



Metropolitan Water Reclamation District of Greater Chicago

**WELCOME
TO THE APRIL EDITION
OF THE 2019
M&R SEMINAR SERIES**

BEFORE WE BEGIN

- **SAFETY PRECAUTIONS**
 - PLEASE FOLLOW EXIT SIGN IN CASE OF EMERGENCY EVALUATION
 - AUTOMATED EXTERNAL DEFIBRILLATOR (AED) LOCATED OUTSIDE
- **PLEASE SILENCE CELL PHONES OR SMART PHONES**
- **QUESTION AND ANSWER SESSION WILL FOLLOW PRESENTATION**
- **PLEASE FILL EVALUATION FORM**
- **SEMINAR SLIDES WILL BE POSTED ON MWRD WEBSITE (www.MWRD.org: Home Page ⇒ Reports ⇒ M&R Data and Reports ⇒ M&R Seminar Series ⇒ 2019 Seminar Series)**
- **STREAM VIDEO WILL BE AVAILABLE ON MWRD WEBSITE (www.MWRD.org: Home Page ⇒ MWRDGC RSS Feeds)**

Sandy Scott-Roberts, P.E.

Ms. Sandy Scott-Roberts, P.E., is the Groundwater Replenishment System (GWRS) Program Manager at the Orange County Water District in California.

She holds a Bachelor's and Master's degree in Environmental and Civil Engineering from California Polytechnic State University, San Luis Obispo, California.

She has 17 years of experience in project management of the planning, feasibility, design and construction phases of water treatment facilities, including pipelines, pump stations, recharge basins, and injection wells. She started her career as a consulting civil engineer and has been at the Orange County Water District since 2006. She is the Project Manager for the Groundwater Replenishment System Final Expansion Project which will increase the treatment capacity of the facility from 100 MGD to 130 MGD.

Operating a Membrane Facility for Decades at the Orange County Water District and Groundwater Replenishment System

Sandy Scott-Roberts, P.E.

Groundwater Replenishment System (GWRS) Program Manager

Orange County Water District

April 26, 2019



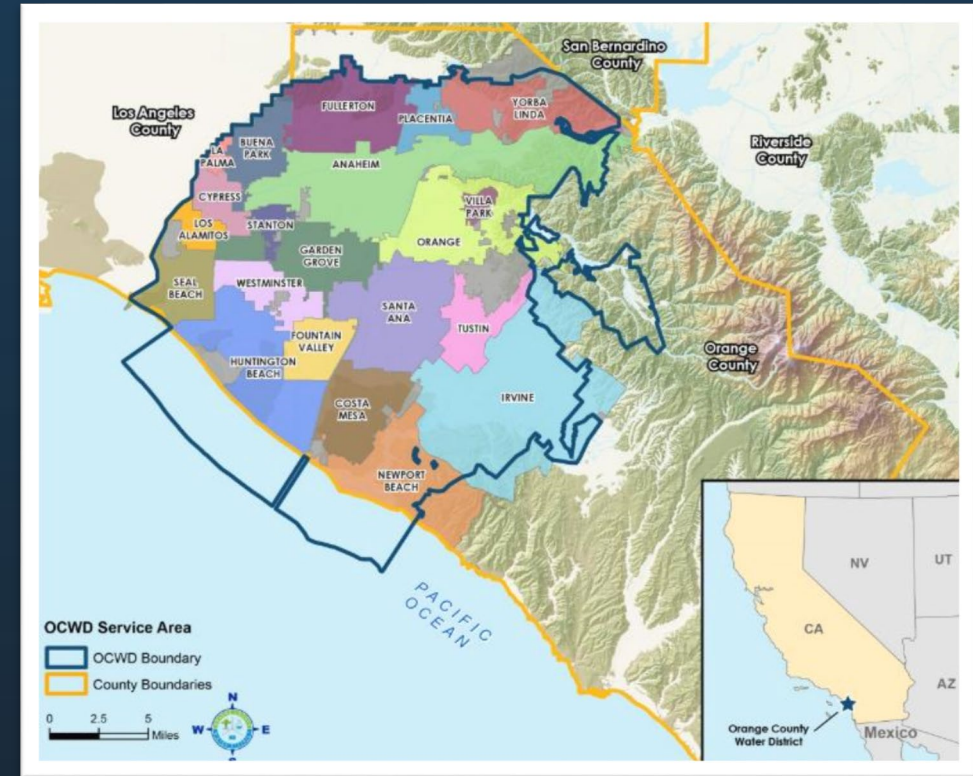
California

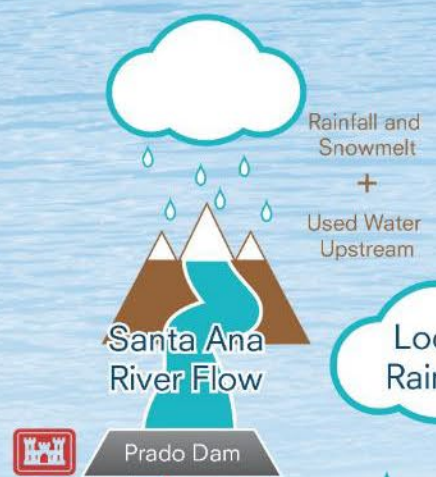
- Most of the population lives in Southern California
- Average rainfall ~12 inches/year
- Water supplies come from:
 - Imported Supplies
 - Groundwater



