Chromium Interim Measures Project and Ongoing Plume Investigation

for the

Northern New Mexico Citizens' Advisory Board

Los Alamos National Laboratory
Danny Katzman

March 11, 2015

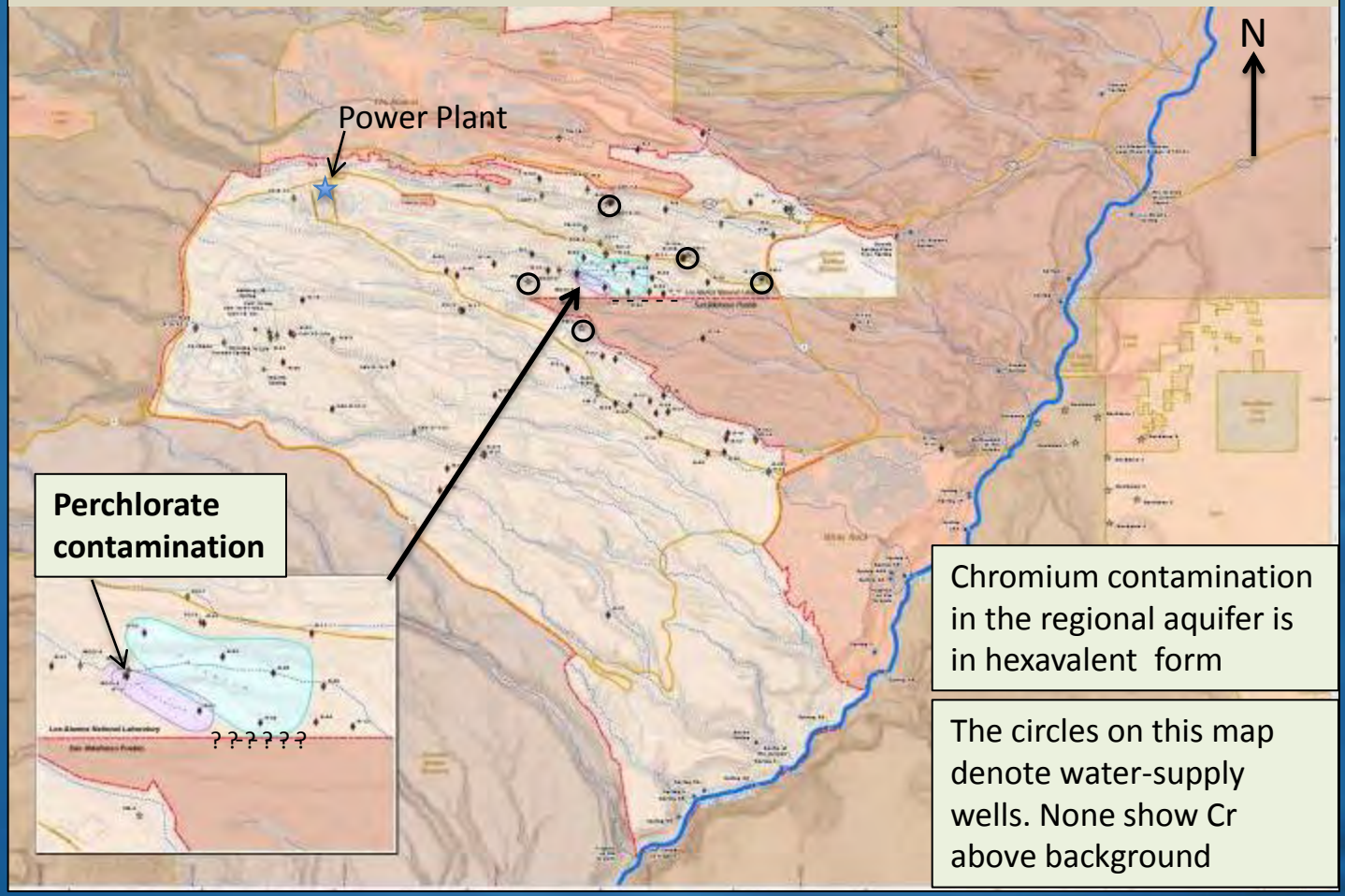
LA-UR-15-21670

Presentation Overview

- History, location and background - refresher
- Nature and extent of Cr plume
- Interim Measures strategy
- Further Cr plume characterization
- 2015-2016 activities

