Transforming Wastewater to Drinking Water: How Two Agencies Collaborated to Build the World's Largest Indirect Potable Reuse Project

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Recharge Planning Manager

April 13, 2017

SINCE 1933

Outline

- Background
  - OCWD
  - OCSD
- Fork in the Road: Import or Recycle?
- Water Factory 21
- The Groundwater Replenishment System
  - OCWD/OCSD Partnership
  - GWRS Treatment Process and Project Costs
  - Final Expansion
  - Public Outreach/Lessons Learned
- Final Thoughts
- A taste of the good life….

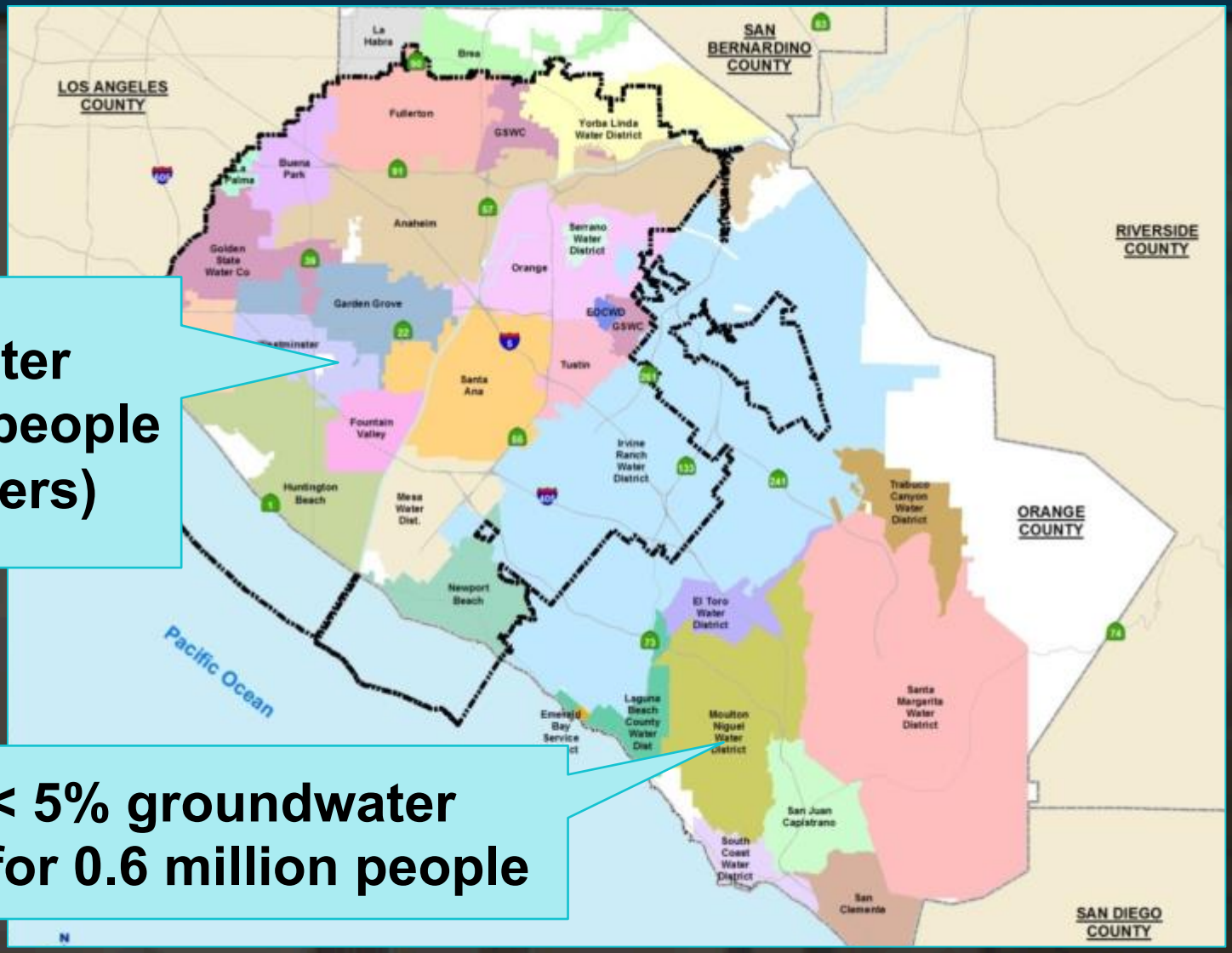
The Orange County Water District was formed by the State in 1933 to protect and manage Orange County's groundwater supplies.

First Board of Directors

Why?

- Declining flow of Santa Ana River
- Basin overdraft
- Seawater intrusion
- Attempts by LA County to obtain water rights in Orange County

OCWD overlies the groundwater basin in the northern half of Orange County.



70% groundwater for 2.4 million people (19 water retailers)

< 5% groundwater for 0.6 million people

California has an extensive water storage and distribution system.

Los Angeles Aqueduct: 1913

Mokelumne Aqueduct: 1926

Hetch Hetchy Aqueduct: 1934

Central Valley Project: 1933

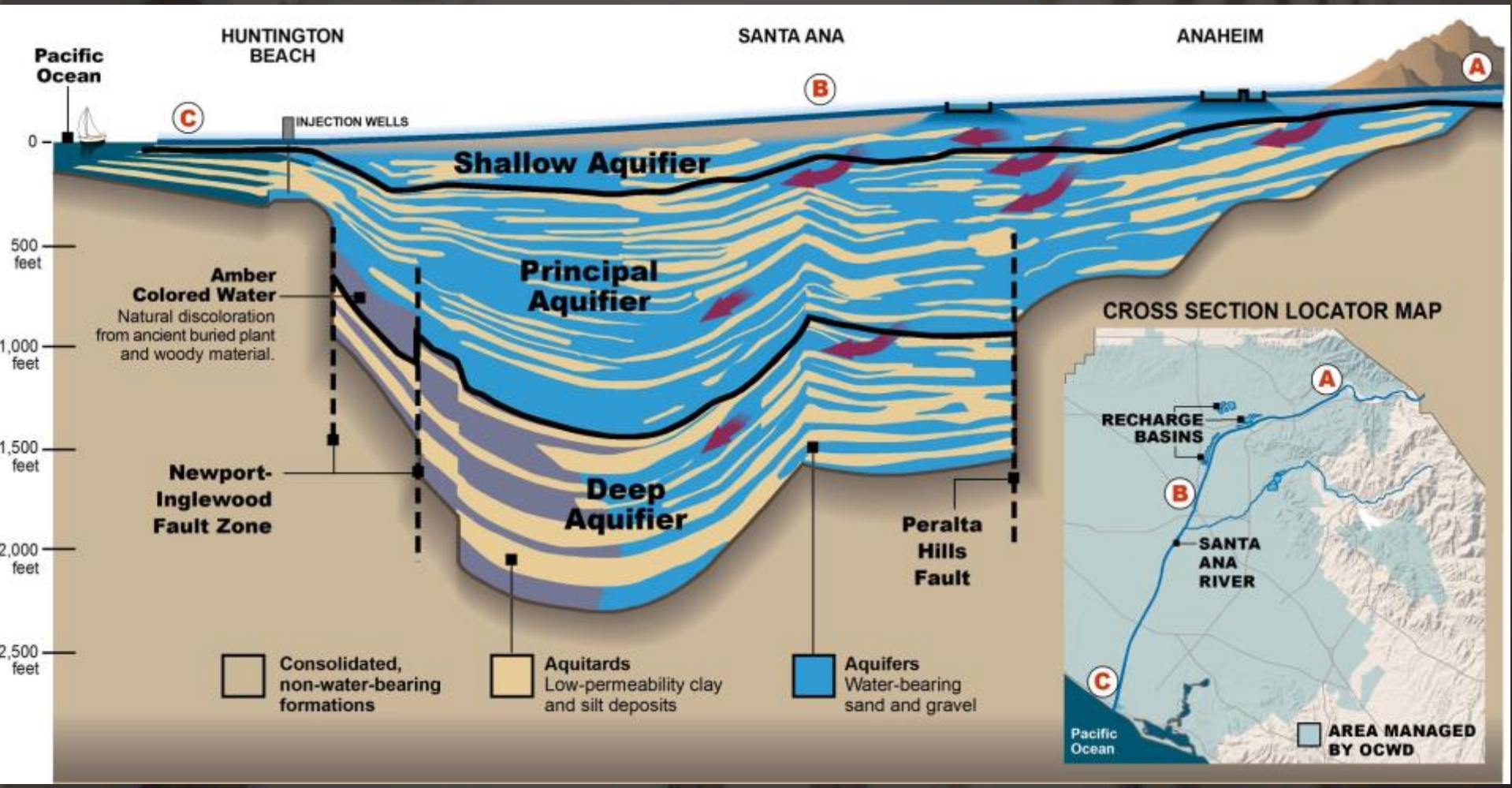
Colorado River Aqueduct: 1939

State Water Project: 1960

OCWD's statutory groundwater management authority is unique and effective.

- 10-member Board of Directors (7 elected; 3 appointed)
- Basin not adjudicated (no court-assigned pumping limitations)
- Pumping determined each year based on basin supplies and storage level
- Over-pumping controlled by economic disincentives (penalty fees)
- Pumping fee charged to pay for OCWD programs and activities

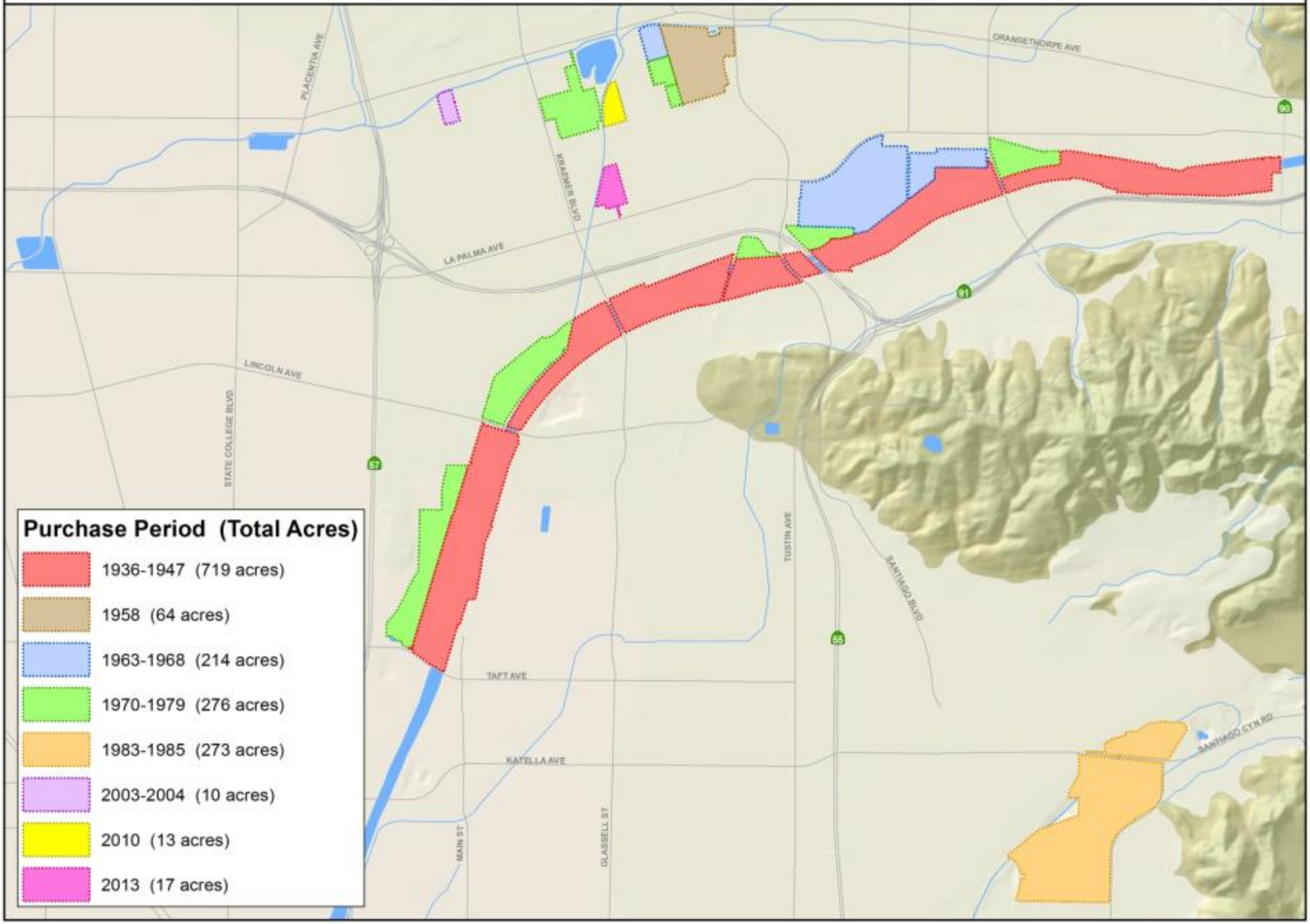
The basin is comprised of three major aquifer systems that are hydraulically interconnected.



