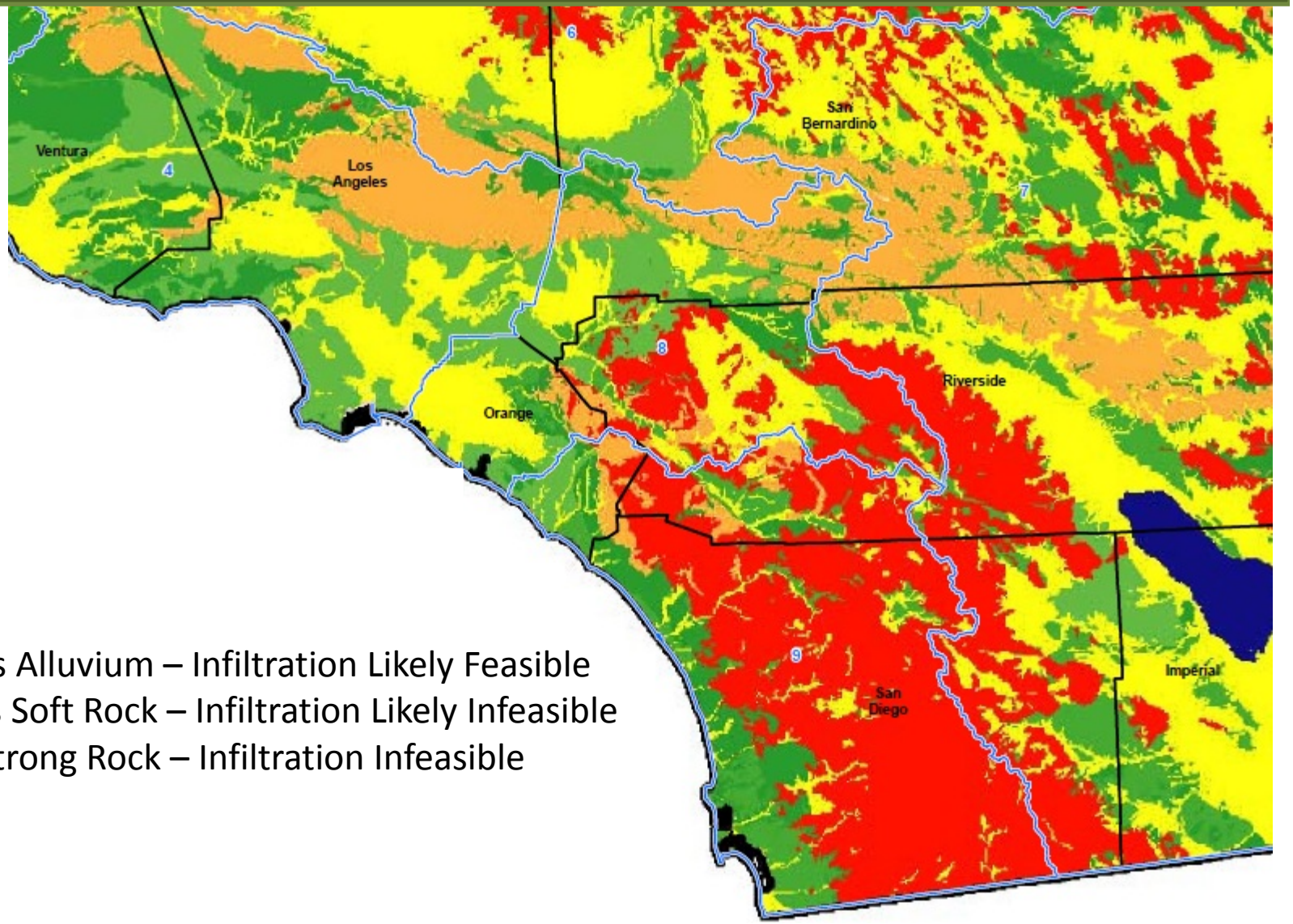
GEOCON

GEOTECHNICAL CONSIDERATIONS FOR STORM WATER

GEOCON

Technical Infeasibility



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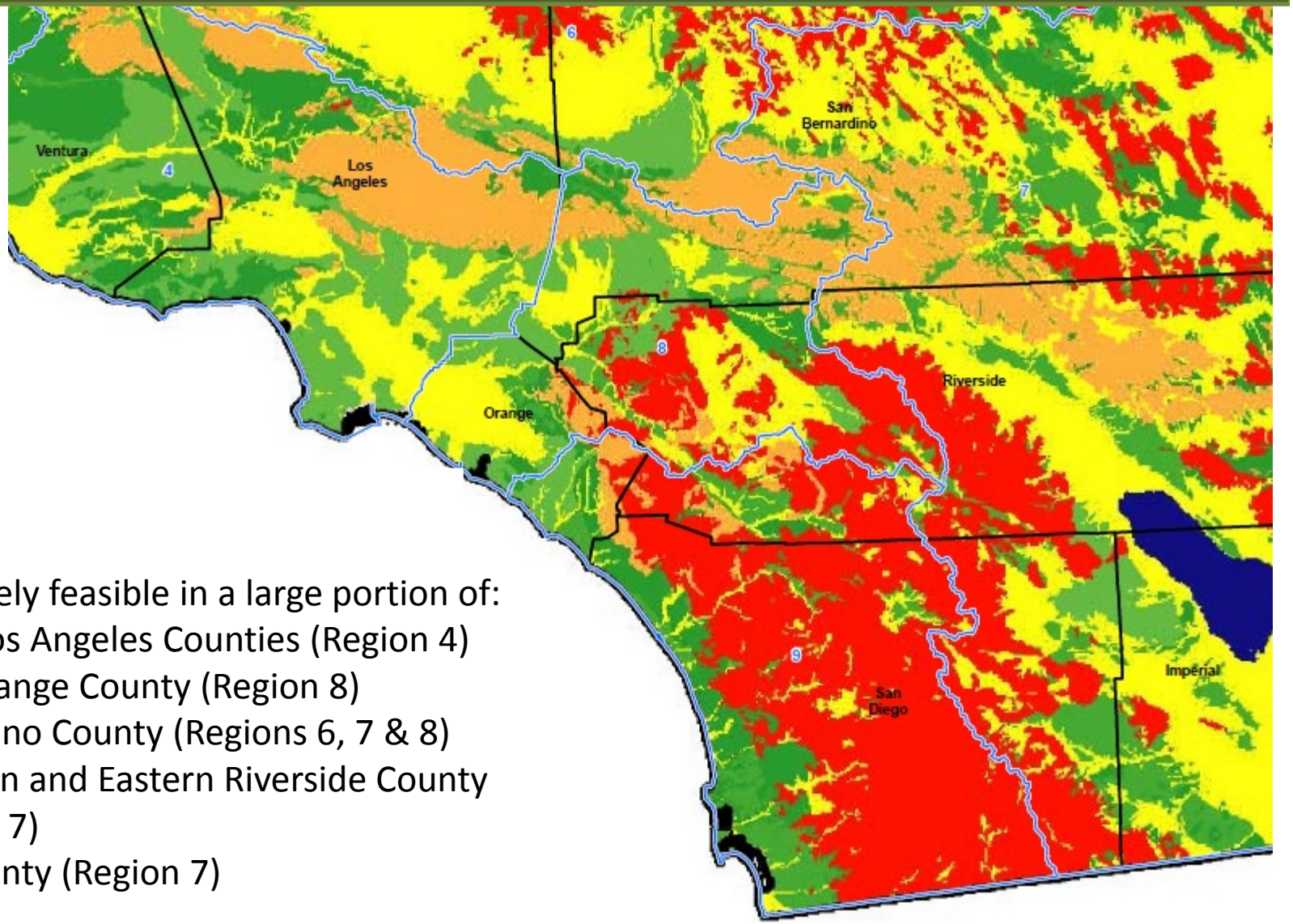

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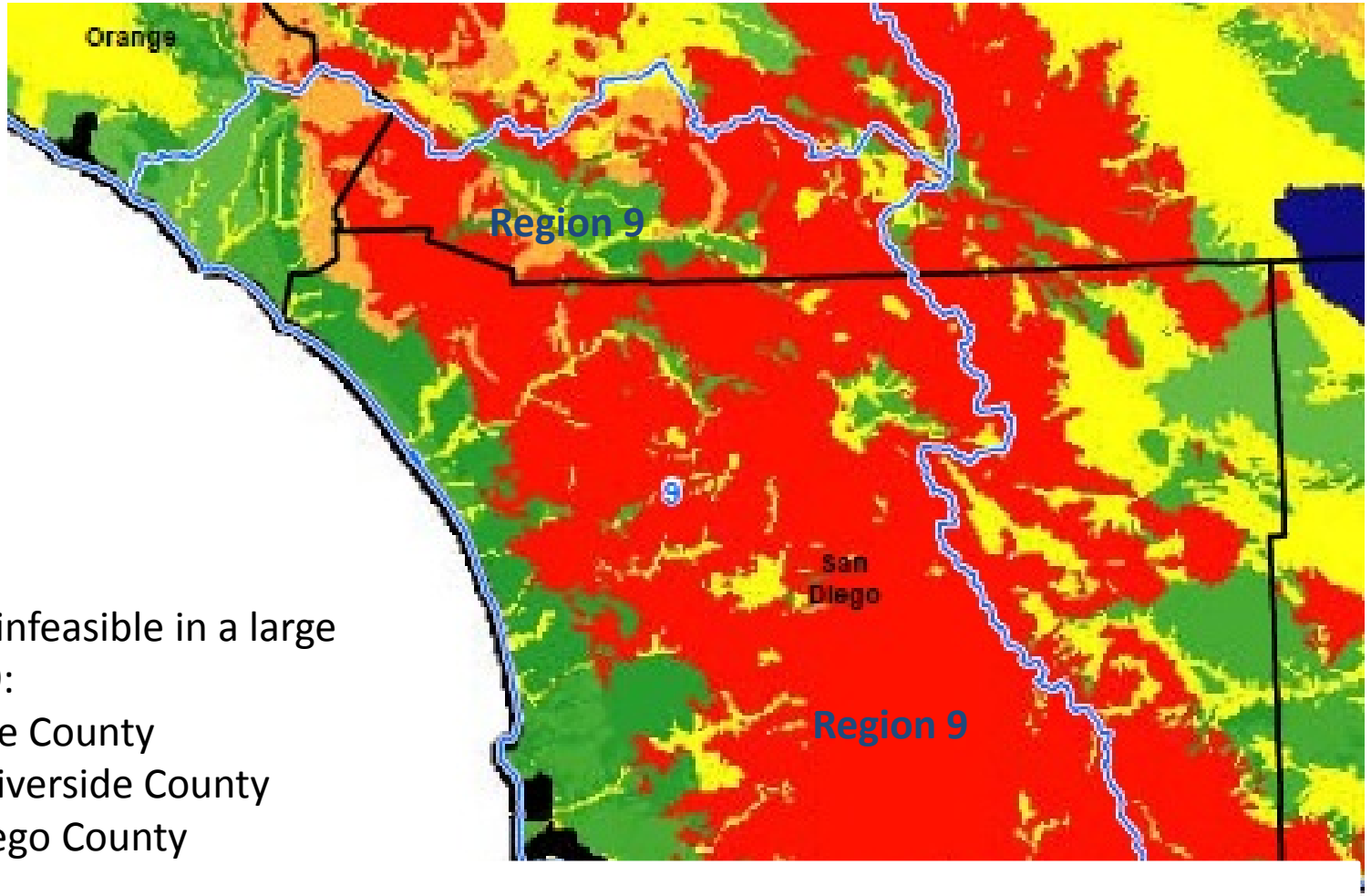

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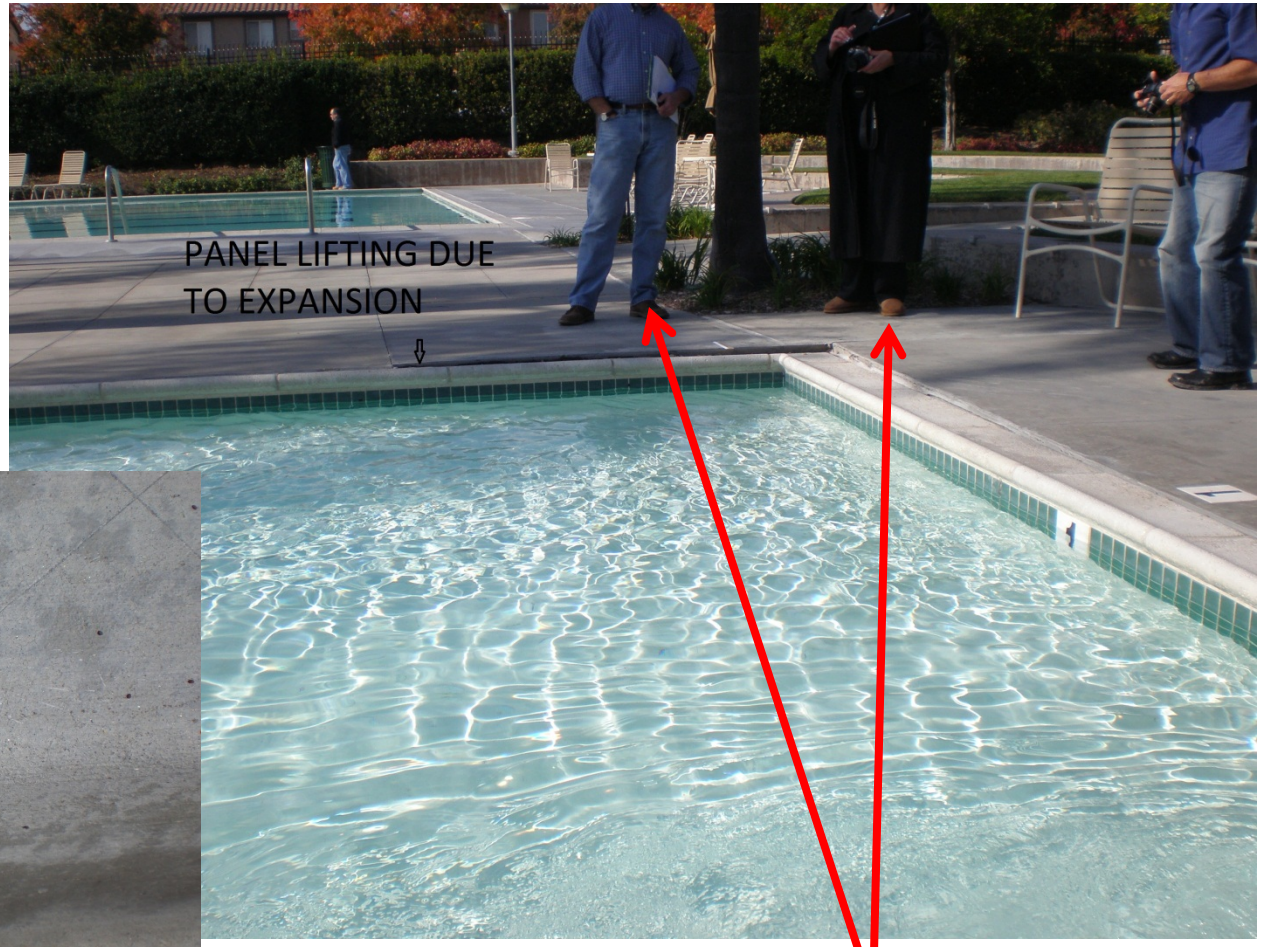

