices developed at the planning phase that will help mitigate environmental impacts. Ideally, these are cost-effective and environmentally friendly.</td></tr>
<tr><td>Minimize the decrease in time of concentration</td><td>• Break up or disconnect the flow of runoff over impervious surfaces
• Sheet flow over pavement that is less than 100 feet</td></tr>
<tr><td>Minimize impervious area or the effect of impervious area</td><td>• Build vertically with multi story buildings and parking garages
• More than 25% of pavement area (overflow) in pervious pavement. All pedestrian walkways are pavers or pervious pavement.
Runoff from paved surfaces should be directed to stabilized, vegetated areas
• Disperse LID techniques throughout development and incorporate into the landscaping
• Infiltrate as much roof runoff as standards allow
Minimize the use of paved areas (sidewalks, driveways and streets)
Minimize the use of hardscaped areas.</td></tr>
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Table 1 – LID Measures and Techniques*		
LID Measure	**Example Technique**	**Design**
Minimize soil compaction	✓ Minimize the construction window and target the development area ✓ Rototilling all areas to be revegetated	Design practices developed at the planning phase that will help mitigate environmental impacts. Ideally, these are cost-effective and environmentally friendly.
Minimize lawns and maximize landscaping that encourages runoff retention	✓ Low maintenance Maine native plants ✓ No invasive plants ✓ Limit the use of pesticides and biocides ✓ Fertilizer application only during initial planting and repair of damaged areas.	
Provide vegetated open-channel conveyance systems	✓ Evaluate road gutters and roof gutters to determine effective means to direct runoff to treatment BMPs ✓ Level spreaders to buffers where possible ✓ Underdrained swales	
Rainwater is stored for later reuse for the building or landscape	Rain Collection Cisterns	
Stormwater Quality Treatment and Retention Requirements	Buffers	Design, size, install and maintain per the Maine recommended guidelines found in a document *entitled Maine Stormwater Management Design Manual, Technical Design Manual, Volume III, May 2016*
	Infiltration (basins, trenches, dry wells, etc.)	
	Underdrained grass filters	
	Underdrained filter bioretention	
	Roofline filtration	
	Roof Greening	
	Pervious Pavement	

*LID measures, example techniques and design practices in this table are intended to be illustrative and shall be taken into consideration where applicable, practicable and allowable pursuant to applicable land use planning and development requirements.