Recharge operations to capture and recharge Santa Ana River flows started in the early 1930s.

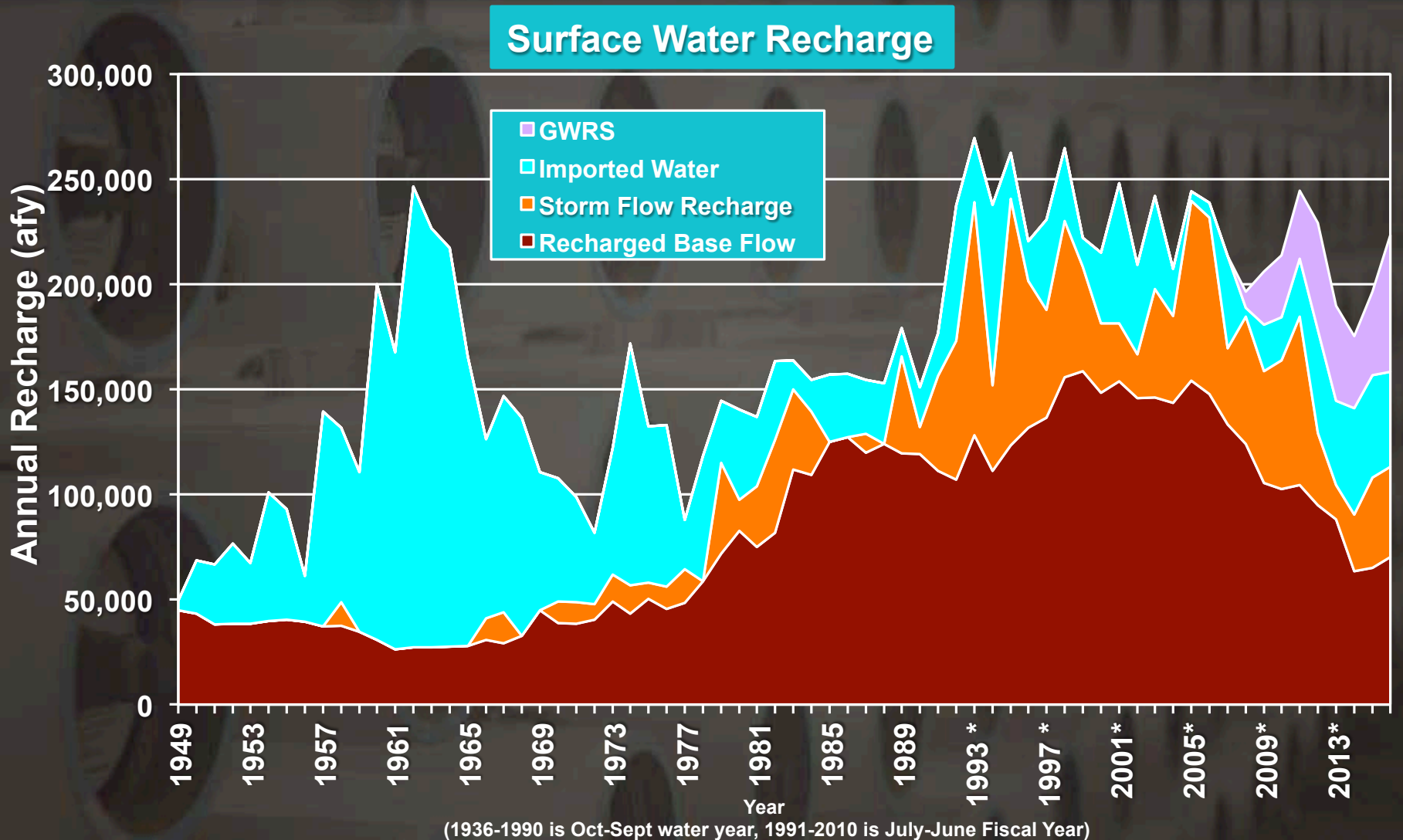
Santa Ana River, Anaheim

Over the course of 77 years, the District has purchased 1,590 acres for recharge.

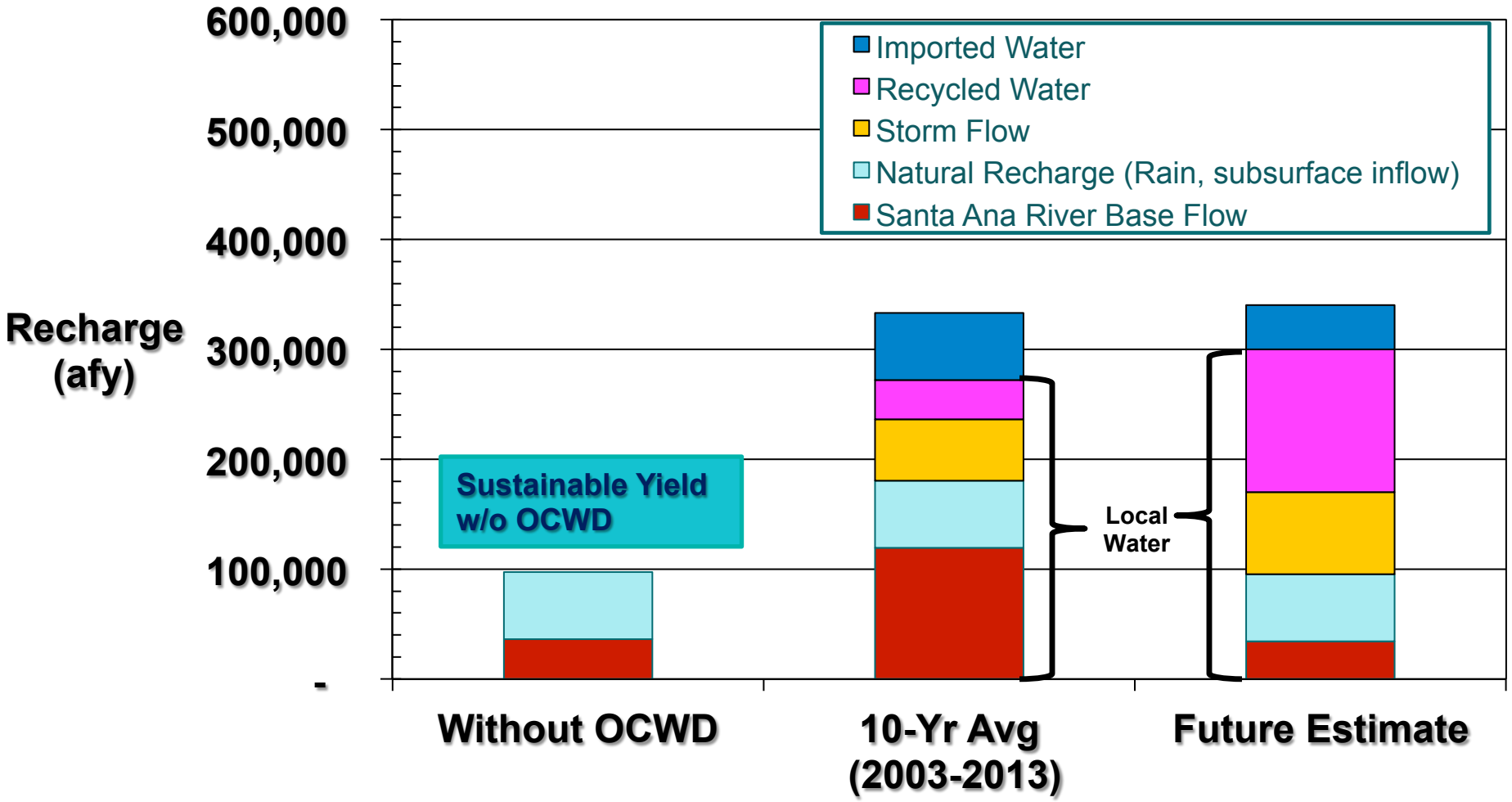


The deep basins are able to recharge up to 100,000 acre-feet per year.

OCWD has a diverse water portfolio with all sources playing different roles at different times.



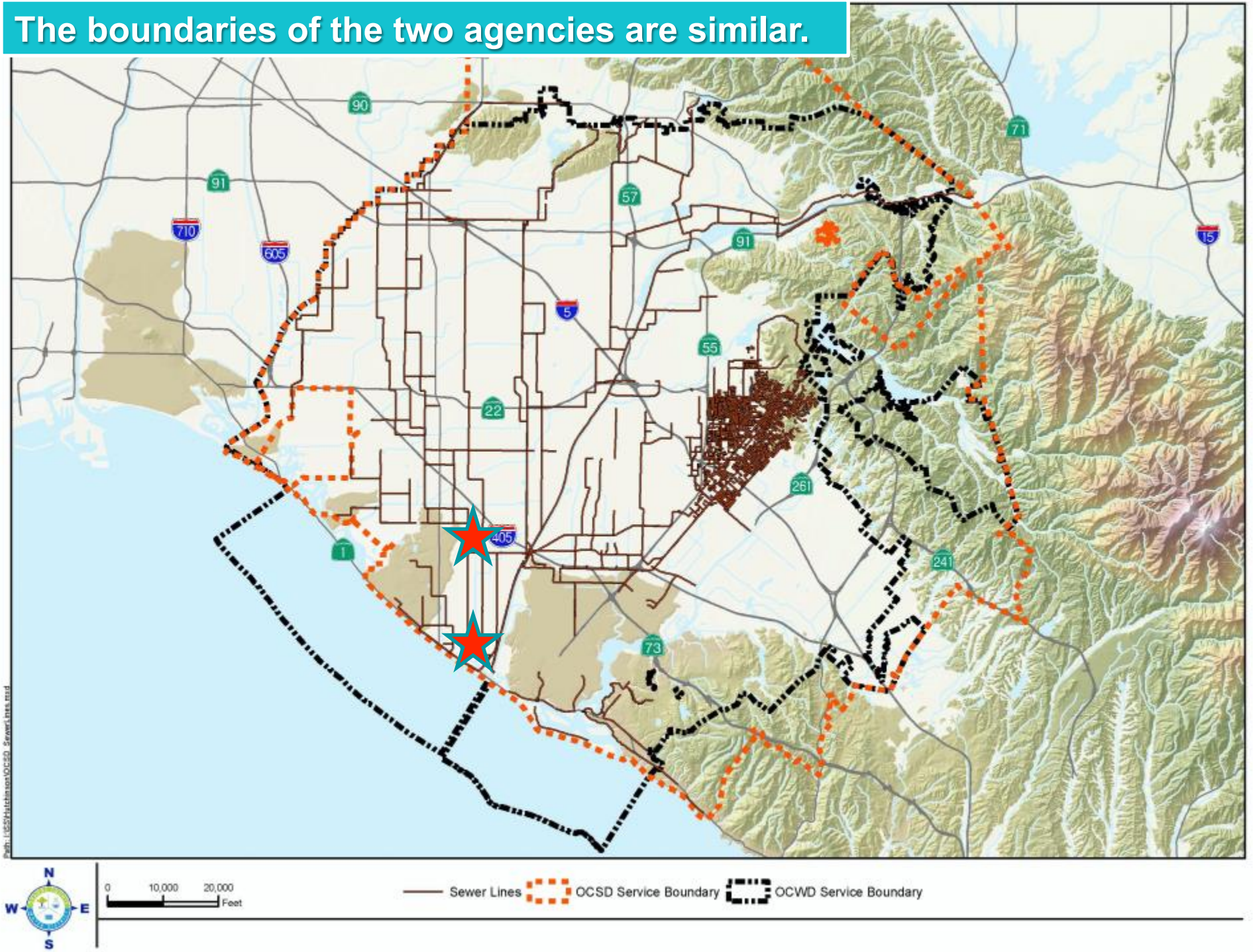
The recharge of local water sources has more than doubled the yield of the basin.



The Orange County Sanitation District was formed in late 1954.

- First ocean outfall in operation in 1924
- Two sanitation districts formed in 1947 and 1948, consolidated into OCSD in 1954
- Five-mile ocean outfall constructed in 1971
- Two treatment plants, Fountain Valley and Huntington Beach
- OCSD and OCWD are both speical districts formed by State of CA.

The boundaries of the two agencies are similar.



