

GLENDALÉ'S CHROMIUM RESEARCH

Leighton Fong, P.E.
City of Glendale, CA

Groundwater Resources Association of California
Concord, California
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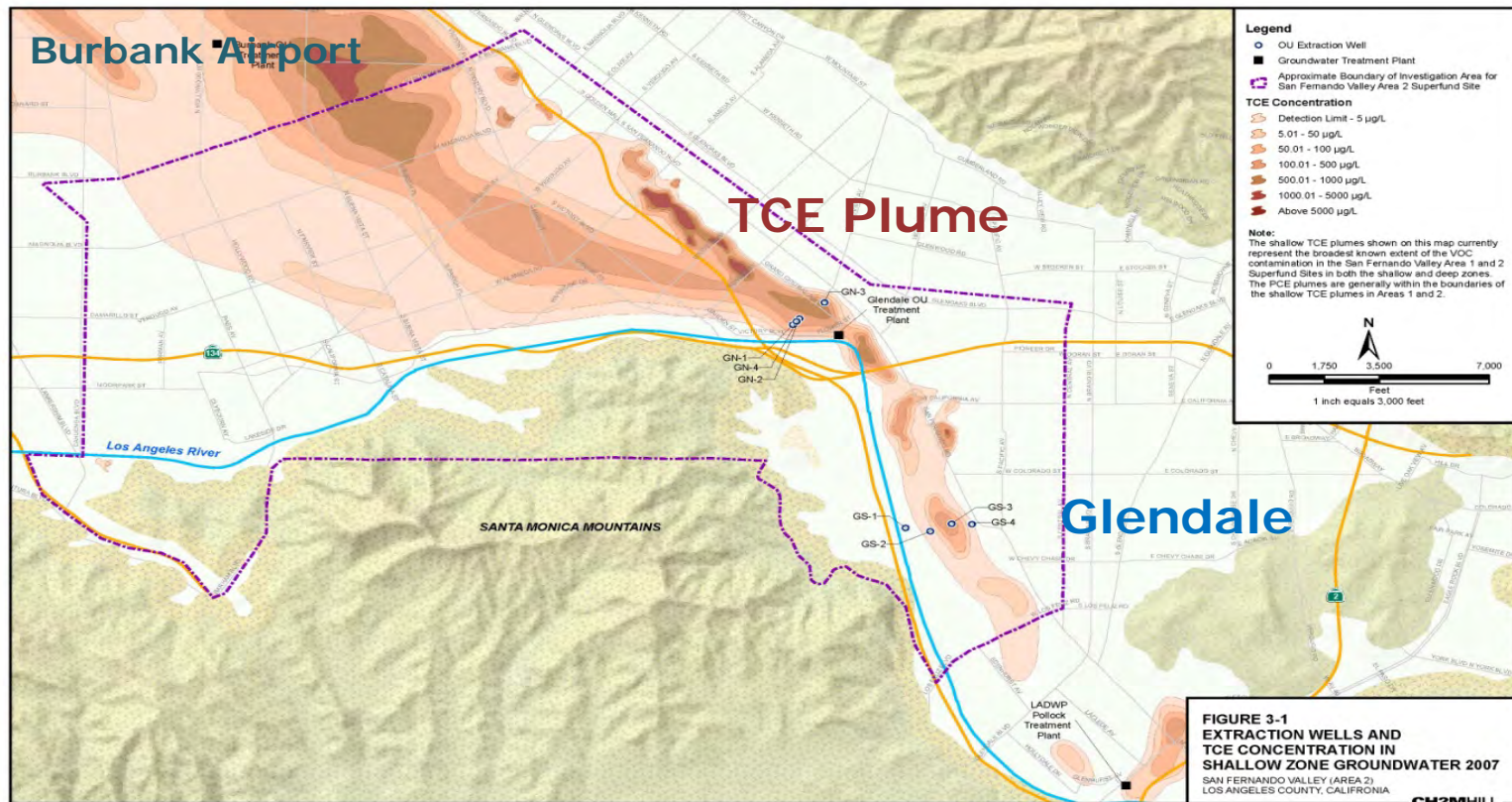
City of Glendale



Population: 196,847
Land area: 30.6 square miles.
Service connections: 33,168
Supply: 66% MWD
34% Groundwater
28,000 AFY

