

# Low Impact Development Technical Guidance Manual For Small Sites



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## **SECTION 1 – INTRODUCTION**

### **1.1 WHAT IS LID?**

LID stands for: Low Impact Development, it is a stormwater management strategy that emphasizes conservation and the use of existing natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings.

### **1.2 WHY IS LID BEING REQUIRED?**

The urbanization of Southern California has disrupted the natural flow of stormwater runoff. Rain falling on roofs now flows into metal or plastic downspouts, then to concrete curbs and gutters along asphalt roads, then to concrete storm drains, then to concrete river channels, and then finally into estuaries and the Pacific Ocean.

You can see the problem; rainwater no longer comes into contact with dirt and vegetation. Any pollutants (heavy metals, bacteria, nutrients, pesticides) that would have previously been naturally degraded, are now flowing straight out to environmentally sensitive areas.

LID is a new design strategy that corrects this problem. There are many highly technical manuals for designing LID systems, some of which are listed in Section 4 herein. The purpose of this guidance manual is to simplify your design.

Typical LID systems include:

- Flow-Through Planter Boxes
- Vegetative Swales
- Rain Gardens
- Semi-pervious Driveways
- Infiltration Trenches

In addition to the LID systems listed above, there are many other acceptable systems such as capture and re-use (cisterns/ rain barrels), green roofs, pervious pavement/pavers, turf block, etc. However, the design, installation, and subsequent operation and maintenance of these systems can be complex and should be carefully evaluated prior to being proposed. When using these other systems, a published design standard shall be followed.

## 1.3 PROJECT APPLICABILITY

### Step 1: Categories.

There are four LID categories. The first step in LID design is to determine which category the project is in.

#### **Category 1.** MS4 LID Category.

The following types of projects do not meet the definition of a small site. These projects are beyond the scope of this manual and are subject to the provisions of the Municipal Separate Storm Sewer System permit (MS4) issued by the California Regional Water Quality Control Board. These projects include the following:

- a. All Development Projects equal to 1 acre or greater of disturbed area<sup>1</sup> that adds more than 10,000 square feet of impervious surface area.<sup>2</sup>
- b. Industrial Parks with 10,000 square feet or more of surface area.<sup>3</sup>
- c. Commercial Malls with 10,000 square feet or more of surface area.<sup>3</sup>
- d. Retail Gasoline Outlets with 5,000 square feet or more of surface area.<sup>3</sup>
- e. Restaurants with 5,000 square feet or more of surface area.<sup>3</sup>
- f. Parking Lots with 5,000 square feet or more of impervious surface area,<sup>2</sup> or with 25 or more parking spaces.
- g. Streets and roads construction with 10,000 square feet or more of impervious surface area.<sup>2</sup> Street and road construction applies to standalone streets, roads, highways, and freeway projects, and also applies to streets within larger projects.
- h. Automotive Service Facilities with 5,000 square feet or more of surface area.<sup>3</sup>
- i. Projects located in or directly adjacent to, or discharging directly to an Environmentally Sensitive Area, where the Development will:
  - (1) Discharge Stormwater Runoff that is likely to impact a sensitive biological species or habitat; and
  - (2) Create 2,500 square feet or more of impervious surface area.<sup>2</sup>
- j. Single-family Hillside Properties.
- k. Redevelopment Projects:
  - (1) Construction Activity that results in the creation, addition or replacement of 5,000 square feet or more of impervious surface area<sup>2</sup> on an already developed Site of one of the Projects identified in this Subsection.

#### **Category 2.** Exempt Category.

The project will disturb less than 800 square feet of soil.

#### **Category 3.** Small Scale Residential LID Category.

The project is residential, will involve 4 or less dwelling units and will result in the addition, creation, or replacement of more than 800 square feet of impervious area.

#### **Category 4.** Small Scale Commercial/Industrial LID Category.

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<sup>1</sup> Disturbed Area is the total area that is altered as a result of clearing, grading, and/or excavation.