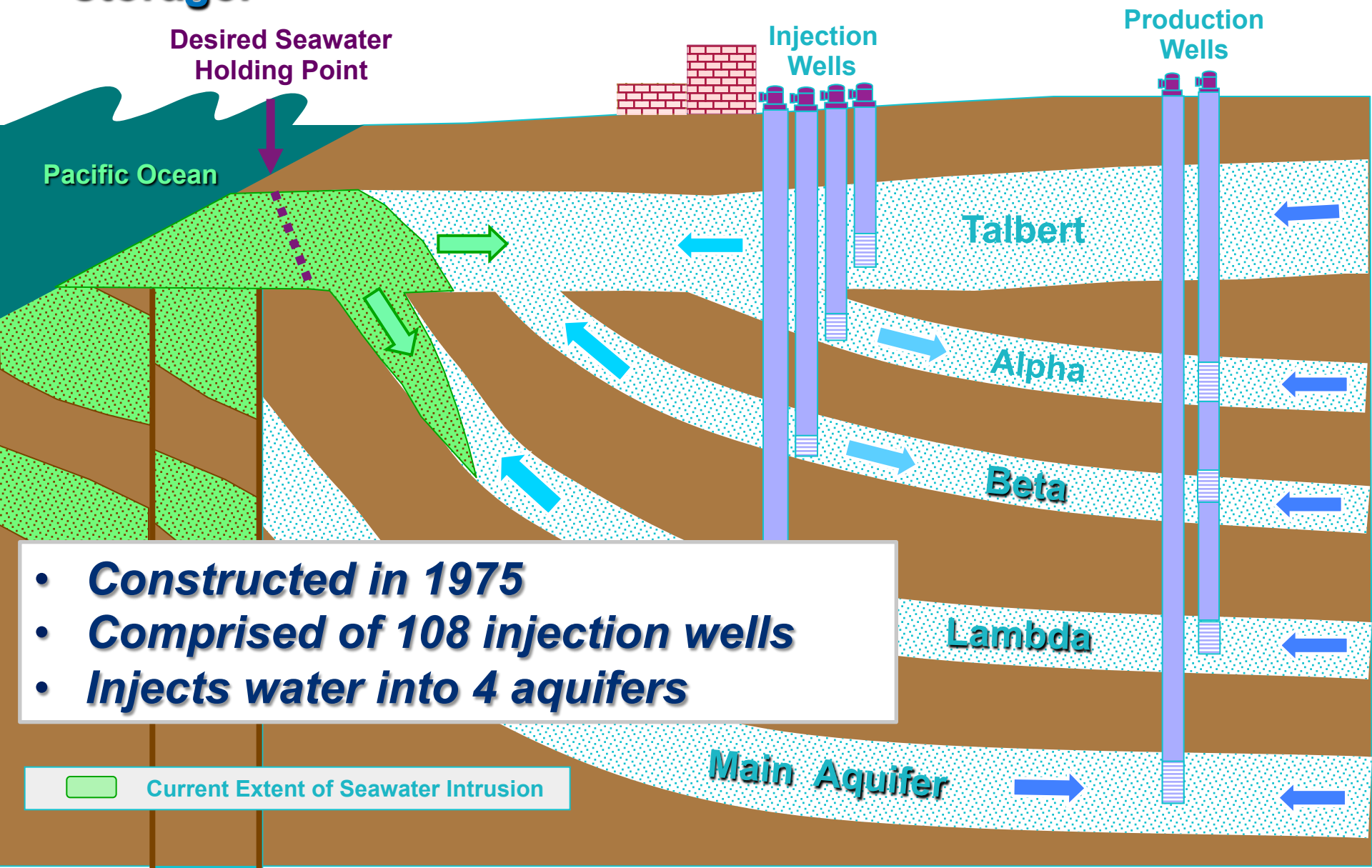
Fork in the Road (early 1970s): Import or Recycle?

- Seawater intrusion in Talbert Gap noted as far back as mid-1920s.
- Seawater barrier of multiple injection wells was needed.
- Imported water was inexpensive and readily available.
  - Legal issues created uncertainties with imported supplies (e.g., Az vs Ca, 1963)
- Recycled water was more expensive, but locally controlled.
  - Would take 30 yrs to perfect technology

The groundbreaking Water Factory 21, 1976-2003.

- 15 MGD desalter (Federal Project)
  - Distillation
  - Only operated for 1 year, produced 3 MGD
- 5 MGD water purification
  - Traditional lime treatment
  - Reverse Osmosis
- Research on RO and pretreatment options
- First plant in the world to use RO to purify wastewater to drinking water standards
- UV/H_2O_2 added in 2001 for NDMA, 1,4-dioxane

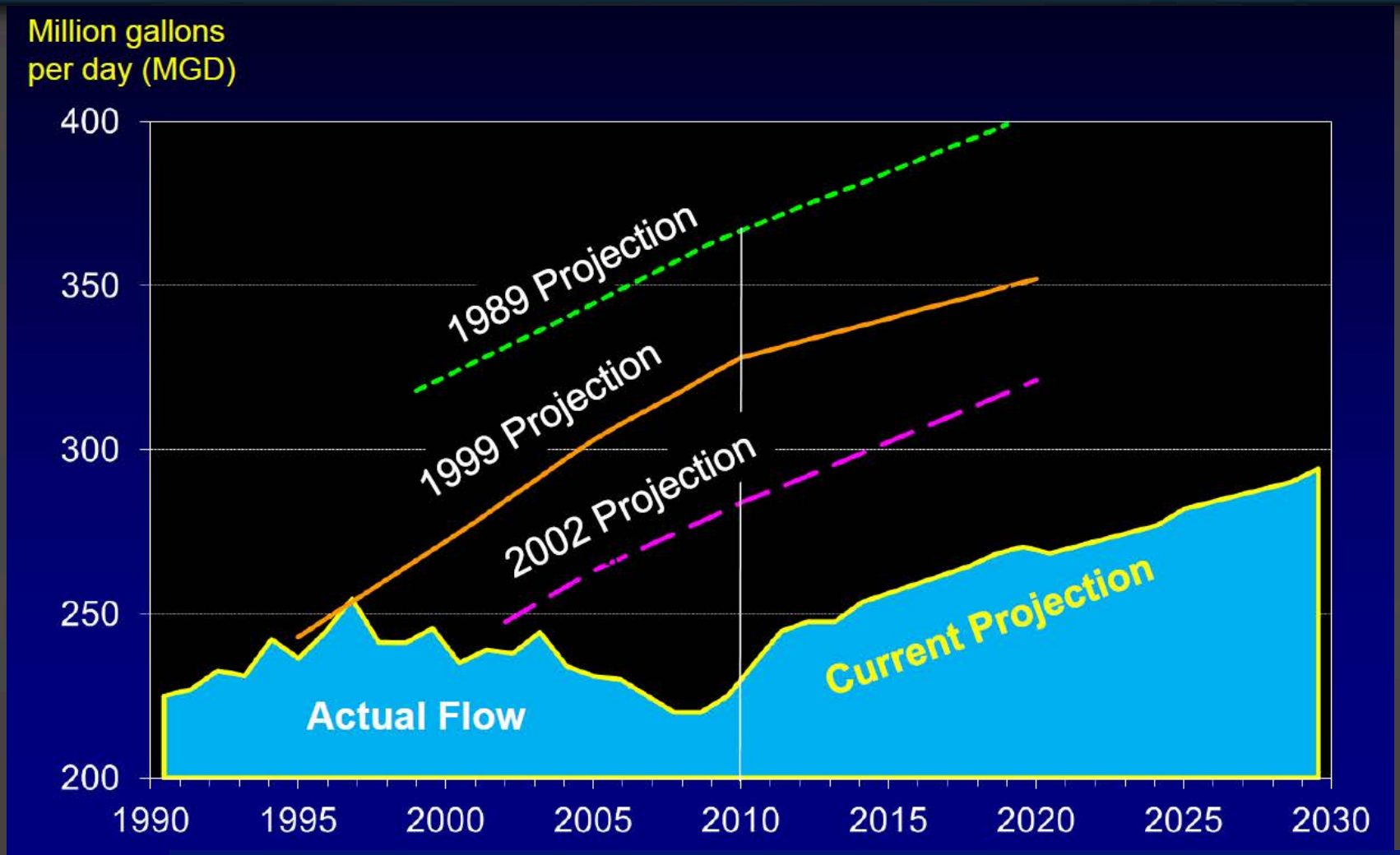
The Talbert Gap Seawater Intrusion Barrier was constructed to protect and maximize the use of basin storage.



- *Constructed in 1975*
- *Comprised of 108 injection wells*
- *Injects water into 4 aquifers*

The Partnership Created to Develop the Groundwater Replenishment System

Projected increases in wastewater inflow meant a new ocean outfall was needed.



Source: Jim Burror, OCSD (WateReuse Association conf, March 2011)

Why did we partner? Planning in the 1990s

OCSD – Defer the need for a new ocean outfall

- Flows increasing.

OCWD – Need more water

- Larger seawater intrusion barrier/ Replace WF-21
- New sources of water to replenish groundwater
- 5 year drought 1987–92
- Imported water supply challenges
- Improve groundwater quality

The Groundwater Replenishment System (GWRS)

- A 100 MGD advanced water purification facility
- Takes treated wastewater that otherwise would be discharged to the ocean, purifies it to near distilled quality and then recharges it into the groundwater basin
- Provides a new source of water, which is enough water for nearly 850,000 people
- Operational since January 2008 (70 MGD), expanded May 2015 (100 MGD)
- Largest planned indirect potable reuse project in the world
- A final expansion to 130 MGD planned for completion by 2023

SINCE 1933

OCWD and OCSD have a long history of collaboration.

- Came together on Water Factory 21 in 1975
- Both serve the same 2.4 million residents plus businesses and industries in northern and central Orange County
- OCSD contributed half the capital cost to the Groundwater Replenishment System (GWRS) to avoid building an additional ocean outfall
- With GWRS Final Expansion, no recyclable wastewater will be discharged to the ocean.
  - OCSD adopted a policy to recycle all wastewater.

Why the Partnership Works

- OCSD needs disposal options beyond ocean disposal
- OCWD needs alternative sources for groundwater supply
- OCSD saves pumping costs by sending flows to GWRS
- OCSD and OCWD are both financially invested in the project, which insures ongoing cooperation
- OCSD enhanced source control effort provides additional protection to the GWRS
- The GWRS project ultimately benefits the same people in the same service area

The Groundwater Replenishment System Treatment Process and Project Costs

OCWD & OCSD: Turning wastewater to drinking water

ORANGE COUNTY WATER DISTRICT
SINCE 1933

G W R S
GROUNDWATER REPLENISHMENT SYSTEM

ORANGE COUNTY SANITATION DISTRICT
PROTECTING THE ENVIRONMENT

OCSD Secondary Effluent

Microfiltration (MF)

Backwash Sent to OCSD

Reverse Osmosis (RO)

