RECORD OF DECISION
20TH STREET & FACTOR AVENUE
WQARF REGISTRY SITE
YUMA, ARIZONA

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List of Acronyms	
µg/L	micrograms per liter
A.A.C.	Arizona Administrative Code
ABC	aggregate base coarse
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
A.R.S.	Arizona Revised Statute
AWQS	Aquifer Water Quality Standard
CAB	Community Advisory Board
CIP	Community Involvement Plan
COCs	contaminants of concern
DCE	1,1-dichloroethene
DEUR	Declaration of Environmental Use Restriction
ERA	early response action
ERD	enhanced reductive de-chlorination
FS	Feasibility Study
ft	feet
bgs	below ground surface
GPL	groundwater protection level
HWS	Hazardous Waste Section
INA	Irrigation Non-Expansion Area
ISCO	in situ chemical oxidation
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
MNA	monitored natural attenuation
NFA	no further action
PCE	tetrachloroethene
PRAP	Proposed Remedial Action Plan
RI	Remedial Investigation
ROs	Remedial Objectives
ROD	Record of Decision
SRLs	Soil Remediation Level
TCA	1,1,1-trichloroethane
TCE	trichloroethene
UST	underground storage tank
VOCs	volatile organic compounds
WDS	waste disposal system
WPA	Water Planning Area
WQARF	Water Quality Assurance Revolving Fund

1.0 DECLARATION

1.1 Site Name and Location

This Record of Decision (ROD) is for the 20th Street and Factor Avenue (20th & Factor) Water Quality Assurance Revolving Fund (WQARF) Registry Site (Site) located in Yuma County, Yuma, Arizona (Figure 1). The Site is located in a mixed commercial, industrial, and residential area of Yuma and is bounded by 17th Street to the north, 21st Street to the south, Kennedy Lane to the east, and 4th Avenue to the west. Contaminants were released from the former Houston Photo Products Facility (Facility) located near the southeast corner of the 20th Street and Factor Avenue intersection (Figure 2).

The Site was added to the WQARF registry in 2000, with an eligibility and evaluation score of 31 out of 120.

1.2 Basis and Purpose

This ROD presents the Selected Remedy for the Site, chosen in accordance with applicable requirements in Title 18, Chapter 16 of the Arizona Administrative Code (A.A.C.). The process for selecting the remedy complied with Arizona Revised Statute (A.R.S.) §49-287.04. The Arizona Department of Environmental Quality (ADEQ), as the lead agency, has reviewed the remedy and determined that Site completion criteria used to evaluate the selected remedial action for contaminants of concern (COCs) in groundwater and soil at the Site and remedial objectives (ROs) will be satisfied. This ROD describes the basis for the Selected Remedy and addresses all elements of A.A.C. R18-16-410 under the WQARF Program. The decision in this ROD is based upon previous activities and investigations conducted and performed for this Site that are documented and located in ADEQ's Administrative Record file. The State of Arizona, acting by and through ADEQ, has selected the remedy detailed in this document.

1.3 Site Assessment

Site COCs are tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (DCE), and cyanide. Cyanide has been detected in soil at concentrations greater than the residential soil remediation level (SRL) of 11 mg/kg (as hydrogen cyanide) and the Site specific groundwater protection level (GPL) of 290 mg/kg. PCE, TCE, and DCE are not present in soil at concentrations greater than their respective residential SRLs of 5.1 milligrams per kilogram (mg/kg) (with a risk factor of 10-5), 3.0 mg/kg, and 120 mg/kg, respectively, or minimum GPLs of 0.80 mg/kg, 0.76 mg/kg, and 0.85 mg/kg, respectively.

The COCs have been detected in the groundwater at concentrations exceeding their respective Aquifer Water Quality Standard (AWQS) of 5 micrograms per liter (µg/L) for PCE and TCE, 7 µg/L for DCE, and 0.2 milligrams per liter (mg/L) for cyanide. TCE and DCE detections may be the result of PCE degradation, rather than a separate TCE and DCE release (Figure 3).

An early response action (ERA) was determined to be necessary to mitigate exposure to cyanide in soil. Based on risk to public health from the cyanide in shallow soils and dispersion by wind, an ERA was undertaken by ADEQ in 2002 along the eastern and southern portions of the Facility (Figure 2). The ERA included removal of the impacted surface soils to a depth of 1 foot. ADEQ implemented engineering controls including installation of a geotextile over the remaining cyanide-impacted soil followed by a 1-foot thick layer of aggregate base coarse (ABC) material. In 2013, an engineered cap consisting of asphaltic concrete with a storm-water drainage system was installed over the ABC material at the cyanide-impacted areas. The cap was designed to mitigate potential leaching of contaminants to groundwater and eliminate potential exposure pathways to contaminated soil via dermal contact, ingestion, and particulate and vapor inhalation. Operation and maintenance activities associated with the cap and ancillary drainage features are on-going.

In addition to removal of the cyanide-impacted surface soils, the five waste disposal systems (WDSs) (Figure 2) that received wastewater from the Facility activities were cleaned in the following manner:

- The contents of WDS-1 and WDS-4 tanks were removed. Following the removal of the sludge/wastewater, WDS-1 and WDS-4 and their associated piping were removed.

- The contents of WDS-2, WDS-3, and WDS-5 were removed. The removed contents were then treated with lime for fecal coliforms and the WDSs were rinsed and the systems were placed back into operation.

Since completion of the ERA for cyanide, WDS-2 continued to operate (after cleaning) for treatment of domestic sewage from the Facility. However, its leach field was located within the source area. Source control was accomplished in March 2008 by removing WDS-2 and its leach field and installation of a new septic system away from previously identified cyanide-impacted soils (Figure 2).

1.4 Selected Remedy

The Selected Remedy at the Site, as specified in the Proposed Remedial Action Plan (PRAP) (Matrix-CALIBRE Team [Matrix], 2017), is to conduct the following remedial tasks identified as reference remedies for soil, and groundwater in the Final Feasibility Study (FS) (Matrix, 2016):

- Cap inspection and maintenance.

- Installation of monitoring and treatment wells to allow focused in situ treatment.

- In-situ plume treatment (hot spot treatment of groundwater with high concentrations of volatile organic compounds [VOCs] utilizing targeted enhanced reductive dechlorination [ERD] injections).

- Monitored natural attenuation (MNA) after the active treatment element of the remedy is complete.

The selected remedy includes the following contingencies:

- Additional in-situ plume treatment to accelerate the clean-up of the VOCs in the groundwater.

- Additional in-situ plume treatment to accelerate the remediation of the cyanide present in the groundwater.

- Wellhead treatment for one production well if the City of Yuma installs a well within the plume and the proposed use of the well is restricted due to impacted groundwater.

- Replacement of school irrigation water if COCs are detected at concentrations greater than the health-based goals presented in the PRAP.

Detailed information on the Selected Remedy is provided in Section 3.0 of this ROD. Upon completion of remedial actions, all remedial equipment and wells associated with the Site will be abandoned in accordance with the PRAP and applicable Arizona Department of Water Resources (ADWR) requirements as promulgated in A.A.C. R12-15-816. After completion of the above actions, ADEQ will delist the Site as stated in A.R.S. §49-287.01(K).

1.5 Statutory Determinations

In June 2014, ADEQ completed the Remedial Investigation (RI) report (Tetra Tech, 2014) pursuant to A.R.S. §49-287.03(E) and A.A.C. 18-16-406. The RI report:

- Established the nature and extent of the contamination and the sources thereof.

- Identified current and potential impacts to public health, welfare and the environment.

- Identified current and reasonably foreseeable uses of land and waters of the state.

- Obtained and evaluated information necessary for identification and comparison of alternative remedial actions.

In August 2016, the FS report (Matrix, 2016) was completed pursuant to A.R.S. §49-287.03(F) and A.A.C. 18-16-407. The FS, based on information obtained during the RI, evaluated three different remedial options and identified the remedy for the Site. The FS:

- Provided for the development of a reference remedy and at least two alternative remedies which were capable of achieving all of the remedial objectives.

- Insured that the reference remedy was based upon best engineering, geological, and hydrogeological judgement.
- Provided one alternative remedy that was more aggressive than the reference remedy.
- Provided one alternative remedy that was less aggressive than the reference remedy.

In 2017, the PRAP (Matrix, 2017) was completed pursuant to A.R.S. §49-287.04 and A.A.C. 18-16-408. The PRAP discussed the remedy (reference) recommended by the FS, selected the remedy, and provided costs to implement the remedy (Matrix, 2017). Public comments on the Selected Remedy (i.e., reference remedy) were solicited and one comment was received. The PRAP:

- Identified the boundaries of the Site.
- Identified results of the RI and FS.
- Proposed the Selected Remedy and its cost.
- Described how the remedial goals and selection factors were evaluated.

Pursuant to A.R.S. §49-287.04(H) and A.A.C. 18-16-410, this ROD is the final administrative decision as defined under A.R.S. §41-1092. Cap inspection and maintenance, groundwater monitoring well and injection well installations, targeted hotspot ERD injections, and MNA with contingencies were selected as the remedy for the Site. This remedy was selected because it met the following criteria as stipulated in A.R.S. §49-282.06:

- Adequately assures the protection of public health and welfare and the environment.
- To the extent practicable, provides for the control, management or cleanup of the COCs maximizing beneficial use of the groundwater.
- Is reasonable, necessary, cost-effective, and technically feasible.

2.0 SITE BACKGROUND

2.1 Site Description

The Site is located in the central area of Yuma, Arizona, in a mixed commercial, industrial, and residential area (Figure 1). The Site is roughly bounded by 17th Street to the north, 21st Street to the south, 4th Avenue to the west, and Kennedy Lane to the east.

Historical operations at the Facility included a motion picture laboratory and an area that manufactured photographic film and paper processing equipment for the photo industry. Operations were discontinued over 20 years ago. The Facility is currently occupied by commercial businesses including an engine services company, wood working company, and a personal storage facility. Numerous industrial properties are located immediately surrounding the Facility. Residentially developed properties occupy most of the parcels within the Site boundaries to the west and northwest. The residential properties are located primarily west of Arizona Avenue, and consist of single-family dwellings and mobile home parks. Schools and private day care facilities are also located in the residential neighborhood west of Arizona Avenue.

2.2 Source of Release

As previously mentioned, the former Houston Photo Products is the source of the COCs at the Site. The Facility used film processing liquids which contained various chemicals including potassium ferricyanide and sodium thiocyanate and solvents including PCE in a vapor degreaser for parts cleaning. The former photographic processing operation and vapor degreaser were the identified sources of the COCs at the Site. Spent processing liquids and solvents were discharged to the various WDSs and a settling pond after silver was removed from the discharge.

2.3 Need for Remedial Action

2.3.1 Soil/Soil Vapor

COCs are present in soil on Site at concentrations greater than Arizona's remediation standards for soil. Based on the RI risk analysis and indoor air sampling, soil gas does not present a significant human health risk factor via intrusion to buildings or other transport pathways. There is a potential that soil gas or associated pockets of contaminated soil are acting as an ongoing source to groundwater, however, the contribution if any, is small. An engineered asphalt cap was installed at the property in 2013 to mitigate the potential leaching of contaminants to groundwater and to eliminate potential exposure pathways to contaminated soil via dermal contact, ingestion, and particulate and vapor inhalation. Additionally, a Declaration of Environmental Use Restriction (DEUR) was put in place at the property in July 2014 to reduce risk of contact to COCs remaining in the soil.

2.3.2 Groundwater

PCE, TCE, and cyanide concentrations in groundwater on Site currently exceed the AWQS. Although groundwater at the Site is not currently used as a drinking water supply, the regional aquifer is considered a water supply for private well owners in the vicinity of the Site. There are three schools: St. Francis of Assisi School, Alice Byrne Elementary School, and O.C. Johnson Elementary School that extract groundwater for irrigation purposes located downgradient from the Site. If the groundwater plumes continue to migrate, irrigation water that is applied to playfields could become a risk driver if the COCs in the groundwater applied to the playfields exceed the health-based goals documented in the PRAP. Therefore, the aquifer must be protected and a remedial action for groundwater is required.

2.4 Chronology of Site Activities

The detailed history of Site investigations and ERAs completed at the Site is summarized in the RI Report, the FS Report, and the PRAP. The following provides a brief summary of the main events, investigative milestones, and ERAs for the Site:

1990 to 1995: Facility reported a leaking tank to the ADEQ Underground Storage Tanks (UST) Section. The ADEQ UST Section referred the facility to the ADEQ Water Pollution Compliance Unit. Consultants for the Facility conducted soil and groundwater investigations under the oversight of the Water Pollution Compliance Unit.

