

**THIRD FIVE-YEAR REVIEW REPORT FOR
TUCSON INTERNATIONAL AIRPORT AREA SUPERFUND SITE
PIMA COUNTY, ARIZONA**



PREPARED BY

U.S. Army Corps of Engineers

Seattle District

FOR

U.S. Environmental Protection Agency

Region 9

Approved by:

Date:

MICHAEL MONTGOMERY

Digitally signed by MICHAEL
MONTGOMERY

Date: 2023.09.30 09:01:03 -07'00'

Michael Montgomery, Director
Superfund and Emergency Management Division
U.S. Environmental Protection Agency, Region 9

Executive Summary

This is the third Five-Year Review of the Tucson International Airport Area Superfund Site (Site) located in Tucson, Arizona. The purpose of this Five-Year Review is to review information to determine if the remedy is and will continue to be protective of human health and the environment.

The Site is located in southeastern Arizona and encompasses sections of southwest Tucson, as well as adjoining lands south of the city. The Site boundaries are the Santa Cruz River on the west, Ajo Way on the north, Alvernon Way on the east, and the Hughes Access Road on the south.

The Site consists of six operable units. The Air Force Plant #44/Raytheon has completed its own Five-Year Review for Operable Units 3 and 4. This Five-Year Review addresses Operable Units 1, 2 and 5. EPA has not selected a remedy for Operable Unit 6, and therefore, this is not assessed in this Five-Year Review.

1. Operable Unit 1 Area A (western half) consists of groundwater at the Tucson Airport Remediation Project area. (Groundwater - Area A)

Operable Unit 1 Area B (eastern half) consists of groundwater at the following locations: Texas Instruments property (formerly Burr-Brown Corporation), the 162nd Arizona Air National Guard Base, the former Western Capacitor property, and the West Plume B area. (Groundwater - Area B)

2. Operable Unit 2 consists of soil and shallow groundwater at the Airport Property (including the Three Hangars Building), and soil at the Arizona Air National Guard Base, Texas Instruments Property, and Western Capacitor Area (Soil and Shallow Groundwater at the Airport Property).
3. Operable Unit 3 consists of soil and groundwater at U.S. Air Force Plant #44/Raytheon. The Air Force has the lead for remediation on the Air Force Plant #44/Raytheon.
4. Operable Unit 4 consists of 1,4-dioxane contamination at U.S. Air Force Plant #44/Raytheon. The Air Force has the lead for remediation on the Air Force Plant #44/Raytheon.
5. Operable Unit 5 consists of 1,4-dioxane in Tucson Airport Remediation Project groundwater and is addressed in the 2023 Interim ROD Amendment for Tucson Airport Remediation Project groundwater. It is discussed as part of Operable Unit 1 (Groundwater – Area A) in this Five-Year Review for simplicity.
6. Operable Unit 6 consists of per- and poly-fluoroalkyl substances (PFAS) groundwater contamination within the entire Site. EPA has not selected a remedy for this operable unit.

The groundwater and soil at the Site were contaminated by former aircraft and electronics manufacturing activities, fire drill training activities, and unlined landfills. The primary contaminant of

concern is trichloroethylene. Other contaminants found at lower concentrations include 1,4-dioxane, tetrachloroethylene, 1,1-dichloroethylene, chloroform, benzene, and chromium. PFAS has more recently been identified in various areas at the Site.

In the 1988 Record of Decision, EPA selected a remedy for Groundwater - Area A. This remedy includes extraction of the contaminated groundwater from two well fields (north and south) and treatment using packed column aeration. Extraction from the North Well Field provides containment of the plume and extraction from the South Well Field provides for mass reduction. The Tucson Airport Remediation Project extraction and treatment facility began operating in 1994. In 2014, an advanced oxidation process was incorporated into the existing treatment system, consisting of ultra-violet reactors, peroxide storage and feed equipment, and a granular activated carbon tank farm for peroxide quenching. The 2014 treatment system upgrade was meant to treat 1,4-dioxane, however it is also capable of treating low level concentrations of PFAS. In 2018, the South Well Field was shutdown to reduce higher concentrations of PFAS from entering the treatment plant. As a result PFAS concentrations in specific locations have the potential to affect the performance of the remedy. In December 2019, ADEQ surveyed the adjacent area to identify any private drinking water wells and collected samples to test for PFAS. ADEQ and the National Guard immediately supplied bottled water to three residences with well water with PFAS concentrations detected above EPA's 2016 Health Advisory screening level of 70 nanograms per liter until those residences could be connected to the City of Tucson's Water System. The City of Tucson formerly served the water as drinking water and intends to use the treated water for drinking water in the future, once water is appropriately and effectively treated for PFAS, in addition to the other Site contaminants. Currently, in accordance with a discharge permit, the treated water is discharged into either the Santa Cruz River or the Tucson Water Recycled Water System, with the majority of water currently being discharged to the recycled water system. The Tucson Airport Remediation Project groundwater treatment facility is operating and groundwater is treated to meet current primary drinking water standards. While EPA has published a proposed rulemaking to establish Maximum Contaminant Levels for PFAS compounds, the standards have not been finalized. Since Tucson Airport Remediation Project is not currently designed to address PFAS in the concentrations present in the South Well Field, failure to address PFAS concentrations appropriately could impact protectiveness by limiting the ability for the Tucson Airport Remediation Project to operate its groundwater extraction system in an efficient and effective manner.

In the 1988 Record of Decision, EPA also selected the remedy at Groundwater - Area B, which includes in-situ chemical oxidation injections of potassium permanganate for the Texas Instruments property, the Arizona Air National Guard Base, and the Western Capacitor area. The remedy for the West Plume B area is monitored natural attenuation. Groundwater performance monitoring is ongoing following the completion of in-situ injections at the Texas Instruments property, the Arizona Air National Guard Base, and the Western Capacitor area. While overall the in situ chemical oxidation injections appear to have reduced contaminant mass of trichloroethylene, additional treatment may be required to contain contaminants in groundwater and/or restore groundwater to drinking water standards. Monitored natural attenuation at the West Plume B area is functioning as intended.

The remedy at Groundwater Area A/Area B at the Tucson International Airport Site currently protects human health and the environment. Contaminant containment for TCE is occurring, and the groundwater treatment systems are operating to treat contaminated groundwater to below current drinking water standards and to reduce groundwater contaminant concentrations. However, in order for the remedy to be protective in the long-term, the following actions must be taken: determine the nature, extent and implement appropriate remedies for PFAS in groundwater; upgrade groundwater treatment system to adequately treat PFAS so extraction wells can be fully operational; and incorporate into the groundwater monitoring program frequent, ongoing sampling of private wells in the vicinity of the potentially impacted area for PFAS.

EPA selected the remedy for soil and shallow groundwater at the Airport Property (including the Three Hangars Building), and soil at the Arizona Air National Guard Base, Texas Instruments Property, and Western Capacitor Area, which consists of excavation of contaminated sludges and soils, closure of the Tucson Airport Area landfill, soil vapor extraction, and groundwater extraction and treatment. Excavation of contaminated sludges and soils occurred between 2007 and 2010. The landfill was closed in 2012. Two soil vapor extraction systems currently operate within this area. The groundwater extraction and treatment system treats the Shallow Groundwater Zone using a packed column aerator. The soil vapor extraction systems are removing contaminant mass in the vadose zone, but the systems may have reached asymptotic conditions. The groundwater extraction and treatment system is made less effective by rising groundwater levels and may not be fully containing contaminants. The treatment system went down in March 2023, but is anticipated to be back online by the end of 2023.

The soil and shallow groundwater remedy at the Airport Property currently protects human health and the environment because contamination in soil and groundwater is being reduced, which reduces the further migration of contaminants in groundwater. In order for the remedy to be protective in the long-term, the remedy for both soil and shallow groundwater (soil vapor extraction and groundwater extraction) need to account for the change in site conditions resulting from rising groundwater levels.

Contents

Executive Summary	ii
List of Figures.....	vii
List of Tables	viii
List of Acronyms and Abbreviations.....	ix
1. Introduction	1
1.1. Background.....	4
1.2. Physical Characteristics.....	4
1.3. Hydrology.....	7
1.3.1. Groundwater – Area A/Area B Hydrology.....	7
1.3.2. Airport Property Hydrology	7
2. Remedial Actions Summary.....	9
2.1. Basis for Taking Action	9
2.2. Remedy Selection.....	9
2.2.1. Groundwater – Area A/Area B – Groundwater North of Los Reales Road.....	9
2.2.2. Soil and Shallow Groundwater at the Airport Property and AANG Base	12
2.3. Remedy Implementation	15
2.3.1. Groundwater – Area A/Area B Groundwater	15
2.3.2. Soil and Shallow Groundwater at the Airport Properties	16
2.3.3. Institutional Controls	17
2.4. System Operations/Operation and Maintenance	18
2.4.1. Operations and Maintenance Requirements	18
2.4.2. Significant Operations and Maintenance over the Past Five Years.....	19
3. Progress Since the Last Five-Year Review.....	21
3.1. Previous Five-Year Review Protectiveness Statement and Issues	21
3.2. Work Completed at the Site During this Five-Year Review Period	22
4. Five-Year Review Process.....	24
4.1. Community Notification, Involvement and Site Interviews	24
4.1.1. Five-Year Review Public Notice	24
4.1.2. Site Interviews	24
4.2. Data Review.....	25
4.2.1. Groundwater – Area A – Tucson Area Remediation Project	25

4.2.2.	Groundwater – Area B – Texas Instruments	30
4.2.3.	Groundwater – Area B – West Cap	31
4.2.4.	Groundwater – Area B – Arizona Air National Guard	32
4.2.5.	Groundwater – Area B – West Plume B	35
4.2.6.	Soil and Shallow Groundwater at the Airport Property	35
4.2.7.	Sustainability	42
4.3.	Site Inspection	42
5.	Technical Assessment	44
5.1.	Question A: Is the remedy functioning as intended by the decision documents?....	44
5.2.	Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?	46
5.3.	Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?	47
6.	Issues/Recommendations	47
7.	Protectiveness Statement	48
8.	Next Review.....	48
Appendix A:	List of Documents Reviewed	49
Appendix B:	Site Chronology	52
Appendix C:	Data Review.....	55
Appendix D:	Applicable or Relevant and Appropriate Requirements Assessment ...	82
Appendix E:	Toxicity Assessment	89
Appendix F:	Public Notice	91
Appendix G:	Interview Forms	93
Appendix H:	Site Inspection Report and Photos	103

List of Figures

Figure 1. Location Map.....	5
Figure 2. Detailed Map.....	6
Figure 3. Conceptual Site Model of the Tucson International Airport Superfund Site and the Complex Groundwater Pathways	8
Figure 4. North Well Field at the Tucson Airport Remediation Project Representing Targeted and Observed Capture Zones for the TCE and 1-4 Dioxane Plumes.....	27
Figure 5. TCE plume (gray) with TCE Concentration and Regional Groundwater Elevations Throughout the Tucson Airport Remediation Project Plume North of Reales Road.	28
Figure 6. 1,4-Dioxane and TCE Occurrence for the Tucson International Airport Superfund Site.	29
Figure 7. TCE Concentrations at Texas Instruments Following the 2016 Injections.	30
Figure 8. Source Area West Cap – March 2022 TCE Analytical Contours (yellow) and the Target Treatment Area (purple).....	31
Figure 9. Downgradient of Source Area West Cap	32
Figure 10. Arizona Air National Guard TCE Concentrations for the Upper and Lower Subunits (Dec. 2020).	34
Figure 11. Airport Property Stratigraphic Unit and Remedy	37
Figure 12. Groundwater Elevations from the Regional Aquifer Monitoring Wells.	39
Figure 13. Volatile Organic Compound Mass Removed since System Startup in 2007.	40
Figure 14. Soil Gas Concentrations Prior To System Startup Compared To Recent Soil Gas Concentrations	41

List of Tables

Table 1. Five-Year Review Summary Form	3
Table 2. Groundwater - Area A Groundwater Cleanup Levels.	10
Table 3. Groundwater - Area B Groundwater Cleanup Levels from 2012 Record of Decision Amendment	11
Table 4. Airport Property Groundwater Cleanup Levels from 1997 Record of Decision	14
Table 5. Status of Recommendations from the 2018 Five-Year Review	22
Table 6. Status of PFAS Investigations	23
Table 7. Trend Analysis for select wells at Arizona Air National Guard	33
Table 8. Trend Analysis Performed on Select Wells at the Airport Property	38
Table 9. Issues and Recommendations Identified in the Five-Year Review	47
Table 10. Protectiveness Statement	48

List of Acronyms and Abbreviations

AANG	162nd Arizona Air National Guard
ADEQ	Arizona Department of Environmental Quality
AF	United States Air Force
AFP44	Air Force Plant #44 Raytheon Missile Systems Company
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
EPA	United States Environmental Protection Agency
gpm	gallons per minute
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ng/L	nanogram per liter
PFAS	per- and poly-fluoroalkyl substances (a.k.a. perfluorinated chemicals (PFCs))
Site	Tucson International Airport Area Superfund Site
TARP	Tucson Airport Remediation Project
TCE	trichloroethylene
USACE	United States Army Corps of Engineers
West Cap	Western Capacitor

1. Introduction

The purpose of a Five-Year Review is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act Section 121, 40 Code of Federal Regulation Section 300.430(f)(4)(ii) of the National Contingency Plan and EPA policy.

This is the third Five-Year Review for the Tucson International Airport Area Superfund Site. The triggering action for this statutory review is the completion of the previous Five-Year Review. The Five-Year Review has been prepared because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

There are six Operable Units¹ at the Site of which four have remedies selected. The Air Force has prepared the Five-Year Review for Operable Units 3 and 4. This Five-Year address Operable Units 1, 2 and 5. EPA has not selected a remedy for Operable Unit 6, and therefore, this is not assessed in this Five-Year Review.

1. Operable Unit 1 Area A (western half) consists of groundwater at the Tucson Airport Remediation Project area. (Groundwater - Area A)

Operable Unit 1 Area B (eastern half) consists of groundwater at the following locations: Texas Instruments property (formerly Burr-Brown Corporation), the 162nd Arizona Air National Guard (AANG) Base, the former Western Capacitor property (West Cap), and the West Plume B area. (Groundwater - Area B)

2. Operable Unit 2 consists of soil and shallow groundwater at the Airport Property (including the Three Hangars Building), and soil at the AANG Base, Texas Instruments Property, and West Cap Area (Soil and Shallow Groundwater at the Airport Property).
3. Operable Unit 3 consists of soil and groundwater at U.S. Air Force (Air Force) Plant #44/Raytheon (AFP44). The Air Force has the lead for remediation on the Air Force Plant #44/Raytheon.
4. Operable Unit 4 consists of 1,4-dioxane at AFP44. The Air Force has the lead for remediation on the Air Force Plant #44/Raytheon.

¹ During cleanup, a site can be divided into distinct areas depending on the complexity of the problems associated with the site. These areas, called operable units, may address geographic areas of a site, specific site problems, or areas where a specific action is required.

5. Operable Unit 5 consists of 1,4-dioxane in Tucson Airport Remediation Project groundwater and is addressed in the 2023 Interim ROD Amendment for Tucson Airport Remediation Project groundwater. It is discussed as part of Operable Unit 1 (Groundwater – Area A) in this Five-Year Review for simplicity.
6. Operable Unit 6 consists of per- and poly-fluoroalkyl substances (PFAS) groundwater contamination within the entire Site. EPA has not selected a remedy for this operable unit.

The Tucson International Airport Area Superfund Site Five-Year Review was led by Mary Aycock, EPA Region 9 Remedial Project Manager. Participants included Cynthia Wetmore, EPA Region 9 Superfund Five-Year Review Coordinator, Cynthia Ruelas, EPA Region 9 Superfund Five-Year Review Coordinator, and from the U.S. Army Corps of Engineers (USACE): Dan Carlson, Physical Scientist; Kristin Addis, hydrogeologist, and Matthew Masten, environmental engineer. The review began on October 20, 2022.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Tucson International Airport Area Superfund Site		
EPA ID: AZD980737530		
Region: 9	State: AZ	City/County: Tucson, Pima County
SITE STATUS		
National Priorities List Status: Final		
Multiple Operable Units? Yes	Has the site achieved construction completion? No	
REVIEW STATUS		
Lead agency: EPA is the lead for the Site, except AFP44. The Air Force is the response agency for AFP44.		
Author name (Federal Project Manager): Mary Aycock		
Author affiliation: EPA Region 9		
Review period: 10/20/2022 - 7/28/2023		
Date of site inspection: 4/20/2023		
Type of review: Statutory		
Review number: 3		
Triggering action date: 9/21/2018		
Due date (five years after triggering action date): 9/21/2023		

1.1. Background

The Site is located in southeastern Arizona and encompasses sections of southwest Tucson, as well as adjoining lands south of the city (Figure 1). The Site boundaries are the Santa Cruz River on the west, Ajo Way on the north, Alvernon Way on the east, and the Hughes Access Road south of the AFP44 on the south.

The Site is divided into seven separate project areas (Figure 2), which include AFP44, Tucson Airport Remediation Project, the Texas Instruments property, the AANG Base, the Airport Property, the West Plume B area, and the former West Cap property. EPA is addressing groundwater and soil remediation efforts at Tucson Airport Remediation Project and the Airport Property, north of Los Reales Road, and at Texas Instruments, AANG, West Plume B, and West Cap. The Air Force is addressing groundwater remediation efforts at AFP44, south of Los Reales Road.

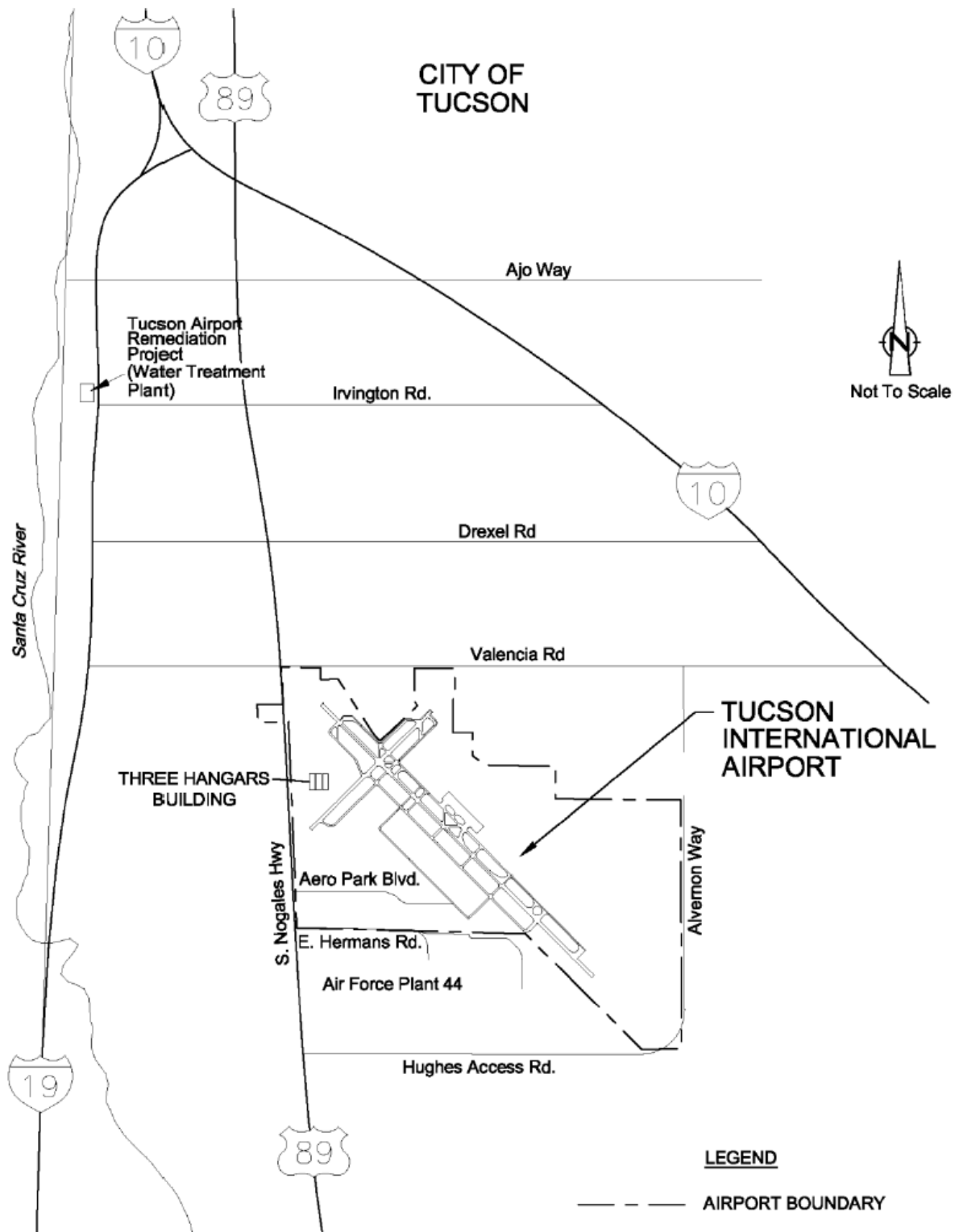
Aircraft and electronics manufacturing activities, fire drill training activities, and unlined landfills from the 1940s – 1970 contaminated soil and groundwater at the Site.

1.2. Physical Characteristics

The Site is an approximately 10-square-mile area comprised of portions of southwest Tucson and adjoining lands south of the city. The Site encompasses industrial, commercial, residential, and undeveloped areas, including the Tucson International Airport, AFP44, residential areas of the cities of Tucson and South Tucson, and northeastern portions of the Tohono O'odham Indian Reservation (San Xavier District).

