City of Los Angeles Low Impact Development (LID)

October 13, 2015

Ida Meisami
Bureau of Sanitation
City of Los Angeles

- **LID Overview**
- **LID Prescriptive Method**
- **LID for Large Scale Development**
- **GRASS**

Background

- **LID Ordinance Adopted: Nov 11, 2011**
- **LID Ordinance Effective: May 12, 2012**

Requirements:

Expanded on the exiting Standard Urban Mitigation Plan (SUSMP) requirements of capturing the greater of either 85th percentile or ¾ inch storm event by incorporating LID practices and standards.

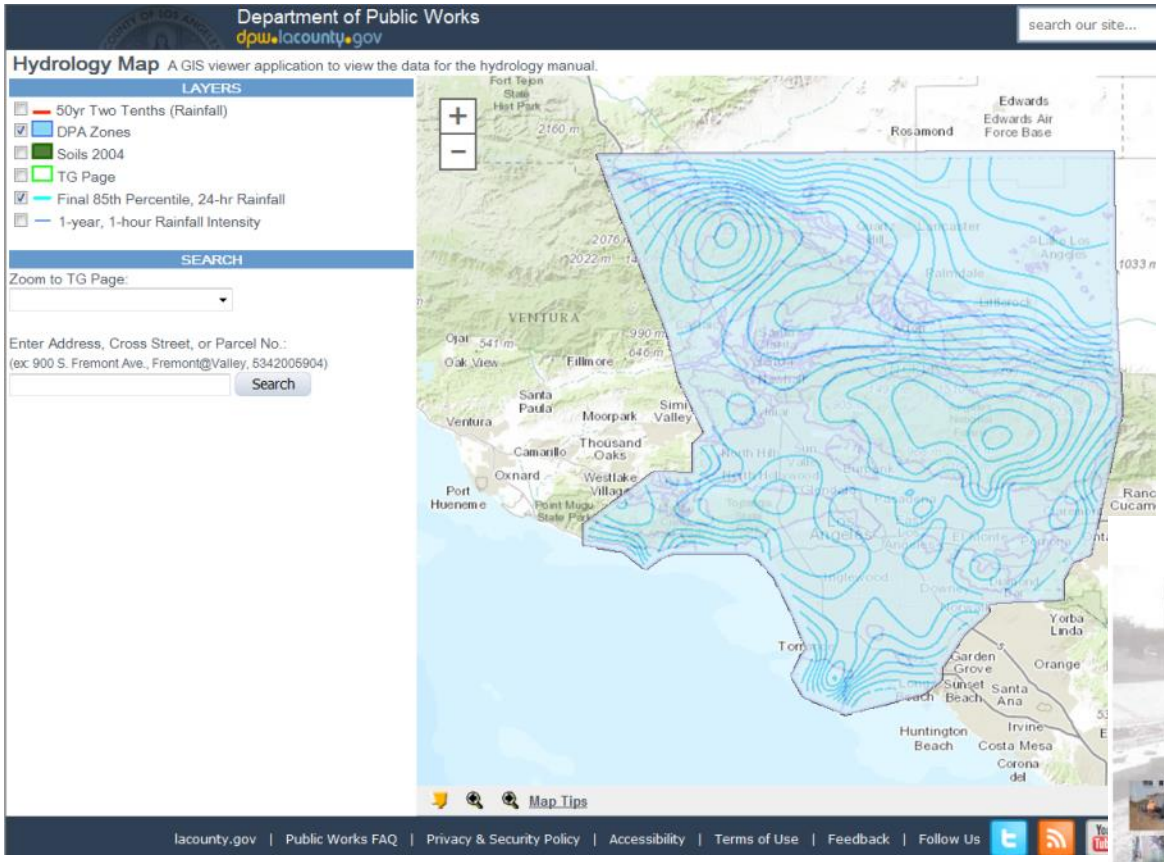
Residential (4 units or less):

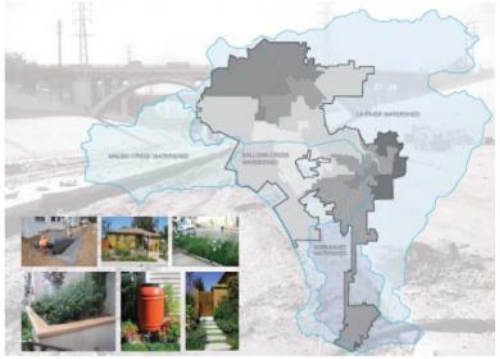
- **Projects must chose from prescriptive list of BMPs**

All other developments:

- **Similar to SUSMP requirements**

85th Percentile





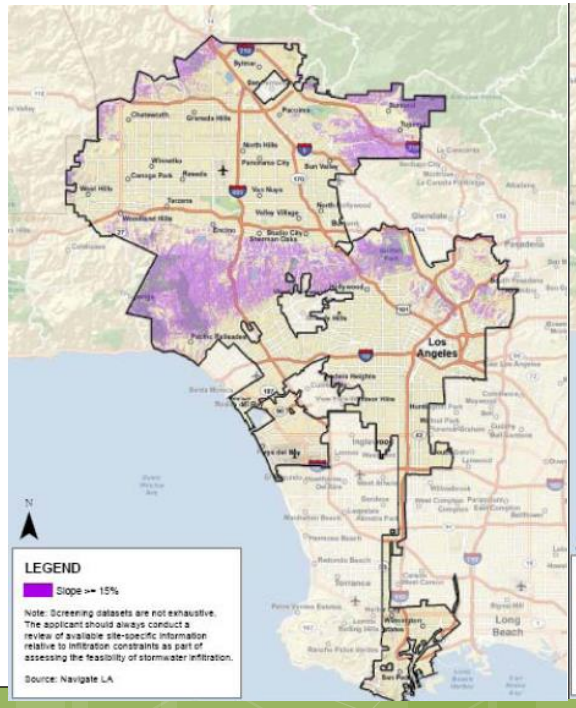
DEVELOPMENT BEST MANAGEMENT PRACTICES HANDBOOK

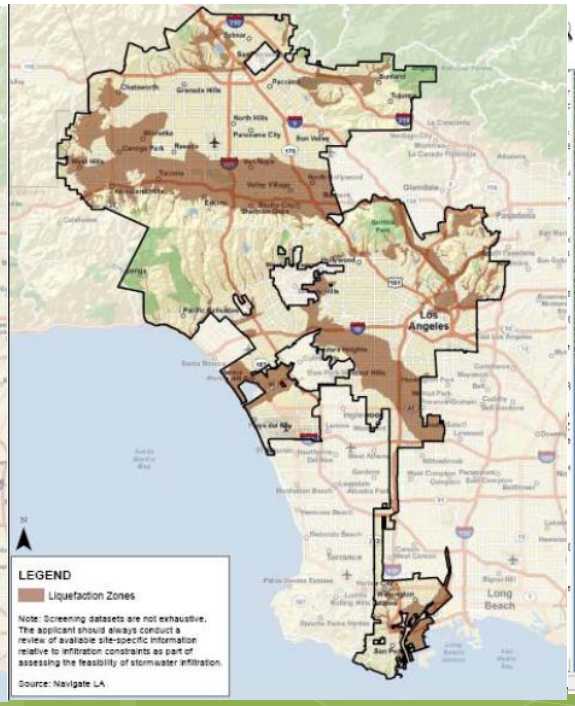
LOW IMPACT DEVELOPMENT MANUAL | PART B PLANNING ACTIVITES