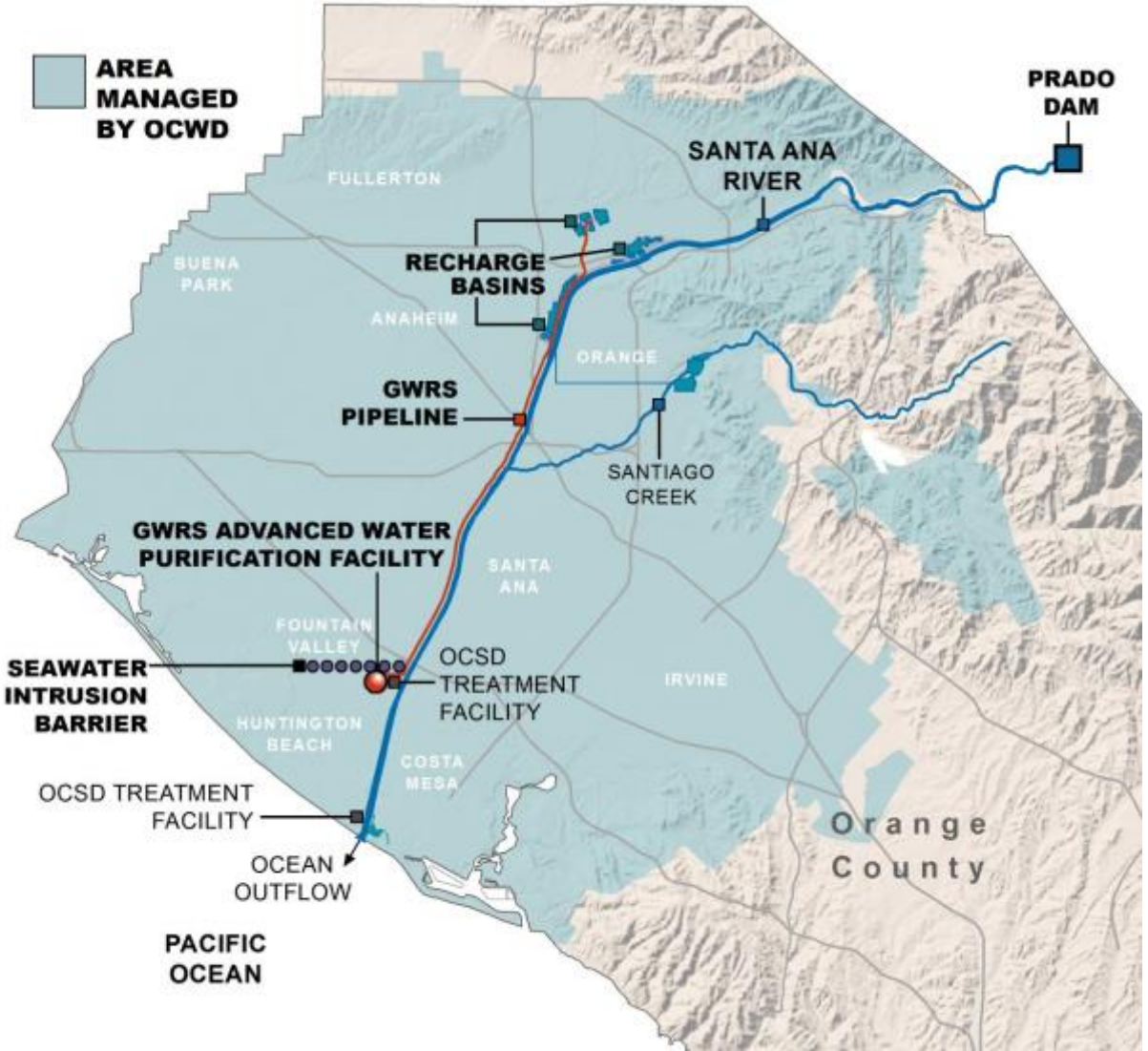
Brine Treated in OCSD Outfall

Ultraviolet Light (UV) with Hydrogen Peroxide

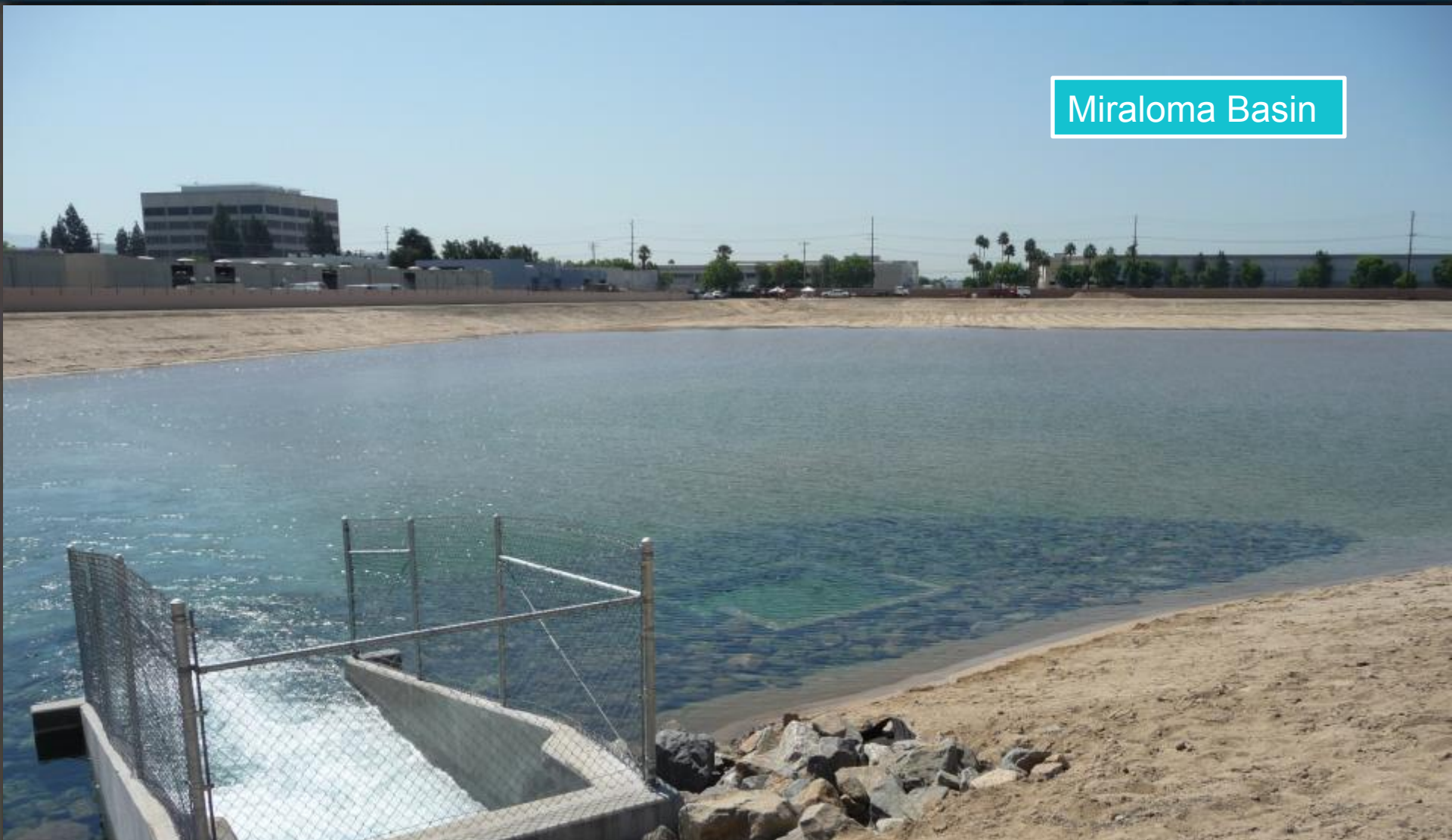
Seawater Barrier (36 well sites)

Recharge Basins in Anaheim

A 13-mile pipeline was constructed to link the treatment plant with the spreading basins.



The bulk of the water is recharged in recharge basins.




LaPalma Basin

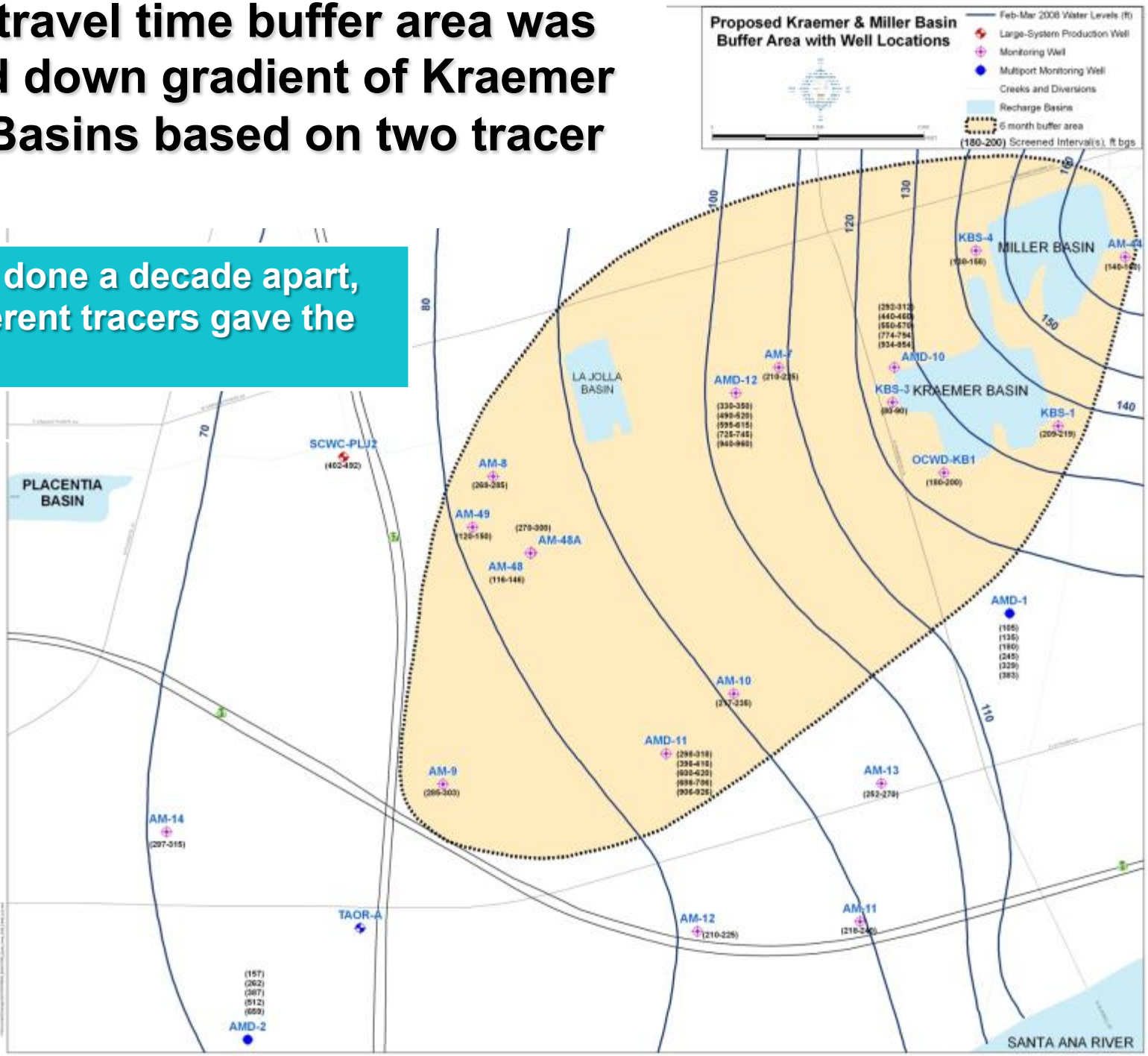
OCWD worked closely with regulators over several years prior to finalization of groundwater recharge regulations.

- OCWD collaborative relationship with regulatory agencies key to successful permitting of original GWRS project
- Regional Water Quality Control Board issues permits for recycling
- State Division of Drinking Water (DDW) regulates drinking water and establishes recycling criteria
- DDW regulations manage microbial and chemical risk, acute & chronic via:
  - Treatment requirements
  - TOC limits
  - Retention time
  - Blending requirements
  - Monitoring requirements
- DDW findings & recommendations incorporated into Regional Board permit
- No direct federal EPA role regulating reuse

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

A 6-month travel time buffer area was established down gradient of Kraemer and Miller Basins based on two tracer studies.

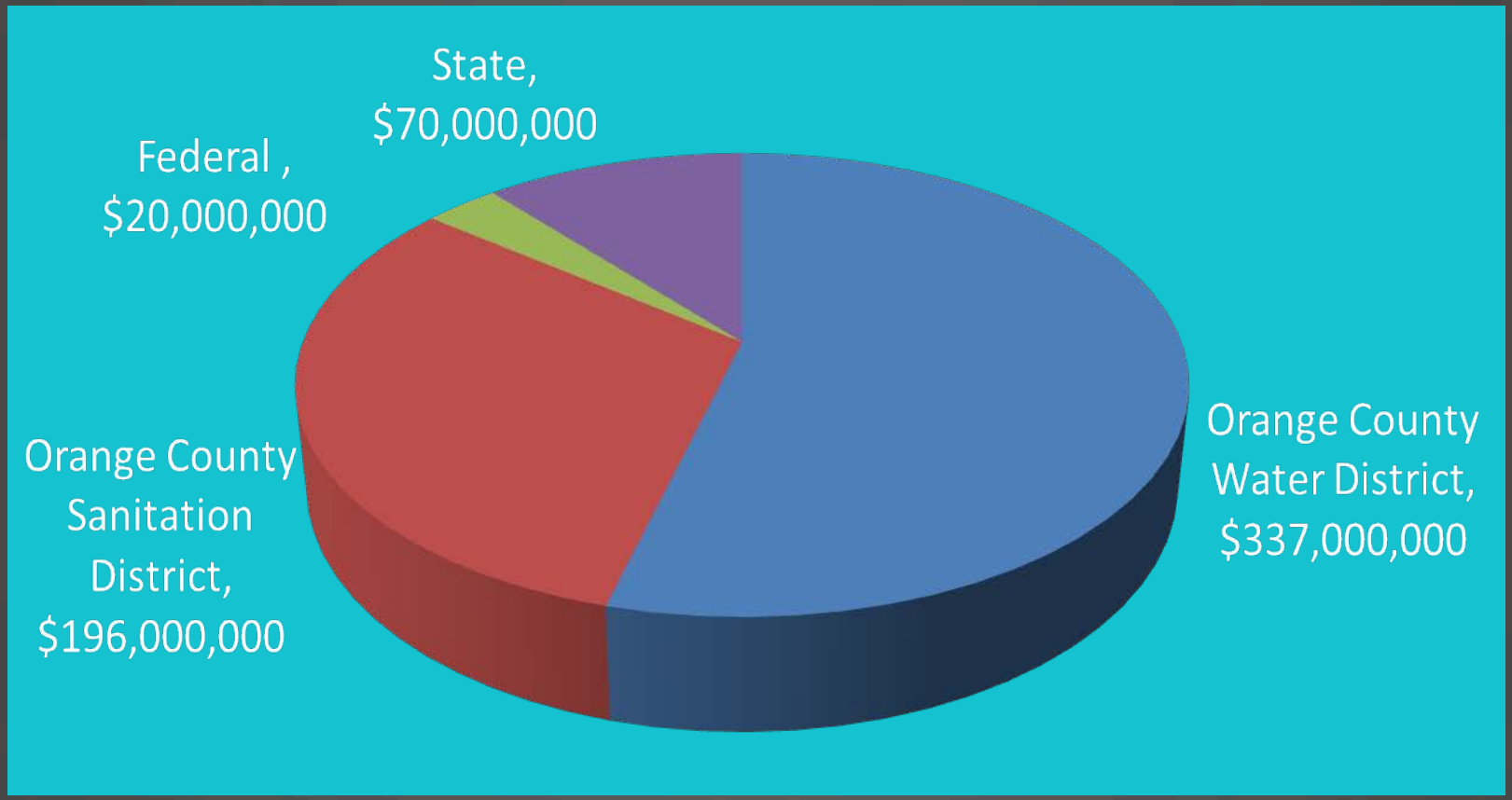
Tracer studies done a decade apart, using two different tracers gave the same result!