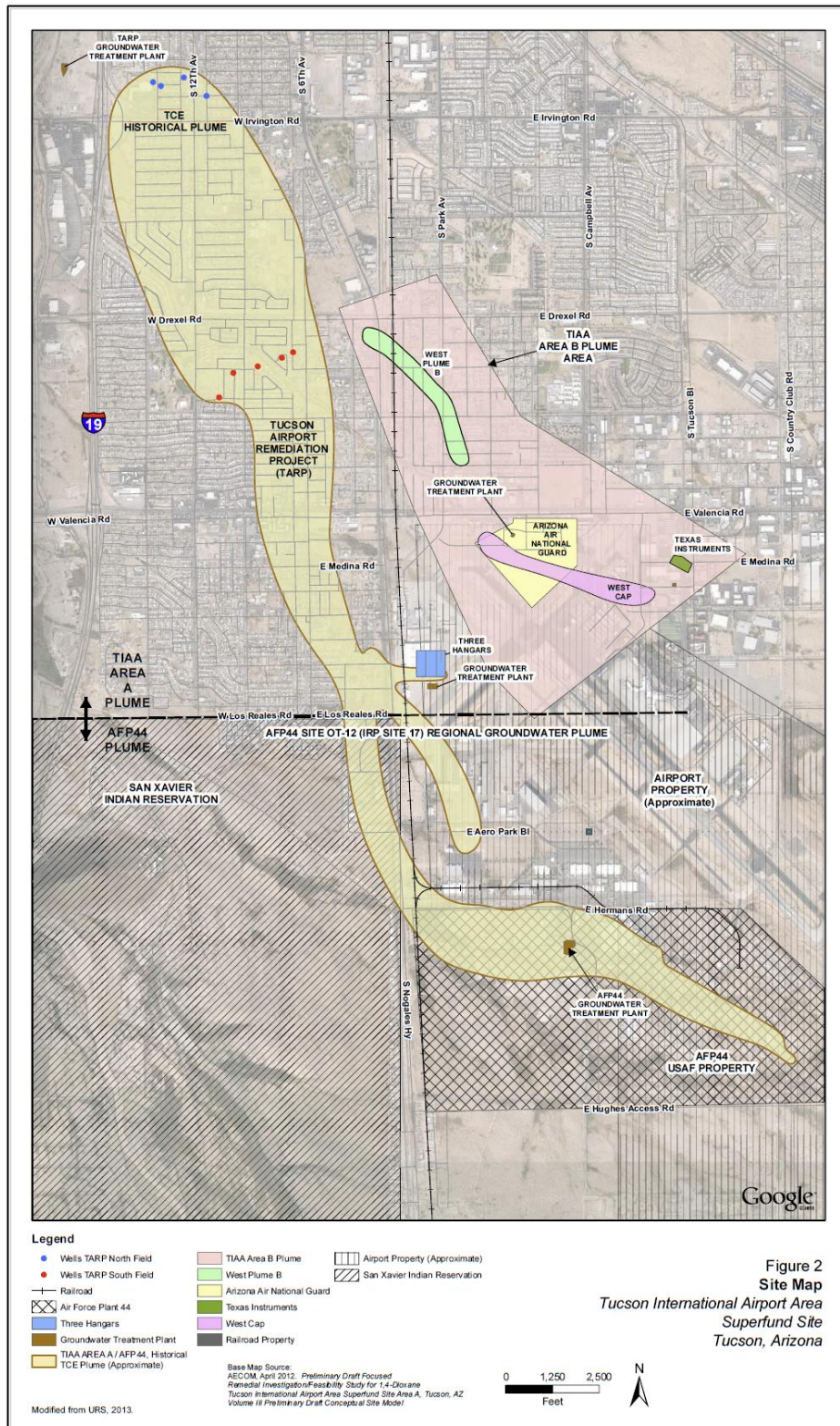
Land use at and in the vicinity of the Site has been a mix of commercial/industrial (e.g., aviation, aerospace), and residential uses. The area in the immediate vicinity of the Site tends to be more commercial/industrial. The residential properties are predominantly to the west and north, commercial/industrial properties lie predominantly to the east, and open/vacant spaces lie to the south. No major changes to land use are anticipated.

Groundwater is the primary source of water for domestic, industrial, and irrigation water in the area. During the initial investigation of the Site, numerous production wells and private wells located within the vicinity of the Site contained groundwater that exceeded the federal drinking water standard for trichloroethylene (TCE) of 5 micrograms per liter ($\mu\text{g/L}$). Production wells were either shut down or taken out of service by the City of Tucson. Some private wells remain in use, but institutional controls to prevent exposure to contaminated groundwater are in place and no use of groundwater containing volatile organic compounds above drinking water standards is known to occur at this time.



Source: EPA, 2018. Second Five-Year Review Report for Tucson International Airport Area Superfund Site, Pima County, Arizona.

Figure 1. Location Map



Source: AECOM, 2012. Preliminary Draft Focused Remedial Investigation Feasibility Study for 1,4-Dioxane Tucson International Airport Area Superfund Site Area A, Tucson, AZ, Volume III Preliminary Draft Conceptual Site Model.

Figure 2. Detailed Map

1.3. Hydrology

The Site is in the Tucson Basin. The Santa Cruz River runs from south to north, about one mile from the western edge of the Site and drains the basin toward the northwest. In general, groundwater elevations in the Regional Aquifer are increasing due to reduced reliance on groundwater and several recharge projects within the Tucson Basin with water from the Colorado River. A thick interconnected water-bearing unit is present basin-wide and is known as the Regional Aquifer. Groundwater flow in the Regional Aquifer is generally toward the northwest. The Regional Aquifer system is hydrogeologically complex because of lateral and vertical variations in hydraulic conductivities of sediments shed by the surrounding mountain ranges. The Regional Aquifer water levels are increasing throughout the Tucson Basin.

1.3.1. Groundwater – Area A/Area B Hydrology

The subsurface of the Tucson Airport Remediation Project area (Groundwater - Area A), north of Los Reales Road, consists primarily of sediments to depths of at least 400 feet, overlying bedrock. The Regional Aquifer (in the northern part of the Tucson Airport Remediation Project) is composed mainly of coarse-grained materials. Groundwater is encountered at 200 feet below ground surface (bgs), and groundwater flow is to the north-northwest. The rate of water level increase in the Tucson Airport Remediation Project area ranges up to about 2 feet per year.

In the southern Tucson Airport Remediation Project plume area, the sediments are divided into Upper and Lower Divided Aquifers, separated by a confining clay unit. This confining unit is thinner to the north-northwest near a transition zone. The Lower Divided Aquifer is more consolidated than the Upper Divided Aquifer and is comprised of clays, clayey sands, and sand and gravel. The groundwater flow is north-northwest, with groundwater found at approximately 75 to 100 feet bgs in the Upper Divided Aquifer and 200 feet bgs in the Lower Divided Aquifer.

The subsurface at Area B is divided into three hydraulic units below the vadose zone – the Upper Zone, the Middle Aquitard, and the Lower Zone. The Upper Zone is further divided into the Upper Unit and the Lower Unit, which are separated by the Upper Aquitard. It should be emphasized that the designation of these subunits and intervening aquitards is established within each respective project area boundary. Because of heterogeneous nature of the aquifer system, subunit correlation is generally difficult between project areas where large hydrogeologic data gaps exist.

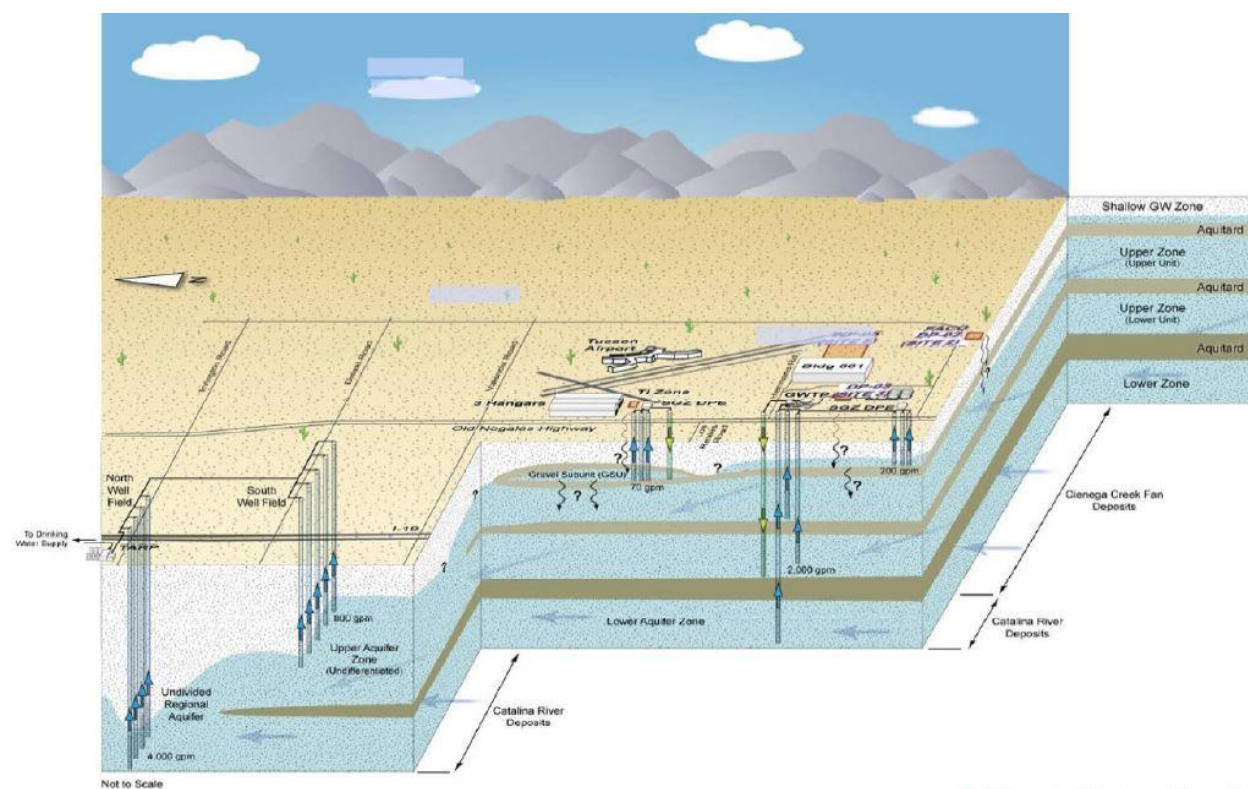
1.3.2. Airport Property Hydrology

The Airport Property is located in the east-central portion of the Site. The stratigraphic relationships between the Shallow Groundwater Zone, the Gravel Subunit, which is within the Shallow Groundwater Zone, and the Regional Aquifer are shown in Figure 3. The focus of remedial actions at the Airport Property is the Upper Zone of the Upper Divided Aquifer. At the Airport Property, the Upper Zone is further divided into the following four site-specific stratigraphic units: Unit 1—10 feet to 15 feet of unconsolidated silt or gravelly sand, Unit 2—35 feet to 40 feet of calcified silty fine sand, Unit 3—20 feet to 40 feet of unconsolidated layer of well to poorly graded silty and gravelly sand, and Unit 4—primarily

a clay-rich deposit. Unit 4 is further divided into three subunits: an Upper Unit 4 Clay, an interbedded Gravel Subunit, and a Lower Unit 4 Clay.

Unit 4 is generally found from approximately 80 feet bgs to 158 feet bgs. The Upper Unit 4 Clay is present beneath the entire Airport Property portion of the Site. The Gravel Subunit is considered a distinct subunit within the Unit 4 Clay and consists of channelized coarse-grained materials that are unevenly distributed across the Airport Property. These buried channel deposits are difficult to remediate due to the lack of connectivity and occurrence throughout the area. Groundwater occurs at a depth of approximately 85 feet bgs within the Shallow Groundwater Zone. Groundwater flows from east to west within the Shallow Groundwater Zone near Three Hangars until it flows into the Regional Aquifer west of Nogales Highway.

The Regional Aquifer underlies Unit 4 and consists of braided channel deposits of the Paleo Santa Cruz. This unit is highly transmissive and groundwater flows to the north.



Source AFCEC, IROD 2023

Figure 3. Conceptual Site Model of the Tucson International Airport Superfund Site and the Complex Groundwater Pathways

2. Remedial Actions Summary

2.1. *Basis for Taking Action*

The City of Tucson operated production wells for its municipal water supply near the Site, some of which had TCE detections above the Federal drinking water standard² of 5 µg/L. Similarly, chromium detections above the Federal drinking water standard were found primarily in municipal wells at or adjacent to AFP44. TCE detections above the Federal drinking water standard of 5 µg/L were also found in some of the private wells within the vicinity of Site (EPA 1988). The primary human health risk posed was the potential for direct ingestion of contaminated groundwater.

The primary human health risk associated with soil at the Airport Property was the potential for incidental ingestion of soil or inhalation of soil gas vapors.

The primary contaminant of concern is TCE in soil gas and groundwater. Other contaminants of concern in soil gas include 1,4-dioxane, tetrachloroethylene, 1,1-dichloroethylene, chloroform, benzene, polychlorinated biphenyls (soil only), and chromium (soil and groundwater).

2.2. *Remedy Selection*

2.2.1. Groundwater – Area A/Area B – Groundwater North of Los Reales Road

Groundwater – Area A/Area B consists of the contaminated groundwater plume north of Los Reales Road and is further subdivided into Area A (Tucson Airport Remediation Project, in the western half) and Area B (eastern half). Area B has contaminated groundwater at several areas: the Texas Instruments property, the AANG Base, the former West Cap Area, and the West Plume B area.

2.2.1.1 Groundwater - Area A (Tucson Airport Remediation Project)

In the 1988 Record of Decision, EPA selected the groundwater remedy for Groundwater - Area A to include groundwater extraction and treatment of the contaminated groundwater using packed column aeration. Discharge of treated water was to be provided to the municipal potable water distribution system.

EPA selected the 1988 remedy to contain the migration of contamination and remove high levels of contamination from groundwater. Groundwater monitoring was also required to verify (1) the control of contaminant migration and (2) the decrease in contaminant concentrations in the aquifer.

The goal of the treatment system is to treat the extracted groundwater to an overall excess cancer risk level (presumably for all contaminants combined) of 1×10^{-6} . EPA in the 1988 Record of Decision further specified treatment of TCE to a concentration of 1.5 µg/L, while noting that the Federal drinking water standard for TCE is 5 µg/L and that “treatment will bring the levels of other contaminants well below

their respective Federal and State drinking water standards, State Action Levels, and 10^{-6} excess cancer risk concentrations.”

This ambiguity in the cleanup levels for groundwater remain the ground was clarified within the 1997 Explanation of Significant Differences, which stated “The in-situ groundwater cleanup standards shall continue to be drinking water standards (Maximum Contaminant Levels) for all contaminants contained within the Area A or Area B groundwater plumes” (Table 2).

While there were no Remedial Action Objectives within the 1988 Record of Decision, EPA stated that a combination of the treatment goals from this 1988 Record of Decision for the northern portion of the Site as well as the remedial actions taking place at AFP44 for the southern portion of the site constitute the overall remedial strategy for groundwater as restoration of the Sole Source Aquifer of the Tucson Basin to drinking water quality.

In March 2023, EPA issued an Interim Record of Decision Amendment to the Groundwater - Area A remedy. Revisions to the remedy included: documenting that 1,4-dioxane in groundwater will be treated solely by the advanced oxidation process system which was already in place at the Tucson Airport Remediation Project and elimination of the packed column aeration system, enhancement of the current remedy by installation of additional remediation wells to further reduce contaminant mass, continued monitoring of treated groundwater at the Tucson Airport Remediation Project to ensure cleanup levels are met, alternate options for beneficial use of water other than drinking water including discharge to the City of Tucson recycled water system, state-permitted discharge to the Santa Cruz River, and continued long-term monitoring of the groundwater contamination. The interim Record of Decision selected 0.35 µg/L as a treatment standard for 1,4-dioxane based on EPA’s Drinking Water Health Advisory level. The cleanup level for 1,4-dioxane will be selected in a subsequent decision document.

Table 2. Groundwater - Area A Groundwater Cleanup Levels.

Contaminant of Concern	Groundwater Cleanup Levels (µg/L)	Basis for Cleanup Level
Benzene	5	Federal drinking water standard (1988 ROD)
Chloroform	100	Federal drinking water standard (1988 ROD)
Chromium	50	Federal drinking water standard (1988 ROD)
1,1-Dichloroethylene	7	Federal drinking water standard (1988 ROD)
trans-1,2-Dichloroethylene	70	Federal drinking water standard goal (1988 ROD)
TCE	5	Federal drinking water standard (1988 ROD)

2.2.1.2 Groundwater - Area B (Texas Instruments Property, AANG Base, West Cap Area, West Plume B Area)

Groundwater - Area B consists of contaminated groundwater at several locations: the Texas Instruments property, the AANG Base, the West Cap Area, and the West Plume B area. There are four decision documents that apply to Groundwater - Area B: the 1988 Record of Decision, 1997 Explanation of Significant Differences, and the 2004 and 2012 Record of Decision Amendments.

EPA selected groundwater extraction and treatment as a remedy in the 1988 Record of Decision. In the 1997 Explanation of Significant Differences, EPA modified the remedy at the AANG Base to allow changes to the treatment method and to reinject treated water into wells. In 2004, EPA issued a Record of Decision Amendment and selected a remedy of groundwater extraction and treatment for groundwater contamination at the West Cap Area and the West Plume B area. EPA issued the 2004 Record of Decision Amendment due to new information: the identification of West Plume B and the further delineation of the West Cap groundwater plume, which includes the former West Cap Area and the AANG Base.

In 2012, EPA issued a Record of Decision Amendment and replaced the previous remedies in Groundwater - Area B with a revised remedy. At the West Cap area, Texas Instruments property, and the AANG Base, the revised remedy consists of in-situ chemical oxidation using potassium permanganate. At West Plume B, the revised remedy consists of monitored natural attenuation.

The remedial action objectives for Groundwater - Area B, as clarified by the most recent 2012 Record of Decision amendment, are to:

- Reduce the risk of potential exposure to contaminants.
- Restore contaminated groundwater to support existing and future uses, i.e., drinking water.
- Prevent or reduce migration of groundwater contamination above maximum contaminant levels (drinking water standards).

For groundwater in Groundwater - Area B, the contaminants of concern and groundwater cleanup levels were selected in the 2012 Record of Decision Amendment (Table 3). EPA maintained the TCE treatment level of 1.5 µg/L in any treated water intended for direct drinking water usage.

Table 3. Groundwater - Area B Groundwater Cleanup Levels from 2012 Record of Decision Amendment

Contaminant of Concern	Groundwater Cleanup Levels (µg/L)	Basis for Cleanup Level ¹
1,1-Dichloroethylene	7	Federal drinking water standard
cis-1,2-Dichloroethylene	70	Federal drinking water standard
Tetrachloroethylene	5	Federal drinking water standard
TCE	5	Federal drinking water standard
Vinyl Chloride	2	Federal drinking water standard

¹ The more stringent of the Federal or State drinking water standard was selected as the basis for the groundwater cleanup level.

2.2.2. Soil and Shallow Groundwater at the Airport Property and AANG Base

The Airport Property contains contaminated soil and shallow groundwater at selected locations both north and south of Los Reales Road. Three decision documents apply to this contamination: the 1996 Record of Decision, 1997 Record of Decision, and 2001 Explanation of Significant Differences, which modifies the 1997 Record of Decision.

In the 1996 Record of Decision, EPA selected the remedy for contaminated soil at an area of the AANG Base. In the 1997 Record of Decision, EPA selected the remedy for contaminated soil and shallow groundwater at the Airport Property, which includes the Three Hangars Building, as well as contaminated soil at the Texas Instruments property and at the West Cap area. In addition, the Shallow Groundwater Zone at the Airport Property contains an approximately 2-acre area called the Technical Impracticability Zone. EPA determined in the 1997 Record of Decision that attainment of potential groundwater cleanup Applicable or Relevant and Appropriate Requirements would be impracticable due to the presence of dense nonaqueous phase liquids and the complexity of hydrogeology in the Technical Impracticability Zone. In the 2001 Explanation of Significant Differences to the 1997 Record of Decision, EPA revised the cleanup level for polychlorinated biphenyls to be consistent with December 1997 changes to Arizona law. In addition, the Explanation of Significant Differences included authorization for final remedial design to incorporate beneficial reuse of remediated groundwater for landscape irrigation or ornamentation. All other requirements of the 1997 Record of Decision remained unchanged.

The remedial action objectives described in the 1996 Record of Decision, for the AANG Base, are to:

- Reduce transport of TCE and other volatile organic compounds from AANG Base soils to groundwater to levels protective of human health and the environment.
- Restore the underlying aquifer to drinking water quality.
- Remove TCE from Former Sludge Drying Beds soils such that the soils could not cause the groundwater to be contaminated above health-based levels.

The remedial action objectives described in the 1997 Record of Decision for the Airport Property, Texas Instruments property, and West Cap Area are listed by media:

- To reduce volatile organic compound vapor concentrations in soil and achieve lateral and vertical vapor containment until contaminant concentrations have been reduced such that ceasing operation of the system will not cause a water quality impact to the Shallow Groundwater Zone outside the Technical Impracticability Zone or to the Regional Aquifer in excess of cleanup standards.
- To remove and properly dispose of all soils and sludges contaminated with polychlorinated biphenyls in excess of cleanup standards (0.76 milligrams per kilogram [mg/kg], which is the Arizona soil remediation level for non-residential areas, according to Arizona Administrative Code R18-7-201).
- To formally close and cap the Tucson Airport Area landfill in accordance with Arizona Resource Conservation and Recovery Act Subtitle D requirements.

- To prevent migration of volatile organic compounds from the Shallow Groundwater Zone into the Regional Aquifer, or into currently clean portions of the Shallow Groundwater Zone, at levels that result in exceedances of cleanup standards; and to restore the Shallow Groundwater Zone to drinking water quality wherever practicable.

The remedy components selected in the 1996 and 1997 RODs are as follows:

AANG Base

- Soil vapor extraction with activated carbon treatment of off-gases.

Airport Property

- Groundwater extraction and treatment to remove volatile organic compound contamination in the Shallow Groundwater Zone, in order to restore the Shallow Groundwater Zone to cleanup levels. However, EPA determined that it is technically impracticable to restore the Shallow Groundwater Zone to cleanup levels within a defined 2-acre zone located within the Shallow Groundwater Zone referred to as the Technical Impracticability Zone. The shallow groundwater remedy outside the Technical Impracticability Zone will be operated until groundwater cleanup standards are met (Table 4). The remedy in the Technical Impracticability Zone will employ hydraulic containment to prevent migration of contamination outside of the Technical Impracticability Zone, and extraction will continue indefinitely in the Technical Impracticability Zone, unless alternative remediation technologies or processes can be developed during remedy implementation.
- Soil vapor extraction will be used to treat volatile organic compound-contaminated soils on Airport Property in the vicinity of the Three Hangars Area, and any other locations determined to require cleanup action after completion of soil investigations.
- Closure of the Tucson Airport Area landfill in accordance with State of Arizona Resource Conservation and Recovery Act Subtitle D requirements. Closure activities include: grading the landfill so that it has a smooth but sloped surface, placing and compacting a two-foot thick (minimum) cap and seeding the cap with drought-resistant vegetation to minimize erosion. A closure and post-closure monitoring program will be required in accordance with landfill closure regulations.
- Excavation and removal of pipeline sludges and soils contaminated with polychlorinated biphenyls above 0.76 mg/kg (the State soil cleanup standard for non-residential properties).

Texas Instruments Property

- No action for soil, because the low levels of volatile organic compounds in soils at this location do not pose a risk to human health or groundwater quality.

West Cap Area

- Deferral of remedy selection until completion of ongoing soil investigations.

