PROPOSED REMEDIAL ACTION PLAN
7TH STREET AND MISSOURI AVENUE
WQARF REGISTRY SITE
PHOENIX, ARIZONA

3/13/2020

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LIST OF ABBREVIATIONS & ACRONYMS

A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
A.R.S.	Arizona Revised Statutes
AWQS	Aquifer Water Quality Standards
bgs	below ground surface
cis-1,2-DCE	*cis*-1,2-dichloroethene
COC	Contaminant of Concern
COP	City of Phoenix
DEUR	Declaration of Environmental Use Restriction
EPA	US Environmental Protection Agency
ERD	Enhanced Reductive Dechlorination
FS	Feasibility Study
ERA	Early Response Action
GETS	Groundwater Extraction & Treatment System
ISCR	In Situ Chemical Reduction
ISCO	In Situ Chemical Oxidation
LUST	Leaking Underground Storage Tank
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
MNA	Monitored Natural Attenuation
O&M	operation and maintenance
PI	Preliminary Investigation
RO	Remedial Objective
RI	Remedial Investigation
SRL	Soil Remediation Level
SRP	Salt River Project
SVE	Soil Vapor Extraction
PRAP	Proposed Remedial Action Plan
PCE	tetrachloroethene
TCE	trichloroethene
VISL	Vapor Intrusion Screening Level
VOC	Volatile Organic Compound
VRP	Voluntary Remediation Program
WQARF	Water Quality Assurance Revolving Fund

1.0 INTRODUCTION

The Arizona Department of Environmental Quality (ADEQ) presents the Proposed Remedial Action Plan (PRAP) for the 7th Street and Missouri Avenue Water Quality Assurance Revolving Fund (WQARF) site (the Site) located in Phoenix, Arizona (Figure 1). This PRAP was prepared in accordance with Arizona Revised Statute (A.R.S.) §49-287.04 and Arizona Administrative Code (A.A.C.) R18-16-408, and was based on information contained in the following documents.

- Pinyon, 2018. Remedial Investigation Report, North 7th Street and East Missouri Avenue, Phoenix, Arizona. November 21
- Geosyntec Consultants, Inc., 2019. Feasibility Study 7th Street and Missouri Avenue Water Quality Assurance Revolving Fund Site, Phoenix Arizona. September 27

The information presented in the PRAP is taken directly from the above-referenced reports without attribution other than that noted in this document. The detailed history of environmental investigations, Early Response Actions (ERAs), and preliminary screening of remedial alternatives completed for the Site is presented in the referenced documents and is not reiterated in detail in this document.

The purpose of the PRAP is to inform the public on the remedy selected from the alternatives evaluation presented in the Feasibility Study (FS), which addresses the site-specific Remedial Objectives (ROs). The PRAP is part of the final remedy selection process under the WQARF program where public input is solicited on the selected remedy and on the rationale for proposing the selected remedy. ADEQ will review the public comments and prepare a responsiveness summary to address the public comments. The responsiveness summary will be part of the Record of Decision (ROD). The remedy for the Site will be finalized by ADEQ in the ROD.
This PRAP, in accordance with A.R.S. §49-287.04, describes the following:

- The boundaries of the Site that is the subject of the remedial action.
- The results of the Remedial Investigation and the FS.
- The proposed remedy and estimated cost.
- How the remediation goals and selection factors in A.R.S. §49-282.06 and rules adopted by the ADEQ Director have been considered.

2.0 SITE BOUNDARIES

The Site is approximately bounded to the north by Bethany Home Road, to the south by East Georgia Avenue, to the west by North 6th Street, and to the east by North 12th Street (Figure 1). The Site includes the area that encompasses the soil and groundwater impacted with compounds that exceed regulatory levels.

3.0 REMEDIAL INVESTIGATION RESULTS

The Remedial Investigation (RI) report was finalized in November 2018. A number of RI data gaps were identified in the RI. Below summarizes findings of the RI and the findings of the work conducted to close the RI data gaps.

3.1 Site History and Description

The Site is in an urban setting that includes a mixture of commercial and residential uses. The Site was initially utilized for agricultural purposes until the 1940s, when gas stations and other businesses including dry cleaners began to be developed near the junction of 7th Street and Missouri Avenue. Groundwater contamination at the Site was first detected in 1995 in wells associated with a Leaking Underground Storage Tank (LUST) investigation for petroleum hydrocarbon releases at a Circle K #3744 facility located on the northwest corner of 7th Street and Missouri Avenue (Figure 2). Tetrachloroethene (PCE) was detected at 720 micrograms per liter (µg/L), over the Aquifer Water Quality Standards (AWQS) of 5 µg/L (SECOR, 1996). Subsequently, a Salt River Project (SRP) well (14.0E-9.6N, ADWR# 55-608424), located approximately 350 feet northwest of the junction of 7th Street and Missouri Ave, was found to have detectable concentrations of PCE in 1998 (Figure 2; HGC, 2015). Since approximately 2002, concentrations of PCE in the SRP well have been over AWQS.

Multiple soil-gas and groundwater investigations during the Preliminary Investigation (PI) determined that PCE was present in high concentrations in soil gas and groundwater on the southwest corner of 7th St and Missouri Ave (Figure 2). Another distinct area of PCE was detected in the soil gas and groundwater not connected to the Site plume was found near Fashion Cleaners, which entered the Voluntary Remediation Program (VRP) in 2016. The 7th Street and Missouri Avenue WQARF Site was listed on the WQARF registry in June 2016.

Groundwater is encountered approximately at 100 feet below ground surface (bgs) at the Site near the source area, and deepens towards the end of the groundwater plume to 125 feet bgs. In the 1990s and early 2000s, the groundwater flow direction at the Site was in a northerly direction. After the lining of the Grand Canal to the south of the Site in 2007, groundwater flow shifted to the north-northeast throughout the late 2000s to 2010s, and currently is to the northeast.

3.2 Source of Contamination

The source of the PCE and related compounds at the Site is the former Kino Drapery Cleaners (former Kino). The former Kino building was demolished in approximately 1986; the location is currently covered by a building at 645 E Missouri Avenue, called the Missouri Falls building (Figure 2). This building was installed with a three-story underground parking garage.

Other current and former area dry cleaners have been ruled out as potential sources by soil-gas and groundwater sampling (Pinyon, 2018). Data from monitoring well MW-102 (Figure 2) shows that

the Fashion Cleaners VRP site plume remains distinct from the 7th Street and Missouri Avenue Site plume. The source of the benzene contamination is the former release at the Circle K #3744 facility.

3.3 Contaminants of Concern

The Site contaminants of concern (COCs) are PCE, trichloroethene (TCE) and *cis*-1,2-dichloroethene (cis-1,2-DCE), and benzene for groundwater, and PCE for soils.

3.4 Nature and Extent of Contamination

PCE is present in soils above Soil Remediation Levels (SRLs) underneath the location of the former Kino (Figure 3a), from approximately 35 to 75 feet bgs. Groundwater results indicate this contamination likely extends to the water table in this location.

PCE is present in soil gas exceeding the vapor intrusion screening levels (VISLs) under the extent of the Missouri Falls building footprint (Figure 3b), from below the level of the underground parking garage (approximately 26 feet bgs) to groundwater. The VISLs were developed using the EPA Regional Screening Levels (RSLs) for indoor air, divided by an attenuation factor of 0.03. PCE was also detected in shallow soil gas at the VISL near to a day care north of the Missouri Falls property, but no PCE was detected in the indoor air at this location. PCE was detected above worker indoor air RSLs in samples collected in the parking garage of Missouri Falls.

PCE, TCE, cis-1,2-DCE, and benzene are present in groundwater over AWQS. The PCE contamination is highest in the well nearest to the former Kino (MW-201; Figure 2), and extends approximately 0.7 miles to the northeast (Figure 3c). The plume is estimated to be approximately 50 to 75 feet thick, and dives as it moves downgradient. PCE is present in SRP Well 14.0E-9.6N well over AWQS. An inactive City of Phoenix (COP) well (#57, ADWR # 55626548) is located near to the end of the PCE plume (Figure 3c); no PCE was detected in this well.

The extent of TCE is currently limited to the area around MVW-3, although TCE has been previously detected above AWQS in wells and boreholes to the northeast (Figure 3d).

Cis-1,2-DCE, and benzene have been detected above AWQS in the area of well MVW-3 (Figure 3e). Figure 3e shows data prior to the start of the ozone pilot test (November – December 2018), as the pilot test has since reduced benzene and cis-1,2-DCE below their respective AWQS.

3.5 Risk Evaluation Summary

The RI determined that the soil exposure pathway is incomplete, as the exposure to the contaminated soils would only occur through direct skin contact and ingestion, requiring direct contact with impacted soils. Currently the concrete flooring of the Missouri Falls underground parking garage provides a physical barrier preventing exposure.

Potential risk to receptors from PCE in soil gas was determined to be low. The PCE in the soil gas could reach receptors through vapor intrusion into buildings; however, while PCE was detected in indoor air samples collected in the parking garage of Missouri Falls, due to the short duration most individuals spend in the parking garage and the standard exhaust fans present, exposure levels to PCE would be low. Additionally, a soil vapor extraction system (SVE) early response action (ERA) was installed in this location in 2018 (see Section 3.6 below), which also reduces the vapor intrusion risk.