ORANGE COUNTY WATER DISTRICT (OCWD)

- Formed in 1933 by an act of the California legislature to manage the OC groundwater basin
- Basin provides groundwater to 19 municipal and special water districts that serve 2.5 million customers in north and central Orange County
- Basin currently supplies 75% of the water supply for north and central OC





G W R S
GROUNDWATER REPLENISHMENT SYSTEM

Advanced Purified Water



Orange County Groundwater Basin

Pacific Ocean



2.5 Million Water Users

MWD Direct

75%
of water demands

North & Central Orange County **↑ 25%**
of water demands

South Orange County **↓ 90%**
of water demands

(MWD)

Treated Imported Water

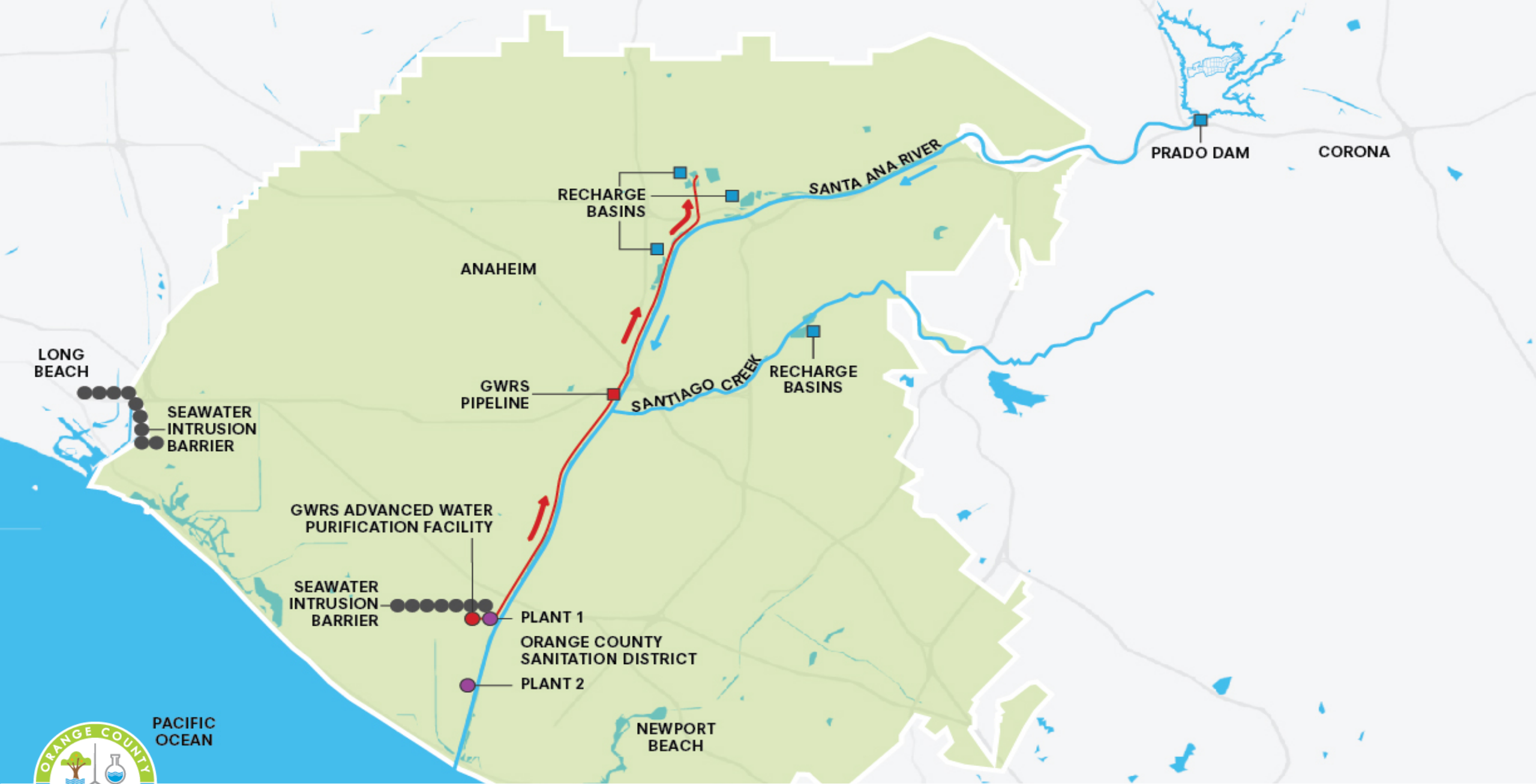
10%
of water demands

Local Groundwater Basin & Recycled Water for Irrigation

600,000 Water Users

Northern California Water

Colorado River Water



PACIFIC OCEAN

OCWD Operational Facilities



Inflatable Rubber Dams

An aerial photograph showing the Santa Ana River and the Burris Basin. The river flows through a series of rectangular basins separated by stone levees. The water is a light blue color. In the background, there are industrial buildings and a city skyline. Two callout boxes with blue borders and white text are present: one pointing to the river and another pointing to the basin.