Table 4. Airport Property Groundwater Cleanup Levels from 1997 Record of Decision

Contaminant of Concern	Groundwater Cleanup Levels (µg/L)	Basis for Cleanup Level ^(a)
1,1-Dichloroethane	5	State guidance level ^(b)
1,1-Dichloroethylene	7	Federal drinking water standard
1,1,1-Trichloroethane	200	Federal drinking water standard
1,2-Dichloroethane	5	Federal drinking water standard
cis-1,2-Dichloroethylene	70	Federal drinking water standard
trans-1,2-Dichloroethylene	100	Federal drinking water standard
1,2-Dichloropropane	5	Federal drinking water standard
Acetone	700	State guidance level ^(b)
Arsenic	50	Federal drinking water standard
Benzene	5	Federal drinking water standard
Bis(2-ethylhexyl)phthalate	6	Federal drinking water standard
Carbon tetrachloride	5	Federal drinking water standard
Chlorobenzene	100	Federal drinking water standard
Chloroform	100	Federal drinking water standard
Chloromethane	2.7	State guidance level ^(b)
Chromium	100	Federal drinking water standard
Dichlorodifluoromethane	1400	State guidance level ^(b)
Ethylbenzene	700	Federal drinking water standard
Lead	15	Federal drinking water standard
Methyl ethyl ketone	350	State guidance level ^(b)
Methylene chloride	5	Federal drinking water standard
Nitrate (as Nitrogen)	10,000	Federal drinking water standard
Tetrachloroethylene	5	Federal drinking water standard
Toluene	1000	Federal drinking water standard
TCE	5	Federal drinking water standard
Trichlorotrifluoroethane (Freon 113) ^(c)	210,000	State guidance level ^(b)
Trichlorofluoromethane	2100	State guidance level ^(b)
Trihalomethanes ^(d)	100	Federal drinking water standard
Xylenes	10,000	Federal drinking water standard
Vinyl chloride	2	Federal drinking water standard

^(a) The more stringent of the Federal or State drinking water standard was selected as the basis for the groundwater cleanup level

^(b) Arizona Department of Environmental Quality (ADEQ) Health Based Guidance Level, Human Health Based Guidance Levels for Contaminants in Drinking Water and Soil, ADEQ, March 1996

^(c) This contaminant of concern was misspelled in the 1997 Record of Decision as “trichlorofluoromethane (Freon 113).”

^(d) Trihalomethanes includes chloroform, bromodichloromethane, dibromochloromethane, and tribromomethane

2.3. *Remedy Implementation*

2.3.1. Groundwater – Area A/Area B Groundwater

Groundwater - Area A (Tucson Airport Remediation Project)

The Tucson Airport Remediation Project groundwater treatment facility is comprised of two extraction well fields: the North Well Field and the South Well Field. The combined extracted groundwater from the North Well Field and the South Well Field is conveyed to the Tucson Airport Remediation Project groundwater treatment facility, located northwest of the I-19/Irvington Road intersection. The objective of the North Well Field, which consists of five high-capacity extraction wells, is to contain the TCE plume in the Regional Aquifer. The objective of the South Well Field, which includes five low-capacity extraction wells, is to provide mass removal of TCE from the Regional Aquifer.

The Tucson Airport Remediation Project groundwater treatment facility began operating in 1994. It used packed column aeration to remove volatile organic compounds from the extracted groundwater and vapor-phase granular activated carbon treatment of the resulting vapor prior to discharge to the atmosphere.

In 2014, the Tucson Water Department replaced the original granular activated carbon treatment system with an advanced oxidation process water treatment system to allow for treatment for 1,4-dioxane, as well as other volatile organic compounds. The treatment system is also capable of treating low level concentrations of PFAS. In August/September 2018, the Tucson Airport Remediation Project Plant was shut down for about three weeks to confirm PFAS levels in the plant's influent and effluent. Since December 2018, the Tucson Water Department has used granular activated carbon treatment at the Tucson Airport Remediation Project / advanced oxidation process treatment system at a frequency to ensure PFAS levels in treated effluent are below the current EPA PFAS health advisory level. The Tucson Airport Remediation Project / advanced oxidation process treatment system was shut down between June and November 2021, during which time the city of Tucson and the Tucson Water Department constructed an outfall to discharge treatment water to the Santa Cruz River and began construction on the infrastructure to send treated water into Tucson Water's recycled water system. The Tucson Water Department began discharging Tucson Airport Remediation Project treated water to the Santa Cruz River in November 2021 and began discharging water into the recycled water system on April 24, 2023.

Groundwater - Area B (Texas Instruments Property, AANG Base, West Cap Area, West Plume B Area)

In 1992, a groundwater pump and treat system for Texas Instruments property began operation. The system used air stripping technologies to remove volatile organic compounds from extracted groundwater, and water was reused in Texas Instruments' manufacturing processes.

In 1997, a groundwater pump and treat system was constructed at the AANG Base. This system also used air stripping technologies, and water was re-injected into shallow vadose zone wells.

Also in 1997, treatment at the Texas Instruments property was temporarily halted while a groundwater extraction system was built at the West Cap Area. The extraction system at the West Cap Area delivered water to the treatment system at the Texas Instruments property. In 1999, groundwater extraction and treatment resumed, treating water from both the Texas Instruments and West Cap areas.

In 2009, groundwater extraction and treatment stopped at the Texas Instruments property, West Cap Area, and the AANG Base, and an in-situ chemical oxidation pilot test was conducted from 2009 to 2017 using potassium permanganate. The pilot test was effective at reducing TCE concentrations. In November and December 2018, the AANG implemented an in-situ chemical oxidation remedial action.

At the West Plume B area, semi-annual groundwater monitoring is ongoing as part of the monitored natural attenuation remedy and is performed by AANG personnel.

2.3.2. Soil and Shallow Groundwater at the Airport Properties

AANG

The soil vapor extraction system at AANG operated from April 1996 to November 1997. The system reduced the concentration of volatile organic compounds in the soil gas to a level at which groundwater would no longer be impacted.

Airport Property

The shallow groundwater remediation system includes six groundwater extraction wells pumping groundwater to the centralized treatment facility. This treatment facility uses an air stripper to remove volatile organic compounds (primarily TCE) from the extracted groundwater. The treated water is reinjected into the Regional Aquifer upgradient of the extraction system, and the air stripper off-gas is treated by vapor-phase granular activated carbon prior to discharge to the atmosphere. The groundwater system has been offline since March 31, 2023, due to failure of an equalization pump flowmeter. Tucson Airport Authority is in the process of procuring the equipment needed to restart the plant and anticipates the system will be back online in 2023.

Soil contamination at the Airport Property is addressed by soil vapor extraction at the technical impracticability zone soil vapor extraction system and at Remedy Required Subsites. The technical impracticability zone soil vapor extraction system includes four soil vapor extraction well nests connected through a pipeline to the centralized treatment facility, which treats extracted vapors through vapor-phase granular activated carbon prior to discharge to the atmosphere. Each technical impracticability zone soil vapor extraction well nest consists of two soil vapor extraction wells, one well screened within Units 2 and 3, and one well screened within Unit 4.

The Tucson Airport Area landfill was capped in July 2011, and monitoring is ongoing.

The excavation and removal of pipeline sludges and soils contaminated with polychlorinated biphenyls above 0.76 mg/kg was completed in June 2012.

West Cap Area

A soil vapor extraction Pilot Treatability Study was conducted between August and December 2002. The soil vapor extraction system extracted approximately 180 pounds of total volatile organic compounds from a single vapor well near Building A. The results from the treatability study concluded that TCE and tetrachloroethylene concentrations were significantly reduced in all soil vapor monitoring wells within the source area. The residual volatile organic compound mass in the vadose zone within the source area was determined not to pose a significant threat to groundwater. Therefore, additional treatment of the vadose zone was not considered necessary.

2.3.3. Institutional Controls

Institutional controls involve controlling exposure to contaminated media by controlling access, implementing administrative policies such as groundwater use restrictions, educating the public, and providing compliance and enforcement mechanisms. Administrative controls in place at the Site and on the Tohono O’odham Nation in relation to the use of groundwater are expected to remain in place and prevent exposure to impacted groundwater. These institutional controls include requiring groundwater withdrawal permits, implementing hazardous waste training, maintaining general security, developing and implementing standard operating procedures, developing and implementing environmental regulations, and holding quarterly community meetings.

The primary institutional controls of the entities affected by the Site consist of the following:

- A policy of the Tucson International Airport Area that prevents drilling production wells and/or using groundwater on airport property affected by the plume.
- In accordance with the City of Tucson Water Department Plan: 2000 – 2050; 2012 Update (Tucson, 2013b), the current and foreseeable future practice that the City of Tucson will provide all potable water to the entire area within and surrounding the Site.
- Arizona Revised Statutes 45, Chapter 2, Article 10, requires that a well is to be drilled by a licensed contractor, the contractor will use approved well construction methods, and a Notice of Intent to be filed with Arizona Department of Water Resources whose staff will review the Notice of Intent for proximity to the Site and confer with EPA and ADEQ before approval.
- Pima County monitored and inspected all private wells within the TCE and 1,4 dioxane groundwater plume footprint and provided reports to the public, EPA, and ADEQ on an annual basis from the 1990s through 2019. The monitoring has not been funded since 2019.
- Regulations of the Tohono O’odham Nation focus on protecting the groundwater and requiring permits for new wells or expanded groundwater withdrawals from existing wells. Groundwater wells are regulated under the Tohono O’odham Nation Water Code that contains requirements for permitting and registering existing and new wells. The code contains provisions that would allow

the Nation to prohibit use or installation of wells that could be affected by contamination such as the Tucson International Airport Area Superfund Site groundwater plume.

2.4. System Operations/Operation and Maintenance

2.4.1. Operations and Maintenance Requirements

2.4.1.1 Groundwater - Area A

The Tucson Airport Remediation Project groundwater treatment facility operates in compliance with the 1991 Tucson Airport Remediation Project consent decree, which has three obligations: 1) control of contaminant migration, 2) aquifer remediation, and 3) treatment of extracted groundwater. Treated water samples from the Tucson Airport Remediation Project groundwater treatment facility are collected weekly to ensure cleanup levels are met. The Tucson Water Department reports to ADEQ monthly the parameters associated with an Arizona Pollutant Discharge Elimination System permit that allows the Tucson Water Department to discharge treated Tucson Airport Remediation Project water into either the Santa Cruz River or the Tucson Water Recycled Water System.

2.4.1.2 Groundwater - Area B

Operations and maintenance of an active remedy are not occurring at AANG, Texas Instruments, or West Cap because groundwater extraction and treatment stopped in 2009. A pilot test for in-situ chemical oxidation was started in 2009. The 2012 Record of Decision selected in-situ chemical oxidation as the remedy at these sites, which occurred through 2018. Post-remedial groundwater monitoring is conducted regularly to evaluate in-situ chemical oxidation effectiveness. At West Plume B, monitored natural attenuation is evaluated by monitoring groundwater concentrations of site chemicals of concern and monitored natural attenuation parameters.

2.4.1.3 Soil and Shallow Groundwater at the Airport Properties Groundwater Extraction and Treatment

The shallow groundwater zone remedy includes the extraction and treatment of contaminated groundwater and reinjection of treated water into the Regional Aquifer. The groundwater extraction system includes three groundwater extraction subsystems: technical impracticability zone shallow groundwater zone extraction system, On-Airport Property shallow groundwater zone extraction system, and the Off-Airport Property shallow groundwater zone extraction system. The three groundwater extraction subsystems operate simultaneously to establish and maintain hydraulic containment of the groundwater in the shallow groundwater zone within each of these sub-areas. The groundwater is conveyed to the central treatment facility for treatment and is ultimately reinjected into the Regional Aquifer. The treatment process includes an equalization tank, air stripper to remove TCE, and vapor carbon treatment of air stripper off-gas.

Soil Vapor Extraction

Two soil vapor extraction systems operate at the Airport Property. The technical impracticability zone soil vapor extraction is used to laterally and vertically contain volatile organic compound soil vapors in

subsurface soils within the technical impracticability zone. The Remedy-Required Subsites³ soil vapor extraction system is operated to mitigate migration of soil vapors outside of Remedy-Required Subsites and to the shallow groundwater zone. Both systems are to be operated until volatile organic compound concentrations are reduced such that ceasing operations of the soil vapor extraction will not cause water quality impacts to the shallow groundwater zone outside the technical impracticability zone or to the Regional Aquifer. The off-gas control for the soil vapor extraction systems is required to ensure discharge standards are met. Soil vapor extraction influent and granular activated carbon off-gas are sampled quarterly.

2.4.2. Significant Operations and Maintenance over the Past Five Years

Groundwater - Area A

Since December 2018, the Tucson Water Department has used granular activated carbon treatment at the Tucson Airport Remediation Project / advanced oxidation process treatment system at a frequency to ensure PFAS levels in treated effluent are below both the current EPA PFAS health advisory level and the Tucson Water Department's own PFAS operating guidelines. The Tucson Airport Remediation Project / advanced oxidation process treatment system was shut down between June and November 2021, during which time the city of Tucson and the Tucson Water Department constructed an outfall and obtained an Arizona Pollutant Discharge Elimination System permit to discharge Tucson Airport Remediation Project treatment water to the Santa Cruz River and began construction on the infrastructure to send Tucson Airport Remediation Project treated water into Tucson Water's recycled water system. The Tucson Water Department began discharging Tucson Airport Remediation Project treated water to the Santa Cruz River in November 2021 and began discharging water into the recycled water system on April 24, 2023.

The Tucson Water Department received a grant from the Arizona Department of Environmental Quality to design and construct a PFAS pre-treatment system at the Plant. The grant was awarded in late December 2022, but preliminary planning activities were already underway with initial design including sediment removal and ion exchange media to remove PFAS. Final design is expected to be complete in early 2024, with construction beginning shortly thereafter.

In order to protect the public health of the Tucson Water Department customers, the Tucson Water Department made the decision in 2018 to remove South Well Field from operation to limit the high concentrations of PFAS from entering the plant. The existing Treatment Plant was not designed to treat PFAS contaminant. The objective of the South Well Field is to provide mass removal of TCE from the Regional Aquifer and the objective of the North Well Field is to contain the TCE plume in the Regional Aquifer.

³ Remedy-Required Sites are areas with elevated Volatile Organic Compounds soil gas in shallow soils and within the TI zone on the Airport Property and include: Former Buildings 14/15, Former Buildings 16/17, Former Buildings 18, South Portion of Hangar 2, Soils beneath West Lease USTs, Former Building 25 and Adjacent Soils, North and East Sides of Hangar 1 and Hangar 1.

Three desanding hydrocyclones were installed in approximately 2019 to remove gravel from the influent, and the extraction well casings were fixed during that time. The desanders are maintained quarterly and have remedied the gravel issue noted in the previous Five-Year Review.

Three new vessels were added to the advanced oxidation process water treatment system within the past two years to handle greater flowrates, which brought the number of vessels to nine.

Soil and Shallow Groundwater at the Airport Property

Routine maintenance and repairs required short periods of downtime for the shallow groundwater zone and soil vapor extraction systems throughout the reporting period. Periods of down time longer than a week for the shallow groundwater zone system are reported below:

- 11.5 days of downtime in June 2019 for tank maintenance.
- 13.3 days of downtime in July 2019 for tank maintenance.
- 18.3 days of downtime in September 2022 due to a pump failure at extraction well EW-2R.
- Anticipated greater than approximately 115 days of downtime starting on March 31, 2023, due to the failure of the Equalization Tank flow meter. As of August 2023, the system was still under repair.

Periods of down time longer than a week for the soil vapor extraction systems are reported below:

- A total of 10.9 days (263 hours) of downtime in June 2019 over a period of 26 days for the Remedy-Required Subsites soil vapor extraction system due to periods of being shut off when incoming air was too hot (>110 degrees Fahrenheit), in order to protect the blower.
- 61.3 days of downtime between April 8 and June 8, 2021, for the Technical Impracticability Zone soil vapor extraction system due to replacement and maintenance of blower bearings.
- 16.6 days of downtime in June 2021 for the Remedy-Required Subsites soil vapor extraction system due to incoming air being too hot (>110 degrees Fahrenheit), in order to protect the blower.
- >291 days of downtime for the Remedy-Required Subsites soil vapor extraction system starting on August 23, 2022, due to a communications component failure. There have been extended delays to obtaining replacement parts due to supply chain issues. As of August 16, 2023, the system was still down.
- Although the South Well Field wells have been shut down since 2018, USACE evaluated six wells downgradient of the South Well Field that were evaluated in the previous Five-Year Review for consistency between reviews and to verify that conditions are not deteriorating due to the shutdown of the South Well Field. Two of the six wells had increasing concentrations, four were had either decreasing or stable trends. The increase in concentrations may be a result of the shutdown of the South Well Field or possibly the extended shutdown of the treatment system at AFP44 located upgradient of the South Well Field; however, all TCE is expected to be captured by the North Well Field. Based on these statistical results the plume margins appear stable and are not expanding during South Well Field shutdown.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statements from the 2018 Five-Year Review for the Tucson International Airport Area Superfund Site for Operable Units 1 through 3 stated the following:

The remedy at Operable Unit 1 currently protects of human health and the environment. Contaminant containment is occurring, and the groundwater treatment systems are operating to treat contaminated groundwater to below MCLs and to reduce groundwater contaminant concentrations. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: re-evaluate the operation of the remedy, if groundwater levels continue to rise; and investigate the extent of PFCs [Perfluorinated or polyfluorinated compounds] in groundwater.

The remedy at Operable Unit 2 currently protects human health and the environment because contamination in the vadose zone is decreasing via soil vapor extraction, reducing transport to groundwater. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: evaluate site conditions and groundwater extraction treatment systems to determine whether to optimize the existing extraction and treatment systems or evaluate alternative remedial technologies; re-evaluate the operation of the remedy, if groundwater levels continue to rise; and investigate the possible presence of PFCs in groundwater.

The remedy at Operable Unit 3 currently protects human health and the environment because treated groundwater meets drinking water standards and regional screening levels, and there is no exposure pathway for human health or the environment. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: prepare an ESD to include Land Use Restrictions the remedy for these sites; consider alternative technology for high chromium area; complete the indoor air investigation at Building 801; re-evaluate the operation of the remedy, if groundwater levels continue to rise; and investigate the extent of PFCs in groundwater.

The 2018 Five-Year Review included three issues and recommendations (Table 5).

Table 5. Status of Recommendations from the 2018 Five-Year Review

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1,2	Rising regional groundwater levels may impact remedies within the next five years.	Continue to monitor groundwater levels and evaluate next steps if remedies are impacted by rising water levels.	Completed	A Revised Conceptual Site Model was prepared for the Airport Property in August 2023 that evaluated the effect of rising groundwater on the remedy. Water level measurements are required as part of the Sampling Plans. EPA has identified remedies that might need modifications due to water levels rising.	August 2023
1,2	Based on the operational history of the Site, Perfluorinated compounds may be present	Perform an investigation to determine extent of Perfluorinated compounds.	Ongoing	Investigations of perfluorinated compounds are ongoing and are at various stages of completion across the Site. See Section 3.2.	Click here to enter a date
2	Increasing TCE concentrations indicate full capture of the TCE plume may not be occurring.	Evaluate Site conditions to determine the cause of TCE contaminant increase and evaluate the existing remedial action to determine whether to optimize the existing system or pursue alternative remedial technologies.	Completed	A Revised Site Conceptual that reflects current conditions was submitted in August 2023. An Optimization Work plan may be prepared in 2024 to evaluate the existing system and alternative remedial technologies.	August 2023

Notes: OU = Operable Unit

3.2. Work Completed at the Site During this Five-Year Review Period

A tenth remediation well (R-127A) was installed in the North Well Field for the Tucson Airport Remediation Project groundwater treatment facility (Groundwater – Area A) and began operation in April 2022. The well was installed to expedite remediation of plume contaminants. Other changes that were made to the Tucson Airport Remediation Project treatment facility are included in Section 2.4.2. (Significant Operations and Maintenance).

A Revised Conceptual Site Model report for the Airport Properties was completed in October 2022 in order to update the 1995 baseline conceptual site model. The Revised Conceptual Site Model updates for fundamental changes that have occurred since the Remedial Investigation, most notably, the effect on the Site of the elevation of the Regional Aquifer elevation having risen by over 20 feet and the implications of it continuing to rise. The report also contains a basis for evaluating and optimizing the existing remedies.

Four nested monitoring wells (WC-25/WC-25A and WC-26/WC-26A) at two locations were installed downgradient of the source area for the West Cap area.

Since the discovery of PFAS, work to characterize the nature and extent of PFAS contamination has been performed across parts of the Site. The investigations at each property are at various stages of progress and are summarized below in Table 6.

Table 6. Status of PFAS Investigations

Subsite Name	PFAS Work	Entity Performing the Work	PFAS Sampled By	Sampling Completed?	Status
Airport Property	One round of PFAS sampling conducted in 2018 by EPA. Source areas were found.	Tucson Airport Authority	EPA	No	At the request of EPA, ADEQ completed sampling of groundwater at 83 Airport wells for PFAS in July and August 2023
Tucson Airport Remediation Project	The City of Tucson is performing routine PFAS sampling for Tucson Airport Remediation Project.	City of Tucson	City of Tucson	Yes	The City of Tucson continues routine PFAS sampling of key wells at Tucson Airport Remediation Project.
Texas Instruments	None	Texas Instruments	None	No	At the request of EPA, ADEQ began planning for sampling of groundwater for PFAS at Texas Instruments in July 2023.
Arizona Air National Guard	Preliminary Assessment / Site Investigation completed.	Air National Guard	Air National Guard and ADEQ	No	Site groundwater wells were sampled for PFAS in 2021. The Remedial Investigation/Feasibility Study workplan is under review and work is scheduled to start in October 2023.
West Cap	None	EPA	None	No	At the request of EPA, ADEQ began planning for sampling of GW for PFAS at West Cap in July 2023 .
West Plume B	Site groundwater wells were sampled for PFAS in 2021	EPA	Air National Guard and City of Tucson	Yes	Additional PFAS sampling considered for 2024.

In 2019, ADEQ worked with the Pima County Department of Environmental Quality with assistance from the Tucson Water Department to identify active private drinking water wells in the vicinity of the Site and sampled them for PFAS. ADEQ identified properties where available data indicated a private well may exist and then reached out to property owners. Based on property owner responses, information from available records, phone conversations, and site visits, most of the private wells that were identified as potentially containing PFAS contamination are likely not active or no longer exist. Eight domestic wells and one irrigation well were identified as being active and having a use that could potentially result in the ingestion of PFAS from contaminated water. In October and December 2019, ADEQ sampled all nine wells. Three wells used for drinking water exceeded EPA's 70 nanogram per liter (ng/L) PFAS advisory level. While EPA has published a proposed rulemaking to establish Maximum Contaminant Levels for PFAS compounds, the standards have not been finalized. ADEQ and the National Guard began supplying bottled water to the residences until the residences were connected to the Tucson Water Department. At the request of the property owner with the irrigation well, ADEQ also sampled the irrigation well, which detected PFAS above EPA's 70 ng/L PFAS advisory level. This property owner was already connected to Tucson Water.

