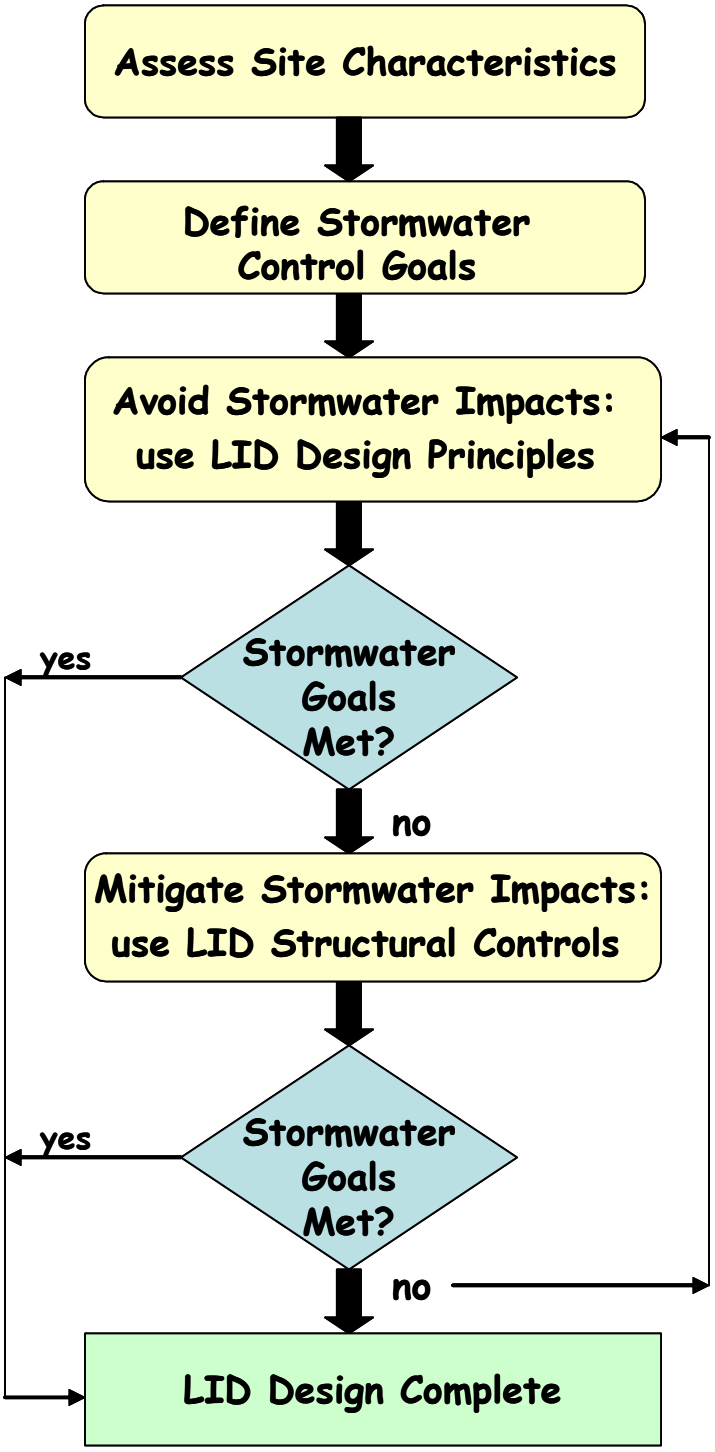
Low Impact Development (LID) for Stormwater Control: New and Redevelopment Project Design Guidance

The purpose of this document is assist project applicants and reviewers (e.g. city, county, state) understand the basic steps involved to successfully integrate LID into a project design as part of their stormwater management for new and redevelopment.

There is a general understanding that LID is a type of site design that strives to protect the natural hydrology once the site is developed. However, there is a common misconception that LID is only about the use of structural practices such as rain gardens, pervious pavements, and bioswales. In fact, a good LID design incorporates both site planning principles and structural practices to achieve site performance objectives. Neglecting to incorporate LID design principles throughout the site planning and design process often results in the designer attempting to fit LID structural practices to the site after all other site design has been defined. This can result in higher costs as well as a reduced ability to meet stormwater management objectives.

Lastly, LID design is often an iterative process that includes evaluating the stormwater benefits (e.g., reduced surface runoff, improved water quality) during the design and going back to the design to revise and then recalculate benefits. The applicant will need to understand any specific stormwater management requirements. By following and documenting the steps outlined in this guidance, the applicant will have conducted their due diligence in creating the best LID design possible for the project.

The LID Site Design Process



Step 1 Assess Site Characteristics

A significant part of conducting Low Impact Development is integrating the site characteristics with the project design in ways that help minimize environmental impacts. Site features that provide opportunities to reduce stormwater runoff include: protected areas, setbacks, easements, riparian areas, soil types, and topographic features.

