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Via Email and Federal Express

Joey Pace
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Subject:
Proposed Remedial Action Plan (P-RAP), Former Capitol Castings Facility Site, Tempe, Arizona, VRP Site Code: 504426-00

ENVIRONMENT

Date:
February 29, 2016

Contact:
Katy Brantingham

Phone:
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Email:
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Our ref:
AZ000905.3814

Dear Ms. Pace:

On behalf of Victoria Technology, Inc., enclosed please find two copies (one bound and one unbound) of the P-RAP for the Former Capitol Castings Facility site located in Tempe, Arizona (VRP Site Code 504426-00). Once approved by the Arizona Department of Environmental Quality, the P-RAP will be sent to City of Tempe, ME Global, and Salt River Project.

Please let us know if you have any questions. Thank you for your continued support on this project.

Sincerely,

ARCADIS U.S., Inc.

K Brantingham

Kathryn Brantingham, RG
Associate Vice President

Copies:
Gerald Pepper, Victoria Technology, Inc.

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Imagine the result

Victoria Technologies, Inc.

Proposed
Remedial Action Plan

Former Capitol Castings Site
Tempe, Arizona

VRP Site Code: 504426-00

February 29, 2016

ARCADIS

REGISTERED GEOLOGIST
CERTIFICATE NO.
42555
C.
SHEPHERD
Date Signed 2/29/16
ARIZONA U.S.A.
Expires 6/30/2017

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EXPIRES 12-31-2016

Quentin R. Moore, P.E.
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Associate Vice President / CPM2

Proposed
Remedial Action Plan

Former Capitol Castings Site
Tempe, Arizona

Prepared for:
Victoria Technologies, Inc.

Prepared by:
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Our Ref.:
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1. INTRODUCTION

Arcadis, on behalf of Victoria Technology, Inc. (VTI), has prepared this proposed Remedial Action Plan (P-RAP) for the former Capitol Castings facility located in Tempe, Arizona (the site, see Figure 1). The P-RAP addresses groundwater affected by 1,1-dichloroethene (1,1-DCE) from the former Capitol Castings facility. The site was entered into the Arizona Department of Environmental Quality (ADEQ) Voluntary Remediation Program (VRP) in 2002 (VRP Site Code: 504426-00).

This P-RAP was prepared in accordance with the ADEQ-approved land and water use study (ARCADIS 2006, ADEQ 2007), ADEQ-approved Remedial Investigation Report (including the ADEQ Remedial Objectives (RO) Report [ARCADIS 2010, ADEQ 2010, 2011a]), and ADEQ-approved Final Feasibility Study (FS) Report (ARCADIS 2014b, ADEQ 2014); and A.R.S. §§ 49-175 and 282.06 and A.A.C. R18-16-408.

The P-RAP describes: (1) the proposed plan for the ADEQ-approved remedy of continued groundwater monitoring; and (2) the proposed plan for the ADEQ-approved contingency remedy of controlled migration coupled with continued groundwater monitoring (ARCADIS 2014b, ADEQ 2014).

1.1 Report Organization

The remainder of the P-RAP is organized as follows:

- **Section 2 – Site Background.** This section briefly describes the site and its historical operations.
- **Section 3 – Remedial Objectives.** This section restates the ADEQ-approved remedial objectives.
- **Section 4 – Remedy.** This section describes the plan for the ADEQ-approved remedy of continued groundwater monitoring, including how a determination would be made whether to implement the contingency remedy of controlled migration coupled with continued groundwater monitoring.
- **Section 5 – Contingency Remedy.** This section describes the details of the ADEQ-approved contingency remedy of controlled migration coupled with continued groundwater monitoring.
- **Section 6 – Estimated Costs.** This section summarizes the estimated costs of the remedy and the contingency remedy.
- **Section 7 – References.** This section lists the sources of information cited in the P-RAP.

2. SITE BACKGROUND

This section presents a site description, facility history, and the current conceptual site model. A more detailed history of historical investigations and remediation to date are provided in the ADEQ-approved Final FS Report.

2.1 Site Location and Facility History

The site is located in the western half of Section 3, Township 1 South, Range 4 East of the Gila & Salt River Baseline and Meridian system and encompasses the monitoring well network (Figure 2), the 1,1-DCE affected groundwater (Figures 3 through 6), and the former Capitol Castings facility.

The facility is located at 5857 South Kyrene Road in Tempe, Arizona. It is bounded more or less by Western Canal and Kiwanis Park to the north and east, Kyrene Road to the west, and Guadalupe Road to the south. Beyond Kyrene Road are industrial and commercial properties (Figure 1).

The facility elevation is approximately 1,190 feet above mean sea level (amsl) and encompasses an area of approximately 27 acres, of which roughly one-half is developed. The developed portion of the facility is predominantly on the southern half of the property while the northern half is mostly undeveloped.

Operation of the facility began in 1953 as a secondary steel foundry that produced various steel castings used primarily by the mining industry for wear-resistant and structural applications. VTI owned and operated the facility from 1988 until 1994, when the facility was purchased by ME International. ME International’s successor in interest, ME Elecmetal (ME Global), currently owns and operates the facility as a metals casting facility.

2.2 Conceptual Site Model

2.2.1 Hydrogeology

The site is located in the western portion of the Eastern Salt River Valley (ESRV) sub-basin, which is part of Arizona’s Basin and Range physiographic province. The ESRV is a typical alluvial basin of the province and is surrounded by block-faulted mountain ranges, including the Phoenix, South, Superstition, and Santan Mountains and the Tempe pediments. Ground surface elevations and the depth to bedrock in the area generally dip away from the more proximal South Mountain and the Tempe pediments. The South Mountain range and the Tempe pediments are located approximately 2 miles west and 3.5 miles north of the site, respectively.

The ESRV basin fill is comprised of Quaternary to Tertiary alluvial deposits, Tertiary volcanic rocks and Tertiary to Precambrian crystalline rocks. The alluvial deposits are regionally divided into Upper, Middle, and Lower Units (Laney and Hahn 1986, ADWR 2006). The Upper, Middle, and Lower Alluvial Units are all present at the site.

The hydrogeology at the site consists of a multi-layered aquifer system and was divided into five primary water-bearing zones (the S-Zone and the four D-Zones). These zones are separated by fine grained sediments, which effectively act as aquitards (two A-Zones). The S-Zone is a perched aquifer system and the four D-Zones are considered to be the primary aquifers at the site. The S-Zone is present from the land surface to 112 feet below ground surface (bgs) and the depth to water in the S-Zone is approximately 65 feet bgs near monitoring well MW-10. The D- and A-Zones are further divided into more distinct zones: D-Zone (112 to 138 feet bgs); A-Zone (138 to 174 feet bgs); D2-Zone (174 to 207 feet bgs); A2-Zone (207 to 250 feet bgs); D3-Zone (250 to 335 feet bgs); and the D4-Zone (335 feet bgs to approximately 600 feet bgs)[1]. The D4-Zone is a sedimentary rock aquifer (breccia/conglomerate). Figure 7 shows the hydrostratigraphic zones in a north-south cross-section.

The groundwater elevations decrease significantly between the S- and D-Zone, the D- and D2-Zone, and between D2- and D3-Zone. The differences in groundwater elevations between D3- and D4-Zones are generally negligible. The aquitard or confining layers are significant hydraulic barriers, contributing to the large vertical gradients and limiting the vertical movement of contaminants of concern (COC) affected groundwater. The groundwater flow directions at the site vary by aquifer; however, they are generally to the south (varying from southeast to southwest), consistent with the regional groundwater flow near the site. The groundwater flow directions and magnitude are influenced by recharge from Kiwanis Lake and the Western Canal, regional pumping, and local groundwater pumping. The D2-, D3-, and the D4-Zones are the most influenced by local groundwater pumping and the S-Zone is primarily influenced by recharge. Figures 8 through 11 present the most current groundwater elevation contours for the S-, D-, D2-, and D3-Zones, respectively and are based on groundwater elevations measured in October 2014.

[1] The ranges provided are based on average depths at the site.

Additional information concerning the site's regional geology and hydrogeology are available in the ADEQ-approved RI Report and ADEQ-approved Final FS Report.

2.2.2 Contaminants of Concern

Groundwater at the site is affected by a chlorinated volatile organic compound (CVOC) release and a gasoline leaking underground storage tank (LUST) release. Based on the historical evaluations, 1,1-DCE, 1,2-dichloroethane (1,2-DCA) and benzene are the primary COCs. These three compounds are detected above their respective Arizona Aquifer Water Quality Standards (AWQS)[2] and the maximum concentrations are typically two times greater than their respective AWQS, based on previous site investigations. The 1,2-DCA and benzene are related to the LUST release and the 1,1-DCE is related to the CVOC release. The 1,1-DCE is the only chemical in groundwater present beyond the facility boundary and addressed by the P-RAP. The LUST is being addressed by a separate plan. Historical information regarding the site, the two releases, and historical remedial actions is available in the ADEQ-approved Final FS Report and the LUST Groundwater Closure Assessment Report (ARCADIS 2014a and 2014b), respectively.

2.2.3 Nature and Extent of 1,1-DCE Affected Groundwater

Groundwater monitoring of the 1,1-DCE affected groundwater has been ongoing since 1993 and the monitoring well network has been expanded to cover the four primary groundwater aquifers (S-, D-, D2-, and D3-Zones). 1,1-DCE has not been detected in the deeper D3b-Zone (lower D3-Zone) or D4-Zone. The most recent (October 2014) distribution of 1,1-DCE among the aquifers is depicted in Figures 3 through 6. The vertical distribution of 1,1-DCE along the primary north-south axis is depicted in Figure 7.

The horizontal and vertical extent of the 1,1-DCE plume has been heavily influenced by regional pumping in the deeper aquifers. Pumping by Salt River Project (SRP) well 21.5E-1.0S has had the greatest influence on the migration of the plume (ARCADIS 2008, 2010) (see Figures 1 and 2). SRP well 21.5E-1.0S is screened in the D2-, A2-, and D3-Zones as well as the unaffected D4-Zone (ARCADIS 2008, 2010).

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[2] A.A.C. R18-11-405

1,1-DCE concentrations in groundwater exceeded the AWQS in 6 of the 23 monitoring wells that are located within the facility boundaries in 2013 or 2014:

- Within the S-Zone (MW-14 and MW-22S);
- Across the S and D-Zones (MW-10, MW-11, and MW-22M); and
- Within the D-Zone (MW-22D).

1,1-DCE concentrations in groundwater exceeded the AWQS in 19 of the 44 monitoring wells that are located hydraulically downgradient of the facility in 2013 or 2014:

- S-Zone (MW-15);
- D-Zone (MW-15D, MW-25D, MW-26D, MW-30D, MW-31D, and MW-35D);
- D2-Zone (MW-15D2, MW-26D2, MW-28D2, MW-31D2, MW-34D2, MW-35D2, and MW-38D2); and
- D3-Zone (MW-26D3, MW-29D3, MW-34D3, MW-36D3, and MW-38D3).

The groundwater monitoring studies establish that 1,1-DCE concentrations have been declining with time (ARCADIS 2015). The peak 1,1-DCE concentrations have declined from:

- 16,000 micrograms per liter (μg/L) in 1994 to 22 μg/L in 2013 in the S-Zone (monitoring well MW-22S was not sampled in 2014 in accordance with the sampling schedule),
- 2,300 μg/L in 2002 to 870 μg/L in 2014 in the D-Zone,
- 530 μg/L in 2004 to 49 μg/L in 2014 in the D2-Zone, and
- 56 μg/L in 2004 to 26 μg/L in 2014 the D3-Zone.

These declines are attributed to natural attenuation of the 1,1-DCE, the source removal, and enhanced reductive dechlorination in-situ reactive zone treatment, described in the ADEQ-approved Final FS Report.

Select monitoring wells exhibit increasing trends along the plume boundaries of the 1,1-DCE affected groundwater (e.g. MW-36D3). This is the result of advective transport[3] of the 1,1-DCE, predominantly due to the SRP well pumping, and some increases in 1,1-DCE concentrations in the downgradient wells were anticipated as indicated in the Final FS Report and the groundwater flow and 1,1-DCE transport modeling.

2.2.4 Groundwater Flow and 1,1-DCE Transport Modeling

The latest groundwater flow and solute transport model for the site (Phase III Model, appendix to the Final FS Report [ARCADIS 2014b]) predicts that any 1,1-DCE in the discharge from SRP well 21.5E-1.0S into Western Canal would never exceed 4 µg/L, based on the most likely (average) pumping rates for SRP well 21.5E-1.0S; and that this peak concentration would occur in 65 years (2080). SRP well 21.5E-1.0S is screened from the D2-Zone to the upper D4-Zone.

The Phase III Model predicts that any 1,1-DCE in the southernmost monitoring wells along Orion Street, hydraulically upgradient of SRP well 21.5E-1.0S, would never exceed 120 µg/L in the D2-Zone and 50 µg/L in the D3-Zone, based on the most likely (average) pumping rates for SRP well 21.5E-1.0S; and that these peaks would occur in 20 to 60 years (between 2035 and 2075).

The Phase III Model predicts that any 1,1-DCE in discharges from other water supply wells would never exceed laboratory reporting limits (0.5 to 1.0 µg/L), based on the most likely (average) pumping rates for the wells. This includes SRP well 20.6E-1.1S, which is located approximately 2,700 feet to the west-southwest of the MW-38 well cluster and discharges into High Line Canal (see Figure 1) and is screened from the A2-Zone to the D3-Zone; and ME Global well WS-1, which is used for industrial (non-potable) purposes, primarily as a fire suppression backup water supply. A more detailed explanation and summary of the modeling can be found in the ADEQ-approved Final FS Report.

3. REMEDIAL OBJECTIVES

Based on the ADEQ-approved RO Report (ADEQ 2009, 2010) the remedial objectives for the site are:

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[3] In some areas, the advective transport rate exceeds the natural attenuation rate.

- To protect against a loss or impairment of each industrial use of groundwater pumped from ME Global's groundwater supply wells that is threatened to be lost or impaired as a result of the 1,1-DCE, while such threat exists; and
- To protect against a loss or impairment of each municipal, agricultural, industrial or other beneficial use of groundwater pumped from SRPs groundwater supply wells that is threatened to be lost or impaired as a result of the 1,1-DCE, while such threat exists.

These remedial objectives are the basis of the ADEQ-approved remedy and ADEQ-approved contingency remedy for the 1,1-DCE affected groundwater (ARCADIS 2014b, ADEQ 2014). The approved remedy and contingency remedy are, respectively, continued groundwater monitoring (see Section 4), and controlled migration coupled with continued groundwater monitoring (see Section 5).

4. REMEDY

As stated in the ADEQ-approved Final FS Report, the ADEQ-approved remedy of continued groundwater monitoring will:

(i) Provide further empirical verification of the Phase III Model's predictions that: (a) 1,1-DCE concentrations in the discharge from SRP well 21.5E-1.0S into Western Canal would never exceed 4 µg/L and the highest concentration would occur around 2080; (b) 1,1-DCE concentrations in the discharge from SRP well 20.6E-1.1S into High Line Canal would never exceed 0.5 to1.0 µg/L; and (c) 1,1-DCE concentrations in the discharge of ME Global well WS-1 would never exceed 0.5 to1.0 µg/L; and

(ii) Enable a determination over the long term of: (a) whether there develops a threat of loss or impairment of any municipal, agricultural, industrial or other beneficial use of groundwater pumped from SRP well 21.5E-1.0S or SRP well 20.6E.1.1S as a result of the 1,1-DCE, which would be a trigger for the implementation of the contingency remedy of controlled migration coupled with continued groundwater monitoring; (b) whether there develops a threat of loss or impairment of any industrial use of groundwater pumped from ME Global well WS-1 as a result of the 1,1-DCE; and/or (c) whether a no action strategy would be consistent with the ADEQ-approved remedial objectives.

4.1 Groundwater Monitoring

Groundwater monitoring wells have been placed throughout the site in order to delineate the extent of the 1,1-DCE plume and evaluate 1,1-DCE concentration trends and advective transport over the years. A more focused group of wells screened within the S-, D-, D2-, D3-, and D4-Zones is selected for the purposes of the P-RAP:

- Conceptual site model (CSM) wells – will be used to monitor the core area of the 1,1-DCE affected groundwater;
- Key wells – will be used to monitor 1,1-DCE primary transport pathways;
- Sentinel wells – will be used to monitor the 1,1-DCE primary transport pathways upgradient of SRP wells 21.5E-1.0S and 20.6E.1.1S;
- Water supply (SRP) wells – SRP wells 21.5E-1.0S and 20.6E.1.1S will be used to monitor for any presence of 1,1-DCE in the discharges from those wells; and
- Water-level (WL) wells – will be used only to measure water levels to support the groundwater flow and 1,1-DCE transport assessments.

The designated wells are depicted in Figures 12 through 15. Groundwater monitoring activities will consist of the following:

- Measurement of water levels, including continuous water level monitoring using data logging pressure transducers in a select number of wells;
- Collection of groundwater samples from monitoring wells and laboratory analysis of the samples for 1,1-DCE using United States Environmental Protection Agency (USEPA) Method 8260B;
- Collection of water supply well discharge samples and laboratory analysis of the samples for 1,1-DCE using USEPA Method 524.2; and
- Monitoring of water supply well pumping.

The groundwater sampling and analysis for 1,1-DCE will be conducted on an semi-annual to every four years basis, depending on the purpose of the well, in accordance with the Base Level monitoring schedule in Table 1. Depth to groundwater measurements will be taken annually and the pressure transducer data will be downloaded annually and converted to groundwater elevations. The monthly and annual pumping totals for SRP wells 21.5E-1.0S and 20.6E.1.1S will also be recorded.

These monitoring frequencies may be increased, if required, as described in Section 4.2.

The groundwater samples will be collected from monitoring wells using a no-purge sampling method, e.g., HydraSleeves™. The first year of no-purge sample analytical results will be collected at the Level 1 schedule (see Table 1) and compared to historical results and trends. If the results are similar to historical results and trends, the no-purge method will continue to be used for groundwater monitoring. Groundwater samples from the SRP wells will be collected from the SRP well discharge monitoring point. A revised Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) will be prepared for the groundwater monitoring activities following approval of the P-RAP.

The groundwater monitoring data will be assessed and reported to the ADEQ annually by March 31st of the following year. The assessment will include verification of: (i) ME Global's industrial use of the groundwater; (ii) the designated uses of the canal water into which SRP well 21.5E-1.0S discharges (Western Canal and Kiwanis Park Lake); and (iii) the designated uses of the canal water into which SRP well 20.6E-1.1S discharges (High Line Canal). The reporting frequency may be increased, if required, as described in Section 4.2.

4.2 Determination of Whether to Implement the Contingency Actions and Remedy

The groundwater monitoring data will be used to determine whether there develops a threat of loss or impairment of any municipal, agricultural, industrial or other beneficial use of groundwater pumped from SRP well 21.5E-1.0S or SRP well 20.6E.1.1S as a result of the 1,1-DCE, which would be a trigger for the implementation of the contingency remedy of controlled migration coupled with continued groundwater monitoring described in Section 5. The approach to such a determination would involve an escalation of remedial activities in a phased manner, depending on the groundwater monitoring data, and include elements such as increased groundwater monitoring, sampling and analysis; increased reporting; installation of additional monitoring wells; updates of the groundwater flow and solute transport model; and, if necessary, installation of contingency groundwater extraction wells and implementation of the contingency remedy. The approach is depicted in Figure 16 (in relation to SRP well 21.5E-1.0S) and Figure 17 (in relation to SRP well 20.6E-1.1S) and is described in sections 4.2.1 through 4.2.3 below; and provides sufficient time to determine whether there develops a threat of loss or impairment of any municipal, agricultural, industrial or other beneficial use of groundwater pumped from SRP well 21.5E-1.0S or SRP well

20.6E.1.1S as a result of the 1,1-DCE. The approach is conservative (decision-making will be based on calculations and models that bias 1,1-DCE discharge concentrations on the high end) and provides a bi-directional framework, allowing for escalation or de-escalation as appropriate.