Exposure to the Site COCs through groundwater was determined to be a potential risk for this Site. SRP Well 14.0E-9.6N, located approximately 350 feet northwest of the corner of 7th Street and Missouri Avenue, is currently in use for irrigation purposes, and SRP anticipates that these wells will be transitioned to a drinking water supply wells in the near future. This well was last sampled by SRP in January of 2018, and contained 19 µg/L of PCE. While the other Site COCs have not been detected in this well, with the proximity of the other COCs to this well, this well is considered threatened by the other COCs.

3.6 Early Response Action and Pilot Test

In June 2018, an SVE system was installed in the basement of the Missouri Falls building, consisting of eight SVE wells and a 75 cfm blower. From start up through the end of June, 2019, the system had removed approximately 540 pounds of PCE from the soils under Missouri Falls.

In November 2018, an ozone sparge pilot test was installed with two injection wells located near to the former Kino location. The ozone sparge system ran until July 2019, and has since been operated periodically.

3.7 Remedial Objectives

A Final Remedial Objectives (RO) Report was provided as Appendix K in the RI report (Pinyon, 2018). The following ROs were presented:

To restore soil conditions at the site to remediation standards for nonresidential use as specified in A.A.C. R18-7-204 (background remediation standards), A.A.C. R18-7-205 (pre-determined remediation standards), or A.A.C. R18-7-206 (site-specific remediation standards) that are applicable to the hazardous substances identified which are. [sic] **The concentrations remaining in soil after remediation standards are met will not cause or threaten to cause a violation of groundwater remediation standards specified in A.A.C. R18-7-203. This action is needed for the present time and for as long as the level of soil contamination exceeds applicable cleanup standards.**

To restore, replace, or otherwise provide for water for its designated municipal use that is lost or impaired by contamination associated with the 7th Street and Missouri Avenue WQARF site. This action is needed for the present time and for as long as the need for the

water exists, the resource remains available and the contamination associated with the 7th Street and Missouri Avenue WQARF site prohibits or limits the designated municipal use of groundwater.

4.0 FEASIBILITY STUDY RESULTS

The Feasibility Study (FS) report was finalized in October 2019. Below summarizes the findings of that report.

4.1 Identification and Screening of Remedial Technologies

The following remedial technologies were identified and screened as shown in Table 1.

Table 1: Screening of remedial technologies

Technology	Retained	Reason for Retention or Elimination
No Action	No	The vadose zone soil would not be remediated; as a result, the ROs for the Site would not be met.
Institutional Controls	Yes	In the event residential standards cannot be achieved for the Site vadose zone, a Declaration of Environmental Use Restriction (DEUR) could to be implemented if non-residential standards are met.
Monitored Natural Attenuation (MNA)	Yes	Retained remedial technology (primarily for abiotic processes).
Soil Vapor Extraction (SVE)	Yes	A remedial technology that was implemented as part of the ERA; has been cost-effective at removing volatile organic compound (VOC) mass from the vadose zone.
Air Sparging	No	Not likely to be cost-effective or improve treatment due to low groundwater concentrations immediately downgradient of the plume, the large extent of the dilute plume, and residual VOC mass in fine grained intervals.
Groundwater Extraction & Treatment System (GETS)	Yes	Retained as effective for control of VOCs in groundwater and as potential wellhead treatment for contingency.
Enhanced Reductive Dechlorination (ERD)	Yes	Retained for potentially targeted treatment areas.
In Situ Chemical Reduction (ISCR)	No	Technically and economically infeasible due to thickness of impacted groundwater zone and the size and depth of the plume.
In Situ Chemical Oxidation (ISCO)	Yes	Retained for potentially targeted treatment areas, including the VOCs source and areas immediately downgradient of the source.

These remedial technologies were screened based on the anticipated ability of the technology to address the ROs at the Site and reduce the contaminant concentration, mass, and/or toxicity. Each technology was screened for effectiveness, implementability, health and safety concerns, flexibility, expandability, and cost. Based on the screening results, Institutional Controls, MNA, SVE, Air Sparging, Groundwater Extraction and Treatment, ERD and ISCR were retained for use at the Site.

4.2 Development of the Reference Remedy and Alternative Remedies

The retained remedial technologies were used to develop a reference remedy and two alternative remedies (a less aggressive remedy and a more aggressive remedy). The reference remedy and the alternative remedies are capable of achieving the ROs. The development of the reference remedy and alternative remedies considered the following:

- The data obtained from the remedial investigations;
- The best available engineering and scientific information concerning available remedial technologies; and
- Preliminary analysis of the comparison criteria and the ability of the remedies to comply with A.R.S. §49-282.06.

The Reference Remedy includes a combination of remedial technologies for source control, the remediation of soil, and the remediation of groundwater including the following:

- Source control to eliminate or mitigate a continuing source of contamination through an SVE system. The ERA SVE blower system will be expanded from 75 cfm to 300 cfm, and the system will be operated for three years. Contingencies include addition of another SVE well, an additional year of runtime, an additional year of operation and maintenance (O&M), and a second SVE system near to the Circle K.

- Plume remediation to achieve water quality standards for COCs near the source area via ISCO. The current ozone injection pilot test will be expanded by the installation of two additional injection wells for the existing ozone generator and installation of an additional ozone generator and up to five new dual-nested injection wells. The ozone injection will occur for a time period up to three years. Contingencies include moving the source area ozone sparge system if the elevated PCE concentrations move downgradient, additional ozone sparge injection wells and a mobile ozone sparge system near to the SRP or COP production wells, and a contingency of wellhead treatment for the SRP and COP wells.

- Monitoring (MNA) to observe and evaluate the contamination of the COCs, including soil vapor sampling from on-site soil vapor probes and SVE wells, installation of two new groundwater monitoring wells, semiannual sampling of the groundwater monitor well network to evaluate plume stability, VOC concentrations, and natural attenuation parameters; and groundwater elevation measurements to evaluate flow direction and hydraulic gradient. MNA is assumed to be needed for three years during the plume remediation, and three years post-remediation.

The Less Aggressive remedy uses the ERA SVE and the pilot test ozone systems without modification (i.e. no further remedial equipment installed), followed by MNA with a contingency of wellhead treatment for the future effected wells. Details including the following:

- Source control to mitigate a continuing source of contamination by continued operation of the current SVE system for two years. Contingencies include an additional year of runtime and an additional year of O&M. If remediation of the vadose zone cannot reach residential SRLs, but non-residential SRLs are met, a DEUR may be established. A contingency of a second small SVE system near to the Circle K is also included.

- Source area groundwater treatment will consist of the current pilot ozone system only with the two current injection wells for a period of two years.

- Monitoring (MNA) to observe and evaluate the contamination of the COCs, including soil vapor sampling from on-site soil vapor probes and SVE wells, installation of two new groundwater monitoring wells, semiannual sampling of the groundwater monitor well network to evaluate plume stability, VOC concentrations, and natural attenuation parameters; and groundwater elevation measurements to evaluate flow direction and hydraulic gradient. MNA is costed to last for 30 years for the less aggressive remedy. Contingencies include wellhead treatment for the SRP and COP well, and two additional monitoring wells,

The More Aggressive Remedy includes an upgrade to the SVE system similar to the Reference Remedy, but includes a larger blower and the installation of additional SVE wells. The More Aggressive remedy uses GETS in addition to the pilot ozone system to contain and remediate the plume. Details as follows:

- Source control to eliminate or mitigate a continuing source of contamination through an SVE system. The ERA SVE blower system will be expanded from 75 cfm to 500 cfm, and five additional SVE wells installed. The system would be operated for a shorter time-frame than the reference and less aggressive remedies due to the expanded treatment footprint. Contingencies include addition of another SVE well, an additional year of runtime, an additional year of O&M, and a second SVE system near to the Circle K.

- Plume remediation will consist of continued operation of the pilot source area ozone sparge system comprising of injection at the two existing source area injection wells for a period of 3 years, combined with installation and operation of a GETS consisting of two groundwater extraction wells and a treatment system for 10 years. Contingencies include an additional GETS extraction well, 10 additional years of GETS runtime, additional ozone sparge injection wells and a mobile ozone sparge system near to the SRP or COP production wells, and a contingency of wellhead treatment for the SRP and COP wells.

- Monitoring (MNA) to observe and evaluate the contamination of the COCs, including soil vapor sampling from on-site soil vapor probes and SVE wells, installation of two new groundwater monitoring wells, semiannual sampling of the groundwater monitor well network to evaluate plume stability, VOC concentrations, and natural attenuation parameters; and groundwater elevation measurements to evaluate flow direction and hydraulic gradient. MNA is assumed to be needed for three years during the plume remediation, and three years' post-remediation.

4.3 Evaluation and Comparison of the Remedies

The Feasibility Study included a comparative evaluation of the Reference, Less Aggressive and More Aggressive Remedies to demonstrate that each remedial alternative will achieve the ROs in accordance A.A.C. R18-16-407(H). The criteria used to evaluate each remedial alternative included the following:

- 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.
- An evaluation of the comparison criteria, including:
    - Practicability
    - Risk
    - Cost
    - Benefit

All remedies met all of the above criteria. A summary of the evaluation for each remedial alternative is presented in Table 2. The comparative evaluation in the feasibility study is included in Appendix A (note: costs in this table were those estimated at the time of the FS).

