



Safe and Sustainable Water Resources (SSWR) Program
Green Infrastructure (GI) Models & Tools Project

Task: Innovative Urban Infrastructure and Management Practices for
Stormwater Capture and Aquifer Recharge in the Arid and Semi-Arid Southwest USA

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Goal: to evaluate the utility of innovative, distributed, low impact development (LID) infrastructure and best management practices (BMPs) for wet weather capture and drinking water aquifer recharge in the arid and semi-arid southwestern USA

- Introduction
 - objectives
 - motivation
 - background
- The Fort Irwin Study
 - site overview
 - team approach
 - milestones
- Summarize - status

EPA SSWR Subtask: Innovative urban infrastructure and practices for stormwater capture and aquifer recharge in the arid and semi-arid Southwest, USA

Objectives:

- Design, build, monitor the performance of systems of BMPs (capture, storage and settling, infiltration, recharge) for the diversion of wash flow, urban and rooftop runoff, recycled wastewater conveyance, into storage, pre-treatment, and focused recharge through infiltration galleries (wider than deep) and dry wells (deeper than wide)
- Utilize a step-wise and progressive computer modeling approach that includes overland, vadose zone, and groundwater flow and water quality, for design and evaluation
- Explore scenarios for upscaling recharge system performance to evaluate Net Zero Water and aquifer sustainability and resilience as measured by a sustainable yield without negative impacts
- Document experience with initial prototype at Fort Irwin military installation with ambition to transfer technology to urban metroplex (e.g. Los Angeles)



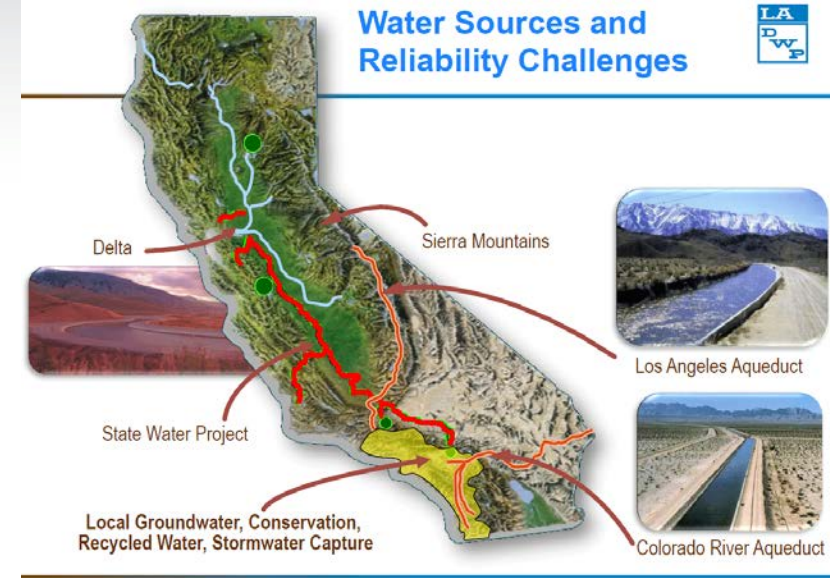
UCLA Grand Challenge: Sustainable LA



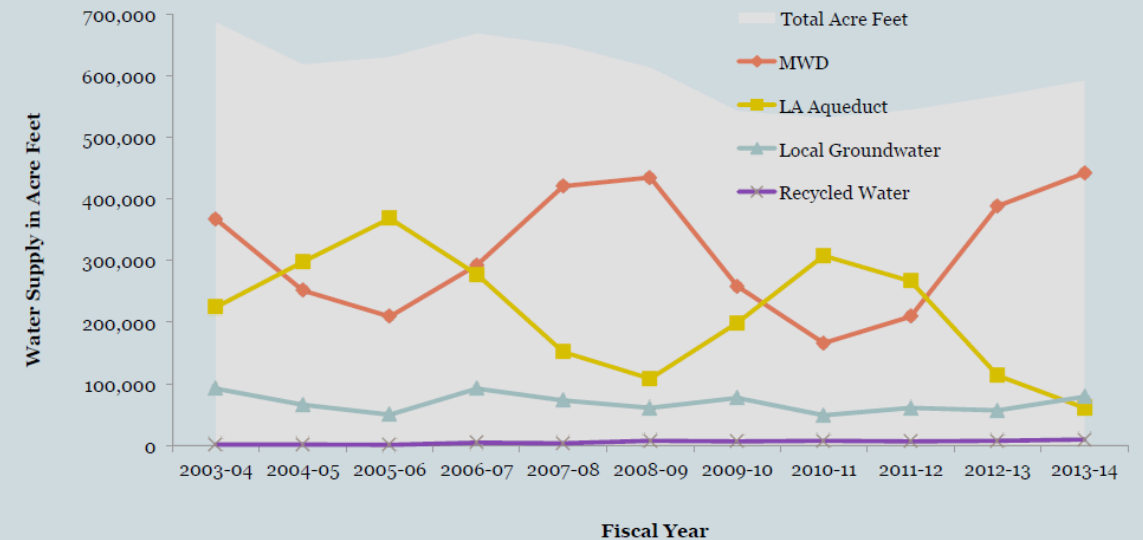
GOAL: 100% renewable energy, 100% locally sourced water, & enhanced ecosystem health by 2050