Since ME Global's industrial use of the groundwater is not threatened (i.e., the maximum groundwater concentration is less than the most conservative, applicable numeric water quality standard [Table 2]), no contingency actions have been established for this well. If ME Global's industrial use of the groundwater changes, VTI will evaluate and employ additional remedial strategies in order to safeguard or achieve the ADEQ-approved remedial objectives pertaining to ME Global's industrial use of groundwater.

4.2.1 Base Level Monitoring

As stated in Section 4.1, the groundwater monitoring will be conducted in accordance initially with the Base Level monitoring schedule in Table 1, using the wells depicted in Figures 12 through 15, and the groundwater samples will be analyzed for 1,1-DCE. VTI will use the monitoring data to determine whether a Scenario 1 or subsequent criterion is met, which would trigger a corresponding Action Level, as described in Sections 4.2.2 and 4.2.3 and depicted in Figures 16 and 17. If a Scenario 1 or subsequent criterion is not met, then the monitoring schedule will remain at the Base Level.

4.2.2 Scenario Criteria

This Section 4.2.2 states the Scenario Criteria which, if met, trigger corresponding Action Level requirements in Section 4.2.3. The Scenario Criteria and Action Level requirements are depicted in Figures 16 and 17.

4.2.2.1. Concentrations of 1,1-DCE in the Transect Sentinel Wells Upgradient of SRP Well 21.5E-1.0S (Figure 16)

- Scenario 1 - If the actual zone-averaged concentration of 1,1-DCE in transect sentinel wells MW-34D2/D3, MW-36D2/D3 and MW-33D2/D3 is greater than 80 percent of the model-predicted peak zone-averaged concentration of 1,1-DCE in those wells, then Action Level 1 applies.
- Scenario 2 - If the actual zone-averaged concentration of 1,1-DCE in transect sentinel wells MW-34D2/D3, MW-36D2/D3 and MW-33D2/D3 is greater than 125

percent of the model-predicted peak zone-averaged concentration of 1,1-DCE in those wells, then Action Level 2 applies.

- Scenario 3 - If the actual concentrations of 1,1-DCE in transect sentinel wells MW-34D2/D3, MW-36D/A2/D2/D3 and MW-33D2/D3 indicate the 1,1-DCE concentration in the SRP well 21.5E-1.0S discharge could be greater than 6.3 µg/L in the future using the mass flux principle, then Action Level 3 applies.

Notes:

1. Actual zone-averaged concentrations of 1,1-DCE in the transect sentinel wells will be calculated as follows: the concentrations of 1,1-DCE in samples collected from monitoring wells MW-34D2, MW-36D2 and MW-33D2 will be averaged; and the concentrations of 1,1-DCE in samples collected from monitoring wells MW-34D3, MW-36D3 and MW-33D3 will be averaged.
2. Model-predicted peak zone-averaged concentrations of 1,1-DCE in the transect sentinel wells will be calculated as follows: the peak D2-Zone model-predicted 1,1-DCE concentrations from monitoring wells MW-34D2, MW-36D2 and MW-33D2 will be averaged; and the peak D3-Zone model-predicted 1,1-DCE concentrations from monitoring wells MW-34D3, MW-36D3 and MW-33D3 will be averaged. The model-predicted zone-averaged concentrations of 1,1-DCE versus time in the transect sentinel wells are depicted in Figure 18. The model-predicted peak 1,1-DCE concentrations are 41 µg/L (occurring in 2063) for the D2-Zone and 18 µg/L (occurring in 2060) for the D3-Zone.
3. Based on the model predictions and flux–based behavior of the 1,1-DCE, the 80 and 125 percent thresholds and the 6.3 µg/L trigger will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.
4. All model predictions employ the average pumping scenario for SRP wells. This pumping scenario is part of the Phase III Model Report which is an appendix to the ADEQ-approved Final FS Report (ARCADIS 2014b) and is the ADEQ-approved model for remedial action planning for the 1,1-DCE affected groundwater at the Site. The scenario criteria take into account also the advective transport rates from the high pumping scenario utilized in the ADEQ-approved Phase II Groundwater Flow and Solute Transport Model (ADEQ 2011b, ARCADIS 2008), an earlier iteration of the Phase III Model.
5. Appendix A describes the mass flux principle and calculation method for estimating the concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S based on

the concentration of 1,1-DCE in the transect sentinel wells (See also ITRC 2010). The method utilizes conservative assumptions to provide a biased high estimate of what the SRP well discharge concentration could be at a future date.

4.2.2.2. Concentrations of 1,1-DCE in the Transect Sentinel Wells Upgradient of SRP Well 20.6E-1.1S (Figure 17)

- Scenario 1 – If the actual concentrations of 1,1-DCE in transect sentinel wells MW-24D2/D3, MW-38D2/D3 and MW-34D2/D3 indicate the 1,1-DCE concentration in the SRP well 20.6E-1.1S discharge could be greater than 3.2 μg/L in the future using the mass flux principle, then Action Level 1 applies.
- Scenario 2 – If the actual concentrations of 1,1-DCE in transect sentinel wells MW-24D2/D3, MW-38D2/D3 and MW-34D2/D3 indicate the 1,1-DCE concentration in the SRP well 20.6E-1.1S discharge could be greater than 5.6 μg/L in the future using the mass flux principle, then Action Level 2 applies.
- Scenario 3 – If the actual concentrations of 1,1-DCE in transect sentinel wells MW-24D2/D3, MW-38D2/D3 and MW-34D2/D3 (including any new SRP well 20.6E-1.1S sentinel wells, as applicable) indicate the 1,1-DCE concentration in the SRP well 20.6E-1.1S discharge could be greater than 6.3 μg/L in the future using the mass flux principle, then Action Level 3 applies.

Notes:

1. Appendix A describes the mass flux principle and calculation method for estimating the concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S based on the concentration of 1,1-DCE in the transect sentinel wells (See also ITRC 2010). The method utilizes conservative assumptions to provide a biased high estimate of what the SRP well discharge concentration could be at a future date. The calculations also conservatively assume all of the 1,1-DCE along the transect will be captured by SRP well 20.6E-1.1S which is unlikely.
2. Based on advective transport calculations and the flux-based behavior of the 1,1-DCE observed in the model simulations, the 3.2 μg/L, 5.6 μg/L and 6.3 μg/L triggers will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.

4.2.2.3. Actual Concentration of 1,1-DCE in the Discharge from SRP Well 21.5E-1.0S (Figure 16)

- Scenario 1 – If the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is greater than 80 percent of the model-predicted peak concentration of 1,1-DCE in the discharge from that well, then Action Level 1 applies.
- Scenario 2 – If the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is greater than 100 percent of the model-predicted peak concentration of 1,1-DCE in the discharge from that well, then Action Level 2 applies.
- Scenario 3 – If the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is greater than 5.6 µg/L, then Action Level 3 applies.
- Scenario 4 – If the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is greater than 6.3 µg/L, then Action Level 4 applies.

Notes:

1. The actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S will be the average of: (a) the concentration of 1,1-DCE that is in an initial sample of the discharge; and (b) the concentration of 1,1-DCE that is in a confirmation sample of the discharge that is collected within 30 days of the initial sample.
2. The current model-predicted peak concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is depicted in Figure 18.
3. Based on the model predictions, the 80 and 100 percent thresholds and the 5.6 µg/L and 6.3 µg/L triggers will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.
4. All model predictions employ the average pumping scenario for SRP wells. This pumping scenario is part of the Phase III Model Report which is an appendix to the ADEQ-approved Final FS Report (ARCADIS 2014b) and is the ADEQ-approved model for remedial action planning for the 1,1-DCE affected groundwater at the Site. The scenario criteria take into account also the advective transport rates from the high pumping scenario utilized in the ADEQ-approved Phase II Groundwater Flow and Solute Transport Model (ADEQ 2011b, ARCADIS 2008), an earlier iteration of the Phase III Model.

4.2.2.4. Actual Concentration of 1,1-DCE in the Discharge from SRP Well 20.6E-1.1S (Figure 17)

- Scenario 1 – If the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S is greater than 1.0 µg/L, then Action Level 1 applies.
- Scenario 2 – If the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S is greater than 4.0 µg/L, then Action Level 2 applies.
- Scenario 3 – If the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S is greater than 5.6 µg/L, then Action Level 3 applies.
- Scenario 4 – If the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S is greater than 6.3 µg/L, then Action Level 4 applies.

Notes:

1. The actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S will be the average of: (a) the concentration of 1,1-DCE that is in an initial sample of the discharge; and (b) the concentration of 1,1-DCE that is in a confirmation sample of the discharge that is collected within 30 days of the initial sample.
2. The model predicts that the concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S will remain below 1.0 µg/L.
3. Based on advective transport calculations and the flux-based behavior of the 1,1-DCE observed in the model simulations, the 1.0 µg/L, 4.0µg/L, 5.6 µg/L and 6.3 µg/L triggers will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.
4. All model predictions employ the average pumping scenario for SRP wells. This pumping scenario is part of the Phase III Model Report which is an appendix to the ADEQ-approved Final FS Report (ARCADIS 2014b) and is the ADEQ-approved model for remedial action planning for the 1,1-DCE affected groundwater at the Site. The scenario criteria take into account also the advective transport rates from the high pumping scenario utilized in the ADEQ-approved Phase II Groundwater Flow and Solute Transport Model (ADEQ 2011b, ARCADIS 2008), an earlier iteration of the Phase III Model.

4.2.2.5. Rate of Increase in the Actual Concentration of 1,1-DCE in the Discharge from SRP Well 21.5E-1.0S (Figure 16)

- Scenario 1 – If the rate of increase in the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is 75 percent greater than the model-predicted (average) rate of increase of the concentration of 1,1-DCE in the discharge, then Action Level 1 applies.
- Scenario 2 – If the rate of increase in the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is significant and indicates the concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S will, within the next four years, exceed 5.6 µg/L, then Action Level 2 applies.
- Scenario 3 – If the rate of increase in the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is significant and indicates the concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S will, within the next two years, exceed 5.6 µg/L, then Action Level 3 applies.
- Scenario 4 – If the rate of increase in the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S is significant and indicates the concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S will, within the next two years, exceed 7 µg/L, then Action Level 4 applies.

Notes:

1. The rate of increase of the actual concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S will be determined using linear regression of four or more sets of sample analytical results and assessed for significance. The current model-predicted 1,1-DCE concentration rate of change in the discharge from SRP well 21.5E-1.0S is depicted in Figure 18.
2. Based on the model predictions, the 75 percent greater than threshold and the 5.6 µg/L and 7 µg/L triggers, and four-year and two-year timeframes will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.
3. All model predictions employ the average pumping scenario for SRP wells. This pumping scenario is part of the Phase III Model Report which is an appendix to the ADEQ-approved Final FS Report (ARCADIS 2014b) and is the ADEQ-approved model for remedial action planning for the 1,1-DCE affected groundwater at the Site. The scenario criteria take into account also the advective transport rates from the high pumping scenario utilized in the ADEQ-approved Phase II Groundwater

Flow and Solute Transport Model (ADEQ 2011b, ARCADIS 2008), an earlier iteration of the Phase III Model.

4. Under Scenario 4, 3 to 4 months would be needed to construct the groundwater capture and treatment system that is part of the contingency remedy described in Section 5.

5. The currently applicable designated uses of canal water in Western Canal and High Line Canal are AgI and AgL, for which there are no 1,1-DCE numeric water quality standards (see Table 2). Western Canal also supplies water to Kiwanis Park Lake. The currently applicable designated uses of water in Kiwanis Park Lake are FBC, PBC, A&Ww and AgI, for which the most stringent 1,1-DCE numeric water quality standard is 950 μg/L (see Table 2). There is presently no proposal in the Arizona Administrative Register to change the designated use of the canal water to DWS. Also, the AZPDES permit that governs discharges into SRP's canals does not impose a numeric discharge limitation for 1,1-DCE because of ADEQ's determination that discharges into Western Canal entail no reasonable potential for an exceedance of a corresponding receiving water quality standard under applicable rules (ADEQ 2005). However, a use of the canal water as a DWS is foreseeable (see Table 2; see also footnote 4 of the ADEQ-approved FS Report). The 5.6 μg/L trigger that is specified would be 80% of the 1,1-DCE numeric water quality standard of 7 μg/L that applies to canal waters the designated uses of which include DWS, assuming a mixing zone is not allowed.

6. If a mixing zone is allowed or the 7 μg/L standard is ever revised, then that would necessitate a corresponding amendment of the Remedial Action Plan to change the Scenario Criteria that are functions of that standard.

4.2.2.6. Rate of Increase in the Actual Concentration of 1,1-DCE in the Discharge from SRP Well 20.6E-1.1S (Figure 17)

- Scenario 2 – If the rate of increase in the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S is significant and indicates the concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S will, within the next four years, exceed 5.6 μg/L, then Action Level 2 applies.
- Scenario 3 – If the rate of increase in the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S is significant and indicates the concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S will, within the next two years, exceed 5.6 μg/L, then Action Level 3 applies.

- Scenario 4 – If the rate of increase in the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S is significant and indicates the concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S will, within the next two years, exceed 7 μg/L, then Action Level 4 applies.

Notes:

1. The rate of increase of the actual concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S will be determined using linear regression of four or more sets of sample analytical results and assessed for significance.
2. Based on advective transport calculations and the flux-based behavior of the 1,1-DCE observed in the model simulations, the 5.6 μg/L and 7 μg/L triggers and four-year and two-year timeframes will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.
3. All model predictions employ the average pumping scenario for SRP wells. This pumping scenario is part of the Phase III Model Report which is an appendix to the ADEQ-approved Final FS Report (ARCADIS 2014b) and is the ADEQ-approved model for remedial action planning for the 1,1-DCE affected groundwater at the Site. The scenario criteria take into account also the advective transport rates from the high pumping scenario utilized in the ADEQ-approved Phase II Groundwater Flow and Solute Transport Model (ADEQ 2011b, ARCADIS 2008), an earlier iteration of the Phase III Model.
4. Under Scenario 4, 3 to 4 months would be needed to construct the groundwater capture and treatment system that is part of the contingency remedy described in Section 5.
5. The currently applicable designated uses of canal water in High Line Canal are AgI and AgL, for which there are no 1,1-DCE numeric water quality standards (see Table 2). There is presently no proposal in the Arizona Administrative Register to change the designated use of the canal water to DWS. However, a use of the canal water as a DWS is foreseeable (see Table 2; see also footnote 4 of the ADEQ-approved FS Report). The 5.6 μg/L trigger that is specified would be 80% of the 1,1-DCE numeric water quality standard of 7 μg/L that applies to canal waters the designated uses of which include DWS, assuming a mixing zone is not allowed.
6. If a mixing zone is allowed or the 7 μg/L standard is ever revised, then that would necessitate a corresponding amendment of the Remedial Action Plan to change the Scenario Criteria that are functions of that standard.

4.2.2.7. Revision of Model-Predicted Peak Concentration of 1,1-DCE in the Discharge from SRP Well 21.5E-1.0S (Figure 16)

- Scenario 3 – If the groundwater flow and solute transport model, as updated pursuant to Action Level 2 requirements, indicates the concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S will, within the next four years, exceed 5.6 μg/L, then Action Level 3 applies.
- Scenario 4 – If the groundwater flow and solute transport model, as updated pursuant to Action Level 3 requirements, indicates the concentration of 1,1-DCE in the discharge from SRP well 21.5E-1.0S will, within the next four years, exceed 7 μg/L, then Action Level 4 applies.

Notes:

1. Based on the model predictions, the 5.6 μg/L and 7 μg/L triggers and four-year timeframe will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.
2. All model predictions employ the average pumping scenario for SRP wells. This pumping scenario is part of the Phase III Model Report which is an appendix to the ADEQ-approved Final FS Report (ARCADIS 2014b) and is the ADEQ-approved model for remedial action planning for the 1,1-DCE affected groundwater at the Site. The scenario criteria take into account also the advective transport rates from the high pumping scenario utilized in the ADEQ-approved Phase II Groundwater Flow and Solute Transport Model (ADEQ 2011b, ARCADIS 2008), an earlier iteration of the Phase III Model.
3. If a mixing zone is allowed or the 7 μg/L standard is ever revised, then that would necessitate a corresponding amendment of the Remedial Action Plan to change the Scenario Criteria that are functions of that standard.

4.2.2.8. Revision of Model-Predicted Peak Concentration of 1,1-DCE in the Discharge from SRP Well 20.6E-1.1S (Figure 17)

- Scenario 3 – If the groundwater flow and solute transport model, as updated pursuant to Action Level 2 requirements, indicates the concentration of 1,1-DCE in the discharge from SRP well 20.6E-1.1S will, within the next four years, exceed 5.6 μg/L, then Action Level 3 applies.
- Scenario 4 – If the groundwater flow and solute transport model, as updated pursuant to Action Level 3 requirements, indicates the concentration of 1,1-DCE in

the discharge from SRP well 20.6E-1.1S will, within the next four years, exceed 7 µg/L, then Action Level 4 applies.

Notes:

1. Based on advective transport calculations and the flux-based behavior of the 1,1-DCE observed in the model simulations, the 5.6 µg/L and 7 µg/L triggers and four-year timeframe will iteratively provide ample time to implement the more aggressive Action Level monitoring and, if necessary, based on the resulting additional monitoring data, the contingency remedy described in Section 5.
2. All model predictions employ the average pumping scenario for SRP wells. This pumping scenario is part of the Phase III Model Report which is an appendix to the ADEQ-approved Final FS Report (ARCADIS 2014b) and is the ADEQ-approved model for remedial action planning for the 1,1-DCE affected groundwater at the Site. The scenario criteria take into account also the advective transport rates from the high pumping scenario utilized in the ADEQ-approved Phase II Groundwater Flow and Solute Transport Model (ADEQ 2011b, ARCADIS 2008), an earlier iteration of the Phase III Model.
3. If a mixing zone is allowed or the 7 µg/L standard is ever revised, then that would necessitate a corresponding amendment of the Remedial Action Plan to change the Scenario Criteria that are functions of that standard.

4.2.3 Action Levels

This Section 4.2.3 states the Action Level requirements that are triggered by corresponding Scenario Criteria described in Section 4.2.2.

4.2.3.1. Action Level 1 Requirements

If a Scenario 1 criterion is met, then that would trigger Action Level 1 requirements as specified below (see also Figures 16 and 17):

- Increase monitoring data density through Level 1 Monitoring (see Table 1) in the vicinity of the SRP well(s) for which a Scenario 1 criterion is met (SRP well 21.5E-1.0S or/and 20.6E-1.1S) and in the vicinity of the key wells and sentinel wells upgradient of the SRP well(s) in order to enhance empirical determinations based on 1,1-DCE concentrations and trends in the wells; and
- Determine whether Action Level 2 applies using the Scenario Criteria described in Section 4.2.2.

4.2.3.2. Action Level 2 Requirements

If a Scenario 2 criterion is met, then that would trigger Action Level 2 requirements as specified below (see also Figures 16 and 17):

- Increase monitoring data density through Level 2 Monitoring (see Table 1) in the vicinity of the SRP well(s) for which a Scenario 2 criterion is met (21.5E-1.0S or/and 20.6E-1.1S) and in the vicinity of the key wells and sentinel wells upgradient of the SRP well(s) in order to enhance empirical determinations based on 1,1-DCE concentrations and trends;
- Verify or update model predictions accordingly and report findings to the ADEQ;
- Determine optimal locations for one or more sentinel/contingency groundwater extraction wells, as appropriate, upgradient of the SRP well(s) for which a Scenario 2 criterion is met (21.5E-1.0S or/and 20.6E-1.1S) and secure access agreements for those locations;
- If a Scenario 2 criterion is met with regard to, or upgradient from, SRP well 20.6E-1.1S, install one to two additional D2- and D3-Zone sentinel wells in order to provide improved definition of 1,1-DCE upgradient from SRP well 20.6E-1.1S; and
- Determine whether Action Level 3 applies using the Scenario Criteria described in Section 4.2.2.

