



EASTERN MUNICIPAL WATER DISTRICT

AquaSel™ Brine Concentration Pilot Project Update

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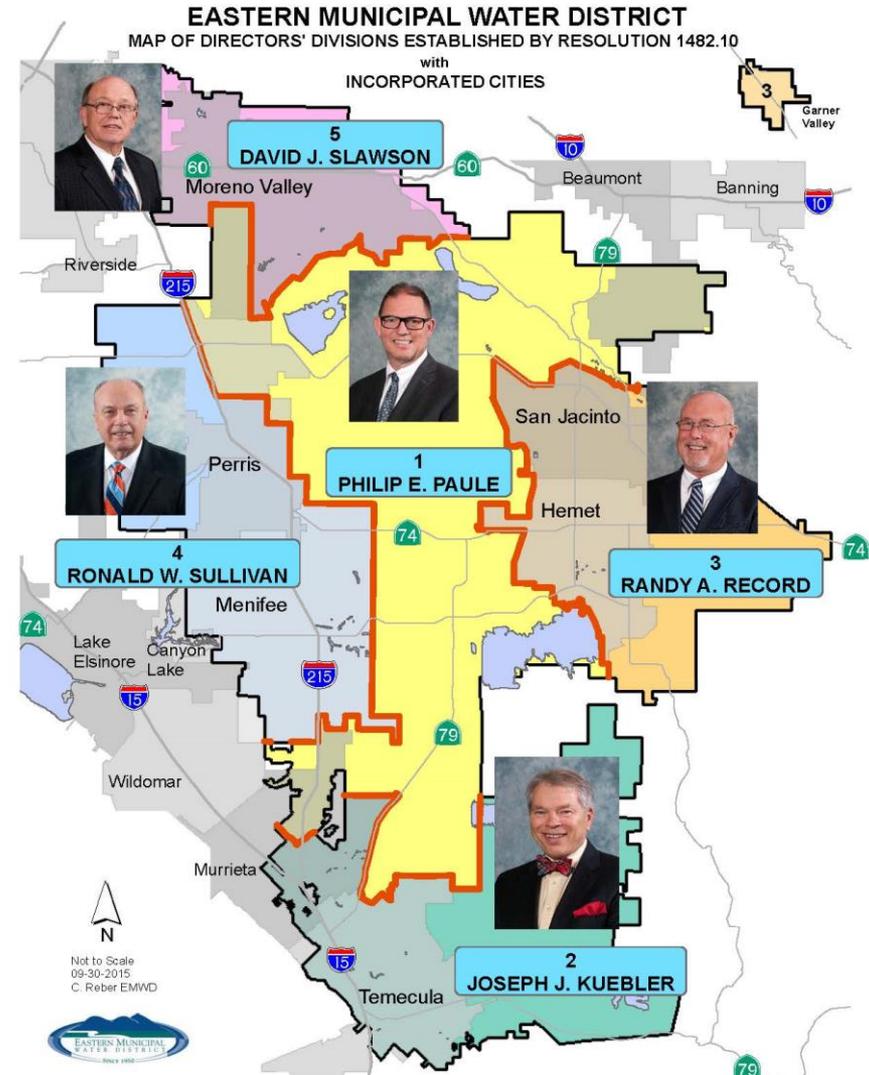


Overview of EMWD

About EMWD



- Established in 1950
- Unique agency, serving:
 - Water/wastewater/recycled
 - Wholesale and retail
- One of more than 600 water purveyors in California
- Five district-elected board members
- More than 600 employees
- Annual operating budget of \$262 million
- Five year capital program of \$484 million



EMWD's Service Area



- 555 square miles
- Population: 785,000
- Seven cities and the unincorporated areas of western Riverside County
- One of 26 member agencies of The Metropolitan Water District of Southern California (MWD)



- **Potable Drinking Water**

- Approx. 142,000 accounts
- 94,528 AF sold in 2014/2015
 - Imported water from the Bay Delta and Colorado River
 - Groundwater wells (managed basin)
 - Menifee and Perris brackish groundwater desalters



- **Wastewater**

- Approx. 237,000 accounts
- 4 regional water reclamation facilities
 - Treating 45 million gallons/day (MGD)