Santa Ana River

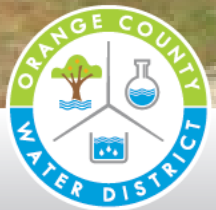
Burris Basin

The T and L levees spread Santa Ana River water and also provide nesting and roosting habitat for numerous types of water fowl.

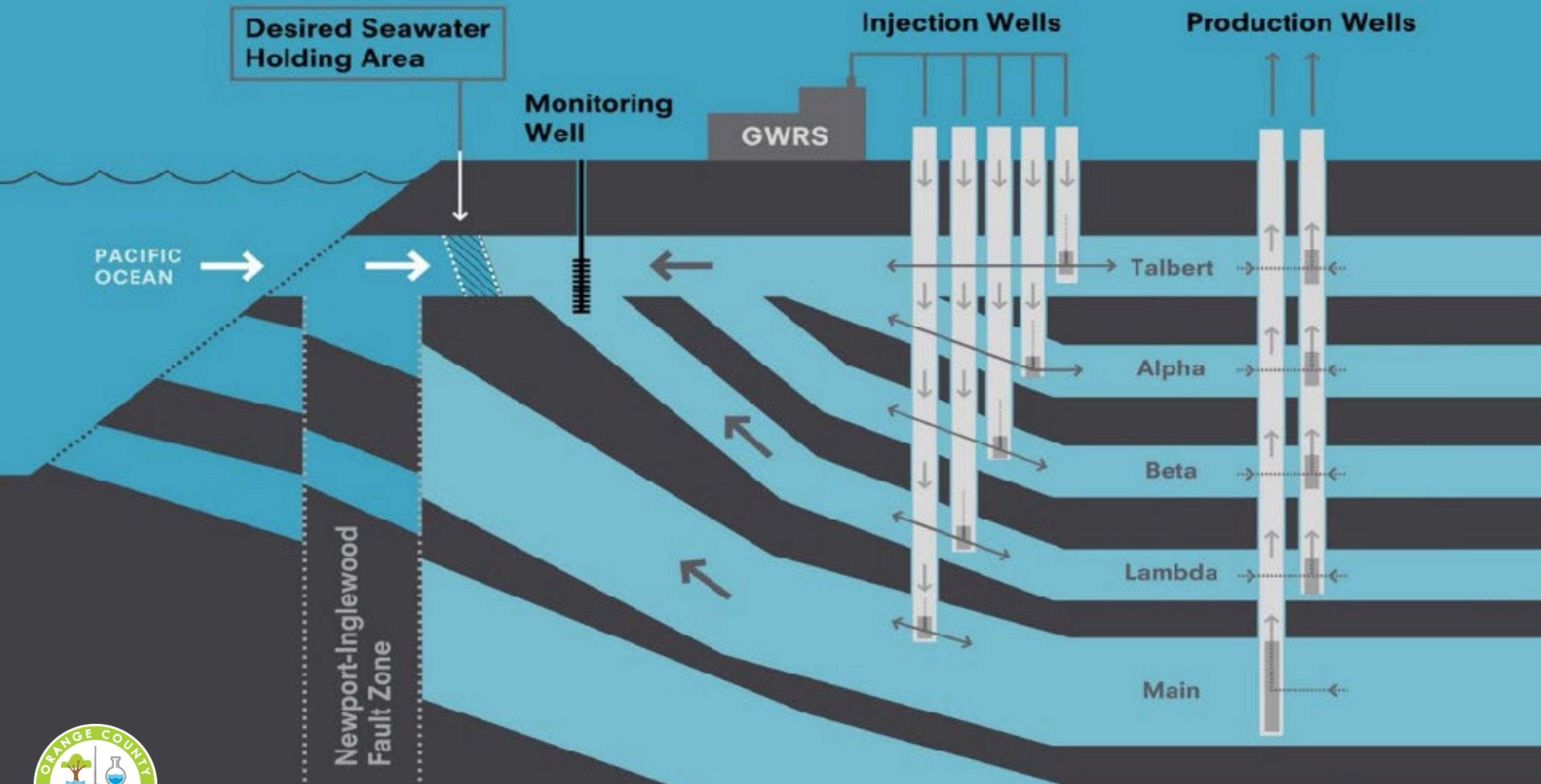




Heavy Equipment Cleans Recharge Basins



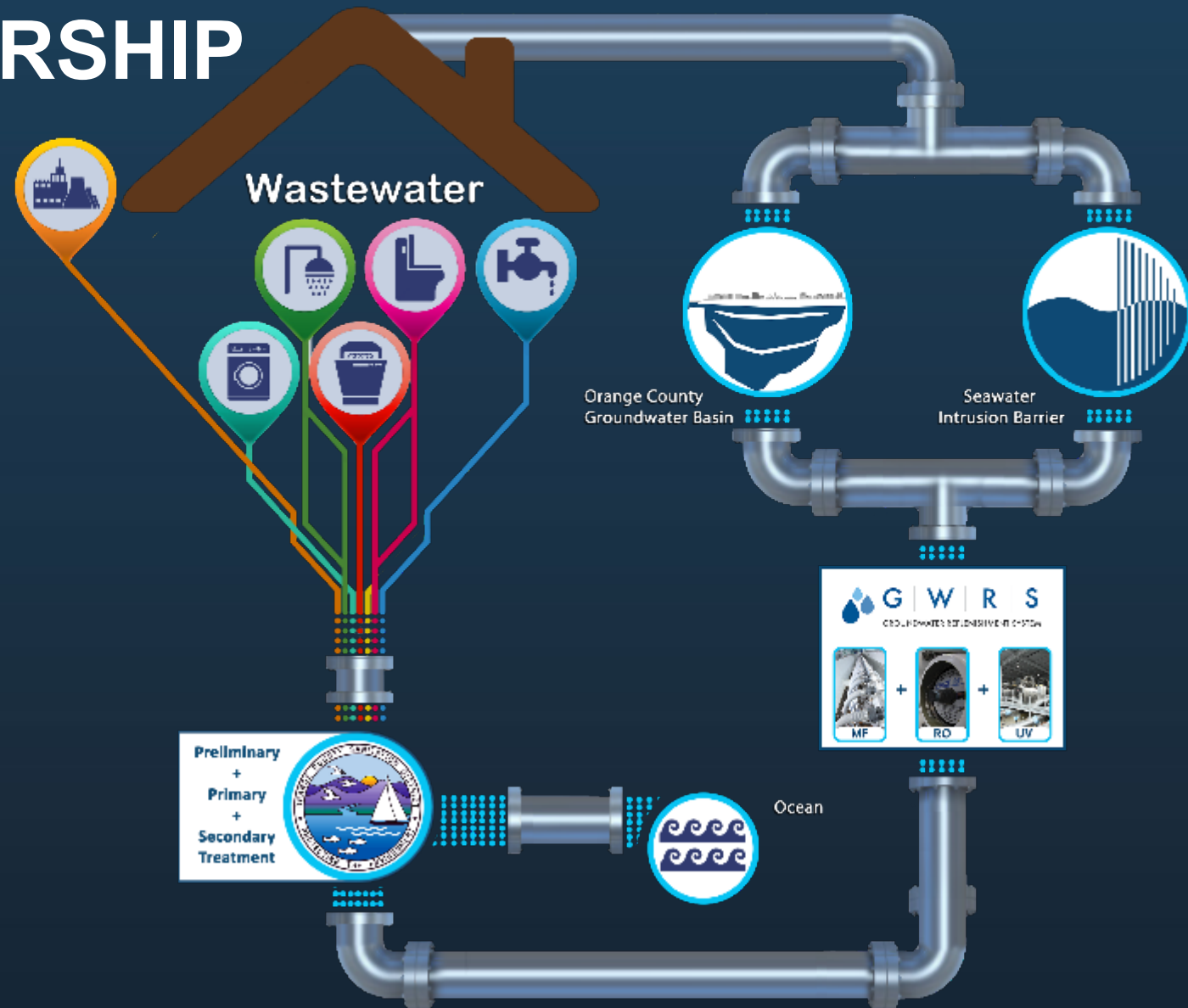
Basin with Submersible Pump Station



Seawater Intrusion Barrier

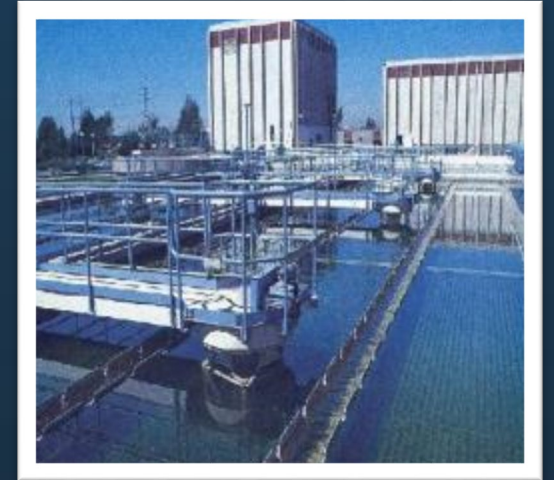
THE GWRS PARTNERSHIP

 **G | W | R | S**
GROUNDWATER REPLENISHMENT SYSTEM



HISTORY OF REUSE AT OCWD

- Water Factory 21 - 1976 to 2003
 - Lime, Recarbonation, Sand Filtration, GAC – 5 MGD, RO – 5 MGD, Deep wells – 5 MGD
 - Research on RO and pretreatment options
 - First plant in the world to use RO to purify wastewater to drinking water standards
 - UV/H₂O₂ added in 2001 for NDMA, 1,4-dioxane removal



