PROPOSED REMEDIAL ACTION PLAN
SOUTH MESA WQARF REGISTRY SITE
MESA AND GILBERT, ARIZONA

Prepared for:

Arizona Department of Environmental Quality
Waste Programs Division
Remedial Projects Unit
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Mr. Kevin Snyder
Project Manager
Remedial Projects Unit
Arizona Department of Environmental Quality
1110 West Washington Street
Phoenix, Arizona 85007

Subject: **Proposed Remedial Action Plan**
South Mesa WQARF Registry Site
ADEQ Task Assignment EV11-0084

Dear Mr. Snyder:

AMEC Environment and Infrastructure, Inc. (AMEC) is pleased to submit this *Proposed Remedial Action Plan* (PRAP) for the South Mesa WQARF Registry Site (SMWRS) located in Mesa and Gilbert, Arizona. This PRAP has been prepared in accordance with Arizona Administrative Code (A.A.C.) R18-16-408.

If you have any questions or comments regarding this report, please contact Mr. Jim Clarke at 602-733-6055.

Sincerely,

AMEC Environment & Infrastructure, Inc.

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ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-Dichloroethylene (*aka* 1,1-dichloroethene)
1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCA	1,1-Dichloroethane
1,2-DCA	1,2-Dichloroethane
1,2-DCP	1,2-Dichloropropane
A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
af	Acre-foot or Acre-feet
AMEC	AMEC Environment and Infrastructure, Inc.
AMI	Applied Metallics Inc.
AMSL	Above Mean Sea Level
A.R.S.	Arizona Revised Statutes
AWQS	Aquifer Water Quality Standards
bgs	Below ground surface
c-1,2-DCE	*cis*-1,2-Dichloroethene (*aka*, *cis*-1,2-dichloroethylene)
CAP	Central Arizona Project
CM	Controlled Migration
COC(s)	Contaminants of Concern
COPC(s)	Compound(s) of Potential Concern
COM	City of Mesa
Earth Tech	Earth Technologies, Inc.
EPA	United States Environmental Protection Agency
ERA(s)	Early Response Action(s)
FOCIS	Feedback Optimized Continuous Injection System
FS	Feasibility Study
ft/day	feet per day
ft./ft.	feet per foot
GAC	Granular Activated Carbon
ISCO	In-situ Chemical Oxidation
LAU	Lower Alluvial Unit
MACTEC	MACTEC Engineering & Consulting, Inc.
MAU	Middle Alluvial Unit
MON	Monitoring
µg/L	Micrograms per Liter
NA	No Action
NAPL	Non-Aqueous Phase Liquid
PA	Preliminary Assessment
PC	Physical Containment
PCE	Tetrachloroethene (*aka* tetrachloroethylene)
PDB	passive diffusion bag
PR	Plume Remediation
PRAP	Proposed Remedial Action Plan
RI	Remedial Investigation
RO(s)	Remedial Objective(s)
SC	Source Control
SI	Site Investigation
SMWRS	South Mesa WQARF Registry Site
SRP	Salt River Project
SVE	Soil Vapor Extraction
TCE	Trichloroethene (*aka* trichloroethylene)

TOG	Town of Gilbert
UAU	Upper Alluvial Unit
VOC(s)	Volatile Organic Compound(s)
WQARF	Water Quality Assurance Revolving Fund
WRA	Water Resources Associates
WTI	Western Technologies, Inc.

1.0 INTRODUCTION

1.1 PURPOSE OF DOCUMENT

The Arizona Department of Environmental Quality (ADEQ) has retained AMEC Environment & Infrastructure, Inc. (AMEC) to prepare this *Proposed Remedial Action Plan* (PRAP) for the South Mesa Water Quality Assurance Revolving Fund (WQARF) Registry Site (SMWRS) located in Mesa and Gilbert, Arizona (Figure 1). ADEQ is required under Arizona Revised Statutes (A.R.S.) § 49-287.04 to issue a PRAP for the proposed site remedy to the public for review and comment. This PRAP was prepared in accordance with Arizona Administrative Code (A.A.C.) R18-16-408 and summarizes information contained in the following documents:

- *Final Remedial Investigation Report, South Mesa WQARF Registry Site, Mesa, Arizona.* (AMEC, 2013a); and,
- *Final Feasibility Study Report, South Mesa WQARF Registry Site, Mesa, Arizona.* (AMEC, 2014a).

The information contained in the PRAP is drawn from and, in many cases, quotes directly from the above-referenced remedial investigation (RI) and feasibility study (FS) reports without attribution other than noted here.

The purpose of the PRAP is to inform the public regarding the proposed remedy selected from the FS to address impacted groundwater at the SMWRS and satisfy the cleanup goals that include site specific remedial objectives (ROs) (ADEQ, 2013). The PRAP is part of the final remedy selection process under WQARF where public input is solicited on all alternatives and on the rationale for proposing the preferred remedy. New information that ADEQ receives during the public comment period could result in the selection of a final remedy that differs from the proposed remedy. Therefore, the public is encouraged to review and comment on all the alternatives presented in this PRAP. Information on public participation activities associated with this PRAP is provided in Section 11.

1.2 SITE NAME AND LOCATION

The SMWRS is located within the boundaries of the former WQARF South Mesa Phase I Study Area and the former WQARF Phase II-A Hydrogeologic Study Area. The SMWRS is generally bounded on the south and west by railroad tracks, on the east by Cooper/Stapley Road, and on the north by Broadway Road (Figure 1). Based on the most recent groundwater data, the SMWRS contaminant plume encompasses a smaller area within the SMWRS described as extending in a northeast direction from the southwest corner of the former Applied Metallics, Inc. (AMI) facility at 1545 North McQueen Road, Gilbert, to the southwest corner of the Superstition Freeway and Hobson Street. The plume is estimated to be less than 1,000 feet wide. The original WQARF investigation was prompted by the 1983 discovery of volatile organic compound (VOC) contamination in two irrigation wells owned and operated by Salt River Project (SRP) (Wells 28E-0N and 28.5E-1N).

2.0 SITE DESCRIPTION AND HISTORY

In 1987, ADEQ began to investigate the nature and extent of the contamination identified in SRP Wells 28E-0N and 28.5E-1N. The VOCs historically detected in groundwater samples collected within the boundaries of the SMWRS were tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (c-1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1,-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), 1,2-dichloropropane (1,2-DCP) and toluene. However, PCE has been detected in the highest concentrations and is the most widespread VOC.

Based on the Phase I and II Investigations and the Preliminary Assessment/Site Investigation (PA/SI) work conducted by ADEQ, a source of the VOC impact was identified as a drywell located at the former AMI facility at 1545 North McQueen Road, Gilbert, Arizona, located south of the intersection of McQueen Road and Baseline Road (Figure 1). A Site Plan for the former AMI facility is shown on Figure 2. As shown on Figure 2, the property is occupied by an approximate 2,000-square foot building that has a concrete floor slab. The remainder of the property is paved with asphalt and concrete.

A detailed history of site investigations and Early Response Actions (ERAs) completed at the SMWRS is provided in the RI Report (AMEC, 2013a) and the FS Report (AMEC, 2014a). Table 1 provides a summary of the main events and investigative/ERA milestones for the SMWRS.

3.0 SITE CHARACTERISTICS

3.1 Site Geology and Hydrogeology

The SMWRS is located within the Eastern Salt River Valley, which is part of the Basin and Range Physiographic Province as described by Fenneman (1931). The Eastern Salt River Valley is a portion of a structural depression formed by Cenozoic crustal extension and is characterized by broad sloping valleys bounded by generally northwesterly trending mountain ranges. Mountain ranges bounding the Eastern Salt River Valley include the following: San Tan Mountains on the south; Mazatzal and Superstition Mountains on the east; McDowell and Phoenix Mountains on the north; and Phoenix Mountains, Papago Buttes and South Mountains on the west (Laney and Hahn, 1986).

The Eastern Salt River Valley 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 near Chandler, as defined by gravity survey methods (Oppenheimer, 1981) and predominantly consists of consolidated to unconsolidated sands and gravels, with local discontinuous clays and silts.

The land surface of the SMWRS gently slopes to the south, ranging from a surface elevation of approximately 1,230 feet above mean sea level (AMSL) in the north end of the SMWRS to approximately 1,205 feet AMSL in the south end of the SMWRS. The slope gradient is approximately 0.006 feet per foot (ft/ft).

The geologic structure in the East Salt River Valley is predominantly controlled by Basin and Range crustal extension causing widespread northeast-trending normal faulting. Generally, the lithology of the East Salt River Valley is divided into six units. These units can be further subdivided into consolidated bedrock and unconsolidated alluvial basin-fill. The six units are identified from shallowest to deepest as follows:

- Three unconsolidated alluvial basin fill units identified as the Upper Unit, Middle Unit, and Lower Unit (Laney and Hahn, 1986). The Upper Unit, Middle Unit, and Lower Unit are also referred to as the Upper Alluvial Unit (UAU), Middle Alluvial Unit (MAU), and Lower Alluvial Unit (LAU) (US Bureau of Reclamation, 1976, and Brown and Pool, 1989);

- Tertiary sedimentary rocks identified as the Red Unit;

- Tertiary extrusive volcanic rocks; and,

- Crystalline basement Tertiary granitic and Precambrian metamorphic rocks.

Bedrock has not been encountered in wells installed in the area of the SMWRS; therefore, depth to bedrock in the area of the SMWRS is unknown.

3.1.1 Upper Alluvial Unit

The UAU is observed at the surface throughout the area. The thickness of the UAU generally increases in an easterly direction and ranges from 180 feet thick in the west to more than 300 feet thick near the SMWRS (Kleinfelder, 1988). These sediments are unconsolidated alluvial deposits. They also include floodplain, fan and playa deposits (Hammett & Herther, 1995). Grain-size distributions for the Upper Unit indicate a general distribution of 80 percent or more sand and gravel (Kleinfelder, 1988).