Design Tips:

- Avoid excessive grading and disturbance of vegetation and soils,

- Concentrate development on portions of the site with less permeable soils, and preserve areas that can promote infiltration.

-Where possible, conform the site layout along natural landforms, and replicate the site's natural drainage patterns.

Step 2 Define Stormwater Control Goals and the LID Evaluation Approach

An understanding of the project site drainage/hydrology provides the initial information from which further analysis can be conducted. The applicant will need to compare baseline stormwater runoff characteristics (i.e., flow and/or water quality) to various LID design alternatives to determine the level of stormwater management that can be achieved. The hydrologic condition baseline will be defined by the local government agency reviewing and approving the project and may be defined as either: 1) pre-development[1], 2) pre-project [2], or 3) some condition in between pre-development and pre-project. The local government agency may require the applicant to use different baselines for different stormwater runoff characteristics (e.g., pre-development for flow characteristics and pre-project for water quality characteristics).

Step 2a: The applicant should clarify with the project permitting agency the acceptable manner in how the storm and runoff scenarios will be calculated and modeled. This may include defining:

- The storm events to be evaluated (e.g., 2-, 5-, 10-yr, 24-hour storms)
- The runoff parameters to be estimated (e.g., runoff volumes, peak, duration, time of concentration, water quality)
- The approach to evaluating the interaction between precipitation and land response (e.g., single event or continuous simulations)

[1] Pre-development: The native vegetation and soil conditions that existed prior to human influence (e.g., urbanization, agriculture, grazing, timber harvest).
[2] Pre-project: The condition immediately prior to the proposed project. The condition includes, but is not limited to, soil type, vegetation, and amount of impervious surface.

- The calculations and models to be used to describe stormwater runoff and or water quality scenarios (e.g., Rational Method, TR-55, HSPF, SWMM)

Step 2b: For each subdrainage area as well as the total project area, conduct baseline stormwater runoff calculations using methods and parameters determined appropriate by the review/approval agency.

Step 4 Avoid Stormwater Impacts: use LID design principles

Impervious surfaces such as buildings, roads, and parking lots are big offenders in changing how rainwater acts on the land. An increase in impervious area impedes rainwater from naturally infiltrating into the ground and causes high volumes and rates of stormwater runoff, which can cause flooding and environmental damage. During the project design, techniques to reduce the amount of impervious surfaces will help greatly in managing stormwater.

Design Tips:

-Reduce the number of parking spaces
-Narrow the road width
-Reduce sidewalks to one side of the street
-Design residential driveways to be shared, narrow
-Evaluate an alternative roadway layout

For necessary impervious surfaces, techniques can be used to reduce their impact.

Design Tips:

-Disconnect roof drains and direct flows to vegetated areas
-Direct flows from paved areas to stabilized vegetated areas
-Break up flow direction from large paved surfaces

Step 5 Evaluate Design to Determine if Stormwater Goals have been Achieved

Once the project site has been delineated, analysis tools defined, and the site layout established, a hydrologic analysis can be conducted to compare the stormwater runoff characteristics of the specified hydrologic condition baseline (Step 2) with the initial site layout (Step 3). This hydrologic analysis will quantify the level of control that has been provided through the site planning process and will provide information as to the additional level of control, if any, required to meet stormwater control objectives for the project.

Step 4a: Calculate the runoff parameters (e.g., volume, rate, peak, duration, water quality) for the initial site layout. Use the same type of calculations and modeling methods as defined in Step 2a in order to compare the results with the baseline conditions.

Step 6 Mitigate Stormwater Impacts: use LID Structural Controls

After completing Steps 1 and 2, additional structural stormwater controls may be required to meet the LID site design objectives. Examples of LID BMPs include bioretention systems (e.g. swales, rain gardens), pervious pavements and pavers, and green roofs. There are several technical BMP manuals that provide design specifications. The permitting agency for your project can guide you to an appropriate manual.

Design Tips:

-To more easily manage the stormwater from the entire site, conduct decentralized management: divide the site into discrete drainage areas within the project site (e.g. roof runoff) and design the BMP(s) as necessary to control that runoff.
-Use simple, small scale practices, such as rain gardens, which mimic nature and manage stormwater at the source.
-Make landscape and infrastructure multifunctional to leverage space and reduce costs. For example, use pervious pavement for a parking lot and direct any runoff to vegetated planting strips designed to provide stormwater benefits.

Step 7 Evaluate Design to Determine if Stormwater Goals have been Achieved

Repeat Step 5 to determine if stormwater goals have been met. If not, reassess Step 4 and 7. An iterative approach to the design may be required to met or establish maximum extent feasible.