Attorneys

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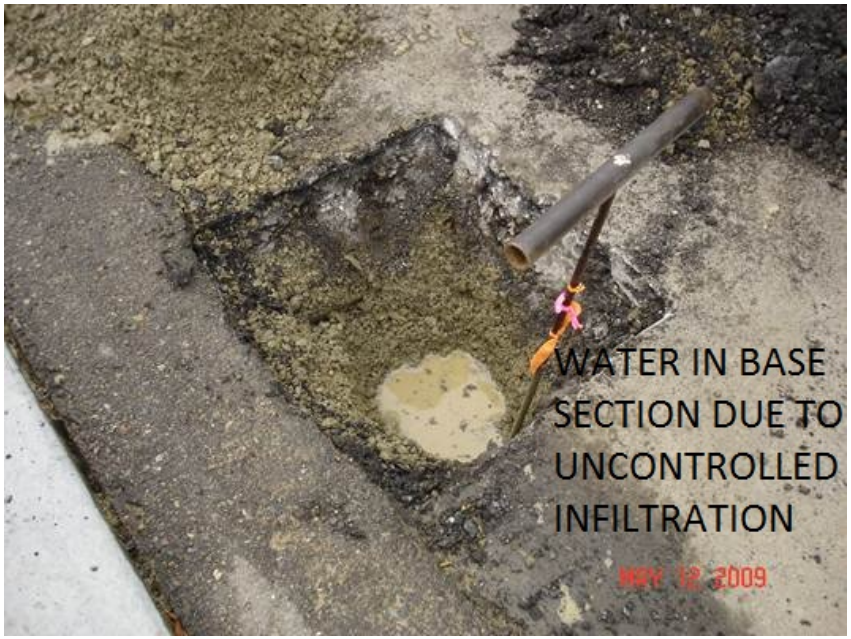

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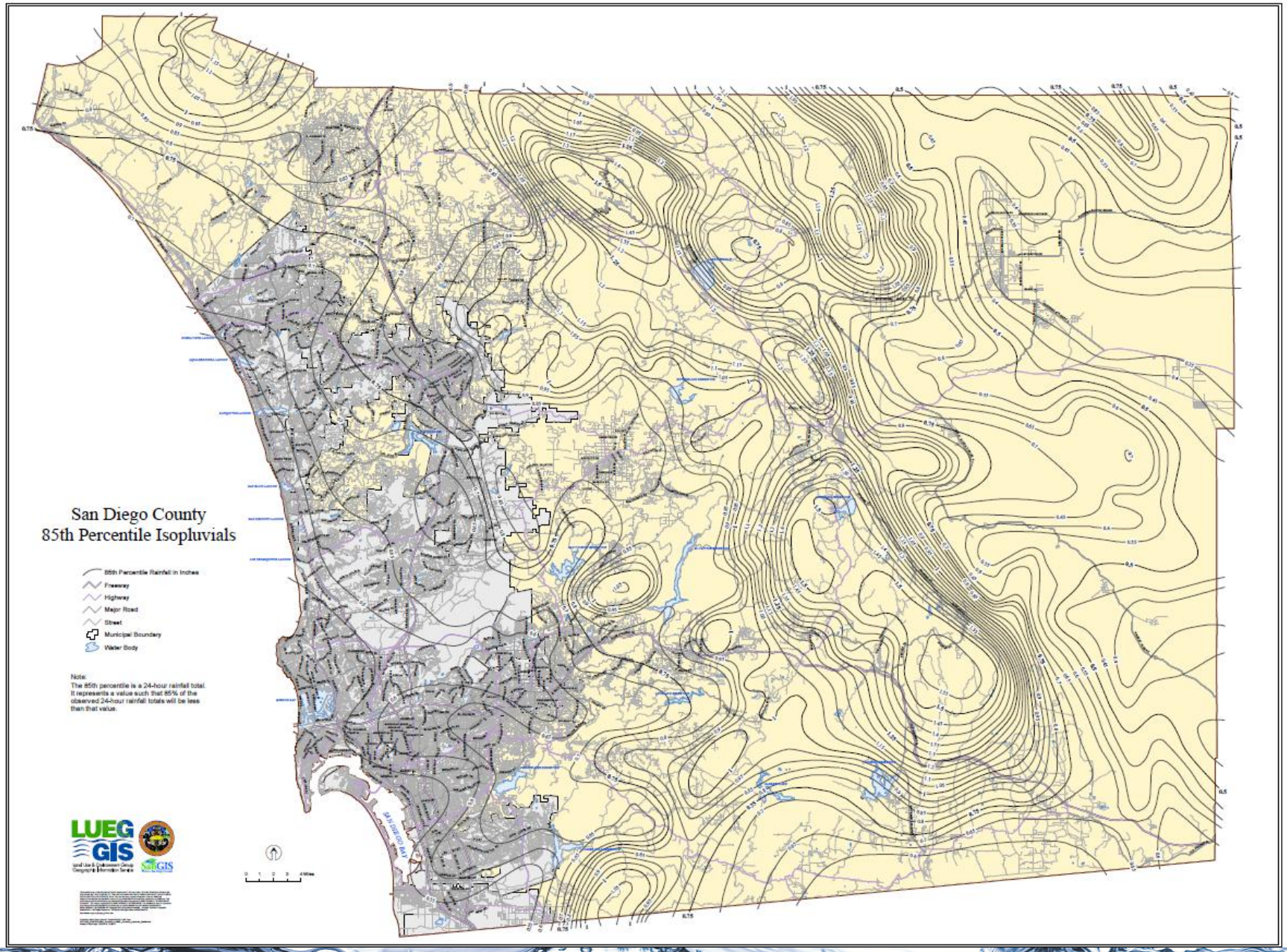
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LUEG GIS
SanGIS

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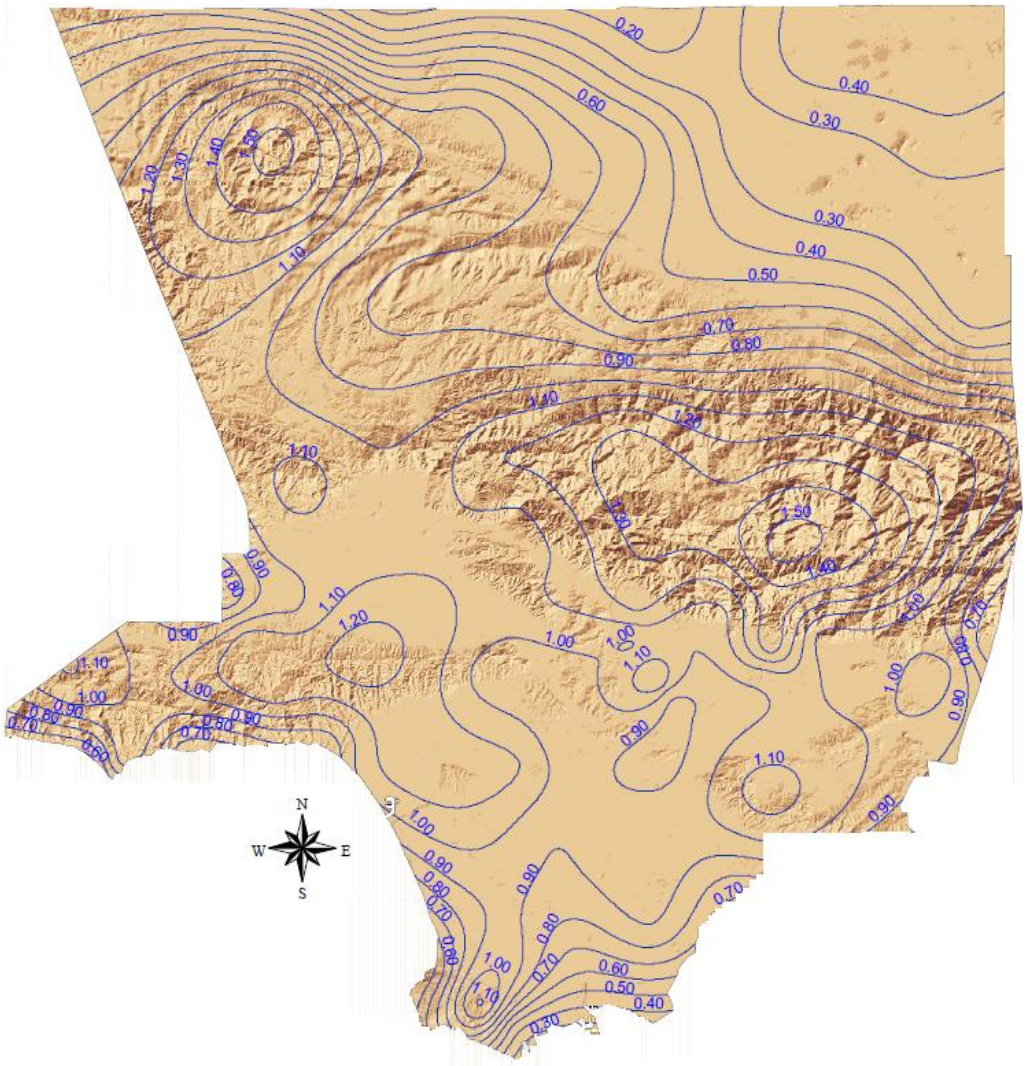

Los Angeles County

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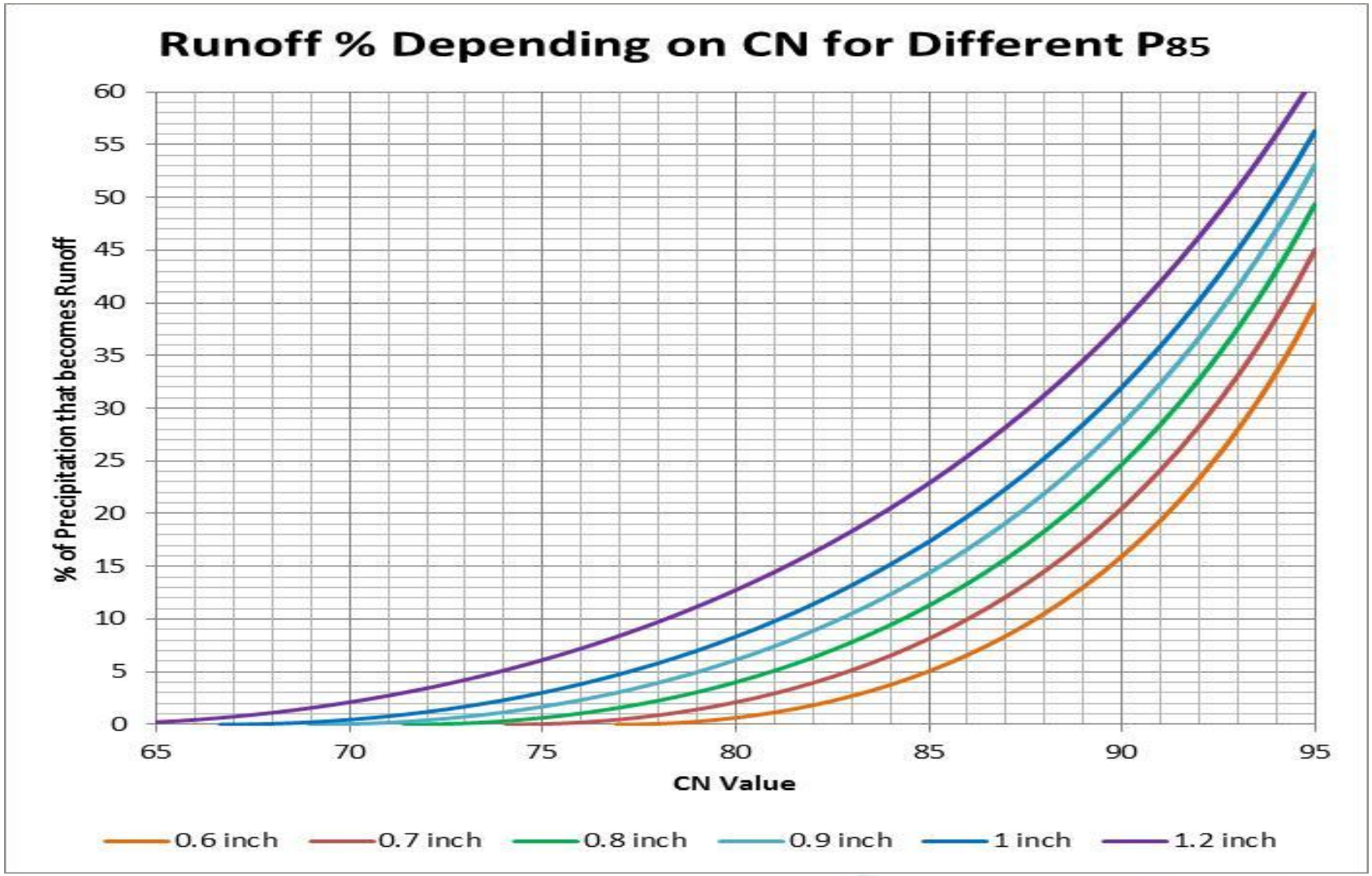

