



# Eastern Municipal Water District: A Desalination Success Story

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Lee Portillo, Black & Veatch

February 8, 2024



**BLACK & VEATCH**

# Acknowledgements

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- Thank you for the opportunity, Cal Desal
- Thank you to all involved
  - EMWD Team
  - Co-Author
    - Lee Portillo, Senior Process Technologist
      - Black & Veatch
  - Agency Partners
    - U.S. Army Corps of Engineers
    - State Water Resources Control Board
    - Metropolitan Water District of Southern California
  - Black & Veatch – Design Engineer
  - Parsons – Construction Manager
  - Kiewit Corporation – Contractor



SANTA ANA WATERSHED  
PROJECT AUTHORITY



**US Army Corps  
of Engineers.**



**BLACK & VEATCH**



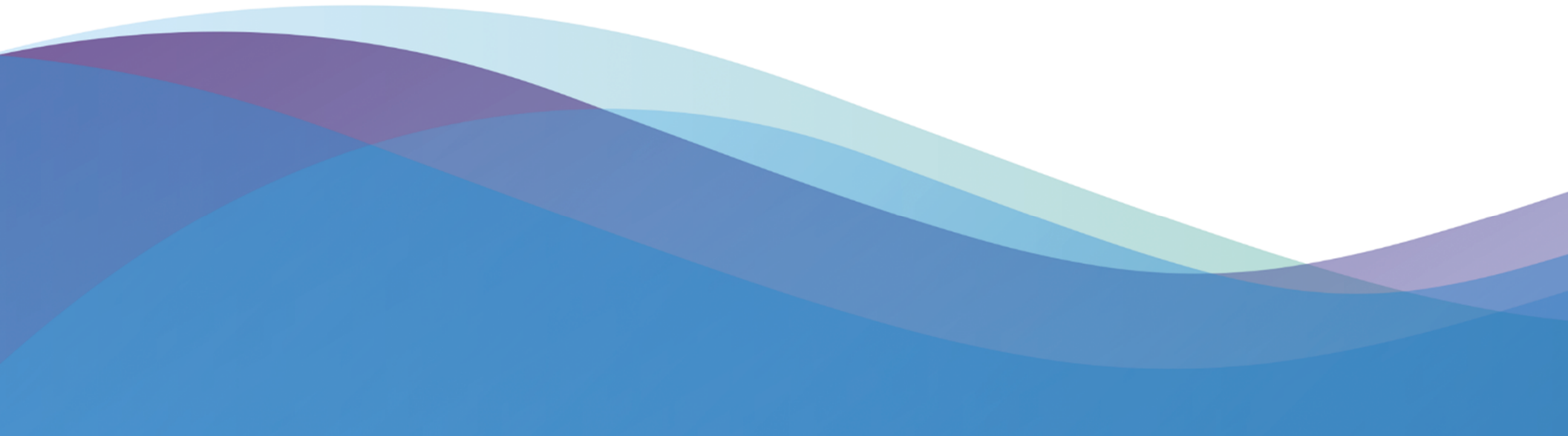
**Kiewit**







# Overview



ESTABLISHED IN  
**1950**



SERVES:



WATER / WASTEWATER / RECYCLED



WHOLESALE

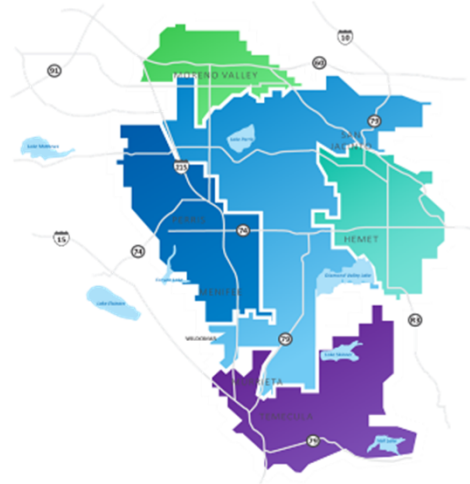
&

RETAIL



POPULATION NEARLY:

**1,000,000**



**601**  
SQUARE MILE  
SERVICE AREA

APPROXIMATELY

**43%** CURRENTLY  
BUILT OUT



ONE  
OF THE

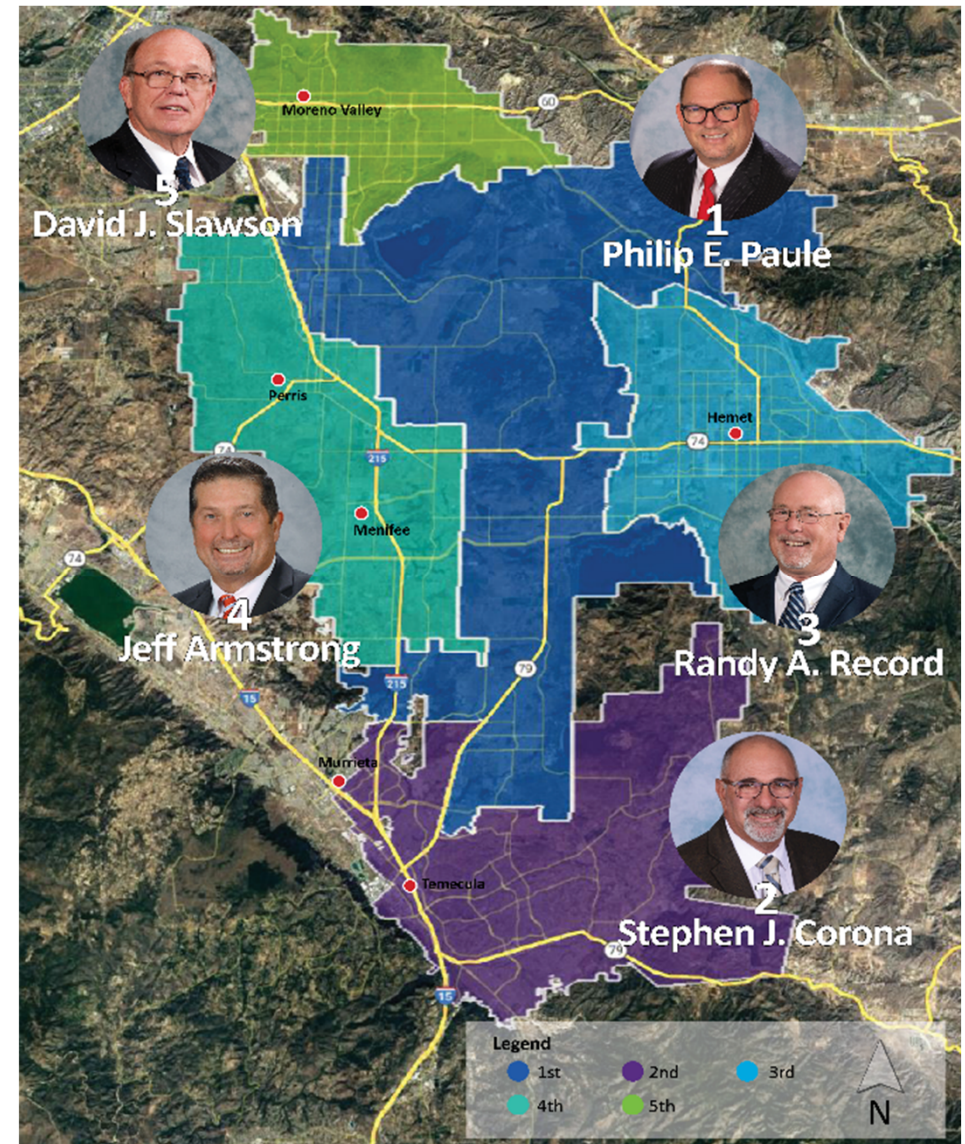


member agencies  
of The Metropolitan  
Water District of  
Southern California



# About EMWD

- Five division publicly-elected Board of Directors
- More than 600 employees
- Annual budget of 557 million for FY 2023-24
- Five-year capital improvement program of 686 million for FY 2023-24 to FY 2027-28
  - 115 million in external funding
  - More than 200 active capital projects
- Sixth largest public water utility in California



# EMWD Compared to Other Retail Water Agencies in California

## California's Largest Retail Water Agencies



## Western Riverside County Water Agencies Statewide Population Rankings



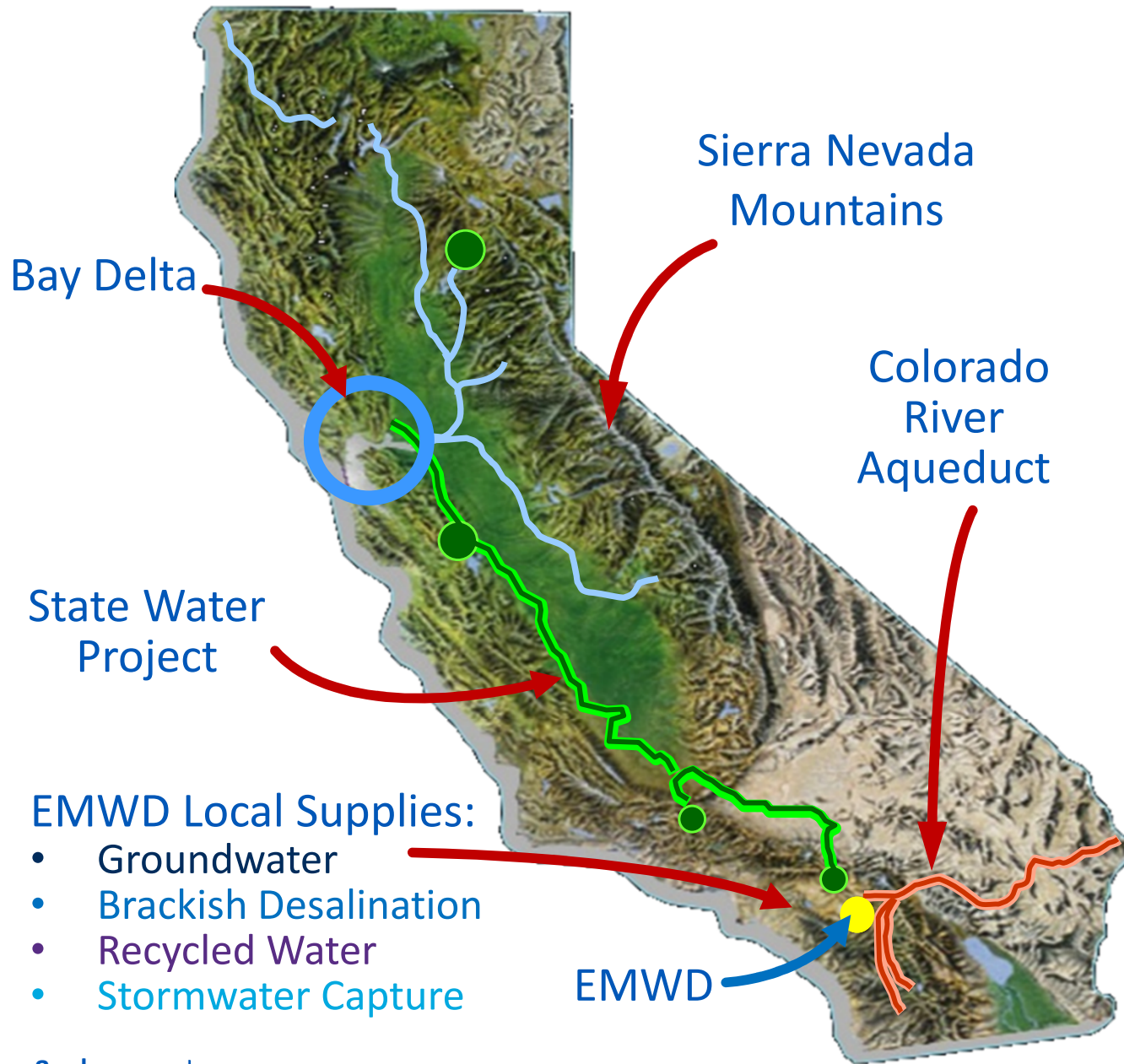


# EMWD's Service Area

- Moreno Valley to Temecula
- Seven cities and the unincorporated areas
- One of 26 member agencies of The Metropolitan Water District of Southern California (Metropolitan)
- EMWD Representative to Metropolitan:
  - Jeff Armstrong



# Sources of Water



- 26 member agencies
- Owns Colorado River Aqueduct
- State Water Project Contractor
- Imports water to meet half of Southern California retail demands
- Demand forecast in FY 23/24: 1.6 MAF

Best Practices  
in Water Use Efficiency

# Water Supply Portfolio

**Colorado River  
and State Water  
Project imported  
via Metropolitan  
44%**



**Recycled  
Water  
38%**



**Groundwater  
8%**



**Groundwater  
Desalination  
10%**

*Total Water Supply: 137,852 AF per  
EMWD Annual Comprehensive Financial Report, FYE 2023*



# Desalination Program



# Desalination Program Overview

- Brackish Desalination Objectives:
  - Develop substantial unused brackish groundwater in service area
  - Protect adjacent high quality groundwater basins from salinity intrusion
  - Decrease reliance on water supply imported from the Sacramento – San Francisco Bay Delta and the Colorado River
  - Increase local water supply reliability
  - Provides water supply to a disadvantaged community