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Los Angeles local sources of water include aquifer (stormwater recharge, treated wastewater injection) and seawater desalinization



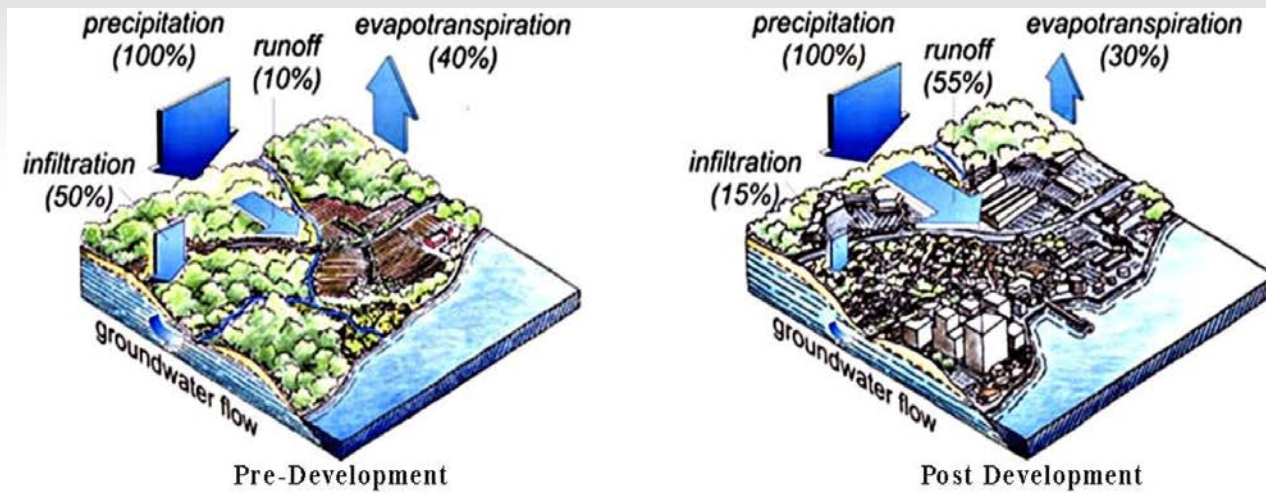
LADWP Water Supply Portfolio 2003 - 2014



Data source: <https://data.lacity.org/A-Livable-and-Sustainable-City/LADWP-Water-Supply-in-Acre-Feet/qyvyz-diiw>

Background

generally understood that urban hardscapes increase runoff at the expense of infiltration, and recharge



arid and semi-arid hydrology quite different from humid zone hydrology

An **arroyo** (Spanish: [a'rojo], "brook"), also called a **wash**, is a dry [creek](#), [stream bed](#) or [gulch](#) that temporarily or seasonally fills and flows after sufficient [rain](#). [Flash floods](#) are common in arroyos following thunderstorms.



Las Cruces arroyo, NM



Los Angeles River

Natural infiltration might take a hundred years to reach a deep water table, if at all

Background

Stormwater Infrastructure BMPs (capture, store, dispense)

