FRESNO-CLOVIS REGIONAL WASTEWATER RECLAMATION FACILITIES

- Located on over 3,300 acres southwest of Fresno. Provides wastewater treatment to the Cities of Fresno, Clovis, and unincorporated areas of the County of Fresno.

- Designed capacity of 80 MGD. Currently receiving an average of 65 MGD. Serves a population of approximately 500,000.

- Waste Discharge Requirements Order No. 5-01-254
The RWRF is a secondary activated sludge plant with common primary treatment followed by three secondary treatment trains.

The original treatment train of 4 aeration basins and 4 clarifiers were constructed in the mid 70s.

The next treatment train was completed in the late 90s.

The latest treatment train was completed in 2010 as part of the $104 million Organic Upgrade Project.
Solids Treatment and Power Generation

- The RWRF currently has 13 anaerobic digesters and 7 belt filter presses.

- Biosolids are hauled to a composting facility outside the County of Fresno.

- The RWRF has a 9 megawatt co-generation facility that captures the methane gas generated from the digestion process.
There are approximately 1,750 acres of land with ponds for effluent disposal.
Uses of Recycled Water

- Direct reuse of final effluent provides irrigation to farmers of non food crops.

- The City leases land to farmers, specifically for farming of non food crops with effluent reuse rather than using agricultural wells.
Title 22 – Recycled Water Criteria

- 22 CCR § 60304

(d) Recycled wastewater used for the surface irrigation of the following shall be at least undisinfected secondary recycled water:

(1) Orchards
(2) Vineyards
(3) Non food bearing trees
(4) Fodder and fiber crops and pasture
(5) Seed crops not eaten by humans
(6) Food crops than undergo commercial pathogen-destroying processes
(7) Ornamental nursery stock and sod farms

Recycled water cannot come into contact with the edible portion of the crop (1, 2), cannot be for pasture for animals producing milk for human consumption (4). Irrigation has to occur 14 days prior to harvesting, retail or general public contact (3, 7).
Reclamation (Direct Reuse) Farming Sites

Effluent Irrigated Acreage
- Onsite: 42%
- Offsite: 58%

Off-site  On-site
In 2013, 14% of Total Plant Flow was used to deliver secondary undisinfected effluent to onsite and offsite farmers.

On-site direct reuse has increased by 49% between 2003 and 2013.
Crop Types

- Alfalfa
- Triticale
- Winter Forage
- Wheat
- Sorghum Sudan
- Corn Silage
Crop Yield with Effluent Reuse

Average Yield in 2013
Quist

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Average Yield (t/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>25</td>
</tr>
<tr>
<td>Triticale + Sorghum/Sudan</td>
<td>20</td>
</tr>
<tr>
<td>Triticale + Rye Grass</td>
<td>15</td>
</tr>
<tr>
<td>Triticale</td>
<td>10</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>5</td>
</tr>
<tr>
<td>Triticale Hay</td>
<td>3</td>
</tr>
</tbody>
</table>