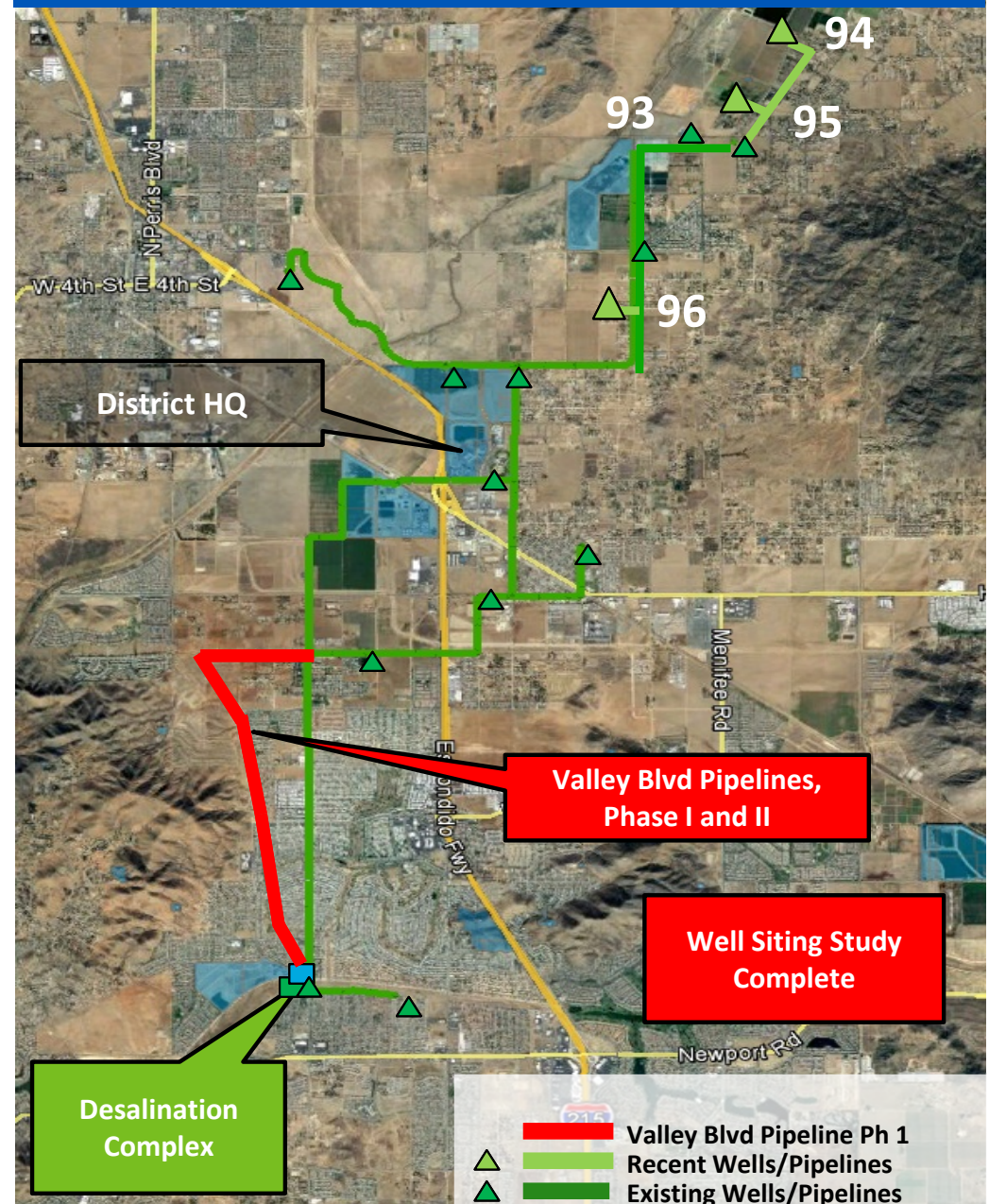
## Strategic Goals:

- Expand brackish desalination to provide more than 15,000-acre feet per year to serve 30,000 households
- Export 65,000 tons of salt annually at build-out

# Desalination Program

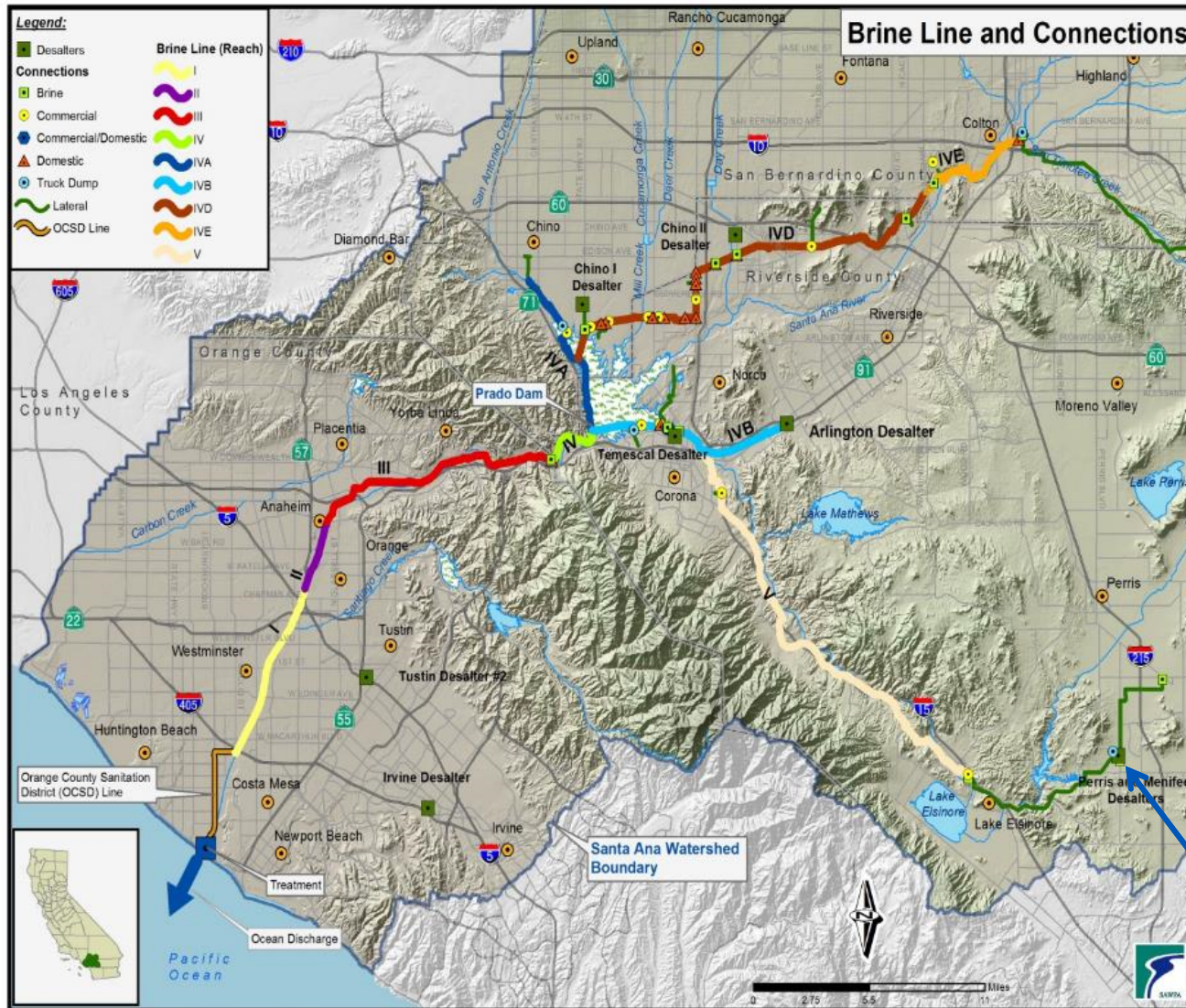
- 15 strategically located brackish groundwater wells
- Desalter feed pipelines
- Treatment facilities
  - Menifee and Perris I Desalters  
8.7 MGD
  - Perris II Desalter  
5.4 MGD
  - 14.1 MGD total capacity
- Brine management
  - Inland Empire Brine Line
    - 3.5 MGD Discharge
  - Brine recovery
    - Demonstration projects
      - Desalitech
      - Other