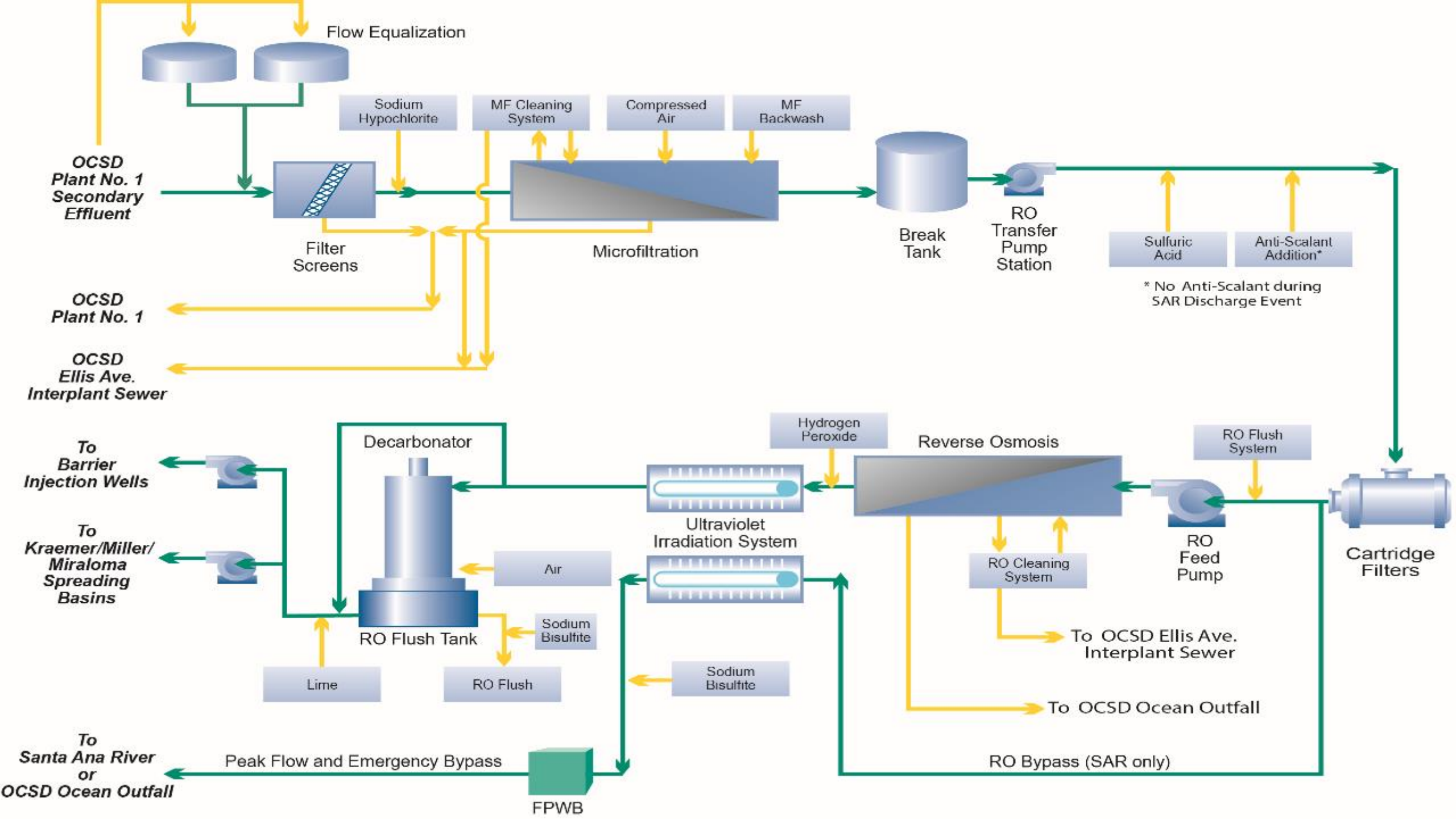
- Green Acres - 1991 to present
 - Tertiary treatment – 7 MGD
- Interim Water Factory - 2003 to 2006
 - MF/RO/UV – 5 MGD
- GWRS – 2008 to present
 - MF/RO/UV – 100 MGD