Superfund Project

- Groundwater contamination around Burbank Airport migrated towards Glendale

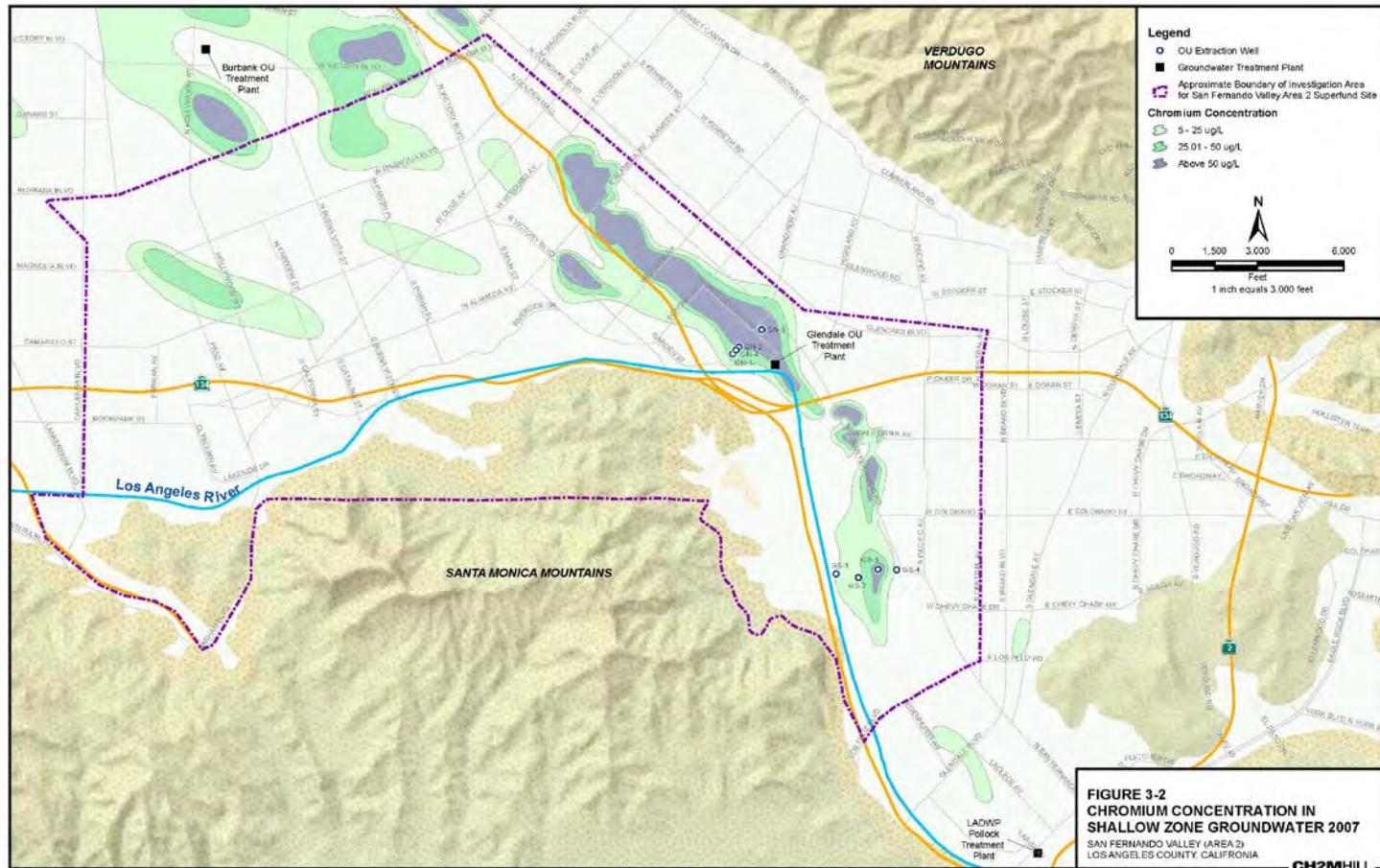


Glendale Operable Unit



Designed to remove VOCs (packed tower aeration and GAC)

