APPENDIX E

SMALL SCALE RESIDENTIAL PRESCRIPTIVE MEASURES (4 UNITS OR LESS)

Small Scale Residential BMP Fact Sheets

The following pages provide fact sheets with recommended criteria for the design and implementation of various residential BMPs. These fact sheets have been designed in a simplified, user-friendly way with the intent of achieving optimal performance of the measures. The siting, design, and maintenance requirements in the fact sheets are not exhaustive. Alternative designs may be approved by the City of Los Angeles based on site specific conditions if equivalent volume and pollutant removal performance is provided. New BMPs that are equivalent to those included in the 2016 LID Manual are acceptable if approved by the City of Los Angeles. All BMPs must be designed and implemented to be in full compliance with all applicable sections of the most recent municipal code, including site drainage requirements per the Los Angeles Building code.

The following BMPs for small scale residential projects are included in this Appendix:

- Rain Barrels (Small Cisterns)
- Rain Tanks (Cisterns greater 130 gal)
- Permeable Pavements (or Porous Pavement Systems)
- Planter Boxes
- Rain Gardens
- Dry Wells

Following the BMP Fact Sheets, a reference section with resources for additional information is provided.

Attached in this Appendix are five maps for guidance purposes in identifying areas that are not suitable for infiltration:

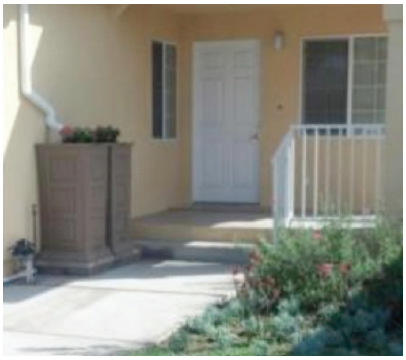
- Figure E-1: Slope Map (Hillside Grading)
- Figure E-2: Landslide Map
- Figure E-3: Groundwater Map
- Figure E-4: Liquefaction Map
- Figure E-5: Hydraulic Conductivity Map

Refer to LADBS Parcel Profile Report to see if a specific project location is located within a designated “Hill side Grading area” or “Liquefaction area.”

SMALL SCALE RESIDENTIAL

RAIN TANKS WITH TREE PLANTING FACT SHEET

(New & Redevelopment 500-999 SF)



Rain tanks capture runoff from roof downspouts during storms and temporarily store that runoff for later use. They are low-cost, effective, and easily maintained device. Retained water may be used for garden watering. In addition, harvested water conserves precious City-supplied potable water. Rain tanks are typically made of heavy duty plastic and can range in size from the standard 55 gallon to more than 80 gallons.

Planting a canopy shade tree near impervious surfaces intercepts precipitation in their leaves, precipitation that would otherwise become stormwater runoff.

How many rain tanks do I need?

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

Are rain tanks and trees feasible for my area?

Rain tanks and trees are only allowed for small scale residential projects that add or redevelop no more than 999 SF of impervious area.

Rain Tank Design Requirements:

- Roof areas with downspouts are required.
- A level, firm surface for support of the rain tank(s). Rain tank should only be elevated with solid construction materials and kept away from retaining walls as a full 55-gallon rain tank will weigh over 400 lbs.
- Vegetated landscape must be located within 25 ft down slope of rain tank (i.e. gravity flow) or connected to a drip irrigation system.
- Can be installed within side yard setbacks provided 30-inch clearance between property line is maintained.
- Direct overflow discharge per LADBS and BOE requirements.
- Collapsible rain tanks are not permitted.
- Rain tanks must provide a minimum 30-inch clearance between edge of rain tank and property line and may not project more than 30-inches into the side yard.

Tree Design Requirements:

- Trees must be planted at least 10 feet from the house foundation and at least 5 feet from fences, patios, driveway and sidewalks.
- Trees should not be planted in areas where permeable pavement, porous concrete or permeable pavers are installed.

Tributary Roof / Impervious Area (sq.ft.)		Required Vegetated Landscape (SF)
500 - 999	4-55 Gallon Rain Tanks * + 1-15 Gallon Shade Tree	**100 SF** (within 25ft of rain tanks)

* Or equivalent capture using larger rain tanks.

A list of shade trees can be found at: **www.cityplants.org**

Design Criteria and Considerations (check all that apply)

❏ Collapsible rain tanks are not allowed.
❏ Screens are present on all rain tank inlets to remove debris and larger particles as the water enters the barrel. Removable child-resistant covers and mosquito screening are in place.
❏ Rain tanks are properly placed on a stable even surface, and if required, anchored (strapped) to the exterior wall, or to the foundation to prevent tank from tipping over.
❏ Overflow outlet is provided and designed to direct overflow discharge per LADBS and BOE requirements.
❏ Rain tank must flow via gravity or obtain LA County Health approval (see Appendix K).
❏ Satisfy minimum area of vegetated landscape requirement and must be within 25 ft of the rain tank or connected to a drip irrigation system.
❏ Rain tank are opaque and dark in color to prevent UV light penetration and discourage algae growth.
❏ Trees must be planted at least 10 feet from the house foundation and at least 5 feet from fences, patios, driveway and sidewalks.
❏ Trees and other large vegetation should be planted away from any infiltration trenches such that drip lines do not overhang the infiltration area.
❏ Trees should not be planted in areas where permeable pavement, porous concrete or permeable pavers are installed.
❏ Shade trees must have a single main trunk.
❏ No trees or shrubs may be planted within ten feet of inlet or outlet pipes or manmade drainage structures such as spillways, flow spreaders, or earthen embankments. Species with roots that seek water, such as willow or poplar, shall not be used within 50 feet of pipes or manmade structures.
❏ See reccomended plant list

Operations and Maintenance (check all that apply)

❏ Rain tank components will be inspected 4 times annually and following major storm events. Screens, spigots, downspouts, and leaders will be repaired or replaced as needed. Rain gutters will be inspected and cleaned at least twice annually
❏ Rain tank will be cleaned as necessary to prevent algae growth and the breeding of vectors. Cleaning should always take place on a permeable surface. If vectors are breeding in a rain barrel, the barrel will be drained immediately.
❏ During dry periods, spigot drains will be left open when barrel is not in use.
❏ Dispersion areas will be maintained to remove trash and debris, loose vegetation. Areas of bare soil should be rehabilitated to minimize erosion.
❏ Where possible, effective energy dissipation and uniform flow spreading methods will be used to prevent erosion and aid dispersion.
❏ If adequate mosquito control is not in place and well-maintained, rain tanks will be emptied as necessary to prevent standing water from remaining in a tank for more than 3 days, thereby preventing vectors from breeding. If vector breeding occurs as a result of contained storm water or inadequately maintained BMPs, I understand that the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).