QUIST EFFLUENT IRRIGATED ACREAGE 2013 - 2014

DPU

Average Yield in 2013
Quist

0 5 10 15 20 25 30
Average Yield (t/a)
## 2013 Direct Reuse Summary

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total ponding area (acre)</strong></td>
<td>1750</td>
<td>1750</td>
<td>1750</td>
<td>1750</td>
<td>1750</td>
<td>1750</td>
<td>1750</td>
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<td>1750</td>
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<tr>
<td><strong>Ponds In use area (acre)</strong></td>
<td>1172</td>
<td>1209</td>
<td>1147</td>
<td>1062</td>
<td>1074</td>
<td>1164</td>
<td>1050</td>
<td>1158</td>
<td>1062</td>
<td>1180</td>
<td>1234</td>
<td>1241</td>
</tr>
<tr>
<td><strong>Dry ponds (acre)</strong></td>
<td>578</td>
<td>541</td>
<td>603</td>
<td>688</td>
<td>676</td>
<td>586</td>
<td>700</td>
<td>592</td>
<td>688</td>
<td>570</td>
<td>516</td>
<td>509</td>
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<tr>
<td><strong>Weighted percolation Rate (Inch/Day)</strong></td>
<td>1.64</td>
<td>1.53</td>
<td>1.75</td>
<td>1.88</td>
<td>1.58</td>
<td>1.53</td>
<td>1.65</td>
<td>2.53</td>
<td>2.16</td>
<td>1.85</td>
<td>1.98</td>
<td>1.83</td>
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<tr>
<td><strong>Monthly plant flow (AF)</strong></td>
<td>5807</td>
<td>5186</td>
<td>5625</td>
<td>5503</td>
<td>5705</td>
<td>5603</td>
<td>5912</td>
<td>5981</td>
<td>5830</td>
<td>5996</td>
<td>5619</td>
<td>5680</td>
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<tr>
<td><strong>Off/On site irrigation (AF)</strong></td>
<td>135</td>
<td>136</td>
<td>721</td>
<td>943</td>
<td>848</td>
<td>1308</td>
<td>1479</td>
<td>1297</td>
<td>1188</td>
<td>695</td>
<td>238</td>
<td>419</td>
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<tr>
<td><strong>Total Effluent Delivery to ponds (AF)</strong></td>
<td>5672</td>
<td>5050</td>
<td>4904</td>
<td>4560</td>
<td>4857</td>
<td>4296</td>
<td>4433</td>
<td>4684</td>
<td>4642</td>
<td>5301</td>
<td>5382</td>
<td>5261</td>
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<tr>
<td><strong>Precipitation (Inch)</strong></td>
<td>0.58</td>
<td>0.89</td>
<td>0.65</td>
<td>0.09</td>
<td>0.07</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
<td>0.03</td>
<td>0.54</td>
<td>0.15</td>
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<tr>
<td><strong>Precipitation Addition to in use ponds (AF)</strong></td>
<td>57</td>
<td>90</td>
<td>62</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>56</td>
<td>16</td>
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<tr>
<td><strong>Average pan evaporation loss (AF)</strong></td>
<td>86</td>
<td>147</td>
<td>264</td>
<td>374</td>
<td>548</td>
<td>708</td>
<td>675</td>
<td>653</td>
<td>433</td>
<td>304</td>
<td>162</td>
<td>88</td>
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<tr>
<td><strong>Percolation amount (AF)</strong></td>
<td>5642</td>
<td>4993</td>
<td>4702</td>
<td>4195</td>
<td>4315</td>
<td>3587</td>
<td>3758</td>
<td>4031</td>
<td>4210</td>
<td>5000</td>
<td>5275</td>
<td>5189</td>
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<tr>
<td><strong>Extraction wells Discharge to FID (AF)</strong></td>
<td>0</td>
<td>1188</td>
<td>3664</td>
<td>2985</td>
<td>3831</td>
<td>2952</td>
<td>2893</td>
<td>2817</td>
<td>2993</td>
<td>2371</td>
<td>1160</td>
<td>3</td>
</tr>
<tr>
<td><strong>On site extraction water use for Irrigation</strong></td>
<td>0</td>
<td>0</td>
<td>70</td>
<td>59</td>
<td>97</td>
<td>146</td>
<td>148</td>
<td>106</td>
<td>95</td>
<td>54</td>
<td>49</td>
<td>0</td>
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<tr>
<td><strong>Addition to the ground water (AF)</strong></td>
<td>5642</td>
<td>3805</td>
<td>968</td>
<td>1151</td>
<td>387</td>
<td>489</td>
<td>717</td>
<td>1108</td>
<td>1122</td>
<td>2574</td>
<td>4066</td>
<td>5186</td>
</tr>
</tbody>
</table>

- During 2013, approximately 9,400 AF of effluent was provided to on-site and off-site farmers.
Network of Extraction Wells

- Effluent disposal to ponds has over the years created an extensive mound under the pond area.

- The City has a contract with Fresno Irrigation District to discharge groundwater from extraction wells into Dry Creek and Houghton Canals.

- Approximately 30,000 AF a year could be extracted for irrigation canals according to the FID agreement.
Network of Extraction Wells

Dry Creek Canal

Houghton Canal

Images of the network of extraction wells and their surroundings.
Winery Stillage Site Monitoring

- RWRF owns and operates a former winery stillage disposal site, approximately 145 acres.

- Several years of Nitrogen accumulation in top 2 feet of soil due to stillage disposal since 1974. Disposal of stillage ceased in December 2003.

- TKN concentrations were estimated in excess of 2,500 mg/kg, decreasing at depths below two feet.
N removal analysis based on tissue N and yield for the 5th cut of 2013

<table>
<thead>
<tr>
<th>Basin</th>
<th>Acreage</th>
<th>% leaf N</th>
<th>% DM</th>
<th>D Wt. (T)</th>
<th>Lbs.N/Acre Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>34</td>
<td>3.79</td>
<td>80.3</td>
<td>27.1</td>
<td>19.4</td>
</tr>
<tr>
<td>CD</td>
<td>29</td>
<td>4.19</td>
<td>82.0</td>
<td>20.1</td>
<td>15.2</td>
</tr>
<tr>
<td>F</td>
<td>48</td>
<td>4.24</td>
<td>86.0</td>
<td>38.2</td>
<td>29.2</td>
</tr>
</tbody>
</table>
Monitoring TN at Stillage Site

ESS WINERY WO#: Winery Bed

TN (mg/kg)

0 1000 2000 3000 4000 5000 6000

Future Direction

- Determining Total N removal for all sites irrigated with effluent using soil and tissue analysis and according to type of crop.
- Continuing leasing land to farmers to keep direct reuse practice.
- Implementation of Recycled Water Master Plan:
  - RWRF’s future 5 MGD tertiary treatment train to be completed by end of 2015
  - Recycled Water Ordinance – in progress
  - Recycled water distribution system infrastructure – in progress
Questions?