Table 2: Summary of Remedial Alternatives				
Alternative	**Practicability**	**Risk**	**Cost***	**Benefit**
Reference Remedy	• Very Feasible • Moderately Implementable • Likely Effective • Duration Six Years	• Protective • Reduces Residual VOCs Source to Groundwater	$6.2M	• Protects Water Supply • Achieves ROs Quickly
Less Aggressive Remedy	• Very Feasible • Moderately Implementable • Potentially Effective • Duration 30 Years	• Unknown • Some Potential Risk • Potential DEUR	$6.8M	• Less Beneficial
More Aggressive Remedy	• Moderately Feasible • Least Implementable • Likely Effective • Duration 10 Years	• Protective • Established Technology	$8.2M	• Protects Water Supply • Contains Plume
Notes: ***The costs presented in this table were taken directly from the FS Report.**				

5.0 PROPOSED REMEDY AND ESTIMATED COST

The remedy proposed in the FS for the Site is the Reference Remedy. The Reference Remedy was proposed because it was found to be the most effective, to have the least amount of risk, to be the most beneficial, and to be the least expensive to implement. The Reference Remedy was proposed because it will achieve the ROs, it meets the remedial action criteria pursuant to A.R.S. §49-282.06, and it is consistent with current and future land and water use.

5.1 Remedy Description

The proposed remedy includes a combination of remedial technologies for remediating the soil and groundwater at the Site. Each of these remedial technologies is described in the following subsections.

5.1.1 Proposed Remedial Action – Soil

SVE

The operation of the existing SVE system will be incorporated into the remedy to remediate the elevated VOC concentrations in the soil vapor that are a source of groundwater contamination (Figure 4a). The current ERA system consists of eight SVE wells and a 75 cfm blower. For the remedy, the ERA SVE blower system will be expanded from 75 cfm to 300 cfm. The SVE system will be operated for a period of up to three years. The remedy includes a contingency to operate the SVE system for one additional years as warranted by the VOC concentrations in the vadose zone.

5.1.2 Proposed Remedial Action – Groundwater

ISCO – ozone injection

ISCO is a remedial measure by which COCs are treated *in-situ* by a chemical reagent with the capability to completely break down the contaminant. Ozone breaks down PCE and other organic compounds by breaking the bonds between the carbon atoms within the molecule. In the case of PCE and other chlorinated compounds, the by-products of the breakdown are carbon dioxide, oxygen, chlorine ions, and water. By injecting a gas into the groundwater (i.e. sparging) rather than a liquid reagent, a larger radius of influence from one injection well can be attained with this form of ISCO.

The remedy consists of treating the source area and near-source area of the plume via ISCO using the ozone injection (Figure 4b). The current system consisting of two dual-nested injection wells and an ozone generator injecting approximately 5.5 lbs/day of ozone will be used, along with the installation of two additional dual-nested injection wells in the source area. A line of five additional new dual-nested injection wells will be installed further downgradient of the source area and

connected to an additional ozone generator with a minimum of 20 lb/day generation. The remedy includes contingencies of additional injection well transects further downgradient should concentrations indicate the need to perform additional ISCO either to meet the remediation time-frame or protect water use.

MNA

MNA is a remedial measure that involves routine groundwater sampling and analysis to monitor the results of one or more naturally occurring physical, chemical, or biological processes that reduce the mass, toxicity, volume, or concentration of chemicals in groundwater. MNA is a mechanism by which COCs are reduced by natural means without other control, removal, treatment, or aquifer-modifying activities. These in-situ processes may include dilution, adsorption, volatilization, precipitation, and biological degradation of the contaminants in the groundwater.

MNA will consist of routine groundwater monitoring and sampling to monitor groundwater contamination at the Site. The groundwater monitoring data will be used to evaluate plume migration, plume stability, and natural attenuation of the plume. The data will also be used to trigger appropriate contingency actions (i.e., wellhead treatment at an impacted water supply well) to manage risk associated with the groundwater plume migration. MNA will continue until the concentrations of the COCs drop below the AWQS.

The MNA program will be conducted at the Site for a period up to 3 years during plume remediation and up to three years post-remediation. The program will include semi-annual water level monitoring of up to 18 wells; groundwater sampling of up to 18 semi-annual wells and annual reporting. The number of wells to be monitored and the frequency of monitoring will be adjusted over time in response to changing groundwater conditions. Costs have been included for the installation of two additional groundwater monitor wells for performance monitoring. Contingencies include an additional 10 years of MNA.

5.2 Proposed Contingencies

A contingency for the soil remedy includes an addition of another SVE well, which will be installed if data indicates an additional hot spot of contamination exists on the edges of the radius of influence of the system. Also included as a contingency is an additional year of runtime with an additional year of O&M, which includes rebound testing periods. The need for additional runtime will be evaluated by the influent data of the system and data from rebound testing at the end of the original three-year run-time period. An additional SVE system to be located near to buildings/infrastructure that may be impacted by fugitive ozone is also included as a contingency. The need for this will be evaluated by monitoring for fugitive ozone during the initial startup of the full-scale system, and periodically during the projected three years of ozone treatment.

For the groundwater, a contingency included is moving the original source area ozone sparge system with five duel-nested injection wells to a point downgradient if the elevated PCE concentrations move downgradient of the second system installed for the remedy. Also included is a mobile ozone sparge system with injection wells that can be moved to hot spots or to treat the groundwater near to the SRP or COP production wells.

A contingency of wellhead treatment for the SRP and the COP wells is included (Figure 4c). This contingency will be triggered by water from either well being used for a potable source and finding PCE above AWQS at the point of compliance of the well.

An additional ten years of MNA is also included. If the concentrations in the groundwater are not below AWQS at the end of the six year period, the additional monitoring will occur. Included in this contingency is modifying the sampling schedule to annual and decreasing the number of wells sampled to control long-term monitoring costs.

5.3 Inspections, Performance Monitoring, and Periodic Reviews

Operation and maintenance of the ozone injection system(s) and SVE system(s) will be performed during system operation. Periodic reviews will occur to insure the systems are operating as expected and to judge the effectiveness and adequacy of the remedy. Monitoring will include the following:

- **Inspections** – Inspections will be conducted to evaluate the conditions of the SVE and ozone sprage systems during system monitoring (see below) to insure no visible damage or interference are occurring with the systems or the system locations. Inspections of the monitoring well conditions will be carried out during sampling events.

- **SVE System Monitoring** – Routine process monitoring will be conducted during the operation of the SVE system to ensure the system is operating effectively. The process monitoring will include the collection of samples from process wells and the carbon adsorption system.

- **Groundwater Performance Monitoring** – Groundwater monitoring, in addition to MNA, will be conducted to evaluate the performance and the post treatment impacts of ozone. The performance monitoring would include quarterly sampling events conducted at up to seven wells located within the target treatment zone during ozone implementation.

- **Periodic Reviews** - Periodic reviews of remedial progress will be conducted as necessary to determine the effectiveness of the remedy in achieving the ROs. These reviews will be conducted, at a minimum, every three years.

5.4 Estimated Cost

The estimated cost of the proposed remedy is $1,938,000. The estimated cost with contingencies is $8,034,000. A summary of the costs is available in Table 3, and a detailed cost breakout is available in Appendix A.

Table 3: Summary of Proposed Remedy Costs	
Remedial Action Element Description	**Cost**
PRIMARY ELEMENTS	
Vadose Zone - Expansion of SVE System and Operation	$256,000
Groundwater - Source and Extended Area Ozone Sparge	$909,000
Groundwater - MNA	$773,000
PRIMARY ELEMENTS SUBTOTAL:	**$1,938,000**
CONTINGENCY ELEMENTS	
SVE Additions	$325,000
Ozone System Additions	$830,000
MNA Additions	$650,000
Wellhead Treatment	$4,511,000
CONTINGENCY ELEMENTS SUBTOTAL:	**$6,316,000**
PROPOSED REMEDY GRAND TOTAL:	**$8,254,000**
Notes: Cost assumes 3% annual inflation rate for multi-year items (e.g. groundwater sampling)	

5.5 Duration

The overall duration of the remedy is up to six years. The duration is the estimated number of years required for the proposed remedy to achieve the ROs.

6.0 CONSIDERATION OF REMEDIATION GOALS AND SELECTION FACTORS

6.1 Rationale for Selection of the Remedy

The proposed remedy is based on what is considered the best combination of effectiveness, practicability, cost and benefit. The proposed remedy includes the following remedial strategies:

- Remove PCE mass from the vadose zone with SVE, remediating the soils and preventing a potential continuing source to groundwater.
- Treat the source area groundwater with ozone to destroy the COCs in the groundwater.
- Perform MNA including the installation of two additional groundwater monitor wells.
- Maintain use of groundwater by including contingencies to include additional ozone systems and wellhead treatment systems.

This remedy is the most practicable with the most benefits for the cost, combined with lower long-term risk at the Site. The proposed remedy will protect against human exposure while allowing continued use of the properties. The proposed systems can be installed and operated with a minimal impact on property operations. The threat of the PCE in the vadose zone acting as a continuing source for VOCs is reduced by the SVE system. The proposed remedy allows for the continued use of the groundwater, while protecting downgradient water supply by treatment of the source area.

6.2 Achievement of Remedial Objectives

Per A.C.C. R18-16-408(B)(3), the proposed remedy must achieve each of the ROs established by ADEQ for the Site as presented in this PRAP. The Proposed Remedy will achieve the soil ROs for the Site by continued operation of the SVE system, restoring the soils to A.A.C. R18-7-204 (background remediation standards), A.A.C. R18-7-205 (pre-determined remediation standards), or A.A.C. R18-7-206 (site-specific remediation standards), and by mitigating potential for ongoing migration to groundwater.