Grey (centralized)
conveyance

dams, permanent,
rubber

green roofs

cisterns, barrels

spreading basins

vegetated swales

infiltration
galleries

storm sewers

rain gardens

dry wells

concrete rivers

riparian buffers

porous pavement

EvapoTrans



Recharge

Centralized vs. Distributed Capture



Background

Dry well technology



Laurel Canyon Blvd

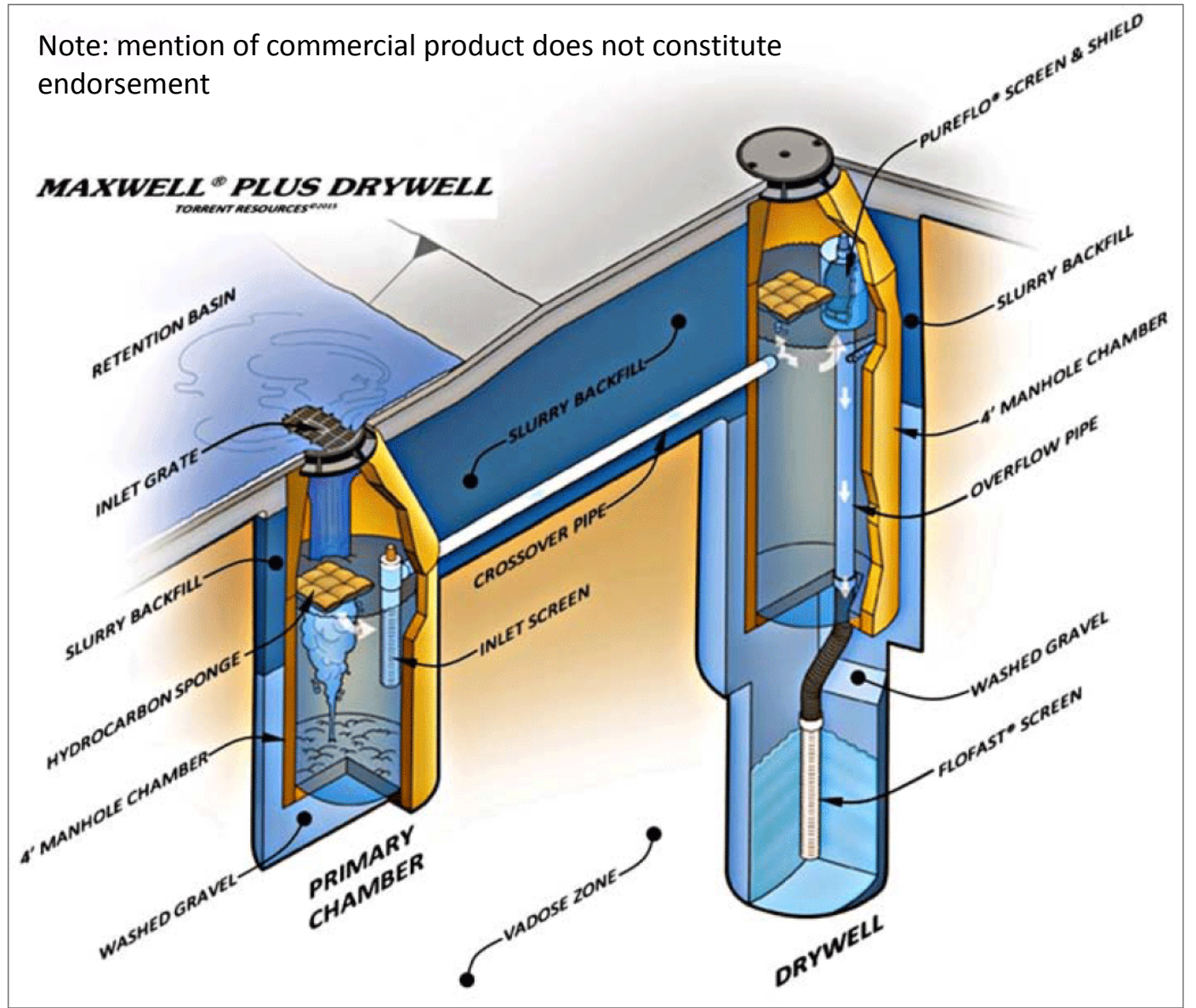
dry wells under construction



GREEN STREETS
SUN VALLEY
LOS ANGELES

Woodman Ave,

established vegetated swale



Video animation <https://youtu.be/uCFyIYPXkCE>

