
FINAL

**Quality Assurance Project Plan
Remedial Investigation at
San Fernando Valley Area 2 Superfund Site
Glendale Chromium Operable Unit**

**EPA Contract No. EP-S9-08-04
EPA Task Order No. 060-RICO-09N2
CH2M HILL Project No. 427727**

Prepared for
**United States Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, CA 94105**

April 2012

CH2MHILL®

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U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 9

Plan Title: Quality Assurance Project Plan for Remedial Investigation at San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Site Name: Glendale Chromium Operable Unit

Site Location: Los Angeles County, California

City/State: Los Angeles County, California

Site EPA ID#: AZD008397127

Anticipated Sampling Dates: April 2012 – July 2013

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Acronyms and Abbreviations

µg /L	micrograms per liter
1,2,3-TCP	1,2,3-trichloropropane
AL	action level
bgs	below ground surface
CAO	Cleanup and Abatement Order
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHHSL	California Human Health Screening Level
CLP	Contract Laboratory Program
COC	chain-of-custody
COPC	chemical of potential concern
CRDL	contract-required detection limit
CSM	conceptual site model
DHS	California Department of Health Services
DMP	data management plan
DO	dissolved oxygen
DPH	California Department of Public Health
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
ELCR	excess lifetime cancer risk
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ESV	ecological screening value
FAR	Federal Acquisition Regulations
FFS	focused feasibility study
FS	feasibility study
FSP	field sampling plan
GC	gas chromatography
GCOU	Glendale Chromium Operable Unit
GNOU	Glendale North Operable Unit
GSOU	Glendale South Operable Unit
HHRA	human health risk assessment
HI	hazard index

HQ	hazard quotient
HSP	health and safety plan
ICP/MS	inductively coupled plasma/mass spectrometry
IDW	investigation-derived waste
ITT	ITT Aerospace Controls Division
LADWP	Los Angeles Department of Water and Power
LARWQCB	California Regional Water Quality Control Board – Los Angeles Region
MCL	maximum contaminant level
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
NFA	No Further Action
NHOU	North Hollywood Operable Unit
NL	notification level
NPL	National Priorities List
ORP	oxidation-reduction potential
OU	operable unit
PCE	tetrachloroethene
PE	performance evaluation
ppb	parts per billion
PRP	potentially responsible party
QA	quality assurance
QAM	quality assurance manager
QAO	quality assurance officer
QAPP	quality assurance project plan
QC	quality control
RAC	Response Action Contract
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
Respondents	Glendale Chromium Operable Unit Respondents Group
RI	remedial investigation
ROD	Record of Decision
RPD	relative percent difference

RPM	Remedial Project Manager
RSCC	Regional Sample Control Center
RSL	regional screening level
RTL	review team leader
SAP	sampling and analysis plan
SFV	San Fernando Valley
SIM	selective ion monitoring
SLERA	screening-level ecological risk assessment
SM	site manager
SOW	statement of work
SRM	standard reference material
SSC	site safety coordinator
STL	sampling team leader
STLC	soluble threshold limit concentration
TC	toxicity characteristic
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons, diesel range
TPH-g	total petroleum hydrocarbons, gasoline range
TTLC	total threshold limit concentration
UCL	upper confidence limit
VOC	volatile organic compound
WET	waste extraction test

Introduction

The United States Environmental Protection Agency (EPA) prepared this Quality Assurance Project Plan (QAPP) associated with the remedial investigation (RI) at the San Fernando Valley (SFV) Area 2 Superfund Site Glendale Chromium Operable Unit (GCOU), Los Angeles County, California. The QAPP includes the policies, organizations, objectives, and functional activities/procedures associated with the proposed sampling and analysis activities. Appendix A presents the data quality objectives (DQOs).

The QAPP is a companion document to the *Remedial Investigation Work Plan – San Fernando Valley Area 2 Superfund Site Glendale Chromium Operable Unit* (EPA, 2012a). This QAPP accompanies the Field Sampling Plan (FSP) (EPA, 2012b), and Data Management Plan (DMP), which together constitute the Sampling and Analysis Plan (SAP) for the project.

The QAPP follows EPA guidelines contained in *EPA Guidance for Quality Assurance Project Plans* (EPA, 2002a) and *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001). Thus, the section titles and numbering conventions in this QAPP correlate with the subtitles found in the EPA guidelines (EPA, 2002a).

Project Management/Data Quality Objectives

A.1 Project Organization

EPA is conducting this project as Task Order No. 060-RICO-09N2 under EPA Response Action Contract (RAC) No. EP-S9-08-04. CH2M HILL designated a site manager (SM) who works directly with the EPA Remedial Project Manager (RPM) to complete the task order. The SM manages the financial, schedule, and technical status of the task order. Key people involved in interfacing with the SM are the EPA RPM, and the CH2M HILL quality assurance manager (QAM), review team leader (RTL), individual task managers for field sampling, and the sampling team leader (STL).

The primary responsibility for project quality rests with the SM, while the RTL and QAM provide independent quality control (QC). The RTL/review team and QAM will review project planning documents, data evaluation, and deliverables. If review of documents identifies quality assurance (QA) problems or deficiencies requiring special action, the SM, RTL, and QAM will identify the appropriate corrective action for the STL or the laboratory.

The sampling team will implement the project in accordance with the SAP (consisting of the QAPP, FSP, and DMP) and the companion Health and Safety Plan (HSP). The CH2M HILL site safety coordinator (SSC) ensures adherence to the HSP and field decontamination procedures, and the STL directs the entire field effort.

The subcontract administrator will procure subcontracts for EPA's RAC projects under Federal Acquisition Regulations (FAR), and provides the interface with project subcontractors. EPA may utilize subcontractors on this task order for laboratory analyses depending on availability of the EPA Regional Laboratory or another laboratory designated by EPA.

Figure 1 illustrates the project organization and the line of authority for CH2M HILL efforts. Figure 2 shows the data users and recipients, including EPA and CH2M HILL technical personnel and QA, consistent with the overall RAC 9 Program Plan; the program plan provides further details on these functions.

A.2 Problem Definition/Background

EPA, the California Regional Water Quality Control Board - Los Angeles Region (LARWQCB) and others have overseen and conducted extensive investigative work in the SFV Area 2 Superfund site through work on the Glendale North Operable Unit (GNOU) and Glendale South Operable Unit (GSOU); the interim remedy for volatile organic compound (VOC)-contaminated ground water; ongoing EPA ground water monitoring; and considerable site-specific investigation and remediation at individual facilities.

EPA previously identified areas for additional chromium investigation in the 2005 *Final Burbank and Glendale Operable Units Focused Chromium Trend Study* (CH2M HILL, 2005a) and in the 2007 *Priority Ranking of Potential Well Sites for Chromium Monitoring Technical Memorandum* (CH2M HILL, 2007b). The nature and extent of chromium contamination in the SFV has been evaluated and mapped through the above studies and regular SFV ground water monitoring. The planned GCOU RI is a supplemental investigation intended to fill remaining data gaps and further delineate the nature and extent of chromium, particularly hexavalent chromium, in ground water throughout the GCOU. The following sections define the objectives of the supplemental data collection activities that will be performed to complete the GCOU RI.

A.2.1 Purpose

This QAPP presents the policies, organizations, objectives, and functional activities/procedures associated with EPA RI sampling and analysis activities at GCOU. This QAPP follows EPA guidelines contained in *Guidance for the Data Quality Objectives Process* (EPA, 2006) and *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001). The QAPP sections correlate with the subtitles found in the EPA guidelines (EPA, 2002) and

consistent with the requirements for *Uniform Federal Policy for Quality Assurance Project Plans* (EPA, 2005). Appendix A presents the DQOs.

A.2.2 Problem Statement

EPA developed specific problem statements and project objectives through the DQO process. The DQOs are presented in Appendix A.

A.2.3 Background

This section provides a description of the SFV Superfund Site (Area 2) and a brief history of the GNOU and GSOU. This section also provides a chronology of significant events related to the chromium investigation and a summary of previous chromium investigations for GCOU. The Focused Chromium Trend Study (CH2M HILL, 2005a) and the First Five-Year Review Report (CH2M HILL, 2008b) provide further details about the information contained in this section.

A.2.3.1 Site Location and Description

The San Fernando Basin, located within the Upper Los Angeles River Area, includes the Los Angeles River and its various tributaries. The San Fernando Basin is approximately 23 miles long in an east-west direction and up to approximately 12 miles wide in a north-south direction (approximately 122,800 acres).

The elevation of the Los Angeles River valley floor slopes from 1,100 feet above mean sea level (msl) in the northwestern portion of the valley to approximately 350 feet above msl near the southern portion of the Los Angeles Narrows. The valley is bounded on the north and northwest by the Santa Susana Mountains, on the northeast by the San Gabriel Mountains, on the west by the Simi Hills, and on the south by the Santa Monica Mountains. The SFV Superfund Site is located between the San Gabriel and Santa Monica Mountains.

Four separate areas originally comprised the SFV Superfund Site:

Area 1 – North Hollywood and Burbank

Area 2 – Glendale

Area 3 – Verdugo (delisted in 2004 and no longer part of the Superfund Site)

Area 4 – Pollock

Figure 3 shows the location of the GCOU in the southeast portion of the San Fernando Basin, where the Los Angeles River turns southward from its west-to-east course. GNOU is located at the northern end of the Los Angeles River Narrows; GSOU is located within the Narrows itself.

A.2.3.2 Site History

From 1940 to 1967, industrial and commercial facilities widely used chlorinated solvents including trichloroethene (TCE) and tetrachloroethene (PCE) for dry cleaning and for degreasing machinery. Disposal of these solvents was not well-regulated. In 1980, the Los Angeles Department of Water and Power (LADWP) conducted a 2-year study to define the extent of contamination in SFV (LADWP, 1983). Results of the study, published in 1983, revealed widespread VOC-contaminated ground water in the SFV, specifically a contaminant plume migrating to the southeast at a rate of 300 feet per year. The cities of Los Angeles, Burbank, and Glendale removed a number of municipal supply wells from service based on these findings. In 1986, EPA placed four ground water areas in the eastern SFV on the National Priorities List (NPL).

EPA manages the four SFV Superfund Sites and adjacent areas where contamination has (or might have) migrated as one large site, using a comprehensive approach for the investigation and cleanup of the contamination. Currently, EPA focuses on five OUs within two of the four SFV Superfund Sites to accelerate investigation and cleanup of the study area. Four of the five OUs represent discrete, interim containment remedies currently in progress throughout the eastern portion of the SFV. Each of these four OUs has a separate, signed Record of Decision (ROD).

Within Area 1, RODs were signed in 1987 and 1989 for North Hollywood OU (NHOU) and Burbank OU, respectively. The NHOU Interim Remedy began operating in 1989; the Burbank OU began operations in 1996.

The ROD for Area 2, signed in 1993, includes GNOU and GSOU. The Interim Remedy for GNOU and GSOU began partial operation in August 2000 and achieved full operational capacity in June 2002. In 2004, EPA delisted Area 3 (Verdugo) from the NPL. EPA monitors the contaminant levels and effectiveness of the treatment plant for Area 4 (Pollock), which is currently being addressed by the LADWP Pollock Wellfield Treatment Plant.

From the late 1980s to late 1990s, EPA provided funds to the LARWQCB to assess facilities in SFV to determine the extent of VOC solvent usage, and to assess past and current chemical handling, storage, and disposal practices. LARWQCB conducted the investigations pursuant to the LARWQCB Well Investigation Program at facilities within SFV where the release of solvents had occurred. LARWQCB did not consistently require collection of data for dissolved metals at these facilities; however, LARWQCB observed several significant areas of dissolved chromium at RI and facility monitoring wells in the Interstate 5 corridor between the Burbank Airport and Los Feliz Boulevard from the data collected. LARWQCB reevaluated site information from these original source investigations during Phase I of the hexavalent chromium investigations.

In 2007, EPA established GCOU, after a 4-year chromium contamination study conducted by LARWQCB and funded by EPA, and subsequent LARWQCB investigations. The investigation revealed extensive hexavalent chromium contamination above the total chromium maximum contaminant level (MCL) in ground water throughout the eastern SFV and a large number of potential hexavalent chromium sources. Hexavalent chromium contamination has adversely affected operation of the interim VOC remedy for GNOU and GSOU. Table 1 provides a chronology of significant events relevant to chromium investigations in GCOU.

EPA's goal in establishing the GCOU includes completing the investigation and cleanup of Glendale area ground water contaminated with hexavalent chromium by identifying Glendale area facilities that are sources of hexavalent chromium. The LARWQCB, with EPA support, is continuing site investigations at numerous facilities in GCOU to identify potential additional sources of chromium contamination to ground water. These efforts have resulted in site-specific remediation of vadose zone soil at a number of facilities.

Beginning with the 2005 Chromium Trend Study (CH2M HILL, 2005), EPA's focused analysis of the data gaps identified seven key areas (A through G) where additional chromium ground water investigation may be warranted to more completely delineate the nature and extent of chromium contamination and to evaluate chromium fate and transport. Figures 3 and 4 show the distribution of hexavalent chromium and total chromium, respectively in GCOU ground water and the seven key investigation areas. Figures 5 through 7 present focused maps that include the locations of facilities identified as potential chromium sources and facility monitoring wells. Table 2 identifies the facility name and site status corresponding to the facility numbers on Figures 5 through 7. A brief summary of the chromium distribution and data needs associated with Area A through G is provided below and in the DQOs (Appendix A).

- **Area A:** Figures 3 and 4 show an area marked by high chromium concentrations in ground water near the northern boundary of the GCOU, just downgradient of the Burbank OU. Additional data points are needed in this area to delineate this contamination and to assess ground water flow directions and contaminant transport rates from the Burbank OU into the northern part of the GCOU.
- **Area B:** Figure 5 shows the hexavalent chromium distribution in Area B. Hexavalent chromium concentrations at a cluster monitoring well downgradient of the NHOU (NH-C06) have consistently exceeded 5 micrograms per liter ($\mu\text{g/L}$). In addition, there is potential migration of lower-level hexavalent chromium contamination from the southwestern portion of the Burbank OU into the western portion of the GCOU. The well network in this area is insufficient to evaluate the extent of contamination and provide data to assess ground water flow directions and contaminant transport rates from the NHOU into the western part of the GCOU.
- **Area C:** This area is on the eastern edge of the largest chromium plume in the GCOU (Figure 6). The eastern extent of chromium contamination along this plume is incompletely delineated. Additional wells are required to evaluate the eastern extent of this plume and monitor chromium concentrations that may be bypassing the GNOU extraction wells.

- **Area D:** This area contains an incompletely delineated plume near the former All Metals Processing facility (facility 6) that contains chromium concentrations exceeding 50 µg/L (shown in Figure 6) and an area of sparse data far to the west (shown in Figure 5). In addition, the western edge of the large area of high-concentration chromium described in Area C is not fully defined.
- **Area E:** The Los Angeles River corridor has been identified as a potential chromium migration pathway; there is an insufficient well network along the unlined portion of the river to evaluate ground water and surface water interaction (Figure 7). In addition, the distribution of chromium downgradient of the GNOU extraction wells is not completely delineated.
- **Area F:** Figure 7 shows a plume near the former Drilube facility (facility 2) that is not adequately delineated. Additional wells are required cross-gradient and downgradient of the former Drilube facility to evaluate the distribution of chromium upgradient of the GSOU extraction wells.
- **Area G:** This area contains an area of chromium contamination that may have migrated downgradient of the GSOU extraction wells either prior to construction of the extraction wells or due to incomplete hydraulic control (Figure 7).

A.2.3.3 Previous Investigations

Between the initial RI in the early 1990s and 2008, numerous investigations characterized ground water conditions within GNOU and GSOU (Area 2). However, based on the conclusions of the RI, initially these investigations focused on exposure to TCE and other VOCs as the primary chronic human health risk.

Beginning in 1992, the investigations included annual collection of ground water samples for dissolved chromium analysis from the 84 RI monitoring wells within EPA's SFV monitoring well network. EPA also conducted several "special" sampling events to collect ground water samples for dissolved chromium and hexavalent chromium from targeted RI monitoring wells, as well as targeted facility monitoring wells.

A.2.4 Data Needs and Uses

EPA identified data needs and data uses through the DQO process, which follows EPA *Guidance for Data Quality Objectives Process-EPA QA/G-4, Document EPA/600/R-96/055* (EPA, 2006 and 2000). For each medium, EPA identified and evaluated multiple specific problems/principal study questions through the seven DQO steps. Appendix A presents the DQOs.

Table 3 summarizes the data needs and data uses resulting from the DQO process. Table 3, presented in two parts: Table 3A (Ground Water Analyses) and Table 3B (IDW Analyses), lists the contaminants of potential concern (COPCs) and presents regulatory criterion/action level (AL) requirements for the COPCs. The tables present a comprehensive listing of regulations reviewed, and identifies the lowest regulatory criteria where there are multiple regulatory criteria/ALs for a given COPC. EPA considered these regulatory limits in selecting appropriate methods and laboratory reporting levels described in Sections A.4.2 and B.4.

Table 3 lists the analytical methods and laboratory reporting limits selected to meet the regulatory criteria. However, some selected methods, due to practicable method limitations, have higher reporting limits than regulatory criteria. Table 3 identifies the analytes with regulatory limits lower than laboratory reporting levels, if any. As applicable, these comparisons are carried out for EPA Contract Laboratory Program (CLP) standard limits or EPA Regional Laboratory limits.

EPA will request lower detection limits, if needed, through the CLP special services program described in Section A.4.2. The final sample detection levels also may be higher than the identified initial reporting limits because of sample matrix effects. EPA will report detection levels for the individual samples in the final data. Laboratory-specific method detection limits (MDLs) are significantly below reporting levels. If reporting limits exceed the regulatory limits, the project team will use MDLs, as needed, for project decisions, which is not expected to impact project decisions. The selected methods are state-of-the-art and what is practicable.