4. Five-Year Review Process

4.1. *Community Notification, Involvement and Site Interviews*

4.1.1. Five-Year Review Public Notice

A public notice was made available by newspaper posting in the *Arizona Daily Star* on May 3, 2023, stating that there was a Five-Year Review and inviting the public to submit any comments to EPA. EPA received no comments. The results of the review and the report will be made available at the Site information repositories located at the Valencia Public Library, 202 W. Valencia Road, Tucson, Arizona 85706 and at the EPA Region 9, Records Center, Mail Stop SFD-7C, 95 Hawthorne Street, Room 403, San Francisco, CA 94105. They will also be posted on the EPA's website at <http://www.epa.gov/superfund/tucsonairport>.

4.1.2. Site Interviews

During the Five-Year Review process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The results of these interviews are summarized below.

EPA either interviewed or solicited written responses to questions from the Tucson Water Administration, AANG, the Arizona Department of Environmental Quality, the Air Force, the Tucson Airport Authority, GHD Services, Inc. (the technical consultant working on behalf of the responsible parties on the cleanup for the Airport Property), and the Unified Community Advisory Board for the Site. The specific responses of individuals from each group that responded can be seen in Appendix G.

The Tucson Water Administrator wrote responses to questions about the Tucson Airport Remediation Project (Groundwater – Area A) on February 16, 2023. The Tucson Water Department continues to proactively address water quality issues that arise at the Site. Since December 2018, the Tucson Water Department has replaced granular activated carbon at the Tucson Airport Remediation Project / advanced oxidation process treatment system to ensure PFAS levels in treated effluent are below both the current EPA PFAS health advisory and the Tucson Water Department's own PFAS operating guidelines. The Tucson Water Department purchased and developed the capability to analyze for PFAS in-house, resulting in turn-around-time of 2-3 days for analytical results, compared to about 6-8 weeks with commercial laboratories. The Tucson Water Department is in the process of designing a PFAS pre-treatment system at the treatment plant, with final design expected to be complete in early 2024 and construction beginning shortly thereafter.

Tucson Airport Authority wrote responses to questions about the Airport Property on February 21, 2023. Both the shallow groundwater zone remedy and soil vapor extraction Technical Impracticability Zone remedy were reported to have high operational run-time rates, at approximately 95% over the past five

years. They recommended that technical questions and next steps resulting from the completion of the revised Conceptual Site Model be discussed at Technical Working Group meetings between agencies, technical support consultants, and the supervising contractor, GHD Services, Inc. Two instances of vandalism were reported, involving damage to fencing and an entrance gate, with one instance including theft of ground wire from a meter.

GHD Services, Inc. wrote responses to questions about the Airport Property on February 21, 2023. The remedies were reported to have successfully removed large volumes of contaminant mass in the shallow groundwater zone and gravel subunit through groundwater extraction and soil vapor extraction since start-up of the remediation systems in 2007. However, the rising groundwater levels are affecting the effectiveness of each treatment system. It was stated that fundamental Site conditions for which the shallow groundwater zone remedy was designed are no longer present and significant modification of the existing groundwater extraction remediation system or an entirely new remedial approach will be necessary as groundwater continues to rise. A Focused Feasibility Study Work Plan was recommended to be prepared to evaluate strategies and/or technologies that would potentially be more effective based on current Site conditions and/or technologies that did not exist when the Record of Decision was issued. Extended delays of the soil vapor extraction remediation system were reported due to system challenges and failures in late 2022 and 2023.

EPA interviewed the community co-chair of the Unified Community Advisory Board on April 11, 2023. The co-chair stated that the City of Tucson is doing a great job at community outreach and gaining community trust, in addition to operating the treatment system and containing groundwater contamination. Because of increasing development around the treatment plant, the co-chair recommended to be proactive with educating new property owners about the Site, including making sure people understand that the plant is not putting them at any risk of exposure to contaminants.

4.2. Data Review

This data review includes an analysis of the multiple remedies established in the RODs for each operable unit and its respective remedial action objectives. These remedies are discussed below with further details presented in Appendix C.

4.2.1. Groundwater – Area A – Tucson Area Remediation Project

The Tucson Airport Remediation Project North Well Field groundwater extraction system appears successful in controlling contaminant migration downgradient of the North Well field. Despite the temporary shutdown of the Tucson Airport Remediation Project from June to November 2021 (discussed in Section 3.3.1), TCE concentrations are not increasing in monitoring wells downgradient of the extraction wells that are beyond the capture zone. Potentiometric surface maps are also consistent with a capture zone that is larger than the targeted capture zone, by showing concave groundwater elevation contours surrounding the extraction wells that extend past the targeted capture zone (Figure 4).

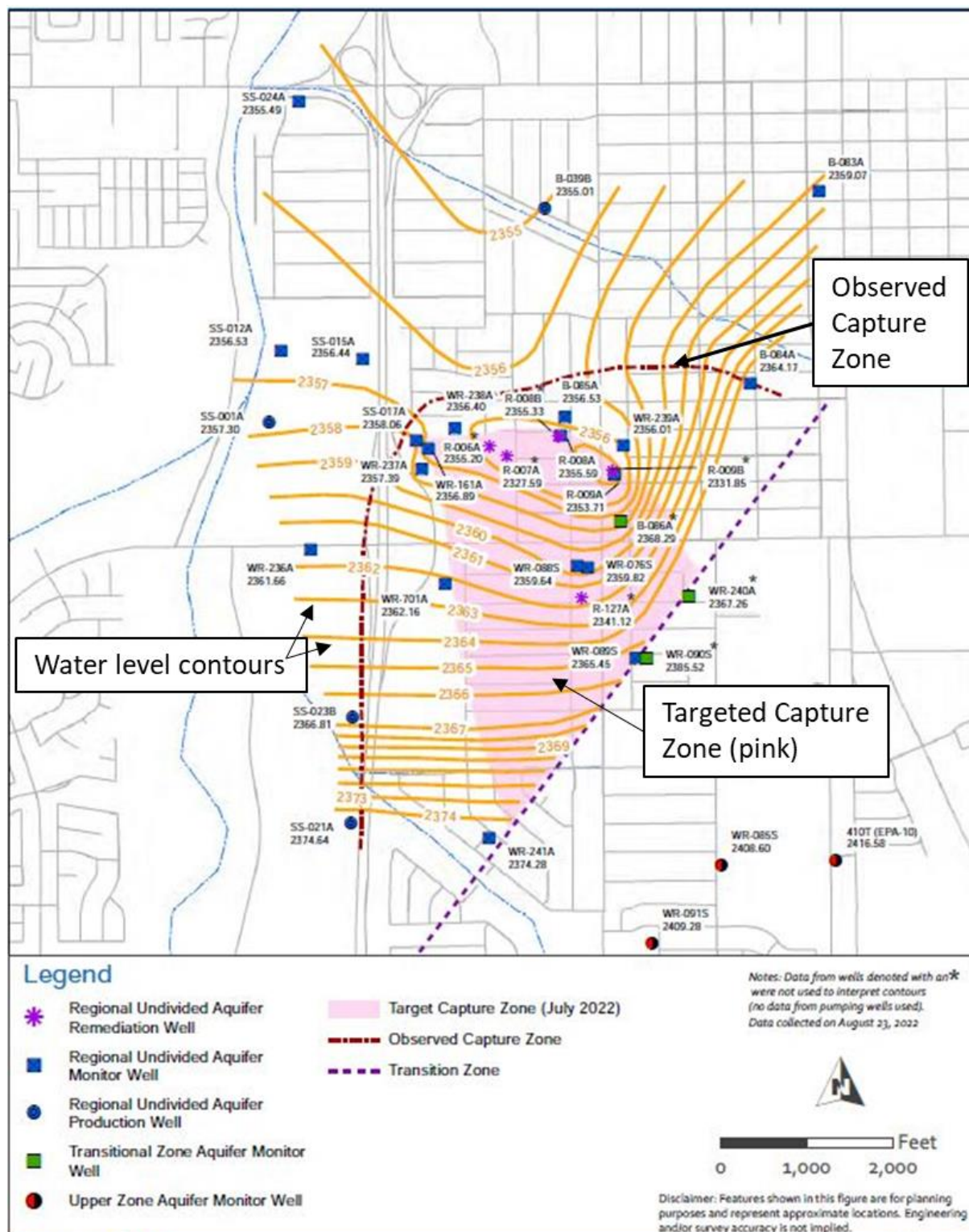
USACE evaluated six wells in the North Well Field along the margins of the plume and six wells downgradient from the North Well Field for contaminant trend analysis for TCE. While six of those

twelve wells had increasing trends, each one was within the observed capture zone and had low level detections that are less reliable for trend analysis. All concentrations of TCE within the increasing trends wells were also below the federal drinking water standard of 5 µg/L, with the exception of temporary exceedances for well SS-017A where TCE was reported at 5.4 µg/L and 5.3 µg/L in June and July 2022, respectively. Further detail on trend analysis is presented in Appendix C.

Although the South Well Field wells have been shut down since 2018, USACE evaluated six wells downgradient of the South Well Field that were evaluated in the previous Five-Year Review for consistency between reviews and to verify that conditions are not deteriorating due to the shutdown of the South Well Field. Two of the six wells had increasing concentrations, four were had either decreasing or stable trends. The increase in concentrations may be a result of the shutdown of the South Well Field or possibly the extended shutdown of the treatment system at AFP44 located upgradient of the South Well Field; however, all TCE is expected to be captured by the North Well Field. Based on these statistical results the plume margins appear stable and are not expanding during South Well Field shutdown.

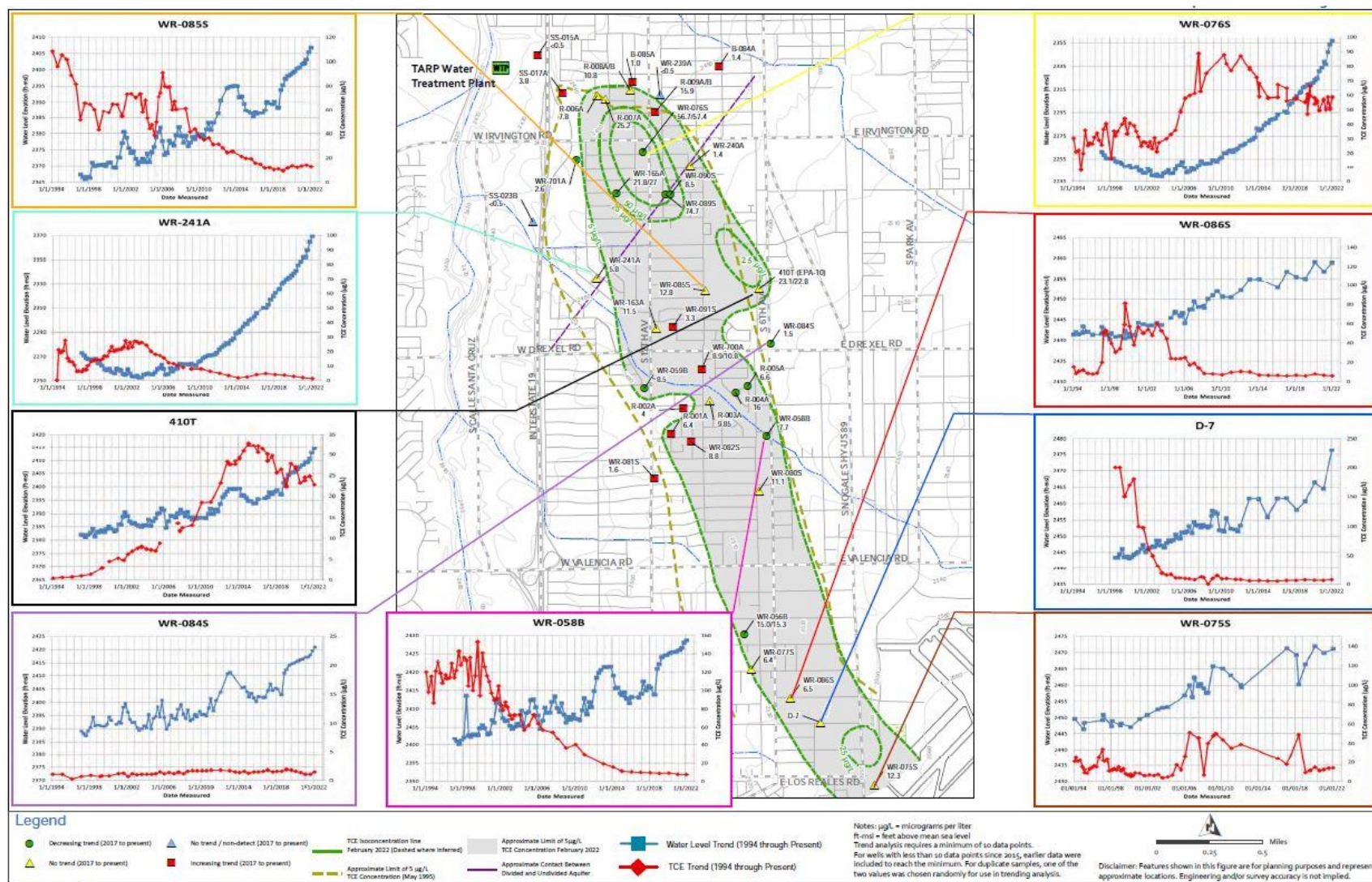
Groundwater in Area A continues to make progress towards aquifer restoration. The majority of the TCE concentrations are stable or decreasing. However, increasing groundwater elevations may be allowing for contaminants to diffuse from fine-grained sediments in some portions of the aquifer and increasing groundwater elevation may make this more of a concern over time.

The Tucson Airport Remediation Project is successful in treating extracted water for contaminants, including the treatment of 1,4-dioxane (Operable Unit 5). The Tucson Water Department currently operates the water treatment plant that captures and treats contaminated groundwater at the leading edge of the groundwater plume to prevent further migration to the north. The water treatment plant treats approximately 5,000-gallons per minute extracted from the Regional Aquifer. The project changed from granular activated carbon filtration to the advanced oxidation process facility to include treatment of 1,4-dioxane in 2014. Currently, Tucson Water Department is discharging treated water to the Santa Cruz River and the Tucson Water recycled water system.



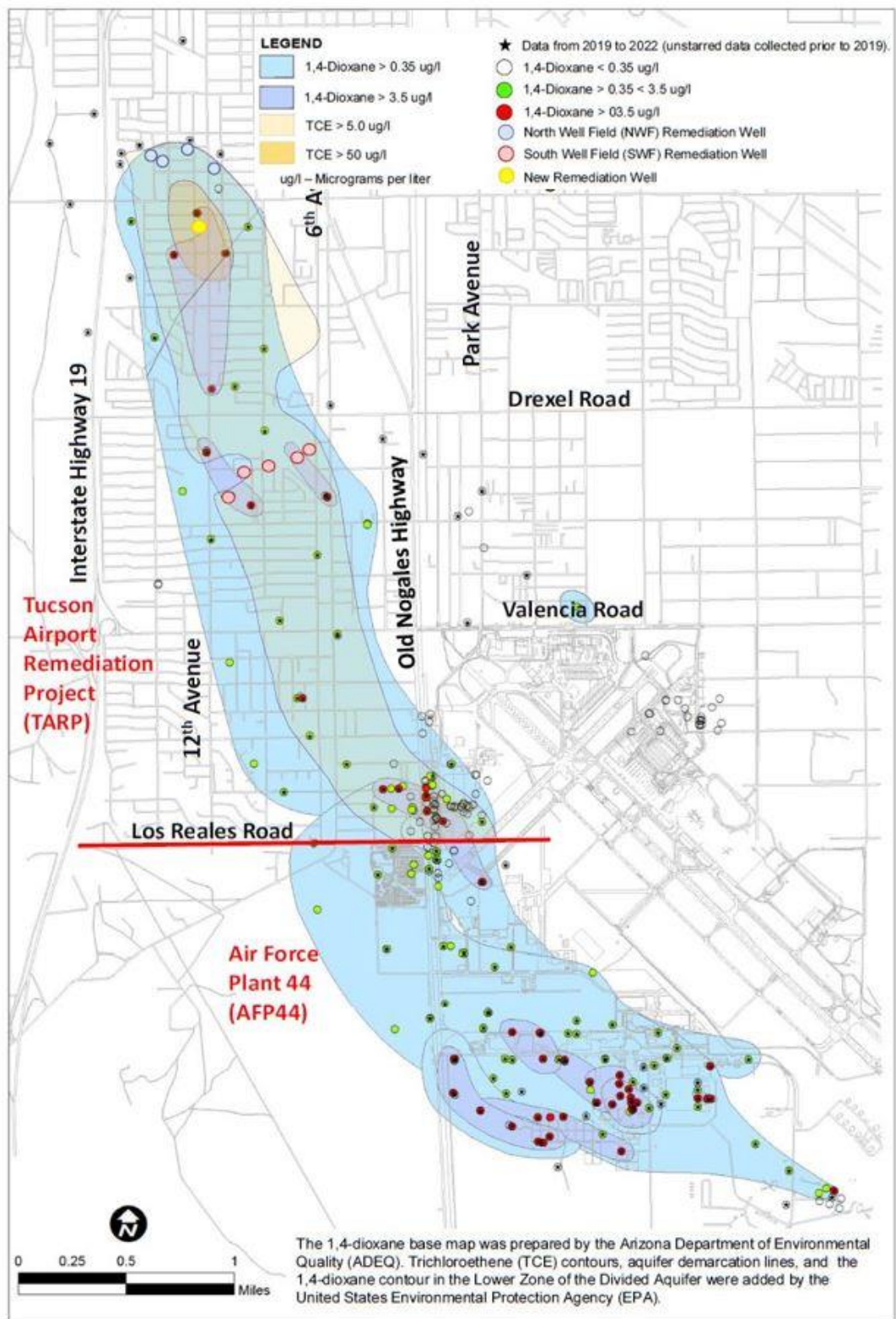
Source: Tucson Water Department. Final Semi-Annual Status Report September 2021 through February 2022.

Figure 4. North Well Field at the Tucson Airport Remediation Project Representing Targeted and Observed Capture Zones for the TCE and 1-4 Dioxane Plumes.



Source: Tucson Water Department. Final Semi-Annual Status Report September 2021 through February 2022.

Figure 5. TCE plume (gray) with TCE Concentration and Regional Groundwater Elevations Throughout the Tucson Airport Remediation Project Plume North of Reales Road.



Source: EPA IROD, 2023.

Figure 6. 1,4-Dioxane and TCE Occurrence for the Tucson International Airport Superfund Site.

4.2.2. Groundwater – Area B – Texas Instruments

In 2016, potassium permanganate, an in-situ chemical oxidant, was injected into the subsurface to reduce contaminant concentrations and prevent migration. USACE evaluated water quality data following treatment in 2016 through 2022. The data show an initial decrease in TCE concentrations in some wells, with rebounding of concentrations again in some wells.

USACE conducted the trend analysis of TCE concentrations in five wells which showed increasing TCE concentration in one well (AW-2R), which also has the highest magnitude of TCE concentrations in the monitoring wells, at 65.4 µg/l in February 2022. AW-2R is located directly downgradient of the injection wells and the increasing trend appears to be the result of rebounding concentrations after an initial decrease following the 2018 injections. The other four wells showed either no trend (three wells) or a decreasing trend (one well). Two of the wells with no trend had concentrations of TCE above the cleanup level. Of the nine wells sampled in total, four remain elevated above the cleanup level (Figure 7).

Progress towards the remedial action objective of restoration of shallow groundwater where practicable does not appear to be on track, as evidenced by the rebounding of TCE concentrations from below the cleanup level shortly after injections to 13 times higher than the cleanup level in AW-2R as of 2022, and the two wells with concentrations remaining above the cleanup level that exhibit no trend after the injections.

An evaluation of total chromium concentrations in three downgradient wells showed concentrations of chromium above the cleanup level in two wells. One well had increasing concentrations of chromium, with a concentration 33 times above the cleanup level. The remedial action objective of preventing migration of contaminants in groundwater only applies to volatile organic compounds, but restoring the Shallow Groundwater Zone to drinking water quality wherever practicable applies to all contaminants.

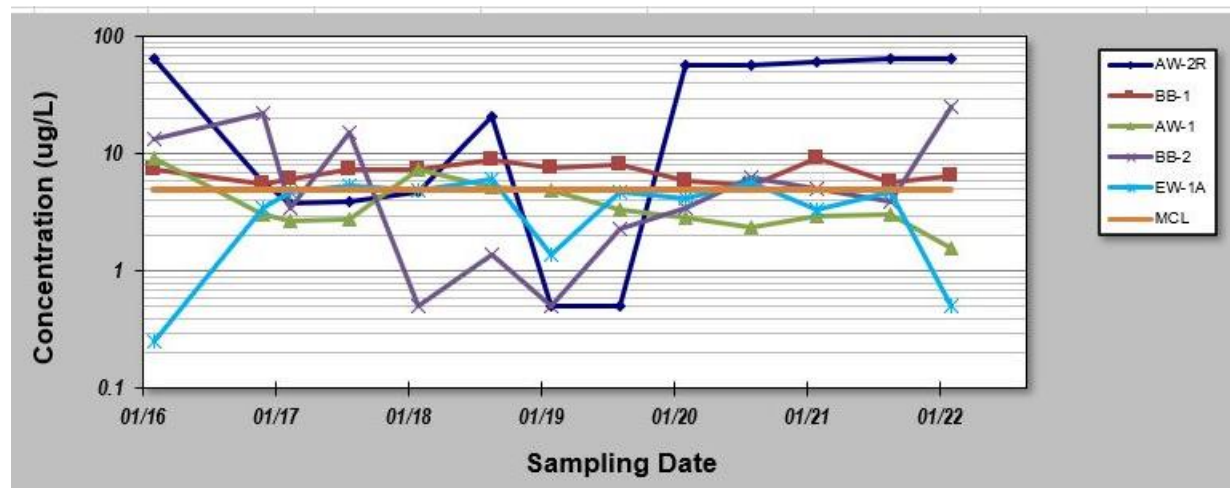
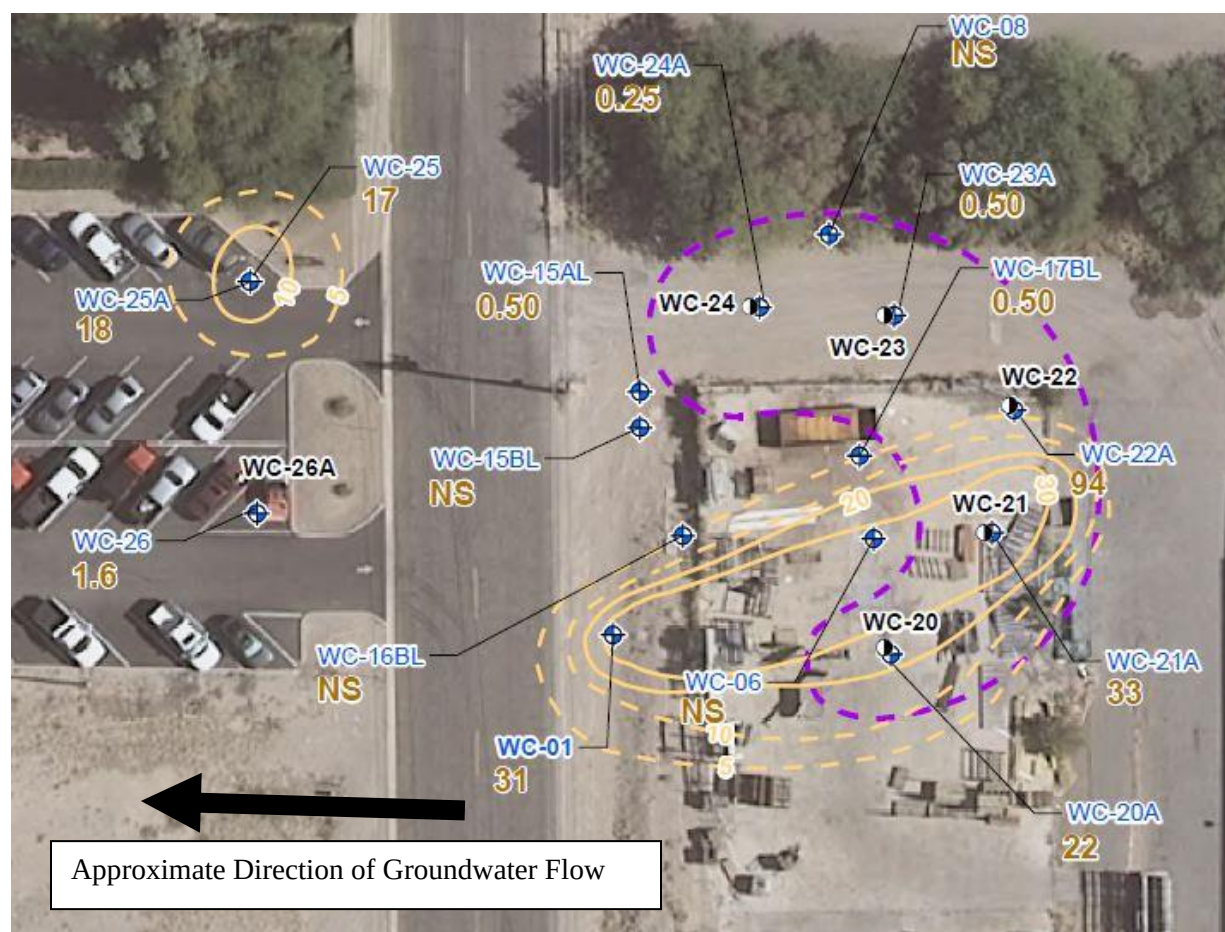


Figure 7. TCE Concentrations at Texas Instruments Following the 2016 Injections.