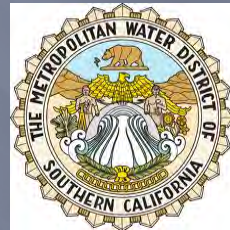
Chromium Plume



GOU Startup

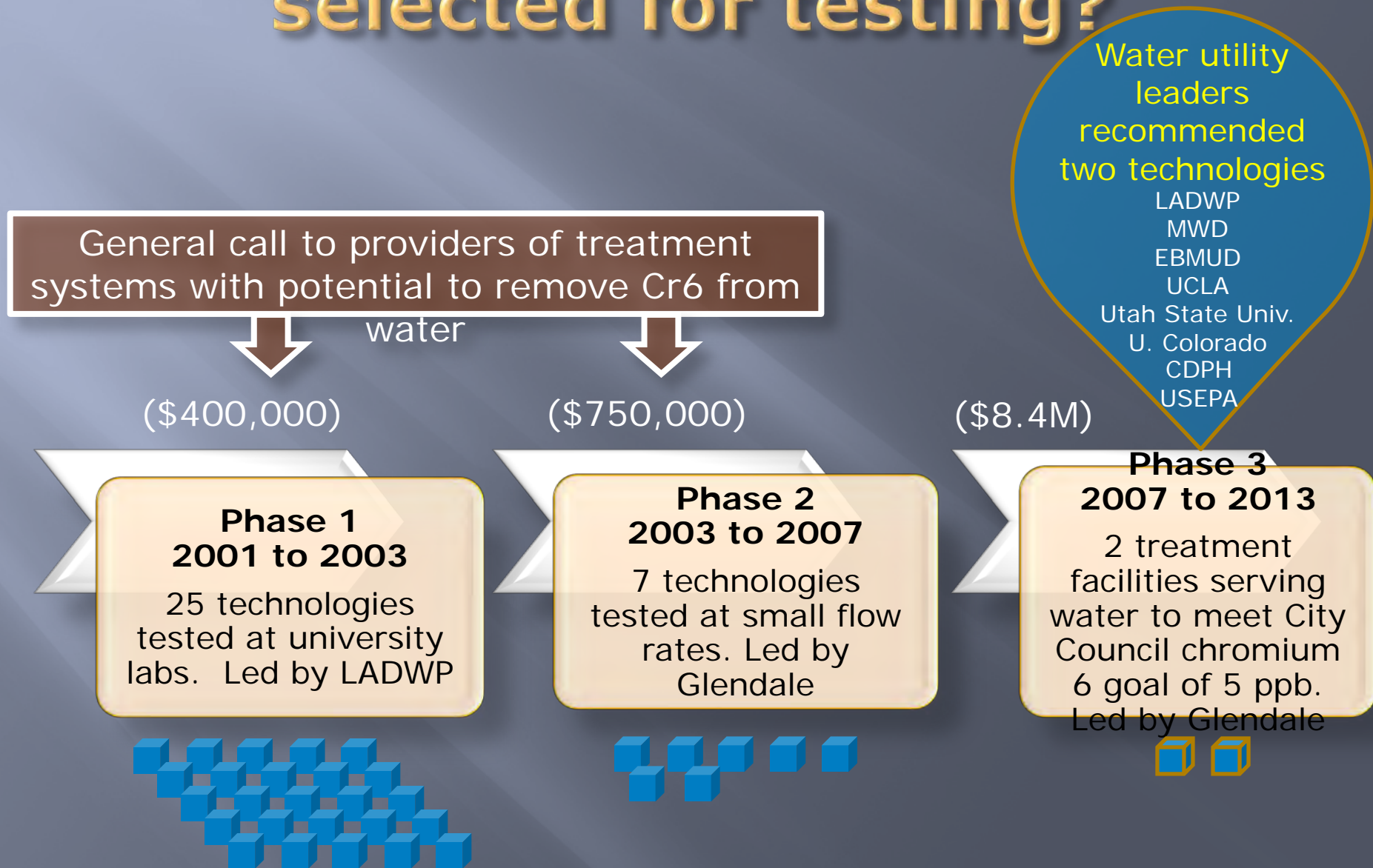
- ▣ GOU Startup restores groundwater supply but with total chromium at 15 ppb
- ▣ Public Health Goal for total chromium of 2.5 ppb (rescinded in 2001)
- ▣ Movie “Erin Brockovich” released in 2000
- ▣ Public concern on the chromium level moved the City Council to limit the chromium level to 5 ppb even though the California MCL was 50 ppb.
- ▣ Council directed studies for chromium removal.