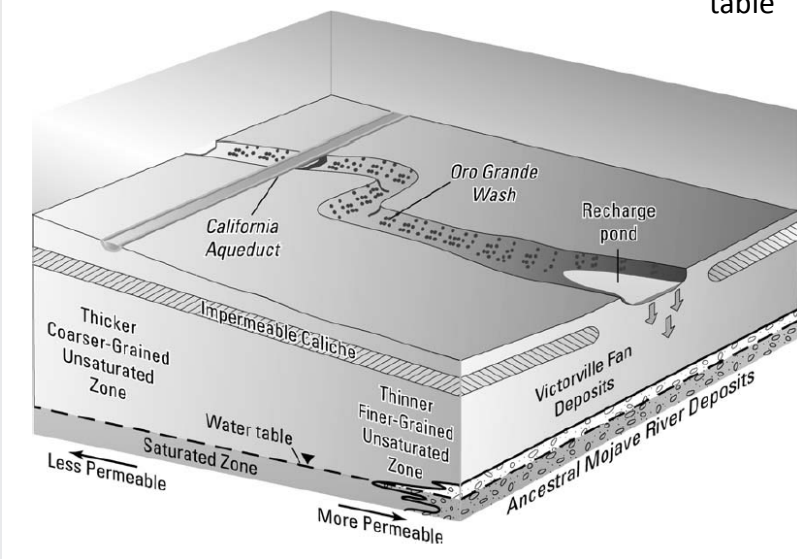
Background

Mojave Desert Hydrology

facilitated, continuous source infiltration

TOUGH2 modeling

120 m depth
to water
table

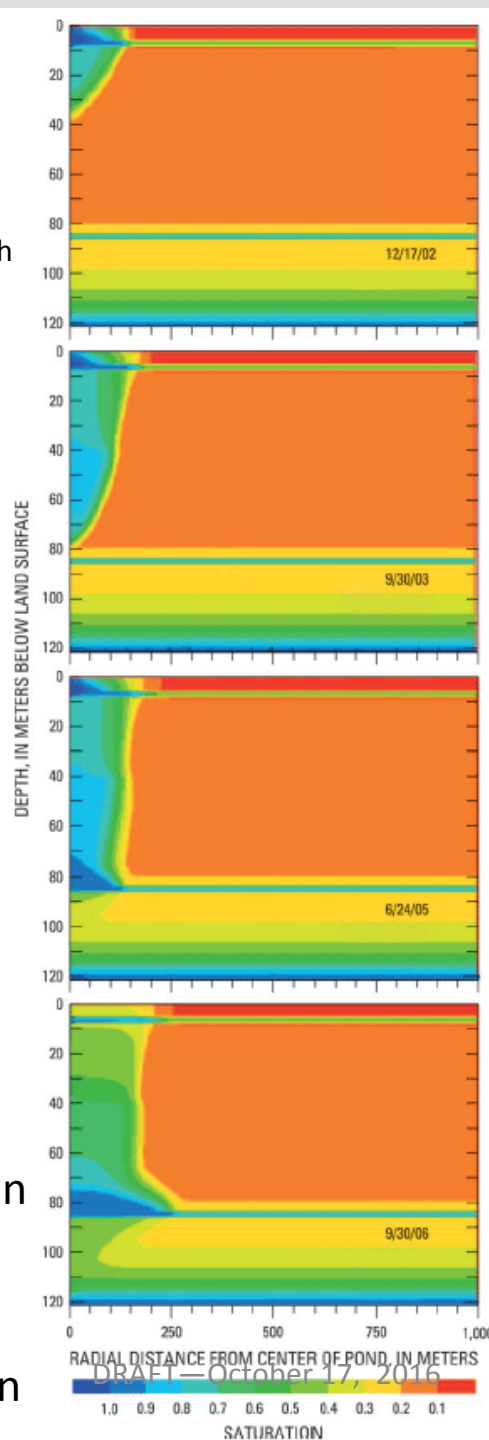


Oro Grande wash, California
spreading area for treated wastewater

Izbicki et al., 2008

notice ponding on
low perm strata

water saturation



Yucca Valley area

Household
septic
infiltrate
water

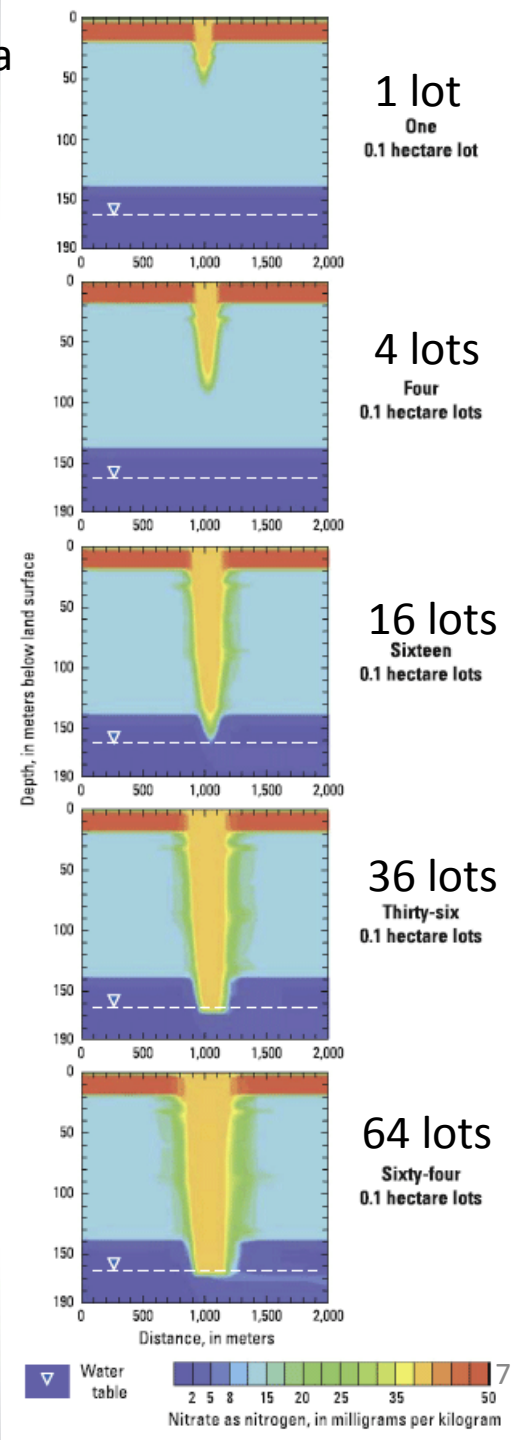
Izbicki et al., 2015

160 m
depth to
water table

100 yrs
simulation

3 yrs

Nitrate conc.