4.2.3. Groundwater – Area B – West Cap

The West Cap remedy includes in-situ chemical oxidation injection in 2014 followed by performance monitoring. Downgradient wells with TCE remaining above the cleanup level outside of the treatment area generally decreased in TCE concentrations following the injections (WC-15A-L, WC-25, WC-25A), with the exception of WC-1, which appeared unaffected and is closer to the source area, at its southern extent (Figure 8). The treatment therefore generally showed success towards meeting the remedial action objective of preventing further horizontal migration of volatile organic compounds. The furthestmost downgradient wells from the source remain slightly elevated above the cleanup levels (Figure 9).



Source: APTIM, 2022.

Figure 8. Source Area West Cap – March 2022 TCE Analytical Contours (yellow) and the Target Treatment Area (purple)



Source: APTIM, 2022.

Figure 9. Downgradient of Source Area West Cap

Initially, the in-situ chemical oxidation reduced concentrations to below cleanup levels; however, TCE concentrations have increased in source area wells at the upgradient extent of the property, at the central and southern extents of the source area (WC-20A, WC-21A, WC-22A) and remain elevated above the cleanup level in the source area. TCE concentrations ranged from non-detect to 94 µg/l (March 2022) at well WC-22A, which is located within the target treatment area.

4.2.4. Groundwater – Area B – Arizona Air National Guard

The AANG Base is generally meeting the remedial action objective of controlling contaminant migration; however, there are increasing TCE trends downgradient in the Upper Subunit, discussed below. Eight out of twenty-six monitoring wells contained TCE concentrations above the cleanup level (five wells in the upper subunit and three wells in the lower subunit). On-site wells ranged in concentration from 0.17 µg/l to 12 µg/l.

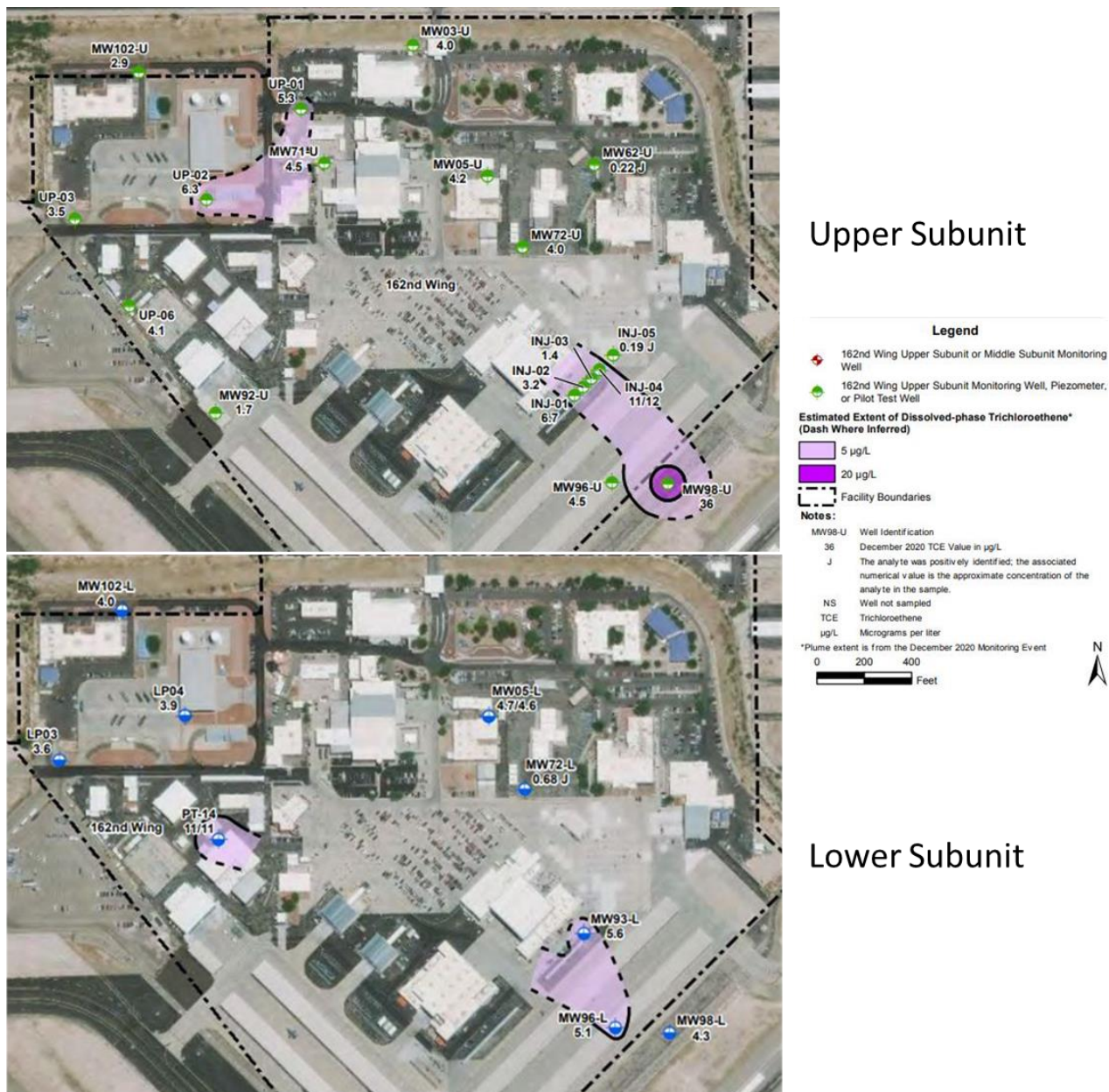
USACE performed Mann-Kendall trend analysis on five wells in the upper subunit (three at the downgradient extent of the plume, one mid-plume, and one off-property upgradient) and six wells in the lower subunit (one at the downgradient extent of the plume, two mid-plumes, two at the source area, and one off-property upgradient; Table 7).

- In general, concentrations in the upper subunit have remained stable or decreased at or near the cleanup level. The upgradient well (MW98-U), which also has the highest concentrations, shows decreasing trends. Two upper subunit wells have increasing trends (UP-01 and UP-02), which are located at the downgradient extent of the plume. The magnitude of contamination in UP-01 and UP-02 fluctuated above and below the cleanup level of 5 µg/l within the past five years, with the highest concentration detected of 6.3 µg/l.
- All monitoring wells analyzed in the lower subunit have either stable or decreasing concentration trends. One well in the source area (MW93-L) remains stable with a concentration generally detected just above the cleanup level of 5 µg/l (5.6 µg/l in December 2020). Downgradient well MW-100L is decreasing and below the cleanup level. Mid-plume well PT-14 has the highest concentration in the lower subunit (11 µg/l in December 2020) and is showing no trend.

The rising groundwater levels may result in back diffusion of contaminants from source areas and contribute to increasing TCE concentration trends over time. There is also a concern that contaminant mass is migrating onto the property from upgradient sources, as evidenced by the high TCE concentrations in MW-98U. This concentration is much greater than concentrations observed on AANG Base property; however, it is decreasing in concentration.

Table 7. Trend Analysis for select wells at Arizona Air National Guard

Well	Subunit	Location within Plume	Trend	Confidence
MW-98U	Upper	Off-property; upgradient	Decreasing	99.9%
MW71-U	Upper	Downgradient	Stable	77.7%
MW05-U	Upper	Mid-plume	Probably Decreasing	93.6%
UP-01	Upper	Downgradient	Increasing	99.8%
UP-02	Upper	Downgradient	Increasing	99.2%
MW05-L	Lower	Mid-plume	Decreasing	96.3%
MW93-L	Lower	Source Area	Stable	81.0%
MW96-L	Lower	Source Area	Stable	77.7%
MW98-L	Lower	Off-property; upgradient	Decreasing	96.9%
MW100-L	Lower	Downgradient	Decreasing	98.9%
PT-14	Lower	Mid-plume	No Trend	86.4%



Source: Wood, 2021

Figure 10. Arizona Air National Guard TCE Concentrations for the Upper and Lower Subunits (Dec. 2020).

4.2.5. Groundwater – Area B – West Plume B

The West Plume B TCE groundwater plume appears to be stable and is not migrating vertically or horizontally. USACE performed trend analysis on five wells; three wells resulted in stable trends and two wells resulted in decreasing trends. TCE concentrations ranged from non-detection to 6.9 µg/L during the review period. Monitoring wells WPB-8, WPB-11 and MW-AF-03 exceeded the federal drinking water standard of 5 µg/L, at concentrations below 5.5 µg/L. These wells are located centrally across the southern, middle, and northern area of West Plume B. Groundwater flows to the north-northwest. The presence of breakdown products of TCE indicate monitored natural attenuation is occurring at the West Plume B.

4.2.6. Soil and Shallow Groundwater at the Airport Property

The multiple remedies operating at the Airport Property are mostly successful in meeting the remedial action objectives. However, rising groundwater levels may impact the performance of the groundwater remediation system as well as the soil vapor extraction system in the long-term.

The regional groundwater level is increasing at a steady rate and is in contact with the clay and overlying gravel/clay (Unit 4) (Figure 12). The soil vapor extraction system relies on draining of the Upper Unit 4 Clay into Unit 4 Gravel Subunit to allow for adequate SVE capture and extraction (Figure 11). In addition, the dewatering and treatment in the Unit 4 Gravel Subunit provides groundwater capture and treatment and prevents its migration into the Regional Aquifer. Currently, the Gravel Subunit is saturated, the effectiveness of the soil vapor extraction remedy is reduced, and potential migration of contamination to the Regional Aquifer may occur over time.

The Soil Vapor Extraction remedy includes the soils within the Technical Infeasibility Zone, the Remedy-Required Sites, and the Plug-in Subsites⁴. The soil vapor extraction system has historically been successful at reducing volatile organic compounds from the soil contaminated in and around the Technical Infeasibility Zone. Most of the mass was removed from the Technical Infeasibility Zone within the first 3 years of startup; however, the system continues to operate and remove approximately 0.5 to 1 pound of volatile organic compound vapors per month (Figure 13). Soil vapor sampling was completed before and after vapor extraction operation, which resulted in 3 to 4 magnitude reduction in vapor concentrations within the Technical Infeasibility Zone and surrounding area. Further details are provided in Appendix C.

Additional evidence for the Soil Vapor Extraction system meeting the remedial action objectives is soil gas confirmation sampling in the Technical Infeasibility Zone and surrounding areas (Figure 14). Recent soil gas sampling has indicated great improvements in concentrations compared to historic soil vapor concentrations. Recent soil vapor concentrations are below regulatory limits in and around the Technical

⁴ The localized plumes in the Shallow Groundwater Zone in the Former Building 32 (S-17) Area and in the West End of Runway 3 Area are separate from the main Shallow Groundwater Zone plume, and they are each identified as separate Plug-In Subsites of the Shallow Groundwater Zone Remedy. The Plug-in Approach allows multiple, similar, but separate subsites (areas within the larger site) to make use of the same remedy at different times. Under this approach, EPA selects a standard remedy that applies to a given set of conditions and defines a process and set of criteria for determining where those conditions exist. There are an additional seven plug-in sites that continue to just monitor groundwater every five years.

Infeasibility Zone providing evidence of reducing volatile organic compounds vapor concentrations to achieve lateral and vertical vapor containment, and of meeting the remedial action objective.

The data review for the Shallow Groundwater Zone evaluated the results of the magnitude and trends of TCE in groundwater. One observed change is an increase in TCE concentrations at GHD-1D and CRA-52S, which are located near each other, mid-plume. TCE concentrations at GHD-1D ranged from 280 milligrams per liter (mg/L) (2017) to 6,100 mg/L (2022), while TCE concentrations at CRA-52S ranged from 1,000 mg/L (2017) to 2,000 mg/L (2022). The increase in concentration may indicate impacts from rising groundwater elevations saturating the Gravel Subunit preventing the remedy from performing as intended. However, contamination from these hot spots is captured by the extraction system and does not appear to be migrating to the Regional Aquifer. Other wells may start to exhibit increasing trends as groundwater levels continue to rise. Another hot spot is observed at S-26, which ranged from 56 mg/L (2017) to 53 mg/L (2022). While the concentration at S-26 appears to be stable, it exceeds the regulatory limit and continues to be outside of the radius of influence of the extraction well network. This condition was observed in the previous review period and appears to be an isolated condition.

TCE concentrations within the Gravel Subunit appear to be stable, as evidenced by trend analysis (Table 9) that resulted in stable or decreasing trends in the Gravel Subunit.

The Regional Aquifer trends indicate mostly stable or decreasing trends for TCE directly beneath or downgradient from the Technical Impracticability Zone. One exception is at D-6 (located on the downgradient end of the TCE plume for the Gravel Subunit), which resulted in an increasing trend. Regardless of whether TCE is migrating down vertically into the Regional Aquifer within the radius of influence of the system, contaminant concentrations exist outside the radius of influence of the extraction system at S-39 and CRA-42 and they are migrating to the Regional Aquifer. Based on this evidence the current remedy is not meeting the remedial action objective of preventing migration from the Shallow Groundwater Zone to the Regional Aquifer.

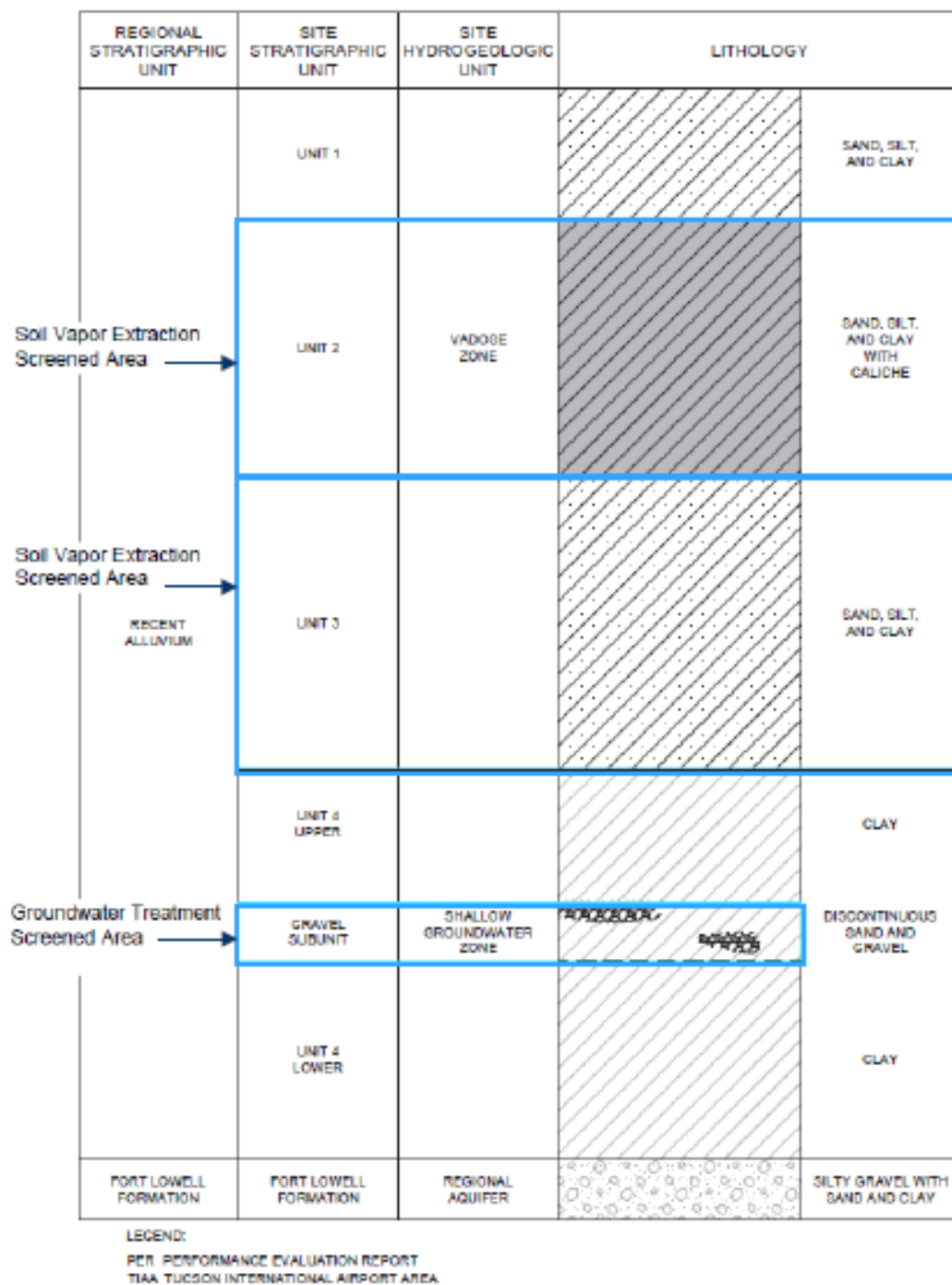


Figure 11. Airport Property Stratigraphic Unit and Remedy

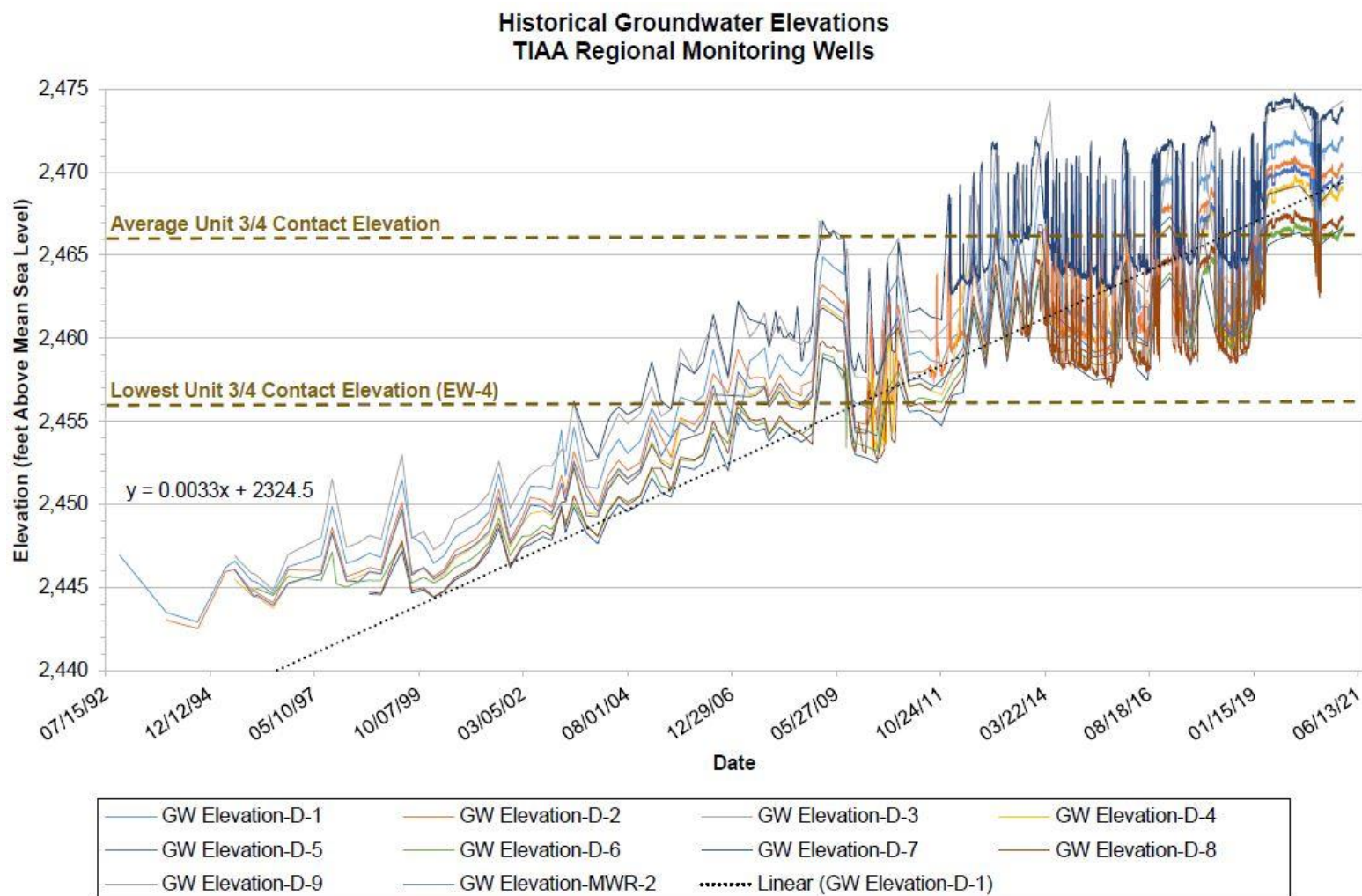
The data review for the Shallow Groundwater Zone evaluated the results of the magnitude and trends of TCE in groundwater. One observed change is an increase in TCE concentrations at GHD-1D and CRA-52S, which are located near each other, mid-plume. TCE concentrations at GHD-1D ranged from 280 µg/L (2017) to 6,100 µg/L (2022), while TCE concentrations at CRA-52S ranged from 1,000 µg/L (2017) to 2,000 µg/L (2022). The increase in concentration may indicate impacts from rising groundwater elevations saturating the Gravel Subunit preventing the remedy from performing as intended. However, contamination from these hot spots is captured by the extraction system and does not appear to be migrating to the Regional Aquifer. Other wells may start to exhibit increasing trends as groundwater levels continue to rise. Another hot spot is observed at S-26, which ranged from 56 µg/L (2017) to 53,000 µg/L (2022). While the concentration at S-26 appears to be stable, it exceeds the regulatory limit and continues to be outside of the radius of influence of the extraction well network. This condition was observed in the previous review period and appears to be an isolated condition.