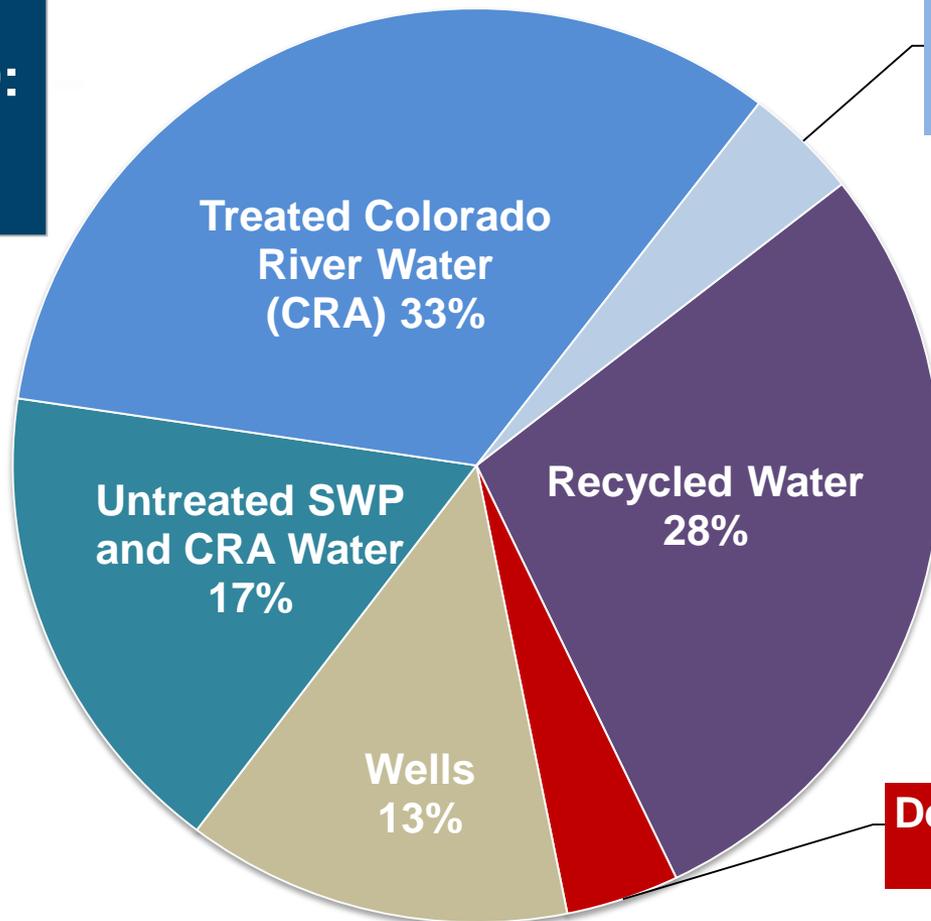
- **Recycled water**

- Approx. 300 accounts
- 38,900 AF sold in 2014
- 10,800 acres of agriculture irrigation