4.2.3.3. Action Level 3 Requirements

If a Scenario 3 criterion is met, then that would trigger Action Level 3 requirements as specified below (see also Figures 16 and 17):

- Increase monitoring data density through Level 3 Monitoring (see Table 1) in the vicinity of the SRP well(s) for which a Scenario 3 criterion is met (21.5E-1.0S or/and 20.6E-1.1S) and in the vicinity of the key wells and sentinel wells upgradient of the SRP well(s) in order to enhance empirical determinations based on 1,1-DCE concentrations and trends;
- Verify or update model predictions accordingly (if necessary, recalibrate the groundwater flow and solute transport model) and report findings to the ADEQ;
- Install the one or more sentinel/contingency groundwater extraction wells pursuant to the previously secured access agreements (see Section 4.2.3.2);

- Determine optimal locations for additional sentinel wells, if appropriate, in relation to the SRP well(s) for which a Scenario 3 criterion is met (21.5E-1.0S or/and 20.6E-1.1S), secure access agreements for those locations, and install such sentinel wells;
- Substantially complete the design of the groundwater treatment system which is described in Section 5, identify optimal location(s) for the treatment system and appurtenances, and secure access agreements for the location(s); and
- Determine whether Action Level 4 applies using the Scenario Criteria described in Section 4.2.2.

4.2.3.4. Action Level 4 Requirements

If a Scenario 4 criterion is met, then that would trigger Action Level 4 requirements as specified below (see also Figures 16 and 17):

- Increase monitoring data density through Level 4 Monitoring (see Table 1) in the vicinity of the SRP well(s) for which a Scenario 4 criterion is met (21.5E-1.0S or/and 20.6E-1.1S) and in the vicinity of the key wells and sentinel wells upgradient of the SRP well(s) in order to enhance empirical determinations based on 1,1-DCE concentrations and trends;
- Verify or update model predictions to support the design or optimization of the groundwater treatment system, as appropriate and report findings to the ADEQ;
- Complete the design of the groundwater treatment system which is described in Section 5;
- Prepare and submit for ADEQ review and approval a groundwater treatment system operation, maintenance and monitoring (OM&M) plan (Section 5.3);
- Construct and install the treatment system pursuant to the completed design and the previously secured access agreements (see Section 4.2.3.3);
- Activate and commence operation of the treatment system;
- Monitor the effectiveness of the treatment system, so as to verify the ability of the contingency remedy to avoid a loss or impairment of any municipal, agricultural, industrial or other beneficial use of groundwater pumped from the SRP well(s) for which a Scenario 4 criterion is met (21.5E-1.0S or/and 20.6E-1.1S) as a result of the 1,1-DCE; and

- Determine if amendments to the FS Report and Remedial Action Plan are required to evaluate and employ a remedial strategy that is more aggressive than the contingency remedy in order to safeguard or achieve the ADEQ-approved remedial objectives or the contingency remedy may be suspended as part of a reversion to Action Level 3 or a lesser Action Level.

5. CONTINGENCY REMEDY

As described above, if a Scenario 4 criterion is met, then that would trigger the requirement to complete the design of, and construct, and operate, the groundwater treatment system while continuing the Level 4 groundwater monitoring. This would comprise the ADEQ-approved contingency remedy (ARCADIS 2014b, ADEQ 2014) of controlled migration using groundwater extraction and granular activated carbon (GAC) adsorption coupled with continued groundwater monitoring.

The goal of controlled migration and treatment would be to ensure that the concentration of any 1,1-DCE in the discharge from SRP well 21.5E-1.0S or SRP well 20.6E-1.1S is no greater than 90 percent of the most stringent 1,1-DCE numeric water quality standard for the currently applicable designated uses or formally proposed designated uses of the canal water into which the SRP well discharges. The treatment process is depicted in Figure 19 and would consist of:

- Using the contingency groundwater extraction wells described in Sections 4.2.3.3 and 4.2.3.4 to extract 1,1-DCE affected groundwater upgradient of the SRP well(s);
- Routing the water to the treatment system location(s) described in Sections 4.2.3.3 and 4.2.3.4;
- Removing solid particulates from the water using cartridge particulate filters;
- Using GAC adsorption to remove 1,1-DCE from the filtered water;
- Sampling and analyzing the treated water to verify the efficacy of the treatment system; and

- Discharging the treated water to publicly owned treatment works or underground as reasonable, necessary, cost-effective, and technically feasible to safeguard or achieve the ROs and pursuant to appropriate permitting/licensing.[4]

The following sections provide a description of the groundwater extraction wells, pumps and piping; treatment system components; treated water discharge; and operation and maintenance of the treatment system in greater detail.

5.1 Groundwater Extraction Wells, Pumps and Piping

The contingency groundwater extraction wells would consist of one pair of 6-inch wells in the D2-Zone and one pair of 6-inch wells in the D3-Zone at locations upgradient of the SRP well for which a Scenario 4 criterion is met (21.5E-1.0S or 20.6E-1.1S), at optimal locations selected in accordance with Section 4.2.3.2.[5] Each D2-Zone well would be drilled to a depth of approximately 200 feet bgs and each D3-Zone well would be drilled to a depth of approximately 280 feet. The final depth of the wells would be determined in the field based on the observed hydrogeology.

Variable speed submersible pumps would be placed above or below the well screens, as allowable. Based on hydraulic capture calculations and groundwater modeling, one to two wells pumping at 25 to 50 gallons per minute (gpm) from each zone would capture the majority of the 1,1-DCE affected groundwater within the contingency well area (depicted in Figures 14 and 15).

Each wellhead would be placed within a subsurface precast, heavy traffic rated vault. The wellhead would connect to a 2-inch diameter horizontal PVC and ball valve that transitions to a 2-inch high density polyethylene (HDPE) conveyance pipe. The well vault would house an instrumentation junction box, grounding rod, volts alternating current (VAC) electrical panel with pump disconnect, and leak detection switch.

Two-inch HDPE piping would route the extracted groundwater to the treatment system. The HDPE piping would be installed underground in a trench designed pursuant to City

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[4] Discharging the treated water into an SRP canal may also occur, provided that the discharge is approved in advance by SRP and subject to (1) the terms and conditions of an agreement with SRP governing such discharge and (2) any applicable AZPDES permit requirements.
[5] For purposes of cost estimation for this plan, it is assumed that two pairs of contingency groundwater extraction wells would be required upgradient of one of the two SRP wells (see Appendix B).

of Tempe and Maricopa County specifications and backfilled with clean material. A magnetic locating tape would be installed to facilitate future location of the piping.

5.2 Treatment System

The treatment system would be designed to handle up to approximately 200 gpm of combined flow from the extraction wells during normal operation. The treatment system components, depicted in Figure 19, would operate as follows:

- 2-bag cartridge particulate filter housings operated in parallel to remove particulate matter.
- Flow meters and pressure indicators would be used to monitor filter performance.
- The pumped water would be routed to a 5,000 gallon equalization storage tank in order to sustain steady flow through the GAC vessels.
- Two Equova PV® 5000ST GAC vessels,[6] capable of handling a maximum flow of 250 gpm, would be operated in a series lead/lag configuration:
  - The lead and lag GAC vessels would remove 1,1-DCE utilizing AquaCarb® S Carbon.
  - Samples of the GAC-treated water would be collected from vessel outlet sample ports and analyzed for 1,1-DCE. The sampling and analysis would occur as required in the applicable discharge permit.
  - If breakthrough occurs,[7] the treatment system would be reconfigured with the lag vessel as the lead vessel. Spent GAC from the former lead vessel would then be regenerated and the vessel would serve as a standby vessel.

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[6] The sizing of the vessels, handling up to 5,000 pounds of GAC, is based on isotherm calculations performed by Equova.

[7] Breakthrough would be considered to have occurred when analysis of samples of the treated water indicates the treated water contains 1,1-DCE at a concentration greater than 50 percent of the 1,1-DCE concentration treatment goal (discussed in this Section 5.2, further below).

- Potable water would be introduced to backwash the GAC vessels, when necessary. The potable water would be obtained from a fire hydrant and stored in a 4,000 gallon tank.[8]

The treatment system would be placed on a foundation within secondary containment:

- The foundation would be a specified earth compacted base and rebar reinforced concrete slab on grade. The slab on grade would be approximately 50 feet by 40 feet and 6 inches thick, with 10-inch thickened edges for stable footing.
- The secondary containment would be 28 feet by 15 feet with 2-foot high walls, sized to hold approximately 130 percent of the liquid capacity of one of the GAC vessels plus the displaced volume of other vessel(s) and equipment.
- A shade structure would be included, as well as a security fence with privacy panels designed to blend in with the local architecture.

The current design and costing assumes the treated water would then be conveyed to the City of Tempe sewer line for routing to the publicly owned treatment works pursuant to appropriate permitting/licensing. The goal of treating the extracted groundwater would be to achieve a concentration of 1,1-DCE in the treated water that is no greater than the 1,1-DCE standard, if any, that is applicable to wastewater discharged to the Tempe sewer system, pursuant to the terms and conditions of a wastewater discharge permit issued by the Tempe public works department.

5.3 Operation, Maintenance and Monitoring

Operation, maintenance and monitoring of the treatment system would be conducted in accordance with its OM&M plan. The OM&M plan would include: purpose/ objectives; start-up criteria; shutdown criteria; operating procedures; maintenance procedures and schedule; and performance monitoring procedures. System pressures and flows would be monitored to ensure the system operates as designed. The pumps and instrumentation would be regularly serviced pursuant to manufacturer specifications. Extraction wells specific-capacity would also be periodically tested to determine if redevelopment or chemical treatment of the extraction wells is necessary. Sampling of

[8] Backwashing would require at least three carbon bed volumes of water (3,815-gallons) at a relatively high flow rate. Any backwashed water that is discharged or disposed of would be in accordance with the terms and conditions of a wastewater discharge permit issued by the City of Tempe public works department or state and local disposal requirements, as applicable.

the influent, intermediate and treated process water would be performed to determine the frequency of the GAC backwash, regeneration and reconfiguration and verify that the applicable treatment level is being achieved prior to discharge of the treated water.

6. ESTIMATED REMEDY COSTS

Estimated costs of implementing the Remedy and the Contingency Remedy are provided in Appendix B. The cost summary includes capital costs as well as yearly, five year, and ten year incremental costs. Since the actual remedy time frame is uncertain, the total remedy costs are also uncertain.

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Tables

Table 1
Proposed Remedial Action Plan and Contingency Groundwater Monitoring Schedule
Former Capitol Castings Facility, Tempe, Arizona

Well Identification	Aquifer (Zone)	P-RAP Use Designation	Groundwater Sampling Frequency					Water Level Monitoring
			Base Level	Level 1	Level 2	Level 3	Level 4	
MW-12B	S	WL	--	--	--	--	--	●
MW-13B	S	WL	--	--	--	--	--	●
MW-14	S	WL	--	--	--	--	--	●
MW-15D	D	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-15D2	D2	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-22S	S	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-22D	D	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-24D*	D	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-24D2	D2	Sentinel	1/yr	2/yr	4/yr	4/yr	4/yr	●
MW-24D3	D3	Sentinel[#]	2/yr	2/yr	4/yr	4/yr	4/yr	●
MW-25S	S	WL	--	--	--	--	--	●
MW-26D	D	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-26D2	D2	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-26D3	D3	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-27D	D	WL	--	--	--	--	--	●
MW-28D	D	WL	--	--	--	--	--	●
MW-28D2	D2	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-28D3	D3	WL	--	--	--	--	--	●
MW-29D	D	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-29D2	D2	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-29D3	D3	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-29D3b	D3	CSM	1/4yrs	1/3yrs	1/3yrs	1/2yrs	1/2yrs	●
MW-30D3	D3	WL	--	--	--	--	--	●
MW-32D	D	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-32D2	D2	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-32D3	D3	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-33D2	D2	Sentinel	1/yr	2/yr	4/yr	4/yr	4/yr	●
MW-33D3	D3	Sentinel[#]	2/yr	2/yr	4/yr	4/yr	4/yr	●
MW-33D4	D4	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-34D2	D2	Sentinel	1/yr	2/yr	4/yr	4/yr	4/yr	●
MW-34D3	D3	Sentinel[#]	2/yr	2/yr	4/yr	4/yr	4/yr	●
MW-36A2	A2	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-36D2	D2	Sentinel	1/yr	2/yr	4/yr	4/yr	4/yr	●
MW-36D3	D3	Sentinel[#]	2/yr	2/yr	4/yr	4/yr	4/yr	●
MW-38D2	D2	Sentinel	1/yr	2/yr	4/yr	4/yr	4/yr	●
MW-38D3	D3	Sentinel[#]	2/yr	2/yr	4/yr	4/yr	4/yr	●
MW-39D2	D2	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
MW-39D3	D3	Key	1/2yrs	1/yr	1/yr	2/yr	2/yr	●
Contingency wells	D2/D3	Contingency	--	--	4/yr	4/yr	4/yr	●
SRP Well 20.6E-1.1S	A2-D3	SRP	1/yr	1/yr	2/yr	2/yr	4/yr	◊
SRP Well 21.5E-1.0S	D2-D4	SRP	1/yr	1/yr	2/yr	2/yr	4/yr	◊

Notes:
Groundwater samples will be collected using hydrasleeves per P-RAP
SRP well water samples will be collected from the SRP well discharge
All groundwater samples will be analyzed for 1,1-dichloroethene only using method USEPA 8260B
Groundwater Monitoring Frequencies:
- 1/4yrs = once every 4 years
- 1/3yrs = once every 3 years
- 1/2yrs = once every 2 years
- 1/yr = once a year
- 2/yr = twice a year
- 4/yr = four times a year

Aquifer (zone) definitions (describes which zone(s) wells are screened within):
- S = S-Zone
- D2 = D2-Zone
- D3 = D3-Zone
- D = D-Zone
- A2 = A2-Zone
- D4 = D4-Zone

-- = not scheduled for monitoring
* = piezometer well - sample using bailer
[#] = D3-Zone sentinel wells monitored 2/yr during Base Level monitoring
● = water level measurement frequency based on sentinel well monitoring frequency (e.g. 1/yr at Base Level)
◊ = water levels (as allowable) and pumping monitoring
CSM = conceptual site model well as designated in the P-RAP
Key = key monitoring well as desiganted in the P-RAP
Sentinel = sentinel monitoring well as designated in the P-RAP
Contingency = contingency sentinel/extraction well as designated in the P-RAP
WL = water levels only monitoring well as designated in the P-RAP

Table 2
Current and Foreseeable Designated Water Uses and Numeric Water Quality Standards
Former Capitol Castings Facility, Tempe, Arizona

Water Quality Standard	1,1-DCE Numeric Water Quality Standard Applicable to Water Use	Western Canal Water	High Line Canal Water	Kiwanis Park Lake Water	ME Global Well Water
Domestic water source (DWS)	7 µg/L[4]	Foreseeable designated use[1]	Foreseeable designated use[1]	--	--
Full-body contact (FBC)[3]	46,667 µg/L	--	--	Current designated use	--
Partial-body contact (PBC)[3]	46,667 µg/L	--	--	Current designated use	Current use exposure pathway
Aquatic and wildlife warm water accute (A&Ww)[3]	15,000 µg/L[5]	--	--	Current designated use	--
Aquatic and wildlife warm water chronic (A&Ww)[3]	950 µg/L[6]	--	--	Current designated use	--
Agricultural irrigation (AgI)[2]	n/a[7]	Current designated use	Current designated use	Current designated use	--
Agricultural livestock watering (AgL)[2]	n/a[7]	Current designated use	Current designated use	--	--

Notes:

1 = This foreseeable use is based on the ADEQ-approved land and water use study (ARCADIS 2006, ADEQ 2006) and ADEQ-approved remedial investigation (RI)/remedial objective (RO) report (ARCADIS 2010, ADEQ 2011).

2 = This designated use is applicable to all Phoenix area canals. A.A.C. Chapter 11, Article 1, Appendix B; 14 Ariz. Admin Reg. 4708, 4911 (December 26, 2008).

3 = This designated use is applicable to Kiwanis Park Lake. A.A.C. Chapter 11, Article 1, Appendix B; 14 Ariz. Admin Reg. 4708, 4911 (December 26, 2008).

4 = This is the Arizona surface water quality standard and U.S. EPA maximum contaminant level (MCL) for 1,1-DCE in drinking water. A.A.C. Chapter 11, Article 1, Appendix B; 14 Ariz. Admin Reg. 4708, 4873 (December 26, 2008).

5 = This is the Arizona surface water quality standard for acute toxicity exposure of A&Ww to 1,1-DCE. A.A.C. Chapter 11, Article 1, Appendix B; 14 Ariz. Admin Reg. 4708, 4873 (December 26, 2008).

6 = This is the Arizona surface water quality standard for chronic toxicity exposure of A&Ww to 1,1-DCE. A.A.C. Chapter 11, Article 1, Appendix B; 14 Ariz. Admin Reg. 4708, 4873 (December 26, 2008).

7 = There is no numeric water quality standard applicable to 1,1-DCE in water used for AgI or AgL. A.A.C. Chapter 11, Article 1, Appendix B; 14 Ariz. Admin Reg. 4708, 4873 (December 26, 2008).

Abbreviations:

1,1-DCE = 1,1-dichloroethene
n/a = no applicable standard
µg/L = micrograms per liter
-- = no current or foreseeable designated use

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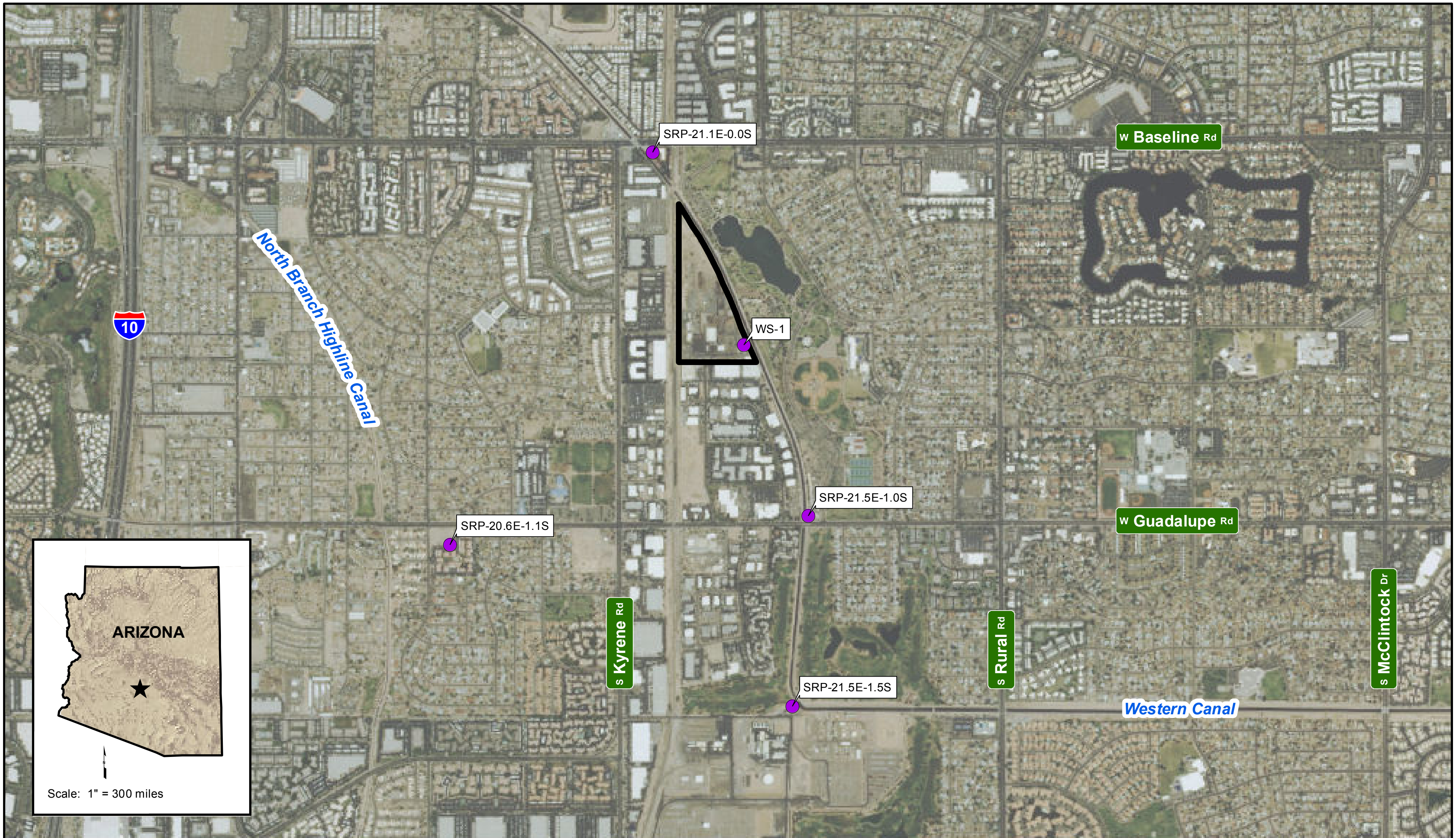
Figures

\\Scottsdale-AZ\OfficeData\Project\Capitol Castings\GIS\Projects\Proposed RAP 03-2015\Figure 01 facility location map.mxd 6/24/2015



LEGEND

Former facility boundary

Water supply well (within ½ mile of the Site)

NOTES

· Aerial photo source: ESRI World Imagery.