Funding partners



San Fernando Valley Industry Group

How were technologies selected for testing?



Phase 1 - Benchscale

- ▣ Led by Los Angeles Department of Water and Power. Study by McGuire Environmental (now Malcolm Pirnie/Arcadis)
- ▣ Understand chromium oxidation and reduction processes (trivalent to hexavalent)
- ▣ Evaluate national chromium occurrence
- ▣ 25 technologies tested

Phase 2 – Pilot Studies

- ▣ Seven technologies pilot tested at low flows for two weeks by McGuire.
- ▣ Weak base anion exchange (WBA), strong base anion exchange (SBA), and reduction/coagulation/filtration (RCF) technologies proved effective.
- ▣ Results presented to expert panel, recommended demonstration scale testing of WBA and RCF

Phase 3 - Demonstration

- ▣ Research led by Nicole Blute (Arcadis/Hazen and Sawyer)
- ▣ Weak Base Anion Exchange – 425 gpm
- ▣ Reduction/Coagulation/Filtration – 100 gpm
- ▣ 50% funding from California Department of Water Resources Prop 50.

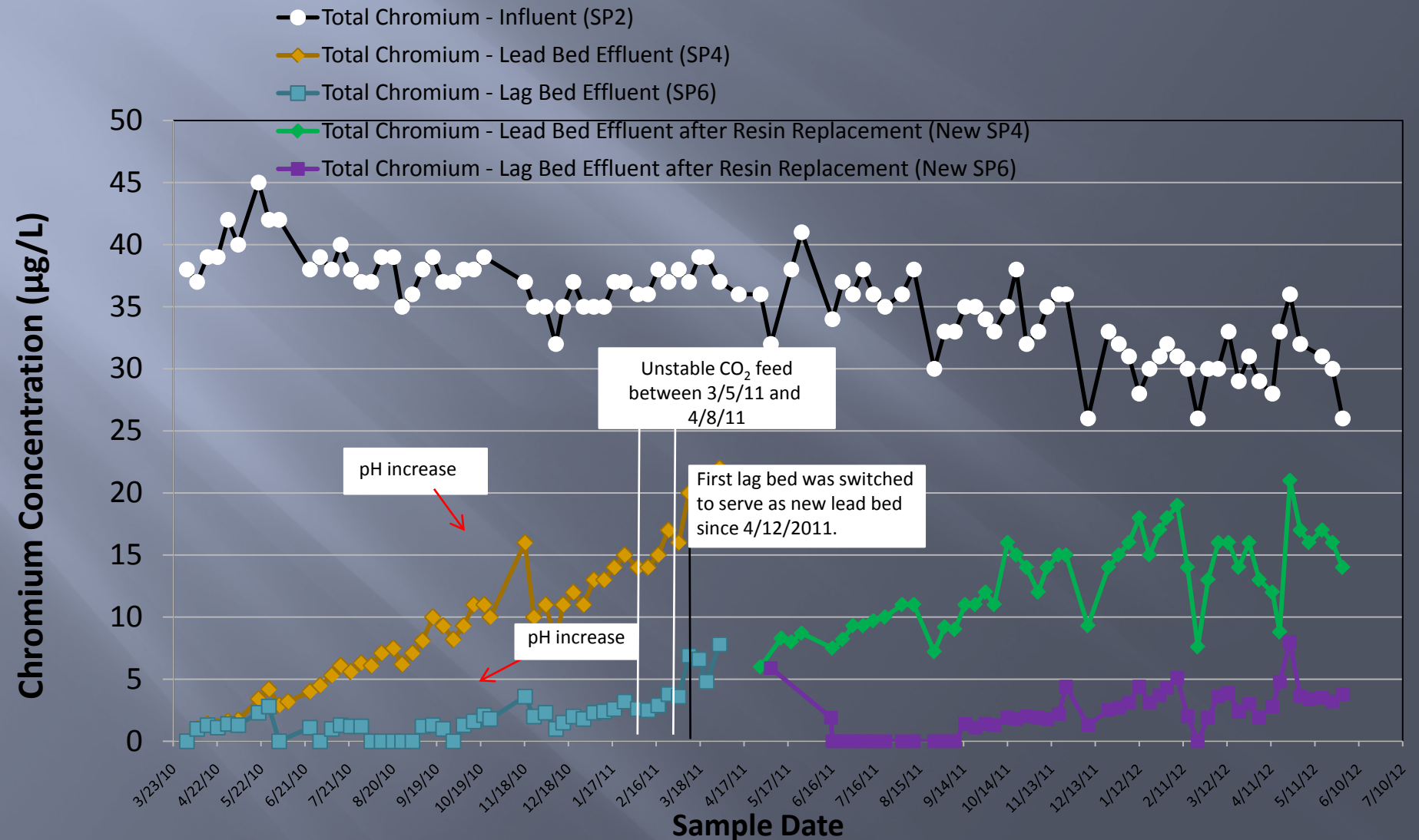
Phase 3 - Demonstration

- ▣ WBA
 - CO₂ used for pH suppression to 6.0
 - Lead/lag configuration of exchange vessels
 - Resin was Dow PWA7
 - 425 gpm
 - Influent Cr6 level at 40 ppb



WBA Results

WBA Hexavalent Chromium Lab Data As of 5/30/2012



WBA Operations

- ▣ Maintain CO₂ feed
- ▣ Calibrate pH probe
- ▣ Startup with PWA7
 - Leaches formaldehyde, needs flushing
 - Spent resin not federal hazardous waste but is in California
 - Resin also removes uranium so spent resin could be Technically Enhanced Naturally Occurring Radioactive Material (TENORM) waste.

