



*Presentado en el seminario:*

**Cambio Climático y Cuencas Hidrográficas  
Vulnerables en los Andes: discusión entre  
tomadores de decisión sobre gobernanza y  
capacidad institucional**

21 de mayo de 2015

8:00 – 17:00

*Lima, Perú*

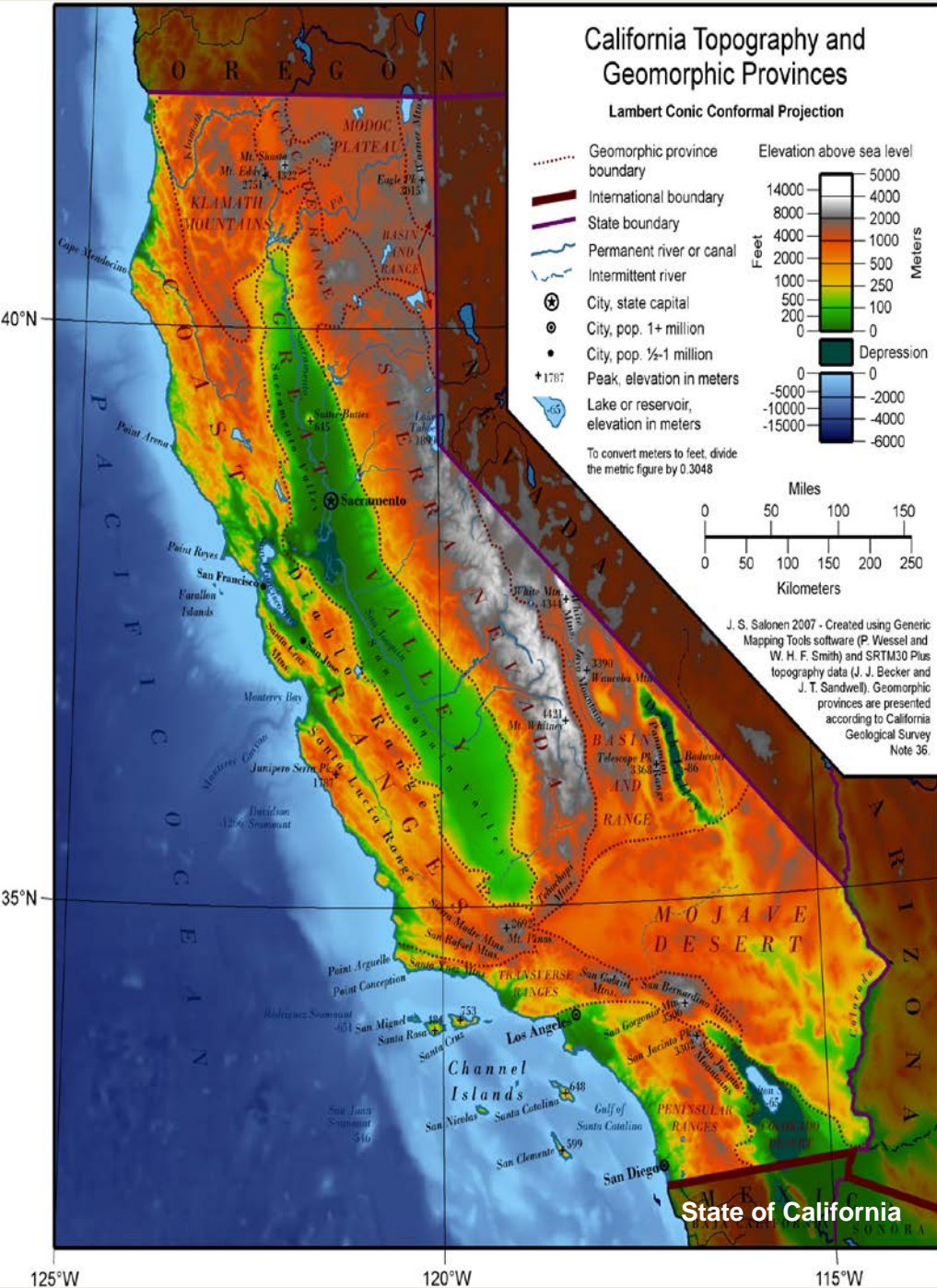
# The Infrastructure for Green Urbanism

Deborah Weintraub, AIA, LEED<sub>AP</sub>  
Chief Deputy City Engineer/Chief Architect  
City of Los Angeles, Bureau of Engineering



# Presentation Outline

- 1. Physical Context**
- 2. Political Context**
- 3. Climate Change Impacts/Adaptations**
- 4. Local Water Systems**
- 5. Local Responses**
- 6. Projects**



# Physical Context



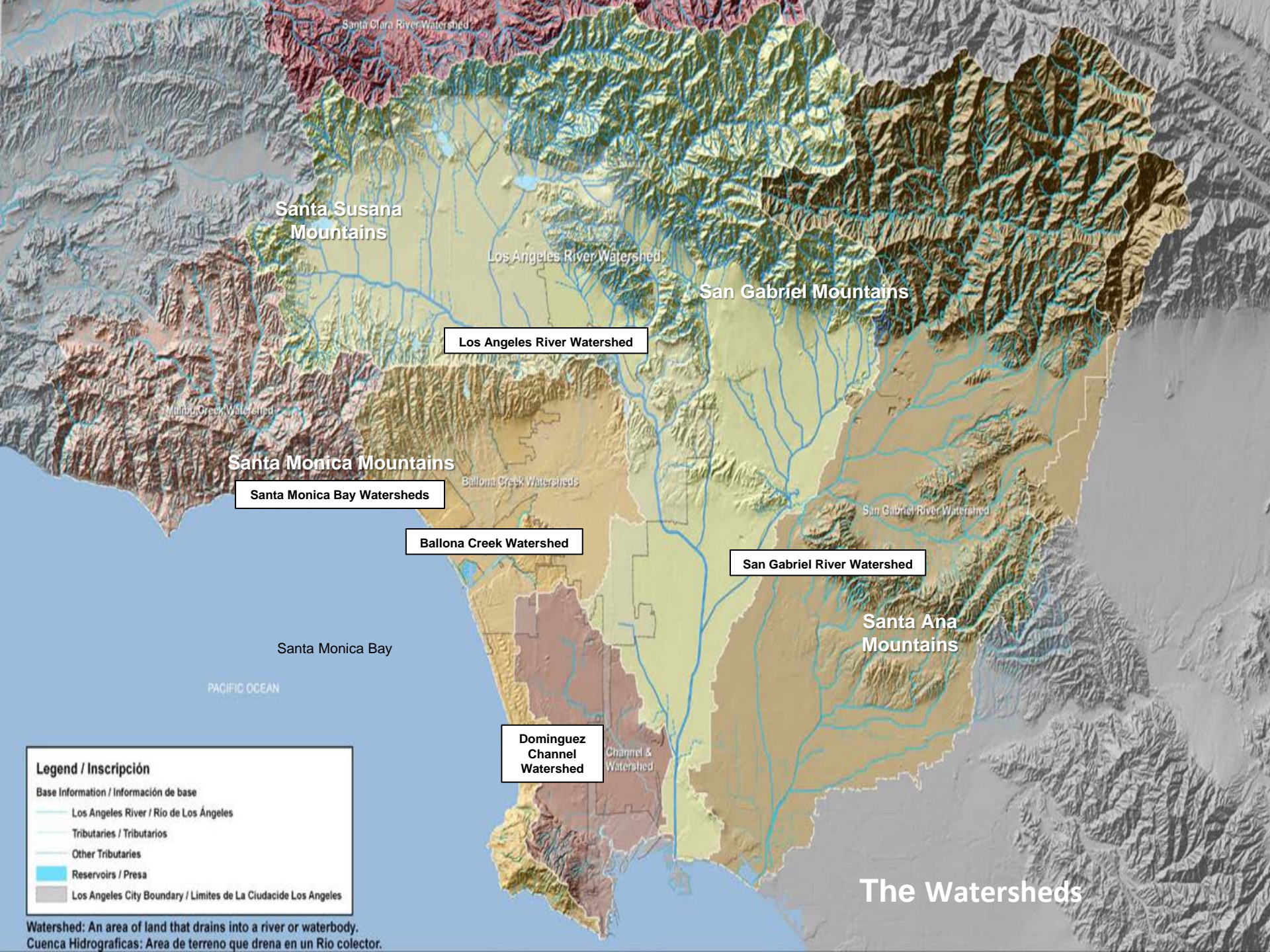
The Los Angeles Basin



The Los Angeles Basin



The Los Angeles Basin



**Santa Susana Mountains**

Los Angeles River Watershed

**San Gabriel Mountains**

**Los Angeles River Watershed**

Mulholland Creek Watershed

**Santa Monica Mountains**

**Santa Monica Bay Watersheds**

Ballona Creek Watersheds

**Ballona Creek Watershed**

San Gabriel River Watershed

**San Gabriel River Watershed**

Santa Monica Bay

PACIFIC OCEAN

**Santa Ana Mountains**

**Dominguez Channel Watershed**

Channel & Watershed

**Legend / Inscripción**

Base information / Información de base

-  Los Angeles River / Río de Los Ángeles
-  Tributaries / Tributarios
-  Other Tributaries
-  Reservoirs / Presa
-  Los Angeles City Boundary / Límites de La Ciudad de Los Angeles

Watershed: An area of land that drains into a river or waterbody.  
 Cuenca Hidrografica: Area de terreno que drena en un Río colector.

**The Watersheds**

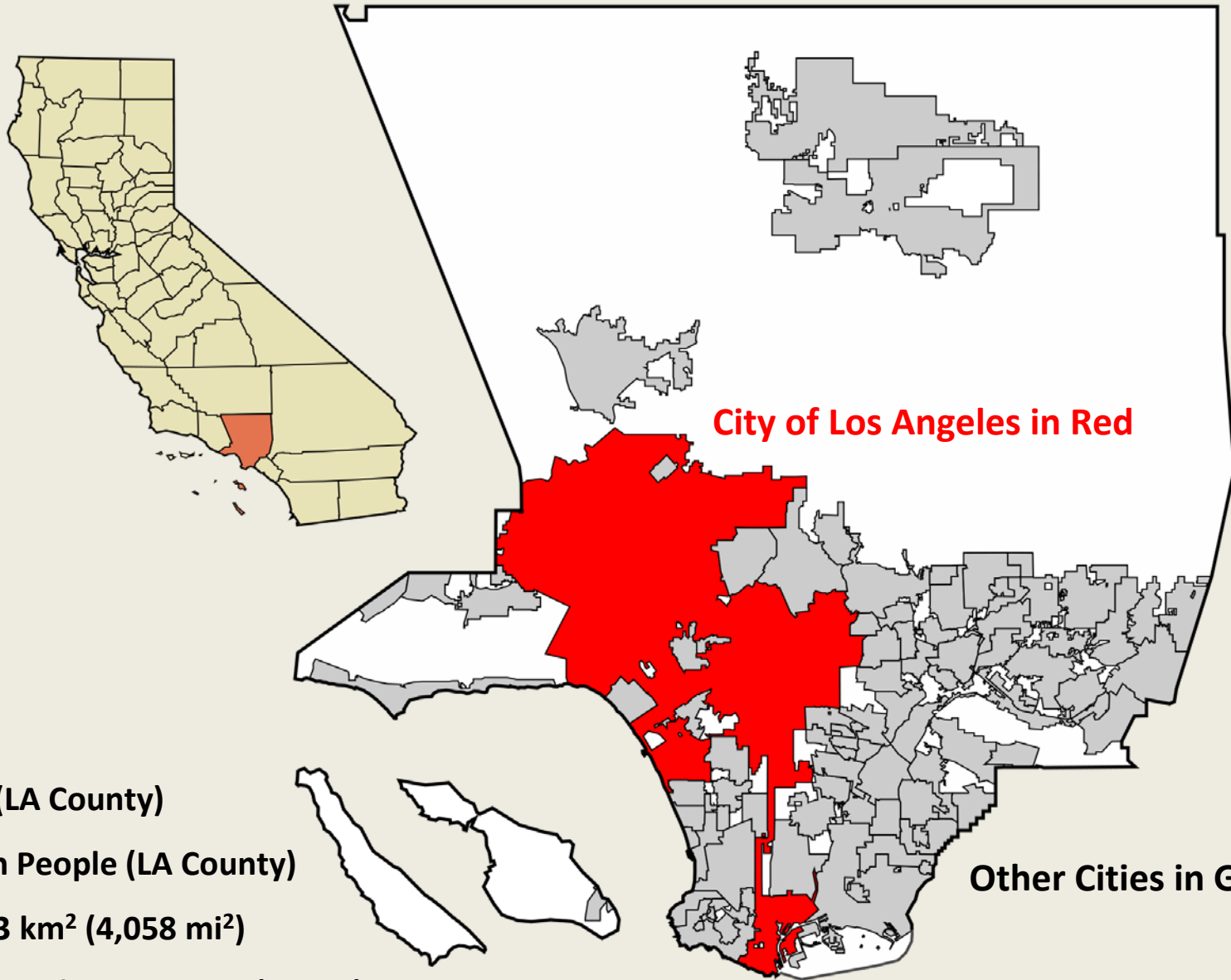




- City contributes to four major watersheds:**
- Los Angeles River
  - Ballona Creek
  - Santa Monica Bay
  - Dominguez Channel

