Arizona Department of Environmental Quality
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Feasibility Study Work Plan
7th Avenue and Bethany Home Road WQARF Site
Phoenix, Arizona

May 2011

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Contents

List of Figures

1. Introduction

1.1. Purpose and Scope

The Feasibility Study (FS) is a process to identify and evaluate remedial options. The goal of the FS is to identify the best option or options for achieving defined Remedial Objectives (ROs). The FS will evaluate the identified remedies based on prescribed comparison criteria to select a remedy that complies with relevant statutes and rules. The FS will evaluate and propose a preferred remedy from among the remedies alternatives which: 1) assures the protection of public health, welfare and the environment; 2) to the extent practicable, provides for control, management, or cleanup of hazardous substances so as to allow for the maximum beneficial use of waters of the state; 3) is reasonable, necessary, cost-effective, and technically feasible; and, 4) addresses any well that either supplies water for municipal, domestic, industrial, irrigation or agricultural uses or is a part of a public water supply system, if the well currently, or in the foreseeable future, would produce water that would not be fit for its current or reasonably foreseeable end use without treatment.

The FS will rely upon the data and findings of the Early Response Action (ERA) and subsequent Remedial Investigation (RI) activities that have been conducted by Arizona Department of Environmental Quality (ADEQ) at the 7th Avenue and Bethany Home Road Water Quality Assurance Revolving Fund (WQARF) Site (Site). The FS report will present and evaluate the proposed remedies, strategies and measures, and select a proposed remedy that best satisfies the criteria presented above. The FS will be conducted in accordance with the ADEQ Remedy Selection Rule (the Rule) as presented in Title 18, Environmental Quality, Chapter 16, Department of Environmental Quality WQARF Program, Article 4, Remedy Selection, R18-16-407 Feasibility Study.

2. Site Background

2.1. Site Description and History

The 7th Avenue and Bethany Home Road WQARF Site (Figure 1) consists of two properties: The Bayless Investment and Trading Company property, (Bayless property) located at 540 West Bethany Home Road (Figure 2), and the SCI Arizona Funeral Services property (SCI property) located at 710 West Bethany Home Road(Figure 3).

On behalf of a prospective lessee and the property owner, site investigations were conducted at the property located at 540 West Bethany Home Road between 1995 and 2001. The results of these investigations confirmed the presence of tetrachloroethene (PCE), and other volatile organic compounds (VOCs), in the soil and groundwater beneath the property. In 2004, the ADEQ conducted a Preliminary Investigation at the Site and placed it on the WQARF Registry with a score of 29 out of a possible 120.

ADEQ and the property owner, Bayless Investment and Trading Company (Bayless), entered into a consent decree in April 2005. ADEQ received a settlement in the amount of $225,000. The decree indicted the owner had already spent approximately $170,000 investigating and remediating the property.

Malcolm Pirnie, Inc. conducted an ERA at the Bayless property under ADEQ Contract EV03-0073 and Task Assignment 04-0100. The objective of the ERA was to collect sufficient information to determine the appropriate cleanup actions needed at the Site to address sources of contamination.

On behalf of the property owner and lessee, site investigations conducted at the SCI property in the early 1990s indicated a release of PCE to the vadose zone but impact to the groundwater beneath the property was not evaluated at that time. Therefore, Malcolm Pirnie, Inc., under contract to ADEQ, conducted an ERA investigation at the SCI property. The objective of the ERA evaluation was to collect the data necessary to characterize the potential source areas of VOC contamination below the property. This investigation was conducted as part of the ongoing investigation of the 7th Avenue and Bethany Home WQARF Site.

The Site lies within the southwest quarter of the southwest quarter of the southwest quarter of section 8, Township 2 North, Range 3 East of the Gila and Salt River Baseline and Meridian. The Site is bounded to the north by Rose Lane, to the south by Bethany Home Road, to the east by 5th Avenue and to the west by 8th Avenue. The groundwater

contamination plume boundary varies and may extend beyond the streets listed, and those locations are considered part of the WQARF site.

2.2. ERA Investigation Summary and CSM for Groundwater

2.2.1. ERA Investigation and Remediation: Bayless Property

In 2005, ADEQ initiated an ERA to address soil and groundwater contamination associated with the Bayless property (Figure 2). Malcolm Pirnie, Inc. was contracted by ADEQ to initiate the ERA Investigation and to collect data to characterize the source area of PCE contamination below the Site. The main focus of the ERA investigation was to assess the extent of the PCE contamination in the vadose zone and groundwater at the property and to determine if a source area remediation soil vapor extraction (SVE) system could be used to efficiently reduce vapor phase VOC contamination within the vadose zone.

During the ERA investigation, the observed PCE soil gas concentrations generally increased with depth in each of the exploratory soil borings. The highest detections of PCE soil gas concentrations occurred in the lower half of the vadose zone from approximately 45 feet to 80 feet below ground surface (bgs) with estimated concentrations in surrounding soil likely exceeding regulatory standards. In the borings closest to the former septic tanks, analyses of the samples indicated that PCE concentrations increased with depth to a maximum measured PCE soil gas concentration of 6,100 milligrams per cubic meter (mg/m^3) at 80 feet bgs. Analytical results of the groundwater samples collected during the ERA indicated that PCE concentrations ranged from 56 micrograms per liter (µg/L) to 10,000 µg/L, well above the Aquifer Water Quality Standard (AWQS) of 5 µg/L.