A.3 Project Description and Schedule

A.3.1 Description of Work to be Performed

The key investigation activities include the following:

- **Pre-field Activities:** EPA will conduct the following pre-field activities:
 - Site reconnaissance visits
 - Site access negotiations for 15 planned drilling locations
 - Procurement of subcontractors
 - Utility clearance activities
- **Monitoring Well Installation:** EPA currently plans to install 17 new monitoring wells at 15 different locations during two separate phases of fieldwork (Phase 1 and Phase 2). The rationale for new monitoring well locations is presented in the RI Work Plan (EPA, 2012a). The final locations and need to install the Phase 2 monitoring wells will be evaluated as part of the RI. Specific details of the planned well installation activities include the following:
 - Installation of 13 shallow monitoring wells (approximately 100 feet deep) using hollow-stem auger drilling methods. EPA will determine the actual depths of monitoring wells based on lithology and depth to ground water encountered at each individual boring location.
 - Installation of two cluster wells, each consisting of one shallow (approximately 100 feet deep) and one deep monitoring well (approximately 200 feet deep), using a combination of hollow-stem auger and air rotary casing hammer or dual-tube percussion drilling methods. EPA will determine the actual depths of the shallow monitoring wells based on lithology and depth to ground water encountered at each individual boring location. EPA will determine the actual depths of deep monitoring wells based on lithology encountered in the boring in conjunction with the analytical data and well depths of deeper wells in the area.
 - Development of monitoring wells using a combination of bailing, swabbing, and pumping.
- **Aquifer Testing:** EPA may perform pumping tests to assess aquifer properties (hydraulic conductivity) in the GCOU. EPA will collect drawdown data from new monitoring wells during development activities to evaluate the specific capacity (i.e., drawdown as a function of pumping rate) of each monitoring well. Specific capacity data will be used to evaluate the usefulness of pumping test data from the new monitoring wells. If EPA determines pumping test data from the monitoring wells would be useful in RI evaluations an addendum to this QAPP will be submitted to describe pumping test rationale, procedures, and data analysis.
- **Ground Water Sampling:** EPA will conduct quarterly ground water sampling at new and existing wells between May 2012 and July 2013. EPA will conduct the different ground water sampling events as follows:
 - One sampling event will include nine existing monitoring wells. Analyses will include hexavalent chromium (filtered and unfiltered) and total chromium (filtered and unfiltered).
 - One sampling event will include the six new EPA Phase 1 monitoring wells. Analyses will include hexavalent chromium (filtered and unfiltered), total chromium (filtered and unfiltered), dissolved metals/cations, general chemistry parameters, VOCs, and emerging compounds. Table 3A presents the dissolved metals/cations and general chemistry parameters.
 - One sampling event will include 18 new monitoring wells (6 EPA and 12 GCOU Respondents Group [Respondents] wells) and 6 existing monitoring wells. Analyses will include hexavalent chromium (filtered and unfiltered) and total chromium (filtered and unfiltered). Depending on initial VOC and emerging compound results from new EPA monitoring wells, EPA may request analysis of VOCs and emerging compounds at selected wells.

- One sampling event will include the 11 new EPA Phase 2 monitoring wells. Analyses will include hexavalent chromium (filtered and unfiltered), total chromium (filtered and unfiltered), dissolved metals/cations, general chemistry parameters, VOCs, and emerging compounds. Table 3A presents the dissolved metals/cations and general chemistry parameters.
- Two sampling events will include 29 new monitoring wells (17 EPA and 12 Respondents wells) and 15 existing monitoring wells. Analyses will include hexavalent chromium (filtered and unfiltered) and total chromium (filtered and unfiltered). Depending on initial VOC and emerging compound results from new EPA monitoring wells, EPA may request analysis of VOCs and emerging compounds at selected new wells.
- Two sampling events will include 29 new monitoring wells (EPA and Respondents wells) and 6 existing wells (9 of the existing wells will be sampled only semiannually). Analyses will include hexavalent chromium (filtered and unfiltered) and total chromium (filtered and unfiltered).

A minimum of four rounds of samples will be analyzed for filtered and unfiltered hexavalent chromium and total chromium at each monitoring well, after which the need for analyzing both filtered and unfiltered samples will be evaluated.

- **IDW Management:** IDW generated during monitoring well installation and aquifer testing will consist of drill cuttings, purge water, and decontamination rinsate. EPA will manage the IDW by properly containing and temporarily storing the IDW at the drill site or a dedicated waste staging area while awaiting analytical results. Table 3B presents the required analyses for the IDW samples. After receipt of IDW analytical results, EPA will dispose the IDW wastes at an appropriate disposal facility.

A.3.2 Schedule of Activities

Field reconnaissance activities will start in December 2011. Mobilization and field activities will commence in April 2012 and continue through approximately July 2013. EPA anticipates completion of the RI report by September 2013.

A.4 Data Quality Objectives

A.4.1 Project Quality Objectives

EPA evaluated the specific needs for data that will be collected during each activity to determine whether project objectives for the RI are optimally achieved. EPA independently considered specific DQOs through the DQO process to meet the data user's needs for each activity. Appendix A presents the DQO decision making process for the remedial field activities.

A.4.2 Measurement Performance Criteria

EPA's quality objective in developing this QAPP is to implement procedures that will provide data of known and appropriate quality for the needs identified through the DQO process. EPA assessed data quality by evaluating representativeness, comparability, accuracy, precision, and completeness. The sections below describe the terms, the applicable procedures, and level of effort for the data quality assessment.

The intended use of the data and nature of the analytical results dictate the applicable QC procedures, quantitative target limits, and level of effort for assessing data quality. Table 4 presents the analytical parameters and applicable detection levels, analytical precision, accuracy, and completeness in alignment with the data needs identified in Section A-2.4. Table 4, presented in two parts, includes Table 4A (Ground Water Analyses) and Table 4B (IDW Analyses).

Table 4 presents the reporting detection levels/target detection limits in accordance with method reporting limits, equivalent to contract-required detection limits (CRDLs). Target detection implies that final sample detection levels may be higher because of sample matrix effects. Table 4 identifies the reporting levels that exceed the regulatory limits identified in Table 3. These comparisons are carried out for EPA CLP standard limits.

EPA may request lower detection limits through the CLP special services program as further described in Section B.4. The final sample detection levels also may exceed the initial reporting limits because of sample matrix effects. EPA will report detection levels for the individual samples in the final data. Laboratory-specific MDLs are significantly below reporting levels. If reporting limits exceed regulatory limits, the project team will use MDLs, as needed, for project decisions, which are not expected to be significantly affected by the higher detection levels. The selected methods are state-of-the-art and what is practicable.

Representativeness measures how closely the results reflect the actual concentration or distribution of the chemical compounds in the matrix samples. EPA developed the sampling plan design, sampling techniques, and sample-handling protocols (e.g., for storage, preservation, and transportation) discussed in subsequent sections of this QAPP. The proposed documentation will establish that protocols have been followed and sample identification and integrity ensured.

Comparability expresses the confidence with which one data set can be compared to another. EPA will maintain data comparability using defined procedures and the use of consistent methods and consistent units. Actual detection limits will depend on the sample matrix and will be reported as defined for the specific samples.

Accuracy assesses the closeness of the measured value to the true value. The laboratory assesses accuracy of chemical test results by spiking samples with known standards and establishing the average recovery. For a matrix spike (MS), the laboratory adds a known amount of standard compounds identical to the compounds being measured. Section D.3 presents a quantitative definition of average recovery accuracy. The laboratory will assess accuracy at a minimum frequency of 1 in 20 samples analyzed.

Precision measures the data spread when more than one measurement has been collected from the same sample expressed as the relative percent difference (RPD). Section D.3 presents a quantitative definition of precision. The laboratory will assess precision at a minimum of 1 in 20 samples analyzed,

Completeness measures the amount of valid data obtained from the analytical measurement system and the complete implementation of defined field procedures. Section D.3 presents a quantitative definition of completeness. The target completeness objective is 90 percent; the actual completeness may vary depending on the intrinsic nature of the samples. The completeness of the data will be assessed during QC reviews.

A.5 Special Training Requirements/Certification

CH2M HILL will require project staff working on the site to complete health and safety training, and will require project staff to follow requirements specified in the project HSP, included in the FSP. The HSP describes the specialized training required for personnel on this project and includes the documentation and tracking of this training.

A.6 Documentation and Records

Section B and the FSP describe the required field documentation and records for the RI. Laboratory will provide documentation in accordance with:

1. Methods and QA protocols listed in Section B
2. EPA Regional Laboratory specific standard operating procedures

The SM will complete overall project documentation in accordance with EPA's Region 9 RAC Program Plan.

Measurement Data Acquisition

This section presents the sampling process design and requirements for sampling methods, sample handling and custody, analytical methods, QC, and instrumentation for the sampling activities described in the work plan. This section also addresses data acquisition requirements and data management for these sampling events.

B.1 Sampling Process Design

B.1.1 Background

Section A.2 presents the site background.

B.1.2 Schedule of Analyses

Field reconnaissance activities will start in December 2011. Mobilization and field activities will commence during April 2012 and continue through approximately July 2013. EPA anticipates completion of the RI report by September 2013. Section 4 of the FSP provides the specific analyses for the individual samples.

B.1.3 Rationale for Sampling Design

DQO Step 7 presented in Appendix A provides the rationale for sampling design.

B.2 Sampling Methods Requirements

Section 5 of the FSP provides details regarding the sampling method requirements.

B.3 Sample Handling and Custody Requirements

A sample is physical evidence collected from a hazardous waste site, from the immediate environment, or from another source. Because of the potential evidentiary nature of samples, EPA must track possession of samples from the time of sample collection until the introduction of samples as evidence. In addition to field notebooks, EPA will use a number of documents for tracking sample custody. Well purging, sample collection, and additional sample handling procedures are included in the FSP (EPA, 2012b).

Field documents include sample custody seals, chain-of-custody (COC) records, and packing lists obtained from the Regional Sample Control Center (RSCC) in EPA's Region 9 Laboratory. EPA will use COC procedures to maintain and document sample collection and possession. After sample packaging, the sampling team will complete one or more of the following COC paperwork forms, as necessary, for the appropriate samples:

- Organic traffic report and COC record
- Inorganic traffic report and COC record
- EPA Region 9 COC record
- Overnight shipping courier air bill

The sampling team will fill out copies of the above forms and distribute the forms per instructions for sample shipping and documentation in FSP. The sampling team will use LITE II or Scribe electronic forms, as applicable. If requested, completed field QA/QC summary forms will be sent to the RSCC at EPA's Region 9 Quality Assurance Office at the conclusion of each sampling event.

B.3.1 Chain-of-Custody

The sampling team will follow the COC procedures to document sample possession.

B.3.1.1 Definition of Custody

A sample is under custody if one or more of the following criteria are met:

- It is in your possession
- It is in your view, after being in your possession
- It was in your possession and then you locked it up to prevent tampering
- It is in a designated secure area

B.3.1.2 Field Custody

In collecting samples for evidence, the sampling team will collect only enough sample volume to provide a good representation of the media being sampled. To the extent possible, the sampling team will determine the quantity and types of samples and sample locations before the actual fieldwork. The sampler holds the responsibility for the care and custody of the collected samples until the proper transfer of the samples occurs. The SM determines whether the sampling team followed proper custody procedures during fieldwork, and will decide if the sample team needs to collect additional samples.

B.3.1.3 Transfer of Custody and Shipment

The COC accompanies shipments identifying its contents. Forms II Lite or Scribe COC procedures will be used for samples shipped to CLP laboratories and traditional paper/carbon copy COCs will be used when shipping samples to the Region 9 Laboratory. The original record (field printout for Forms II Lite/Scribe and white copy for Region 9) accompanies the shipment to the laboratory, and the SM retains a copy (duplicate printout for Forms II Lite/Scribe and pink copy for Region 9). When transferring samples, the individuals relinquishing and receiving the samples must sign, date, and note the time on the COC record. This record documents custody transfer from the sampler, often through another person, to the analyst at the laboratory.

The sampling team will properly package samples for shipment to the appropriate laboratory for analysis, with a separate COC record accompanying each shipping container (one for each field laboratory, and one for samples driven to the laboratory). The sampling team will seal the shipping containers with custody seals for shipment to the laboratory. The sampling team will enter the courier names and other pertinent information in the "Received by" section of the COC record. When appropriate, as in the case where the representative is unavailable, the COC record should contain a statement that the samples were delivered to the designated location at the designated time.

If samples are sent by mail, the sampling team will register the package with return requested. If the samples are transmitted by common carrier, the courier will provide a bill of lading. The SM will retain freight bills, postal service receipts, and bills of lading as part of the permanent documentation.

B.3.1.4 Laboratory Custody Procedures

A designated sample custodian accepts custody of the shipped samples, and verifies that the packing list sample numbers match those on the COC records. The custodian will record pertinent information as to shipment, pickup, and courier in the "Remarks" section. The custodian then enters the sample numbers into a bound notebook, arranged by project code and station number. The custodian uses the sample identification number or assigns a unique laboratory number to each sample. The custodian transfers the samples to the proper analyst or stored in the appropriate secure area.

Laboratory personnel assume responsibility for the care and custody of samples from the receipt of samples until the sample is exhausted or returned to the custodian. Laboratory personnel use report forms to record data from sample analyses.

When the laboratory has completed sample analyses and necessary QA checks, the laboratory will properly dispose of the unused portion of the sample in compliance with all federal, state and local regulatory requirements. The laboratory will retain all identifying stickers, data sheets, and laboratory records.

B.3.2 Custody Seals

When shipping samples to the laboratory, the sampling team must place the samples in containers sealed with custody seals. The sampling team must place one or more custody seals on each side of the shipping container (cooler).

B.3.3 Field Notebooks

Section 5 of the FSP describes the typical field information that the sampling team should enter in the field notebook. In addition to COC records, the STL must maintain a bound field notebook to provide a daily record of significant events, observations, and measurements during field investigations. The STL should sign and date all entries. The SM should keep the field records as a permanent record.

These notebooks should provide sufficient data and observations to enable participants to reconstruct events that occurred during the project, and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence.

B.3.4 Corrections to Documentation

Waterproof ink will be used to record all original data recorded in field notebooks, sample identification tags, COC records, and receipts-for-sample forms, unless prohibited by weather conditions. The SM should prevent destruction of accountable serialized documents, even if the documents are illegible or contain inaccuracies that require a replacement document.

If an accountable document contains an error assigned to one team, the STL may make corrections simply by drawing a single line through the error and entering the correct information. However, the STL should not obliterate the erroneous information. The person making the entry should correct any subsequent error discovered on an accountable document and then initial and date the corrections.

B.4 Analytical Methods Requirements

Table 4 provides the project analytes, methods, and detection limits.

The CLP will analyze ground water samples following the applicable EPA SOW. The SOWs specify methodology, QA/QC, and documentation. The laboratory will implement the EPA CLP methodology and QC for low concentration analyses as needed. Table 4 shows the project-required detection levels as well as the CLP CRDLs. As described in Section A.2 .4, some standard CLP limits may exceed regulatory or risk limits. For these cases, the laboratory will carry out the analyses in accordance with special services provisions currently available under the CLP. The laboratory may use a low-level inductively coupled plasma/mass spectrometry (ICP/MS) SOW ILM 5.1 for metals. Similarly, the laboratory may use a low-level organic SOW OLC 3.2, selective ion monitoring (SIM) methodology or larger sample volumes to attain lower-level organic detection limits.

The EPA Regional Laboratory will analyze for the parameters not covered by the CLP. The Regional Laboratory will implement standard EPA methods following laboratory standard operating procedures for the specific method. The EPA Regional Laboratory may request CH2M HILL to subcontract laboratories to analyze some of the parameters following the review of this QAPP and the associated analyses request. CH2M HILL will then prepare laboratory statements of work for the individual methods with methodology and QA/QC equivalent to the Regional laboratory standard operating procedures.

If the lowest regulatory limit is lower than the analytical reporting limit shown in Table 4, the laboratory-specific detection levels are expected to be significantly below the listed reporting limit. The selected methods are state-of-the-art and the practicable methods; the higher limits are not expected to have a significant effect on project decisions.

The distribution of analyses may change at the time of analysis depending on implementation of additional procedures at the regional laboratory as well as capacity.

B.5 Quality Control Requirements

The subsections below detail QC requirements for the RI.

B.5.1 Field QC Procedures

Previous sections of the QAPP discussed QC requirements related to the sample collection process (i.e., design, methods, handling, and custody). Field QC samples include field duplicates, field blanks, and laboratory QC samples (for matrix spike and matrix spike duplicates [MS/MSDs]). The sampling team will collect QC samples immediately following collection of target samples, and will use the same procedures as the collection of the target sample. The FSP presents these procedures.

B.5.2 Laboratory QC Procedures

Laboratory QC procedures include the following:

- Analytical methodology according to specific methods listed in Table 4
- Instrument calibrations and standards as defined in specific methods listed in the CLP SOW or EPA Regional Laboratory specifications
- Laboratory blank measurements at a minimum of 5 percent or 1-per-batch frequency
- Accuracy and precision measurements at a minimum of 1 in 20, 1 per set
- Data reduction and reporting according to specific methods listed in Table 4
- Performance evaluation (PE) samples will be sent to the laboratory. The PE samples will be provided by the EPA Region 9 quality assurance officer (QAO), and will be representative of the concentration range of interest.

B.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The laboratories maintain instrument maintenance logbooks at all times. The logbooks, in general, contain a schedule of maintenance, as well as a complete history of past maintenance, both routine and nonroutine.

The laboratory performs preventive maintenance according to the procedures described in the manufacturer's instrument manuals, including lubrication, source cleaning, detector cleaning, and the frequency of such maintenance. The laboratory cleans or replaces the chromatographic carrier gas-purification traps, injector liners, and injector septa on a regular basis. The laboratory also examines precision and accuracy data for trends and excursions beyond control limits to determine evidence of instrument malfunction. The laboratory will perform maintenance when an instrument begins to degrade as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the QC criteria.

The laboratory minimizes instrument downtime by keeping adequate supplies of all expendable items, where expendable means an expected lifetime of less than 1 year. These items include gas tanks, gasoline filters, syringes, septa, gas chromatography (GC) columns and packing, ferrules, printer paper and ribbons, pump oil, jet separators, open-split interfaces, and mass spectroscopy filaments.

The sampling team will complete preventive maintenance for field equipment (e.g., pH meter) in accordance with procedures and schedules outlined in the operation and maintenance handbook for the particular model.

B.7 Instrument Calibration and Frequency

The following subsections review instrument calibration and frequency information.

B.7.1 Field Calibration Procedures

For water analyses, field equipment requiring calibration includes pH, conductivity, temperature, dissolved oxygen, and oxidation-reduction potential (ORP) meters. The sampling team will calibrate these meters before the start of work and at the end of the sampling day. The sampling team will record any instrument "drift" from prior calibration in the field notebook. The sampling team will calibrate the meters in accordance with procedures and schedules outlined in the operations and maintenance manual for the particular instrument.

The sampling team will identify the calibrated equipment by using either the manufacturer's serial number or other means. Each meter will contain a label with the identification number and the date of the next calibration or, the sampling team will have records traceable to the equipment readily available for reference. In addition, the sampling team will record the results of calibrations and records of repairs in a logbook.

Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, remove the device from service and tagged it to prevent use. The STL will notify the appropriate personnel to schedule a recalibration or request a substitute piece of equipment.

The STL will evaluate the results of activities performed using equipment that failed recalibration. If the activity results are adversely affected, the STL will document results of the evaluation and notify the task manager and QA/QC reviewer.

B.7.2 Laboratory Calibration Procedures

All calibrations will be as defined per standard EPA method; the calibrations, at a minimum, are at the following level of effort:

- Initial calibration for all methods will include, at a minimum, three-point calibration before a run.
- Continuing calibration for all methods will include a mid-range calibration standard after every 10th sample or every 12 hours.

B.8 Data Acquisition Requirements (Nondirect Measurements)

EPA will use previously collected data and other information to assist decision making during the RI field activities, and for RI evaluations. EPA maintains the SFV basinwide database, a comprehensive database of water quality data for SFV including GCOU. In addition, EPA will also use data collected during the Respondents RI activities for RI evaluations.

B.9 Data Management

The companion DMP describes specific data management procedures.

All data for all parameters will undergo two levels of review and validation: (1) at the laboratory, and (2) outside the laboratory as described in Section D. For this project, EPA will submit samples to the Region 9 laboratory and/or designated CLP laboratories and contract laboratories. EPA will provide validated data to CH2M HILL for input into the database to facilitate database inquiries and report preparation. The data stored in the databases will include all laboratory qualifiers. CH2M HILL will adapt established data queries and formats developed during the previous task orders for incorporation of laboratory data from files, provided by EPA's QAO, to files compatible with the project database. CH2M HILL will maintain the database in a manner that is compatible with EPA requirements, and will provide the database to EPA, or others at EPA's request. Major components for complete data management include:

Data Conversion/Manipulation/Review. The QAM provides reports of sample-quality data from sampling in hardcopy or electronic format. CH2M HILL must convert, input, review and QC check these data. In addition, CH2M HILL may incorporate available data from other sources into the database. CH2M HILL will manually input, output, review, QC check, and then upload the data into the database.