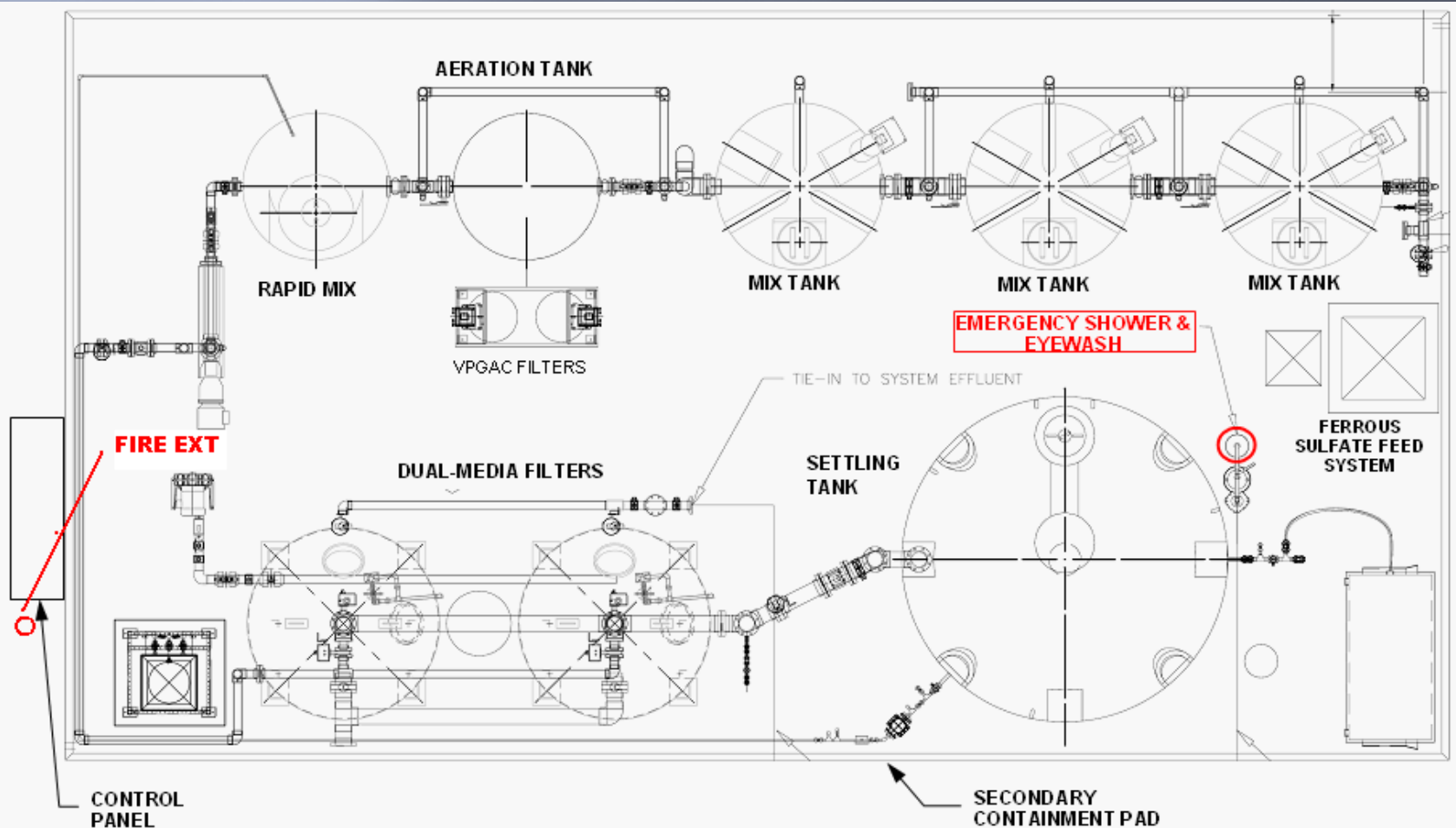
Reduction/Coagulation/ Filtration

- ▣ 100 gpm capacity
- ▣ Influent Cr6 at 80 ppb
- ▣ Ferrous Sulfate added for reduction to trivalent chromium (Cr3)
- ▣ Polymer added as coagulant
- ▣ Dual media sand/gravel filter removes iron and Cr3
- ▣ Backwash water settled, passive solids removal