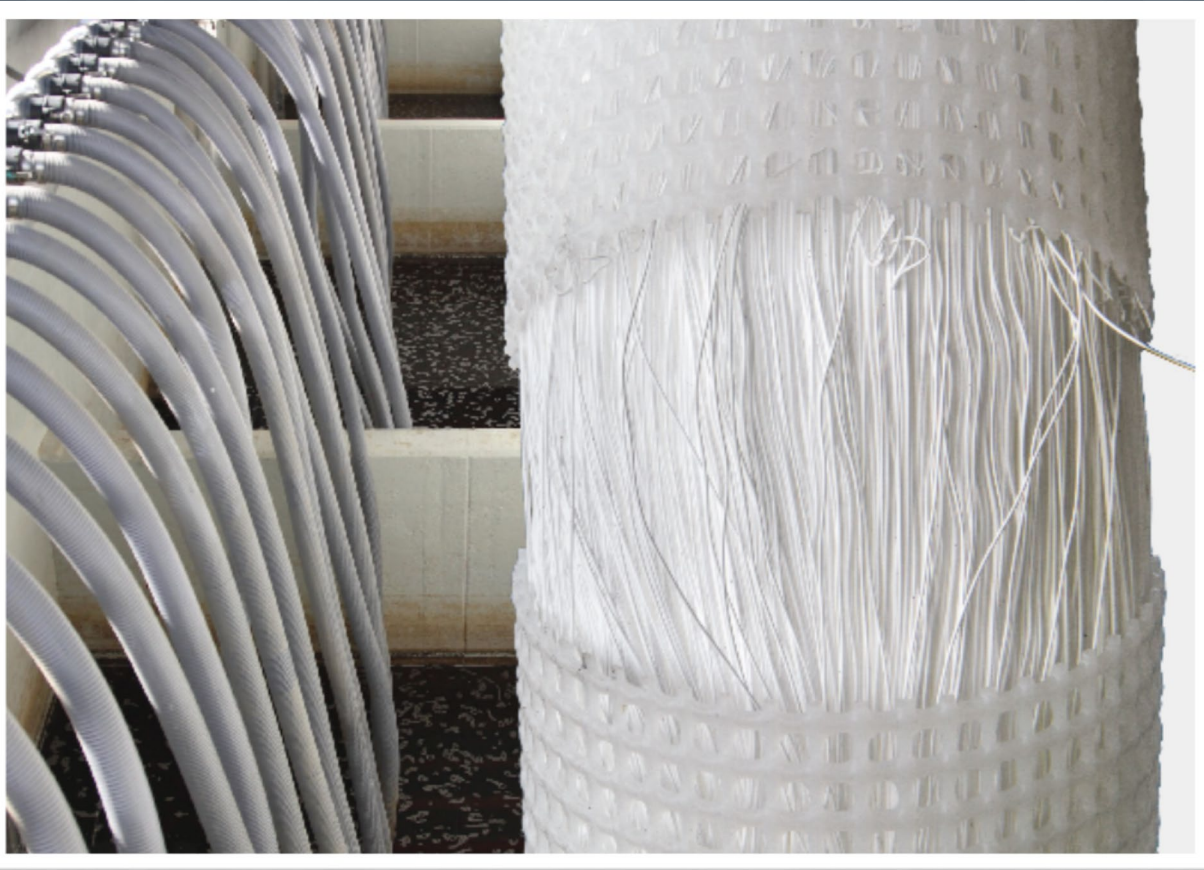
GROUNDWATER REPLENISHMENT SYSTEM (GWRS)

- 100 mgd advanced water purification facility
- Takes sewer water 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 103,000 acre-foot per year source of water, which is enough water for nearly 850,000 people
- Operational since January 2008 (70 MGD) expanded in May 2015 (100 MGD)
- Largest potable reuse facility in the world





MICROFILTRATION (MF) PROCESS SYSTEM



- 125 mgd Evoqua CMF-S Microfiltration System
- In basin submersible system
- Tiny, straw like hollow fiber polypropylene membrane
- 0.2 micron pore size
- Recovery rate: 90%
- Removes bacteria, protozoa, and suspended solids







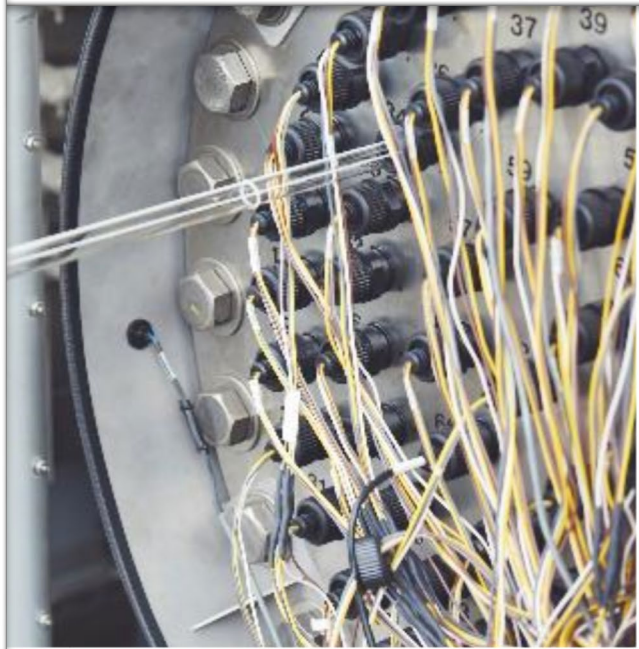
REVERSE OSMOSIS (RO) PROCESS



- 100 mgd Reverse Osmosis System
- 3 stage: 78-48-24 array
- Hydranautics ESPA-2 and DOW XFRLE-400 Membranes
- Recovery rate: 85%
- Removes dissolved minerals, viruses, and organic compounds (incl. pharmaceuticals)
- Pressure range: 130 psi – 220psi



ADVANCED OXIDATION PROCESS (AOP)