<sup>2</sup> Impervious Area is the area of a development covered by impenetrable materials such as asphalt, concrete, brick, stone, and rooftops. Soils compacted by urban development are also highly impervious.

<sup>3</sup> Surface Area is the total area of a development.

The project will involve 5 or more dwelling units or is at a commercial or industrial site and will result in the addition, creation, or replacement of more than 800 square feet of impervious area, but is not a Category 1 project.

**Step 2: LID Design Requirements.**

For Residential LID Projects (Category 3 above)

- A Residential LID Project must incorporate one or more LID system(s) in the project design. The system(s) must be shown on the plans submitted to the City.
- Include the following statement:

*As the engineer/architect of record for this project, I have designed the LID system in accordance with the design criteria of the City of South Gate's LID Guidance Manual.*
- The project engineer/architect must make sure the safety and soil stability of the LID system is carefully evaluated prior to its inclusion in the design.
- Language describing maintenance activities and indicating the responsible party for such activities (including signature) must be located on the document(s) submitted to the City.
- The entire project area must drain to the LID system(s). If water is flowing to the LID system from areas outside the project area, the LID system must be designed accordingly to treat all tributary areas. In instances where a project cannot treat the runoff from the development area, an equivalent area may be treated as an alternative.
- Calculations must be included on the plans showing the LID system is adequately sized. For Residential LID Projects, the BMP(s) size must be 4% of the tributary area.

For Commercial/Industrial LID Projects (Category 4 above)

- A Commercial/Industrial LID Project must incorporate one or more LID system(s) in the project design. The system(s) must be shown on the plans submitted to the City.
- Include the following statement:

*As the engineer/architect of record for this project, I have designed the LID system in accordance with the design criteria of the City of South Gate's LID Guidance Manual.*
- The project engineer/architect must make sure the safety and soil stability of the LID system is carefully evaluated prior to its inclusion in the design.
- Language describing maintenance activities and indicating the responsible party for such activities (including signature) must be located on the document(s) submitted to the City.
- The entire project area must drain to the LID system(s). If water is flowing to the LID system from areas outside the project area, the LID system must be designed accordingly to treat all tributary areas. In instances where a project cannot treat the runoff from the development area, an equivalent area may be treated as an alternative.
- Calculations must be included on the plans showing the LID system is adequately sized. A calculation template is shown on the following specification pages. For Commercial/Industrial LID Projects, the BMP(s) must be sized to treat the entire design capture volume (DCV).

**Step 3: Plan development and submittal.**

The LID system(s) design and location must be shown on the plans and submitted to the City. The Standard Plans are available (yet not required) for guidance.

## **1.4 LID EXEMPTIONS**

**Exemptions from LID Requirements.** LID requirements do not apply to any of the following:

1. A Development that creates, adds or replaces less than 800 square feet of impervious area;
2. A Development involving only emergency construction activity required to immediately protect public health and safety;
3. Infrastructure projects within the public right-of-way;
4. A Development or Redevelopment involving only activity related to gas, water, cable, or electricity services on private property;
5. A Development involving only resurfacing and/or re-striping of permitted parking lots, where the original line and grade, hydraulic capacity, and original purpose of the facility is maintained;
6. A project involving only exterior movie or television production sets, or facades on an existing developed site;
7. A project not requiring a City building, grading, demolition or other permit for construction activity.

