



Monterey Regional Storm Water and Education Alliance

Design Guidelines for Low Impact Development: Site Planning, Source Control, Runoff Volume Reduction, and Treatment Control Practices

(January 2011)

The following design guidelines have been developed and are being implemented in response to Joint Effort requirements of the Central Coast Regional Water Quality Control Board in relation to State Water Resources Control Board (SWRCB) Water Quality Order No. 2003-0005-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit CAS000004, Waste Discharge Requirements (WDRs) for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s), the so-called Municipal General Permit. These guidelines are general in nature and represent basic requirements for projects located within the area covered by the Monterey Regional Phase II Municipal General Permit.

Each Applicant is directed to contact the specific municipality in which the project is located for runoff volume reduction criteria and guidance, and other additional requirements or modifications to this document. These standards are presented for general guidance to the Applicant and are not intended to be inclusive of all conditions or situations for each of the participating municipalities. In the event that there are overlapping requirements, the stricter standard shall apply.

Contact Information by Municipality:

City of Carmel by the Sea:	Community Planning and Building	831.620.2010
City of Del Rey Oaks	City Manager's Office	831.394.8511
City of Marina	Engineering/Public Works	831.884.1212
City of Monterey	Engineering Office	831.646.3921
City of Pacific Grove	Public Works Department	831.648.5722
City of Sand City	Department of Public Works	831.394.1386
City of Seaside	Public Works Division	831.899.6825
County of Monterey	Department of Public Works	831.755.4800

Design Guidelines for Low Impact Development: Site Planning, Source Control, Runoff Volume Reduction, and Treatment Control Practices

All applicable Tier 1 and Tier 2 discretionary new and redevelopment projects subject to the Interim Low Impact Development (LID) Program must address post-construction runoff volume and water quality through the use of post-construction storm water control (or LID) practices. These control practices shall be applied in the following order of priority: site planning, source control, runoff volume reduction. In addition to the LID criteria for Tier 1, Tier 2 projects must also address treatment control, among other items, as a part of the storm water “Design Standards” of Attachment 4 of the Phase II Municipal Separate Storm Sewer System (MS4) Program, found at: http://www.swrcb.ca.gov/water_issues/programs/stormwater/docs/final_attachment4.pdf

Examples of LID control practices include, but are not limited to the following:

Site planning – Measures that preserve natural drainage and vegetative areas and reduce directly connected impervious areas in the overall site design;

Source control – Measures that cover trash enclosures, use alternate (pervious) paving materials, and the use of Integrated Pest Management techniques in landscape maintenance;

Runoff volume reduction – Measures that infiltrate, retain, evapotranspire, and capture/store/reuse the runoff, such as cisterns/rain barrels, permeable pavement, downspout disconnection to landscaped areas, and soil amendments; and

Treatment control – Measures that either detain and/or filter water to remove pollutants prior to discharge from the site, such as flow-through planters/tree boxes, bioretention swales, green roofs, and the like.

A general listing of site planning, source control and runoff volume reduction measures is located in the “Monterey Regional Interim LID Guidelines” handout, and more information is available from the “Additional Resources” noted there. Additional references are also included on page 6 of this document. Numerous other LID documents exist and may be utilized as applicable to the site conditions and deemed appropriate by the project’s storm water design professional.

I. For Tier 1 and Tier 2 Projects:

Site planning, source control, and runoff volume reduction measures are required to be incorporated into both Tier 1 and Tier 2 projects, and documented appropriately using the “LID Worksheet & Implementation Tracking Form”.

Runoff volume reduction measures must limit the post-project runoff volume to the pre-project runoff volume for the smallest storms up to the 85th percentile storm event (or the smallest storm event that generates runoff, whichever is larger). Applicants may use the Post-Construction Water Balance Spreadsheet (Microsoft Excel file) from Appendix 2.1 of the Construction General Permit, found:

http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml

Other water balance or storm water modeling approaches may be acceptable as demonstrated by the applicant to the municipality. Also, runoff volume reduction measures with a vegetated or filter component may also accomplish storm water treatment. Such integrated approaches to runoff volume reduction are encouraged to achieve multiple storm water objectives to the maximum extent practicable. A municipality may waive the requirement for runoff volume reduction where its use is not practicable per site-specific soil conditions as demonstrated by a geotechnical report.

