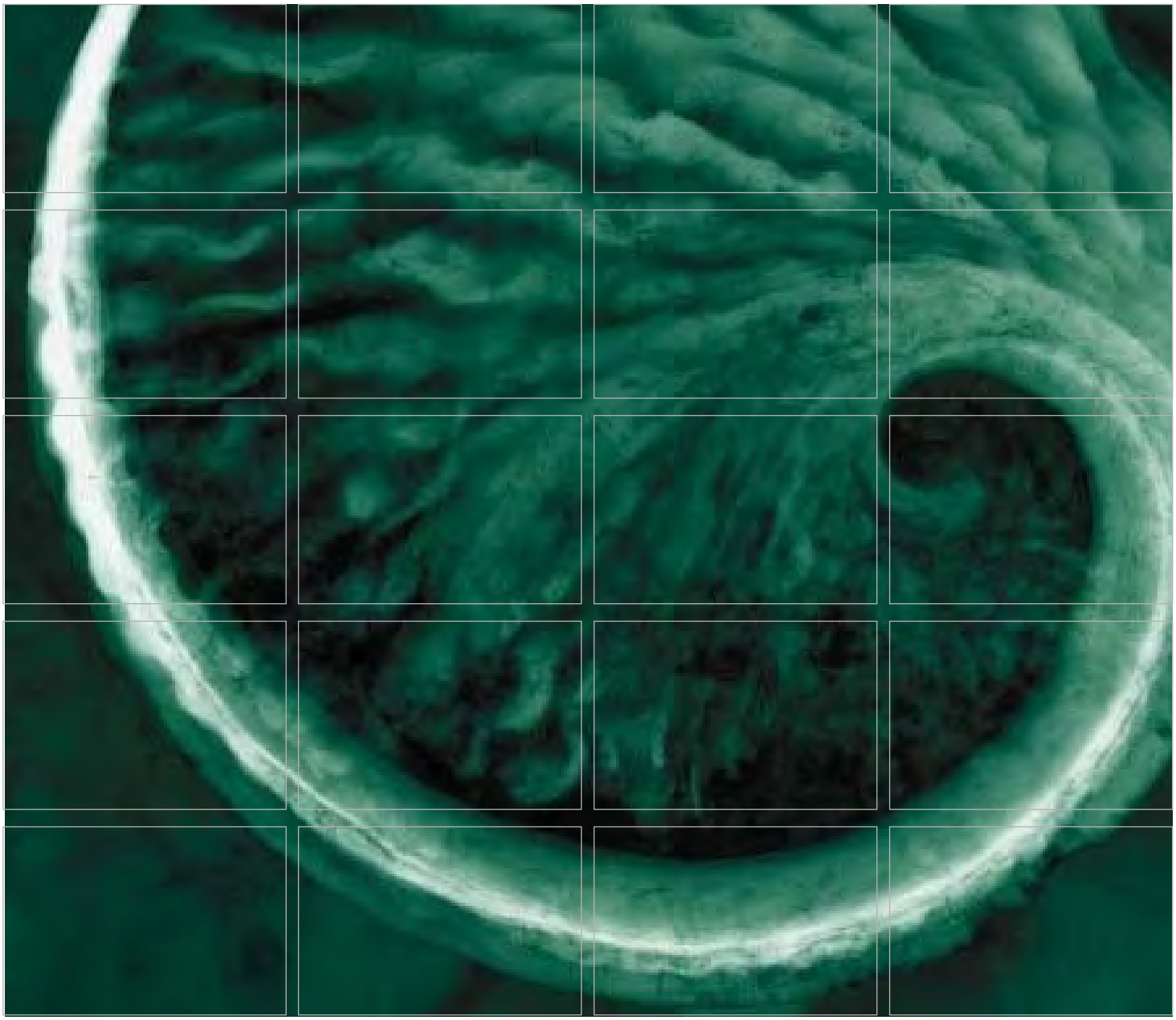

Final OU3 Phase III Groundwater Remedial Investigation and Feasibility Study Work Plan

52nd Street Superfund Site Operable Unit 3 Study Area
Phoenix, Arizona

Prepared for:
Motorola 52nd Street
Superfund Site Operable
Unit 3 Working Group

August 2010

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Motorola 52nd Street Superfund Site
Operable Unit 3
Working Group

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LIST OF ACRONYMS

µg/L	Microgram per liter
1,1-DCE	1,1-dichloroethylene
ADD	Average Daily Dose
ADEQ	Arizona Department of Environmental Quality
AOC	Administrative Order on Consent
AWQS	Arizona Aquifer Water Quality Standard
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
COC	Contaminant of concern
COPC	Chemicals of potential concern
CSF	Cancer slope factor
CSM	Conceptual site model
EDC	Effective diffusion coefficient
EDD	Electronic data deliverable
EQuIS	Environmental Quality Information System
ERM	ERM-West, Inc.
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Feet
GBRA	Groundwater Baseline Risk Assessment
GIS	Geographic information system
HASP	Health and Safety Plan
HI	Hazard Index
HSU	Hydrostratigraphic Unit
IUR	Inhalation unit risks
LADD	Lifetime Average Daily Dose
LAU	Lower Alluvial Unit

MAU	Middle Alluvial Unit
mg/kg	Milligram per kilogram
mg/m^3	Milligram per cubic meter
MHHSL	Motorola 52nd Street Human Health Screening Level
OU	Operable Unit
PIC	Partner-in-Charge
PM	Project Manager
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RfC	Reference concentration
RfD	Reference dose
RI	Remedial Investigation
RSL	Regional Screening Level
SOW	Statement of Work
SVMW	Soil vapor monitoring well
TCE	Trichloroethene
TRACS	Temporary Restrictions and Closure Permit
UAU	Upper Alluvial Unit
UCL	Upper confidence limit
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
Working Group	Motorola 52nd Street Superfund Site Operable Unit 3 Working Group, which is comprised of Honeywell and Arizona Public Service Company
WQARF	Water Quality Assurance Revolving Fund

1.0 INTRODUCTION

The Motorola 52nd Street Superfund Site is located in Phoenix, Arizona (Figure 1-1). The Site was placed on the National Priorities List in October 1989. The Site is separated into three Operable Units (OU1, OU2, and OU3). The OU3 Study Area, which is hydraulically downgradient of OU2, has been established by United States Environmental Protection Agency (USEPA) and Arizona Department of Environmental Quality (ADEQ) to further determine the nature and extent of groundwater contamination between 20th Street and 7th Avenue (Figure 1-1).

The primary purpose of this Work Plan is to conduct work set forth in the Statement of Work (SOW) as required by the Administrative Order on Consent (AOC) entered into between the OU3 Motorola 52nd Street Superfund Site Operable Unit 3 Working Group (Working Group), which is composed of Honeywell International, Inc. (Honeywell) and Arizona Public Service Company, a subsidiary of Pinnacle West, and USEPA Docket No. 2008-17 with an effective date of 23 September 2009 (USEPA 2009c). The AOC was issued under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The SOW anticipates the collection of the data necessary to complete an OU3 Groundwater Remedial Investigation (RI) Report and prepare a Feasibility Study (FS) for groundwater located in the OU3 Study Area. Field work in this Phase III RI will supplement prior investigations undertaken by USEPA to assess the lateral and vertical distribution of OU3 contaminants of concern (COCs) in groundwater, defined in Section 19 of the AOC as volatile organic compounds (VOCs), including trichloroethene (TCE), tetrachloroethene, 1,1,1-trichloroethane, and VOC degradation by-products, cis-l,2-dichloroethylene (cis-1,2-DCE), 1,1-dichloroethylene (1,1-DCE), vinyl chloride, 1,1-dichloroethane, and chloroethane. The RI will also evaluate the potential for migration of COC concentrations in groundwater into soil vapor, better define the hydrogeological parameters within the OU3 Study Area, and collect the data to conduct a groundwater baseline risk assessment (GBRA). Following completion and based on the findings of the OU3 RI Report, an OU3 FS Work Plan will be prepared and an OU3 Feasibility Study will be performed to evaluate potential remedial alternatives for OU3 groundwater. After completion of the OU3 FS, an OU3 FS Report will be prepared summarizing the results of the OU3 FS and identifying the preferred remedial alternative for OU3 groundwater.

This Work Plan documents the methods, procedures, and rationale for the Phase III groundwater RI activities (Phase III RI) at the Motorola 52nd Street Superfund Site OU3 Study Area. All Phase III RI/FS work will be

conducted in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA 1988). ERM-West, Inc. (ERM) has prepared this Work Plan on behalf of the Working Group.

After this introduction, this document contains the following sections:

- Section 2.0 describes the site background and physical setting;
- Section 3.0 summarizes prior investigations, existing site data, and the conceptual site model (CSM);
- Section 4.0 presents the technical approach for the OU3 Phase III RI field tasks, including required permitting, waste management, and subcontracting;
- Section 5.0 describes the process for developing the GBRA;
- Section 6.0 includes the In Situ Implementability Technical Memorandum and decision process for determining the need for bench-scale or pilot tests;
- Section 7.0 describes the required elements for the OU3 FS Work Plan and OU3 FS Report;
- Section 8.0 describes the project management plan, including the regulatory structure and summary of project team member roles and responsibilities, and required agency reporting and communication during field work;
- Section 9.0 describes the data management plan for this project;
- Section 10.0 summarizes the required deliverables for this project;
- Section 11.0 summarizes the field program implementation schedule, project reporting, and milestones; and
- Section 12.0 provides references used in preparing this document.

Figures follow the main Work Plan text. Supporting documentation for this Work Plan is included in Appendices A through C, as follows:

- Appendix A – Field Sampling Plan (FSP);
- Appendix B – Quality Assurance Project Plan (QAPP); and
- Appendix C – Health and Safety Plan.

2.0 SITE BACKGROUND AND PHYSICAL SETTING

This section briefly summarizes the Motorola 52nd Street Superfund Site history, describes the previous investigations conducted in the OU3 Study Area, and outlines the physical setting of the site. Figure 1-1 provides a site location map of the Motorola 52nd Street Superfund Site Study Areas.

The Motorola 52nd Street Superfund Site is approximately 7,800 acres and consists of three adjoining groundwater OUs: OU1, OU2, and OU3. OU1, approximately 1,000 acres, is the easternmost OU and contains the former Motorola 52nd Street semiconductor plant. The boundaries of OU1 are 52nd Street to the east, Palm Lane to the north, Van Buren Street to the south, and 44th Street to the west.

OU2 is approximately 3,800 acres, lies west of OU1, and contains the OU2 Groundwater Extraction System and several OU2 potentially responsible party facilities, including the Honeywell International (Honeywell) 34th Street facility. The approximate boundaries of OU2 are McDowell Street to the north, 44th Street to the east, Buckeye Road to the south, and the OU2 Groundwater Extraction System and 20th Street to the west.

OU3 is approximately 3,000 acres and lies west of OU2. The boundaries of the OU3 Study Area are McDowell Road to the north, the OU2 Groundwater Extraction System and 20th Street to the east, Buckeye Road to the south, and 7th Avenue to the west. The USEPA is the lead regulatory agency for OU3 and the OU2 Groundwater Extraction System. The ADEQ is the lead regulatory agency for OU1 and OU2.

2.1 MOTOROLA 52ND STREET SUPERFUND SITE HISTORY

On 4 October 1989, the USEPA placed the Motorola, Inc. (52nd Street Plant) Site on the National Priorities List. Motorola (now Freescale Semiconductor, Inc. [Freescale]) investigated their facility and implemented the OU1 groundwater treatment plant beginning in 1992 under ADEQ oversight. Beginning in 1991, investigation activities in the OU2 Study Area under ADEQ oversight resulted in the selection of the OU2 interim remedy for the OU2 Study Area, consisting of containment of the groundwater plume at approximately 20th Street with a groundwater extraction and treatment system. Freescale and Honeywell constructed and have operated the OU2 treatment system under USEPA oversight. The companies (Honeywell and Freescale) recently negotiated an AOC

with ADEQ to continue to operate and maintain the system under ADEQ oversight.

In 1983, a groundwater sample collected from the Eastlake Park irrigation well located in the OU3 Study Area near 16th Street and Jefferson Street contained chlorinated VOCs. The Motorola 1992 OU2 RI report indicated that the chemicals migrating from the Motorola facility extended into the East Washington Area, which prompted ADEQ and USEPA to create the OU3 Study Area to address co-mingled VOC groundwater impacts.

3.0 PREVIOUS SITE INVESTIGATIONS AND SITE PHYSICAL SETTING

3.1 PREVIOUS SITE INVESTIGATIONS

Between February 2002 and July 2003, ADEQ installed and monitored 28 wells in the area now known as the OU3 Study Area pursuant to the Arizona Water Quality Assurance Revolving Fund (WQARF) program.

Two previous phases of OU3 groundwater investigation have been conducted by the USEPA. The scope of work for the Phase I and II field programs were presented in the following documents:

- *Final Groundwater Investigation Work Plan, Motorola 52nd Street Superfund Site Operable Unit 3 Study Area, Phoenix, Arizona* (IT 2001).
- *Work Plan Supplement to the Final Groundwater Investigation Work Plan for Proposed Phase II Wells, Motorola 52nd Street Superfund Site Operable Unit 3 Study Area* (IT 2003).

Phases I and II included construction of the following groundwater monitoring wells:

- Phase I: 15 wells were installed from February to May 2002.
- Phase II: 13 wells were installed from May to July 2003. This phase included the abandonment and replacement of three Phase I wells (OU3-5S/M/D).

The Phase I and II groundwater investigation results were presented in the *Final Groundwater Investigation Report Phase I and II Well Installation, Motorola 52nd Street Superfund Site OU3 Study Area, Phoenix, Arizona* (Shaw 2005). Continued groundwater monitoring results have been submitted for the following quarterly and semiannual groundwater events, after the completion of Phase I and Phase II groundwater investigations:

- Phase I wells were sampled on a quarterly basis for one year, beginning in June 2002. Phase I wells, selected East Washington Project Area monitoring wells, and private monitoring wells within OU3 were sampled in June 2002, September 2002, December 2002, and September 2003. The East Washington monitoring wells are located within the former ADEQ East Washington Area WQARF Site, which includes the OU3 Study Area. Phase I wells, selected East Washington Project Area monitoring wells, and private monitoring wells are currently sampled on a semiannual basis, which began with the September 2003 event.

- Phase II wells were sampled on a quarterly basis for one year, beginning in June 2003. Phase II wells were sampled in June 2003, September 2003, December 2003, and September 2004. Phase II well monitoring was reduced in frequency to semiannual monitoring beginning in September 2004 through the September 2009 event.

Facility-specific Focused RIs have been or are currently being conducted at several sites within the OU3 Study Area. These reports will be provided by the USEPA as they become available. Groundwater data considered essential to the OU3 Phase III RI will be evaluated and incorporated in the OU3 Phase III RI as appropriate.

Figure 3-1 provides a site plan of all OU3 monitoring well locations, and Figures 3-2, 3-3, and 3-4 provide cross sections illustrating the Upper Alluvial Unit (UAU) lithology and well screen intervals. Table 3-1 provides OU3 monitoring well construction details.

Table 3-1 OU3 Groundwater Monitoring Well Construction Details

Well ID	Hydrostratigraphic Zone	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Total Depth (ft bgs)	Well Diameter (inches)
BE-MW-8	Shallow	75	105	105	4
DT-DW-5	Shallow	59	99	99	2
EWOU3-10S-R	Shallow	60	100	102	4
EW-13-118	Shallow	114.5	119.5	309	4
EW-13-168	Intermediate	164.5	169.5	--	4
EW-13-228	Deep	224.5	229.5	--	4
EW-13-268	Deep	264.5	269.5	--	4
EW-19D	Deep	247	267	270	4
EW-19S	Shallow	57	107	112	4
EW-20	Shallow	59	109	109	4
EW-21	Shallow	58	108	108	4
GH-MW-11	Shallow	50	100	100.9	4
IN-MW-1	Shallow	70	90	90	4
SC-MW-1D	Shallow	83	123	125	4
SC-MW-7	Shallow	45.5	90.5	91	4
OU3-1D	Deep	235	255	259	4
OU3-1M	Intermediate	140	160	162	4
OU3-2M	Intermediate	150	170	175	4
OU3-4S	Shallow	59.2	110	110	4
OU3-6D	Deep	230	250	261	4
OU3-6M	Intermediate	152	172	172.5	4
OU3-7M2	Intermediate	195	215	221	4
OU3-7S	Shallow	60	110	112	4
OU3-8D	Deep	260.5	270	273	4
OU3-8M2	Intermediate	205.5	225.6	228	4
OU3-8S	Shallow	59.9	110.5	110.5	4
OU3-9S	Shallow	59.6	110.2	110.5	4
OU3-5M2	Intermediate	202.7	222.7	253?	4
OU3-9M2	Intermediate	219.7	229.7	235	4
OU3-10M	Intermediate	146.7	166.7	170	4
OU3-10M2	Intermediate	199.2	219.2	225	4
Ou3-11M	Intermediate	153.7	173.7	178	4
OU3-11M2	Intermediate	196.7	216.7	230	4
OU3-11S	Shallow	69.7	119.7	123	4
OU3-12D	Deep	245.6	265.6	396	4
OU3-12M	Intermediate	146.7	166.7	170	4
OU3-13D	Deep	224.7	244.7	250	4
OU3-13M	Intermediate	154.7	174.7	175	4
OU3-14D	Deep	231.2	251.2	251.5	4
OU3-14M	Intermediate	145.7	165.7	168	4
OU3-5DR	Deep	232.7	252.7	253	4
OU3-5MR	Intermediate	148.7	168.7	169	4
OU3-5SR	Shallow	69.7	119.7	120	4

3.2 OU3 PHYSICAL SETTING

This section summarizes the regional and OU3 geologic and hydrogeologic settings, which are based on the Phase I and II investigation programs and presented in the *Final Groundwater Investigation Report, Phase I and II Well Installation, Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix, Arizona* (Shaw 2005).

3.2.1 Regional Geology and Hydrogeology

The Phoenix area lies within the Salt River Valley Basin, which is part of the Basin and Range physiographic province. The Salt River Valley Basin is a structural depression characterized by broad sloping valleys bounded by northwest-trending mountain ranges that include the McDowell, Superstition, and White Tank Mountains, and the Sierra Estrella. The Salt River Valley Basin lies within a broad alluvial valley composed of Cenozoic (Oligocene to Recent) sedimentary deposits. The alluvial basin extends to maximum projected depths of approximately 10,000 feet (ft). It contains consolidated to unconsolidated sands and gravels, with local discontinuous layers of clay and silt. These sedimentary deposits are underlain by crystalline and volcanic bedrock formations of late Cretaceous to early Tertiary age. Low permeability bedrock formations are observed at the surface at the mountain fronts bordering the alluvial basin. The bedrock surface dips steeply beneath the adjacent alluvial deposits. Valley floor elevations range from a minimum of 800 ft in the southwest portion of the basin to a maximum of 2,000 ft in the northeast.

The Salt River Valley Basin is divided into several sub-basins by smaller mountains. These interior mountains include the Phoenix Mountains located 6 miles northwest of the OU3 Study Area; Barnes, Papago, and Tempe Buttes immediately west of OU1; and South Mountains 6 miles south of the OU3 Study Area.

Within the Salt River Valley Basin, Cenozoic basin-fill material can be divided into four general stratigraphic units:

- Red Unit of Oligocene-Miocene age;
- Lower Alluvial Unit (LAU) of Miocene-Pliocene age;
- Middle Alluvial Unit (MAU) of Pliocene-Pleistocene age; and
- UAU of Holocene (Recent) age.

The Red Unit consists of reddish, poorly sorted, well-cemented breccia, conglomerate, sandstone, and siltstone that were largely deposited by debris flows with interfingered volcanic deposits. The sediments were generally derived from granitic and rhyolitic sources. Bedding is generally poorly defined except within interfingering finer-grained units. The Red Unit reaches a maximum thickness of 2,000 ft. This unit is further divided into the Camel's Head Formation, Tempe Beds, and Tertiary volcanics (Dames & Moore 1992). The Camel's Head Formation overlies the Precambrian granites and is an alluvial fan deposit of coarse, angular rock debris. At nearby outcroppings, the basal portion of the Camel's Head Formation is a pale green to gray, tuffaceous sandstone, and breccia. The breccia contains angular, boulder-sized fragments of granite and metarhyolite. Interbedded reddish-brown and arkosic breccias overlie this unit. The upper units consist of finer-grained, brownish-red, arkosic cemented alluvial fan deposits.

The Tempe Beds subunit directly overlies the Camel's Head Formation. The Tempe Beds is also an alluvial fan deposit; however, it was deposited farther from the mountain front and hence it is finer-grained than the Camel's Head Formation. It is composed of coarse- and fine-grained pink to red arkose with some siltstone, volcanic arenite, and tuff. Shale and siltstone are predominant in the upper part of the Tempe Beds. Dames & Moore (1992) distinguished the two units based on whether they were clast or matrix supported. If the deposit was clast supported with minimum weathering by transport process, it was assigned to the Camel's Head Formation. Conversely, if the deposit was matrix supported with evidence of weathering by transport processes, it was assigned to the Tempe Beds.

The LAU overlies the Red Unit and is divided into two subunits. The basal portion consists of consolidated to semiconsolidated homogeneous and massive evaporite deposits of anhydrite and gypsum that were deposited in a closed basin. These deposits contain occasional interfingering sand, gravel, and basaltic flows. The upper portion of the LAU consists of poorly sorted, weakly- to moderately-cemented mudstone, siltstone, gypsiferous mudstone, sand, and gravel. The upper portion of the LAU is generally less homogeneous than the basal portion.

The MAU conformably overlies the LAU. The MAU consists of weakly consolidated interbedded clay, siltstone, silty sand, and gravel deposited in playa, alluvial fan, and fluvial environments. The grain size of the MAU generally increases at shallower depths. The thickness of the MAU ranges from 0 ft in the east to 800 ft in the west.

The UAU contains the most productive aquifer and is observed at the surface throughout much of the area. The UAU consists of unconsolidated gravel, sand, and silt with occasional areas of calcium carbonate cementation. These sediments were deposited in flood-plain, terrace, and alluvial fan environments. The thickness of the UAU generally increases in a westerly direction, from a minimum thickness of 200 ft in the east to 450 ft in the west. A recent unpublished reinterpretation of OU2 soil cores indicate that the UAU is composed of the Salt River Gravel and Basin Fill deposits (CRA Engineering, Inc. [CRA] 2009).