0 1,000 2,000 Feet

Scale: 1" = 2,000'

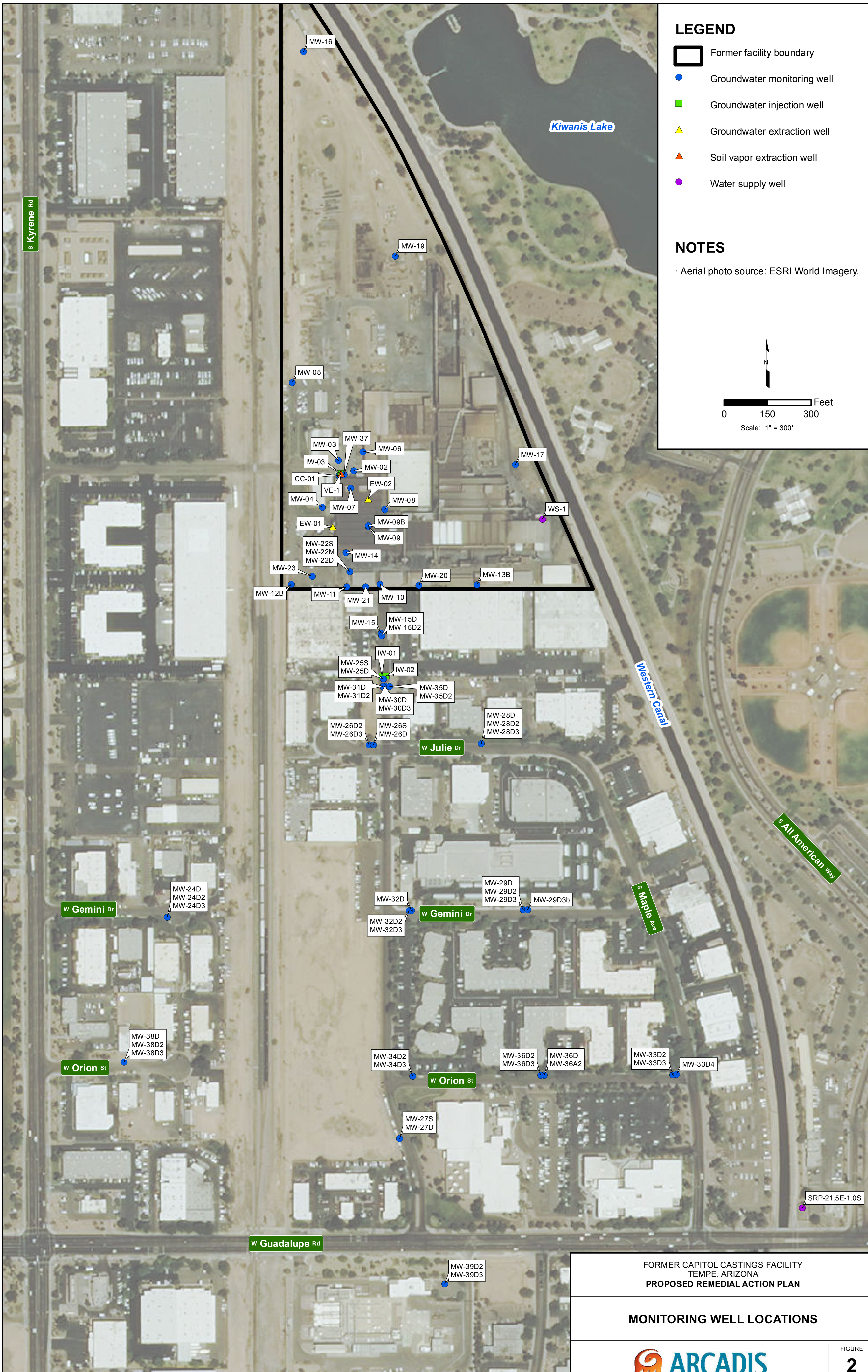
FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

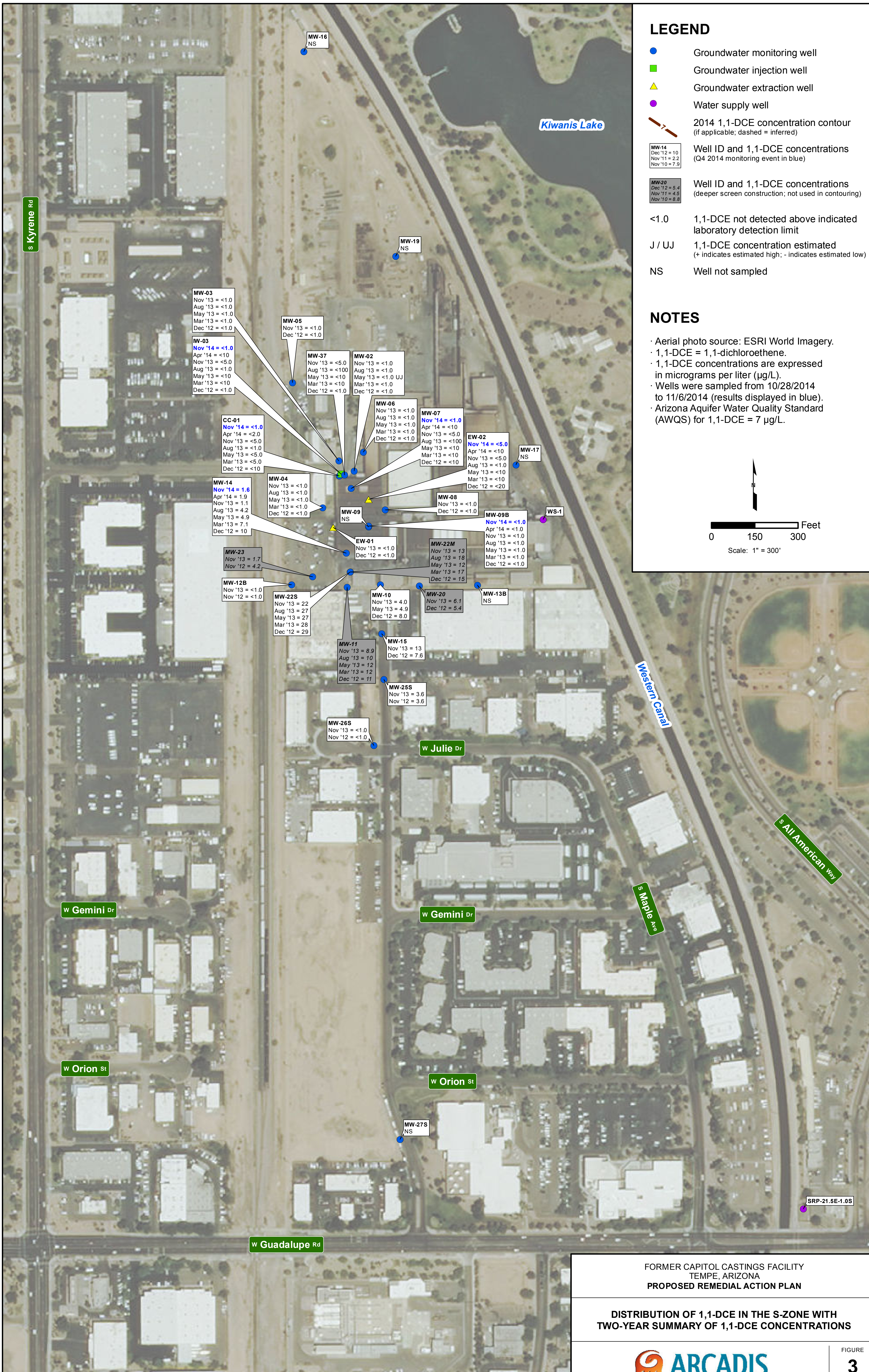
FACILITY LOCATION

ARCADIS

FIGURE
1

\\Scottsdale-AZ\OfficeData\Project\Capitol Castings\GIS\Projects\Proposed RAP 03-2015\Figure 02 well location map.mxd 6/24/2015





LEGEND

- Groundwater monitoring well
- Groundwater injection well
- Groundwater extraction well
- Water supply well
- 2014 1,1-DCE concentration contour (if applicable; dashed = inferred)
- MW-14 / Dec '12 = 10 / Nov '11 = 2.2 / Nov '10 = 7.9 — Well ID and 1,1-DCE concentrations (Q4 2014 monitoring event in blue)
- MW-20 / Dec '12 = 5.4 / Nov '11 = 4.5 / Nov '10 = 8.8 — Well ID and 1,1-DCE concentrations (deeper screen construction; not used in contouring)
- <1.0 — 1,1-DCE not detected above indicated laboratory detection limit
- J / UJ — 1,1-DCE concentration estimated (+ indicates estimated high; - indicates estimated low)
- NS — Well not sampled

NOTES

- Aerial photo source: ESRI World Imagery.
- 1,1-DCE = 1,1-dichloroethene.
- 1,1-DCE concentrations are expressed in micrograms per liter (µg/L).
- Wells were sampled from 10/28/2014 to 11/6/2014 (results displayed in blue).
- Arizona Aquifer Water Quality Standard (AWQS) for 1,1-DCE = 7 µg/L.

N

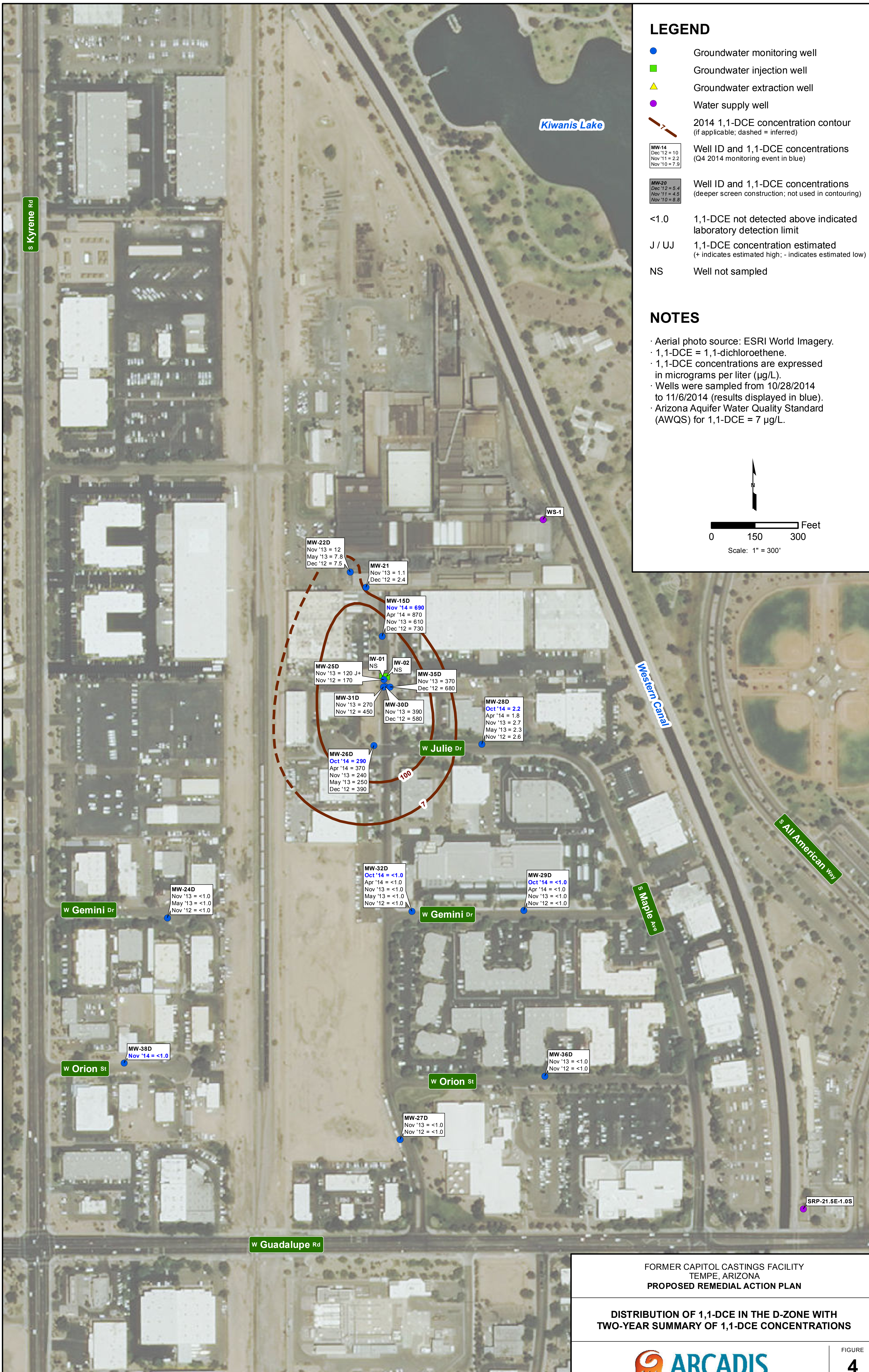
Feet
0 150 300
Scale: 1" = 300'

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

DISTRIBUTION OF 1,1-DCE IN THE S-ZONE WITH TWO-YEAR SUMMARY OF 1,1-DCE CONCENTRATIONS

ARCADIS

FIGURE
3



LEGEND

- Groundwater monitoring well
- Groundwater injection well
- Groundwater extraction well
- Water supply well
- 2014 1,1-DCE concentration contour (if applicable; dashed = inferred)
- MW-14 / Dec '12 = 10 / Nov '11 = 2.2 / Nov '10 = 7.9 — Well ID and 1,1-DCE concentrations (Q4 2014 monitoring event in blue)
- MW-20 / Dec '12 = 5.4 / Nov '11 = 4.5 / Nov '10 = 8.8 — Well ID and 1,1-DCE concentrations (deeper screen construction; not used in contouring)
- <1.0 — 1,1-DCE not detected above indicated laboratory detection limit
- J / UJ — 1,1-DCE concentration estimated (+ indicates estimated high; - indicates estimated low)
- NS — Well not sampled

NOTES

- Aerial photo source: ESRI World Imagery.
- 1,1-DCE = 1,1-dichloroethene.
- 1,1-DCE concentrations are expressed in micrograms per liter (µg/L).
- Wells were sampled from 10/28/2014 to 11/6/2014 (results displayed in blue).
- Arizona Aquifer Water Quality Standard (AWQS) for 1,1-DCE = 7 µg/L.

N

0 150 300 Feet

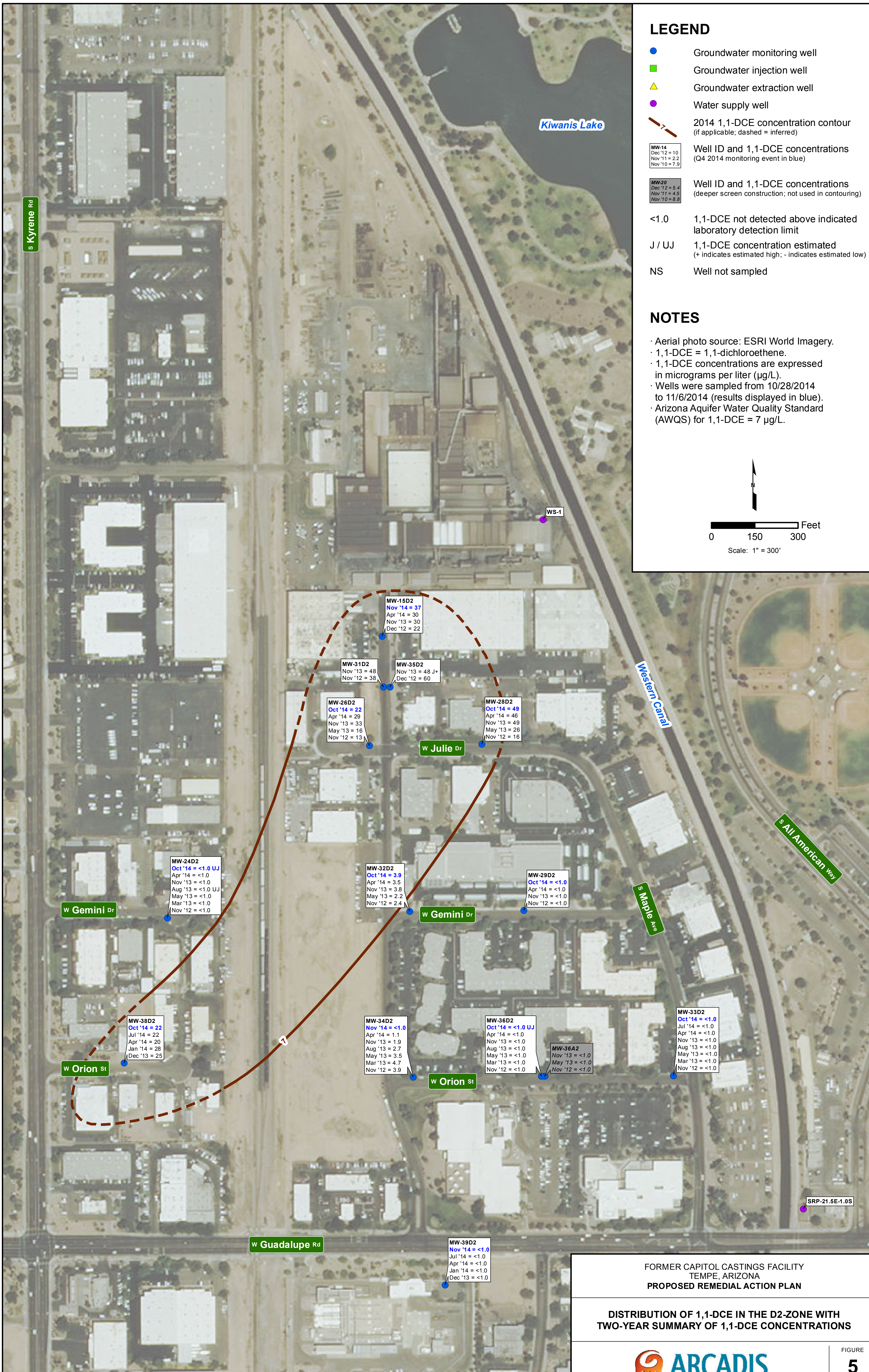
Scale: 1" = 300'