EMWD Water Supply Overview



**Imported Water
Supply from MWD:
71,628 AF
54%**



**Treated State
Water Project
(SWP) 4%**

**Local Water
Supply:
60,367 AF
46%**

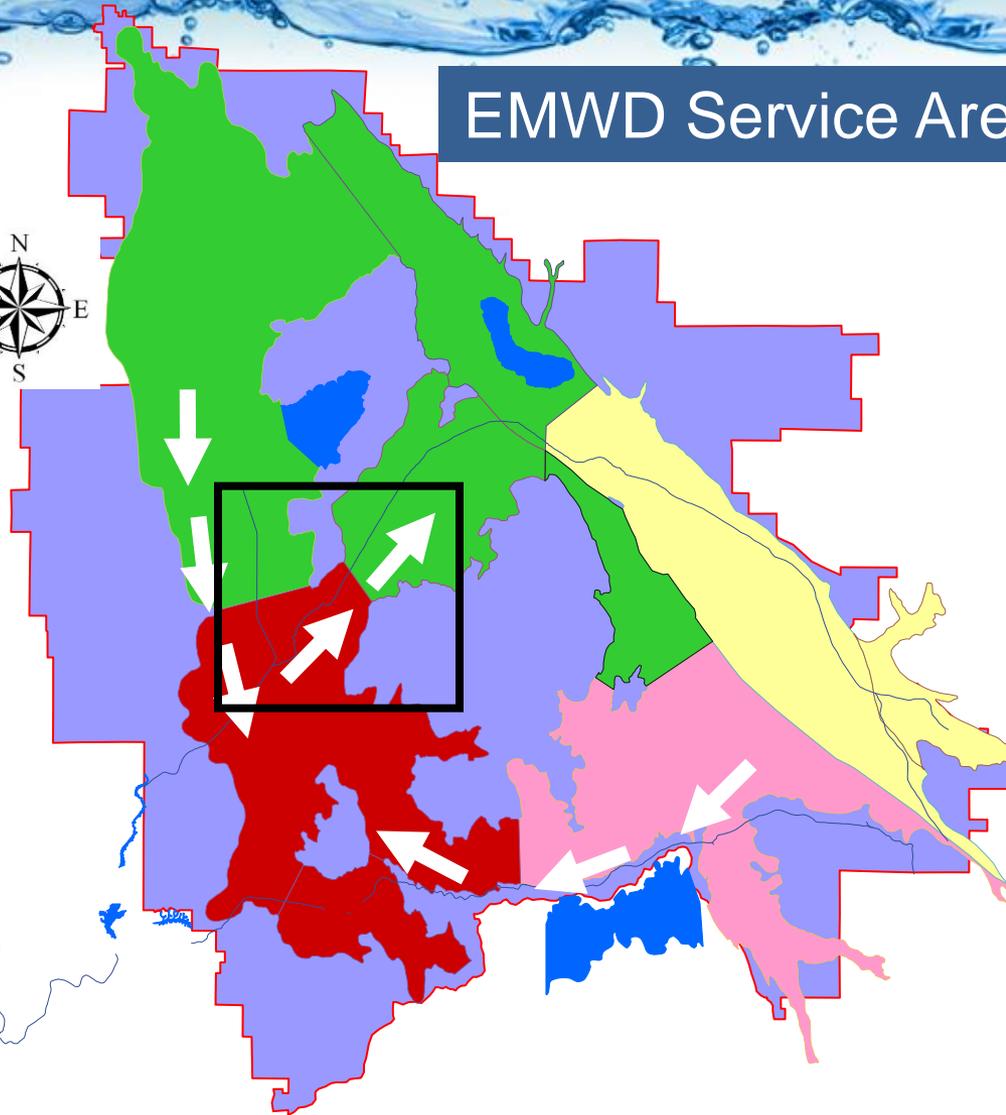
**Desalination
4%**



EMWD's Brackish Groundwater Desalination Program

Salinity Management

EMWD Service Area and Groundwater Basins



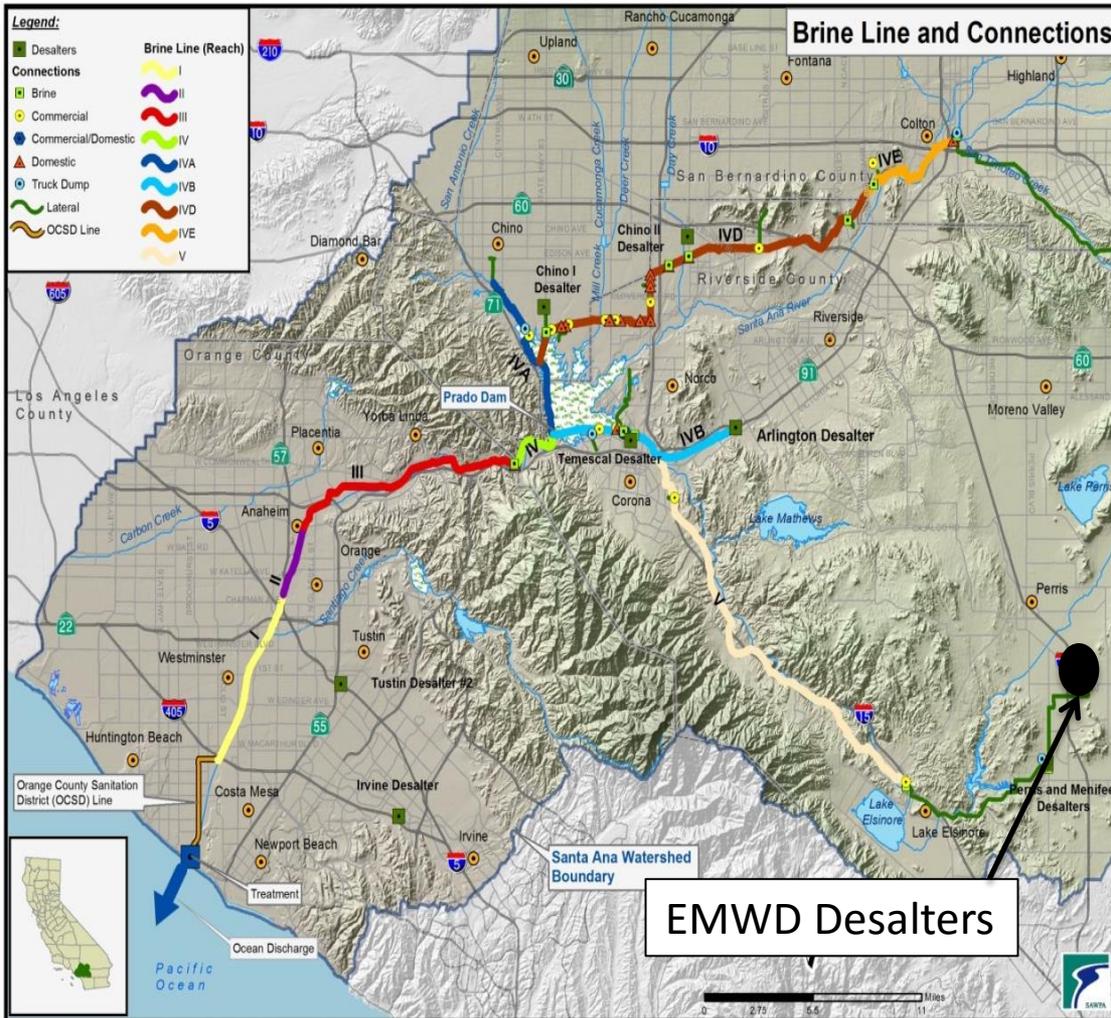
Groundwater Basin

- Canyon - 230 mg/l
- S.J. Up. Press. - 320 mg/l
- S.J. Low. Press. - 520 mg/l
- Lakeview - 520 mg/l
- Hemet North - 520 mg/l
- Perris North - 570 mg/l
- Hemet South - 730 mg/l
- Menifee - 1020 mg/l
- Perris South - 1260 mg/l

- Brackish Groundwater Production Wells
- Desalter Feed Pipelines
- Treatment Facilities
 - Meniffee Desalter (3.1 MGD)
 - Perris I Desalter (5.6 MGD)
 - Perris II Desalter (future)
- Brine Disposal
 - Inland Empire Brine Line
 - On-site recovery (future)



Brine Disposal Options



- Constructed by a Five Agency Joint Powers Authority
- Pipeline is 70 miles long
- Capacity is 32.6 MGD
- Supports Six Desalters and Industrial Dischargers Including EMWD's Perris and Menifee Desalters
- EMWD has 5.9 MGD Pipeline Capacity and is currently using about 2.3 MGD

- **Purchased Cost for Pipeline Capacity ~ \$3.75M/MG**
 - \$8.6M Total
- **Cost for O&M \$1.05M/year**



EMWD's AquaSel™ Brine Concentration Pilot Project

AquaSel™ Brine Recovery Technology



- Improves desalting efficiency from 75% to 95%
- Completed a six month pilot test in August 2015
- Promising operational performance:
 - 1,700 hours of operation
 - 320 hours of continuous run-time
- Achieved 95% overall water recovery from brackish groundwater
- Total pilot project cost - \$512,000
 - MWD's Foundational Action Program funding - \$192,000
 - USBR funding - \$131,000
 - Also providing technical support (current peer review).