The geologic structure in the Phoenix area is predominantly associated with the Basin and Range crustal extension that caused widespread, northwest-trending normal faulting. High-angle normal faults separate large mountain blocks by a series of broad, downfaulted alluvial valleys. The Red Unit and the basal portion of the LAU are offset by these high-angle normal faults throughout the Salt River Basin. The upper portion of the LAU and younger deposits were not subject to this faulting.

The mountain ranges bounding the alluvial valleys and the smaller isolated mountains within the central basin generally form low-permeability groundwater barriers. The consolidated sedimentary rocks of the Red Unit and LAU are also thought to restrict groundwater flow. Regional groundwater flow, which generally follows the ground surface slope, is toward the west and southwest. Groundwater recharge to the basin aquifers is from precipitation, controlled releases from upstream reservoirs on the Salt River, runoff from adjacent mountains, and return flow from agricultural irrigation.

3.2.2 *OU3 Study Area Geology and Hydrogeology*

This section presents a general description of geology and hydrogeology of the OU3 Study Area.

Geology

The UAU within the OU3 Study Area consists of packages of interbedded sand, silt, and clay belonging to the basin fill and thick sequences of predominantly sand and gravel belonging to the Salt River Gravels. The Salt River gravels were deposited by the ancestral Salt River (Reynolds and Bartlett 2002). The OU3 Study Area is covered with a veneer of Recent-age alluvial deposits, which are a mixture of sand, silt, clay, and gravels.

Along the eastern edge of the OU3 and the western edge of the OU2 Study Areas, the Camel's Head formation has been encountered in the subsurface and forms a series of bedrock ridges. Within the OU2 Study Area, a northwesterly-trending buried bedrock ridge lies between 32nd Street and 24th Street, just north of Sky Harbor International Airport, with a buried Valley immediately to the ridge's east (Reynolds and Bartlett 2002). A similar buried bedrock ridge was mapped across the OU2/OU3 boundary between Van Buren Street and the Southern Pacific Railroad tracks (CRA 2009). This ridge trends northwest and southeast, across Adams and 17th Street to Pierce and 17th Street. Bedrock has not been encountered during the previous two phases of drilling in the OU3 Study Area.

The central and western portions of OU3 are a typical representation of basin fill in the UAU. Lithologic descriptions of these areas, based on boring logs from wells drilled during the initial and subsequent investigations by IT (2003), APS (2009), and ARCADIS (2008) are provided within Shaw (2005) and CRA (2009). These descriptions indicate that the immediate upper portion of the site is a recently deposited layer of silts, clays, sand, and gravel. Engineered fill is present locally in the upper portion of the western and central portions of the site. The Salt River gravels dominate the upper portion of the basin fill with a fine-grained layer as the lower boundary. This fine-grained boundary layer is reported to be laterally discontinuous. A second layer of gravel, similar to the Salt River gravels, is divided by separate fine-grained layers, made up of predominantly silt and sand. These boundary layers split the gravel into two separate zones. The deepest drilled section in the central and western areas tends to be made up of massively bedded fine-grained materials (silt or clay) with sand. Please see Figure 3-2 for a generalized graphical representation of the OU3 site in cross section. Each section of the UAU is divided into four separate hydrostratigraphic zones discussed in the following section.

Hydrogeology

Groundwater within the OU3 Study Area is primarily found within the unconsolidated UAU. Four hydrostratigraphic zones; Shallow (S), First Intermediate (M), Second Intermediate (M2), and Deep (D), have been designated in the OU3 Study Area. These zones are further described below in Table 3-2. The Shallow Zone generally corresponds to the ADEQ's A Hydrostratigraphic Unit (HSU) recognized in OU1 and OU2. The Intermediate Zone generally corresponds to the B HSU and the Deep Zone to the D HSU.

Table 3-2 OU3 Study Area Hydrostratigraphic Zones

Aquifer Unit	Aquifer Subunit	Hydrostratigraphic Zone	ADEQ Hydrostratigraphic Unit	Description
Upper Alluvial Aquifer	Salt River Gravels	Shallow Zone (S)	A	Coarse-grained Salt River Gravels, including minor amounts of interbedded and laterally discontinuous fine-grained deposits.
	Basin Fill	First Intermediate Zone (M)	B	Interbedded coarse and fine-grained deposits dominated by gravel similar to Salt River Gravels. Base of zone commonly includes a fine-grained layer.
		Second Intermediate Zone (M2)	B	Interbedded coarse and fine-grained deposits dominated by gravel similar to Salt River Gravels.
		Deep Zone (D)	D	Upper fine-grained layer with an underlying interval of interbedded fines and sand.

The top of the groundwater table in the OU3 Study Area in September 2008 ranged from 88 to 101 ft below ground surface (bgs). Intermediate Zone groundwater levels ranged from 88 to 103 ft bgs, and Deep Zone groundwater levels ranged from 82 to 95 ft bgs. Groundwater within all three units flows toward the west and southwest (Shaw 2009).

Based on historical groundwater elevation data presented in Shaw 2005, groundwater within all three units flows toward the west and southwest. Groundwater flow in the shallow and intermediate zones is influenced by the OU2 extraction well system. Once groundwater is outside the influence of the OU2 capture zone, the average gradient slightly increases from 0.001 to 0.002 ft/ft toward the western edge of the OU3 site.

Groundwater flow in the deep zone exhibits two trends across the Study Area. In the eastern portion of OU3, groundwater flows southwest to south at 0.0035 ft/ft. Groundwater flow is reported to change near EW-19D, in the central portion of the site, to the southwest at 0.003 ft/ft (Shaw 2005). It is unclear what causes the shift in flow direction, though Shaw gives several possibilities that might cause flow direction change including the bedrock ridge or the OU2 extraction system operation.

The March 2009 groundwater contour maps presented by Shaw (2009) indicate that the current groundwater trends are consistent with the historical trends. Historical groundwater elevations, based on the Shaw 2009 *Groundwater Monitoring Report*, indicate a general downward trend in groundwater elevation.

The proximity of the Salt River to the OU3 Study Area may result in seasonal and/or flood-event-related variations in hydrogeologic conditions. APS, upon the request of the USEPA, conducted an investigation to determine if the Salt River exerted any influence on the groundwater flow at their facility within the OU3 Study Area (501, 502, and 505 South 2nd Avenue). APS reviewed historical groundwater data, collected data from the on-site APS site monitoring wells and the OU3 Site, United States Geological Survey stream gauging station and identified any "pumping centers" in close proximity to the APS facility. The APS study determined that the historically predominant groundwater flow direction up- and downgradient of the facility occurs in a west-southwest direction. This appears to closely match the historical regional groundwater flow. Based upon the information presented in the draft study, APS determined that during flood events, the Salt River has a minor, but measurable impact on the regional groundwater flow direction. These flood events, such as the 2008 event, change the groundwater direction from the historical west-southwest (260 degrees) to a more westerly direction (270 degrees). The APS study also reports that the length of the effect of the flood tends to be limited and the historical regional groundwater flow quickly returns to pre-flood conditions. Pumping centers also appear to have a similar effect, as they normally influence local groundwater flow, but the regional trend remains to the west-southwest upgradient to or immediately downgradient of the APS facility (APS 2009).

The APS facility is presented as an example of the observed influence of Salt River flooding on groundwater flow conditions within OU3. Because the APS facility is located within the extreme southwestern portion of the OU3 Study Area, these results cannot be reliably extrapolated to the entire OU3 Study Area. Historical groundwater flow maps representative of flooding conditions show that there is a greater influence of flooding in proximity to the Salt River, or in areas with a thinner UAU. As part of the Phase III RI, additional data evaluation will be performed to evaluate the relationship between seasonal and/or flood events in the Salt River and hydrogeologic conditions within the OU3 Study Area.

3.3 CONCEPTUAL SITE MODEL

This section provides a review of OU3 Study Area conditions and the current distribution and migration of COCs detected in groundwater. This information provides the basis for the current OU3 CSM presented in the *Final Groundwater Investigation Report Phase I and II Well Installation* (Shaw 2005). This information is also used to identify potential exposure pathways included in the OU3 human health CSM, which include volatilization from groundwater to indoor and outdoor air, and ingestion if the groundwater is used as drinking water. The OU3 CSM also serves as a framework for providing rationale for the FSP. The current OU3 CSM will be refined using the data obtained during the Phase III RI and used in the FS to develop and evaluate potential remedial alternatives for groundwater containing COC concentrations within the OU3 Study Area.

3.3.1 Potential Contaminant Sources

The OU3 Study Area is downgradient of the OU2 Study Area. Prior investigations and monitoring within the OU1 and OU2 Study Areas confirm the presence of chlorinated VOCs. USEPA has identified additional properties within OU3 as potential sources of COCs. Figure 3-1 illustrates the location of the EPA identified potentially responsible parties within the OU3 Study Area.

3.3.2 Chemical Distribution

Monitoring data collected by the USEPA from February 2002 through March 2009 showed halogenated and non-halogenated COCs and 1,4-dioxane in groundwater samples collected from OU3. The initial analytical program for groundwater samples included perchlorate. However, the analysis was removed because perchlorate was not detected. Table 3-3 provides a list of the maximum concentrations of VOCs detected during the March 2009 groundwater monitoring event, with the corresponding Arizona Aquifer Water Quality Standard (AWQS).

Table 3-3 Summary of Maximum Groundwater Monitoring Analytical Results - March 2009

Compound	Monitoring Well	Maximum Concentration Detected (µg/L)	Aquifer Water Quality Standard (µg/L)
1,1,1-Trichloroethane	NA	ND	200
1,1,2,2-Tetrachloroethene	NA	ND	None
1,1,2-Trichloro-1,2,2-trifluoroethane	OU3-5M2	0.46J,Tr	None
1,1,2-Trichloroethane	NA	ND	**5**
1,1-Dichloroethane	OU3-10M2	6	None
1,1-Dichloroethene	OU3-10M2	11 J+S	**7**
1,2-Dichloroethane	NA	ND	**5**
1,4-Dioxane	EWOU3-10SR	9	None
Acetone	NA	ND	None
Bromodichloromethane	NA	ND	**80 (total trihalomethanes)**
Bromoform	NA	ND	
Chlorodibromomethane	NA	ND	
Chloroform	OU3-5SR	0.95	
Bromochloromethane	NA	ND	None
Chloromethane	NA	ND	None
cis-1,2-Dichloroethene	OU3-5M2	11 J+S,	**70**
Dibromomethane	NA	ND	None
Dichlorodifluoromethane	NA	ND	None
Methyl ethyl ketone	NA	ND	None
Tetrachloroethene	BE-MW-08	**4.3**	**5**
Trichloroethene	OU3-5M2	**68**	**5**
trans-1,2-Dichloroethene	NA	ND	**100**
Trichlorofluoromethane	OU3-13M	0.68	None
Vinyl chloride	NA	ND	2

Notes:
Data obtained from March 2009 sampling event (Shaw 2009)
µg/L = micrograms per liter
N/A = not applicable
ND = not detected
J = The analyte was positively identified, but the reported numerical value may not be consistent with the amount actually present in the environmental sample
J+ = The analyte was positively identified, but is biased high in the sample
S= Surrogate recovery outside control limit
Compounds and results exceeding the AWQS are in bold type.

COC Distribution

TCE is the most widespread COC detected in OU3 groundwater samples, followed by tetrachloroethene, cis-1,2-DCE, and 1,1-DCE. Two COCs were detected at concentrations above their AWQS during the March 2009 monitoring event: TCE (5 micrograms per liter [µg/L) and 1,1-DCE (7 µg/L). Vinyl chloride was not reported above AWQS during the March 2009 monitoring event.

Shallow Zone TCE Concentrations

Within the Shallow Zone, elevated TCE concentrations have historically been observed along Van Buren Street. Figure 3-5 illustrates the TCE concentrations detected in Shallow Zone monitoring wells during the March 2009 OU3 monitoring event. Elevated TCE concentrations were detected in samples collected at Wells OU3-5SR, EW-20, EWOU3-10S-R and EW-19S. The maximum historical TCE concentration of 720 µg/L was detected in the December 2002 sample collected at Well EW-19S. However, results from recent groundwater monitoring events indicate a general trend of declining TCE concentrations in Shallow Zone groundwater. Figure 3-6 presents historical TCE concentrations in selected Shallow Zone monitoring wells.

Generally, the northern and southern boundaries of the TCE plume within the Shallow Zone are defined. However, the TCE extent at the southern boundary is uncertain, due to a 5,000 ft data gap between Wells OU3-11S and TT-2. The Shallow Zone plume extends beyond the western OU3 boundary into the West Van Buren WQARF site. Wells AVB14-01 and AVB 115-01, which provide data on the plume's core extension into the West Van Buren WQARF site and outside of OU3, exhibited TCE concentrations in groundwater in September 2008 of 51 µg/L and 130 µg/L, respectively. Data for these wells were not reported in the March 2009 sampling report (Shaw 2009).

Intermediate Zone TCE Concentrations

The Intermediate Zone is subdivided into the First Intermediate Zone (M) and Second Intermediate Zone (M2). The VOC concentrations are similar in magnitude between the M and M2 cluster wells. The areal extent of the TCE plume in the Intermediate Zone is historically similar to the Shallow Zone TCE plume and also exhibits a pattern of higher TCE concentrations along Van Buren Street. Figure 3-7 illustrates the TCE concentrations detected in Intermediate Zone monitoring wells during the March 2009 OU3 monitoring event. TCE concentrations in Wells OU3-10M2,

OU3-5MR, and OU3-5M2 have historically exceeded 100 µg/L (Shaw 2005). However, recent groundwater monitoring events indicate a general trend of declining TCE concentrations in Intermediate Zone groundwater (Shaw 2009). Figure 3-8 presents historical TCE concentrations in selected Intermediate Zone monitoring wells.

The northern TCE plume boundary in Intermediate Zone groundwater is well defined, with the possible exception of the area near the OU2/OU3 boundary. In the south, the plume does not appear to extend south of Wells OU3-6M and OU3-12M, where TCE concentrations are less than 5 µg/L (Figure 3-7). Limited data are available to define TCE distribution for the remaining southern plume extent, with only Well EW-13-168 providing data in the southeast. The Intermediate Zone plume appears to extend beyond the western OU3 boundary into the West Van Buren WQARF site.

Deep Zone TCE Concentrations

TCE detections above AWQS in Deep Zone groundwater have historically been limited to a small area in the southeastern portion of the OU3 Study Area (Figure 3-9). The highest Deep Zone TCE concentration detected during the March 2009 monitoring event occurred at Wells NW-7D and NW-14D at 18 and 10 µg/L, respectively. Recent well installations along the OU3/OU2 boundary have better defined the northern and southern extent of the plume through southeastern OU3 (CRA 2008). The TCE extent to the south crosses the OU2/OU3 boundary between East Jackson Street and East Sky Harbor Circle North. The plume's northern edge crosses the OU3/OU2 boundary between Washington Street and Madison Street. Very limited mass flux of TCE is apparent along the OU2/OU3 boundary outside of this area. This is evident by non-detect TCE concentrations in OU2 monitoring wells NW-10D and NW-8D during the March 2009 monitoring round. Recent detections of TCE in monitoring well EW-13-268 (1.6 µg/L in March 2009) indicate a downward trend from historical concentrations, indicating that the southern portion of the Deep Zone plume is fully characterized. Based on the historical data and the limited mass flux of TCE across the OU3/OU2 boundary, no additional wells are necessary to characterize the OU3 Deep Zone plume.

Vertical Extent

Figure 3-2 shows an east-west cross section that transverses the OU3 Study Area through much of the TCE plume axis. Historically, TCE concentrations within the OU3 Study Area are slightly greater in the Intermediate Zone than in the Shallow Zone. Near the OU2/OU3

boundary, the March 2009 TCE concentrations for well pair NW-6S and NW-6D were 11 and 52 µg/L, respectively. Within the central portion of the plume, the September March 2009 TCE concentrations for well pair EW-19S and OU3-2M were 12 and 41 µg/L, respectively. Approximately 3,500 ft downgradient of the EW-19S/OU3-2M well pair, the March 2009 TCE concentrations for well cluster OU3-5MR and OU3-5M2 were 49 and 68 µg/L, respectively. Near the western boundary of the OU3 Study Area, the March 2009 TCE concentrations for wells OU3-10M and OU3-10M2 were 18 and 46 µg/L, respectively. The Deep Zone TCE concentrations above the AWQS are limited to the southeastern portion of the OU3 Study Area.

3.3.3 Contaminant Fate and Transport within the Alluvial Aquifer

Contaminant fate refers to the expected final state that a compound, or group of compounds, will achieve following release to the environment. Contaminant transport refers to the mechanisms controlling the migration of contaminants away from the source through groundwater, soil, and soil vapor.

Contaminant Fate

Processes that dictate the fate of organic contaminants in the alluvial aquifer include sorption, volatilization, hydrolysis, abiotic degradation, and biodegradation. Biodegradation occurs in either anaerobic or aerobic environments. Given appropriate conditions, many chlorinated VOCs degrade in anaerobic environments; however, the rate of anaerobic degradation is often substrate-limited in the low organic carbon aquifers present in the OU3 Study Area. Conversely, in aerobic environments, chlorinated VOCs degrade slowly, if at all. An exception to this is vinyl chloride, which can be rapidly oxidized in an aerobic environment.

Anaerobic biodegradation, also known as reductive dechlorination, typically occurs in the deeper aquifer units as bacteria break complex compounds down into simpler compounds. For reductive dechlorination to take place, adequate concentrations of carbon must be available for the metabolic processes responsible for the degradation. If high concentrations of dissolved oxygen and low concentrations of carbon are present, aerobic biodegradation occurs. A natural attenuation evaluation of VOCs in the shallow and intermediate zone suggests that the conditions are not likely to be conducive to reductive dechlorination (Shaw 2005). This conclusion will be further evaluated based on additional data in the Phase III RI.

Contaminant Transport

Transport mechanisms include advection, dispersion, diffusion, and volatilization. Contaminant transport by advection occurs when the contaminant is moved with the bulk transport of groundwater. Dispersion is the spreading of a contaminant plume due to the heterogeneity of the aquifer materials. Transport by diffusion is the result of molecular motion across a concentration gradient. Where there is groundwater movement, most contaminant transport is due to advection, which is determined by the hydraulic conductivities, physical dimensions, and hydraulic heads of the aquifer.

The current OU3 CSM includes dissolved-phase transport of TCE in sands and gravels (higher permeability layers) interbedded with silty and clayey zones (lower permeability layers) in the UAU. In the eastern OU3, observed complex bedrock geometry likely influences dissolved-phase transport. Limited hydraulic data are available for the Shallow, Intermediate, and Deep Zones in the eastern boundary of OU3; therefore, additional data will be collected during the Phase III RI. These data will be used to refine the CSM and better understand groundwater flow contaminant transport within the OU3 Study Area.

4.0 PHASE III REMEDIAL INVESTIGATION TECHNICAL APPROACH

4.1 DATA AQUISITION SCOPE OF WORK

This subsection provides a summary and rational for the field activities included in the Phase III RI. Detailed procedures for the data acquisition tasks are provided in the FSP and QAPP in Appendix A and Appendix B, respectively.

4.1.1 Groundwater Monitoring Well Installation

The AOC stipulates the installation of eight new groundwater monitoring wells during the Phase III RI. However based on a the chemical distribution evaluation presented in Section 3.3.2, the Working Group in consultation with the USEPA concluded that the installation of proposed monitoring well OU3-18D is not necessary (USEPA 2010a).

Up to seven groundwater monitoring wells will be installed during the Phase III RI. Four Shallow Zone monitoring wells will be installed to provide data on the eastern, western, and southern extent of the plume. Three Intermediate Zone monitoring wells will be installed to provide data on the southern and western edges of the plume, and to better define the central and eastern core of the plume. Figure 4-1 shows the proposed locations of the new groundwater monitoring wells.

An initial core borehole will be completed at each monitoring well location using a sonic drill rig for the collection of lithologic and screening-level groundwater COC data that will be used to determine monitoring well construction. Continuous undisturbed soil cores will be obtained from each core borehole. A stainless-steel screen will be exposed periodically at the bottom the borehole for the collection of discrete groundwater samples. Discrete groundwater samples will be collected from up to three intervals at each boring location. Sample intervals will be selected based on the lithology of the soil cores retrieved from each location and screen intervals of nearby wells completed in the target hydrostratigraphic zone. Discrete samples will be collected from the top, middle, and bottom of the design screen interval for the new wells provided in Table 4-1. The discrete groundwater samples will be analyzed for COCs with a 24-hour turnaround time to allow the data to be used for well construction decision-making purposes. A technical team consisting of the ERM Project Manager (PM) and Project Geologist, Working Group representatives and hydrogeologists from the ADEQ and USEPA will use

field and historical data to make decisions on the proper placement of well screen intervals.

Following is a description of the location and rationale for each new Phase III RI monitoring wells.

OU3-10S will be located adjacent to OU3-10M and OU3-10M2. Historical monitoring data indicate that VOCs are present at shallow depths at EWOU3-10-S-R but, due to declining groundwater levels, this well is frequently dry and is no longer available to monitor the VOC movement at the western edge of the plume core. Therefore, the replacement Well OU3-10A will be installed at this location.

OU3-16S will be located in the vicinity of 6th Avenue between Monroe Street and Van Buren. Recent sample results indicate that VOCs are present in groundwater above the AWQS at East Van Buren Well AVB115-01. This location was chosen to evaluate plume concentrations within the northwestern edge of the OU3 Shallow Zone plume.

OU3-17S has tentatively been located approximately 1,000 feet upgradient of existing shallow monitoring well GH-MW-11. Recent gauging of the well indicates the presence of a petroleum product release, which may have compromised the VOC concentrations in the well due to in situ biological activity. Therefore, a replacement Shallow Zone monitoring well is necessary to delineate this portion of this plume. Prior to the initiation of well installation of well OU3-17S, the Working Group will evaluate the use of existing wells in this area as potential replacements for GH-MW-11. Several monitoring wells owned by the City of Phoenix will be evaluated as potential replacements for GH-MW-11. The Working Group will prepare a Technical Memorandum evaluating the suitability of one of these wells as a replacement for GH-MW-11. The Technical Memorandum will summarize the historical chemical data, well construction detail, and well condition in order to determine if any of these wells can serve as an appropriate alternative to the installation of proposed monitoring well OU3-17S.

OU3-20S will be located on the eastern side of the Honeywell Aerospace facility parking lot, on the southeastern OU3/OU2 border. This well will be screened in the Shallow Zone to provide information regarding the potential mass flux of TCE across the OU3/OU2 border.