TCE concentrations within the Gravel Subunit appear to be stable, as evidenced by trend analysis (Table 9) that resulted in stable or decreasing trends in the Gravel Subunit.

The Regional Aquifer trends indicate mostly stable or decreasing trends for TCE directly beneath or downgradient from the Technical Impracticability Zone. One exception is at D-6 (located on the downgradient end of the TCE plume for the Gravel Subunit), which resulted in an increasing trend. Regardless of whether TCE is migrating down vertically into the Regional Aquifer within the radius of influence of the system, contaminant concentrations exist outside the radius of influence of the extraction system at S-39 and CRA-42 and they are migrating to the Regional Aquifer. Based on this evidence the current remedy is not meeting the remedial action objective of preventing migration from the Shallow Groundwater Zone to the Regional Aquifer.

Table 8. Trend Analysis Performed on Select Wells at the Airport Property

Stratigraphic Unit	Well	Trend	Confidence %
Shallow Groundwater Zone	CRA-52S	Increasing	99.5
	GHD-1S	Probably Increasing	93.4
	S-1	Decreasing	61.4
	S-12	Stable	99.5
	S-26	Decreasing	99.4
Gravel Subunit	S-37	Probably Decreasing	93.2
	S-38	Decreasing	98.2
	GHD-1D	Stable	89.1
	CRA-8	Stable	82.1
	CRA-15	No Trend	75.8
	CRA-52D	Decreasing	95.5
	CRA-57D	Decreasing	99.9
Regional Aquifer	D-1	Probably Decreasing	92.5
	D-3	Stable	50.0
	D-4	Stable	66.8
	D-6	Increasing	99.7
	D-7	Stable	83.2
	D-8	No Trend	89.2
	D-9 (RA-1)	No Trend	72.9



Source: GHD, 2023

Figure 12. Groundwater Elevations from the Regional Aquifer Monitoring Wells.

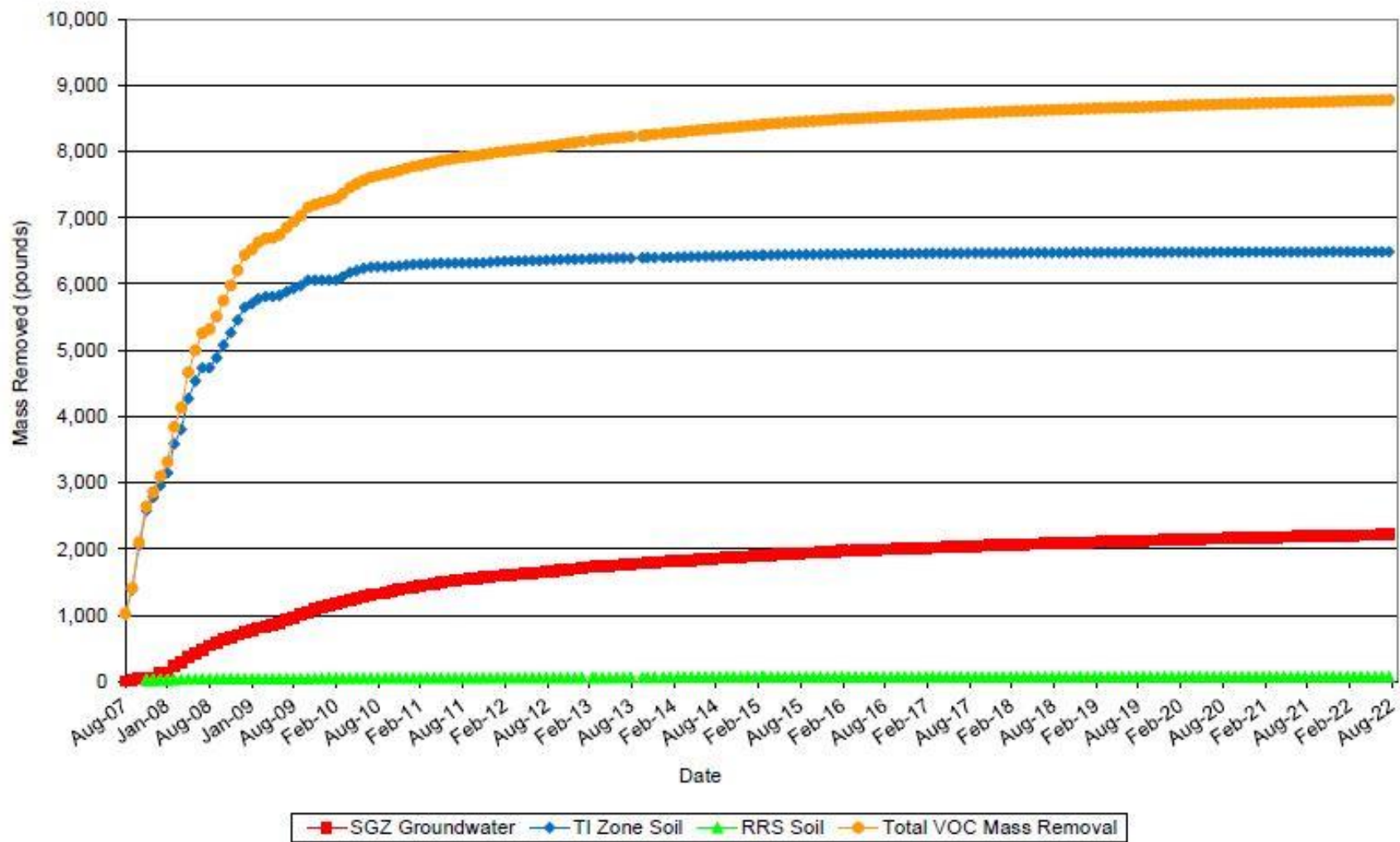
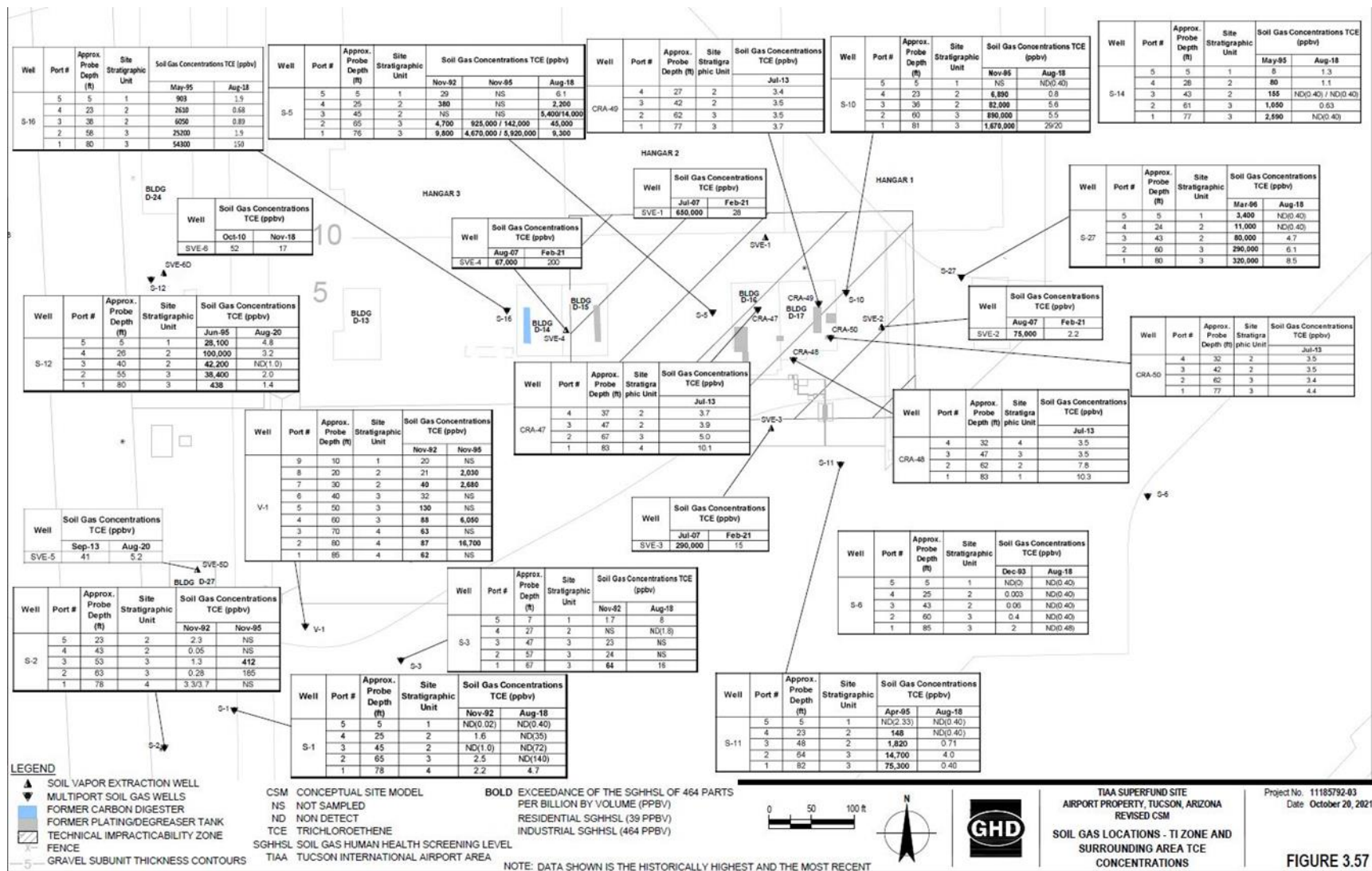


Figure 13. Volatile Organic Compound Mass Removed since System Startup in 2007.



Source: GDH, 2023

Figure 14. Soil Gas Concentrations Prior To System Startup Compared To Recent Coil Gas Concentrations

Table 9. Trend Analysis Performed on Select Wells at the Airport Property

Stratigraphic Unit	Well	Trend	Confidence %
Shallow Groundwater Zone	CRA-52S	Increasing	99.5
	GHD-1S	Probably Increasing	93.4
	S-1	Decreasing	61.4
	S-12	Stable	99.5
	S-26	Decreasing	99.4
Gravel Subunit	S-37	Probably Decreasing	93.2
	S-38	Decreasing	98.2
	GHD-1D	Stable	89.1
	CRA-8	Stable	82.1
	CRA-15	No Trend	75.8
	CRA-52D	Decreasing	95.5
	CRA-57D	Decreasing	99.9
Regional Aquifer	D-1	Probably Decreasing	92.5
	D-3	Stable	50.0
	D-4	Stable	66.8
	D-6	Increasing	99.7
	D-7	Stable	83.2
	D-8	No Trend	89.2
	D-9 (RA-1)	No Trend	72.9

4.2.7. Sustainability

The U.S. Government Accountability Office released a report in October 2019 that evaluated all Superfund sites for risks natural hazards posed to each site (e.g., floods, wildfires) and whether additional actions should be taken to mitigate those risks in light of potential exacerbation from climate change. No hazards were identified for the Site.

As detailed in Section 2.4.2, the Remedy-Required Subsites soil vapor extraction system at the Airport Property had downtime in June 2021 due to the incoming air being too hot (greater than 110 degrees Fahrenheit). An increased frequency and duration of heat waves due to climate change may put the operation of the remedial systems at the site at increased risk of outages.

4.3. Site Inspection

The inspection of the Site was conducted on April 20, 2023. In attendance were Mary Aycok, EPA Remedial Project Manager; Matthew Masten, USACE; Michelle Rogow, EPA; Jon Owens, EPA; Sarah Simmons, Tucson Airport; Ken Nichols, Tucson Airport; Manfred Plaschke, GHD; Tim Fish, GHD; Karin Harker, ADEQ; Marc Yalom, ADEQ; Michael Moraga, Tucson Water Department; and Rick Motz, Tucson Water Department. The purpose of the inspection was to assess the condition of the remedy and verify that the remedy is operating as intended. Multiple areas were visited, including the Airport Property, the Tucson Area Remediation Project, the West Plume B area, the Former West Cap area, and the Former Texas Instruments (Former Burr Brown) area. The inspection included visual observation of overall site conditions and inspection of various components of the remedy. The inspection evaluated the

various groundwater treatment systems, groundwater extraction wells and monitoring wells. The site inspection report and photographs are included in Appendix H.

At the Airport Property, the remedy for the shallow groundwater zone was stated to be offline due to the failure of the equalization tank flow meter on March 31, 2023. All other parts of the groundwater treatment plant appeared to be in excellent shape and were said to have been operating normally. No issues were noted for the soil vapor extraction system. All systems and wells were found to be free of vandalism and no significant issues were noted.

At the Tucson International Airport Area Superfund Site Remediation Program part of the Site, the following areas and system components were included in the inspection: the advanced oxidation process facility, the advanced oxidation process treatment train, the advanced oxidation process water treatment system, the granular activated carbon vessels, and the effluent storage tank. All components of the remedial action were found to be in good working order and functioning as intended. The South well field was not operating due to concerns with managing PFAS in the groundwater. No issues of concern were noted.

At the Former Texas Instruments part of the Site, no issues of concern were noted. There is no current active remedy taking place at the facility, which is now operated by Materion Corporation, a multinational chemical and specialty material manufacturer.

At the Former West Cap part of the Site, no issues of concern were noted. There is no current active remedy taking place at the facility, which is now operated by Glaz-Tech, a glass manufacturer. There was a notable amount of materials and debris in the paved area, compared to images from the previous Five-Year Review.

At the West Plume B part of the Site, monitoring wells and residential neighborhoods within and near the boundary of the groundwater plume at the Site were visited. There is no active remedy taking place at the area, which is primarily residential. No evidence of tampering with wells or issues of concern were noted during the visit.

At the AANG part of the Site, only a drive-by was conducted. The base was observed to be well secured, with fencing and military patrols.

5. Technical Assessment

5.1. Question A: Is the remedy functioning as intended by the decision documents?

The majority of the remedies at the Tucson International Airport Area Superfund Site are functioning as intended. The groundwater treatment systems at Groundwater – Area A/Area B continue to extract and treat contaminated groundwater and are generally making progress towards restoring the aquifer to existing and future uses, with exceptions noted below.

Groundwater – Area A/Area B

Area A

The Tucson Airport Remediation Project groundwater treatment facility is functioning as intended. Capture within the Regional Aquifer has been occurring, the TCE plume has reduced in width since system startup, and contaminant mass continues to be removed.

The March 2023 Interim Record of Decision documented that 1,4-dioxane will be solely treated by the advanced oxidation process system already in place and specified the risk-based treatment level required for 1,4-dioxane. The treatment facility successfully treats groundwater to that treatment level.

Groundwater from the Tucson Airport Remediation Project treatment facility is treated to meet or exceed drinking water standards, but not currently distributed for use as potable water due to the discovery of PFAS in groundwater and because the facility was not designed to treat PFAS. Treated water is currently discharged to either the Santa Cruz River or the Recycled Water System, in accordance with an Arizona discharge permit.

While the Site continues to make progress towards aquifer restoration, the increasing regional groundwater elevations may be allowing for contaminants to diffuse from fine-grained sediments in some portions of the aquifer.

Area B

The remedial action objectives for Area B apply to all four properties: the West Cap area, Texas Instruments property, the AANG Base, and West Plume B. The current revised remedy for the West Cap area, Texas Instruments property, and the AANG Base of in-situ chemical oxidation appears to largely be functioning as intended, with exceptions noted below. The current revised remedy of monitored natural attenuation at the West Plume B area is functioning as intended.

At the West Plume B Area, the remedy is functioning as intended and is effective at preventing the migration of groundwater contamination above drinking water standards, as evidenced by stable or decreasing contaminant concentrations at the downgradient extent of the plume.

The Texas Instruments property has monitoring wells with TCE concentrations above the cleanup level that have either rebounded following initial reduction after the 2018 injections or that were unaffected by the injections. One of those wells (AW-2R) also has an increasing trend of TCE concentrations. The remedy does not appear to be progressing toward remedial action objective of restoring the Shallow Groundwater Zone to drinking water quality wherever practicable and preventing the vertical migration of volatile organic compounds to the Regional Aquifer may be in question. Additional post-injection monitoring and stabilization of TCE concentration trends in groundwater may be necessary prior to recommending additional remedial action at this time.

For the West Cap area, the in situ chemical oxidation injections appear successful at preventing further migration of TCE downgradient from the source area, as evidenced by decreasing TCE concentrations downgradient.

At the AANG Base, the remedy is generally effective at preventing the migration of groundwater contamination above drinking water standards, but there are two wells in the Upper Subunit that have increasing concentrations and they are located at the downgradient extent of the plume. Those concentrations are currently fluctuating above and below the cleanup level of 5 µg/L. There is also an upgradient well in the upper subunit (MW98-U) which has high TCE concentrations relative to the site, and while currently is decreasing in concentration, may represent an off-site source contributing to the TCE contamination at the AANG Base.

There is some correlation between rising groundwater levels and increasing TCE concentrations in select wells that could represent back diffusion of contaminants within the vadose zone, but that trend is not currently widely observed and trends as a whole continue to decrease or remain stable. However, this could be a concern as groundwater levels continue to rise and the relationship between TCE concentrations and rising groundwater levels should continue to be monitored to ensure future protectiveness of the remedies.

Airport Property

Shallow Groundwater. The groundwater extraction systems have removed significant amounts of contaminant mass since their start up in 2007. Horizontal capture is occurring throughout most of the site with the exception of the area near the intersection of S Nogales Hwy and E. Corona Rd., off-Airport Property. A TCE hotspot (S-26) is observed outside the radius of influence of the extraction well network, with a stable trend. Rising groundwater levels are decreasing the effectiveness of contaminant mass removal and prevention of contaminant migration. The existing extraction system was not designed for the increased groundwater levels and is anticipated to perform worse as groundwater continues to rise due to not being able to maintain sufficient drawdown needed to maintain capture of contaminated groundwater.

Soil Vapor Extraction. The soil vapor extraction systems put in place have removed significant amounts of contaminant mass since their start up in 2007 and largely function as designed. However, TCE contaminant mass removal reached asymptotic conditions within each of the soil vapor extraction areas and the systems also become less effective as the regional groundwater levels continue to rise.

5.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedial Selection Still Valid?

The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selections are still valid, with the exception of select cleanup levels that remain less stringent than current drinking water standards; however, the remedial goals currently remain protective, as discussed below.

Three contaminants have drinking water standards more stringent than the cleanup levels that were selected for them in the Records of Decision. Those contaminants are chloroform for groundwater at Area A, and chloroform, total trihalomethanes, and arsenic for groundwater at the Airport Property. The protectiveness of the remedial goals for Groundwater – Area A is not affected because chloroform in groundwater remains well below the current drinking water standard. In groundwater at the Airport Property, chloroform, total trihalomethanes, and arsenic concentrations in groundwater remain above drinking water standards; however, the groundwater extraction and treatment system is ongoing at the Airport Property, and there are currently no exposures to impacted groundwater. As remediation of groundwater at the Airport Property progresses, monitoring for these three substances continues and measured concentrations are compared to current drinking water standards.

The current risk-based screening levels for dichlorodifluoromethane and trichlorotrifluoroethane (Freon 113) remain more stringent than their respective risk-based groundwater cleanup levels. However, their concentrations in groundwater remain below their respective risk-based screening levels and so the remedy remains protective.

PFAS are a group of man-made substances that have become understood in recent years to be more toxic than originally thought. PFAS are present in various materials, including aqueous film-forming foam used in firefighting foam, and are present in soil and groundwater at the Site due to past operations. Investigations into the nature and extent of contamination are already underway at certain areas of the Site. EPA currently only has health advisory levels for select PFAS compounds, but EPA has formally proposed drinking water standards for certain PFAS compounds and the remedies at the Site may need to be adjusted to remain protective once enacted. ADEQ has sampled all existing nearby private drinking water wells, and connected homes to Tucson Water Department if the private well samples concentrations exceed EPA's health advisory for PFAS.

As documented in the 2nd Five-Year Review, past investigations of vapor intrusion for Operable Units 1 and 2, which included vapor sampling, did not find unacceptable risk. The vapor intrusion pathway is currently not a concern for buildings overlying the contaminant plume so long as building construction features and their use (e.g., industrial/commercial) remain the same into the future. Future building construction or changes in use for current buildings will require evaluation to ensure there is not unacceptable vapor intrusion risk.

5.3. Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

As detailed in Section 2.4.2, the Remedy-Required Subsites soil vapor extraction system at the Airport Properties had downtime in June 2021 due to the incoming air being too hot (>110 degrees Fahrenheit). An increased frequency and duration of heat waves due to climate change may put the operation of the remedial systems at the Site at increased risk of outages.

6. Issues/Recommendations

Table 9. Issues and Recommendations Identified in the Five-Year Review

Operable Unit (s): Operable Unit 2	Issue Category: Changed Site Conditions			
	Issue: Rising regional groundwater levels are decreasing the effectiveness of the shallow groundwater zone and soil vapor extraction remedies at the Airport Property and may affect the ability to prevent migration of contaminants in the shallow groundwater zone.			
	Recommendation: An Optimization Plan for SVE and the Groundwater remedy should be developed to address rising groundwater levels and other changes at the Site.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	10/30/2025
Operable Unit (s): Operable Unit 1, Operable Unit 5,	Issue Category: Changed Site Conditions			
	Issue: PFAS is present in groundwater at the Site and the EPA has formally proposed drinking water standards for certain PFAS compounds.			
	Recommendation: Determine the nature, extent and implement appropriate remedies for PFAS in groundwater. And upgrade groundwater treatment system to adequately treat PFAS so extraction wells can be fully operational			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	11/30/2027
Operable Unit (s): Operable Unit 1, Operable Unit 5,	Issue Category: Monitoring			
	Issue: PFAS is present in groundwater at the Site and has been detected in downgradient private wells.			
	Recommendation: Incorporate into the groundwater monitoring program frequent, ongoing sampling of private wells in the vicinity of the potentially impacted area for PFAS			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	EPA	9/30/2025

7. Protectiveness Statement

Table 10. Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: Operable Unit 1 & 5	Protectiveness Determination: Short-term Protective
<i>Protectiveness Statement:</i> The remedy at Groundwater Area A/Area B at the Tucson International Airport Site currently protects human health and the environment. Contaminant containment for TCE is occurring, and the groundwater treatment systems are operating to treat contaminated groundwater to below current drinking water standards and to reduce groundwater contaminant concentrations. However, in order for the remedy to be protective in the long-term, the following actions must be taken: determine the nature, extent and implement appropriate remedies for PFAS in groundwater; upgrade groundwater treatment system to adequately treat PFAS so extraction wells can be fully operational; and incorporate into the groundwater monitoring program frequent, ongoing sampling of private wells in the vicinity of the potentially impacted area for PFAS.	