RCF



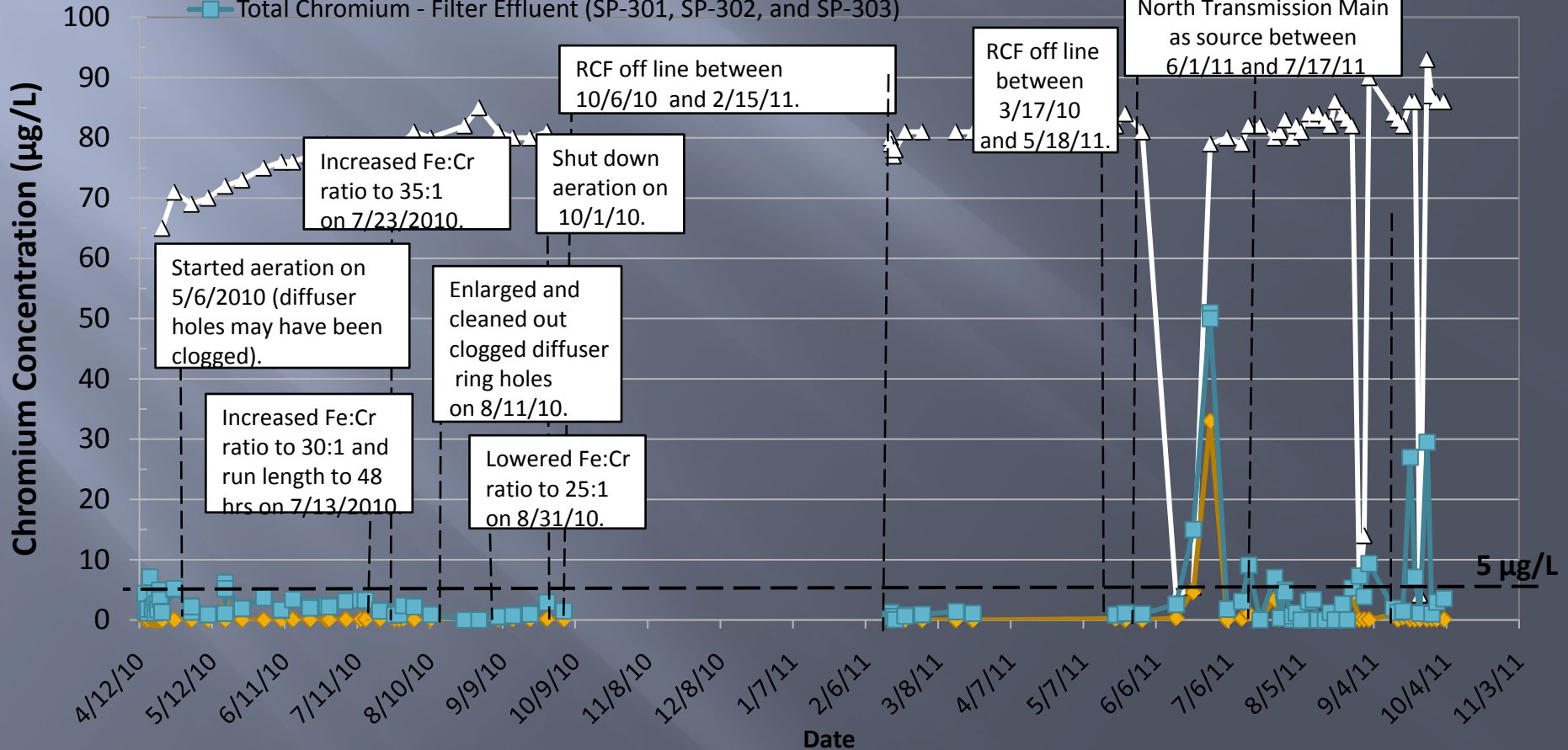
RCF Schematic



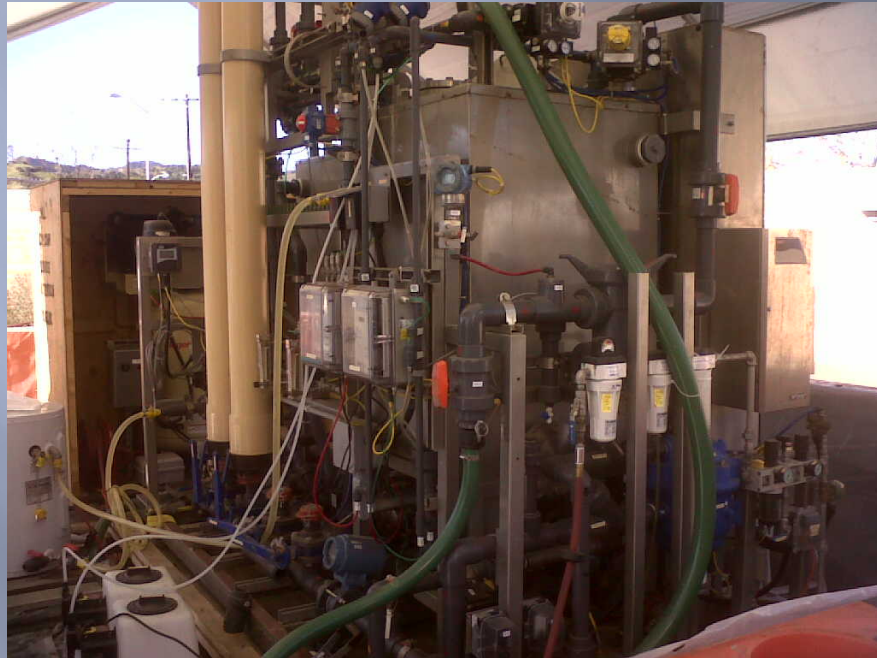
RCF Results

Lab Results of Hexavalent and Total Chromium at Influent and Filter Effluent As of 10/3/2011

- △ Hexavalent Chromium - Influent (SP-001)
- ◆ Hexavalent Chromium - Filter Effluent (SP-301, SP-302 and SP-303)
- Total Chromium - Filter Effluent (SP-301, SP-302, and SP-303)