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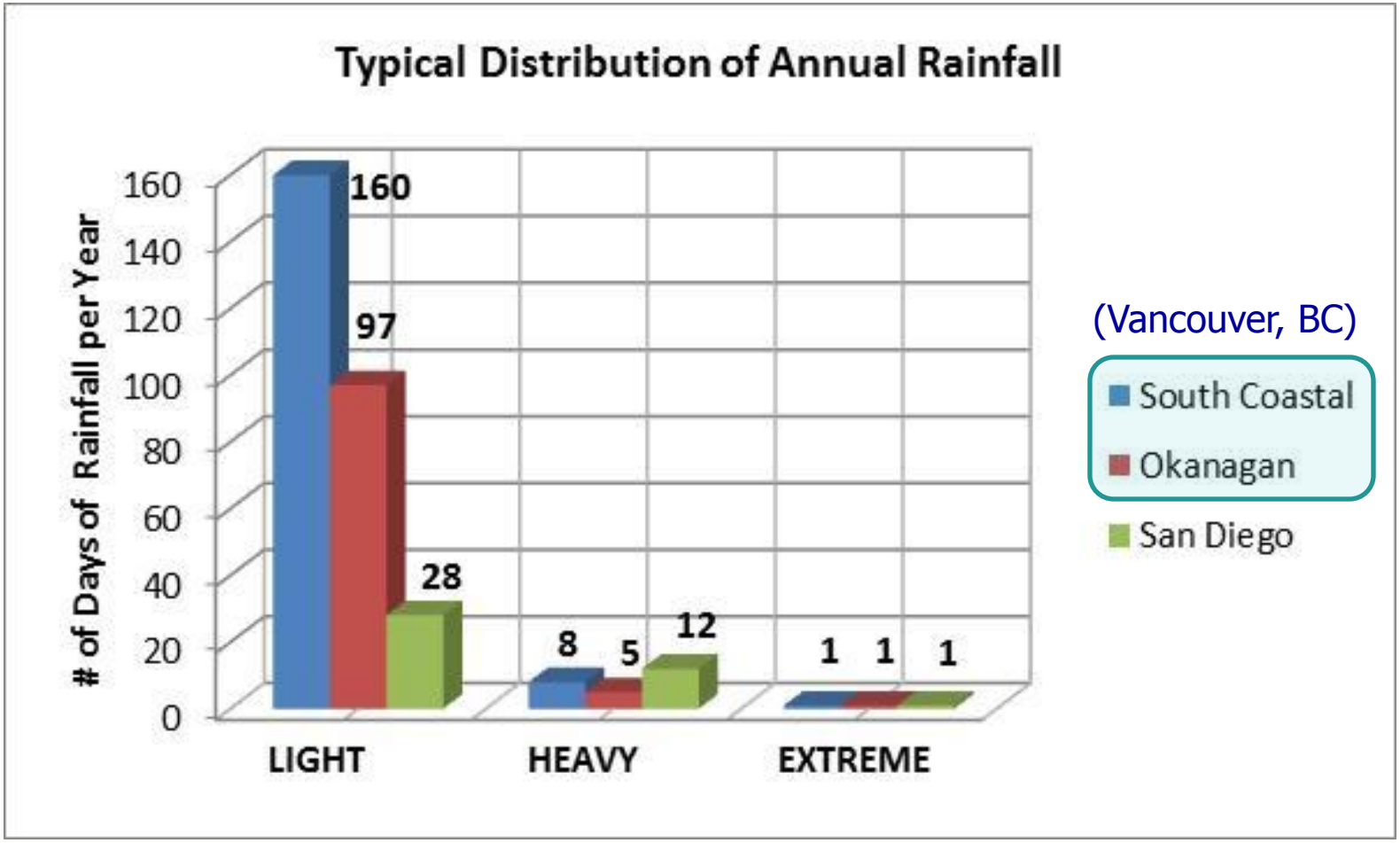

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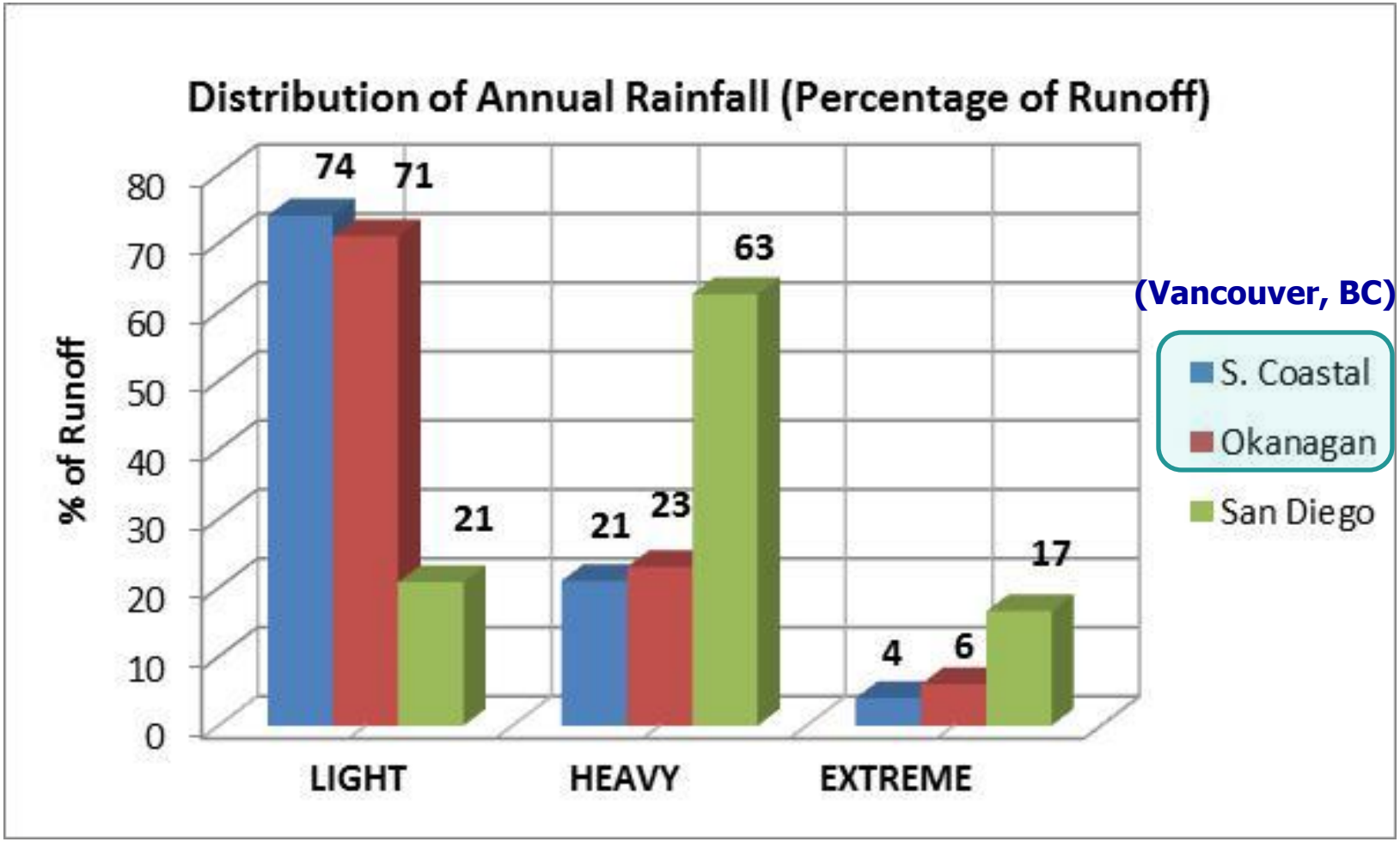

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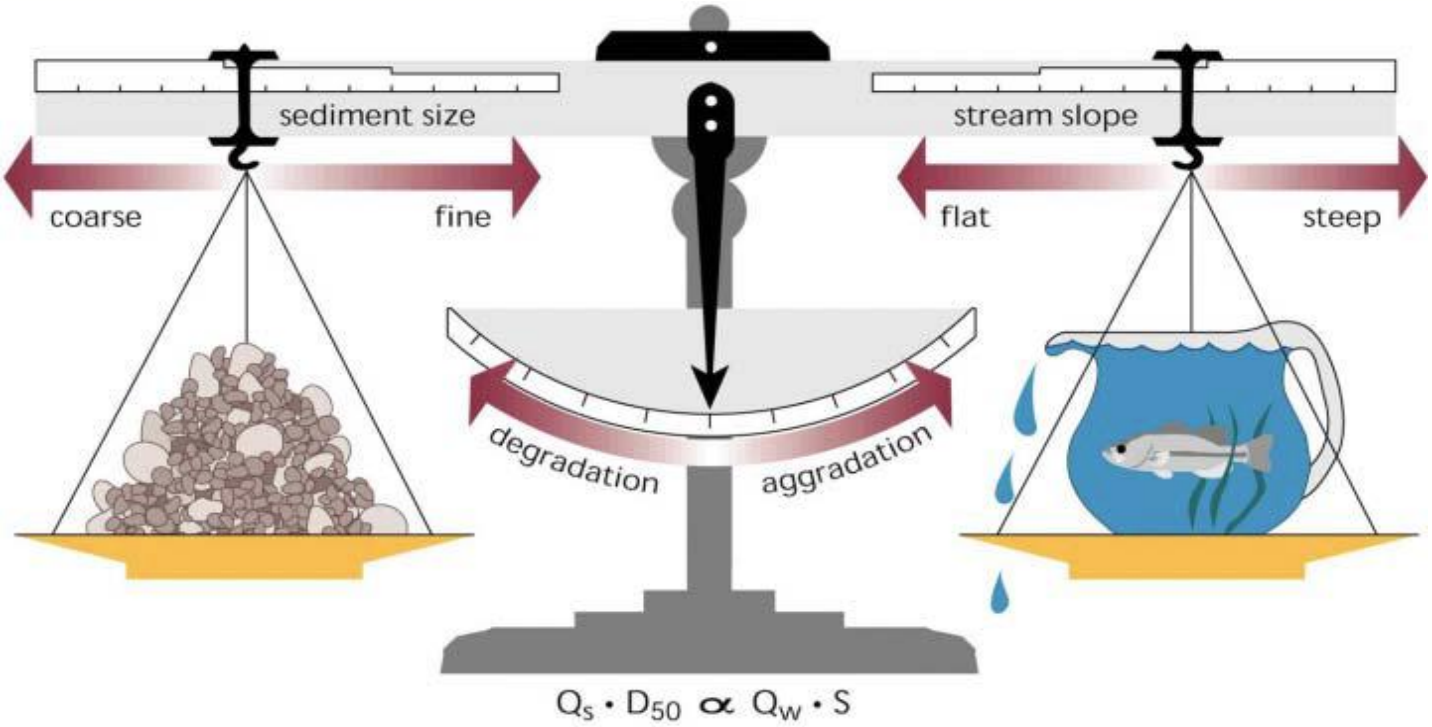
Lane's Stream Balance Relationship

Lane's classic description of channel stability states that dynamic equilibrium exists between stream power and the discharge of bed-material sediment (Lane, 1955 as cited in Chang, 1998):

$$Q_s d \alpha Q_w S$$

where Q_s is the sediment discharge, d is the median sediment size, Q is the discharge and S is the bed slope.



ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

Foundation Drains, Footing Drains, and Other Subsurface Drainage Systems

- **Source of the Proposed Regulation**

  The direction and language of the Administrative Draft proceeds from 40 CFR 122.26(d)(2)(iv)(B & B1), but with ***a difference for the following subcategory of non-storm water discharges***:

  a. Uncontaminated pumped ground water;
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- 40 CFR says:

  "the following category of non-storm water discharges or flows shall be addressed where such discharges are ***identified by the municipality as sources of pollutants to waters of the United States***:"

  the Administrative Draft (E.2.a(1)) would require that:

  "Discharges of non-storm water to the MS4 from the following categories ***must be addressed as illicit discharges unless the discharge has coverage under NPDES Permit No. (CAG919001 or CAG919002)***."

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

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- **Concern #1: the Term "Groundwater"**
  - "Groundwater" here is an undefined term and seems to describe any underground water that could enter the MS4 through this subcategory of drains.
  - "Groundwater" should be properly defined as water that occurs beneath the water table in soil and geologic formations that are fully saturated, as defined by the geotechnical engineer or engineering geologist.