# Political Context

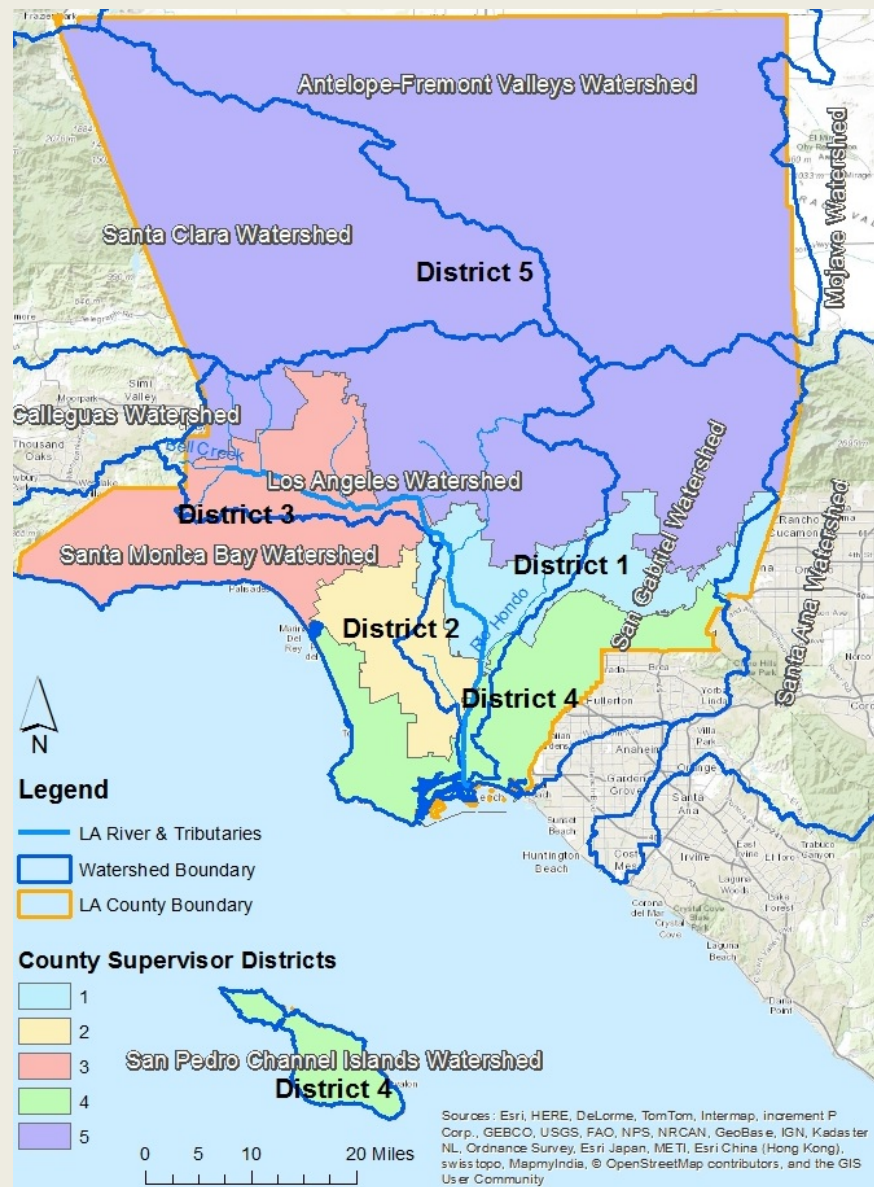
Los Angeles County Boundary in Black







City of Los Angeles in Red

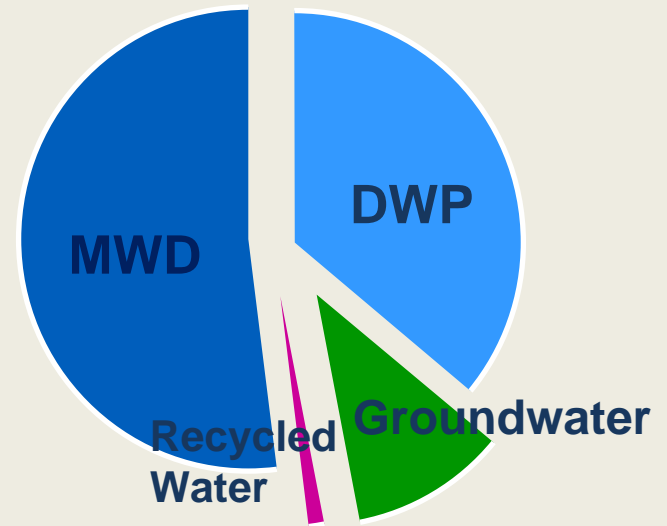
Other Cities in Grey

- 88 Cities (LA County)
- 10 Million People (LA County)
- Area: 12.3 km<sup>2</sup> (4,058 mi<sup>2</sup>)
- Average Rainfall 14 inches (36 cm)

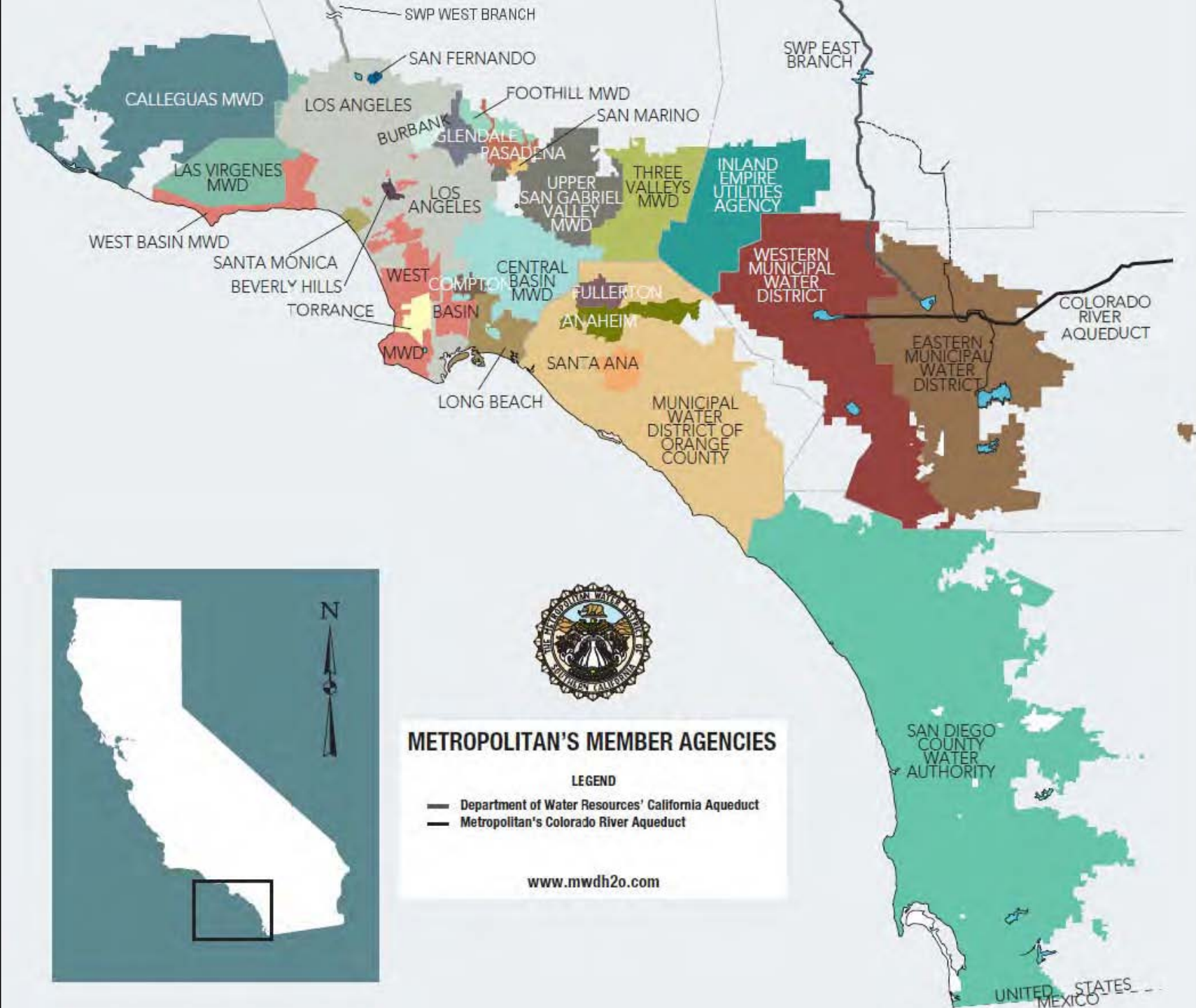


# City of Los Angeles Depends on Imported Water

	<b>MWD</b>	<b>52%</b>
	<b>DWP LA Aqueduct</b>	<b>36%</b>
	<b>DWP Ground Water</b>	<b>11%</b>
	<b>LA Recycled Water</b>	<b>1%</b>



**Total:**  
-621,700 Acre Feet Per Day (AF) or  
-555 Million Gallons Per Day (MGD)



### METROPOLITAN'S MEMBER AGENCIES

#### LEGEND

-  Department of Water Resources' California Aqueduct
-  Metropolitan's Colorado River Aqueduct

[www.mwdh2o.com](http://www.mwdh2o.com)



# Flooding Potential



# Flooding Potential



# Flooding Potential





# Taming the Water

<b>1781</b>	45 Settlers from Mexico arrive. Pueblo de Los Angeles. Zanja established.
<b>1815</b>	Floods wash away original Pueblo and changes River course to Ballona Creek.
<b>1825</b>	River floods, returns to original course.
<b>1854</b>	City appoints water overseer to administer water, based on population growth.
<b>1858</b>	Los Angeles incorporated.
<b>1861-62</b>	50" of rain in 5 weeks washes away River banks & water distribution system. Much of San Fernando Valley under water.
<b>1863-64</b>	Drought kills most of livestock in region.
<b>1867</b>	Floods cause River to overflow. Large temporary lake out to Ballona Creek.
<b>1904</b>	William Mulholland, Superintendent of LA City Water Co. announces LA need new water sources. Outgrown LA River and local aquifers.
<b>1913</b>	Owens Valley Aquaduct opens (LA Aquaduct).
<b>1914</b>	Flooding from LA River. Channelization discussed.
<b>1915</b>	LA Flood District founded.
<b>1920</b>	Devil's Gate Dam finished. 1st LA County dam. City population 930,000.
<b>1930</b>	Groundwater levels dropping by 2' to 20'. First spreading grounds constructed.

<b>1934</b>	Heavy flooding. 40 die in LA Crescenta.
<b>1936</b>	Flood Control Act redefines role of Corps to supervising permanent future flood control plans for LA River.
<b>1938</b>	Heavy flooding. Congress authorizes LA County Drainage Area plan (LACDA).
<b>1941</b>	Sepulveda & Hansen Basins completed. Channelization ongoing for 20 years.
<b>1969</b>	LA County flooding kills 73. Improvements to LACDA authorized.
<b>1978</b>	Flooding, 11 die Countywide.
<b>1980</b>	Flooding, 18 die Countywide.
<b>1983</b>	Flooding, 6 die.
<b>1986</b>	Friends of the Los Angeles River founded (FoLAR).
<b>1991</b>	LA County River Master Plan begun.
<b>1992</b>	Flooding.
<b>1994</b>	LA County at 9 million.
<b>1995</b>	LACDA Flood control project approved to raise flood walls on Lower LA River.