- **Preparation of Tables.** CH2M HILL will prepare data tables following receipt of validated data from the QAO after each sample event. CH2M HILL will create queries for the database to generate updated tables. The project team will use the tables for the tasks described above.
- **Database Documentation.** CH2M HILL will perform updates of the database and complete documentation as needed. The SM will document the commands, file names, and general operating procedures for the data queries as directed by the EPA RPM. The SM will provide this documentation to EPA and transferred to others at EPA's request.

Assessment/Oversight

C.1 Assessment and Response Actions

The review team, quality assurance manager (QAM), and SM will monitor the performance of the QA procedures. If problems arise and the RPM directs the SM, the review team will conduct field audits, currently not scheduled or included in the SOW. Audits may be scheduled to evaluate the following:

1. Execution of sample identification, COC procedures, field notebooks, sampling procedures, and field measurements
2. Evaluation of personnel training
3. Evaluation of equipment (i.e., calibration)
4. Evaluation of the use of proper sampling equipment
5. Evaluation of the use of appropriate sample containers, sample preservatives, and techniques
6. Evaluation of sample packaging and shipment techniques
7. Evaluation of collection of QC samples

At a minimum, the QAM will implement one unannounced assessment of items 5, 6, or 7 once per year.

The EPA Regional Laboratory, EPA CLP, and contract laboratories, as described in Section B.4, will perform the analyses. The distribution of analyses may change at the time of analysis depending on implementation of additional procedures at the Regional Laboratory. The EPA QAO manages QA of the Regional Laboratory. For laboratories subcontracted to CH2M HILL, if any, CH2M Hill will select the laboratory based on prior performance on regional Superfund projects. Additionally, the project QAM will administer onsite audits or PE samples, as necessary. The PE samples will be sent to the laboratory blind, labeled as field samples. PE sample results will be compared against PE supplier's results and acceptance ranges. Following these initial evaluations, results that are outside the acceptance range of the supplier, if any, will be further evaluated to understand the cause of the deviation. Subsequently, feedback will be provided to the laboratory that analyzed the PE sample.

An audit report prepared by the reviewer will document results of the audits. The auditor will also debrief the laboratory or the field team at the end of the audit and request that the laboratory or field team comply with the corrective action requests.

C.1.1 Reporting and Resolution of Issues

If QC audits result in detection of unacceptable conditions or data, the SM is responsible for developing and initiating corrective action. The SM will notify the RPM if nonconformance is of program significance or requires special expertise not normally available to the project team. In such cases, RPM will decide whether any corrective action should be pursued. Corrective action may include the following:

- Reanalyzing samples if holding time criteria permit
- Resampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting data acknowledging a level of uncertainty

C.2 Reports to Management

The SM or RPM may request development of a QA report regarding the performance of sample collection and data quality. The report will include the following:

- Assessment of measurement data accuracy, precision, and completeness
- Results of performance audits

- Results of systems audits
- Significant QA problems and recommended solutions

Monthly progress reports will summarize overall project activities and any problems encountered. QA reports generated on sample collection and data quality will focus on specific problems encountered and solutions implemented. Alternatively, in lieu of a separate QA report, the SM may summarize sampling and field measurement data quality information in the final reports summarizing field activities (e.g., well installation or aquifer testing technical memoranda). The summary will include the objectives, activities performed, overall results, sampling, and field measurement data quality information of the project, along with any QA reports.

Data Validation and Usability

D.1 Data Review, Validation, and Verification Requirements

All data for all parameters will undergo two levels of review and validation: (1) at the laboratory, and (2) outside the laboratory by the EPA Quality Assurance Management Section or their designee. The EPA QAO will have the data reviewed outside the laboratory at the following level of effort:

- Review of 90 percent of the sample analytical batches for all the analytical parameters, detections, and nondetections at Tier 2, per the regional EPA QAO guidance. For CLP analyses, this level of effort corresponds to Level 1B. In addition, review of 10 percent of the analytical batches (selected randomly) at Tier 3 for all parameters, detections, and nondetections. If a new laboratory is performing the analyses, the first analytical batch should undergo the Tier 3 review as a proactive measure.
- Tier 2 review will provide all the QA/QC summary forms in accordance with EPA CLP National Functional Guidelines for Inorganic/Organic Data review. The Tier 2 review will include all calibrations and internal standards and flagging of the individual results, as opposed to review of a subset of the QC data in the Tier 1A review. Tier 2 (CLP Tier 1B) economizes the laboratory data review compared to Tier 3 by limiting the review to QC summary data as opposed to raw data checks. Review of QC summary data that includes all QC parameters provides for the needed comprehensive coverage for this RI. The review will compare QC summary data to acceptable limits and will qualify the individual associated data points per guidelines. The review also will compare detects in blanks to associated samples and qualify/modify sample concentrations per guidelines.

EPA based the level of effort for the data review on the objectives of this project and deals with quantitative evaluation of samples at trace levels for all analytes. The full database needs consistent flags/qualifiers for comparable and reproducible data. The level of effort is appropriate because data are compared to regulatory limits used for risk assessments and quantitative comparisons to establish trends at trace levels. Quantitative use at trace levels applies to all analytes, not just a subset of the target analytes. All analytes are contaminants of concern, even though, for example, arsenic may be detected more often than the other analytes. Establishing the validity of nondetect results is equally as important as the detected results for the RI, thus both detections and nondetect results will be reviewed.

D.2 Validation and Verification Methods

Initial data reduction, validation, and reporting at the laboratory will be performed as described in the laboratory standard operating procedures.

Independent data validation by EPA or their designee will follow EPA *Contract Laboratory Program National Functional Guidelines for Inorganic/Organic Data Review* (EPA, 2002b and 2010) and the regional guidance as described above.

D.3 Reconciliation with Data Quality Objectives

The QAM will reconcile results obtained from the project with the requirements specified in Table 4 of this QAPP. Assessment of data for precision, accuracy, and completeness will be in accordance with the following quantitative definitions:

D.3.1 Precision

If calculated from duplicate measurements:

$$\text{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

Where:

RPD	=	relative percent difference
C ₁	=	larger of the two observed values
C ₂	=	smaller of the two observed values

If calculated from three or more replicates, use relative standard (RSD) rather than relative percent difference (RPD):

$$\text{RSD} = (s / \bar{y}) \times 100\%$$

Where:

RSD	=	relative standard deviation
s	=	standard deviation
\bar{y}	=	mean of replicate analyses

Standard deviation, s, is defined as follows:

$$s = \sqrt{\frac{\sum_{i=1}^n (y_i / \bar{y})^2}{n - 1}}$$

Where:

s	=	standard deviation
y _i	=	measured value of the i th replicate
\bar{y}	=	mean of replicate analyses
n	=	number of replicates

D.3.2 Accuracy

For measurements where MS are used:

$$\%R = 100\% \times \left[\frac{S - U}{C_{sa}} \right]$$

Where:

%R	=	percent recovery
S	=	measured concentration in spiked aliquot
U	=	measured concentration in unspiked aliquot
C _{sa}	=	actual concentration of spike added

For situations where a standard reference material (SRM) is used instead of, or in addition to, MS:

$$\%R = 100\% \times \left[\frac{C_m}{C_{sm}} \right]$$

Where:

%R	=	percent recovery
C _m	=	measured concentration of SRM
C _{sm}	=	actual concentration of SRM

D.3.3 Completeness (Statistical)

Defined as follows for all measurements:

$$\%C = 100\% \times \left[\frac{V}{T} \right]$$

Where:

%C	=	percent completeness
V	=	number of measurements judged valid
T	=	total number of measurements

D.3.4 Representativeness

Representativeness measures how closely the results reflect the actual concentration or distribution of the chemical compounds in the matrix samples. EPA developed the sampling plan design, sampling techniques, and sample-handling protocols (e.g., for storage, preservation, and transportation) discussed in subsequent sections of this QAPP. The proposed documentation will establish that protocols have been followed and sample identification and integrity ensured.

SECTION E

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Tables

TABLE 1
Chronology of Significant Site Events
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Date	Type of Event
1980	California Department of Health Services (DHS), now known as California Department of Public Health (DPH), detected TCE, PCE, and other VOCs in a large number of production wells exceeding the respective MCLs and/or state ALs; those wells were removed from service. The Metropolitan Water District provided an alternative water supply where needed. LADWP initiated a study to define the extent of ground water contamination in SFV.
July 1983	Ground Water Management Plan - SFV Basin completed. LADWP's study detected widespread VOC contamination in the eastern SFV and located a contaminant plume migrating to the southeast at 300 feet per year.
1986	EPA listed SFV Areas 1, 2, 3, and 4 on the NPL.
1987	Basinwide remedial investigation/feasibility study (RI/FS) initiated under LADWP lead.
April 1992	RI of SFV Superfund Site (Area 2) (<i>Remedial Investigation of Groundwater Contamination in the San Fernando Valley</i> , December 1992) completed. RI data shows elevated levels of chromium in ground water from 13 of 81 monitoring wells. Concentrations ranged from 61 to 1,020 µg /L.
June 1993	RODs signed for GNOU and GSOU.
January 1999	EPA initiated chromium source investigation through Cooperative Agreement with LARWQCB. The Upper Los Angeles River Area Watermaster and LARWQCB form Chromium Task Force to investigate increasing hexavalent chromium trends in drinking water wells in SFV OUs. Reviewed 4,040 potentially responsible Parties (PRPs) previously investigated; identification of 255 suspected hexavalent chromium sites.
August 2002	Phase I of Chromium Investigation completed by LARWQCB and report <i>Final Chromium VI Investigation Report, San Fernando Valley, Phase I Investigations</i> , August 2002, submitted to EPA. From the list of 255 suspected hexavalent chromium sites identified, 105 sites (majority of which are heavy metal plating shops) requiring further investigation.
November 2002	California Department of Toxic Substances Control (DTSC) identifies list of 260 additional "suspected" sites with chromium users identified in DTSC database.
October 2004	At the request of EPA, evaluation of the occurrence, transport, and fate of dissolved chromium in ground water in the Burbank and Glendale OUs conducted; known as the <i>Burbank and Glendale Operable Units Focused Chromium Trend Study</i> .
February 2005	LARWQCB Phase 1 list revised to 82 sites requiring additional investigation. EPA prepares chromium contamination map for eastern SFV prepared for use with figures for <i>Facilities under Existing Consent Decrees and RWQCB Investigation and Facilities Identified as Potential Sources of Groundwater Contamination</i> (CH2M HILL, 2005b).
June 2005	<i>Final Burbank and Glendale Operable Unit Focused Chromium Trend Study</i> (CH2M HILL, 2005a) report prepared and submitted to EPA.
Early 2006	City of Glendale conducts batch pilot tests on various chromium treatment technologies.
September 2006	EPA conducts well survey to augment monitoring well network.
June 2007	LARWQCB general permit revision lowering the river discharge limit for hexavalent chromium to 8 parts per billion (ppb) becomes effective, creating a similar requirement for City of Glendale.
July 2007	EPA initiates the Glendale Chromium Operable Unit at the SFV Area 2 site.
March 2008	EPA-sponsored Chromium Workshop held in City of Glendale.
September 2008	EPA approves the final design/build proposal for the two chromium treatment Demonstration Projects to be constructed at GNOU and GSOU treatment plants.
March 2011	EPA reaches agreement with Glendale Chromium Respondents on an Administrative Order on Consent that includes implementation of a portion of the GCOU RI.
September 2011	EPA issues Task Order to CH2M HILL for implementation of the GCOU RI.

TABLE 2

**Facilities Within Area 2 Being Investigated as Potential Sources of Chromium Contamination to Ground Water
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit**

Facility Name or Type	Site Number	Site Status
Sites Having Received General Notice Letters from EPA		
All Metals Processing	6	Removal action completed. Additional remediation on hold.
Drilube Company - Wilson	2	Initial removal action completed. Additional remediation pending.
Automation Plating Corp.	7	Limited soil investigation completed.
Excello Plating Co., Inc.	1	Work started on implementation of the Remedial Action Plan.
ITT Aerospace Controls (Home Depot)	8	Remedial Action Plan in place; starting implementation of the final phase of remediation.
Menasco Division (Goodrich Corporation)	11	Remedial Action Plan in place; planning underway for additional remedial action steps.
PRC-Desoto International	4	Remedial Action Plan in place; final round of in situ remediation underway and cleanup confirmation sampling being planned.
Sites Being Investigated by the RWQCB*		
Former metal finishing facility	13	Initial soil investigation conducted.
Former industrial wastewater discharger	5	Initial soil investigation completed.
Former metal finishing facility	12	Shallow soil remedial action completed. Potential deep soil remediation on hold.
Former metal finishing facility	10	Planning underway for initial soil investigation.
Former heavy metal processes	14	Initial soil investigation conducted.
Former metal finishing facility	16	Planning underway of initial soil investigation.
Sites Being Investigated by DTSC		
Former metal finishing facility	17	Soil characterization complete.

Notes:

*The sites listed are, in general, those where active soil investigation or remediation is being overseen by the RWQCB. Numerous additional sites are also under consideration as potential sources of chromium contamination.

RWQCB = Regional Water Quality Control Board

DTSC = Department of Toxic Substances Control

TABLE 3A
 Data Needs and Uses – Ground Water Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Ground Water Analyses

Parameter	Data Use	Data Users	Regulatory Limits/Action Level			
			EPA Tap Water RSL ^a (µg/L)	EPA MCL ^b (µg/L)	CA MCL ^c (µg/L)	Lowest Limit (µg/L)
Dissolved metals/cations:	<ul style="list-style-type: none"> Exceedances with respect to drinking water standards and other State and Federal screening levels Risk assessment Evaluate water treatment and supplement extent and quality of existing database Evaluate contaminant migration and distribution associated with GCOU 	Regulators Risk assessors Hydrogeologists Water purveyors Legal counsel				
Aluminum			16,000	50 – 200 (S)	1,000	50 S
Antimony			6	6	6	6
Arsenic			0.045	10	10	0.045
Barium			2,900	2,000	1,000	1,000
Beryllium			16	4	4	4
Cadmium			6.9	5	5	5
Calcium			--	--	--	--
Chromium (total)			--	100	50	50
Chromium (hexavalent)			0.031	--	--	0.31
Cobalt			4.7	--	--	4.7
Copper			620	1,000 (S)	1,000 (S)	620
Iron			11,000	300 (S)	--	300 S
Lead			--	15 (AL)	15 (AL)	15 AL
Magnesium			--	--	--	--
Manganese			320	50 (S)	50 (S)	50 S
Nickel			300	--	100	100
Potassium			--	--	--	--
Selenium			78	50	50	50

TABLE 3A
 Data Needs and Uses – Ground Water Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Ground Water Analyses

Parameter	Data Use	Data Users	Regulatory Limits/Action Level			
			EPA Tap Water RSL ^a (µg/L)	EPA MCL ^b (µg/L)	CA MCL ^c (µg/L)	Lowest Limit (µg/L)
Silica			--	--	--	--
Silver			71	100 (S)	100 (S)	71
Sodium			--	--	--	--
Thallium			0.16	2	2	0.16
Vanadium			78	--	--	78
Zinc			4,700	5,000 (S)	5,000 (S)	4,700
General chemistry parameters:	<ul style="list-style-type: none"> Evaluate water treatment and supplement extent and quality of existing database Evaluate contaminant migration and distribution associated with GCOU 	Regulators Hydrogeologists Water purveyors Legal counsel				
Chloride			--	250 (S)	--	250
Fluoride			620	2,000 (S)	2,000	620
Nitrate			25,000	10,000	10,000	10,000
Nitrite			1,600	1,000	1,000	1,000
Total Kjeldahl Nitrogen			--	--	--	--
Orthophosphate			--	--	--	--
Sulfate			--	250 (S)	--	250
Sulfide			--	--	--	--
Ammonia			--	--	--	--
Total Alkalinity			--	--	--	--
Total Dissolved Solids			--	500 (S)	500 (S)	500 S
Total Organic Carbon			--	--	--	--
Dissolved Oxygen			--	--	--	--

TABLE 3A
 Data Needs and Uses – Ground Water Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Ground Water Analyses

Parameter	Data Use	Data Users	Regulatory Limits/Action Level			
			EPA Tap Water RSL ^a (µg/L)	EPA MCL ^b (µg/L)	CA MCL ^c (µg/L)	Lowest Limit (µg/L)
Field Parameters:	<ul style="list-style-type: none"> • Ground water characterization • Fate and transport • Evaluate sample quality assurance 	Hydrogeologists				
pH			--	--	--	--
Turbidity			--	--	--	--
Dissolved oxygen			--	--	--	--
Oxidation reduction potential			--	--	--	--
Electric conductivity			--	--	--	--
Temperature			--	--	--	--
VOCs:	<ul style="list-style-type: none"> • Evaluate water treatment and supplement extent and quality of existing database • Evaluate contaminant migration and distribution associated with GCOU 	Hydrogeologists Treatment engineers Regulatory specialists Water purveyors				
Acetone			12,000	--	--	12,000
Benzene			0.39	5	1	0.39
Bromodichloromethane			0.12	--	--	0.12
Carbon tetrachloride			0.39	5	0.5	0.39
Chloroform			0.19	--	--	0.19
1,1-Dichloroethane			2.9	--	5	2.9
1,2-Dichloroethane			0.15	5	0.5	0.15
1,1-Dichloroethene			260	7	6	6
cis-1,2-Dichloroethene			2	70	6	2
trans-1,2-Dichloroethene			86	100	10	10
1,2-Dichloropropane			0.38	5	5	0.38
trans-1,3-Dichloropropene			0.41	--	0.5	0.41
Methylene chloride			4.7	5	5	4.7

TABLE 3A
 Data Needs and Uses – Ground Water Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Ground Water Analyses

Parameter	Data Use	Data Users	Regulatory Limits/Action Level			
			EPA Tap Water RSL ^a (µg/L)	EPA MCL ^b (µg/L)	CA MCL ^c (µg/L)	Lowest Limit (µg/L)
Tetrachloroethene			0.072	5	5	0.072
Toluene			860	1,000	150	150
1,1,1-Trichloroethane			7,500	200	200	200
1,1,2-Trichloroethane			0.24	5	5	0.24
Trichloroethene			0.44	5	5	0.44
Vinyl chloride			0.015	2	0.5	0.015
Emerging Compounds:	<ul style="list-style-type: none"> Evaluate water treatment and supplement extent and quality of existing database Evaluate contaminant migration and distribution associated with GCOU 	Hydrogeologists Treatment engineers Regulatory specialists Water purveyors				
1,4-dioxane			0.67	--	1.0 (NL)	0.67
N-nitrosodimethylamine			0.003	--	0.01 (NL)	0.003
Perchlorate			11	--	6	6
1,2,3-Trichloropropane			0.00065	--	0.005 (NL)	0.00065

Notes:

NL = Notification Level

S = Secondary MCL

RSL = Regional Screening Level

MCL = Maximum Contaminant Level

^a Source: EPA Region 9 RSL Table, November 2011 (EPA Region 9 Web site, December 5, 2011).