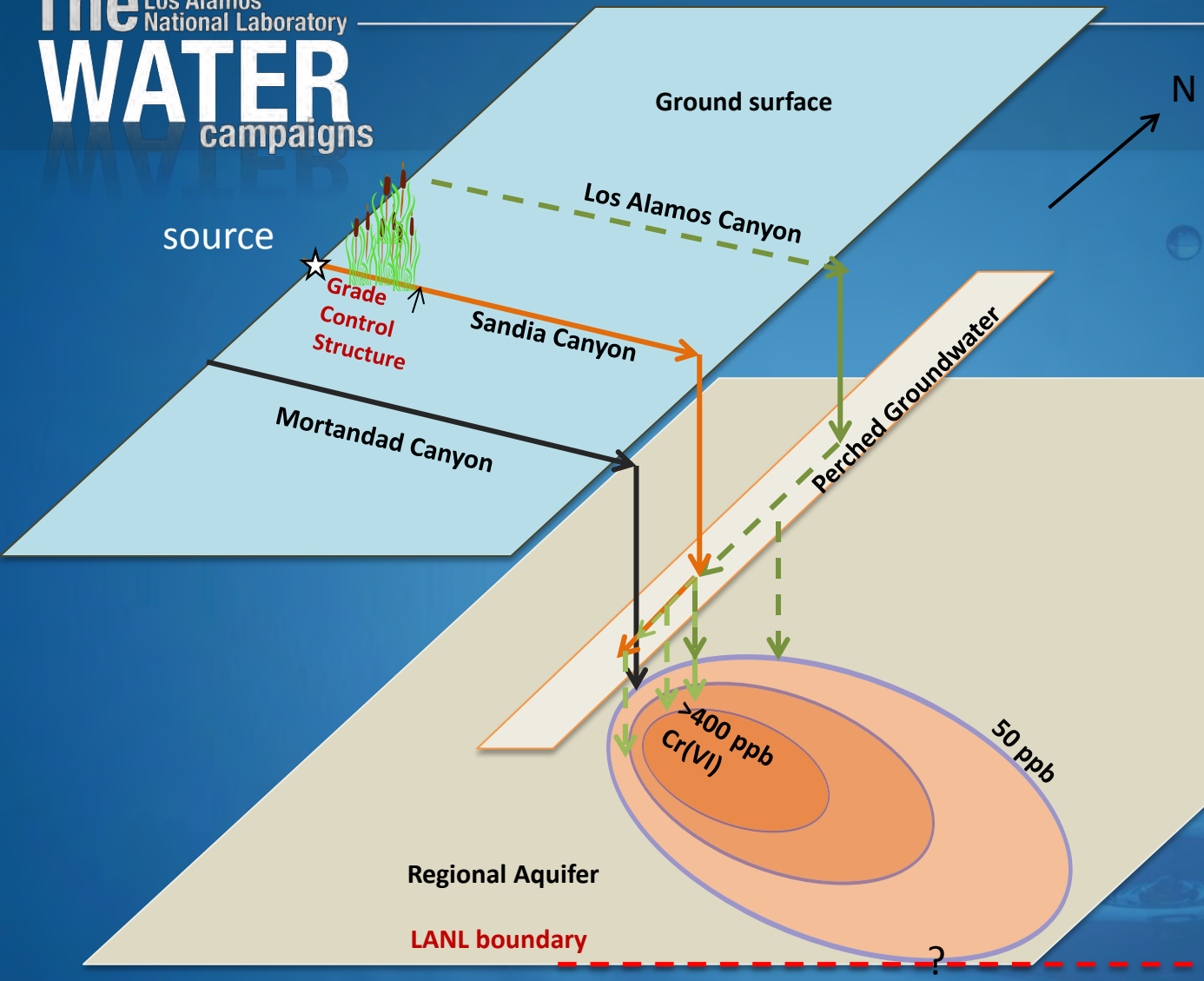
Chromium Plume Location

- Potassium dichromate used in cooling towers at a Laboratory power plant
- Up to 72,000 kg released from 1956-72 in hexavalent form [Cr(VI)]