The Fort Irwin Study

National Training Center at Fort Irwin (Army Net Zero Program)

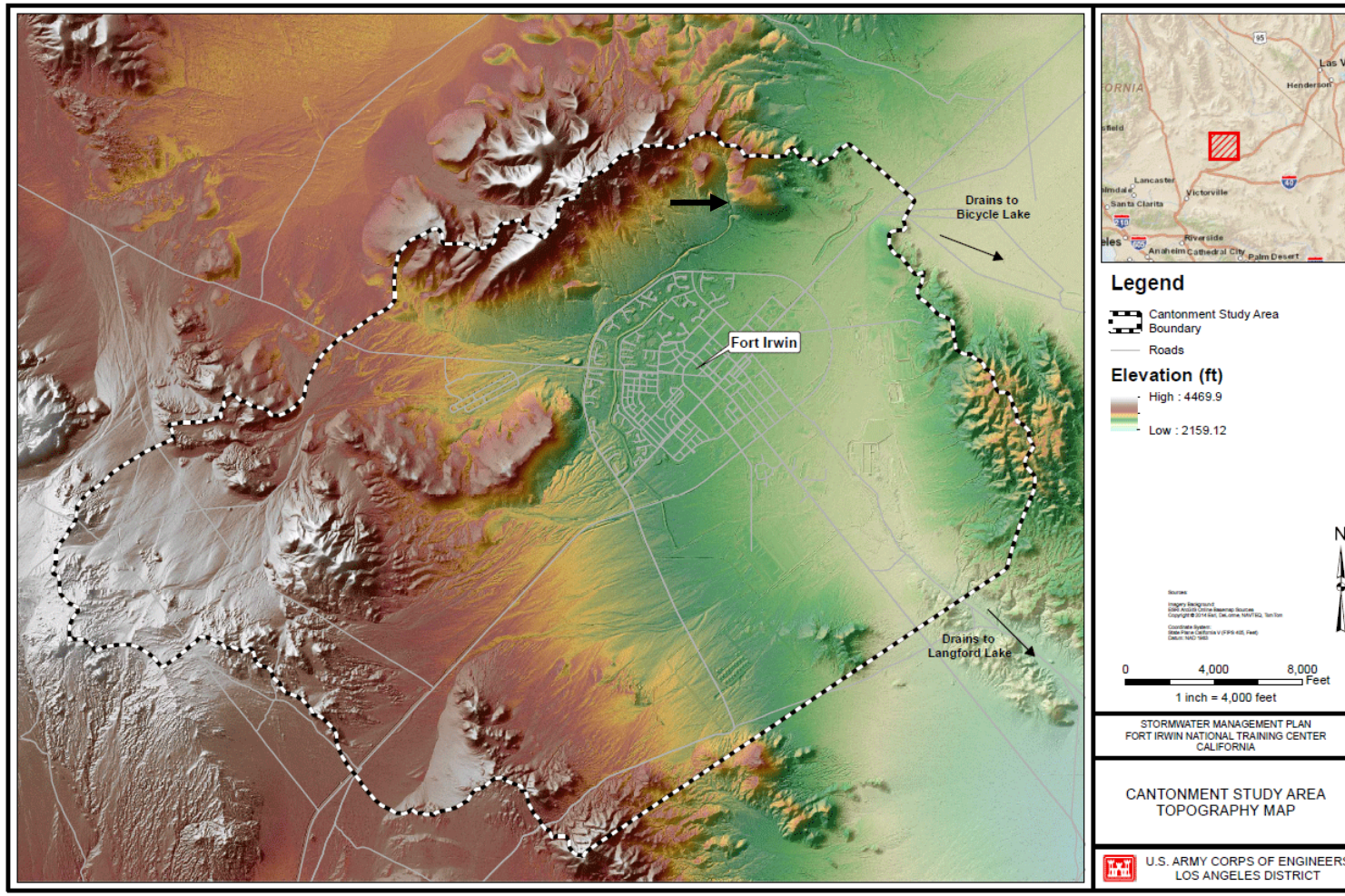


PLATE 2

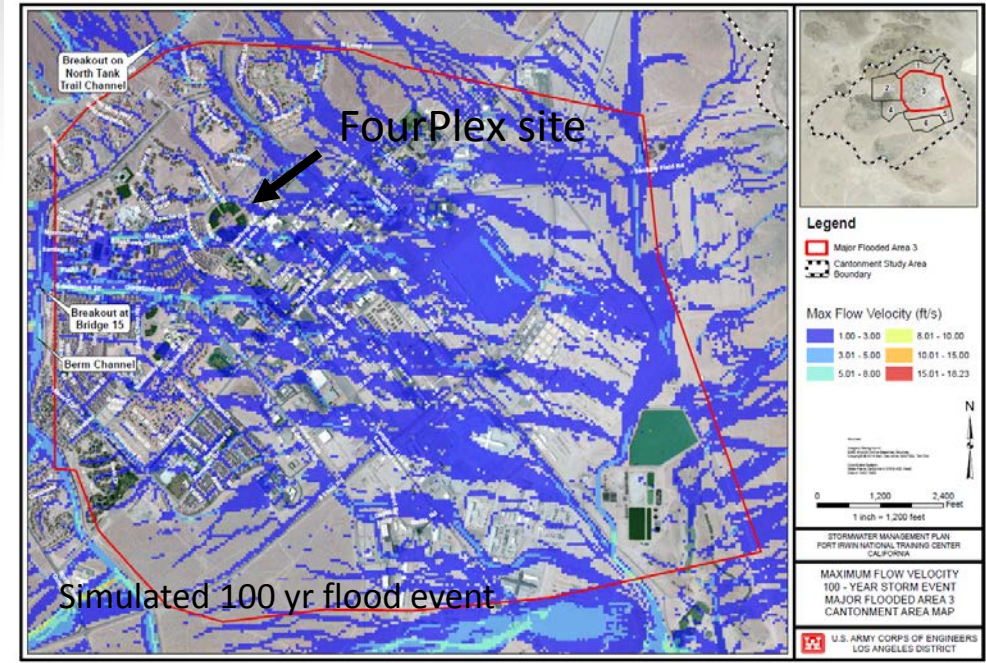


PLATE 25