The RI activities at the SMWRS have primarily focused on the UAU. In 1996, SRP performed groundwater modeling and a capture zone analysis for SRP Well 28E-0N. SRP reported the following characteristics for the UAU (SRP, 1996):

- Generally varying from unconfined to confined (confining intervals increasing with depth);

- Aquifer thickness is approximately 250 to 350 feet;

- Hydraulic conductivity ranges from 50 to 500 feet/day (ft/day);

- Lateral hydraulic gradient is approximately 0.0002 feet per foot (ft./ft.);

- Vertical hydraulic gradient estimated at approximately 0.09 ft./ft.;

- Saturated aquifer thickness was approximately 222 feet;

- Estimate of porosity (for sand and gravel) is between 10 and 30 per cent (Kleinfelder, 1990); and,

- Calculated (estimated) groundwater velocity is 0.6 to 9.6 ft/day (Kleinfelder, 1990).

Based on the findings of the RI and review of available boring and geophysical logs, the UAU ranges from approximately 250 feet thick at MW-6D to approximately 240 feet thick at MW-12. The UAU/MAU contact is present at an elevation of approximately 960 feet AMSL at the former AMI facility and at an elevation of approximately 985 feet AMSL in the vicinity of MW-12. The piezometric surface in the UAU is relatively flat across the SMWRS. The saturated thickness of the UAU ranges from approximately 130 feet near MW-12 to approximately 150 feet at the AMI facility.

Based on observations during the AMI Source Characterization and review of available boring and geophysical logs, AMEC identified four water bearing zones within the UAU as follows:

- Existing water table to 140 feet below ground surface (bgs) (UAU1);

- 155 feet bgs to 175 feet bgs (UAU2);

- 195 feet bgs to 205 feet bgs (UAU3); and,

- 220 feet bgs to 250 feet bgs (UAU4 and contact with the MAU).

These zones are referred to as zones UAU1, UAU2, UAU3, and UAU4, respectively. Each zone is separated by fine-grained units consisting of clays and silts. The saturated thickness of the UAU is characterized as being predominantly coarse-grained, containing a large percentage of boulder, cobble, gravel and sand sized particles. The fine-grained units were characterized by lower water yields and larger percentages of clay and silt-sized particles, typically between 15 and 50 percent.

Water yield of the hydrologic zones increases with depth. The water yields for zones UAU1 through UAU3 were relatively moderate. However, zone UAU4 yielded large quantities of water and the water appeared to be under pressure. This correlated with the particle size distribution observed for Zone UAU4, specifically a higher percentage of cobbles and boulders and a lower percentage of clay and silt-sized particles. The Rotasonic drilling method was used to drill MW-12 and a continuous core of the UAU was available for observation and logging. The saturated portion of the UAU at MW-12 contained a higher percentage of silt and clay-sized particles as compared to the former AMI facility. Zones UAU1 through UAU3 were distinguishable.

Since 2000 groundwater levels in the UAU have varied, with the lowest levels recorded in July 2004 and the highest levels recorded in April 2012. Since April 2012, groundwater levels have been declining. Groundwater elevation maps from July 2000 to September 2008 are included in the Final RI Report (AMEC, 2013a). Based on collected groundwater elevation data, groundwater generally flowed in a north to northeasterly direction at a relatively shallow gradient of less than 0.0007 feet/feet (ft/ft) up until June 2005. However, from June 2005 to April 2012 groundwater flowed in a southerly direction. The changes in groundwater elevations and flow direction between June 2004 and April 2012 were attributed to local changes in groundwater pumping and recharge. However, on December 20, 2012, regional groundwater was indicated to be once again flowing in a northerly direction. Groundwater has continued to flow in a northerly direction through May 12, 2014 (AMEC, 2014b).

3.1.2 Middle Alluvial Unit

The MAU ranges from 600 to 800 feet thick in the vicinity of the SMWRS. Based on review of available boring logs and geophysical logs, the contact between the UAU and MAU occurs at an average of 250 feet bgs. The contact between the UAU and the MAU is typically characterized by a sharp “kick” to the left on a 16-inch resistivity log, thus indicating a transition from coarse-grained sediments to fine-grained sediments. The MAU consists predominantly of silty and clayey sediments with sandy intervals. Grain-size distributions show a southwesterly trend toward fine-grained materials, with approximately 50 percent sand and gravel northeast of the SMWRS to approximately 35 percent sand and gravel to the southwest of the SMWRS (Kleinfelder, 1988). The MAU is comprised of unconsolidated to moderately consolidated fanglomerate and alluvial deposits that were laid down during the later stages of the Basin and Range disturbance.

Due to the lack of wells and monitoring points within the MAU, there is minimal information regarding the characteristics of the MAU at the SMWRS. Based on the available information, there are only two wells screened entirely in the MAU near and at the SMWRS. Those wells are City of Mesa (COM) Well No. 14 and MW-6D (Figure 1). Based on the available information, the MAU appears to be saturated throughout its entire thickness.

3.1.3 Lower Alluvial Unit

The LAU is encountered in wells in the vicinity of the SMWRS at depths ranging from 800 feet bgs to the west and approximately 1,100 feet bgs to the east. Therefore, it is unlikely that the deepest wells and borings within the boundaries of the SMWRS have penetrated the LAU. The thickness of this unit increases in an easterly direction. However, there is no available data regarding the thickness of the LAU within the area. The LAU is comprised of weakly to highly consolidated fanglomerate and alluvial deposits that were laid down during the first stages of the Basin and Range disturbance. Grain-size distributions within the LAU indicate a trend toward finer-grained materials to the east-southeast, with clastics ranging from approximately 30 percent sand and gravel in the northwest, to 10 percent sand and gravel in the southeast (Kleinfelder, 1988).

3.2 Nature and Extent of Contamination

3.2.1 Source and Release Information

Based on the Phase I and II Investigations and the PA/SI work conducted by ADEQ, a potential source of VOC impacts was identified as a drywell located at the former AMI facility at 1545 North McQueen Road, Gilbert, located south of the intersection of McQueen Road and Baseline Road (Figure 1). A Site Plan for the former AMI facility is shown on Figure 2. As shown on Figure 2, the property is occupied by an approximate 2,000 square-foot building that has a concrete floor slab. The remainder of the property is paved with asphalt and concrete.

AMI leased the property from 1979 to 1990 and operated a facility that produced metal plated electronic parts. Parts were plated with tin, copper, chromium, nickel and zinc. The plating process used acids (chromic, nitric, sulfuric and hydrochloric) and cyanide (copper plating process). Acids (nitric, sulfuric, hydrochloric, acetic and phosphoric) and chlorinated solvents were also used to clean/degrease parts prior to plating. AMI used a chemical called *Perclene*, which contained 99 percent PCE (Water Resources Associates [WRA], 1991).

Wastewater from the facility was reportedly discharged to the on-site drywell (Earth Technologies, Incorporated [Earth Tech], 1995). Based on the Phase I and II Investigations and the PA/SI work conducted by ADEQ, the drywell was identified as the primary source of the VOC impact. Other suspected sources for the PCE and metals impact included: tanks, process equipment, drums which were stored inside and outside the building, and the septic tank and associated leach field located at the west side of the former AMI facility (see Figure 2). The drywell was abandoned in 1991. Since 1990, the office spaces within the 1545 North McQueen Road building have been leased to various commercial tenants.

The volume of PCE discharged to the subsurface by the AMI facility activities is unknown. The ERAs that have been performed at the SMWRS removed approximately 142 gallons of PCE, with all but 48 gallons removed as vapor phase PCE (Earth Tech 1995-1997). Based on the volume removed from the subsurface during the ERAs and the likely fate and transport of PCE, the estimated quantity of PCE discharged by AMI is at least 150-200 gallons.

Compounds of potential concern (COPCs) were selected and separated from naturally occurring or background compounds. Based on the investigations that have been performed at the SMWRS, the hazardous substances that were reportedly released were VOCs, metals, and potentially cyanide. The releases potentially impacted three environmental media: air, vadose zone (unsaturated) soils, and groundwater. All detected compounds were initially considered COPCs. Compounds were then eliminated from further consideration through comparison to background concentrations and regulatory or risk-based criteria. Based on the results of the RI, metals and cyanide were eliminated as COPCs in soil and groundwater. VOCs were not detected in soil samples collected during the RI and were also eliminated as COPCs in soil. However, PCE and TCE were detected in indoor air, soil vapor, and groundwater samples above risk-based action levels. ERAs performed at the former AMI facility removed PCE and TCE as COPCs to indoor air and soil vapor. Therefore, PCE and TCE in groundwater are the only COPCs that remained at the completion of the RI.

TCE was reportedly never used at the former AMI facility. However, TCE is a daughter product of the reductive dechlorination of PCE under anaerobic conditions that include the presence of organic carbon and microorganisms that can mediate this reduction. Natural attenuation studies conducted during the RI did not identify widespread naturally occurring conditions in the subsurface that were favorable for reductive dechlorination of PCE (AMEC, 2013a). However, these conditions would be present in a septic tank and could have contributed to the production of TCE that was detected in indoor air, soil vapor, and groundwater samples collected at the site.

The former AMI facility was not fully characterized until after soil and groundwater ERAs had been performed. Based on the results of the former AMI facility characterization and the chemical properties of PCE, the conceptual site model for contaminant transport is summarized below:

1. PCE was intermittently discharged to the former drywell and septic system during operation of the AMI facility from 1979 to 1990. As indicated above, the TCE detected in indoor air, soil vapor, and groundwater samples at the former AMI facility possibly originated from the septic tank and leach field. PCE was also intermittently leaked or spilled in the process equipment area. The practice of discharging wastes to the drywell and septic system may have been discontinued following the 1983 discovery of PCE in SRP Well 28E-0N.
2. Released PCE, likely in the dissolved phase, migrated both vertically and laterally through the vadose zone. Lateral migration occurred through the sandy intervals present from approximately 40 to 50 feet bgs and from 55 to 62 feet bgs. Based on passive and active soil gas sample analytical data, PCE entering this interval primarily migrated toward the west and southwest, collecting in the southwest corner of the AMI facility. The passive soil gas survey data indicated that PCE did not migrate across McQueen Road.
3. Soil gas data, collected during soil vapor extraction (SVE) system operation and during the former AMI facility characterization, did not indicate the presence of non-aqueous phase liquid (NAPL) PCE in the vadose zone.
4. PCE penetrated the fine-grained intervals present from approximately 40 to 50 feet bgs and from 55 to 62 feet bgs and migrated into the underlying coarse sediments. Due to the low retentive capacity of the coarser sediments, the PCE migrated vertically towards the water table, which was present at a depth greater than 200 feet bgs at the time the PCE discharges occurred. The measured depth to groundwater in SRP Well 28E-0N on January 11, 1983 was 274.2 feet (SRP, 1996).
5. As the PCE migrated vertically, PCE was possibly retained on and within the fine-grained intervals identified at approximately 140 feet, 175 feet, and 205 feet bgs. Based on the fact that the PCE impact in the groundwater extends to Zone UAU4, PCE penetrated the three clay zones. It is possible that PCE transport in the vadose zone occurred as an aqueous solution and/or as contaminated soil vapor.
6. Following the discovery of PCE in samples collected from SRP wells 28E-0N and 28.5E-1N in 1983, pumping of groundwater in the area was minimized or discontinued. After 1983, water levels at the AMI facility began to rise, eventually encountering residual PCE contaminated media in Zones UAU-1 through UAU-4.
7. From 1993 to 1997, SRP placed well 28E-0N back on-line and installed a wellhead treatment system to decrease PCE concentrations in water transmitted to their irrigation canal system below the risk-based level of 33 micrograms per liter (µg/L). The pumping of SRP Well 28E-0N over this time period removed an estimated 650 pounds of dissolved PCE from the groundwater.
8. From 1995 to 1997, the SVE system installed as an ERA removed approximately 1,107 pounds of VOCs from the vadose zone near the former drywell. Based on the results of the passive soil vapor survey and analytical results for soil gas samples collected from boring LB-3, the SVE system effectively removed a majority of the PCE from this area, reducing the potential for on-going groundwater impacts.
9. Based on passive and active soil gas data collected in 2001, an extensive vapor plume was present beneath the 1545 North McQueen Road building, extending from the

former process equipment area to the southwest corner of the AMI facility. SVE system operation from September 2004 to October 2008 removed more than 168 pounds of PCE from the ground.

3.2.2 Groundwater Impact and Distribution

3.2.2.1 Upper Alluvial Unit

With the identified source of the dissolved PCE being the former AMI facility, the distribution of the dissolved PCE has been influenced by pumping of SRP Wells 28E-0N and 28.5E-1N and the regional groundwater flow direction. The dissolved PCE plume has generally followed a northeast-southwest line that runs from the former AMI facility to SRP Well 28.5E-1N. Therefore, nested BARCAD wells MW-12-159 (UAU1), MW-12-183 (UAU2), MW-12-217 (UAU3), and MW-12-238 (UAU4) were installed north of SRP Well 28.5E-1N and nested BARCAD wells MW-14-130 (UAU1), MW-14-163 (UAU2), MW-14-186 (UAU3), and MW-14-215 (UAU4) were installed south of the former AMI facility. PCE has not been detected in groundwater samples collected from these wells; therefore, these nested wells define the extent of the dissolved PCE plume on the north and south of the study area. PCE has also not been detected in samples collected from wells MW-1S/MW-1D and MW-3S on the west and in samples collected from Wells MW-2S and MW-4D on the east; therefore, these wells define the extent of the dissolved PCE plume on the west and east. PCE has been detected in groundwater samples collected from Zone UAU4 wells. Therefore, the PCE impact extended vertically to Zone UAU4. As indicated by the highest PCE concentrations, a majority of the dissolved PCE mass was present in Zones UAU2 and UAU3. Groundwater in Zone UAU1 likely became impacted when rising groundwater encountered PCE vapors.

Dissolved PCE concentrations in samples collected from monitoring wells have not indicated the presence of NAPL PCE and PCE has not been detected in soil samples collected below the former AMI facility. However, vapor-phase PCE has been present and a majority of the PCE mass removed by the ERAs has been in the vapor phase. Therefore, the dissolved PCE in the groundwater probably originated from the rising groundwater encountering PCE vapors within the hydrologic zones. Groundwater in Zone UAU1 would have only been impacted after 1997 as the water levels rose into this zone. The PCE released was sufficient to create a dissolved PCE plume in the UAU that at one time extended nearly two miles and was approximately 0.5 miles wide. Since groundwater monitoring activities associated with the RI started in 1991, the maximum PCE concentration of 300 µg/L was detected in a sample collected from former AMI facility well MW-AM-8S on January 11, 1994. Since that time, PCE concentrations across the area have been decreasing. The most recent post-RI groundwater monitoring events performed in December 2012, September 2013, and March 2014 have indicated a much smaller dissolved PCE plume that is apparently limited to the region surrounding the former AMI facility, with a maximum PCE concentration in groundwater of 11 µg/L. Figure 3 depicts the approximate distribution of the PCE plume to the Arizona Aquifer Water Quality Standard (AWQS) of 5.0 µg/L based on the March 2014 data. Recent decreases in groundwater PCE concentrations are likely due to source removal from completed ERAs and ongoing natural attenuation mechanisms.

3.2.2.2 Middle Alluvial Unit

The MAU is the primary drinking water supply aquifer in the area; however, due to the availability of surface water supplies such as SRP and the Central Arizona Project (CAP), it is currently not being extensively used. The MAU has not been extensively studied at the SMWRS. Only one monitoring well, MW-6D, penetrates the MAU and it is only screened in the upper 50 feet of the MAU. SRP Wells 28E-0N and 28.5E-1N penetrate the MAU; however, they screen across the UAU/MAU contact. COM Well No. 14 is screened entirely in the MAU and is a supplemental drinking water supply well for the COM.

There are currently minimal data regarding the nature and extent of PCE groundwater impact in the MAU below the SMWRS. As indicated previously, the deepest water level measured at the SMWRS was 274.2 feet bgs in 1983, which is about 30 feet below the UAU/MAU contact. The PCE concentration detected in the discharge sample collected from SRP Well 28E-0N at that time was 1.8 µg/L. SRP Well 28E-0N is screened to 373 feet bgs; therefore, this reported concentration was influenced by mixing. PCE was also detected above the AWQS of 5.0 µg/L at SRP Well 28.5E-1N, which was screened from 190-700 feet bgs before being backfilled to 549 feet bgs in 1997. However, the detection does indicate that PCE had migrated to the upper portion of the MAU. PCE would have been drawn deeper into the MAU by the pumping of the SRP wells; however, the dissolved PCE would have been pumped and removed from the aquifer. Depth-specific groundwater sampling has been performed in SRP Well 28E-0N to obtain a vertical contaminant profile; by Kleinfelder in January 1990 as the pump was running (Kleinfelder 1992), and by AMEC in July 2002 using passive diffusion bag (PDB) samplers. The results are summarized in the RI report and indicate that PCE was present at high concentrations prior to conducting the ERA and were subsequently reduced to concentrations at the AWQS of 5.0 g/L.

The Kleinfelder results demonstrate the drawdown, mixing, and extraction of PCE under dynamic conditions. Based on this, SRP Well 28E-0N was utilized as an ERA to remove PCE mass.

COM Well No. 14 is located in the north portion of the study area and outside the historic and current PCE plume boundaries in the UAU (see Figure 1 for location). COM Well No. 14 is the only production well in the study area screened entirely in the MAU. SRP Well 28.5E-1N was backfilled to 549 feet bgs in 1997 to protect the water supply for COM Well No. 14. COM Well No. 14 was last sampled in October 2013 and the results indicated that PCE is not present at reportable concentrations in the extracted groundwater.

4.0 SUMMARY OF SITE RISKS

4.1 Soil and Soil Vapor

The risks to human health are an important consideration in selecting and evaluating potential remedial alternatives for a site and proposing the preferred remedy. The Human Health Screening presented in the RI Report evaluated human exposure to soil, soil vapor, indoor air, and groundwater impacted by the releases of PCE at the SMWRS (AMEC, 2013a). The only compounds that were found to exceed risk-based cleanup levels were PCE and TCE. PCE and TCE were not detected in soil samples collected at the former AMI facility above risk-based soil cleanup levels. Therefore, the direct contact with soil exposure pathway was evaluated as incomplete. However, vapor phase PCE and TCE were detected in the soil, which represented a source of PCE and TCE to groundwater, a source of PCE and TCE to indoor air, and a potential inhalation exposure pathway to site workers that may dig excavations at the former AMI facility. An ERA involving SVE was performed at the former AMI facility from 1995 to 1998, over which approximately 1,107 lbs of VOCs were extracted from the subsurface. The SVE system was shut down in 1998 due to low and asymptotic VOC mass extraction rates and it was concluded that vadose zone remediation at the former AMI facility was completed.

As part of source characterization, a soil vapor assessment was performed. The first phase, involving collection of passive soil gas samples, identified an area of elevated soil gas at the southwest corner of the former AMI facility and at an area next to the septic tank. The second phase involved the collection of depth-specific soil and soil vapor samples during installation of nested monitoring wells. PCE and TCE were not detected in the soil samples; however, elevated PCE and TCE concentrations were detected in the soil vapor samples. Indoor air quality samples were then subsequently collected to evaluate the potential risk for intrusion of PCE and TCE vapors into the building. The indoor air quality sampling indicated that PCE and TCE vapors were migrating into the building and represented a potential health risk to workers. ADEQ subsequently performed SVE in this area to mitigate the vapor intrusion and remove a potential source of groundwater impact. The SVE system operated from 2004 to 2007 and removed more than 168 lbs of PCE from the subsurface. Post-SVE indoor air quality samples confirmed that PCE and TCE vapors in the building had been decreased below risk-based levels. A second indoor quality sampling event was conducted on April 11, 2012 and confirmed that PCE and TCE levels remained below risk-based levels (AMEC, 2013b). On this basis, the vapor intrusion exposure pathway is incomplete.