OU3-16M will be located in the vicinity of 6th Avenue between Monroe Street and Van Buren. Recent sampling results indicate that VOCs are present in groundwater above the AWQS at East Van Buren Well

AVB115-01. This location was chosen to evaluate plume concentrations within the northwestern edge of the OU3 Intermediate Zone plume.

OU3-19M will be located in the vicinity of East Van Buren and 15th Street. Recent sampling events at OU3-12 and OU3-13 indicate that the core of the plume could lie between the two wells. This well will be used to further delineate the core of the Intermediate Zone plume.

OU3-20M will be located on the eastern side of the Honeywell Aerospace facility parking lot, on the southeastern OU3/OU2 border. This well will be screened in the Intermediate Zone to provide information regarding the potential mass flux of TCE across the OU3/OU2 border.

Phase III monitoring well designs have been developed based on a review of historical analytical data and lithological data provided on boring logs developed during previous investigations in the OU3 Study Area. These designs may be modified by the technical team based on data collected during installation of the initial pilot borehole. The technical team will primarily base well construction decisions and recommendations on lithologic and discrete groundwater sampling data collected from pilot boreholes.

It is anticipated that the total depths of Shallow, Intermediate, and Deep Zone wells will be about 120 ft, 210 ft, and 270 ft, respectively. Further information about the proposed groundwater well installations is provided in the FSP (Appendix A). Table 4-1 provides a summary of the well construction details for each aquifer subunit. A detailed description of well construction details is provided in the FSP (Appendix A).

Table 4-1 Phase III RI Groundwater Monitoring Well Designs

Shallow Zone (Figure 3)				
Blank Casing (4-inch Schedule 40 PVC)	0	to	70	feet bgs
0.020-inch Slotted Screen (4-inch Schedule 40 PVC)	70	to	120	feet bgs
Cement Bentonite Grout	0	to	64	feet bgs
Bentonite Seal	64	to	67	feet bgs
Sand Filter Pack (10-20)	67	to	121	feet bgs

Intermediate Zone (Figure 4)				
Blank Casing (4-inch Schedule 40 PVC)	0	to	190	feet bgs
0.020-inch Slotted Screen (4-inch Schedule 40 PVC)	190	to	210	feet bgs
Cement Bentonite Grout	0	to	183	feet bgs
Bentonite Seal	183	to	187	feet bgs
Sand Filter Pack (10-20)	187	to	211	feet bgs

4.1.2 *Quarterly Groundwater Sampling*

Newly installed monitoring wells will be sampled quarterly for COCs for a minimum of 1 year. The groundwater samples will be analyzed for VOCs using USEPA Method 8260B and for 1,4-dioxane using USEPA Method 8270C. Dissolved oxygen, pH, oxidation-reduction potential, temperature, turbidity, and conductivity will also be measured in the field during sample collection. Table 4-2 provides the sampling schedule for the newly installed monitoring wells. Further information about groundwater sampling procedures is provided in the FSP (Appendix A).

Table 4-2 Groundwater Monitoring Program – New Monitoring Wells

NEW MONITORING WELLS	2010				2011			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
OU3-10A			X	X	X	X		
OU3-16A			X	X	X	X		
OU3-17A			X	X	X	X		
OU3-20A			X	X	X	X		
OU3-16B			X	X	X	X		
OU3-19B			X	X	X	X		
OU3-20B			X	X	X	X		

Notes:
Analyses: EPA Test Method 8260B and 8270C.
Field: pH, temperature, D.O., ORP and conductivity
X = Groundwater sample and water level measurements will be collected

4.1.3 *Semiannual Groundwater Sampling*

Existing monitoring wells included in the OU3 groundwater monitoring program are shown in the FSP. The monitoring wells selected for sampling, based on the March 2009 monitoring event conducted by Shaw, is provided in Table 4-3. The groundwater samples will be analyzed for VOCs using USEPA Method 8260B and for 1,4-dioxane using USEPA Method 8270C. Further information about groundwater sampling procedures that will be used during this Phase III RI is provided in the FSP (Appendix A).

Table 4-3 Groundwater Monitoring Program

EXISTING MONITORING WELLS	2010			
	1Q	2Q	3Q	4Q
OU3-1	X		X	
OU3-2	X		X	
OU3-4	X		X	
OU3-5	X		X	
OU3-6	X		X	
OU3-7	X		X	
OU3-8	X		X	
OU3-9	X		X	
OU3-10	X		X	
OU3-11	X		X	
OU3-12	X		X	
OU3-13	X		X	
OU3-14	X		X	
BE-MW-8	X		X	
DT-DW-5	X		X	
EW-OU3-10-S-R	X		X	
EW-11	X		X	
EW-13	X		X	
EW-19	X		X	

EXISTING MONITORING WELLS	2010			
	1Q	2Q	3Q	4Q
EW-20	X		X	
EW-21	X		X	
GH-MW-11	X		X	
SC-MW-1D	X		X	

4.1.4 *Vapor Monitoring Wells*

Tentative soil vapor monitoring well (SVMWs) locations stipulated in the SOW are to be placed adjacent to Shallow Zone wells EW-19S, OU3-5SR, and OU3-10S. These locations will be confirmed after reviewing the initial groundwater sampling results from the existing and new groundwater monitoring wells to ensure that the SVMWs are located near the Shallow Zone wells with the highest COC concentrations and where there are significant variations of Shallow Zone lithology.

The SVMWs will be installed within 100 ft of the Shallow Zone wells to allow for correlation of groundwater concentrations to deep soil vapor concentrations. This configuration will provide a direct measurement of the relationship between observed groundwater concentrations and potential soil vapor concentrations due to off-gassing from the Shallow Zone water table surface, and the attenuation of soil vapor concentrations in the vadose zone at increasing distances from the water table. If there is a potential for safety or physical access constraints whereby a SVMW cannot be installed within 100 ft of the selected Shallow Zone groundwater monitoring wells, revised locations will be approved by the technical team.

Table 4-4 provides a summary of the SVMW construction details. The technical team will evaluate lithologic data collected from the SVMW locations, along with regional data to make final decisions on SVMW well screen intervals. Further information regarding the vapor monitoring well installation is provided in the FSP (Appendix A).

Table 4-4 Soil Vapor Monitoring Well Design

Blank Casing (1/2-inch Schedule 80 PVC)	0	to	18	feet bgs
	0	to	38	feet bgs
	0	to	58	feet bgs
	0	to	78	feet bgs

0.010-inch Slotted Screen (1/2-inch Schedule 80 PVC)	18	to	20	feet bgs
	38	to	40	feet bgs
	58	to	60	feet bgs
	78	to	80	feet bgs
Cement Grout	0	to	13	feet bgs
Bentonite Seal (hydrated bentonite)	13	to	16	feet bgs
	21	to	36	feet bgs
	41	to	56	feet bgs
	61	to	76	feet bgs
Sand Filter Pack (10-20 sand)	16	to	21	feet bgs
	36	to	41	feet bgs
	56	to	61	feet bgs
	76	to	81	feet bgs

Soil samples will also be collected for total organic carbon, bulk density, total soil porosity, percent moisture, and air content in soil. These data will be used as site-specific input parameters for the vapor intrusion modeling that will be conducted to support the GBRA (Section 5.0).

4.1.5 *Quarterly Vapor Well Sampling*

The SVMW will be outfitted with air-tight fittings and all soil vapor sampling activities will conducted in accordance with California Regional Water Quality Control Board, *Interim Guidance For Active Soil Gas Investigation* (25 February 1997), *Advisory - Active Soil Gas Investigations,* jointly developed by Department of Toxic Substances Control and California Regional Water Quality Control Board - Los Angeles Region (28 January 2003), and the ADEQ *Soil Gas Sampling Guidance* (10 July 2008). The SVMWs will be monitored quarterly for up to 1 year. Samples will be collected in 1-liter Summa canisters and submitted to a fixed-based laboratory for USEPA Test Method TO-15 analysis. The first quarterly sampling event will be conducted approximately 2 weeks after the completion of the SVMW installations. If the first two quarterly soil vapor sampling show no COC concentrations above detection limits stipulated in the QAPP, monitoring of the SVMW will be discontinued. Further information regarding the sampling of the vapor monitoring wells is provided in the FSP (Appendix A).

4.1.6 *Aquifer Testing*

The aquifer testing program will be conducted to estimate the hydraulic parameters of the Shallow and Intermediate hydrostratigraphic zones identified in the OU3 Study Area. These tests will be done to augment the limited data available for these hydrostratigraphic zones, and will provide estimates of the hydraulic conductivity, specific yield, storage coefficient and transmissivity. Aquifer tests will be performed after completion of the new monitoring well installations and the receipt of validated analytical data from the first round of semiannual monitoring that includes the new wells. The aquifer testing program will consist of two 12-hour constant-rate discharge tests, one in the Shallow Zone and one in the Intermediate Zone, and approximately 20 slug-type aquifer tests. The constant-rate discharge tests will be used to calculate hydraulic parameters averaged over a pump-induced cone of depression. The slug-type aquifer tests will be conducted in geographically distributed monitoring wells to evaluate the variability in hydraulic parameters within the OU3 Study Area. The aquifer test program will try to utilize existing OU3 monitoring wells as test and observation wells. The following criteria will be used to select the locations of the aquifer tests:

- Aquifer test well screen intervals are within the aquifer unit being tested;
- Aquifer test well screens penetrate at least 80 percent of the aquifer unit being tested;
- Constant-rate discharge tests are conducted in the central portion of the OU3 Study Area where potential remedial actions would likely be implemented;
- Slug-type test wells are located (spatially) across the OU3 Study Area;
- Observation well(s) for the constant-rate discharge tests are located no farther than 100 ft from the pumping well;
- Observation well(s) screen interval is similar to the screen interval of the pumping well; and
- Aquifer test wells are outside of the influence of pumping wells, such as the OU2 extraction system or local irrigation wells.

Aquifer test locations will be selected after the Phase III RI monitoring well installations are completed and will be communicated to the technical team in a Technical Memorandum.

Once performed, aquifer test data will be analyzed with the AQTESOLV aquifer test software (Version 4.5). Analysis will be done with appropriate

aquifer solutions such as the Bouwer and Rice slug-test method, the Theis and Cooper-Jacob methods for the constant-rate discharge tests of an unconfined aquifer, and Hantush for constant-rate discharge tests of a leaky aquifer. The aquifer test data will be used in the identification and evaluation of potential remedial alternatives. The field procedures for performing these tests are described in the FSP (Appendix A).

4.2 *PROJECT PROCEDURES*

The standard operating procedures for conducting the field activities included in this Work Plan are detailed in the FSP provided in Appendix A. Any deviation from these procedures must be authorized by the Working Group prior to implementation.

4.2.1 *Quality Control*

The FSP is in Appendix A, and the QAPP is in Appendix B of this Work Plan. Detailed measurement quality requirements, and standard operating procedures for the implementation of the RI are provided in these documents. A brief summary of quality control measures for the RI are provided in this subsection.

The elements to be addressed for each definable field activity include:

- Review applicable project requirements specified in the AOC and SOW.
- Assemble required equipment and coordinate with an approved laboratory to arrange for specified analyses.
- Provide all field personnel with the site-specific Health and Safety Plan (HASP) and current site security procedures.
- Review applicable Work Plan requirements and design drawings as appropriate.
- Verify that shop drawings and submittals for materials and equipment have been submitted and approved, if required. Verify receipt of any test results, as necessary.
- Verify that required inspections and testing are scheduled and/or in place.
- Inspect the site to ensure all preliminary work is completed in accordance with specifications or requirements.

- Physically examine materials, equipment, and sample work to ensure that they are present and conform to the approved drawings and submitted data, their required project task, and that they are operational, and/or stored properly.
- Review appropriate activity hazard analyses reports and the HASP to ensure safety requirements are met and that the applicable Material Safety Data Sheets have been submitted to the ERM PM, if required, and are present on site.
- Discuss procedures for site operations, construction tolerances, workmanship standards, and the methods used to ensure quality.
- Confirm USEPA certification for proposed investigation-derived-waste-receiving facilities in accordance with SOW Section 6.0.
- Notify the ERM PM of initiation of all required actions of the Preparatory Phase.
- Attend meetings with the Working Group and other project representatives prior to site work and address all construction and procedural questions.
- Document discussions at any such meetings and also results of all Preparatory Phase items.
- Instruct site workers of the results of meetings, as applicable, and inform all personnel of acceptable levels of workmanship that are required to meet contract requirements.

4.2.2 *Initial Phase*

The PM will notify the USEPA at least 15 days in advance of the initiation of field activities. When field work is ready to begin, the PM and the personnel responsible for that definable field activity will complete the initial phase. The PM shall observe initial work activities to ensure compliance with contract requirements. The results of the initial phase shall be documented on the daily Subcontractor Quality Control Report. For each definable activity, the following shall be completed:

- Establish the quality of workmanship required.
- Verify work procedures comply with the requirements of the HASP and applicable activity hazard analyses. Any variance from planned safety procedures shall be documented and reviewed with affected personnel.
- Resolve any conflicts identified.

- Verify that all preliminary work has been completed and is in compliance with the specifications.

4.2.3 *Follow-up Phase*

As work for each definable activity is being performed, and until it is completed, the following items shall be documented on the daily project Subcontractor Quality Control Reports:

- The work is in compliance with contract requirements;
- The quality of workmanship required is being maintained;
- Required testing is performed by qualified analytical laboratories;
- Any rework items are being corrected; and
- Daily site safety inspections are completed.

Final follow-up checks shall be conducted and all deficiencies corrected prior to startup of additional field activities that may be affected by the deficient work.

Additional Preparatory and Initial Phases may be conducted on the same definable field activities as determined by the Working Group, if work on a definable field activity is resumed after a substantial period of inactivity, or if other problems develop. For example, if deficiencies are found in the personal monitoring program and it is upgraded, then the Working Group may ask that the Preparatory and Initial Phase controls be reactivated.

4.2.4 *Completion Inspection*

Near the completion of each task, the PM shall conduct an inspection of the work and develop a list of items that do not conform to the approved drawings or project requirements, if any are identified. The list will be based on requirements for each task compared to actual work completed. The list shall include a description of the deficiency and an estimated correction date.

If any deficiencies are found during the inspection, the PM shall ensure that the items are corrected in a timely manner and shall inform the Working Group when the deficiencies have been corrected. If no deficiencies are found during the inspection, no further action will be required by ERM and documentation of this approval shall be entered into the project daily activity report.

The Analytical Program Quality Assurance/Quality Control (QA/QC) Manager reports to the Partner-in-Charge (PIC) and has responsibility for all analytical data collection, storage, and reporting. As an example, the Analytical Program QA/QC Manager responsible for data management and data quality assessments will assure that data storage, tabulation, and assessment activities are completed by staff members, and will perform or assign to a designee routine QC checks for calculations and data transfer operations. In general, the Analytical Program QA/QC Manager will oversee QC checks and independently verify that appropriate QC measures have been undertaken. Furthermore, the Analytical Program QA/QC Manager has overall responsibility for ensuring that QA/QC processes are documented for future use. Additional information regarding the Analytical Program QA/QC Manager's responsibility is provided in the QAPP (Appendix B).

The PM shall conduct follow-up inspections as necessary until all deficient items on the list are corrected. When these items have been corrected, the Working Group shall be notified in writing within 5 days that the field work has been completed. At the completion of all field activities to be conducted under this Work Plan, the PM will provide written notice to the USEPA within 5 days of completion of field activities.

4.3 FIELD WORK MANAGEMENT

ERM will provide planning, oversight, and subcontractor management of all Phase III RI activities. ERM will submit daily updates and weekly reports to the Working Group during all field activities that will detail the actions taken to comply with this Work Plan, describe any upcoming field work, and note any potential problems and solutions to those problems. Equipment lists for field planning and activities are provided in Appendix C.

4.3.1 Staging

The main secure area for staging of the equipment, at this time, will be at the Honeywell Engines facility located at 406 South 36th Street. All activities associated with the staging area will be coordinated through the appropriate Honeywell Engines facility point of contact. Additional staging areas near grouped well clusters may be identified to streamline the City of Phoenix requirement to clear the streets at the end of each workday.

4.3.2 *Access and Permitting*

A majority of the groundwater and soil vapor monitoring wells will be installed in the City of Phoenix right-of way, which will require a Temporary Restrictions and Closure Permit (TRACS) and a Well Construction Permit. Arizona Department of Water Resources also requires a Notice of Intent to drill a well (Form 55-44A) to be submitted.

4.3.3 *Access Agreements*

Permission to access existing wells for groundwater sampling activities will be requested from the current owners. Permission will also be requested from the City of Phoenix Water Department, Pollution Control, to discharge monitoring well purge and decontamination water to the sanitary sewer.

Two of the new monitoring wells will not be installed in the City of Phoenix right-of-way and will require access agreements with property owners. Wells OU-3 20S and OU-3-20M will be installed on City of Phoenix property leased by Honeywell. The Working Group will be responsible for obtaining and executing access agreements for these wells. The following table summarizes the permits that are, or may be, required for the installation and sampling of monitoring wells.

Table 4-5 Permitting Information

Permit	Office/Contact	Telephone Number	Notes
TRACS (traffic control)	City of Phoenix Street Transportation Department	602-262-6235 (Yolanda Osario)	Must be obtained prior to city well permit.
Well Permit (City of Phoenix right-of-way)	City of Phoenix Development Services Department	602-262-7811	Obtain checklist from department prior to submittal.
Notice of Intent to Drill	State of Arizona Department of Water Resources	602-771-8500	Filed a minimum of 14 days prior to drilling.
Sewer Discharge Permit	City of Phoenix Department of Pollution Control	602-262-1859	For discharge of purge and aquifer test water into sanitary sewer.

Permit	Office/Contact	Telephone Number	Notes
Access to existing and new wells not in City of Phoenix right-of-way	OU3 Working Group	Judy Heywood (602) 250-3850 Troy Kennedy (973) 455-4279	EPA/ADEQ/OU3 Working Group will facilitate coordination of access agreement transfers.

4.3.4 *Site Security*

A centrally located, secure staging area will be maintained during the project. Work zones around all field activities will be cordoned off with yellow caution tape and various types of barricades to discourage public access. Drill rigs will be removed from the work area as required by the TRACS permit and City of Phoenix regulations. All monitoring wells will be secured with identical keyed locks and expansion caps. If night work is required, ERM and its subcontractor(s) will contract security guards and light towers to ensure the safety of the on-site workers per the HASP included in Appendix C.

4.3.5 *Investigation-Derived Waste*

To characterize investigation-derived waste for transportation, disposal, or recycling, representative samples will be collected. The drill cuttings produced during drilling activities will be collected using a tilt hopper and temporarily stored in roll-offs. Well development water, purge water, and decontamination fluids will be contained and stored in 55-gallon drums or another approved storage containers prior to disposal. Liquid investigation-derived waste will be stored at the staging area at 402 South 36th Street, and solid investigation-derived waste will be stored at the waste transporter's facility (Red-J Environmental). A composite sample will be collected and then submitted to the laboratory to provide representative sampling results for the soil and groundwater waste streams, as described in Section 4.1.5 of the FSP and Section 3.2.4 of the QAPP included as Appendix A and Appendix B, respectively. Investigation-derived waste will be disposed of at a USEPA certified disposal facility.

4.3.6 *Health and Safety*

A site-specific HASP has been developed for this project and is included as Appendix C of this Work Plan. Training, hazard identification, standard operating procedures, personal protection, safe work practices, decontamination and confined space procedures, spill and site

communication, and emergency response procedures are outlined in this project-specific HASP.

5.0 GROUNDWATER BASELINE RISK ASSESEMENT

An OU3 GBRA will be prepared that evaluates the potential threat to human health and the environment posed by groundwater containing COCs in concentrations in the absence of any remedial action. The GBRA will be used to assess whether groundwater remediation is necessary at the OU3 Study Area, provide justification for performing remedial action, and determine relevant exposure pathways. The draft and final GBRA will be submitted as part of the draft and final RI report.

The evaluation of risk to human health will be based on estimated theoretical upper-bound cancer risks and non-cancer hazard indices using standard USEPA methods. If the carcinogenic risks or non-cancer hazard indices exceed USEPA's acceptable levels, then remedial action alternatives will be evaluated. The acceptable risk levels for the protection of human health are:

- For non-carcinogenic compounds, concentrations to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating factors related to uncertainty.
- For known or suspected carcinogens, concentrations that represent an excess theoretical upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level is typically applied by regulatory agencies as the point of departure for determining remediation goals.

The following subsections present the approaches, procedures and methods for each of the key elements of the GBRA process. These features parallel the risk assessment process as recommended by USEPA.

5.1 RISK ASSESSMENT PROCESS

The GBRA will follow the basic procedures outlined in the *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual* (USEPA 1989). Other guidance documents that will be consulted, as needed, include:

- USEPA. 1991a. *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual. Supplemental Guidance.*
- USEPA. 1992a. *Guidelines for Exposure Assessment*.

- USEPA. 1992b. *Supplemental Guidance to RAGS: Calculating the Concentration Term.*
- USEPA. 2001. *Risk Assessment Guidance for Superfund Human Health Evaluation Manual Part D.*
- USEPA. 2004. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).*
- USEPA. 2009a. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment).*

The GBRA will be prospective, and will present risk estimates derived using deterministic methodologies. The deterministic approach to risk assessment uses discrete point estimates, based on conservative assumptions, as input parameters. These conservative estimates compound each other so that the calculated risks likely exceed the true risks at a site.

5.2 *HUMAN HEALTH CONCEPTUAL SITE MODEL*

The human health CSM is a tool used in risk assessment to describe relationships between chemicals and potentially exposed human receptor populations, thereby delineating the relationships between the suspected sources of chemicals identified at the site, the mechanisms by which the chemicals might be released and transported in the environment, and the means by which the receptors could come in contact with the chemicals. The human health CSM provides a basis for developing exposure scenarios.

For a complete exposure pathway to exist, each of the following elements must be present (USEPA 1989):

- A source and mechanism for chemical release;
- An environmental transport medium (i.e., air, water, soil);
- A point of potential human contact with the medium; and
- A route of exposure (e.g., inhalation, ingestion, dermal contact).

Potential exposure pathways included in the current OU3 CSM include volatilization from groundwater to indoor and outdoor air, as well as ingestion, if groundwater is used as a drinking water source. The current OU3 CSM will be refined if necessary during the Phase III RI to take into

account both present and potential future hypothetical land uses to ensure that the human health CSM is conservative in scope.

5.2.1 *Potential Human Receptors*

USEPA risk assessment guidance (1989) states that potential future land use should be considered, in addition to current land use, when evaluating the potential for human exposure at a site. Based on the current and future OU3 land uses, the following hypothetical exposure scenarios will be included in the GBRA:

- Indoor commercial and outdoor maintenance (utility) worker scenario; and
- Residential land-use scenario for adult and child residents.