## Desalination Program – 2024





# Brine Disposal



- Constructed by a five agency Joint Powers Authority
- Partnership with SWRCB
- Pipeline is 70 miles
  - Capacity is 30 MGD
- Supports six desalters and industrial dischargers, including EMWD's desalters

EMWD  
Desalination  
Complex



# Perris II Desalter



# Perris II Desalter – Site Rendering



View of Facility from Valley Blvd, City of Menifee - Looking Northeast

EMWD Staff conducted extensive public outreach with local neighborhood which drove the architectural style of the facilities.

# Perris II Desalter Overview

- Program
  - 5.4 MGD RO Treatment Facility Phase I
    - Expandable to 10.8 MGD (Phase II)
  - Brine Pumping Facilities
  - 4 Brackish Groundwater Wells
  - Brackish Conveyance Pipelines
- Funding Support
  - 22,500,000 grant from SWRCB Prop. 1, 50% match
  - 1,000,000 grant from SWRCB Prop. 84 (SAWPA OWOW), 25% match
  - 13,185,369 WRDA from USACE
  - MWD LRP Subsidy
    - Fixed rate contribution of \$215 per acre foot produced
    - 5,500 acre feet per year maximum production yield
    - 25-year term; approx. 29.6 million contribution



**Scan Me for more Information  
on Perris II Desalter**





# New Perris II Desalter Online

- Perris II Desalter
  - 5.4 MGD Reverse Osmosis (RO) Treatment and related improved brine pumping facilities
  - Online in Summer 2022
- Associated projects underway to drive reliability and next expansion
  - Brine Pipeline Maintenance Access Improvements
  - Future Brackish Well Sites
  - Valley Blvd. Brackish Transmission Line
- USACE and SWRCB Partnership



*Perris II Desalter Valve Turning Ceremony*



*Perris II Desalter – Process Room*

# Water Delivery in a Cost-Effective Manner

**Table 1 - Perris II Desalter Phase I (5.4 MGD) - Treatment, Wells, and Pipeline Cost Summary (\$, USD)**

Project Heading	EMWD Cost	USACE Cost	Total Cost
Well 93 Drilling and Equipping	4,374,416	-	4,374,416
Well 94, 95, & 96 Drilling and Equipping	3,358,001	10,107,000	13,465,001
Wells 94, 95, & 96 Discharge Pipelines	415,567	1,247,000	1,662,567
Raw Water Transmission Main - 1207W	998,574	990,791	1,989,365
Property Acquisition Costs	50,000	840,578	890,578
Perris II Desalination Facility/Brine Pumping Facility	80,000,000	-	80,000,000
<b>Totals</b>	<b>89,196,558</b>	<b>13,185,369</b>	<b>102,381,927</b>

Note: Well Flow is 3750 gpm or 6,048 AFY, Product Water Flow is 5444 AFY with 90% uptime. See table 2 for incentives.



# Water Delivery in a Cost-Effective Manner

**Table 2 - Perris II Desalter Phase I (5.4 MGD) - Cost Summary w/ Incentives (\$, USD)**

Description	EMWD Cost	EMWD Cost w/ Incentives	Total Cost w/o Incentives
<b>Total Costs, Table 1</b>	89,196,558		102,381,927
State Prop 1 Grant		22,498,250	
State Prop 84 Grant - SAWPA - Well 93		1,000,000	
<b>Total Cost w/ Grants</b>		65,698,308	
<b>Annual O&amp;M (\$600/AFY) – Year 1</b>	3,266,125	3,266,125	3,266,125
<b>Amortized Capital Cost (3.5%, 30-yr)</b>	4,849,736	3,572,104	5,566,642
<b>Total Annual Cost (Amortized Cap + Annual O&amp;M)</b>	8,115,861	6,838,230	8,832,767
<b>Annual Cost (/AFY)</b>	1,491	1,256	1,623
<b>Adjusted LRP Contribution per AF</b>	196	196	
<b>Annual Cost (\$/AFY) w/ LRP</b>	<b>1,295</b>	<b>1,060</b>	<b>1,623</b>
<b>MWD Tier 1 Rate 2024 Full Service Treated Volumetric Cost (\$/AF)</b>	1,256	1,256	1,256
<b>Difference/Savings</b>	39	(196)	367

Note: Base LRP per AF is 215, LRP adjusted for grant funding received.

# Integrated Desalter Infrastructure

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- 13 Northern Wells
  - Brackish water quality
  - Relatively fair quality but sediment, silica, iron, manganese
- 2 Southern Wells
  - Brackish water quality
  - Relatively poor-quality pH, sediment, silica, iron, manganese
- Menifee Desalter
  - Legacy RO Design, low recovery
- Perris I Desalter
  - Energy recovery design, low recovery
- Integrated Chemical Facility
- Pre-existing Brine Line