Chromium Fate and Transport

Complex Migration Pathway

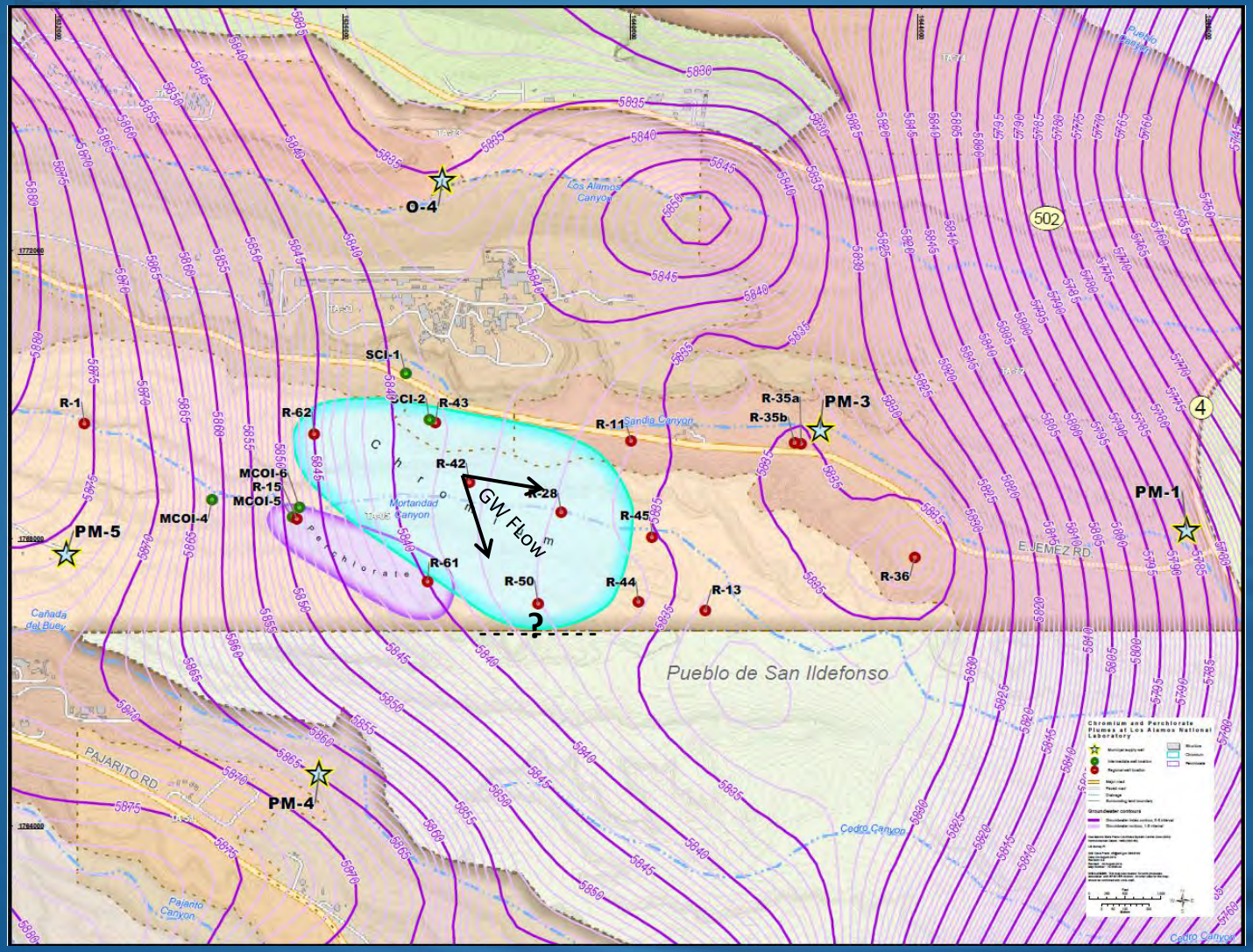


Plume is 900–1,000 feet below canyon bottom

Size is approximately 1 mile x 1/2 mile x <100 feet thick

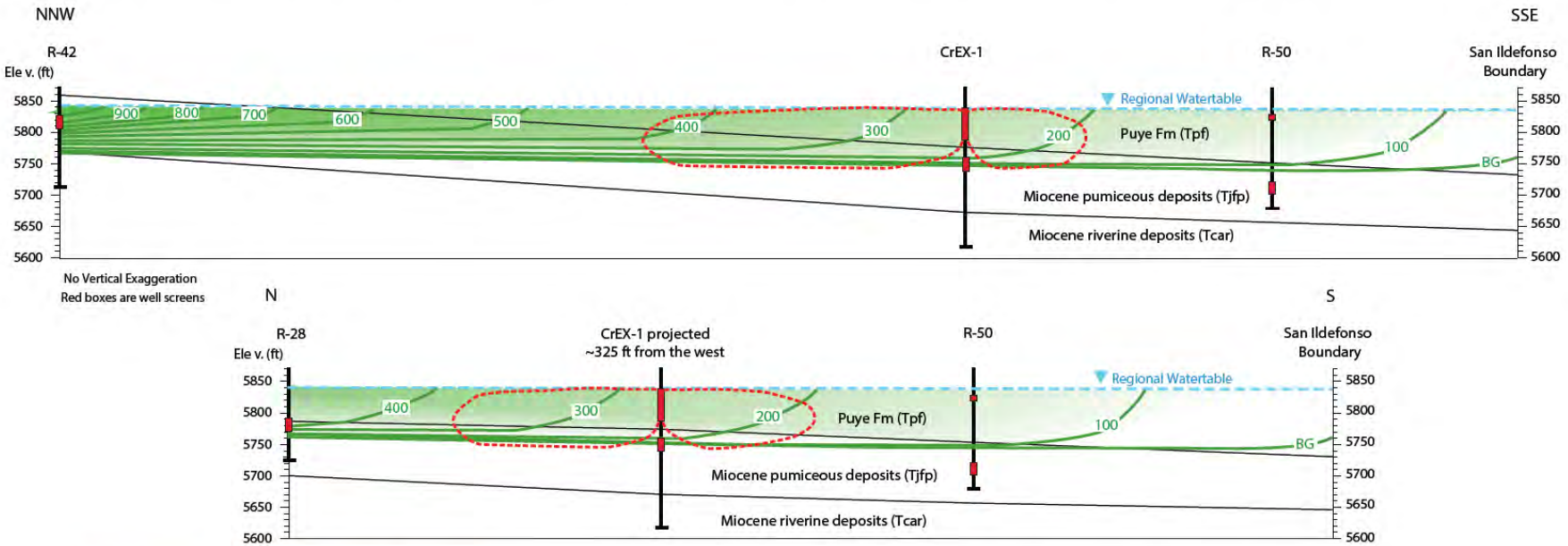
Downgradient plume edge is approximately ½ mile from the closest drinking water well

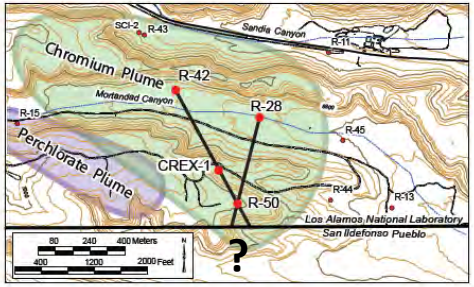
Hydrologic Setting



Plume Cross Section

Geologic Cross Sections Through the Chromium Contaminant Plume Showing Contours of Chromium Concentration in the Upper Part of the Regional Aquifer