In 1990, PCE and metals were detected in on-site soils. In 1991, the Facility began to use Industroclean (which contains ethylene glycol monobutyl ether) in place of PCE. Consultants for the Facility installed three groundwater monitor wells (MW-1, MW-2, and MW-3) and performed groundwater sampling in 1993. The PCE concentrations exceeded the AWQS for PCE of 5.0 µg/L.

Also in 1993, the ADEQ Hazardous Waste Section (HWS) inspected the facility, and in 1994, the Facility and the ADEQ HWS entered into a compliance order. Consultants for the Facility conducted additional soil and groundwater investigations under the compliance order. In 1994, a soil vapor survey was conducted. Elevated concentrations of PCE were present in the soil vapor samples. TCE and 1,1,1-trichloroethane (TCA) were also detected in soil vapor samples. The Facility moved its motion picture laboratory operation off-site.

1996: One nested groundwater monitoring well (MW-102) and one up gradient monitor well (MW-101) were installed. The maximum PCE concentration detected was 520 µg/l in MW-2 at 140 to 150 feet (ft) below ground surface (bgs).

1998 to 2000: In 1998, the ADEQ HWS referred the Facility to the ADEQ Superfund Programs Section, Site Assessment Unit. The Site was placed on the WQARF Registry in March 2000 with a score of 31 out of a possible 120.

2001: ADEQ began Site investigation activities. A review of the Material Safety Data Sheets of the chemicals used at the Facility indicated that two cyanide compounds, potassium ferricyanide and sodium thiocyanate were used at the Facility. Both of the cyanide compounds can degrade to hydrogen cyanide in sunlight or in an environment with a near neutral pH. Analyses of wastewater in the septic systems indicated that elevated cyanide concentrations were present in the wastewater disposal system. Cyanide was also detected in groundwater samples above the AWQS of 0.2 mg/L.

ADEQ completed the characterization of cyanide-contaminated soils at the Site. Several areas at the Site exceed the non-residential SRL of 11 mg/kg for hydrogen cyanide.

2002: ADEQ completed an ERA at the Facility, which included the removal and over-excavation of two unused sumps and the settling pond and disposal of the upper foot of cyanide-contaminated surface soils. Approximately 1,700 tons of contaminated soils were removed from the Facility. A one-foot cap of ABC material was placed over the remaining cyanide-contaminated soils. This cap helps prevent direct exposure to the underlying contaminated soils remaining. The ERA also included the cleaning of three active septic systems. Approximately 15,000 gallons of PCE and cyanide-contaminated wastewater and sludge were removed from the disposal systems during cleaning operations. The removal of this source material addressed a continuing source of groundwater contamination.

2003: Soil and soil vapor samples were collected from six borings at the Facility. Samples were collected to evaluate the vertical extent of PCE contamination. Sampling results indicated that the concentrations of PCE remaining in the soil did not exceed regulatory standards.

2004: ADEQ collected indoor air data from the buildings at the Facility and one building adjacent to the Facility. These data were collected as part of an ongoing risk assessment of the indoor air. ADEQ also drilled and sampled four deep borings beneath two of the remaining septic tanks and the former disposal pond area. The purpose of these borings was to evaluate the cyanide contamination at depth in these areas. Cyanide contamination above the non-residential SRL extends to a depth of approximately 17 feet bgs in some areas. ADEQ used these data and other information to develop GPLs for the cyanide contaminated soils remaining in place.

Also, ADEQ drilled and sampled two deep groundwater monitor wells. Analysis of groundwater samples from these deep wells did not indicate PCE or cyanide contamination above an AWQS.

2005 to 2006: ADEQ drilled and sampled ten additional groundwater monitor wells to further define the extent of the contaminant plume. Laboratory analyses from these monitor wells indicate that the contaminant plume extends approximately ½ mile downgradient of the Facility. The lateral extent of the plume had not yet been fully characterized.

2007: Installation of additional deep groundwater monitor wells indicated that groundwater was present in three distinct zones: shallow (50 to 90 ft bgs); middle (105 to 170 ft bgs) and deep (starting at 170 ft bgs). Each zone is divided by separate clay units. Groundwater samples from

each zone indicated that the majority of the contaminant plume was located within the middle zone.

2008: ADEQ installed one groundwater extraction well in the middle of the contaminant plume. An aquifer test was completed to determine aquifer characteristics. The last remaining septic system on the Facility property was taken out of service and replaced with a new system and leach field located away from contaminated soil. Additional information was gathered north of the Facility to locate potential sources areas.

2009 to 2011: A soil vapor investigation was performed which included the installation of several permanent soil vapor monitor probes and a soil vapor survey in order to help identify potential source areas. Additional permanent soil vapor monitor probes were installed and groundwater samplings were conducted. ADEQ continued to investigate the Site to identify the extent of the groundwater contamination. Groundwater sampling results indicate the PCE plume extends over 4,000 feet downgradient from the Facility.

2012: ADEQ continues to investigate the Site to identify the extent and severity of the groundwater contamination. ADEQ finalized plans to install a permanent asphalt based cap over the cyanide impacted soils still remaining at the Facility below a depth of one foot. This cap will limit further impacts to groundwater by minimizing the amount of cyanide leaching from cyanide contaminated soils.

2013: ADEQ completed the installation of a permanent asphalt based cap over the cyanide impacted soils. ADEQ installed three additional wells down gradient of the Facility and the horizontal and vertical definition of the plume is complete. ADEQ is finalizing the draft RI report. Groundwater monitoring is at a minimum conducted annually at the Site.

2014: ADEQ installed seven additional soil vapor monitor wells. A round of soil vapor sampling was also conducted. Soil vapor samples were analyzed for hydrogen cyanide and VOCs including PCE and TCE. No samples detected hydrogen cyanide. PCE and TCE were detected at concentrations below ADEQ's suggested soil vapor screening levels. ADEQ completed the draft RI report, solicited comments on the draft RI and on the proposed ROs. The RI and RO reports were finalized in June 2014. Groundwater monitoring is normally conducted annually at the Site.

2015: During March 2015, ADEQ completed one round of ground water monitoring. PCE concentrations and distribution in the upper part of the aquifer remained relatively constant with the highest PCE concentration detected at a concentration of 54 µg/L. In the middle portion of the aquifer, PCE concentrations and distribution also remained relatively constant with the exception of one well where concentrations continued to rise and PCE was detected at 1000 µg/L.

In the upper part of the aquifer, cyanide concentrations remain above the AWQS of 200 µg/L in one monitor well. In the middle part of the aquifer, cyanide is present at the AWQS in one monitor

well. Cyanide concentrations in the middle part of the aquifer continue to separate from the source area.

No contaminants were detected above standards in the deeper part of the aquifer.

2016: A downgradient deep monitor well was installed in January. ADEQ completed one round of ground water monitoring and sampling. COC concentrations and distribution in the aquifer remained relative constant. The FS report was completed in August.

2017: The PRAP was completed in June 2017 and subsequently issued for public review and comment. The proposed remedy for the Site included monitoring and maintenance of the engineered cap, installation of treatment wells and additional monitoring wells, in-situ hot spot treatment utilizing ERD injection technology, and MNA.

2.5 Source Area Definition

The former Houston Photo Products was identified as the source of soil, soil vapor, and groundwater contamination at the Site. A leaking UST was reported to the ADEQ UST Section which was then referred to the ADEQ Water Pollution Compliance Unit. Consultants for the Facility owner conducted soil and groundwater investigations under the oversight of the Water Pollution Compliance Unit. In 1993, the ADEQ HWS inspected the facility, and in 1994, the Facility and the ADEQ HWS entered into a compliance order. In 1998, HWS referred the Facility to the ADEQ WQARF program. No other businesses that used chlorinated VOCs or other related chemicals reportedly operated at this location.

ADEQ took over field investigation activities for the Site starting in 2001 through June 2014 and are documented in the RI Report. The field activities included soil sampling, soil vapor sampling, groundwater monitor well installations, groundwater elevation measurements, groundwater sampling, aquifer testing, particle tracking, and groundwater modeling. The distribution of contaminant concentrations in soil vapor, soil, and groundwater during the Site RI indicate that the COCs released from the former Facility transferred from the soil and soil vapor to groundwater, and migrated with historic groundwater flows to the west northwest, leading to a plume nearly 4,500 feet long.

2.5.1 Soil and Soil Vapor Contamination

Cyanide is present in soil at the Facility at concentrations greater than residential SRLs and Site specific GPLs in the southern and eastern portions of the Facility (Tetra Tech, 2014). The highest concentration detected after soil containing total cyanide was excavated was 3,300 mg/kg which exceeds the residential SRL of 11 mg/kg for hydrogen cyanide and a Site specific GPL of 290 mg/kg. However, an engineered cap with a storm-water drainage system was installed over the cyanide contaminated soil to prevent exposure to the contaminated soil and leaching to groundwater.

The highest PCE concentration detected in soil samples was at a concentration 0.75 mg/kg which is less than the residential SRL of 5.1 mg/kg (with a risk factor of 10-5) and the minimum GPL of 0.80 mg/kg. This soil sample was collected in the vicinity of WDS-1 at a depth of 20 ft bgs. Other VOCs were also detected in soils at the Facility at the WDSs but at concentrations less than SRLs and minimum GPLs.

PCE and other VOCs including TCE, DCE, TCA, and petroleum hydrocarbon constituents including benzene, toluene, ethylbenzene, and xylenes were detected in soil vapor samples collected at the Facility. PCE was detected at the highest concentration of all VOCs at a concentration of 570 milligrams per cubic meter (mg/m3). This concentration is less than the residential SRL equivalent of 7,787 mg/m3 (with a risk factor of 10-5) and the minimum GPL equivalent of 1,230 mg/m3. Based on an RI risk analysis and indoor air sampling, soil gas does not present a human health risk factor via intrusion to buildings or other transport pathways. A DEUR was put in place at the property in July 2014 to reduce risk of contact to cyanide remaining in the soil.

2.5.2 Groundwater Contamination

PCE is the primary COC identified in groundwater at the Site; other COCs identified in the 2014 RI include TCE, DCE, and cyanide (Tetra Tech, 2014). Based on the areal extent of COCs above the AWQSs, groundwater is the most significantly impacted environmental media. As of 2016, the extent of the VOC plume in groundwater covers approximately 64 acres (Matrix, 2016a).

The aquifer underlying the Site includes three zones that are separated by discontinuous fine-grained layers that locally restrict vertical flow; Zone A (from the water table to approximately 105 feet bgs), Zone B (from 105 feet to 170 feet bgs), and Zone C (below 170 feet bgs). Contaminated groundwater associated with releases from the Facility has impacted Zone A and Zone B of the aquifer. As of 2016, Zone C has not been impacted by releases at the Site.

The most recent groundwater data collected for the entire Site was in February 2016 (Matrix, 2016a). Data indicate that the highest PCE concentration detected in Zone A was in well MW-14A at a concentration of 75 µg/L (Figure 4). The highest PCE concentration detected in Zone B was in well MW-18B at a concentration of 1,400 µg/L (Figure 5). The PCE concentrations in Zone A near the Facility are relatively low: MW-6A has a PCE concentration of 17 µg/L. Historic data collected at groundwater monitor well MW-102B1 completed in Zone B and located at the east boundary of the Facility indicate that the PCE concentrations have been less than the AWQS of 5 µg/L since November 2013. This pattern of substantial concentration decreases at the source area and concentration increases at wells distal from the source area can be characterized as a "detached plume".

The most recent groundwater data for TCE indicate that the highest TCE concentration detected in Zone A was in well MW-18A at a concentration of 8.3 µg/L (Figure 6). The highest TCE concentration detected in Zone B was in well MW-18B at a concentration of 220 µg/L (Figure 7).

The TCE concentrations in Zone A near the Facility are relatively low and are only present in well MW-6A at a concentration slightly above the AWQS. Historic data collected at groundwater monitor well MW-102B1 completed in Zone B and located at the east boundary of the Facility indicate that the TCE concentrations have been less than the AWQS of 5 µg/L since November 2005.