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

DISTRIBUTION OF 1,1-DCE IN THE D-ZONE WITH TWO-YEAR SUMMARY OF 1,1-DCE CONCENTRATIONS

ARCADIS

FIGURE
4



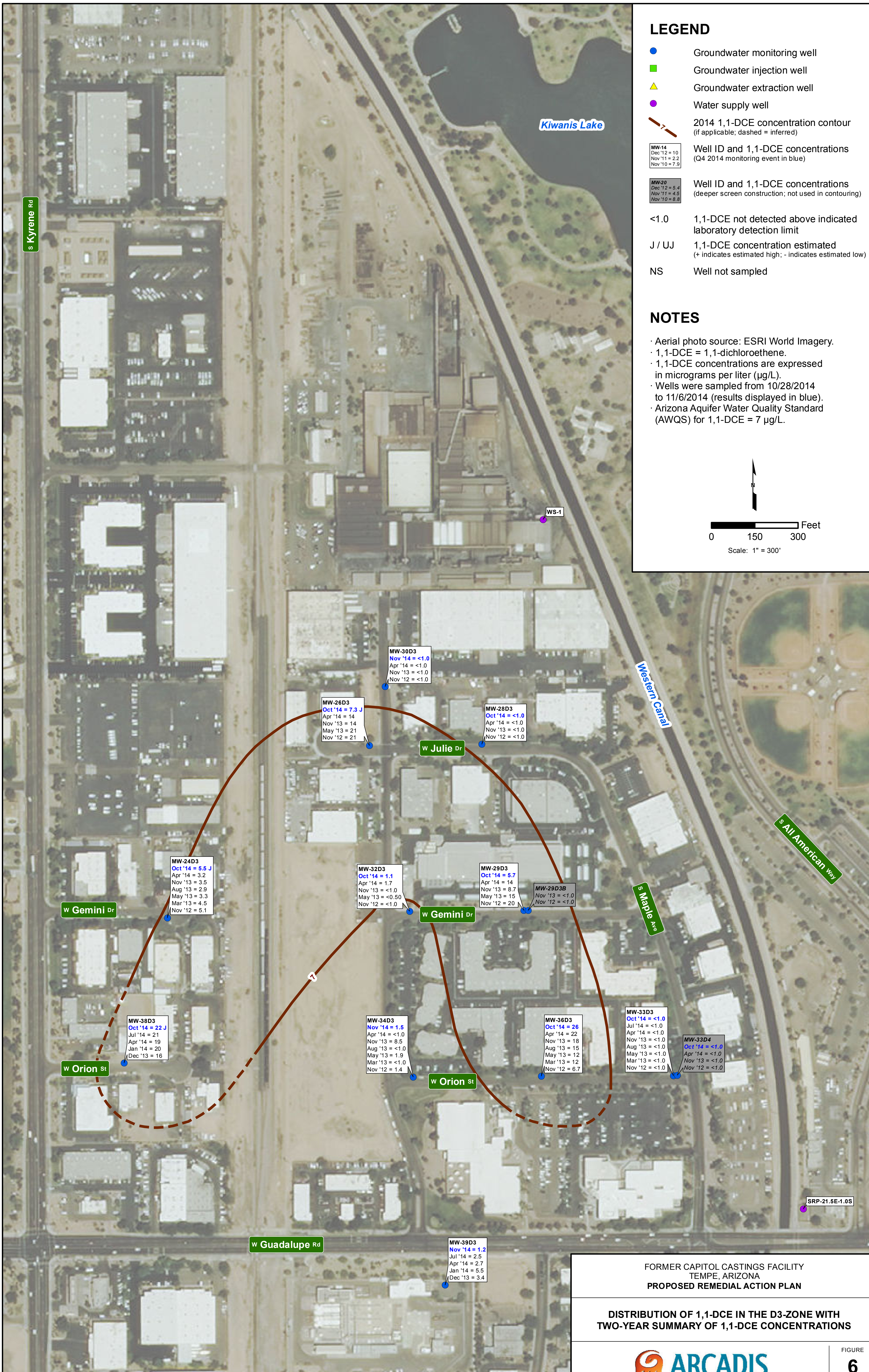
FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

DISTRIBUTION OF 1,1-DCE IN THE D2-ZONE WITH TWO-YEAR SUMMARY OF 1,1-DCE CONCENTRATIONS

ARCADIS

FIGURE
5

\\Scottsdale-AZ\OfficeData\Project\Capitol Castings\GIS\Projects\Proposed RAP 03-2015\Figure 06 11DCE concentrations D3 Q4 2014.mxd 6/24/2015

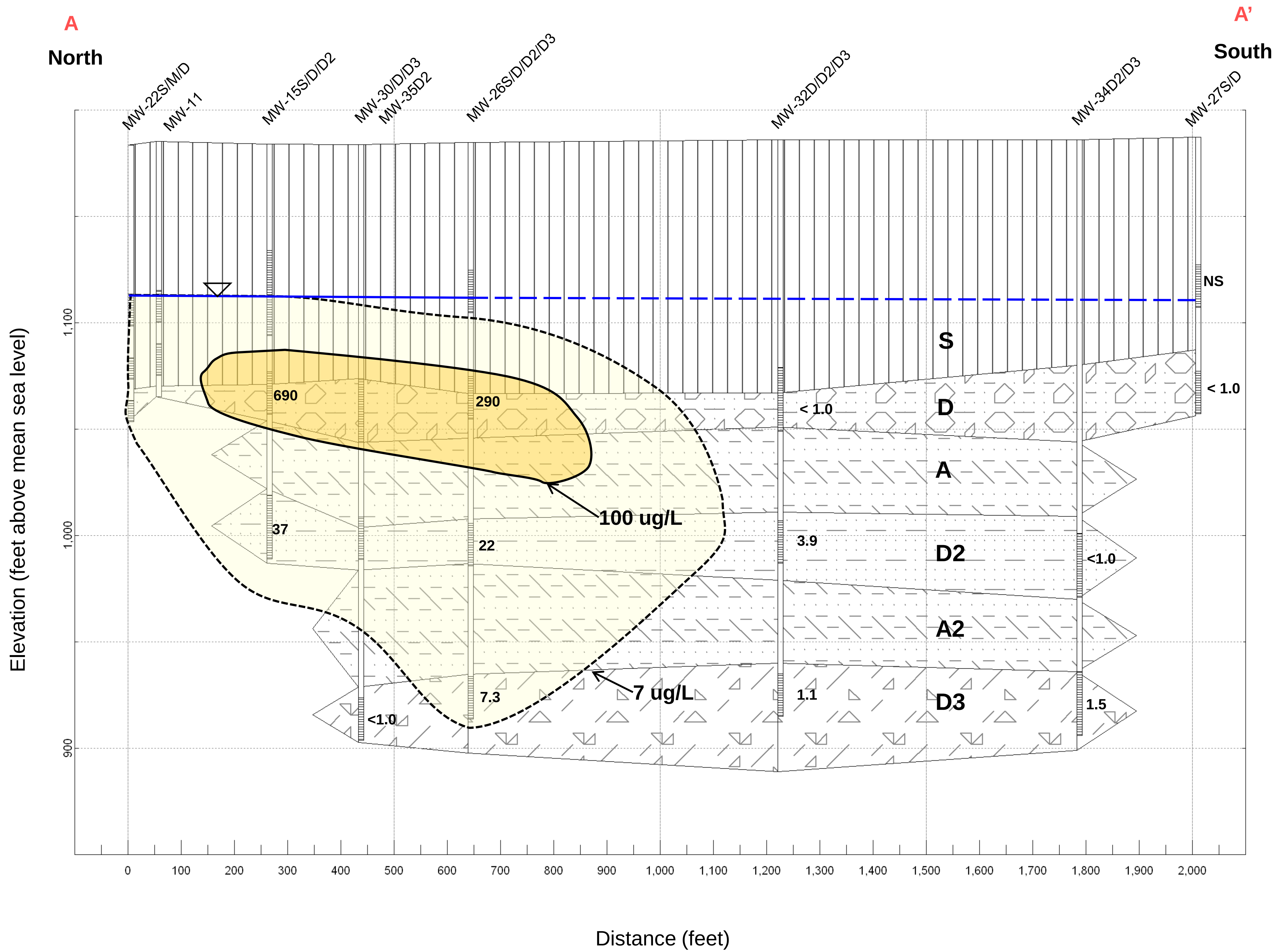


FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

DISTRIBUTION OF 1,1-DCE IN THE D3-ZONE WITH TWO-YEAR SUMMARY OF 1,1-DCE CONCENTRATIONS

ARCADIS

FIGURE
6



Vertical Exaggeration = 4:1

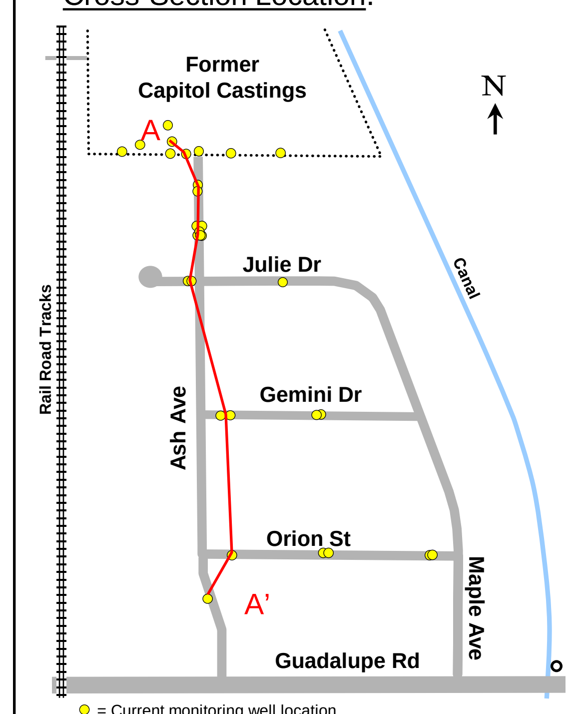
Hydrogeologic Cross-Section and Vertical Distribution of 1,1-DCE (North-South)

Proposed Remedial Action Plan
Former Capitol Castings, Tempe, Arizona

Legend:

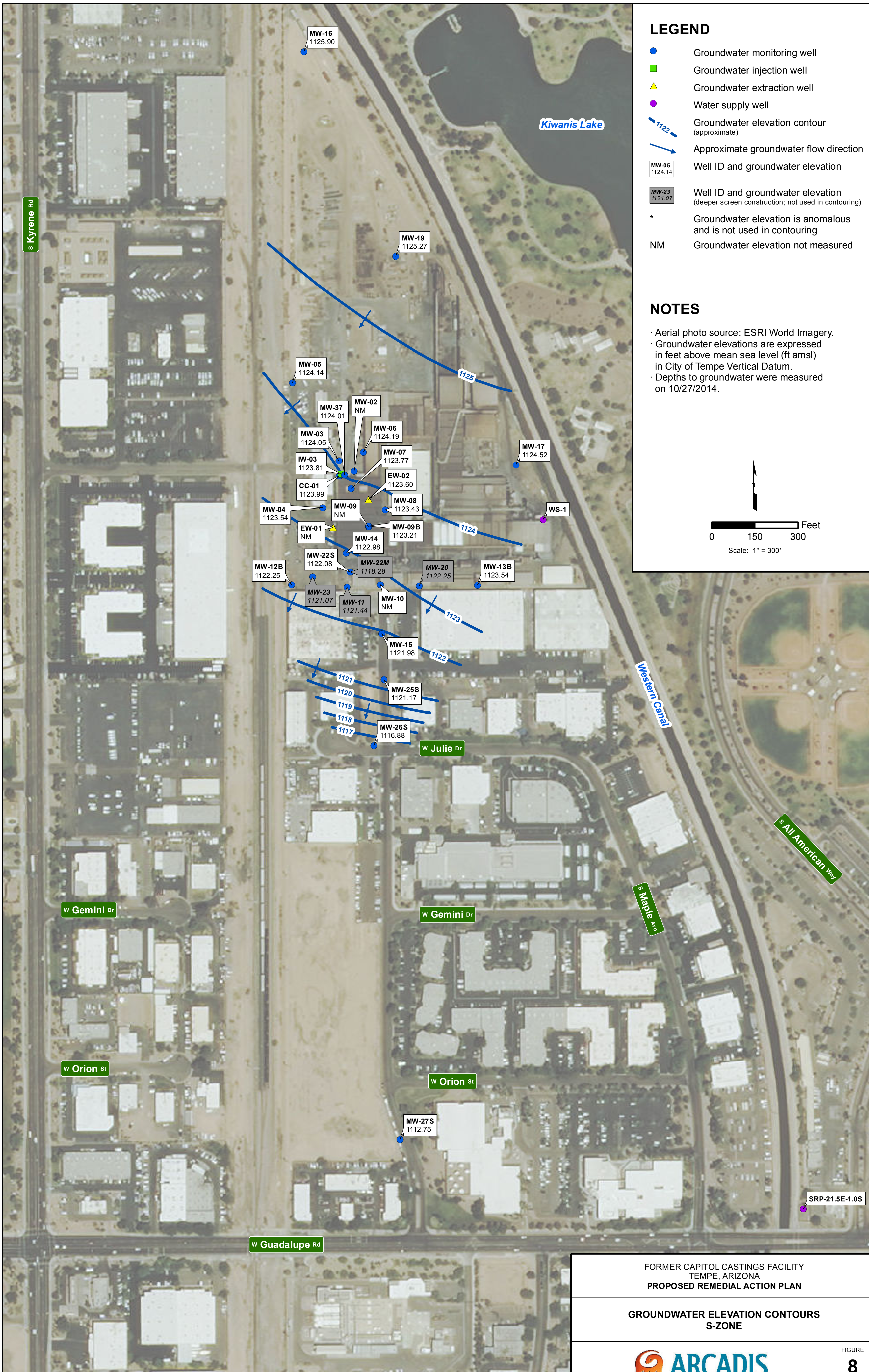
= Monitoring Well
7.6 = Concentration of 1,1-DCE in ug/L (Fourth Quarter 2014)
< 1 = Not detected above specified laboratory reporting limit
1,1-DCE = 1,1-dichloroethene
ug/L = Micrograms per liter
S, D, A = Designated aquifer
= Approximate water table

Cross-Section Location:



ARCADIS

FIGURE
07



LEGEND

- Groundwater monitoring well
- Groundwater injection well
- Groundwater extraction well
- Water supply well
- Groundwater elevation contour (approximate)
- Approximate groundwater flow direction
- MW-05 1124.14 — Well ID and groundwater elevation
- MW-23 1121.07 — Well ID and groundwater elevation (deeper screen construction; not used in contouring)
- * — Groundwater elevation is anomalous and is not used in contouring
- NM — Groundwater elevation not measured

NOTES

· Aerial photo source: ESRI World Imagery.
· Groundwater elevations are expressed in feet above mean sea level (ft amsl) in City of Tempe Vertical Datum.
· Depths to groundwater were measured on 10/27/2014.

N

0 150 300 Feet

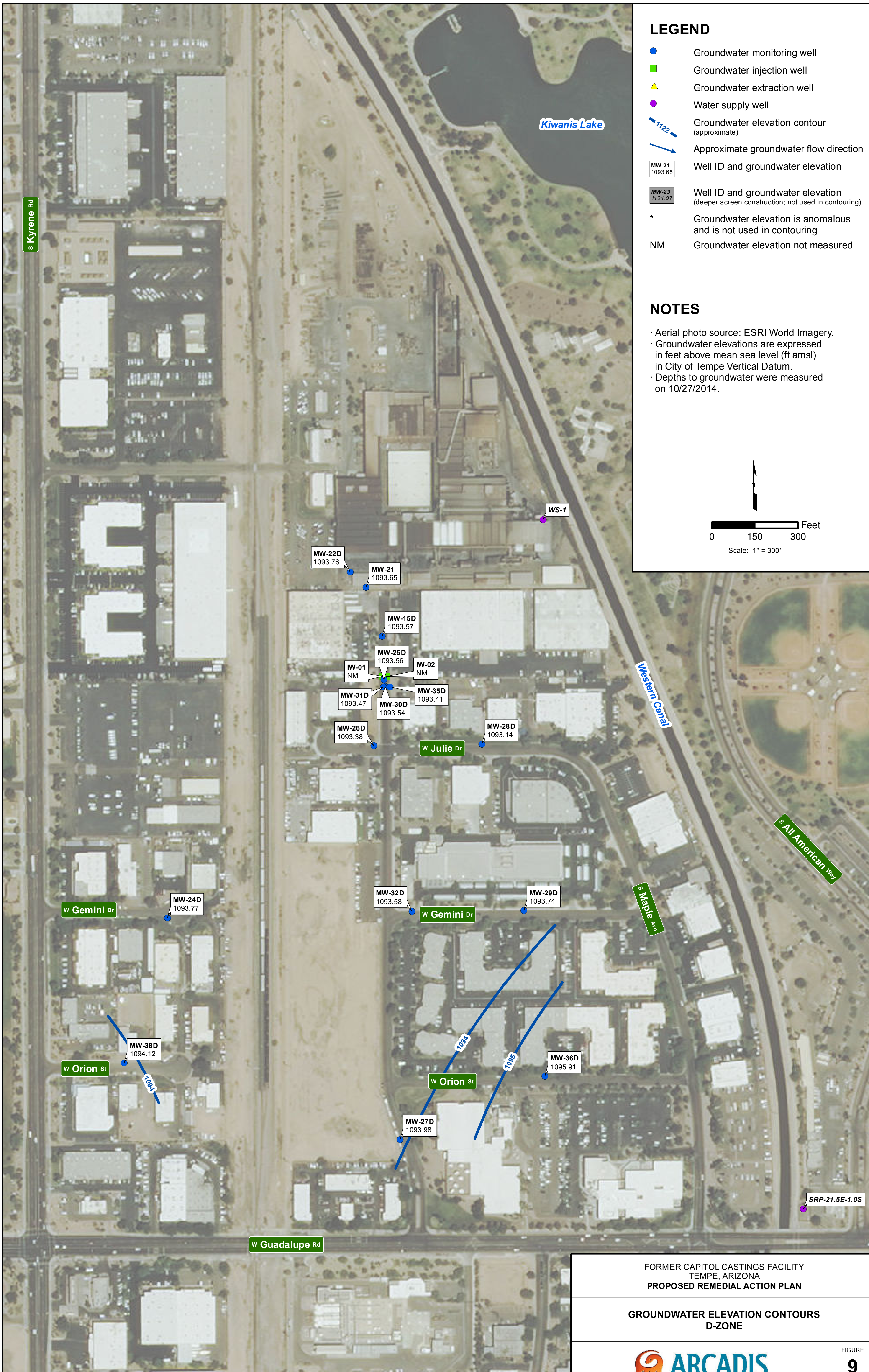
Scale: 1" = 300'

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

GROUNDWATER ELEVATION CONTOURS
S-ZONE

ARCADIS

FIGURE
8



LEGEND

- Groundwater monitoring well
- Groundwater injection well
- Groundwater extraction well
- Water supply well
- 1122 — Groundwater elevation contour (approximate)
- Approximate groundwater flow direction
- MW-21 1093.65 — Well ID and groundwater elevation
- MW-23 1121.07 — Well ID and groundwater elevation (deeper screen construction; not used in contouring)
- * Groundwater elevation is anomalous and is not used in contouring
- NM Groundwater elevation not measured

NOTES

- Aerial photo source: ESRI World Imagery.
- Groundwater elevations are expressed in feet above mean sea level (ft amsl) in City of Tempe Vertical Datum.
- Depths to groundwater were measured on 10/27/2014.