Map showing locations of cross sections

0 200 400 600 800 1000 feet

0 200 400 meters

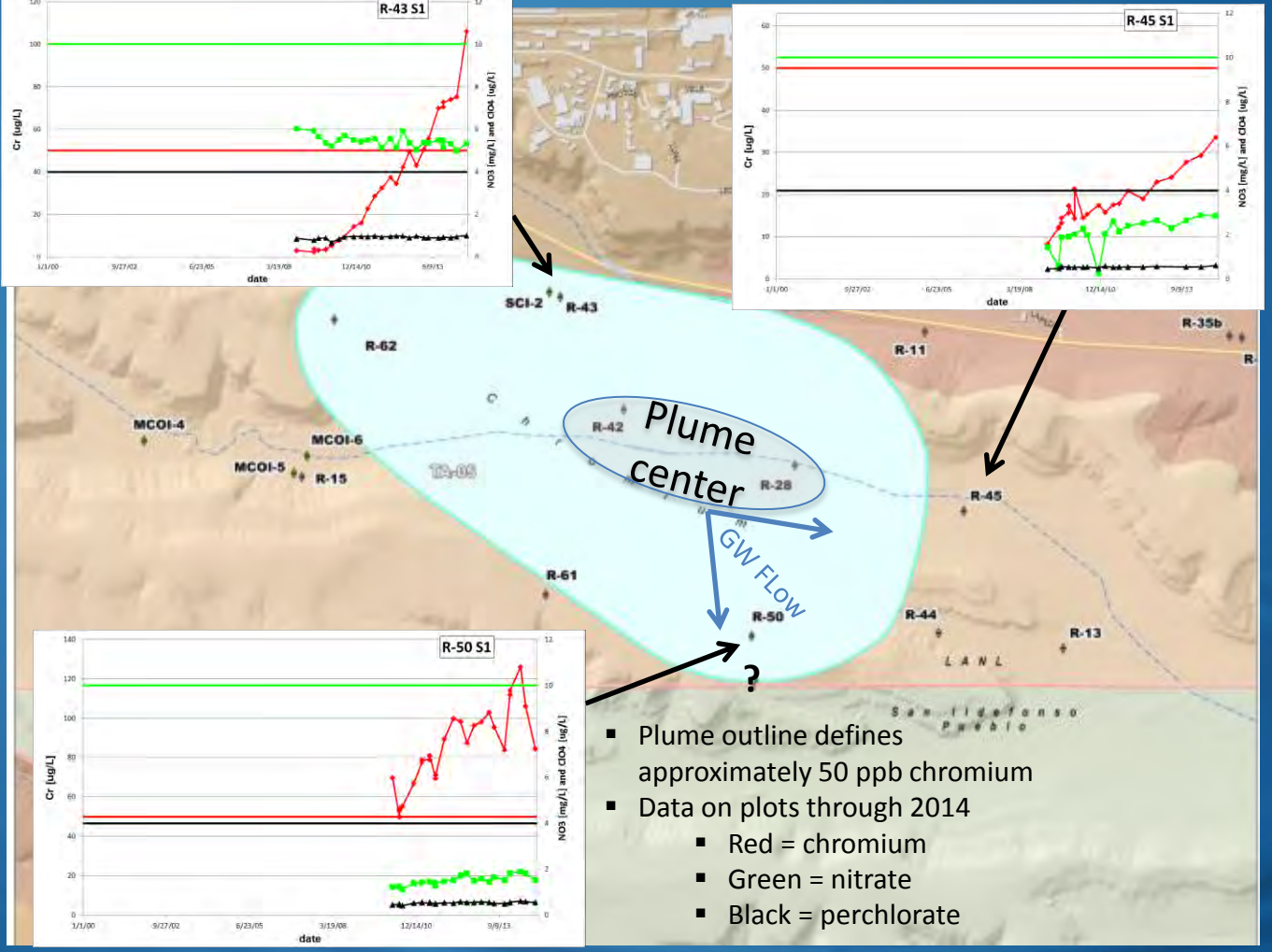
Green numbers indicate chromium concentrations in µg/L for contours; BG indicates background Concentrations. Dashed red line shows schematic zone of water extraction from the upper well screen during pumping of well CrEX.

Chromium migration remains dominantly in upper portion of aquifer

- Minimal downward vertical gradient
- Minimal affect from nearby water-supply pumping

Plume Behavior

Monitoring data from several wells at the plume periphery show increasing trends in chromium