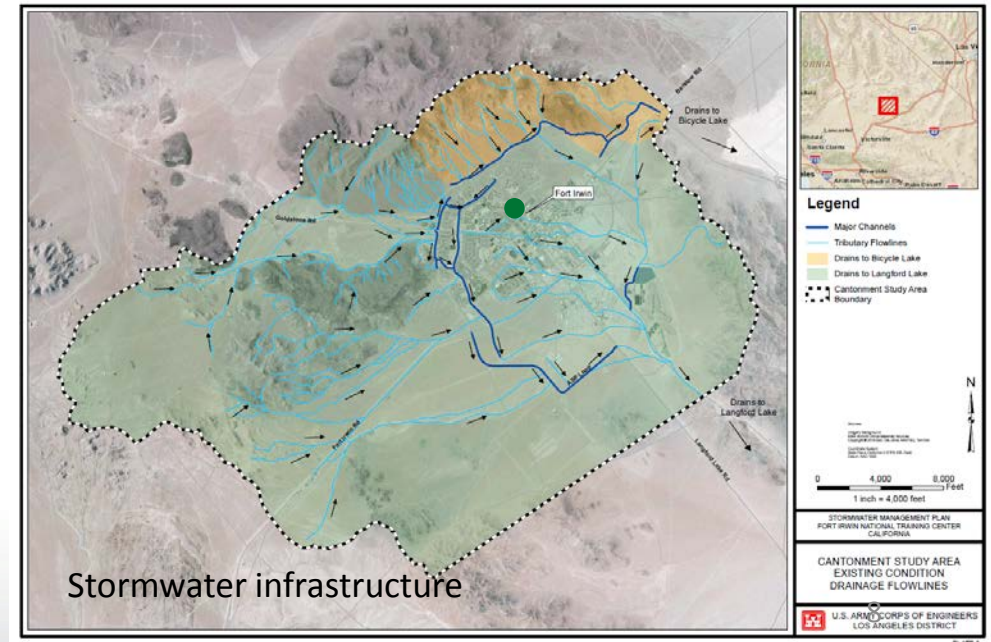
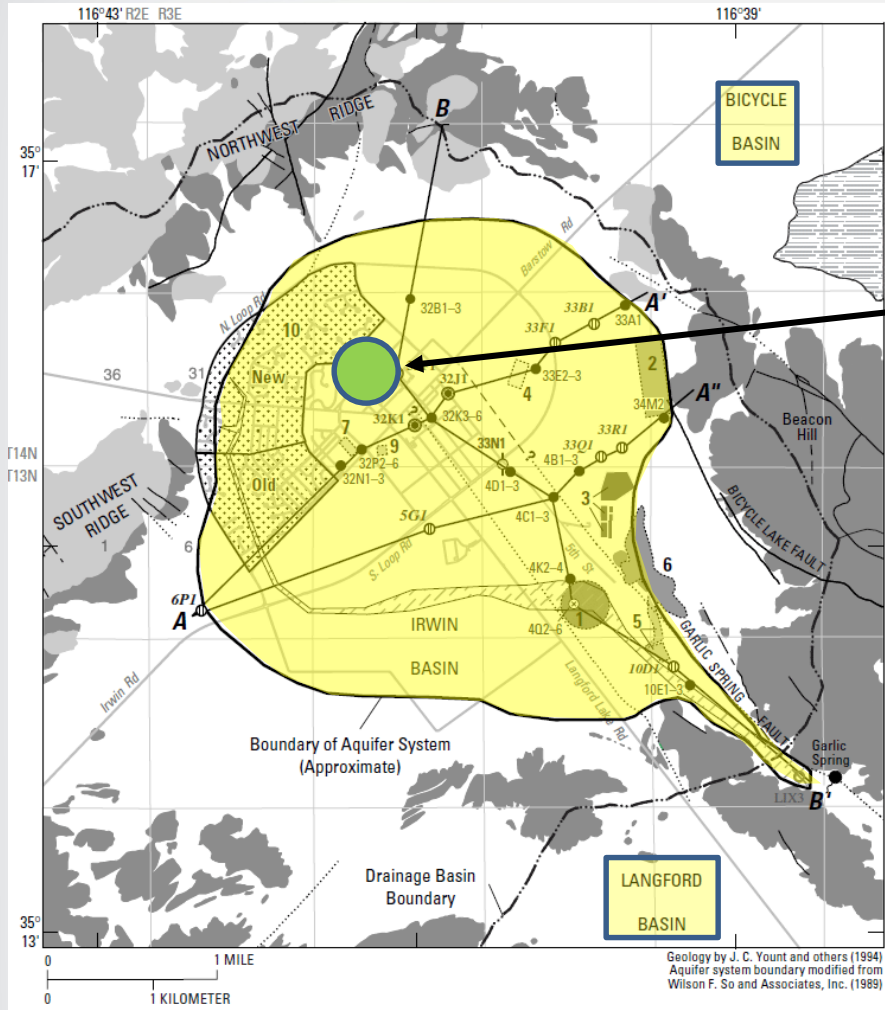
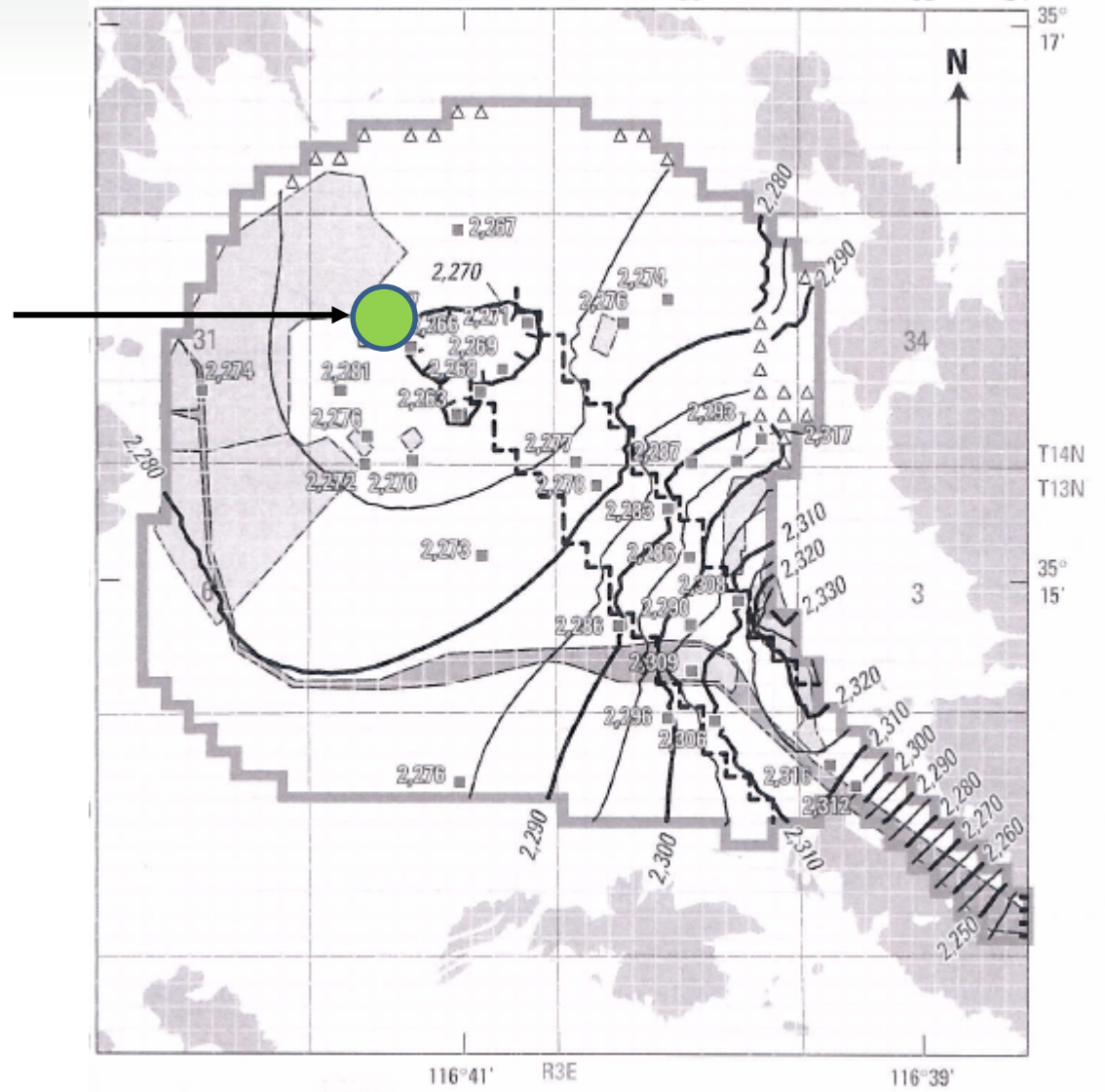