Based on the results of the ERA investigation, there appeared to be significant concentrations of PCE gas vapors in the vadose zone below the location of the former septic system. Therefore, ADEQ directed Malcolm Pirnie, Inc. to design, install and operate an SVE system to reduce the VOC mass in the vadose zone. The goal of the interim SVE remediation system was to remove as much of the VOC mass, primarily PCE, as possible, from the source area below the Site and reduce further impacts to groundwater quality.

The SVE system was installed during the Second Quarter 2005 and was operational by the end of June 2005. The SVE system consisted of five SVE wells, with screened intervals from 40 to 75 feet bgs, located within the septic system source area. The VOCs were removed from the extracted air using two 5,000 pound granular activated carbon (GAC) vessels that were operated in series. Air emissions from the SVE system were regulated under an air permit issued by the Maricopa County Environmental Services Department.

By January 2006, field data and analytical soil gas samples indicated that relatively low mass removal rates were occurring and that the majority of the extractable VOC mass in the vadose zone had been removed.

A SVE rebound test was conducted on April 11, 2006 to determine whether a substantial amount of removable VOCs remained in the unsaturated soils of the vadose zone previously treated by the SVE system. The results of the rebound test indicated that there did not appear to be enough extractable VOCs remaining in the vadose zone to warrant the continuation of the operation of the SVE system. During operations from June 2005 to January 2006, the SVE system removed approximately 380 pounds of PCE.

After termination of the source area remediation activities, but prior to the decommissioning of the SVE system, two verification borings were drilled within the SVE system extraction area. The purpose of the verification borings was to collect soil and soil gas samples to assess the residual concentrations of PCE that may be remaining in the vadose zone after operating the SVE system. PCE was not detected in the soil samples at or above the laboratory reporting limit of 0.050 milligrams per kilogram (mg/kg), the Groundwater Protection Level (GPL) of 0.8 mg/kg or the residential soil remediation level (SRL) of 5.1 mg/kg in any of the soil samples from the verification borings.

Soil gas samples were also collected from the two verification borings. In general, the PCE gas concentrations increased with depth in each of the soil borings. PCE soil gas concentrations at the shallowest depths, ranging from 10 to 30 feet bgs, were relatively low, ranging from non-detect, less than 0.003 mg/m^3, to 1.1 mg/m^3. PCE soil gas concentrations increased with depth to a maximum measured concentration of 142.6 mg/m^3 at 80 feet bgs. The PCE soil gas concentrations detected in the borings were up to three orders of magnitude less than the levels detected in the samples collected from comparable depths in the borings that were drilled during the ERA Investigation. Converting the soil gas concentrations collected from the verification borings to equivalent estimated soil solid concentration indicates the remaining concentrations in the soil range from approximately 0.0005 to 0.06 mg/kg, well below the residential SRL and GPL for PCE.

Based upon a request from the property owner, Bayless, ADEQ granted the property owner a No Further Action (NFA) determination for soil at the property in December 2008. The soil NFA is for VOCs in soil and does not address any other area of land, groundwater or other contaminants.

Subsequent groundwater samples collected during additional monitor well installation and quarterly sampling activities indicated PCE concentrations ranged from less than 2 µg/L to 2,200 µg/L. The most recent groundwater sampling, in September 2010, indicates concentrations of PCE as high as 320 µg/L. The location with the highest PCE

concentration is immediately downgradient of the suspected source area, the former septic tank locations.

2.2.2. ERA Investigation: SCI Property

The SCI property is located at 710 West Bethany Home Road, Phoenix, Arizona and consists of four separate parcels (Figure 3). Two of the parcels are of interest in this investigation. Based on the currently available information in ADEQ files, a dry cleaner operated on parcel 2 from the 1950's until the 1990's. A dry well was installed on parcel 2 in September 1982, approximately 20 feet west of the dry cleaning operations. The dry well is 120 feet deep with drainage fabric located at approximately 18 feet bgs with gravel pack beneath the fabric to total depth. Parcel 4 was occupied by a mortuary and parking lot and contained two surface drains; one that lead to a septic tank and one the lead to a brick-lined seepage pit.

On behalf of the property owner, Water Resources Associates, Inc (WRA) performed the initial environmental investigations at the SCI property in the early 1990s. WRA conducted the site investigations in the first half of 1990 on parcels 1 through 4, which included four soil borings, 21 soil gas sampling locations, abandonment of a septic tank in place and the evacuation of a seepage pit.

According to a report submitted to ADEQ from WRA, "detectable" concentrations of PCE were detected during the initial investigation in February 1990 with the highest concentrations detected near the dry well. A sediment sample was collected from the dry well at approximately 16.5 feet bgs and analyzed for chlorinated VOCs using United States Environmental Protection Agency (US EPA) Method 8010. The detected analytes from the sediment sample were PCE, TCE, and total 1,2-dichloroethene (1,2-DCE) at concentrations of 1,300 mg/kg, 19 mg/kg, and 11 mg/kg, respectively.

In June 1990, on behalf of the lessee, SCS Engineers (SCS) provided oversight of dry well cleaning activities on parcel 2. SCS collected samples of the material located at the base of the dry well settling chamber. A total of two samples were collected by SCS, but only one sample was analyzed for chlorinated VOCs using US EPA Method 8010. The results of the one analyzed sample, collected prior to the washing of the gravel located at the base of the dry well, reported detections of PCE and TCE at concentrations of 65.9 mg/kg and 2.4 mg/kg, respectively.