Extensive water quality monitoring is required.

- DDW helped develop Regional Board permit requirements
- Test Final Product Water (FPW) quarterly for **400+ targets**
  - Volatile Organic Compounds (e.g., industrial solvents)
  - Non-Volatile Synthetic Organic Compounds (e.g., pesticides)
  - Inorganics and metals (e.g., arsenic, lead, copper, nitrate)
  - Disinfection By-Products (e.g, TTHMs, HAAs, NDMA)
  - EPA Priority Pollutants
  - Pharmaceuticals and personal care products (PPCPs)
  - Endocrine Disrupting Compounds (EDCs)
- All results below permit limits or non-detect (ND)

GWRS Project Construction Funding Sources (including recent expansion)



GWRS Total Capital Cost at current 100 MGD capacity is $623 million

FY 2015-16 Operating Cost (July 2015 to June 2016)

Item	Annual Cost	Cost/AF
Electricity Power used is 1,385 kWH/acre foot or 1.12 kWh/m^3	$12,494,5299	$122
Chemicals	$5,559,252	$54
Labor	$9,678,633	$95
R&R Fund Contribution	$6,882,996	$67
Plant Maintenance	$3,586,290	$35
Debt Service	$20,700,000	$203
Sub Total	$58,901,700	$577
Operating Subsidies (Includes Demand Response and MWD LRP)	($9,469,996)	($93)
Total Net Cost*	$49,431,704	$484/af

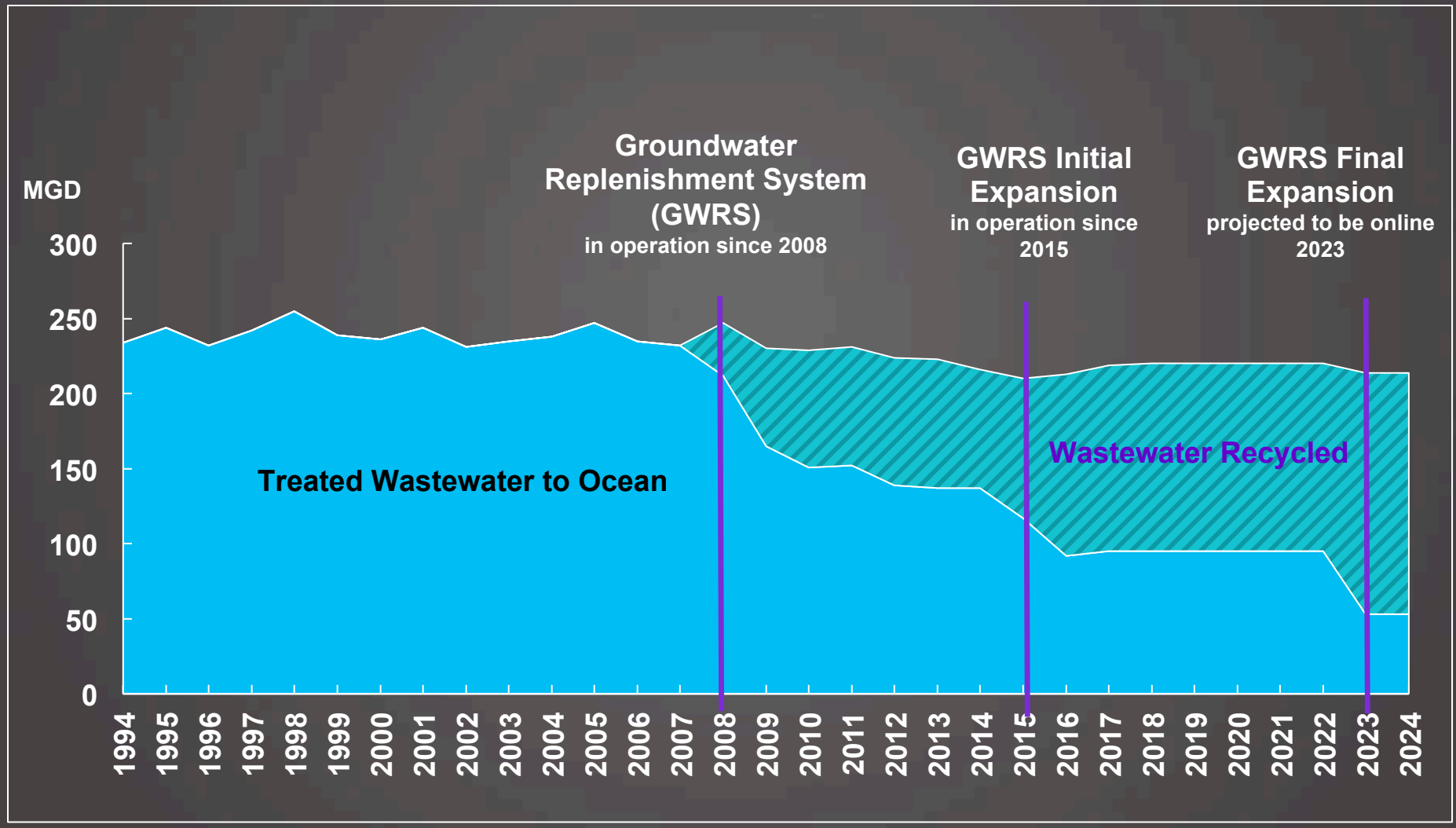
* Based on a production of 102,138 afy

The Final Expansion of the Groundwater Replenishment System

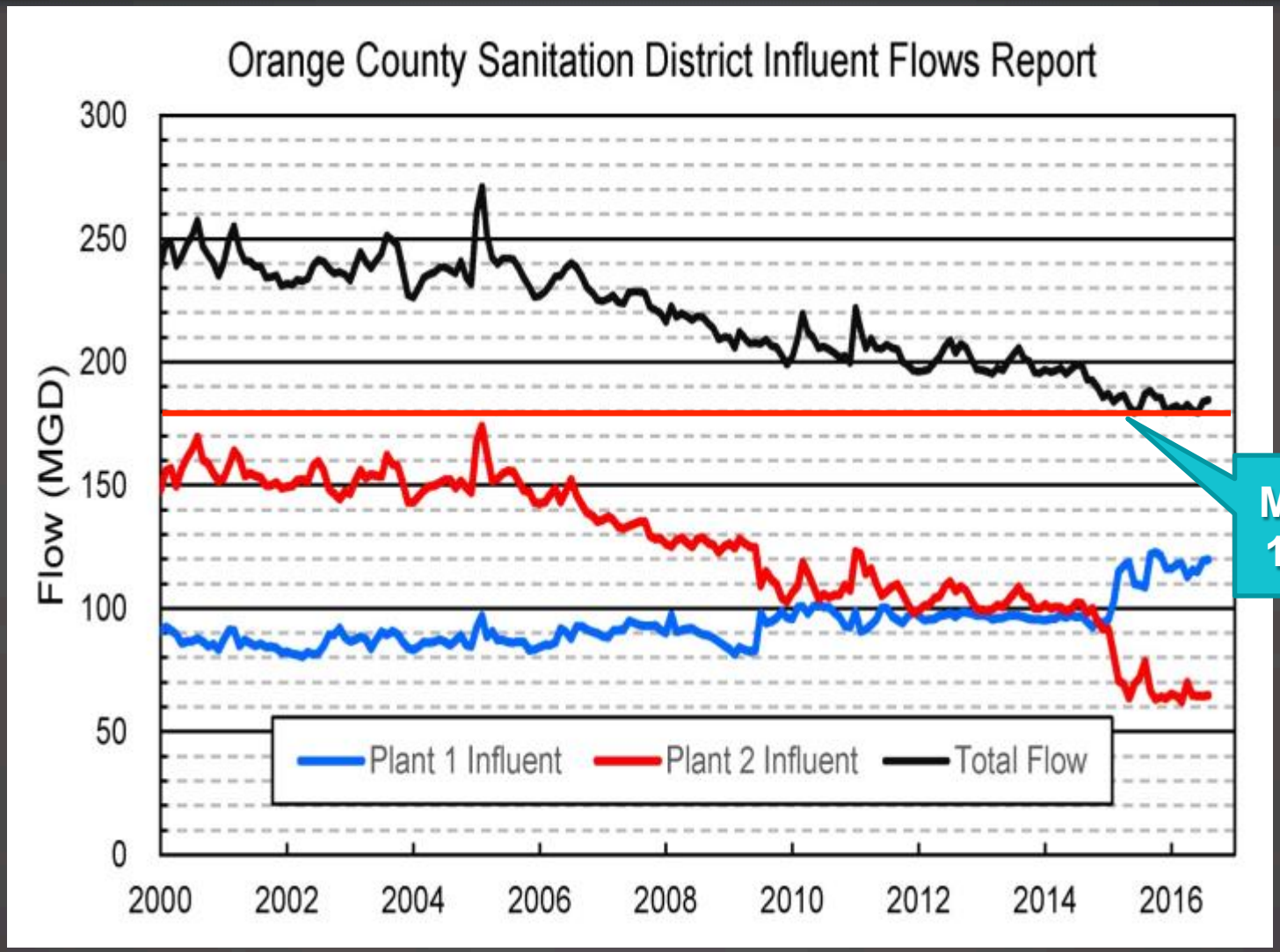
From the start, GWRS was envisioned as a three-phase project.

- **Phase 1**: GWRS Project (Completed 2008)
  - Construction of 70 MGD treatment facility **with future expansion capacities (up to 130 MGD)**, injection wells, and pipeline
- **Phase 2**: GWRS Initial Expansion (Completed 2015)
  - Expansion of 70 MGD treatment facility to 100 MGD
  - Two Flow equalization tanks
- **Phase 3**: GWRS Final Expansion (Est completion 2023)
  - Expansion to 130 MGD
  - Flow equalization tanks

Goal is to recycle all water that can be recycled.



Wastewater flows have been declining for several years due to drought, economic downturn and increased conservation.



Further wastewater declines are possible with potential future State regulations.

- Considering 55 gpd per person limit
- 2.4 million people = 132 MGD + Industrial discharges = ?? MGD
- Will there be enough?