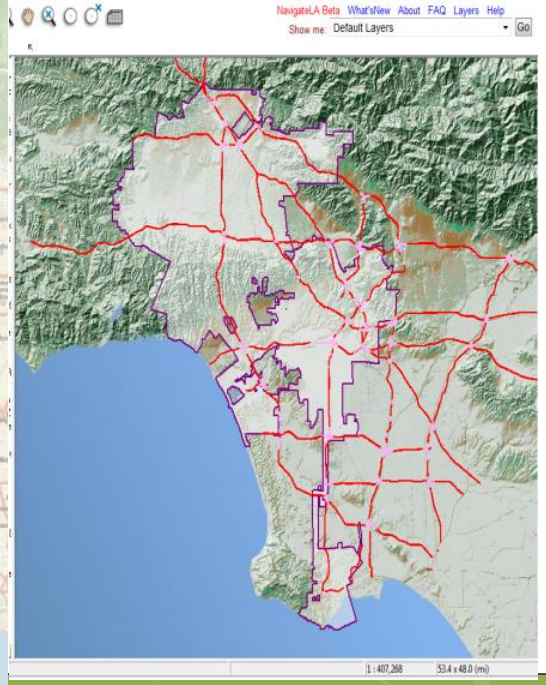
June 2011 | 4th EDITION

Screening Criteria

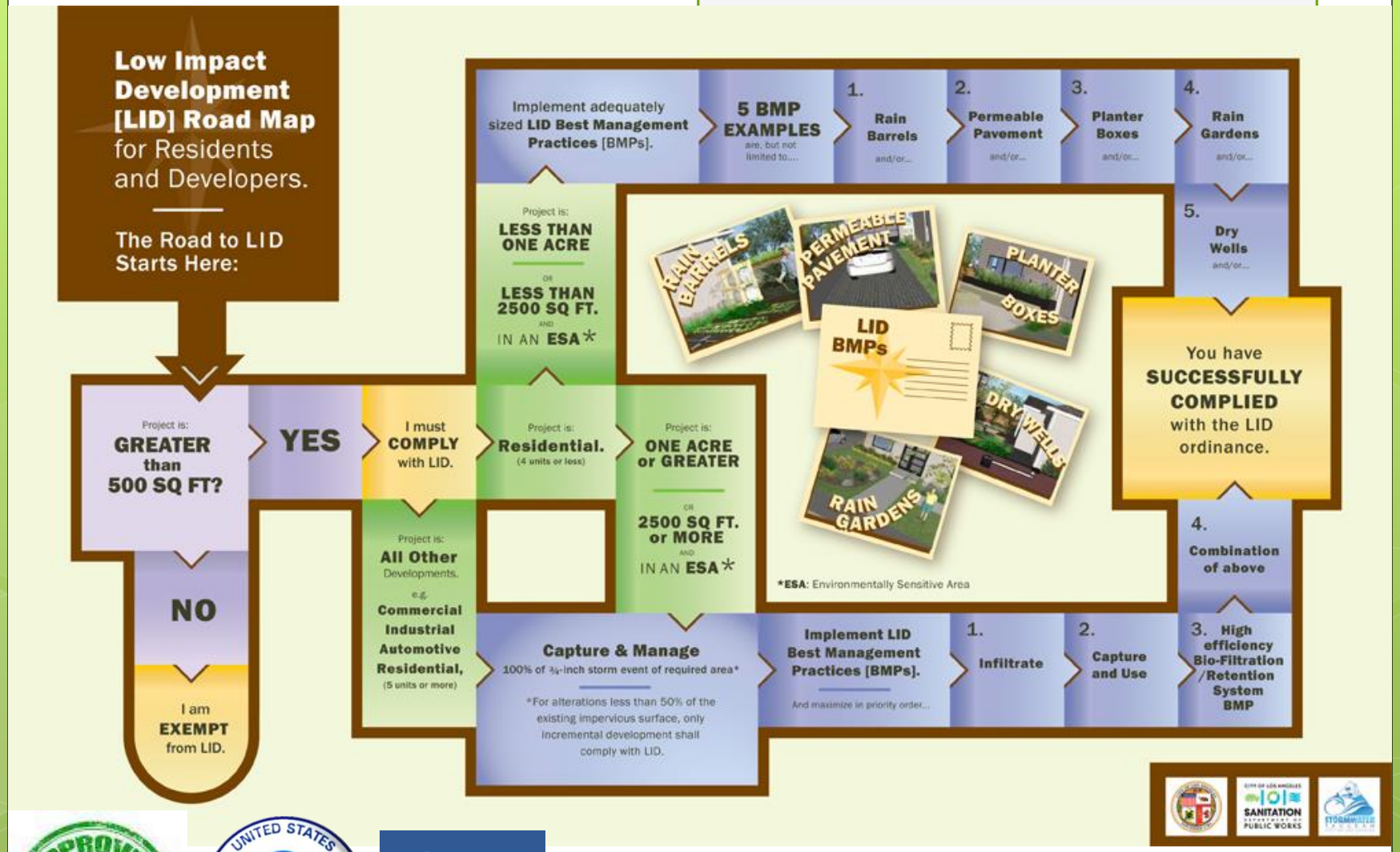
- **Hillside Grading Areas**
- **Earthquake Induced Liquefaction Areas**
- **Building and Safety Infiltration Information Bulletin**







LID Roadmap



APPROVED OK APPROVED

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Water Boards

Rain Barrels

SMALL SCALE RESIDENTIAL
RAIN BARREL FACT SHEET

Rain barrels capture runoff from roof downspouts during storms and temporarily store that runoff for later use. They are low-cost, effective, and easily maintained devices that can be sized for a specific volume of water. Retained water may be used for garden watering, and other outdoor non-potable uses. Rain barrel storage can reduce the amount of stormwater pollutants that are picked up and conveyed to local streams and the ocean. In addition, harvested water conserves precious City-supplied potable water and, if directed to unpaved surfaces, can recharge groundwater. Rain barrels are typically made of heavy duty plastic and can range in size from the standard 55 gallons to more than 80 gallons.

How many rain barrels do I need?

The number of rain barrels required to capture runoff from a given roof or impervious area is shown in the following table.

Are Rain Barrels Feasible at My Residence?

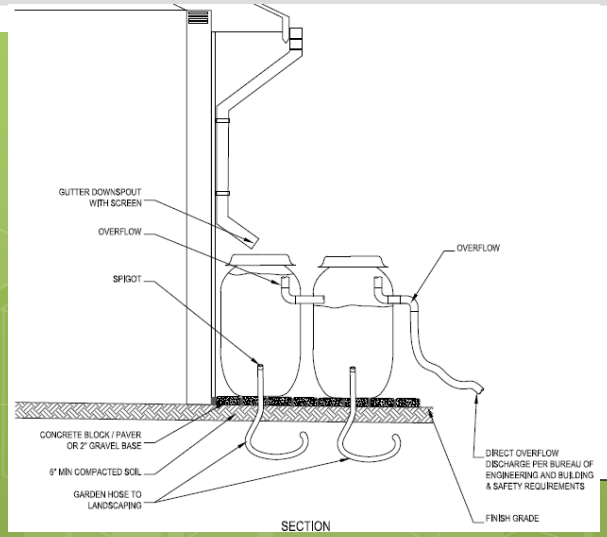
Rain barrels are appropriate where the following site characteristics are present:

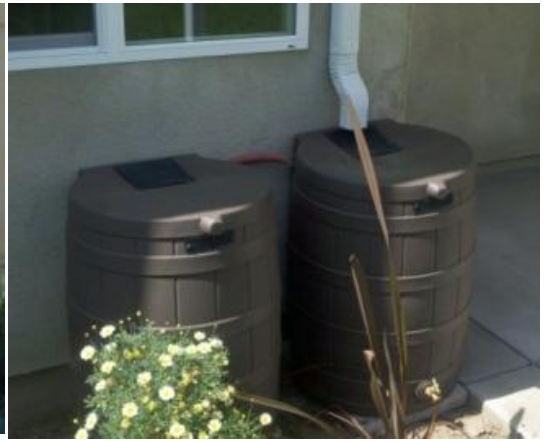
- Roof areas with downspouts are required.
- A level, firm surface for support of the rain barrel(s) is required. Rain barrels should only be elevated with solid construction materials and kept away from retaining walls as a full 55-gallon rain barrel will weigh over 400 lbs.
- An area where the captured water can be used is required to be present within a reasonable distance from the rain barrel(s).
- Design of an appropriate area for overflow from the barrel is necessary.

For sites within, immediately adjacent to, or discharging to an environmentally sensitive area, see the LID Manual for applicable criteria

Roof or Impervious Area (sq.ft.)	Number of 55 Gallon Rain Barrels*
500 – 1,000	4**
1,001 – 1,500	8**

* Or equivalent capture using larger rain barrels.
** Minimum landscape area for 4 rain barrels shall be 200 square feet and the minimum landscape area for 8 rain barrels shall be 400 square feet.





Permeable pavers

SMALL SCALE RESIDENTIAL PERMEABLE PAVEMENT FACT SHEET

Permeable Paver Driveway
Photo Credit: City of Los Angeles

Permeable pavement contains pores or separation joints that permits non-concentrated water to flow through and seep directly into a base material. Permeable pavement systems include porous asphalt and concrete, permeable pavers (i.e. permeable interlocking concrete pavers), and restrained systems (plastic or concrete grid systems with gravel-filled voids). These systems reduce runoff and encourage infiltration of stormwater into surrounding soils.

Installing permeable pavement reduces stormwater quantity and filters out contaminants that would otherwise run off into storm drains, creeks, and the ocean. This improves water quality, reduces runoff velocity and volume, and can encourage groundwater recharge. Permeable pavement is available in many different types that offer environmentally friendly and aesthetically pleasing options for driveways, wallkways, parking areas, and patios.

Is Permeable Pavement Feasible at My Residence?

Permeable pavement is appropriate where the following site characteristics are present

- Permeable pavements should work well on most resi dential sites where paved surfaces such as patios and driveways exist. Areas with slopes greater than 3 percent may not be appropriate.
- If the permeable pavement is designed to receive runoff other than incidental rainfall (e.g. roof) it should be in-stalled at least 3 feet from public sidewalks and 10 feet from building foundations.
- Promoting infiltration should be avoided under perme-able pavements at sites with expansive, clay-rich soils, or soils susceptible to tunnel erosion.
- At sites with certain characteristics that do not permit infiltration, an underdrain system can be installed to route the water to a storm drain or other BMP (i.e. rain garden). This type of system provides temporary stor-age, slows runoff, and filters some pollutants.
- There are many types of permeable pavements, includ-ing pour-in-place concrete or asphalt, unit paver blocks, and granular materials. Modular types, such as stone or brick pavers and open cell pavers, tend to be good options for residential projects. The use of the surface (i.e. vehicles, foot traffic, recreation), site conditions, aesthetic qualities, price, and maintenance require-ments should be considered during the design process.

For sites within, immediately adjacent to, or discharging to an environmentally sensitive area, see the LID Manual for applicable criteria.

How Much Permeable Pavement Do I Need?

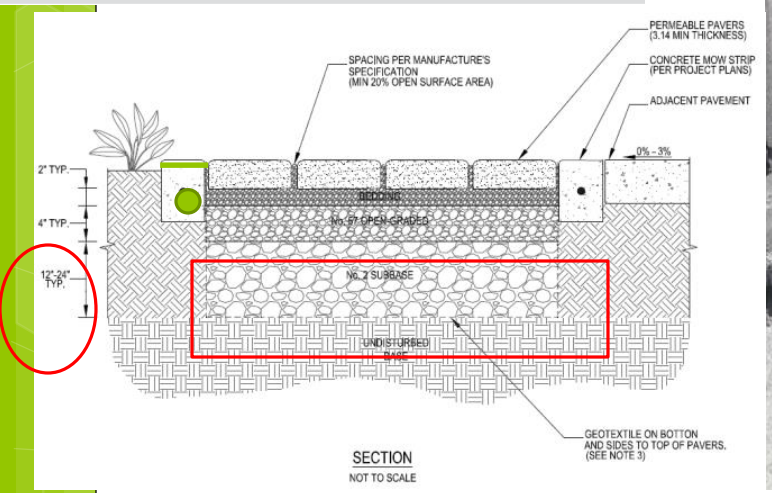
Permeable pavement should be sized to capture the runoff produced from the design storm within the gravel subbase of the pavement. This will ensure the capture and infiltration of the design storm volume. The following table should be used as minimum sizing guidance for permeable pavement.

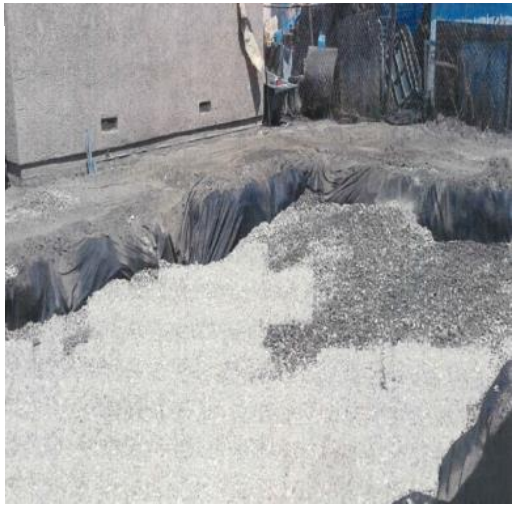
Contributing Area (ft²)	Permeable Pavement Area 1ft Gravel Subbase (ft²)	Permeable Pavement Area 2ft Gravel Subbase (ft²)
500 – 1000	90	50
1001 – 1500	150	80
1501 – 2000	210	110
2001 – 2500*	280	140

* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 60 sq. ft. of permeable pavement (with 1' of gravel subbase) or 30 sq. ft. of permeable pavement (with 2' of gravel subbase) per every 500 sq. ft. of addition.

Incidental Rainfall

Roof Runoff





Planter Boxes

SMALL SCALE RESIDENTIAL
PLANTER BOX FACT SHEET

Photo Credit: Deco Alfresco

Planter boxes function as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. The components normally consist of a ponding area, mulch layer, planting soils, plantings, drainage layer, and an outlet drain. As stormwater passes down through the planting soil, pollutants are filtered by the soil and plants.

Planter boxes at residential locations should be placed beneath rain gutter downspouts, or they may be placed directly beneath roof drip lines where rain gutters are not present so as to directly capture runoff from the roof. The overflow outlet should discharge away from the building to ensure water does not percolate into footings or foundations. Planter boxes can be designed as a single linear trough or a series of "pots" of various shapes and sizes.