During March 1990, the seepage pit located on parcel 4 was evacuated by a vacuum service truck and soil samples were collected by WRA. A single soil boring was drilled inside the seepage pit to a total depth of 59.5 feet bgs. Two chlorinated solvent compounds were detected in the soil boring at a depth of 32 feet bgs. PCE and 1,2-DCE were detected at concentrations of 0.21 mg/kg and 0.06 mg/kg, respectively.

As a result of these and other samples, WRA conducted a soil excavation and soil sampling event on April 12, 1990. A total of eleven soil samples were collected, but only seven of the samples were analyzed. A single soil sample, collected beneath the septic tank, had a detection of PCE of 0.01 mg/kg. A sludge sample was collected from the bottom of the seepage pit on April 16, 1990 and had detections of PCE, TCE, and 1,2-DCE at concentrations of 43.5 mg/kg, 0.4 mg/kg, and 0.3 mg/kg, respectively.

The field investigations in the early 1990s indicated a release of PCE to the vadose zone but any impact to the groundwater beneath the SCI property was not evaluated at that time. Therefore, Malcolm Pirnie, Inc. was contracted by ADEQ to initiate the ERA investigation and to collect data to characterize the source area of PCE contamination below the SCI property. The purpose of the ERA investigation at the SCI property was to collect the data necessary to characterize the potential source areas of VOC contamination and determine if further remedial actions were necessary at the property.

Six exploratory soil borings, B1 through B6, were drilled and two groundwater monitoring wells, MW-11 and MW-12, were installed as part of the ERA investigation conducted in March and April of 2008. The exploratory boring locations were selected based on the known location of the former dry cleaner building, potential source areas including a dry well and former septic system and seepage pit, and estimated groundwater flow direction.

Analytical results indicated PCE, propene (propylene), and acetone to be the most prevalent compounds in the soil gas samples, occurring in each boring and generally increasing in concentration with depth. Soil gas samples collected from borings B1 and B4, at approximately 65 feet bgs, had the highest concentrations of PCE detecting 100 mg/m3 and 120 mg/m3, respectively. Boring B1 is located near the former septic tank and seepage pit and boring B4 is located near the former dry cleaning building. TCE, chloroform, hexane and toluene were also present in most of the boreholes in lower concentrations. Benzene, 2-butanone (MEK), 1,2,4-trimethylbenzene, and dichlorodifluoromethane (Freon 12) occurred in a few borings and at relatively low concentrations. Results indicated that detected analytes occurred at their highest concentration between the 55 feet bgs to 75 feet bgs. No concentrations were detected above regulatory standards and no further remediation of the vadose zone at the SCI property is planned.

On March 18, 2008, groundwater samples were collected from monitoring wells MW-11 and MW-12 immediately after well development and analyzed for VOCs using US EPA Method 8260B. PCE was detected in both wells at concentrations in excess of the AWQS of 5 µg/L. Monitoring wells MW-11 and MW-12 had PCE concentrations of 7.4 µg/L and 22 µg/L, respectively. MW-12 also had a TCE concentration of 23 µg/L, which is above the AWQS for TCE of 5 µg/L. Vinyl chloride was also detected in monitor wells

MW-12 at concentration above the AWQS. Concentrations of vinyl chloride ranging from 2.6 µg/L to 2.7 µg/L, just above the AWQS for vinyl chloride of 2 µg/L. The most recent groundwater sampling, in September 2010, indicates concentrations of PCE were 17 µg/L and 1.4 µg/L, in monitor wells MW-11 and MW-12, respectively.

2.3. Contaminant Distribution in Groundwater

A detailed description of the Site geology and hydrogeology is provided in the RI Report (ADEQ and Malcolm Pirnie, 2011).

2.3.1. Bayless Property

With the exception of the east side of the Bayless property, the horizontal extent of groundwater PCE contamination is defined by the current Site groundwater monitor wells. Currently, PCE is detected in groundwater at the following locations: Monitor wells MW-3, MW-4, MW-5, MW-7, MW-10, MW-11, and MW-12 (Monitor wells MW-11 and MW-12 are located on the SCI property). This is based on the most recent groundwater sampling event conducted in September 2010. It is important to note that prior to September 2010, PCE had not been detected above laboratory reporting limits in down gradient well MW-7.

The downgradient extent of PCE contamination, above the AWQS, assessed to date is estimated to be between monitor wells MW-10 and MW-7 where the most recent groundwater sample detected PCE at a concentration of 2.1 µg/L. Monitor well MW-7 is located approximately 950 feet north of the Bayless property. Groundwater sampling in November 2008 indicated the presence of PCE in monitor well MW-8 at a concentration of 0.61 µg/L. Monitor well MW-8, is located approximately 1,350 feet north of the property. Previously, PCE has not been detected in this well. The most recent groundwater sampling event conducted in September 2010 indicated that PCE was below the laboratory report limit of 0.5 µg/L at monitor well MW-8. Figure 4 presents the most recent distribution of PCE contamination in groundwater at the Site, and estimated groundwater elevation contours across the site.

Groundwater PCE concentration trends in monitor wells MW-3, MW-4, MW-5, MW-10, are shown on Figure 5. The graph shows that the overall trend indicates PCE concentrations have remained relatively stable, with a slight long-term decrease in concentrations from initial concentrations.