It is important to note that groundwater in the OU3 Study Area, which ranges from 88 to 101 ft bgs, is not currently being used for drinking water purposes. New domestic groundwater wells are prohibited within the OU3 Study Area by Arizona Department of Water Resources and the City of Phoenix supplies drinking water, primarily from surface water sources, to the users within the site. Therefore, although included in the OU3 GBRA, potable use of groundwater is a hypothetical exposure pathway that is considered unlikely.

Construction workers could also experience short-term exposure during construction activities within the OU3 Study Area. These types of exposures are typically associated with direct contact with impacted media (e.g., soil and/or groundwater during construction activities). Because of the depth to groundwater at the Site, these exposures are unlikely for this receptor. In addition, exposures for this receptor are usually less than those associated with long-term worker and/or residential exposures. Therefore, short-term exposure during construction activities will not be addressed in the OU3 GBRA.

5.2.2 *Potential Exposure Pathways*

The primary focus for this assessment will be the evaluation of theoretical risks associated with chemicals in groundwater and soil gas. The exposure pathways that will be evaluated in the GBRA are:

- Groundwater to soil vapor to outdoor air;
- Groundwater to soil vapor to indoor air; and
- Hypothetical potable use of COC-impacted groundwater (including ingestion, dermal contact, and inhalation of vapors).

5.3 DATA EVALUATION

This section describes the procedures that will be employed to evaluate the acceptability of data for use in the risk assessment. Overall quality of sample results is a function of proper sample management. Management of samples begins at the time of collection and continues throughout the analysis process. Standard operating procedures presented in the FSP and QAPP will be followed to ensure samples are collected and managed properly and consistently and to ensure that the data used in the GBRA is valid and representative. According to the *Guidance for Data Usability in Risk Assessment, Final* (USEPA 1992c; hereinafter "USEPA Data Usability Guidance"), there are six principal criteria by which data are determined usable for risk assessment. The six criteria are:

- Reports to the risk assessor;
- Documentation;
- Data sources;
- Analytical methods and detection limits;
- Data review; and
- Data measurement indicators, which include completeness, comparability, representativeness, precision, and accuracy.

These criteria are described in the following subsections.

5.3.1 *Reports to the Risk Assessor*

USEPA's guidance recommends that preliminary data reports be reviewed to identify sampling or analytical problems and to ensure sufficiency of information provided to the risk assessor. The laboratory reports will be reviewed to confirm the validity of the data using procedures defined in the Project Work Plan, the *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1999), and the *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994a) (hereinafter "National Functional Guidelines"). Data qualifiers will be presented in the data tables for risk assessment.

5.3.2 *Documentation*

USEPA's Data Usability Guidance recommends that data collection and analysis procedures be accurately documented to substantiate how the samples were analyzed, conclusions derived from the data, and the reliability of the reported analytical data. Documentation can be used to

evaluate completeness, comparability, representativeness, precision, and accuracy of a combination of data sets. Types of documentation may include project work plans, QA/QC reviews, field and analytical records, and COC records. The data review will include identification and documentation of any significant non-conformances (e.g., those that would affect data usability) during the sampling events or in laboratory records, if any.

5.3.3 *Data Sources*

USEPA's Data Usability Guidance recommends that all data sources used in risk assessments be identified whether historical or current. All data used for the OU3 GBRA will have comparable sampling and analytical techniques, have comparable detection limits, and have undergone a sufficient review.

5.3.4 *Analytical Methods and Detection Limits*

USEPA's Data Usability Guidance recommends that appropriate analytical methods and associated detection limits meet risk assessment requirements for chemicals and have sufficient QC measures to quantify target compound identification and measurement. Analytical methods with detection limits above the relevant COC screening levels will not be used. The analytical methods that will be used in generating the data for the OU3 GBRA are widely used industry standards with recognized QA/QC procedures.

As part of the data review process, the detection limits achieved in the risk assessment data will be compared to the relevant concentrations of concern. Detection limits in excess of these levels of concern will be identified, and the associated results will be evaluated to determine whether they could affect the data usability or risk assessment validity.

5.3.5 *Data Review*

USEPA's Data Usability Guidance recommends that all data have a minimum level of review as soon as the data become available. The data review can range from a full review of all site samples and all site data to specific key analytes and samples. Consideration must be given to the level of data review to be consistent with the measurement quality requirements. Generally, the more in-depth the review, the more confidence can be placed in the usability of the data. Review and validation of all data collected at OU3 will be performed in accordance with QAPP requirements to ensure that the data are of acceptable quality

and that any limitations to data usability are identified prior to making decisions associated with the risk assessment that are based on these data.

5.3.6 *Measurement Quality Indicators*

The USEPA Data Usability Guidance recommends that measurement quality indicators be identified to provide quantitative measures of the data quality. The measurement quality indicators (for completeness, comparability, representativeness, precision, and accuracy) that will be used for this project are defined in Section 2.3 of the QAPP (Appendix B).

5.3.7 *Summary Evaluation*

Using the above criteria, an evaluation of the risk assessment data will be conducted. A Data Usability Worksheet, which succinctly summarizes the criteria used to identify data usability, will be incorporated into the GBRA report.

5.3.8 *Data Adequacy*

The concept of data adequacy incorporates (1) an analytical program that seeks to quantify all relevant site chemicals that have the potential to affect risk calculations and (2) a spatial density of sampling points that provides confidence that the site has been sufficiently characterized and that local exceedance in areas requiring remediation has not been missed. The risk assessment analytical program for the site represents suite of analyses that cover all COCs reasonably expected to be present at elevated levels within the OU3 Study Area.

5.4 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern (COPCs) will be identified through screening of the maximum concentration with USEPA Regional Screening Levels (RSLs) and California screening levels. For soil vapor screening levels, the Motorola 52nd Street Human Health Screening Levels (MHHSLs) will be used (USEPA 2009d). For chemicals without MHHSLs, a screening level will be calculated using the California Human Health Based Screening Level methodology. For groundwater, the lower of either the tap water RSL or the California public health goal will be used.

The final step for organic COPC selection is to evaluate the frequency of detection of each organic compound. Organic chemicals below screening levels with a frequency of detection less than 5 percent are excluded as

COPCs, provided that (1) the chemical is not related to source-area operations; (2) is not closely related to others detected in the medium; (3) has adequate detection limits; and (4) is not a degradation product of other chemicals detected in the same medium. Chemicals having maximum concentrations less than screening levels *and* a frequency of detection less than 5 percent are excluded as COPCs. As part of COPC identification for chemicals that were not detected in a given medium, the maximum reporting limit (practical quantitation limit) will be compared with USEPA RSLs.

5.5 DETERMINATION OF REPRESENTATIVE EXPOSURE CONCENTRATIONS

A representative exposure concentration is a chemical-specific and media-specific concentration value used in the risk assessment. In the GBRA, these exposure concentrations are values incorporated into the OU3 GBRA from which potential human risks are calculated. As described below, the methods, rationale, and assumptions employed in deriving these concentration values are consistent with USEPA guidance and will reflect site-specific conditions.

Due to the uncertainty associated with determining the true average concentration of a chemical at a site, the USEPA recommends using the lower of the maximum detected concentration or the 95 percent upper confidence limit (95% UCL) as the concentration of a chemical to which an individual could be exposed over time (USEPA 1992b, 2002a). The 95% UCL is defined as the value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95% of the time. The purpose for using the 95% UCL is to take into account the different concentrations a person may be exposed to on any given day. Use of the 95% UCL concentration (as representative of the average concentration), instead of the maximum concentration, is recommended by the USEPA because "…average concentration is most representative of the concentration that would be contacted at a site over time…" (USEPA 1992b, 2002a). That is, an individual will not be exposed to a single (e.g., maximum) concentration over the entire duration of exposure. Rather, an individual will be exposed to a range of concentrations that exist at the exposure area, from non-detect to the maximum concentration, over the entire exposure period.

However, for the OU3 GBRA, risk estimates will be determined on a point-by-point basis. That is, risk estimates will be calculated for each individual groundwater and soil vapor monitoring well. The maximum

measured concentration of each COPC from the most recent four groundwater sampling events will be used as the representative exposure concentration for a particular COPC for a particular groundwater and soil vapor monitoring well.

USEPA indoor air vapor intrusion guidance (USEPA 2002b) and the Johnson and Ettinger (1991) model will be used to estimate indoor air concentrations from VOCs measured in soil gas and shallow groundwater. Where soil gas and shallow groundwater samples are co-located, soil gas data will be used. The OU3 GBRA will use the multi-depth soil gas sampling results to assess/calibrate the appropriateness of the USEPA (2004) "SG-ADV" version of the Johnson and Ettinger vapor intrusion model used to predict soil vapor transport from groundwater and within the vadose zone. Per the 23 June 2010 conference call, USEPA's (2004) screening version of the Johnson and Ettinger will not be used in this assessment since USEPA indicated they could relatively easily run the screening model themselves and the purpose of proposed sampling is to refine/calibrate the advanced model.

The OU3 GBRA will graphically present side-by-side comparisons of modeled and actual measured soil gas attenuation within the vadose zone. The variability in modeled and empirical results for the proposed multi-depth soil gas sampling locations will also be evaluated and shown using error bars. The "average" results will be shown, along with an upper estimate on the mean (if feasible based on the results/variability). This should assist in determining the overall vadose zone attenuation over the proposed four quarters of soil gas sampling.

Three transport mechanisms that are incorporated into the J&E model include:

- Diffusion through vadose zone soils;
- Advection into the building due to the negative pressure differential between the subsurface and building; and
- Mixing of soil gas within a building resulting from building ventilation.

The soil gas samples that will be collected as part of the Phase III RI are intended to provide a better understanding of the site conditions affecting the diffusion of VOCs through the vadose zone soils. Given the large depth to shallow groundwater in the study area, the uncertainties related to estimating diffusion across large distances can result in significant underestimation or overestimation of indoor air concentrations.

The diffusion through the vadose zone soils portion of the J&E vapor intrusion model is a function of the source vapor concentration and the total overall effective diffusion coefficient (EDC). Likewise, the differences in measured soil gas concentrations across a vertical profile at a single location are a function of the EDC. Therefore soil gas samples will be use to calibrate the diffusion portion of vapor intrusion model to observed site conditions.

To accomplish this, the measured soil gas concentrations from vertical profiling study will be used as input concentrations into the Johnson and Ettinger vapor intrusion model. The model will be run with identical building parameters, such that differences between the estimated indoor air concentrations will be due to differences in the EDC. For example, if the indoor air concentration is higher from the modeling using a measured 40 ft bgs soil gas concentration relative to using the measured 20 ft bgs soil gas concentration, then the overestimation is due to the over-estimation of the EDC between 20 and 40 ft bgs. Adjusting the EDC used in the model can be done by either modifying soil input parameters or simply overriding the model calculation of the EDC across that soil layer. This will be done such that the estimated indoor air concentration using measured 40 ft and 20 ft soil gas samples are equal. At that point, the site-specific vapor migration model will be calibrated for observed site conditions between 20 and 40 ft bgs. This process can be repeated for all intervals between the vertical profiles sol gas sampling. The overall EDC across multiple varying soil layers from groundwater to the surface is the harmonic average of the diffusion coefficients through each layer and is described by:

$$D_{eff}^{T} = L_T \Big/ \sum \frac{L_i}{D_{eff,i}}$$

Where:

D^T_{eff} = overall effective diffusion coefficient (m^2/s);

L_T =the total diffusive distance (m);

$D_{eff,\,i}$ =effective diffusion coefficient through layer i (m^2/s); and

L_i =the thickness of layer, i (m).

The results will be an overall site-specific EDC that is calibrated to measured site conditions. The site-specific EDC can be applied to the

vapor migration model and greatly reduce the uncertainty in the diffusion through the vadose zone portion of the model.

A site-specific EDC will also be used to determine the appropriateness of potentially comparing multi-depth soil gas sampling results with the December 2009 MHHSLs referenced in the document titled, *EPA Region 9's Suggested Framework for Investigating and Evaluating Vapor Intrusion to Indoor Air of Residential or Industrial Buildings Motorola 52nd Street Superfund Site*. The MHHSLs were derived assuming soil vapor samples were collected immediately beneath a slab and may not be appropriate for comparison to results from samples collected at deeper depths, particularly if vapors attenuate during vertical transport in the vadose zone.

The modeling parameters proposed to be used in the OU3 GBRA are presented in Table 5-1. These parameters may be modified during preparation of the GBRA based on evaluation of site-specific conditions.

Table 5-1 Modeling Parameters

Parameter	Abbrev.	Value	Units	Reference
Soil parameters	--	Site-Specific		--
Chemical parameters	--	Chemical-Specific		--
Depth below grade to bottom of enclosed space floor	L_F	15	cm	Cal/EPA 2005
Building air exchange rate, residential	ER_r	0.5	hr^{-1}	Cal/EPA 2005
Building air exchange rate, commercial	ER_w	1.0	hr^{-1}	Cal/EPA 2005
Building area	A_B	100	m^2	Cal/EPA 2005
Building mixing height	H_B	2.44	m	Cal/EPA 2005
Crack width	W_B	0.1	cm	Cal/EPA 2005
Vapor flow rate	Q_{soil}	5	L/min	Cal/EPA 2005

5.6 EXPOSURE ASSESSMENT

The overall goal of the exposure assessment is to estimate the nature and magnitude of actual or potential human exposures to chemicals present in groundwater and soil gas within the OU3 Study Area.

5.6.1 *Exposure Parameters*

The exposure parameters proposed to be used in the OU3 GBRA are presented in Table 5-2. These generally conservative default values are based on standard USEPA guidance values. Exposure parameters that have significant impact on the results will be discussed in the uncertainty section of the OU3 GBRA.

Table 5-2 Exposure Parameters

Parameter	Abbrev.	Value	Units	Reference
Averaging time, carcinogenic	ATc	70	years	USEPA 1991b
Averaging time, non-carcinogenic	ATnc	30 / 25	years	Based on ED
Adult body weight	BWa	70	kg	USEPA 1991b
Residential Receptors				
Dermal absorption fraction	ABS	chemical-specific		USEPA 2004
Dermal event frequency	EV	1	events/day	USEPA 2004
Adult dermal exposure time	ETa	0.58	hrs/event	USEPA 2004
Child dermal exposure time	ETc	1	hrs/event	USEPA 2004
Child body weight	BWc	15	Kg	USEPA 1991b
Residential water ingestion rate	IRa	2	L/day	USEPA 1991b
Residential exposure frequency	EFr	350	days/year	USEPA 1991
Residential exposure duration	EDr	30	years	USEPA 1991
Available skin surface area, adult	SAa	18,000	Cm^2	USEPA 2004
Available skin surface area, child	SAc	6,600	cm^2	USEPA 2004
Worker Receptors				
Indoor worker water ingestion rate	IRw	1	L/day	USEPA 1991b
Indoor worker exposure frequency	EFw	250	days/year	EPA 2002
Outdoor worker exposure frequency	EFw	225	days/year	EPA 2002
Worker exposure duration	EDw	25	years	USEPA 1991b
Trench worker exposure duration	ED_T	1	year	EPA 2002

The GBRA will use a resident life stage for the child of 6 years and 24 years for an adult. A 30-year duration will be used for exposure to carcinogens and for non-carcinogenic effects, and an exposure duration of

6 years is used for the child resident. A water ingestion rate of 1 liter per day will be used for the child resident based on the *USEPA-Oak Ridge National Laboratory Regional Screening Levels User's Guide* (USEPA 2010b).

5.6.2 *Estimation of Exposure Levels*

Reasonable maximum exposure levels to chemicals will be calculated for each receptor of concern, using the exposure parameters identified in Table 5-2. Risk estimates for inhalation exposures will follow USEPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)* (USEPA 2009a). That is, the concentration of a chemical in air is used as the exposure metric (e.g., milligram per cubic meter [mg/m^3]), rather than inhalation intake of a chemical in air based on inhalation rate and body weight (e.g., milligrams per kilogram [mg/kg]-day). The generic equation for calculating inhalation exposures is:

$$EC = \frac{C_{air}\ x\ ET\ x\ ED\ x\ EF}{AT\ x\ 365\ d/yr}$$

Where*:*

EC	=	exposure concentration (in mg/m^3)
C_{air}	=	chemical concentration in air (in mg/m^3)
ET	=	exposure time (hours per day)
ED	=	exposure duration (years of exposure)
EF	=	exposure frequency (number of days per year)
AT	=	averaging time; same as the ED for non-carcinogens and 70 years (average lifetime) for carcinogens

For non-inhalation exposures, the methodology used to estimate the average daily dose (ADD) of the chemicals via each of the complete exposure pathways will be based on USEPA (1989, 1992a, 2009a) guidance. For carcinogens, lifetime average daily dose (LADD) estimates are based on chronic lifetime exposure extrapolated over the estimated average 70-year lifetime (USEPA 1989). This is performed in order to be consistent with cancer slope factors, which are based on chronic lifetime exposures. For non-carcinogens, ADD estimates will be averaged over the

estimated exposure period. The generic equation for calculating the ADDs and LADDs is:

$$Dose = \frac{C \times IR \times ED \times EF \times BIO}{BW \times AT \times 365\ d/yr}$$

Where:

C	=	chemical concentration in the contact medium (e.g., milligrams per liter water)
IR	=	intake rate (e.g., mg/day water ingestion and dermal contact [requires a conversion factor of 10^6 mg/kg])
BW	=	average body weight over the exposure period (kilograms)
BIO	=	relative bioavailability (unitless)

The relative oral bioavailability of all COCs will conservatively assume to be 100 percent. Chemical-specific dermal absorption values from USEPA guidance (2004 [*Part E Risk Assessment Guidance for Superfund*]) will be used in the OU3 GBRA. USEPA does not recommend dermal absorption factors for VOCs based on the rationale that VOCs are volatilized from the skin and exposure is accounted for via inhalation routes.

Exposure levels of potentially carcinogenic and non-carcinogenic chemicals will be calculated separately because different exposure assumptions apply (e.g., ADD for non-carcinogens and LADD for carcinogens). Exposure levels will be estimated for each relevant exposure pathway (i.e., soil, air, and water), and for each exposure route (i.e., oral, inhalation, and dermal). For non-inhalation exposures, ADDs will be derived for a child (0 to 6 years of age) receptors only. For chemical carcinogens, LADDs will be derived for an age-adjusted receptor: child (0 to 6 years of age) and adult (7 to 30 years of age). These age classes are consistent with USEPA (1991b) guidance. Daily doses for the same route of exposure will be summed. The total dose of each chemical is the sum of doses across all applicable exposure routes.

The results of the exposure assessment will be used with information on the toxicity of the COCs in the risk characterization step of the risk assessment to estimate the potential risks to human health posed by exposure to the COCs.

5.7 TOXICITY ASSESSMENT

This section identifies how toxicity values to be used for the OU3 GBRA will be obtained. Toxicity values are published by the USEPA in the on-line Integrated Risk Information System (USEPA 2009b). Cancer slope factors (CSFs) and inhalation unit risks (IURs) are chemical-specific and experimentally derived potency values that are used to calculate the risk of cancer resulting from exposure to potentially carcinogenic chemicals. A higher value implies a more potent carcinogenic potential. Reference dosages (RfDs) and reference concentrations (RfCs) are experimentally derived "no-effect" levels used to quantify the extent of toxic effects other than cancer due to exposure to chemicals. With RfDs/RfCs, a lower value implies a more potent toxicant. These criteria are generally developed by USEPA risk assessment work groups and listed in the USEPA risk assessment guidance documents and databases. Should COCs be found that do not have established toxicity criteria, these will be qualitatively addressed in the uncertainty analysis of the GBRA report.

Available toxicity values for all site COCs to be used in the GBRA will generally be obtained from the USEPA. The following hierarchy for selecting toxicity criteria will be used (based on USEPA 2003):

1. Integrated Risk Information System;
2. USEPA's Provisional Peer Reviewed Toxicity Values;
3. National Center for Environmental Assessment (or other current USEPA sources);
4. Health Effects Assessment Summary Tables;
5. USEPA Criteria Documents (e.g., drinking water criteria documents, drinking water Health Advisory summaries, ambient water quality criteria documents, and air quality criteria documents);
6. Agency for Toxic Substances and Disease Registry toxicological profiles;
7. USEPA's Environmental Criteria and Assessment Office; and
8. Peer-reviewed scientific literature.

5.8 RISK CHARACTERIZATION

In the last step of a risk assessment, the estimated rate at which a person intakes a COC is compared with information about the toxicity of that

COC to estimate the potential risks to human health posed by exposure. This step is known as risk characterization. In the risk characterization, cancer risks will be evaluated separately from non-cancer adverse health effects. The methods used for assessing cancer risks and non-cancer adverse health effects are discussed below. For both non-carcinogens and carcinogens, the relative contribution of specific COCs and pathways to total risk and Hazard Index (HI) will be identified.

5.8.1 *Non-Carcinogenic Effects*

Non-cancer adverse health effects are estimated by comparing the estimated average exposure rate (i.e., ADDs estimated in the exposure assessment) with an exposure level at which no adverse health effects are expected to occur for a long period of exposure (e.g., the RfDs). ADDs/ECs and RfDs/RfCs are compared by dividing the ADD by the RfD (or EC by the RfC) to obtain the ADD:RfD (EC:RfC) ratio, as follows:

$$HQ = \frac{EC}{RfC} \; or \; \frac{ADD}{RfD}$$

Where:

HQ = hazard quotient

ADD = average daily dose (mg/kg-d)

EC = exposure concentration (or mg/m^3)

RfD/RfC = reference dose/concentration (mg/kg-d or mg/m^3)

The ADD-to-RfD (EC-to-RfC) ratio is known as a hazard quotient. If a person's average exposure is less than the RfD/RfC (i.e., if the hazard quotient is less than 1), the chemical is considered unlikely to pose a significant non-carcinogenic health hazard to individuals under the given exposure conditions. Unlike carcinogenic risk estimates, a hazard quotient is not expressed as a probability. Therefore, while both cancer and non-cancer risk characterizations indicate a relative potential for adverse effects to occur from exposure to a chemical, a non-cancer adverse health effect estimate is not directly comparable with a cancer risk estimate.

Hazard quotients for each pathway, for all COCs, will be summed to determine whether exposure to a combination of pathways poses a health concern. This sum of the hazard quotients is known as an HI.

$$\text{Hazard Index} = \sum \text{Hazard Quotients}$$

A total HI that includes all COCs and all exposure pathways will be presented in the GBRA. The USEPA non-cancer risk management target is an HI value of less than or equal to 1.0.