## **SECTION 2 – COMMONLY ASKED QUESTIONS**

- 1. I am adding a second story to my house. The existing footprint will remain unchanged, does LID apply?**

*No, LID is required only where 800 square feet of soil is being disturbed.*

- 2. I will be adding a new 800 square foot room that will replace some of my backyard. Does LID apply?**

*Yes, you've crossed the 800 square foot threshold.*

- 3. I will be building a new addition that will be over 800 square feet, but I can't fit an LID system into the new addition. Can I create an LID system for an equivalent area of the existing building?**

*Yes, you can create an LID system for an equivalent area of the existing building.*

- 4. I own a business. It is concrete and asphalt all around. Will LID be required if infeasible?**

*A waiver for technical infeasibility may be issued by the Director; however in this situation it is unlikely to be granted. Generally there is always a way to implement LID requirements.*

- 5. How big do I have to design the LID systems?**

*On the following pages are design criteria. Generally you have to make the systems big enough to treat runoff from a ¾ inch storm.*

- 6. I am removing a 800 square foot concrete pad that is in need of repair and replacing it with an identical new concrete pad. Does LID apply?**

*If the construction would not result in soil disturbance, this would be considered routine maintenance. However, if the construction did result in soil disturbance an LID system would be required.*

- 7. I am installing new interior electrical and new plumbing and will have more than 800 square feet of disturbed soil. When the project is finished, the trenches will be patched to match the existing surrounding surfaces. The existing building will be unchanged. Will LID apply?**

*No, utility projects are exempt from LID requirements. See Section 1.4 of this document.*

- 8. My project does not require any permits from the City, does LID apply?**

*No, only projects requiring city permits need to comply with LID.*

- 9. If at some time in the future I want to change the design of the LID system, can I?**

*Only with Planning Department approval.*



## **SECTION 3 – DESIGN GUIDELINES AND SPECIFICATIONS**

### **3.1 DESIGN CAPTURE VOLUME**

The Design Capture Volume (DCV) is required to design the flow through planter box, vegetated swale, rain garden, and any other volume-based LID system.

**DCV Equation:**

$$DCV (ft^3) = C \times d \times A \times 43,560 \times \frac{1}{12}$$

**With:**

$$C = (0.75 \times \text{Impervious Percentage}) + 0.15$$

$d$  = Design Storm Depth (assume 0.75 inch unless otherwise known)

$A$  = Tributary Area (Acres)

*Impervious Percentage = Impervious Area/Tributary Area*

*Tributary Area = Total area draining to the BMP*

The information provided below are guidelines that must be followed when designing LID for your project. Standard drawings for each LID are included for reference.