# Drought



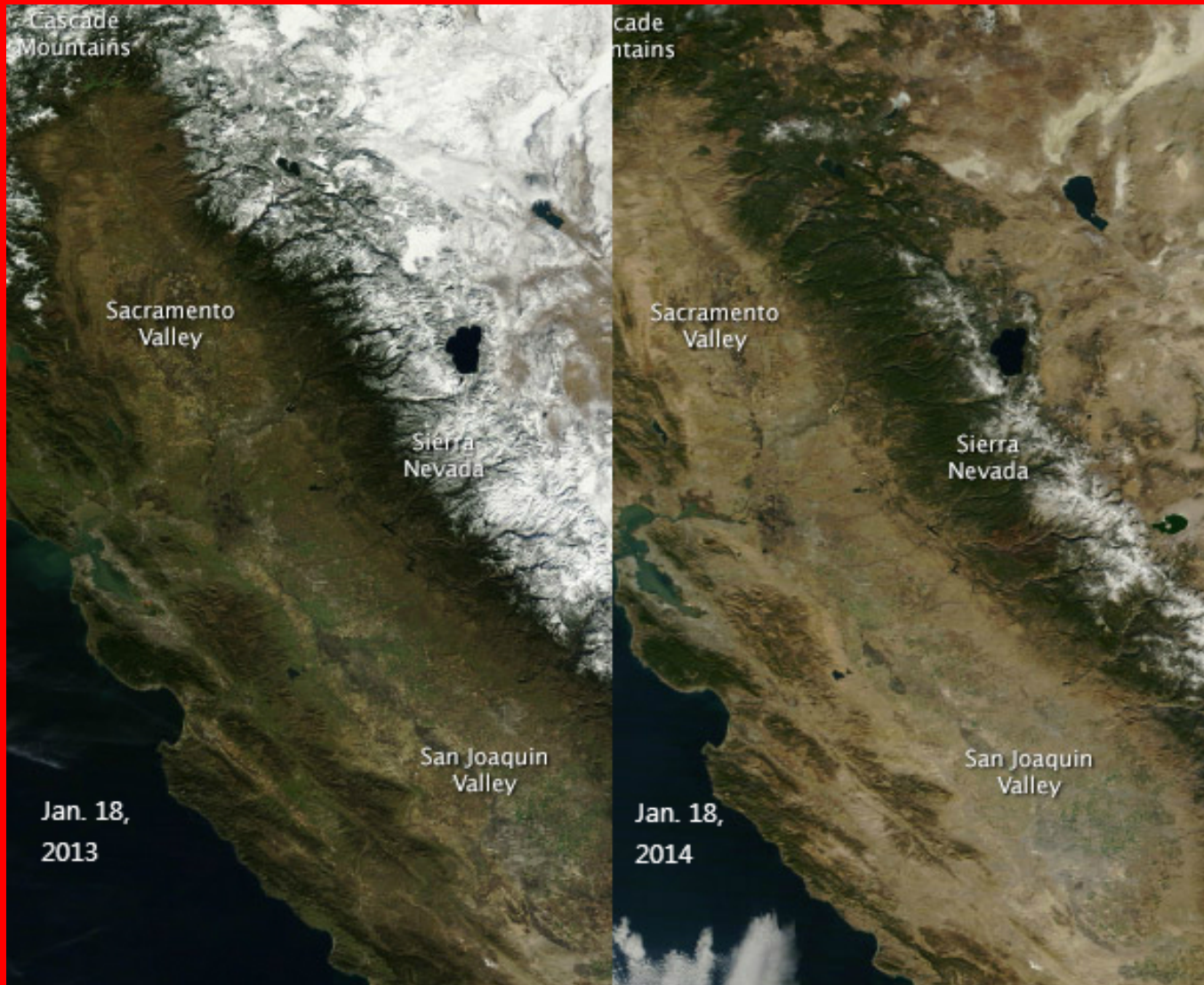
# Drought



# Drought

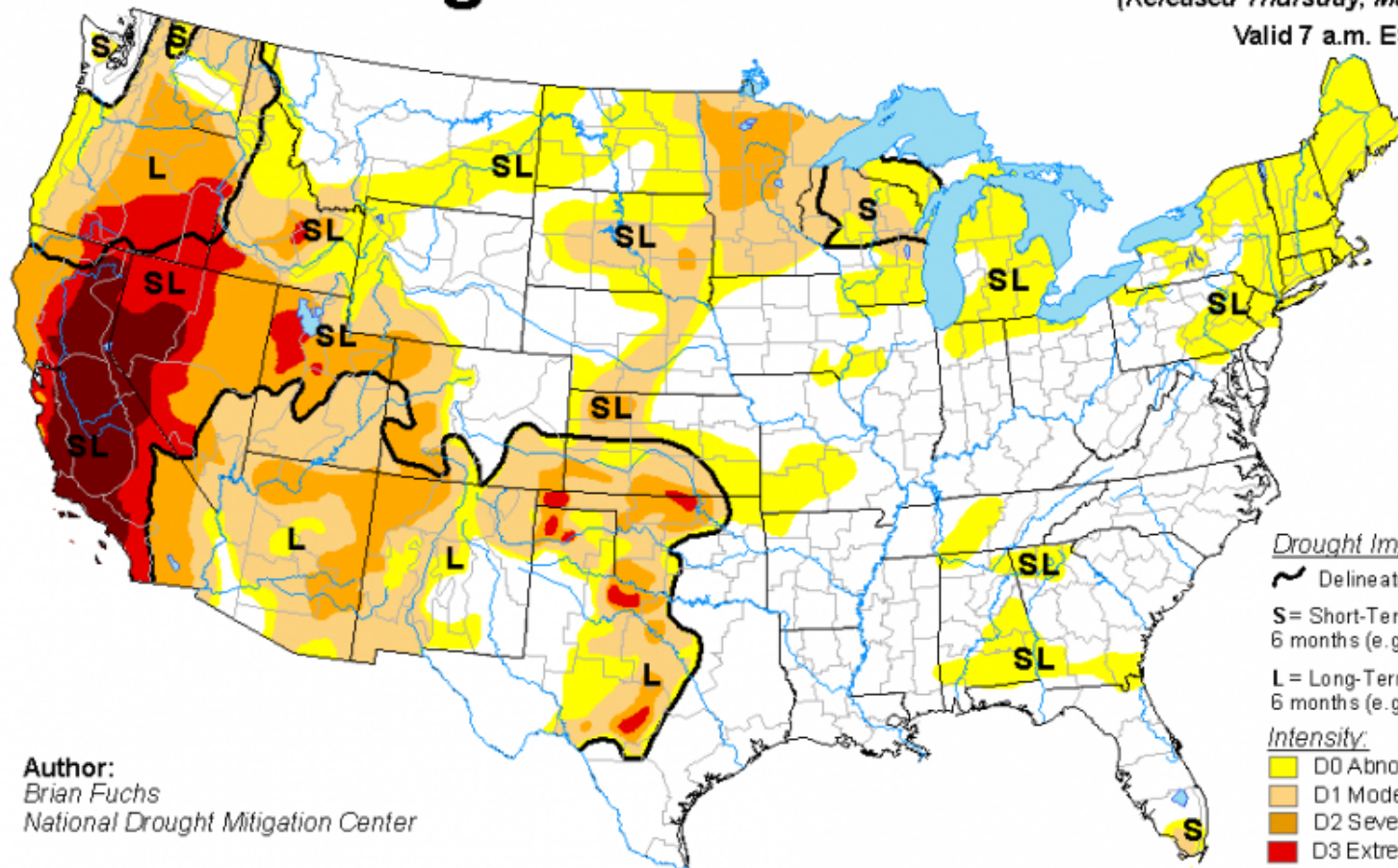


# Drought



# U.S. Drought Monitor

May 12, 2015  
(Released Thursday, May. 14, 2015)  
Valid 7 a.m. EST



Author:  
Brian Fuchs  
National Drought Mitigation Center

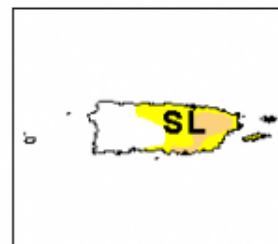
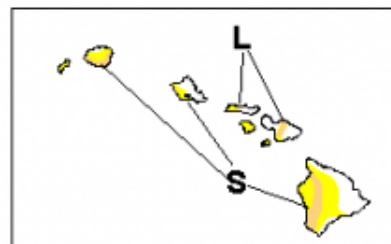
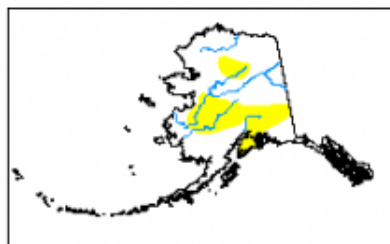
### Drought Impact Types:

- ~ Delineates dominant impacts
- S= Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L= Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

### Intensity:

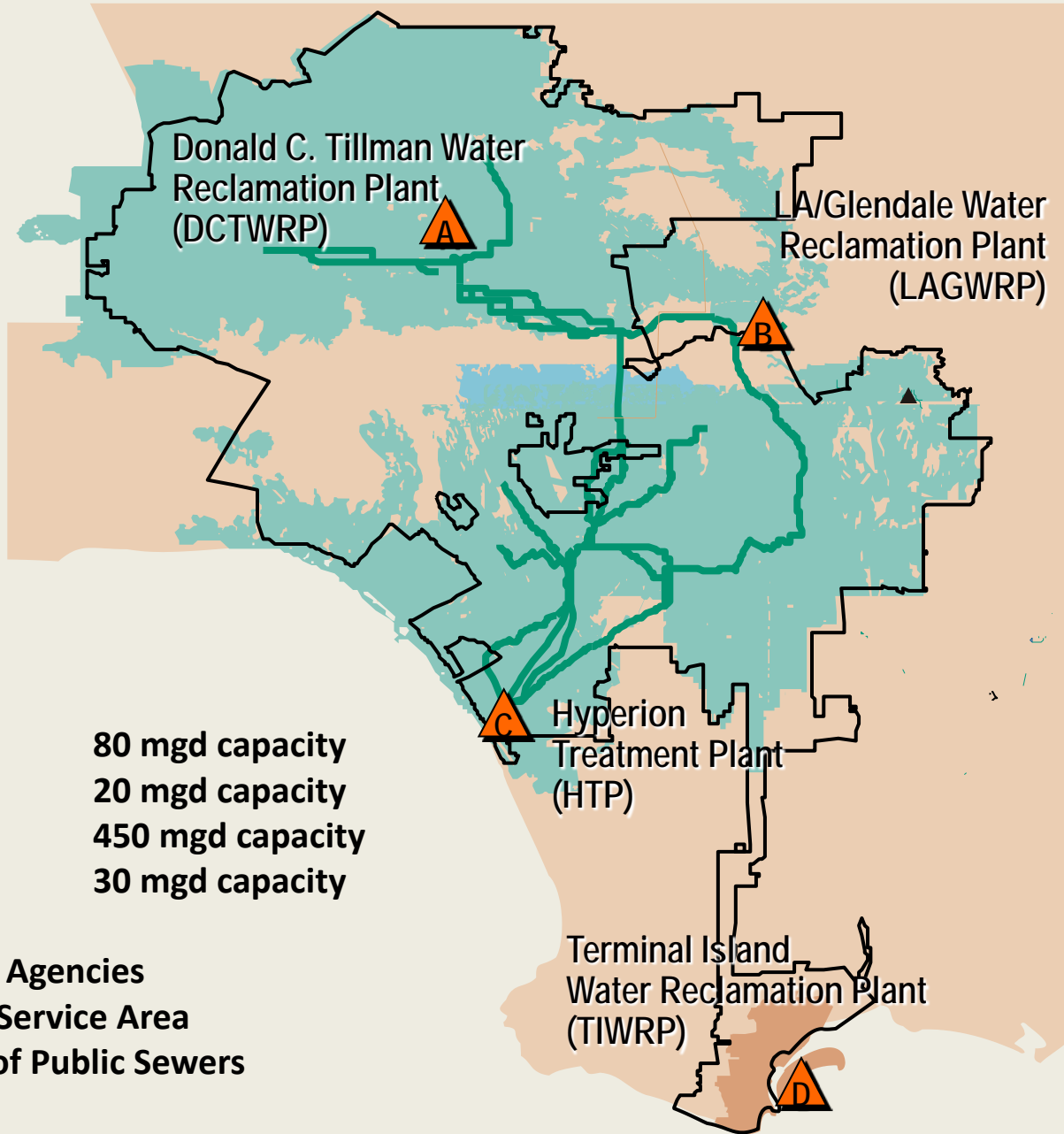
- Yellow: D0 Abnormally Dry
- Light Orange: D1 Moderate Drought
- Orange: D2 Severe Drought
- Red: D3 Extreme Drought
- Dark Red: D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>

