2.1 Reduction of Impervious Areas

Description

Impervious area is the largest cause of increased stormwater runoff as a result of development. Any type of surface that does not allow water to penetrate it is considered impervious. Impervious areas do not allow precipitation to infiltrate into the ground or be absorbed by vegetation, thus increasing the quantity of stormwater runoff and all of its associated problems. Impervious areas consist of asphalt or concrete used in roads, parking lots, drive ways, sidewalks and roofs.

Condition Where Practice Applies

Almost every development project includes the construction of some type of impervious surface, which will contribute to the increase in stormwater runoff. Opportunities to reduce the amount of impervious area exist on practically every project.

Planning Considerations

Although the developers have the ability to incorporate alternative designs that reduce the amount of impervious area in their project, it is the local-governmental agency(ies) that will actually determine what can and will be used. It is in the best interest of communities to allow some alternative design options, especially with Phase II stormwater regulations.

- *Parking Lots*

  Local community officials may change or modify the zoning ordinance pertaining to parking lots. The number of required parking spaces can be reduced.

"Green space" can be added to or increased within the parking lot. Additional overflow parking can utilize non-paved areas. The minimum number of trees required in parking lots can be increased. Some types of grass reinforcement can be used to provide maintenance and emergency access instead of traditional hard surfaces.

- ***Decrease Pavement Connectivity***

  Another proven method to reduce and slow down stormwater runoff is to provide breaks in the connectivity of pavement. Instead of having large paved areas, provide a grass area for water to flow to and then into the storm sewer system. This slows down runoff, and provides other environmental benefits.

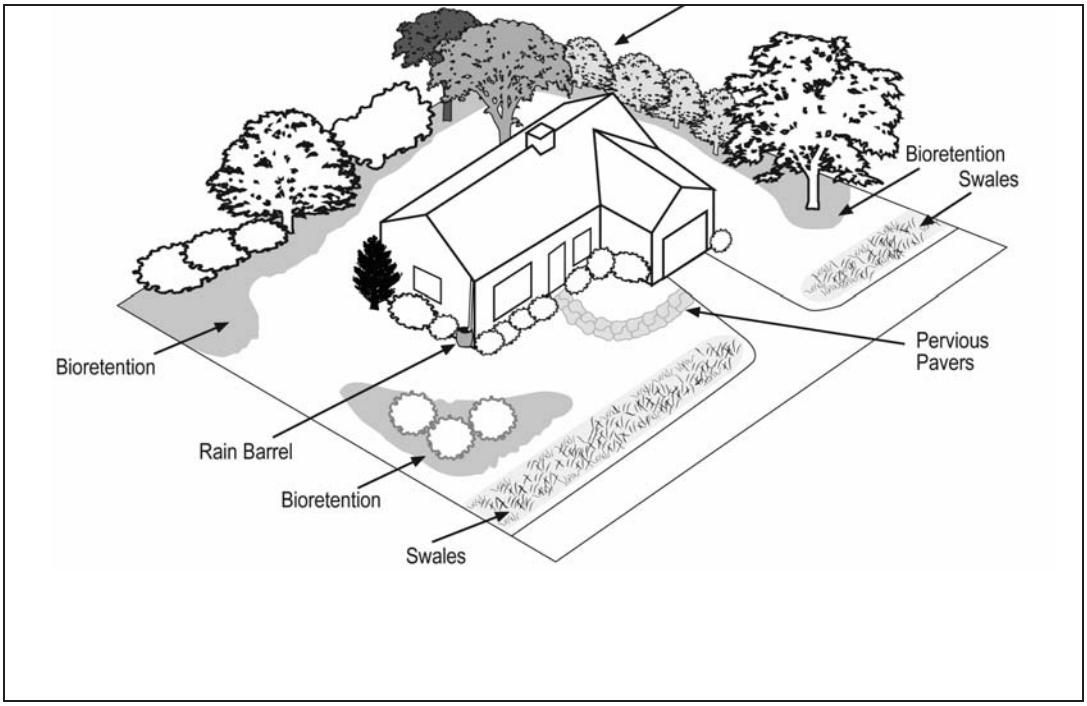
- ***Sidewalks***

  The width of sidewalks may be reduced to reduce the amount of impervious area. Or some type of stepping stones can be used as a walk way. Pavers with permeable bases allow water to infiltrate between the individual stones, instead of increasing runoff.

- ***Buildings***

  Buildings can also be designed to reduce the amount of impervious area. Instead of having a large floor plan, buildings can be built higher reducing the amount of impervious area added by its roof. The amount of runoff created by its roof can be reduced by using a "green" roof. These are typically planted with grass, ground cover, and even small trees and bushes. They are very popular in large cities where land is not available. Green rooftops can serve as a park-like setting open to the people in the building. They may also be used solely to provide stormwater benefits. However, if there is flexibility in the local and state codes that permit green roofs, few developers will proceed with the concept. Once again it would be in the community's best interest to include green roofs as an acceptable design alternative in their standards.

2.2 Low Impact Development



Description

Low-impact development (LID) is a site design approach, which seeks to integrate hydrologically functional design with pollution prevention measures to compensate for land development impacts on hydrology and water quality. LID's goal is to mimic natural hydrology and processes by using small-scale, decentralized practices that infiltrate, evaporate, detain, and transpire stormwater. LID stormwater controls are uniformly and strategically located throughout the site.