Are Planter Boxes Feasible at My Residence?

Planter boxes are appropriate where the following site characteristics are present:

- Roof areas with downspouts, or roof areas without downspouts that drain runoff to impervious surfaces.
- A level, firm surface away from retaining wall structures for support of the planter(s). Planters should only be elevated with solid construction materials.

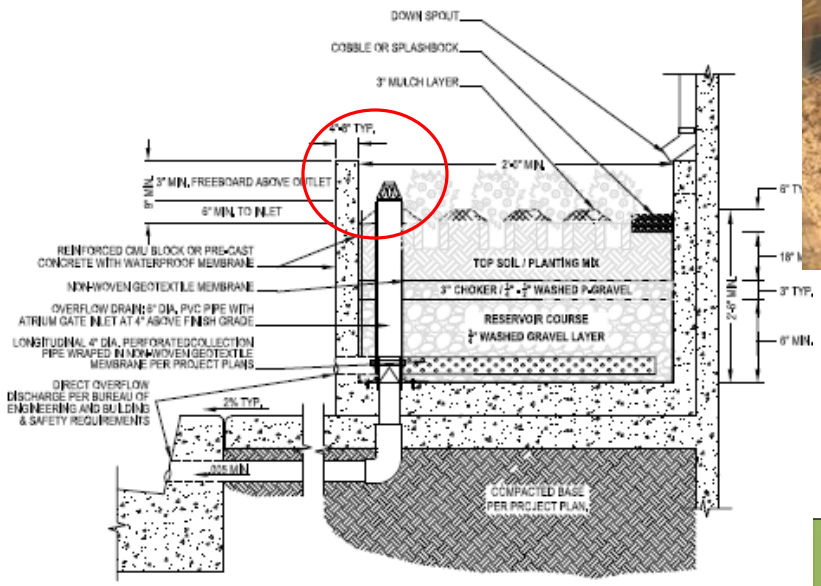
For sites within, immediately adjacent to, or discharging to an environmentally sensitive area, see the LID Manual for applicable criteria.

How Large Does My Planter Box Need to Be?

The total size of planter(s) necessary to capture run-off from a given roof area is shown in the table to the right. The table assumes a minimum planter depth of 2.5 feet, with 2 feet of soil and 0.5 feet of storage space, or "freeboard", above the soil surface.

Roof Area Tributary to Planter Boxes(sq.ft.)	Total Surface Area of Planter(s) (sq.ft.)
500 – 1,000	32
1,001 – 1,500	52
1,501 – 2,000	108
2,001 – 2,500*	168

* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 20 sq. ft. of planter box surface area per every 500 sq. ft. of additional area.



Rain Garden

SMALL SCALE RESIDENTIAL
RAIN GARDEN FACT SHEET

Rain gardens are simply gardens designed to capture and treat runoff. Stormwater runoff from impervious surfaces is directed toward a depression in the ground, which is planted with flood and drought-resistant plants. As the water nourishes the plants, the garden stores, evaporates, and infiltrates rainwater, reducing runoff and pollutant loads.

Rain gardens are a low-cost, effective, and aesthetically pleasing way to reduce the amount of stormwater that runs off your property and washes pollutants into storm drains, local streams, and the ocean. They are most often planted with native species. While mitigating the environmental impacts of land development, rain gardens also provide attractive landscaping and habitat for birds, butterflies, and other animals.

Photo Credit: City of Los Angeles

Are Rain Gardens Feasible at My Residence?

Rain gardens are appropriate where the following site characteristics are present:

- Edge of rain gardens should be installed at least 25 feet from building foundations, 3 feet from public sidewalks, 10 feet from property lines, and in an area where potential overflow will not run onto neighboring properties. Rain gardens may be located closer than the above mentioned criteria provided
  1) A geotechnical report is submitted and approved by LADBS or;
  2) A impermeable liner is installed to prevent infiltration under these facilities, and an over flow drain pipe to the street is installed
- Ground adjacent to the building should slope away at a 2% minimum. The rain garden area should receive full sunlight throughout most of the day. A downspout extension or bioswale can be used to convey rain from a roof directly into a rain garden. They are also appropriately sited downstream from a rain barrel overflow line.
- Do not site rain gardens above septic systems.
- The site should have well-drained soil and be relatively flat. Soil amendments can improve infiltration in areas with poor drainage.
- A front or back yard can work well for a rain garden, but look for areas where the slope naturally takes the stormwater. Areas where water naturally flows or ponds are ideal locations for a rain garden. Work with the site drainage and hydrology.
- Areas highlighted in Figures E-1 through E-4 are not ideal for rain gardens and must be approved by the City prior to installation. Areas highlighted in Figures E-5 require soils amendments to increase the natural soils infiltration abilities.

For sites within, immediately adjacent to, or discharging to an environmentally sensitive area, see the LID Manual for applicable criteria.

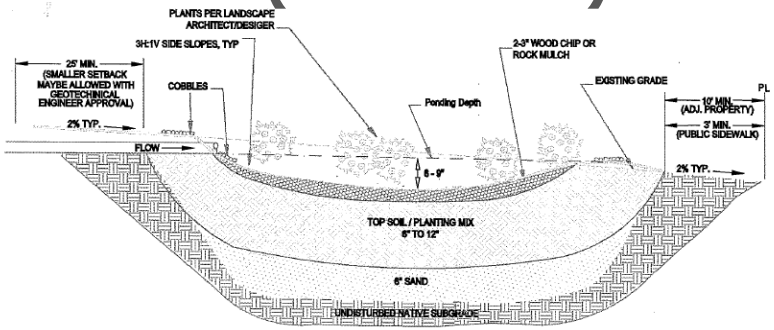
How Large Does My Rain Garden Need to Be?

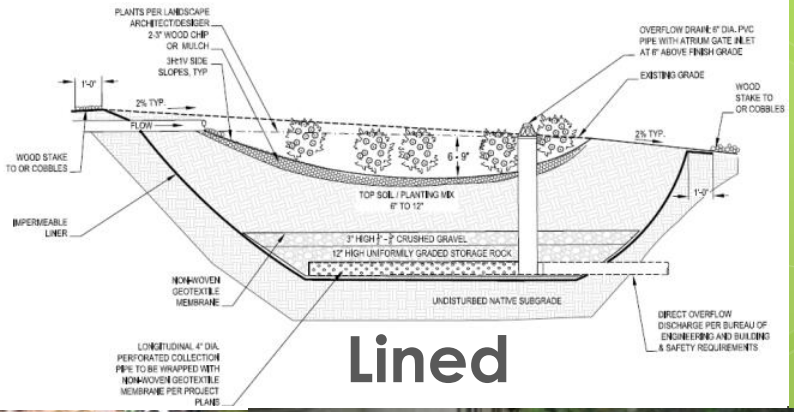
Rain gardens should not exceed 300 square feet, and the contibuting impervious area should not be more than 4,000 square feet. A general recommendation for a garden with a 6-inch ponding depth is to size the rain garden to approximately 6% of the contributing area. The infiltration rate of water into the soil will affect how the rain garden should be sized; rain gardens will need to be larger in areas with slower infiltration. The following table can be used as general guidance.

Contributing Area (sq.ft.)	Rain Garden Area (sq.ft.)
500 – 700	36
701 – 900	48
901 – 1100	60
1101 – 1300	72
1301 – 1500	84
1501 – 2000*	105

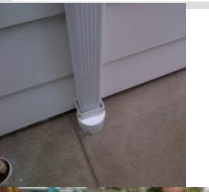
* Projects adding roof or impervious areas in excess of 2,000 sq. ft. shall add 30 sq. ft. of rain garden surface area per every 500 sq. ft. of additional area.