# LA City Wastewater Infrastructure

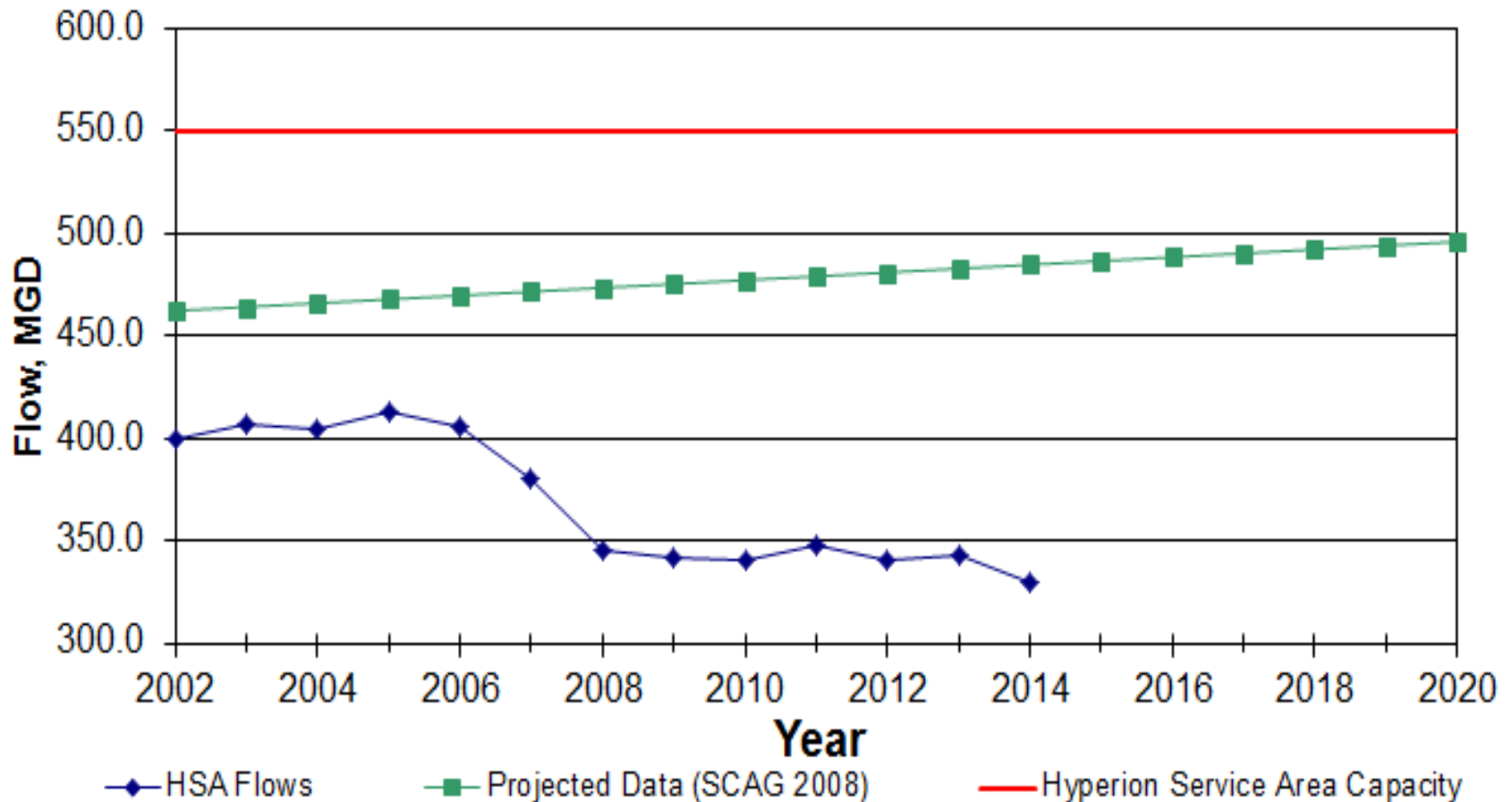


- 🔹 DCTWRP 80 mgd capacity
- 🔹 LAGWRP 20 mgd capacity
- 🔹 HTP 450 mgd capacity
- 🔹 TIWRP 30 mgd capacity

- 🔹 29 Contract Agencies
- 🔹 600 sq. mi. Service Area
- 🔹 ~6,500 mi. of Public Sewers

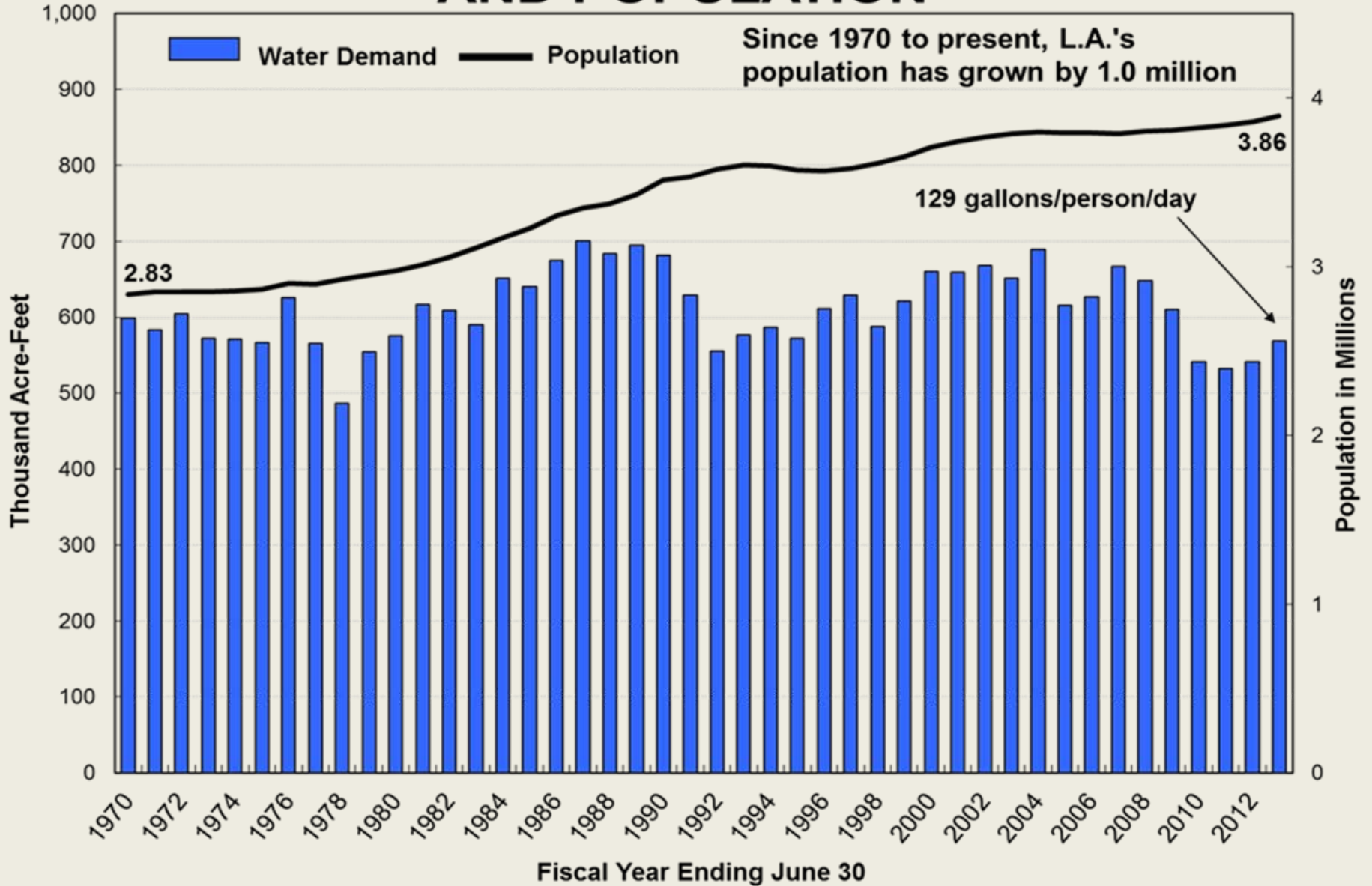
# LA's Sewer Flows Are Decreasing

## Hyperion Service Area Flows

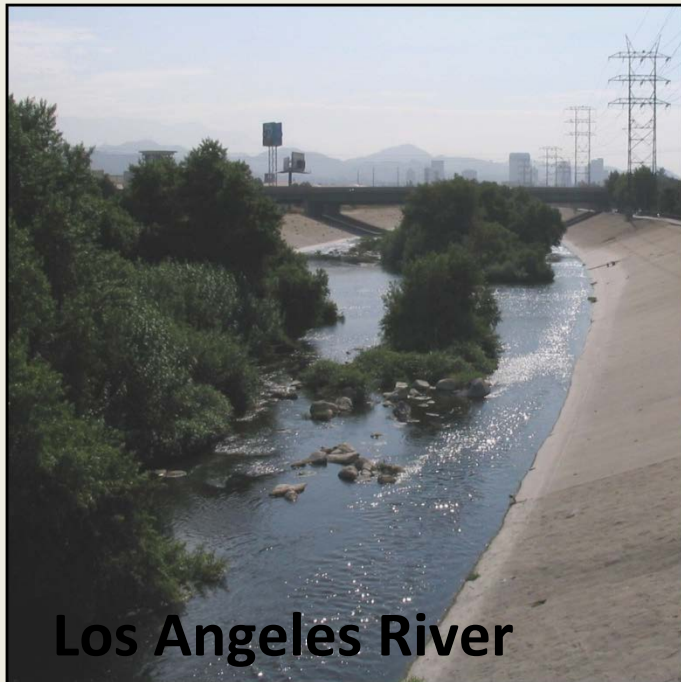




# CITY OF LOS ANGELES WATER USE AND POPULATION



# LA's Storm Drain System

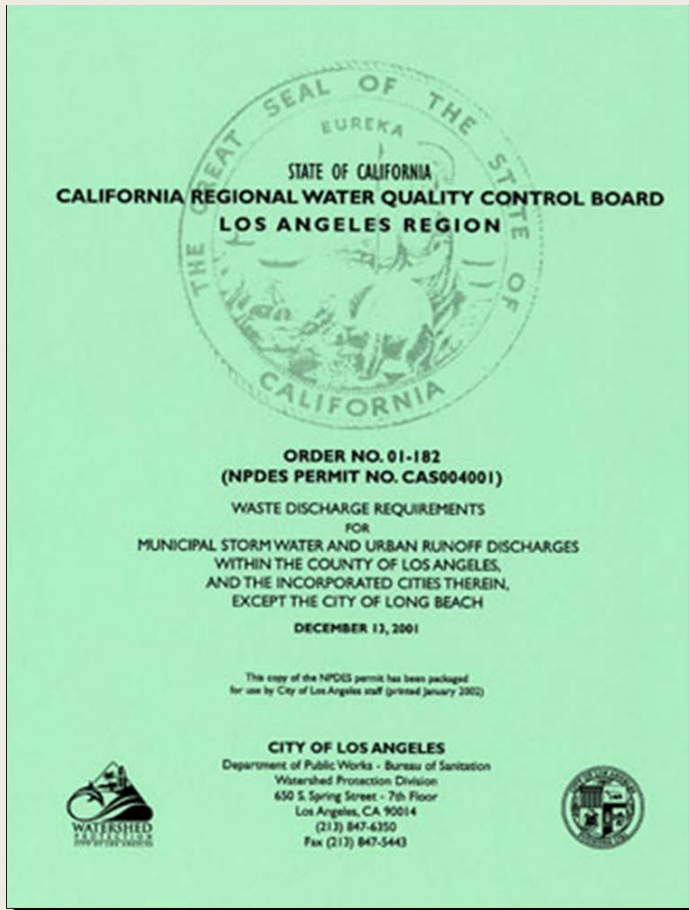
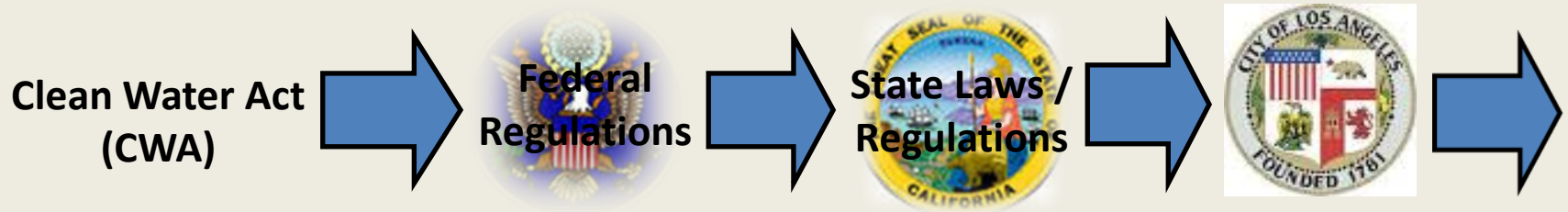


# LA Storm Drain System – and Pollution

- -Storm drains are separate from sewer pipes.
- -Stormwater collects pollutions from properties and City streets.
- -Storm drains flow directly to the ocean
- -Pollution is washed onto LA's beaches