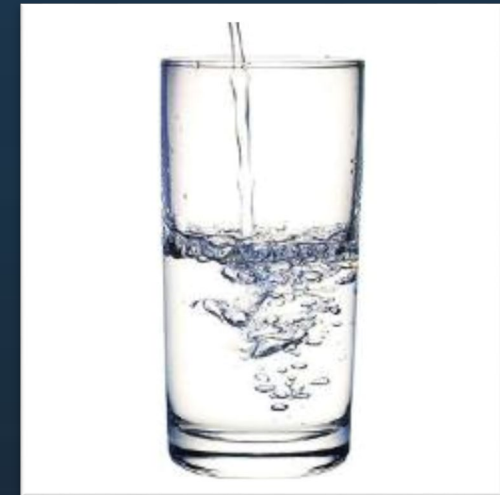


- 100 mgd Trojan UVPhox System
- Low pressure – high output lamp system
- Destroys trace organics
- Uses hydrogen peroxide to create an Advanced Oxidation Process
- After treatment, water is so pure that minerals (lime) are added back into the water



REGULATORY OVERSIGHT

- Regional Water Quality Control Board issues permits for recycling
- Division of Drinking Water (DDW) regulates drinking water and establishes reclamation criteria
 - Treatment
 - TOC limit
 - Travel time
 - Blending
- No federal role regulating reuse
- DDW hearing findings and recommendations incorporated into permit by Regional Board



INDEPENDENT ADVISORY PANEL

- Appointed by National Water Research Institute
- Leading experts in hydrogeology, chemistry, toxicology, microbiology, engineering, public health, public communications and environmental protection
- Review operations, monitoring and water quality
- Panel makes recommendations to OCWD and regulatory agencies to assure quality and reliability

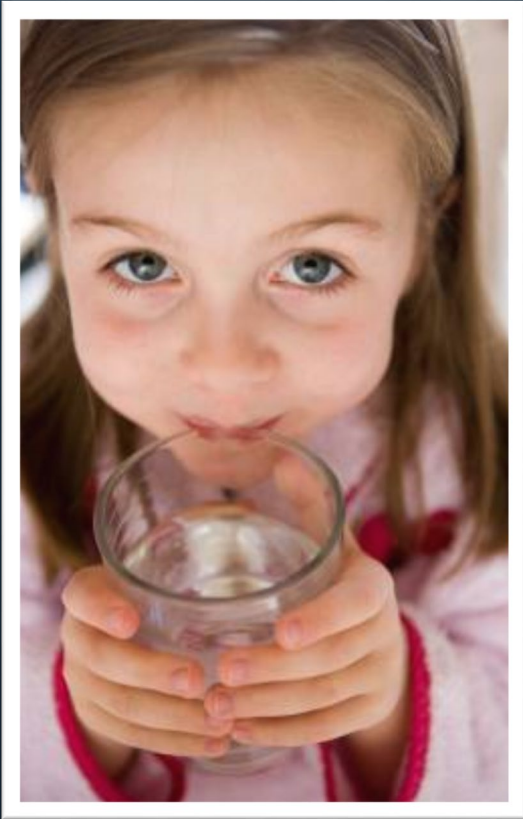


GWRS PROVEN RELIABILITY

- California Department of Public Health developed permit requirements
- Test for over 400 compounds with all results well below permit levels or at non-detection (ND) levels
 - 28 Volatile Organic Compounds – All ND
 - 39 Non-Volatile Synthetic Organic Compounds – All ND
 - 8 Disinfection By-Products – All ND
 - 10 Unregulated Chemicals – All but one ND, all below permit levels
 - 51 Priority Pollutants – All ND
 - 16 Endocrine Disrupting Chemicals and Pharmaceuticals – All ND



PROJECT FUNDING



- Original Project Cost: \$481 million
 - Split equally between OCWD and OCSD
 - Received \$92 million in state and federal grants, and \$3.8 million per year (21 year) operation and maintenance subsidy from Metropolitan Water District
- Expansion Project Cost: \$142 million
 - Received \$1 million in state grants
- Costs comparable to imported water
- Both projects used State Revolving Fund (SRF) loans
- Costs \$500/acre-foot (\$850/acre-foot without subsidies)



BENEFITS OF GWRS

- Creates a new local water supply
- Reuses a wasted resource
- Increases water supply reliability
- Costs less than water from the Colorado River and the State Water Project
- Uses one-half the energy it takes to import water and one-third the energy to desalinate seawater
- Improves quality of water in the basin