Unlined (infiltration)





Lined



Dry-wells

SMALL SCALE RESIDENTIAL
DRY WELL FACT SHEET

Prefabricated Dry Well
Photo Credit: Canale Landscaping

A dry well is a bored, drilled, or driven shaft or hole designed specifically for the infiltration of stormwater. Simple dry wells may consist of a small excavated pit filled with gravel media, while more advanced dry wells typically consist of a prefabricated storage chamber or perforated pipe segment placed in the ground. These latter types of dry wells offer more storage capacity per unit area since they are not typically filled with media and also conserve land area since they may be buried completely in the ground.

Dry wells are situated to capture runoff from roofs or other impervious areas. They can easily be designed to be directly connected to rain gutter systems to capture runoff from rooftops. Once filled with stormwater, dry wells can accept water at the same rate at which they can dissipate water.

Is a Dry Well Feasible at My Residence?

Dry wells are appropriate where the following site characteristics are present:

- Roof areas with downspouts or other impervious areas are required.
- Sites must have soils suitable for infiltration, with a minimum saturated hydraulic conductivity of 0.3 in/hr.
- Edge of dry wells should be installed at least 25 feet from building foundations, 3 feet from public sidewalks, 10 feet from property lines and an overflow drain pipe to the street is required. Dry wells may be located closer than the above mentioned criteria provided a geotechnical report is submitted and approved by LADBS.
- Do not site rain gardens above septic systems.
- An overflow area that drains to the street is required.

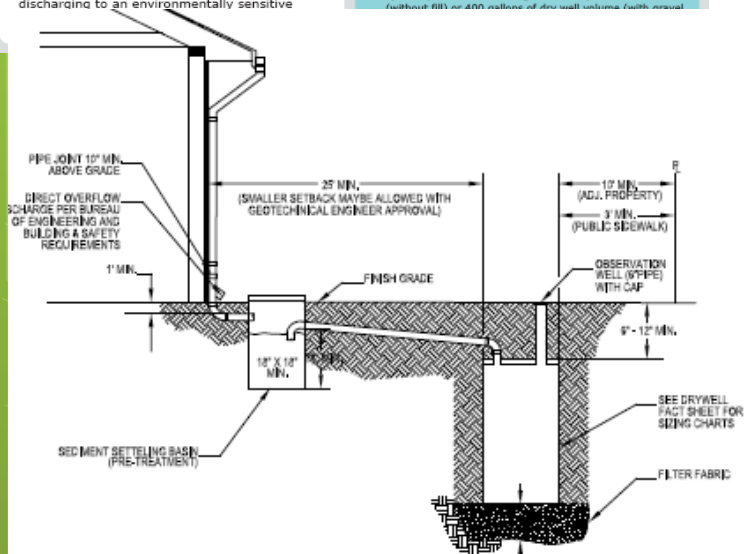
For sites within, immediately adjacent to, or discharging to an environmentally sensitive

How Large Does My Dry Well Need To Be?

A dry well should be sized to capture the runoff produced from the design storm over the connected impervious area, with account taken for any gravel or fill material that is used. This will ensure the capture and infiltration of the design storm volume. The following table should be used as minimum sizing guidance for dry wells.

Contributing Area (ft²)	Dry Well Volume - Without Fill (gallons)	Dry Well Volume - Including Gravel Fill (gallons)
500 – 1000	250	600
1001 – 1500	400	1,000
1501 – 2000	550	1,400
2001 – 2500*	700	1,800

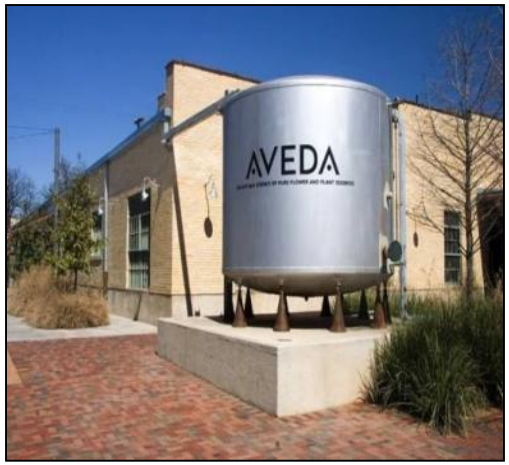
* Projects adding roof or impervious areas in excess of 2,500 sq. ft. shall add 150 gallons of dry well volume (without fill) or 400 gallons of dry well volume (with gravel



All Other Developments (commercial, industrial, etc.)

Prior to LID, implemented under SUSMP

- **Maximize each option in priority order.**



Infiltration

- Infiltration Trenches
- Infiltration Basins
- Dry Wells
- Permeable Pavement
- Underground Detention Chambers

Capture and Use

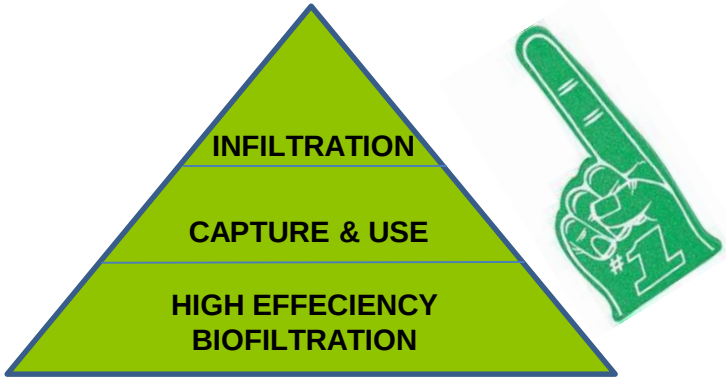
- Cisterns
- Rain Tanks

High Efficiency Bio-filtration

- Biofiltration (Flow thru Planters)
- Bioinfiltration
- Vegetated Swales

Infiltration

- Infiltration Trenches
- Infiltration Basins
- Dry Wells
- Permeable Pavement
- Underground Detention Chambers



Infiltration Trenches

Porous Pavement

Dry well

Infiltration Galleries

Permeable Pavers

Infiltration

BENEFITS

- Meet LID Requirements
  - Reduce Runoff
  - Improve Stormwater Quality
- Recharge Aquifers
- Retain open space

Underground Infiltration Chambers

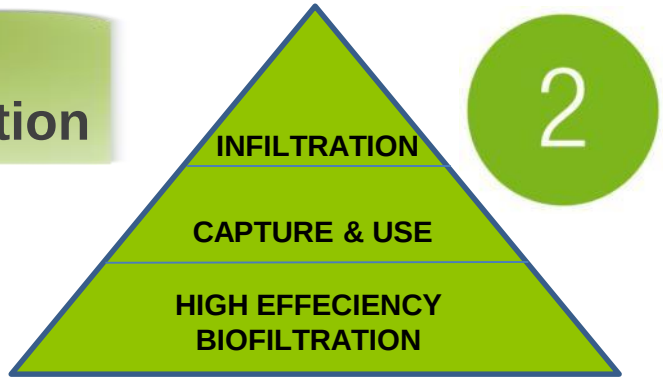
Underground Dry Wells

Capture & Use

- **Capture & Use Cisterns (above/below ground) with Irrigation**

Aboveground Storage

Underground Cistern



Drip Irrigation

Capture & Use

WILSHIRE GRAND

Wilshire Grand
Mixed Use (Commercial / Hotel)