### 3.2 FLOW-THROUGH PLANTER BOX

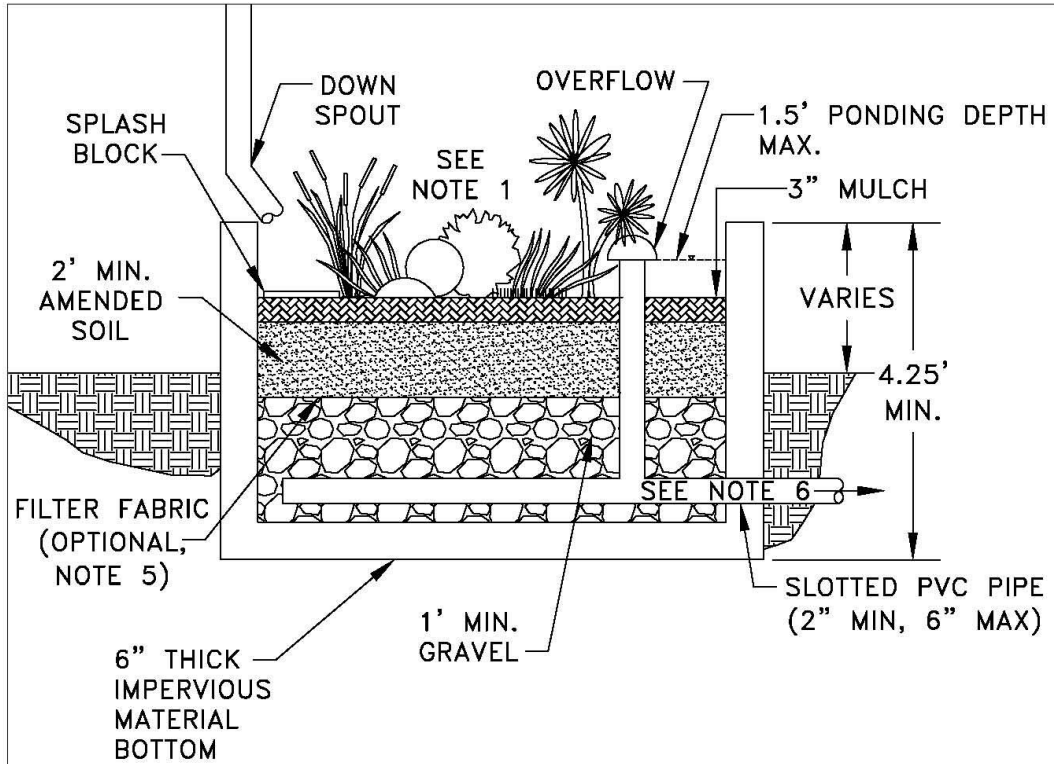


Figure 1: Flow-through planter box (<http://lateameffort.blogspot.com>).

A flow-through planter box is a landscape planter box designed to capture and filter stormwater runoff. These types of BMPs typically consist of a ponding area, mulch layer, planting soils, and plants to promote filtration through the media in order to remove pollutants. Stormwater is typically directed to the system from roof downspouts or curb inlets and pollutants are treated as the stormwater drains through the planting soil and collected by an underdrain and directed to a collection system.

Design criteria for a flow-through planter box include the following:

- Design drawdown time = 48 hours (surface); 72 hours (total)
- Factor of safety = 2
- Max ponding depth = 18 inches
- Soil depth = 2 feet (3 preferred)
- Slotted PVC pipe (2 inches Minimum) within 6 inches of bottom of facility
- The area (width \* length) must equal 4% of the tributary area
- Flows may outlet to a curb drain, rain garden, or equivalent
- Cover must be drought tolerant vegetation



**GENERAL NOTES:**

1. DENSE, WET AND DRY TOLERANT VEGETATION.
2. PONDED WATER MUST DRAIN WITHIN 72 HOURS TO PREVENT VECTOR BREEDING.
3. IF NEEDED, MULTIPLE PIPES MAY BE USED.
4. THE PLANTER BOX AREA (WIDTH \* LENGTH) MUST EQUAL 4% OF THE TRIBUTARY AREA.
5. FILTER FABRIC AVAILABLE AT LOCAL HARDWARE STORES.
6. FLOWS MAY OUTLET TO A CURB DRAIN, RAIN GARDEN, OR EQUIVALENT.

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	LID-FLOW THROUGH PLANTER BOX	