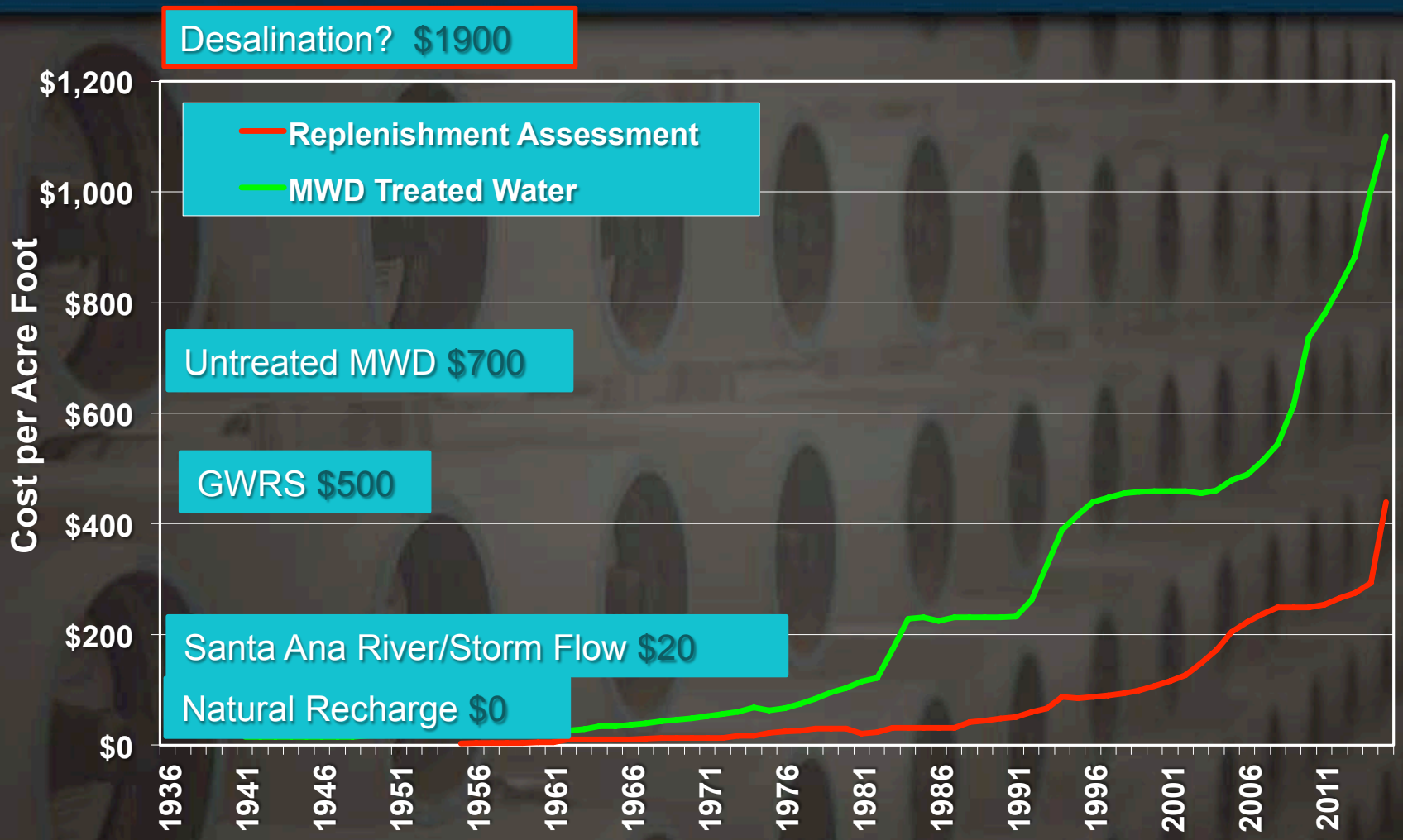
GWRS Final Expansion Projected Costs

Project Description	Cost (Millions)
OCWD AWTF Expansion to 130 mgd	$130
OCSD Plant No. 2 Pump Station	$18
OCSD Pipeline Rehabilitation	$37
OCSD Plant No. 2 Headworks Modification	$44
Flow EQ Tanks	***$23***
TOTAL	**$252**

Melded Unit Cost for GWRS

*This unit cost does not include the MWD LRP subsidy for GWRS – which expires in 2019

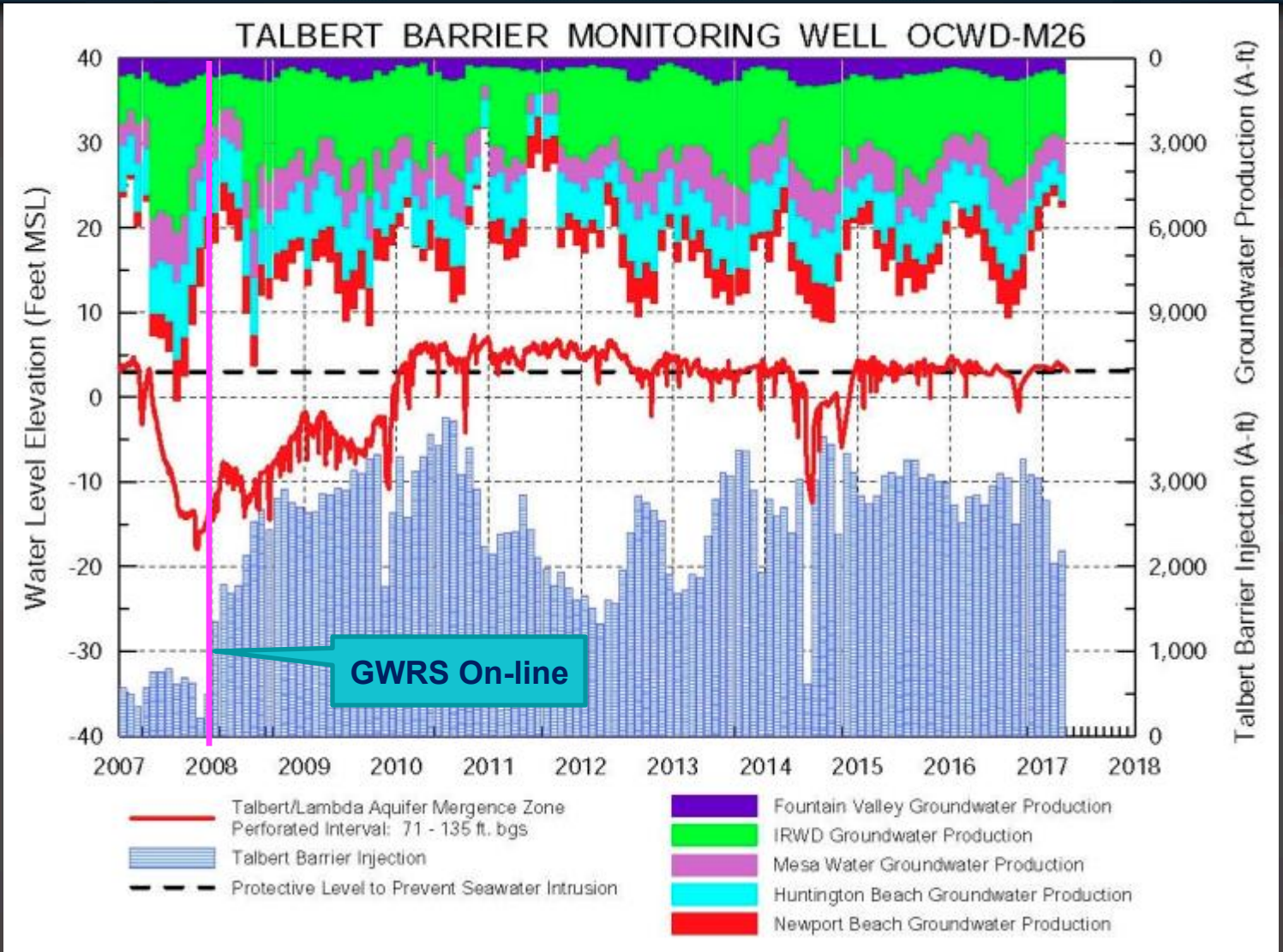
High imported water costs makes local resources development attractive.



GWRS has improved basin conditions.

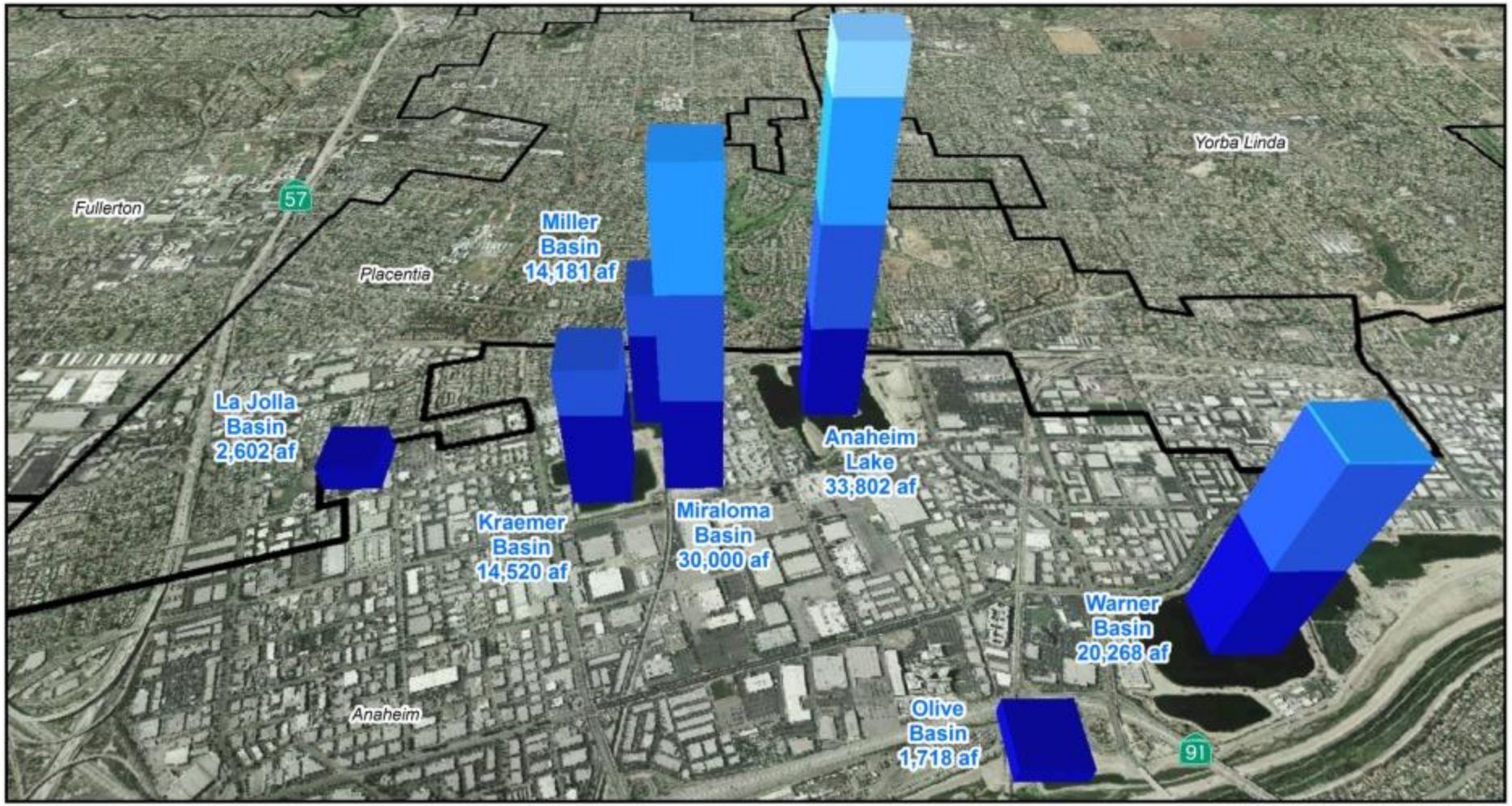
- Shifts salt balance into positive territory
  - Santa Ana River base flow: 600 mg/L
  - Imported Colorado River water: 650+ mg/L
  - GWRS: 70 mg/L
- Significantly reduced clogging
  - Barrier recharge increased
  - Surface recharge extremely high: 10 ft/day
- Maximizes performance of existing facilities and reduces need for future facilities

Additional, high quality supply has allowed the barrier to perform as intended.