Operable Unit: Operable Unit 2	Protectiveness Determination: Short-term Protective
<i>Protectiveness Statement:</i> The soil and shallow groundwater remedy at the Airport Property currently protects human health and the environment because contamination in soil and groundwater is being reduced, which reduces the further migration of contaminants in groundwater. However, in order for the remedy to be protective in the long-term, the remedy for both soil and shallow groundwater (soil vapor extraction and groundwater extraction) need to account for the change in site conditions resulting from rising groundwater levels.	

8. Next Review

The next Five-Year Review report for the Tucson International Airport Superfund Site is required five years from the completion date of this review.

Appendix A: List of Documents Reviewed

AANG 1996. Record of Decision for Site 5 Soils, 162nd Fighter Wing, Arizona Air National Guard, Tucson International Airport Superfund Site. August 1996.

AANG 2011. Environmental Restoration Program, Final Conceptual Site Model Report. July 2011.

Air Force Civil Engineer Center 2023. Five-Year Review of Five Sites at Air Force Plant 44, Tucson, Arizona. Draft Final. June 19, 2023

Amec Foster Wheeler Programs, Inc. 2018, Five-Year review of Five Sites at Air Force Plant 44, Tucson, Arizona. August 10, 2018

APTIM Federal Services (APTIM) 2022. Final Summary of Well Installation, Development, Baseline Sampling, Remedial Action, and Performance Monitoring Through March 2022, Former Western Capacitor Site, Tucson International Area Superfund Site, Tucson, AZ. August 26, 2022.

ARCADIS 2022. October 2021 through February 2022 Semi-Annual Report; Former Texas Instruments Tucson Fabrication Facility. June 30, 2022.

Carollo 2020. TARP: Tucson International Airport Area Groundwater Remediation Project, Semi-Annual Status Report, March 2019 through August 2019. September 2020.

Carollo 2021. TARP: Tucson International Airport Area Groundwater Remediation Project, Semi-Annual Status Report, March 2021 through August 2021. September 2021.

Carollo 2022. TARP: Tucson International Airport Area Groundwater Remediation Project, Semi-Annual Status Report, September 2021 through February 2022. December 2022 (Revised January 2023).

Carollo 2022. TARP: Tucson International Airport Area Groundwater Remediation Project, Semi-Annual Status Report, March 2022 through August 2022. December 2022.

Desert Earth Engineering 1992. Geotechnical Engineering Investigation on Tucson Airport Remedial Project (TARP) Treatment Plant, Tucson, Arizona. February 7, 1992.

U.S. Environmental Protection Agency (EPA) 1988. Record of Decision for Groundwater Remediation, North of Los Reales Road. August 1988.

EPA 1994. Tucson International Airport Area Superfund Site, Tucson Airport Remediation Project (TARP) Consent Decree, Civil Action No. 90-57 TUC-RMB, as modified EPA Approval of TARP Final Start-up Plan. August 26, 1994.

EPA 1996. Record of Decision for Site 5 Soils, 162nd Fighter Wing, Arizona Air National Guard, Tucson International Airport Superfund Site. August 1996.

EPA 1997. Explanation of Significant Differences for the Record of Decision, Tucson International Airport Area (Areas A and B Groundwater OU). February 7, 1997.

EPA 1997. Record of Decision, Tucson International Airport Area, OU2, Airport Property (Soils and

Shallow Groundwater Zone), Burr-Brown Property (Soils), Former West Cap Property (Soils). September 1997.

EPA 2001. Explanation of Significant Difference for the Record of Decision, Tucson International Airport Area OU2. April 2001.

EPA 2004. Record of Decision Amendment for Tucson International Airport Area, Former West Cap and West Plume B Areas, Areas A and B Groundwater OU. September 2004.

EPA 2012. Record of Decision Amendment for Tucson International Airport Superfund Site, Area B. April 2012.

EPA 2013. First Five-Year Review for Tucson International Airport Area Superfund Site. September 30, 2013.

EPA 2023. Interim Record of Decision Amendment, Tucson International Airport Area, Superfund Site Area A, North of Los Reales Road, Tucson, Arizona. March 2023

GHD Services, Inc. (GHD) 2019. In-Situ Chemical Oxidation Pilot Test Closure Report, Samsonite Building Area, Tucson International Airport Area, Superfund Site – Airport Property, Tucson, Arizona. April 8, 2019.

GHD 2020. Twenty-sixth Performance Evaluation Report – SGZ Remedy & SVE Remedy, March – August 2020. November 13, 2020.

GHD 2021. Twenty-seventh Performance Evaluation Report – SGZ Remedy & SVE Remedy, September 2020 – February 2021. May 14, 2021.

GHD 2021. Twenty-eighth Performance Evaluation Report – SGZ Remedy & SVE Remedy, March 2021 – August 2021. November 15, 2021.

GHD 2022. Twenty-ninth Performance Evaluation Report – SGZ Remedy & SVE Remedy, September 2021 – February 2022. May 13, 2022.

GHD 2022. Revised Conceptual Site Model – Airport Property, Tucson International Airport Area, Superfund Site, Tucson, Arizona. October 14, 2022.

GHD 2022. Thirtieth Performance Evaluation Report – SGZ Remedy & SVE Remedy, March 2022 – August 2022. November 15, 2022.

GHD 2023. Groundwater Monitoring Report, Soil Vapor Extraction Plug-In Subsites, Tucson International Airport Area Superfund Site – Airport Property, Tucson, Arizona. February 2, 2023.

Oneida Sustainment and Restoration Services, 2023, draft final Five-Year review of Five Sites at Air Force Plant 44, Tucson, Arizona. June 19, 2023

Tucson Airport Authority 2018 - 2022. SRP (Soils Remediation Project) October 2018 to September 2022 Monthly Operational Reports, SGZ Remedy, Tucson International Airport Area Superfund Site - Airport Property. October 2018 to September 2022.

Tucson Airport Authority 2023. Tucson International Airport Area Superfund Site, Airport Property Soils Remediation Project, December 2022 Progress Report. January 11, 2023.

Malcom Pirnie, Inc., 1986. Feasibility Study for Ground Water Remediation in the Tucson Airport Area. February 1986.

Malcom Pirnie 2006. TARP: Tucson International Airport Area Groundwater Remediation Project, Field Operations Plan for Groundwater Remedial Action, North of Los Reales Road in Area A. November 2006.

Malcom Pirnie 2010. TARP: Tucson International Airport Area Groundwater Remediation Project, Operations & Maintenance Plan. January 2010.

URS, 2019. Final Explanation of Significant Differences, Installation Restoration Program Sites DP001, DP002, and DP003, Air Force Plant 44, Tucson, Arizona. March 2019.

URS, 2020. Final Record of Decision, Installation Restoration Program, Site OT012, Air Force Plant 44, Tucson, Arizona. August 2020.

URS, 2020. Memorandum – Final, Re: Completion Summaries, Groundwater Remediation System Upgrade, OT012 – South of Los Reales Road, Regional Groundwater Plume, Air Force Plant 44, Tucson, Arizona Southwest PBR, SubCLIN # 0009DV - Contract No. FA8903-09-D-8565, DO 0011. September 23, 2020.

URS, 2019. Final Vapor Intrusion Study Summary Report Installation Restoration Program Site WP005, Building 801 Air Force Plant 44 Tucson, Arizona. May 2019.

Wood, 2021. Final Groundwater Monitoring Program, Third Quarter 2020 Monitoring Report, Environmental Restoration Program, 162nd Wing, Arizona Air National Guard, Tucson, Arizona. March 18, 2021.

Wood, 2021. Final Groundwater Monitoring Program, Fourth Quarter 2020 Monitoring Report, Environmental Restoration Program, 162nd Wing, Arizona Air National Guard, Tucson, Arizona. July 30, 2021.

Appendix B: Site Chronology

Event	Date
Airport Property—Industrial use and disposal of metals, chlorinated solvents and other hazardous wastes began.	1942
Hughes Missile Systems Company and/or its subsidiaries have operated the AFP44 plant since construction.	1951-1997
A groundwater sample from a municipal supply well indicated elevated levels of chromium. Residents complained of foul-smelling water.	1952
A well at AFP44 was closed by the state because of high levels of chromium.	1976
Tucson International Airport Area Superfund Site was listed on “Expanded Eligibility List,” a Preliminary National Priorities List (NPL).	July 23, 1982
Tucson International Airport Area Superfund Site proposed for inclusion on the Final NPL.	December 30, 1982
Final NPL listing of Tucson International Airport Area.	September 8, 1983
Tucson Airport Remediation Project, Airport Property, and AFP44—The Arizona Department of Health Services (ADHS) completed the remedial investigation (RI) for the area north of Los Reales Road. The Arizona Department of Water Resources (ADWR) conducted a feasibility study (FS). The Air Force issued a Record of Decision for regional groundwater at AFP44.	1985
EPA sent general notice letters to the potentially responsible parties (PRPs) officially notifying them of their potential liability for groundwater remedy north of Los Reales Road.	August and September 1987
U.S. Air Force began operation of a groundwater pump-and-treat system to address contamination at the AFP44 Facility. Groundwater remediation includes extracting groundwater, treatment for removal of hexavalent chromium (ion exchange) and volatile organic compounds (VOCs; packed column aeration with partial control of emissions using vapor-phase granular activated carbon [GAC]), and re-injecting treated water into the aquifer.	1987
The draft “Feasibility Study for Groundwater Remediation in the Tucson Airport Area” report was released for public review and comment.	March 3, 1988
Tucson Airport Remediation Project Record of Decision signed by EPA to treat the groundwater north of Los Reales Road by pumping and treating the contaminated groundwater followed by discharging the treated water to the municipal water distribution system.	July 25, 1988
Tucson Airport Remediation Project—EPA and the Settling Parties entered a Consent Decree for the Tucson Airport Remediation Project.	June 1991
EPA issued a Unilateral Order (UAO; Docket No. 92-09, July 9, 1992) to Tucson Airport Authority, City of Tucson, General Dynamics Corporation, and McDonnell Douglas Corporation, for performance of a RI/FS of the Tucson International Airport Area Superfund Site.	August 25, 1992
Texas Instruments (formerly Burr-Brown) began operation of a groundwater pump and treat system to address the contamination at its facility.	1992
162nd AANG—EPA and the National Guard Bureau signed a Federal Facilities Agreement (FFA).	1993

Event	Date
Tucson Airport Remediation Project—The Tucson Airport Remediation Project treatment plant began operation.	September 1994
Airport Property—RI was completed. RI characterized extent of contamination in soil and shallow groundwater zone.	1996
Airport Property—Daniel B. Stephens & Associates (DBS&A) completed the RI of the shallow groundwater zone and vadose zone.	April 1995 – April 1996
Airport Property – Record of Decision issued; selected remedy of soil vapor extraction for contaminated soil at AANG.	August 1996
Airport Property—DBS&A completed RI report for EPA submittal.	October 31, 1996
Airport Property—Excavation of PCB-contaminated soil (El Vado Residential Neighborhood and Three Hangars Area).	March – May 1997
Airport Property—EPA approved RI report submitted by DBS&A.	May 2, 1997
Airport Property—Conestoga-Rovers and Associates (CRA) prepared an FS and submitted to EPA to identify remedial technologies that may be applicable to the site and was approved by EPA on July 10, 1997.	June 10, 1997
Formation of Unified Community Advisory Board	September 1997
Airport Property—EPA issued a Record of Decision for the selected RA.	September 30, 1997
Airport Property—A Consent Decree was signed between EPA and the PRPs for the cleanup.	February 2000
Tucson Airport Remediation Project and AFP44—1,4-dioxane was discovered in groundwater.	March – April 2002
West Cap Arizona—A soil vapor extraction Pilot Treatability Study was conducted; extracting approximately 180 pounds of total VOCs from a single vapor well near Building A. TCE and tetrachloroethylene concentrations were significantly reduced such that additional treatment of the vadose zone was not necessary.	August – December 2002
Airport Property—Five extraction wells were installed in gravel subunits to cut off the shallow groundwater zone from the Tucson Airport Remediation Project plume.	2002
Tucson Airport Remediation Project—EPA asked Tucson Water Department and Tucson Airport Remediation Project representatives to begin RI/FS to evaluate available remedial technologies to address 1,4-dioxane contamination.	2004
Airport Property—1,4-dioxane was detected at up to 36 µg/L.	2004
Airport Property—The final Shallow Groundwater Zone remedy and soil vapor extraction remedy design report (100% Design) (Final Report) and RA work plan were submitted to EPA.	July 25, 2004
Airport Property—EPA approved the final Shallow Groundwater Zone remedy and soil vapor extraction remedy design report (100% Design; Final Report) and RA work plan.	September 3, 2004
Airport Property—Proposal submitted to characterize carbon tetrachloride in the Shallow Groundwater Zone at West End of Runway 3.	2005
Airport Property—In situ chemical oxidation using potassium permanganate (KMnO ₄) to treat dichloroethylene (1,1-DCE) concentration at Samsonite Building Area.	2006

Event	Date
EPA issued a Safe Drinking Water Act Order to the Air Force and Raytheon to design, build, and operate advanced oxidation treatment plant at AFP44 to treat TCE and 1,4-dioxane.	July 13, 2007
Airport Property—EPA provided an “Operational and Functional Determination” for the Shallow Groundwater Zone remedy and soil vapor extraction remedy and routine operation commenced.	October 29, 2007
AFP44—Advanced oxidation treatment systems operational. The treatment system was designed to remove 1,4-dioxane but also effectively remove VOCs.	September 2009
Tucson Airport Remediation Project—Tucson Water Department conducted pilot testing of ozone-peroxide and UV light– peroxide advanced oxidation treatment for 1,4-dioxane and concluded that UV light– peroxide is the preferred technology. AFP44—Air Force conducted Phase II Focused RI.	2010
Airport Property – Tucson Airport Area Landfill capped.	July 2011
Federal Facilities Agreement for Air Force Plant 44 signed.	September 2011
Groundwater - Area B – Record of Decision Amendment revises the remedy. At the West Cap Area, Texas Instruments property, and AANG Base, the revised remedy consists of In-Situ Chemical Oxidation (ISCO) using potassium permanganate. At West Plume B, the revised remedy consists of Monitored Natural Attenuation (MNA).	April 2012
Airport Property – Pipeline sludges contaminated with PCBs above 0.76 mg/kg were excavated and removed.	June 2012
First FYR	2013
Groundwater - Area A – Advanced Oxidation Process (AOP) water treatment system incorporated to the existing system at Tucson Airport Remediation Project. The AOP system removes 1,4-dioxane, as well as other VOCs, including TCE, from water. The treated water from the Tucson Airport Remediation Project groundwater treatment facility is delivered to the Tucson Water Department distribution system.	2014
At West Cap Area, potassium permanganate ISCO injection was performed in June 2014. Post-injection performance monitoring on a semi-annual basis has been implemented since October 2014.	2014
A vapor intrusion investigation was completed in the neighborhood immediately west of the Airport Property Three Hangars area. Results showed that vapor intrusion was not a significant health concern.	2015
Groundwater - Area A – Proposed Plan issued for Tucson Airport Remediation Project Record of Decision Amendment.	March 2017
At Texas Instruments (formerly Burr-Brown) property, potassium permanganate ISCO injection was performed in July 2016. Post-injection performance monitoring was performed from September 2016 to February 2017, and long-term monitoring on a semi-annual basis is ongoing.	July 2017
Second FYR	2018
A Record of Decision was signed for the OT012 site, also known as the AFP44 Regional Groundwater Plume South of Los Reales Road.	2020
A Revised Conceptual Site Model was completed for the Airport Property.	October 2022
EPA issued an Interim Record of Decision Amendment to the Groundwater - Area A remedy.	March 2023
Groundwater sampling—All project areas.	Ongoing

Appendix C: Data Review

All sites below are currently affected by regional groundwater increase rise. The impacts of rising groundwater levels on contaminant concentrations are an overall concern for the long-term protectiveness of each of the sites and may impact the effectiveness of some of the remedial technologies. All responsible parties are aware of the issues created by a rising regional groundwater level. The following data review will evaluate the current remedies and their effectiveness at meeting their respective remedial action objectives.

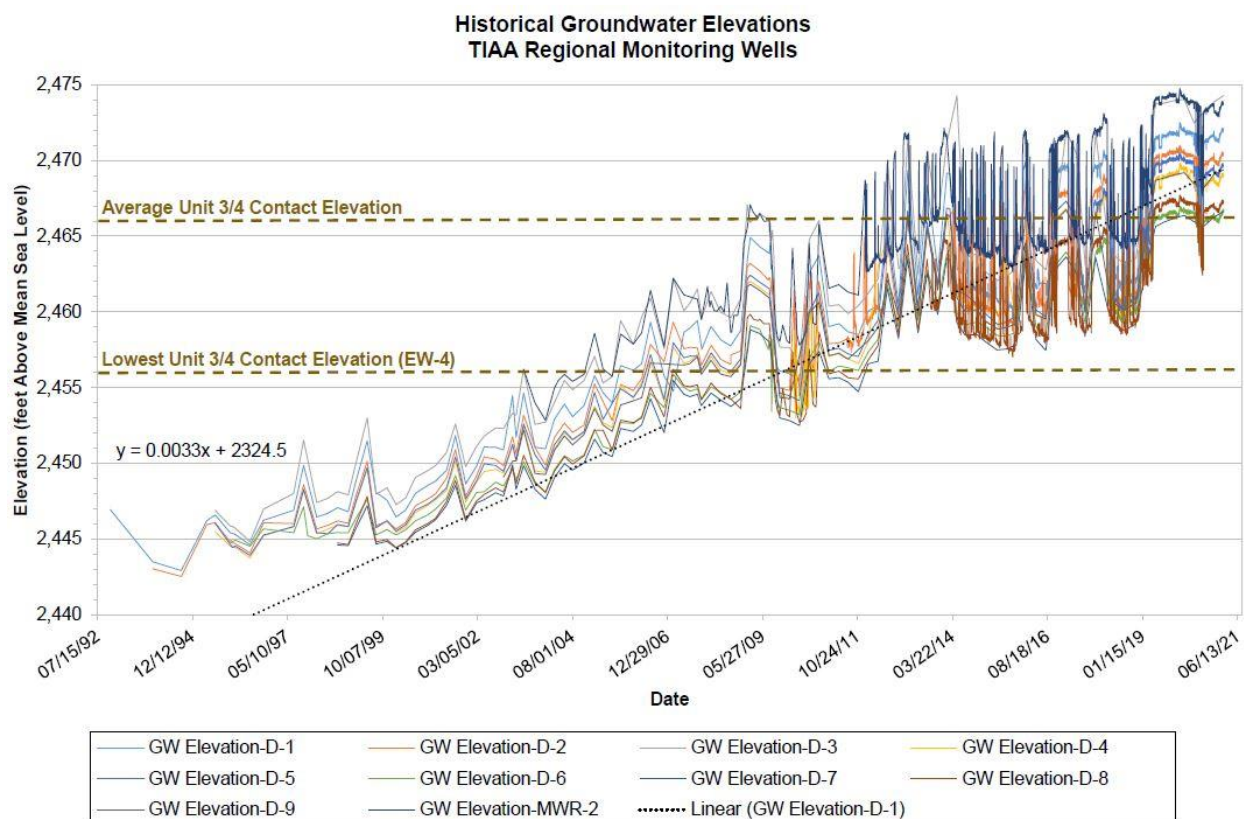


Figure C1 Historical Groundwater Elevations across the Tucson Airport Area Superfund Site.
(Source: GHD, 2023)

Tucson Airport Area Remediation Project (Groundwater - Area A)

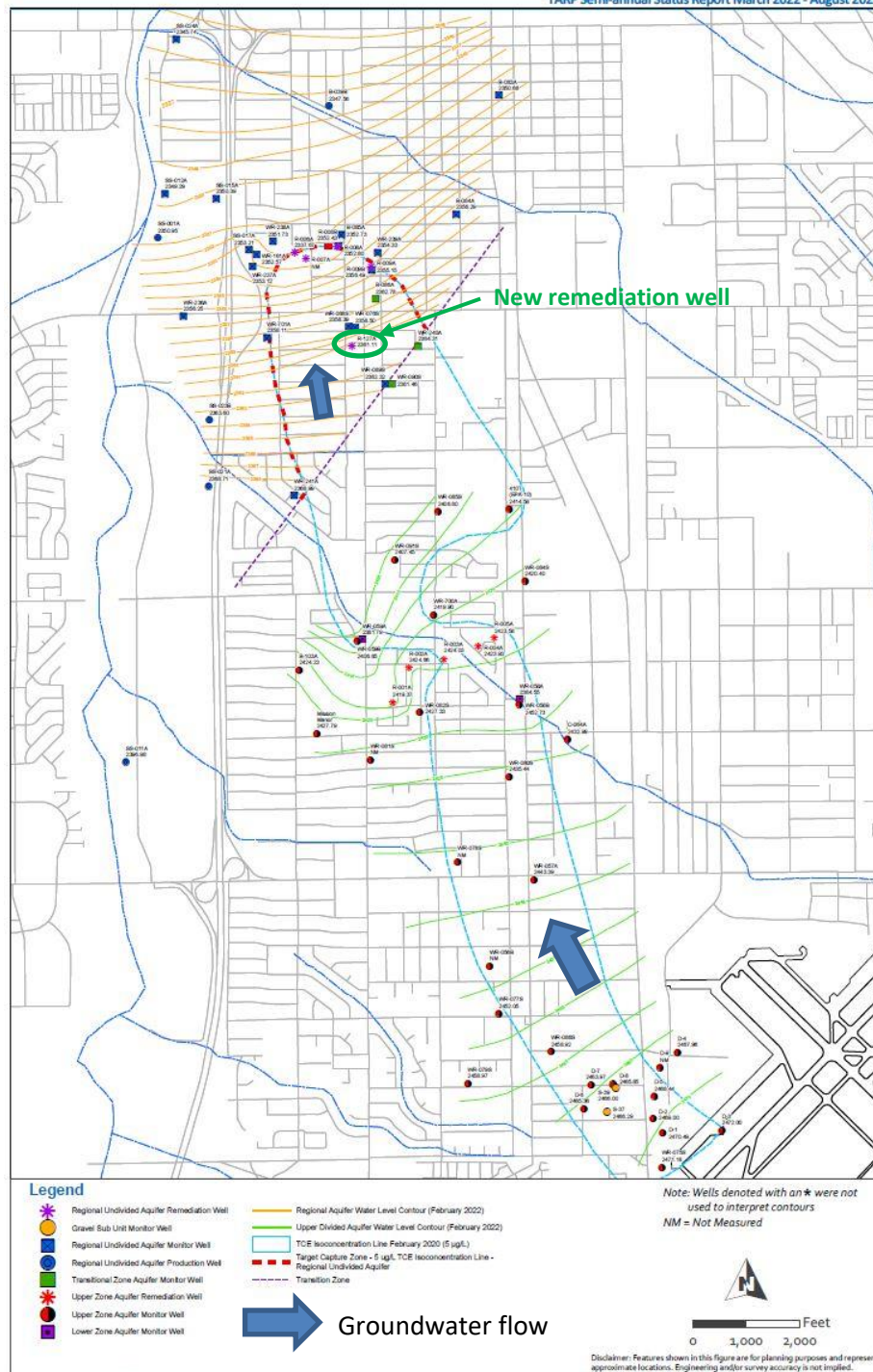
Remedial Action Objectives for the Tucson Airport Area Remediation Project are to 1) control contaminant migration, 2) remediation of the aquifer, 3) treatment of extracted groundwater. Several lines of evidence are used to evaluate if remedial action objectives are being met including contaminant concentrations, water level data, and treatment system data.