GE Power & Water
Water & Process Technologies

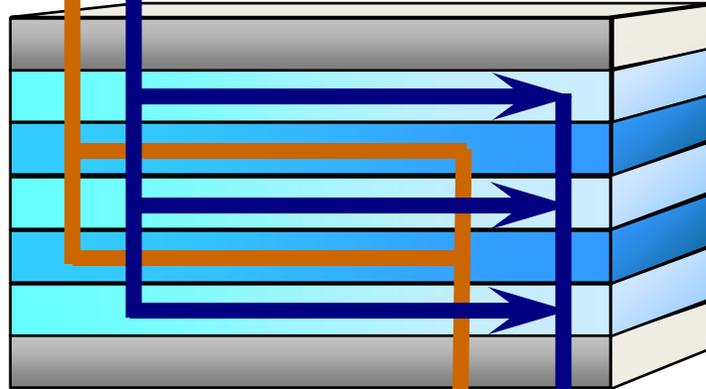
EDR Process



Feed



Concentrate Make-up



Concentrate Recycle

Product

Concentrate Blowdown

AquaSel Process



Feed

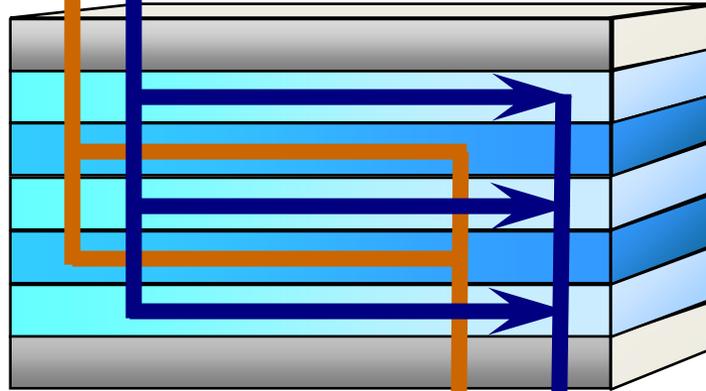


Concentrate Make-up



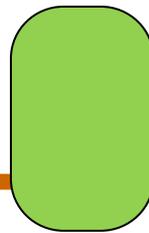
Concentrate Recycle

HCl



Product

H_2SO_4



Precipitator

Concentrate Blowdown
Slurry of precipitated salt

Pilot System Water Quality



Parameter	Units	Value
RO Recovery		75%
Calcium	mg/l	1079
Magnesium	mg/l	260.6
Sodium	mg/l	774
Potassium	mg/l	25.7
Strontium	mg/l	6.1
Barium	mg/l	0.75
Ammonia	mg/l	< 0.5
Bicarbonate	mg/l	809
Sulfate	mg/l	489
Chloride	mg/l	2,953
Fluoride	mg/l	0.61
Nitrate	mg/l	97
Total PO ₄	mg/l	4.1
Silica (total)	mg/l	154
Total Hardness	CaCO ₃	3,772
TDS	mg/l	~6,500 – 7,500
Conductivity	uS/cm	10,500
pH		7.4

Pilot Feed (Desalter Brine)