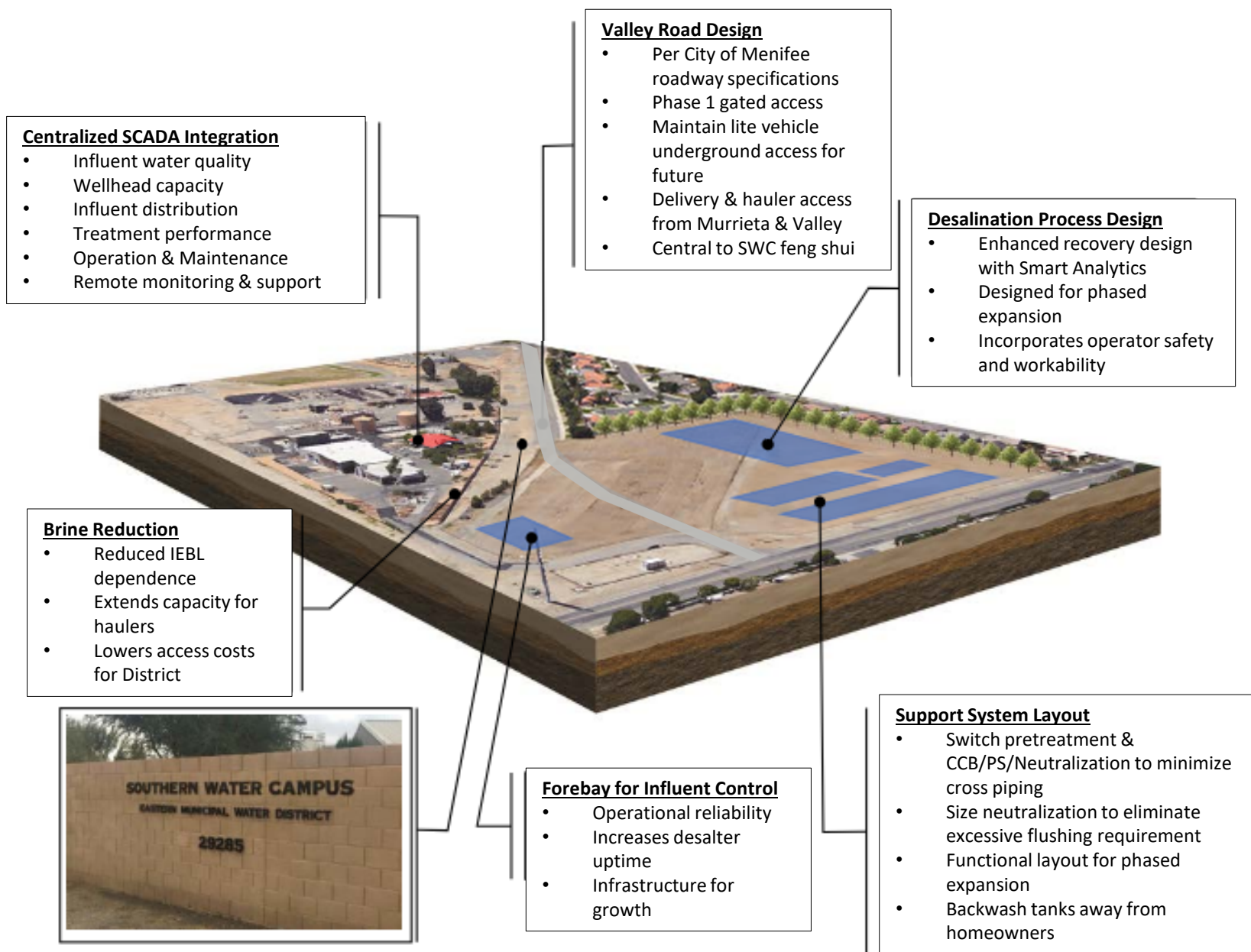
# Integrated Desalter Design Challenge

- How to Design and integrate a new facility that:
  - Adds a new brackish water desalter facility
  - Increases overall annual water production
  - Improves source water recovery and;
  - Improves operator efficiency across all integrated infrastructure