II. For Tier 2 Projects:

Site planning, source control, runoff volume reduction, and treatment control measures are required to be incorporated into Tier 2 projects, and documented appropriately using the “LID Worksheet & Implementation Tracking Form”.

Treatment control measures shall be incorporated into Tier 2 projects to meet the following specific design requirements, unless otherwise approved by the appropriate permitting authority of the municipality where the project is located. Other flow- or volume-based treatment approaches may be acceptable as demonstrated by the project’s qualified engineer to the municipality.

1. **Volume-Based Treatment Practices.** Detention of storm water runoff allows for the settling of fine particles and associated pollutants. Detention times for water quality control practices are generally longer than those required for flood control. Although a detention system for water quality could be combined with a flood control system, the volume assigned for water quality control must meet minimum detention times. The required design volume for detention-based storm water quality treatment practices is equal to the runoff volume that would occur from the contributing area from the 85th percentile, 24-hour storm event.

- a) The volume calculation will be computed as follows:

$$WQDV = R \times 0.6'' \times A \times 3630$$

Where: *WQDV* = Water Quality Design Volume (cubic feet)

R = Volumetric Runoff Coefficient, where $R = (0.05 + 0.9 \times IMP)$

IMP = Impervious Cover Ratio (Impervious Area ÷ Drainage Area)

0.6'' = 85th percentile 24-hour rainfall event, per regional precipitation data

A = Tributary Drainage Area (acres) to the treatment BMP

3630 = Conversion factor (from acre-inch to cubic feet)

Note: The *WQDV* is the volume of runoff expected to be generated from 0.6 inch of rainfall for the 85th percentile 24-hour rainfall event. The *WQDV* should be calculated for each treatment practice using the drainage area that will flow to that practice. If storm water flows from off-site areas that enter the project site (run-on) cannot be directed around the project site, LID treatment practices must be sized to include these run-on flows.

- b) The draw-down (or draining) time for the detention volume, which is intended to drain down completely (vs. permanent wet volume), shall be greater than or equal to 36 hours but less than 72 hours. For the top half of the detention volume, the drawdown time shall be greater than or equal to 12 hours. The remaining bottom-half of the detention volume must drain in no less than 24 hours. The outlet shall be sized to achieve the required detention times and shall be large enough that clogging is unlikely to occur. Pipes less than 4 inches in diameter shall not be used. Perforated risers are acceptable for controlling the flow rate; however, potential clogging of the perforations should be addressed in the design and maintenance plan.

A suggested reference for general information and design guidance may be found on the California Stormwater Quality Association (CASQA) website at www.casqa.org under the [CA LID Portal](#). The [Low Impact Development Manual for Southern California](#) (on the CA LID Portal) provides technical design guidance for a number of LID practices and design examples.

- c) The detention system shall be designed to maximize the distance between the inlet and outlet, and to minimize "dead spaces" (areas where little or no flow occurs during a storm event), thereby limiting short-circuiting. A minimum flow-path length to width ratio of 3:1 is recommended and can be achieved using internal berms or other means to prevent short-circuiting.
- d) For ponds designed to be permanently wet, the applicant must show a water balance that demonstrates that there will be sufficient dry weather flow to maintain the planned pool volume, without creating stagnant conditions. A Mosquito Management Plan or Service Contract must be approved or waived by the municipality for any LID practice that maintains a pool of water for 72 hours or more.
- e) For dry extended detention ponds, the applicant must show that the pond will be able to handle dry-weather flows (such as irrigation return flows) without causing a nuisance (visual eye sore, stagnant water, etc.).
- f) Detention based water quality systems are recommended to be off-line from flood conveyance systems. If they are to be on-line or combined with a flood detention BMP, then the BMP must be designed to pass the appropriate flood without damage to the BMP, as well as to minimize re-entrainment of pollutants.

2. **Flow-through Treatment Practices.** Flow-based storm water treatment practices are structures where the flow is either passed with little or no storage through a filtration media or infiltrated into a subsurface soil matrix. The purpose is to remove, through filtration, the smaller sized suspended particles. Examples of these LID practices include vegetated swales, infiltration features, bioretention filters, and some types of commercial filters.