### 3.3 VEGETATED SWALE

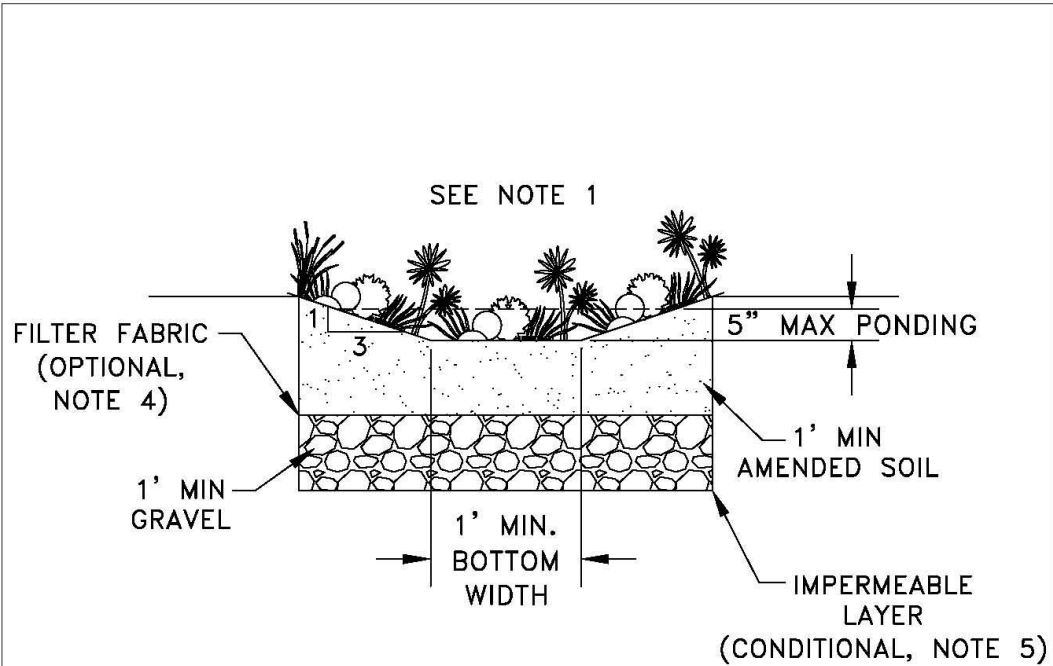


**Figure 2: Vegetated Swale (Signal Hill, CA).**

A vegetated swale is a gently sloping depression planted with vegetation to treat stormwater runoff through filtration and subsequent infiltration. As the runoff flows through the vegetated swale, the vegetation filters the water and discharges the treated stormwater to a collection system. Stormwater is typically directed to the beginning of the system in order to reach the full treatment potential.

Design criteria for a vegetated swale include the following:

- Design flow velocity  $\leq 1$  ft/sec.
- Side slopes shall not exceed 3:1 (H:V).
- Slope in flow direction 1% (min) to 6% (max).
- Minimum bottom width = 1 foot
- Minimum swale length = 15 feet
- Max ponding depth = 5 inches
- Soil depth = 2 feet min
- Design drawdown time = 48 hours (surface); 72 hours (total)
- The area (width \* length) must equal 4% of the tributary area
- Cover must be drought tolerant vegetation



**GENERAL NOTES:**

1. DENSE, WET AND DRY TOLERANT VEGETATION.
2. PONDED WATER MUST DRAIN WITHIN 72 HOURS TO PREVENT VECTOR BREEDING.
3. THE BOTTOM AREA (WIDTH \* LENGTH) MUST EQUAL 4% OF THE TRIBUTARY AREA.
4. FILTER FABRIC AVAILABLE AT LOCAL HARDWARE STORES.
5. AN IMPERMEABLE LAYER MUST BE USED IF GROUNDWATER IS LESS THAN 10 FEET FROM THE BOTTOM OF THE GRAVEL LAYER.