During groundwater sampling in February 2016, DCE was only detected in one Zone A well, MW-18A, which was at a concentration less than the AWQS of 7 µg/L (Figure 8). The highest DCE concentration detected in Zone B wells was in well MW-18B at a concentration of 77 µg/L which exceeds the AWQS of 7 µg/L (Figure 9). DCE did not exceed the AWQS in any of the other samples collected from Zone B wells.

The highest most recent total cyanide concentration of 10.5 mg/L detected in Zone A was in well MW-5A, which is located at the Facility (Figure 10). The most distal detection exceeding the AWQS of 0.2 mg/L was in well MW-14A at a concentration of 0.256 mg/L. The cyanide plume in Zone A where it exceeds the AWQS is approximately 1,300 ft long. The only detection of cyanide exceeding the AWQS in Zone B was in well MW-18B at a concentration of 1.22 mg/L (Figure 11).

3.0 SELECTED REMEDY

The FS was prepared in August 2016 to evaluate remedial alternatives for VOCs in soil and groundwater at the Site (Matrix, 2016b). The remedial alternatives were developed to meet the ROs (ADEQ, 2014a). The Selected Remedy proposed by the FS and carried forward to the PRAP includes the following components:

- Cap inspection and maintenance to maintain the integrity of the cap and to evaluate whether minor repairs such as crack sealing are required or whether the cap needs to be replaced due to degradation from the exposure to the elements or vehicle traffic. Inspection and maintenance of the asphalt cap would be conducted for a total of 30 years or until transfer of ownership of the Facility at which time the new owner will assume cap inspection and maintenance duties.

- Groundwater monitoring well and injection well installations. The injection wells will be installed at the hotspots where COC concentrations are highest. Monitoring wells will be installed at and adjacent to the hotspots. Wells will be installed in a phased approach based on recent groundwater data to optimize well locations (Figure 12).

- Targeted ERD injections at the hotspots within the Zone A and Zone B aquifers. Hotspot treatment would be implemented in phases at various treatment wells by injecting bio-remediation agents over a ten year period. Bioaugmentation (injecting microbes to accelerate bio-remediation) will be implemented twice. Groundwater samples will be collected after the injection events at the treatment wells and other nearby monitoring wells to track the progress of the remedy.

- Plume monitoring utilizing MNA will be utilized at the Site following the completion of hotspot treatment. This remedial measure will involve annual groundwater monitoring at select wells throughout the plume to verify that attenuation continues to occur at the Site. MNA will be conducted at the outer edges of the Site during ERD injections and then for an additional ten years, for a total of twenty years.

- The Selected Remedy includes the following contingencies:

    - Additional in-situ treatment of groundwater contaminants to accelerate the degradation processes should this be determined to be beneficial based on intermediate monitoring results. This contingency includes the option of utilizing in-situ chemical oxidation (ISCO) in place of ERD.

    - A contingency to accelerate remediation of cyanide present in the groundwater by monitoring well and injection well installations and ERD injections should data indicate that this would be beneficial.

- Wellhead treatment by ADEQ for one production well if the City of Yuma installs a well within the plume and the proposed use of the well is restricted due to the presence of COCs in the water supplied from the well.

- Replacement of school irrigation water by ADEQ if COCs should be detected at concentrations greater than the health-based goals documented in the PRAP.

The PRAP provides the basis for the Selected Remedy (Matrix, 2017).

3.1 Selected Remedy Summary

In 2002, ADEQ conducted an ERA involving excavation of cyanide contaminated soil and capping with ABC material in the southern and eastern portions of the Facility. In 2013, ADEQ placed an asphalt cap over the ABC cap material. The cap includes a storm-water collection and filtration system that collects and treats the storm water that falls on the cap. A DEUR was put in place in July 2014 that identified the location of the cyanide impacted soils remaining in place beneath the cap and stipulated the engineering controls required to maintain the integrity of the cap. The surface of the cap will be inspected annually for the presence of parked vehicles, stored equipment, materials, debris, cracks, flora intrusion (weeds, grasses, or other vegetation), and subterranean biological activity (primarily, but not limited to, ants and other insects). The surface of the asphalt concrete cap, the gutters, the filter separator manhole grates and structures, and all other components of the cap will be inspected for evidence of deterioration, movement, settlement, and other signs of stress that would negatively affect the ability of the cap to function as designed. During each inspection, the debris build-up around the manhole structures will be cleared and the filter will be replaced. Additionally, each inspection will include interviews of the tenants at the Site to identify the types of activities conducted on the cap, to determine if any spills or releases occurred on the cap, and to collect other pertinent information concerning activities that occurred at the Site during the previous year. The results of the inspection will be used to determine whether minor repairs such as crack sealing are required or whether the cap should be replaced/resurfaced due to degradation from the exposure to the elements or vehicle traffic. Inspection and maintenance of the asphalt cap will be required until the cyanide-impacted soils are degraded or removed from the property. For the purposes of the ROD, this time period is anticipated to be 30 years.

The Selected Remedy includes the installation of up to 10 monitoring wells and up to 13 treatment wells. The wells will be installed over a four-year period so that data from early monitoring and treatment wells can be used to optimize plume treatment and the treatment well locations. Each well will be constructed with two or three screened zones with a seal between the screened intervals to allow depth-specific injection in zones with the highest COC concentrations. The treatment wells will be located up-gradient of the new monitoring wells so that performance monitoring can be performed to assess overall remedy performance. The injection wells will be registered with the U.S. Environmental Protection Agency (EPA) in accordance with Code of Federal Regulations

(CFR) Title 40, Chapter I, Subchapter D, Part 144 – Underground Injection Control (UIC) Program prior to installation.

Hotspot treatment will be implemented at several locations where concentrations are the highest. Hotspot treatment will be implemented in phases at various treatment wells by injecting bio-remediation agents over a ten year period. ERD injections will include a biostimulation amendment such as molasses to be injected into the contaminant plume to provide a carbon source to drive the redox conditions lower and a hydrogen releasing compound that will serve as the electron donor. During each injection event, the field crew will inject between 1,000 and 1,500 gallons of a 0.1 percent sugar substrate solution into each injection well. This volume of injection solution is expected to achieve a 25-foot radius of influence around each well. The injection solution will be mixed in an onsite tank. Mixtures will be adjusted based on oxygen demand (chemical oxygen demand [COD] or biological oxygen demand [BOD]) of the substrate; theoretical mass of hydrogen that may be produced (based on reaction stoichiometry); actual efficiency of hydrogen generation; and rate and longevity of hydrogen generation.

Bioaugmentation (injecting microbes to accelerate bio-remediation) will be implemented twice using microbial cultures (Dehalococcoides). The bio-augmentation could be completed or supplemented (if the Site conditions warrant it) by extracting groundwater from a well within the same plume that is known to contain Dehalococcoides and injecting that water into well(s) that are experiencing slower dechlorination rates because of insufficient microbial activity. As appropriate, trace levels of nutrients (i.e., nitrogen, phosphorus, etc.) and/or yeast extracts may also be added to the wells to promote accelerated bacterial growth and increase dechlorination rates. Groundwater samples will be collected after each injection event to track the progress of the remedy.

MNA will be conducted at the Site concurrently with the hotspot treatment. MNA is a mechanism by which COCs are reduced (often slowly) by natural means without other control, removal, treatment, or aquifer-modifying activities. Natural dechlorination is occurring in some downgradient portions of the plume as evidenced by the presence of PCE daughter products (TCE and DCE). This remedial measure will involve annual groundwater monitoring at select wells throughout the Site to verify that attenuation continues to occur. Groundwater samples will be analyzed for COCs and parameters indicative of natural attenuation including but not limited to electron acceptors and donors, dissolved oxygen, oxygen reductive potential, and ethene. The COC concentrations in groundwater are expected to drop below the health-based goals (as presented in the PRAP) within 10 years of initiating the hot spot treatment program. The COC concentrations in groundwater are expected to require an additional 10 years before dropping below the AWQS. Thus, MNA will be required at the Site for a period of 20 years. The duration of monitoring and the number of wells to be monitored will be adjusted as warranted by the monitoring results.

Four contingencies are included to address changes in the viability of the remedy to protect human health, and/or changes in groundwater usage by the City of Yuma. These contingencies may be

implemented based on periodic reviews of the remedy and groundwater use evaluation of the community involvement area.

3.2 Achievement of Remedial Objections and Remedial Action Criteria

In accordance with A.A.C. R18-16-406(I), ADEQ prepared the Remedial Objectives Report (ADEQ, 2014a) that established ROs for the current and reasonably foreseeable uses of land and waters of the State of Arizona that have been or are threatened to be affected by a release of a hazardous substance. In accordance with A.A.C. R18-16-407, the ROs were evaluated in the FS Report and, according to A.A.C. R18-16-408 and A.R.S. §49-287.04, considered in development of the remedial action alternatives presented in the PRAP Report.

The RO for soil at the Site is to restore soil conditions to the remediation standards for non-residential or residential use specified in A.A.C. R18-7-203 (specifically background remediation standards prescribed in A.A.C. R18-7-204, predetermined remediation standards prescribed in A.A.C. R18-7-205, or Site specific remediation standards prescribed in A.A.C. R18-7-206) that are applicable to the hazardous substances identified. This action is needed for the present time and for as long as the level of contamination in the soil threatens its use as a residential or non-residential property.

The DEUR issued for the Facility restricts the use of the Facility where cyanide soil contamination remains to non-residential uses only. Therefore the RO for residential use has been met. The engineered cap installed at the Facility prevents exposure to the contaminant remaining in the soil. Therefore the Selected Remedy to inspect and maintain the cap meets the RO for non-residential use.

The RO for groundwater at the Site is to restore and protect for the use of the groundwater supply by private well owners in the vicinity of the Site from contamination at the Site. This action is currently needed and will be needed for as long as private well owners use water for domestic use. This action is currently needed and will be needed as long as private well owners use water for irrigation. This action will be needed should the City of Yuma develop groundwater resources in the area of the Site for municipal drinking water uses. This action will be needed for as long as the level of contamination in the groundwater threatens the use of the regional groundwater for municipal drinking water uses.

ERD injections have shown their effectiveness in removing contaminant mass from the groundwater. ERD injection at similar sites across the country has proven to be a viable remedy for the removal of contaminant mass. Therefore, the Selected Remedy for groundwater includes targeted ERD injection at hotspots. Combined ERD injection and MNA will reduce COCs to below AWQS and meet the RO for groundwater.

The surface water use portion of the Land and Water Use Report indicates no surface water usage within the Site. Accordingly, a surface water RO for the Site is not applicable.

Based on these determinations, the Selected Remedy demonstrates:

- The ability to achieve the ROs with regard to both land use and groundwater use;
- Consistency with plans of affected water providers and the general land use plans of the local government(s); and
- Compatibility with regard to practicability, cost, risk, and benefit.

3.3 Compliance with Arizona Administrative Code and Arizona Revised Statues

In 2000, the Site was placed on the WQARF Registry by ADEQ with a score of 31 out of a possible 120. In 2014, ADEQ issued the RI Report (Tetra Tech, 2014) for public comment to meet the requirements under A.A.C. R18-16-404(C)(1)(b) and A.A.C. R18-16-406(F). The report documented the results of field investigation activities that were conducted between 1990 and 2014. Solicitation for ROs to be included in the RO report was conducted during the Community Advisory Board (CAB) meeting process per A.A.C. R18-16-406(I). Based on the solicitation, Land and Water Use Study, and water management plans of providers, a draft RO Report was prepared and put out for public comment prior to finalization. The Remedial Objectives Report (ADEQ, 2014a) was finalized in August 2014 and included as an appendix to the RI Report.

A FS Work Plan (ADEQ, 2014b) was prepared by ADEQ in November 2014 and a public notice was issued in accordance with the requirements outlined in A.A.C. R18-16-404(C)(1)(d). A FS Report (Matrix, 2016b) was prepared documenting the development and evaluation of alternatives for remediation of the Site and providing a recommendation of a final remedy capable of achieving the ROs developed for the project.

As a result of the work executed under the FS work plan and contained in the FS Report, a PRAP was prepared (Matrix, 2017). The PRAP documented the results of the FS and evaluated the selected remedy. Cap inspection, well installations, ERD injections, and MNA have been selected as the remedy for the Site. Based on a comparison with alternative remedies the Selected Remedy:

- Adequately assures the protection of public health, welfare, and the environment.
- To the extent practicable, provides for the control, management and cleanup of COC contamination, maximizing beneficial use of the groundwater use; and
- Is reasonable, necessary, cost-effective, and technically feasible.