PLATE 3

The Fort Irwin Study

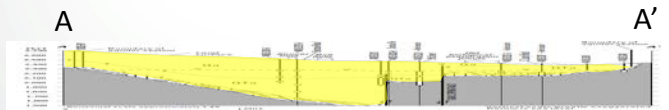


Fourplex
Site



MODFLOW

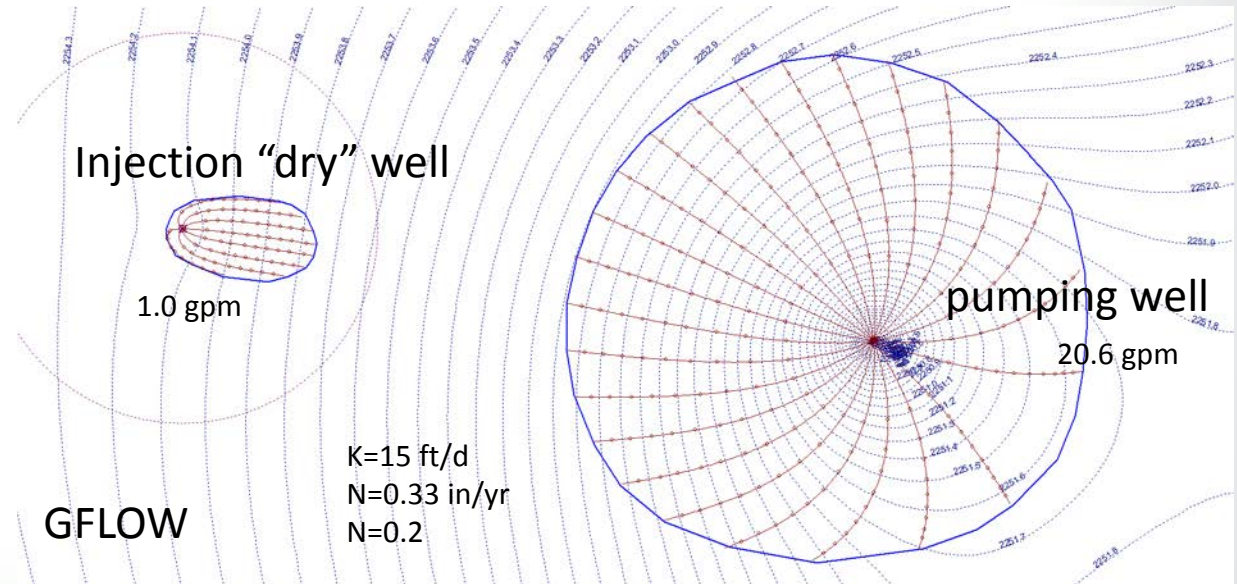
Densmore et al., 2003



The Fort Irwin Study



Fourplex site



streamlines 10 yrs residence time

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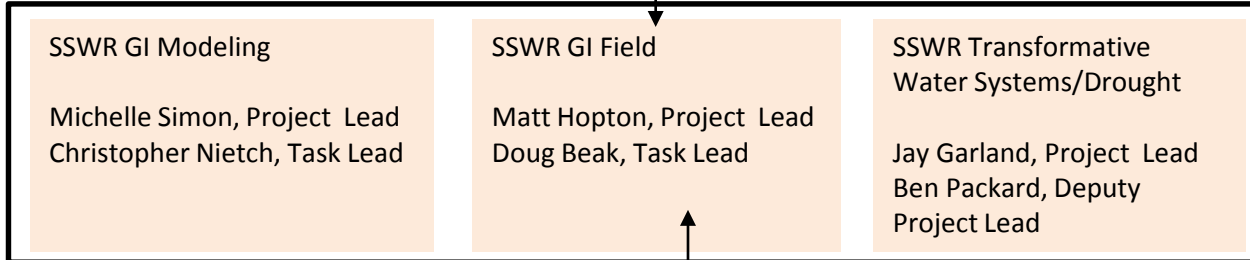
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Summary: Milestones

Innovative infrastructure and practices for stormwater capture and aquifer recharge in the arid and semi-arid Southwest, USA

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Notice: Mention of trade names or commercial products does not constitute endorsement. The views expressed in this presentation are those of the author(s) and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

	Date
EPA ORD commitment to Fort Irwin	May 2016
Army HQ commitment to Fort Irwin	Sept 2016
EPA-USDA/ARS Interagency Agreement	Sept 2016
EPA-USGS Interagency Agreement draft	Sept 2016
Approved EPA QMP, QAPPs	Dec 2016
Stormwater monitoring, weather station, culverts	Jan 2017
Dry well soil and unsat zone characterization	Mar 2017
Dry well system design and construction	Jun 2017
Dry well performance monitoring	Jun 2019
Scenario evaluation and documentation	Sept 2019