N

0 150 300 Feet

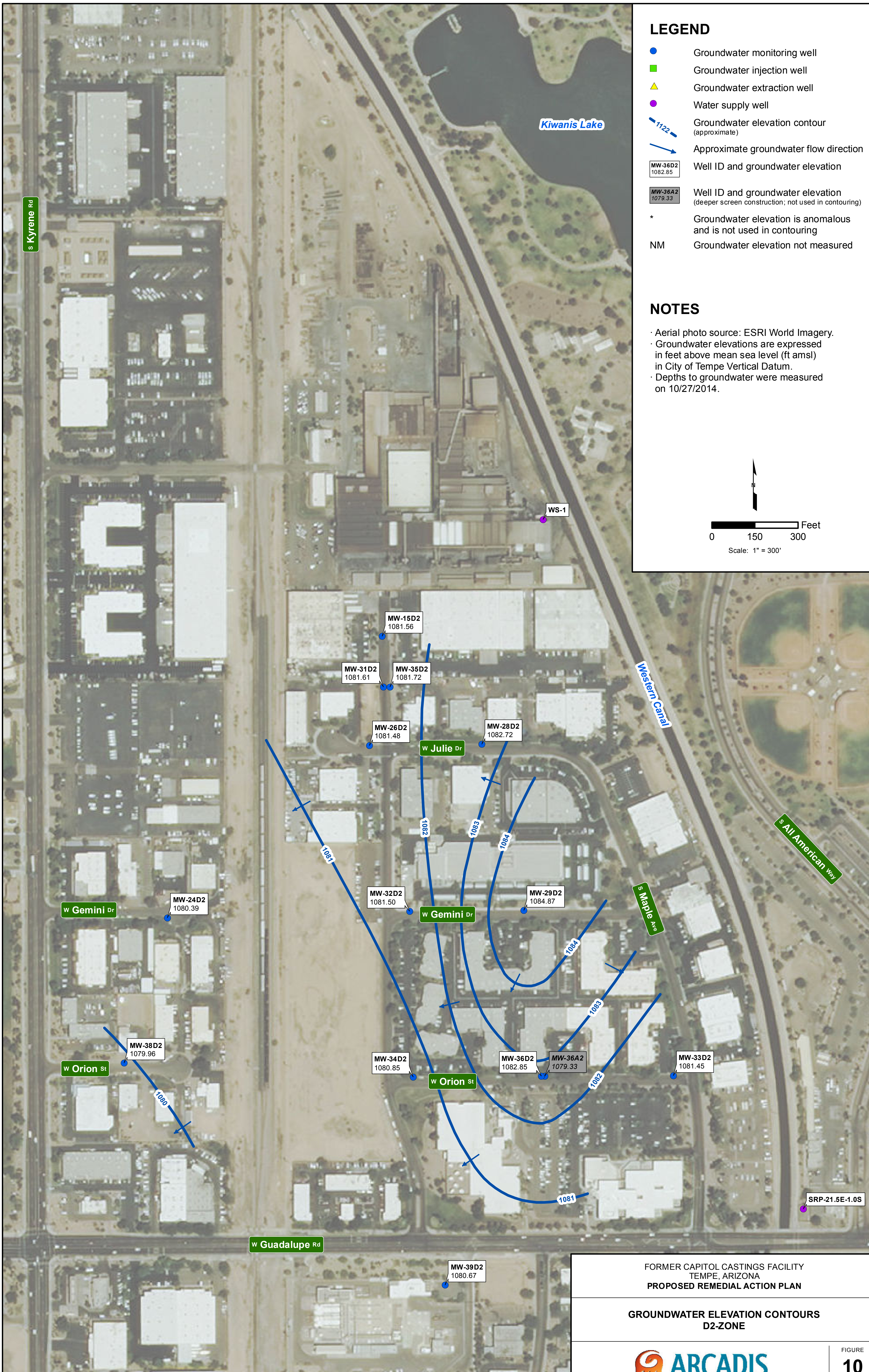
Scale: 1" = 300'

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

GROUNDWATER ELEVATION CONTOURS
D-ZONE

ARCADIS

FIGURE
9



LEGEND

- Groundwater monitoring well
- Groundwater injection well
- Groundwater extraction well
- Water supply well
- 1122 — Groundwater elevation contour (approximate)
- Approximate groundwater flow direction
- MW-36D2 1082.85 — Well ID and groundwater elevation
- MW-36A2 1079.33 — Well ID and groundwater elevation (deeper screen construction; not used in contouring)
- * — Groundwater elevation is anomalous and is not used in contouring
- NM — Groundwater elevation not measured

NOTES

- Aerial photo source: ESRI World Imagery.
- Groundwater elevations are expressed in feet above mean sea level (ft amsl) in City of Tempe Vertical Datum.
- Depths to groundwater were measured on 10/27/2014.

N

0 150 300 Feet

Scale: 1" = 300'

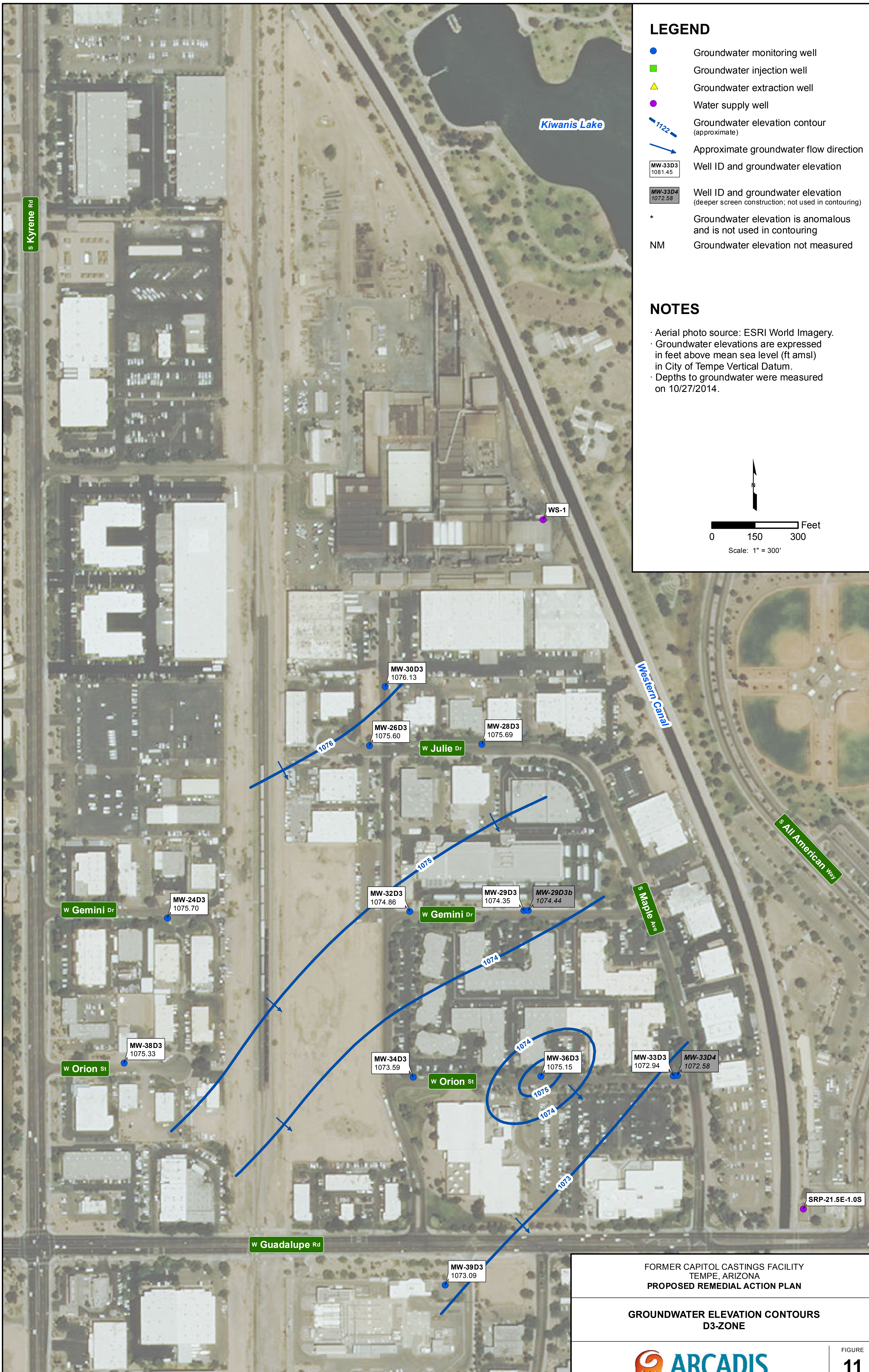
FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

GROUNDWATER ELEVATION CONTOURS
D2-ZONE

ARCADIS

FIGURE
10

\\Scottsdale-AZ\OfficeData\Project\Capitol Castings\GIS\Projects\Proposed RAP 03-2015\Figure 11 GW elevations D3 Q4 2014.mxd 6/24/2015



LEGEND

- Groundwater monitoring well
- Groundwater injection well
- Groundwater extraction well
- Water supply well
- 1122 — Groundwater elevation contour (approximate)
- Approximate groundwater flow direction
- MW-33D3 1081.45 — Well ID and groundwater elevation
- *MW-33D4 1072.58* — Well ID and groundwater elevation (deeper screen construction; not used in contouring)
- * — Groundwater elevation is anomalous and is not used in contouring
- NM — Groundwater elevation not measured

NOTES

- Aerial photo source: ESRI World Imagery.
- Groundwater elevations are expressed in feet above mean sea level (ft amsl) in City of Tempe Vertical Datum.
- Depths to groundwater were measured on 10/27/2014.

N

0 150 300 Feet

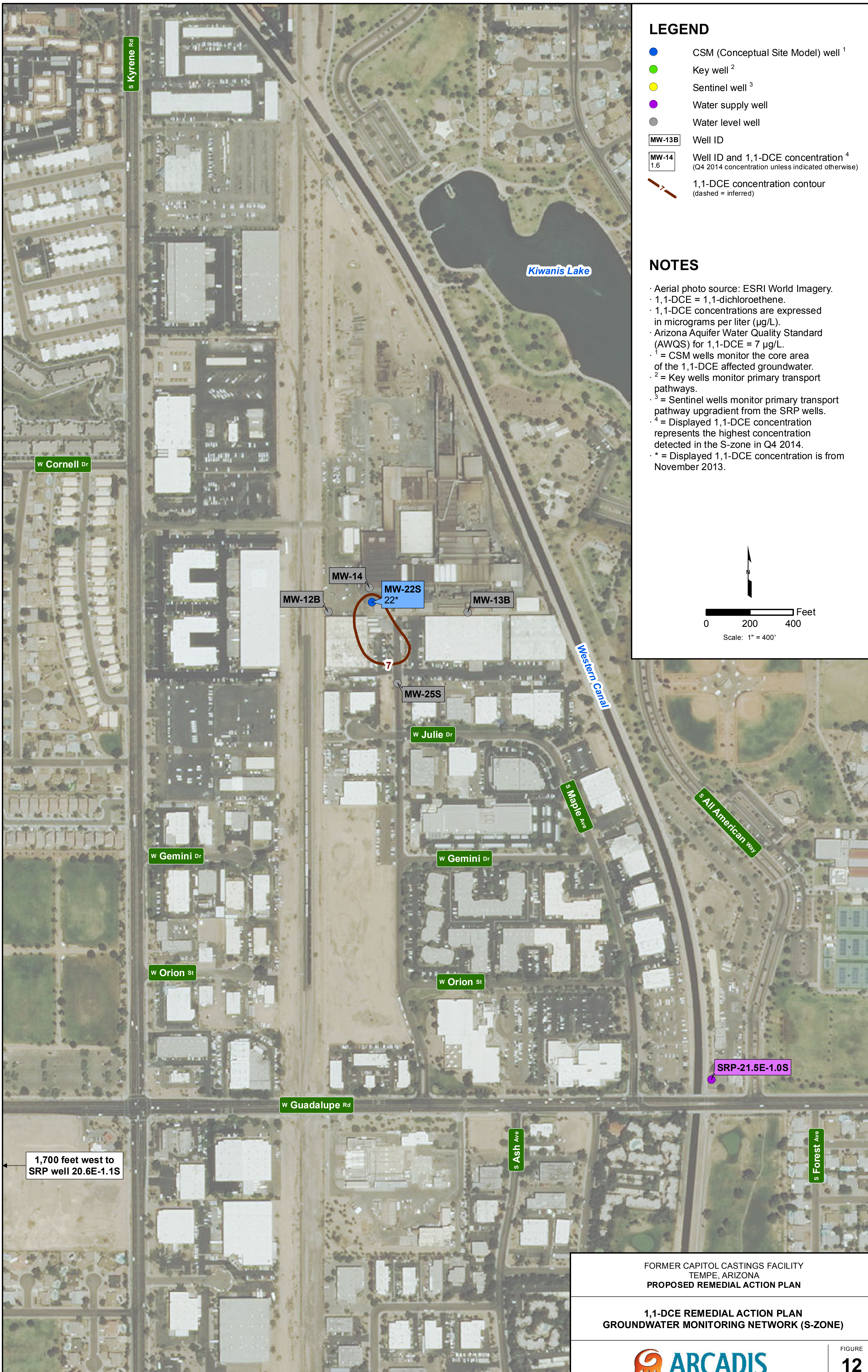
Scale: 1" = 300'

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

GROUNDWATER ELEVATION CONTOURS
D3-ZONE

ARCADIS

FIGURE
11



LEGEND

- CSM (Conceptual Site Model) well [1]
- Key well [2]
- Sentinel well [3]
- Water supply well
- Water level well
- MW-13B — Well ID
- MW-14 1.6 — Well ID and 1,1-DCE concentration [4] (Q4 2014 concentration unless indicated otherwise)
- 1,1-DCE concentration contour (dashed = inferred)

NOTES

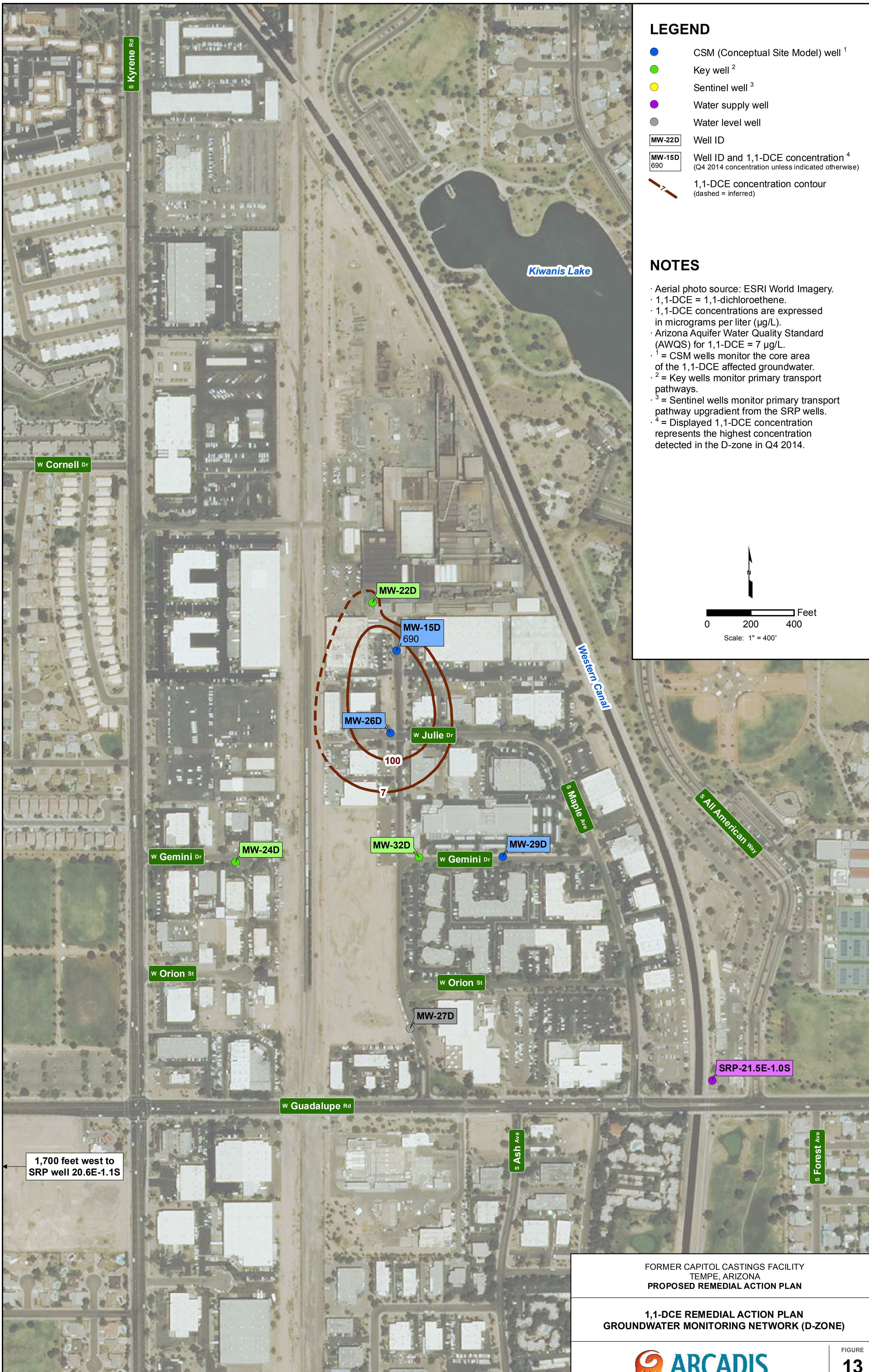
- Aerial photo source: ESRI World Imagery.
- 1,1-DCE = 1,1-dichloroethene.
- 1,1-DCE concentrations are expressed in micrograms per liter (µg/L).
- Arizona Aquifer Water Quality Standard (AWQS) for 1,1-DCE = 7 µg/L.
- [1] = CSM wells monitor the core area of the 1,1-DCE affected groundwater.
- [2] = Key wells monitor primary transport pathways.
- [3] = Sentinel wells monitor primary transport pathway upgradient from the SRP wells.
- [4] = Displayed 1,1-DCE concentration represents the highest concentration detected in the S-zone in Q4 2014.
- * = Displayed 1,1-DCE concentration is from November 2013.