# Stormwater Quality Regulations

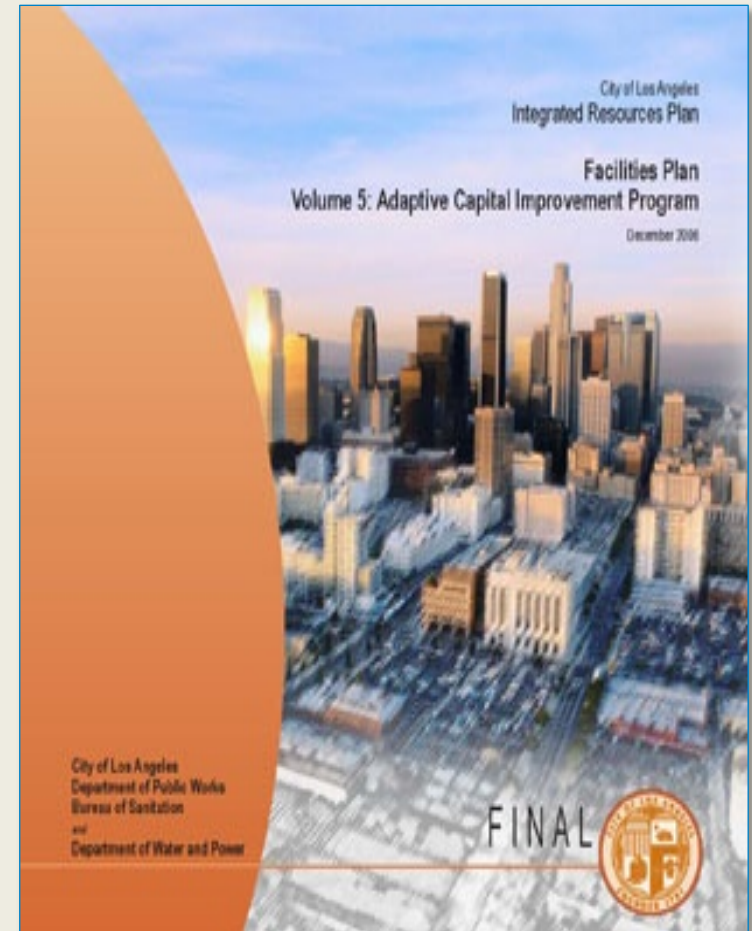


**National Pollution Discharge Elimination System Permits  
Total Maximum Daily Loads (TMDL's)**

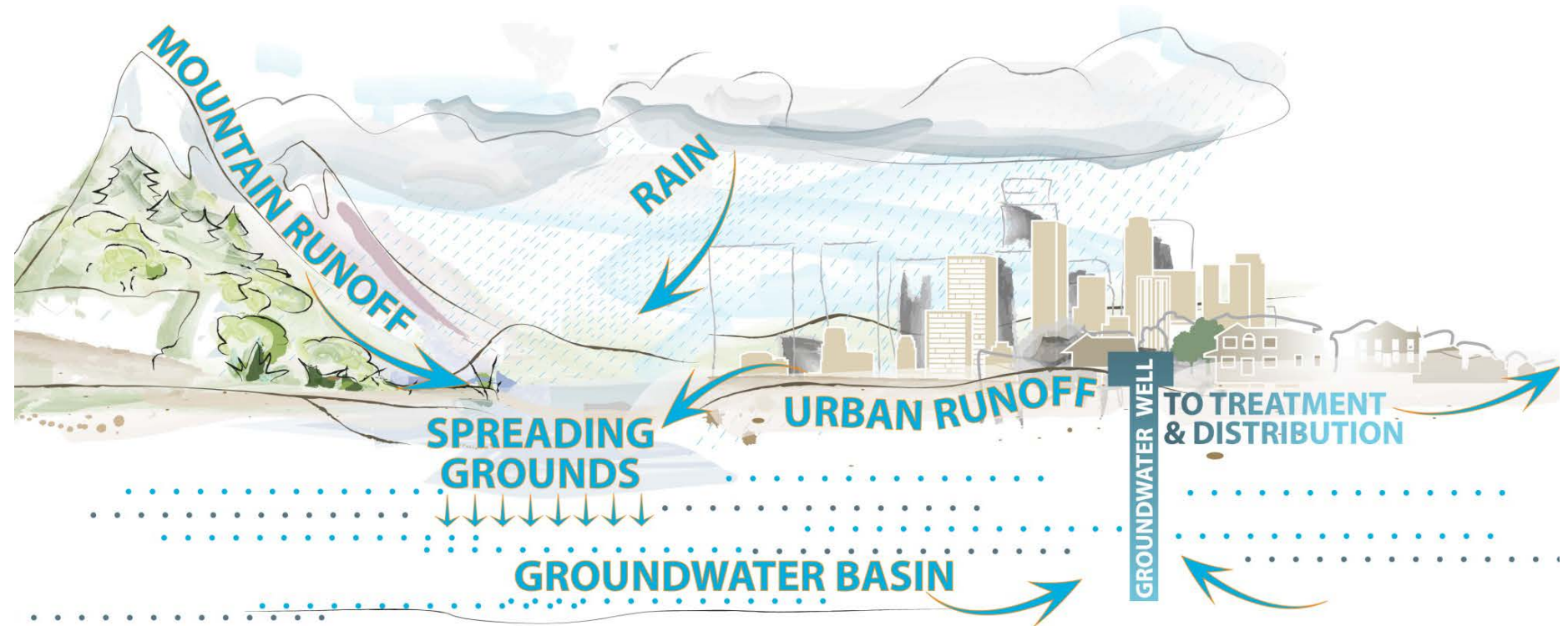
**Pollutants of concern: Trash, Bacteria, Metals,  
Pesticides, Oil & Grease, etc.**

# LA's Integrated Resources Plan (IRP) for Water

- Adopted by LA's City Council in 2006
- Provided an integrated facilities plan for water, wastewater, and runoff management programs through 2020
- Innovative:
  - Integrated Watershed Planning
  - City Department Collaboration
  - Stakeholder Involvement



# Local Responses



LADWP Stormwater Capture Master Plan

# A Sustainable Approach that is Climate Adaptive



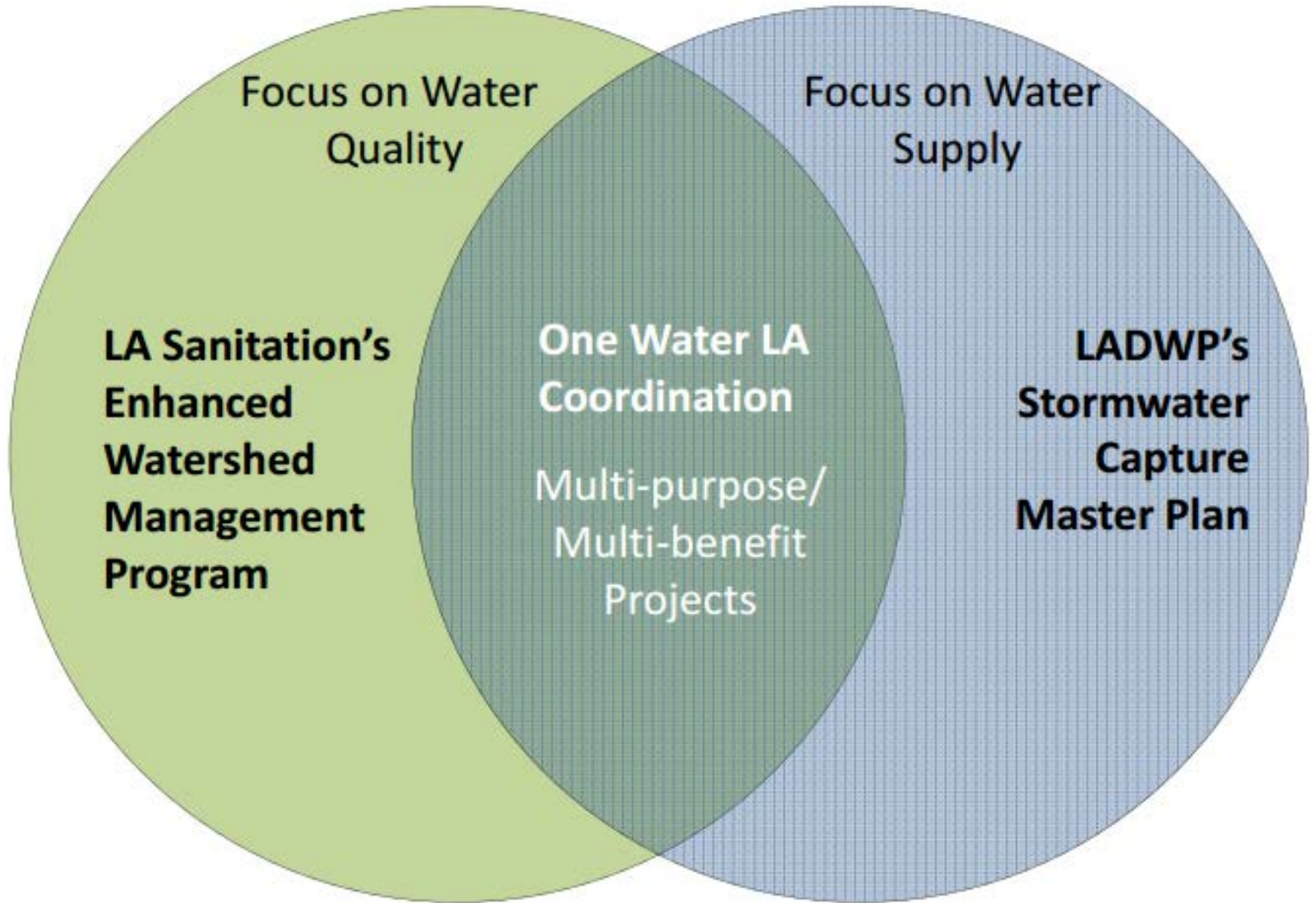
**Innovation  
Integration  
Inclusion**

Manage all Water as One Water

- 💧 Drinking Water
- 💧 Rain/Storm Water
- 💧 Groundwater
- 💧 Recycled Water
- 💧 Wastewater



# One Water





# Added Benefits

## Livable Communities

- Green Streets
- Parks & Open Space

## Environment

- Ecosystem Restoration
- Reduced Carbon Emissions



## Economic Benefits

- Local Job Creation
- Utility Efficiencies

## Energy Management

- Lower Energy Needs
- Greener Energy

# Mayor's Executive Directive # 5

October 14, 2014

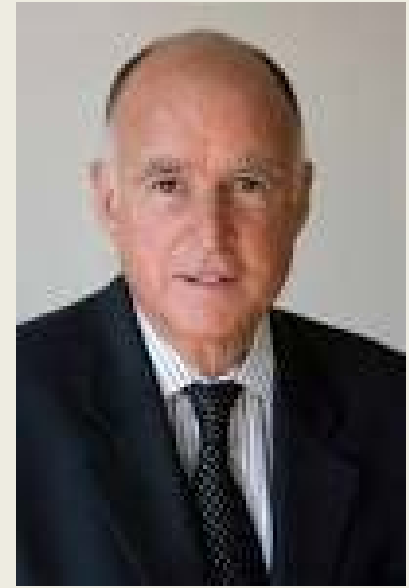
- **Drought has caused LA to increase reliance on imported water**
- **Imported water supply at long term risk due to-**
  - Impacts of Global Warming (e.g. reduced snowpack)
  - Earthquake events that could damage aqueducts & water infrastructure
- **Goals for Directive**
  - Reduce per capita potable water use 20% by 2017
  - Reduce DWP's purchase of imported water by 50% by 2024
  - Create water strategy to improve water security in context of climate change & seismic vulnerability



Mayor Eric Garcetti

# Governor's California Drought Directive

- Reduce urban water consumption by 25 percent.
- This ranges from 4 to 36 percent for local water suppliers.
- Implement urban water conservation measures.
- Agricultural water uses are not impacted.



Governor Jerry Brown

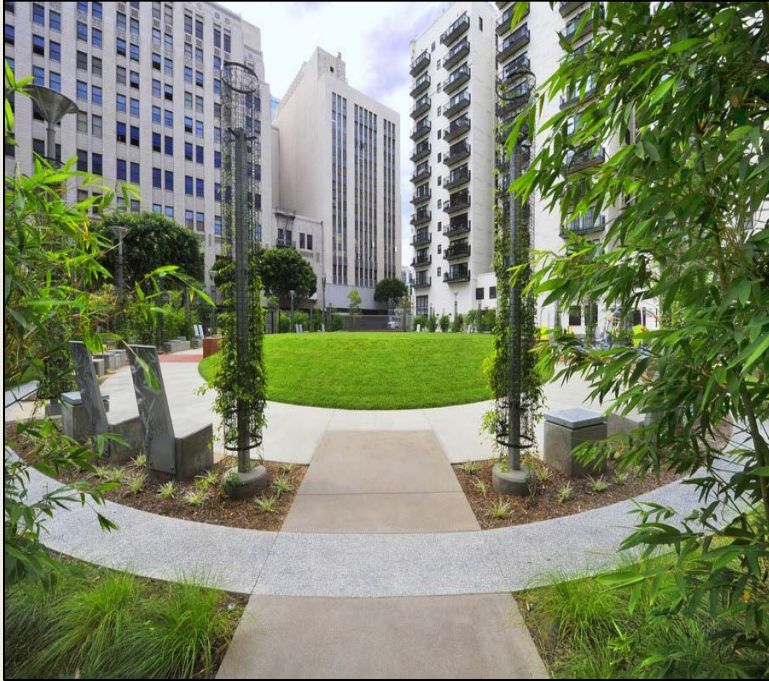


California Reservoirs at historic lows (Lake Oroville)

# Local Responses



# Smart Irrigation Systems



- Use weather and/or site data as a basis for irrigation scheduling
- Variations: Weather data, built-in sensor, soil-based
- Can cut water usage by 20-30% (1 acre-ft of water per acre of landscape per year) and savings of over \$700 over lifetime
- Cost: \$200