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	LID-VEGETATED SWALE		

### 3.4 RAIN GARDEN

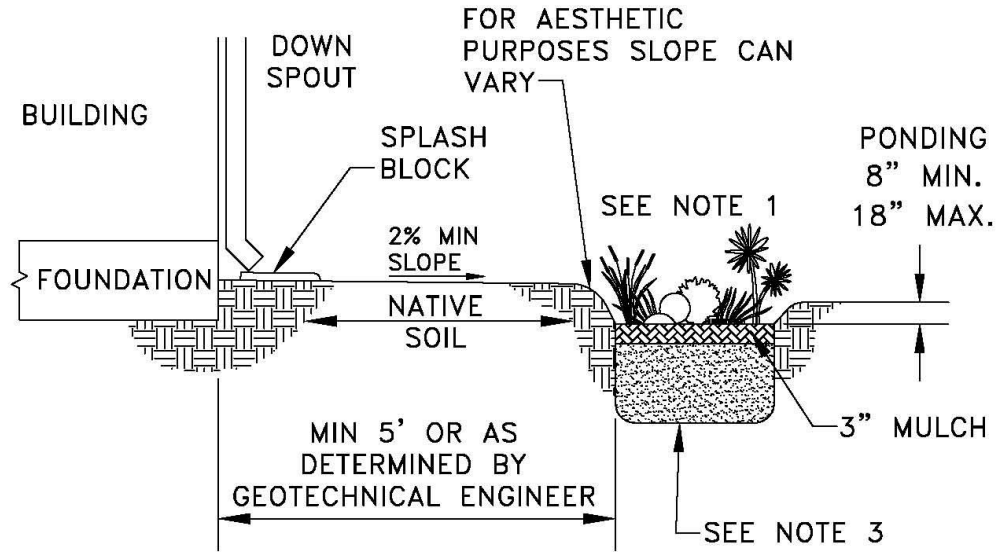


Figure 3: Rain Garden (<http://www.prairiefirenewspaper.com/2009/04/rain-gardens>).

A rain garden is a landscaped area designed to capture, filter, and infiltrate stormwater runoff. These types of BMPs typically consist of a ponding area, mulch layer, planting soils, and plants to promote filtration through the media in order to remove pollutants. Stormwater is typically directed to the system from roof downspouts and pollutants are treated as the stormwater drains through the planting soil.

Design criteria for a rain garden include the following:

- Design drawdown time = 48 hours (surface); 72 hours (total)
- Factor of safety = 2
- Maximum ponding depth = 18 inches
- Minimum ponding depth = 8 inches
- Soil depth = 2 feet minimum (3 preferred)
- If downspout is directed to rain garden, slope must be 2% minimum
- Cover must be drought tolerant vegetation
- The bottom of the rain garden should be no less than 10 feet from the groundwater table unless an underdrain is included



**GENERAL NOTES:**

1. DENSE, WET AND DRY TOLERANT VEGETATION.
2. PONDED WATER MUST DRAIN WITHIN 72 HOURS TO PREVENT VECTOR BREEDING.
3. BIORETENTION SOIL DEPTH 2' MINIMUM (3' PREFERRED).
4. THE RAIN GARDEN AREA (WIDTH \* LENGTH) MUST EQUAL 4% OF THE TRIBUTARY AREA.
5. THE BOTTOM OF THE RAIN GARDEN SHOULD BE NO LESS THAN 10' FROM THE GROUNDWATER TABLE.

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	LID-RAIN GARDEN	

### 3.5 SEMI-PERVIOUS DRIVEWAY



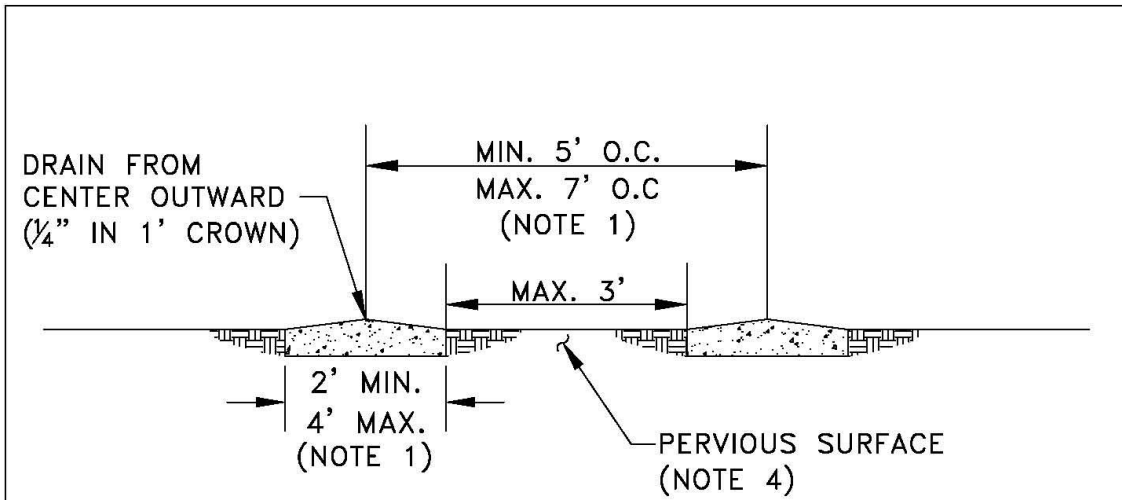
Figure 4: Semi-Pervious Driveway (<http://www.apartmenttherapy.com>).