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

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- **Concern #2: Misconception about the Drains**
  - This broad use of "Groundwater" may have led to a misconception of the purpose and function of this subcategory of drains:
  - The designer doesn't include these drains because a fully saturated soil condition exists or is expected to exist on the site. Instead, the designer uses these drains to avoid overdesigning for saturated conditions. Many such drains never yield any water to the MS4.
  - These drains are provided for in state and local building codes and ordinances to protect public health, safety & welfare in case a fully saturated soil condition should develop.
  - If a fully saturated soil condition exists or is expected to exist, the foundations, footings, and other subsurface drainage systems would likely be designed differently.

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

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- **Concern #3: Coverage under NPDES Permits**
  - The NPDES Permits process is not structured to address "theoretical" discharges.
  - At the time of drain design & approval, metrics such as flow rates, pollutant loads, and types of pollutants cannot be known.
  - At the time of drain design such discharges cannot be "***identified by the municipality as sources of pollutants to waters of the United States***".
  - With the Administrative Draft, the Copermittees and the Building Community are in a difficult position – the Copermittees can't approve categorical illicit discharges and the Builders can't get coverage under an NPDES Permit for discharges that don't exist.

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

Foundation Drains, Footing Drains, and Other Subsurface Drainage Systems

- **Concept Revision**
  - Address these potential non-storm water discharges per 40 CFR and as in Administrative Draft E.2.a(3):

  "Discharges of non-storm water to the MS4 from the following categories (*include foundation drains, footing drains, and other Subsurface Drainage Systems*) must be addressed by the Copermittees as illicit discharges only if the Copermittees or the San Diego Water Board identifies the discharge as a source of pollutants to receiving waters based on test results:"

Restoration projects for alternative compliance

Restoration projects (onsite and offsite) can provide more benefit to the receiving waters than conventional LID and HMP BMP's

The Administrative Draft permit requires a technical infeasibility analysis for any alternative compliance.

Restoration projects for alternative compliance should be encouraged by the permit. If they enhance the beneficial uses within the watershed, and provide the same or better level of water quality protection, they should not require proof of infeasibility.

The permit should include an “off ramp” that would eliminate the need for a technical infeasibility analysis for restoration projects.

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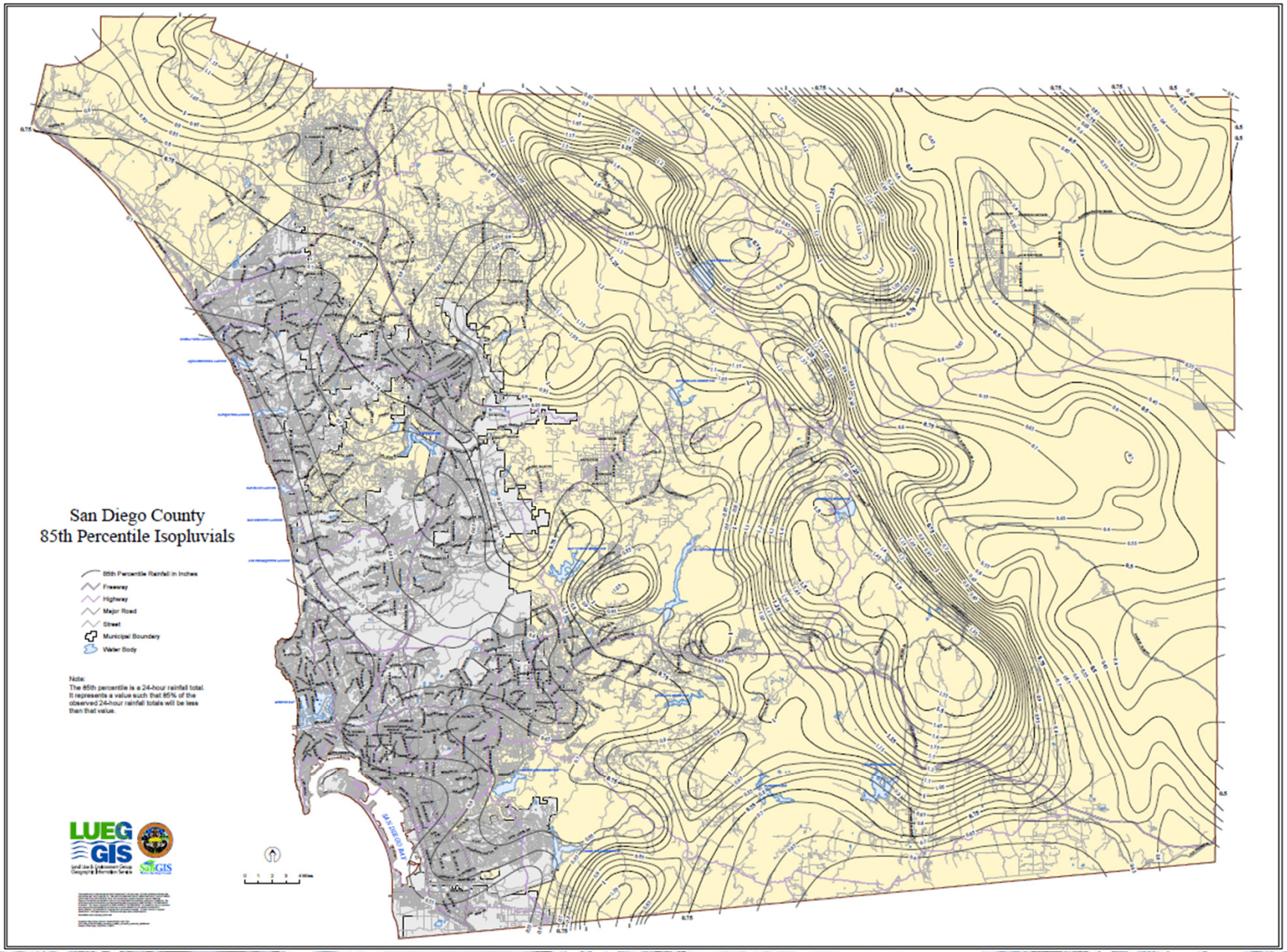
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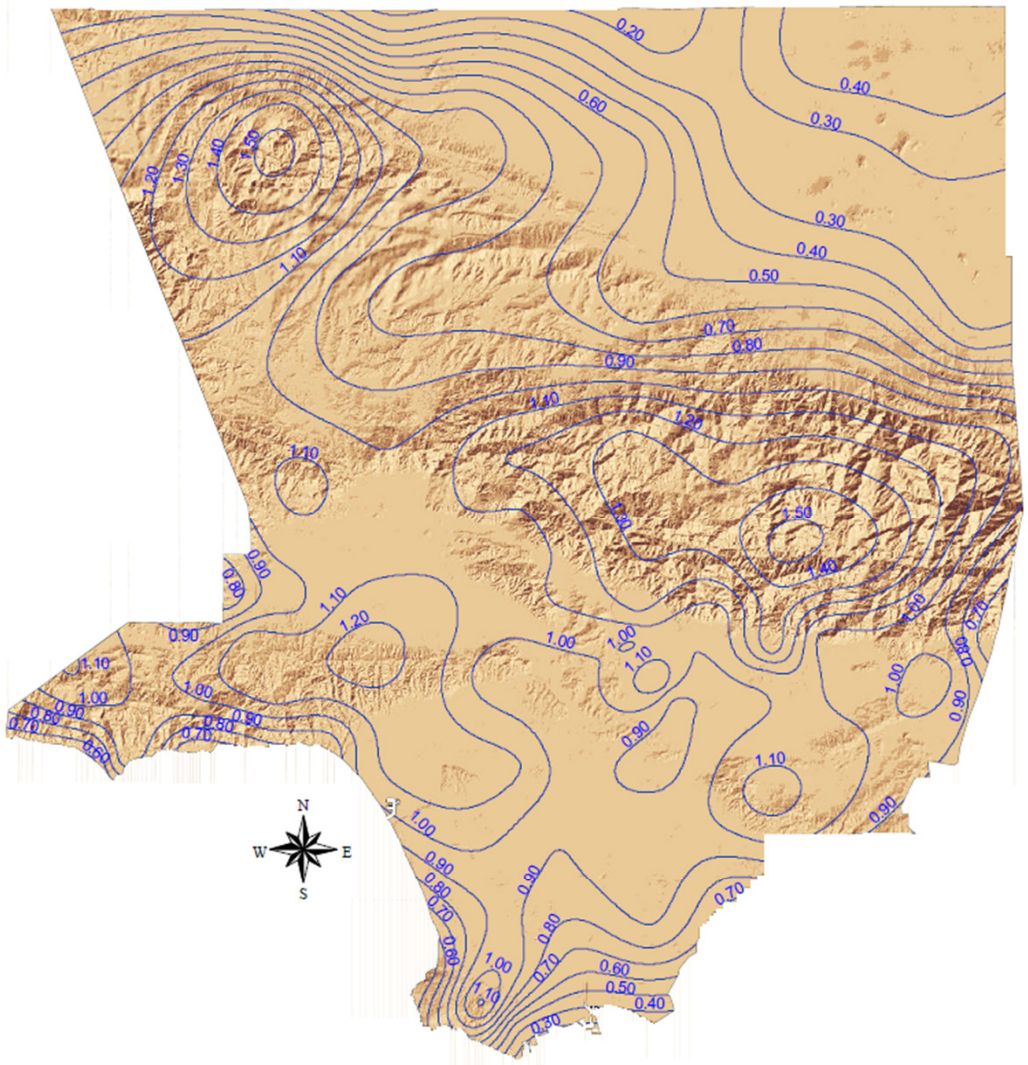

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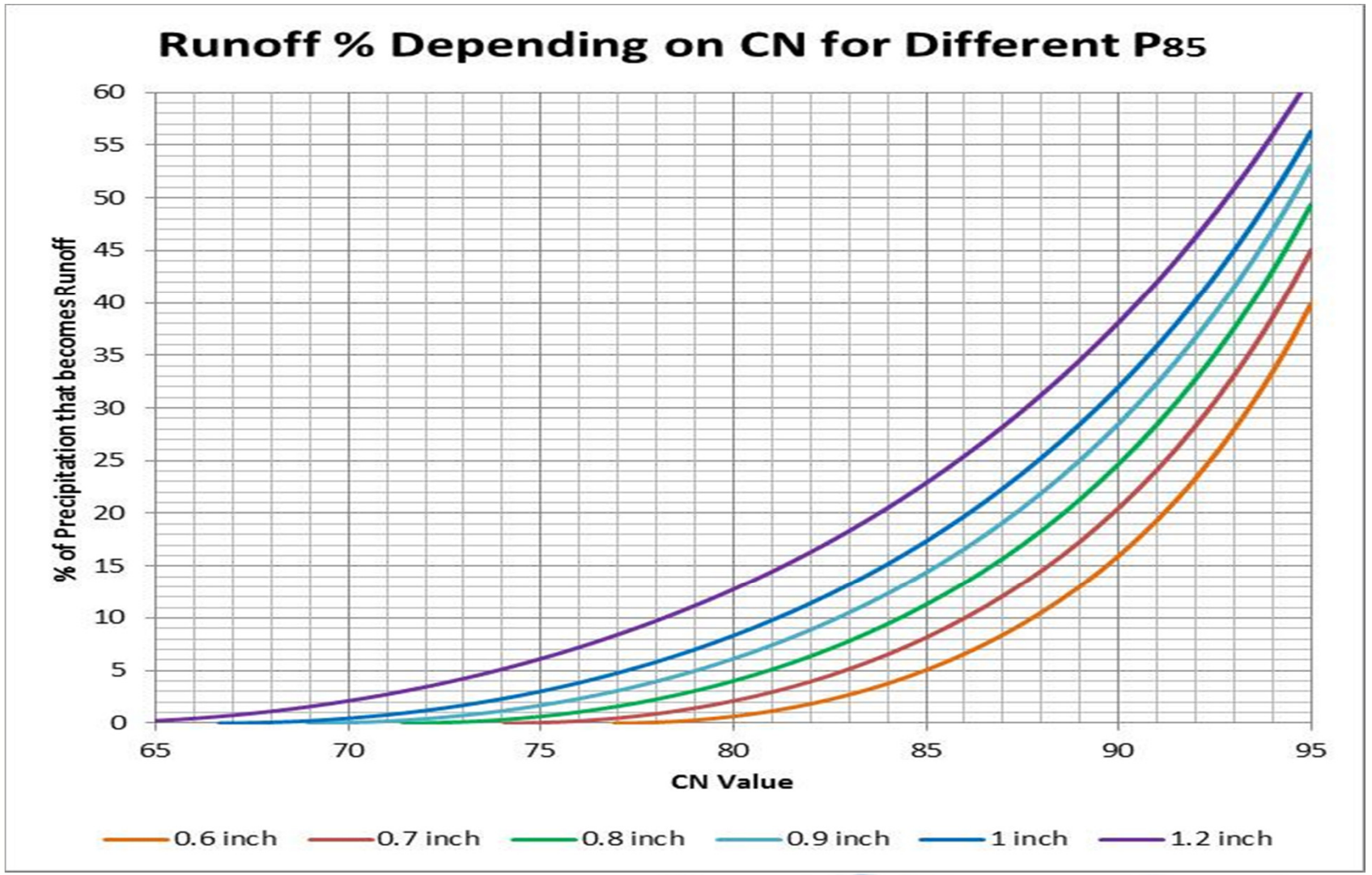