Product Targets

Parameter	Value
TDS (mg/l)	< 2,000 – 2,200
Conductivity (uS/cm)	3,300

Site Photos



**EDR Pilot
Container**



Precipitator



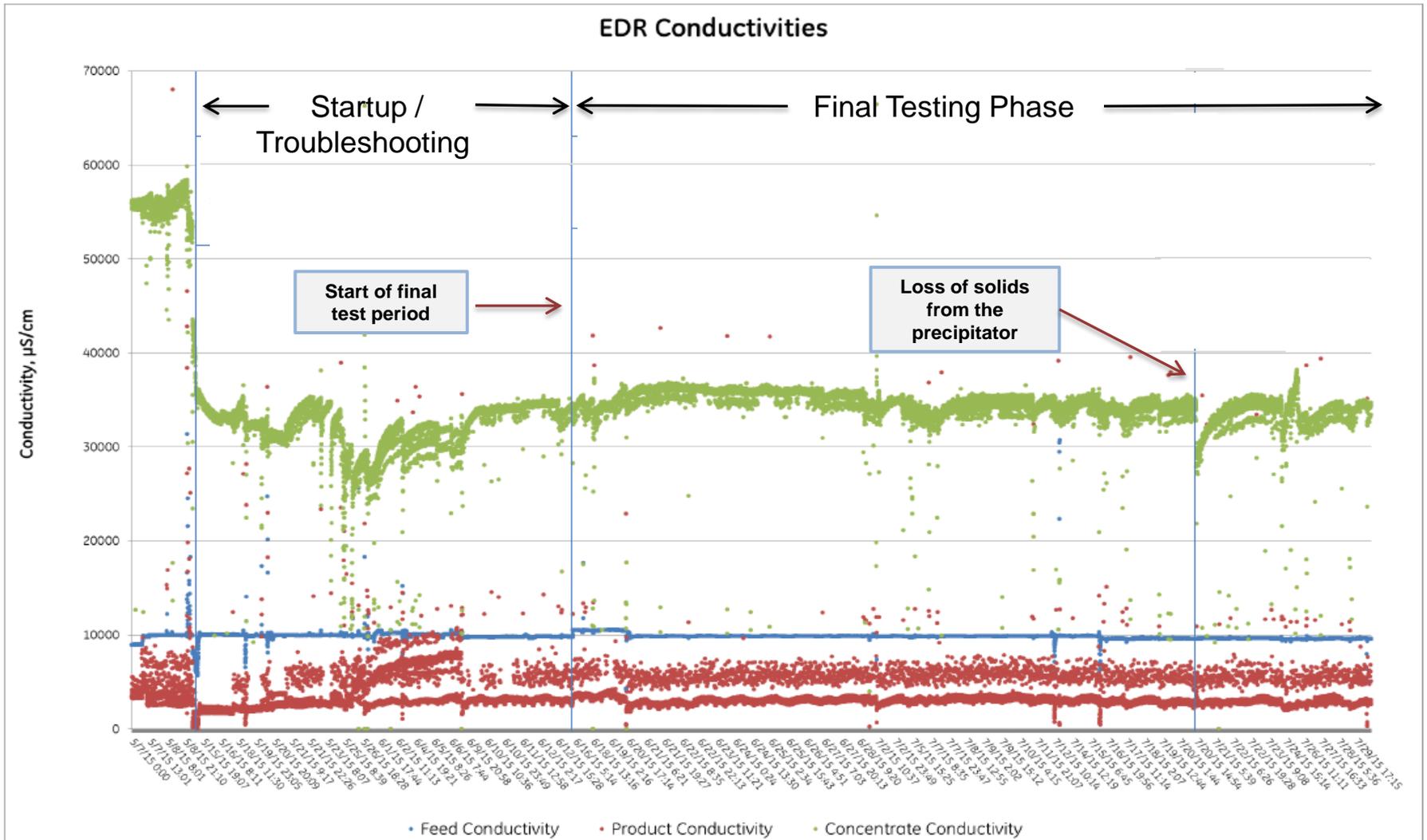
**EDR Stack
(inside container)**

Precipitator

- Designed for controlled gypsum precipitation
- Continuous mixing zone maintains solids in solution vs. settling in bottom of precipitator
- Operates at reduced pH
 - H_2SO_4 added
- Monitored daily for solids loading
- Purged on a periodic basis to maintain chemistry