Semi-pervious driveways are an alternative option for the typical driveway design in order to promote stormwater filtration and infiltration. These types of BMPs consist of a vegetated strip down the center of a driveway to allow for minimum impervious area. Stormwater runoff is filtered through the vegetation prior to leaving a site consequently removing pollutants.

Design criteria for a Semi-Pervious Driveway include the following:

- Recommended spacing between ribbons is 5 to 7 feet (may vary depending on expected traffic)
- Ribbon width = 2 feet minimum
- Ribbon thickness = 6 inches minimum (with mesh or rebar)
- Ribbons should drain outward from the center of crown
- Center strip should include an irrigation line





**GENERAL NOTES:**

1. MAXIMUM WIDTH AND SPACING ARE RECOMMENDED AND MAY VARY DEPENDING ON EXPECTED TRAFFIC.
2. DRIVEWAY RIBBONS SHOULD BE AT LEAST 2 FEET IN WIDTH.
3. DRIVEWAY RIBBONS SHOULD BE AT LEAST 6 INCHES THICK WITH MESH OR REBAR.
4. PERVIOUS SURFACE INCLUDES; VEGETATION (GRASS), WIDELY SPACED INTERLOCKING PAVERS, AND GRAVEL.
5. DRIVEWAY RIBBONS SHALL BE CONCRETE, TRAFFIC RATED PAVERS, BRICK, OR EQUIVALENT MATERIAL.

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	LID – SEMI-PERVIOUS DRIVEWAY	