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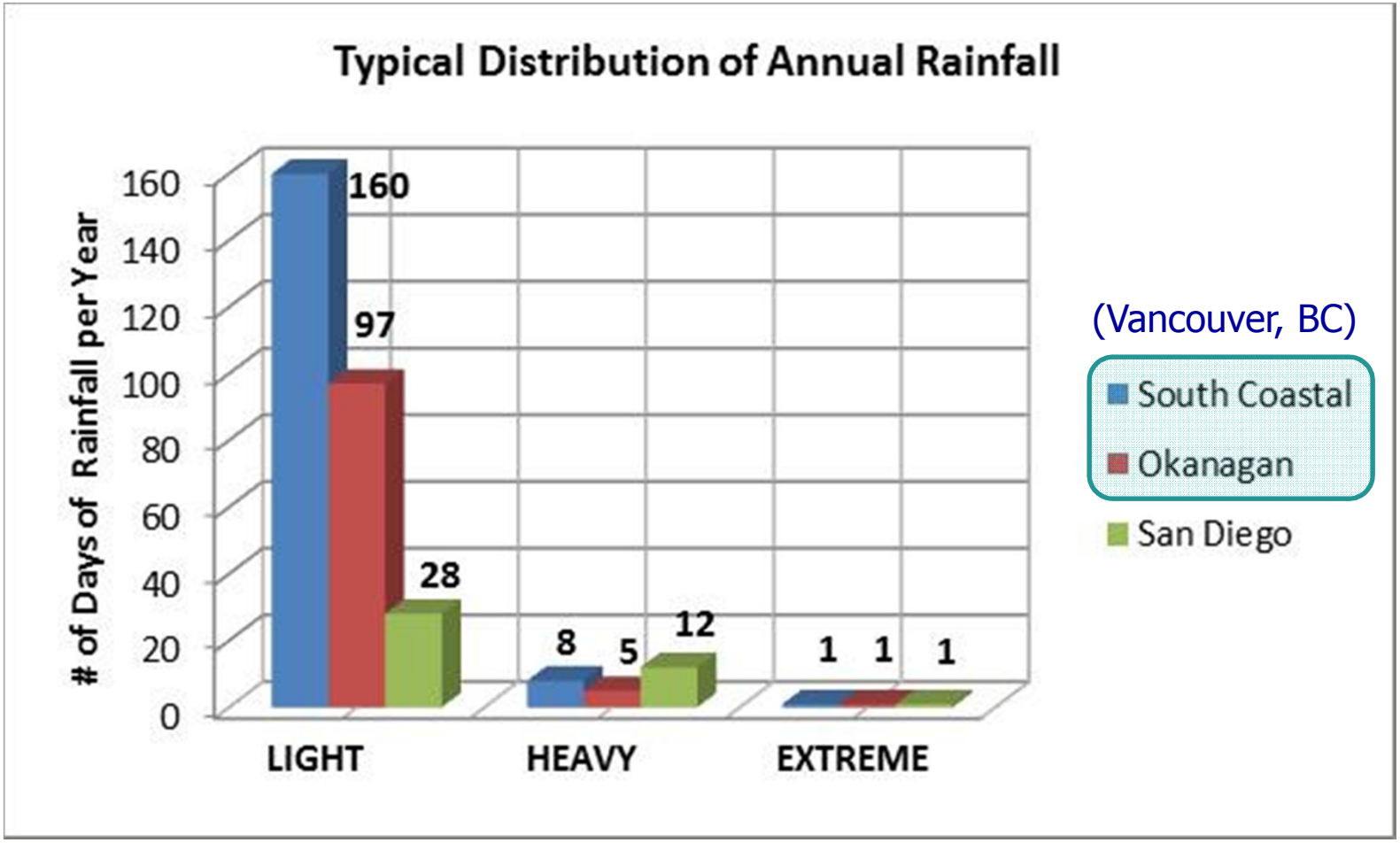

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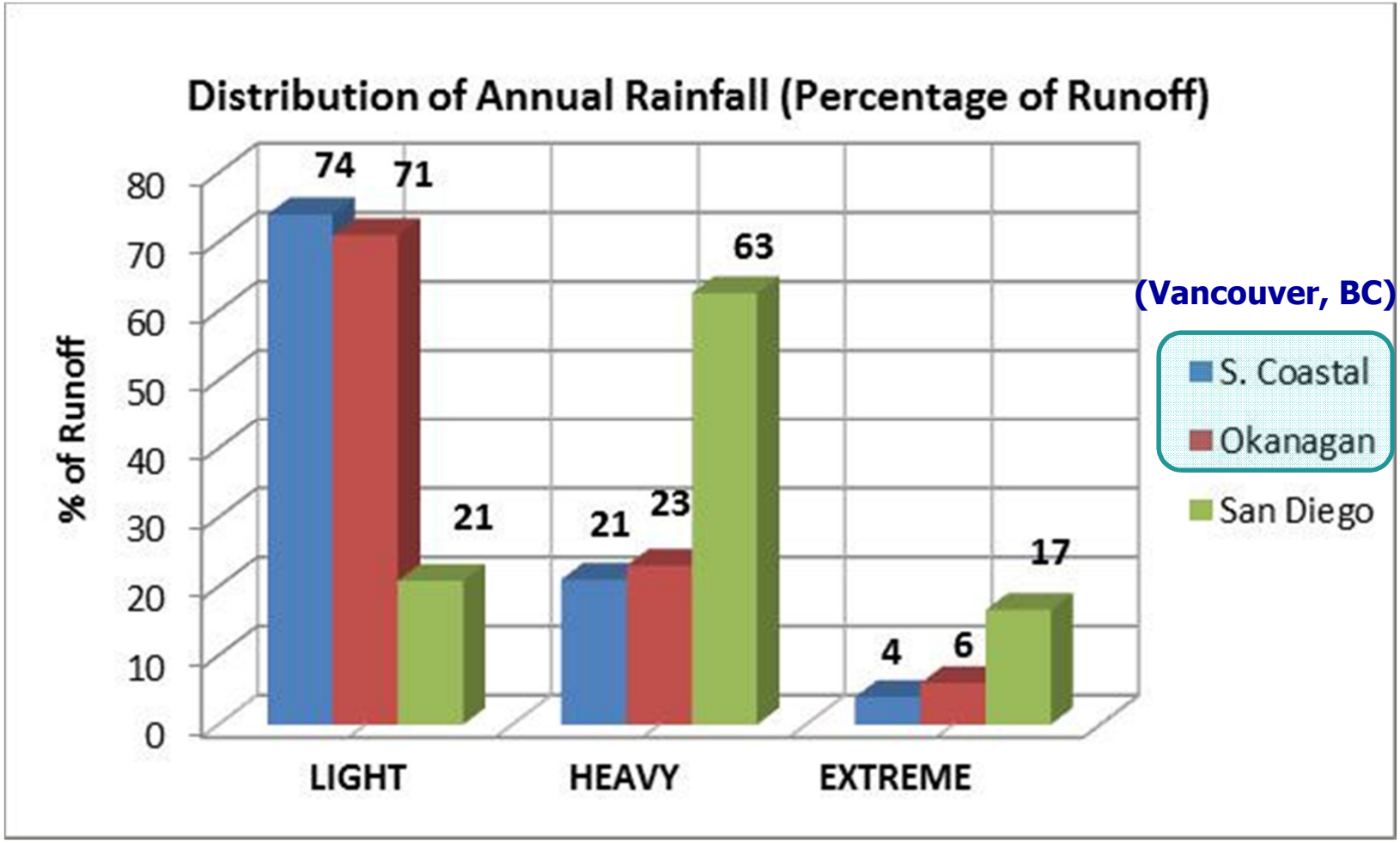

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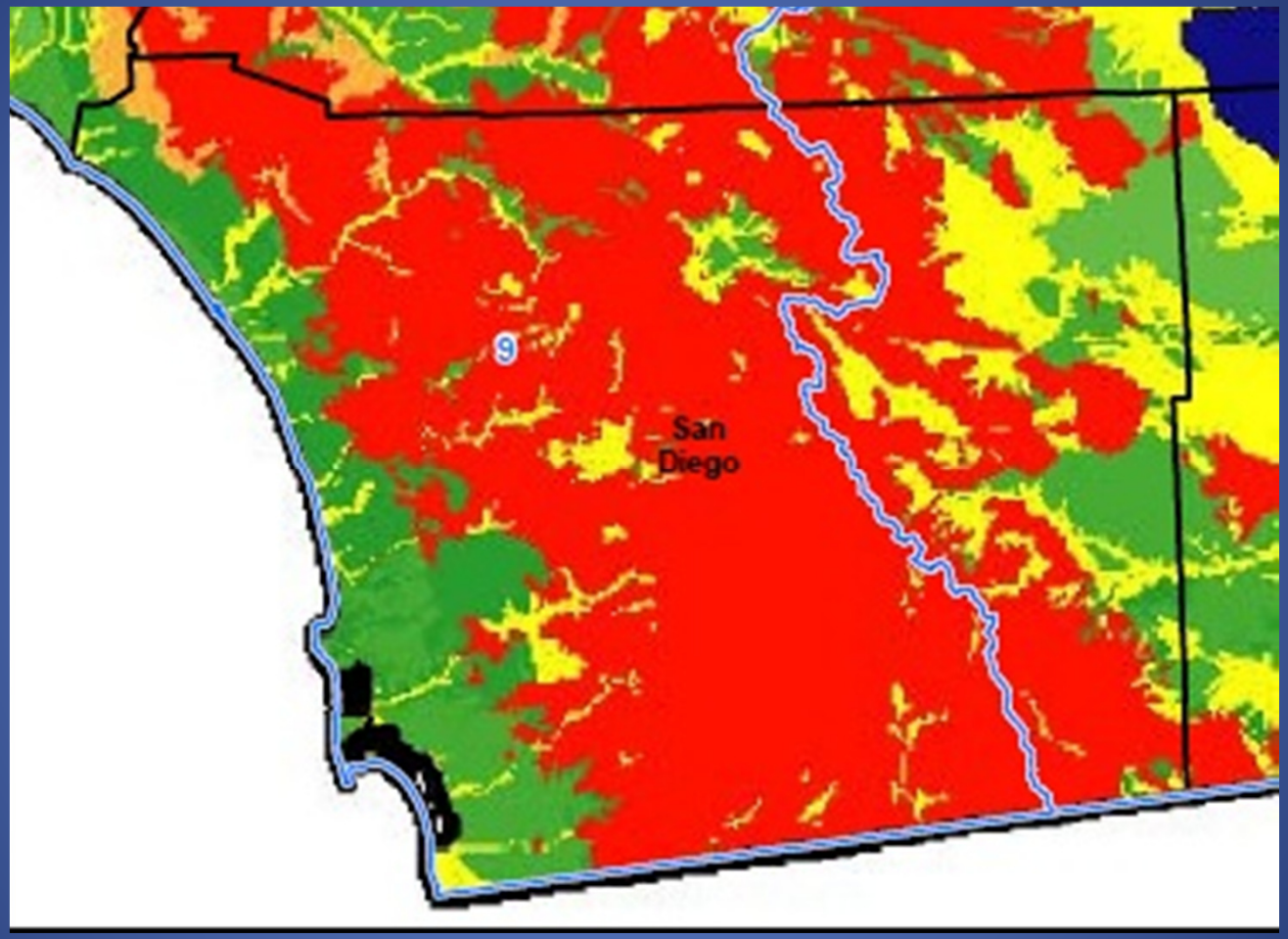
Stormwater Infiltration in Clay Soils

A Liability Time Bomb

Geological Map of San Diego County



Yellow--Sands, Gravel

Green--Clay, Cobble

Red--Hard Rock, Granite, Boulders

Soil Types In San Diego County

Clay

Liability Issues Associated with Building In Clay Soils

- In a nutshell, **foundation settlement** is the movement your home experiences when the soil beneath it shrinks, settles, or can no longer support the structure's weight.
- Changes that occur in those soils -- such as drying & shrinking, wetting & softening, compacting and swelling -- all affect the stability, strength and overall condition of your foundation. .
- A foundation with **bowing, buckling walls** is demonstrating the damage caused by expansive soils. When clay-rich soils absorb moisture, their volume increases dramatically.
- This can increase pressure on your home's foundation walls by thousands of pounds, causing walls to bow and buckle inward..
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Soil Types In San Diego

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Damage to Buildings in Clay Soils

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Efflorescence caused by water migration thru the slab