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

1,1-DCE REMEDIAL ACTION PLAN
GROUNDWATER MONITORING NETWORK (S-ZONE)

ARCADIS

FIGURE
12



LEGEND

- CSM (Conceptual Site Model) well [1]
- Key well [2]
- Sentinel well [3]
- Water supply well
- Water level well
- MW-22D — Well ID
- MW-15D 690 — Well ID and 1,1-DCE concentration [4] (Q4 2014 concentration unless indicated otherwise)
- 1,1-DCE concentration contour (dashed = inferred)

NOTES

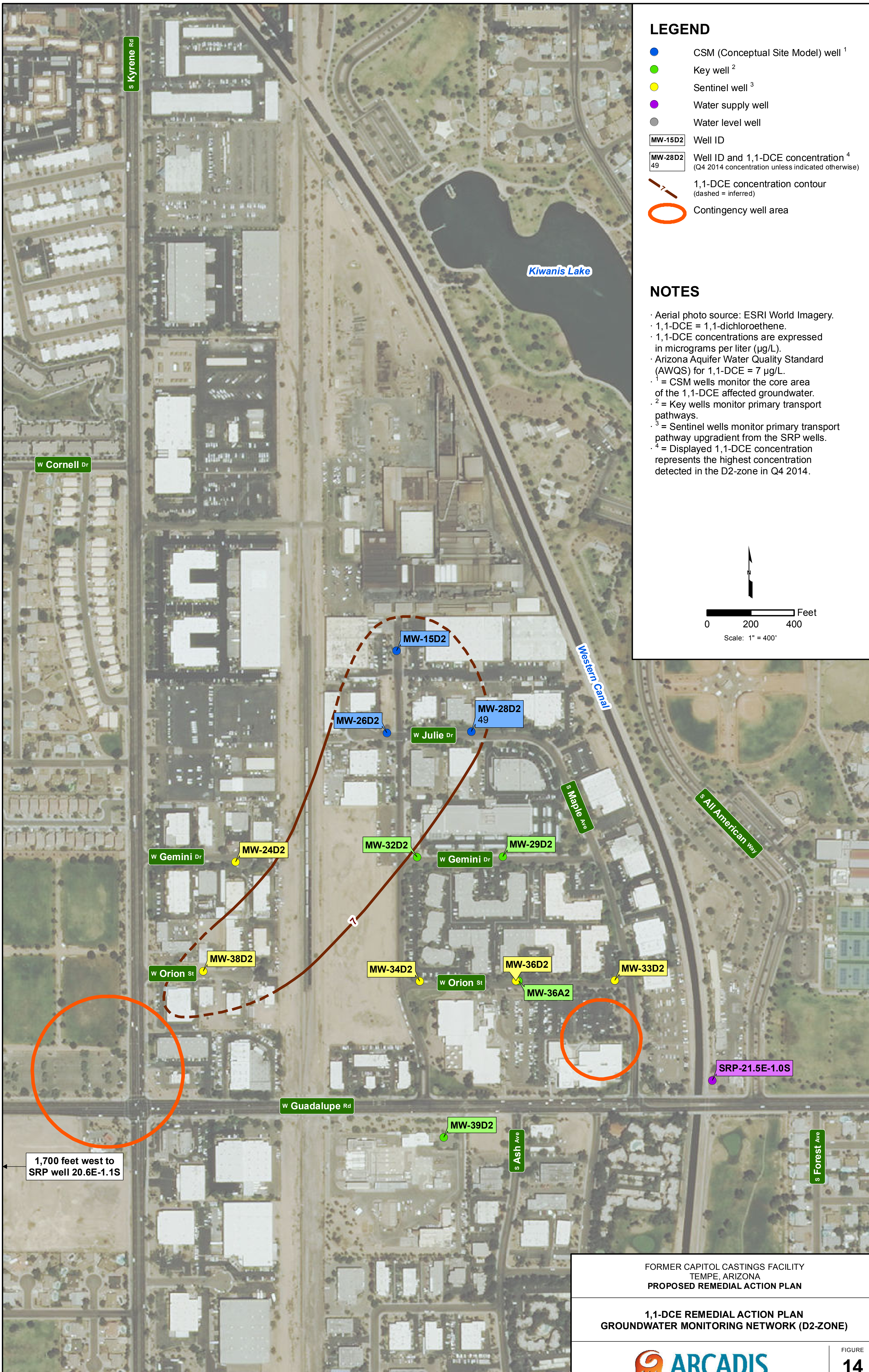
- Aerial photo source: ESRI World Imagery.
- 1,1-DCE = 1,1-dichloroethene.
- 1,1-DCE concentrations are expressed in micrograms per liter (µg/L).
- Arizona Aquifer Water Quality Standard (AWQS) for 1,1-DCE = 7 µg/L.
- [1] = CSM wells monitor the core area of the 1,1-DCE affected groundwater.
- [2] = Key wells monitor primary transport pathways.
- [3] = Sentinel wells monitor primary transport pathway upgradient from the SRP wells.
- [4] = Displayed 1,1-DCE concentration represents the highest concentration detected in the D-zone in Q4 2014.

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

1,1-DCE REMEDIAL ACTION PLAN
GROUNDWATER MONITORING NETWORK (D-ZONE)

ARCADIS

FIGURE
13



LEGEND

- CSM (Conceptual Site Model) well [1]
- Key well [2]
- Sentinel well [3]
- Water supply well
- Water level well
- MW-15D2 — Well ID
- MW-28D2 49 — Well ID and 1,1-DCE concentration [4] (Q4 2014 concentration unless indicated otherwise)
- 1,1-DCE concentration contour (dashed = inferred)
- Contingency well area

NOTES

- Aerial photo source: ESRI World Imagery.
- 1,1-DCE = 1,1-dichloroethene.
- 1,1-DCE concentrations are expressed in micrograms per liter (µg/L).
- Arizona Aquifer Water Quality Standard (AWQS) for 1,1-DCE = 7 µg/L.
- [1] = CSM wells monitor the core area of the 1,1-DCE affected groundwater.
- [2] = Key wells monitor primary transport pathways.
- [3] = Sentinel wells monitor primary transport pathway upgradient from the SRP wells.
- [4] = Displayed 1,1-DCE concentration represents the highest concentration detected in the D2-zone in Q4 2014.

N

0 200 400 Feet

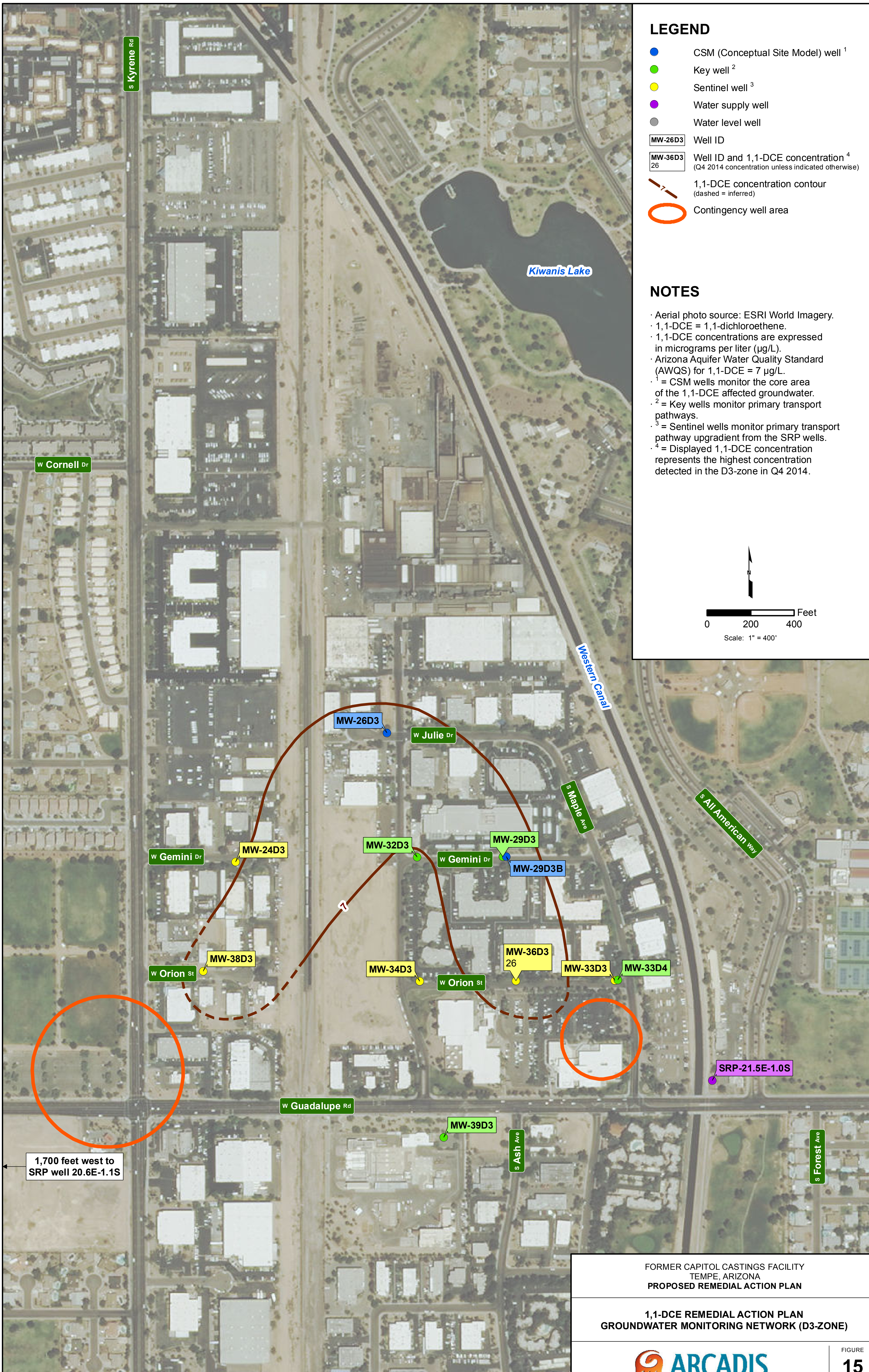
Scale: 1" = 400'

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

1,1-DCE REMEDIAL ACTION PLAN
GROUNDWATER MONITORING NETWORK (D2-ZONE)

ARCADIS

FIGURE
14



LEGEND

- CSM (Conceptual Site Model) well [1]
- Key well [2]
- Sentinel well [3]
- Water supply well
- Water level well
- MW-26D3 — Well ID
- MW-36D3 / 26 — Well ID and 1,1-DCE concentration [4] (Q4 2014 concentration unless indicated otherwise)
- 1,1-DCE concentration contour (dashed = inferred)
- Contingency well area

NOTES

- Aerial photo source: ESRI World Imagery.
- 1,1-DCE = 1,1-dichloroethene.
- 1,1-DCE concentrations are expressed in micrograms per liter (µg/L).
- Arizona Aquifer Water Quality Standard (AWQS) for 1,1-DCE = 7 µg/L.
- [1] = CSM wells monitor the core area of the 1,1-DCE affected groundwater.
- [2] = Key wells monitor primary transport pathways.
- [3] = Sentinel wells monitor primary transport pathway upgradient from the SRP wells.
- [4] = Displayed 1,1-DCE concentration represents the highest concentration detected in the D3-zone in Q4 2014.

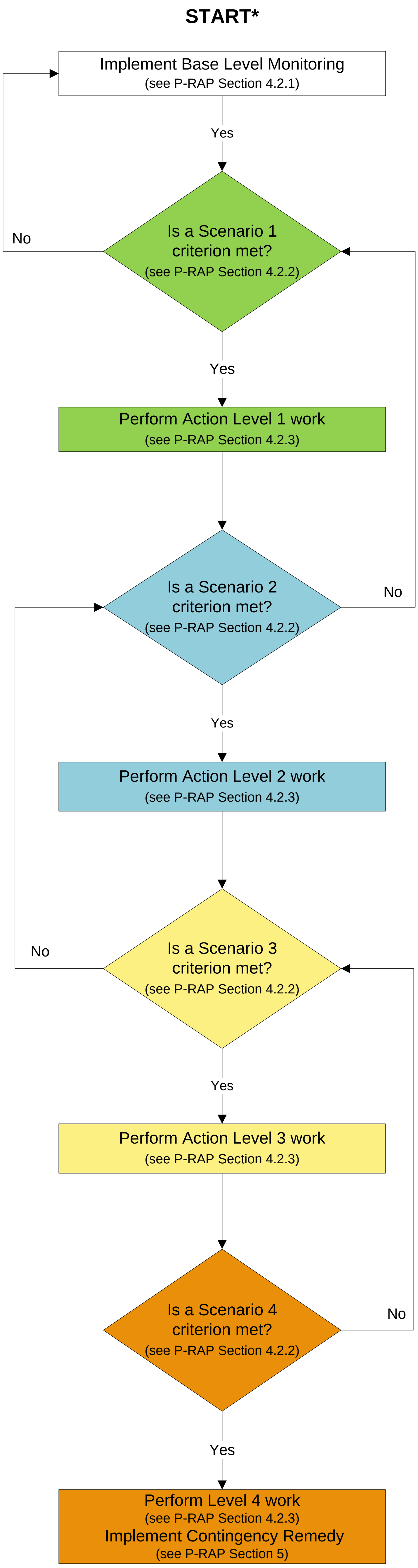
FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

1,1-DCE REMEDIAL ACTION PLAN
GROUNDWATER MONITORING NETWORK (D3-ZONE)

ARCADIS

FIGURE
15

SRP WELL 21.5E-1.0S



Monitoring Program Overview (see P-RAP Table 1)

Level	CSM verification wells	Key wells	Sentinel wells	Contin-gency wells	SRP well	Water-levels	Reporting
Base	1/4yrs	1/2yrs	2/yr# - 1/yr	--	1/yr	1/yr	1/yr
1	1/3yrs	1/yr	2/yr	--	2/yr	2/yr	2/yr
2	1/3yrs	1/yr	4/yr	--	2/yr	4/yr	2/yr
3	1/2yrs	2/yr	4/yr	4/yr	2/yr	4/yr	4/yr
4	1/2yrs	2/yr	4/yr	4/yr	4/yr	4/yr	4/yr

Notes:
1/4yrs = once every 4 years
1/3yrs = once every 3 years
1/2yrs = once every 2 years
1/yr = once a year
2/yr = twice a year
4/yr = four times a year
=D3-Zone sentinel wells monitored 2/yr during Base Level monitoring

Triggering Criterion Overview (see P-RAP Section 4.2.2)

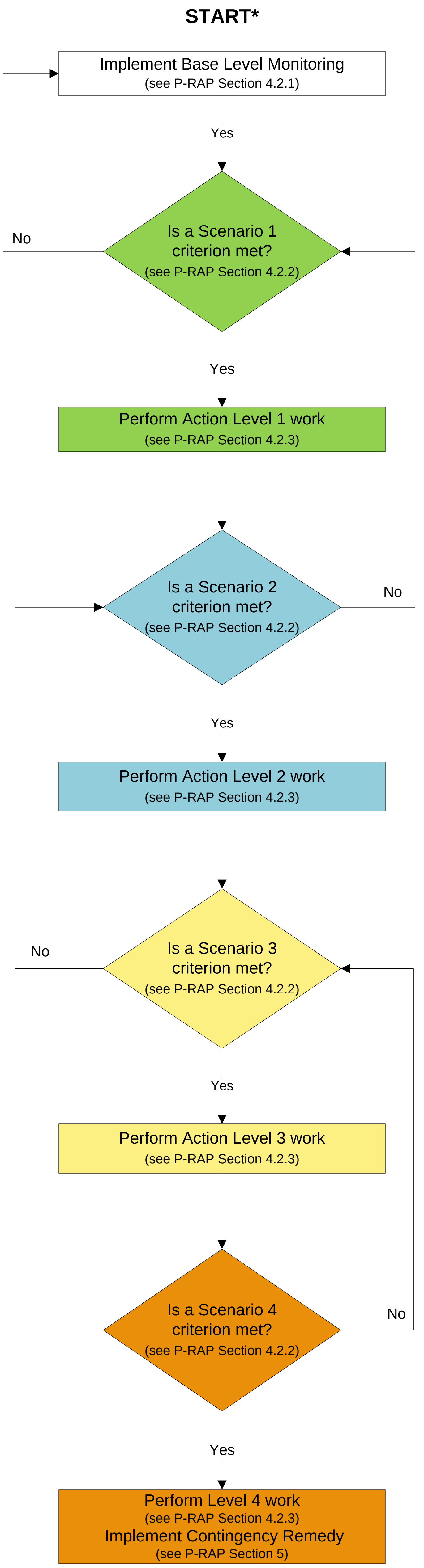
Criterion Scenario	Sentinel wells [A]	SRP well discharge[B]	SRP Well Trend[C]	Groundwater Flow and Solute Transport Model[D]
1	Zone average >80% of model-predicted peak zone average or	>80% of model-predicted peak or	75% >model-predicted slope	
2	Zone average >125% of model-predicted peak zone average or	>100% of model-predicted peak or	>5.6 µg/L in SRP well discharge in <4 years	
3	Mass flux estimate[E] indicates SRP well discharge >6.3 µg/L or	>5.6 µg/L or	>5.6 µg/L in SRP well discharge in <2 years or	Revised model predicts >5.6 µg/L in SRP well discharge in <4 years
4		>6.3 µg/L or	>7 µg/L in SRP well discharge in <2 years or	Revised model predicts >7 µg/L in SRP well discharge in <4 years

Notes:
A = 1,1-DCE groundwater concentration in sentinel wells upgradient from SRP well 21.5E-1.0S
B = Actual SRP well 21.5E-1.0S 1,1-DCE discharge concentration
C = 1,1-DCE concentration trends in SRP well discharge based on a linear regression
D = Revised groundwater flow and solute transport model-predicted 1,1-DCE concentrations in SRP well discharge
E = Based on mass flux principle (see P-RAP Appendix A)

Triggered Contingency Actions Overview (see P-RAP Section 4.2.3)

Action Level	Actions
1	▪ Level 1 monitoring program ▪ Determine if a Level 2 criterion is met
2	▪ Level 2 monitoring program ▪ Verify or update model accordingly ▪ Determine optimal locations for contingency extraction wells & secure access agreements ▪ Determine if a Level 3 criterion is met
3	▪ Level 3 monitoring program ▪ Verify or update model accordingly ▪ Install contingency extraction well(s) upgradient from SRP well 21.5E-1.0S ▪ Determine optimal location for additional sentinel wells, secure access agreements, and install wells, if appropriate ▪ Substantially complete groundwater treatment system design ▪ Determine if a Level 4 criterion is met
4	▪ Level 4 monitoring program ▪ Verify or update model to support design/optimization of groundwater treatment system, as appropriate ▪ Complete design of groundwater treatement system ▪ Construct treatment system and commence operation ▪ Monitor effectiveness of the treatment system ▪ Determine if amendments of the FS report and remedial action plan are required

*This figure is for illustrative purposes. See P-RAP Sections 4 and 5 for decision making mechanism.



SRP WELL 20.6E-1.1S

Monitoring Program Overview (see P-RAP Table 1)

Level	CSM verification wells	Key wells	Sentinel wells	Contin-gency wells	SRP well	Water-levels	Reporting
Base	1/4yrs	1/2yrs	2/yr# - 1/yr	--	1/yr	1/yr	1/yr
1	1/3yrs	1/yr	2/yr	--	2/yr	2/yr	2/yr
2	1/3yrs	1/yr	4/yr	--	2/yr	4/yr	2/yr
3	1/2yrs	2/yr	4/yr	4/yr	2/yr	4/yr	4/yr
4	1/2yrs	2/yr	4/yr	4/yr	4/yr	4/yr	4/yr

Notes:
1/4yrs = once every 4 years
1/3yrs = once every 3 years
1/2yrs = once every 2 years
1/yr = once a year
2/yr = twice a year
4/yr = four times a year
= D3-Zone sentinel wells monitored 2/yr during Base Level monitoring

Triggering Criterion Overview (see P-RAP Section 4.2.2)

Criterion Scenario	Sentinel wells [A]	SRP well discharge[B]	SRP Well Trend[C]	Groundwater Flow and Solute Transport Model[D]
1	Mass flux estimate[E] indicates SRP well discharge >3.2 µg/L or	>1 µg/L in SRP well discharge or		
2	Mass flux estimate[E] indicates SRP well discharge >5.6 µg/L or	>4 µg/L in SRP well discharge or	>5.6 µg/L in SRP well discharge in <4 years	
3	Mass flux estimate[E] indicates SRP well discharge >6.3 µg/L or	>5.6 µg/L or	>5.6 µg/L in SRP well discharge in <2 years or	Revised model predicts >5.6 µg/L in SRP well discharge in <4 years
4		>6.3 µg/L or	>7 µg/L in SRP well discharge in <2 years or	Revised model predicts >7 µg/L in SRP well discharge in <4 years

Notes:
A = Zone-averaged 1,1-DCE groundwater concentration in sentinel wells upgradient from SRP well 20.6E-1.1S
B = SRP well 20.6E-1.1S 1,1-DCE discharge concentration
C = 1,1-DCE concentration trends in SRP well discharge based on a linear regression
D = Revised groundwater flow and solute transport model-predicted 1,1-DCE concentrations in SRP well discharge
E = Based on mass flux principle (see P-RAP Appendix A)

Triggered Contingency Actions Overview (see P-RAP Section 4.2.3)

Action Level	Actions
1	• Level 1 monitoring program • Determine if a Level 2 criterion is met
2	• Level 2 monitoring program • Verify or update model, if appropriate • Determine optimal locations for sentinel & contingency extraction wells & secure access agreements • Install additional sentinel well(s) upgradient from SRP well 20.6E-1.1S • Determine if a Level 3 criterion is met
3	• Level 3 monitoring program • Update model • Install contingency extraction wells upgradient from SRP well 20.6E-1.1S • Determine optimal location for additional sentinel wells, secure access agreements, and install wells, if appropriate • Substantially complete groundwater treatment system design • Determine if a Level 4 criterion is met
4	• Level 4 monitoring program • Verify or update model to support design/optimization of groundwater treatment system, as appropriate • Complete design of groundwater treatement system • Construct treatment system and commence operation • Monitor effectiveness of the treatment system • Determine if amendments of the FS report and remedial action plan are required

*This figure is for illustrative purposes. See P-RAP Sections 4 and 5 for decision making mechanism.