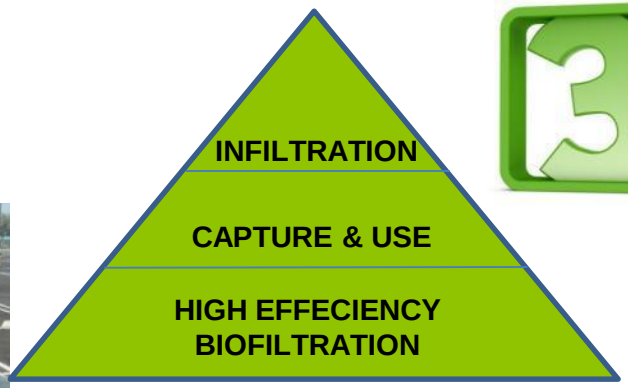
BENEFITS

- Meet LID Requirements
  - Reduce Runoff
  - Improve Stormwater Quality
- LEED Credits
  - Stormwater Quality
  - Stormwater Quantity
  - Water Efficient Landscaping
  - Water Use Reduction

50,000-gallon cisterns store both rainwater and air-conditioner condensate, which will then used in cooling towers.

Biofiltration

- **Biofiltration (Flow thru Planter Boxes)**
- **Vegetated Swales**

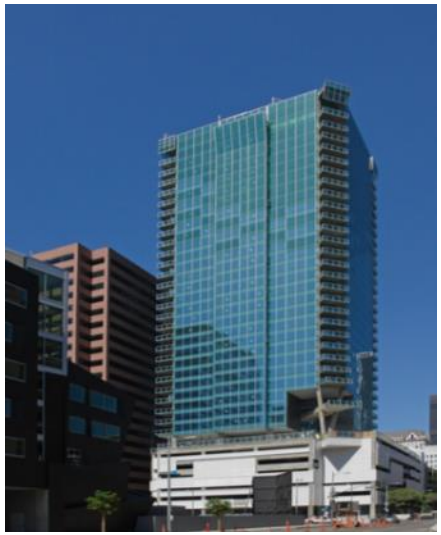


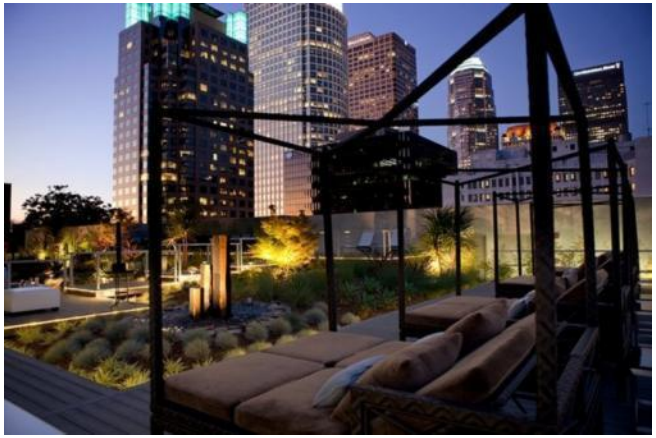
Planter Boxes

Bioinfiltration

Vegetated Swale

Biofiltration





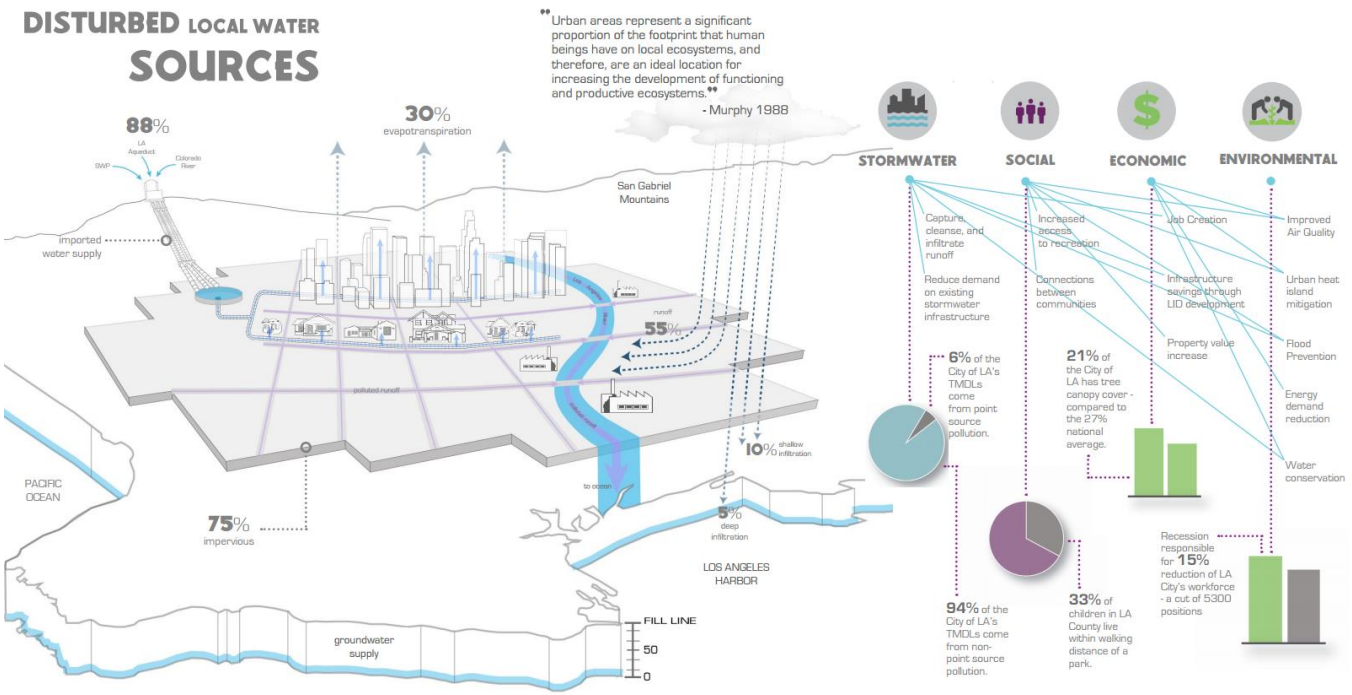
717 W. 9th St
34 story high Rise
Residential Building

BENEFITS

- Meets LID Requirements
  - Reduce Runoff
  - Improve Stormwater Quality
- Higher rental values
- Creates open community space

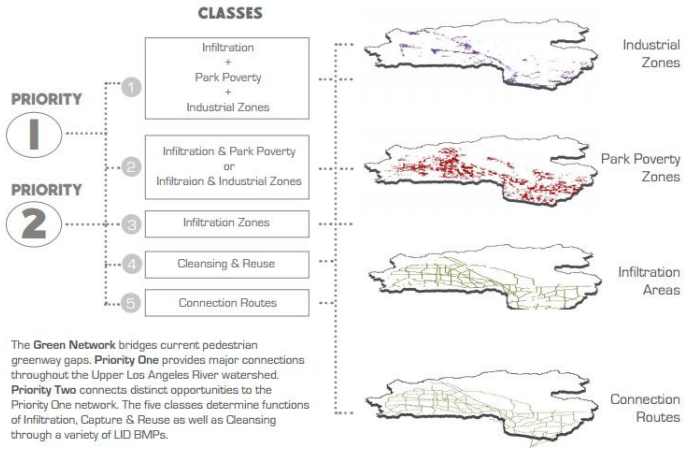
Greenways to Rivers Arterial Stormwater System