Once trees have been planted, the following criteria should be adhered to.
❏ For the first month after planting your tree, water deeply twice a week. For the second and third months after planting, water deeply once a week. The next few months you should only water every two weeks and once the tree is at least six months old, you can water once a month for the rest of its first year.
❏ After the tree is a year old watering requirement are minimal. Expect to water every six weeks as necessary for the next few years of the tree's growth.
❏ Once trees are mature, maintenance will also include pulling weeds around the base of the tree and pruning (removing dead or diseased branches), which helps the tree structure and increases its longevity.
❏ Cover the whole planting area with a 4 inch layer of mulch, leaving a 2 inch area around the base of the tree trunk free of mulch. Mulch is plant matter that includes: shredded leaves, straw or composted wood chips. Adding mulch keeps soil temperate, reduces surface evaporation of water and slows weeds from growing around the base of the tree.

Rain Tank Suppliers (The City of Los Angeles does not endorse any specific product or vendor)

- Bushman Rain Tanks: http://bushmanusa.com/
- Rain Tank Depot: http://www.raintankdepot.com/
- Plastic Mart: http://www.plastic-mart.com/
- Graf Rain Tanks: http://www.graf-water.com/
- Home Depot: http://www.homedepot.com/
- Rainwater HOG: http://rainwaterhog.com/
- Lowes: http://www.lowes.com/
- http://www.rainharvest.com/
- Hey Tanks LA: http://heytanksla.com/

SMALL SCALE RESIDENTIAL

RAIN TANKS FACT SHEET

(New & Redevelopment over 1,000 SF)

Rain tanks are similar to rain barrels as they also capture runoff from roof downspouts during storms and temporarily store that runoff for later use. Retained water may be used for garden watering. 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. Rain tanks are made of heavy duty plastic and are available in many shape and sizes.

How many rain tanks do I need?

A rain tank shall be a minimum of 130 gallons.

The size of rain tank(s) required to capture runoff from a given roof or impervious area shall be sized using the following formula.

Are rain tanks feasible for my area?

Rain tanks are only allowed for small scale residential projects that add or redevelop more than 1,000 SF of impervious area.

Design Requirements:

- Roof areas with downspouts are required.
- A level, firm surface for support of the rain tank(s).
- Rain tanks must be placed on a solid base and anchored to the exterior wall, and if required, to the foundation.
- Rain tanks shall not be located near retaining walls.
- Rain tanks must flow via gravity to vegetated landscape or obtain LA County Health approval (see Appendix K).
- Vegetated landscape must be located within 25 ft down slope of rain tanks (i.e. gravity flow).
- Can be installed within side yard setbacks provided 30-inch clearance between property line is maintained.
- Direct overflow discharge per LADBS and BOE requirements.
- Rain tanks must provide a minimum 30-inch clearance between edge of rain tank and property line and may not project more than 30-inches into the side yard.

Rain Tank Sizing (for each tributary area):

_____ (SF) x 0.42 = _____ Gallons

Tributary Roof or Impervious Area

Total Gallons Required to be Captured

Minimum required landscaping within 25 ft of rain tank shall be one third (1/3) of required volume to be captured.

EXAMPLE: 500 gallons captured -> min 166 sq ft of landscaping.

Design Criteria and Considerations (check all that apply)

❏ Screens are present on all rain tank inlets to remove debris and larger particles as the water enters the tank. Removable child-resistant covers and mosquito screening are in place.
❏ Rain tank(s) is properly cited on a stable surface, and anchored (strapped) to the exterior wall, or, to the foundation to prevent tank from tipping over.
❏ Above-ground tanks are not located on uneven or sloped surfaces; if installed on a sloped surface, the base where the tank is installed has been leveled using appropriate construction materials prior to installation.
❏ Overflow outlet is provided and designed to direct overflow discharge per LADBS and BOE requirements.
❏ Rain tanks must flow via gravity or obtain LA County Health approval (see Appendix K)
❏ Installed rain tank have not been placed on elevated platforms, decks or porches without consulting local building code officials.
❏ A minimum area of vegetated landscape equal to half the amount of captured gallons is required and must be within 25 ft of the rain tanks or connected to a drip irrigation system.
❏ Dispersion is directed so as not to knowingly cause geotechnical hazards related to slope stability or triggering expansive (clayey) soil movement. Overflow dispersion will take place at least 3 feet away from public sidewalks, at least 5 feet away from property lines and foundations, and at least 10 feet from building foundations.
❏ Rain tanks are opaque and dark in color to prevent UV light penetration and discourage algae growth.
❏ Rain tank placement allows easy access for regular maintenance.

Operations and Maintenance (check all that apply)

❏ Rain tank components will be inspected 4 times annually and following major storm events. Screens, spigots, downspouts, and leaders will be repaired or replaced as needed.
❏ Rain tank will be cleaned as necessary to prevent algae growth and the breeding of vectors. Cleaning should always take place on a permeable surface. If vectors are breeding in a rain barrel, the barrel will be drained immediately.
❏ During dry periods, spigot drains will be left open when barrel is not in use.
❏ Dispersion areas will be maintained to remove trash and debris, loose vegetation. Areas of bare soil should be rehabilitated to minimize erosion.
❏ Where possible, effective energy dissipation and uniform flow spreading methods will be used to prevent erosion and aid dispersion.
❏ If adequate mosquito control is not in place and well-maintained, rain barrels will be emptied as necessary to prevent standing water from remaining in a barrel for more than 3 days, thereby preventing vectors from breeding. If vector breeding occurs as a result of contained storm water or inadequately maintained BMPs, I understand that the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).
❏ Rain gutters will be inspected and cleaned at least twice annually.

Rain Tank Suppliers (The City does not endorse any specific product or vendor)

- Bushman Rain Tanks: http://bushmanusa.com/
- Rain Tank Depot: http://www.raintankdepot.com/
- Plastic Mart: http://www.plastic-mart.com/
- Graf Rain Tanks: http://www.graf-water.com/
- Home Depot: http://www.homedepot.com/
- Lowes: http://www.lowes.com/
- http://www.rainharvest.com/

SMALL SCALE RESIDENTIAL
PLANTER BOX FACT SHEET

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 over flow 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 the 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 to 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 0.5 feet of storage space, or "freeboard," above the soil surface.

PLANTER BOX SIZING:

_____ SF (Impervious Tributary Area) x 0.05 = _____ SF

The table assumes that all runoff generated from the roof area will be directed to the planter(s).
If a planter only extends across a fraction of the roof drip line for which it was designed to capture all runoff, one of the following methods shall be implemented:

- Additional planters shall be installed to extend across the entire roof drip line.
- Gutters or other devices shall be installed on the tributary roof to direct all runoff to the planter(s).
- Additional LID BMPs shall be implemented to capture the runoff unacounted for by the planter(s).

Design Criteria and Considerations

When installing a planter box, the following criteria should be adhered to unless otherwise permitted by the City of Los Angeles. The owner should check all boxes that will be complied with.