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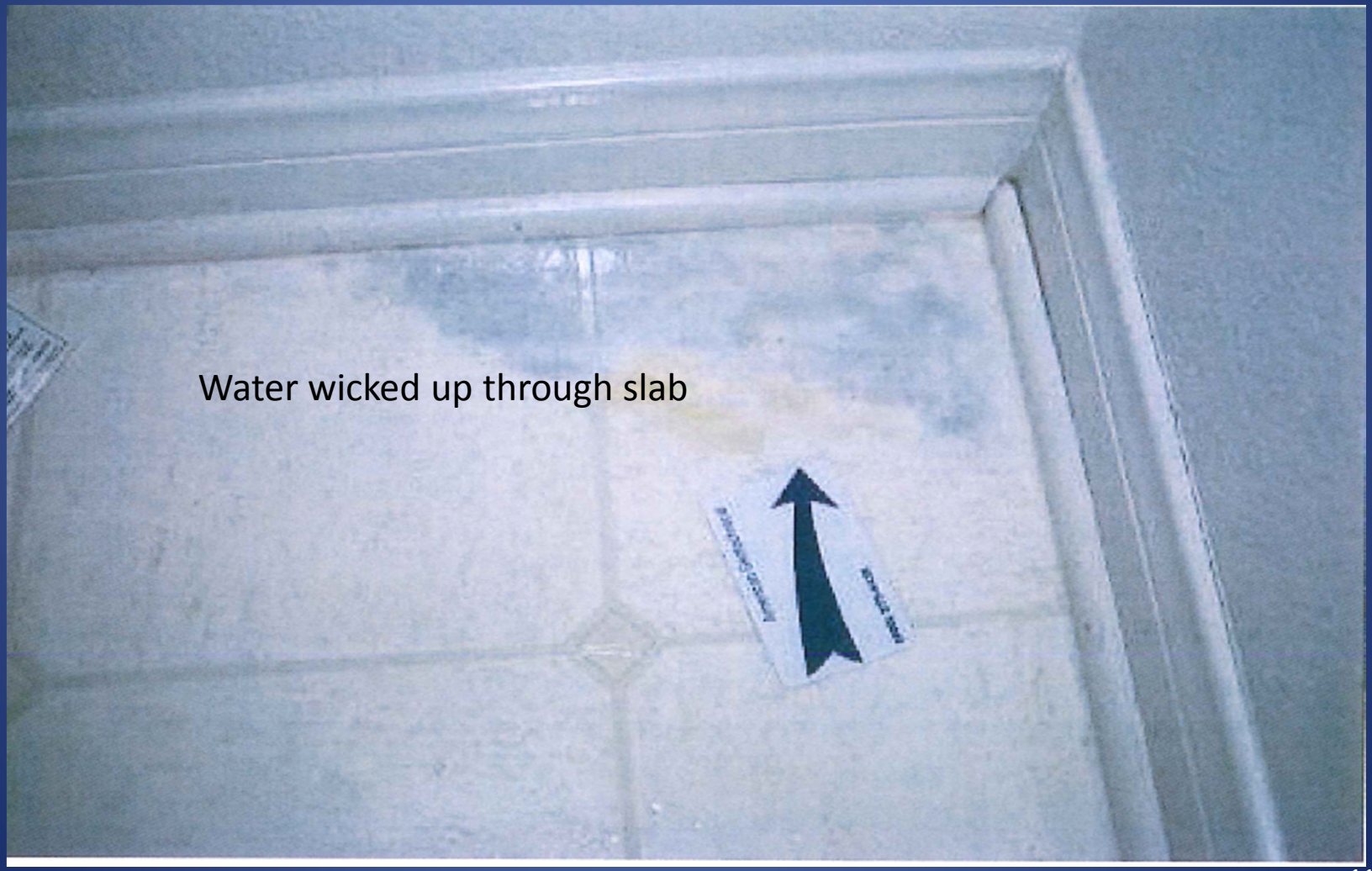

Damage to Concrete pavement in Clay Soils

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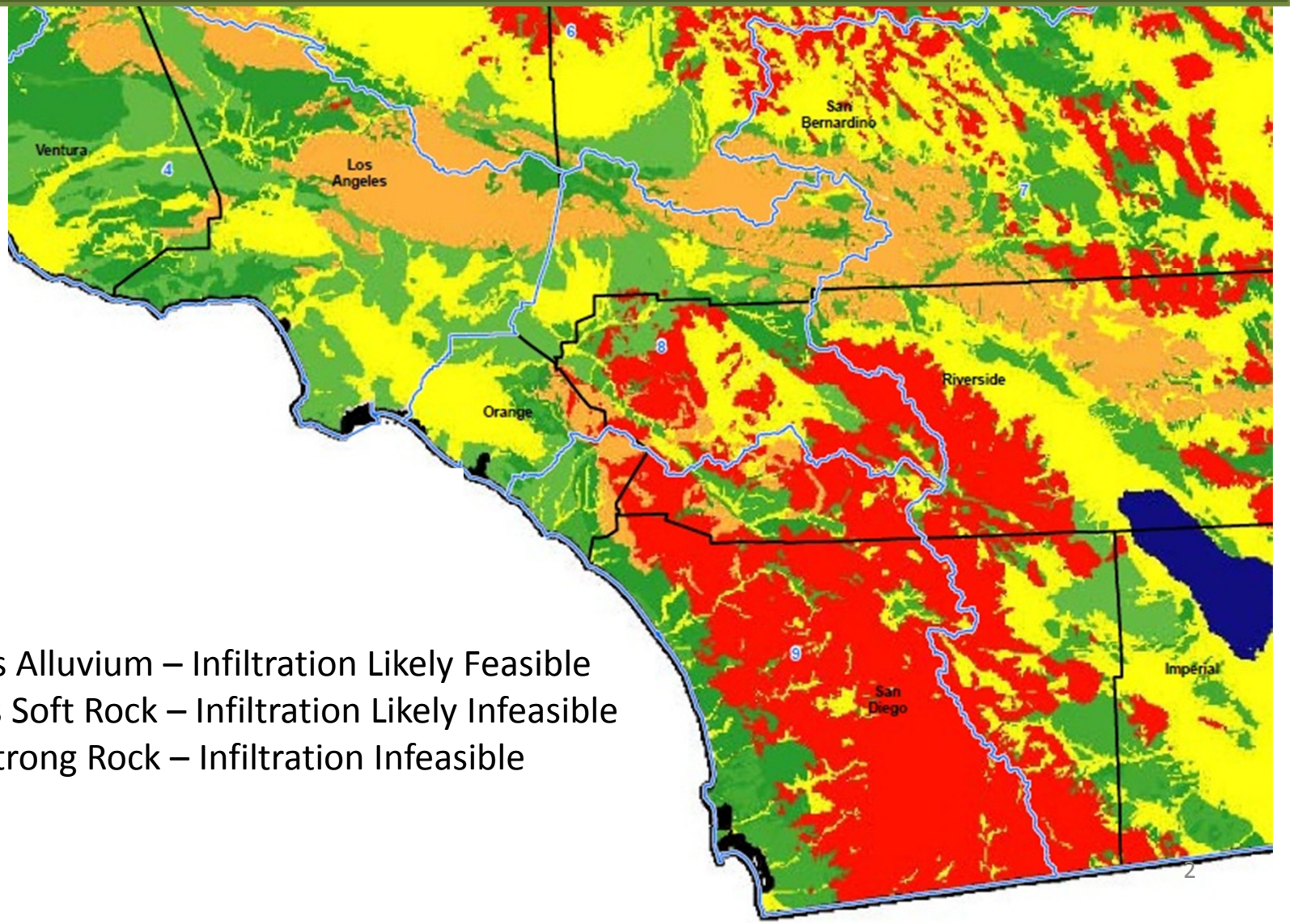

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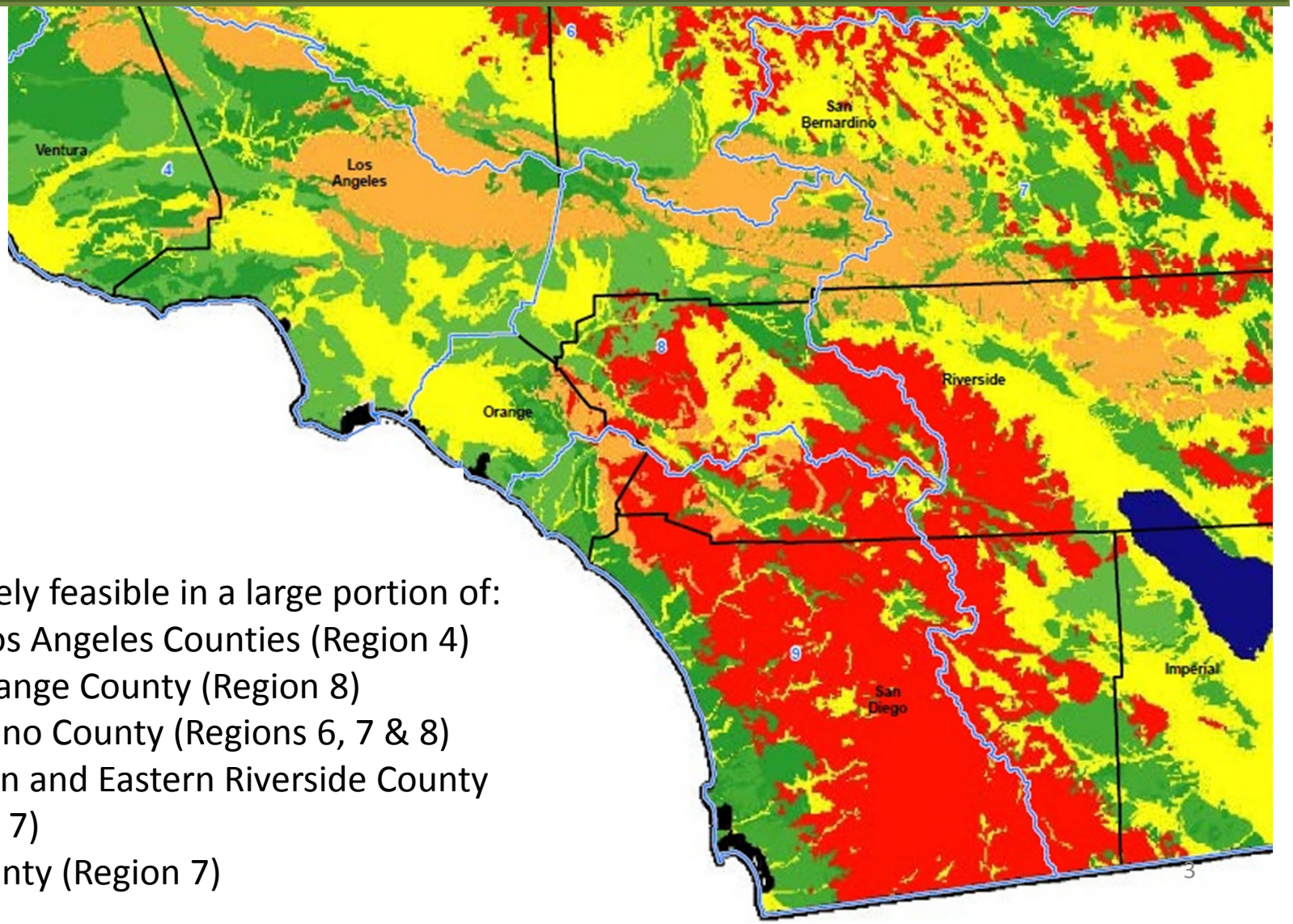

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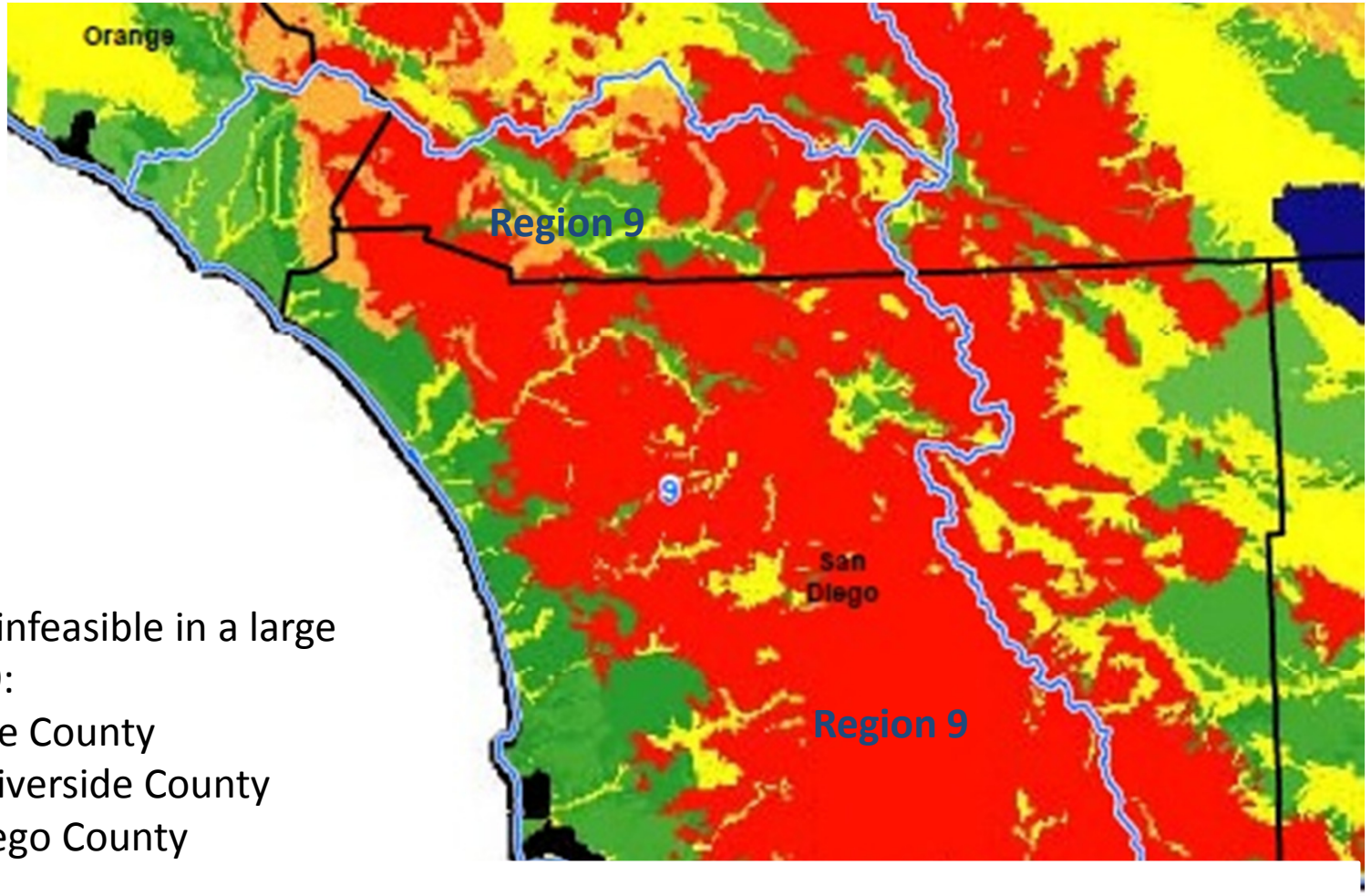