The vertical extent of contamination is defined by one deep monitor well, monitor well MW-9, located on the Bayless property near MW-4. Monitor well MW-9 is screened from 178 to 218 feet bgs where as the other monitor wells are generally screened from 70 to 120 feet bgs. PCE has not been detected above laboratory reporting limits in MW-9 since it was initially sampled in November 2006.

Analyses of groundwater samples collected from wells downgradient of the source area at the Bayless property do not contain significant amounts of TCE or other PCE daughter products, indicating attenuation is not a significant factor at this property.

At the Bayless property, the contaminant plume is generally oriented in the groundwater flow direction. Concentrations are generally higher in the vicinity of source areas and decline both longitudinally (downgradient) and laterally away from the source area. The width of a contaminant plume is likely controlled by hydrodynamic dispersion.

2.3.2. SCI Property

Analytical results of the groundwater samples collected after the ERA investigations indicated that PCE concentrations ranged from 4.9 µg/L in monitor well MW-11 to 24 µg/L in monitor well MW-12. Monitor well MW-12 is located near the former drywell while monitor well MW-11 is located approximately 25 feet downgradient of the former septic tank and seepage pit. The most recent distribution of PCE contamination, in September 2010, at the Site is presented in Figure 4. PCE was detected in groundwater samples collected from MW-11 and MW-12, at 1.4 and 17 µg/L, respectively in September 2010.

Monitor well MW-12, at the SCI property, does contain significant amounts of TCE, 1,2-DCE and vinyl chloride indicating a some attenuation may be taking place at this property. The concentrations and occurrence of these compounds are discussed in more detail in the RI Report (ADEQ and Malcolm Pirnie, 2011).

Groundwater PCE concentration trends in monitor wells MW-11 and MW-12 are shown on Figure 5. Only four quarters of data have been collected from these monitor wells and PCE concentrations appear to be declining over time.

With the limited number of monitor wells downgradient from the source area at the SCI property, it is difficult to determine the downgradient extent of contamination. As with the Bayless property, the contaminant plume is suspected to be generally oriented in the direction of the groundwater flow direction. Concentrations are expected to be generally higher in the vicinity of the source area and decline both longitudinally (downgradient) and laterally away from the source. The width of a contaminant plume is likely controlled by hydrodynamic dispersion.

3. Remedial Objectives

3.1. Remedial Objectives

ROs are established for current and reasonably foreseeable uses of land and waters of the State that have been or are threatened to be affected by a release of a hazardous substance. An ROs report has been prepared by ADEQ (2011) with stakeholder input gathered during the 7th Avenue and Bethany Home Road Community Advisory Board and public meetings, written comments received during the 45 day public comment period as well as land and water use study questionnaires gathered during the RI.

R-18-16406(D) specifies that the reasonably foreseeable uses of land are those likely to occur at the Site, and the reasonably foreseeable uses of water are those likely to occur within 100 years unless site-specific information suggests a longer time period is more appropriate. Reasonably foreseeable uses are those likely to occur based on information provided by water providers, well owners, land owners, government agencies, and others. Not every use identified in the remedial investigation will have a corresponding RO. Uses identified in the RI may or may not be addressed based on information gathered during the public involvement process, WQARF limitations, and whether the use is reasonably foreseeable.

The ROs chosen for the Site will be evaluated in the FS, which will compare remedial measures and strategies required to meet ROs. A remedial strategy is one or a combination of the six general strategies identified in Paragraph B.4 of A.R.S. 49-282.06 (plume remediation, physical containment, controlled migration, source control, monitoring, and no action). A remedial measure is a specific action taken in conjunction with remedial strategies to achieve one or more ROs (for example, well replacement, well modification, water treatment, water supply replacement, and engineering controls).

The FS will propose at least three remedies (a reference remedy and generally two alternative remedies) considered capable of meeting the ROs. A reference remedy is a combination of remedial strategies and measures that is compared with alternative remedies for purposes of selecting a proposed remedy. An alternative remedy is a combination of remedial strategies and measures different from the reference remedy. Proposed remedies will also be generally compatible with future land use specified by land owners. Remedial actions should be reasonable, appropriate and cost-effective.

Based upon review of public comment, the ROs are based on the following:

- Protect against possible exposure to hazardous substances in surface and subsurface soil that could occur during development of property based upon applicable zoning regulations.
- Protect against possible leaching of hazardous substances from the upper portion of the aquifer into deeper portions of the aquifer where groundwater use is occurring.

ROs for this Site have been established for the following groundwater uses:

- municipal;
- agricultural;
- private use (including domestic, and irrigation).

Based on public comment, proposed ROs for current and future municipal groundwater use in the 7th Avenue and Bethany Home Road WQARF site are:

- To protect the supply of groundwater for municipal use and for the associated recharge capacity that is threatened by contamination emanating from the 7th Avenue and Bethany Home Road WQARF Site. To restore, replace or otherwise provide for the groundwater supply lost due to contamination associated with the 7th Avenue and Bethany Home Road WQARF Site. This action will be needed for as long as the need for the water exists, the resource remains available and the contamination associated with the 7th Avenue and Bethany Home Road WQARF Site prohibits or limits groundwater use.