- ❑ At locations without rain gutters, planters are placed directly below roof drip lines to capture runoff as efficiently as possible.
- ❑ At least 6 inches of storage is present between the planting surface and the crest of each planter.
- ❑ At locations implementing multiple planters, planters are placed directly adjacent to one another so as to minimize the impervious space between planters.
- ❑ Planters are not located on uneven or sloped surfaces.
- ❑ Planting soil is at least 2 feet deep.
- ❑ Planting soil contains no more than 30% compost.
- ❑ Minimum of 2 feet in width
- ❑ Planters have not been installed on elevated platforms, decks or porches without consulting local building code officials.
- ❑ The project is in full compliance with all applicable sections of the current municipal code, including drainage requirements per the Los Angeles Building and Safety Code.

Photo Credit: City of Los Angeles

Operations and Maintenance

Once a planter box is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- ❑ Planters will undergo annual plant and soil maintenance typical of landscape care procedures to ensure optimum filtration, storage, and drainage capabilities.
- ❑ Following rain events, planters will be inspected to ensure that standing water is not present in the planter for more than 72 hours (3 days). Ponded water that is not completely drained after 72 hours can cause vector breeding. If vector breeding occurs as a result of contained stormwater or inadequately maintained BMPs, I understand that the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).
- ❑ Pesticide additives will not be used in the planters.

SMALL SCALE RESIDENTIAL
RAIN GARDEN FACT SHEET

Rain gardens are simply depressed 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.

Are Rain Gardens Feasible at My Residence?

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

- 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 other non erosive device must be used to convey roof runoff directly onto a rain garden.
- Consider areas where the natural slope conveys runoff as potential areas for a rain garden.
- Rain gardens shall be located over a relatively flat surface area.

Unlined Rain Gardens:

- Allowed in areas that are not designated as areas of "Hillside Grading" or "Liquefaction." Refer to LADBS Parcel Profile Report to see if project is located within one of these areas.
- Edge of rain garden must meet LADBS guidelines for stormwater infiltration (unless LADBS Grading Division approves otherwise):
- 10 feet from building foundations and adjacent private property line.
- 3 feet from public right of way.
- Do not place rain gardens above septic systems.

Lined Rain Gardens:

- Rain gardens designated in areas of "Hillside Grading," or "Liquefaction" must have an impermeable linear to prevent infiltration and must provide an overflow (with under drain) to street.
- Rain gardens with an impermeable linear have no setback requirements.
- To avoid the need for a sump pump, the site must have a minimum of 27-inches between the inlet of the rain garden and the invert of the outlet to the street.

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 following shall be used for size.

RAIN GARDEN WITHOUT LINER (infiltration):

_____ SF x 0.05 = _____ SF

Impervious Tributary Area

RAIN GARDEN WITH LINER:

_____ SF x 0.07 = _____ SF

Impervious Tributary Area

Design Criteria and Considerations

When installing a rain garden, the following criteria should be adhered to unless otherwise permitted by the City of Los Angeles. The owner should check all boxes that will be complied with.

❑Location is at least 10 feet from building foundation and adjacent private property lines and 3 feet from public sidewalks 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.

❑Rain Garden has been located to intercept and collect runoff via a downspout or adjacent impervious area.

❑The rain garden is not located underneath the canopy of existing trees.

❑Rain garden is appropriately sized to the soil type and drainage area.

❑Rain garden is not located over septic systems or shallow utilities. Utilities have been located before digging by calling Dig Alert at 811.

❑The rain garden has been built on a relatively flat area. Refer to LADBS Parcel Profile Report to see if project is located within one of these areas. Permits are not required for typical residential landscaping projects. If you plan on making major landscaping modifications such as moving more than 50 cubic yards of soil or altering 1 acre or more, contact the Los Angeles Building and Safety Department at (866) 452-2489 for further assistance.

❑An overflow has been incorporated in the rain garden such that excess water will discharge per LADBS and BOE requirements.

❑Drought and flood resistant native plant species are used whenever possible. Invasive or pest species have been avoided. A listing of resources where information on native plant species can be found is in the reference section. A list of invasive species may be found at the California Invasive Plant Council, Southern California Region website (**www.cal-ipc.org**).

Operations and Maintenance

Once a rain garden is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

❑ Rain gardens will be irrigated deeply once a week during dry months to encourage root growth and keep plants strong, especially while plants are being established. Plants will be inspected for health and weeds will be removed as often as necessary.

❑ Rain gardens will be monitored after storm events for signs of overflow. If overflow occurs significantly or often, the size and/or depth of the garden may need to be increased, or other actions to increase infiltration (e.g., soil ammendments, underdrain installation) may be necessary.

❑ Signs of erosion will be repaired immediately. Further erosion can be prevented by reinforcing the surrounding area with groundcover or using energy dispersion techniques on downspouts.

❑ Infiltration effectiveness and excess sediment deposition will be monitored annually, preferably prior to the start of the rainy season.

❑ Standing water will not remain in a rain garden for more than 3 days. Extended periods of flooding will not only kill vegetation, but may result in the breeding of mosquitos or other vecotrs. If vector breeding occurs at a site as a result of contained stormwater or inadequately maintained BMPs, I understand that the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).

❑ Rain gutters and downspouts will be inspected and cleaned at least twice annually.

SMALL SCALE RESIDENTIAL PERMEABLE PAVEMENT FACT SHEET

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 characteristic are present:

- Permeable pavements should work well on most residential sites where paved surfaces such as patios and driveways exist. Areas with slopes greater than 3 percent may not be appropriate.
- There are many types of permeable pavements, including 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 requirements should be considered during the design process.

Permeable Paving areas receiving roof runoff (concentrated flow) shall be sized using table herein.

- Not allowed in areas that are designated as areas of "Hillside Grading", "Liquefaction" or "landslide". Refer to LADBS Parcel Profile Report to see if project is located within one of these areas.
- Edge infiltration area must meet LADBS guidelines for stormwater infiltration (unless LADBS Grading Division approves otherwise):
- 10 feet from building foundations and adjacent private property line.
- 3 feet from public right of way.
- Does not infiltrate above septic systems.

Permeable Paver area receiving only incidental rainfall (no runoff from impervious areas):

- Concentrated roof runoff cannot discharge onto pavers.
- Can be located anywhere on the property but must be comply with BOE site drainage requirements.

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 shall be used as minimum sizing guidance for permeable pavement.

For One (1) Foot Subbase:

_____ SF (Impervious Tributary Area) x 0.14 = _____ SF

For Two (2) Foot Subbase:

_____ SF (Impervious Tributary Area) x 0.07 = _____ SF

Design Criteria and Considerations

When installing permeable pavement, the following criteria should be adhered to unless otherwise permitted by the City of Los Angeles. The owner should check all boxes that will be complied with.