4.2 Groundwater

SMWRS groundwater in the UAU is currently not used as a drinking water supply and has only been used for irrigation purposes by SRP. In 1991, SRP performed a risk assessment and calculated a risk-based PCE action level of 33 µg/L for their water uses (Malcolm-Pirnie, 1991). At that time, PCE exceeded this level in water samples collected from the discharge from SRP Well 28E-0N. A wellhead treatment system was subsequently installed in 1993 and the well was pumped from 1994 to 1997. The wellhead treatment system was removed in 1996 when PCE concentrations in the pump discharge were consistently below 33 µg/L. In 1997, SRP no longer needed the well and discontinued pumping operations. During the time that the well was pumped, an estimated 650 pounds of PCE were removed from the groundwater. Since 1997, SRP has not consistently pumped wells 28E-0N and 28.5E-1N and, until recently as mentioned above, has only pumped these wells on a periodic basis to collect groundwater samples. SRP well 28.5E-1N has been recently pumped for irrigation purposes totaling approximately 349.33 acre-feet (af) in June and July 2012 and 0.34 af in November and December 2012. Since 1992 PCE concentrations in the discharges from these wells have not exceeded 33 µg/L. Analytical data for groundwater samples collected from SRP well 28E-0N since 2003 have been less than the AWQSs for all of the analytes tested. Additionally, PCE has not been detected in excess of 33 µg/L in groundwater samples collected from the SMWRS UAU monitoring wells since 2002; the highest concentration observed has been 18 µg/L. The maximum PCE concentration detected in the December 2012 samples collected from the SMWRS monitoring wells was 17 µg/L (MW11-200). Therefore, the data indicate that the risk-based PCE action level for SRP water use has been achieved at the SMWRS for current SRP groundwater use. However, the data indicate that PCE concentrations in the UAU still exceed the AWQS in groundwater monitor wells at the former AMI facility. SRP has indicated that they may start pumping their wells in the area, which have not been pumped consistently since 1997. Considering that the groundwater samples collected from the SMWRS wells since 1997 have been collected under static conditions, pumping of the wells may result in changes in the PCE concentrations in monitoring well samples and the discharges from the SRP wells.

COM Well No. 14 is the only drinking water well currently present within the boundaries of the SMWRS and is screened entirely in the MAU. As indicated in Section 3.2.2.2, PCE was not detected above the reporting limit of 0.05 µg/L in a groundwater sample collected from COM Well No. 14 on October 25, 2012. COM Well No. 14 is in compliance with drinking water well standards and has been issued a New Drinking Water Source Approval by Maricopa County Environmental Services Department.

5.0 REMEDIAL OBJECTIVES SUMMARY

The Final Remedial Objectives Report dated February 15, 2013 and prepared by ADEQ presents the ROs for the Site (ADEQ, 2013). The ROs are based on the current and reasonably foreseeable uses of land and the current and reasonably foreseeable beneficial uses of waters of the state identified in the SMWRS Land and Water Use Report, dated June 5, 2007 (MACTEC, 2007). ROs were not established for every use identified in the Land and Water Use Report. The determination as to whether a use was addressed was based on information gathered during the public involvement process, limitations of WQARF, and whether the use is reasonably foreseeable.

A public meeting was held on July 20, 2011 to discuss the Draft RI Report and the proposed ROs. Reponses from the public regarding the proposed ROs were received by ADEQ. ADEQ made the Proposed RO Report available for public comment on February 12, 2013 during a meeting of the Community Advisory Board. No comments were received from the public and the Final RO Report dated February 15, 2013 is included as Appendix B to the Final RI Report (AMEC, 2013a).

5.1 Remedial Objectives for Land Use

The RO Report (ADEQ 2013), the RI Report (AMEC 2013a), and FS Report (AMEC 2014a) provide detailed descriptions of the land use ROs. The SMWRS is located in the COM and Town of Gilbert (TOG) and is bounded approximately by Broadway Road to the north, Cooper/Stapley Drive to the east, and the railroad south of Baseline Road to the south and west. Generally, the SMWRS is located in a mixed urban, commercial and residential area. Based on the current zoning maps provided by the COM and the TOG, the area of the SMWRS is zoned as R-3 and C-2, which represent transitional and multi-family residential and general commercial zoning, respectively. The land use ROs were identified only for the former AMI facility area and are listed as follows:

1. Protecting against the loss or impairment of each use;
2. Restoring, replacing, or otherwise providing for each use;

3. Determining when action is needed; and,
4. How long action is needed to protect or provide for the use.

Based on human health risk screening, the exposure pathways that influence land use ROs at the SMWRS are direct contact with impacted soil and intrusion of PCE vapors into the on-site building at the former AMI facility (AMEC, 2013a). ERAs using SVE have been conducted at the former AMI facility and addressed both the concentrations of contaminants in soil and soil vapor to the extent that exposure pathways have been mitigated. On this basis, the ROs for land use have been achieved. Therefore, no further development of remedies for land use ROs is necessary.

5.2 Remedial Objectives for Groundwater Use

The Water Use portion of the Land and Water Use Study Report (MACTEC 2007) is an inclusive summary of information gathered from discussions with SMWRS water providers, municipalities, well owners, and persons holding water rights. The water providers within the SMWRS are the COM, TOG, and the SRP. The RO Report (ADEQ 2013), the RI Report (AMEC 2013a), and FS Report (AMEC 2014a) provide detailed descriptions of the ROs. In summary, the ROs for groundwater use are limited to SRP water uses and municipal use of the groundwater supplies in the MAU.

6.0 SCOPE AND ROLE OF REMEDIAL ACTION

6.1 Overall Cleanup Goal

The overall cleanup goal is to address groundwater contamination in the UAU and possibly in the MAU associated with the SMWRS to:

- Satisfy ROs as discussed in Section 6.0
- In accordance with A.R.S. §49-282.06A:
  - Assure protection of public health and welfare and the environment;
  - Provide for, as practicable, the control, management or cleanup of the hazardous substances in order to allow the maximum beneficial use of the water of the state; and,
  - Be reasonable, necessary, cost-effective and technically feasible.

The UAU at the SMWRS is designated as a potential drinking water supply aquifer. Therefore, before closure of the SMWRS can be considered, it must be demonstrated using groundwater monitoring that dissolved PCE in the UAU has been remediated below the AWQS of 5.0 µg/L.

6.2 Scope of Remedial Action

The overall remedial strategy is to: a) allow for continued definition and monitoring of the UAU plume; and, b) to provide for SRP to use groundwater at the Site or provide a replacement water source. The proposed remedy for the UAU plume (Section 9.0) will be the final action for the SMWRS to reduce the toxicity, mobility, and/or volume of PCE found in the UAU that will satisfy the cleanup goals presented in Section 6.1. The UAU is the most significant water-bearing zone in the vicinity of the SMWRS; however, the MAU is the primary drinking water supply aquifer in the area. The proposed remedy incorporates one or more remediation technologies or methodologies as provided in A.A.C. Rl8-16-407(F).

The remaining sections of this PRAP describe the risks associated with the Contaminants of Concern (COCs) in groundwater, the ROs specific to the UAU plume, and the remedial alternatives evaluation process that lead to the selection of the proposed remedy. Section 10 describes the avenues by which this PRAP will be issued for public comments.

7.0 SUMMARY OF REMEDIAL ALTERNATIVES

The FS Report (AMEC, 2014a) presents the evaluation process used to develop and select remedial strategies and alternatives to achieve ROs for the SMWRS. This section summarizes the process used to develop a reference remedy and two alternative remedies for evaluation and documents the remedies described in the FS.

Remedial strategies considered in the development of remedial alternatives per A.C.C R18-16-407F are as follows:

1. Plume remediation (PR): a strategy to achieve water quality standards for contaminants of concern in waters of the state throughout the site
2. Physical containment (PC): a strategy to contain contaminants within definite boundaries
3. Controlled migration (CM): a strategy to control the direction or rate of migration but not necessarily to contain migration of contaminants
4. Source control (SC): a strategy to eliminate or mitigate a continuing source of contamination
5. Monitoring (MON): a strategy to observe and evaluate the contamination at the site through the collection of data
6. No action (NA): a strategy that consists of no action at a site

In general, multiple remedial strategies are combined to address ROs and these remedies are evaluated using prescribed criteria in the FS. Due to the history of proactive interim remediation at the SMWRS, implemented Early Response Actions conducted to date have significantly reduced contaminant concentrations in groundwater at the SMWRS, effectively addressed source control at the former AMI facility, and by default were incorporated into all remedial alternatives evaluated in the FS. However, they have not achieved ROs protecting groundwater use. Since contamination is currently confined to the UAU and this aquifer does not serve as a source of drinking water to the COM and TOG (the municipal wells in the vicinity of the current SMWRS groundwater plume are screened in the MAU), the current primary use that must be considered to achieve ROs at this time is SRP's right to extract and use groundwater from wells 28E-0N and 28.5-1N for irrigation purposes.

The objective is to close the SMWRS; however, leaving PCE in the groundwater above the AWQS of 5.0 µg/L requires that the aquifer be designated a non-drinking water aquifer. Though not currently utilized as a drinking water supply, the UAU at the SMWRS is designated as a potential drinking water supply. Therefore, ADEQ cannot close the SMWRS until PCE groundwater concentrations in the groundwater are below the AWQS of 5.0 µg/L. However, water use criteria can be used to select the final remedy. Since SRP's water quality criterion for this use is their risk-based action level (i.e., 33 µg/L of PCE), this concentration is the current water quality criterion for remedial action at the SMWRS. This remedial action criterion will be changed to 5.0 µg/L if/when SRP changes groundwater use for their wells to drinking water. PCE has not been detected above the SRP risk-based action level in groundwater samples collected from UAU wells since June 2004 (a total of 12 sampling events). Although this suggests that use of the UAU by SRP is currently protected, the effect of pumping SRP wells on the nature and extent of the groundwater plume is unknown and must be addressed to achieve groundwater ROs. Remedy development for the site is based on addressing this issue and protecting both municipal and SRP groundwater use.

7.1 Reference Remedy

The reference remedy involves monitoring of groundwater. SRP has indicated that they intend to resume full-time or periodic pumping of wells 28E-0N and 28.5E-1N and use the water for irrigation. The previous pumping of the SRP wells has shown that they are capable of removing dissolved PCE mass. Therefore, operation of these wells may facilitate removing the remaining PCE mass to a level where PCE concentrations are below the AWQS of 5.0 µg/L without initiating additional remedial approaches. As long as PCE concentrations remain below SRP acceptable levels, which will not require implementation of wellhead treatment, this is a feasible and cost effective approach to achieve the ROs and closure of the SMWRS. Monitoring will be used to ensure that PCE concentrations do not exceed concentrations that restrict SRP water use. This will also monitor for migration of the plume to the northeast if SRP Well 28.5E-1N is also pumped. Since there are no monitoring wells screened entirely in the MAU in the area, monitoring of groundwater extracted from appropriate COM and TOG municipal wells would be conducted to evaluate the potential future impact of the SMWRS plume on these MAU water supplies. If PCE is detected at SRP wells at concentrations that would restrict water use, then ADEQ would institute contingencies such as wellhead treatment to allow unrestricted water use by SRP.