The Proposed Remedy will achieve the groundwater ROs for the Site by remediating the source area with ISCO, followed by MNA for the diffuse plume. Contingencies of additional ISCO treatments and wellhead treatment systems are included to also protect the future use of groundwater.

As demonstrated in this PRAP, the proposed remedy for the Site meets the requirements of A.R.S. § 49-282.06. The proposed remedy is protective of human health and the environment, compliant with applicable laws, and allows for the maximum beneficial use of the waters of the State with the lowest cost. The proposed remedy is the best combination of practicability, risk, cost, and benefit to achieve the ROs.

6.3 Consideration of Remedial Action Criteria

Consistent with A.R.S. §49-282.06 the proposed remedy will:

- Assure the protection of public health and welfare and the environment by reducing contaminant mass in both the soil and groundwater and providing further groundwater treatment to protect water use;
- Provide for the control, management or cleanup of the COCs in the groundwater by remediating the source area with ISCO;
- Allow the maximum beneficial use of the waters of the state by continuing operation of wellhead treatment systems, providing for possible future well head treatment system, and containing the plume with pump and treat;
- Be reasonable, necessary, cost-effective and technically feasible (Table 1).

6.4 Consistency with Water Management Plans

The proposed remedy is consistent with the water management plans of local water providers. There are no current drinking supply wells currently impacted by the plume and the proposed remedial actions will restore water quality prior to the water being used for drinking water. This remedy will allow for the maximum beneficial use of the waters of the State and will protect the groundwater supply for future use by treating the water at the wellhead or remediating the groundwater prior to reaching the well via ISCO.

6.5 Consistency with General Land Use Planning

The Proposed Remedy allows continued non-residential use of the properties with minimal disturbance to site operations.

6.6 Lead Agency Statement for Proposed Remedy

Based on the information currently available, ADEQ believes the proposed remedy provides the best balance of tradeoffs among the other alternatives with respect to the comparison criteria. ADEQ expects the Proposed Remedy will satisfy the remedial action criteria pursuant to A.R.S. §49-282.06 and the ROs.

6.7 Uncertainties

Uncertainties associated with the proposed remedy at the Site include the following:

- The volume of COCs that were released and are still present in the vadose zone is unknown. Thus, the estimated duration required to remediate the vadose zone at the Site could be more or less than the time-frame assumed by the Proposed Remedy.
- The rate at which VOCs will desorb/volatilize from fine materials is unknown.
- The duration of time required for the groundwater to meet cleanup standards is unknown. No groundwater model has been prepared to assess the duration of time required for the reduction of COC concentrations in groundwater to below cleanup standards. The time

required was estimated on observations of changes of COCs at the Site along with professional judgement from working on similar environmental investigations. Thus, the estimated duration required to remediate the groundwater at the Site could be more or less than the time-frame estimated.

6.8 Public Comment Period

Notice of the PRAP shall be issued according to the community involvement plan and R18-16-404, and will include a description of the proposed remedy and its estimated cost, the location where the RI, FS, and PRAP reports can be inspected, how comments on the PRAP can be submitted, and the closing date for comments The PRAP will be issued for a 90-day public comment period. A Community Advisory Board (CAB) meeting may be held during the public comment period. ADEQ will accept written comments on this PRAP that are postmarked within the comment period and submitted the address in the public notice.

Copies of the PRAP shall also be sent to each person on the preliminary list of potentially responsible parties, including the information on the notice above and that prescribed by 287.04(C).

7.0 REFERENCES

Pinyon, 2018. Remedial Investigation Report, North 7th Street and East Missouri Avenue, Phoenix, Arizona. November 21

SECOR, 1996. Site Characterization Report, Circle K Store No. 03744, SECOR International Incorporated, May 19.

HGC, 2015. Preliminary Investigation Report, 7th Street and Missouri Avenue Study Area, Phoenix, Arizona, Hydo Geo Chem, Inc., January 16

Figures

KEY MAP

NOT TO SCALE

AERIAL IMAGE FROM BING

100' 50' 0 100 Feet

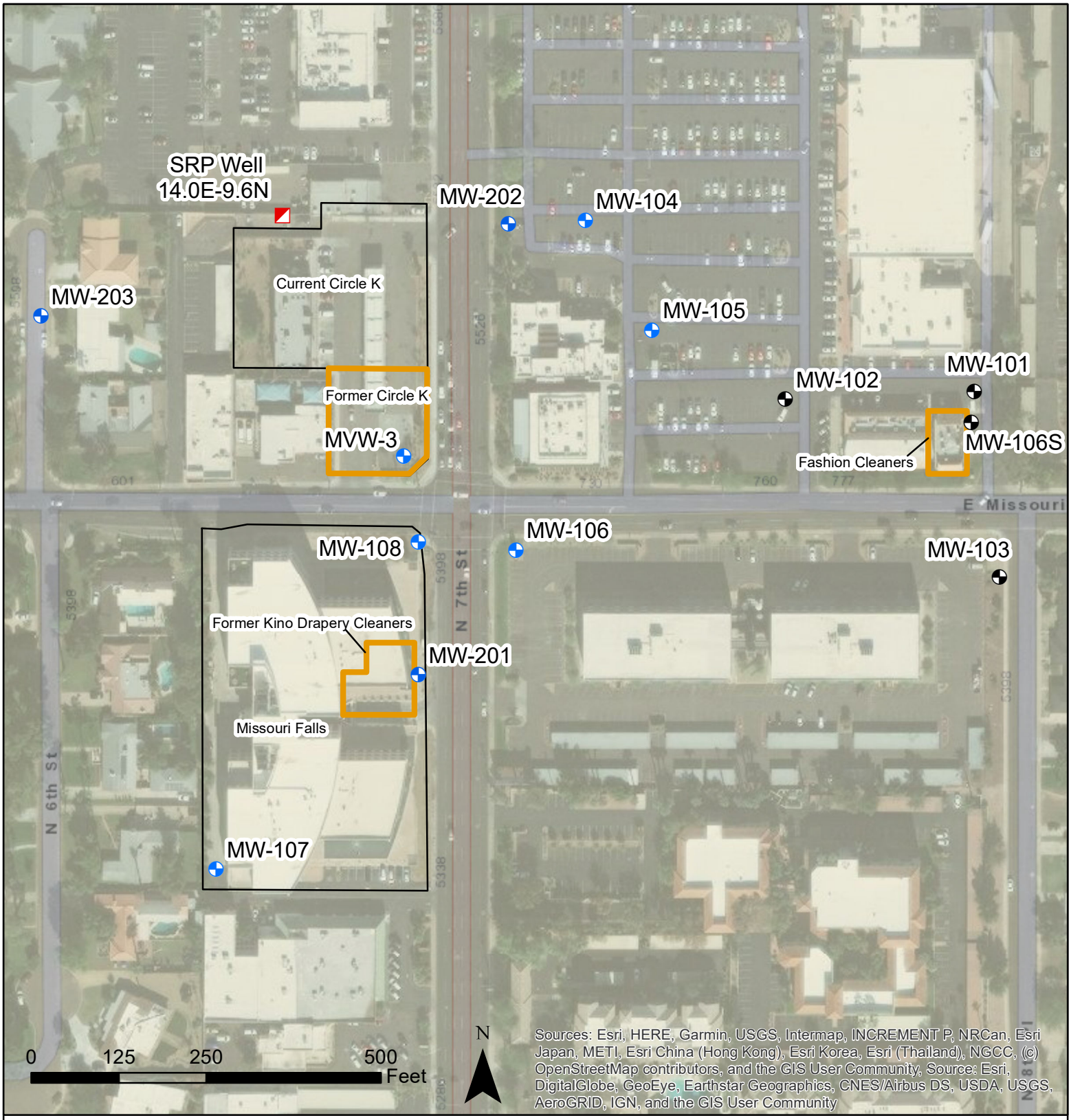
SITE LOCATION

Proposed Remedial Action Plan
North 7th Street and East Missouri Avenue
Phoenix, Arizona

