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)
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
• 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
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
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/H$_2$O$_2$ 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
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

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<thead>
<tr>
<th>Constituent</th>
<th>Current GWRS Influent</th>
<th>Predicted GWRSFE Influent</th>
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<tr>
<td>Suspended Solids</td>
<td>5 mg/L</td>
<td>7.1 mg/L</td>
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<tr>
<td>Turbidity</td>
<td>2 NtU</td>
<td>3.1 NtU</td>
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<tr>
<td>Ammonia</td>
<td>2.1 mg/L</td>
<td>8.5 mg/L</td>
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<tr>
<td>Boron</td>
<td>0.38 mg/L</td>
<td>0.57 mg/L</td>
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<tr>
<td>Silica (SiO2)</td>
<td>20.2 mg/L</td>
<td>22.6 mg/L</td>
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<tr>
<td>Total Dissolved Solids</td>
<td>1035 mg/L</td>
<td>1408 mg/L</td>
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<tr>
<td>Total Organic Carbon</td>
<td>9.2 mg/L</td>
<td>10.3 mg/L</td>
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<tr>
<td>Alkalinity</td>
<td>196 mg/L</td>
<td>234 mg/L</td>
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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
QUESTIONS?

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