- ❏ Installed subsurface is an open-graded base of crushed stone, which has 35 to 45 percent pore space, to allow for adequate drainage and storage.
- ❏ Site soils have adequate drainage (at least 0.5 inches per hour) and depth to groundwater (5 feet) if water will infiltrate from the open-graded base into site soils.
- ❏ Infiltration will not cause geotechnical hazards related to expansive soil movement, tunnel erosion, or slope stability.
- ❏ If infiltration hazards are a concern, an underdrain has been installed to drain water into a storm drain inlet or onsite BMP.
- ❏ Slope is not greater than 3 percent.
- ❏ Flow directed to permeable pavement is dispersed.
- ❏ Pavers have a minimum thickness of 80 mm (3.14 inches).
- ❏ If required by LAFD, the project has been approved y LAFD.
- ❏ Pre-fabricated products have been installed per all appropriate manufacturer's specifications. If required, sub-grade soil has been compacted in accordance with product installation specifications.
- ❏ Project is in full compliance with all applicable sections of the current municipal code, including disabled access requirements and site drainage requirements per the Los Angeles Building Code.

Operations and Maintenance

Once permeable pavement is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

- ❏ Pavement will be inspected after rains for pooling or other visible problems. Surface clogging or movement of modular pavers can cause problems with both drainage and pavement function. Missing sand or gravel between pavers will be replaced as necessary
- ❏ Pavement will be inspected for vegetation. Depending on the type of pavement and growth, vegetation may need to be removed.
- ❏ Home owners have talked with the contractor or manufacturer for additional maintenance requirements for their specific installation. Permeable pavement can involve significant maintenance, depending on the type of pavement installed.

Permeable Paver / Pavement Suppliers (The City does not endorse any specific product or vendor)

- Xeripave: http://www.xeripave.com/
- Angelus Paving: http://www.angeluspavingstones.com/category/details-and-specs/details/permeable/
- Grasecrete: http://www.grasscrete.com/
- Terrafirm enterprises: http://www.terrafirmenterprises.com/
- Home Depot: http://www.homedepot.com/
- Lowes: http://www.lowes.com/

SMALL SCALE RESIDENTIAL
DRY WELL FACT SHEET

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. Dry wells require supporting documentation of infiltration rate* and must be stamped by a licensed engineer.

Are Dry Wells feasible for my Residence?

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

- Dry wells located in areas designated as "Hillside Grading", "Liquefaction" or "landslide" areas are not allowed unless a geotechnical report is submitted and approved by LADBS. Refer to LADBS Parcel Profile Report to see if project is located within one of these areas.
- Edge of dry well (infiltration area) must meet LADBS guidelines for stormwater infiltration (unless LADBS Grading Division approves otherwise):
- 10 feet from building foundations and adjacent private property line.
- 3 feet from public right of way.
- Dry wells may be located closer than the above mentioned criteria provided a geotechnical report is submitted and approved by LADBS.
- Sites must have soils suitable for infiltration, with a minimum saturated hydraulic conductivity of 0.3 in/hr*.
- Roof areas with downspouts or other impervious areas are required.
- Do not site dry wells above septic systems.
- Overflow is provided and designed to direct overflow discharge per LADBS and BOE requirements.
- Do not site dry well above septic systems.

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 shall be used as minimum sizing guidance for dry wells.

Dry Well Volume Without Fill:

_____ SF (Impervious Tributary Area) x 0.42 = _____ Gal

Dry Well Volume With Gravel Fill:

_____ SF (Impervious Tributary Area) x 1.05 = _____ Gal

*Supporting documentation: Soils report which address infiltration and/or any results per LA County DPW Geotechnical and Materials Engineering Division testing methods that can be used to determine the insitu infiltration rates. Results must be stamped by a licensed engineer.

Design Criteria and Considerations (check all that apply)

When installing a dry well, the following criteria should be adhered to unless otherwise permitted by the City of Los Angeles. The owner should check all boxes that will be complied with.

❏ Supporting documentation of infiltration rate.
❏ Plan requires an engineer's wet stamp.
❏ Edge of dry wells should be installed at least 10 feet from building foundations, 3 feet from public sidewalks, 10 feet from private 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.
❏ Dry well has been properly located and installed to intercept and collect runoff via a downspout from a roof or adjacent impervious area.
❏ Dry well is appropriately sized in accordance with the sizing table above.
❏ For dry wells with gravel fill, gravel used is 2" or greater diameter stone.
❏ The soil under the dry well has been over-excavated to at least one foot in depth. The soil has been replaced uniformly without compaction, or amended with 15-30% of coarse sand and replaced without compaction.
❏ A fine mesh screen has been installed on the inlet to prevent sediment and debris from entering the dry well.
❏ An observation well has been incorporated into the dry well design. The observation well consists of a slotted or perforated pipe (typically PVC), 4-6 inches in diameter, capped with an above-ground, sealable lid.
❏ Overflow is provided and designed to direct overflow discharge per LADBS and BOE requirements.

Operations and Maintenance

Once a dry well is installed, the following criteria should be adhered to. The owner should check all boxes that will be complied with.

❏ Water level, drawdown time, and evidence of clogging will be monitored monthly during the rainy season.
❏ Standing water will not remain in an exposed dry well for more than 3 days. Extended periods of flooding may result in the breeding of mosquitoesor other vectors. If vector breeding occurs at asite as a result of contained stormwater or inadequately maintained BMPs, I understand that the Greater Los Angeles County Vector Control District has the ability to fine site owners for violating the California Health and Safety Code (Section 2060 – 2067).
❏ Rain gutters and downspouts will be inspected and cleaned at least twice annually.
❏ If the dry well ever becomes plugged and overflows on a continual basis, the dry well will be excavated and removed. The dry well will be repaired or replaced as necessary, and gravel media fill will be cleaned or replaced to enhance the infiltration capacity.

Dry Well Suppliers: (The City does not endorse any specific product or vendor)

- Advanced drainage Systems, Inc: www.ads-pipe.com
- Invesiable Structures, Inc.: www.invisablestructures.com
- Contech Stormwater Solutions: www.contech-cpi.com
- Tensar Technologioes, Inc.: www.tensacorp.com
- Cultec, Inc.: www.cultec.com
- Hydrologic Solutions: www.hydrologicsolutions.com
- NDS www.ndspro.com
- Stormtech, Inc: www.stormtech.com
- Trition Stormwater Solutions: www.tritonsws.com

References

The City of Los Angeles maintains a rainwater harvesting website that provides information on LA's Rainwater Harvesting Program and instructional content for the implementation of various BMPs. The website can be accessed at www.lastormwater.org. *A Homeowner's "How-to" Guide*, which gives helpful information on rain barrel and rain garden installation, can be found on this website as well.