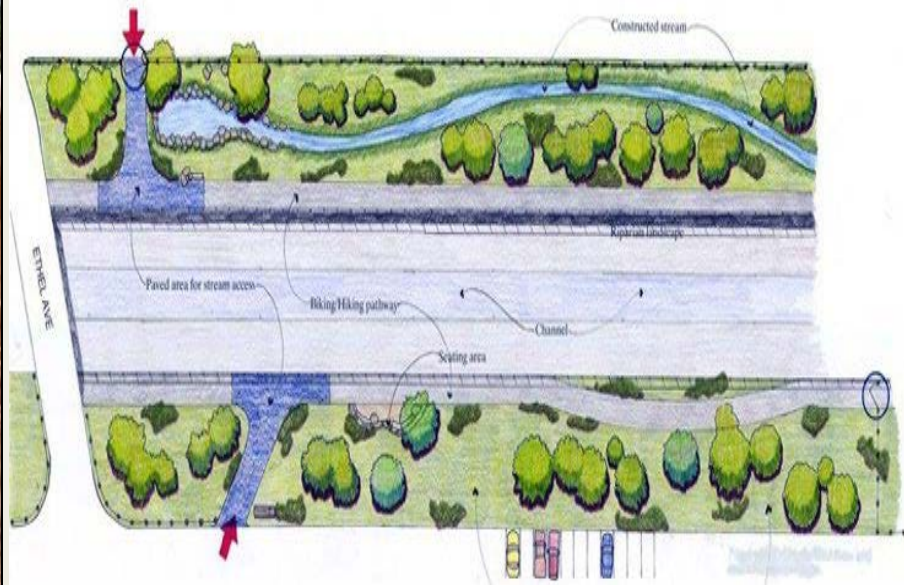
**Typical Smart Irrigation Control**

# Green Streets



**Elmer Avenue Retrofit**

# Greenways



Tujunga Wash Greenway

# LA's Clean Water Bond

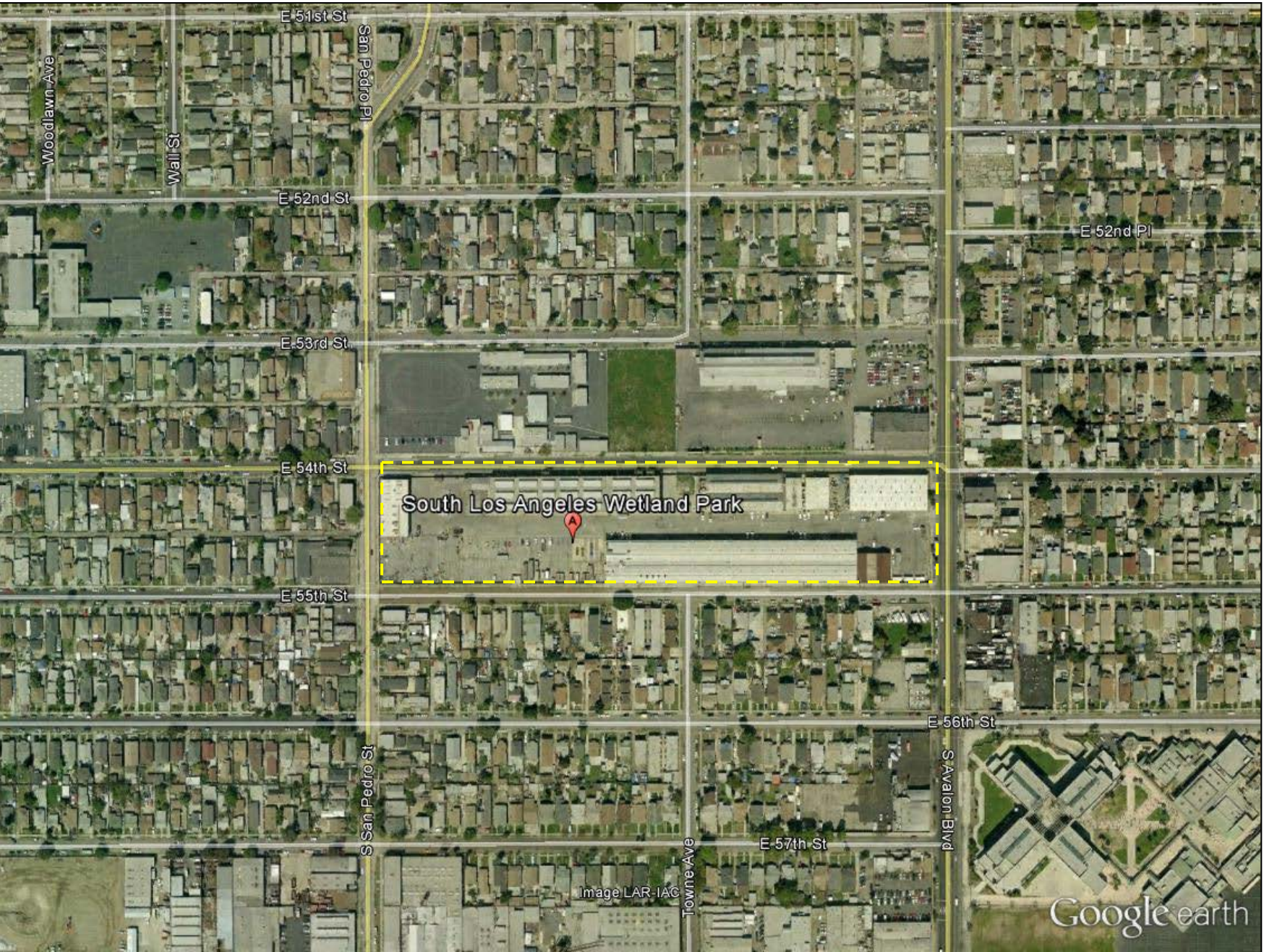




# South Los Angeles Wetlands Park



# Before Construction



South Los Angeles Wetland Park

Google earth

# Project Objectives

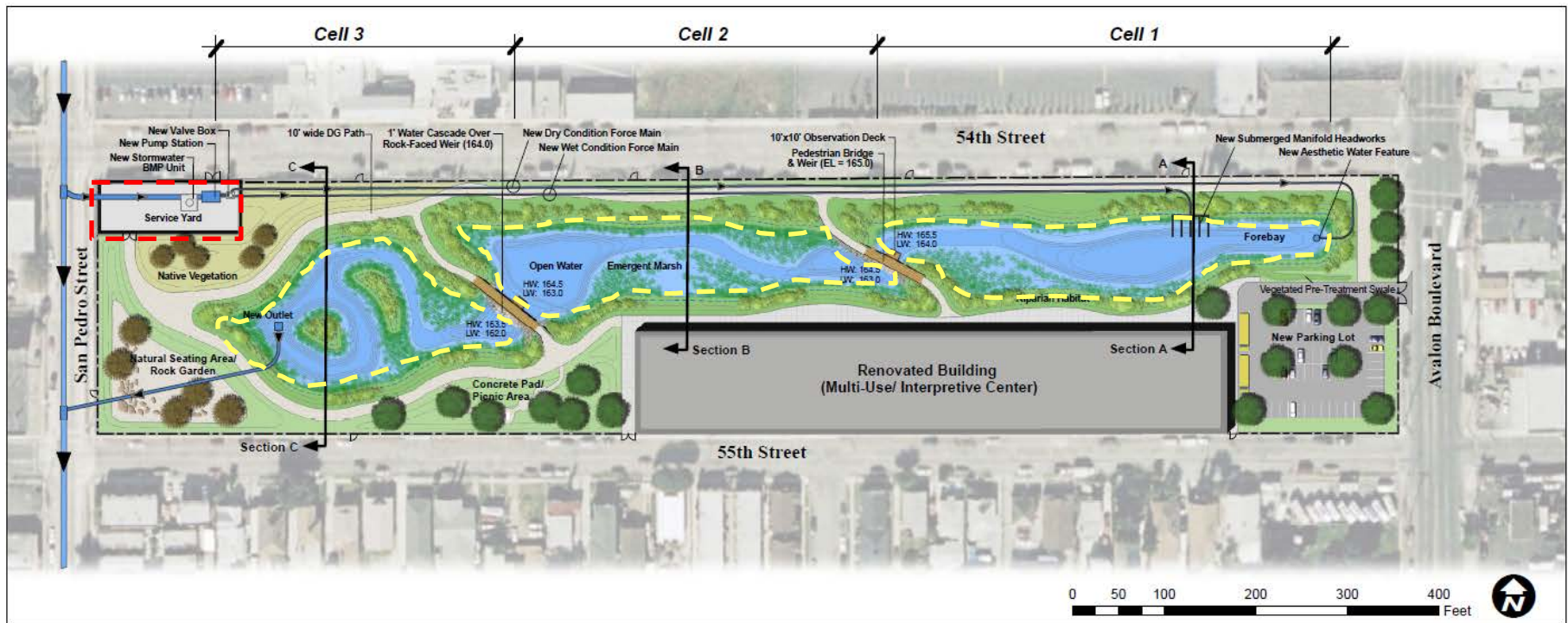


- 1. Improve water quality in the Los Angeles River Watershed**
- 2. Create a green space in a highly industrialized area of Los Angeles**
- 3. Create educational opportunities for the neighboring high school and community**



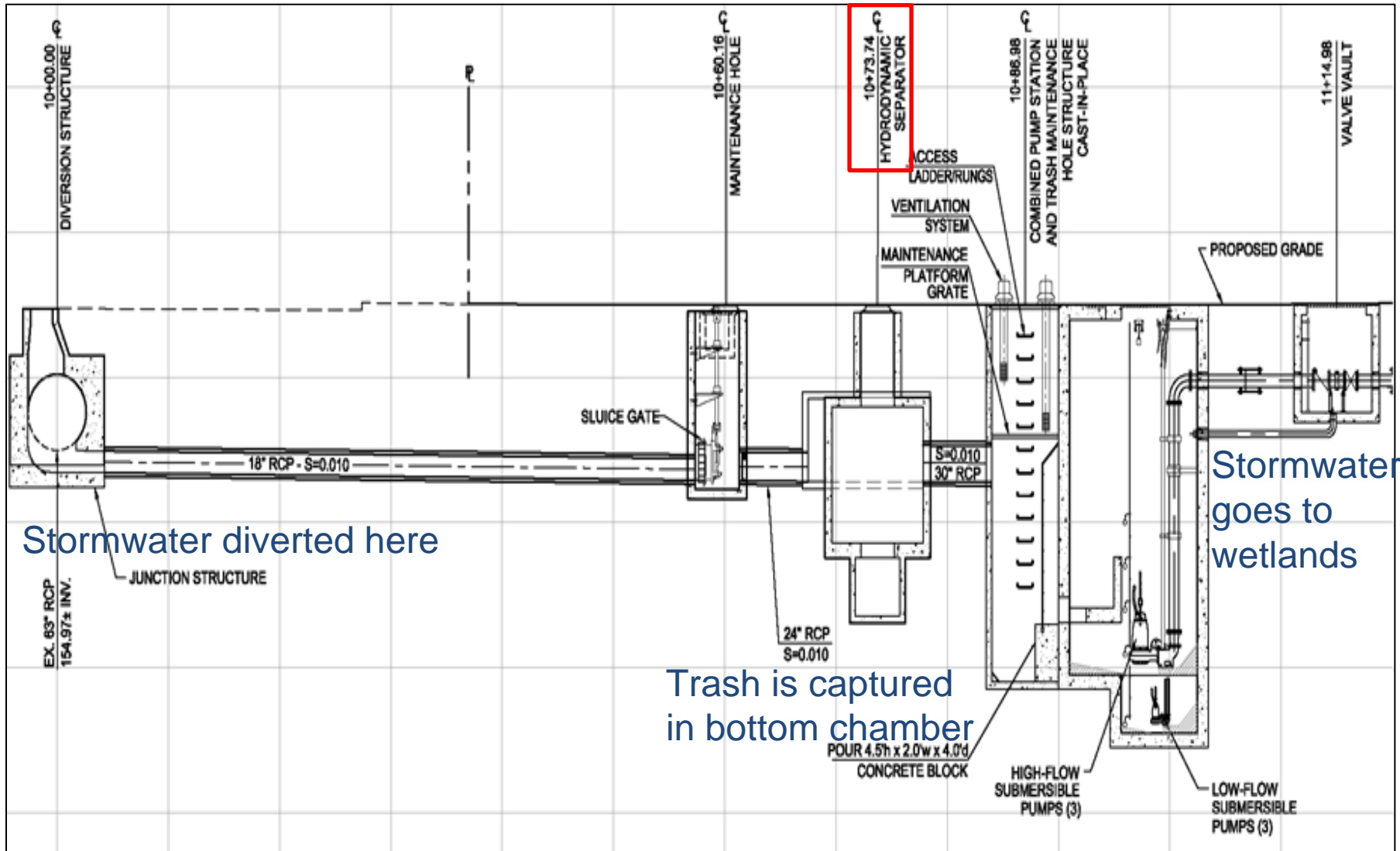
**Rail Yard Before Construction**

# Conceptual Design



- = Wetland Cells
- = Pre-Treatment System

# Pre-Treatment System



# Wetland Cells

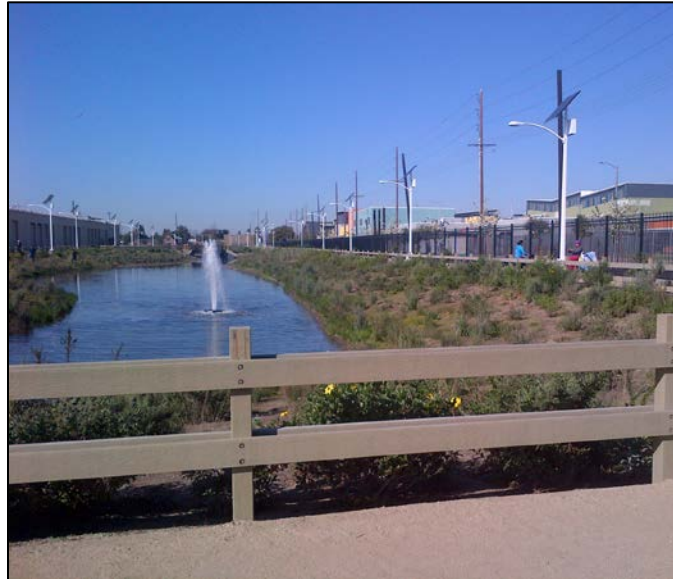


- **3 Wetland Cells**
- **Footprint: 4.5 acres**
- **Total Capacity: 2.4 million gallons of pre-treated stormwater**
- **Stormwater returned to LA River**



