Chino Desalters Phase 3 Expansion Project

Presenter:
Cindy Miller, P.E., Program Manager
Who is the Chino Basin Desalter Authority?

- Chino Basin Desalter Authority (CDA) is a Joint Powers Authority (JPA), located in the Inland Empire.

- CDA’s JPA is made up of 8 member agencies:
  - City of Chino
  - City of Chino Hills
  - City of Norco
  - City of Ontario
  - Inland Empire Utilities Agency
  - Jurupa Community Services District
  - Santa Ana River Water Company
  - Western Municipal Water District

- CDA purifies brackish water extracted from the lower Chino Groundwater Basin (Chino Basin) with the Chino I and II Desalter facilities and distributes drinking water to its member agencies.

- Member agencies purchase water from CDA under take-or-pay contracts.
Who is the Chino Basin Desalter Authority?

- The CDA owns the Chino Desalters (I and II), groundwater wells and raw water pipelines, product water pump stations, pipelines, and turnout facilities.

- Chino I Desalter - 14.2 mgd nameplate capacity.

- Chino II Desalter
  - Original 15 mgd nameplate capacity
  - Phase 3 expanded capacity to 20.5-mgd
Pre-Phase 3 Expansion Operation

- **Groundwater Production:** 29,000 AF/Year
  - 22 Wells
  - 2 separate well fields (Chino I and Chino II)
  - CDA wells strategically located in cooperation with Chino Basin Watermaster as part of the Optimum Basin Management Program (OBMP)

- **Treated Water:** 24,600 AF/Year

- **Two Desalters**
  - Chino I – Constructed by SAWPA (2000):
    - Reverse Osmosis/Ion Exchange/Air Stripping
    - Operated by IEUA (contract w/CDA)
    - Production ~11 mgd, below original nameplate capacity
Pre-Phase 3 Expansion Operation

- Chino II (2006):
  - Reverse Osmosis/Ion Exchange/Bypass
  - Operated by Jurupa CSD (contract w/CDA)
  - Production ~12 mgd, below original nameplate capacity
- Brine Disposal: SAWPA Inland Empire Brine Line (IEBL)
- Exports ~ 23,000 tons of salt annually from Chino Basin
- Chino I: One connection to Brine Line
  - 2 million gallons per day (mgd)
- Chino II: Two connections to Brine Line
  - 1.2 million gallons per day (mgd)
- Brine Line charges are second largest component of O&M budget (behind electricity)
Pre-Phase 3 Expansion Operation

• Feasible Alternatives to Brine Line Discharge: None
  – Unable to send brine to upstream wastewater plants
  – Trucking Option: Chino I would require 400 trucks per day
  – Trucking Option: Chino II would require 240 trucks per day

• The Brine Line is a critical element for the operation of the Desalters.
Phase 3 Expansion Project

- Investment of $150 Million
- $82 million grant funding
- Sponsor Agencies: City of Ontario, Jurupa CSD, Western MWD
- Increase Groundwater Production to 40,000 AF/Year
- Increase Total CDA Treated Water to 35,200 AF/Year
- Provide at least 10 mgd of additional product water capacity for Sponsor Agencies (3.33 mgd per agency)
- Completed end of 2018
- Innovative Brine Treatment – Concentrate Reduction Facility (CRF) at Chino II Desalter
Phase 3 Expansion Project

• Project Components
  – Eight new wells
    • Five Chino Creek Wells (180 – 300 gpm) – Chino I Desalter
    • Three High Capacity Wells (~2,000 gpm) – Chino II Desalter
  – Chino II Raw Water Pipeline Extension
  – Chino I/II Raw Water Intertie and Flow Control Facility
Phase 3 Expansion Project

• Project Components
  – Chino II Expansion (RO and IX)
  – Concentrate Reduction Facility
  – 1010 Product Water Pump Station
  – 1110 Product Water Pump Station Expansion
  – 1010 Product Water Pipeline and Turnouts
  – Milliken Product Water Pump Station (1010 to 1212)
Concentrate Reduction Facility (CRF) Goals

**Sustainability**
- Reduce basin water exports
- Reduce impacts to brine line
- Create beneficial byproduct

**Water Supply**
- Provide additional potable supply
- Reduce groundwater pumping

**Cost**
- Cost effective option
- Utilize grant funding
- Offset O&M costs with product
Chino II Desalter Operation Without CRF

Expanded brine volume of 2.68-mgd exceeds current brine line capacity of 1.62-mgd.
A large portion of solid residuals have beneficial use value.
CRF Process Flow Diagram
Existing Chino II RO recovery is limited by hardness and silica concentrations

<table>
<thead>
<tr>
<th>Flow Stream</th>
<th>Chino II Concentrate</th>
<th>CRF Secondary RO Feed</th>
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</thead>
<tbody>
<tr>
<td>Ca$^{2+}$ (mg/L)</td>
<td>679</td>
<td>7</td>
</tr>
<tr>
<td>Mg$^{2+}$ (mg/L)</td>
<td>102</td>
<td>4</td>
</tr>
<tr>
<td>Alkalinity (mg/L as CaCO$_3$)</td>
<td>1,145</td>
<td>302</td>
</tr>
<tr>
<td>Ca Hardness (mg/L as CaCO$_3$)</td>
<td>1,697</td>
<td>17</td>
</tr>
<tr>
<td>Mg Hardness (mg/L as CaCO$_3$)</td>
<td>420</td>
<td>16</td>
</tr>
<tr>
<td>Total Hardness (mg/L as CaCO$_3$)</td>
<td>2,116</td>
<td>33</td>
</tr>
<tr>
<td>TDS (mg/L)</td>
<td>3,319</td>
<td>2,718</td>
</tr>
<tr>
<td>Si (mg/L)</td>
<td>194.3</td>
<td>74.8</td>
</tr>
<tr>
<td>pH</td>
<td>7.61</td>
<td>9.47</td>
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Chemical softening removes scaling precursors in the primary RO concentrate.

Secondary RO recovery of 66% (and higher) achieved through:
- Calcium reduction
- Magnesium reduction
- Alkalinity reduction
- Silica reduction

**CHINO CRF TREATMENT GOALS**

<table>
<thead>
<tr>
<th></th>
<th>Silica</th>
<th>Calcium</th>
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<tr>
<td>Goal</td>
<td>&lt;80 mg/L</td>
<td>&lt;40 mg/L</td>
</tr>
<tr>
<td>Current</td>
<td>180 mg/L</td>
<td>1,700 mg/L</td>
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Pellet reactors were selected as the primary chemical softening configuration

- **Basics**
  - Upflow, fluidized bed
  - Soda ash (30 mg/L @ 7 gph) and caustic (550 mg/L @ 40 gph) are injected at bottom of bed
  - Seed (CaCO$_3$) introduced to provide crystal growth sites
  - Pellet blowdown frequency determines size

- **Benefits**
  - High rate (small footprint)
  - “Easily” dewatered residuals
Dried pellets have marketable value and are easier to store and transport

- Pellets are value-added products
  - Industrial applications: concrete block manufacturers, limestone industry, other yet to be determined
  - Convert waste stream to usable commodity
CRF Actual Operational Data & Challenges

• Meeting CRF Treatment Goals
  – Recovery > 66% with typical 325 – 375 gpm secondary RO permeate flow
  – Secondary RO Influent
    • Ca hardness typically 10 – 20 mg/L
    • Silica typically ~50 mg/L

• Challenges
  – Excess solids in media filter backwash has required shutdowns for removal and additional temporary on-site storage
Concentrate Reduction Facility Photos