The Selected Remedy is consistent with A.R.S. §49-282.06 as it provides protection to the public by providing control of hazardous substances with contingencies. Future use of groundwater by private or municipal well owners in the area is not anticipated based on the Land and Water Use Study (Tetra Tech, 2014).

3.4 Community Involvement and Public Comment Requirements

A CAB was formed that has previously met on a regular basis to discuss issues and status of investigation and cleanup activities conducted at the Site. These meetings are open to the public and the last meeting was held on 08 November 2017. A Community Involvement Plan (CIP) (ADEQ, 2014c) was also developed and regularly updated for the Site. Table 1 provides specific public participation activities that have been completed for the Site:

Table 1 - Community Involvement Activities

Community Involvement Activities	Regulatory Citation/Rule	Date
Establish Community Involvement Area	A.R.S. §49-289.02(A)	1999
Notice of the Site listing on the Registry	A.R.S. §49-287.01 A.R.S. §49-289.03(A)	11 February 2000
Hazardous substance contamination notice and fact sheet	A.R.S. §49-289.02(B) A.R.S. §49-287.03(B) A.A.C. R18-16-404(C)(1)(i)	2001
Notice of RI scope of work, fact sheet, and outline of CIP	A.R.S. §49-287.03(B) A.R.S. §49-287.03(C) A.A.C. R18-16-403(F) A.A.C. R18-16-403(G)	January 2013
Establish CAB selection committee	A.R.S. §49-289.03(D)	May 2013
Establish CAB	A.R.S. §49-289.03(C) A.R.S. §49-289.03(F)(1)	May 2013
Prepare and update CIP	A.R.S. §49-287.03(D) A.R.S. §49-289.03(C) A.A.C. R18-16-403(E) A.A.C. R18-16-404(C)	January 2013, January 2014
Land and Water Use Study Questionnaires mailed	A.A.C. R18-16-404(C)(1)(a)	2012
Notice of opportunity to comment on draft RI Report	A.A.C. R18-16-404(C)(1)(b) A.A.C. R18-16-406(F)	7 February 2014
Public notice for solicitation of ROs	A.A.C. R18-16-404(C)(1)(b) A.A.C. R18-16-406(I)(2)	7 February 2014
Notice of opportunity to comment on Proposed RO Report	A.A.C. R18-16-404(C)(1)(c) A.A.C. R18-16-406(I)(5)	26 July 2014
Public meeting(s) to discuss proposed/revised RO Report if needed	A.A.C. R18-16-406(I)(5)	Not Applicable
Notice of availability of final RI and RO Reports	A.A.C. R18-16-406(J)	27 October 2014
Notice of availability of the FS Work Plan	A.A.C. R18-16-404(C)(1)(d)	15 December 2014
Issue notice of availability and opportunity to comment on the PRAP	A.R.S. §49-287.04(B) A.A.C. R18-16-404(C)(1)(e) A.A.C. R18-16-408(C)(1)	12 July 2017
Notice of ROD & Responsiveness Summary Availability	A.R.S. §49-287.04 (G) A.A.C. R18-16-404(C)(1)(f)	TBD

- **7 February 2014:** The draft RI Report was issued for public comment to meet the requirements under A.A.C. R18-16-404(C)(1)(b) and A.A.C. R18-16-406(F). No comments were received during the 60-day comment period.

- **26 March 2014:** A CAB meeting was conducted, pursuant to A.A.C. R18-16-404(C)(1)(b) and A.A.C. R18-16-406(I)(1), to discuss the RI Report, as well as to obtain input on ROs for the Site. ROs were provided during the CAB meeting.

- **26 July 2014:** ADEQ issued the Proposed RO Report for public comment to meet the requirements established under A.A.C. R18-16-404(C)(1)(c) and A.A.C. R18-16-406(I)(5). One comment was received during the 30-day comment period.

- **15 December 2014:** ADEQ issued the public notice on the availability of the FS Work Plan in accordance with the requirements outlined in A.A.C. R18-16-404(C)(1)(d).

- **6 September 2016:** ADEQ issued the public notice on the availability of the FS Report even though not required by statue or rule to keep the community informed about progress made at the Site.

- **12 July 2017:** ADEQ issued the PRAP for 90-day public comment period to meet the requirements established under A.R.S. §49-287.04(B), A.A.C. R18-16-404(C)(1)(e), and A.A.C. R18-16-408(C)(1). One comment was received during the 90-day comment period.

3.5 Schedule

The schedule for implementing the Selected Remedy will be dictated by the WQARF program priorities and available funding after the ROD has been executed and entered into the Administrative Record. Cap inspection and maintenance is scheduled to be conducted for a period of 30 years or until the cyanide impacted soil has degraded or has been removed from the Site. Hotspot ERD injections and MNA will remain in place until COCs are no longer present above their respective AWQS or the Director determines that the conditions of A.R.S. §49-282.06(D) have been met. Based on current groundwater data trends, ADEQ estimates groundwater remediation at the Site will be needed for 20 years.

A 10-year, ERD hotspot injection remediation program will be established for the Site followed by an additional 10-year MNA remediation program. This remedy will enhance existing biodegradation of the COCs and monitor COC migration and attenuation as the contaminant mass is degraded. The remediation program will use the existing well network including the school irrigation wells with installation of additional monitoring and injection wells. The wells will be installed over a four-year period so that data from early monitoring and treatment wells can be used to optimize plume treatment and treatment well locations. Hotspot treatment will be implemented in phases at various treatment wells by injecting bio-remediation agents over a ten year period. Injections and subsequent performance monitoring will be performed three times per

year for the first five years and semi-annually for the last five years. The number of wells and the frequency of injections, performance monitoring, and MNA monitoring could be adjusted as the aerial extent of the plume decreases with the progression of the remedy.

During the remedial period, a Periodic Site Review will be performed as necessary to determine the viability of the remedy. At a minimum, a Periodic Site Review will be conducted every five years. As part of each Periodic Site Review, a groundwater use survey of the community involvement area will be performed to identify potential changes to groundwater usage by the public.

As previously mentioned, four contingencies are included to address changes in the viability of the remedy to protect human health and/or possible changes in groundwater usage by the City of Yuma. A contingency to provide additional in-situ treatment of groundwater contaminants to accelerate the degradation processes is included should this be determined to be beneficial based on intermediate monitoring results and Periodic Site Reviews. A contingency is also included to accelerate remediation of cyanide present in the groundwater by ERD injections should data indicate that acceleration of the degradation process would be beneficial to the Site. In addition, a contingency for wellhead treatment by ADEQ is included if the City of Yuma installs a well within the plume and its proposed use is restricted because of COCs present in the water supplied from the well. A contingency is also included for ADEQ to replace school irrigation water if COCs should be detected in discharge water at concentrations greater than the health-based goals presented in the PRAP.

4.0 RESPONSIVENESS SUMMARY

As per A.A.C. R18-16-410(B)(2) and A.R.S. §49-287.04(F), a comprehensive responsiveness summary shall be prepared by the director regarding all comments received on the PRAP after the conclusion of all public comment periods. A 90-day comment period for the PRAP was held starting on 12 July 2017 through 11 October 2017. An email containing written comments was received during the comment period from Susanna Hitchcock of Yuma, Arizona. A copy of the email comments and ADEQ response to the comments are provided in Appendix A. No other comments were received on the PRAP.

5.0 COST

As required in A.A.C. R18-16-410(C), this section presents the costs (excluding non-recoverable costs) previously incurred by ADEQ during Site characterization and implementation of the ERAs and presents the costs of the Selected Remedy.

5.1 Historic Costs

The Site was placed on the WQARF Registry in 2000 due to the discovery of soil and groundwater contamination at the Site. Investigation and remediation of the Site by ADEQ began in 2001 and will continue as the Selected Remedy is implemented. ERAs were conducted at the Site starting in 2002 and were instrumental in reducing contaminant concentrations and risk of exposure. Significant costs have been incurred by ADEQ during characterization of the Site and implementation of the ERAs. These activities to date have cost ADEQ $7,868,090.53.

5.2 Future Costs

The estimated life cycle costs for implementing the Selected Remedy at the Site are summarized in Table 2.

Table 2 - Selected Remedy Cost Summary

Selected Remedy		
Year	***Activity Description***	***Cost***
1	Monitoring, install five wells, in-situ treatment at two wells, and cap inspection	$370,000
2	Monitoring, install five wells, in-situ treatment at five wells, and cap inspection	$464,000
3	Monitoring, install five wells, in-situ treatment at nine wells, and cap inspection	$678,000
4	Monitoring, install five wells, in-situ treatment at 13 wells, and cap inspection	$709,000
5	Monitoring, in-situ treatment at eight wells, cap inspection, and cap maintenance (crack sealing)	$186,000
6	Monitoring, in-situ treatment at five wells, and cap inspection	$166,000
7	Monitoring, in-situ treatment at four wells, and cap inspection	$154,000
8	Monitoring, in-situ treatment at two wells, and cap inspection	$125,000
9	Monitoring, in-situ treatment at two wells, and cap inspection	$129,000
10	Monitoring, cap inspection, and cap maintenance (crack sealing)	$81,000
11	Monitoring and cap inspection	$80,000
12	Monitoring and cap inspection	$82,000
13	Monitoring and cap inspection	$84,500
14	Monitoring and cap inspection	$87,000
15	Monitoring, cap inspection, and cap replacement	$283,500
16 to 19	--	$0
20	Monitoring, cap inspection, and cap maintenance (crack sealing)	$91,000
21 to 24	--	$0
25	Monitoring, cap inspection, and cap maintenance (crack sealing)	$105,000
26 to 29	--	$0
30	Monitoring, cap inspection, and cap replacement	$405,000
Subtotal		***$4,280,000***
Closure Costs (Year 30)		$1,000,000
Total Cost		**$5,280,000**
Contingencies		
Contingency Description		***Cost***
VOC Treatment Acceleration		$1,082,000
Cyanide Treatment Acceleration		$931,000
City of Yuma Wellhead Treatment		$3,418,000
Irrigation Water Replacement		$3,110,000
Contingencies Total Costs		**$8,541,000**

Notes:
Inflation rate assumed to be 3%

6.0 CONCLUSIONS

The Selected Remedy chosen for the Site consists of inspection and maintenance of the existing cap. The cap will be repaired or replaced as determined by the inspections. The Selected Remedy also consists of well installations and of targeted ERD injections at groundwater hotspots. MNA will be implemented following ERD injections. Contingencies are included for expanded ERD injections, wellhead treatment by ADEQ if the City of Yuma should install a municipal well within the Site plume, and water replacement by ADEQ for the schools if COCs in irrigation water exceed health-based goals. Based on the schedule presented in the PRAP, cap inspection and maintenance will be implemented for 30 years or until transfer of ownership of the Facility at which time the new owner will assume cap inspection and maintenance duties. The schedule presented in the PRAP for ERD injections and MNA is for up to 20 years when groundwater concentrations are anticipated to be below AWQS. At such time, remedial and monitoring activities will cease and all equipment, monitoring wells, etc. associated with the Site investigation and remediation will be abandoned in accordance with the PRAP and ADWR requirements promulgated in A.A.C. R12-15-816. At such time there will be no need to protect human health and the environment and the Site will be delisted as stated in A.R.S. §49-287.01 (K). At any time prior to completion of the ROD, a portion of the Site may be issued a no further action (NFA) based on criteria contained in A.R.S. §49-287.01 (F) & (G).

7.0 REFERENCES

ADEQ, 2014a. Remedial Objectives Report, 20th Street and Factor Avenue WQARF Registry Site, Yuma, Arizona. August 2014.

ADEQ, 2014b. Feasibility Study Work Plan, 20th Street and Factor Avenue WQARF Registry Site, Yuma, Arizona. November 25, 2014.

ADEQ, 2014c. Community Involvement Plan, 20th Street and Factor Avenue Water Quality Assurance Revolving Fund (WQARF) Site, Yuma, Arizona. January 2014.