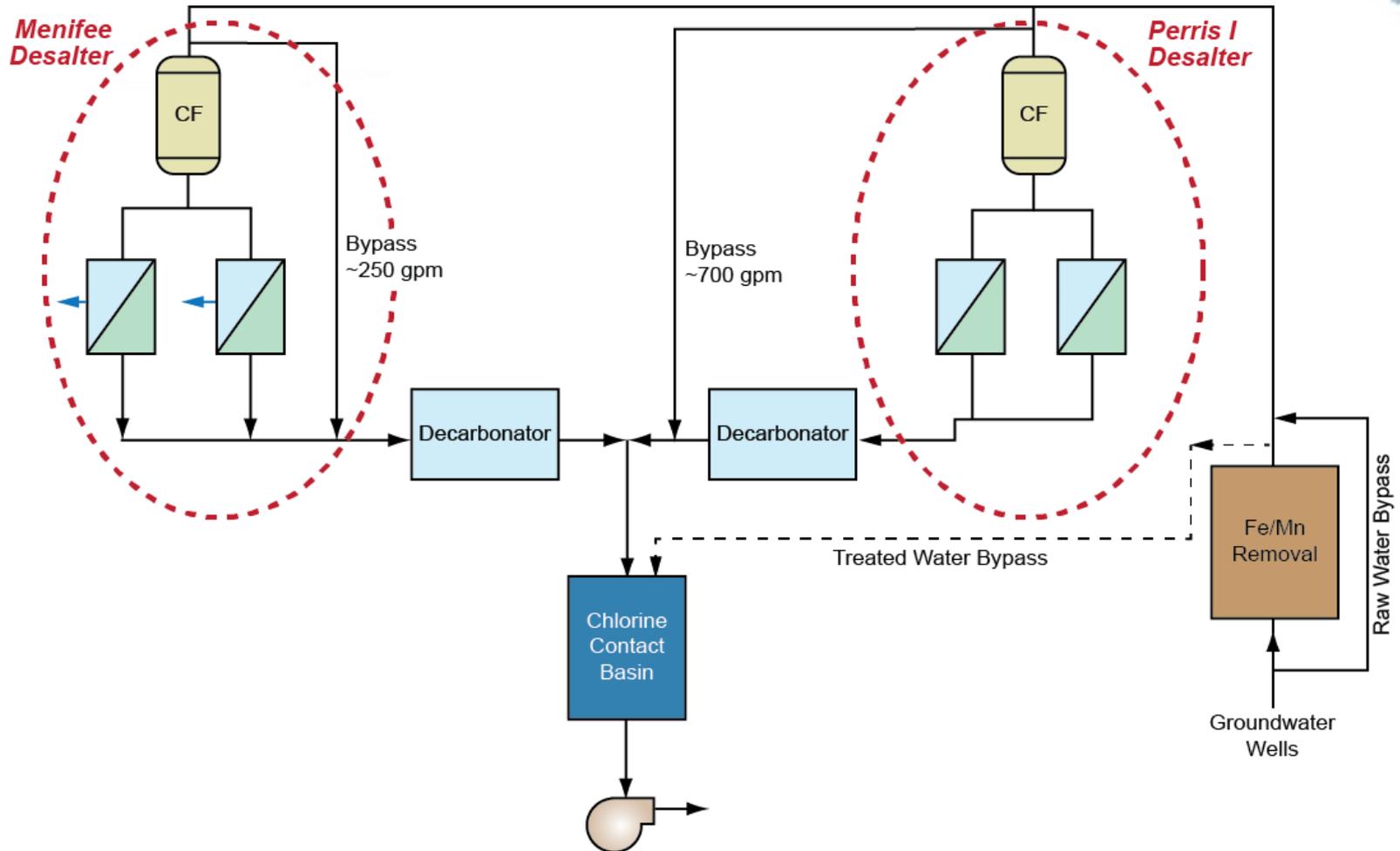
Pilot Plant Performance Overview



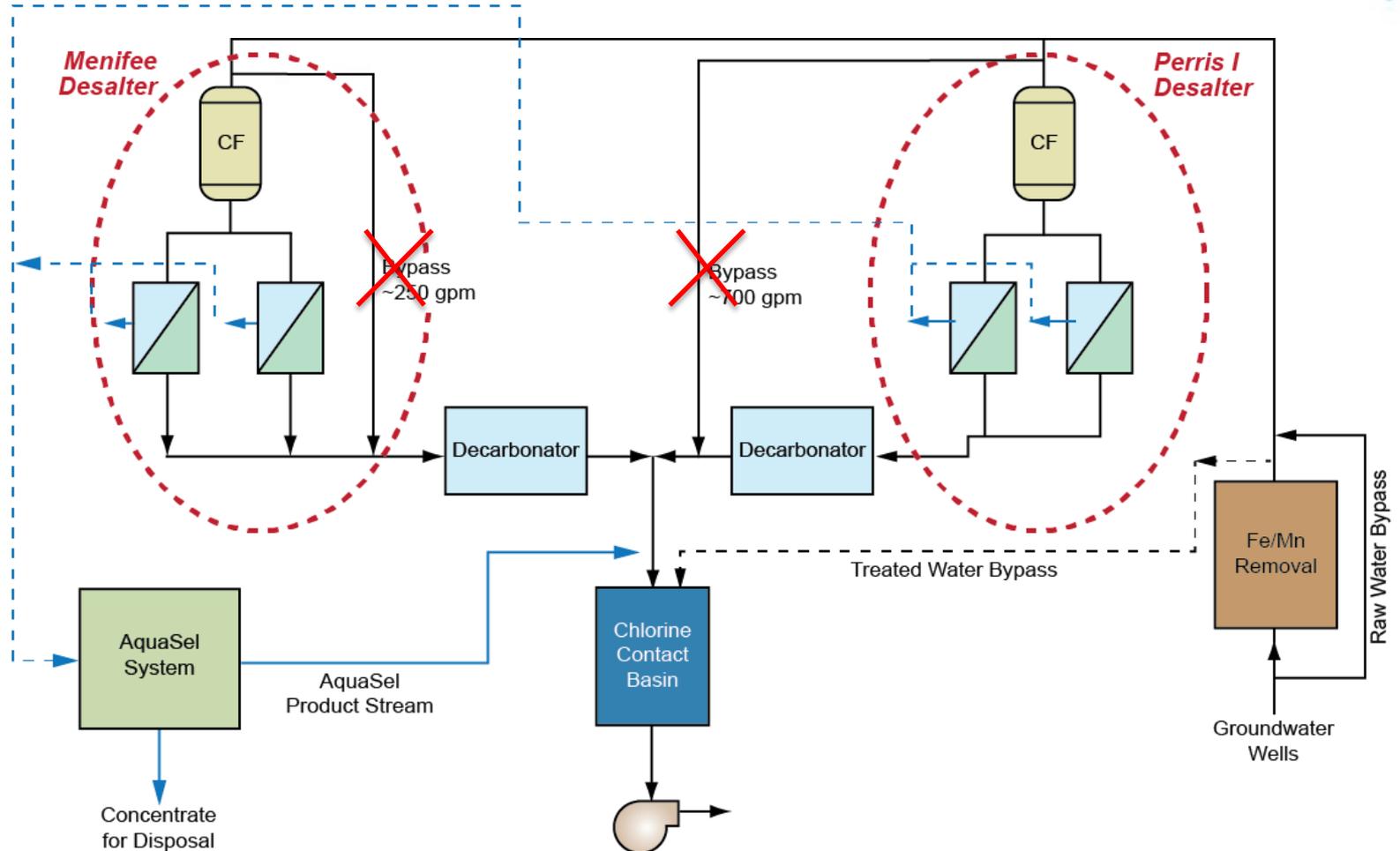


Alternatives for Integrating AquaSel™ with EMWD's Desalters

Menifee and Perris Desalter Configuration



Implementation Alternative 1



Results - Alternative 1

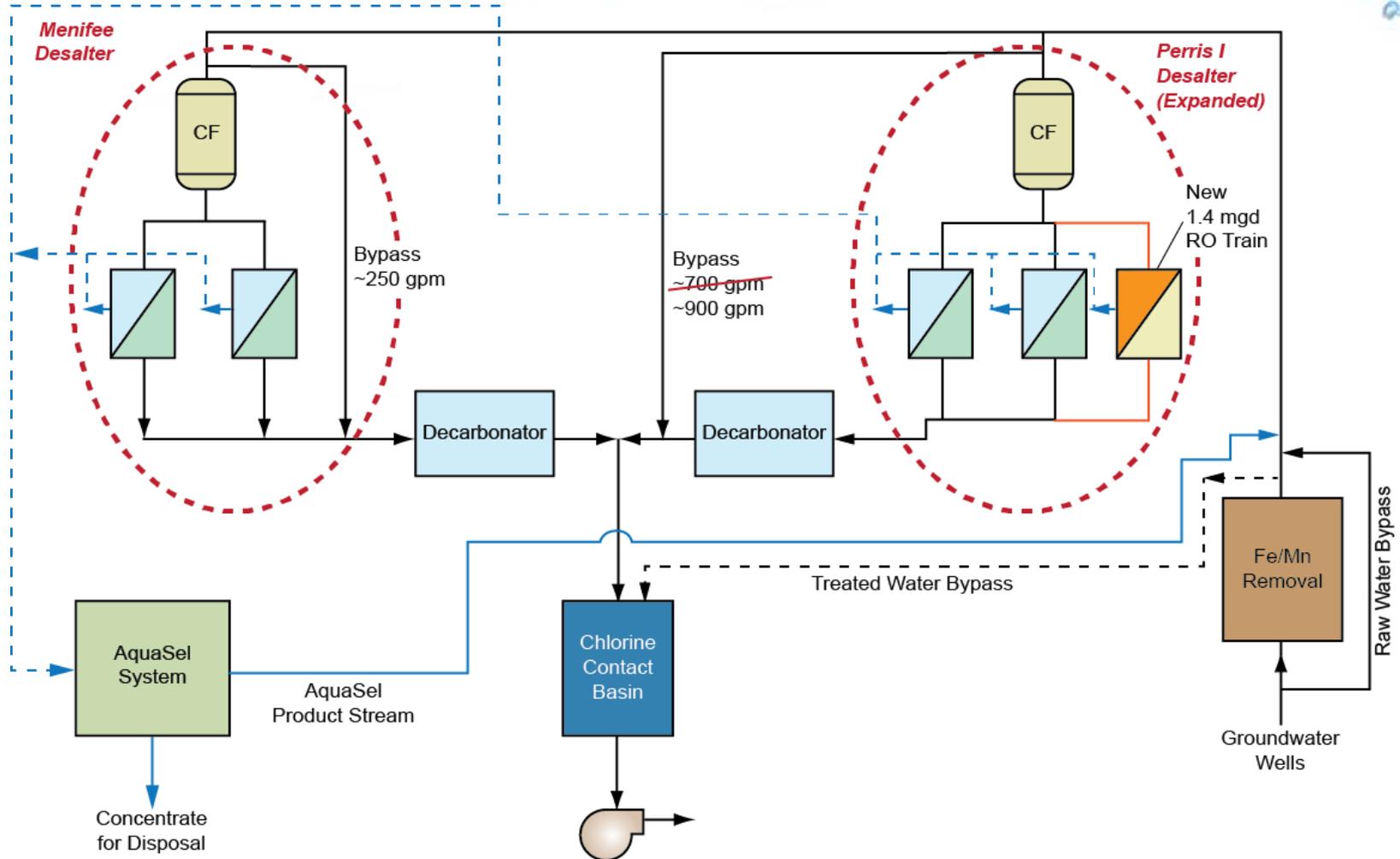
Existing Alt 1

Parameter	Avg. Desalter Blended Product	With AquaSel Only
TDS	570	748
Alkalinity	48	95
Calcium	62	76
Bicarbonate	57	120
Hardness	205	270
Silica	13	37
Sodium	110	185



- AquaSel quality – similar to existing well water bypass (~ 950 gpm)
- “New” water = 383 gpm (618 AFY)