^b Source: List of Drinking Water and Contaminants and MCLs (EPA Web site, January 20, 2005).

^c Source: List of MCLs and NLs (California Department of Public Health Web site, October 4, 2011).

TABLE 3B
 Data Needs and Uses – Investigation-Derived Waste Analyses
San Fernando Valley Area 2 Superfund Site - Glendale Chromium Operable Unit

Investigation-Derived Waste Analyses

Analyte	Data Use	Data Users	TCLP Regulatory Standards (mg/L)	CA TTLC/STLC			
				Title 22 TTLC (mg/kg)	If TTLC Concentration is \geq this value STLC Analysis Must be Performed	Title 22 STLC (mg/L)	Most Stringent Screening Level ^a (mg/L)
Metals	• Waste disposal decisions	Project team					
Antimony			--	500	150	15	15
Arsenic			5	500	50	5	5
Barium			100	10,000	1,000	100	100
Beryllium			--	75	7.5	0.75	0.75
Cadmium			1	100	10	1	1
Chromium (total)			5	2,500	50	5	5
Chromium (hexavalent)			--	500	50	5	5
Cobalt			--	8,000	800	80	80
Copper			--	2,500	250	25	25
Lead			5	1,000	50	5	5
Molybdenum			--	3,500	3500	350	350
Nickel			--	2,000	200	20	20
Selenium			1	100	10	1	1
Silver			5	500	50	5	5
Thallium			--	700	70	7	7
Vanadium			--	2,400	240	24	24
Zinc			--	5,000	2500	250	250
Mercury							
Mercury			0.2	20	2	0.2	0.2
VOCS							
Acetone			--	--	--	--	--
Benzene			0.5	--	--	--	0.5
Bromodichloromethane			--	--	--	--	--
Carbon Tetrachloride			0.5	--	--	--	0.5

TABLE 3B
 Data Needs and Uses – Investigation-Derived Waste Analyses
San Fernando Valley Area 2 Superfund Site - Glendale Chromium Operable Unit

Investigation-Derived Waste Analyses

Analyte	Data Use	Data Users	TCLP Regulatory Standards (mg/L)	CA TTLC/STLC		Most Stringent Screening Level ^a (mg/L)
				Title 22 TTLC (mg/kg)	If TTLC Concentration is \geq this value STLC Analysis Must be Performed	
Chlorobenzene			100	--	--	100
Chloroform			6	--	--	6
1,4-Dichlorobenzene			7.5	--	--	7.5
1,1-Dichloroethane			--	--	--	--
1,2-Dichloroethane			0.5	--	--	0.5
1,1-Dichloroethene			0.7	--	--	0.7
cis-1,2-Dichloroethene			--	--	--	--
trans-1,2-Dichloroethene			--	--	--	--
1,2-Dichloropropane			--	--	--	--
trans-1,3-Dichloropropene			--	--	--	--
Methylene Chloride			--	--	--	--
Methyl Ethyl Ketone			200	--	--	200
1,1,1-Trichloroethane			--	--	--	--
1,1,2-Trichloroethane			--	--	--	--
Tetrachloroethene			0.7	--	--	0.7
Toluene			--	--	--	--
Trichloroethene			0.5	2,040	--	2,040
Vinyl Chloride			0.2	--	--	0.2

TABLE 3B
 Data Needs and Uses – Investigation-Derived Waste Analyses
San Fernando Valley Area 2 Superfund Site - Glendale Chromium Operable Unit

Investigation-Derived Waste Analyses

Analyte	Data Use	Data Users	TCLP Regulatory Standards (mg/L)	CA TTLC/STLC		
				Title 22 TTLC (mg/kg)	If TTLC Concentration is \geq this value STLC Analysis Must be Performed	Title 22 STLC (mg/L)
Total Petroleum Hydrocarbons						
TPH – diesel ^(b)			--	--	--	--
TPH – gasoline ^(b)			--	--	--	--

Notes:

TCLP = Toxicity Characteristic Leaching Procedure

TTLC = Total Threshold Limit Concentration

STLC = Soluble Threshold Limit Concentration

mg/L = milligrams per liter

^a For waste, most stringent of: California TTLCs and STLCs – Subsection 66261.24(a)(2) of California Hazardous Waste Regulations

^b TPH-diesel and TPH-gasoline do not have federal or state screening criteria to determine waste characterization. The allowable detection limits for disposal are determined by the waste facility accepting the IDW. Level of detection values will be set to achieve analyte detections to allow for waste disposal at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Offsite Rule approved facilities.

TABLE 4A
 Measurement Performance Criteria – Ground Water Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Ground Water Analyses

Parameter	Method	Lowest Project Criteria (µg/L)	Reporting Limit/Target Detection Limit ^a (µg/L)	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
Dissolved metals/cations:	CLP ^b or EPA 6000/7000 series ^c					
Aluminum		50	200	75-125	±25	90
Antimony		6	60	75-125	±25	90
Arsenic		0.045	10	75-125	±25	90
Barium		1,000	200	75-125	±25	90
Beryllium		4	5	75-125	±25	90
Cadmium		5	5	75-125	±25	90
Calcium		--	5,000	75-125	±25	90
Chromium (total)		50	10	75-125	±25	90
Cobalt		4.7	50	75-125	±25	90
Copper		620	25	75-125	±25	90
Lead		15	10	75-125	±25	90
Iron		300	100	75-125	±25	90
Magnesium		--	5,000	75-125	±25	90
Manganese		50	15	75-125	±25	90
Nickel		100	40	75-125	±25	90
Potassium		--	5,000	75-125	±25	90
Selenium		50	35	75-125	±25	90
Silica		--	CLP	75-125	±25	90
Silver		71	10	75-125	±25	90
Sodium		--	5,000	75-125	±25	90
Thallium		0.16	25	75-125	±25	90
Vanadium		78	50	75-125	±25	90
Zinc		4,700	60	75-125	±25	90
Chromium (hexavalent)	EPA 218.6 ^c	0.031	0.2	75-125	±25	90

TABLE 4A
 Measurement Performance Criteria – Ground Water Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Ground Water Analyses

Parameter	Method	Lowest Project Criteria (µg/L)	Reporting Limit/Target Detection Limit ^a (µg/L)	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
General chemistry parameters:						
Chloride	EPA 300c	250	1 mg/L	75-125	+25	90
Fluoride	EPA 300c	1,500	0.1 mg/L	75-125	+25	90
Nitrate	EPA300c	10 mg/L	0.1 mg/L	75-125	+25	90
Nitrite	EPA300c	1 mg/L	0.1 mg/L	75-125	+25	90
Total Kjeldahl Nitrogen	EPA351c	-	.3 mg/L	75-125	+25	90
Orthophosphate	EPA300c	-	1 mg/L	75-125	+25	90
Sulfate	EPA300c	250	1 mg/L	75-125	+25	90
Sulfide	EPA376c	-	2 mg/L	75-125	+25	90
Ammonia	EPA350c	-	0.3 mg/L	75-125	+25	90
Total Alkalinity	SM2320Bd	-	20 mg/L	75-125	+25	90
Total Dissolved Solids	EPA160.1	500	100mg/L	70-130	+30	90
Total Organic Carbon	EPA415c	-	2 mg/L	70-130	+30	90
Volatile Organics	CLPb or EPA 8260c					
Acetone		12,000	5.0	CLP	CLP	90
Benzene		0.39	0.50	CLP	CLP	90
Bromodichloromethane		0.12	0.50	CLP	CLP	90
Carbon tetrachloride		0.39	0.50	CLP	CLP	90
Chloroform		0.19	0.50	CLP	CLP	90
1,1-Dichloroethane		2.4	0.50	CLP	CLP	90
1,2-Dichloroethane		0.15	0.50	CLP	CLP	90
1,1-Dichloroethene		6	0.50	CLP	CLP	90
cis-1,2-Dichloroethene		6	0.50	CLP	CLP	90
trans-1,2-Dichloroethene		10	0.50	CLP	CLP	90
1,2-Dichloropropane		0.38	0.50	CLP	CLP	90
trans-1,3-Dichloropropene		0.41	0.50	CLP	CLP	90
Methylene chloride		4.7	0.50	CLP	CLP	90
Tetrachloroethene		0.072	0.50	CLP	CLP	90

TABLE 4A
 Measurement Performance Criteria – Ground Water Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Ground Water Analyses

Parameter	Method	Lowest Project Criteria (µg/L)	Reporting Limit/Target Detection Limit ^a (µg/L)	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
Toluene		150	0.50	CLP	CLP	90
1,1,1-Trichloroethane		200	0.50	CLP	CLP	90
1,1,2-Trichloroethane		0.24	0.50	CLP	CLP	90
Trichloroethene		0.44	0.50	CLP	CLP	90
Vinyl chloride		0.015	0.50	CLP	CLP	90
Emerging Compounds:						
1,4-dioxane	8260SIM or 8270SIM ^c	0.67	1	60-140	±40	90
N-nitrosodimethylamine (NDMA)	EPA1625 ^c	0.003	0.002	50-140	±50	90
Perchlorate	EPA314 ^c	6	4	70-130	±30	90
1,2,3-trichloropropane	CLP ^b , 8260 SIM ^c or 524 SIM ^b	0.00065	1	60-140	±40	90
Field Parameters:						
pH			NA	NA	25	90
Turbidity			NA	NA	25	90
Dissolved oxygen			NA	NA	25	90
Oxidation reduction potential			NA	NA	25	90
Electric conductivity			NA	NA	25	90
Temperature			NA	NA	25	90

Notes:

SIM = selective ion monitoring

^a Equivalent to EPA CLP CRDL

^b EPA CLP. QC criteria apply for VOCs, semivolatile organic compounds (SVOCs), and metals. For analytes not covered by CLP, EPA Regional Laboratory specifications apply.

^c EPA, 1979. *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, revised March 1983; *EPA Test Methods for Evaluating Solid Waste*, SW846.

^d *Standard Methods for the Examination of Water and Wastewater*, 17th Edition (1989).

TABLE 4B
 Measurement Performance Criteria – Investigation-Derived Waste Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Investigation-Derived Waste Analyses						
Analyte	Method	Lowest Project Criteria (mg/L)	Reporting Limit/Target Detection Limit ^a (µg/L)	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
Metals	TTL ^c , TCLP ^a EPA 1311 ^b /CLP ^c or EPA 6000/7000 series ^b					
Antimony		15	60	75-125	±25	90
Arsenic		5	10	75-125	±25	90
Barium		100	200	75-125	±25	90
Beryllium		0.75	5	75-125	±25	90
Cadmium		1	5	75-125	±25	90
Chromium (total)		5	10	75-125	±25	90
Chromium (hexavalent)		5	0.2	75-125	±25	90
Cobalt		80	50	75-125	±25	90
Copper		25	25	75-125	±25	90
Lead		5	10	75-125	±25	90
Mercury		0.2	0.2	75-125	±25	90
Molybdenum		350	CLP	75-125	±25	90
Nickel		20	40	75-125	±25	90
Selenium		1	35	75-125	±25	90
Silver		5	10	75-125	±25	90
Thallium		7	25	75-125	±25	90
Vanadium		24	50	75-125	±25	90
Zinc		250	60	75-125	±25	90
Volatile Organics	TTL ^c , TCLP ^a EPA1311 ^b /CLP ^c or EPA8260					
Acetone		--	5.0	CLP	CLP	90
Benzene		0.5	0.5	CLP	CLP	90
Bromodichloromethane		--	0.5	CLP	CLP	90
Carbon Tetrachloride		0.5	0.5	CLP	CLP	90
Chlorobenzene		100	0.5	CLP	CLP	90
Chloroform		6	0.5	CLP	CLP	90
1,4-Dichlorobenzene		7.5	0.5	CLP	CLP	90

TABLE 4B
 Measurement Performance Criteria – Investigation-Derived Waste Analyses
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Investigation-Derived Waste Analyses

Analyte	Method	Lowest Project Criteria (mg/L)	Reporting Limit/Target Detection Limit ^a (µg/L)	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
1,1-Dichloroethane		--	0.5	CLP	CLP	90
1,2-Dichloroethane		0.5	0.5	CLP	CLP	90
1,1-Dichloroethene		0.7	0.5	CLP	CLP	90
Cis-1,2-Dichloroethene		--	0.5	CLP	CLP	90
Trans-1,2-Dichloroethene		--	0.5	CLP	CLP	90
1,2-Dichloropropane		--	0.5	CLP	CLP	90
Trans-1,3-Dichloropropene		--	0.5	CLP	CLP	90
Methylene Chloride		--	0.5	CLP	CLP	90
Methyl ethyl ketone		200	0.5	CLP	CLP	90
1,1,1-Trichloroethane		--	0.5	CLP	CLP	90
1,1,2-Trichloroethane		--	0.5	CLP	CLP	90
Tetrachloroethene		0.7	0.5	CLP	CLP	90
Toluene		--	0.5	CLP	CLP	90
Trichloroethene		0.5	0.5	CLP	CLP	90
Vinyl Chloride		0.2	0.5	CLP	CLP	90
Total Petroleum Hydrocarbons						
TPH – diesel	EPA 8015M ^b	--	5 mg/kg	60-140	±40	90
TPH – gasoline	EPA 8015M ^b	--	1 mg/kg	60-140	±40	90

Notes:

^a TCLP = EPA Toxicity Characteristic Leaching Procedure, Total Threshold Limit Concentration (TTL) leaching procedure per California Title 22 procedure. The extract from these procedures will be analyzed per the following methods.

^b EPA *Test Methods for Evaluating Solid Waste*, SW846.

^c CLP. QC criteria apply for VOCs, SVOCs, metals. For analytes not covered by CLP, EPA Regional Laboratory specifications apply.

Figures

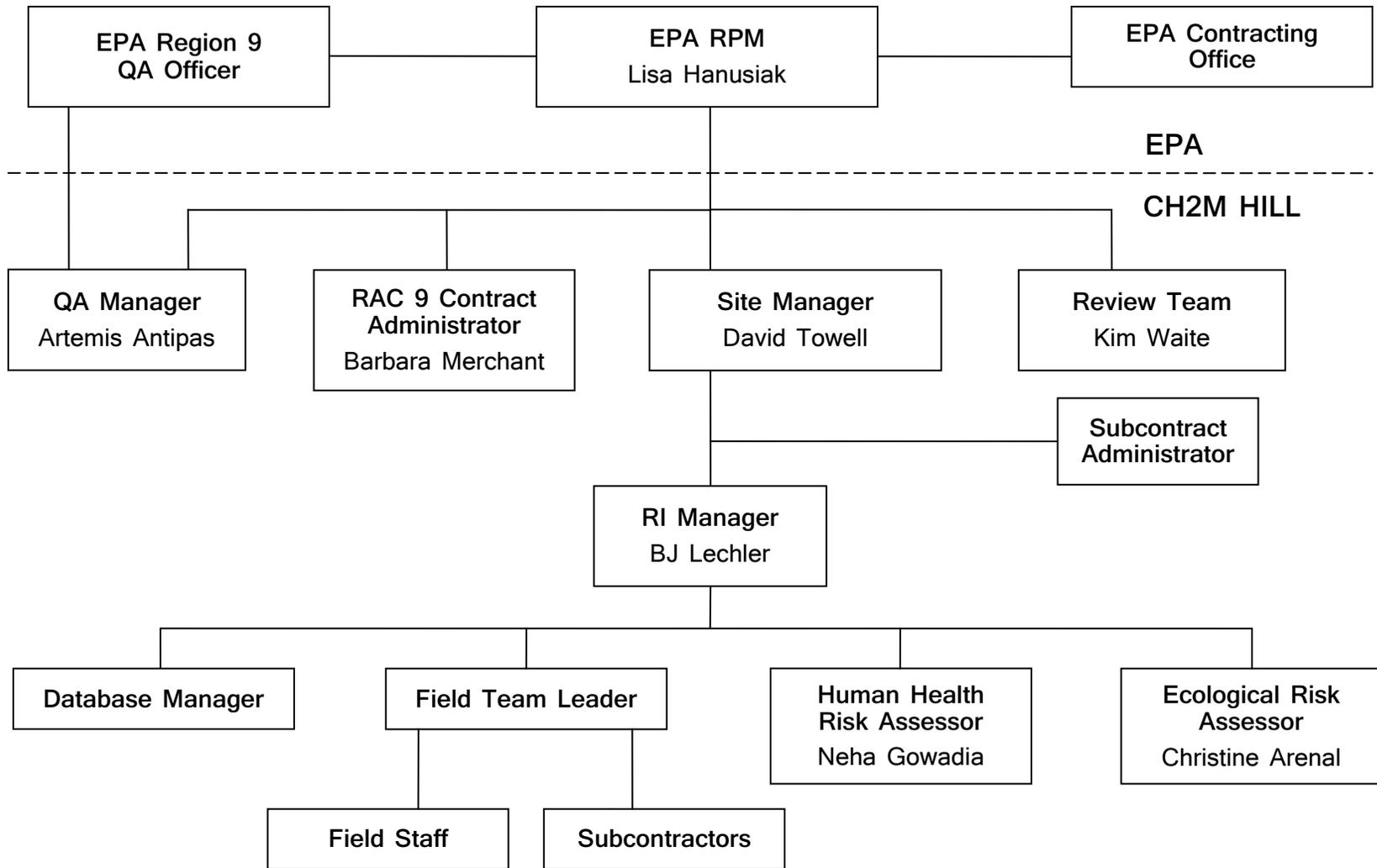


FIGURE 1
 Project Organization
 San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