Additional Manuals

Many LID manuals exist that offer additional insight and information with regards to residential BMP implementation. The following manuals may be consulted to obtain more information on LID practices in Southern California:

- City of Santa Barbara, Storm Water BMP Guidance Manual (June 2013).
- County of Los Angeles, Low Impact Development Standards Manual (January 2014).
- County of San Diego, Low Impact Development Handbook – Stormwater Management Strategies. (July 2014).
- County of Ventura, Ventura County Technical Guidance Manual for Stormwater Quality Control Measures Manual (July 2011).
- Los Angeles Unified School District (LAUSD), Stormwater Technical Manual (October 2009).

Web Resources

A host of information is available on the world wide web to help homeowners design and implement LID BMPs. The following is a brief list of agencies and websites devoted to the protection and conservation of our water resources:

- The City of Los Angeles Stormwater Program (www.lastormwater.org)
- Los Angeles County Department of Public Works, Low Impact Development (http://ladpw.org/wmd/dsp_LowImpactDevelopment.cfm)
- Council for Watershed Health (www.watershedhealth.org)
- The Low Impact Development Center (www.lowimpactdevelopment.org)
- Metro Blooms (Rain garden installation video and information) (http://metroblooms.org)
- Metropolitan Water District of Southern California and The Family of Southern California Water Agencies (http://bewaterwise.com)
- Rainwater Harvesting for Drylands and Beyond by Brad Lancaster (www.harvestingrainwater.com)
- Rancho Santa Ana Botanic Gardens: California's Native Garden (native plant list and gardening workshops) (www.rsabg.org)
- TreePeople (www.treepeople.org)
- The U.S. Environmental Protection Agency (www.epa.gov/owow/NPS/lid)

Vendor Information

A short list of potential product vendors is provided below. The City of Los Angeles does not endorse any specific product or vendor.

Rain Barrels / Rain Tanks & Planter Boxes:

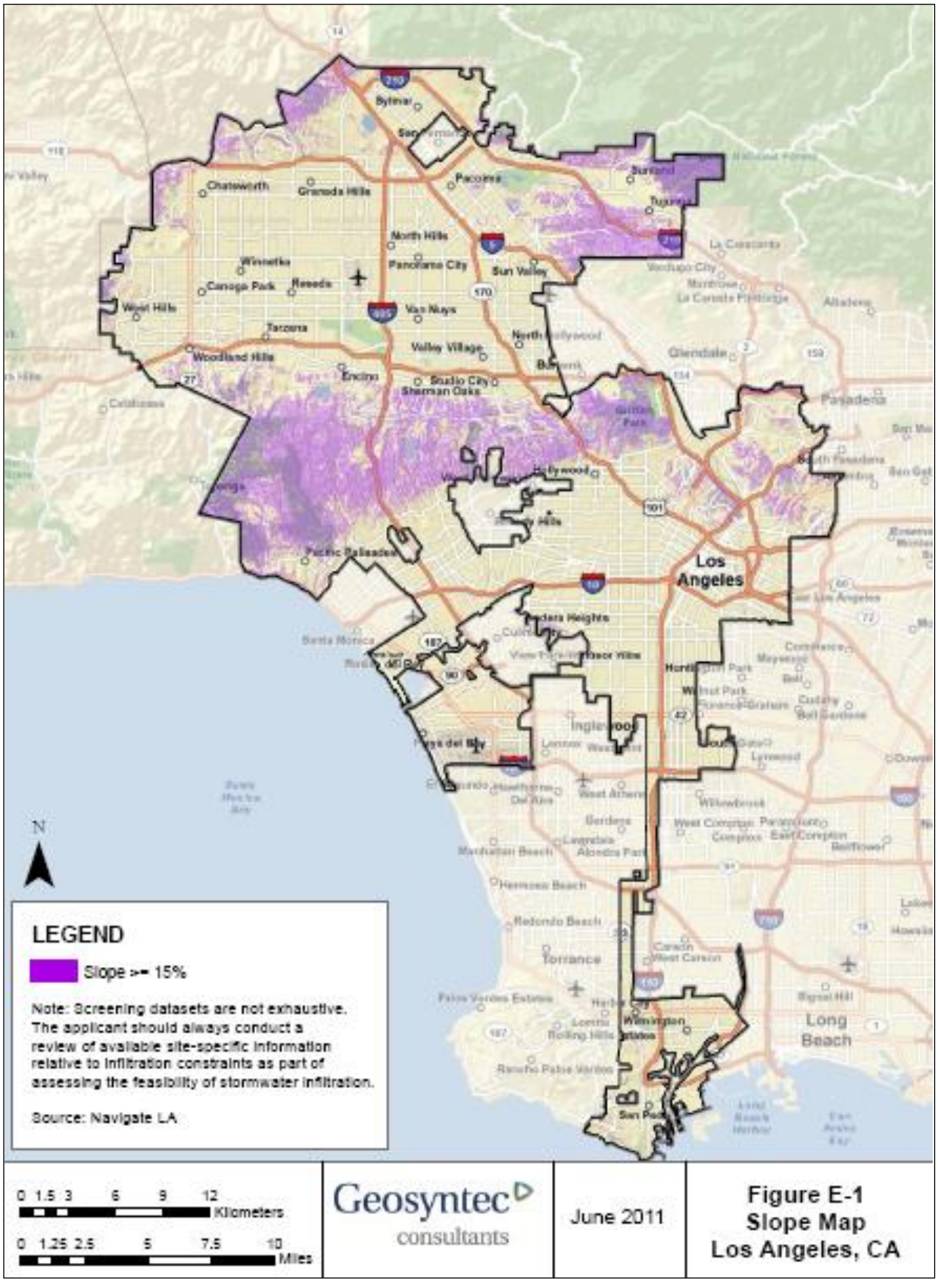
- Gutter Guy (www.gutterguyonline.com)
- Bushman Tanks (www.bushmanusa.com/)
- Hey!Tanks LA (www.heytanksla.com)
- H&H Nursery (www.hhnursery.com/current)
- The Home Depot (www.homedepot.com)
- Rain Barrels International (www.rainbarrelsintl.com)
- Bourjet Brothers Building Materials (www.bourgetbros.com)
- Lowes (www.lowes.com)
- Simply Rain Barrels (www.simplyrainbarrels.com)
- Ultra Greens Nursery (www.ultragreens.com/index.html)
- Water Tanks (www.watertanks.com)