**Wetland Cell Construction**

# Native Landscaping and Recreation



# Results

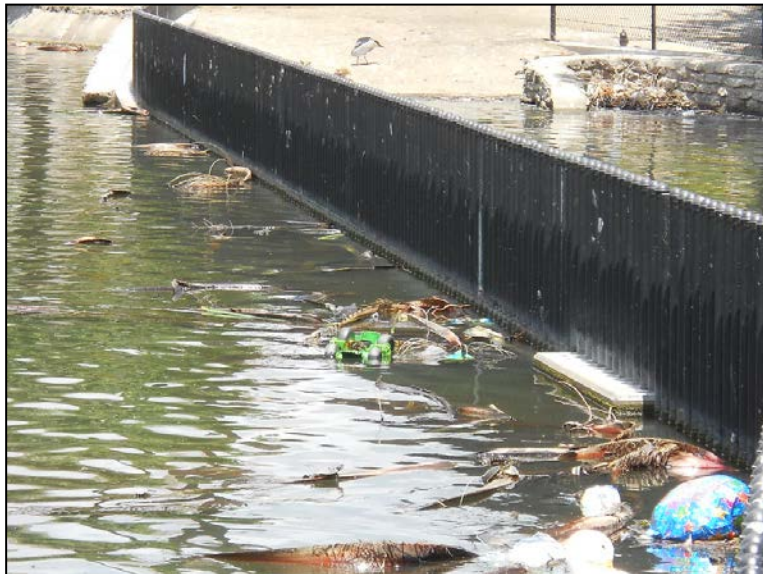




# Echo Park Lake



# Before Construction



# Project Objectives



- 1. Improve the water quality in Echo Park Lake and the L.A. River**
- 2. Significantly reduce the amount of potable water use**
- 3. Restore a healthy habitat for fish and migrating birds**
- 4. Enhance public recreation and restore historical features**



**Echo Park Lake Previous Conditions**

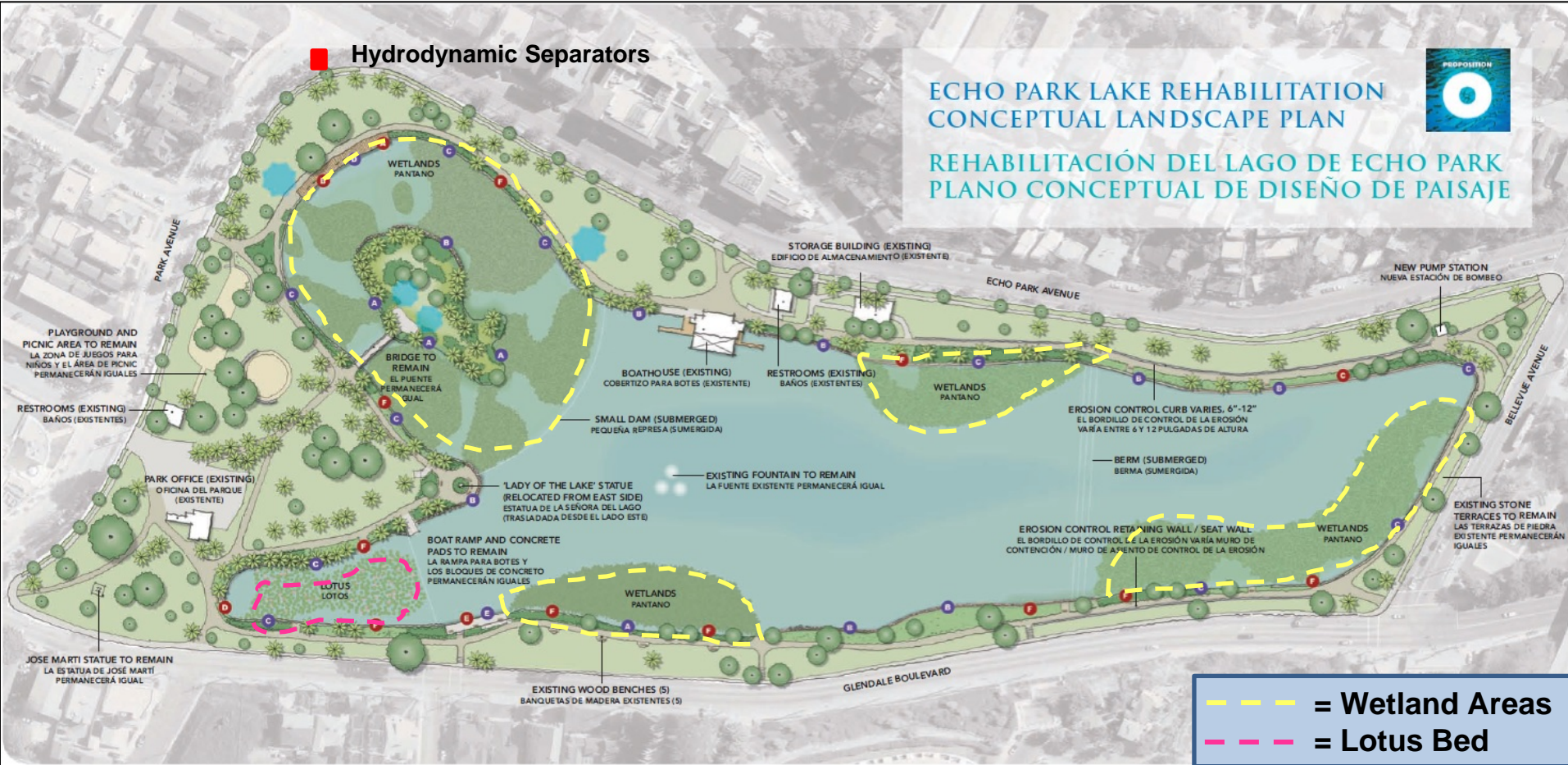
# Conceptual Design

## Hydrodynamic Separators

### ECHO PARK LAKE REHABILITATION CONCEPTUAL LANDSCAPE PLAN



### REHABILITACIÓN DEL LAGO DE ECHO PARK PLANO CONCEPTUAL DE DISEÑO DE PAISAJE



--- --- = Wetland Areas  
--- --- = Lotus Bed

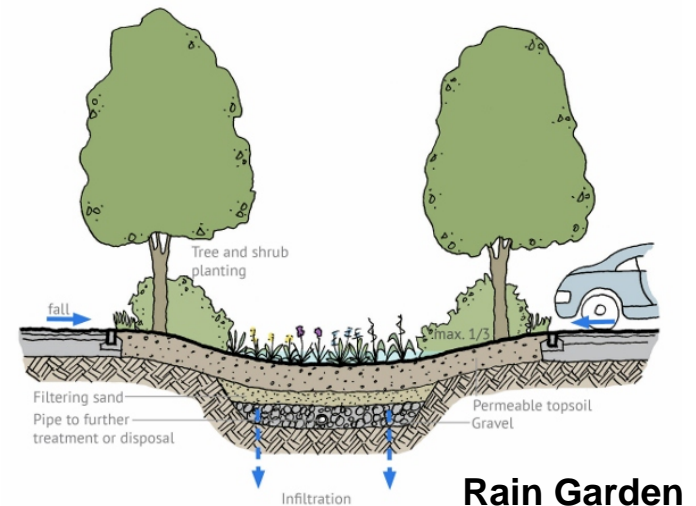
# Stormwater Best Management Practices



- Reroutes all dry-weather urban runoff and 25% of wet-weather flow from the watershed to the lake
- 1-mile of porous pavement directs rainwater towards lake
- Rain gardens
- Savings: 55,000 gallons/day of potable water