### 3.6 INFILTRATION TRENCH

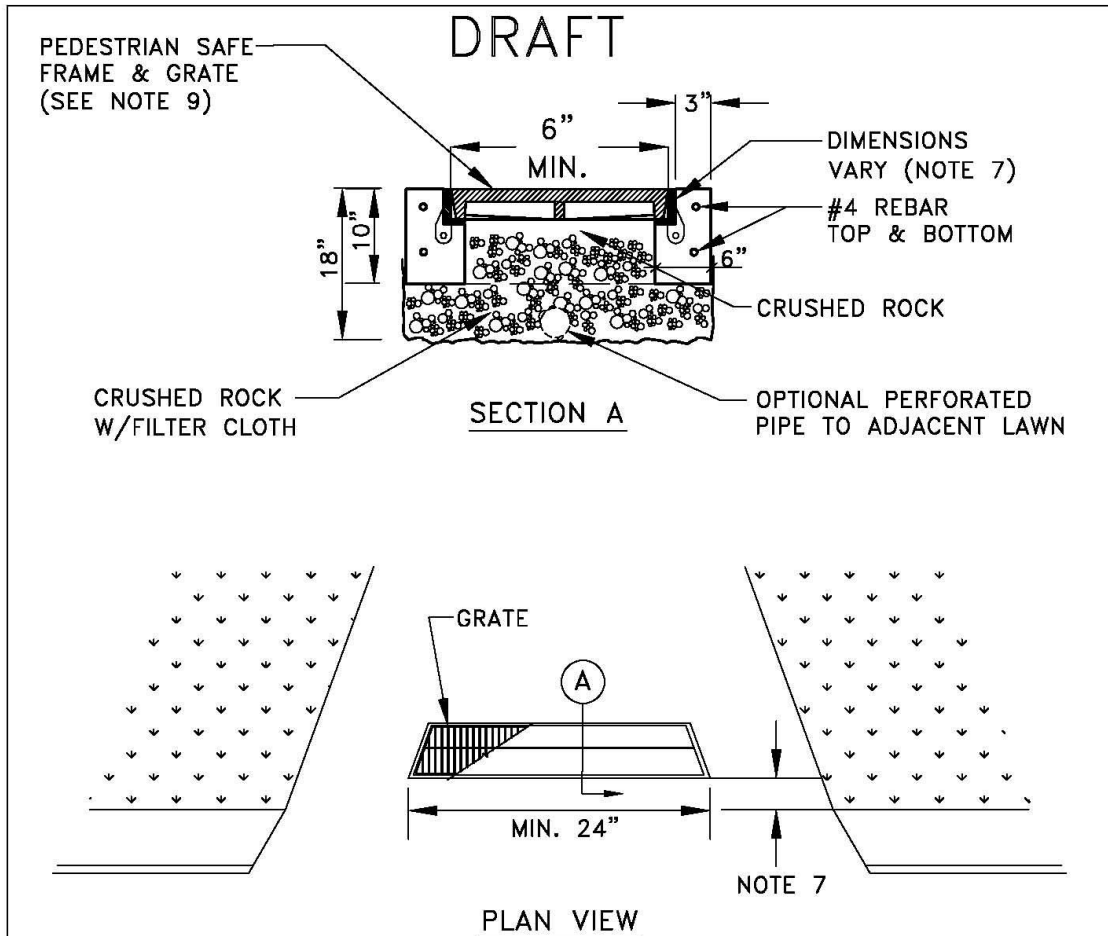


Figure 5: Infiltration trench (<http://www.cob.org/services/environment/water-quality/>).

Infiltration trenches utilize rock, gravel, and other specially selected materials which are highly permeable and promote on-site infiltration. Stormwater runoff is directed to the trenches to allow for ponding and infiltration into the soils for on-site retention and groundwater recharge. These types of BMPs are often placed at the end of driveways to capture and retain runoff from the surrounding area.

Design criteria for an Infiltration Trench include the following:

- Trench width = 24 inches (across driveway)
- Trench depth = 18 inches
- Bottom 8 inches of the trench must be filled with crushed rock
- Trench must be at least 12 inches from property line
- Longitudinal width = 6 inches (along driveway)
- Frame and grate must be pedestrian safe
- Minimum of 5 feet away from building foundation
- The bottom of the trench should be no less than 10 feet from the groundwater table



**GENERAL NOTES:**

1. TRENCH SHOULD BE 24" WIDE (ACROSS DRIVEWAY) X 18" DEEP.
2. PRECAST MAY BE USED.
3. FILTER CLOTH MUST BE PLACED IN THE TRENCH EXTENDING 12" VERTICAL.
4. BOTTOM 8" OF THE TRENCH MUST BE FILLED WITH CRUSHED ROCK.
5. DIMENSIONS DETERMINED BY GRATE FRAME DIMENSION. USE FRAME AS A FORM.
6. MUST BE APPLIED AT LEAST 12" FROM BACK OF SIDEWALK OR EDGE OF PAVEMENT IN THE CASE OF NO SIDEWALK.
7. MINIMUM LONGITUDINAL WIDTH (MEASURED ALONG DRIVEWAY) OF FRAME & GRATE IS EQUAL TO 6" WITH 3/8" SLOT OPENINGS. EAST JORDAN IRON OR EQUAL.
8. TRENCH MUST BE A MINIMUM OF 5' FROM BUILDING FOOTPRINT.

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	LID- INFILTRATION TRENCH	

## **SECTION 4 – REFERENCES**

The Los Angeles County Low Impact Development Standards Manual at:

*[http://dpw.lacounty.gov/wmd/dsp\\_LowImpactDevelopment.cfm](http://dpw.lacounty.gov/wmd/dsp_LowImpactDevelopment.cfm)*

The City of Los Angeles Low Impact Development Best Management Practices Handbook at:

*<http://lacitysan.org/wpd/Websiteorg/program/LID/lidintro.htm>*

Please note that the City of South Gate's LID ordinance takes precedent in the event of any inconsistencies with any outside references.