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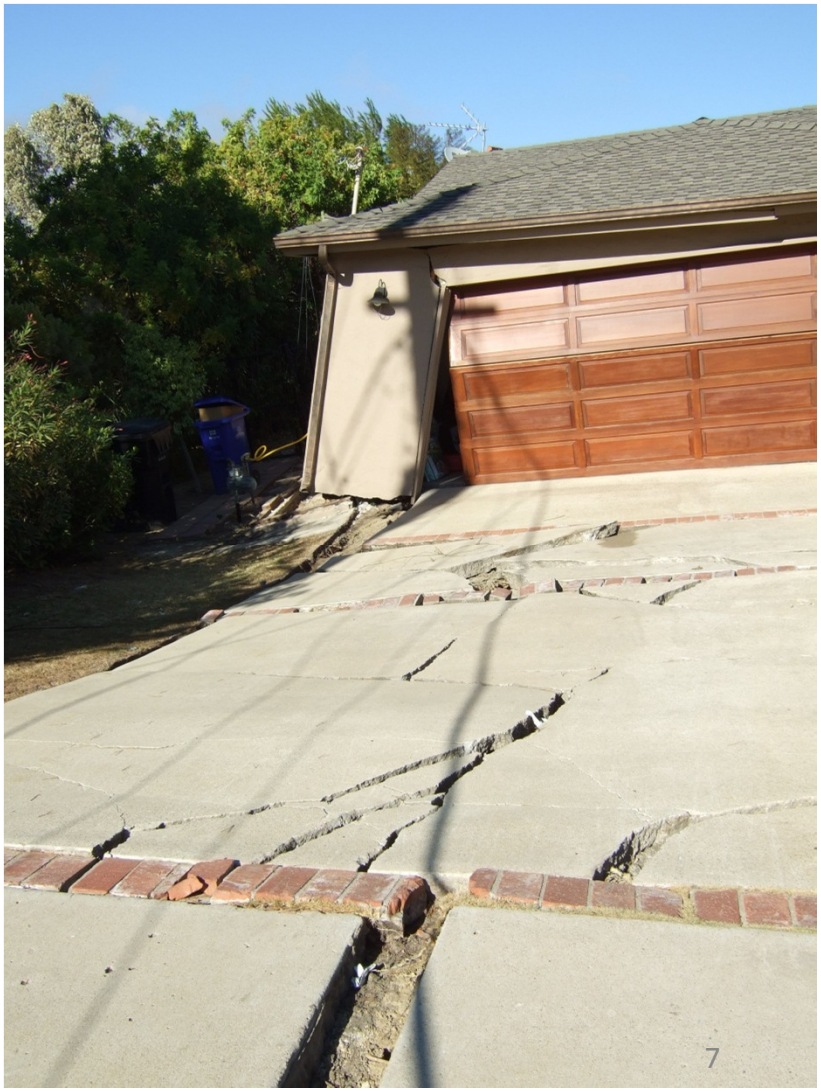

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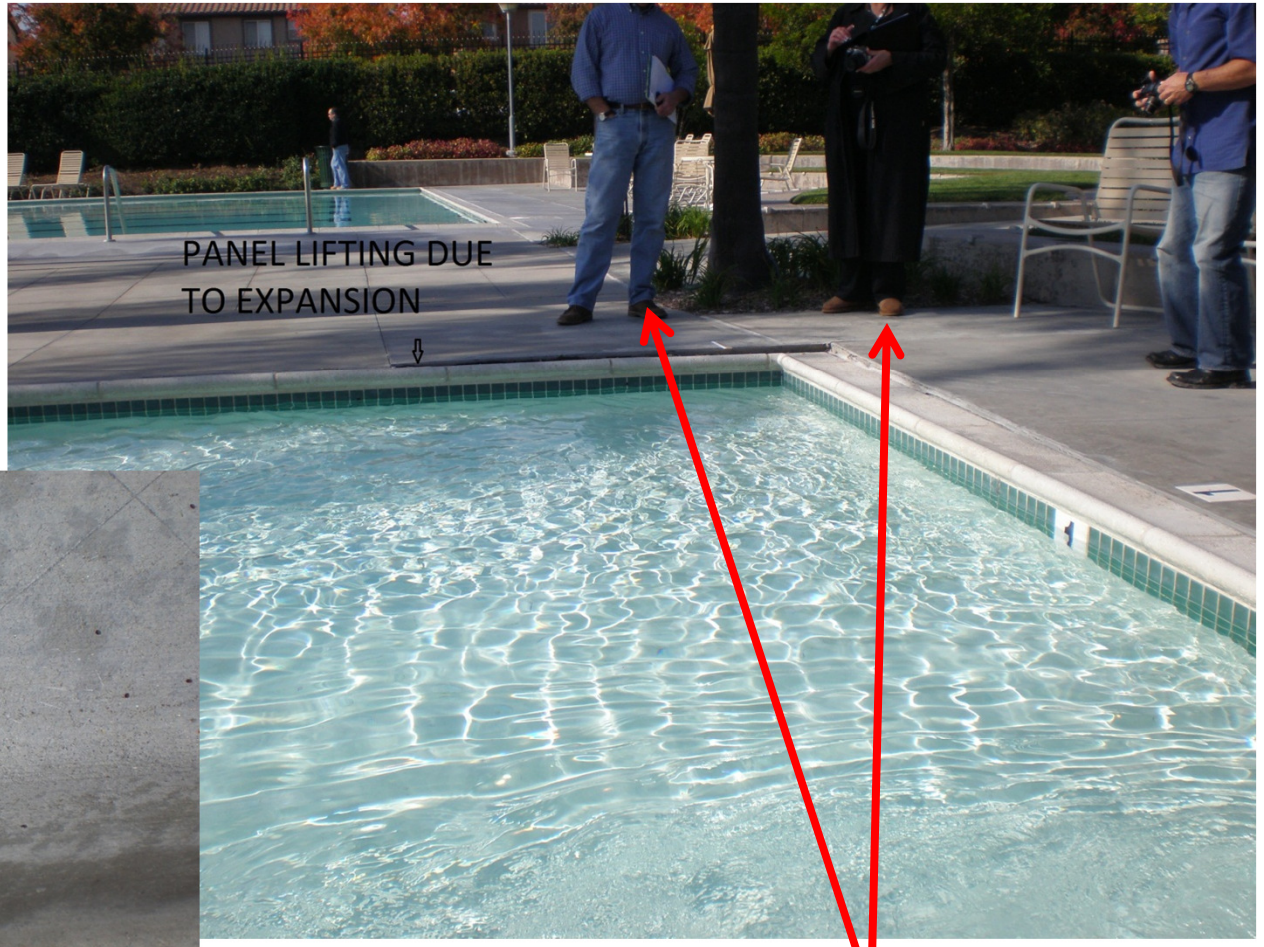

Attorneys

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Seepage

GEOCON

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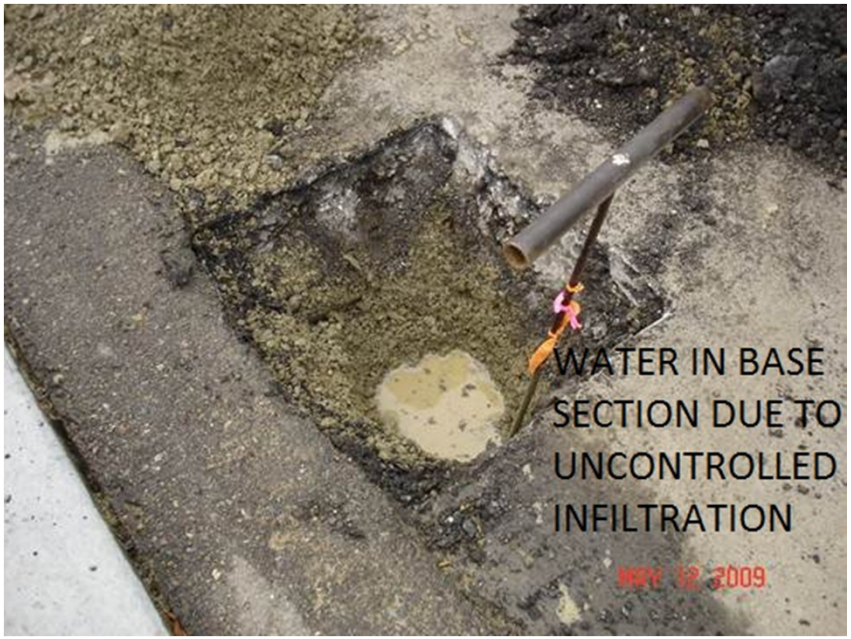
Loss of Support



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- 40 CFR says:

  "the following category of non-storm water discharges or flows shall be addressed where such discharges are ***identified by the municipality as sources of pollutants to waters of the United States***:"

  the Administrative Draft (E.2.a(1)) would require that:

  "Discharges of non-storm water to the MS4 from the following categories ***must be addressed as illicit discharges unless the discharge has coverage under NPDES Permit No. (CAG919001 or CAG919002)***."

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

Foundation Drains, Footing Drains, and Other Subsurface Drainage Systems

- **Concern #1: the Term "Groundwater"**
  - "Groundwater" here is an undefined term and seems to describe any underground water that could enter the MS4 through this subcategory of drains.
  - "Groundwater" should be properly defined as water that occurs beneath the water table in soil and geologic formations that are fully saturated, as defined by the geotechnical engineer or engineering geologist.

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

Foundation Drains, Footing Drains, and Other Subsurface Drainage Systems

- **Concern #2: Misconception about the Drains**
  - This broad use of "Groundwater" may have led to a misconception of the purpose and function of this subcategory of drains:
  - Typically these drains are not prompted because a fully saturated soil condition exists or is expected to exist on the site. Many such drains never yield any water to the MS4.
  - These drains are provided for in state and local building codes and ordinances to protect public health, safety & welfare in case a fully saturated soil condition should develop.
  - If a fully saturated soil condition exists or is expected to exist, the foundations, footings, and other subsurface drainage systems would likely be designed differently.

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

Foundation Drains, Footing Drains, and Other Subsurface Drainage Systems

- **Concern #3: Coverage under NPDES Permits**
  - The NPDES Permits process is not structured to address "theoretical" discharges.
  - At the time of drain design, metrics such as flow rates, pollutant loads, and types of pollutants cannot be known.
  - At the time of drain design such discharges cannot be "***identified by the municipality as sources of pollutants to waters of the United States***".

ILLICIT DISCHARGE DETECTION & ELIMINATION – NON-STORM WATER DISCHARGES

Foundation Drains, Footing Drains, and Other Subsurface Drainage Systems

- **Concept Revision**
  - Address these potential non-storm water discharges per 40 CFR and as in Administrative Draft E.2.a(3):

  "Discharges of non-storm water to the MS4 from the following categories (*include foundation drains, footing drains, and other Subsurface Drainage Systems*) must be addressed by the Copermittees as illicit discharges only if the Copermittees or the San Diego Water Board identifies the discharge as a source of pollutants to receiving waters:"

Offsite Mitigation

An Equal or Better Alternative

Restoration projects for alternative compliance

- Restoration projects (onsite and offsite) can provide more benefit to the receiving waters than conventional LID and HMP BMP's

- The Administrative Draft permit requires a technical infeasibility analysis for any alternative compliance.

- Restoration projects for alternative compliance should be encouraged by the permit. If they enhance the beneficial uses within the watershed, and provide the same or better level of water quality protection, they should not require proof of infeasibility.

- Infeasibility analysis are a complex and unnecessary expense for mitigation projects.