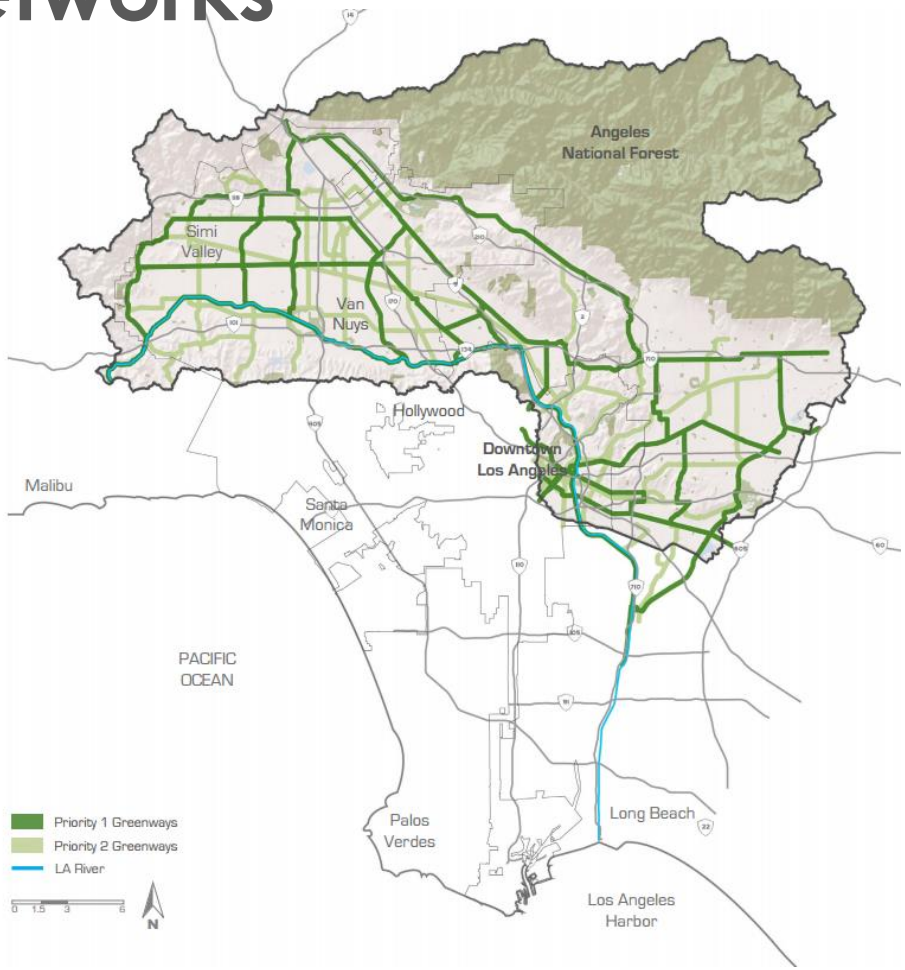
- A multifunctional greenway system
- Addresses park poverty
- Captures storm water through a variety of BMPs



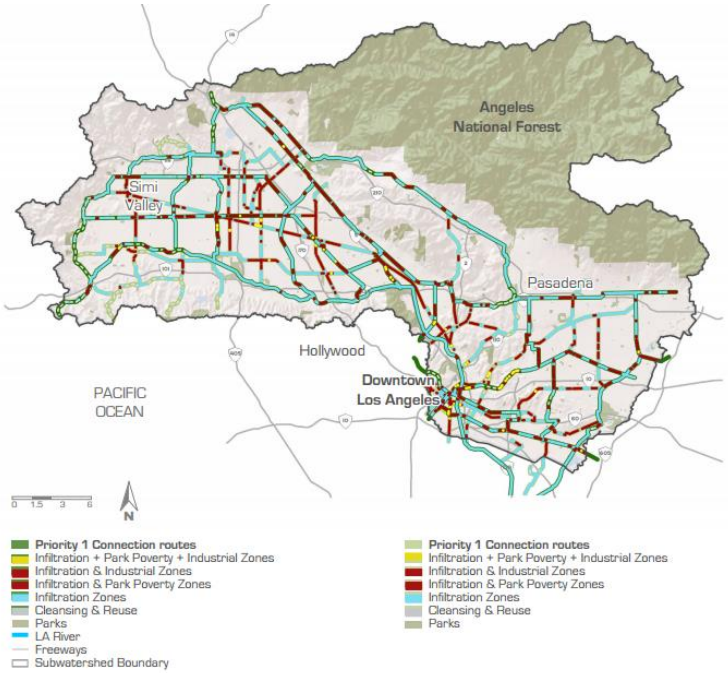
Regional Green Networks

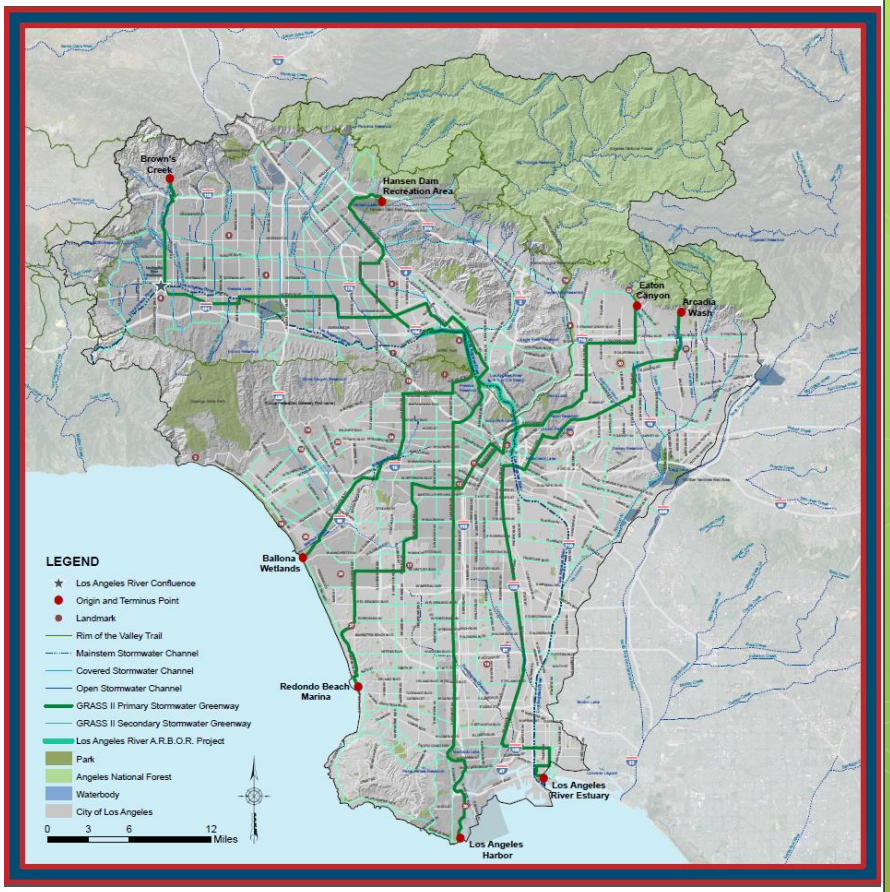
- PRIORITY 1
  - Grid of greenways
  - Major attractions
  - Spaced 5 miles apart
- PRIORITY 2
  - 2-3 mile grid
  - Connect remaining corridors