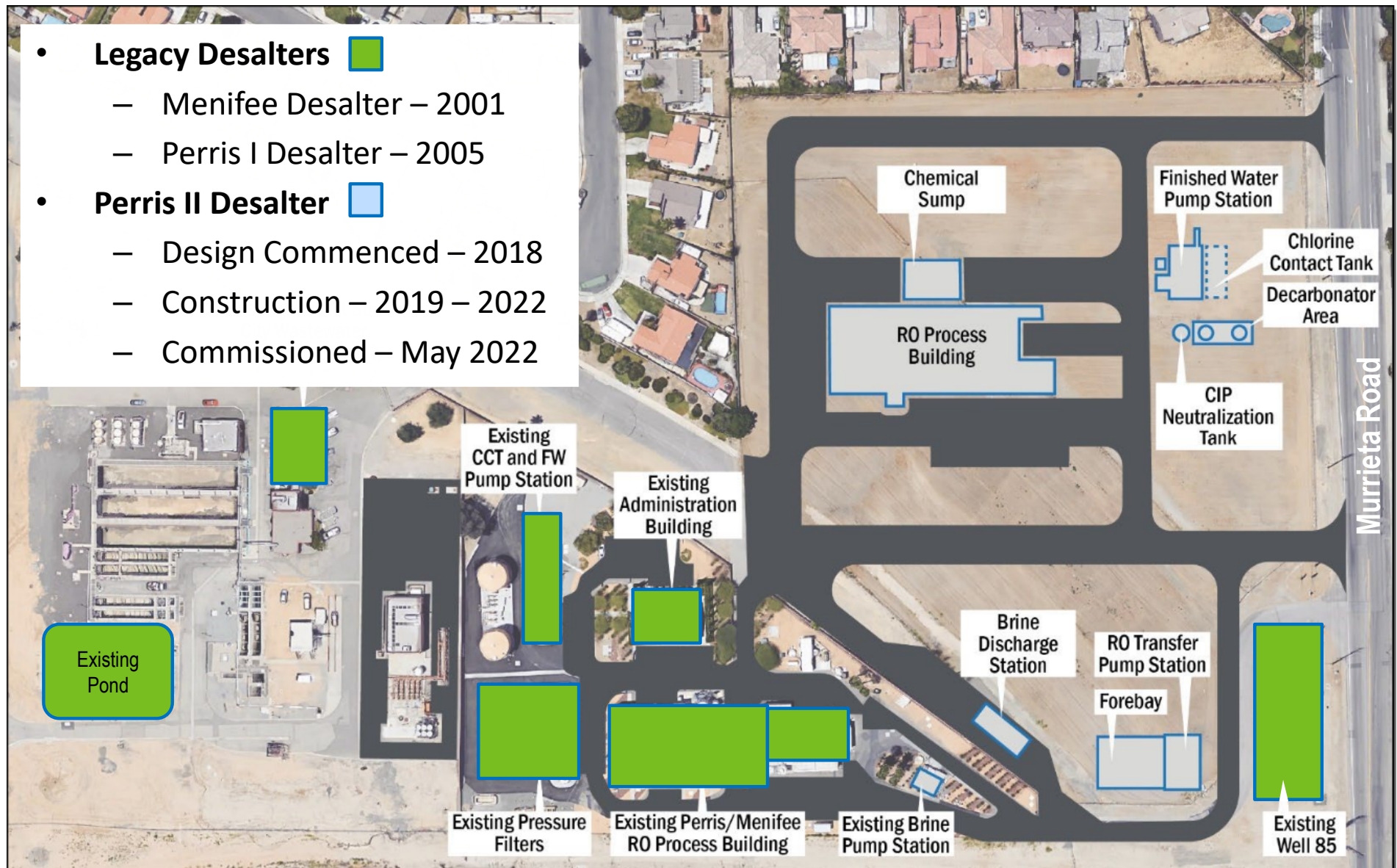


# EMWD Desalter Original Ideation

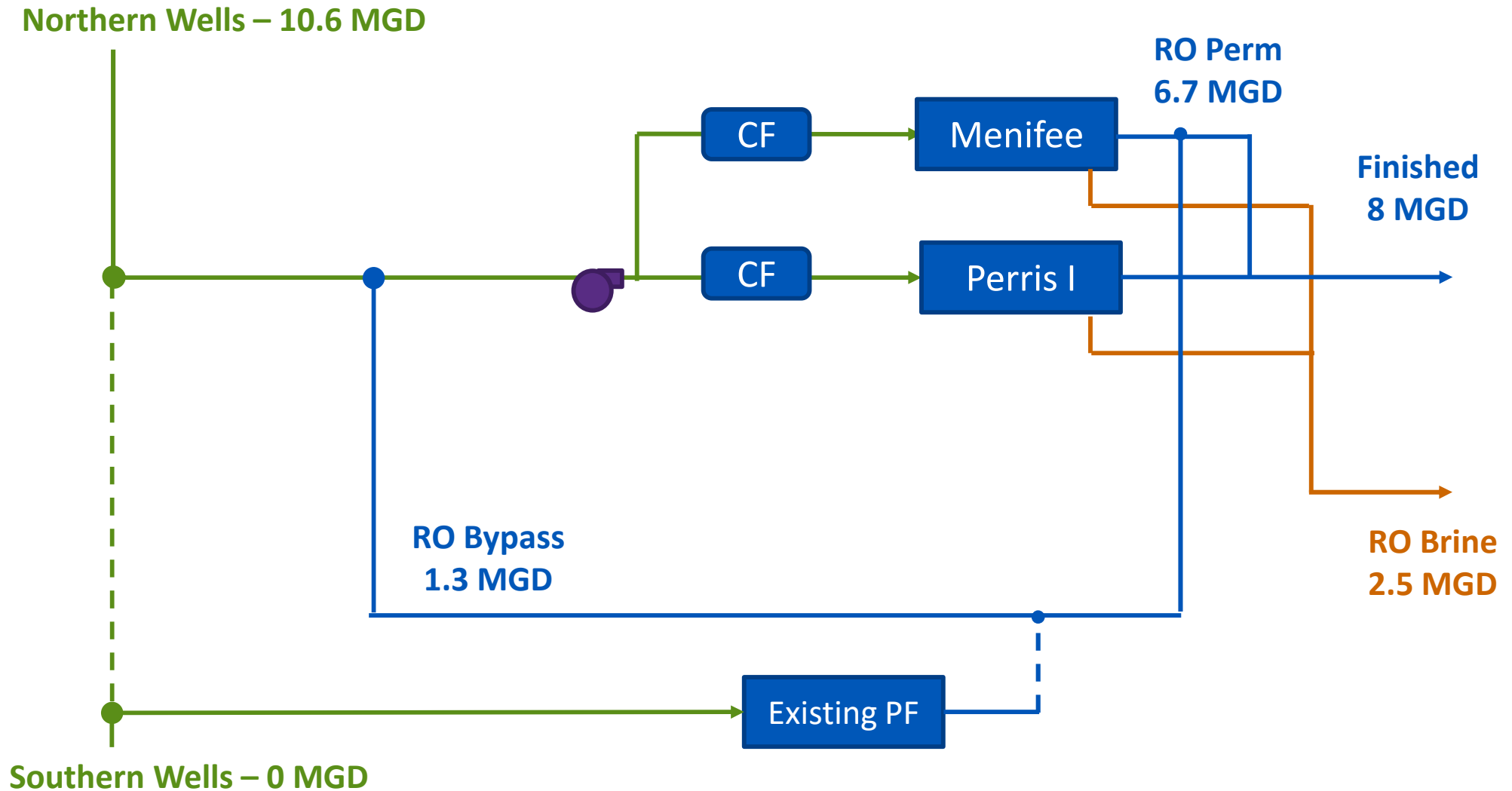


# EMWD Desalination Complex

- **Legacy Desalters** 
  - Meniffee Desalter – 2001
  - Perris I Desalter – 2005
- **Perris II Desalter** 
  - Design Commenced – 2018
  - Construction – 2019 – 2022
  - Commissioned – May 2022