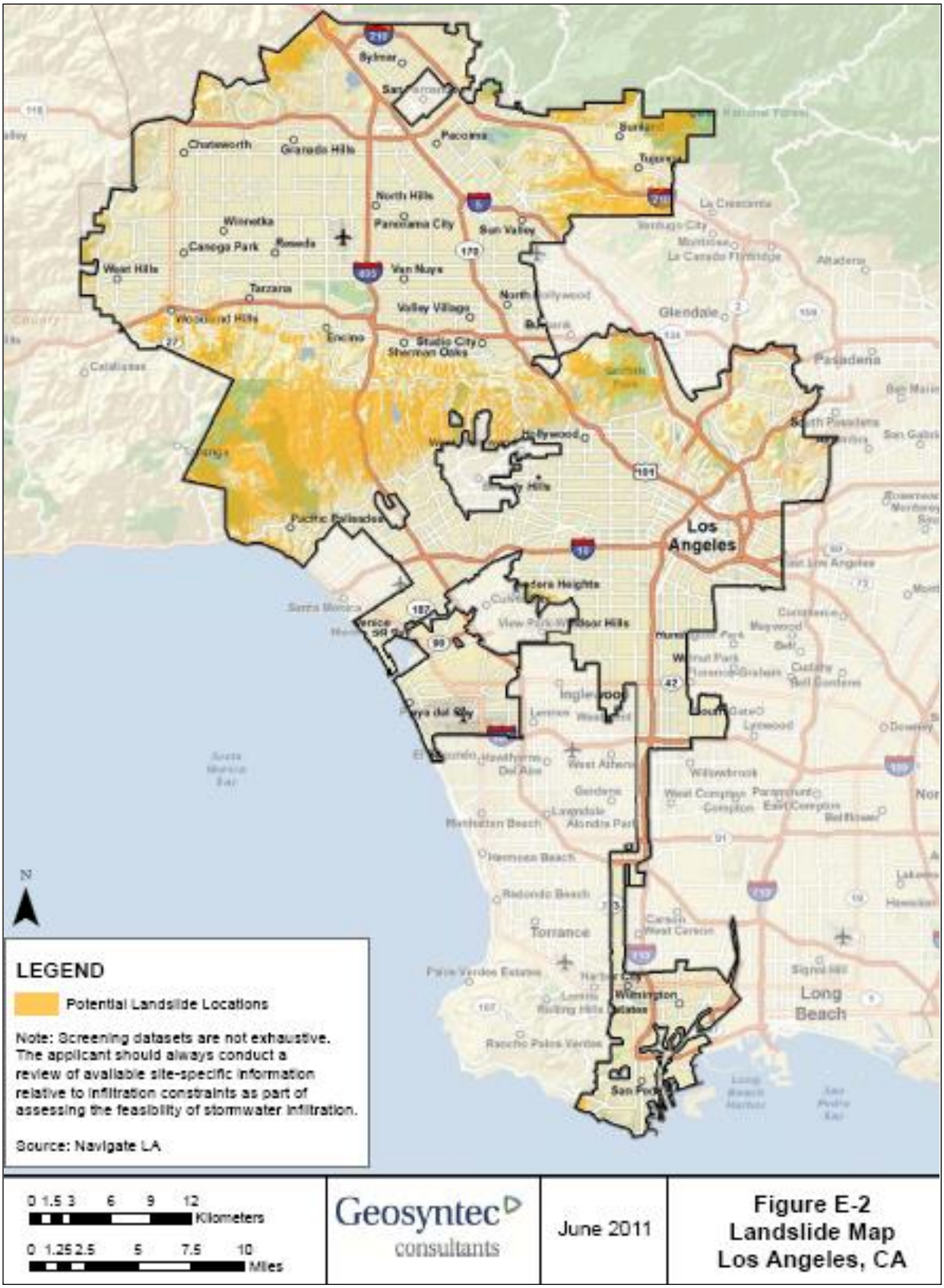
Dry Wells and Underground Storage Solutions:

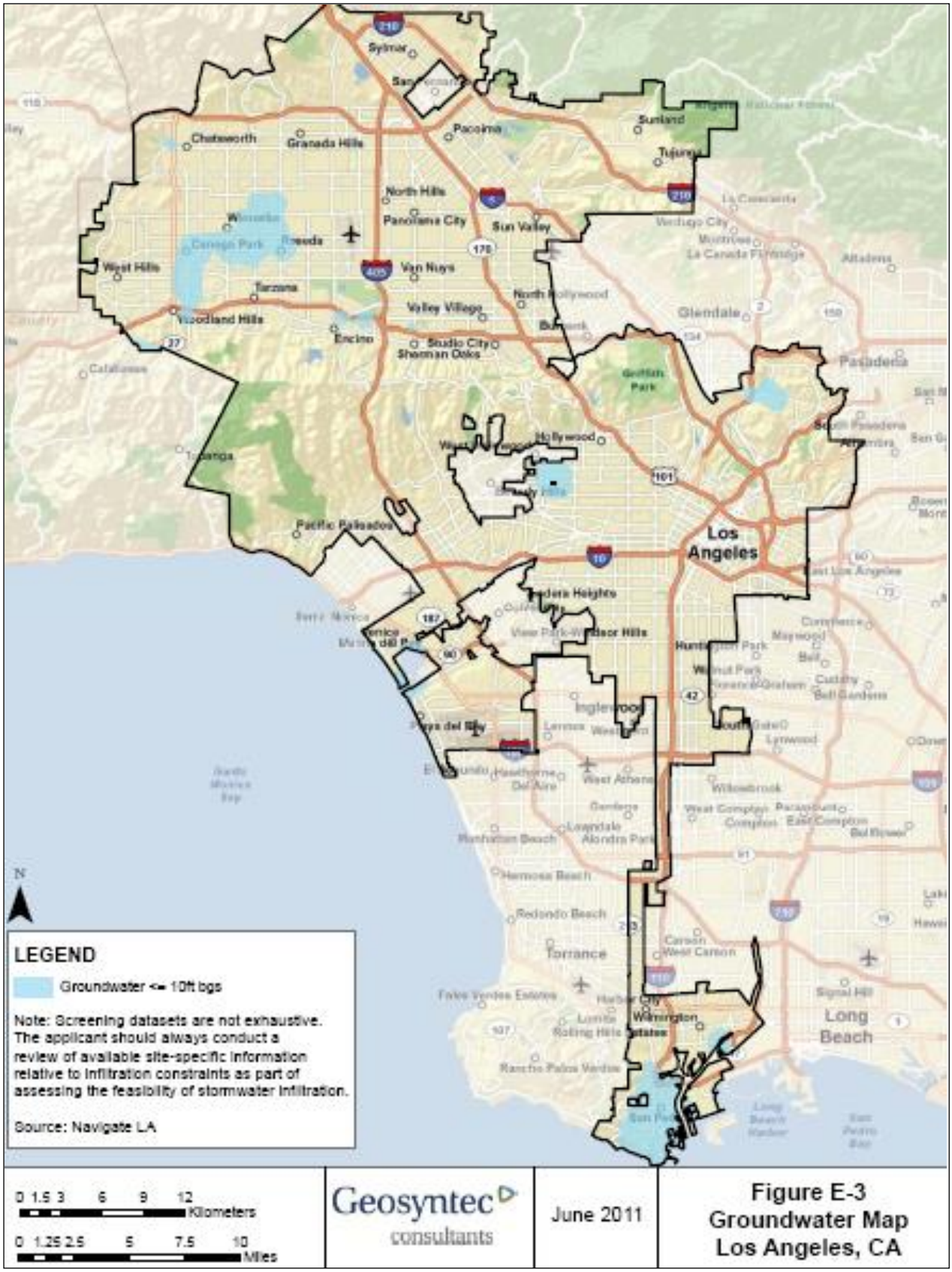
- Advanced Drainage Systems, Inc. (www.ads-pipe.com)
- Contech Stormwater Solutions (www.contech-cpi.com)
- Cultec, Inc. (www.cultec.com)
- HydroLogic Solutions (www.hydrologicsolutions.com)
- Invisible Structures, Inc. (www.invisiblestructures.com)
- NDS (www.ndspro.com)
- StormTech, Inc. (www.stormtech.com)
- Tensar Technologies, Inc. (www.tensarcorp.com)
- Triton Stormwater Solutions (www.tritonsws.com)

