



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

The purpose of this document is to assist project applicants to understand the basic steps involved to successfully integrate LID into a project design. These interim guidelines act as a transition during the development of long-term stormwater management regulations, a joint effort activity sponsored by Region 3 municipalities and the Central Coast Regional Water Quality Control Board.

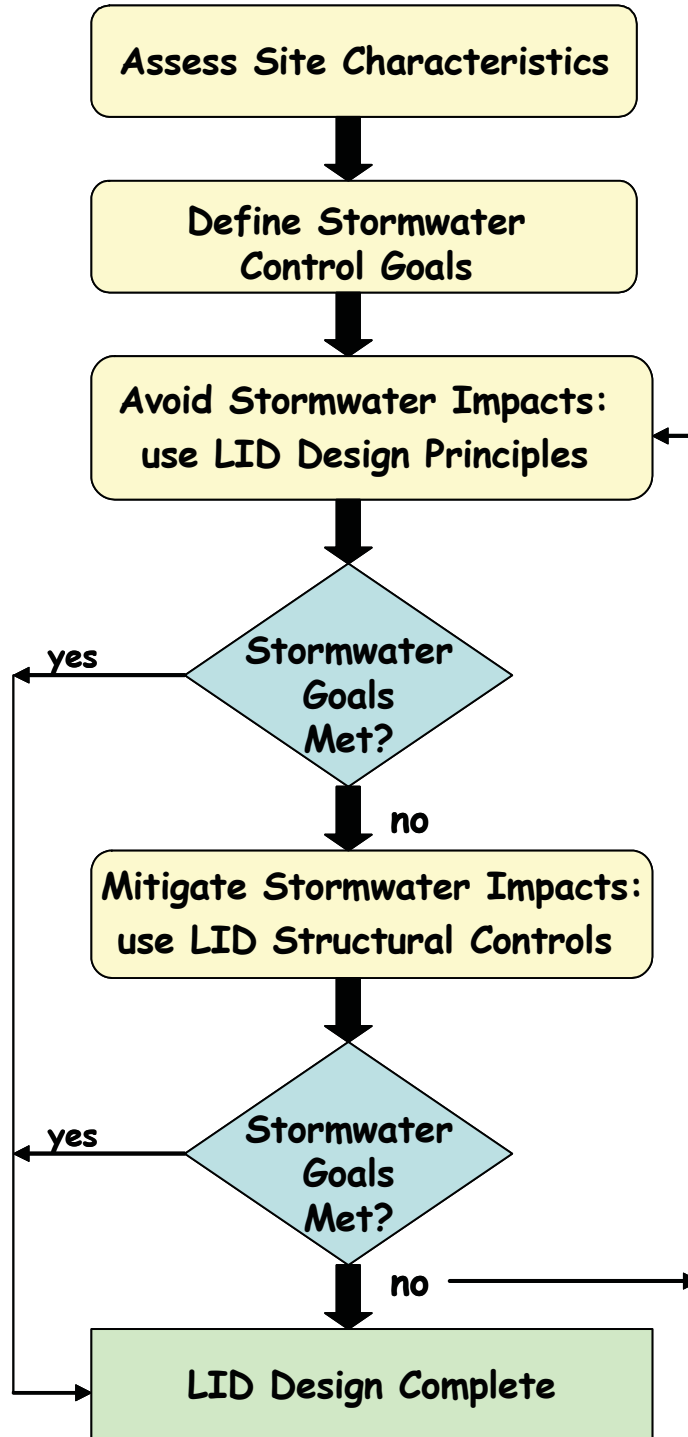
There is a general understanding that LID is a type of site design that strives to protect the natural hydrology once the site is developed. However, there is a common misconception that LID is only about the use of structural practices such as rain gardens, pervious pavements, and bioswales. In fact, 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. By following and documenting the steps outlined in this guidance, the applicant will have conducted their due diligence in creating an appropriate LID design for the project.

APPLICABILITY THRESHOLDS

- Exempt projects: Project that create less than 2,500 square feet of impervious surface are exempt from these guidelines, though encouraged to incorporate LID principles.
- Tier 1 Projects: Projects that create between 2,500 and 5,000 square feet of impervious surface should incorporate LID into site planning and to implement at least one agency approved LID structural practice into the project. Refer to the brochure *Interim Low Impact Development Guidelines* for further information and references for LID design.
- Tier 2 Projects: Projects that create over 5,000 square feet of impervious surface should incorporate LID into site planning and to implement at least two agency-approved LID structural practices into the project. Refer to the brochure *Interim Low Impact Development Guidelines* for further information and references for LID design.
- Tier 3 Projects: Projects, or projects with components that meet one or more of the following criteria should comply with the interim guidance set forth in the subsequent pages of this document. The interim guidance must be applied to the entire project, not just that portion that meets the criteria.
 - Commercial developments of over 100,000 square feet of impervious surface
 - Residential projects with a potential of 10 or more units and over 10,000 square feet of impervious surface
 - Parking lots with 25 spaces or more than 5,000 square feet of impervious surface

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 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 should 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 is defined as: the condition of the site immediately prior to the proposed project. The condition includes, but is not limited to, soil type, vegetation, and amount of impervious surface.