RCF w/ Microfiltration

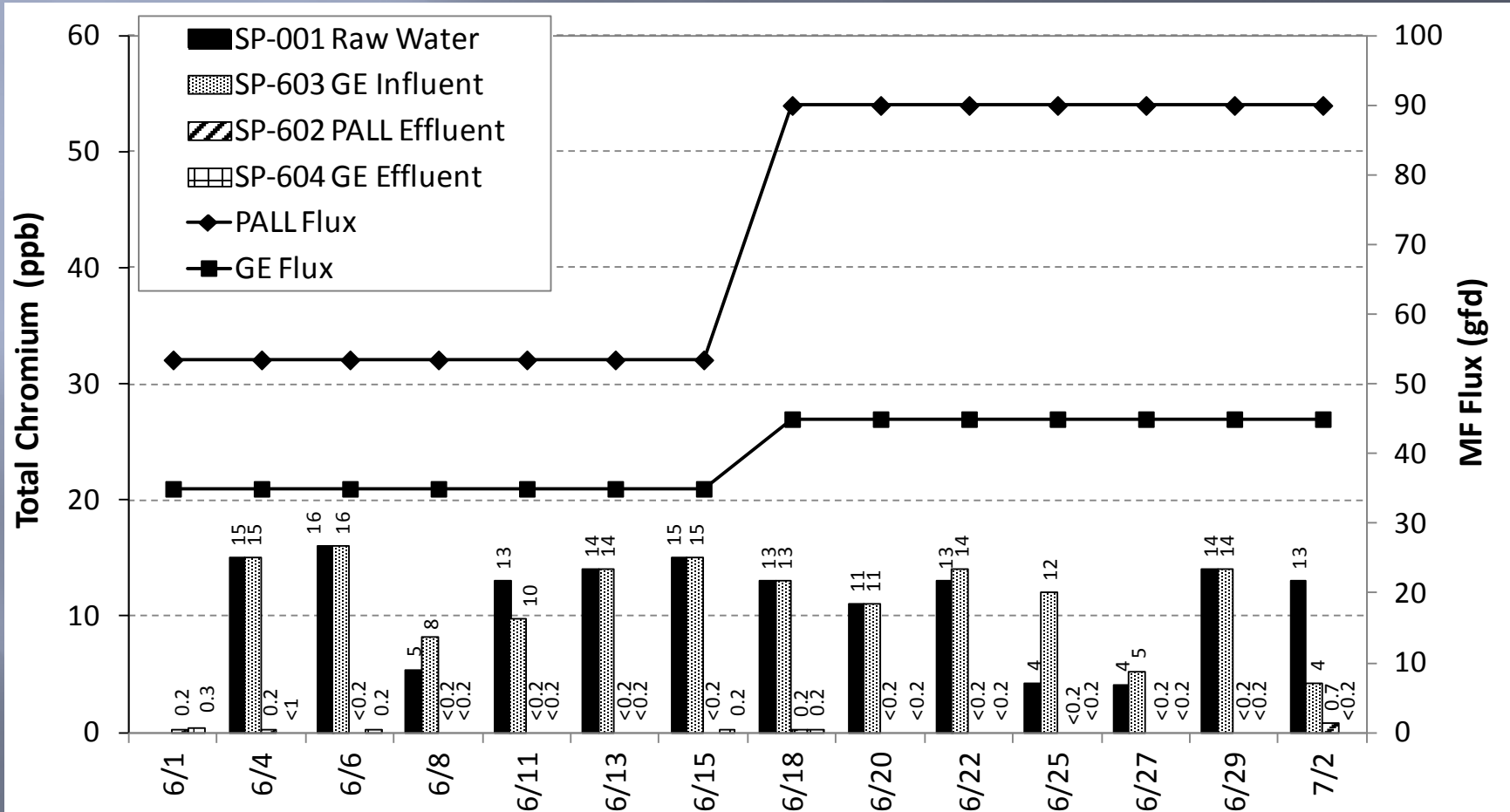


Pall pressure membrane



GE / Zenon submerged membrane

RCMF Results



Range of Estimated Costs (\$/AF)



Additional Studies

▣ RCF

- Low dose chlorination can reduce mix time without oxidizing Cr6 back to Cr3.
- This can reduce mix time and need for aeration.
- Higher doses of iron can also reduce mixing times.

▣ WBA

- Dow and Siemens investigating conditioning of the PWA7 resin to reduce formaldehyde leaching
- Other resins w/o formaldehyde being tested.

Additional Information

A Project Report summarizing these studies is available on the City's website:



http://www.glendalewaterandpower.com/about/chromium6_report_appendices.aspx