LID is achieved by:

- Minimizing stormwater runoff impacts to the extent practicable through preservation of existing landscape features and their hydrologic functions.
- Maintaining predevelopment time of concentration through strategic routing of flows using a variety of site design techniques.
- Dispersing runoff storage measures through a site's landscape through the use of a variety of detention, retention, and runoff practices.

LID practices manage stormwater at its source. LID measures reduce impervious cover, minimize disturbance, preserve and recreate natural landscape features, increase hydrologic disconnects and facilitate infiltration and detention opportunities. LID creates a multifunctional landscape which relies on natural features and processes and emphasizes simple, nonstructural, low-tech methods.

Conditions Where Practice Applies

LID can be used in a broad range of land use situations. Due to maintenance considerations, LID may be most appropriately utilized on institutional, industrial, commercial and governmental developments. However, LID in tandem with conventional stormwater control features can be successfully integrated into any development. LID has been demonstrated to work in new developments and constrained sites involving urban infill or retrofit to reduce combined storm sewer inflows.

Planning Considerations

LID is a design approach and represents a collection of stormwater management practices that may be utilized together to manage stormwater. LID measures are often used as a supplement to conventional stormwater practices to meet the state critical storm criteria and provides post construction water quality benefits.

Nine steps in the LID Site Planning Process.

1. Determine the applicable zoning, land use, and subdivision regulations,
2. Define development envelope (total areas that affect hydrology on site),
3. Use drainage/hydrology as a design element,
4. Reduce total site impervious areas,
5. Integrate preliminary site layout plan,
6. Minimize directly connected impervious areas,
7. Modify/increase drainage flow patterns,
8. Compare pre and post development hydrology and identify Integrated Management Practices (IMP's),
9. Complete LID site plan.

The LID principals are designed to minimize disturbance and manage the stormwater as close to its source as possible. Specific low impact development controls called Integrated Management Practices (IMP's) are tools for developers to utilize to manage stormwater at its source rather than relying solely on centralized BMP's such as detention basins. Common IMP's are detailed below under Design Criteria. Each IMP will have specific planning considerations; however the following details several of the common planning considerations.

- **Clay Soils:** Higher proportions of clay particles in the soil (greater than 27%) will reduce the effectiveness of infiltration-based measures and require greater use of surface depression measures.
- **High Water Table:** High water table, even high seasonal water tables, may restrict the use of some IMP's. Provide at least 2 to 4 feet of separation between the bottom of the IMP and the top of the seasonally high water table elevation. On-site soil evaluation by a qualified professional is highly recommended.
- **Building Foundation and Structures:** IMPs should not be located near foundations of buildings or other structures.
- **Deed Restrictions:** Maintaining distributed depression storage measures within residential subdivisions will require deed restrictions on individual parcels as well as homeowner education programs to ensure measures are maintained.

- **Zoning Variances:** Variances from zoning, subdivision, building, stormwater management, and drainage regulations may be required unless LID is permitted.
- **Snow:** Snowbelt areas of Ohio may find that parking lot LID measures will need to consider snow storage and the effects of road salt on plant material.
- **Design Costs:** Up-front design costs may increase over design of conventional stormwater management approaches due to the need to "fingerprint" the site and complete microscale design of the integrated management practices. However, construction and maintenance costs often decrease.
- **Public Health:** Public health concerns exist about West Nile Virus and other mosquito borne diseases. Brackish water pools may serve as the breeding ground for the mosquitos that carry West Nile Virus. Proper design and construction of stormwater management facilities are necessary to minimize or eliminate this issue.
- **Maintenance Access:** Easements may be necessary to give the community access for maintenance on IMPs.
- **Contractor Guarantees:** Obtaining contractor guarantees for some integrated management measures may not be possible due to lack of standard construction and material specifications.
- **Public Education:** Public education materials are essential for long term management of IMP's.

LID is a relatively new approach to stormwater management in the U.S and has not been used extensively in Ohio because of historic focus on water quality control, climatic factors, lack of regional design standards and cost. However, many of the IMPs, including bioretention, vegetated swales, filter strips and porous pavers, have been utilized individually. LID may also be an important tool to reduce the effects of land use changes near ecological sensitive areas.

Design Criteria

The goal of LID is to mimic the predevelopment hydrology through runoff volume control, peak runoff rate control, flow frequency/duration control, and water quality control. To effectively manage stormwater using LID, the developer must define the hydrologic control (runoff, groundwater recharge, infiltration), evaluate the site constraints (slopes, soils), evaluate and select IMP's that are appropriate considering the hydrologic scheme and site constraints. The addition of some conventional controls may be necessary to complete the stormwater management scheme for the developed site.

See other sections of the Rainwater and Land Development Manual for applicable design criteria on grassy swales, and bioretention. There is no limit to the number of IMP's which may be implemented as part of a low impact development.

Some additional integrated management practices include:

- Biofiltration
- Dry Wells
- Filter/Buffer Strips
- Vegetated Swales
- Cistern & Rain Barrels
- Infiltration Trench
- Green Roof
- Wetland Channels
- Soil Amendment
- Impervious Surface Reduction

Pervious Paver installation

Bioretention

Maintenance

LID may be most appropriately used in institutional, industrial, commercial and governmental developments, as these facilities are more likely than residential developments to receive maintenance on LID features over residential developments. When maintenance is required, additional easements may be necessary to facilitate maintenance access. In residential developments the landowners or homeowners association are often responsible for any required maintenance. Regular inspections, by or for the responsible party, must be completed to ensure LID and conventional stormwater control features continue to operate properly.

Plans and Specifications

See other sections of the Rainwater and Land Development or the resources below for applicable specifications for integrative management measures.

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