Based on public comment, proposed ROs for current and future agricultural groundwater use in the 7th Avenue and Bethany Home Road WQARF site are:

- To protect the supply of groundwater for irrigation use and for the associated recharge capacity that is threatened by contamination emanating from the 7th Avenue and Bethany Home Road WQARF site. To restore, replace or otherwise provide for the groundwater supply lost due to contamination associated with the 7th Avenue and Bethany Home Road WQARF site. This action will be needed for as long as the need for the water exists, the resource remains available and the contamination associated with the 7th Avenue and Bethany Home Road WQARF site prohibits or limits groundwater use.

Based on public comment, proposed ROs for current and future private groundwater use in the vicinity of the 7th Avenue and Bethany Home Road site are:

- To protect, restore, replace or otherwise provide a water supply for domestic and irrigation use by private well owners outside the current plume boundaries of the 7th Avenue and Bethany Home Road WQARF Site if the current use is impaired or lost due to contamination from the site. This action will be needed for as long as the need for the water exists, the resource remains available and the contamination associated with the 7th Avenue and Bethany Home Road WQARF site prohibits or limits groundwater use.

4. Identify and Screen Appropriate Remedial Technologies

During the FS, appropriate remedial technologies for groundwater will be identified and screened according the following criteria:

- contaminant treatment effectiveness;
- compatibility with drinking water systems;
- constructability;
- flexibility/expandability;
- operation and maintenance requirements;
- management of residual waste products;
- chemical use/operational hazards; and,
- cost/effectiveness.

The following site assumptions and system requirements will be used during the identification and screening of the remedial technologies:

- Contaminants in groundwater - PCE up to 320 micrograms per liter (µg/L), TCE up to 29 µg/L , and vinyl chloride up to 3.7 µg/L.
- Remedial Efficiency- Must achieve drinking water standards, Aquifer Water Quality Standards(AWQSs) at agriculture, municipal supply and domestic wells.
- End Use – agricultural, municipal and domestic.
- Cost – Compared, based on each remedial scenario.

The remediation technologies that pass the technology screening will be retained for use in development of the reference remedy and alternative remedies.

4.1. Remediation Technology

Technologies that have been identified and will be screened for groundwater will include, but will not be limited to:

- Monitored Natural Attenuation (MNA);
- In-situ Chemical Oxidation;
- Enhanced Bioremediation;
- Air-sparge; and
- Pump-and-Treat Remediation.

4.2. Retained Technologies

Following screening, the treatment technologies which have been retained for future consideration will be evaluated as to compatibility with applicable state and federal regulations, the effectiveness at treating the target contaminants, the operation and maintenance requirements, and the overall costs.

Selected retained technologies will then be assembled with selected strategies and measures to develop the reference remedy and alternative remedies.

5. Develop Reference Remedy and Remedial Alternatives

Based upon the retained remedial technologies, a reference remedy and two alternative studies will be developed and compared. The reference remedy and each alternative remedy also may include contingent remedial strategies or remedial measures to address reasonable uncertainties regarding the achievement of ROs or uncertain time-frames in which ROs will be achieved. The reference remedy and alternative remedies will be described in the FS report in sufficient detail to allow evaluation using the comparison criteria, but plans at construction level details are not required at this time. Where appropriate, the reference remedy and an alternative remedy may incorporate different strategies for different aquifers, or portions of aquifers.

The remedial strategies to be developed, consistent with A.A.C. R18-16-407 (F), are listed below. A strategy may incorporate more than on remediation technology or methodology.

- plume remediation;
- physical containment;
- controlled migration;
- source control;
- monitoring; and,
- no action alternative.

In identifying remedial measures, the needs of the well owners and the water providers and their customers will be considered, including quantity and quality of water, water rights, and other legal constraints on water supplies, reliability of water suppliers and any operational implications. Such remedial measures may include, but will not be limited to, well replacement, well modification, water treatment, provision of replacement water supplies and engineering controls. Where remedial measures are relied upon to achieve ROs, such remedial measures will remain in effect as long as required to ensure the continued achievement of those objectives.

5.1. Reference Remedy: Strategy and Measures

The reference remedy will be developed based upon the best engineering, geological or hydrogeological judgment following industry standards of practice, considering the following:

- The information in the RI report;
- The base available scientific information concerning available remedial technologies; and,
- Preliminary analysis of the comparison criteria and the ability of the reference remedy to comply with ARS §49-282.06.

5.2. More Aggressive Alternatives Remedy: Strategy and Measures

At least one of the alternative remedies must employ a remedial strategy or combination of strategies that is more aggressive than the reference remedy. A more aggressive strategy is a strategy that requires additional remedial measures to achieve ROs, a strategy that achieves, ROs in a shorter period of time or a strategy that is more certain in the long term and requires fewer contingencies. One of the more aggressive alternative remedies may use the same strategy as the reference remedy, but may use different viable technologies or a more intensive use of the same technology utilized in the reference remedy.

5.3. Less Aggressive Alternative Remedy: Strategy and Measures

At least one of the alternatives must be employ a remedial strategy or combination of strategies that is less aggressive than the reference remedy. This alternative will still be capable of achieving the defined ROs, but may use less intensive or fewer remedial measures than the reference remedy.

6. Additional Studies

6.1. Data Gaps

Potential data gaps may be identified during the development of the Reference Remedy and Remedial Alternatives. Data gaps may include the need to collect additional field data and/or perform laboratory studies to be able to complete an evaluation of the Reference Remedy and Remedial Alternatives. If necessary, an addendum to this work plan will be prepared to present the methodologies and data quality objectives for additional data collection. The work plan addendum may also include a description of potential permitting requirements, investigative derived waste management, data management, abbreviate quality assurance project plan, and a health and safety plan.