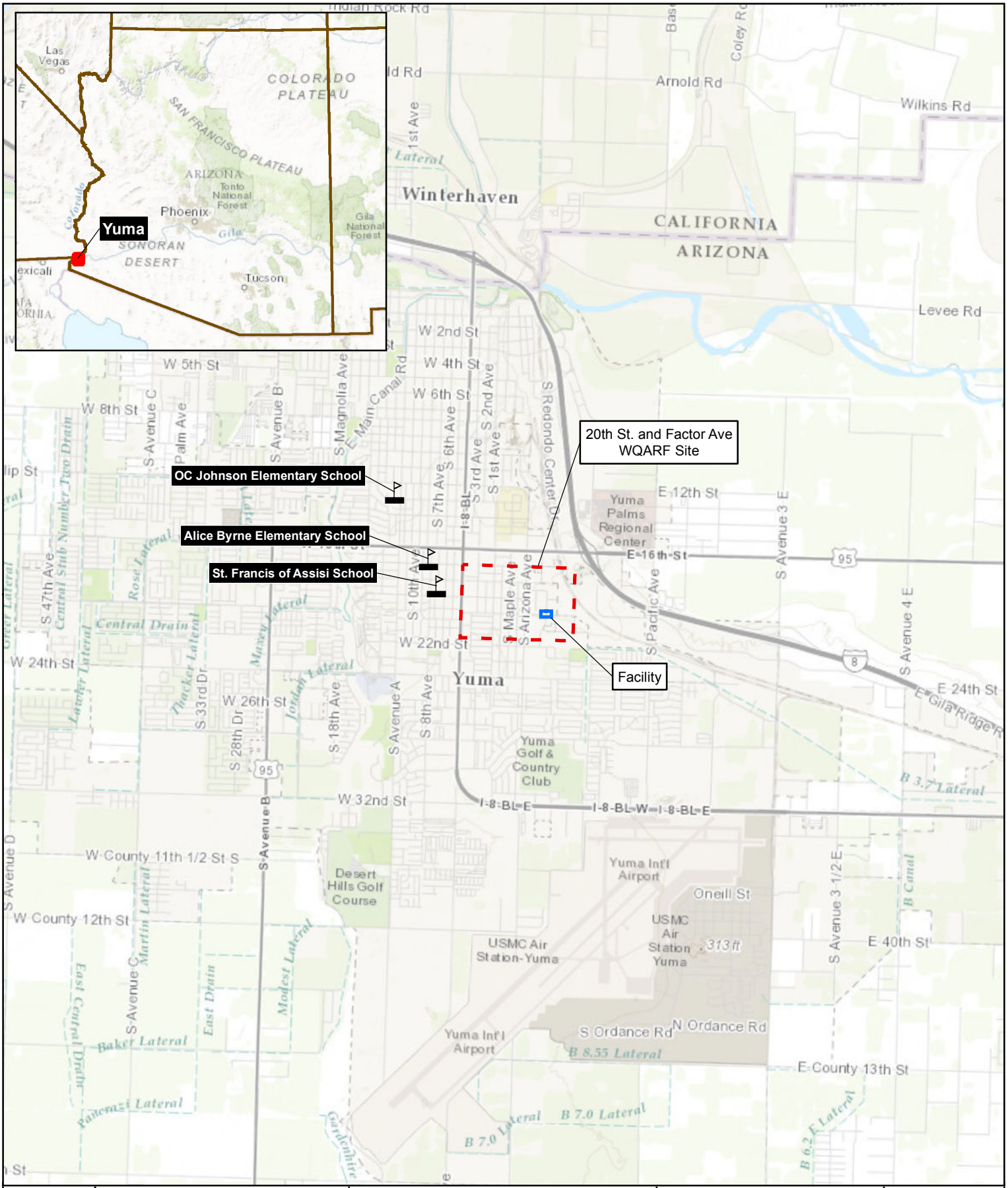
Matrix-CALIBRE Team, 2016a. 2016 Groundwater Monitoring and MW-31B Monitor Well Installation Report, 20th Street and Factor Avenue Water Quality Assurance Revolving Fund (WQARF) Site, Yuma, Arizona. June, 2016.

Matrix-CALIBRE Team, 2016b. Final Feasibility Study, 20th Street and Factor Avenue Water Quality Assurance Revolving Fund (WQARF) Site, Yuma, Arizona. August 11, 2016.

Matrix-CALIBRE Team, 2017. Proposed Remedial Action Plan, 20th Street and Factor Avenue WQARF Site, Yuma, Arizona. June 2017.

Tetra Tech, 2014. Remedial Investigation Report, 20th Street and Factor Avenue WQARF Site, Yuma, Arizona. June 27, 2014.

FIGURES



Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

20th St. and Factor Ave WQARF Site (Approximate Boundary)

Schools

WQARF = Water Quality Assurance Revolving Fund

Site Location Map

Record Of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality

Matrix Design Group

CALIBRE

Figure 1

0 0.5 Miles

FILE: G:\gis_projects\ADEQ\activeapps\WQB_Sample_Locs.mxd, 11/13/2014, wilson_wheeler

DMW-16
DMW-17
E 20th St
MW-6A
MW-7
WDS-5
S Factor Ave
Former WDS 2
Building #5
MW-103D
MW-103C
MW-1A
MW-102B1
MW-102A
MW-2
MW-104D
MW-104E
Building #4
Building #1
Former WDS 1
New WDS 2
Former Settling Pond
MW-5A
MW-3
MW-4A
Building #3
Building #2
Former WDS-4
WDS-3

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Drawn By: JKC

QC'd By: JC

7/25/2016

Legend

- Existing Buildings
- Well Location
- Manhole
- Cap Boundary
- Houston International, Ltd Property Boundary
- Concrete Drainage Improvements
- Fence

Facility Layout

Record of Decision
20th Street & Factor Avenue
WQARF Site Yuma, Arizona

ADEQ Arizona Department of Environmental Quality

Matrix Design Group

CALIBRE

N

0 25 50 Feet

Figure 2

OC Johnson School
Alice Byrne Elementary School
St. Francis of Assisi School
Ron Martin
Pumphouse
Former UST
Plume is 64 acres and 4,500 feet long
MW-25A
MW-25B
MW-28B
MW-30B
MW-31B
MW-11A
MW-21A
MW-21B
MW-21C
MW-24B
MW-17C
MW-17A
MW-13A
MW-18A
MW-18B
MW-29B
PZ-2B
PZ-2A
PZ-2C
PZ-1A
PZ-1B
PZ-1C
EW-1
MW-8C
MW-15A
MW-27A
MW-27B
MW-26A
MW-26B
MW-12A
MW-8A
MW-8B
MW-22B
MW-22A
MW-9A
MW-23B
MW-44A
MW-20A
MW-10A
DMW-10
DMW-11
DMW-25
DMW-16
MW-7
MW-6A
MW-104C
MW-104B
MW-5A
MW-19A
MW-16A
MW-4A
MW-2A
MW-1A
MW-3A
DEW-19
DMW-17
DMW-6
DMW-18
KL-1
MW-102A
MW-102B1
MW-102B2
MW-101A
MW-103B
MW-103C
W 12th St
W 12th Ln
W Santa Maria Way
W 13th St
W 13th Pl
W 14th St
W Hillside Pl
W Las Lomas St
W 15th St
Arroyo Dr
W el Paseo Real
US Hwy 95
W 16th St
W County 9th St
W 16th Pl
W 17th St
W 17th Pl
W 18th St
W 18th Pl
W 19th St
W 19th Pl
W Ridge View Dr
W Park Way Dr
W 20th St
W Parkway Dr
W Cam Real
W 20th Pl
W 21st St
W 21st Pl
W 22nd St
W 22nd Pl
W 23rd St
George St
W Lowell Dr
14th Pl
W 15th Pl
E 12th St
E 16th St
E 16th Pl
E 17th St
E 19th St
E 20th St
E 21st St
E 22nd St
E 22nd Pl
E 23rd St
E Burr St
17th St
Kennedy Loop
Crowder Ave
S 14th Ave
S 16th Ave
S Arroyo Dr
S Arena Dr
S 13th Ave
S 12th Dr
S 11th Ave
S 10th Ave
S 9th Ave
S 8th Ave
S 7th Ave
S 6th Ave
S 5th Ave
S 4th Ave
S 3rd Ave
S 2nd Ave
S 1st Ave
S Ave A
S Redondo Center Dr
I-8
S Castle Dome
S Castle Dome Ave
S Ave 2e
Ave 2 E
S Arizona Ave
S Madison Ave
S Maple Ave
S Walnut Ave
Riley Ave
S Sunridge Dr
S Pacific Ave
S Mary Ave
Via Cielo
13th Ave
11th Ave
Ridgeview Dr
S del Valle Way
S Terrace Way
W Ridgeview Dr
S Cam Tierra
S Elks Ln

Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well
- Irrigation Well
- Facility
- Extent of Groundwater Contamination (2016)
- 20th St. and Factor Ave WQARF Site (Approximate Boundary)
- Pumphouse
- Former UST
- 4" Diesel Pipeline
- Approximate Boundary of Dieselville Site
- Streets

WQARF = Water Quality Assurance Revolving Fund

Extent of Groundwater Contamination (February 2016)

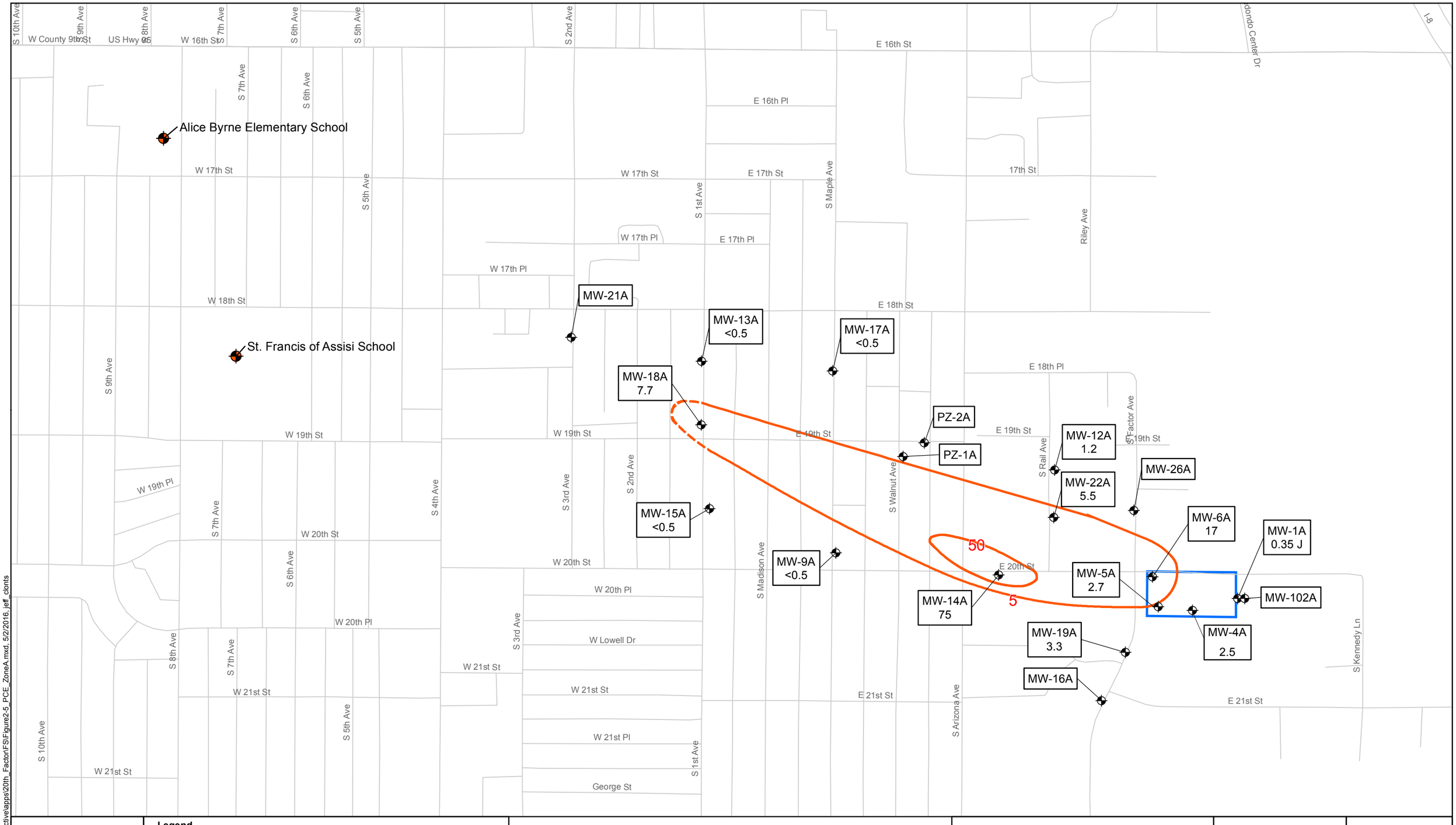
Record of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality
Matrix Design Group
CALIBRE