Step 2.1: Define goals and methods - the following parameters and methods may be used to calculate storm and runoff scenarios:

- The Interim LID goal for Tier 3 projects is for runoff volume from post-development conditions to not exceed runoff volume from pre-project conditions.
- The storm event to be evaluated for LID design is the 85th percentile 24-hour storm rainfall depth as indicated in the following table.

Average Annual rainfall for Site Location http://frap.cdf.ca.gov/webdata/maps/statewide/rainmap.pdf or County of San Luis Obispo DPW Public Improvement Standards (Drawing H-1)	85 th percentile 24-Hour Rainfall Depth
Less than or equal to 15 inches per year	0.50 inches
> 15 and less than or equal to 18 inches per year	0.75 inches
> 18 and less than or equal to 25 inches per year	1.00 inches
Greater than or equal to 25 inches per year	1.32 inches

*Based on 85th percentile storm depth calculated using available rain gage data

- Runoff volume is the product of the project area, the weighted runoff coefficient, and the rainfall depth.
- Weighted runoff coefficients for undeveloped portions of the project site (both pre- and post-project) may be determined by using the County of San Luis Obispo DPW Public Improvement Standards (Drawing H-3a)
- Weighted runoff coefficients for the fully improved portions of the project site (both pre- and post-project) may use the weighted impervious formula described in the ASCE Urban Runoff Quality Management Manual of Practice No. 87¹.

¹ Per the ASCE Urban Runoff Quality Management Manual, the runoff coefficient "C" is calculated as follows:

$$C = (0.858)i^3 - (0.78)i^2 + (0.774)i + 0.04 \quad (\text{where } i = \text{site impervious \% expressed as a decimal})$$

- Pre- and post runoff volumes may also be determined with the Water Balance Calculator spreadsheet found in Appendix 2.1 of the DWQ Construction General Permit available on the State Water Board website at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml
- Alternate methods may be used upon agency approval.

Step 2.2: For each subdrainage area as well as the total project area, the applicant should conduct baseline (pre-project) stormwater runoff volume calculations using the above methods and parameters.

Step 3 Avoid Stormwater Impacts: use LID design principles

Impervious surfaces such as buildings, roads, and parking lots are significant factors 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:

- ⇒ 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 4 Evaluate Design to Determine if Stormwater Goals have been Achieved

Once the project site has been delineated, analysis tools defined, and the initial site layout established, a preliminary 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, needed to meet stormwater control objectives for the project. If the post-project runoff volume is less than or equal to pre-project conditions, LID design is complete. If not, proceed to Step 4.1.

Step 4.1: Calculate the runoff volume for the initial site layout. Use the same type of calculations and modeling methods as defined in Step 2.1 in order to compare the results with the baseline conditions. The difference between the pre- and post-project runoff volumes is the volume goal to be mitigated using LID structural controls. Proceed to Step 5.

Step 5 Mitigate Stormwater Impacts: use LID Structural Controls

After completing the above steps, additional structural stormwater controls may be needed to meet the LID site design goal. LID BMPs include a variety of techniques such as bioretention systems (e.g. swales, rain gardens),

pervious pavements and pavers, and green roofs. Refer to the BMP manuals listed in the *Interim Low Impact Development Guidelines* brochure for more examples and design specifications. If water quality treatment features are part of the design, consider using or modifying them to retain or infiltrate runoff volumes. Bioswales, for example, can be modified to enhance retention and infiltration by adding small check dams.

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.

Calculations are needed to size BMPs and to demonstrate that the runoff volume reduction goal has been met. If the Water Balance Calculator spreadsheet is used, all calculations are included in the spreadsheet. If other methods are used to calculate the runoff volume to managed, two design options are available:

- Impervious diversion to pervious areas: Runoff from impervious surfaces may be routed to pervious surfaces to achieve volume reduction. Volume reduction will be considered accomplished if impervious areas are drained to pervious areas at a ratio not to exceed 2 to 1. The pervious area must be level with small berms or curbs to prevent runoff from the design storm. For example, directing 1000 square feet of roof runoff to a 500 square foot infiltrative landscaped area would satisfy this condition.
- Volume Retention: Designing volume based BMPs that retain and/or infiltrate captured runoff is a straightforward calculation. If partial volume control is achieved by the previous option of routing impervious surfaces to pervious areas, then volume retention goals should be adjusted accordingly. For example, if the original project goal is to retain 100 cubic feet of run-off, but half of the impervious area is designed to drain to pervious surfaces at the proper ratio, then the volume retention goal for the remaining impervious surface is 50 cubic feet of run-off.

A checklist is also provided to help document completion of the LID design process.

Step 6 Evaluate Design to Determine if Stormwater Goals have been Achieved

Repeat Step 4 to determine if stormwater goals have been met. If not, reassess Step 3 and 5. An iterative approach to the design may be needed to meet stormwater management goals.

In the rare case where it is impossible or unsafe to meet the interim LID goal, an exemption may be requested.