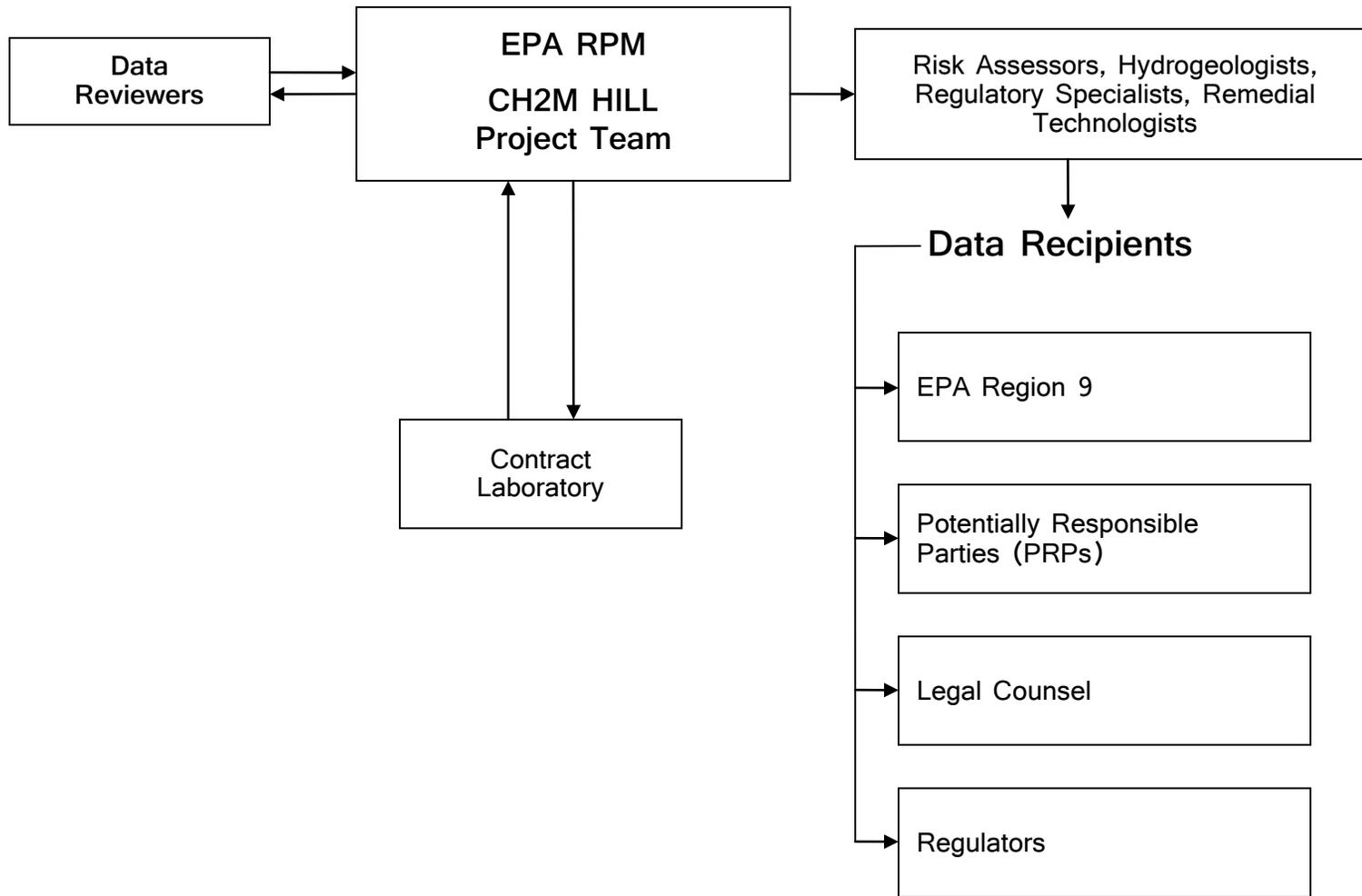
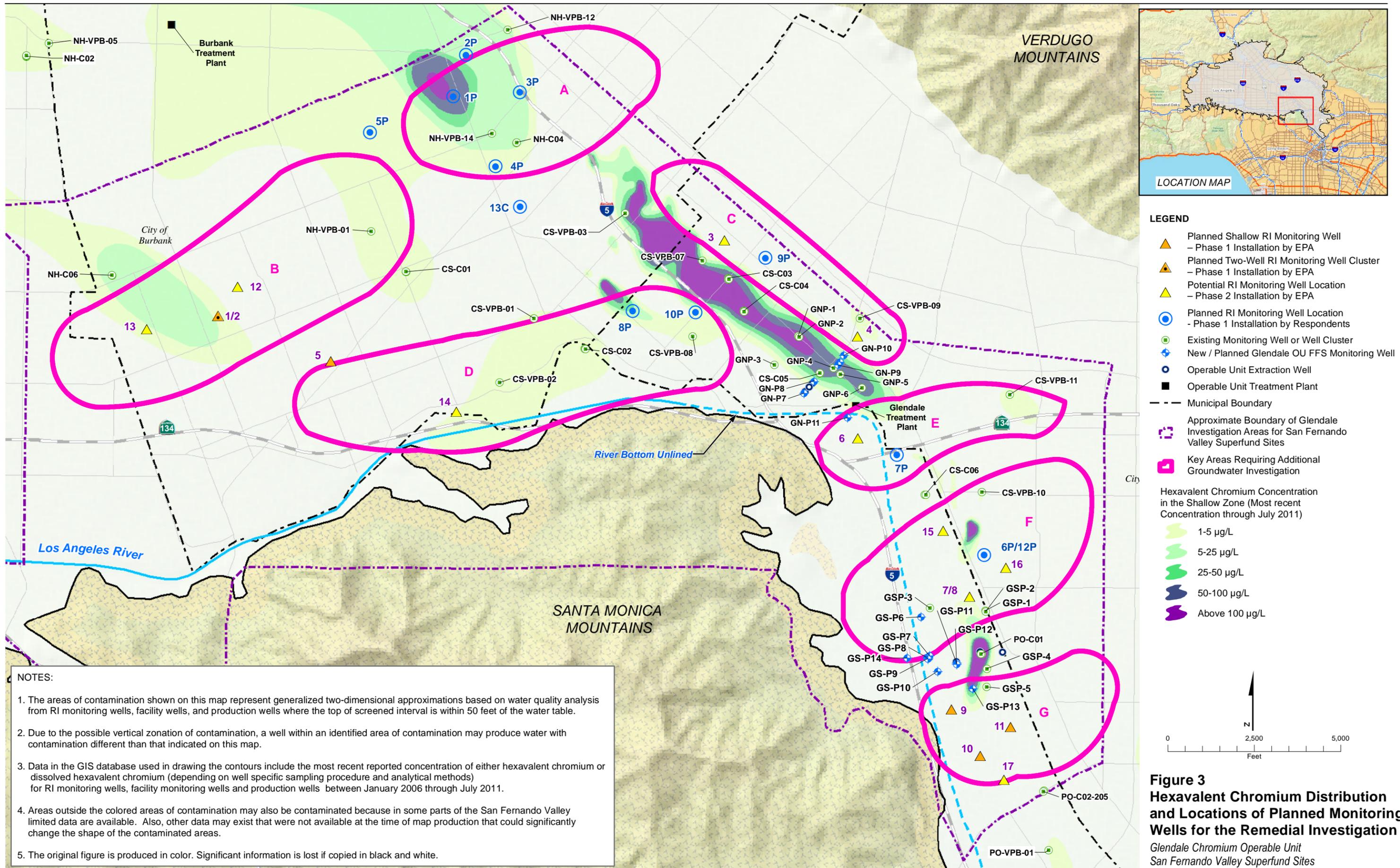


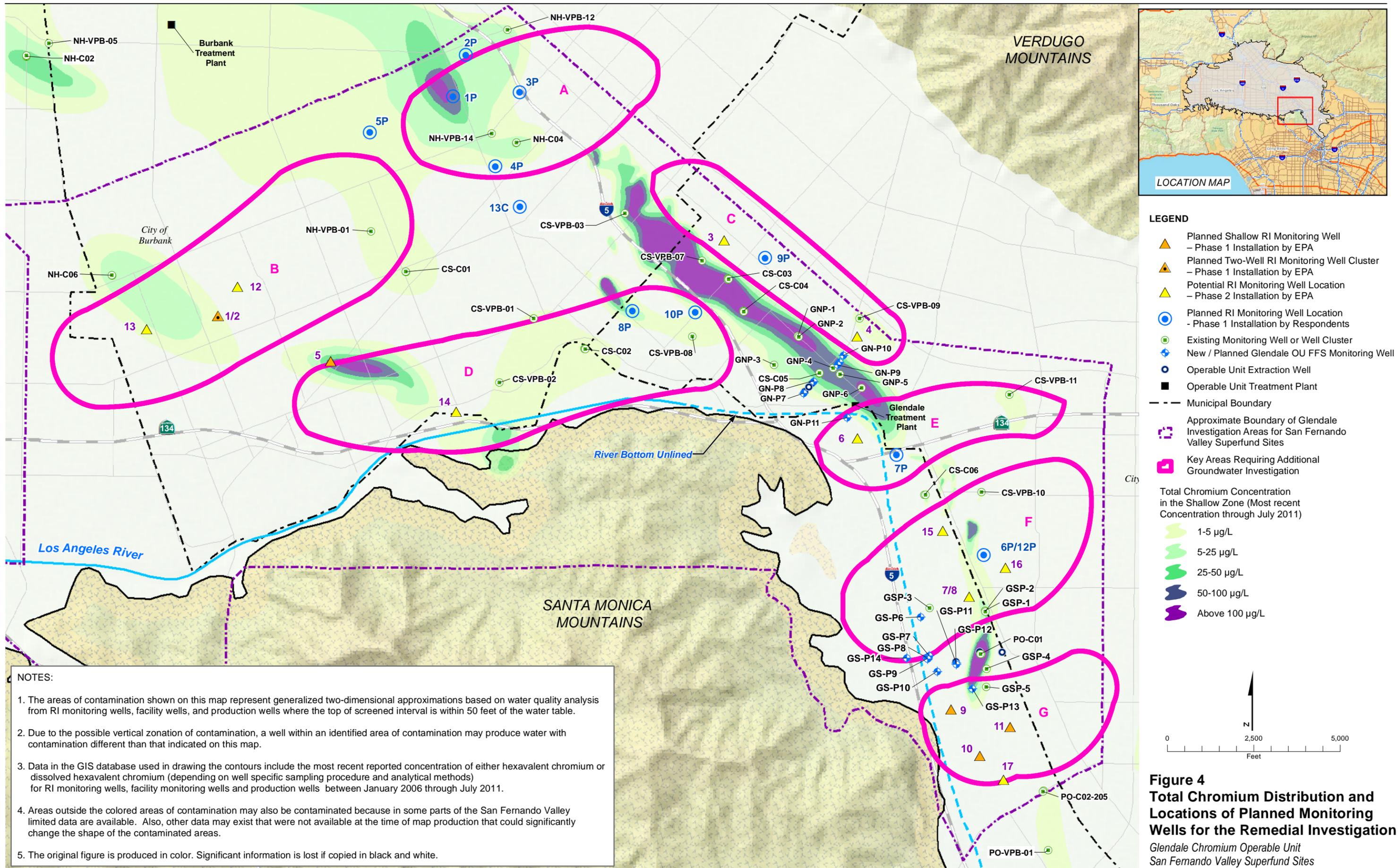
FIGURE 2
 Data Users/ Recipients
 San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

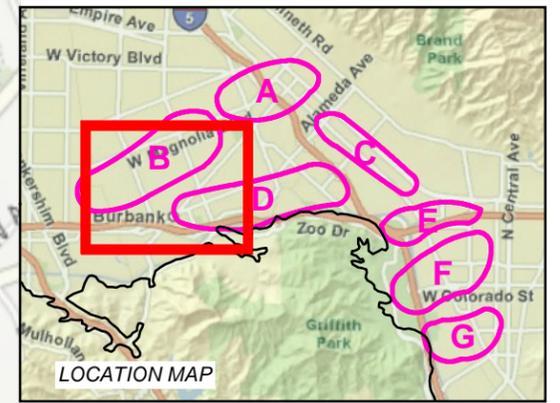
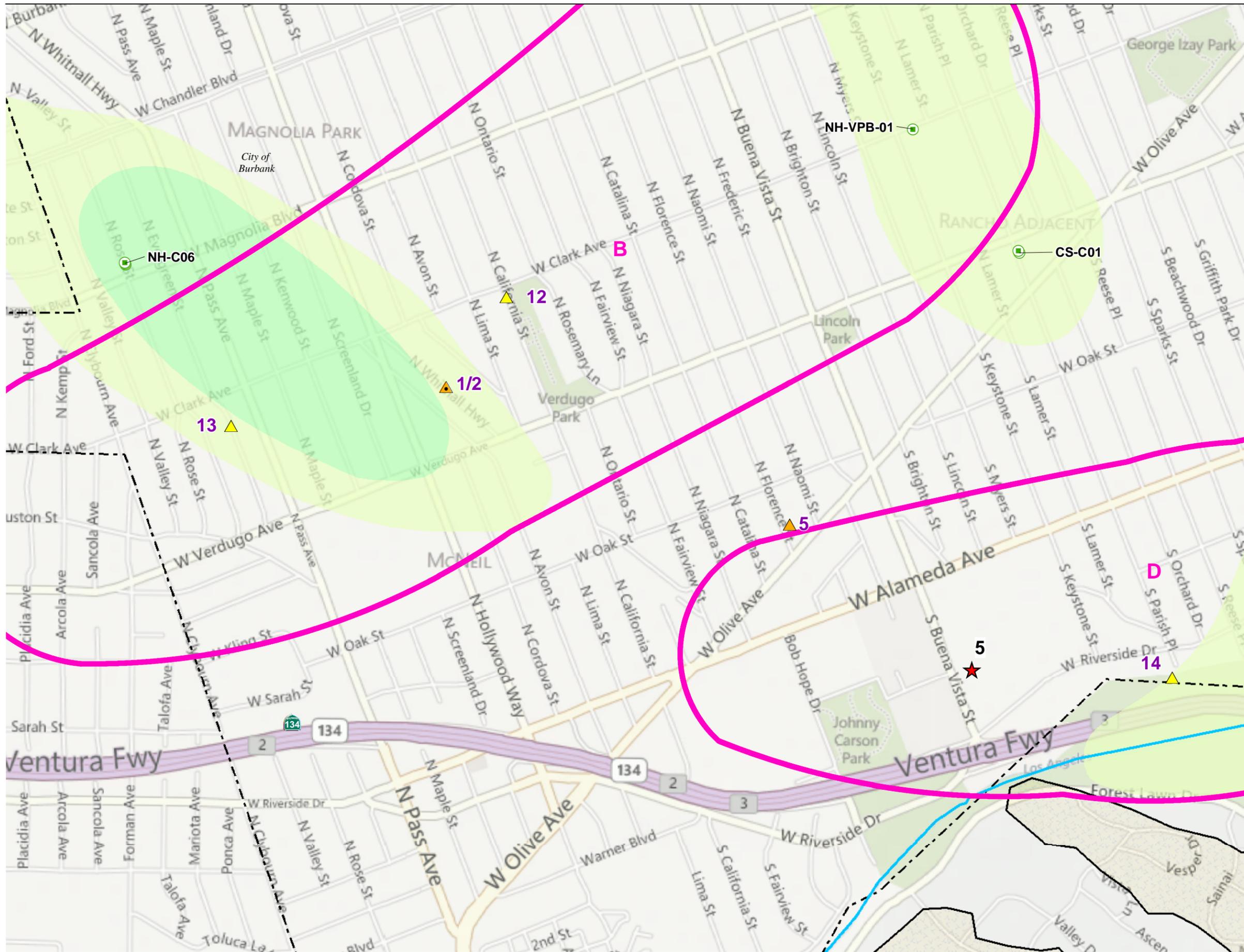


NOTES:

1. The areas of contamination shown on this map represent generalized two-dimensional approximations based on water quality analysis from RI monitoring wells, facility wells, and production wells where the top of screened interval is within 50 feet of the water table.
2. Due to the possible vertical zonation of contamination, a well within an identified area of contamination may produce water with contamination different than that indicated on this map.
3. Data in the GIS database used in drawing the contours include the most recent reported concentration of either hexavalent chromium or dissolved hexavalent chromium (depending on well specific sampling procedure and analytical methods) for RI monitoring wells, facility monitoring wells and production wells between January 2006 through July 2011.
4. Areas outside the colored areas of contamination may also be contaminated because in some parts of the San Fernando Valley limited data are available. Also, other data may exist that were not available at the time of map production that could significantly change the shape of the contaminated areas.
5. The original figure is produced in color. Significant information is lost if copied in black and white.

Figure 3
Hexavalent Chromium Distribution and Locations of Planned Monitoring Wells for the Remedial Investigation
 Glendale Chromium Operable Unit
 San Fernando Valley Superfund Sites





LEGEND

- Planned Shallow RI Monitoring Well – Phase 1 Installation by EPA
- Planned Two-Well RI Monitoring Well Cluster – Phase 1 Installation by EPA
- Potential RI Monitoring Well Location – Phase 2 Installation by EPA
- Existing Monitoring Well or Well Cluster
- Municipal Boundary
- Key Areas Requiring Additional Groundwater Investigation

Potential Source Facility Lead Oversight Agency:

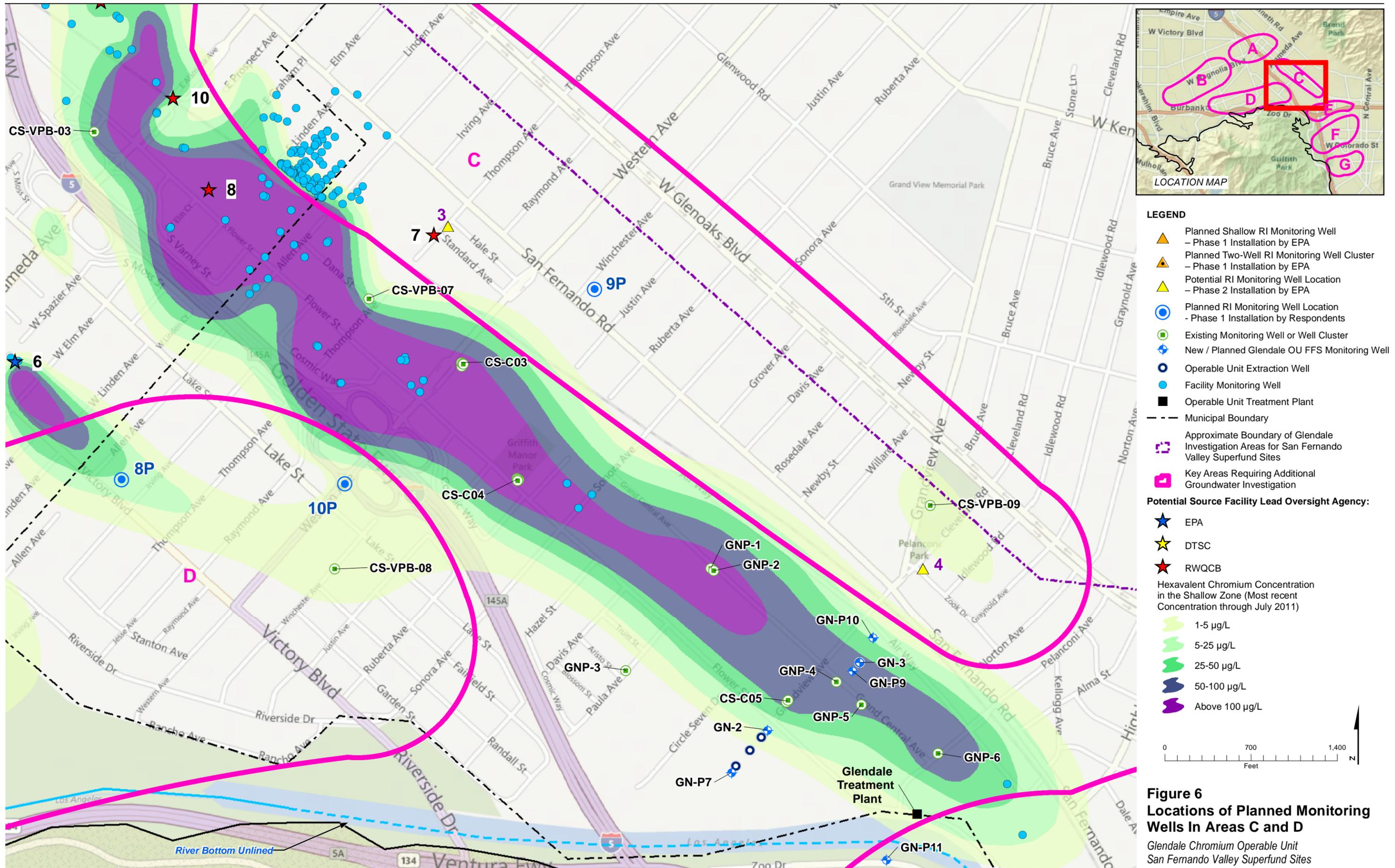
- EPA
- DTSC
- RWQCB

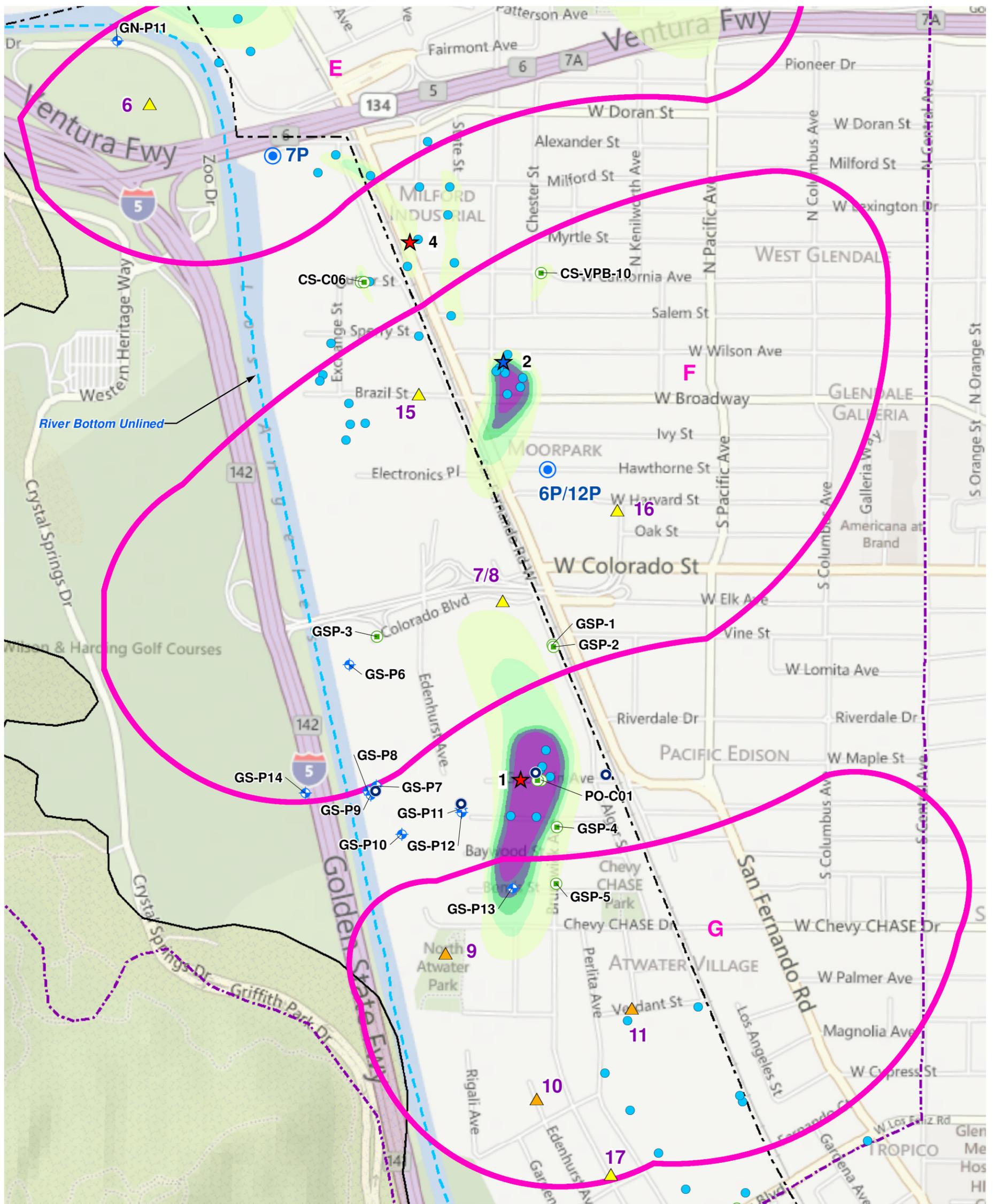
Hexavalent Chromium Concentration in the Shallow Zone (Most recent Concentration through July 2011)

- 1-5 µg/L
- 5-25 µg/L
- 25-50 µg/L
- 50-100 µg/L
- Above 100 µg/L

0 900 1,800
Feet

Figure 5
Locations of Planned Monitoring Wells In Areas B and D
 Glendale Chromium Operable Unit
 San Fernando Valley Superfund Sites





LEGEND

- ▲ Planned Shallow RI Monitoring Well - Phase 1 Installation by EPA
- ▲ Planned Two-Well RI Monitoring Well Cluster - Phase 1 Installation by EPA
- ▲ Potential RI Monitoring Well Location - Phase 2 Installation by EPA
- Planned RI Monitoring Well Location - Phase 1 Installation by Respondents
- Existing Monitoring Well or Well Cluster
- New / Planned Glendale OU FFS Monitoring Well
- Operable Unit Extraction Well
- Facility Monitoring Well
- - - Municipal Boundary
- Approximate Boundary of Glendale Investigation Areas for San Fernando Valley Superfund Sites
- Key Areas Requiring Additional Groundwater Investigation

Potential Source Facility Lead Oversight Agency:

- ★ EPA
- ★ DTSC
- ★ RWQCB

Hexavalent Chromium Concentration in the Shallow Zone (Most recent Concentration through July 2011)

- 1-5 µg/L
- 5-25 µg/L
- 25-50 µg/L
- 50-100 µg/L
- Above 100 µg/L

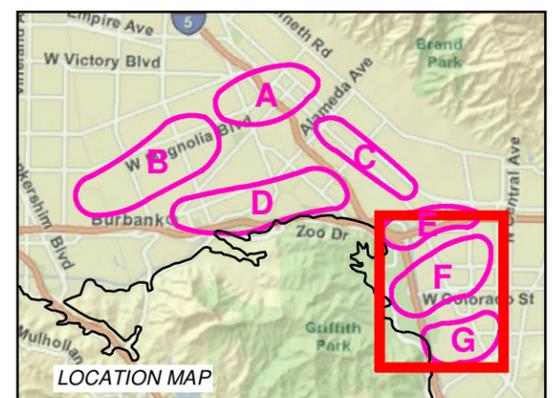
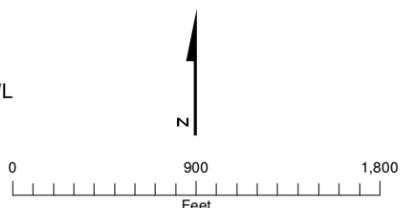


Figure 7
Locations of Planned Monitoring Wells
In Areas E, F and G

Glendale Chromium Operable Unit
 San Fernando Valley Superfund Sites

Appendix A

Data Quality Objectives

APPENDIX A

Data Quality Objectives for Remedial Investigation

San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Step 1: State the Overall Problem

Background

Chlorinated solvents including trichloroethene (TCE) and tetrachloroethene (PCE) were widely used starting in the 1940s for dry cleaning and for degreasing machinery; disposal of these solvents was not well-regulated. In 1980, the Los Angeles Department of Water and Power (LADWP) conducted a 2-year study to define the extent of contamination in the San Fernando Valley (SFV) (LADWP, 1983). The study, published in 1983, revealed widespread VOC-contaminated ground water in the SFV, specifically a contaminant plume migrating to the southeast at a rate of 300 feet per year. A number of municipal supply wells for the cities of Los Angeles, Burbank, and Glendale were taken out of service based on the results of the study. In 1986, the United States Environmental Protection Agency (EPA) placed four ground water areas in the eastern SFV on the National Priorities List (NPL).

EPA manages the four SFV Superfund Sites and adjacent areas where contamination has (or might have) migrated as one large site, using a comprehensive approach for the investigation and cleanup of the contamination. Currently, EPA's focus is on five operable units (OUs) within two of the four SFV Superfund Sites to accelerate the investigation and cleanup of the study area. Four of these five OUs represent discrete, interim containment remedies currently in progress throughout the eastern portion of the SFV. Each of these four OUs has a separate, signed Record of Decision (ROD). Within Area 1 are the North Hollywood OU and Burbank OU, for which RODs were signed in 1987 and 1989, respectively. The North Hollywood OU Interim Remedy began operating in 1989; the Burbank OU has been operational since 1996. Within Area 2 are the Glendale North and South OUs (also referred to as Glendale North Operable Unit [GNOU] and Glendale South Operable Unit [GSOU]), which were combined and the ROD signed in 1993. The Interim Remedies for GNOU and GSOU began partial operation in August 2000 and achieved full operational capacity in June 2002. Area 3 (Verdugo) was delisted from the NPL in 2004. The LADWP Pollock Wellfield Treatment Plant addresses contamination in Area 4 (Pollock) and EPA is monitoring the contaminant levels and the effectiveness of the plant.

From the late 1980s to late 1990s, EPA provided funds to the California Regional Water Quality Control Board – Los Angeles Region (LARWQCB) to conduct assessments of facilities in the SFV to determine the extent of volatile organic compound (VOC) solvent usage and to assess past and current chemical handling, storage, and disposal practices. LARWQCB conducted these investigations pursuant to their Well Investigation Program. The investigations resulted in source remediation activities at facilities within the SFV where the release of solvents had occurred. LARWQCB reevaluated site information from the original source investigations during Phase I of the hexavalent chromium investigations.

Glendale Chromium Operable Unit (GCOU) is the fifth OU in the SFV Superfund Site. The GCOU was established in 2007 after a 4-year chromium contamination study, which was conducted by LARWQCB and funded by EPA, and a subsequent LARWQCB investigation. The study and investigation revealed extensive hexavalent chromium contamination in ground water throughout the eastern SFV and a large number of potential hexavalent chromium sources.

In addition to the formation of the GCOU, the investigations determined that the operation of the interim VOC remedy for the Glendale OUs was adversely affected by hexavalent chromium contamination. The goal of the GCOU is to complete the investigation and cleanup of Glendale area ground water contaminated with hexavalent chromium and to investigate and clean up Glendale area facilities that are sources of hexavalent chromium and for which EPA has taken the lead agency role.

Conceptual Site Model (CSM)

The GCOU Respondents Group (Respondents), a group of potentially responsible parties (PRPs) also performing remedial investigation (RI) activities in the GCOU, developed a preliminary CSM for GCOU in preparation of their Data Compilation and Evaluation Report (ERM, 2011). The preliminary CSM is summarized below. EPA will use data collected during EPA-lead and Respondents RI activities to refine the CSM.

EPA identified numerous potential source areas for hexavalent chromium in the GCOU. Hexavalent chromium in ground water generally occurs laterally along the industrial area of the Interstate 5 corridor in the GCOU and extends from the Burbank OU in the north to the Los Angeles River narrows in the south. The vertical distribution of hexavalent chromium in GCOU ground water is generally limited to the Upper Regional Zone ground water, which extends from the water table to approximately 250 feet below ground surface (bgs). Some perched ground water zones containing high levels of hexavalent chromium have been reported beneath suspected source areas.

Water supply wells and extraction wells for the Glendale OU remedy are used as a public drinking water source and are known or potential receptors for hexavalent-chromium-contaminated ground water in the GCOU. Residents in the vicinity of the GCOU that use water from these wells are potential receptors of hexavalent chromium contamination. It has not yet been determined if a direct exposure route exists for ecological receptors.

Problem Statements:

Per the above background information and the site conceptual model, the issues/objectives to be addressed by this project are as follows:

- **Problem Statement (PS) 1:** There is a need to refine the current understanding of the nature and extent of hexavalent chromium contamination in GCOU ground water.

- **PS 2:** There is a need to evaluate the physical and chemical characteristics of the subsurface in the GCOU that affect hexavalent chromium fate and transport.
- **PS 3:** There is a need to evaluate potential human health risks of residential exposure to hexavalent-chromium-contaminated ground water in the GCOU.
- **PS 4:** There is a need to evaluate potential risks to ecological receptors due to contact with hexavalent-chromium-contaminated ground water in the GCOU.
- **PS 5:** There is a need to collect additional ground water analytical information to enhance the ongoing regional evaluation of VOCs and emerging compounds (1,4-dioxane, n-nitrosodimethylamine [NDMA], perchlorate, and 1,2,3-trichloropropane) in the SFV.
- **PS 6:** There is a need to identify proper disposal for investigation-derived waste (IDW).

DQO Participants and Function

David Towell, CH2M HILL Project Manager
 BJ Lechler, CH2M HILL RI Manager
 Artemis Antipas, CH2M HILL Quality Assurance Manager
 Neha Gowadia, CH2M HILL Human Health Risk Assessor
 Christine Arenal, CH2M HILL Ecological Risk Assessor

Project Resources

EPA and the Respondents will perform RI activities in the GCOU. EPA will use data collected during the EPA-lead and Respondents RI activities, in conjunction with data generated from past and ongoing monitoring and investigation efforts in the GCOU, for RI evaluations.

Step 2: Identify Goals of Remedial Investigation

Goals of the Remedial Investigation

PS 1: What is the nature and extent of hexavalent-chromium-contaminated ground water in the GCOU? Hexavalent and total chromium results from new monitoring wells and existing wells will be used to further evaluate and refine the current understanding of the nature and extent of contamination in the GCOU.

PS 2: What contaminant fate and transport mechanisms affect the migration of hexavalent chromium to and in GCOU ground water?

PS 3: What is the incremental baseline human health risk from potential exposure to hexavalent chromium contamination in GCOU ground water? Will estimated human health risks exceed 10^{-6} ?

PS 4: Are ecological receptors exposed to GCOU ground water containing hexavalent chromium? If ecological receptors exist, are the potential incremental risks from exposure to hexavalent-chromium-contaminated ground water in the GCOU unacceptable?

PS 5: What are the concentrations of VOCs and emerging compounds at new monitoring wells?

PS 6: What is the proper disposal of IDW?

Possible Outcomes

PS 1: (1) The nature and extent of hexavalent chromium contamination in the GCOU is characterized well enough to proceed with the human health risk assessment (HHRA) and ecological risk assessment (ERA); or (2) additional data collection is required to characterize the nature and extent of hexavalent chromium contamination.

PS 2: (1) Evaluation of the fate and transport of hexavalent-chromium-contaminated ground water in the GCOU will be used to guide the baseline HHRA and ERA and, potentially, for development of remedial alternatives; or (2) additional data collection is required to thoroughly evaluate hexavalent chromium fate and transport.

PS 3: (1) No further action (NFA); (2) greater than 10^{-6} risk and additional action are potentially warranted; (3) greater than 10^{-4} risk and additional action is necessary; or (4) there is a need for additional data collection to support risk evaluations.

PS 4: If ecological exposure pathways exist, the potential outcomes include: (1) no action; (2) unacceptable ecological risk exists and additional action is warranted; or (3) there is a need for additional data collection to support risk evaluations. If no complete ecological exposure pathways exist, then ecological risks will not be calculated.

PS 5: Data collected for this subtask will provide additional information on the distribution of VOCs and emerging compounds in the SFV. GCOU RI evaluations and risk assessments will focus on chromium contamination in ground water, so there are no outcomes that pertain to the GCOU RI.

PS 6: IDW is disposed of (1) properly, or (2) improperly.

Step 3: Identify Data Needs for Remedial Investigation

Data Needs for Remedial Investigation

PS 1: Hexavalent and total chromium (filtered and unfiltered) concentrations in ground water, ground water field parameters (pH, turbidity, electric conductivity, temperature, dissolved oxygen [DO], and oxidation-reduction potential [ORP]), and an understanding of the ground water flow characteristics including vertical and horizontal hydraulic gradients. See Table A1 for analytical requirements for ground water samples.

PS 2: Ground water flow characteristics, aquifer properties, and ground water geochemical information. The analytical ground water data needed are hexavalent chromium (filtered and unfiltered) and total chromium (filtered and unfiltered), general chemistry parameters (chloride, fluoride, orthophosphate, sulfate, sulfide, total alkalinity, ammonia, nitrate, nitrite, total dissolved solids [TDS], total Kjeldahl nitrogen [TKN], total organic carbon [TOC], DO, and dissolved metals/cations, and ground water field parameters (pH, turbidity, electric conductivity, temperature, DO, and ORP). See Tables A-1 for analytical requirements for ground water.

PS 3: Hexavalent chromium concentration for ground water samples. Other analytes may be considered at EPA's direction.

PS 4: Exposure pathways for ecological receptors need to be confirmed. If exposure pathways exist, then hexavalent chromium (unfiltered) and total chromium (unfiltered and filtered) concentrations are needed. Other analytes may be considered at EPA's direction.

PS 5: Analytical results for the VOCs listed in Table A-1 and emerging compounds.

PS 6: IDW generated during the RI (drill cuttings, ground water, and decontamination rinsate) will be analyzed for VOCs (Table A-2), total petroleum hydrocarbons (TPH) gasoline range (TPH-g), TPH diesel range (TPH-d), California Title 22 metals, hexavalent chromium, and pH.

Sources of Information

PS 1 through PS 4: Existing data from EPA's SFV basinwide database, data collected during EPA-lead RI, and data collected during Respondents RI activities.

PS 5 and PS 6: New data collected during EPA-lead RI activities.

Action Levels (ALs)

PS 1: Existing maps illustrating the distribution of total chromium and hexavalent chromium contamination in the SFV have contour intervals down to less than 1 microgram per liter ($\mu\text{g/L}$). For consistency, the RI should have reporting limits below 1 $\mu\text{g/L}$ for total chromium. Considering EPA's tap water regional screening level (RSL) for hexavalent chromium (0.031 $\mu\text{g/L}$), hexavalent chromium reporting limits should be less than 0.031 $\mu\text{g/L}$ to allow for potential delineation of all contamination that exceeds the RSL.

PS 2: No ALs are used in the fate and transport evaluation. Professional judgment will be used to evaluate the fate and transport of hexavalent chromium contamination in ground water.

PS 3: The EPA tap water RSL for hexavalent chromium (0.031 $\mu\text{g/L}$) will be the AL considered in the HHRA.

PS 4: If exposure pathways exist, potential ecological receptors may include aquatic invertebrates, fish, amphibians and reptiles, and semi-aquatic birds (e.g., waterfowl) and mammals (e.g., raccoons). Exposure pathways and ecological receptors will be verified during a site visit prior to conducting the ERA. Receptor-specific ecological screening values (ESVs) will be used once the type(s) of receptors are confirmed. It is assumed that, if an ERA is performed for ecological exposure to hexavalent-chromium-contaminated ground water in the GCOU, the lowest screening level used would be 2 $\mu\text{g/L}$, which corresponds to the lowest chronic value for aquatic plants and organisms (Suter and Tsao, 1996).

PS 5: VOCs and emerging compounds will be analyzed to the ALs listed in Table A-1.

PS 6: IDW characterization samples will be screened against the California Title 22 hazardous waste criteria, as summarized in Table A-2.

Method Availability

PS 1 through PS 6: Methods are available to achieve the above ALs for field and laboratory data and are discussed further in the quality assurance project plan (QAPP) main text.

Step 4: Define Boundaries for Remedial Investigation

Population of Interest

PS 1: Ground water.

PS 2: Ground water.

PS 3: Ground water and residents with potential exposure to GCOU ground water.

PS 4: Ground water and ecological receptors. Potential ecological receptors may include aquatic invertebrates, fish, amphibians and reptiles, and semi-aquatic birds (e.g., waterfowl) and mammals (e.g., raccoons). Ecological receptors will be verified during a site visit prior to conducting the screening level ERA (SLERA).