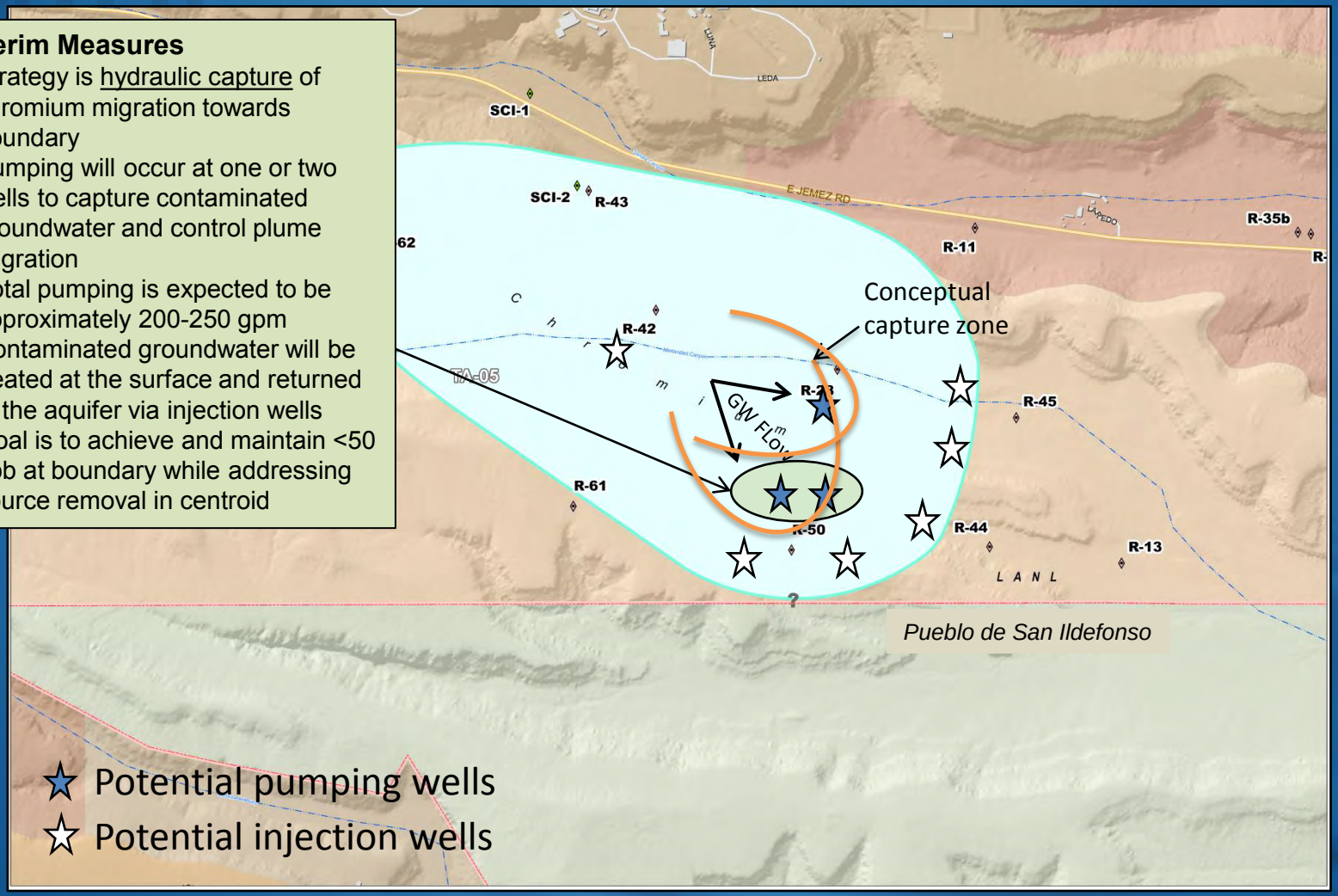


- Plume outline defines approximately 50 ppb chromium
- Data on plots through 2014
  - Red = chromium
  - Green = nitrate
  - Black = perchlorate

Interim Measure

Interim Measures

- Strategy is hydraulic capture of chromium migration towards boundary
- Pumping will occur at one or two wells to capture contaminated groundwater and control plume migration
- Total pumping is expected to be approximately 200-250 gpm
- Contaminated groundwater will be treated at the surface and returned to the aquifer via injection wells
- Goal is to achieve and maintain <50 ppb at boundary while addressing source removal in centroid