FORMER CAPITOL CASTINGS
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

DECISION TREE FOR SRP WELL 20.6E-1.1S CONTINGENCY ACTIONS AND REMEDY

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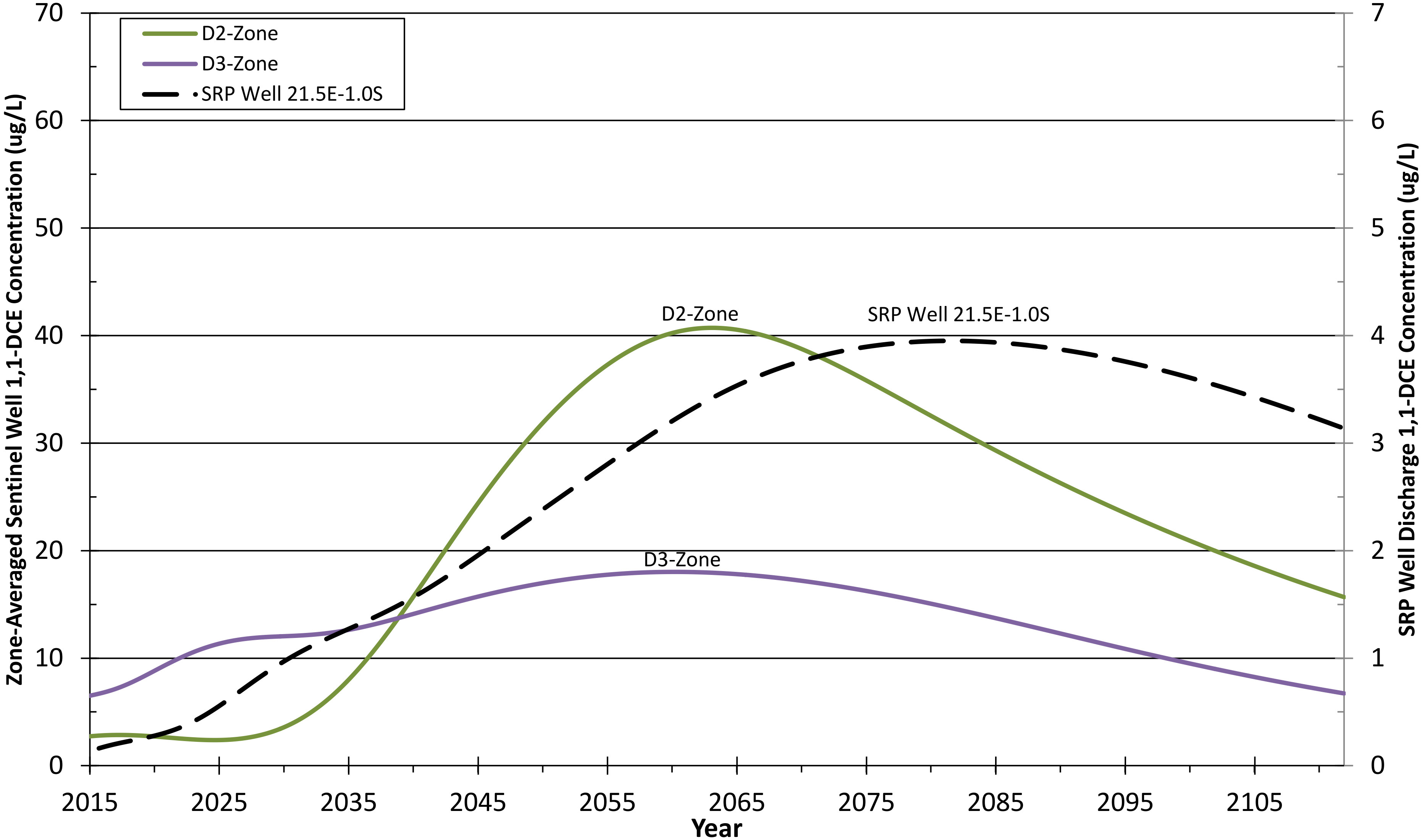

Note:
D2-Zone average1,1-DCE concentration based on MW-34D2, MW-36D2, and MW-33D2
D3-Zone average 1,1-DCE concentration based on MW-34D3, MW-36D3, and MW-33D3

FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA
PROPOSED REMEDIAL ACTION PLAN

PREDICTED 1,1-DCE CONCENTRATIONS IN SRP WELL 21.5E-1.0S DISCHARGE AND THE SENTINEL WELL ZONE-AVERAGED CONCENTRATIONS IN GROUNDWATER

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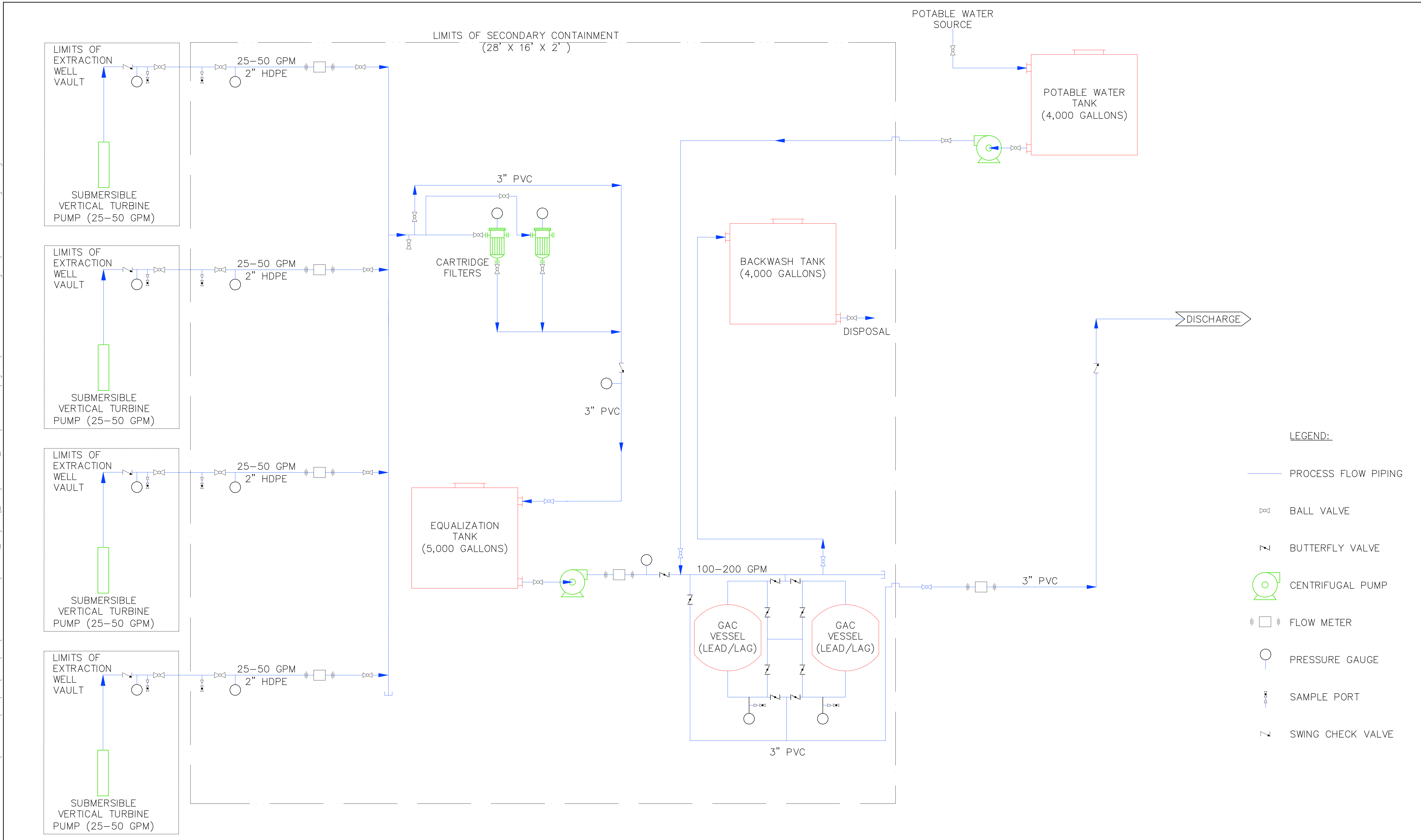
FIGURE
18



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Acad Version : R18.1s (LMS Tech)
User Name : bbrockman

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REVISIONS:	DATE:	BY:

PROJECT TITLE

PROPOSED REMEDIAL ACTION PLAN
FORMER CAPITOL CASTINGS FACILITY
TEMPE, ARIZONA

PROJECT MANAGER	DEPARTMENT MANAGER	DESIGNER	CHECKED
K. BRANTINGHAM	R. MONGRAIN	B. BROCKMAN	C. SHEPHERD

SHEET TITLE
CONTINGENCY REMEDY
EXTRACTION WELLS AND
TREATMENT SYSTEM
PROCESS AND FLOW DIAGRAM

PHASE/TASK NUMBER: .3814.00001
DRAWN BY: B. BROCKMAN
PROJECT NUMBER: AZ000905
FIGURE NUMBER: 19

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Appendix A

Mass Discharge Concentration Calculator

Appendix A
Mass Discharge Concentration Calculator
Former Capitol Castings Facility
Tempe, Arizona

The mass discharge concentration calculator[1] will be used to make conservative estimates of future 1,1-DCE concentrations in the discharge of SRP well 21.5E-1.0S into Western Canal and future 1,1-DCE concentrations in the discharge of SRP well 20.6E-1.1S into High Line Canal water. These estimates will be used as described in Section 4.2.3.

To determine the predicted concentration in the SRP well discharge, a mass discharge profile is defined. The mass discharge is equal to total mass flux integrated across the entire area of the well transect and given by the following formulas:

$$M_d = \sum_{j=1}^{j} C_j q_j A_j$$

where

M_d = mass discharge
C = contaminant concentration
q_j = specific discharge
A_j = flow area

q_j can be calculated using:

$$q_i = -K_j i_j$$

where

K = hydraulic conductivity
i = hydraulic gradient

An example transect calculation in relation to SRP 21.5E-1.0S is provided below. The calculation employs the most recent aquifer property data from the updated groundwater flow and solute transport model, including hydraulic conductivity and hydraulic gradient, and 1,1-DCE concentration data from the most recent groundwater sampling events at individual monitoring points along the transect.

The 1,1-DCE plume is measured in width along the main flow path towards the SRP well in the aquifer zone with highest nearby observed concentrations. The calculation applies a percentage multiplier to the plume distribution profile since the monitoring well transect is not perpendicular to the groundwater flow in relation to the SRP well. To be conservative, a peak concentration multiplier is factored in for the reported concentrations along the varied screened depths of the transect.

Once the mass discharge profile is determined, the total mass per day is totaled and averaged over the entire transect area. A percentage multiplier is assumed for the pumping frequency since the pump does not run

[1] "Use and Measurement of Mass Flux and Mass Discharge," Interstate Technology and Regulatory Council Integrated DNAPL Site Strategy Team, August 2010 (http://www.itrcweb.org/GuidanceDocuments/MASSFLUX1).

continuously. The average mass discharge per day is used to estimate the average concentration in the discharge of the SRP well as follows:

$$C_d = \frac{M_d}{Q_t}$$

where

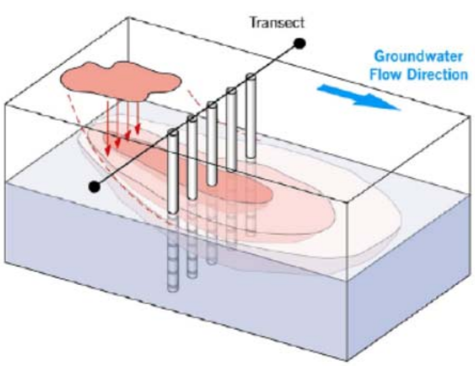
C_d = average concentration of entire transect
Q_t = steady state flow from extraction well

Sources of error in the calculation include hydraulic conductivity and concentration data. However, the calculator is conservative and will be calibrated as needed to match the latest groundwater monitoring results and pumping data, by adjusting input parameters and SRP well pumping characteristics over time. The calculation conservatively assumes that the 1,1-DCE arrives instantaneously to the well and there is no degradation of 1,1-DCE.

Example Calculation – SRP 21.5E-1.0S 1,1-DCE Mass Discharge Concentration

This example calculation walks through the transect methodology used to estimate the future 1,1-DCE mass in the discharge of SRP 21.5E-1.0S into Western Canal.

The picture below is representative of the monitoring well transect used in this calculation. From West to East and upgradient of the SRP well, monitoring wells MW-34, MW-36, and MW-33 screened across the D-, A-, D2-, A2-, D3-, and D4-Zones are used in the calculation.



To determine the mass discharge, the specific discharge is first calculated using:

$$q_i = -K_j i_j$$

where

K = hydraulic conductivity
i = hydraulic gradient

Data used for this calculation include the most recent aquifer property data from the updated groundwater flow and solute transport model, including hydraulic conductivity and hydraulic gradient, and 1,1-DCE concentration data from the Fourth Quarter 2014 groundwater sampling of the monitoring wells comprising the transect.

Specific Discharge (q) Profile (ft/day)							
		West	⇨	*East*			
Zone	Bottom Depth	MW-34	MW-36	MW-33	Total	K (feet/day)	i (feet/feet)
D	140	0.09	0.09	0.09	0.270	15	0.006
A	160	0.012	0.012	0.012	0.036	2	0.006
D2	190	0.066	0.066	0.066	0.198	11	0.006
A2	220	0.09	0.09	0.09	0.270	15	0.006
D3	290	0.08	0.08	0.08	0.240	40	0.002
D3b	330	0.08	0.08	0.08	0.240	40	0.002
D4	400	0.03	0.03	0.03	0.090	15	0.002

Next, the width profile of the current plume dimension is determined based on iso-contours from the most recent groundwater monitoring data. Currently, monitoring well MW-36D3 is allocated the higher percentage while monitoring wells MW-34 and MW-33 are given lower percentages of the total plume width. A factor of 60% is conservatively assigned to the primary flow path in line with monitoring well MW-36, with respect to the plume width, and 20% to the exterior transect monitoring wells (MW-34 and MW-33).

Width Profile (feet)						
		West	⇨	*East*		
Zone	Bottom Depth	MW-34	MW-36	MW-33	Total Width	Peak Transect
D	140	130	390	130	650	60%
A	160	130	390	130	650	60%
D2	190	130	390	130	650	60%
A2	220	130	390	130	650	60%
D3	290	130	390	130	650	60%
D3b	330	130	390	130	650	60%
D4	400	130	390	130	650	60%
Width of each area determined from isocontours						
Peak concentration area should be minimum of 60% of the total width						

Using the width profiles above, areas are then calculated for each transect cell.

Area (A) Profile (feet^2)					
		West	⇨	*East*	
Zone	Bottom Depth	MW-34	MW-36	MW-33	Total Area
D	140	5200	15600	5200	26,000
A	160	2600	7800	2600	13,000
D2	190	3900	11700	3900	19,500
A2	220	3900	11700	3900	19,500
D3	290	9100	27300	9100	45,500
D3b	330	5200	15600	5200	26,000
D4	400	9100	27300	9100	45,500

Data from the latest monitoring event is then referenced to populate the concentration profile.

Concentration (C) Profile (ug/L)						
		West	⇨	*East*		
Zone	Bottom Depth	MW-34	MW-36	MW-33	Total	%
D	140	0	0	0	0	0%
A	160	0	0	0	0	0%
D2	190	0	0	0	0	0%
A2	220	0	0	0	0	0%
D3	290	1.5	26	0	28	90%
D3b	330	0.15	2.6	0	3	9%
D4	400	0.015	0.26	0	0	1%

Where concentrations are unknown, a conservative concentration is assumed:

- In the A2-Zone, the concentration will be set equal to the concentration in the D2-Zone
- In the D3b-Zone, the concentration will be set equal to the 1/10th of the D3-Zone, and
- In the D4-Zone, the concentration will be set equal to the 1/10th of the D4-Zone.

The mass discharge is then calculated for the individual cells based on the following equation:

$$M_d = \sum_{j=1}^{j} C_j q_j A_j$$

where

M_d = mass discharge
C = contaminant concentration
q_j = specific discharge
A_j = flow area
j = unit area cell of transect

Mass Disharge Profile (Md) (ug/day)				$M_{dj} = C_j \cdot q_j \cdot A_j$		
		West	⇨	*East*		
Zone	Bottom Depth	MW-34	MW-36	MW-33	Total Mass	% Flux
D	140	0	0	0	0	0%
A	160	0	0	0	0	0%
D2	190	0	0	0	0	0%
A2	220	0	0	0	0	0%
D3	290	30,922	2,009,930	0	2,040,852	94%
D3b	330	1,767	114,853	0	116,620	5%
D4	400	116	7,537	0	7,653	0%

Finally, the average estimated concentration in the SRP extraction well is calculated as follows:

$$C_d = \frac{M_d}{Q_t}$$

where

C_d = average concentration of entire transect
Q_t = steady state flow from extraction well

Based on the referenced concentration profiles, plume dimensions, aquifer properties, and the average flow rate of the SRP well (481 gpm), the estimated 1,1-DCE concentration in the well's discharge is 0.8 µg/L. For the same time period, the groundwater flow and solute transport model predicts a concentration of 0.13 µg/L, indicating the mass discharge calculation is conservative.

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Appendix B

Estimated Costs

Appendix B
Estimated Remedial Action Plan Capital and Incremental Costs
Former Capitol Castings Tempe, AZ

Proposed Remedial Action Plan (Base Level) Costs	
Monitoring Equipment Capital	$15,000
Annual Groundwater Sampling (Average 25 groundwater samples per year)	
Labor and expenses	$24,400
Laboratory	$3,200
Permits, Well Repair, and Maintenance	$23,000
Annual Groundwater Monitoring Reporting	
Labor and expenses	$18,300
Miscellaneous/ Contingency	$18,700
Total Annual Cost	**$88,000**
5 Years	**$440,000**
10 Years	**$880,000**

Notes:

Miscellaneous costs include: stakeholder engagement, project management, health and safety, and quality control.

Appendix B
Estimated Contingency Remedial Action Plan Capital and Incremental Costs
Former Capitol Castings Tempe, AZ

Contingency Remedial Action Plan (Level 4) Costs	
Contingency Treatment System Installation	
FS/PRAP/Model subtotal	$125,500
System Design/ OM&M Plan	$60,300
Permitting/Surveying/Utility Clearance	$57,000
Extraction Well Installation (2 wells to 200 feet and 2 wells to 280 feet)	$307,000
Treatment System Equipment	$391,100
Treatment System Installation	$536,200
System Startup and Shakedown	$80,000
Miscellaneous/ Contingency	$482,700
Total Capital Costs, Treatment System Installation	**$2,039,800**
Annual Costs	
Quarterly Groundwater Sampling (Average 83 groundwater samples per year)	
Labor and expenses	$187,500
Laboratory	$10,700
Permits, Well Repair, and Maintenance	$26,000
Groundwater Monitoring Report (Quarterly)	
Labor and expenses	$52,800
Pump and Treat System	
Operation, Maintenance, and Disposal	$354,000
Syststem Evaluation and Reporting	
Labor and expenses	$11,600
Miscellaneous/ Contingency	$91,400
Total Annual Cost	**$745,600**
5 Years	**$3,728,000**
10 Years	**$7,456,000**

Notes:

Miscellaneous costs include: stakeholder engagement, project management, health and safety, and quality control.