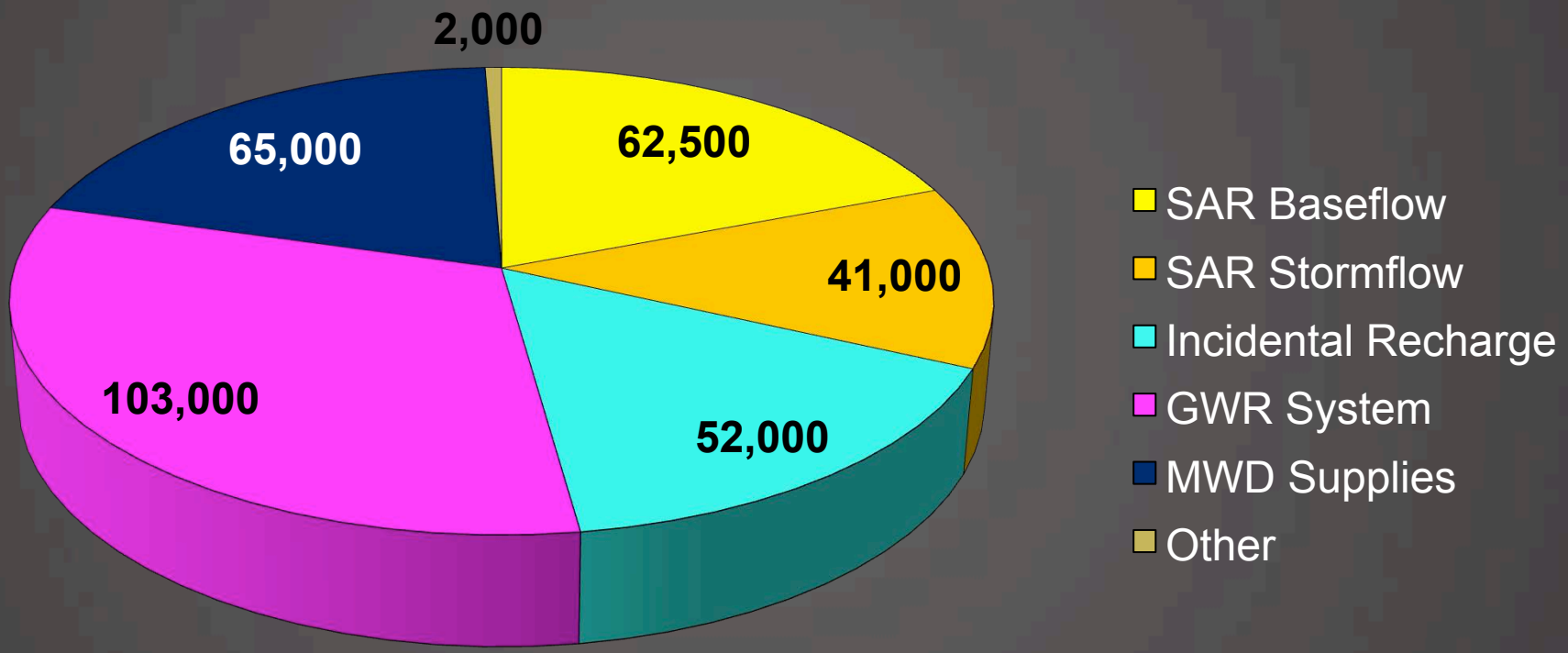


Miraloma Basin is small relative to other basins in the area.

The annual average recharge rate in Miraloma was greater than 8 ft/day in 2012-13.

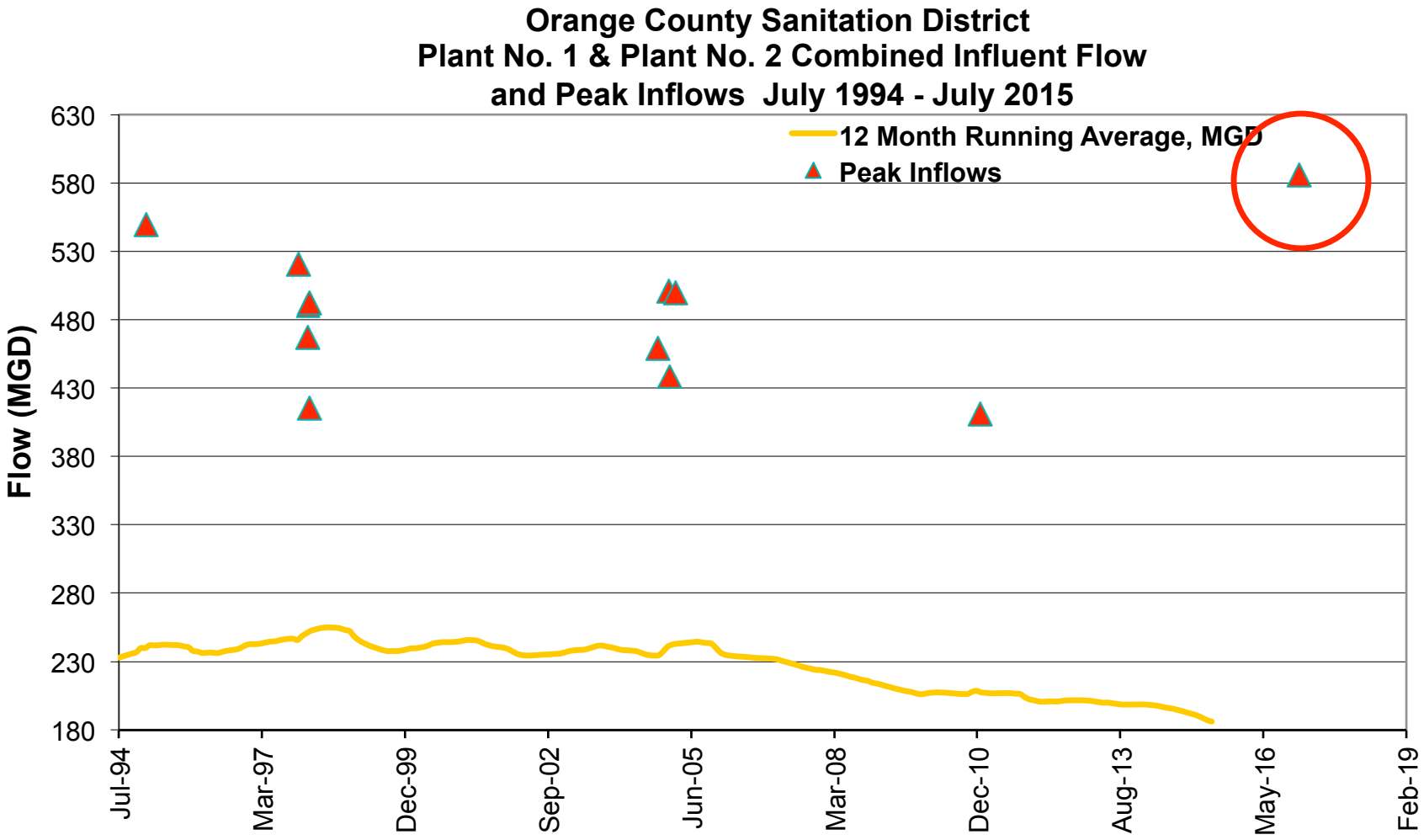


GWRS is expected to supply 32 percent of recharge to the basin in 2017-18.



80 percent of recharge water is local supply.

GWRS provides emergency relief for OCSD.



GWRS Prevents Need for Emergency Outfall Use

+ Board of Directors
+ Transparency
+ General Information
+ Management
– In the News
News
Press Releases
Media Requests
+ Jobs
+ Financials
Calendar

In the News

Keep me Informed Font Size: Share & Bookmark Feedback Print

GWRS Prevents The Need For Emergency Outfall Use
Post Date: 02/24/2017 7:16 AM

The Groundwater Replenishment System (GWRS), the world's largest advanced water purification facility of its kind, has been online since January 2008. The project is a joint partnership between the Orange County Water District (OCWD; the District) and the Orange County Sanitation District (OCSD).

On January 22-23, 2017, OCSD saw influent flows that had not been seen since 1995. OCSD experienced peak flows of up to 586 million gallons per day (mgd) coming into both of their wastewater treatment plants. As events started to unfold, OCSD staff worked tirelessly to ensure that its facilities could handle the unprecedented flows and OCWD staff worked to ensure that the GWRS would continue to run at its normal 100 mgd flow rate. This alleviated any concerns that flows would exceed their discharge capacity of the five mile outfall line and force OCSD to use its one mile outfall, which would have resulted in beach closures.

"I am very proud to be part of this organization," said OCSD Board Chairman Greg Sebourn. "Facing the highest flows ever seen at OCSD, we were able to keep the flow in the pipes without any interruption in service to our customers. This was possible through the hard work and dedication of our staff, and the sound policy making, foresight and commitment of our past and current board to invest in infrastructure for the future. All of these factors came into play to allow OCSD to stay true to our mission of protecting public health and the environment, even during challenging times."

Media Contact information

Jennifer Cabral
714.593.7581 phone
Twitter: @OCSewers
Facebook

Sign up for e-notification

For upcoming events, please see our Upcoming Events list page

Source: www.ocsd.com

In the News

GWRS Prevents The Need For Emergency Outfall Use
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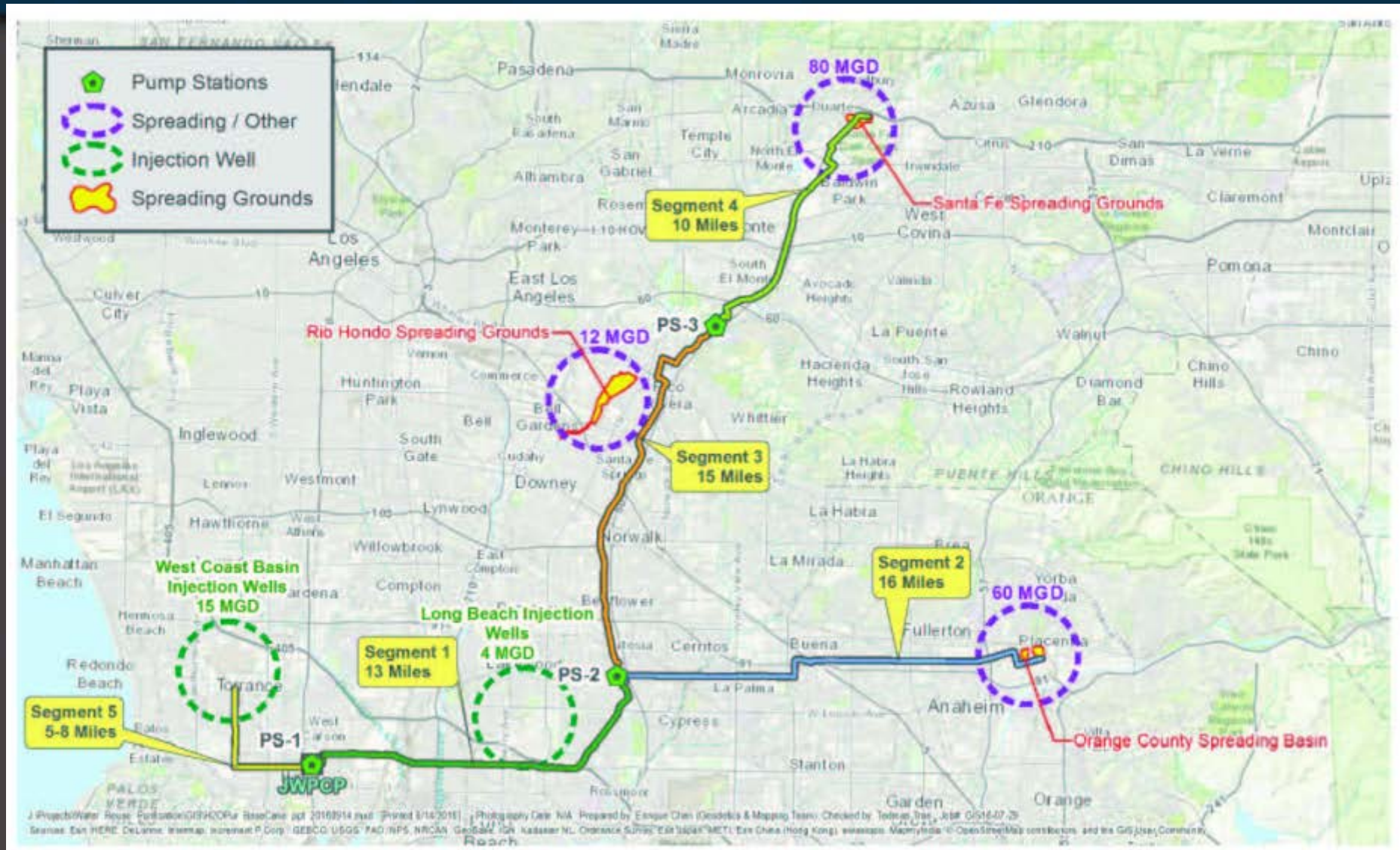
Source: www.ocsd.com

The Metropolitan Water District is assessing the feasibility of constructing a 150 MGD recycled water project.



Public Outreach, Lessons Learned, and Keys to Success

Public outreach is critical.

- Many projects stopped by public and political opposition
- Outreach began early, more than 10 years prior to start-up
- Researched public concerns
- Face-to-face presentations
- Community leaders
- Measured effects of outreach
- Community support
- Outreach continues today, assisted by media interest
- No active opposition

What have we learned?