- a) The required flow rate for flow-based storm water quality treatment practices is two times the 85th percentile hourly rainfall intensity (0.11 inches per hour) for the area, or 0.22 inches per hour. Flows above this rate can either be by-passed, or routed through the facility if it can be demonstrated that velocities will not re-entrain captured pollutants.
- b) Flow-based practices must be able to completely treat the flow rate based upon the following:

$$WQFR = R \times 0.22 \times (A)$$

Where: *WQFR* = Water Quality Flow Rate (cubic feet per second)

R = Volumetric Runoff Coefficient, where ***R* = (0.05+0.9×*IMP*)**

IMP = Impervious Cover Ratio (Impervious Area ÷ Drainage Area)

0.22 = Two times the 85th percentile rainfall intensity (0.11 in/hr)

A = Tributary Drainage Area (acres) to the treatment structure

- c) LID practices used in combination, or treatment trains, are encouraged to provide better treatment capacity. For example, short-term detention may be placed upstream of a flow-based LID practice to reduce the size of the structure. In such cases, each practice may be reduced in size accordingly, based upon demonstrated water quality effectiveness for the pollutants of concern.

III. Applicable to All Projects (Tier 1 and 2):

1. These are minimum requirements. If the municipality determines that additional controls and/or lower thresholds for developments are required to meet specific water quality regulatory requirements (NPDES, TMDL, etc.) in watersheds that drain to sensitive receiving waters (as defined by the Central Coast Regional Water Quality Control Board), additional requirements may be imposed. These may include design requirements that result in larger or more effective LID practices, as well as additional types of structural or non-structural controls. The design solution will effectively reduce pollutants that are found to be impacting such water bodies and meet the regulatory statutes of the water body.
2. Infiltration practices shall only utilize permeable soils with significant pollutant removal capacities. Soils with infiltration rates less than 0.5 inch per hour and soils listed in Hydrologic Soils Groups C or D are not suitable for infiltration. The applicant must demonstrate that slope stability, groundwater quality, and depth to groundwater are suitable for infiltration. Infiltration practices will require periodic maintenance to maintain permeability. Guidance on these requirements is available from the appropriate municipality and from the [Low Impact Development Manual for Southern California](#) available on the California [LID Portal](#) on the [CASQA website](#).
3. Vegetated (wetland/native plants and/or grass) swales shall be designed so that at the water quality flow rate (WQFR), the swale width is such that the flow depth is no greater than 4 inches and the hydraulic grade line is no greater than 2 percent (unless drop structures are employed) between structures. The inflow should enter as close to the upstream end of the swale as possible, but at a minimum should enter evenly over the length of the swale. The length of flow in the swale should be a minimum of 100 feet or the swale should provide 10 minutes of contact time with the vegetation.
4. Bioretention filters are vegetated (landscaped) areas where runoff is directed through vegetation and soils for filtration. In most cases, unless there is shown to be adequate infiltration capacity, underdrains and overflow drains should be included to collect filtered runoff for discharge into the storm drainage system. The ponding depth should be 6 inches or less with a stabilized mulch layer of 2 to 3 inches. A sandy planting soil should be used with a depth of 2 to 3 feet. Each feature should have no more than 1 acre of tributary area and shall be designed to convey larger flows in a manner that does not cause re-entrainment of trapped materials.
5. Commercial media filters and similar devices shall be accompanied by a written warranty from the manufacturer that the filter/device will maintain an effluent quality not exceeding 30 mg/L of total suspended solids with no visible oily sheen under design operating conditions.
6. The selection of LID practices shall be based upon the ultimate use of the drainage area, unless the practice will be re-built/sized during subsequent phases of construction.
7. Projects cannot be subdivided or phased to avoid complying with these requirements. Development and redevelopment of the same or adjacent property(ies) permitted within 5 years may be considered together for purposes of assessing the above criteria.
8. All LID and water quality storm water treatment practices require regular maintenance. A [Maintenance Plan](#) shall be submitted for approval with the project application prior to Final Map Recordation, Zoning Clearance, or final Discretionary Permit approval, whichever applies or comes first. The Maintenance Plan shall identify the person(s) responsible for maintenance,