For any HI that exceeds 1.0, the potential for adverse health effects will be further evaluated by considering the target organs upon which each chemical could have an adverse effect. Target organ-specific HIs will be assessed only after approval by USEPA. The target-organ-specific HIs will be summed for all relevant COCs. The segregation of HI by target organ is consistent with USEPA guidance for non-carcinogens, including metals (USEPA 1989b).

5.8.2 *Theoretical Upper-Bound Incremental Lifetime Cancer Risks*

In the risk characterization, carcinogenic risk will be estimated as the incremental probability of an individual developing cancer over a lifetime as a result of a chemical exposure. Carcinogenic risks will be evaluated by multiplying the estimated average exposure rate (e.g., LADD calculated in the exposure assessment) by the chemical's CSF or IUR. The CSF converts estimated daily doses averaged over a lifetime to incremental risk of an individual developing cancer. According to USEPA (1989b), this approach is appropriate for theoretical upper-bound incremental lifetime cancer risks of less than 1×10^{-2}. The following equations will be used to calculate chemical-specific risks and total risks:

$$Risk = EC \times IUR \quad or \quad LADD \times CSF$$

Where:

LADD= lifetime average daily dose (mg/kg-d)

CSF/IUR= cancer slope factor/inhalation unit risk $(mg/kg\text{-}d)^{-1}$ or $(mg/m^3)^{-1}$

and

$$\text{Total Carcinogenic Risk} = \sum \text{Individual Risk}$$

It will be assumed that cancer risks from various exposure routes are additive. Thus, the result of the assessment is representative of the total carcinogenic risk. High-end carcinogenic risk estimates will be evaluated by USEPA in light of site-specific risk management decision criteria.

5.9 UNCERTAINTY ANALYSIS

Consistent with USEPA (1989b) guidance, a qualitative discussion of the uncertainties associated with the estimation of risks for the site will be presented in the GBRA report. The uncertainty analysis will discuss uncertainties associated with each step of the risk assessment, including site characterization data, data usability, data set size, representative exposure concentrations, fate and transport modeling, exposure assessment, toxicity assessment, and risk characterization. The uncertainty analysis will identify factors that introduce the greatest uncertainties specific to the risk assessment, are most likely to have the greatest effect on the risk calculations, and/or are otherwise most likely to affect risk management decisions.

An uncertainty analysis will be done on the soil gas data to evaluate usability in Johnson and Ettinger model calibration. A typical analysis of the site-specific lithology and measured concentrations in the vertical profile soil gas samples will be done to determine the appropriateness in calibrating the EDC from a deep groundwater source. For example, if higher concentrations are measured in shallower soil gas samples than deeper soil gas samples, it may be an indication of a shallow soil gas source rather than off-gassing from the deep groundwater and would not be appropriate to calibrate the model or to be used to evaluate the vapor intrusion risk associated with the OU3 groundwater plume.

5.10 INTERPRETATION OF FINDINGS

The risk characterization results will be presented in tabular format in the GBRA report. Key exposure (e.g., estimated intakes, important modeling assumptions, and summary of exposure pathways for each receptor) and toxicity information (e.g., cancer slope factors, RfDs, and target organs) will be provided. In addition, the risk characterization results will be placed into proper perspective, including a discussion of the concept of de minimis risk. In addition, those chemicals and exposure pathways having the greatest influence on the OU3 GBRA results will be identified. Ambient chemical source influences on site risk due to anthropogenic contributions, that are not site related, will also be incorporated into the findings. Graphical presentation of the results will also be included in the RI report. In addition, the format and content of the GBRA report will follow the guidelines presented in USEPA's *Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual – Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments* (USEPA 2001) and *Risk Assessment Guidance for Superfund: Volume I Human Health*

Evaluation Manual –Part A (USEPA 1989) to ensure that essential issues are adequately addressed by the risk assessment. Although there are no table templates for the Johnson and Ettinger model, tables will be developed that are compatible with this format.

6.0 IN SITU IMPLEMENTABILITY TECHNICAL MEMORANDUM AND DECISION PROCESS FOR BENCH AND PILOT TESTING

This section provides the rational and scope of a comprehensive literature review of in situ groundwater remediation technologies potentially applicable to OU3 COCs. The review will focus on remediation technologies that have been successfully applied to large-scale groundwater plumes in southwestern alluvial aquifers similar to OU3. This evaluation will include the assessment of chemical oxidation, chemical reduction, and enhanced bioremediation technologies used to treat dissolved-phase OU3 COCs and their degradation products. The specific objectives and approach for conducting this evaluation include:

- A brief technical summary of the each remediation technology, including a description of supporting field methods that may increase implementability in a deep groundwater alluvial environment;
- A comprehensive literature review of available case studies for the implementation of remediation technologies in the southwestern region;
- Efficacy of the remediation technologies and, if possible, a discussion of design elements key to their success or failure;
- A comparison of case studies to site-specific conditions at OU3, including but not limited to hydrogeologic and geochemical conditions, lithologic characteristics, and location-specific factors;
- An evaluate the potential for success of these technologies at OU3; and
- A recommendation for the type of remediation technology and the need for bench-testing to support an FS.

Bench-testing will only be deemed necessary if factors influencing the success or failure of a specific remediation technology are independent of field-specific conditions, and thus can be rigorously and conclusively tested in a laboratory environment. For example, the effectiveness of an oxidant in reducing COC mass can be tested under laboratory conditions; however, oxidant injection methods and distribution methodologies cannot.

7.0 FEASIBILITY STUDY

A FS will be conducted to evaluate remediation alternative(s) for COC impacted groundwater in the OU3 Study Area. An FS Work Plan and FS Report will be prepared in accordance with the AOC SOW and the requirements of CERCLA, utilizing USEPA guidance documents relating to the performance of an FS under CERCLA.

7.1 FEASIBILITY STUDY WORK PLAN

The FS Work Plan will draw on the data presented in the RI and the recommendations in the In Situ Implementability Technical Memorandum to identify remedial alternatives to be included in the FS. In accordance with USEPA guidance on conducting FSs, the selected remedial alternatives, response technology type, and associated process options will be subjected to an initial screening process on the basis of technical implementability (USEPA 1988). The FS Work Plan will identify any additional work required to finalize an evaluation of alternatives and to prepare the FS Report. The Draft OU3 FS Work Plan will be submitted 60 days after USEPA approval of the Final OU3 RI Report and will provide a schedule for submittal of the FS Report. The OU3 FS Work Plan will provide the following information:

1. INTRODUCTION
    - 1.1. FS Purpose and Scope
    - 1.2. Work Plan Organization
2. PHYSICAL SETTING/SITE HISTORY
    - 2.1. Physical Setting
        - 2.1.1. Geologic Setting
        - 2.1.2. Hydrogeologic Setting
        - 2.1.3. Land Use & Demographics
    - 2.2. Site History
        - 2.2.1. Site Description
        - 2.2.2. Nature and Extent of COCs
        - 2.2.3. Groundwater Baseline Risk Assessment

3. FEASIBILITY STUDY APPROACH
    3.1. Remedial Action Objectives
    3.2. Applicable or Relevant and Appropriate Requirements
    3.3. Preliminary General Response Actions
    3.4. Identification and Screening of Remedial Technologies
    3.5. Development of Alternatives
    3.6. Screening of Alternatives
    3.7. Detailed Evaluation Criteria
    3.8. FS Report Outline
4. SCHEDULE

7.2 FEASIBILITY STUDY REPORT

The OU3 FS Report will be prepared consistent with USEPA's October 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*. The OU3 FS Report will provide a detailed analysis of the remedial alternatives by evaluating each alternative against the nine National Contingency Plan evaluation criteria. Once the alternatives have been assessed against the nine criteria, a comparative analysis will be conducted to evaluate the relative performance of each alternative in relation to each specific evaluation criterion.

The Draft OU3 FS Report will be prepared and submitted to USEPA for review in accordance with the approved FS Work Plan schedule.

8.0 PROJECT ORGANIZATION AND REGULATORY OVERSIGHT

This section describes the project management plan, including the regulatory structure, summary of project team member roles and responsibilities, and required agency reporting and communication during field work. The project organization for the OU3 Study Area Phase III RI is shown on Figure 5-1.

8.1 REGULATORY OVERSIGHT

The USEPA is the lead agency for the Motorola 52nd Street Superfund Site. Ms. Janet Rosati is the USEPA Remedial PM, and will oversee all OU3 Study Area RI activities and will provide direction to the Working Group. Mr. Brian Stonebrink is the ADEQ PM and will consult with the USEPA. James Maes is the U.S. Army Corps of Engineers PM, and will be responsible for providing technical assistance to the USEPA and may conduct field work oversight of the OU3 Study Area RI. USEPA is the primary party responsible for community outreach, although the OU3 Working Group and their consultant may be asked to support such activities.

8.2 THE WORKING GROUP

The Working Group is composed of representatives from Arizona Public Service and Honeywell The role of the Working Group is to manage the implementation of the SOW. The Working Group has primary responsibility to receive direction from USEPA and provide direction to ERM.

8.3 ERM PROJECT MANAGEMENT ORGANIZATION

Following are descriptions of the qualifications and responsibilities of the key ERM project personnel assigned to this project.

Partner-in-Charge – Mr. Robert Livermore is the PIC for the OU3 RI/FS and will be the primary contact at ERM for the Working Group. Mr. Livermore will be responsible for administration of all actions by the Working Group, as required by the SOW and Settlement Agreement. As

the designated PIC, Mr. Livermore is also responsible for the quality of all work products and services performed on this project. The PM and Analytical Program QA/QC Manager will report directly to the PIC. Team members generating, compiling, and evaluating project data, and providing other services in a technical, administrative or support function, report directly to the PM. Because the Analytical Program QA/QC Manager does not report to the PM, the Analytical Program QA/QC Manager role is not influenced by the individual direction daily line activities. Furthermore, the Analytical Program QA/QC Manager has direct access to the PIC, and thus can direct the project quality system and influence the project performance at the management level if required.

Project Manager – Mr. David Abranovic, P.E., is the PM and will be responsible for the coordination of the RI/FS activities described in this work plan. All project-related activities will be addressed to the ERM PM. In addition, any updates or revisions recommended for future versions of the QAPP should be presented by the project team to the ERM PM. The ERM PM will notify the PIC and Working Group of any personnel or contractor changes.

Project Geologist – Mr. Jason Hilker, R.G., will act as Lead Geologist for this project and will report directly to the PM. Mr. Hilker will oversee all phases of field work at OU3.

Analytical Program Quality Assurance/Quality Control Manager – The Analytical Program QA/QC Manager, Ms. Jill Quillin, or designee, will ensure that analytical data is collected in a manner consistent with USEPA QA guidance and QAPP objectives. Ms. Quillin will be responsible for implementing the project analytical QA/QC program. She is responsible for laboratory coordination, data validation, and data quality assessment. The QA/QC Manager or ERM designee will be responsible for maintaining the QAPP. Ms. Quillin is the ERM corporate QA Officer.

Health and Safety Officer – The ERM Health and Safety Officer, Mr. Ron Brazeal, or designee, reports to the ERM PM or directly to the Working Group, if appropriate, and will be responsible for final approval of the OU3 HASP to ensure that health and safety procedures for the project are conducted in accordance with the Occupational Safety and Health Administration regulations and guidelines. The Health and Safety Officer will also be responsible for updating the HASP as needed, ensuring that proper health and safety procedures are followed, performing periodic field audits, and assigning site safety coordinators.

Database Manager and GIS Specialist – Mr. Mike Appel, or designee, will report to the ERM PM or PIC and be responsible for maintenance of the OU3 database and the Geographic Information Systems (GIS) component of the database. The GIS Specialist will be responsible for ensuring that the data will be submitted to the ADEQ database in a compatible format. The GIS Specialist is responsible for creating, editing, and manipulating geo-referenced spatial data to efficiently display OU3 information in a visual form. The GIS Specialist is responsible for producing high-quality maps via ArcGIS and AutoCAD.

Risk Assessor – The Risk Assessor, Mark Jones or designee, reports to the ERM PM or PIC and is responsible for providing a framework of risk information necessary to assist in decision-making during RI/FS activities. The framework is formed by analyzing baseline and residual site risks, determining levels of chemicals that are protective of human health, comparing health impacts of various remedial alternatives, and evaluating and documenting public health threats.

Field Personnel – ERM Field Personnel report to the ERM PM and PIC and are responsible for field activities including directing drilling, logging boreholes, overseeing installation of monitoring wells and vapor monitoring wells, and hydraulic testing. Field Personnel will coordinate with Lead Geologist Jason Hilker, R.G., to gather, interpret, and map technical data related to the project. The Field Personnel report to the ERM PM and are responsible for field activity preparation and execution. This includes carrying out all sampling in accordance with approved procedures and methodologies, collecting all QA/QC samples, completing sampling forms, labels and chain-of-custody forms, applying custody seals, and packaging and delivering or shipping samples to the laboratory.

Laboratory Project Manager – The Laboratory PM, Ms. Kylie Emily, will coordinate with the ERM QA/QC Manager. Analytical services will be subcontracted, as required, to meet the requirements of the SOW. The laboratory will be a USEPA and Arizona Department of Health Services-approved laboratory. The laboratory is designated as the primary analytical subcontractor and will perform the analyses for the standard analytical methods. Key positions and quality related responsibilities for laboratory personnel are discussed in the laboratory Quality Assurance Manual (QAM). The laboratory certifications are located along with the laboratory QAM in Appendix A.

Laboratory Quality Assurance Manager – The laboratory QA Manager, Ms. Elizabeth Wueschner, or designee, is the QA Manager for TestAmerica. The QA Manager will be responsible for implementing the laboratory's QA/QC programs, as described in the laboratory QAM.

8.4 *SUBCONTRACTORS*

The following subcontractors and outside organizations have been retained for the duration of this project for the stated services. Other subcontractors maybe retained as the work proceeds.

TestAmerica, Phoenix, Arizona. TestAmerica has been retained for the duration of this contract to provide analytical services for all groundwater, soil vapor, and waste analyses.

Boart Longyear, Peoria, Arizona. Boart Longyear has been retained for the duration of this contract to provide drilling, well development, and field support services.

Red-J Environmental, Gilbert, Arizona. Red-J has been retained to provide waste transportation services for the duration of this contract.

Yellow Jacket Drilling Services, Gilbert, Arizona. Yellow Jacket Drilling Services has been retained to provide utility clearance and field support services for the duration of the contract.

Laboratory Data Consultants, Carlsbad, California. Laboratory Data Consultants has been retained for the duration of this contract to provide data validation services.

Highway Technologies, Phoenix, Arizona. Highway Technologies has been retained to provide traffic control services for the duration of the contract.

AZTEC Engineering Services, Phoenix, Arizona. AZTEC has been retained for the duration of the contract to provide survey services.

ERM subcontractor management includes the following:

- Require appropriate insurance coverage as specified in the OU3 RI/FS contract between ERM and the Working Group;
- Ensure their understanding of the SOW for the tasks assigned, as well as the obligations of the AOC;
- Proactively manage project scope, schedule, and cost;

- Ensure quality standards are met (technical, safety, QA/QC); and
- Provide feedback to other ERM PMs on subcontractor performance.

Quality inspections will focus on proper conduct of definable elements of the field program such as permitting; utility clearance; safety practices; drilling; well installation and development; sampling; waste transportation, storage, and disposal; and site restoration.

8.5 *LINES OF COMMUNICATION*

Two significant elements of the project management plan include communications and documentation. Effective agency and OU3 Working Group (including the consultant) communication is an essential element of the project management process and is addressed in ERM's Quality Management Plan. Communication procedures include face-to-face project meetings, telephone conversations, e-mails, and memos. All pertinent project management issues such as those regarding the scope and schedule will be communicated to the Agencies (the USEPA, ADEQ, and their consultant[s]) by the OU3 Working Group PMs and will be documented and filed at the ERM office in Scottsdale, Arizona. Alternate points of contact for the OU3 Working Group PMs will be the ERM PIC and PM.

The ERM PM will communicate to the Working Group daily during field activities. ERM Field Support personnel will communicate with the ERM PM and QA/QC Manager on a daily basis during execution of field events. The ERM PM will be responsible for preparing and submitting the Weekly Field Activity Reports, per the SOW, during execution of the field work. Subcontractors that provide on-site services will report directly to Field Support personnel. All required subcontractor QA/QC documentation will be provided to the ERM PM. The ERM PM will provide written monthly reports to the OU3 Working Group according to the project schedule provided in Section 9.0. In addition, the ERM PM will communicate immediately with the OU3 Working Group in the event of problems encountered as they may occur, especially during field work.

The QA/QC Manager and other ERM project personnel will also participate in public outreach programs as directed by the OU3 Working Group in response to direction from the USEPA. The Working Group and

their Consultant's participation may vary by meeting type, current site activities, and the amount of information being presented.

ERM will provide engineering and field services required for well installations and monitoring activities. ERM will provide control for this project using a phased inspection process that includes preparatory, initial, follow-up, and completion inspections for each definable field activity.

9.0 DATA MANAGEMENT

Electronic data management systems will be used for organizing, tracking, and reporting laboratory analytical data and other sample collection information acquired during well installation and groundwater and soil vapor investigation activities at the OU3 Study Area. This section establishes procedures for the complete and efficient archival, retrieval, and transfer to the USEPA and ADEQ of stored information in the form of both computerized databases and printed records. This data management system will be used to support well installation and groundwater and soil vapor investigation activities that are conducted in accordance with the FSP (Appendix A).

9.1 OVERVIEW

ERM will maintain analytical, water level, and soil vapor and groundwater well construction information within an Environmental Quality Information System (EQuIS) Data Management System database. Historical analytical, water level, and well construction data previously collected by various contractors has been entered into a relational database maintained by Shaw. ERM obtained a copy of this database and will incorporate this historical data into the new EQuIS database. All additional data collected during the RI will also be entered into the EQuIS database, including soil vapor analytical results and water quality data. ERM will utilize the database to generate electronic analytical data deliverables for ADEQ and USEPA conforming to the requirements provided in its *Groundwater Data Submittal Guidance Document* (ADEQ 2005). In addition to data storage in the EQuIS database, an additional geodatabase will be created to store groundwater contours, well locations, plume extents, and other spatial data for easy display using GIS software.

There are two basic types of data: tabular and spatial. Tabular data from fixed laboratory analyses will be reported to ERM in EQuIS-ready electronic data deliverables (EDDs) for immediate importation in the EQuIS database. Other tabular data such as water levels and field parameters will be manually entered into EQuIS -formatted EDDs for importation into the project database. Spatial data will be generated using EQuIS and ArcGIS to depict plan view maps of the site vicinity, well locations, COC distributions, and groundwater flow patterns. Spatial data

will be maintained in ArcGIS shapefile, personal geodatabase, or file geodatabase format following established GIS standards already in use.

9.2 SOFTWARE

The EQuIS package will be used to store all analytical, water level, and well construction information. This software package maintains the data in either a Microsoft Access or Sequel Server Express database. The EQuIS software also contains built-in report and table generation features, EDD importation tools, and several cross-program plug-ins that allow for data migration directly from the EQuIS database into various modeling and visualization software packages such as ArcGIS, visual mudflow, Surfer, and EVS. ESRI's ArcGIS Desktop software will be used to visualize spatial data for the project. Additional company computer programs and information technology procedures are outlined in the Quality Management Plan.

9.3 DATABASE STRUCTURE

The EQuIS system is a relational database with an industry standard internal structure. Since the system was specifically designed to store environmental geochemical and project information, the proven structure is not anticipated to be altered from its stock configuration. Data in the database can be queried and exported in spreadsheet or ASCII format files that serve as EDDs for transmittal to the USEPA and ADEQ.

9.4 DATA PROCESSING PROCEDURES

The following steps will be followed for processing data:

- All water levels will be measured from accessible wells and recorded in field logbooks. After all measurements have been taken and recorded, the database team will enter recorded water levels into a Microsoft Excel spreadsheet that will be used as an EDD for importation into the EQuIS database.
- All sample information will be recorded on chain-of-custody forms, sample purge forms, or field boring logs at the time of collection. This information will be entered into the database and linked to survey and sample results information once received.

- ERM will acquire analytical data from the laboratory in an electronic format that will be directly imported into EQuIS after review. ERM will also populate the database with ADEQ data qualifiers in electronic format that can be linked to the analytical data records in a straightforward manner.
- Database files and laboratory data files will be maintained in original uncompressed format to facilitate distribution and compatibility with most database applications. All original unmodified versions of electronic laboratory data will be stored in the electronic project file.
- Original hard copies of laboratory analytical and soil physical data will be kept in the project file.

9.5 DOCUMENTATION

Changes and updates to the database will be logged electronically into the database. Telephone conversation logs, facsimiles, and electronic messages will be stored in the project file.

10.0 PROJECT DELIVERABLES

The following deliverables will be provided to USEPA, with copies to the ADEQ to document the progress and results of the Phase III RI:

- Unvalidated water quality analytical data submitted electronically as soon as available;
- Unvalidated soil vapor analytical data submitted electronically as soon as available;
- Quarterly Groundwater Monitoring Data Transmittal Reports;
- Quarterly Soil Vapor Monitor Well Data Transmittal Reports;
- Weekly Reports (during field activities); and
- Monthly Project Progress Reports when field activities are not being conducted.

In addition to the data transmittal and progress reports, the following reports will be provided to the Working Group, USEPA, and ADEQ to document the results of the Phase III RI:

- In Situ Implementability Technical Memorandum
- Groundwater Well Installation Report
- Soil Vapor Well Installation Report
- Aquifer Test Report
- Annual Groundwater Monitoring Report(s)
- Soil Vapor Well Monitoring Report
- Technical Memorandums (if required)
- Bench Scale/Pilot Work Plans and Reports (if required)
- OU3 RI Report
- OU3 Groundwater Baseline Risk Assessment
- OU3 FS Work Plan
- OU3 FS Report

Draft versions of these reports will be provided to the ADEQ and USEPA for review. The draft reports will be revised to address USEPA and ADEQ

comments, as appropriate, and according to the schedules in the AOC and SOW. The reports will then be issued as final reports.