0 400 800 Feet

Figure
3

FILE: G:\gis_projects\ADEQ\active\apps\20th_Factor\FS\Figure2-1_GW_Conc_Extent.mxd, 8/15/2016, jeff_clonts



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Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well (Zone A) PCE Concentration (ug/L)
- Irrigation Well
- 5 PCE Concentration (ug/L) (dashed where inferred)
- Facility
- Streets

Notes:
ug/L = micrograms per liter
PCE = Tetrachloroethene
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard
AWQS = 5 ug/L
J = estimated concentration

PCE in Zone A (February 2016)

Record of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality

Matrix DESIGN GROUP CALIBRE

0 200 400 Feet

Figure
4

Alice Byrne Elementary School
<0.5

MW-30B
< 0.05

MW-31B
< 0.05

MW-28B

MW-25B

MW-24B
< 0.5

MW-21B
0.28 J

St. Francis of Assisi School
<0.5

MW-18B
1400

MW-29B
< 0.5

5

500

50

PZ-2B

PZ-1B

MW-8B
1.3

50

5

MW-102B1
0.28 J

MW-23B
< 0.5

MW-22B
92

W County 9th St
US Hwy 60
W 16th St
S 10th Ave
S 9th Ave
S 8th Ave
S 7th Ave
S 6th Ave
S 5th Ave
S 4th Ave
S 3rd Ave
S 2nd Ave
S 1st Ave
E 16th St
E 16th Pl
S Maple Ave
W 17th St
E 17th St
17th St
W 17th Pl
E 17th Pl
Riley Ave
W 18th St
E 18th St
S Walnut Ave
E 18th Pl
W 19th St
E 19th St
S 2nd Ave
S Rail Ave
S Factor Ave
E 19th Pl
W 19th Pl
W 20th St
E 20th St
S Madison Ave
W 20th Pl
W Lowell Dr
W 21st St
E 21st St
S Arizona Ave
W 21st Pl
George St
S Kennedy Ln
Adondo Center Dr
I-8

FILE: G:\gis_projects\ADEQ\active\apps\20th_Factor\FS\Figure2-7_PCE_ZoneB.mxd, 5/2/2016, jeff_clonts

Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well (Zone B) PCE Concentration (ug/L)
- Irrigation Well
- PCE Concentration (ug/L) (dashed where inferred)
- Facility
- Streets

Notes:
ug/L = micrograms per liter
PCE = Tetrachloroethene
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard
AWQS = 5 ug/L
J = estimated concentration

PCE in Zone B (February 2016)

Record of Decision
20th Street and Factor Avenue
WQARF Site

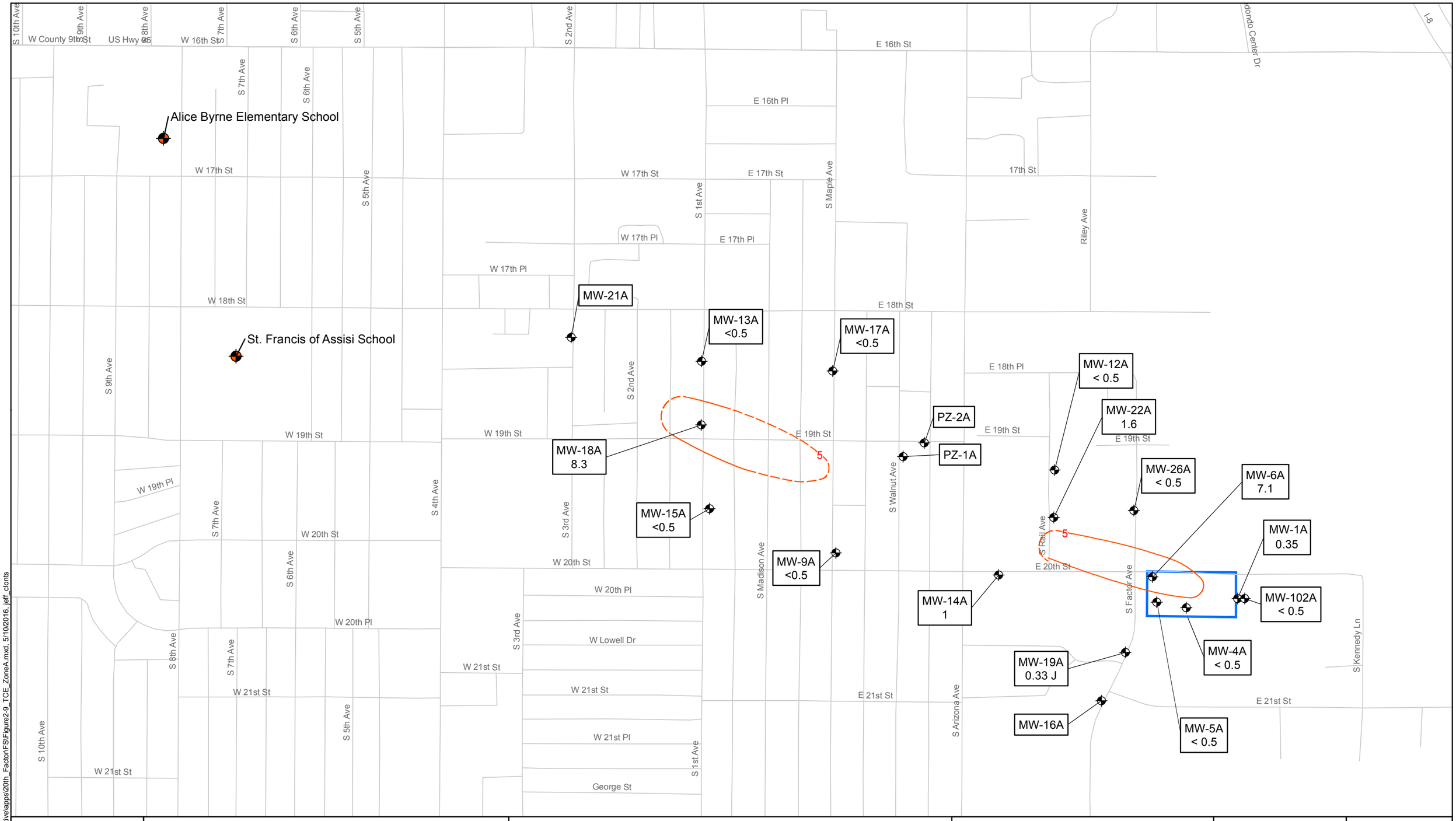
ADEQ Arizona Department of Environmental Quality

Matrix DESIGN GROUP
CALIBRE

N

0 225 450 Feet

Figure
5



FILE: G:\gis_projects\ADEQ\active\apps\20th_FactorFS\Figure2-9_TCE_ZoneA.mxd, 5/10/2016, jeff_clonts

Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well (Zone A) TCE Concentration (ug/L)
- Irrigation Well
- 5 TCE Concentration (ug/L) (dashed where inferred)
- Facility
- Streets

Notes:
ug/L = micrograms per liter
TCE = trichloroethene
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard
AWQS = 5 ug/L

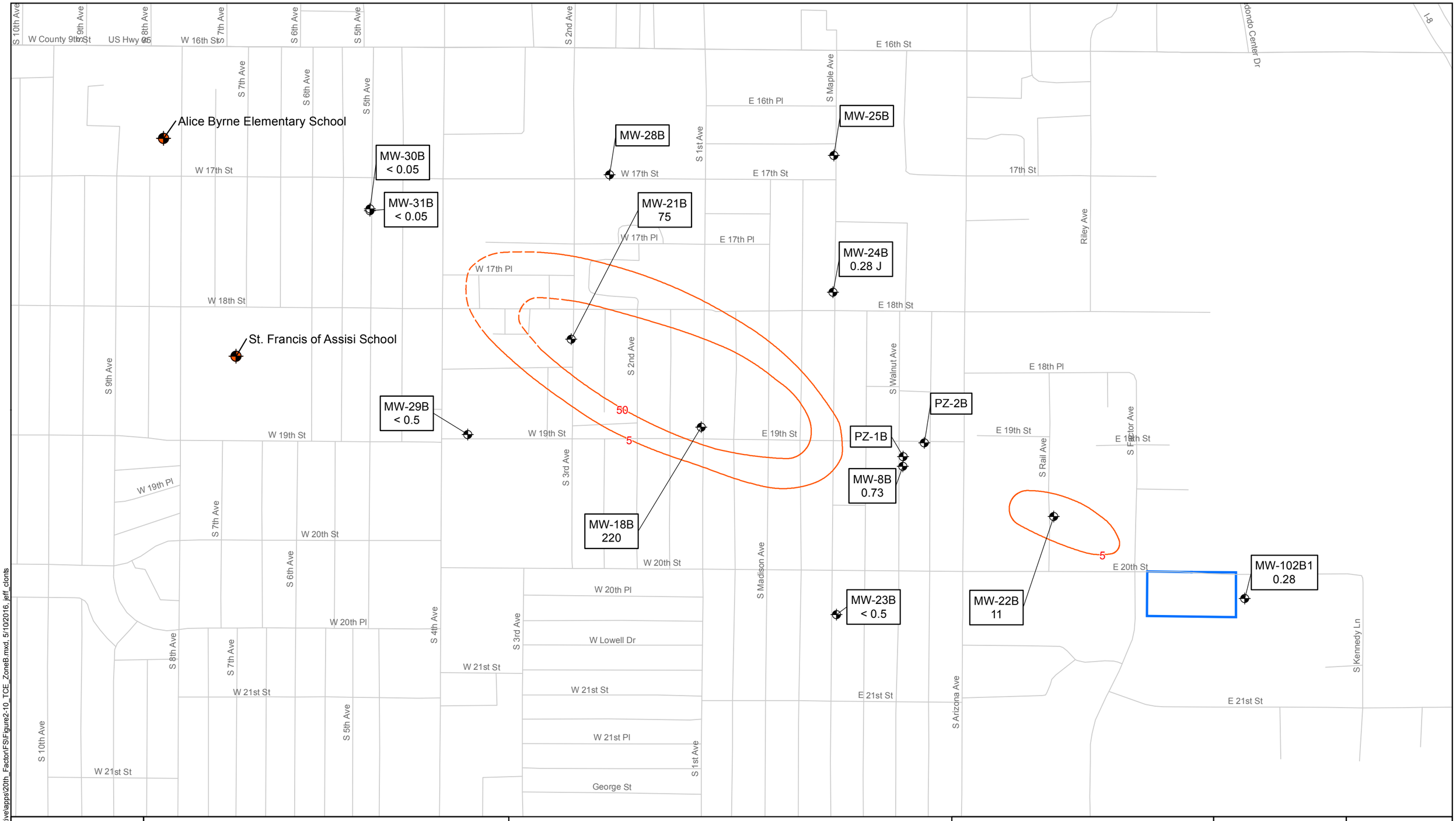
TCE in Zone A (February 2016)

Record of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality
Matrix Design Group
CALIBRE

0 225 450 Feet

Figure
6



FILE: G:\gis_projects\ADEQ\active\apps\20th_FactorFS\Figure2-10_TCE_ZoneB.mxd, 5/10/2016, jeff_clonts

Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well (Zone B) TCE Concentration (ug/L)
- Irrigation Well
- TCE Concentration (ug/L) (dashed where inferred)
- Facility
- Streets

Notes:
ug/L = micrograms per liter
TCE = trichloroethene
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard
AWQS = 5 ug/L