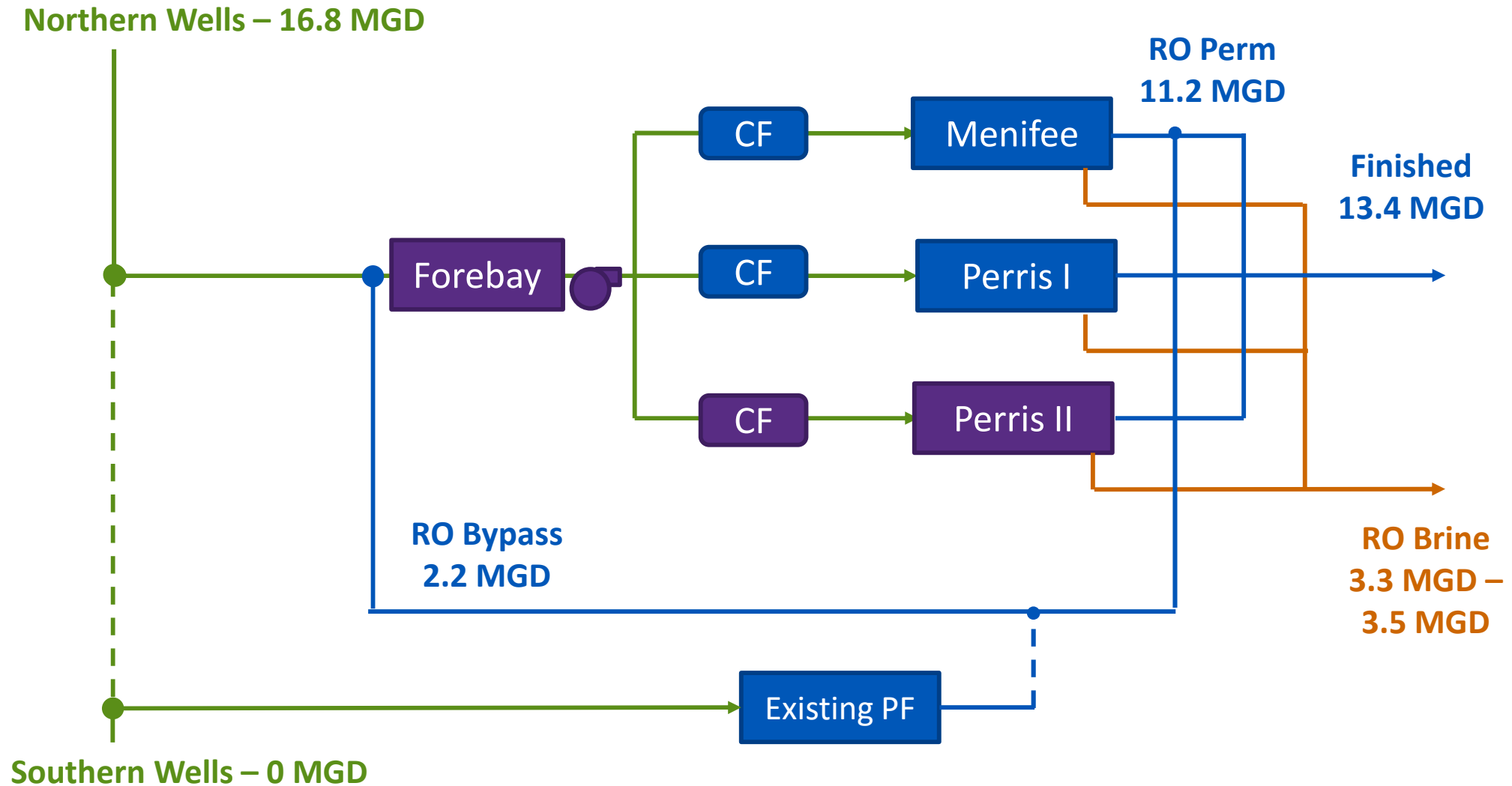


# Legacy Desalters



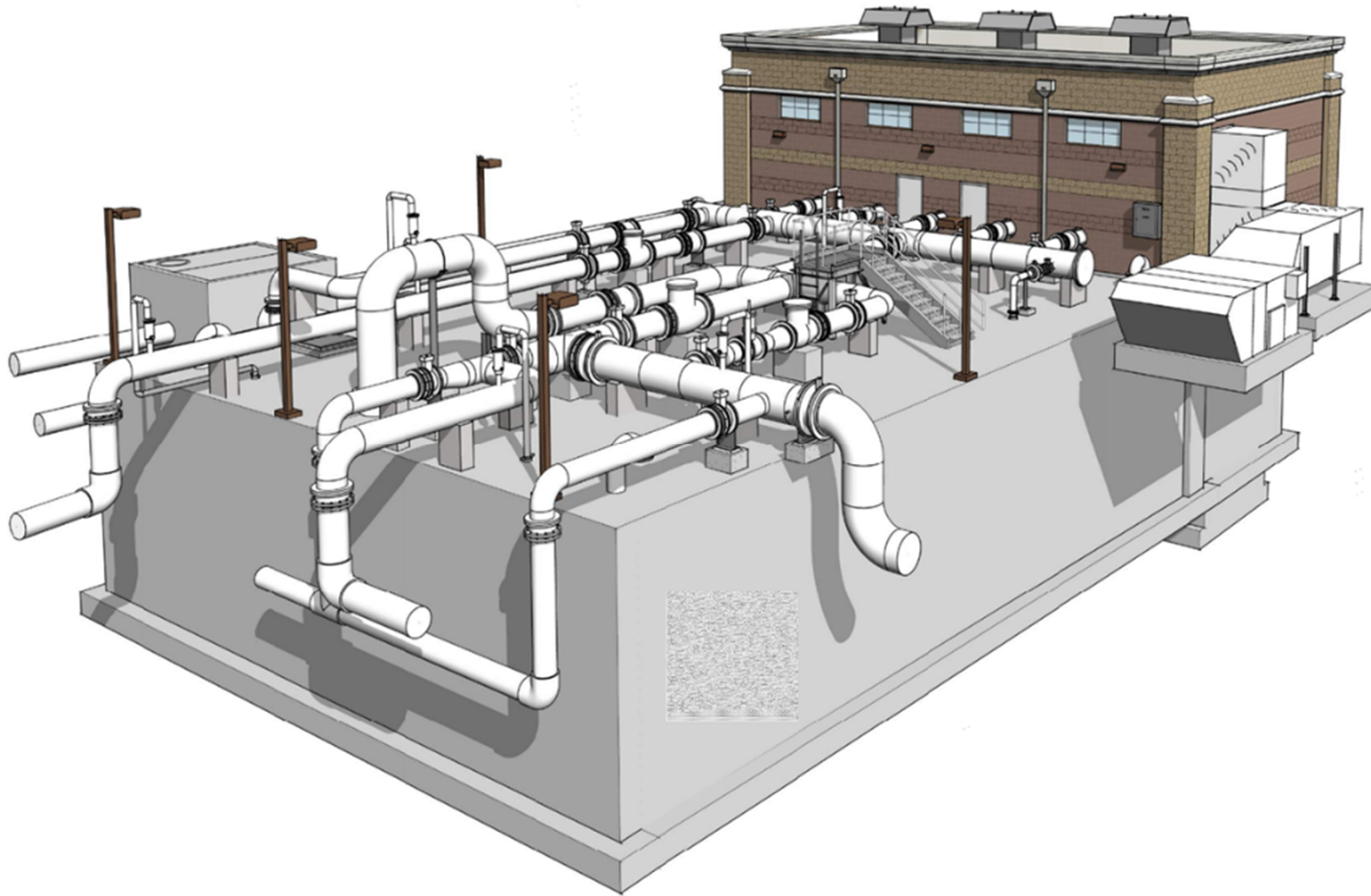


# Integrated Infrastructure Forebay and Bypass Lines



# Forebay - Pipe Infrastructure

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Forebay was engineering innovation added to increase annual production and RO uptime by eliminating direct well field connection and to provide global raw water bypass control

# Forebay - Pipe Infrastructure



Forebay was engineering innovation added to increase annual production and RO uptime by eliminating direct well field connection and to provide global raw water bypass control



# Design Impacts from Operators

- Benefits
  - Reaction time between northern well field and desalters
    - seconds to half an hour
  - Reduced shutdowns due to wellfield equipment issues
  - Allowed for utilization of southern wells for bypass
  - Increased annual uptime and production
- Detriments
  - Added another “system” to total operations
  - Accumulates sediment during well upsets