7. Detailed Analysis of Reference Remedy and Alternatives

7.1. Description of Evaluation Criteria

A comparative evaluation of the Reference Remedy and the Alternative Remedies developed will be conducted. In accordance with A.A.C. §18-16-407 (H) each remedial alternative, will be evaluated using the following:

1. A demonstration that the remedial alternative will achieve the ROs.
2. An evaluation of consistency with the water management plans of the affected water providers and the general land use plans of the local governments with land use jurisdiction.
3. An evaluation of the comparison criteria, including:
    a. practicability of the alternative;
    b. risk of the alternative;
    c. cost of the alternative ;
    d. benefit or value the alternative.

8. Proposed Remedy

Based upon the evaluation and comparison of the Reference Remedy and the other Alternative Remedies developed, a proposed remedy will be selected. The FS report will describe the following for the proposed remedy:

- process and reason for the selection;
- comparison criteria;
- achievement of ROs;
- achievement of remedial action criteria, pursuant to § 49-282.06;
- consistency with water management plans;
- consistency with general land use planning; and,
- contingencies.

9. Feasibility Study Report

An FS Report will be prepared documenting the FS process. The FS Report will include the following sections:

- Section 1.0 Introduction
- Section 2.0 Site Background
- Section 3.0 Feasibility Study Scoping
- Section 4.0 Identification and Screening of Remediation Technologies
- Section 5.0 Development of Reference Remedy and Alternative Remedies
- Section 6.0 Summary of Additional Studies Necessary to Complete Analysis of Remedial Alternatives
- Section 7.0 Detailed Comparison of the Reference Remedy and the Alternative Remedies
- Section 8.0 Proposed Remedy
- Section 9.0 Community Involvement

10. References

Malcolm Pirnie, Inc. and Arizona Department of Environmental Quality, 2011. Remedial Investigation Report. 7th Avenue and Bethany Home Road WQARF Site. Phoenix, Arizona. April 2011.

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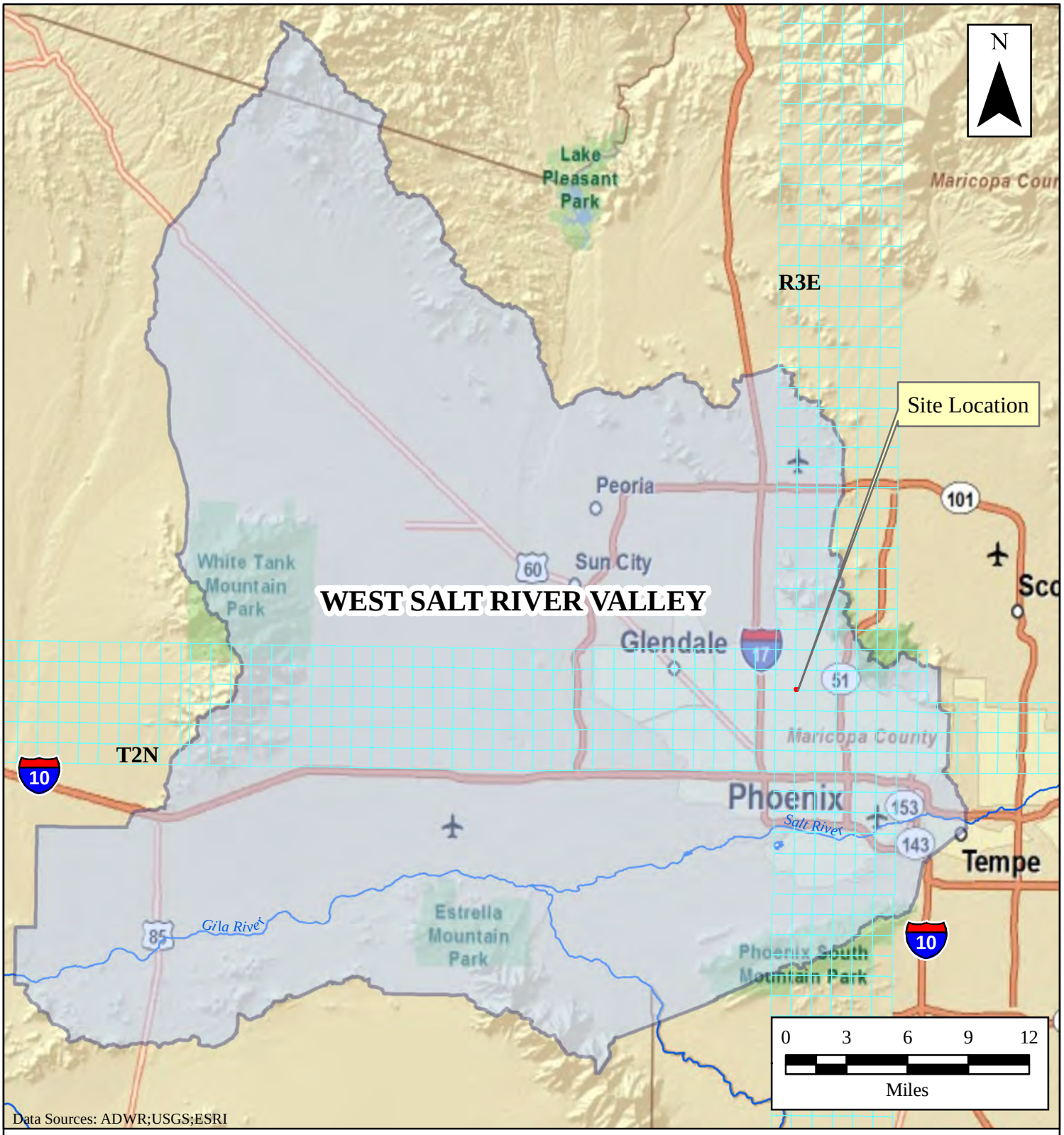