PS 5: Not applicable; data will be provided to others for evaluation.

PS 6: Drill cuttings (soil), ground water, and decontamination rinsate generated during monitoring well installation and sampling activities.

Physical Boundaries

PS 1 through PS 4: The lateral investigation boundary of the GCOU RI is defined by the approximate boundary of Glendale investigation areas for the SFV Superfund Sites (Figure A-1). The lateral decision boundary will be defined by the extent of the new and existing monitoring wells used in RI evaluations. The vertical investigation boundary will be defined by ground surface extending to the depth of the deepest monitoring well installed. The vertical decision boundary will be ground surface to the depth of the deepest data point used in RI evaluations.

PS 5: Not applicable.

PS 6: The physical boundaries for IDW will be the containers they are placed in. Drill cuttings will be placed in 55-gallon drums and 20-cubic-yard roll-off bins. Ground water produced during well development, aquifer testing, and ground water sampling, and decontamination rinsate will be contained in 55-gallon drums and larger (3,000- to 21,000-gallon) tanks.

Temporal Boundaries

PS 1 through PS 4: Decisions will hold until a feasibility study (FS) is performed, site remediation is implemented, or additional data are collected.

PS 5: Not applicable; EPA will not make decisions for the GCOU RI based on VOC or emerging compound analytical data.

PS 6: Decisions made concerning IDW generated during the RI field activities are indefinite.

Potential Difficulties in Field Data Collection

PS 1 through PS 6: Potential difficulties that may be encountered during the field investigation include arranging access to the desired locations for monitoring well installation and potential for inclement weather that could significantly delay data collection efforts.

PS 5: Not applicable.

PS 6: No difficulties are anticipated in the collection of samples from IDW.

Step 5: Develop Process to Complete Remedial Investigation

Statistical Parameter to be Used

PS1 through PS 4: Individual data points.

PS 5: Not applicable; EPA will not make decisions for the GCOU RI based on VOC or emerging compound analytical data.

PS 6: Individual data points.

Action Levels (ALs)

PS 1 through PS 6: See Step 3 of the DQOs for the ALs.

Analytical Approach

PS 1: EPA will use data collected during EPA-lead and Respondents RI field activities and data from EPA's SFV basinwide database to evaluate the nature and extent of hexavalent chromium in ground water. EPA will perform the following exercises to assist in evaluating the nature and extent of hexavalent chromium contamination in GCOU ground water.

- Review lithologic logs.
- Assess geologic and hydraulic aquifer properties.
- Calculate ground water elevations.
- Assess ground water flow directions.
- Calculate horizontal and vertical hydraulic gradients.
- Assess the presence of separate hydrostratigraphic units or ground water zones.
- Review ground water analytical data generated from well sampling.
- Review of potential contaminant sources identified by the LARWQCB.

EPA will use results of the above exercises to develop the following maps, tables, and diagrams to evaluate the nature and extent of hexavalent chromium contamination.

- Tabulated summaries of well construction information, ground water elevation data, and analytical results.
- Develop hydrogeologic cross-sections.
- Develop ground water elevation contour maps.
- Develop maps showing the hexavalent chromium distribution in ground water for each aquifer zone.
- Post contaminant concentrations on hydrogeologic cross-sections to evaluate the vertical extent of contamination.

PS 2: EPA will use the products of the nature and extent evaluation (PS 1) to evaluate the fate and transport of hexavalent-chromium-contaminated ground water in the GCOU. In addition, EPA will develop the following items to assess the fate and transport of contamination:

- Time series data for chemical concentrations (in particular hexavalent chromium) in ground water at individual wells.
- Hydrographs for ground water wells.
- Maps that show the locations of known or potential chromium sources in the GCOU.

EPA will use time series plots of hexavalent chromium and other chemicals of interest, monitoring well hydrographs, and estimated aquifer properties to evaluate ground water flow conditions and associated impacts on contaminant migration directions and rates. No decision rules apply to the fate and transport evaluation because professional judgment will be used to evaluate the fate and transport of chromium contamination in ground water.

PS 3: EPA will compile analytical results from ground water samples in a database and evaluate analytical data for usability in the risk assessment following the *Guidance for Data Usability in Risk Assessments* (EPA, 1992), and according to the *Risk Assessment Guidance for Superfund (RAGS), Volume 1 Part A* (EPA, 1989). EPA will consider all data passing the data usability review for the risk assessment.

This RI focuses on hexavalent chromium; therefore, only hexavalent chromium will be considered as a chemical of potential concern (COPC). EPA will determine exposure point concentrations (EPCs) for the COPC by statistical analysis as the lesser of the maximum detected medium concentration and the 95 percent upper confidence limit (UCL). EPA will assume a residential scenario for exposure to ground water.

EPA will assess risks to human health using EPA guidelines (EPA, 1989, 2011a, 2011b). EPA will use the current tap water RSLs for hexavalent chromium (0.031 µg/L – cancer; and 110 µg/L – noncancer [EPA, 2011a]) in the risk assessment. EPA will compare the estimated excess lifetime cancer risk (ELCR) to the EPA risk management range of 10^{-6} to 10^{-4} . EPA will compare noncancer hazard index (HI) to the target noncancer HI of 1. In interpreting estimates of ELCRs, the EPA under the Superfund program generally considers action to be warranted when the multi-chemical aggregate cancer risk for all exposure routes within a specific exposure scenario exceeds 1×10^{-4} . EPA may not require action for risks falling within 1×10^{-6} and 1×10^{-4} ; however, this is judged on a case-by-case basis. Under state guidance, the California Department of Toxic Substances Control (DTSC) considers a cancer risk exceeding 1×10^{-6} as a regulatory point-of-departure value.

Under both EPA and state guidance, unacceptable noncancer hazard exists if the multi-chemical aggregate noncancer hazard (for similar-acting toxicants) for all exposure routes within a specific exposure scenario exceeds a target noncancer HI of 1.

EPA will evaluate remedial alternatives as part of an FS if results of ground water analysis indicate concentrations of the COPC are present at levels that potentially pose unacceptable risk to human health.

PS 4: EPA will conduct the ERA for the GCOU in accordance with EPA guidance including the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment, Interim Final* (EPA, 1997) and *Final Guidelines for Ecological Risk Assessment* (EPA, 1998). EPA will conduct the ERA in a phased approach as outlined in these documents. This approach entails increasingly sophisticated levels of data collection and analysis, wherein the conservative assumptions of the initial evaluations are replaced by more site-specific data and more ecologically realistic assumptions. The phased approach serves to reduce conservatism and uncertainties in the risk assessment, and focuses effort on issues most likely to drive remedial actions. The ERA is generally composed of three phases: scoping assessment, screening-level assessment, and baseline assessment. EPA (1997) outlines an eight-step process for Superfund with built-in critical management and decision points to allow stakeholder input on the evaluation of interim findings and refinement of the technical approach. Steps 1 and 2 make up the SLERA, while Steps 3 through 8 comprise the baseline ERA (BERA).

Complete exposure pathways from ground water to ecological receptors may exist if ground water from the site is discharged to surface water bodies via natural or anthropogenic processes. A possible mechanism for this discharge is the use of ground water to maintain community ponds within the urban landscape that surrounds the site. Potential ecological receptors may include those associated with these ponds such as aquatic invertebrates, fish, amphibians and reptiles, and semi-aquatic birds (e.g., waterfowl) and mammals (e.g., raccoons). EPA will verify exposure pathways and ecological receptors during a site visit prior to conducting the ERA.

EPA will compile analytical results from ground water samples in a database and evaluate the analytical data for usability in the risk assessment following the *Guidance for Data Usability in Risk Assessments* (EPA, 1992) and according to *RAGS, Volume 1 Part A* (EPA, 1989). EPA will consider all data passing the data usability review for the risk assessment. If complete exposure pathways exist, the maximum detected concentration (SLERA) or 95UCL concentration (refined SLERA and BERA) of hexavalent chromium will be divided by its receptor-specific ESV to derive an analyte/receptor-specific hazard quotient (HQ). EPA will further evaluate analytes for which HQs exceed 1 in the initial screening evaluation using a weight-of-evidence approach in a refined SLERA (Step 3a) or a BERA, as necessary. EPA will evaluate the HQs in the initial SLERA to determine if:

- Ground water from the GCOU does not pose an unacceptable ecological risk and no further action is warranted (i.e., SLERA HQs < 1).
- Ground water from the GCOU poses a potentially unacceptable risk that requires additional evaluation through a refined SLERA or BERA (i.e., SLERA HQs > 1).

PS 5: Not applicable.

PS 6: EPA will screen IDW characterization samples of solids against the hazardous waste classification criteria summarized in Table A-2. If total concentrations equal or exceed the total threshold limit concentration (TTLC), then EPA will classify the waste as non-Resource Conservation and Recovery Act (non-RCRA) hazardous waste. If total concentrations equal or exceed 20 times the RCRA toxicity characteristic (TC) limit, EPA will perform the toxicity characteristic leaching procedure (TCLP) for those constituents. If any constituents in the TCLP extract equal or exceed the RCRA TC limits, EPA will classify the waste as RCRA hazardous for those constituents. If the waste

has been classified as hazardous at this point, EPA will not perform further analyses. However, if the waste has not been classified as hazardous, but a total concentration equals or exceeds 10 times the soluble threshold limit concentration (STLC), EPA will perform the California waste extraction test (WET) for those constituents. If the concentration of a constituent in the WET extract equals or exceeds the STLC, EPA will classify the waste as non-RCRA hazardous.

EPA will compare IDW characterization sample results for liquids directly to the RCRA TC and STLC limits (Table A-2), and classify the waste as RCRA-hazardous or non-RCRA hazardous, respectively, if the results equal or exceed these limits. EPA will test liquid samples using the TCLP and WET, respectively, before classifying waste if liquid samples contain greater than 0.5 percent filterable solids.

Step 6: Specify Acceptance Criteria for Remedial Investigation

This step is not applicable because the sampling design (i.e., locations for monitoring well installation and ground water sampling) was selected based on a review of existing hydrogeologic and geochemical data and is based on professional judgment.

Step 7: Develop Detailed Plan for Completing Remedial Investigation

PS 1 through PS 4:

- EPA identified seven key areas (A through G) where additional investigation of chromium in ground water may be warranted (Figure A-1). The Respondents plans to install 12 new monitoring wells as part of their RI activities; EPA plans to install 17 new monitoring wells at 15 different locations. Table A-3 presents the data need associated with each new EPA RI monitoring well location. EPA plans to perform the work in two phases, with 6 monitoring wells (5 locations) installed in the first phase of work, and 11 wells (10 locations) installed during the second phase. EPA will use the results of ground water samples from Phase 1 monitoring wells and the Respondents RI activities to evaluate the location and need for Phase 2 monitoring wells.
- EPA will use results of the RI activities, Respondents RI activities, and data from EPA's SFV database to assess the nature and extent (PS 1) and the fate and transport (PS 2) of hexavalent chromium contamination in GCOU ground water. EPA will use the results of evaluations in PS 1 and PS 2 in performing a baseline HHRA (PS 3) and an ERA (PS 4).
- Specific details of the planned well installation activities will include the following:
 - Installation of 13 shallow monitoring wells using hollow-stem auger drilling methods. These shallow wells are expected to be approximately 100 feet deep. The actual depths of monitoring wells will be determined based on the lithology and depth to ground water encountered at each individual boring location.
 - Installation of two cluster wells, each consisting of one shallow and one deeper monitoring well, using a combination of hollow-stem auger and air rotary casing hammer or dual-tube percussion drilling methods. The shallow wells are expected to be approximately 100 feet deep; the deeper wells are expected to be 200 feet deep. The actual depths of the shallow monitoring wells in each cluster will be determined based on the lithology and depth to ground water encountered at each individual boring location. The depths of deep monitoring wells at each cluster will be determined based on the lithology encountered in the boring in conjunction with the analytical data and well depths of deeper wells in the area.
 - Development of monitoring wells by a combination of bailing, swabbing, and pumping.
- In addition to installing monitoring wells, during Phase 2 of the RI field activities, EPA may perform pumping tests to assess aquifer properties (hydraulic conductivity) in the GCOU. EPA will collect drawdown data from new monitoring wells during development activities to evaluate the specific capacity (i.e., drawdown as a function of pumping rate) of each monitoring well. Specific capacity will be used to evaluate the usefulness of pumping test data from the new monitoring wells. If EPA determines pumping test data from the monitoring wells would be useful in RI evaluations an addendum to this QAPP will be submitted to describe pumping test rationale, procedures, and data analysis.
- EPA will conduct quarterly ground water sampling at new and existing wells. The different ground water sampling events will be as follows:
 - One sampling event will include 9 existing monitoring wells. Analyses will include hexavalent chromium (unfiltered), total chromium (filtered and unfiltered).
 - One sampling event will include only the 6 new EPA monitoring wells. Analyses will include hexavalent chromium (unfiltered), total chromium (filtered and unfiltered), dissolved metals/cations, general chemistry parameters, VOCs, and emerging compounds. See Table A-1 for list of dissolved metals/cations and general chemistry parameters.
 - One sampling event will include 18 new monitoring wells (EPA and Respondents wells) and 6 existing monitoring wells. Analyses will include hexavalent chromium (unfiltered) and total chromium (filtered and unfiltered). Depending on the initial results, VOCs and emerging compounds may be analyzed at selected wells.
 - One sampling event will include only the 11 new EPA monitoring wells. Analyses will include hexavalent chromium, dissolved metals/cations, general chemistry parameters, VOCs, and emerging compounds. See Table A-1 for a list of dissolved metals/cations and general chemistry parameters.
 - Two sampling events will include all 29 new monitoring wells (EPA and Respondents wells) and 15 existing monitoring wells. Analyses will include hexavalent chromium and total chromium. Depending on the initial results, VOCs and emerging compounds may be analyzed at selected new wells.

- Two sampling events will include 29 new monitoring wells (EPA and Respondents wells) and 6 existing wells (9 of the existing wells are sampled semiannually). Analyses will include hexavalent chromium and total chromium.

PS 5:

EPA will collect ground water samples during the initial sampling event at the newly installed EPA monitoring wells (see Table A-3 for descriptions of new EPA monitoring wells) and analyze for VOCs (see Table A-1 for list) and emerging compounds (1,4-dioxane, NDMA, perchlorate, and 1,2,3-TCP) to provide additional information on the distribution of these compounds in the SFV. EPA may determine that additional analysis of ground water samples for these analytes is warranted based on the initial sampling event results.

PS 6:

EPA will collect samples from IDW (soil, ground water, and decontamination rinsate) generated during EPA's RI field investigation for analysis of California Title 22 metals, full-scan VOCs by 8260, TPH-d, TPH-g, pH, and hexavalent chromium to allow for proper waste classification and offsite disposal at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Offsite Rule approved facility.

EPA will collect IDW soil samples at a rate of 1 from each roll-off bin, or 1 per 10 55-gallon drums at every drilling location. EPA will analyze a composite soil sample by collecting approximately 1 liter of soil from the four corners of each roll-off bin or drum and mixing in a stainless steel bowl prior to filling sample containers.

EPA will collect IDW water (purge water and decontamination rinsate) grab samples at a rate of one per tank.

TABLE A-1
 Ground Water Analytical Parameters for EPA's Remedial Investigation
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Analyte	Method	Units	Screening Level	Lowest Screening Level Value	Required Detection Limit
Chromium					
Hexavalent Chromium (filtered and unfiltered)	EPA 218.6	µg/L	EPA RSL	0.031	0.01
Total Chromium (filtered and unfiltered)	EPA 6000 series	µg/L	CA MCL	50	10
Dissolved Metals/Cations^a					
Aluminum	--	µg/L	--	--	--
Antimony	--	µg/L	--	--	--
Arsenic	--	µg/L	--	--	--
Barium	--	µg/L	--	--	--
Beryllium	--	µg/L	--	--	--
Cadmium	--	µg/L	--	--	--
Calcium	--	µg/L	--	--	--
Cobalt	--	µg/L	--	--	--
Copper	--	µg/L	--	--	--
Iron	--	µg/L	--	--	--
Lead	--	µg/L	--	--	--
Magnesium	--	µg/L	--	--	--
Manganese	--	µg/L	--	--	--
Nickel	--	µg/L	--	--	--
Potassium	--	µg/L	--	--	--
Selenium	--	µg/L	--	--	--
Silica	--	µg/L	--	--	--
Silver	--	µg/L	--	--	--
Sodium	--	µg/L	--	--	--
Thallium	--	µg/L	--	--	--
Vanadium	--	µg/L	--	--	--
Zinc	--	µg/L	--	--	--
General Chemistry Parameters^a					
Chloride	--	µg/L	--	--	--
Fluoride	--	µg/L	--	--	--
Nitrate	--	µg/L	--	--	--
Nitrite	--	µg/L	--	--	--
Total Kjeldahl Nitrogen (TKN)	--	µg/L	--	--	--
Orthophosphate	--	µg/L	--	--	--
Sulfate	--	µg/L	--	--	--
Sulfide	--	µg/L	--	--	--
Ammonia	--	µg/L	--	--	--
Total Alkalinity	--	µg/L	--	--	--
Total Dissolved Solids (TDS)	--	µg/L	--	--	--
Total Organic Carbon (TOC)	--	µg/L	--	--	--
Dissolved Oxygen (DO)	--	µg/L	--	--	--
Volatile Organic Compounds					
Acetone	EPA 8260B	µg/L	EPA RSL	12,000	10
Benzene	EPA 8260B	µg/L	EPA RSL	0.39	1.0
Bromodichloromethane	EPA 8260B	µg/L	EPA RSL	0.12	1.0

TABLE A-1
 Ground Water Analytical Parameters for EPA's Remedial Investigation
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Analyte	Method	Units	Screening Level	Lowest Screening Level Value	Required Detection Limit
Carbon Tetrachloride	EPA 8260B	µg/L	EPA RSL	0.39	0.5
Chloroform	EPA 8260B	µg/L	EPA RSL	0.19	1.0
1,1-Dichloroethane	EPA 8260B	µg/L	EPA RSL	2.4	1.0
1,2-Dichloroethane	EPA 8260B	µg/L	EPA RSL	0.15	0.5
1,1-Dichloroethene	EPA 8260B	µg/L	CA MCL	6	0.5
Cis-1,2-Dichloroethene	EPA 8260B	µg/L	CA MCL	6	0.5
Trans-1,2-Dichloroethene	EPA 8260B	µg/L	CA MCL	10	1.0
1,2-Dichloropropane	EPA 8260B	µg/L	EPA RSL	0.38	0.5
Trans-1,3-Dichloropropene	EPA 8260B	µg/L	EPA RSL	0.41	0.5
Methylene Chloride	EPA 8260B	µg/L	EPA RSL	4.7	1.0
Tetrachloroethene	EPA 8260B	µg/L	EPA RSL	0.072	0.5
1,1,1-Trichloroethane	EPA 8260B	µg/L	Federal MCL	200	0.5
1,1,2-Trichloroethane	EPA 8260B	µg/L	EPA RSL	0.24	0.5
Toluene	EPA 8260B	µg/L	CA MCL	150	0.5
Trichloroethene	EPA 8260B	µg/L	EPA RSL	0.44	0.5
Vinyl Chloride	EPA 8260B	µg/L	EPA RSL	0.015	0.5
Emerging Compounds					
1,4-Dioxane	EPA 8270C M	µg/L	EPA RSL	0.67	1
N-Nitrosodimethylamine (NDMA)	EPA 1625C M	µg/L	EPA RSL	0.003	0.002
Perchlorate	EPA 314	µg/L	CA MCL	6.0	2
1,2,3-Trichloropropane (1,2,3-TCP)	EPA 8260 SIM	µg/L	EPA RSL	0.00065	0.005

Notes:

RSL = Regional Screening Level

MCL = Maximum Contaminant Level

µg/L = micrograms per liter

^a Dissolved metals/cations and general chemistry parameters will not be compared to regulatory screening levels. Standard methods and detection limits apply.