The primary question for the reference remedy is how long will be required for the AWQS of 5.0 µg/L for PCE to be achieved under different pumping scenarios? Based on calculation provided in the FS, a minimum of four years may be sufficient to achieve the remedial goals if full time pumping of wells by SRP and a maximum of eight years may be sufficient to achieve the remedial goals if half year pumping of wells by SRP. The remedial cost estimate is based on a five year program of semi-annual groundwater monitoring and reporting with closure considered after Year 5 if the remedial goals have been achieved. Monitoring may continue after Year 5 if PCE and/or TCE concentrations remain greater than the AWQS of 5 µg/L. Based on the current concentrations and dilution effects of pumping the well, it is unlikely that PCE will exceed the

AWQS of 5.0 µg/L at the wellhead for SRP Well 28E-0N. Additionally, due to the current position of the plume and PCE concentrations, it is unlikely that PCE would exceed 5.0 µg/L at the wellhead for SRP Well 28.5E-1N, even if SRP Well 28E-0N is not pumped. In the event PCE concentrations exceed SRP action levels at the wellheads, then wellhead treatment may be installed as a contingency.

7.2 More Aggressive Remedy

A more aggressive alternative to the reference remedy would include all the remedial strategies of the reference remedy (i.e., PR and MON) plus in-situ chemical oxidation (ISCO) treatment of the impacted groundwater at the former AMI facility. This is identified as a more aggressive alternative due to the requirement to install deep injection points and an injection system. ISCO, if properly delivered to the impacted media, has been proven to be a successful groundwater remedy. The EN Rx reagent, which is a catalyzed hydrogen peroxide based reagent, has been selected for the treatment. Based on the concentrations and extent of PCE at the former AMI facility, a limited EN Rx injection is expected to achieve the AWQS of 5.0 µg/L for PCE in the groundwater below the former AMI facility in one year. However, the five year monitoring program proposed for the reference remedy would still be included to evaluate any changes in PCE concentrations outside the former AMI facility or at the SRP wells. Wellhead treatment may still be implemented at SRP well 28E-0N as a contingency.

7.3 Less Aggressive Remedy

A less aggressive alternative to the reference remedy would include obtaining an alternative source of water to replace water lost from the SRP wells for as long as SRP cannot use the groundwater or abandonment and replacement of the SRP wells at the well sites if an alternate source cannot be obtained or maintained. This alternative is considered less aggressive because of the reduction in proposed remedial activities. However, this alternative may be cost restrictive if an alternate source cannot be obtained or becomes unavailable with time and replacement wells are needed at the well sites.

8.0 REMEDY COMPARISON

In accordance with A.A.C. R18-16-407 (H) (2-3), each remedial alternative was compared using the following:

1. An evaluation of consistency with the water management plans of affected water providers and the general land use plans of local governments with land use jurisdiction.
2. An evaluation of comparison criteria, including:

- Practicability of the alternative, including its feasibility, short and long term effectiveness, and reliability;

- Risk, including fate and transport of contaminants, assessment of current and future land and resource use, exposure pathways and duration of exposure, protection of health and biota during and after implementation of remedial action, and residual risk in aquifer at end of remediation;

- Cost of remedial alternative, including capital, operating, maintenance, life cycle, and transactional costs;

- Benefit or value of remediation, including lowered risk, reduction in concentration or volume, decreased liability, acceptance by public, aesthetics, enhancement of future uses, and improvement to local economics; and,

- Discussion of comparison criteria in relation to each other.

The proposed remedy must meet the requirements provided in A.R.S §49-282.06 (A) as listed below:

- Assure the protection of public health and welfare and the environment;

- To the extent practicable, provide for the control, management, or cleanup of the hazardous substances so as to allow for the maximum beneficial use of the waters of the state; and,

- Be reasonable, necessary, cost effective, and technically feasible.

8.1 Evaluation of the Reference Remedy

The reference remedy requires monitoring of monitoring wells and the SRP wells if/when pumped during a five year groundwater monitoring period. This approach is intended to monitor PCE migration and attenuation while possibly removing additional dissolved contaminant mass from the UAU and will protect the SRP water use in the area. Over this five year period, groundwater sampling will be performed twice annually, in January and July of each year at monitoring wells and quarterly at SRP wells each year when the wells are pumped. This will capture water quality data during winter and summer pumping schedules. Water levels will also be measured quarterly to evaluate seasonal changes in groundwater flow direction. This should be a sufficient time period to evaluate changes in groundwater concentrations in the UAU if/when the SRP wells are pumping. Groundwater samples will be collected from SRP wells during pumping pending access agreements and scheduling with SRP. In the event COM Well No. 14 is pumped, water samples should be collected and analyzed for VOCs. ADEQ will request these data from the COM. During this five year monitoring period, if PCE concentrations in the samples from the SRP wells do not exceed the risk-based PCE concentration of 33 µg/L for irrigation use (or 5.0 µg/L if SRP changes the water use designation to drinking water) and the samples collected from COM Well No. 14 do not exceed the drinking water standard of 5.0 µg/L, then groundwater monitoring will be continued until PCE concentrations in all groundwater monitor wells stabilize at a concentration less than the AWQS of 5.0 µg/L. This alternative protects water uses in the area, achieves the ROs, and meets the above listed requirements.

For cost estimation purposes, the monitoring program will include quarterly water level monitoring and semiannual collection of groundwater samples from site monitoring wells. Groundwater samples will also be collected quarterly by ADEQ or SRP from SRP wells 28E-0N and 28.5E-1N. The groundwater samples will be analyzed for VOCs using United States Environmental Protection Agency (EPA) Method 8260B. Following the Spring groundwater monitoring event each year, an annual groundwater monitoring report will be prepared.

Following the fifth year, a Periodic Review Report will be prepared. If PCE concentrations have been below the AWQS of 5.0 µg/L in the samples collected from all wells for at least two consecutive sampling events, including the final sampling event, then a recommendation for closure of the site will be made. The estimated cost for the first year monitoring program is $27,300. Applying a three percent annual escalation and the cost for the Periodic Review, the total estimated cost for a five year program is $150,000. The estimated cost for post-closure well abandonment is $105,000. Groundwater monitoring performed beyond the five year period will cost an estimated $27,300 per year.

As a contingency to this remedy, in the event PCE concentrations in water samples collected from the SRP wells exceeds the risk-based PCE concentration of 33 µg/L for irrigation use or 5.0 µg/L if SRP changes the water use designation to drinking water, a wellhead treatment program will be implemented. Groundwater monitoring will continue while wellhead treatment is implemented at SRP wells (as required) using a series of two granular activated carbon (GAC) vessels per well to treat SRP well effluent. The wellhead treatment system(s) would be operated until PCE concentrations in samples collected from the pump discharge are below 33 µg/L or 5.0 µg/L (depending on use) for four consecutive sampling events. The estimated cost of supplying vessels and GAC for wellhead treatment is on the order of $1,240,000. The estimated operating and maintenance cost for wellhead treatment (based on assumed annual changeouts of one vessel per treatment system per year) is approximately $357,500 over the five year period. System decommissioning cost is estimated to be $25,000.

8.2 More Aggressive Remedy

The more aggressive remedy is the reference remedy plus limited ISCO at the former AMI facility as PR including wellhead treatment at SRP wells, if necessary, as a contingency. This is considered more aggressive due to the requirement for installation of injection wells and construction of the remediation system. For cost estimation purposes, the EN Rx Feedback Optimized Continuous Injection System (FOCIS) is assumed to deliver the EN Rx reagent, which is a sodium catalyzed hydrogen peroxide reagent. This reagent provides the high oxidation potential to safely breakdown chlorinated solvents into inert compounds without generation of more hazardous daughter products. Unlike other chemical oxidants used for chlorinated solvents, such as permanganate, EN Rx is relative safe to mix and deliver.

A supply of water will be required to operate the system. Electrical power to operate the controls can be provided by a solar panel and battery. For the limited treatment at the former AMI facility, EN Rx has provided a cost estimate of $100,000 for the equipment and chemicals. The injection would be conducted over a period of six months; however, the chemicals remain active in the subsurface for up to three months after the injection is completed. A total of four nested (4 interval) injector wells would be installed using the sonic drilling method, with the deepest interval being installed to 230 feet bgs. Due to this depth, a total of five days is anticipated for installation of each well. Due to the limited space and size of the drilling platform, this will cause disruptions for the businesses that currently occupy the property. The total estimated cost to install, operate, and decommission the ISCO system is $300,000.

The more aggressive remedy also includes monitoring operation of the SRP wells over the five year period presented by the reference remedy. Wellhead treatment at SRP wells would be conducted, if necessary, as a contingency.

This remedy is considered reasonable and cost effective. However, due to disruptions to businesses and site access during construction, it would be difficult to implement.

8.3 Less Aggressive Remedy

The less aggressive remedy is intended to minimize exposure to impacted groundwater within the UAU due to pumping of SRP wells. An alternative source of water may be available to replace groundwater lost because of the contamination in the groundwater. Wells 28.5E-1N and 28E-0N would be abandoned in a manner that seals the portions of the wells that screen across the UAU/MAU contact. If an alternate source of water is not available, the wells would be replaced at the same location as the abandoned wells and screened entirely within the MAU. This contingency is considered because of the lack of water available via the CAP and the uncertainty of other potential sources. For cost estimation purposes, ADEQ has based water needs for SRP well 28E-0N on the volume pumped during the ERA and for SRP well 28.5E-1N using the volume reported during June and July 2012. The estimated volume of water needed was then multiplied by fees presented on the CAP website for an estimate of $48.9 million for both wells for a period of ten years (CAP fees are used to calculate costs to understand the possible expense even though CAP water will not be available). Note that another source of water at a reduced rate may be available and will be pursued. Alternatively, for cost estimation purposes, the replacement wells would be installed to a depth of 880 feet bgs. The well casing would be a minimum of 20 inches in diameter and would be screened from approximately 400 to 880 feet bgs, which is similar to the construction of the replacement well for COM-14. The estimated cost to abandon and replace the SRP wells is $1,500,000 each. The UAU in the area is designated as a potential drinking water supply; therefore, PCE must be remediated below the AWQS of 5.0 µg/L for closure to be considered. Currently, PCE only exceeds the AWQS of 5.0 µg/L in wells located at the former AMI facility. Several years of monitoring may still be required to determine that the remedial goals have been achieved and the SMWRS is eligible for closure.