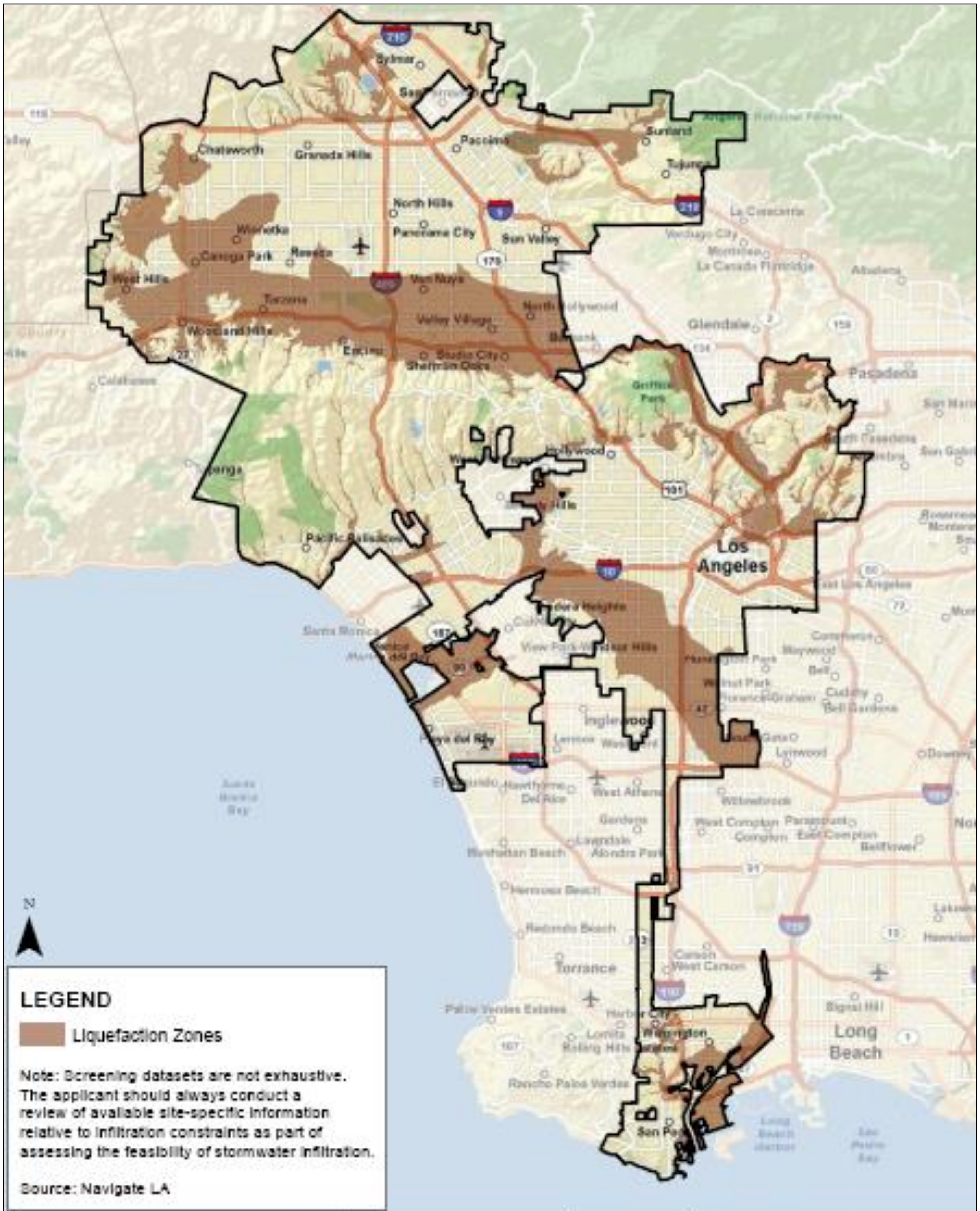
Permeable Pavement:

- Invisible Structures, Inc. (www.invisiblestructures.com)
- Geofill Cellular Concrete (www.geofill.com)
- The Home Depot (www.homedepot.com)
- Lowes (www.lowes.com)
- PermaPave (www.permapave.com)
- Terrafirm Enterprises (www.terrafirmenterprises.com)
- Uni-Group U.S.A. (www.uni-groupusa.org)


Chatsworth
Granada Hills
Pacoima
Sunland
Tujunga
North Hills
Winnetka
Canoga Park
Reseda
Panorama City
Sun Valley
La Crescenta
Montrose
La Canada Flintridge
Altadena
West Hills
Van Nuys
Tarzana
Woodland Hills
Encino
Valley Village
Studio City
Sherman Oaks
Glendale
Pasadena
Hollywood
Pacific Palisades
Los Angeles
Baldwin Hills
Santa Monica
Inglewood
Marina del Rey
Hawthorne
Gardena
Manhattan Beach
Hermosa Beach
Redondo Beach
Torrance
Carson
Palos Verdes Estates
Rancho Palos Verdes
Wilmington
Long Beach
San Pedro
N
LEGEND
Slope >= 15%
Note: Screening datasets are not exhaustive. The applicant should always conduct a review of available site-specific information relative to infiltration constraints as part of assessing the feasibility of stormwater infiltration.
Source: Navigate LA
0 1.5 3 6 9 12 Kilometers
0 1.25 2.5 5 7.5 10 Miles
Geosyntec consultants
June 2011
Figure E-1
Slope Map
Los Angeles, CA