TABLE A-2
 Comparison of Reporting Levels to Screening Objectives for Waste Classification (Soil and Water)
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Analyte	CA TTLC/STLC				
	TCLP Regulatory Standards (mg/L)	Title 22 TTLC (mg/kg)	If TTLC Concentration is \geq this value STLC Analysis Must be Performed	Title 22 STLC (mg/L)	Most Stringent Screening Level ^a
Metals, Method SW6010B					
Antimony	--	500	150	15	15
Arsenic	5	500	50	5	5
Barium	100	10,000	1,000	100	100
Beryllium	--	75	7.5	0.75	0.75
Cadmium	1	100	10	1	1
Chromium (total)	5	2,500	50	5	5
Chromium (hexavalent)	--	500	50	5	5
Cobalt	--	8,000	800	80	80
Copper	--	2,500	250	25	25
Lead	5	1,000	50	5	5
Molybdenum	--	3,500	3500	350	350
Nickel	--	2,000	200	20	20
Selenium	1	100	10	1	1
Silver	5	500	50	5	5
Thallium	--	700	70	7	7
Vanadium	--	2,400	240	24	24
Zinc	--	5,000	2500	250	250
Mercury, Method SW7470A					
Mercury	0.2	20	2	0.2	0.2
VOCs, Method SW8260C					
Acetone	--	--	--	--	--
Benzene	0.5	--	--	--	0.5
Bromodichloromethane	--	--	--	--	--
Carbon Tetrachloride	0.5	--	--	--	0.5
Chlorobenzene	100	--	--	--	100
Chloroform	6	--	--	--	6
1,4-Dichlorobenzene	7.5	--	--	--	7.5
1,1-Dichloroethane	--	--	--	--	--
1,2-Dichloroethane	0.5	--	--	--	0.5
1,1-Dichloroethene	0.7	--	--	--	0.7
Cis-1,2-Dichloroethene	--	--	--	--	--
Trans-1,2-Dichloroethene	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--
Trans-1,3-Dichloropropene	--	--	--	--	--
Methylene Chloride	--	--	--	--	--
Methyl ethyl ketone	200	--	--	--	200
1,1,1-Trichloroethane	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--
Tetrachloroethene	0.7	--	--	--	0.7
Toluene	--	--	--	--	--
Trichloroethene	0.5	2,040	--	2,040	0.5
Vinyl Chloride	0.2	--	--	--	0.2

TABLE A-2
 Comparison of Reporting Levels to Screening Objectives for Waste Classification (Soil and Water)
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Analyte	TCLP Regulatory Standards (mg/L)	CA TTLC/STLC			Most Stringent Screening Level ^a
		Title 22 TTLC (mg/kg)	If TTLC Concentration is \geq this value STLC Analysis Must be Performed	Title 22 STLC (mg/L)	
Total Petroleum Hydrocarbons					
TPH – diesel ^(b)	--	--	--	--	--
TPH – gasoline ^(b)	--	--	--	--	--

Notes:

TCLP = Toxicity Characteristic Leaching Procedure

TTLC = Total Threshold Limit Concentration

STLC = Soluble Threshold Limit Concentration

STLC = Soluble Threshold Limit Concentration

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

^a For waste, most stringent of:

California TTLCs and STLCs – Subsection 66261.24(a)(2) of California Hazardous Waste Regulations

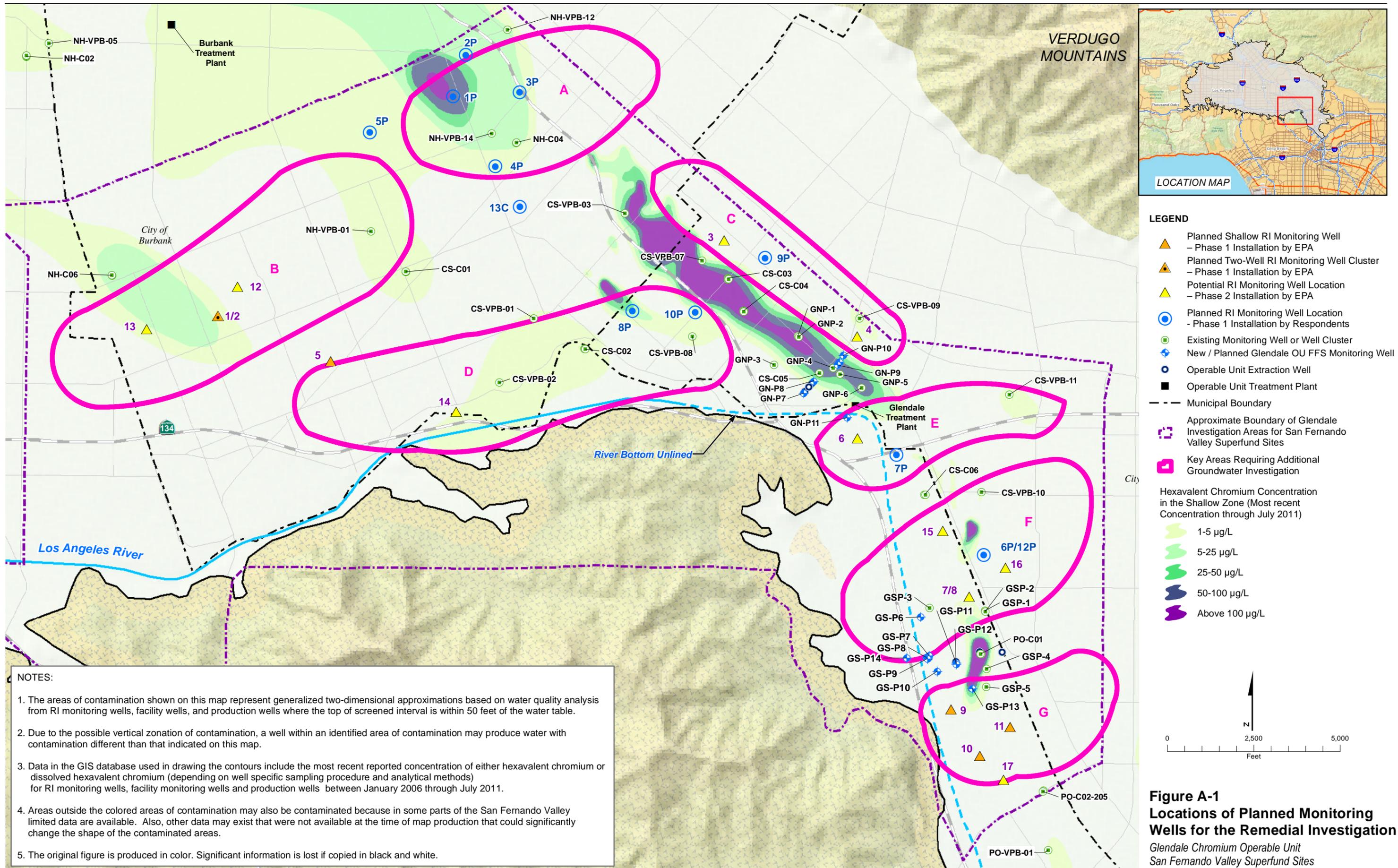
^b TPH-diesel and TPH-gasoline do not have federal or state screening criteria to determine waste characterization. The allowable detection limits for disposal are determined by the waste facility accepting the IDW. Level of detection (LOD) values will be set to achieve analyte detections to allow for waste disposal at CERCLA Offsite Rule approved facilities.

TABLE A-3
Data Needs and Potential Monitoring Well Locations
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Data Gap Area ¹	Data Need	Well ID	Notes/Justification for New EPA Monitoring Well	Considerations for Placement of Phase 2 EPA Monitoring Wells
A ²	Insufficient hexavalent chromium and ground water level data are available in this area to delineate the extent of contamination and to assess ground water flow directions and contaminant transport rates from the Burbank OU into the northern part of the GCOU.	None	All required RI monitoring wells in Area A will be installed by the GCOU Respondents.	
B	Insufficient hexavalent chromium and ground water level data are available in this area to delineate the extent of contamination and provide data to assess ground water flow directions and contaminant transport rates from the North Hollywood OU into the western part of the GCOU. The area of particular concern is an undefined area of contamination in the western part of the GCOU that contains hexavalent chromium concentrations exceeding 5 µg/L. In addition, there is potential migration of lower-level hexavalent chromium contamination from the southwestern portion of the Burbank OU into the western portion of the GCOU.	1	Two-well cluster is intended to: - Evaluate the lateral and vertical extent of hexavalent chromium contamination detected at Basinwide RI monitoring wells NH-C06-160 and NH-C06-285.	Well location will be based on water quality results from Wells 1/2 and 5 and an updated review of flow directions based on new ground water elevation data: - For example, may move northeast if ground water flow is more easterly and concentrations in Wells 1/2 are low. - May move southeast if ground water flow is to the southeast and Wells 1/2 or 5 contain elevated concentrations.
		2	- Provide additional information to evaluate ground water flow direction and horizontal and vertical gradients in western GCOU.	
		12	Well is intended to further delineate the lateral extent of the contamination detected in NH-C06.	
		13	Well is intended to further delineate the lateral extent of the contamination detected in NH-C06.	
C ²	The eastern extent of hexavalent chromium contamination in this area (east of the merging, intermingled plumes that parallel Interstate 5) is incompletely delineated. In addition, ground water with elevated hexavalent chromium concentrations may be bypassing the GNOU extraction wells to the northeast.	3	Well is intended to evaluate hexavalent chromium concentrations along the eastern edge of the primary hexavalent chromium contamination that parallels Interstate 5 and in the vicinity of a plating facility that is not currently monitored.	Well location could be moved or the well eliminated pending results from the Respondents Well 9P: - If Well 9P contains hexavalent chromium; install well either at planned location or further to the north. - If Well 9P does not contain hexavalent chromium; Well 3 may not be needed or may be specifically focused on the plating facility.
		4	Well is intended to evaluate hexavalent chromium concentrations between the GNOU extraction wells and CS-VPB-09.	Well may move or no longer be needed pending results from GRG Well GN-P10: - If Well GN-P10 contains elevated hexavalent chromium; install well generally as planned or move south/southeast. - If Well GN-P10 hexavalent chromium concentration is low/nondetect; Well 4 may not be needed or may be moved southeast near the leading edge of contamination.
D	Insufficient hexavalent chromium and ground water level data are available in the southwestern part of the Glendale OU to delineate the extent of contamination and provide data to assess ground water flow directions and contaminant transport rates in this area. Areas of particular concern include an incompletely delineated plume near the former All Metals Processing facility that contains chromium concentrations exceeding 50 µg/L and an area of sparse data far to the west.	5	Well is intended to: - Provide additional data to evaluate hexavalent chromium concentrations and ground water flow directions in western GCOU. - Assist in characterizing an anomalous upgradient total chromium detection noted during recent site investigation activities.	
		14	Well is intended to evaluate conditions north of the Los Angeles River in an area of historic ground water recharge.	This is a lower-priority location because of the limited number of potential sources in this vicinity. Location could be moved to the north if Well 5 contains elevated hexavalent chromium.
		None	The required monitoring downgradient of the former All Metals Processing facility will be provided by two Area D wells to be installed by the GCOU Respondents.	
E ²	Insufficient hexavalent chromium data are available along the Los Angeles River corridor and south/southeast of the GNOU extraction wellfield to indicate whether hexavalent chromium contamination is present in this area and migrating into the GSOU or along the river corridor.	6	Well is intended to: - Provide data on chromium concentrations and ground water flow conditions south/southwest of the GNOU extraction wells. - Improve the conceptual model regarding surface water and ground water interaction along the Los Angeles River in this area.	Well may move or no longer be needed pending results from GRG Well GN-P11 and Respondents Well 7P: - If Well GN-P11 contains hexavalent chromium and the Well 7P concentration is low/nondetect; well is likely to be installed as planned. - If Well 7P contains hexavalent chromium and Well GN-P11 concentration is low/nondetect; well may be moved east of Well 7P. - If Well GN-P11 and Well 7P chromium concentrations are both nondetect; well may not be needed in this area. Conversely, if both wells have elevated hexavalent chromium, additional wells may be needed in the western portion of Area E.

TABLE A-3
Data Needs and Potential Monitoring Well Locations
San Fernando Valley Area 2 Superfund Site, Glendale Chromium Operable Unit

Data Gap Area ¹	Data Need	Well ID	Notes/Justification for New EPA Monitoring Well	Considerations for Placement of Phase 2 EPA Monitoring Wells	
F ²	Insufficient hexavalent chromium data are available in the Los Angeles River Narrows area to delineate the eastern and western margins of contamination in the GSOU and between known hexavalent chromium source areas upgradient from the GSOU extraction wells.	7	Two-well cluster is intended to:- Evaluate the lateral and vertical extent of chromium between upgradient sources and the GSOU extraction wells.- Provide data to more accurately predict future hexavalent chromium concentrations and arrival times at the GSOU extraction wells.	Well may move pending results from Respondents Wells 6P/12P and existing well sampling (Well of Opportunity and GNOU monitoring wells): - If 6P/12P both contain high levels of hexavalent chromium; Well cluster 7/8 will likely be shifted west, using the existing well results as a guide.- If both the existing shallow well sampling and Well 6P contain high levels of chromium; Well 7, the planned EPA shallow well, may not be needed.	
		8			
		15	Well is intended to: - Evaluate hexavalent chromium concentrations downgradient of PRC-Desoto and cross-gradient of the former Drilube Facility. - Improve understanding of impacts from the Los Angeles River on ground water conditions in the area.		Well may move pending results from Respondents Well 7P and Respondents existing well sampling in the area: - If 7P contains elevated hexavalent chromium; Well 15 may be moved west closer to the river. - If Well 7P and the existing well sampling in this vicinity are nondetect for hexavalent chromium; Well 15 may not be needed.
		16	Well is intended to evaluate hexavalent chromium concentrations between the upgradient former Drilube Facility and the downgradient former Excelllo Plating facility/GSOU extraction wells.		Well may move or no longer be needed pending results from Respondents Wells 6P/12P: - If 6P/12P contains elevated hexavalent chromium; Well 16 location will remain generally unchanged. - If Wells 6P/12P contain low or nondetect levels of hexavalent chromium; Well 16 will not likely be needed.
G ²	Insufficient hexavalent chromium data are available to (1) delineate the extent of contamination downgradient (south) of the GSOU extraction wellfield where contamination migrated either prior to construction of the extraction wells or due to incomplete hydraulic control; and (2) assess hydraulic gradients between the GSOU and LADWP's Pollock water supply wellfield.	9	Well is intended to: - Characterize conditions downgradient of the GSOU extraction wells. - Improve understanding of impacts from the Los Angeles River on ground water conditions in the area.		
		10	Well is intended to characterize conditions downgradient of the GSOU extraction wells and upgradient of the Pollock wellfield.		
		11	Well is intended to characterize conditions downgradient of the GSOU extraction wells and upgradient of the Pollock wellfield. An active facility has nearby monitoring wells that may be used to supplement information in this area. The facility well closest to Well No. 11 extends greater than 50 feet beneath the water table and is not adequate for RI evaluations.		
		17	Well is intended to evaluate ground water conditions at the southern end of the GCOU upgradient of the Pollock wellfield.	Well may move or no longer be needed pending results from EPA Phase Wells 9-11: - If all three new Phase 1 wells contain hexavalent chromium, Well 17 may move farther south and would be placed downgradient of the highest concentrations. - If all three wells contain low or nondetect levels of hexavalent chromium; Well 17 is no longer needed.	
Orange shading - Priority well to be installed during in Phase 1 of the EPA RI (6 wells).					
Yellow shading - Well to be installed in EPA RI Phase 2 (up to 11 wells); final locations to be determined based on Phase 1 EPA and Respondents results and data from the Glendale OU Focused Feasibility Study fieldwork.					
¹ Areas for additional chromium investigation were originally identified in the 2005 Burbank and Glendale OUs Focused Chromium Trend Study (CH2M HILL, 2005a). This was followed by the 2007 Priority Ranking of Potential Well Sites for Chromium Monitoring Technical Memorandum (TM) (CH2M HILL, 2007b). The current areas were developed by CH2M HILL in early 2009 following evaluation of hexavalent chromium data generated during the 2008 sampling of wells identified in the 2007 TM and other updated water quality data. The areas represent fairly broad, generalized areas where data gaps remain. The proposed RI well locations shown in Figure A-1 were placed in focused, higher-priority areas within the bounds of the larger investigation areas.					
² The investigation areas shown in Figure A-1 extend well to the east of any of the currently planned monitoring locations. However, based on our current understanding of ground water flow conditions, the documented extent of hexavalent chromium contamination, and potential hexavalent chromium source locations, additional investigation further to the east does not appear to be warranted at this time.					



NOTES:

1. The areas of contamination shown on this map represent generalized two-dimensional approximations based on water quality analysis from RI monitoring wells, facility wells, and production wells where the top of screened interval is within 50 feet of the water table.
2. Due to the possible vertical zonation of contamination, a well within an identified area of contamination may produce water with contamination different than that indicated on this map.
3. Data in the GIS database used in drawing the contours include the most recent reported concentration of either hexavalent chromium or dissolved hexavalent chromium (depending on well specific sampling procedure and analytical methods) for RI monitoring wells, facility monitoring wells and production wells between January 2006 through July 2011.
4. Areas outside the colored areas of contamination may also be contaminated because in some parts of the San Fernando Valley limited data are available. Also, other data may exist that were not available at the time of map production that could significantly change the shape of the contaminated areas.
5. The original figure is produced in color. Significant information is lost if copied in black and white.

LEGEND

- ▲ Planned Shallow RI Monitoring Well – Phase 1 Installation by EPA
- ▲ Planned Two-Well RI Monitoring Well Cluster – Phase 1 Installation by EPA
- ▲ Potential RI Monitoring Well Location – Phase 2 Installation by EPA
- Planned RI Monitoring Well Location - Phase 1 Installation by Respondents
- Existing Monitoring Well or Well Cluster
- New / Planned Glendale OU FFS Monitoring Well
- Operable Unit Extraction Well
- Operable Unit Treatment Plant
- - - Municipal Boundary
- Approximate Boundary of Glendale Investigation Areas for San Fernando Valley Superfund Sites
- Key Areas Requiring Additional Groundwater Investigation

Hexavalent Chromium Concentration in the Shallow Zone (Most recent Concentration through July 2011)

- 1-5 µg/L
- 5-25 µg/L
- 25-50 µg/L
- 50-100 µg/L
- Above 100 µg/L

Figure A-1
Locations of Planned Monitoring Wells for the Remedial Investigation
 Glendale Chromium Operable Unit
 San Fernando Valley Superfund Sites