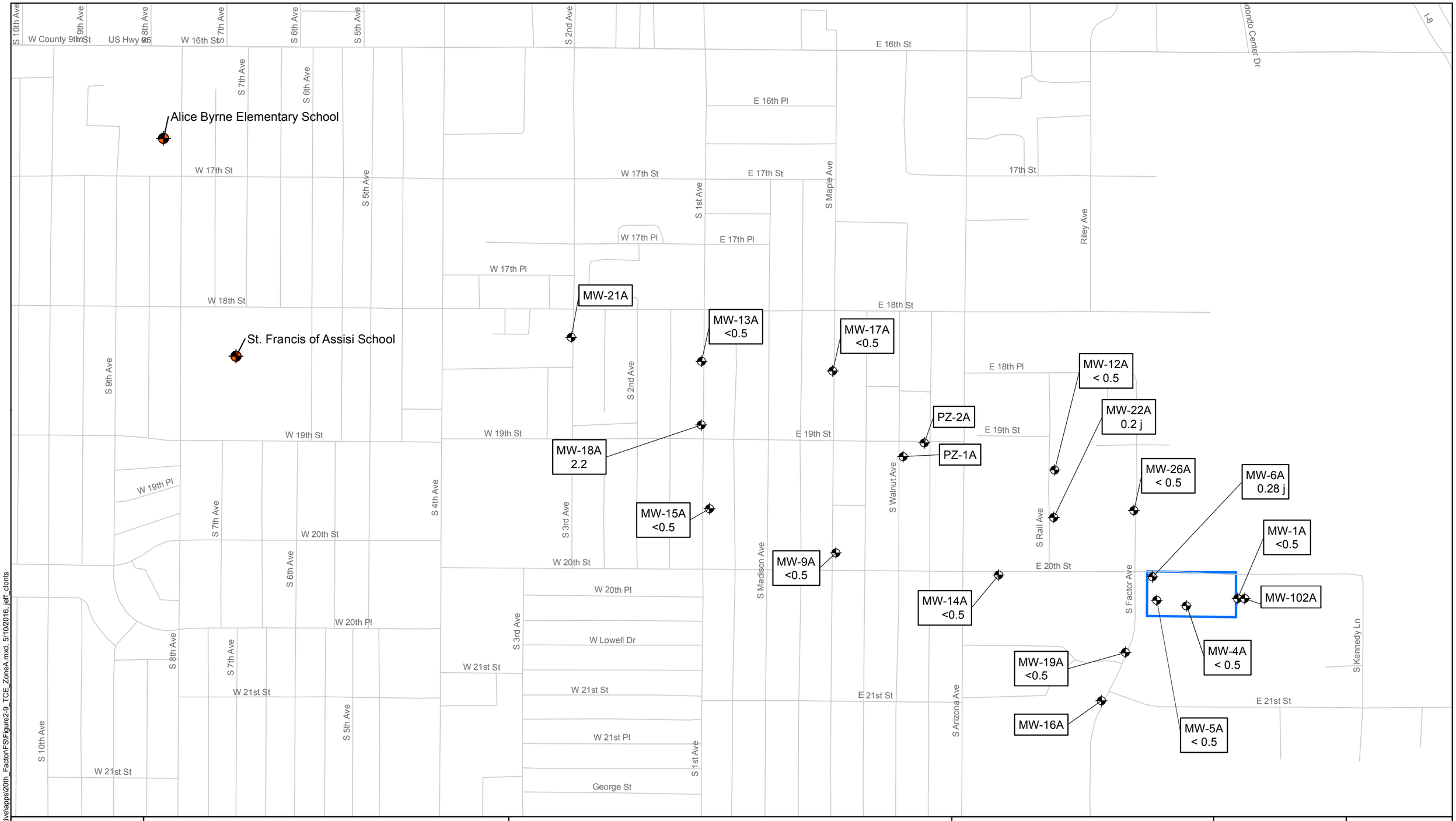
TCE in Zone B (February 2016)

Record of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality
Matrix Design Group
CALIBRE

0 200 400 Feet

Figure
7



FILE: G:\gis_projects\ADEQ\active\apps\20th_FactorFS\Figure2-9_TCE_ZoneA.mxd, 5/10/2016, jeff_clonts

Drawn By: JKC	
QC'd By: CHW	
Drawing Date: 5/2/2016	

Legend

- Monitoring Well (Zone A) DCE Concentration (ug/L)
- Irrigation Well
- Facility
- Streets

Notes:
ug/L = micrograms per liter
DCE = dichloroethene
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard
AWQS = 7 ug/L

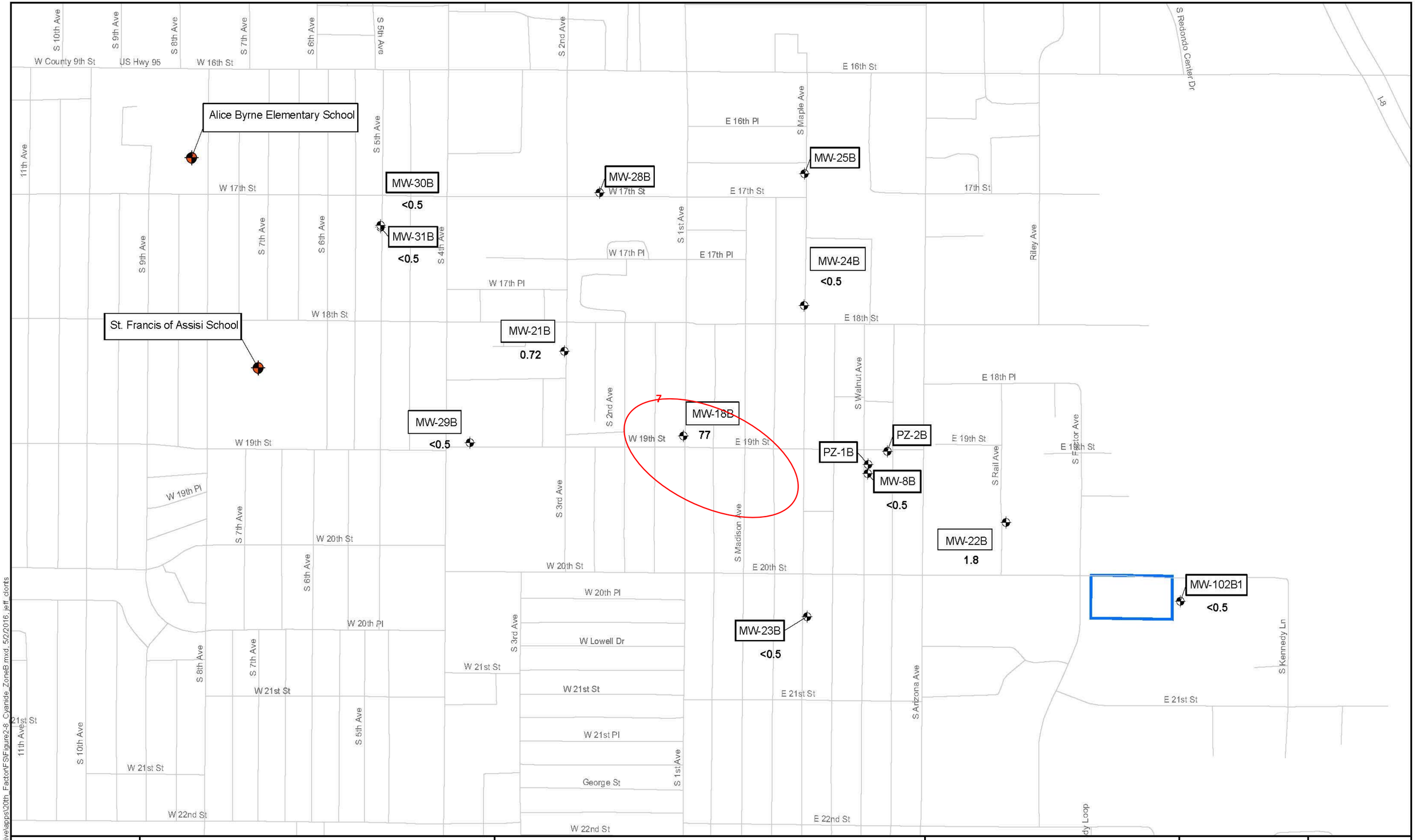
DCE in Zone A (February 2016)

Record of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality
Matrix DESIGN GROUP
CALIBRE

0 225 450 Feet

Figure
8



Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well (Zone B) DCE Concentration (ug/L)
- Irrigation Well
- 7 DCE Concentration (ug/L) (dashed where inferred)
- Facility
- Streets

Notes:
ug/L = micrograms per liter
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard AWQS = 7 ug/L

DCE in Zone B (February 2016)

Record of Decision
20th Street and Factor Avenue
WQARF Site

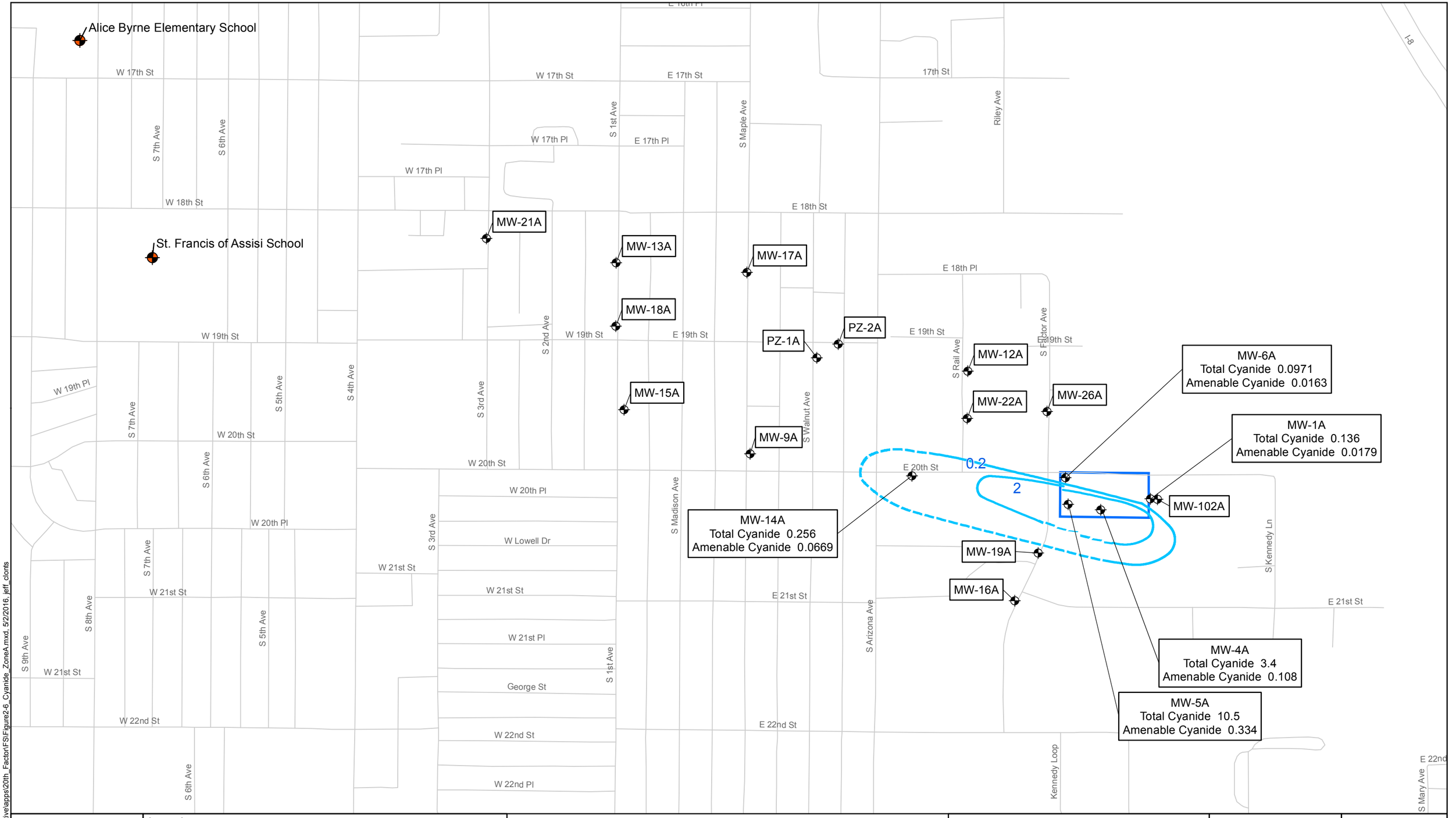
ADEQ Arizona Department of Environmental Quality
Matrix Design Group
CALIBRE

N

0 200 400 Feet

Figure 9

FILE: G:\gis_projects\ADEQ\active\apps\20th_FactorFS\Figure2-8_Cyanide_ZoneB.mxd, 5/2/2016, jeff_clorts



Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well (Zone A) Cyanide Concentration (mg/L)
- Irrigation Well
- 0.2 Cyanide Concentration (mg/L) (dashed where inferred)
- Facility
- Streets