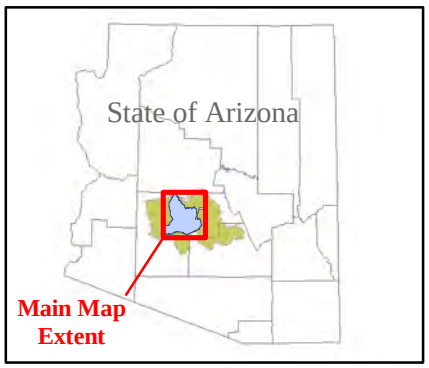

Legend

- River
- Section
- West Salt River Basin
- Phoenix AMA

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Location Map
Remedial Investigation Report
7th Ave & Bethany Home Rd
WQARF Site

2011	**Figure 1**

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Aerial Photo Copyright of Landiscor, flown in March 2004.

Legend

- Septic Pipping
- Former Buildings
- Site Boundary

ARCADIS
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Former Buildings and Septic Piping
Feasibility Study Workplan
7th Ave & Bethany Home Rd
WQARF Site

2011	**Figure 2**

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Legend

- Monitor Well
- Former Seepage Pit
- Former Septic Tank
- Dry Well
- Former Septic System Area
- Limits of Excavation
- Parcel
- Former Tank Pit
- Property Boundary

0 25 50 100
Feet

ARCADIS
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Site Map with Monitoring Locations
at SCI Property
Feasibility Study Workplan
7th Ave & Bethany Home Rd
WQARF Site

2011 | **Figure 3**

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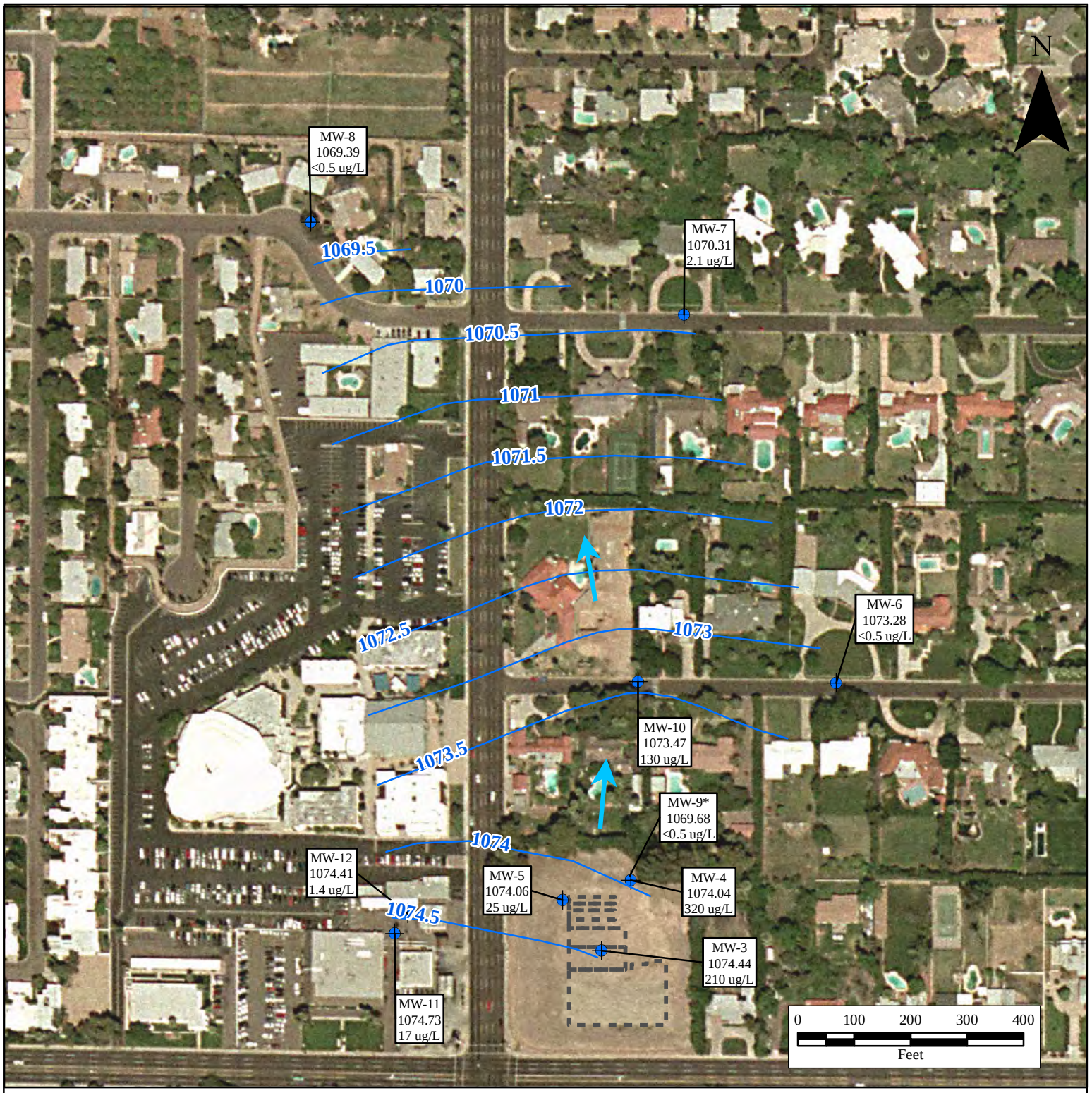

* MW-9 GW elevation not used for contouring. MW-9 is approximately 10 feet north of MW-4

Note: ft amsl - feet above mean sea level
Aerial Photo Copyright of Landiscor, flown in March 2004.