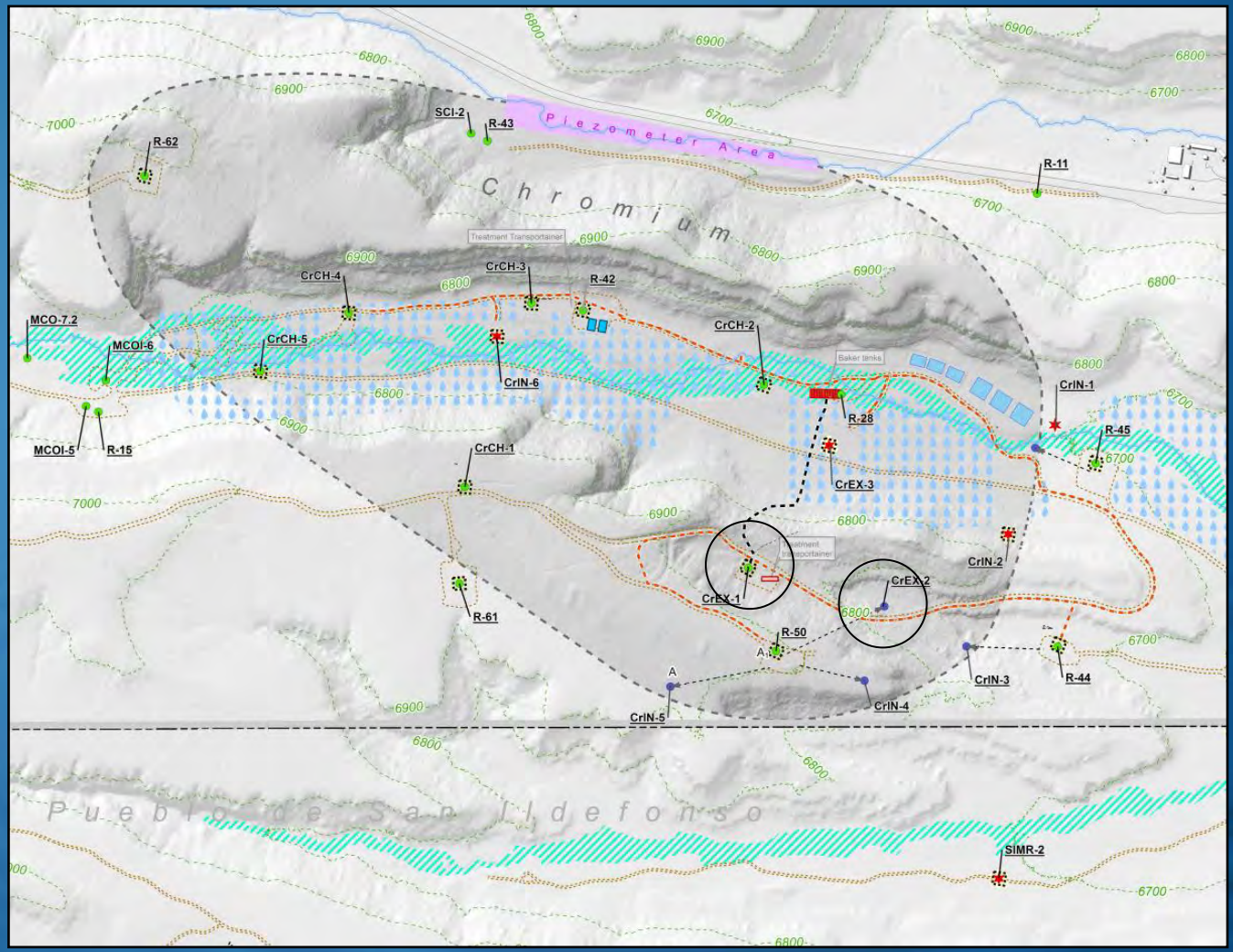
Interim Measure Infrastructure

Extraction well(s)

- CrEX-1 (80 - 100 gpm)
- CrEX-2? (est. ~100 gpm)

Injection wells (6)

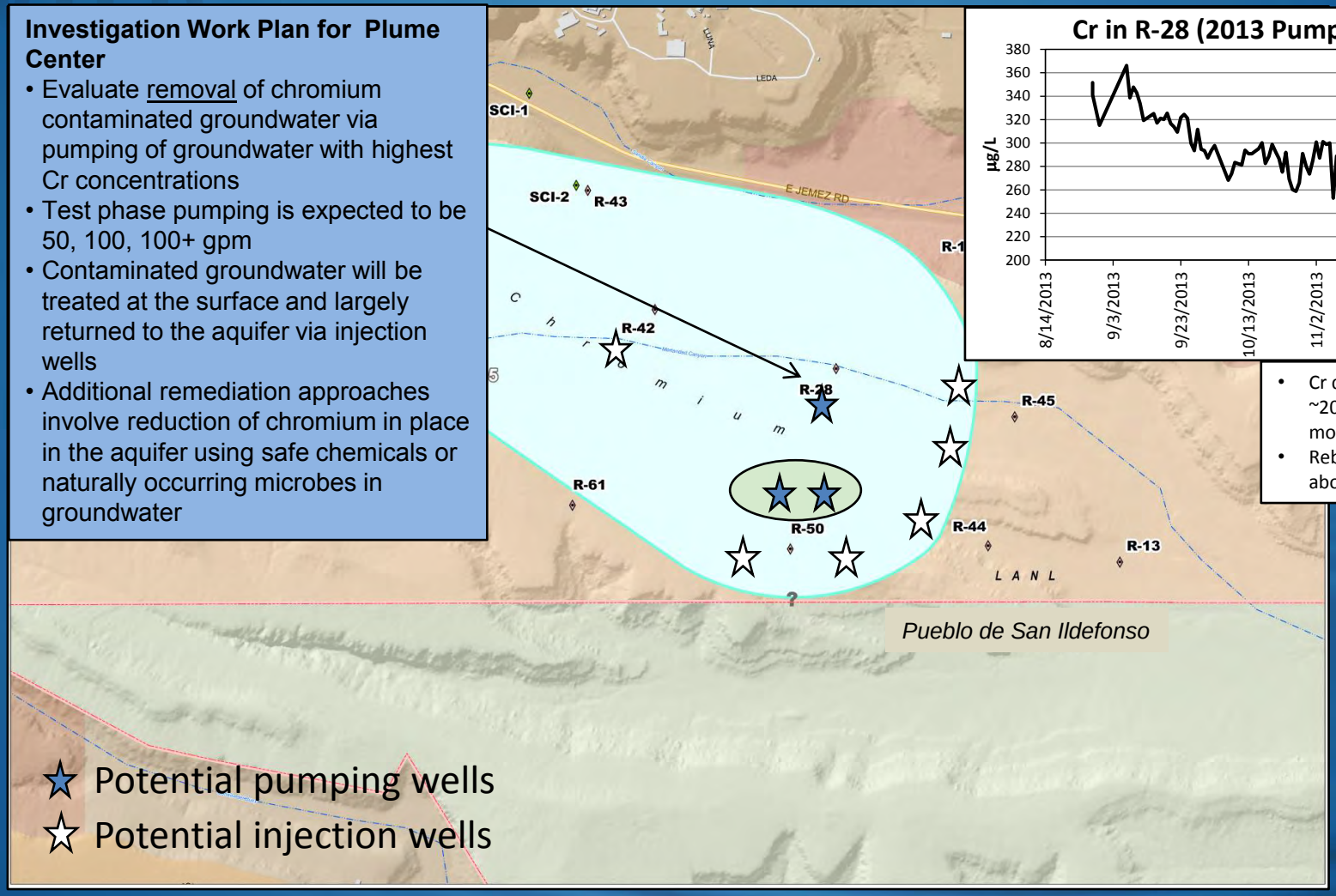
- 50 – 100 gpm/ea
- Return Credit
- Hydraulic benefit
- Some angled drilling to avoid sensitive archeology sites and terrain challenges