- Public can accept indirect potable reuse projects if:
  - Need is clear
  - Outreach is effective and ongoing
  - Elected officials and community leaders make commitment
  - Quality is higher than alternatives
  - Regulators have ongoing oversight
- The more people know about GWRS, the more they accept it

Keys to Success

- Project meets Orange County's water needs
- Board of Director's insistence on highest quality water
- Effective medical and minority outreach programs
- History of successful water reuse in Orange County from the Water Factory 21 recycling facility
- Groundwater basin as final destination (not tap)
- Excellent outreach speakers bureau program obtained written support of project
- Successful outreach from conception of facility, to construction and finally commissioning

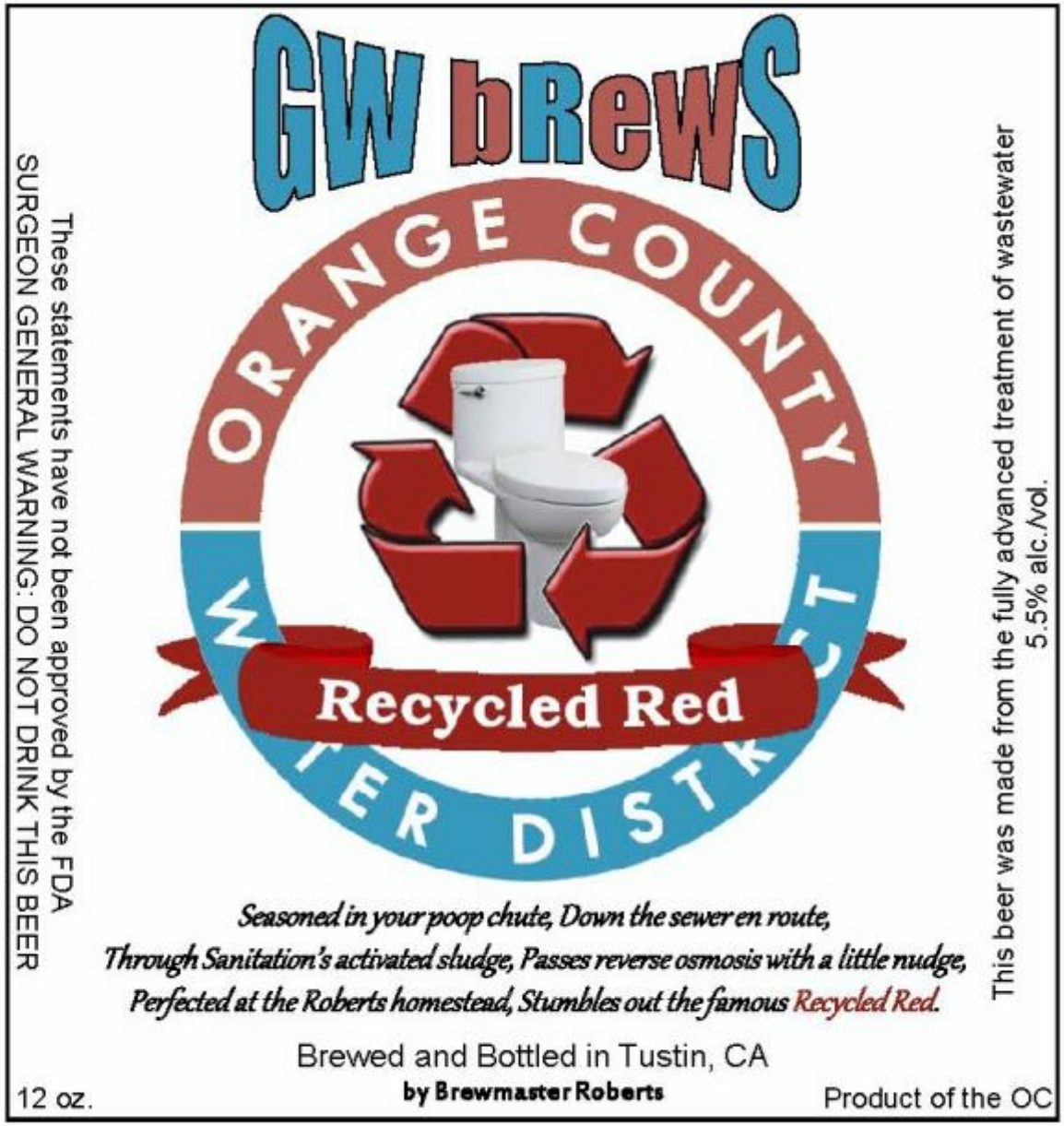
Final Thoughts

- Timing is everything
- Look for win-win opportunities within the water world
- Take the long-view
  - Are elected leaders willing to take risks?
- What is the cost of doing nothing?
  - Need to define cost of alternative supply
- Recycled water is low-hanging fruit in Southern California
  - Reliable source of supply
  - Brine disposal can be issue in inland areas
  - Public acceptance is high

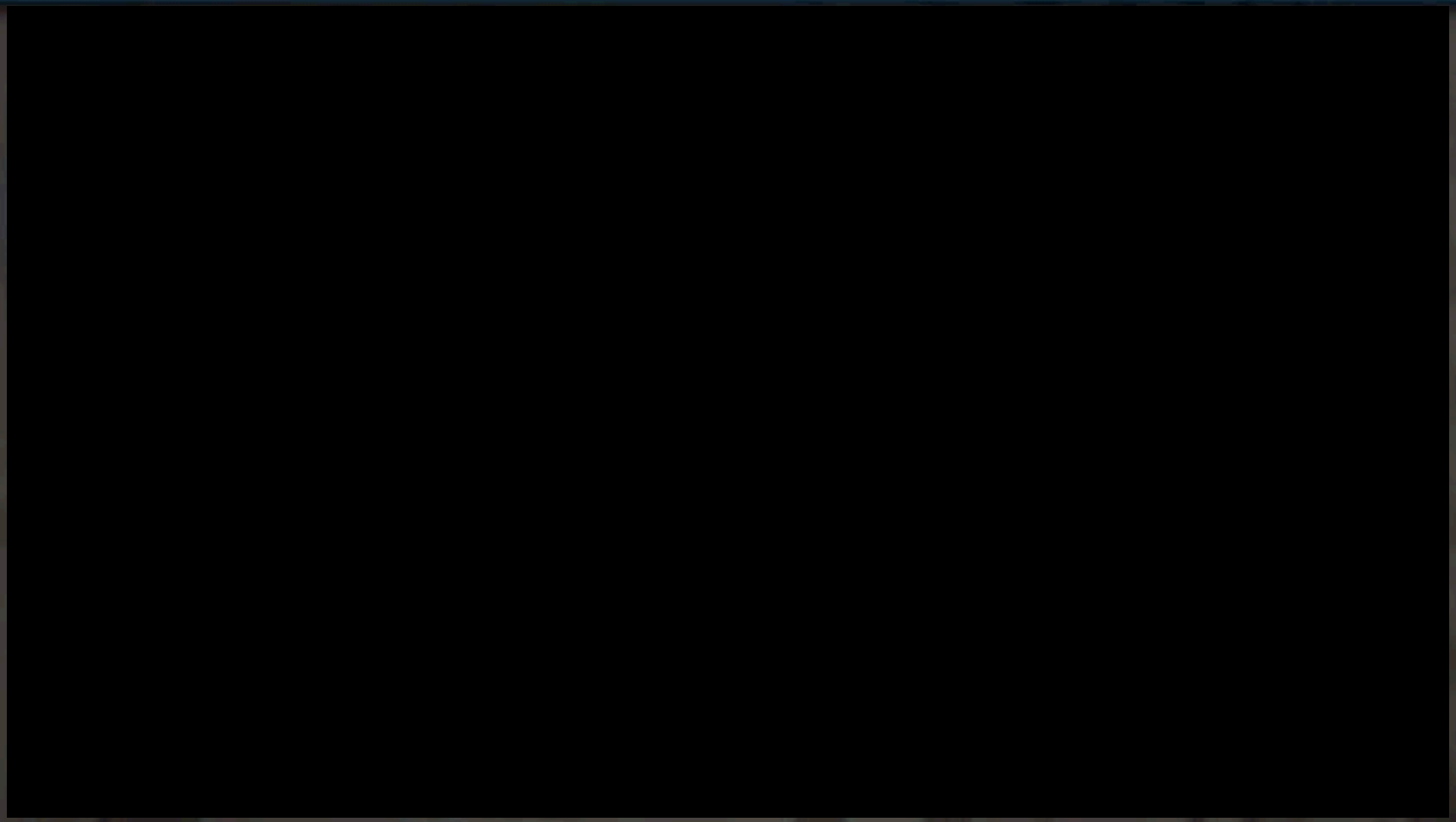

S.KELLEY
MOVE OVER...
DRINKING WATER FROM SEWAGE?

FROM TOILET TO TAP

"Water? Bottled, on tap or from the toilet?"


GW bRewS
ORANGE COUNTY
WATER DISTRICT
Recycled Red
Seasoned in your poop chute, Down the sewer en route,
Through Sanitation's activated sludge, Passes reverse osmosis with a little nudge,
Perfected at the Roberts homestead, Stumbles out the famous Recycled Red.
Brewed and Bottled in Tustin, CA
by Brewmaster Roberts
12 oz.
Product of the OC
These statements have not been approved by the FDA
SURGEON GENERAL WARNING: DO NOT DRINK THIS BEER
This beer was made from the fully advanced treatment of wastewater
5.5% alc./vol.

How far we have come!



A taste of the good life…

- **Bottling GWRS Water**
- **Needed legislation (**AB 2022)
  - Took effect in January 2017
  - Allows for the bottling of advanced purified water to support educational outreach efforts
  - Authored by Assembly Member Rich Gordon
  - Co-sponsored by OCWD, OCSD and WateReuse
  - A critical step in the process of gaining the public's approval for water reuse projects

Groundwater Resources Association of California and the Arizona Hydrological Society Present:

16th Biennial Symposium on Managed Aquifer Recharge

BSMAR 16

Recharge to the Rescue! Managed Aquifer Recharge as a Water Management Tool.

March 5-7, 2018

The Dana on Mission Bay

San Diego, California, USA


Thank You!
Contact:
Adam Hutchinson
ahutchinson@ocwd
714-378-3214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ORANGE COUNTY
Recycled Red
WATER DISTRICT
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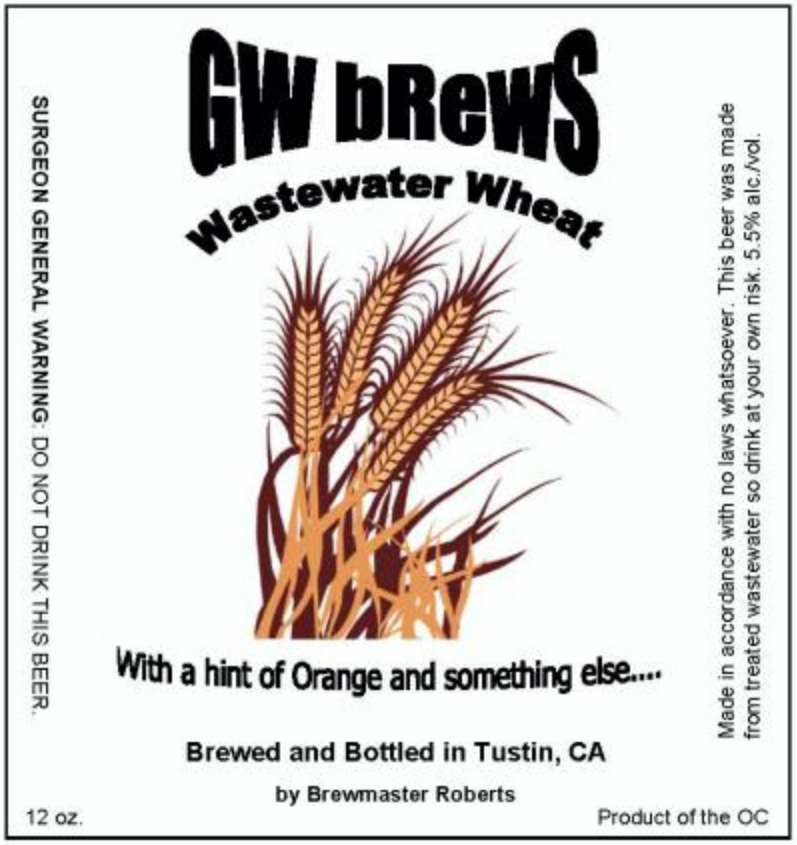
GW bRewS
Wastewater Wheat
SURGEON GENERAL WARNING: DO NOT DRINK THIS BEER.
With a hint of Orange and something else....
Made in accordance with no laws whatsoever. This beer was made
from treated wastewater so drink at your own risk. 5.5% alc./vol.
Brewed and Bottled in Tustin, CA
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12 oz.
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