8.4 Summary

The three alternatives evaluated will meet the ROs, with the least aggressive alternative meeting the ROs in the greatest amount of time and the most aggressive alternative meeting the ROs in the least amount of time. The remedial alternatives have been evaluated in relation to each other in Table 4. The evaluation per assessment factor is summarized below:

- **Practicability.** The reference remedy and more aggressive alternative are considered feasible and will provide both short-term and long-term effectiveness. Implementation of the more aggressive remedy is more difficult due to access limitations. The less aggressive alternative is considered the least practicable of the three alternatives due to logistics and unknown costs associated with obtaining an alternative water source or replacing the SRP wells.

- **Risk.** All three alternatives provide overall protection of human health and the environment. However, the reference remedy and most aggressive remedy remove dissolved PCE from the UAU.

- **Cost.** The reference remedy is the least costly of the three alternatives. The less aggressive alternative is possibly the most costly alternative.

- **Benefit.** Both the reference and more aggressive remedies provide the greatest benefit of the three in that they actively remove contamination from the aquifer while controlling migration. The most aggressive remedy has the added benefit of removing the contamination more efficiently and quickly; however, the reference remedy is more cost effective and easier to implement.

All three alternatives will meet the water use plans of SRP, COM, and TOG, which were used to establish the ROs.

9.0 PROPOSED REMEDY

Based on the results the FS, the reference remedy was recommended as the final remedy. If PCE concentrations do not exceed 5.0 µg/L during the five year monitoring period, then a recommendation will be made for closure of the SMWRS. If PCE concentrations in the pump discharge for SRP well 28E-0N and/or SRP well 28.5E-1N exceed 33 µg/L (or 5.0 µg/L if the use designation changes to drinking water during the five year monitoring period), then wellhead treatment may be installed on the wells as a contingency.

The FS demonstrated that the reference remedy will achieve the ROs and described how the comparison criteria were considered. The reference remedy also meets the requirements of A.R.S §49-282.06 as follows:

Requirement	Does remedy meet this requirement and how?
Assures the protection of public health and welfare of the environment.	Yes. The only user of the UAU in the area is SRP and the water is currently not used for drinking water purposes. PCE concentrations are currently below the risk-based level of 33 µg/L established by SRP for the intended use of the water. COM Well No. 14 is not impacted with PCE above drinking water standards.
Provides for the control, management, or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state.	Yes. PCE concentrations are currently below the risk-based level of 33 µg/L established by SRP for the intended use of the water. The recommended five year monitoring program is intended to confirm that this does not change.
Be reasonable, necessary, cost effective, and technically feasible.	Yes. The reference remedy is considered both reasonable and necessary and is considered the least costly of the three evaluated remedial alternatives. The reference remedy is technically feasible because existing wells will be used for the monitoring program.

Requirement	Does remedy meet this requirement and how?
Must be fully integrated with the results of the RI and shall include an alternative screening step to select a reasonable number of alternatives in a manner consistent with the rules and procedures adopted pursuant to A.R.S §49-282.06	Yes. The Conceptual Site Model is based on the results of the RI. There is also data presented in the FS that was collected after the RI was completed.

10.0 COMMUNITY PARTICIPATION

10.1 Public Comment Period of PRAP

The public comment period will be no less than 30 days. ADEQ will accept written comments on this PRAP that are postmarked within the comment period and submitted to:

Arizona Department of Environmental Quality
ATTN: Kevin Snyder, Project Manager
1110 West Washington Street, 4415B-1
Phoenix, Arizona 85007

10.2 Public Meetings

ADEQ will explain the PRAP and all of the alternatives presented in the FS in a SMWRS Community Advisory Board meeting. Oral and written comments will also be accepted at the meeting. The meeting will be held approximately one week prior to the end of the comment period.

10.3 Administrative Record

Interested parties can review the PRAP and other Site documents and the complete official Site file at the ADEQ Main Office located at 1110 West Washington Street, Phoenix, Arizona. With 24-hour notice, an appointment to review related documentation is available Monday through Friday from 8:30 a.m. to 4:30 p.m., at the ADEQ Records Management Center. Please contact (602) 771-4380 or (800) 234-5677 to schedule an appointment to review these documents.

10.4 Other Contact Information

Name/Title/Address	Phone/Fax	E-mail
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11.0 REFERENCES

ADEQ, 2013. *Final Remedial Objectives Report, South Mesa Area WQARF Registry Site, Mesa and Gilbert, Arizona.* February 15, 2013.

AMEC, 2013a. *Final Remedial Investigation Report, South Mesa WQARF Registry Site, Mesa, Arizona.* June 7, 2013.

AMEC, 2013b. *Groundwater Monitoring Report, December 2012 Sampling Event, South Mesa WQARF Registry Site, Mesa, Arizona.* May 23, 2013.

AMEC, 2014a. *Final Feasibility Study Report, South Mesa WQARF Registry Site, Mesa and Gilbert, Arizona.* April 4, 2014.

AMEC, 2014b. *Groundwater Monitoring Report, First Half 2014, South Mesa WQARF Registry Site, Mesa, Arizona.* June 26, 2014.

Brown, James G. and Poole, D.R, 1989. *"Hydrogeology of the Western part of the Salt River Valley Area, Maricopa and Pinal Counties, Arizona, U.S. Geologic Survey Water Resources Investigation Report 88-4202",*1989.

Earth Tech, 1995. *Design Report and Interim Remediation System, Applied Metallics, Inc. 1545 North McQueen Road, Gilbert, Arizona, - South Mesa Water Quality Assurance Revolving Fund Area,* August 31, 1995. Not referenced in text

Earth Tech, 1995-1997. Periodic SVE System Operation and Maintenance Reports

Hammett, B.A and Herther, R.L, 1995. *"Maps Showing Groundwater Conditions in the Phoenix Active Management Area, Maricopa, Pinal, and Yavapai Counties, Arizona – 1992, Arizona Department of Water Resources Hydrologic Map Series Report Number 27",* July 1995.

Kleinfelder, 1988. *Final Summary Report, Task Assignment K-4, South Mesa Area, Maricopa County, Arizona,* June 1988.

Kleinfelder, 1990. *Results of Hydrogeologic Investigation, Task Assignment K-4, Phase IIA, South Mesa Area, Maricopa County, Arizona,* 1990.

Kleinfelder, 1992. *Technical Memorandum Report – Phase IIC, Task Assignment K-4, South Mesa Area, Maricopa County, Arizona,* March 1992.

Laney, R.L. and Hahn, M.E, 1986. *"Hydrogeology of the Eastern part of the Salt River Valley Area, Maricopa and Pinal Counties, Arizona, USGS Water investigations Report 86-4147",* 1986.

MACTEC, 2007. *Land and Water Use Study Report, South Mesa WQARF Registry Site, Mesa, Arizona.* June 5, 2007.

Malcolm Pirnie, 1991. *Remedial Action Plan for SRP Well 28E-0N,* July 1991.

Oppenheimer, J.M., and Sumner, J.S., 1981. *"Depth to Bedrock Map of Southern Arizona, in Basin and Range Province, Arizona, Claudia Stone and J.P Jenney eds., Arizona Geological Society Digest, v.13, pp. 111-115".*

Salt River Project (SRP), 1996. *"Groundwater Modeling and Capture Zone Analysis of SRP Well 29E-0N,"* October 23, 1996.

United States Department of the Interior, Bureau of Reclamation, Lower Colorado Region, 1976. *Central Arizona Project, Geology and Groundwater Resources Report, Maricopa and Pinal Counties, Arizona, 2 Volumes*.

Water Resources Associates, Inc. (WRA), 1991. *"Site Investigation Results For work Conducted At Applied Metallics, Inc. Gilbert, Arizona"*.

TABLES

Table 1. Chronology of Events	
Year	**Event**
1979-1990	AMI operated a metal plating facility at 1545 North McQueen Road. A dry well was used to dispose of wastes.
1983	ADWR reported first groundwater in South Mesa area was greater than 200 feet deep.
1983	SRP conducted region-wide sampling of their production well system. PCE was detected in SRP Wells 28E-0N and 28.5E-1N. Water was reported at 274.2 feet bgs in SRP Well 28E-0N. SRP subsequently took Well 28E-0N off-line.
1987-1988	Kleinfelder performed a Phase I Investigation of the South Mesa WQARF Area. The AMI facility, located near the intersection of Baseline Road and McQueen Road, was identified as a possible source.
1989	Western Technologies, Inc. (WTI) performed an initial assessment of the AMI facility.
1990-1991	Kleinfelder performed a Phase II Hydrogeological Investigation, installed 9 monitoring wells and drilled 2 exploratory borings (MW-7X and MW-2S). Depth to water ranged from 138 feet bgs to 164 feet bgs.
1991	Water Resources Associates (WRA) identified a dry well at AMI and installed a single monitoring well (MW-AM-8S). Soil samples were collected to 60 feet bgs and concentrations of PCE less than the Groundwater Protection Level (GPL) were reported. Metals were not analyzed for in the soil samples.
1991	SRP conducted a risk assessment and determined a risk-based PCE discharge level for irrigational use of 33 micrograms per liter (ug/L) for SRP Well 28E-0N. PCE in water pumped from SRP Well 28E-0N exceeded 700 ug/L and PCE in water pumped from SRP Well 28.5E-1N ranged from 30-33 ug/L.
1993	A wellhead treatment system was installed on SRP Well 28E-0N and the well was placed back on-line.
1994	SRP Well 28.5E-1N was taken off-line.