# EMWD Desalter Water Quality Limiting Recovery

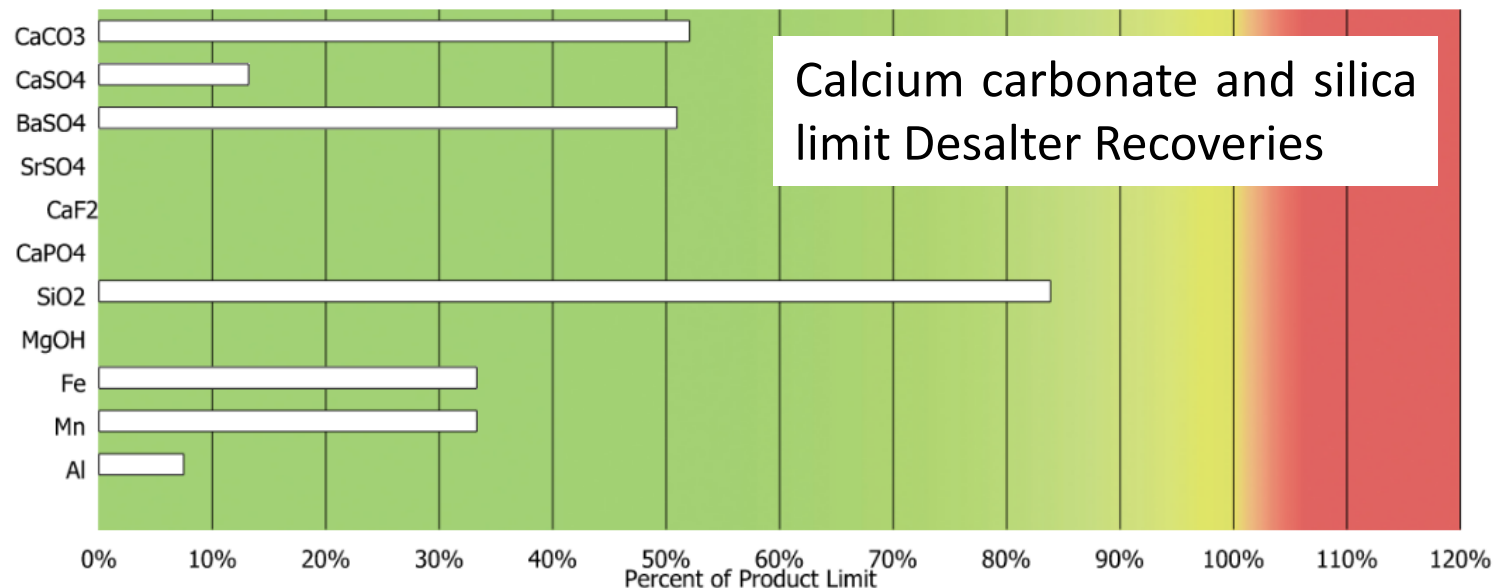
- **Two Stage Legacy Desalters**

- Total Feed Required – 10.6 mgd
- Menifee Permeate – 2.4 mgd
- Perris I Permeate – 4.3 mgd
- Finished w/ bypass – 8.1 mgd
- Average RO Recovery – 72.5%

- **Three Stage Perris II Desalter**

- Includes Flux Balancing
- PIID Feed Required – 6.2 mgd
- Permeate – 4.5 mgd
- Finished w/ bypass – 5.4 mgd
- Design RO Recovery – 85%

## Saturation Indices





# Perris II Desalter – Process Room



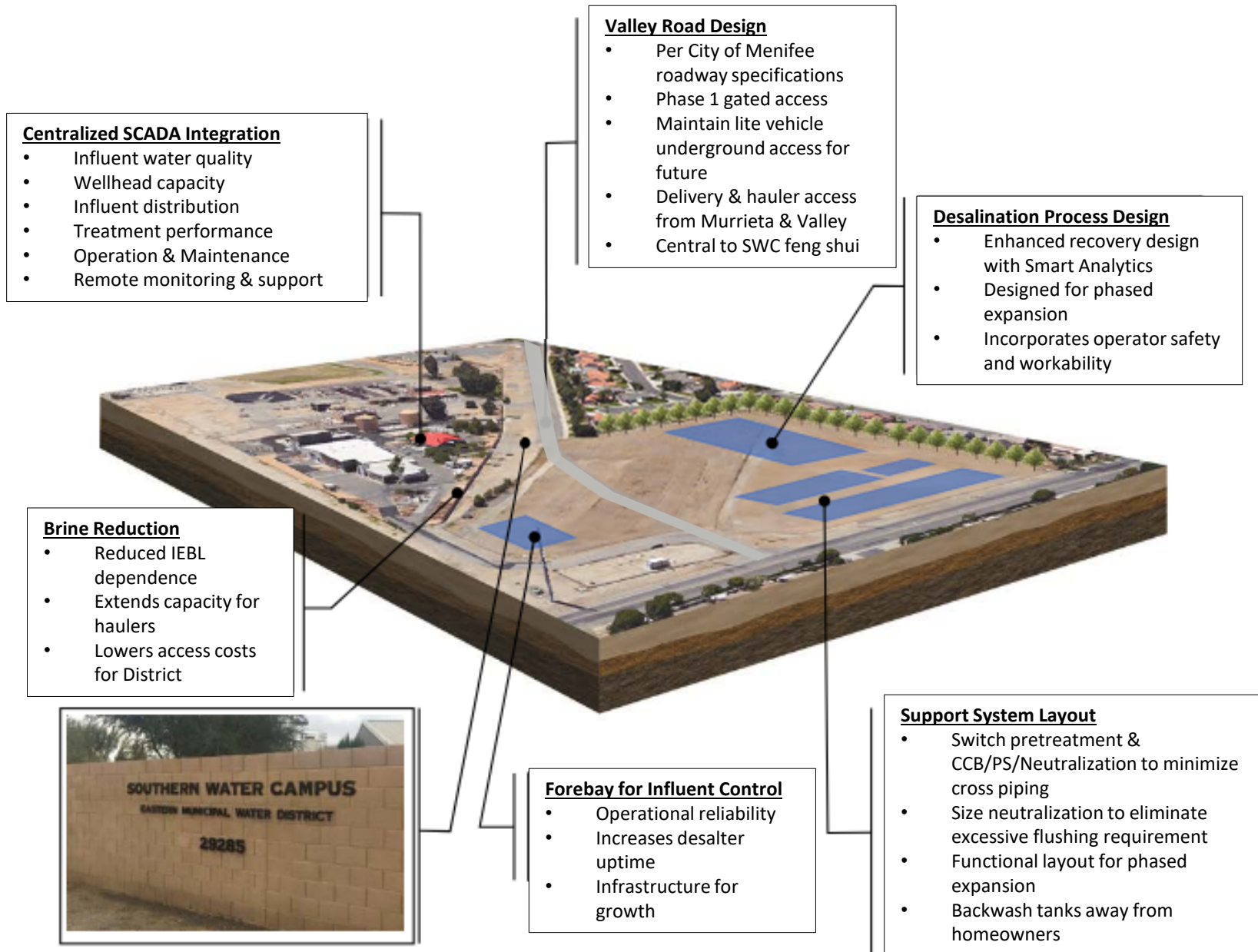


# Perris II Desalter – Process Room





# EMWD Desalter Original Ideation



# Final Site







# Conclusion

# EMWD Water Supply Future

- Partnerships and Diversification
  - Funding Partners
  - Other Agencies
    - South Coast Water District
      - Doheny Desalination Project



DOHENY OCEAN  
**DESALINATION**  
P R O J E C T

*Local Water, Local Control.*  
Sponsored by South Coast Water District



**Scan Me for a Virtual  
Tour of the EMWD  
Desalination Complex**



## Contact Information

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