Electronic copies of all draft and final documents will be made available to the project team for download onto ERM's OU3 ftp site. The distribution of all hard copies and electronic copies on CDs will be done according to the following:

Two hard copies and one electronic copy on a CD will be sent to:

Janet Rosati
Remedial Project Manager
Superfund Division (SFD-6-2)
USEPA, Region IX
75 Hawthorne Street
San Francisco, CA 94105
Rosati.Janet@epa.gov

One hard copy and two electronic copies on CDs will be sent to:

Brian Stonebrink
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, AZ 85007-2935
Stonebrink.Brian@ azdeq.gov

One electronic copy on a CD will be sent to:

James Maes
U.S. Army Corps of Engineers
3636 North Central Avenue, Suite 900
Phoenix, AZ 85012
James.H.Maes@usace.army.mil

One hard copy and one electronic copy on a CD will be sent to:

Sue Kraemer
Shaw Environmental, Inc.
1326 North Market Street
Sacramento, CA 95834-1912
Sue.Kraemer@shawgrp.com

11.0 RI/FS PROJECT SCHEDULE

The RI/FS III project is expected to extend from approximately September 2009 to October 2012. A draft project schedule for the OU3 RI/FS has been prepared to comply with the requirements listed in the SOW. The current Microsoft Project® schedule for the project activities is provided as Figures 11-1a and 11-1b. The duration of the scheduled tasks is based on a 5-day work week. USEPA will be notified immediately of any delays to the project schedule, the associated cause of the change, and a strategy to address any anticipated delays to keep the overall project on schedule.

11.1 FIELD WORK IMPLEMENTATION SCHEDULE

Anticipated start and finish dates for implementing the field activities included in this Work Plan are provided in Table 11-1. The anticipated implementation dates provided in this table may be adjusted in the future due to the interdependency of the tasks involved in the project. Significant events that may affect the schedule are permit approvals, regulatory review of work plans and reports, and equipment failures. The Working Group will provide the USEPA with an updated schedule periodically as necessary.

Table 11-1 Field Work Anticipated Implementation Schedule

Task	Start Date	Finish Date
New Groundwater Well Installations	27 September 2010	5 November 2010
Soil Gas Well Installations	13 January 2011	24 January 2011
Aquifer Testing	27 January 2011	16 February 2011
Vapor Well Sampling Event 1	7 February 2011	11 February 2011
Vapor Well Sampling Event 2	9 May 2011	13 May 2011
Vapor Well Sampling Event 3	8 August 2011	12 August 2011
Vapor Well Sampling Event 4	7 November 2011	11 November 2011
Semiannual Monitoring March 2010 Event	16 March 2010	26 March 2010
Semiannual Monitoring September 2010 Event	13 September 2010	24 September 2010

Task	Start Date	Finish Date
1 Quarterly Monitoring of New Wells Event	17 November 2010	19 November 2010
2 Quarterly Monitoring of New Wells Event	23 February 2011	25 February 2011
3 Quarterly Monitoring of New Wells Event	25 May 2011	27 May 2011
4 Quarterly Monitoring of New Wells Event	24 August 2011	26 August 2011

11.2 PRIMARY DELIVERABLE SCHEDULE

The anticipated due dates for submitting draft versions of the primary reports to the ADEQ and USEPA for review are provided in Table 11-2. The anticipated submittal dates provided in Table 11-2 may be adjusted in the future based on the schedule and duration of field activities. The Working Group will provide the USEPA with an updated schedule periodically as necessary.

Table 11-2 Primary Report Anticipated Submittal Schedule

Deliverable	Due Date
In Situ Implementability Technical Memorandum	5 June 2010
Groundwater Well Installation Report	31 December 2011
Soil Vapor Well Installation Report	8 April 2011
Aquifer Test Report	6 April 2011
Annual Groundwater Monitoring Report 2010	22 November 2010
Soil Vapor Well Monitoring Report	30 December 2011
RI Report	3 February 2012
OU3 Groundwater Baseline Risk Assessment	3 February 2012
FS Work Plan	9 July 2012
FS Report	In accordance with approved FS Work Plan

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Figures

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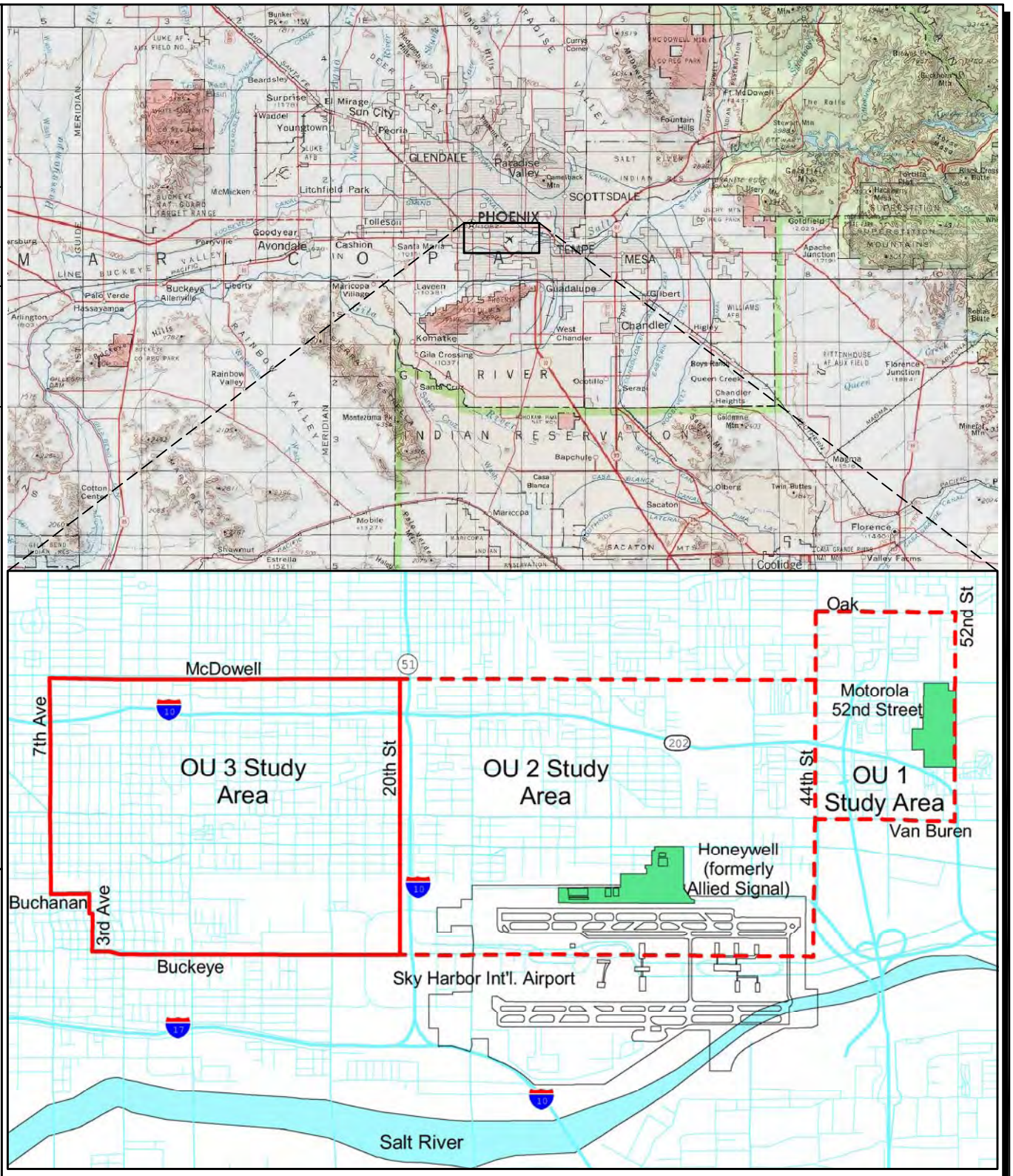


LEGEND

OU3 Study Area Boundary

OU1 and OU2 Study Area Boundary

References:
TOPO!® Software
U.S.G.S. 500k Map Series; Phoenix, Arizona
Shaw Environmental, 04/19/04.

Figure 1-1
Site Location Map
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 05/09

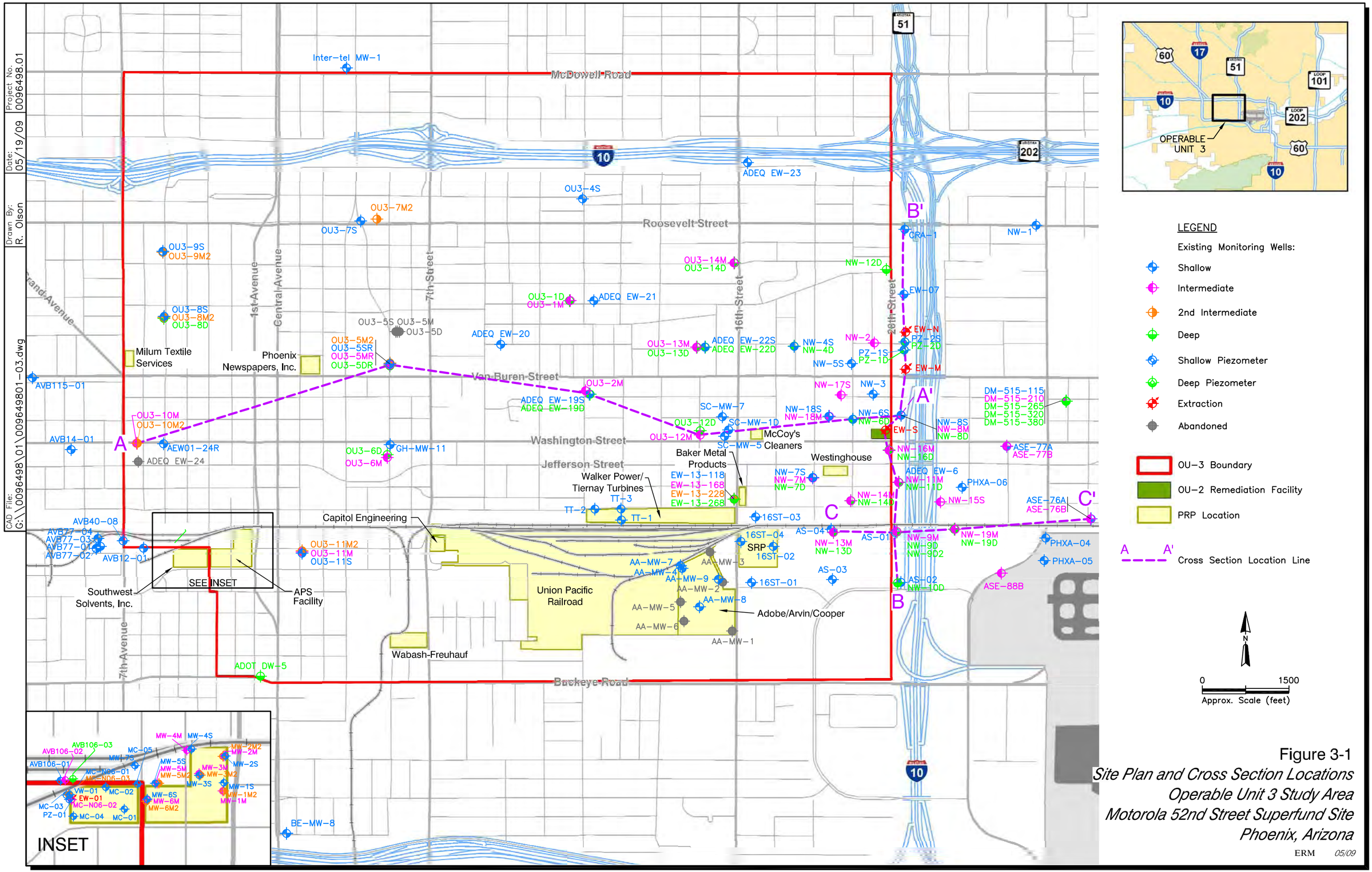
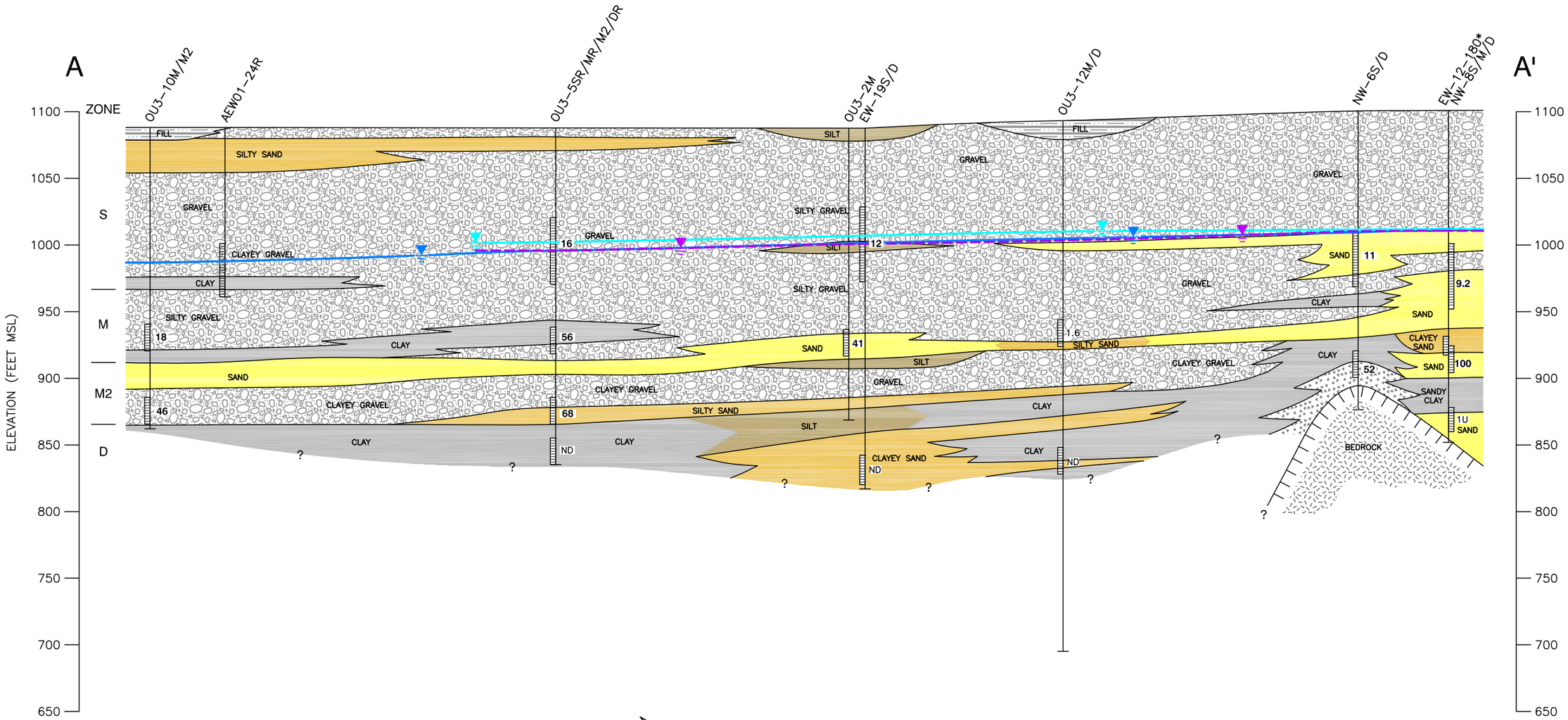


Figure 3-1
Site Plan and Cross Section Locations
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 05/09



(Vertical Exaggeration = 15X)

VERTICAL SCALE IN FEET 1" = 80'

HORIZONTAL SCALE IN FEET 1" = 1200'

LEGEND

- Engineered Fill
- Clay
- Silt and Fines
- Silty Sand and Clayey Sand
- Poorly- and Well-Graded Sand
- Gravel, Clayey Gravel, and Silty Gravel
- Reworked Weathered Bedrock and Colluvium
- Weathered Bedrock
- Bedrock

OU3-2M Monitoring Well Designation

Monitoring Well

Monitoring Well Screen Interval

Groundwater Elevation, Shallow Zone (March 2009)

Groundwater Elevation, Middle Zone (March 2009)

Groundwater Elevation, Deep Zone (March 2009)

Posted TCE Concentrations (µg/L), March 2009

BOLD	Above AWQS (5 µg/L)
U	Qualified at Non-Detect
J	Estimated Result
Tr	Value Between MDL and PQL
ND	Not Detected

NOTES:
* EW-12-180 was abandoned in 2003, and was used only for lithology.
Source of cross section data, Shaw, 2005.

Figure 3-2
Cross Section A-A'
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 09/09

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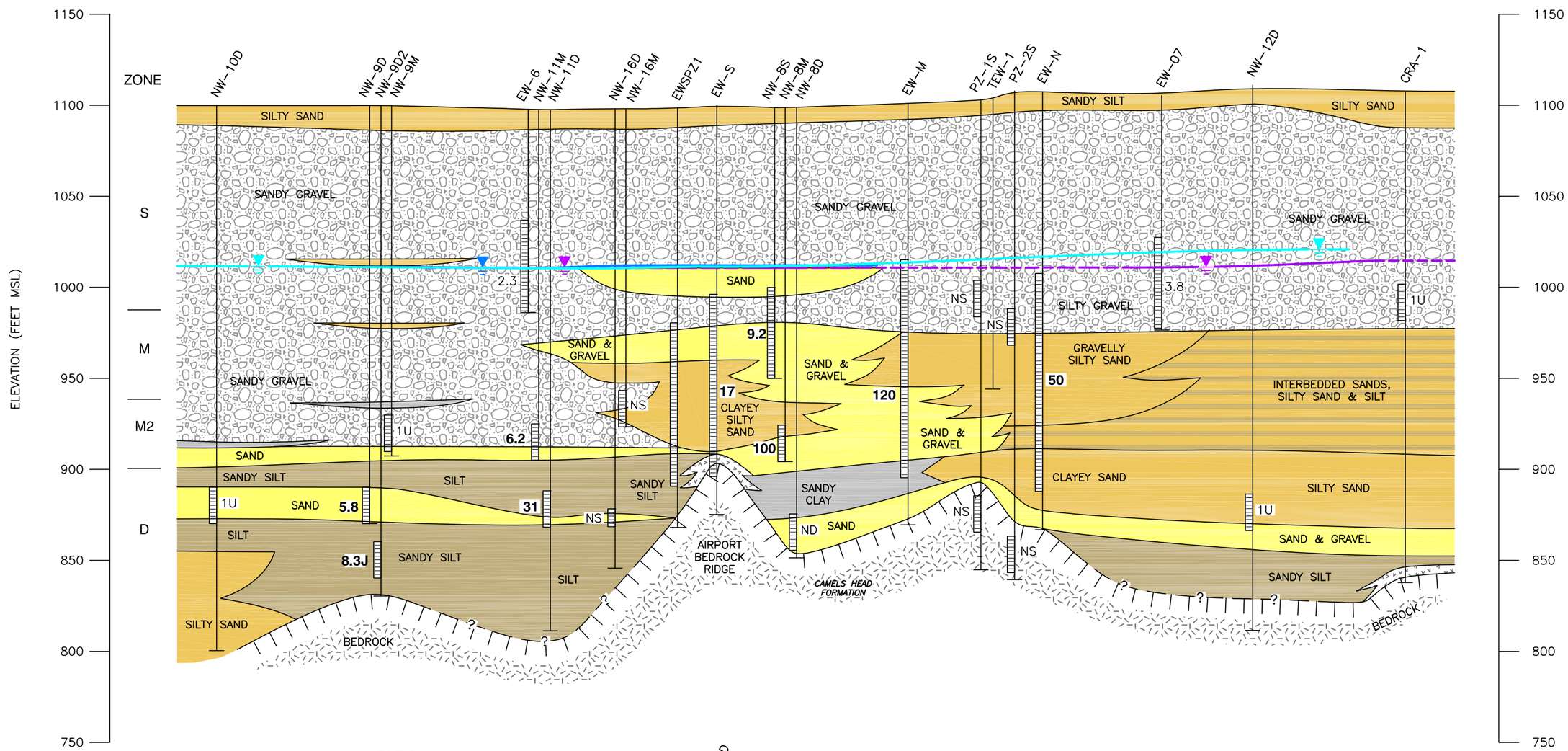
Date: 09/11/09
Project No. 0096498.01



(Vertical Exaggeration = 10X)

VERTICAL SCALE IN FEET 1" = 60'

HORIZONTAL SCALE IN FEET 1" = 600'

LEGEND

- Clay
- Silt and Fines
- Silty Sand and Clayey Sand
- Poorly- and Well-Graded Sand
- Gravel, Clayey Gravel, and Silty Gravel
- Reworked Weathered Bedrock and Colluvium
- Weathered Bedrock
- Bedrock

NW-10D Monitoring Well Designation

Monitoring Well

Monitoring Well Screen Interval

Posted TCE Concentrations (µg/L), March 2009

BOLD	Above AWQS (5 µg/L)
U	Qualified at Non-Detect
J	Estimated Result
ND	Not Detected
NS	Not Sampled

Groundwater Elevation, Shallow Zone (March 2009)

Groundwater Elevation, Middle Zone (March 2009)

Groundwater Elevation, Deep Zone (March 2009)

NOTE:
Source of cross section data, CRA, 2009.