Legend

September 2010 Groundwater Elevation Contours (ft amsl)

Monitor Well

Former Buildings

MW-3
1074.44
210 ug/L

Monitor Well Name
September 29, 2010 Groundwater Elevation (ft amsl)
PCE Concentration (ug/L)

General Groundwater Direction

ARCADIS
4646 E. Van Buren St.,
Suite 400
Phoenix, AZ 85008

Groundwater Elevations
September 2010
Feasibility Study Workplan
7th Ave & Bethany Home Rd
WQARF Site

2011 | **Figure 4**

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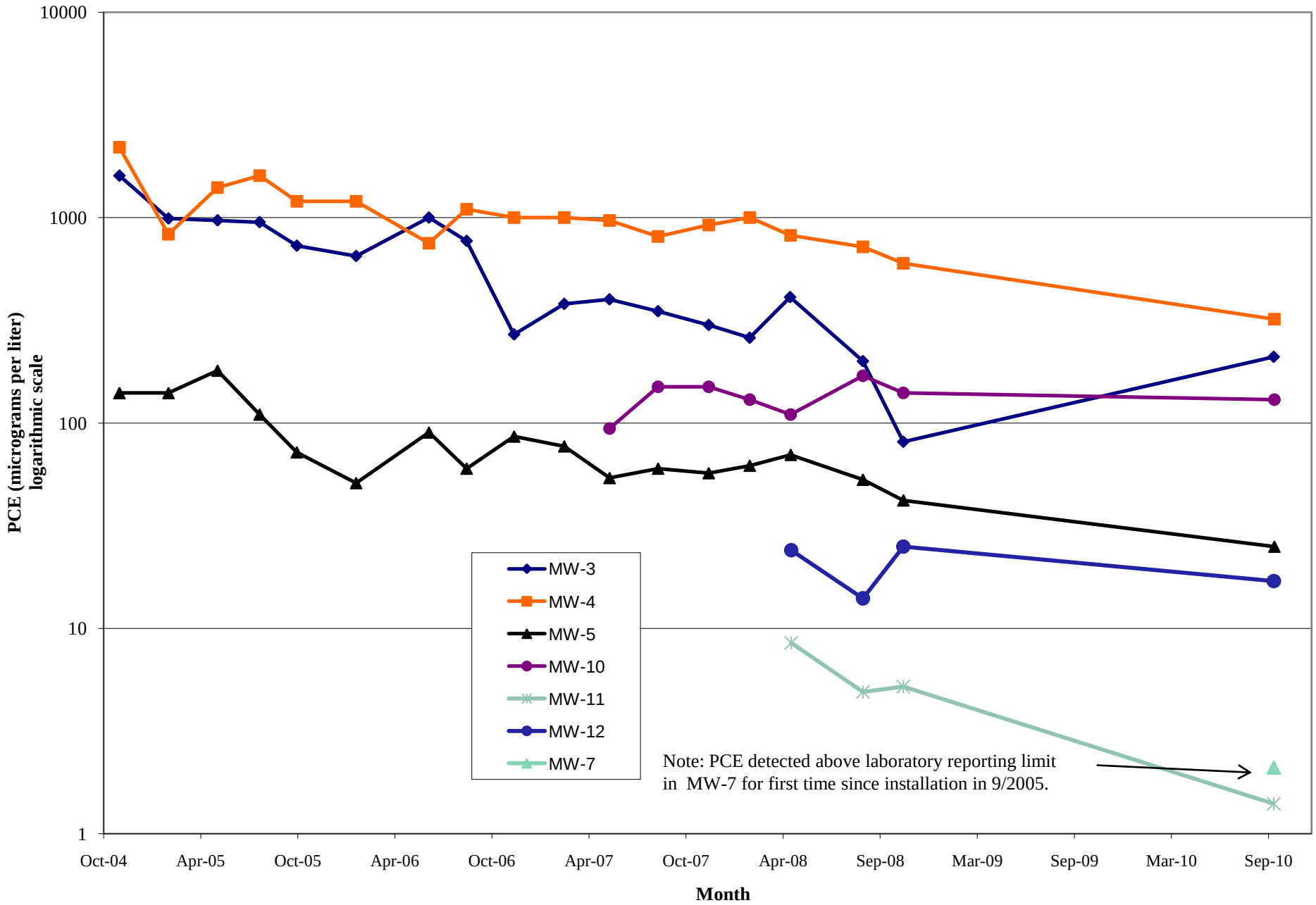

ARCADIS

Groundwater Tetrachloroethene (PCE) Concentrations
Feasibility Study Workplan
7th Ave & Bethany Home Rd WQARF Site

2011

Figure 5

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