Geosyntec consultants

Phoenix, AZ | March 2020

Figure: 1



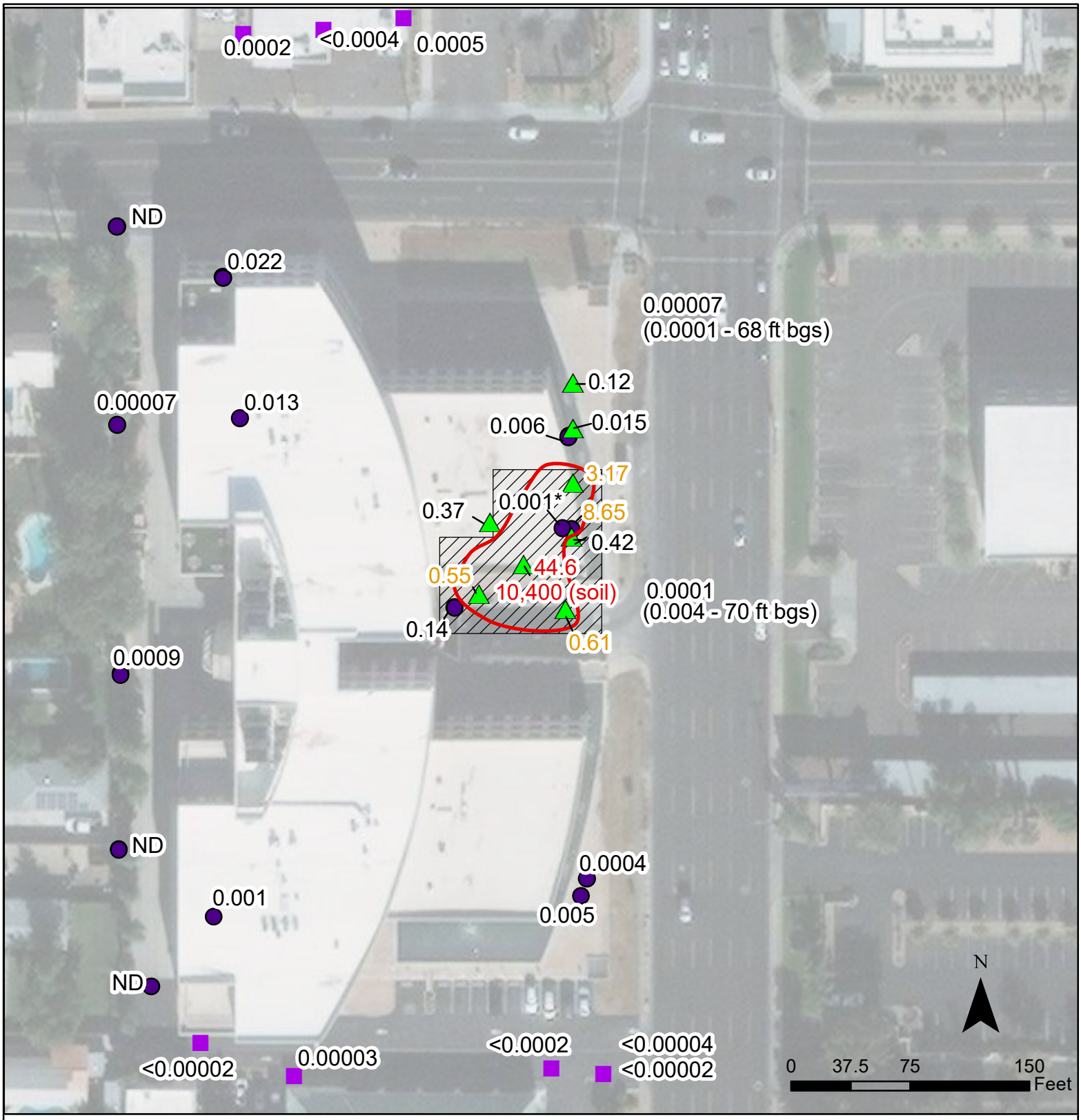
Legend

- Site Wells
- VRP Site Wells
- Production Well
- Area Facilities
- Area Properties

Figure 2

Site Detail
7th St. and Missouri Ave.
Proposed Remedial Action Plan

ADEQ
Arizona Department of Environmental Quality



Legend

- Nov 2018, 20 ft bgs (highest concentration and depth in parenthesis)
- June 2018 - ~35 ft bgs
- 2017 - 5-15 ft bgs
- 2014 - 20-35 ft bgs
- Approximate area above SRLs
- Former dry cleaner location

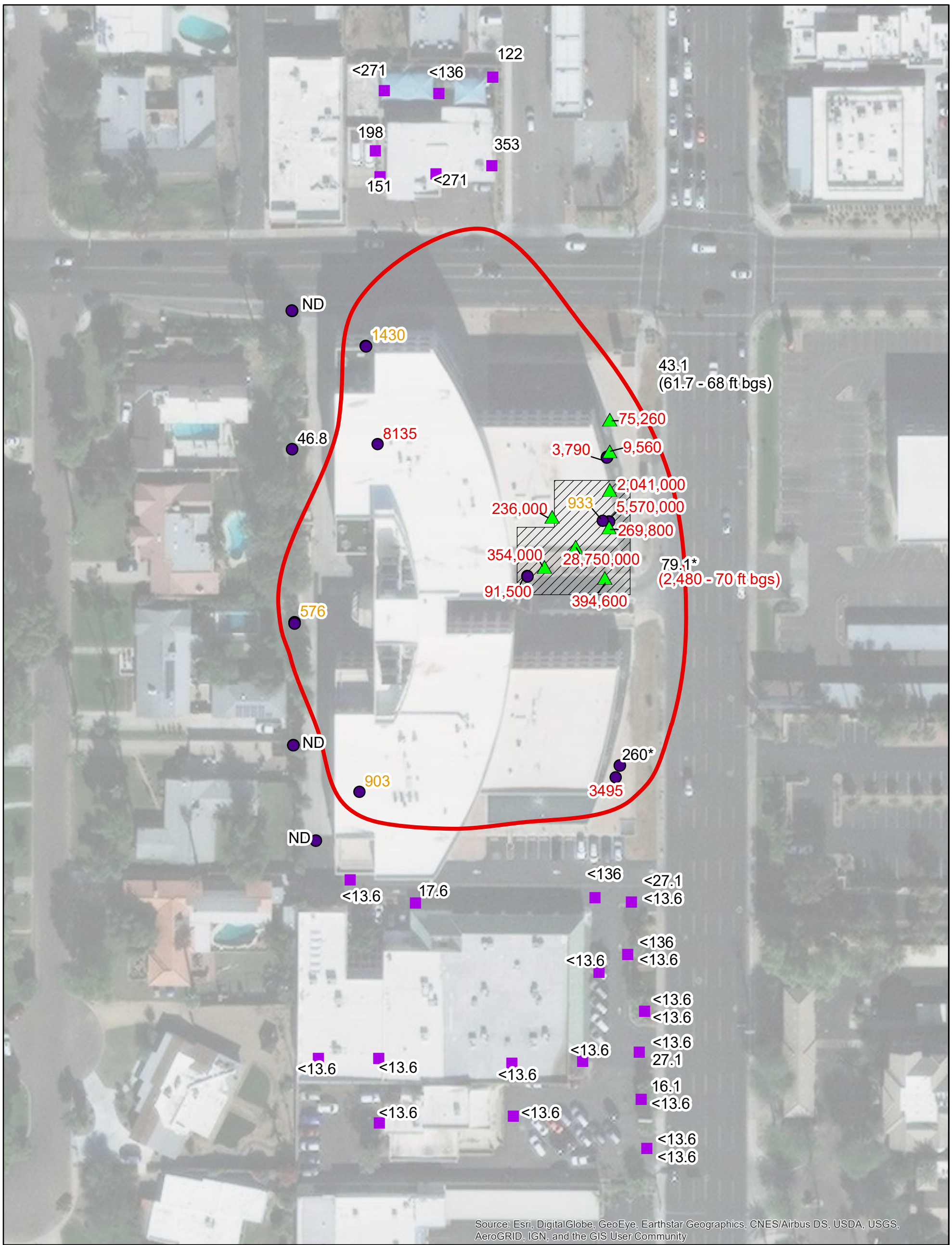
Notes:

All numbers in mg/kg
Values from converting soil-gas into soil equivalents unless otherwise noted
Red indicates above non-residential SRL
Orange indicates above residential SRL
* Not used for contouring

Figure 3a

Extent of Contamination
In Soil - PCE
7th St. and Missouri Ave.
WQARF Site
Proposed Remedial Action Plan

ADEQ
Arizona Department of Environmental Quality



Legend

- Nov 2018, 20 ft bgs (highest concentration and depth in parenthesis)
- June 2018 - ~35 ft bgs
- 2017 - 5-15 ft bgs
- 2014 - 20-35 ft bgs
- Approximate area above VISLs
- Former dry cleaner location

N

0 50 100 200 Feet

Notes:

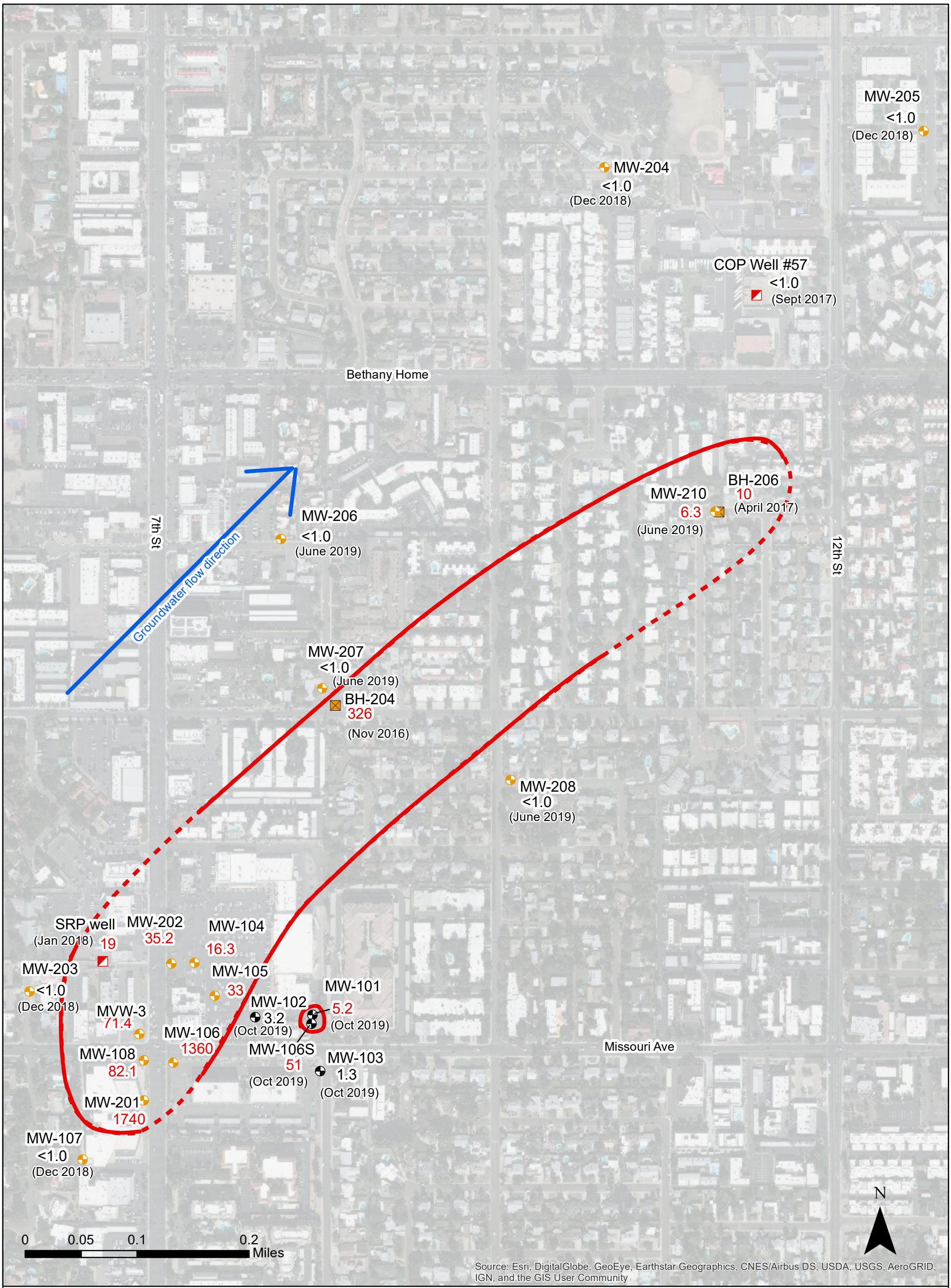
All numbers in mg/kg
Red indicates above non-residential VISL
Orange indicates above residential VISL
* Not used for contouring

Figure 3b

Extent of Contamination
In Soil Gas - PCE

7th St. and Missouri Ave. WQARF Site
Proposed Remedial Action Plan

ADEQ
Arizona Department of Environmental Quality



Legend

- 7th St and Missouri Ave Site wells
- VRP Site wells
- Boreholes
- Production well
- Approx PCE extent (dashed where inferred)
- 430 PCE concentration, µg/L

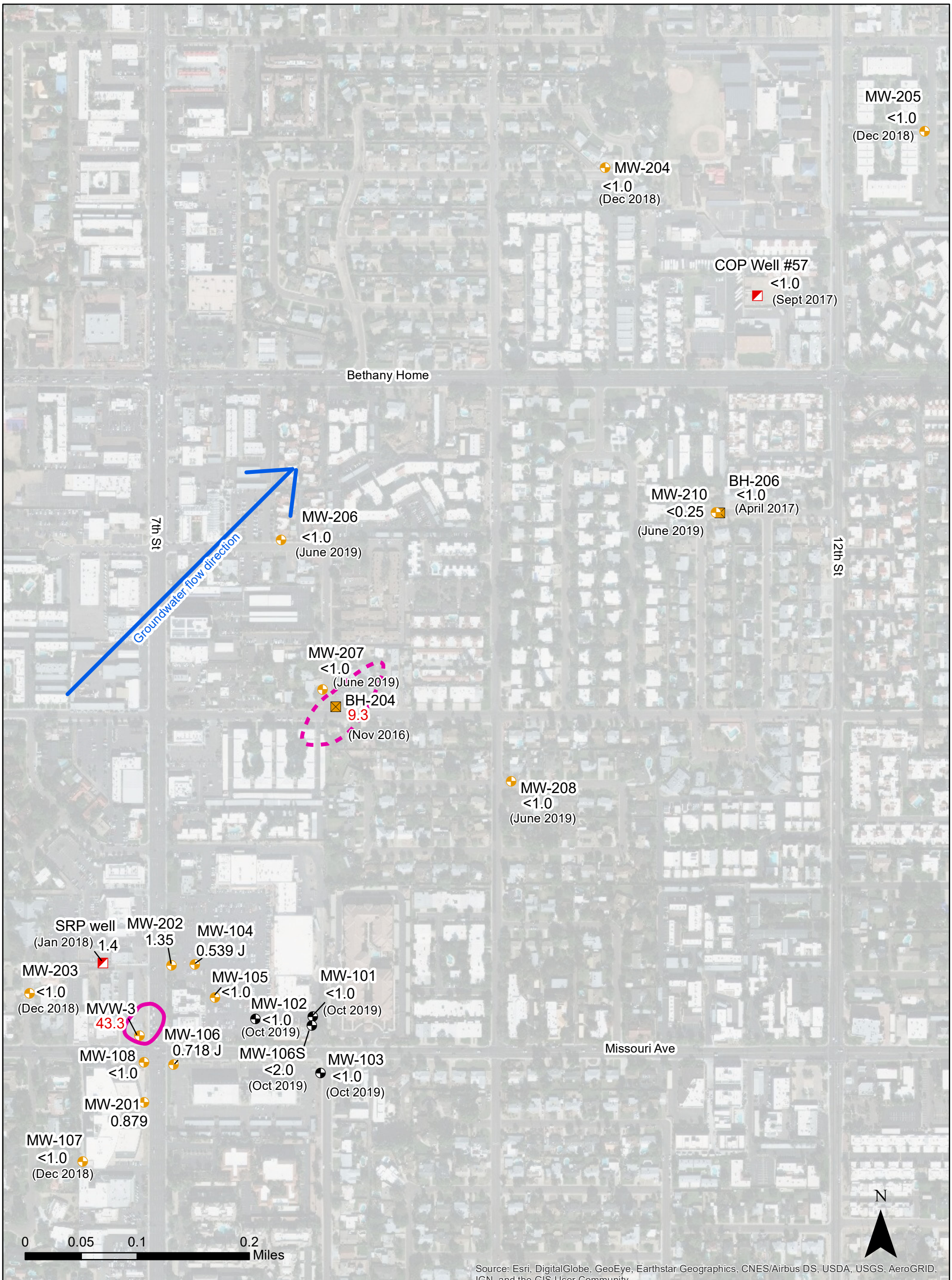
Notes:
Results from January 2020 unless otherwise noted

Figure 3c

Extent of Contamination in Groundwater - PCE

7th St. and Missouri Ave.
Proposed Remedial Action Plan

ADEQ
Arizona Department of Environmental Quality



Legend

- 7th St and Missouri Ave Site wells
- VRP Site wells
- Boreholes
- Production well
- Approx TCE extent (dashed where inferred)
- 64 TCE concentration, µg/L

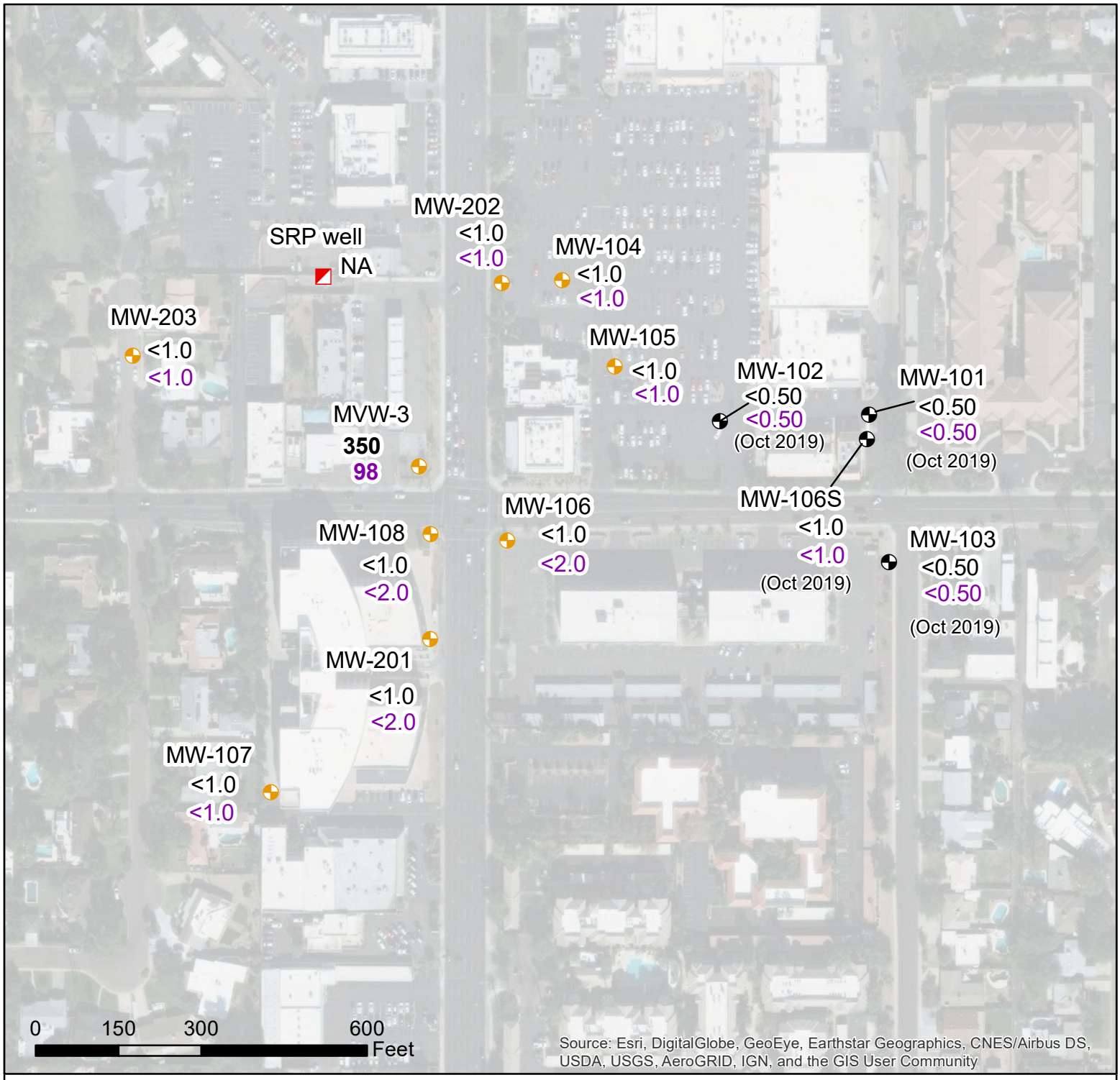
Notes:
Results from January 2020 unless otherwise noted