PUBLIC OUTREACH

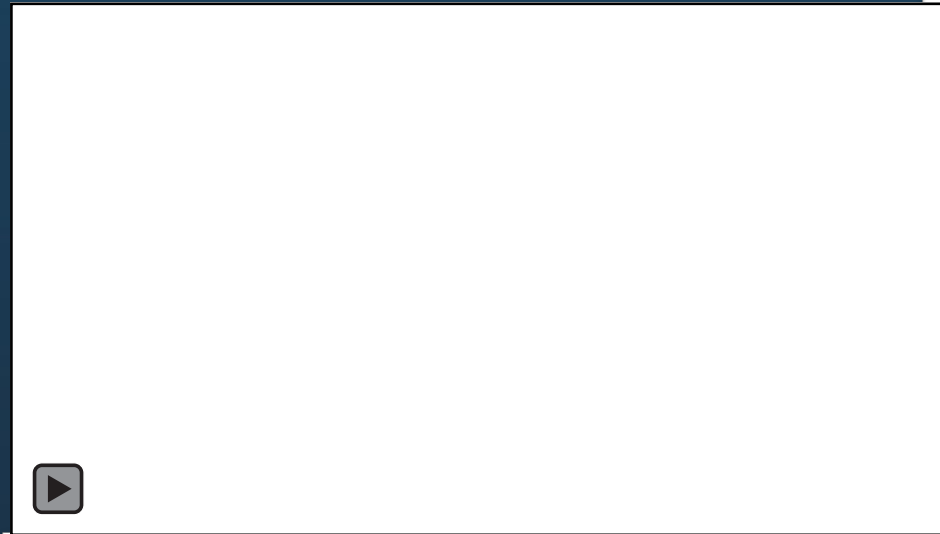


- Many projects stopped by public and political opposition
- Outreach began early, over 10 years prior to start-up
- Researched public concerns
- Face to face presentations
- Community leaders
- Measured effects of outreach
- Community support
- Outreach continues today, assisted by media interest
-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

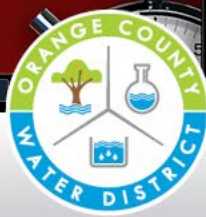


GWRS SUCCESS

- 50+ awards
- National & international media attention
- 35,000+ visitors



FEATURED IN





GWRS Expansion



Post-treatment

FINAL EXPANSION ELEMENTS

- Current Influent for GWRS from OCSD Plant No. 1
 - AWTF Expansion (MF, RO, UV/AOP)
- Final Expansion Influent will be supplemented from Plant No. 2
 - Pipeline
 - Flow Equalization
 - Effluent Pump Station
 - Headworks Segregation



PREDICTED INFLUENT QUALITY

GWRSFE 643,000 m³/d Influent:

- P2: TF/SC – 189,000 m³/d
- P1: AS and TF – 454,000 m³/d

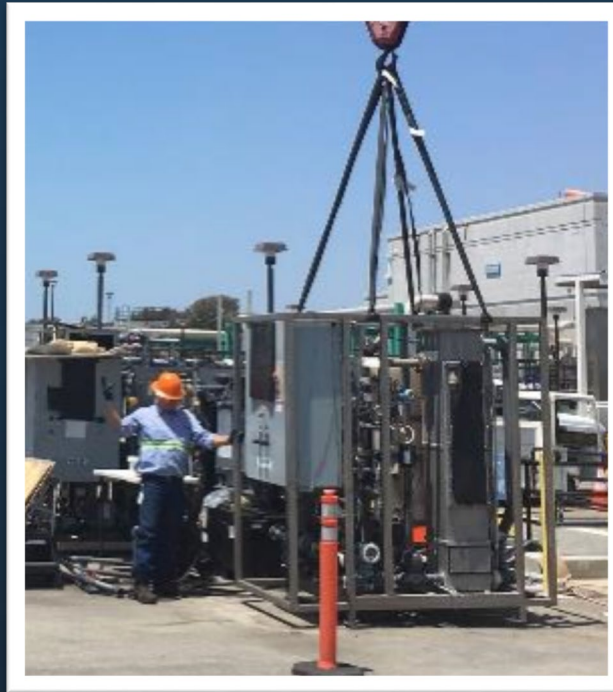
P2 Water Quality Affects:

- Higher Ammonia – Increase MF/RO Fouling
- Higher TDS – Increases RO feed pressure
- Increased Alkalinity – Increase in sulfuric acid use

Constituent	Current GWRS Influent	Predicted GWRSE Influent
Suspended Solids	5 mg/L	7.1 mg/L
Turbidity	2 NtU	3.1 NtU
Ammonia	2.1 mg/L	8.5 mg/L
Boron	0.38 mg/L	0.57 mg/L
Silica (SiO ₂)	20.2 mg/L	22.6 mg/L
Total Dissolved Solids	1035 mg/L	1408 mg/L
Total Organic Carbon	9.2 mg/L	10.3 mg/L
Alkalinity	196 mg/L	234 mg/L



PILOT TESTING AT PLANT NO. 2



Existing GWRS membranes plus membranes with good potential for installation as part of GWRSFE were further tested with Plant No. 2 effluent



RESULTS

- OCWD preference is to NOT have a piecemeal treatment facility with two or more different MF treatment processes operating separately.
- Current MF equipment on 36 cells are in good working order (new and improved headers, blowers, pumps, piping, etc)
 - Retrofit to scrap existing equipment not desirable
- GWRSFE design will match existing MF cells with the addition of maintenance washes and Sodium Hypochlorite cleaning capabilities
 - Allows for future potential of Evoqua, Scinor, or Toray membranes to be installed
 - Optimization pilot tests of these three membranes on GWRS predicted influent are still on-going
 - OCWD will select lowest net present worth membrane for GWRSFE new cells





GWRS Aerial View

QUESTIONS?

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