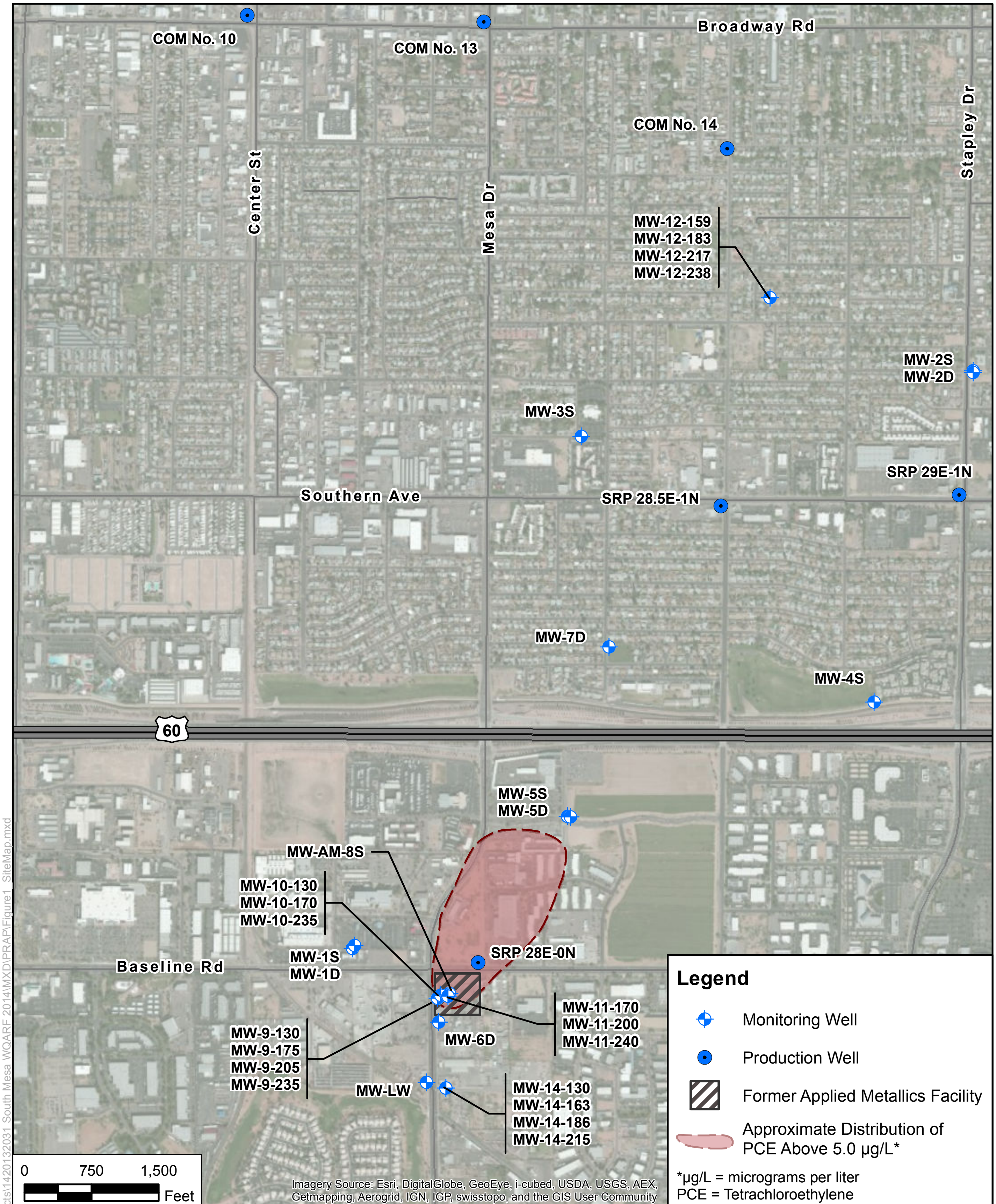
Table 1. Chronology of Events

Year	Event
1995	Earth Tech performed a soil vapor investigation at AMI. Fifteen samples were collected. Highest PCE concentration reported was 110 ug/L near the northeast corner of the site structure and approximately 100 feet from the former dry well. A septic tank was present on the west side of the site. The nearest soil vapor sample was located more than 40 feet away from the septic tank.
1995	Earth Tech installed 3 vapor extraction wells (VW-1, VW-3, and VW-4) and a SVE system at the site. Soil samples were collected during drilling of VW-1 and VW-3 and PCE concentrations were below the GPL. Metals were not analyzed in the samples.
1995-1996	On June 30, 1995, Earth Tech began operation of the SVE system. The SVE system was operated until June 10, 1996, over which time approximately 1,053 pounds of VOCs were reportedly removed from the vadose zone.
1996	EMCON installed two additional vapor wells at AMI: VW -5 (located near the soil vapor sample location reported with 110 µg/L PCE) and VW-6 (located near the former dry well). Detectable concentrations of PCE were not reported in the soil samples. The samples were not analyzed for metals.
1996	Concentrations of PCE in water pumped from SRP Well 28E-0N were consistently less than 33 ug/L. SRP subsequently removed the wellhead treatment system and continued pumping untreated water into the canal system.
1997	VW-6 was incorporated into the SVE system. The SVE system operated from February 13, 1997 through June 12, 1997, over which time an additional 54 lbs of VOCs were extracted. The SVE system was then shut-down due to low mass removal rates. A total of 1,107 lbs or approximately 85 gallons of VOCs were removed from the vadose zone between 1995 and 1997.
1997	SRP determined that water from SRP Wells 28E-0N was no longer needed. The well was taken off-line and operated only for periodic maintenance and sampling between 1997 and present. The bottom 150 feet of SRP Well 28.5-1N was abandoned to protect downgradient supply wells.
1991-1998	ADEQ conducted periodic sampling of the South Mesa wells.

Table 1. Chronology of Events	
Year	**Event**
March 2000-February 2001	AMEC compiled data for the SMWRS, prepared a Conceptual Site Model and identified data gaps. Records were obtained that indicated a septic tank and a 60-foot deep seepage pit were located on the west side of the AMI site. The seepage pit was not investigated during previous investigations.
May 2001-July 2001	A geophysical survey and passive soil gas survey were performed at the AMI facility
August 2001-September 2001	AMEC characterized the nature and vertical extent of vadose zone and groundwater impact at the AMI facility. Ten additional groundwater monitoring points were installed.
June 2002	AMEC installed four additional groundwater monitoring points in a nested monitoring well in the vicinity of 9th Avenue and Horne Drive in Mesa, Arizona to define the downgradient extent of PCE impact at the SMWRS.
June 2002	Indoor air quality samples were collected at the 1545 North McQueen Road building to assess migration of VOC vapors from the vadose zone into the building.
July 2002	Three additional passive soil vapor samples were collected at the AMI facility to define the areal extent of soil vapor impact to the west.
July 2002	Depth-specific groundwater samples were collected from SRP Well 28E-0N to obtain a vertical contaminant profile.
July 2002	Groundwater monitoring of the SMWRS wells was conducted.
December 2002	AMEC collected a second round of indoor air quality samples at the 1545 North McQueen Road building.
June 2004	AMEC conducted a baseline groundwater sampling event in advance of implementing a SVE ERA. Nested vapor wells VW-7A, VW-7B, and VW-7C were installed at the AMI facility.
July 2004	The SVE system was connected to vapor wells VW-5 and VW-7.
September 2004-May 2008	AMEC operated the SVE system as an ERA. The SVE system removed more than 168 pounds of PCE.
December 2004-September 2008	Semiannual ERA groundwater sampling events conducted.

Table 1. Chronology of Events	
Year	**Event**
May 2008	SVE system was decommissioned and removed from Site.
October 2008	AMEC installed four additional groundwater monitoring points in a nested monitoring well (MW-14) east of the intersection of McQueen Road and Melody Drive in Gilbert, Arizona to evaluate groundwater conditions to the south of the former AMI facility.
November 2008	Collection and analysis of groundwater samples from BARCAD wells MW14-130, MW-14-163, MW-14-186, and MW-14-215.
March 2011	Draft RI Report submitted to ADEQ.
July 2011	Draft RI Report made available for public comment.
April-May 2012	Performance of FS support activities including a groundwater monitoring event and collection of an indoor air quality sample from Suite 1 of the 1545 North McQueen Road building.
June 2012	Final FS Work Plan submitted to ADEQ.
December 2012	Performance of annual groundwater sampling event in support of FS.
February 2013	RO Report presented to the public for comment and then finalized.
June 2013	Final RI and RO Reports are submitted with public comments and responsiveness summaries.
October 2013	Performance of a groundwater sampling event in support of FS.
March 2014	Performance of a groundwater sampling event in support of FS.
April 2014	Final FS Report is submitted to ADEQ.

FIGURES



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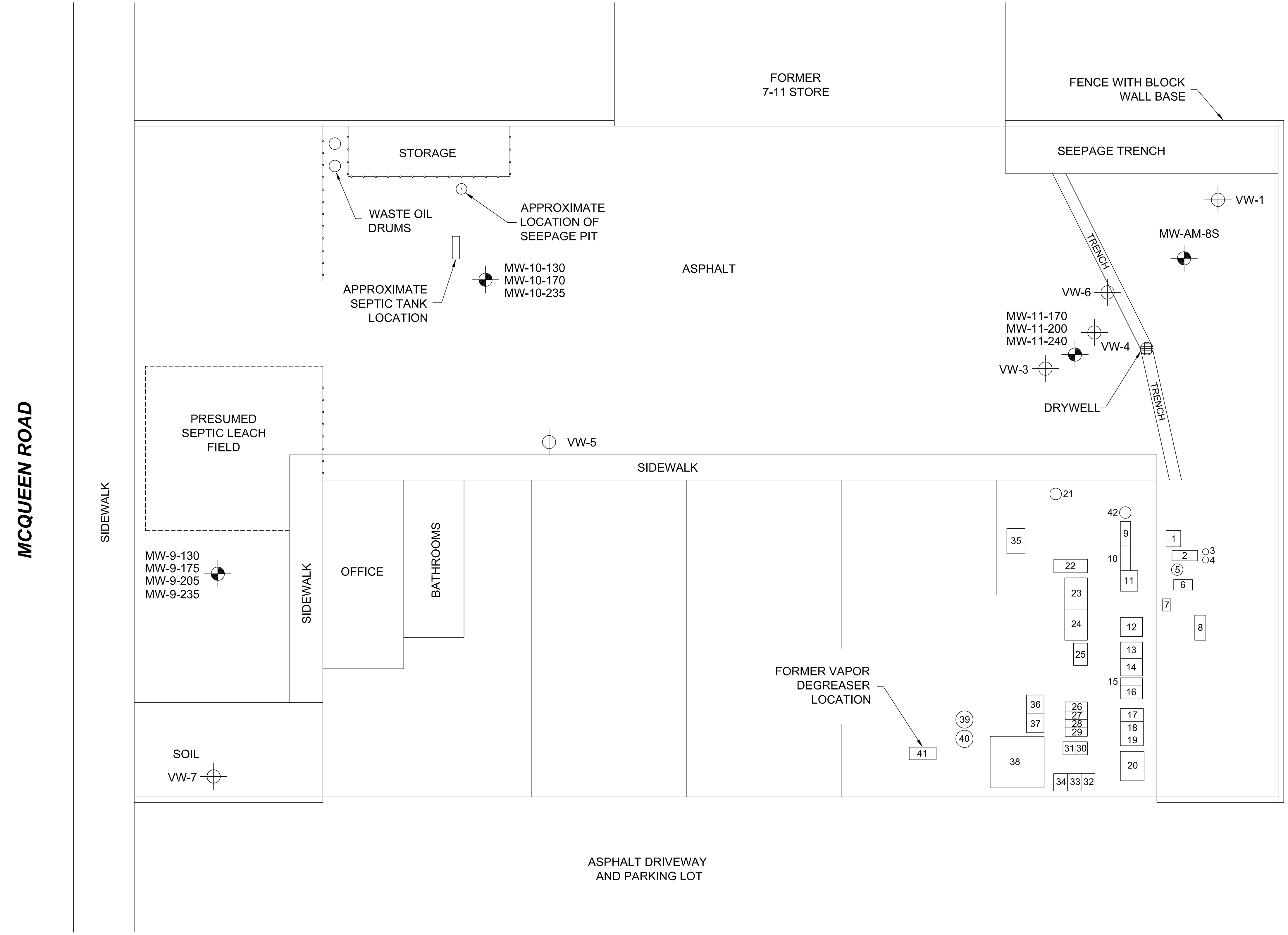
Job No.	1420132031
PM:	JNC
Date:	5/7/2014
Scale:	1" = 1500'