Implementation Alternative 2



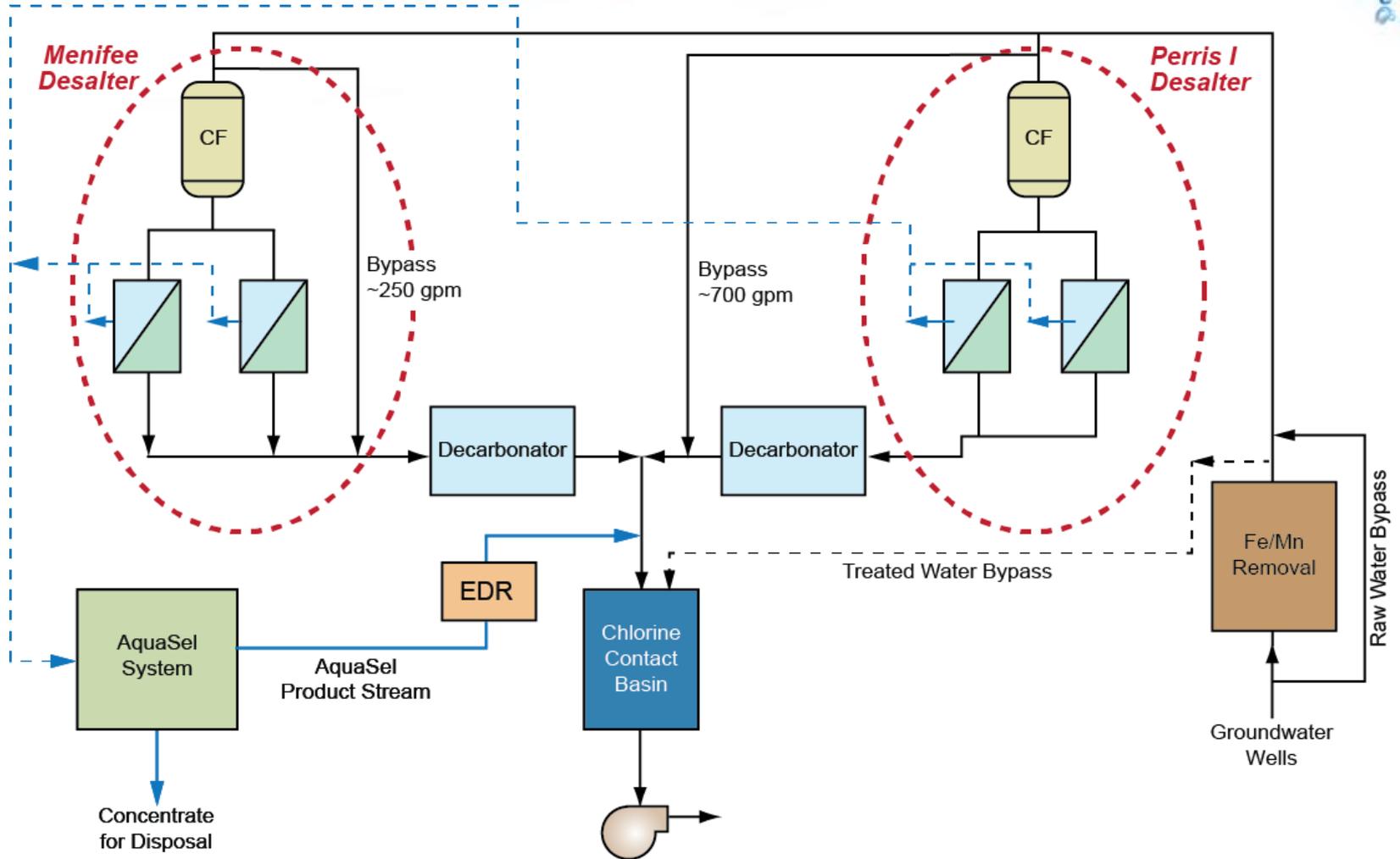
Results - Alternative 2



	Existing	Alt 1	Alt 2
Parameter	Avg. Desalter Blended Product	With AquaSel Only	With AquaSel & New RO Train
TDS	570	748	580
Alkalinity	48	95	50
Calcium	62	76	62
Bicarbonate	57	120	58
Hardness	205	270	215
Silica	13	37	?
Sodium	110	185	110

- Most new water production but not feasible due to silica

Implementation Alternative 3



Results - Alternative 3



	Existing	Alt 1	Alt 3
Parameter	Avg. Desalter Blended Product	With AquaSel Only	With AquaSel & New EDR
TDS	570	748	610
Alkalinity	48	95	58
Calcium	62	76	66
Bicarbonate	57	120	70
Hardness	205	270	220
Silica	13	37	20
Sodium	110	185	120

- AquaSel quality – similar to existing well water bypass
- “New” water = 1,116 gpm (1,800 AFY)

Comparison of Alternatives



	Alternative 1 Direct Blend to Distribution System	Alternative 2 New R.O. Train	Alternative 3 New EDR Train
“New” Production (AFY)	618	2,060	1,829
Fatal Flaw *	No	Yes (Silica)	No
Finished Water Quality	Higher TDS	Similar	Similar
Capital Cost	-	\$2 M more	\$2.5 M more
Annual O&M Cost	-	~ \$0.3 M more	~ \$0.35 M more
Relative Overall Cost	Highest	Lowest	2 nd Lowest

* Increased concentration of silica returned to the feed water for the Menifee and Perris Desalters in Alternative 2 would result in reduced water production from the desalters.

- Right-sizing the precipitator for improved performance
- Evaluate best filtration method for recirculating feed to EDR
- Balance hydraulic flow
- Review options for blending
- Size a “demonstration plant” and prepare cost estimate
- Determine the best layout and return on investment (ROI) for a full scale plant



Next Steps



- **Complete pilot study analyses and develop plans for a potential demonstration project**
 - Site layout
 - Cost estimates

February 2016
- **Present final pilot study analyses and recommendations for a single full-size EDR module (100 gpm) demonstration project**

March 2016
- **Pursue additional funding**

On-going

Acknowledgements



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