Figure 3-3
Cross Section B-B'
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 09/09

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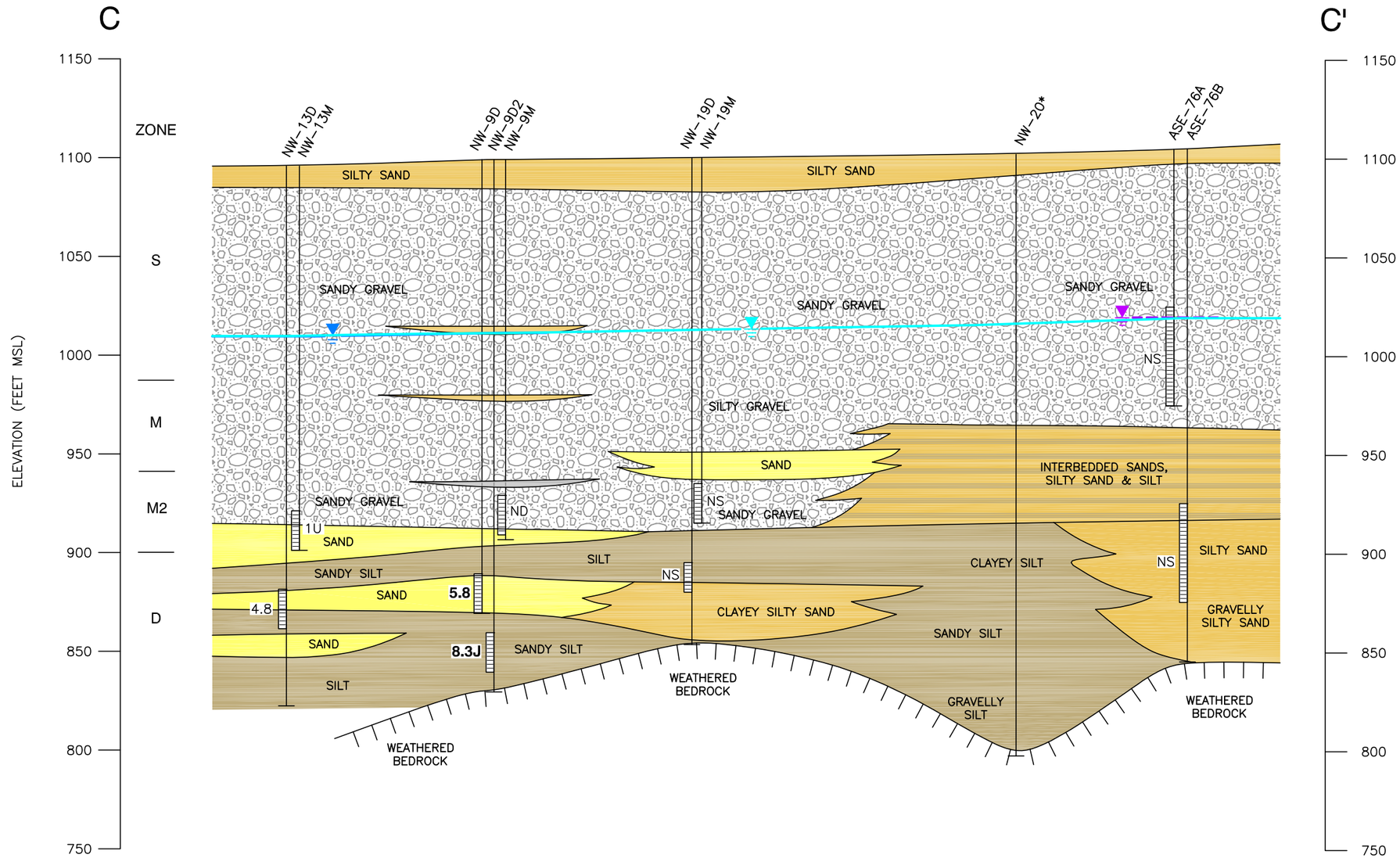

(Vertical Exaggeration = 10X)

VERTICAL SCALE IN FEET 1" = 60'

HORIZONTAL SCALE IN FEET 1" = 600'

LEGEND

- Clay
- Silt and Fines
- Silty Sand and Clayey Sand
- Poorly- and Well-Graded Sand
- Gravel, Clayey Gravel, and Silty Gravel
- Weathered Bedrock

NW-13M Monitoring Well Designation

Monitoring Well

Monitoring Well Screen Interval

Posted TCE Concentrations (µg/L), March 2009

BOLD	Above AWQS (5 µg/L)
U	Qualified at Non-Detect
J	Estimated Result
NS	Not Sampled

Groundwater Elevation, Shallow Zone (March 2009)

Groundwater Elevation, Middle Zone (March 2009)

Groundwater Elevation, Deep Zone (March 2009)

NOTES:
* Test boring for lithological data only.
Source of cross section data, CRA, 2009.

Figure 3-4
Cross Section C-C'
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 09/09

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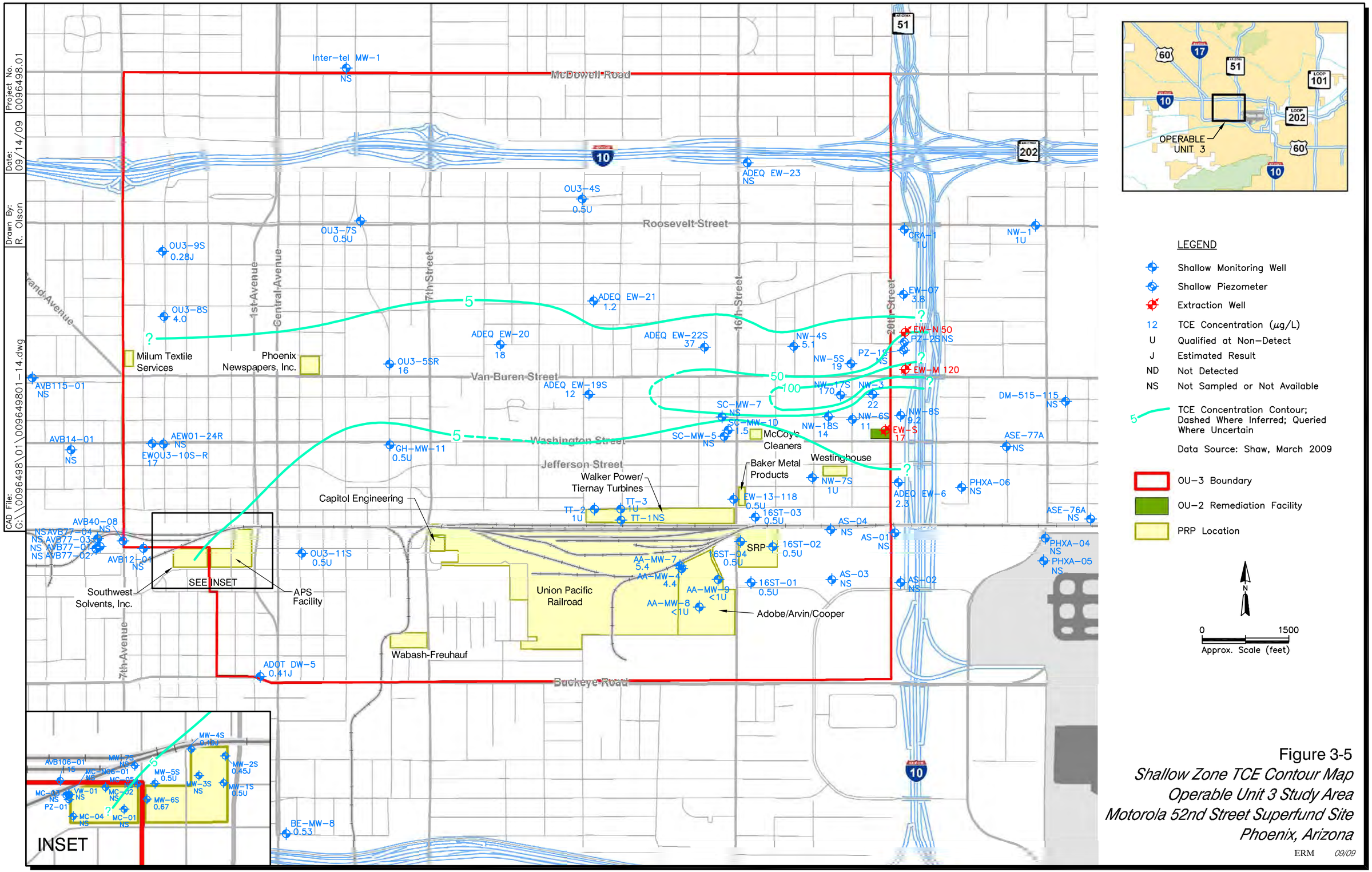

Figure 3-5
Shallow Zone TCE Contour Map
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 09/09

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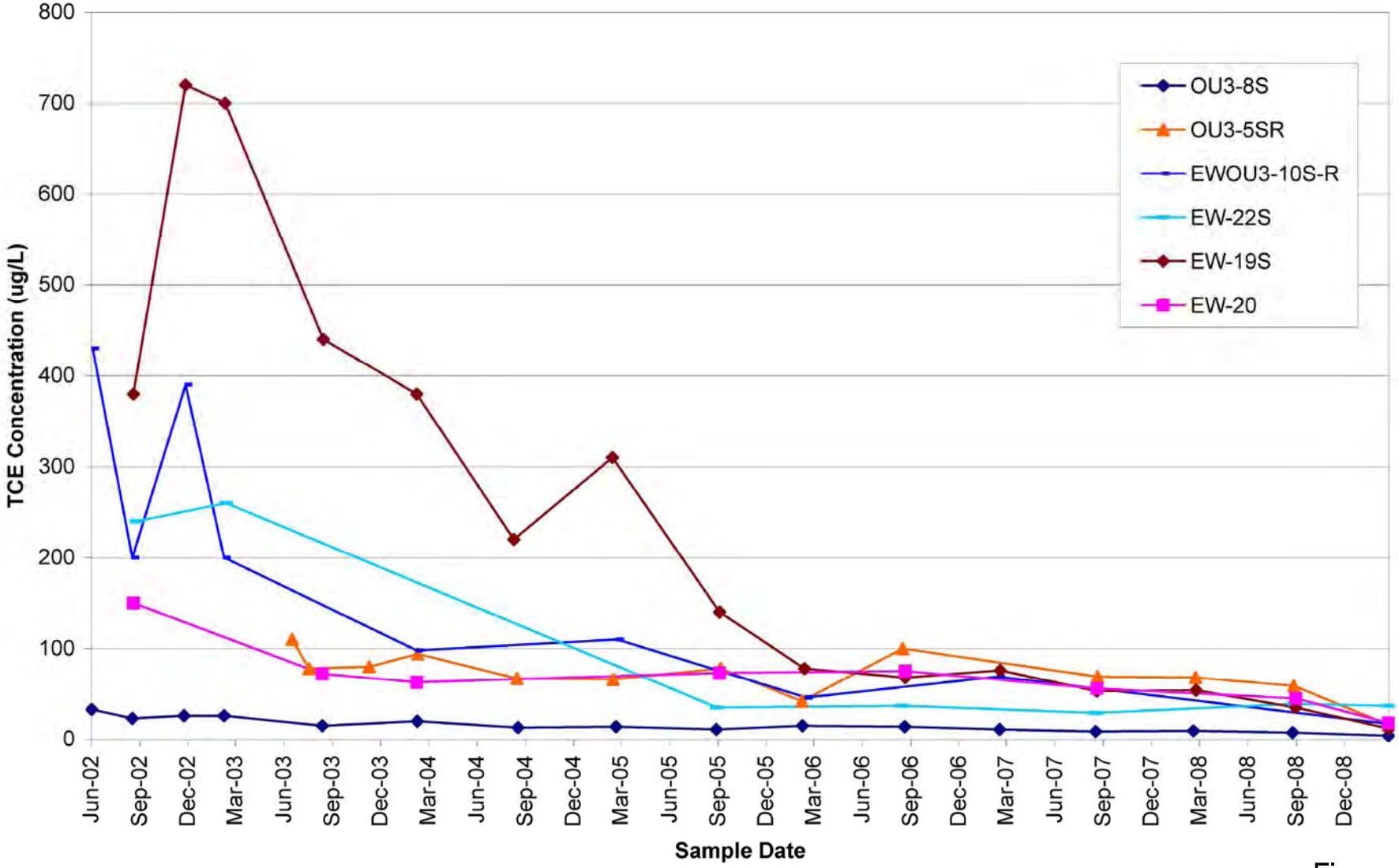

Figure 3-6

Historical TCE Concentration in Shallow Zone Groundwater
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM *11/09*

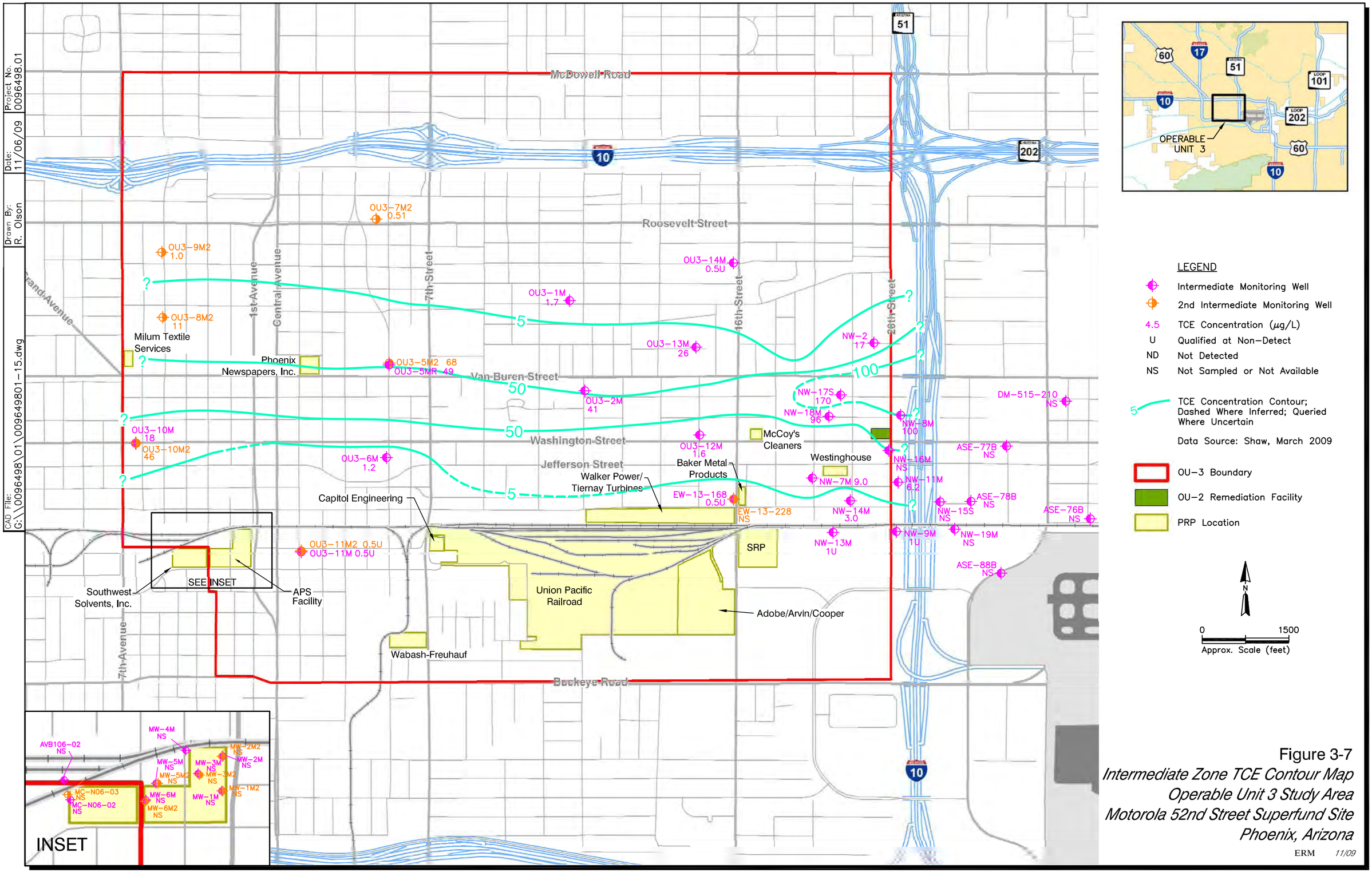

Figure 3-7
Intermediate Zone TCE Contour Map
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 11/09

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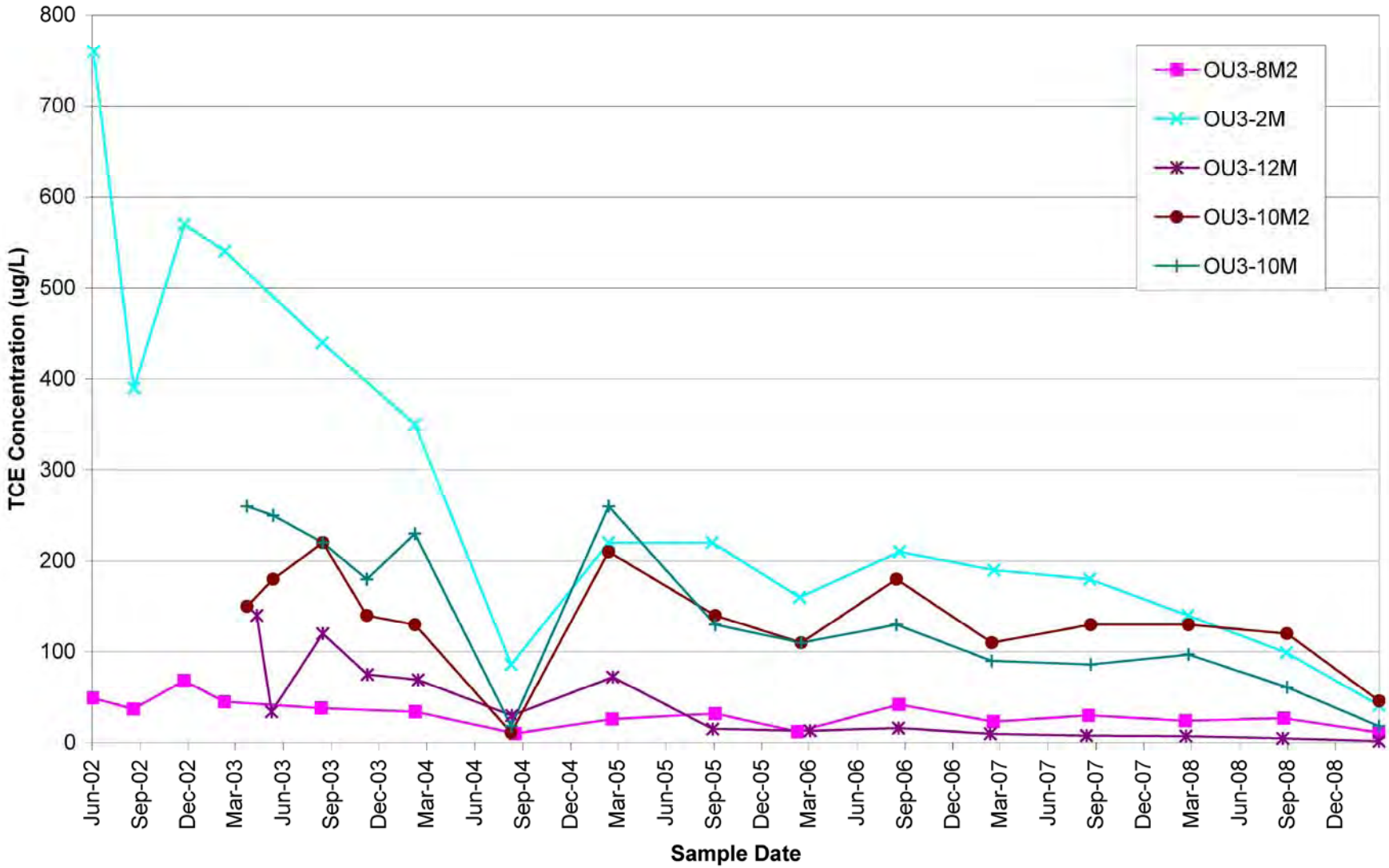

Figure 3-8

Historical TCE Concentration in Intermediate Zone Groundwater
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM *11/09*

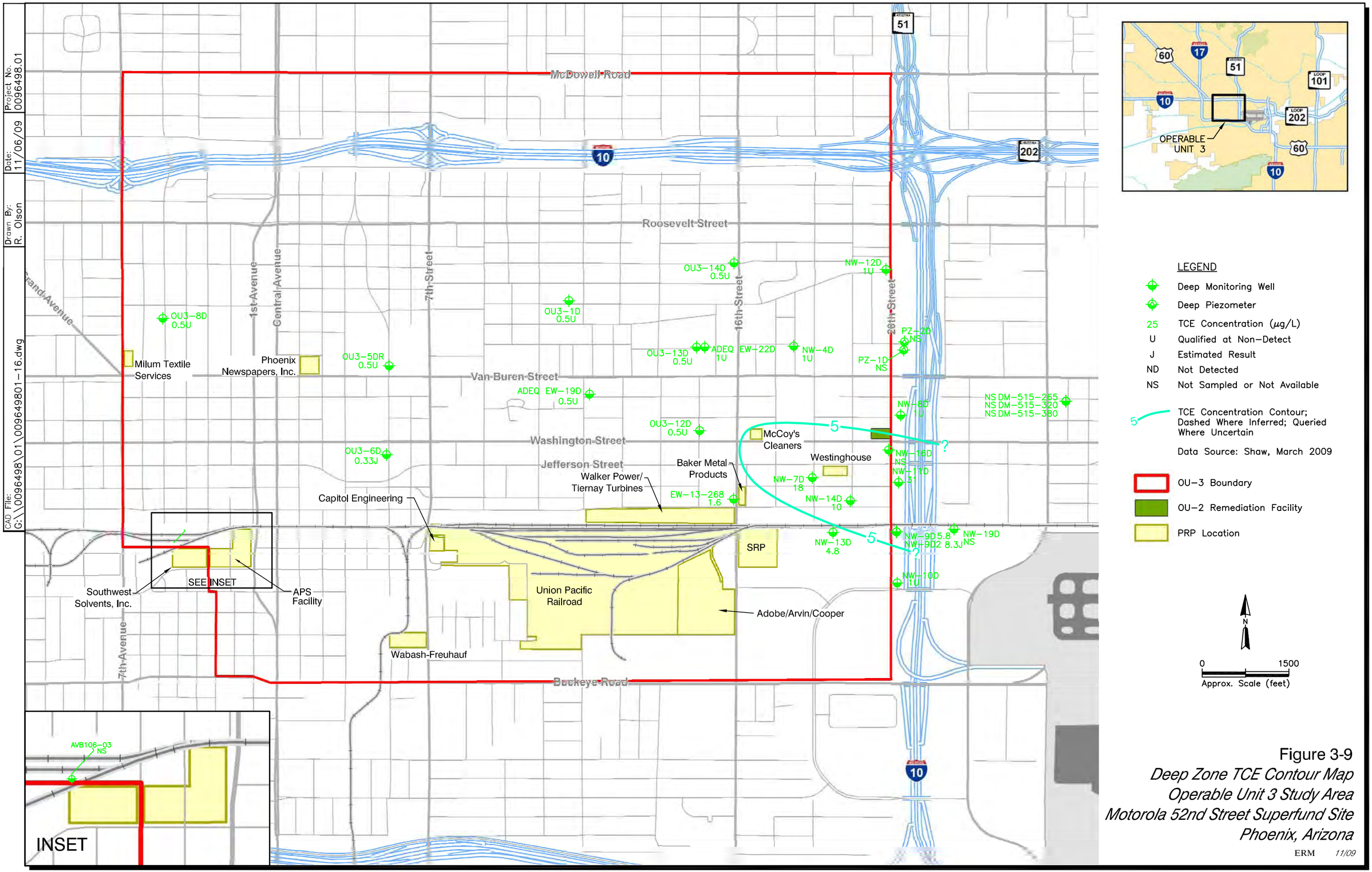

Figure 3-9
Deep Zone TCE Contour Map
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 11/09