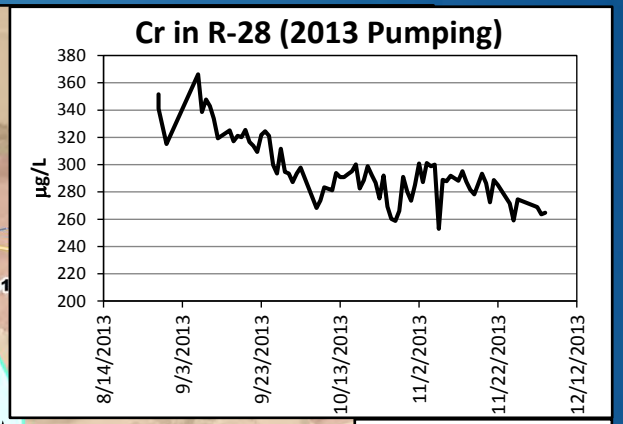


Plume Characterization

Investigation Work Plan for Plume Center

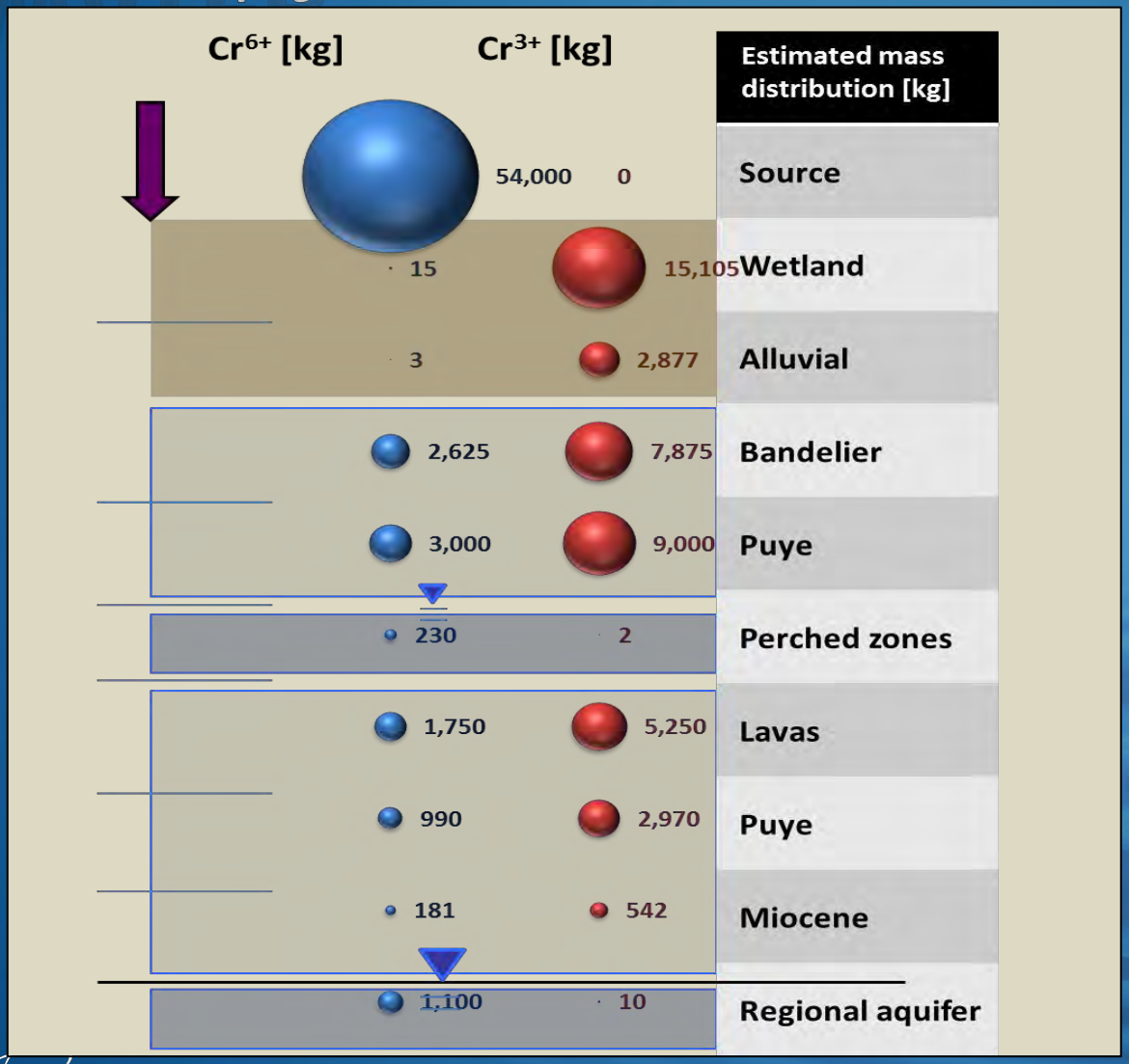
- Evaluate removal of chromium contaminated groundwater via pumping of groundwater with highest Cr concentrations
- Test phase pumping is expected to be 50, 100, 100+ gpm
- Contaminated groundwater will be treated at the surface and largely returned to the aquifer via injection wells
- Additional remediation approaches involve reduction of chromium in place in the aquifer using safe chemicals or naturally occurring microbes in groundwater