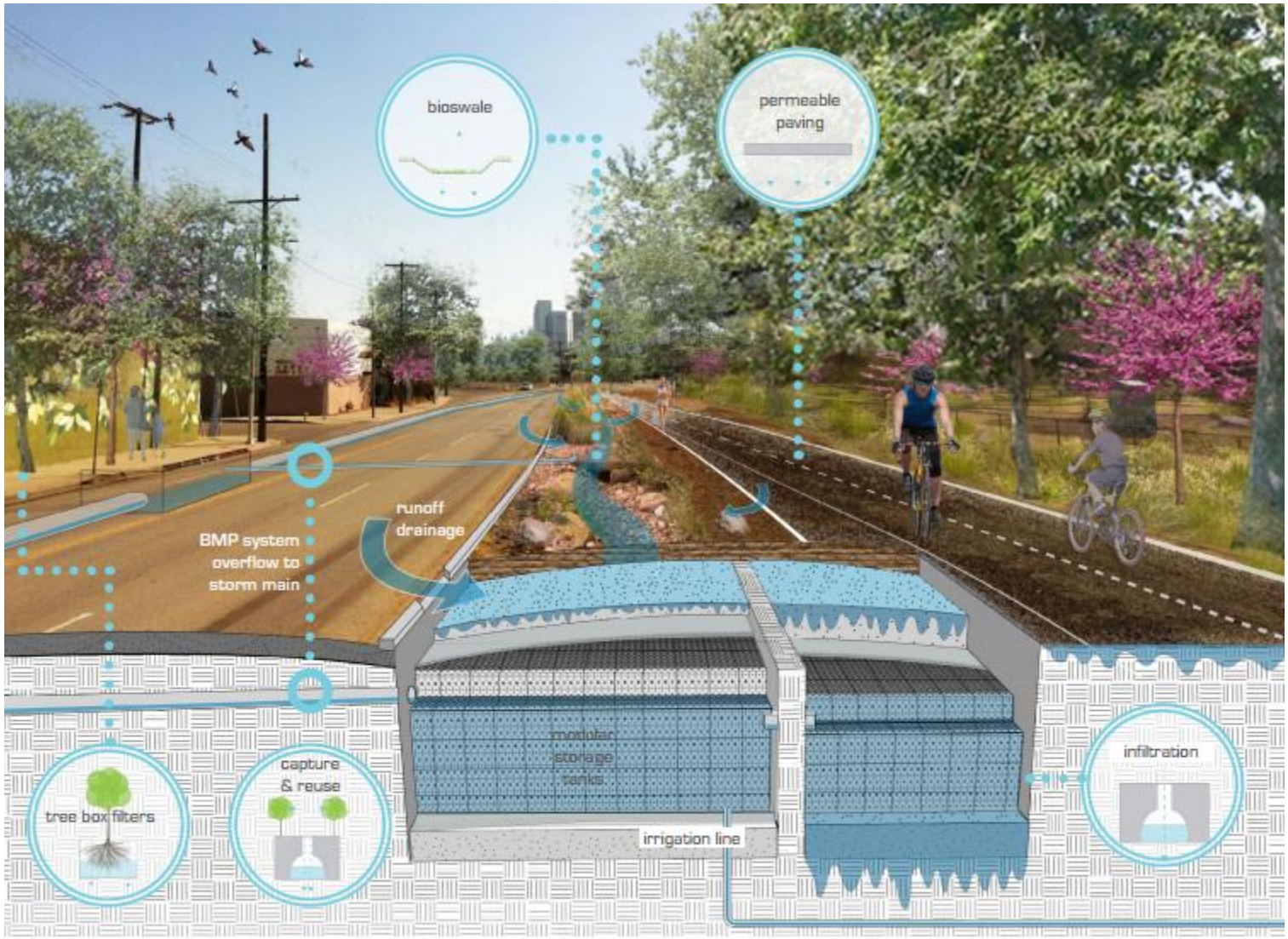


Modeling


Angeles
National Forest
Simi
Valley
Pasadena
Hollywood
Downtown
Los Angeles
PACIFIC
OCEAN
0 1.5 3 6
N
Priority 1 Connection routes
Infiltration + Park Poverty + Industrial Zones
Infiltration & Industrial Zones
Infiltration & Park Poverty Zones
Infiltration Zones
Cleansing & Reuse
Parks
LA River
Freeways
Subwatershed Boundary
Priority 1 Connection routes
Infiltration + Park Poverty + Industrial Zones
Infiltration & Industrial Zones
Infiltration & Park Poverty Zones
Infiltration Zones
Cleansing & Reuse
Parks


Brown's
Creek
Hansen Dam
Recreation Area
Eaton
Canyon
Arcadia
Wash
Ballona
Wetlands
Redondo Beach
Marina
Los Angeles
River Estuary
Los Angeles
Harbor
LEGEND
Los Angeles River Confluence
Origin and Terminus Point
Landmark
Rim of the Valley Trail
Mainstem Stormwater Channel
Covered Stormwater Channel
Open Stormwater Channel
GRASS II Primary Stormwater Greenway
GRASS II Secondary Stormwater Greenway
Los Angeles River A.R.B.O.R. Project
Park
Angeles National Forest
Waterbody
City of Los Angeles
0 3 6 12
Miles

Greenway Design



Question / Answers

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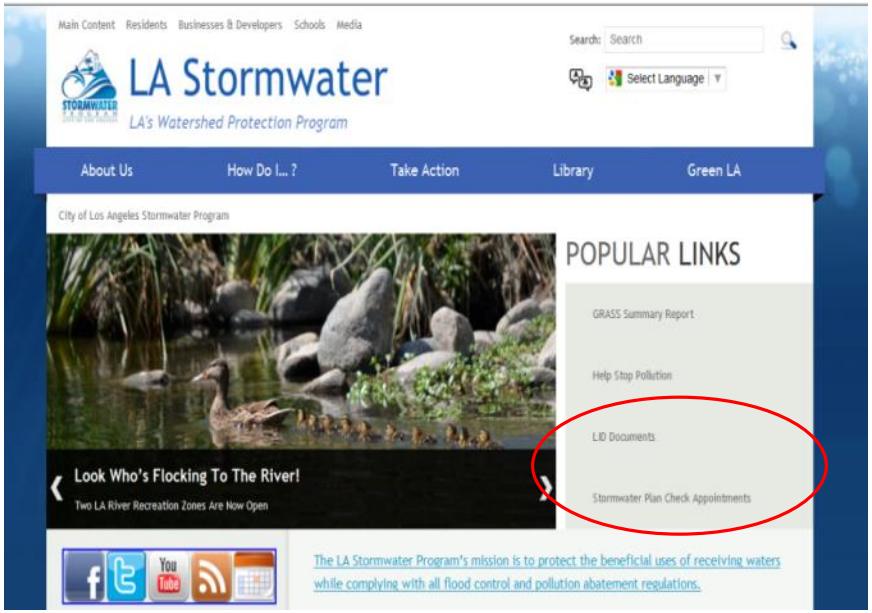

Additional Information:

www.facebook.com/lastormwaterprogram

www.youtube.com/user/lastormwaterprogram

www.lastormwater.org/blog/

Mission Statement:
"To Protect the Beneficial Uses of Receiving Waters, while Complying with All Pollution Abatement Regulations"