Notes:
mg/L = milligrams per liter
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard
AWQS = 0.20 mg/L (free cyanide)

Cyanide in Zone A (February 2016)

Record of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality

Matrix Design Group

CALIBRE

0 225 450 Feet

Figure
10

FILE: G:\gis_projects\ADEQ\active\apps\20th_Factor\FS\Figure2-6_Cyanide_ZoneA.mxd, 5/2/2016, jeff_clonts

Alice Byrne Elementary School
Total Cyanide < 0.01
Amenable Cyanide < 0.01

MW-28B

MW-25B

MW-30B

MW-31B

MW-24B
Total Cyanide 0.0113
Amenable Cyanide < 0.01

St. Francis of Assisi School
Total Cyanide < 0.01
Amenable Cyanide < 0.01

MW-21B
Total Cyanide < 0.01
Amenable Cyanide < 0.01

MW-18B
Total Cyanide 1.22
Amenable Cyanide 0.0347

MW-29B
Total Cyanide = < 0.01
Amenable Cyanide = < 0.01

0.2

PZ-2B

PZ-1B

MW-8B

MW-22B
Total Cyanide 0.151
Amenable Cyanide 0.0168

MW-102B1

MW-23B

W County 9th St
US Hwy 95
W 16th St
E 16th St
S Redondo Center Dr
I-8
S 10th Ave
S 9th Ave
S 8th Ave
S 7th Ave
S 6th Ave
S 5th Ave
S 4th Ave
S 3rd Ave
S 2nd Ave
S 1st Ave
11th Ave
E 16th Pl
S Maple Ave
W 17th St
E 17th St
17th St
W 17th Pl
E 17th Pl
Riley Ave
W 18th St
E 18th St
S Walnut Ave
E 18th Pl
W 19th St
E 19th St
S 2nd Ave
S Rail Ave
S Factor Ave
E 19th St
W 19th Pl
S Madison Ave
W 20th St
E 20th St
W 20th Pl
W Lowell Dr
S Kennedy Ln
W 21st St
E 21st St
S Arizona Ave
W 21st Pl
George St
W 22nd St
E 22nd St

FILE: G:\gis_projects\ADEQactive\apps\20th_Factor\FS\Figure2-8_Cyanide_ZoneB.mxd, 5/2/2016, jeff_clonts

Drawn By: JKC

QC'd By: CHW

Drawing Date: 5/2/2016

Legend

- Monitoring Well (Zone B) Cyanide Concentration (mg/L)
- Irrigation Well
- 0.2 Cyanide Concentration (mg/L) (dashed where inferred)
- Facility
- Streets

Notes:
mg/L = milligrams per liter
WQARF = Water Quality Assurance Revolving Fund
AWQS = Aquifer Water Quality Standard
AWQS = 0.20 mg/L (free cyanide)

Cyanide in Zone B (February 2016)

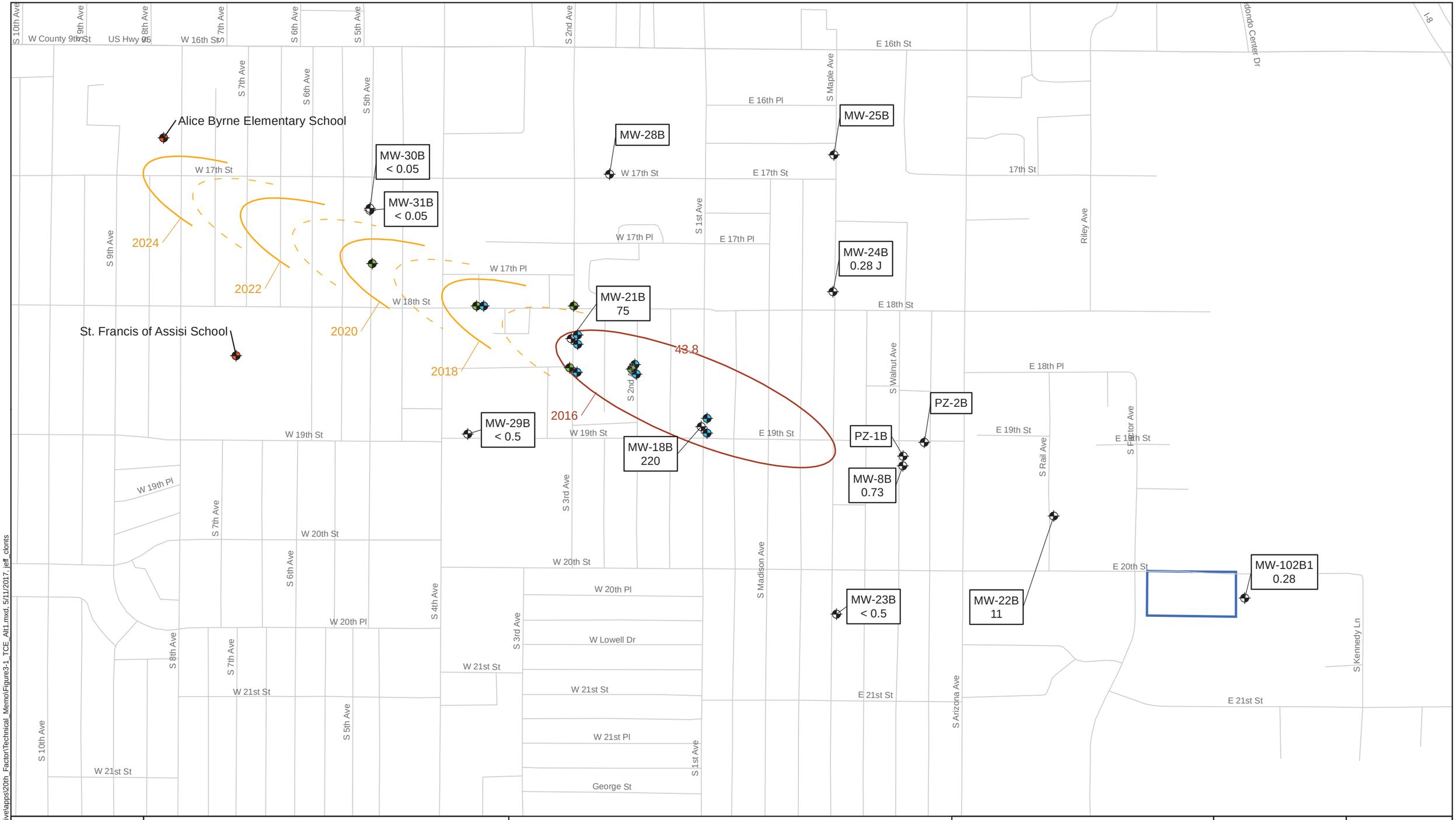
Record of Decision
20th Street and Factor Avenue
WQARF Site

ADEQ Arizona Department of Environmental Quality
Matrix Design Group
CALIBRE

N

0 200 400 Feet

Figure
11



Drawn By: JKC	**Legend**	**Elements of the Selected Remedy**	Figure 12
QC'd By: CHW	Monitoring Well (Zone B) TCE Concentration (ug/L) Irrigation Well New Monitoring Well New Treatment Well TCE = 43.8 ug/L (2016) TCE = 43.8 ug/L (Predicted) Facility Streets	Record of Decision 20th Street and Factor Avenue WQARF Site	0 200 400 Feet
Drawing Date: 5/11/2017	Notes: ug/L = micrograms per liter TCE = trichloroethene WQARF = Water Quality Assurance Revolving Fund Health Based Goal = 43.8 ug/L	ADEQ Arizona Department of Environmental Quality Matrix Design Group CALIBRE	

FILE: G:\gis_projects\ADEQactive\apps\20th_Factor\Technical_Memo\Figure3-1_TCE_Alt1.mxd, 5/11/2017, jeff_clonts

APPENDIX A

RESPONSIVENESS SUMMARY

PROPOSED REMEDIAL ACTION PLAN COMMENTS

RESPONSIVENESS SUMMARY

In accordance with A.A.C. R18-16-410(B)(2) and A.R.S. §49-287.04(F), this comprehensive responsiveness summary has been prepared to identify and respond to all comments received on the PRAP after the conclusion of the public comment period. A 90-day comment period for the PRAP was held starting on 12 July 2017 through 11 October 2017. An email containing written comments was received during the comment period from Susanna Hitchcock of Yuma, Arizona. No other comments were received on the PRAP. The email comments are presented below with ADEQ responses.

Written Comment from Susanna Hitchcock of Yuma, Arizona

Comment #1

Ms. Hitchcock wrote:

"I would like to comment on the 20th Street and Factor Proposed Remedial Action Plan (PRAP). I read the report and would like to suggest that a modified Alternative 1 and 3 be considered."

ADEQ Response:

Thank you for your comment. ADEQ has reviewed each of the alternatives and combinations of the alternatives presented in the PRAP and believes that the most appropriate option for the Site has been selected.

Comment #2

Ms. Hitchcock wrote:

"If Alternative 3 was modified to have the schools, St. Francis and Alice Bryne switch from well water to City of Yuma water for irrigation in 2018. This would protect the students, teachers/coaches and maintenance workers sooner than later. When ground water is pumped out of the aquifer, the water in the aquifer will move toward the school wells. By eliminating the school wells the migration of the contamination plume would be greatly reduced."

ADEQ Response:

Thank you for your comment. The contaminant plume is naturally degrading as it migrates downgradient of the source area. ERD injections will expedite the degradation process and are anticipated to prevent the contaminant plume from reaching the irrigation wells at a concentration that would present a risk to the students and/or school personnel. Additionally, the contaminant plume is not currently present at the school irrigation wells, therefore, there is no current risk to students and/or school personnel. If the contaminant plume should migrate to the school irrigation wells at a concentration that would present a risk to the students and/or school personnel, ADEQ has contingencies in the ROD that would be implemented to protect students, teachers, and maintenance workers from the contaminant plume.

Comment #3

Ms. Hitchcock wrote:

"Use components of Alternative 1 by treating the plume in the area of highest contamination with the anaerobic bioremediation. I am not sure that the ICSO [sic] method of using a strong chemical to remediate the environment is practical. ICSO [sic] sounds expensive."

ADEQ Response:

ADEQ agrees. ADEQ must select remedial actions that are reasonable, necessary, cost-effective, and technically feasible pursuant to ARS 49-282.06 (A) (3). ADEQ has selected a phased approach to the remediation at the site which will allow a determination of future actions at the appropriate time based on data collection efforts.

Comment #4

Ms. Hitchcock wrote:

"Tax payers in this state have spent a lot of money to assess and remediate the contamination caused by the owners of Houston Film labs. The most practical and economical way to remediate this contamination should be considered."

ADEQ Response:

ADEQ agrees and has considered this in selecting the proposed alternative presented in the ROD.

RESPONSIVENESS SUMMARY – COMMENT EMAIL

From: Susanna Hitchcock
To: Kevin C. Snyder
Subject: Fw: 20th Street and Factor Proposed Remedial Action Plan
Date: Tuesday, October 10, 2017 8:57:41 PM

----- Forwarded Message -----
From: Susanna Hitchcock
To: "kcs@adeq.gov"
Cc: Susanna Hitchcock
Sent: Tuesday, October 10, 2017 7:32 PM
Subject: 20th Street and Factor Proposed Remedial Action Plan

Dear Kevin Snyder,

I would like to comment on the 20th Street and Factor Proposed Remedial Action Plan (PRAP). I read the report and would like to suggest that a modified Alternative 1 and 3 be considered.

If Alternative 3 was modified to have the schools, St. Francis and Alice Bryne switch from well water to City of Yuma water for irrigation in 2018. This would protect the students, teachers/coaches and maintenance workers sooner than later. When ground water is pumped out of the aquifer, the water in the aquifer will move toward the school wells. By eliminating the school wells the migration of the contamination plume would be greatly reduced.

Use components of Alternative 1 by treating the plume in the area of highest contamination with the anaerobic bioremediation. I am not sure that the ICSO method of using a strong chemical to remediate the environment is practical. ICSO sounds expensive.

Tax payers in this state have spent a lot of money to assess and remediate the contamination caused by the owners of Houston Film labs. The most practical and economical way to remediate this contamination should be considered.

Thank you for letting me comment on the PRAP.

Respectfully,

Susanna Hitchcock

4394 West 14th Place

Yuma, AZ 85364