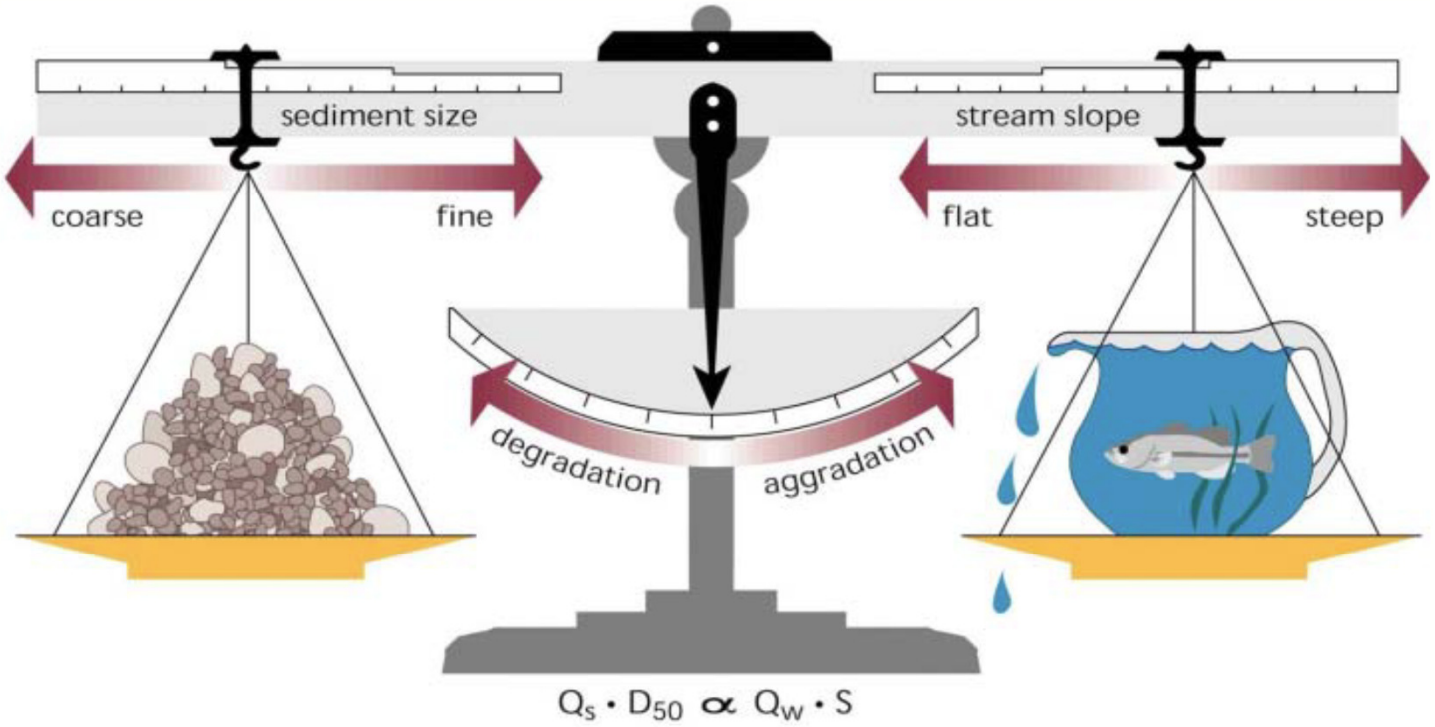
- The permit should include an “off ramp” that would eliminate the need for a technical infeasibility analysis for restoration projects.

Lane's Stream Balance Relationship

Lane's classic description of channel stability states that dynamic equilibrium exists between stream power and the discharge of bed-material sediment (Lane, 1955 as cited in Chang, 1998):

$$Q_s d \propto Q_w S$$

where Q_s is the sediment discharge, d is the median sediment size, Q is the discharge and S is the bed slope.



Planning and Land Development Program
Element Suggestions: BIA/SC-CICWQ

Permit Issue	Interpretation and Concerns	Suggested Approach
Flow-thru biofiltration does not meet onsite retention standard	A zero discharge standard is established; it is scientifically and technically unsupported; limits LID BMPs in toolbox	Use established LID BMP selection hierarchy that includes biofiltration as an option when other retention BMPs are infeasible
Use of flow-thru biofiltration must be accompanied by mitigation of SWQDv	Biofiltration and bioretention BMPs are established LID practices; requiring accompanying mitigation of SWQDv that has already been biofiltered penalizes use of effective LID controls	Remove this provision; no other permit requires accompanying mitigation for volume that has already been managed in biofilters

Planning and Land Development Program Element Suggestions: BIA/SC-CICWQ

Permit Issue	Interpretation and Concerns	Suggested Approach
Sub-regional and regional LID approaches and watershed planning using LID practices within watershed planning are absent or minimized	Draft permit minimizes any type of regional approach Draft permit doesn't allow co-permittees to incorporate watershed and sub-watershed scale LID and hydromodification control BMPs into a JURMP	Provide co-equal approach to onsite compliance when benefit to groundwater replenishment is established Allow compliance when watershed master plans include LID BMPs implemented at appropriate scale
Hydromodification exemptions for other hardening techniques and urban area have been removed	Requirement is unduly restrictive and requires controls when they are not needed and will have no effect	Substitute "concrete lined" with "hardened"; recognize urban area exemption >70% per HMP

Comparison of New and Re-development Low Impact Development Performance Criteria in Southern California MS4 Permits

Permit Criteria	Southern California Phase I MS4 Permit Comparison—Low Impact Development BMP Permit Criteria							
	Administrative Draft San Diego Regional Permit SDRWQCB Tentative Order	**Adopted South Riverside County Permit SDRWQCB 11/10/2010**	**Adopted Ventura County Permit LARWQCB 7/8/2010**	**Adopted Western Riverside County Permit SARWQCB 1/29/2010**	**Adopted San Bernardino County Permit SARWQCB 1/29/2010**	**Adopted South Orange County Permit SDRWQCB 12/16/2009**	**Adopted North Orange County Permit SARWQCB 6/3/2009**	**Adopted San Diego County Permit SDRWQCB 1/24/2007**
LID Sizing Criteria	1. Size and design BMPs to retain the volume equivalent to runoff produced by the 85th percentile storm event 2. If onsite retention is technically infeasible, flow-thru LID BMPs must be implemented to treat remaining SWQDv not retained onsite 3. Mitigate portion of SWQDv pollutant load not retained onsite	1. Size and design BMPs to ensure onsite retention, without runoff, the 24-hour 85th percentile storm event 2. If #1 infeasible, treat excess surface discharge with biofiltration; increase sizing for biotreatment BMPs by 0.75 times the design storm volume remaining 3. Treat excess surface discharge not retained or biofiltered using treatment controls	1. 5% EIA, with finding of infeasibility allowance to use biofiltration for 1.5X remaining design volume; disconnection is defined as full retention of the water quality volume (85th percentile event) 2. Treat directly connected impervious and pervious areas	1. Retain and treat WQ volume (85th percentile event) 2. Treat excess surface discharge from water quality design storm per WQMP	1. Retain and treat WQ volume (85th percentile event) 2. Treat excess surface discharge from water quality design storm per WQMP	1. Fully retain onsite water quality volume (85th percentile event) without any runoff 2. If #1 infeasible, treat excess surface discharge with biofiltration; increase sizing for biotreatment BMPs by 0.75 times the design storm volume remaining 3. If #2 infeasible to biofilter or biotreat, use conventional BMPs and mitigate volume reduction offsite	1. Retain water quality volume (85th percentile event) or biotreat with a showing of infeasibility to retain the entire volume 2. Treat excess surface discharge from water quality design storm per WQMP	1. Size all treatment systems for 85th percentile event 2. Treat excess surface discharge
LID BMP Selection Priority/Allowable LID BMPs to meet On-site Retention Standard	1. Infiltration 2. Harvest and Use 3. Evapotranspiration 4. Flow-thru LID treatment control BMPs; project applicants must perform mitigation for portion of the pollutant load in the SWQDv that is not retained onsite	1. Site design (conserve natural areas, etc) 2. Infiltration 3. Other LID BMPs sized at 0.75 x portion of design capture volume not retained onsite. 4. Treatment control measures	1. Infiltration 2. Harvest and Use 3. Evapotranspiration 4. Bioretention/ biofiltration 1.5 times remaining design volume	1. Site design (conserve natural areas) 2. Infiltration 3. Harvest and Use 4. Evapotranspiration 5. Bioretention / biofiltration	1. Site design (conserve natural areas) 2. Infiltration 3. Harvest and Use 4. Evapotranspiration 5. Bioretention / biofiltration	1. Infiltration 2. Harvest and Use 3. Evapotranspiration 4. Bioretention / biofiltration	1. Site design (conserve natural areas, etc) 2. Infiltration 3. Harvest and Use 4. Evapotranspiration 5. Bioretention/ Biofiltration	1. Site design (conserve natural areas) 2. Drain portion of impervious area to pervious areas (landscaping) 3. Low traffic areas and appropriate soils, use permeable materials 4. Treatment control measures
LID Technical Infeasibility and Mitigation Process	1. Demonstrate retention LID BMPs implemented to maximum extent technically feasible given project site conditions 2. Perform mitigation with net result the same level of water quality protection as would have been	1. LID waiver program 2. Mitigate pollutant load estimated from each project participating in program 3. Water quality credit option 4. In-lieu fee option	1. Submit hydrologic and/or design analysis showing project meets various criteria 2. Make up volume retention requirement offsite either directly or via in-lieu fee 3. All feasible measures to reduce	1. Submit hydrologic and/or design analysis showing project meets various criteria 2. Create watershed based infiltration map to target stormwater infiltration and storage 3. Create urban runoff fund to fund watershed and sub-	1. Submit hydrologic and/or design analysis showing project meets various criteria 2. Create watershed based infiltration map to target stormwater infiltration and storage 3. Create urban runoff fund to fund watershed and sub-watershed	1. Offsite “waiver” (mitigation) programs to be developed 2. In-lieu fees 3. Water quality credit system	1. Submit hydrologic and/or design analysis showing project meets various criteria 2. Create watershed based infiltration map to target stormwater infiltration and storage 3. Create urban runoff fund to fund watershed and sub-watershed	1. No requirement 2. Model SUSMP to include criteria for LID BMP applicability and feasibility

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LID Technical Infeasibility and Mitigation Process	achieved with full implementation of LID BMPs onsite 3. For SWQDv not retained on-site, require either: i) implement an offsite mitigation project; or ii) provide sufficient funding for a public or private offsite mitigation project via a mitigation fund: a. <u>Project Locations:</u> preferably within same hydrologic subarea or within the same hydrologic unit if infeasibility demonstrated b. <u>Project Type:</u> retrofit, stream habitat restoration, green streets, or regional BMPs upstream of receiving waters c. <u>Project Timing</u>: regional projects completed at time of occupancy of first project d. <u>Mitigation Fund</u>: fund pollution credit or mitigation fund allowed		EIA <30% 4. Projects achieving <30% EIA, mitigation or payment in lieu equivalent to stormwater not managed onsite 5. Projects >30% EIA, mitigation or payment in lieu equivalent to stormwater not managed onsite multiplied by 1.5 6. Offsite mitigation must be in same sub-watershed 7. Offsite mitigation must be completed in 4 yrs	watershed scale LID projects 4. Create watershed LID water quality credit system	scale LID projects 4. Create watershed LID water quality credit system		scale LID projects 4. Create watershed LID water quality credit system	

National Comparison of New and Redevelopment Low Impact Development Performance Criteria

Permit Criteria	West Virginia Small MS4 Permit Effective: 7/22/2009	Georgia Phase II MS4 Permit Effective: 1/3/2012	Washington DC Phase I MS4 Permit Effective: 10/7/2011	Philadelphia, Pennsylvania Phase I MS4 Permit Effective: 1/1/2006	Portland, Oregon Phase I MS4 Permit Effective: 1/22/2011
LID Sizing Criteria	1. Keep and manage on site the first one inch of rainfall from a 24-hour storm preceded by 48 hours of no measureable precipitation.	1. Capture and treat the runoff volume resulting from the first 1.2 inches of rainfall from a site.	1. On-site retention of 1.2" of stormwater from a 24-hour storm with a 72-hour antecedent dry period for all development greater than or equal to 5,000 square feet.	1. Manage water quality volume of 1-inch of rainfall over directly connected impervious area. 2. Sizing differs for areas of separate or combined sewers.	1. Infiltrate the 10-year, 24-hour storm event. 2. Three sizing methodologies allowed: Simplified, Presumptive, and Performance 3. Capture and treat 80% of average annual runoff volume
LID BMP Selection Priority/Allowable LID BMPs to meet Onsite Retention Standard	1. Runoff volume reduction achieved thru: canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration, and evapotranspiration. 2. In addition to practices listed in #1 above, use: dry swales, bioretention, rain tanks and cisterns, soil amendments, roof top disconnections, permeable pavement, porous concrete, permeable pavers, reforestation, grass channels, and green roofs for volume reduction.	1. Determine feasibility to include green infrastructure practices, such as infiltration, reuse, and evapotranspiration.	1. Achieved through evapotranspiration, infiltration, and/or stormwater harvesting. 2. Green landscaping incentives program required to encourage use of planters, permeable paving, green roofs, vegetated walls, preservation of existing trees, and layering of vegetation. 3. Every major renovation/rehabilitation project for District owned properties will include on-site stormwater retention measures, such as green roofs, and stormwater harvest/reuse, to meet the retention performance standard.	1. Infiltrate water quality volume (WQV) unless infeasible 2. If infeasible to infiltrate WQV, remaining volume treated by an approved stormwater management practice for volume reduction: planter boxes, biofiltration/bioretention, swales, constructed wetlands, ponds and wet basins, rain barrels and cisterns and green roofs 3. Use rooftop disconnection, pavement disconnection, maximize tree canopy cover, install green roofs, or install porous pavement to reduce directly connected impervious area and WQV to be managed	1. Infiltration and discharge hierarchy of practices subject to 4 categories covering onsite infiltration and offsite discharge. 2. Implement ecoroofs, pervious pavement, or street trees to reduce impervious area (aka hydrologic source controls) 3. Implement total infiltration (>2.0 in/hr), partial infiltration (2.0 to 0.5 in/hr) , or flow-through stormwater management facilities (<0.5 in/hr) depending upon in situ soil infiltration rate.
LID Technical Infeasibility and Mitigation Process	1. If onsite retention is infeasible using practices listed in **LID BMP Selection Priority**, use two alternatives: i) Off-site mitigation, or ii) Payment in-lieu 2. Volume reduction credits available for certain development types, (eg. brownfield redevelopment)	1. Submit determination of infeasibility with associated set of proposed plans. 2. Develop policy or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under state and local law.	1. If onsite mitigation is infeasible, two alternatives are considered: i) Off-site mitigation, or ii) Fee-in-lieu 2. Any allowance for adjustments in the retention standard shall be defined in the Permittee's regulations.	1. LID BMP waiver process	1. Applicant may fulfill all or portion of storm water quality volume by compensating the City for future development of offsite facilities per square foot of unmanaged impervious surface