Figure 3d

Extent of Contamination in Groundwater - TCE

7th St. and Missouri Ave.
Proposed Remedial Action Plan

ADEQ
Arizona Department of Environmental Quality



Legend

- 7th St and Missouri Ave Site wells
- VRP Site wells
- Boreholes
- Production well

350 Benzene concentration, µg/L

98 c-1,2-DCE concentration, µg/L

N

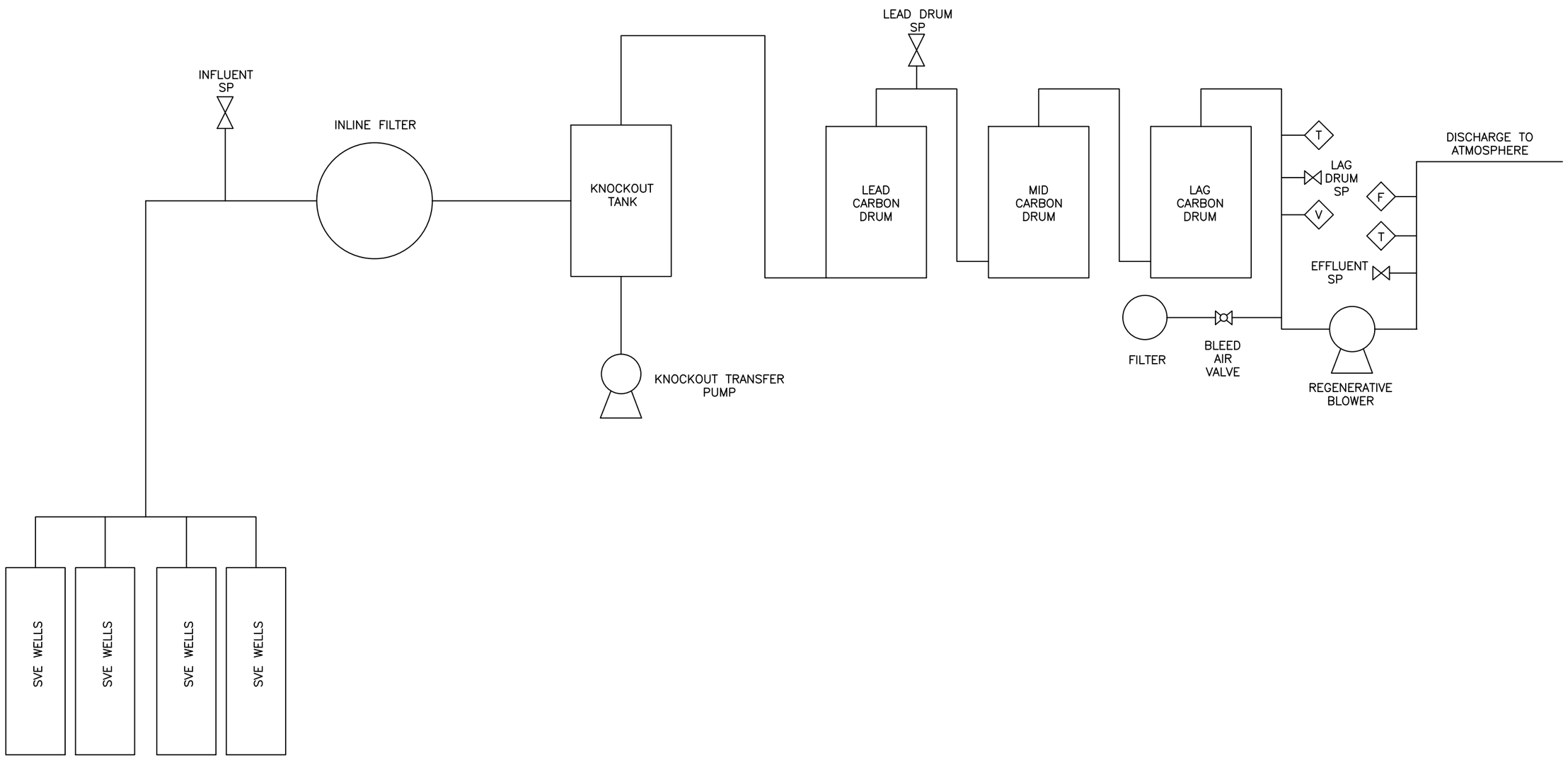
Figure 3e

Extent of Contamination in Groundwater - Other contaminants

7th St. and Missouri Ave.
Proposed Remedial Action Plan

Notes:
Results from December 2018 unless otherwise noted
Bold indicates over AWQS
c-1,2-DCE = cis-1,2-dichloroethene

ADEQ Arizona Department of Environmental Quality



LEGEND

SP	Sample Port	F	Flow Sensor
T	Temperature Sensor	——	Piping
V	Vacuum Sensor		

Pinyon Environmental, Inc.

Conceptual Design of Remedy - SVE

North 7th Street and East Missouri Avenue, Phoenix, Arizona

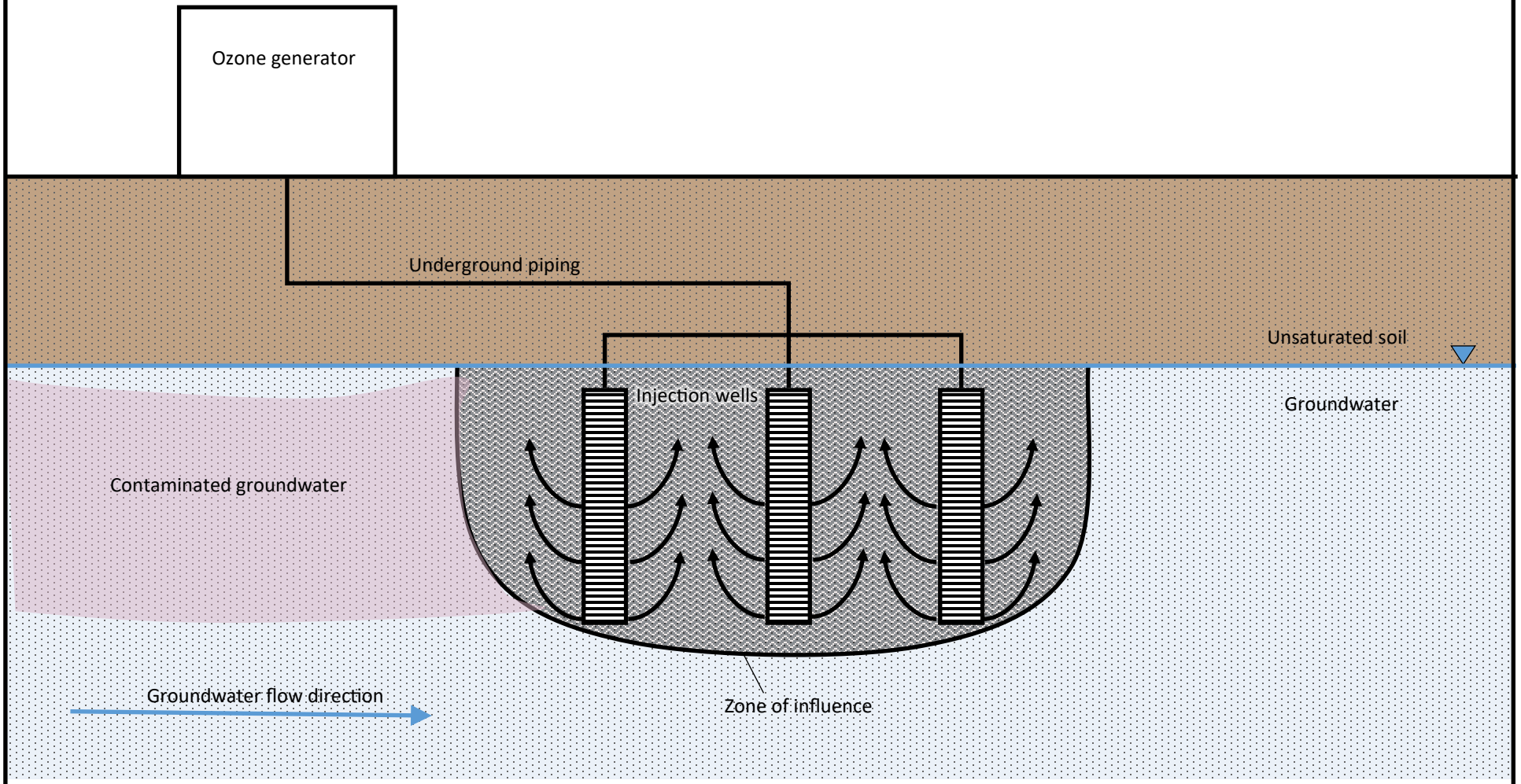
Proposed Remedial Action Plan

Site Location: North 7th Street and East Missouri Avenue, Phoenix, Arizona	Drawn By: GMD	Figure: 4a
Pinyon Project Number: 7/17-1006-03.REM001.4	Reviewed By: AMG	Date: 6/24/2019