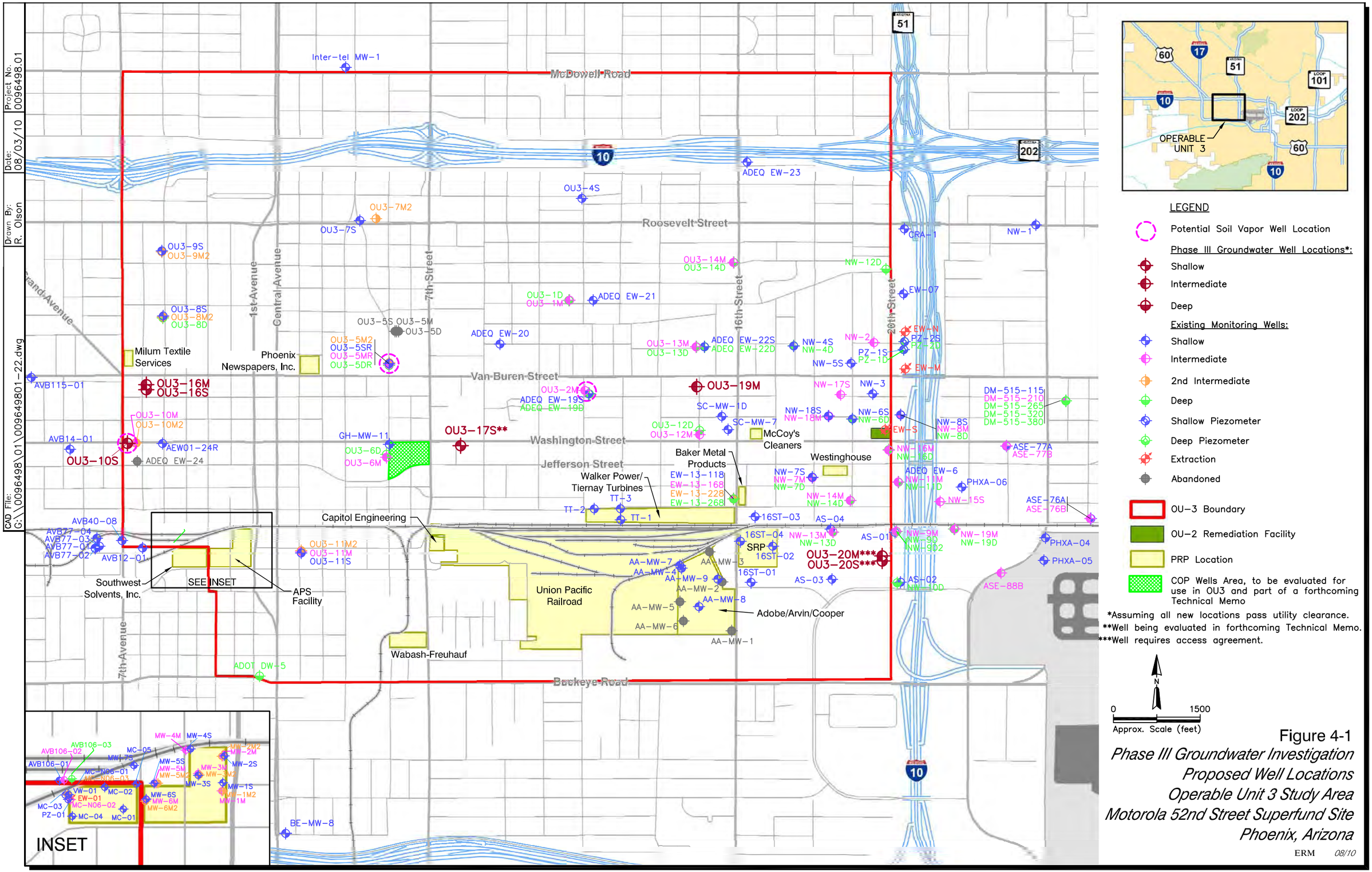

Figure 4-1

Phase III Groundwater Investigation
Proposed Well Locations
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 08/10

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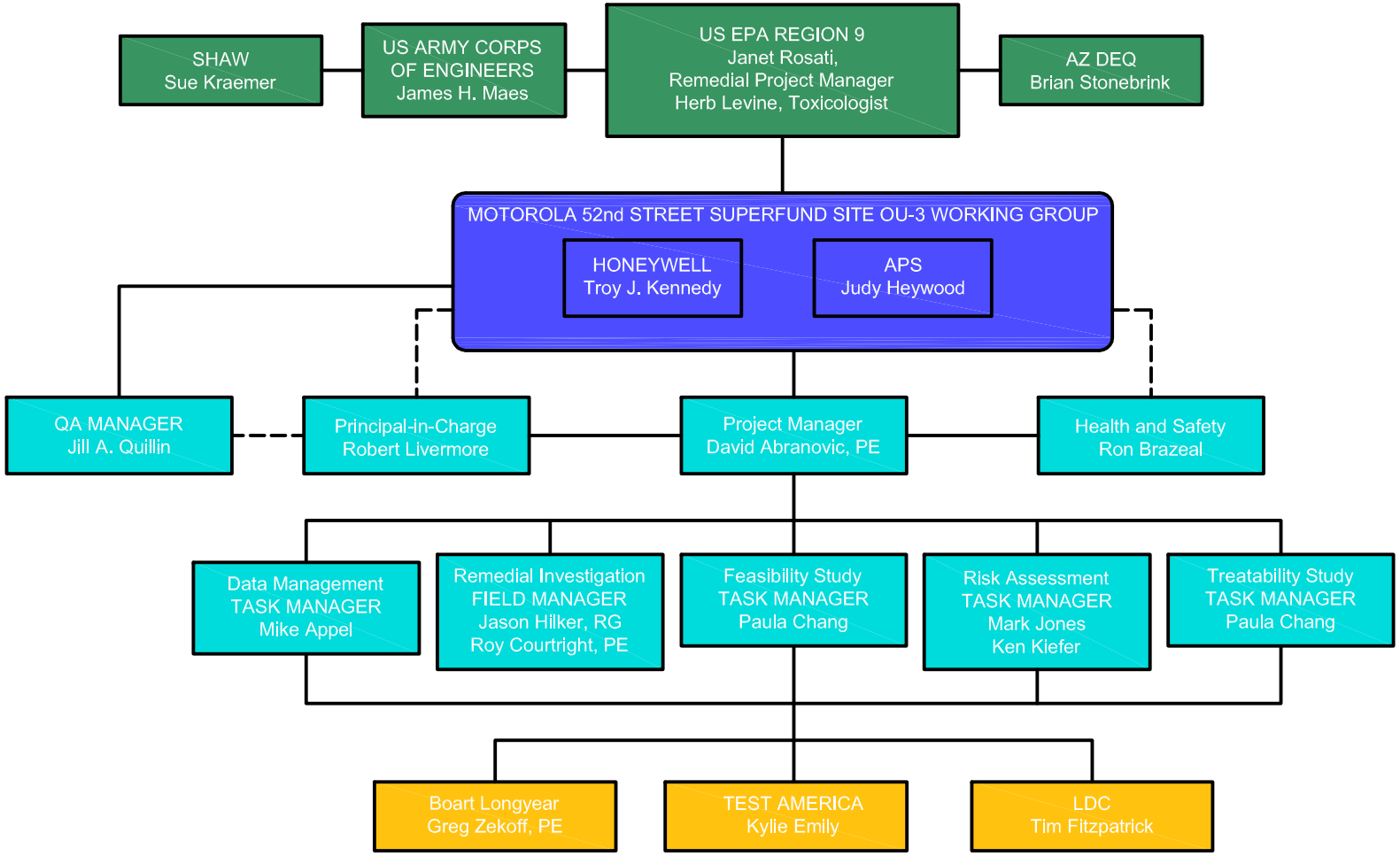


Figure 5-1

Project Organization Chart
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM *08/10*

CAD File: G:\0096498\01\009649801-25.dwg

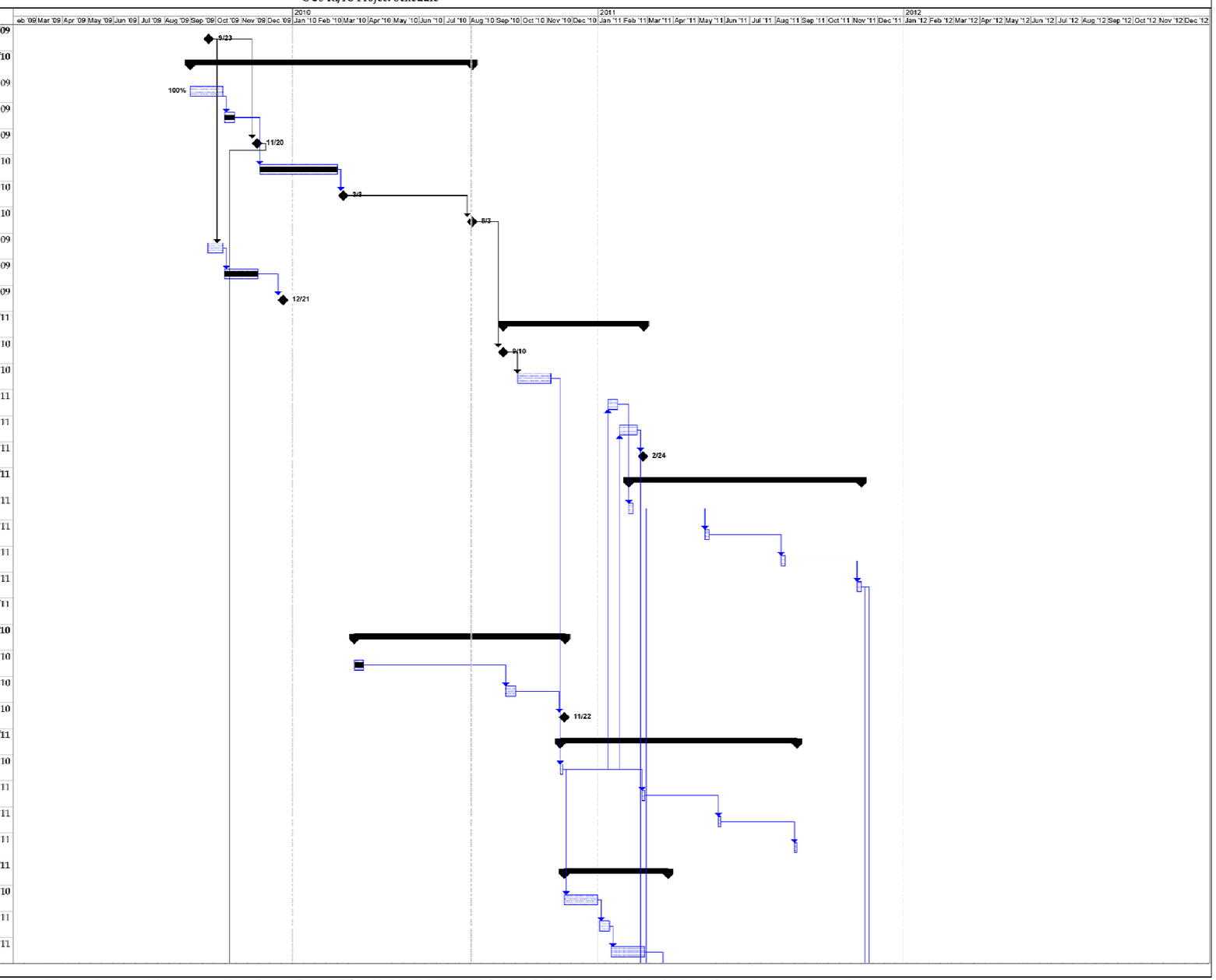
Drawn By: R. Olson

Date: 08/03/10

Project No. 0096498.01

OU3 RI/FS Project Schedule

ID	Task Name	Duration	Start	Finish
1	**AOC Effective Date**	**0 days**	**Wed 9/23/09**	**Wed 9/23/09**
2	**Planning Documents (WP, FSP, QAPP, HASP)**	**241 days**	**Tue 9/1/09**	**Tue 8/3/10**
3	Draft Planning Documents	29 days	Tue 9/1/09	Fri 10/9/09
4	Group Review	10 days	Mon 10/12/09	Fri 10/23/09
5	AOC Due Date for Planning Documents	1 day	Fri 11/20/09	Fri 11/20/09
6	EPA Review	67 days	Mon 11/23/09	Tue 2/23/10
7	RTC Meetings & Comment Resolution	70 days	Wed 3/3/10	Tue 6/8/10
8	Final Planning Documents	1 day	Tue 8/3/10	Tue 8/3/10
9	Draft QCP	14 days	Tue 9/22/09	Fri 10/9/09
10	EPA Review	30 days	Mon 10/12/09	Fri 11/20/09
11	Final QCP	1 day	Mon 12/21/09	Mon 12/21/09
12	**Field Work**	**120 days**	**Fri 9/10/10**	**Thu 2/24/11**
13	Notification of FW Initiation	1 day	Fri 9/10/10	Fri 9/10/10
14	Groundwater Well Installations	30 days	Mon 9/27/10	Fri 11/5/10
15	Soil Gas Well Installations	8 days	Thu 1/13/11	Mon 1/24/11
16	Aquifer Testing	15 days	Thu 1/27/11	Wed 2/16/11
17	Notification of FW Completion	1 day	Thu 2/24/11	Thu 2/24/11
18	**Vapor Well Sampling**	**200 days**	**Mon 2/7/11**	**Fri 11/11/11**
19	Vapor Well Sampling 1	5 days	Mon 2/7/11	Fri 2/11/11
20	Vapor Well Sampling 2	5 days	Mon 5/9/11	Fri 5/13/11
21	Vapor Well Sampling 3	5 days	Mon 8/8/11	Fri 8/12/11
22	Vapor Well Sampling 4	5 days	Mon 11/7/11	Fri 11/11/11
23	**Groundwater monitoring**	**379 days**	**Tue 3/16/10**	**Fri 8/26/11**
24	**Semiannual Monitoring of OU-3 Wells**	**180 days**	**Tue 3/16/10**	**Mon 11/22/10**
25	March 2010 Event	9 days	Tue 3/16/10	Fri 3/26/10
26	September 2010 Event	10 days	Mon 9/13/10	Fri 9/24/10
27	Annual Report 2010	1 day	Mon 11/22/10	Mon 11/22/10
28	**Quarterly Monitoring of New Wells**	**203 days**	**Wed 11/17/10**	**Fri 8/26/11**
29	Quarterly GW Monitoring 1	3 days	Wed 11/17/10	Fri 11/19/10
30	Quarterly GW Monitoring 2	3 days	Wed 2/23/11	Fri 2/25/11
31	Quarterly GW Monitoring 3	3 days	Wed 5/25/11	Fri 5/27/11
32	Quarterly GW Monitoring 4	3 days	Wed 8/24/11	Fri 8/26/11
33	**Groundwater Well Installation Report**	**90 days**	**Mon 11/22/10**	**Fri 3/25/11**
34	Draft Well Inst. Report	30 days	Mon 11/22/10	Fri 12/31/10
35	Group Review	10 days	Mon 1/3/11	Fri 1/14/11
36	EPA Review	30 days	Mon 1/17/11	Fri 2/25/11



Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Figure 11-1a
Project Schedule
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 08/10

CAD File: G:\0096498\01\009649801-25.dwg

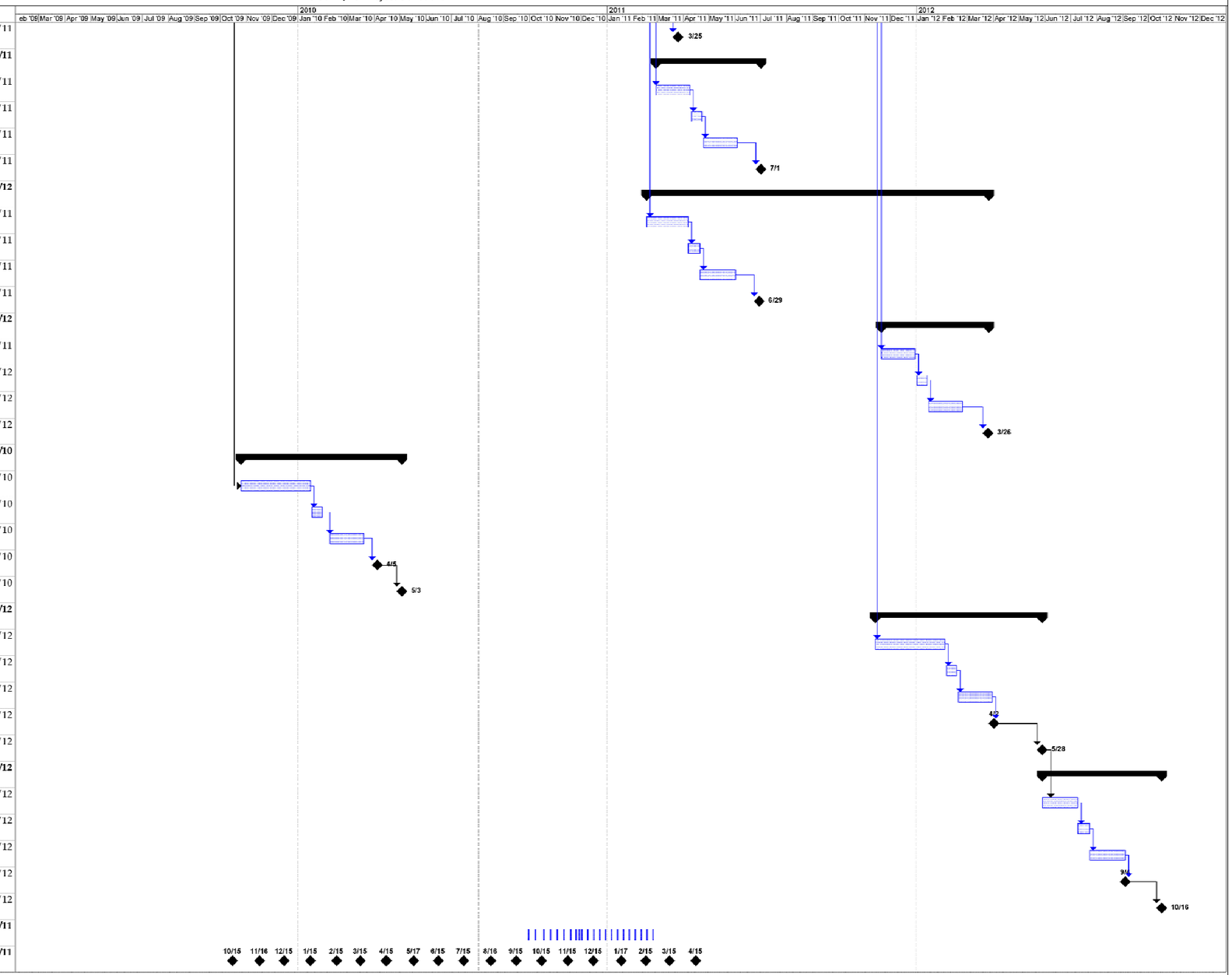
Drawn By: R. Olson

Date: 08/03/10

Project No. 0096498.01

OU3 RI/FS Project Schedule

ID	Task Name	Duration	Start	Finish
37	Final Well Inst. Report	20 days	Mon 2/28/11	Fri 3/25/11
38	**Soil Vapor Monitoring Well Installation Report**	**90 days**	**Mon 2/28/11**	**Fri 7/1/11**
39	Draft Soil Vapor Well Inst. Monitoring Report	30 days	Mon 2/28/11	Fri 4/8/11
40	Group Review	10 days	Mon 4/11/11	Fri 4/22/11
41	EPA Review	30 days	Mon 4/25/11	Fri 6/3/11
42	Final Soil Vapor Well Monitoring Inst. Report	20 days	Mon 6/6/11	Fri 7/1/11
43	**Aquifer Test Report**	**288 days**	**Thu 2/17/11**	**Mon 3/26/12**
44	Draft AT Report	35 days	Thu 2/17/11	Wed 4/6/11
45	Group Review	10 days	Thu 4/7/11	Wed 4/20/11
46	EPA Review	30 days	Thu 4/21/11	Wed 6/1/11
47	Final AT Report	20 days	Thu 6/2/11	Wed 6/29/11
48	**Soil Vapor Well Monitoring Report**	**91 days**	**Mon 11/21/11**	**Mon 3/26/12**
49	Draft Soil Vapor Well Monitoring Report	30 days	Mon 11/21/11	Fri 12/30/11
50	Group Review	10 days	Mon 1/2/12	Fri 1/13/12
51	EPA Review	30 days	Mon 1/16/12	Fri 2/24/12
52	Final Soil Vapor Well Monitoring Report	1 day	Mon 3/26/12	Mon 3/26/12
53	**Insitu Implementability Technical Memo**	**136 days**	**Mon 10/26/09**	**Mon 5/3/10**
54	Draft Technical Memorandum	60 days	Mon 10/26/09	Fri 1/15/10
55	Group Review	10 days	Mon 1/18/10	Fri 1/29/10
56	EPA Review	30 days	Mon 2/8/10	Fri 3/19/10
57	Comment Resolution Meeting	1 day	Mon 4/5/10	Mon 4/5/10
58	Final Technical Memorandum	20 days	Tue 4/6/10	Mon 5/3/10
59	**OU-3 RI Report**	**141 days**	**Mon 11/14/11**	**Mon 5/28/12**
60	Draft RI Report	60 days	Mon 11/14/11	Fri 2/3/12
61	Group Review	10 days	Mon 2/6/12	Fri 2/17/12
62	EPA Review	30 days	Mon 2/20/12	Fri 3/30/12
63	Comment Resolution Meeting	1 day	Mon 4/2/12	Mon 4/2/12
64	Final RI Report	20 days	Tue 5/1/12	Mon 5/28/12
65	**OU-3 FS Workplan**	**101 days**	**Tue 5/29/12**	**Tue 10/16/12**
66	Draft FS Workplan	30 days	Tue 5/29/12	Mon 7/9/12
67	Group Review	10 days	Tue 7/10/12	Mon 7/23/12
68	EPA Review	30 days	Tue 7/24/12	Mon 9/3/12
69	Comment Resolution Meeting	1 day	Tue 9/4/12	Tue 9/4/12
70	Final FS Workplan	30 days	Wed 9/5/12	Tue 10/16/12
71	**Weekly Field Activity Reports**	**106 days**	**Thu 9/30/10**	**Thu 2/24/11**
94	**Monthly Progress Reports & Management**	**392 days**	**Thu 10/15/09**	**Fri 4/15/11**



Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Figure 11-1b
Project Schedule
Operable Unit 3 Study Area
Motorola 52nd Street Superfund Site
Phoenix, Arizona

ERM 08/10