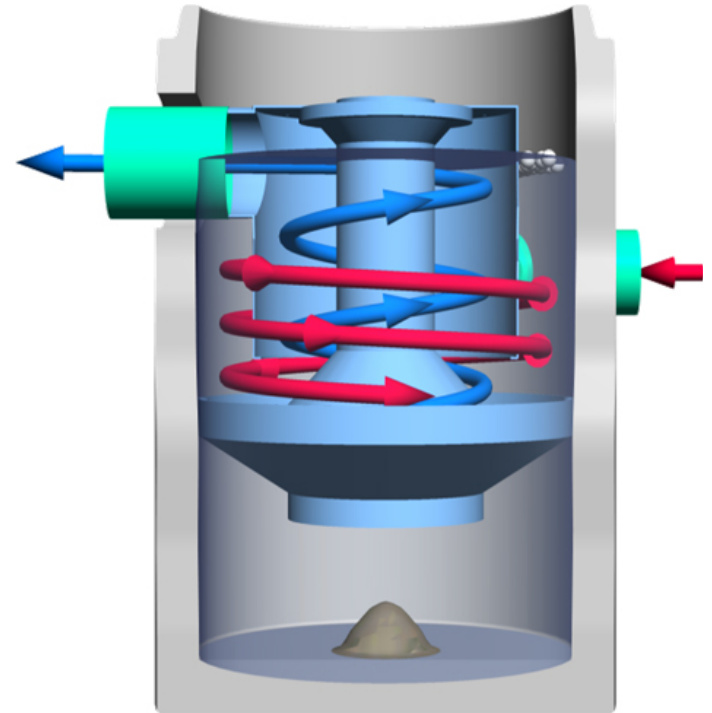


**Porous Pavement**



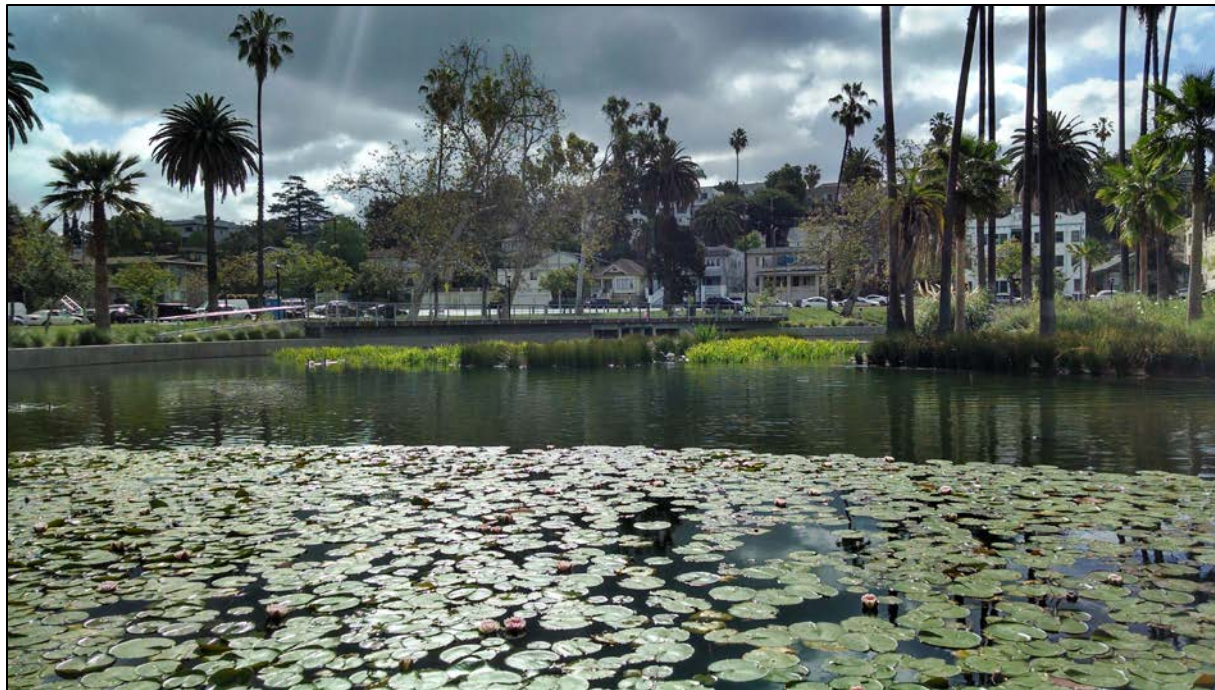
# Hydrodynamic Separators

Stormwater Inlet to the Lake



Hydrodynamic Separator

# Wetlands



# Sediment Removal and Lake Liner



**Lake Bed Construction**

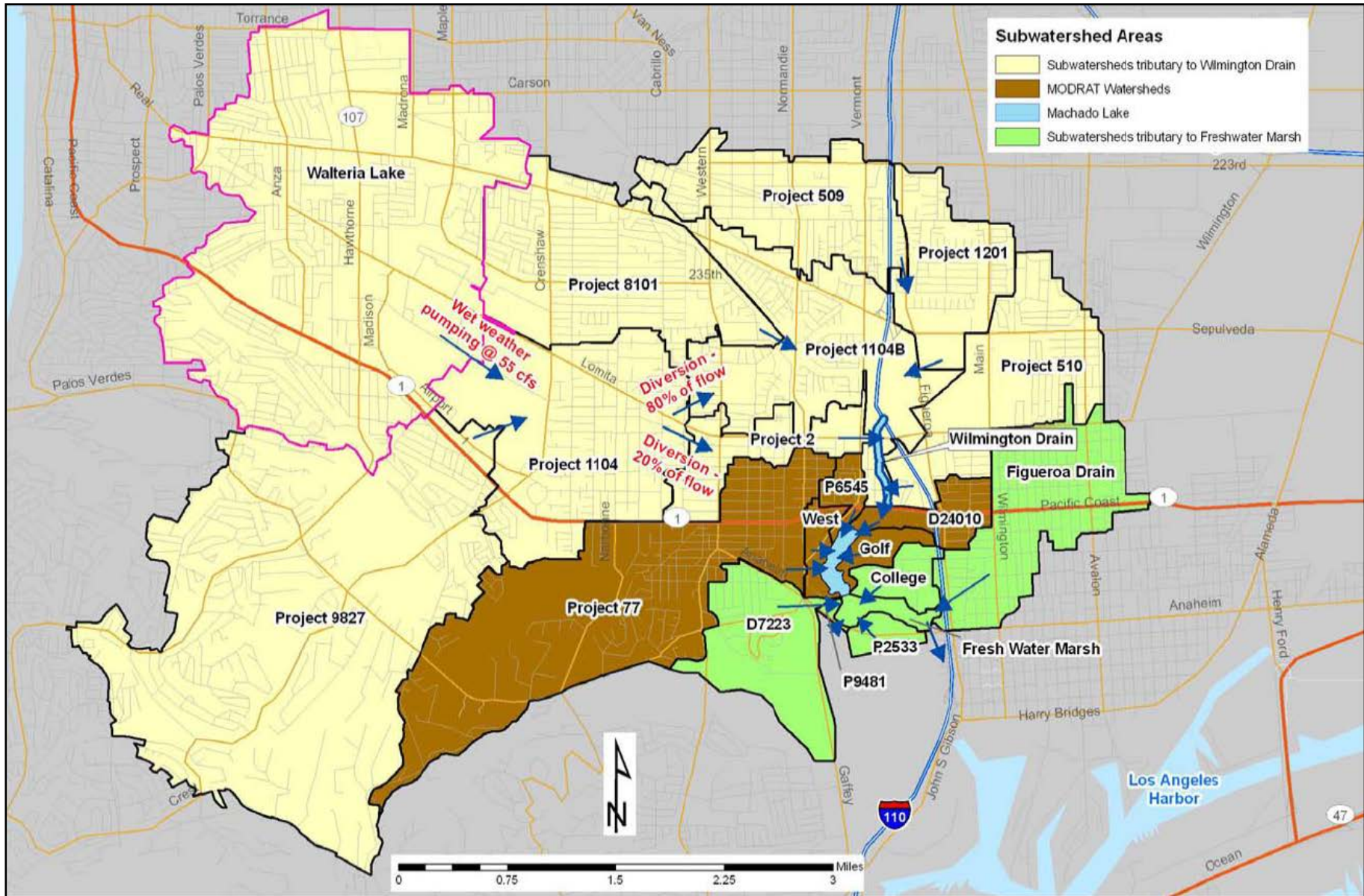


# Lake Aeration & Recirculation Systems





# Machado Lake Watershed Map



# Project Description

Total Budget:

\$111,886,560

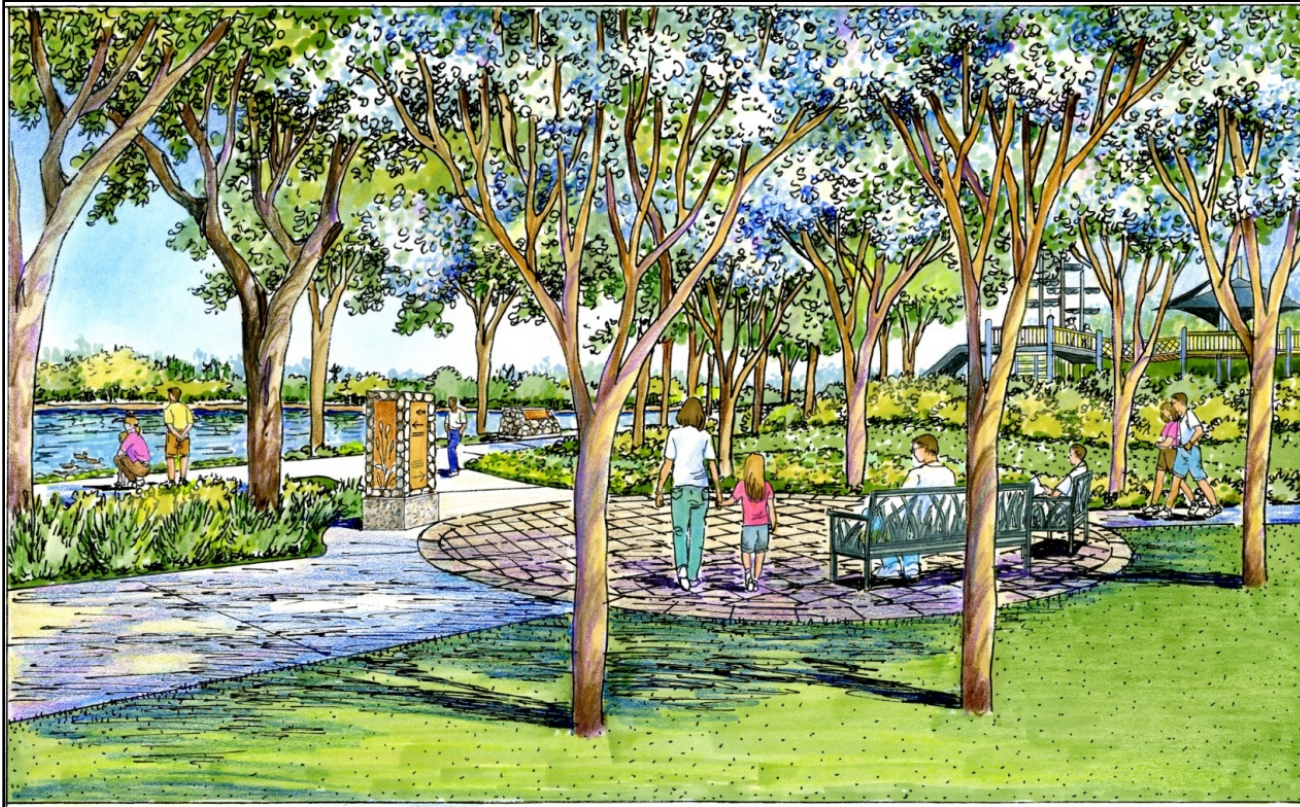
Construction Schedule:

March 2014 – April 2017



**Rendering of Pedestrian Bridge and Plaza**

# Status of Construction



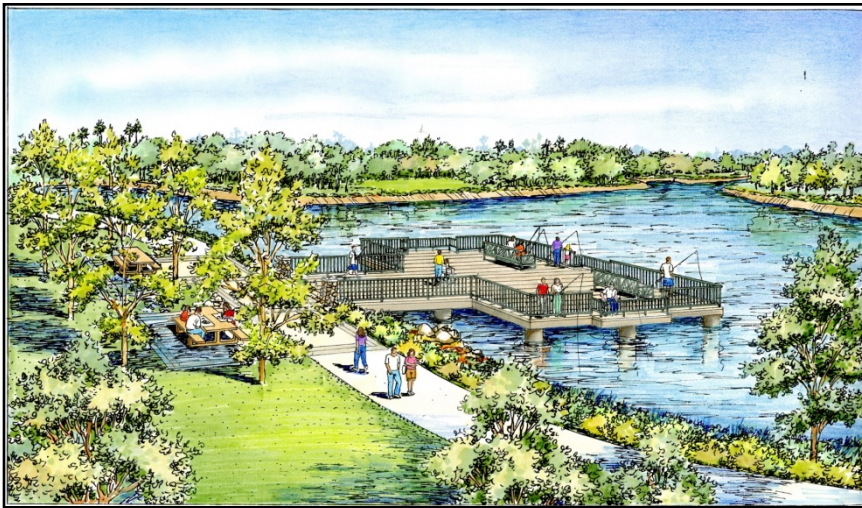
**Rendering of Plaza and Lake Viewing Area**

**-40% Construction Completed**

**-45% Dredging Completed**

**-100,000 cubic yards removed, or 6,600 truck loads**

# Construction of Fishing Piers



# Dredging and Sediment Dewatering

Mechanical  
(left) and  
Hydraulic  
(right)  
Dredging



Sediment Dewatering Belt Presses



Sediment Dewatering Return Water

# Northern Channel & CDS Unit Installation





# North Sediment Basin Excavation



# Invasive Vegetation Removal



# Rendering of Rehabilitated Machado Lake



# North Atwater Park Before Construction



Baywood St

Bemis St

North Atwater Park

Chevy Chase Dr

Edenhurst Ave

Brunswick Ave

Verdant St



Golden State Fwy

Los Angeles River Bike Path

Crystal Springs Dr

# Conceptual Design



# North Atwater Park



# Project Objectives

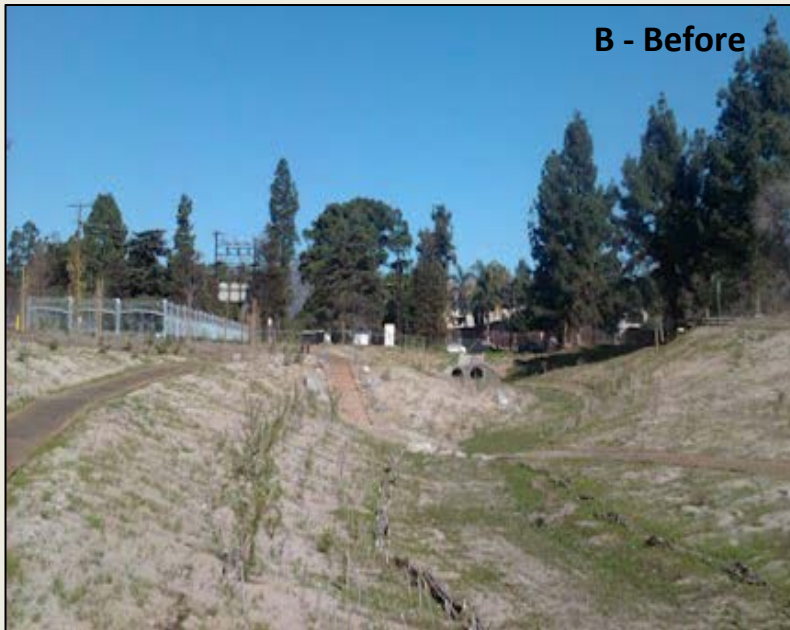


- 1. Stream Restoration**
- 2. Stormwater Quality Treatment**
- 3. Stormwater Infiltration**
- 4. LA Riverfront Access**
- 5. Park Expansion**



View of LA River from Park

# Creek Restoration





# Landscaping



**Native Vegetation**

# Park



LA River at High Flow



Community Resources

# South Los Angeles Neighborhood City Hall Site



# South Los Angeles Neighborhood City Hall





# Stormwater Collection Pond



**Collection Pond Views**



# Green Roof



**40 Different Plant  
Species**





**Gracias**  
**Deborah Weintraub, AIA, LEED<sub>AP</sub>**  
**Chief Deputy City Engineer**  
**City of Los Angeles**  
**<http://eng.lacity.org/>**

**[deborah.weintraub@lacity.org](mailto:deborah.weintraub@lacity.org)**