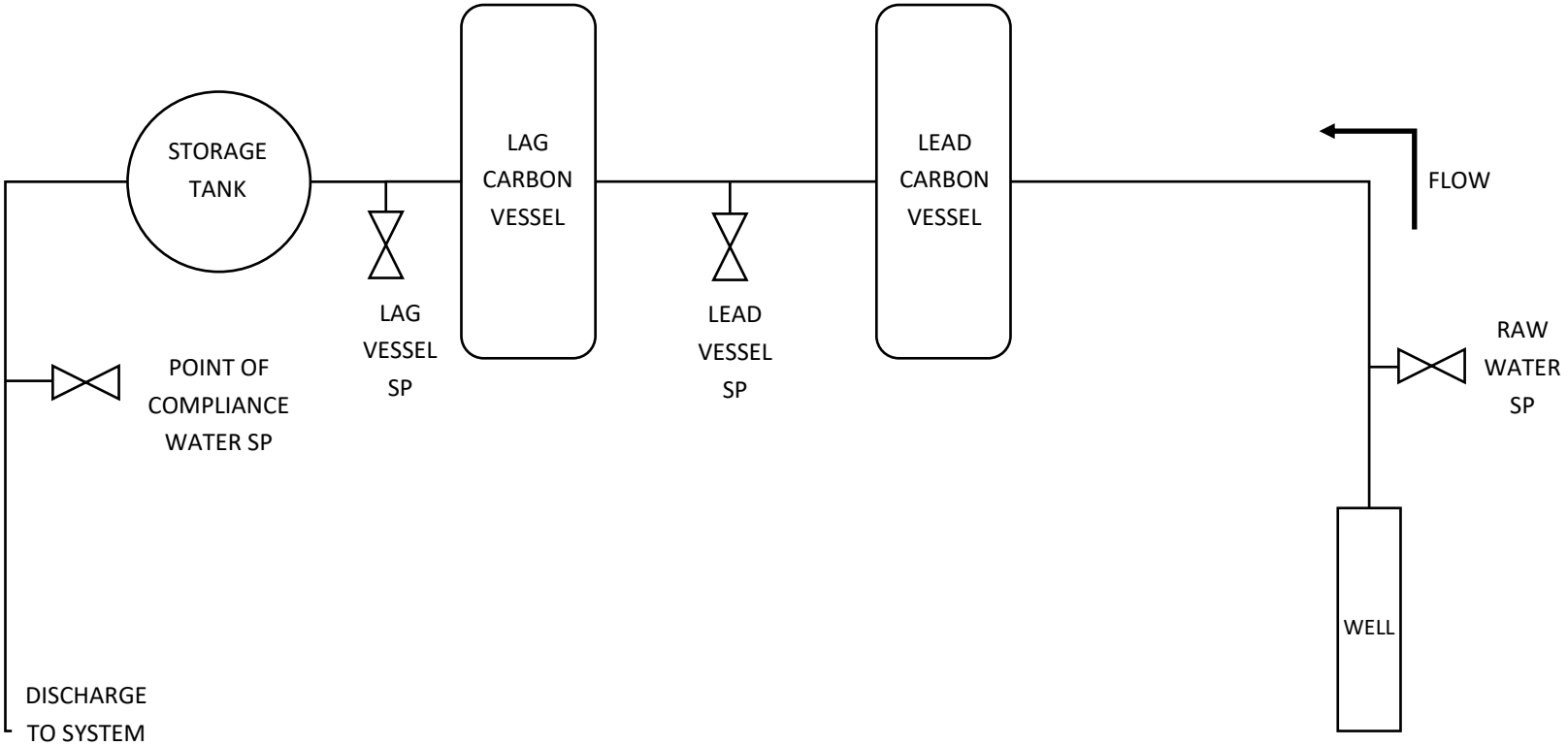
PLOT DATE: 6/28/2019

Z:\PROJECTS\2017\717100603 ADEQ 7th & Missouri\Figures\AutoCAD\DWG\SVESkidPlacement.dwg

Figure 4b
Conceptual Design of Remedy
Ozone Sparge
7th St. and Missouri Ave
Proposed Remedial Action Plan



ADEQ
Arizona Department of Environmental Quality



FE Flow Element (Totalizer)

Sample Port

2/19/2020

Figure 4c

Conceptual Design of Remedy - Wellhead Treatment

7th St and Missouri Ave WQARF Site
Proposed Remedial Action Plan

Appendix A

APPENDIX A - PROPOSED REMEDY DETAILED COST SUMMARY
7th St. and Missouri Ave.
Proposed Remedial Action Plan

Remedial Action Element Description	Quantity	Unit	Unit Cost	Cost	Detail
PRIMARY ELEMENTS					
Vadose Zone - Expansion of Soil Vapor Extraction (SVE) System and Operation					
Installation of 300 CFM SVE Unit	1	Lump Sum	$25,000	$25,000	Includes cost of equipment and installation
Estimated Vadose Zone Annual O&M Costs (Year 1-3)	3	Year	$77,000	$231,000	Cost was adjusted to reflect an average of 3.0% inflation over 3 years
			Subtotal:	**$256,000**	
Groundwater - Source and Extended Area Ozone Sparge					
Design and Installation of Ozone System	1	Lump Sum	$786,000	$786,000	Includes cost of design, equipment, installation of equipment and wells, and 15% Project Management/Administration
Sampling and maintenance (Year 1-3)	3	Year	$41,000	$123,000	Assumes periodic sampling and reporting, and occasional maintenance
			Subtotal:	**$909,000**	
Groundwater - MNA					
Installation of two additional Monitoring Wells	1	Lump sum	$125,000	$125,000	Assumes two additional monitoring wells are needed to begin MNA on diffuse plume
Groundwater Monitoring Annual Costs	6	Year	$108,000	$648,000	Assumes two groundwater monitoring events per year with reporting costs
			Subtotal:	**$773,000**	
PRIMARY ELEMENTS SUBTOTAL:				**$1,938,000**	
CONTINGENCY ELEMENTS					
SVE Additions					
SVE Well Installation (1) and Associated Capital Improvement	1	Lump Sum	$25,000	$25,000	Includes equipment and installation costs
Additional 1 year SVE O&M Costs	1	Year	$80,000	$80,000	Includes labor, laboratory, and electrical costs, assuming an average of 3.0% inflation over years 3-4
Off-site SVE Contingency at Circle K	1	Lump Sum	$220,000	$220,000	Includes installation of two wells, SVE System Installation and O&M (Up to 1 Year)
			Subtotal:	**$325,000**	

APPENDIX A - PROPOSED REMEDY DETAILED COST SUMMARY
7th St. and Missouri Ave.
Proposed Remedial Action Plan

Remedial Action Element Description	Quantity	Unit	Unit Cost	Cost	Detail
Ozone System Additions					
Ozone System O&M and GW Monitoring for system for 1 Additional Year	1	Year	$125,000	$125,000	Assumes monitoring of system for 1 additional year; includes labor equipment, lab analysis, and reporting. Cost was adjusted to reflect an average of 3.0% inflation over years 4-5
Ozone Sparge IWs Installation North of Cinema Park Villag	1	Lump sum	$470,000	$470,000	Assumed use of source area generator and O&M for 1 year. Costs include Installation, Development, Survey and Oversight
Ozone Sparge IWs Installation Near COP or SRP Well	1	Lump sum	$235,000	$235,000	Assumed use of source area generator and O&M for 1 year. Costs include Installation, Development, Survey and Oversight
			Subtotal:	**$830,000**	
MNA Additions					
Additional years of monitoring	10	Year	$65,000	$650,000	Assumes one monitoring event per year. Cost was adjusted to reflect an average of 3.0% inflation over years 7-17
			Subtotal:	**$650,000**	
Wellhead Treatment					
Installation of Wellhead Treatment	1	Each	$2,011,000	$2,011,000	Includes permitting, drilling, oversight, waste management
O&M costs (1-20 Years)	20	Event	$125,000	$2,500,000	Cost was adjusted to reflect an average of 3.0% inflation over years 1-20
			Subtotal:	**$4,511,000**	
CONTINGENCY ELEMENTS SUBTOTAL:				**$6,316,000**	
PROPOSED REMEDY GRAND TOTAL:				**$8,254,000**	