Chatsworth
Granada Hills
Pacoima
Sylmar
Burbank
Tujunga
North Hills
Panorama City
Sun Valley
Winnetka
Canoga Park
Reseda
West Hills
Van Nuys
Tarzana
Valley Village
North Hollywood
Glendale
Woodland Hills
Encino
Studio City
Sherman Oaks
Pasadena
Hollywood
Pacific Palisades
Los Angeles
Venice
Inglewood
Torrance
Long Beach
Wilmington
San Pedro
N
LEGEND
Potential Landslide Locations
Note: Screening datasets are not exhaustive. The applicant should always conduct a review of available site-specific information relative to infiltration constraints as part of assessing the feasibility of stormwater infiltration.
Source: Navigate LA
0 1.5 3 6 9 12
Kilometers
0 1.25 2.5 5 7.5 10
Miles
Geosyntec consultants
June 2011
Figure E-2
Landslide Map
Los Angeles, CA


Sylmar
Chatsworth
Granada Hills
Pacoima
Sunland
Tujunga
North Hills
Panorama City
Sun Valley
Reseda
West Hills
Van Nuys
Tarzana
Valley Village
North Hollywood
Burbank
Glendale
Pasadena
Woodland Hills
Encino
Studio City
Sherman Oaks
Griffith Park
Hollywood
Los Angeles
Pacific Palisades
Inglewood
Torrance
Redondo Beach
Hermosa Beach
Long Beach
Wilmington
N
LEGEND
Groundwater <= 10ft bgs
Note: Screening datasets are not exhaustive. The applicant should always conduct a review of available site-specific information relative to infiltration constraints as part of assessing the feasibility of stormwater infiltration.
Source: Navigate LA
0 1.5 3 6 9 12 Kilometers
0 1.25 2.5 5 7.5 10 Miles
Geosyntec consultants
June 2011
Figure E-3
Groundwater Map
Los Angeles, CA



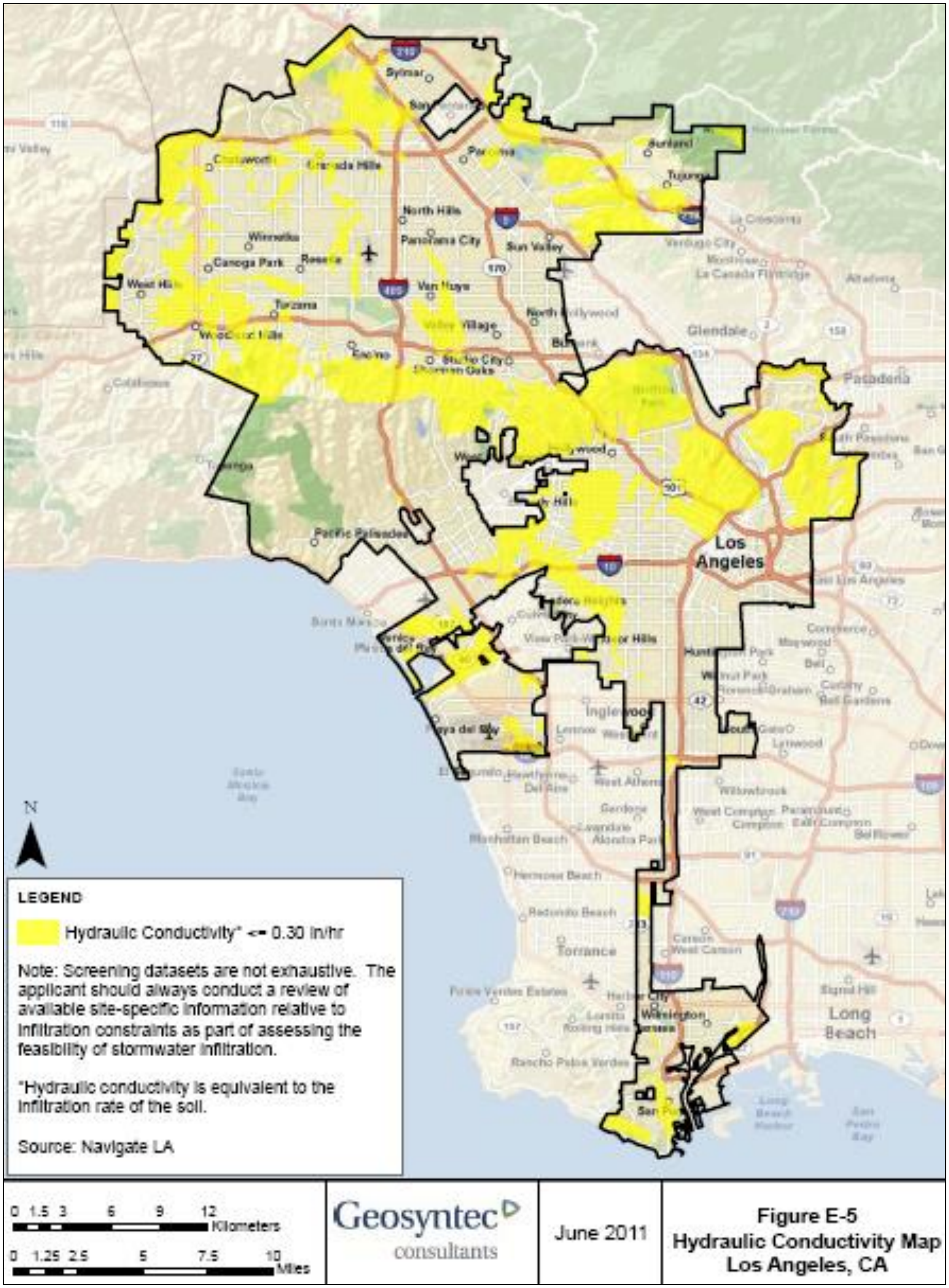
0 1.5 3 6 9 12 Kilometers

0 1.25 2.5 5 7.5 10 Miles

Geosyntec consultants

June 2011

Figure E-4
Liquefaction Map
Los Angeles, CA


LEGEND
Hydraulic Conductivity* <= 0.30 in/hr
Note: Screening datasets are not exhaustive. The applicant should always conduct a review of available site-specific information relative to infiltration constraints as part of assessing the feasibility of stormwater infiltration.
*Hydraulic conductivity is equivalent to the infiltration rate of the soil.
Source: Navigate LA
N
0 1.5 3 6 9 12 Kilometers
0 1.25 2.5 5 7.5 10 Miles
Geosyntec consultants
June 2011
Figure E-5
Hydraulic Conductivity Map
Los Angeles, CA
Sylmar
Chatsworth
Granada Hills
Sunland
Tujunga
North Hills
Panorama City
Sun Valley
Winnetka
Canoga Park
Reseda
West Hills
Van Nuys
Tarzana
Glendale
Encino
Studio City
Sherman Oaks
Pasadena
Pacific Palisades
Los Angeles
Inglewood
Torrance
Long Beach
Willowbrook
Gardena
Manhattan Beach
Hermosa Beach
Redondo Beach
Lynwood
Carson
Harbor City
Wilmington
Rancho Palos Verdes