- Cr declined by ~20% over 1.5 month
- Rebound over about 2 months

Distribution of Cr(VI) and Cr(III)



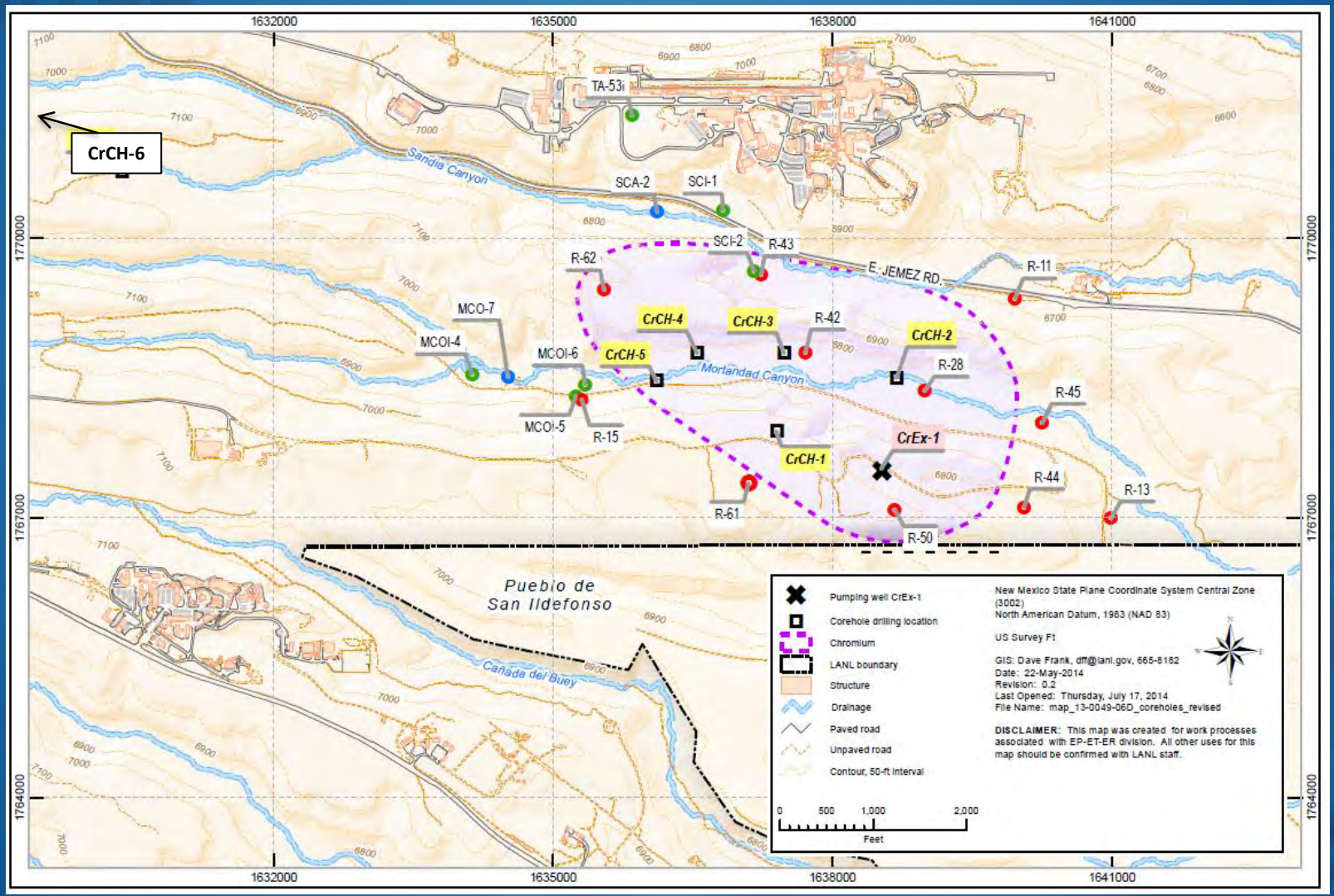
- Natural processes have converted much Cr(VI) to stable, non-toxic Cr(III)
- Important to understand distribution and form of Cr mass to guide evaluation of potential remedial actions
- Final remediation approach likely to involve removal of Cr from system and/or "push" Cr from Cr(VI) to Cr(III)

Plume Characterization

Bench and field studies

- Natural attenuation processes/capacity
  - Studies on core from sonic drilling campaign
- Potential for insitu remedies including chemical and biological reduction
  - Field cross-hole tracer studies
  - Potential future field-scale studies with amendments

Sonic Coreholes



Key Permits, Reviews, Interfaces

- **NMED** – work plan review/approval, discharge permits for land application and injection
- **OSE** – permits for new "points of diversion
- **NEPA** – review project scope for impacts
- **San Ildefonso**
  - ✓ Installation of monitoring well on Pueblo de San Ildefonso land
  - ✓ Project objectives
- **Los Alamos County and City/County of SF**
  - ✓ Ensure that pumping and other remediation strategies do not interfere with water-supply wells
  - ✓ Engage with the county if it appears that water-supply pumping is adversely affecting plume behavior
  - ✓ Continue to monitor at sentinel wells and within water-supply wells
- **CAB and other Stakeholders**
  - ✓ Transparent communications of plans and progress

Questions?