Proposed Remedial Action Plan
South Mesa WQARF Registry Site
Mesa and Gilbert, Arizona

Site and Vicinity Plan

FIGURE
1

amec



TANK IDENTIFICATION

1. TIN STRIP TANK - USED TO STRIP TIN AND CLEAN PARTS
2. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 1, 3 AND 4.
3. HYDROCHLORIC ACID (50%) TANK - USED TO CLEAN STEEL PARTS.
4. SAME AS TANK 3
5. BRIGHT DIP TANK - MIXTURE OF NITRIC ACID AND PHOSPHORIC ACID, USED TO CLEAN COPPER OR BRASS PARTS.
6. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 5, 7 AND 8.
7. NICKEL STRIP TANK - PROPANE HEATED SOLUTION USED TO STRIP NICKEL.
8. NITRIC ACID TANK - USED TO CLEAN OR STRIP PARTS.
9. TIN/LEAD TANK - USED TO PLATE PARTS (TIN).
10. TIN PLATE TANK - USED TO PLATE PARTS (TIN).
11. TIN PLATE TANK - USED TO PLATE PARTS (TIN).
12. COPPER/CYANIDE TANK - USED TO PLATE PARTS (COPPER).
13. COPPER/CYANIDE DRAGOUT TANK - USED TO PRE-RINSE PARTS PRIOR TO FINAL RINSE.
14. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 12, 13, 15 AND 16.
15. SULFURIC ACID (50%) TANK - USED TO CLEAN PARTS.
16. SULFURIC ACID TANK - USED TO MAKE-UP AND HOLD RAW SULFURIC ACID SOLUTION.
17. HYDROCHLORIC (MURIATIC) ACID TANK - USED TO CLEAN STEEL PARTS.
18. HYDROCHLORIC (MURIATIC) ACID TANK - USED TO CLEAN COPPER AND BRASS PARTS.
19. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 17, 18 AND 20.
20. OAKITE 90 TANK - USED TO CLEAN PARTS.
21. CENTRIFUGE - USED TO SPIN DRY PARTS.
22. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 9, 10, 11 AND 23.
23. FLUOROBORIC TIN TANK - USED TO PLATE PARTS (TIN).
24. BRIGHT TIN TANK - USED TO PLATE PARTS (BRIGHT TIN).
25. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 24 AND 35.
26. DEIONIZED WATER TANK - USED TO PRE-RINSE PARTS PRIOR TO TANK 35.
27. DEIONIZED WATER TANK - USED TO PRE-RINSE PARTS PRIOR TO TANK 35.
28. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 26, 27 AND 29.
29. ACETIC ACID TANK - USED TO PRE-CLEAN PRIOR TO TANK 35.
30. NITRIC ACID TANK - USED TO CLEAN ALUMINUM.
31. ZINCATE TANK - USED TO PRE-CONDITION ALUMINUM.
32. IRIDITE TANK - USED TO PUT CHROMATE FINISH ON ALUMINUM.
33. IRIDITE DRAGOUT TANK - USED TO PRE-RINSE PARTS PRIOR TO FINAL RINSE.
34. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 32 AND 33.
35. SULFURIC ACID/TIN TANK - USED TO PLATE PARTS (TIN).
36. OVERFLOW RINSE TANK - ASSOCIATED WITH PROCESS TANKS 37 AND 38.
37. ELECTROLESS NICKEL DRAGOUT TANK - USED TO PRE-RINSE PARTS PRIOR TO FINAL RINSE.
38. ELECTROLESS NICKEL TANK - USED TO PLATE PARTS (NICKEL).
39. ELECTROLESS NICKEL HOLDING TANK.
40. ELECTROLESS NICKEL HOLDING TANK.
41. TETRACHLOROETHYLENE VAPOR DEGREASER - USED TO DEGREASE PARTS TO BE PLATED.
42. SAME AS TANK 21.

REFERENCE

- APPLIED METALLICS, INC. "TANK LOCATION DIAGRAM, FIGURE 2" WESTERN TECHNOLOGIES, INC., 1989

N

LEGEND

- DRYWELL
- VAPOR EXTRACTION WELL
- GROUNDWATER MONITORING WELL

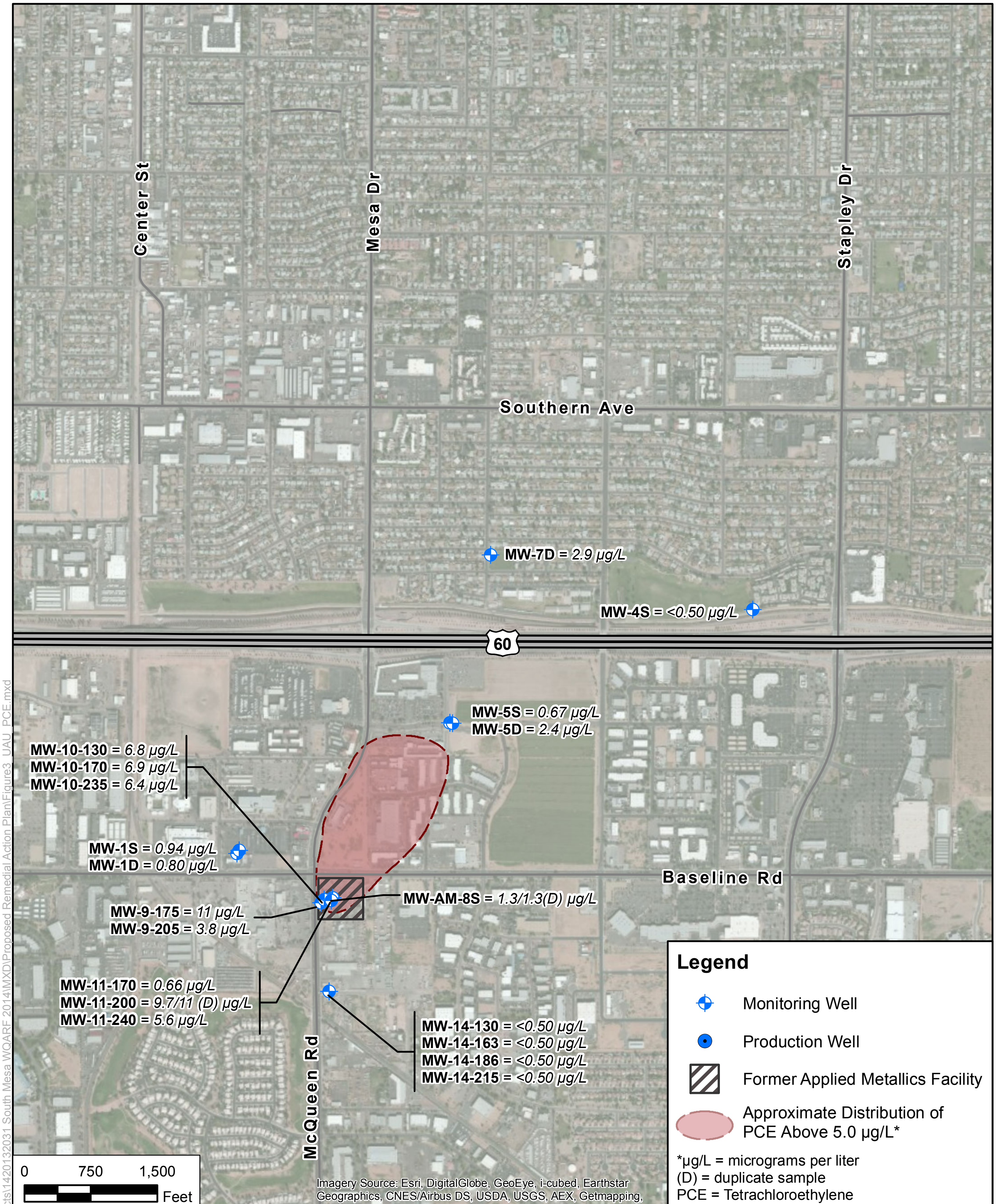
JOB NO.	14-2012-2020.06.24
DESIGN:	JC
DRAWN:	GWH
DATE:	4/2012
SCALE:	NTS

Proposed Remedial Action Plan
South Mesa WQARF Registry Site
Mesa and Gilbert, Arizona

Former Applied Metallics
Site Plan and Location Map

FIGURE 2

amec



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Date:	11/19/2014
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N

South Mesa WQARF Registry Site
Mesa and Gilbert, Arizona

March 2014
Upper Alluvial Unit PCE Distribution

FIGURE
3

amec foster wheeler

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