describe the long-term activities intended to maintain the performance requirements of the water quality treatment practices, and include a schedule for performing those activities. Maintenance records shall be retained by the property owner for the prior 5 years of record and shall be provided to the applicable local agency annually or upon request. Applicants are required to enter into a maintenance agreement with the municipality to ensure adequate performance and to allow emergency access. The agreement is perpetual and requires the present and future owners of the property to be responsible for the construction, ownership, and maintenance of all private water quality treatment facilities. This agreement shall be recorded in the land records of the appropriate municipality.

8. Easements, fencing, grading, access roads, ramps, etc. for water quality treatment practices shall be provided in accordance with current policies of the municipality. Easements, if required, shall be dedicated on the Final Map or dedicated by a separate instrument. The developer will pay the cost for easement acceptance and processing by the local municipality.
9. A surety bond for improvements located within the public right-of way may be required to be posted with the municipality prior to Final Map Recordation, Zoning Clearance, or final Discretionary Permit approval. Bond amounts will be based on the submitted cost estimates of proposed drainage improvements to be constructed.
10. The appropriate department of the local municipality shall be notified 5 working days in advance of storm drain and related construction of water quality treatment practices. Each municipality may provide periodic inspection during construction at the developers cost. A note to this effect shall be placed on the plans.
11. During the construction process, the municipality shall review and approve in writing any significant design revisions to the approved Plans prior to construction of the proposed revisions.
12. Prior to occupancy clearance, "As-Built" Plans shall be submitted to the appropriate department of the municipality.
13. Review of plans and/or granting of encroachment permits by the municipality does not relieve the applicant, developer, contractor and/or owner from the responsibility to obtain all other required permits and approvals required by law, including but not limited to grading permits, building permits, environmental review for CEQA/NEPA requirements, Fish & Game permits, Army Corps of Engineers permits and other City, CalTrans or other municipal departmental approvals and the approval of the underlining property owner(s) of record.
14. The municipality reserves the right to modify these standards as site conditions warrant to maintain water quality standards to the maximum extent practicable in conformance with its Municipal General (NPDES) Permit.

IV. List of LID Resources

Bay Area Storm Water Management Agencies Association, Start at the Source: Design Guidance Manual for Storm Water Quality Protection

→ http://www.cleanwaterprogram.org/uploads/SAS_Manual_index.pdf

California Stormwater Quality Association, California LID Portal and New Development and Redevelopment Handbook

→ www.casqa.org

California Water and Land Use Partnership, Low Impact Development Factsheet

→ <http://www.coastal.ca.gov/nps/lid-factsheet.pdf>

Central Coast Regional Water Quality Control Board, Low Impact Development

→ http://www.swrcb.ca.gov/centralcoast/water_issues/programs/stormwater/low_impact.shtml

City of Los Angeles, Rainwater Harvesting Program, Green Streets and Green Alleys Design Guidelines and Standards

→ http://san.lacity.org/wpd/Siteorg/GreenStreets/GreenstreetGuidelines_Ch1-3.pdf

City of Salinas, Storm Water Development Standards

→ <http://www.ci.salinas.ca.us/services/engineering/engineering.cfm>

Contra Costa Clean Water Program, Storm Water C.3 Guidebook, Chapter 4: LID Design Guide, C.3 Guide

→ http://www.cccleanwater.org/Publications/Guidebook/Stormwater_C3_Guidebook_5th_Edition.pdf

County of San Diego, Low Impact Development Handbook

→ <http://www.sdcounty.ca.gov/dplu/docs/LID-Handbook.pdf>

Guidance Manual for Low Impact Development for Southern California: Technical Guidance and Site Planning Strategies

→ <http://www.casqa.org/LID/SoCalLID/tabid/218/Default.aspx>

Low Impact Development Center

→ <http://www.lowimpactdevelopment.org/links.htm>

U.S. Environmental Protection Agency, Low Impact Development

→ <http://www.epa.gov/owow/NPS/lid/>

U.S. Environmental Protection Agency, Post-Construction Management in New Development and Redevelopment Guidance

→ http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5