Tucson Water Department monitors groundwater elevations at forty-four monitoring wells as one line of evidence to demonstrate capture of the contaminant plume (TCE and 1,4-dioxane). Groundwater in the southern portion of the plume (North of Los Reales Road) is monitored in the Upper Divided Aquifer and transition into the Regional Aquifer at the northern part of the plume (Figure C2).

The groundwater extraction and treatment system is composed of two extraction well fields: the North Well Field designed to contain the plume, and the South Well Field designed to removed contaminant mass. The extraction wells deliver groundwater to the Tucson Airport Remediation Project Water Treatment Plant. Operation and maintenance performance is discussed in Section 2.4.1.

The North Well Field has contained the TCE plume within the Regional Aquifer by maintaining hydraulic capture. The highest TCE concentrations are observed in the North Well Field of the Regional Aquifer. Tucson Water Department also installed an additional extraction well R-127A to provide additional mass removal. This action was a response to the community regarding concerns for time for restoration (Figure C2). The installation has provided additional mass removal and has improved overall capture of the contaminant plume (Carollo, 2022).

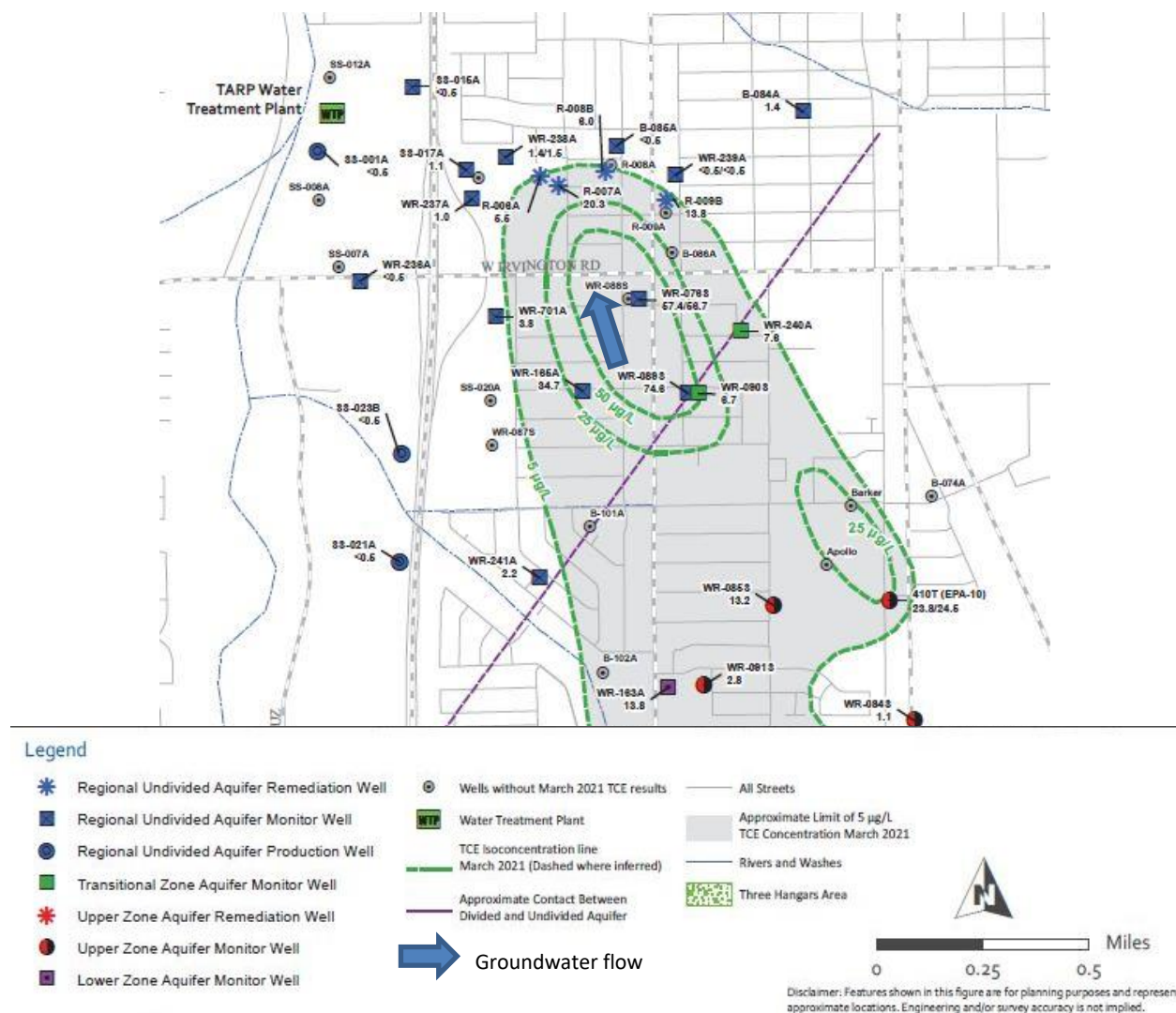
The South Well Field is comprised of five extraction wells that operate at a lower pumping capacity than the North Well Field wells. Nevertheless, the South Well Field was successful in decreasing the concentrations of TCE and other contaminants within the plume as required by the Record of Decision. The plume has been stable over the review period and while mass continues to be reduced, the plume has maintained its basic areal extent during the review period. The South Well Field is currently not operational due to PFAS concerns (discussed in Section 4.2).



Source: Carollo, Final Semi-Annual Status Report March 2022 through August 2022

Figure C2. Groundwater Elevations, March to August 2022

Based on the review performed by USACE, the Tucson Airport Area Remediation Project extraction well fields are operating as intended. The groundwater extraction treatment system is designed to remove volatile organic compounds and 1,4-dioxane.



Source: Carollo, Semi-Annual Status Report September 2020 through February 2021.

Figure C3. TCE plume prior to Tucson Airport Remediation Project shutdown at the North Well Field.

Tucson Water Department performs groundwater monitoring at twenty-four monitoring wells across the Tucson Airport Remediation Project plume to monitor TCE concentrations. USACE evaluated the concentration data to analyze for trends in the dataset to identify if the remedial action objectives are being met and if other potential issues can be identified from statistical analysis.

USACE analyzed wells on the margins of the south well field that were evaluated in the previous Five-Year Review for consistency between reviews and to verify that conditions are not deteriorating due to

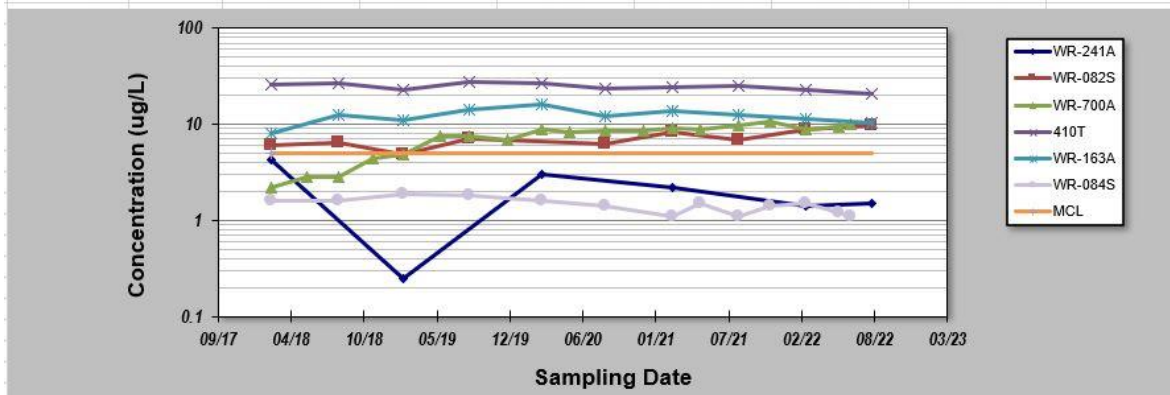
the shutdown of the South Well Field (Figure C4). Six wells were used for Mann-Kendall statistical analysis. Two wells (WR-241A and WR-163A) resulted in stable trends, two wells (WR-084S and 410T) resulted in decreasing trends, and two wells (WR-700A and WR-082S) resulted in increasing trends. The greatest increase in concentrations was observed at WR-700A which ranged in TCE concentration 2.0 µg/l to 10 µg/l. WR-700A is located directly downgradient from the South Well Field. This may be a result of the shutdown of the extraction wells for the South Well Field or possibly the extended shutdown of the treatment system at AFP44; however, all TCE is expected to be captured by the North Well Field. Based on these statistical results the plume margins appear stable and are not expanding during South Well Field shutdown.

USACE performed Mann-Kendall analysis on TCE concentrations for wells located in the North Well Field, along the margins of the plume. A total of six wells were analyzed for trends (Figure C5). Three wells (WR-701A, WR-084S and 410T) resulted in decreasing trends and one well (WR-057A) resulted in stable trends. Two wells (B-084A and WR-238A) resulted in increasing trends, however due to the low concentrations detected in these wells (below the cleanup level) and how close they are to laboratory detection limits, any apparent trends are subject to more confounding factors. Both increasing trends are not of concern at this time.

USACE performed Mann-Kendall analysis on wells downgradient from the North Well Field to evaluate plume migration. Four out of the six wells evaluated resulted in increasing trends, however these concentrations are below the cleanup level. Well SS-017A was the only well that resulted in a concentration above the cleanup level, for two sampling events in June and July 2022, with a concentration of 5.4 and 5.3. SS-017A demonstrates an increasing TCE trend. SS-017A is within the capture zone of the North Well Field. Based on the statistical evaluation during the temporary shutdown, the leading edge of the TCE plume did not extend beyond the influence of the north extraction well field.

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date:	5-Apr-23				Job ID:	Tucson International Airport Superfund Site		
Facility Name:	TARP				Constituent:	TCE		
Conducted By:	Kristin Addis				Concentration Units:	ug/L		
Sampling Point ID:		WR-241A	WR-082S	WR-700A	410T	WR-163A	WR-084S	MCL
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)						
1	14-Feb-18	4.3	6.0	2.2	25.7	8	1.6	5
2	22-May-18			2.8				
3	19-Aug-18		6.5	2.8	26.5	12.6	1.6	
4	20-Nov-18			4.4				
5	12-Feb-19	0.25	4.9	4.9	22.5	11.1	1.9	
6	22-May-19			7.5				
7	12-Aug-19		7	7.6	27.9	14	1.8	
8	26-Nov-19			6.9				
9	26-Feb-20	3		8.7	27.1	16.1	1.6	
10	12-May-20			8.2				
11	19-Aug-20		6.3	8.6	23.2	12.1	1.4	
12	30-Nov-20			8.5				
13	17-Feb-21	2.2	8.4	9.2	24.5	13.8	1.1	
14	4-May-21			8.7			1.5	
15	19-Aug-21		6.8	9.6	24.8	12.7	1.1	
16	15-Nov-21			10.8			1.4	
17	20-Feb-22	1.4	8.8	8.9	23.1	11.5	1.5	
18	20-May-22			9.4			1.2	
19	22-Jun-22			10.0			1.1	
20	19-Aug-22	1.5	9.8		20.9	10.5		5
21								
22								
23								
24								
25								
Coefficient of Variation:		0.67	0.21	0.36	0.09	0.18	0.18	0.00
Mann-Kendall Statistic (S):		-5	24	143	-17	-1	-42	0
Confidence Factor:		76.5%	99.4%	>99.9%	92.2%	50.0%	99.5%	
Concentration Trend:		Stable	Increasing	Increasing	Prob. Decreasing	Stable	Decreasing	



Notes:

At least four independent sampling events per well are required for calculating the trend. Methodology is valid for 4 to 40 samples.
 Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing;
 $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
 Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales,
Ground Water, 41(3):355-367, 2003.

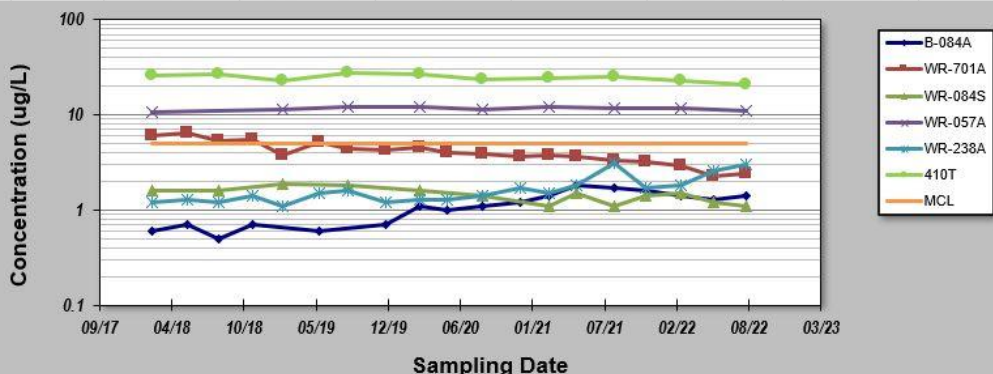
DISCLAIMER: The GSI Mann-Kendall Toolkit is available "as is". Considerable care has been exercised in preparing this software product; however, no party, including without limitation GSI Environmental Inc., makes any representation or warranty regarding the accuracy, correctness, or completeness of the information contained herein, and no such party shall be liable for any direct, indirect, consequential, incidental or other damages resulting from the use of this product or the information contained herein. Information in this publication is subject to change without notice. GSI Environmental Inc., disclaims any responsibility or obligation to update the information contained herein.

GSI Environmental Inc., www.gsi-net.com

Figure C4. TCE concentration data, Mann-Kendall statistics, and time series plot for wells north of Los Reales Road.

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: 5-Apr-23		Job ID: Tucson International Airport Superfund Site					
Facility Name: TARP		Constituent: TCE					
Conducted By: Kristin Addis		Concentration Units: ug/L					
Sampling Point ID:		B-084A	WR-701A	WR-084S	WR-057A	WR-238A	410T
							MCL
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)					
1	14-Feb-18	0.6	6.1	1.6	10.8	1.2	25.7
2	22-May-18	0.7	6.5			1.3	
3	19-Aug-18	0.5	5.4	1.6		1.2	26.5
4	20-Nov-18	0.7	5.5			1.4	
5	12-Feb-19		3.8	1.9	11.5	1.1	22.5
6	22-May-19	0.6	5.1			1.5	
7	12-Aug-19		4.4	1.8	12.3	1.6	27.9
8	26-Nov-19	0.7	4.3			1.2	
9	26-Feb-20	1.1	4.5	1.6	12.3	1.3	27.1
10	12-May-20	1.0	4			1.3	
11	19-Aug-20	1.1	3.9	1.4	11.5	1.4	23.2
12	30-Nov-20	1.2	3.6			1.7	
13	17-Feb-21	1.4	3.8	1.1	12.1	1.5	24.5
14	4-May-21	1.8	3.6	1.5		1.8	
15	19-Aug-21	1.7	3.3	1.1	11.9	3.1	24.8
16	15-Nov-21	1.6	3.2	1.4		1.7	
17	20-Feb-22	1.4	2.9	1.5	11.9	1.8	23.1
18	20-May-22	1.3	2.3	1.2		2.6	
19	19-Aug-22	1.4	2.4	1.1	11.1	3.0	20.9
20							5
Coefficient of Variation:		0.38	0.28	0.18	0.04	0.36	0.09
Mann-Kendall Statistic (S):		90	-145	-42	-1	113	-17
Confidence Factor:		>99.9%	>99.9%	99.5%	50.0%	>99.9%	92.2%
Concentration Trend:		Increasing	Decreasing	Decreasing	Stable	Increasing	Prob. Decreasing



Notes:

At least four independent sampling events per well are required for calculating the trend. Methodology is valid for 4 to 40 samples.
 Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing;
 $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
 Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, Ground Water, 41(3):355-367, 2003.

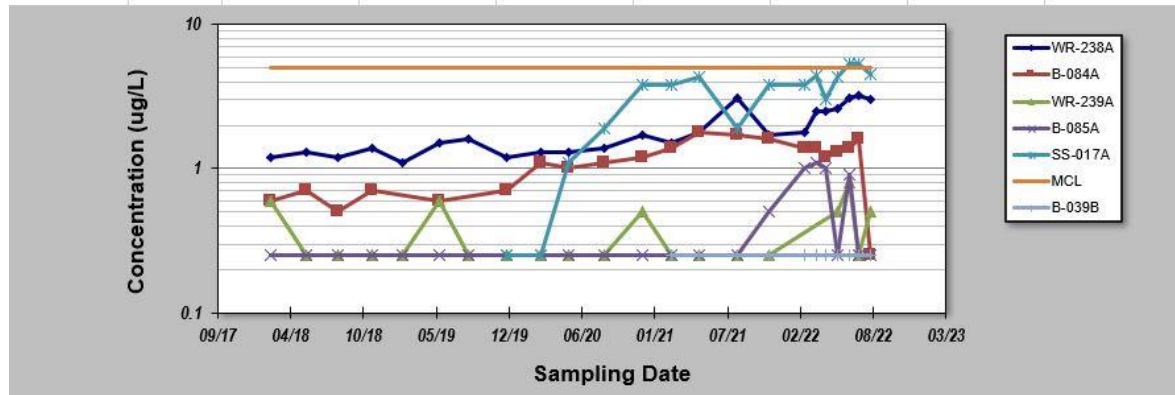
DISCLAIMER: The GSI Mann-Kendall Toolkit is available "as is". Considerable care has been exercised in preparing this software product; however, no party, including without limitation GSI Environmental Inc., makes any representation or warranty regarding the accuracy, correctness, or completeness of the information contained herein, and no such party shall be liable for any direct, indirect, consequential, incidental or other damages resulting from the use of this product or the information contained herein. Information in this publication is subject to change without notice. GSI Environmental Inc., disclaims any responsibility or obligation to update the information contained herein.

GSI Environmental Inc., www.gsi-net.com

Figure C5. TCE concentration data, Mann-Kendall statistics, and time series plot for wells near the north Tucson Airport Remediation Project well field.

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date:	5-Apr-23			Job ID:	Tucson International Airport Superfund Site			
Facility Name:	TARP			Constituent:	TCE			
Conducted By:	Kristin Addis			Concentration Units:	ug/L			
Sampling Point ID:	WR-238A	B-084A	WR-239A	B-085A	SS-017A	MCL	B-039B	
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)						
1	14-Feb-18	1.2	0.6	0.6	0.25	5		
2	22-May-18	1.3	0.7	0.25	0.25			
3	19-Aug-18	1.2	0.5	0.25	0.25			
4	20-Nov-18	1.4	0.7	0.25	0.25			
5	12-Feb-19	1.1		0.25	0.25			
6	22-May-19	1.5	0.6	0.6	0.25			
7	12-Aug-19	1.6		0.25	0.25			
8	26-Nov-19	1.2	0.7	0.25	0.25	0.25		
9	26-Feb-20	1.3	1.1	0.25	0.25	0.25		
10	12-May-20	1.3	1	0.25	0.25	1.1		
11	19-Aug-20	1.4	1.1	0.25	0.25	1.9		
12	30-Nov-20	1.7	1.2	0.5	0.25	3.8		
13	17-Feb-21	1.5	1.4	0.25	0.25	3.8	0.25	
14	4-May-21	1.8	1.8	0.25	0.25	4.3	0.25	
15	19-Aug-21	3.1	1.7	0.25	0.25	1.9	0.25	
16	15-Nov-21	1.7	1.6	0.25	0.5	3.8	0.25	
17	20-Feb-22	1.8	1.4		1.0	3.8	0.25	
18	22-Mar-22	2.5	1.4		1.1	4.4	0.25	
19	19-Apr-22	2.5	1.2		1.0	3.0	0.25	
20	20-May-22	2.6	1.3	0.5	0.25	4.3	0.25	
21	22-Jun-22	3.1	1.4	0.8	0.9	5.4	0.25	
22	18-Jul-22	3.2	1.6	0.25	0.25	5.3	0.25	
23	19-Aug-22	3.0	0.25	0.5	0.25	4.5	5	0.25
24								
25								
Coefficient of Variation:	0.38	0.40	0.48	0.75	0.51	0.00	0.00	
Mann-Kendall Statistic (S):	185	95	19	63	81	0	0	
Confidence Factor:	>99.9%	99.8%	71.8%	94.9%	>99.9%		45.1%	
Concentration Trend:	Increasing	Increasing	No Trend	Prob. Increasing	Increasing		Stable	



Notes:

At least four independent sampling events per well are required for calculating the trend. Methodology is valid for 4 to 40 samples.
 Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing;
 $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
 Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, Ground Water, 41(3):355-367, 2003.

DISCLAIMER: The GSI Mann-Kendall Toolkit is available "as is". Considerable care has been exercised in preparing this software product; however, no party, including without limitation GSI Environmental Inc., makes any representation or warranty regarding the accuracy, correctness, or completeness of the information contained herein, and no such party shall be liable for any direct, indirect, consequential, incidental or other damages resulting from the use of this product or the information contained herein. Information in this publication is subject to change without notice. GSI Environmental Inc., disclaims any responsibility or obligation to update the information contained herein.

GSI Environmental Inc., www.gsi-net.com

Figure C6. TCE concentration data, Mann-Kendall statistics, and time series plot for wells downgradient of the Tucson Airport Remediation Project northern extraction wells.

Texas Instruments

Texas Instruments monitors eight wells to assess the in-situ chemical oxidation remedy performance on a semi-annual basis. Water levels are measured in 15 monitoring wells semi-annually. Groundwater flows from south to north (Figure C7). TCE concentrations ranged from non-detect to 65.4 µg/l located at well AW-2R.

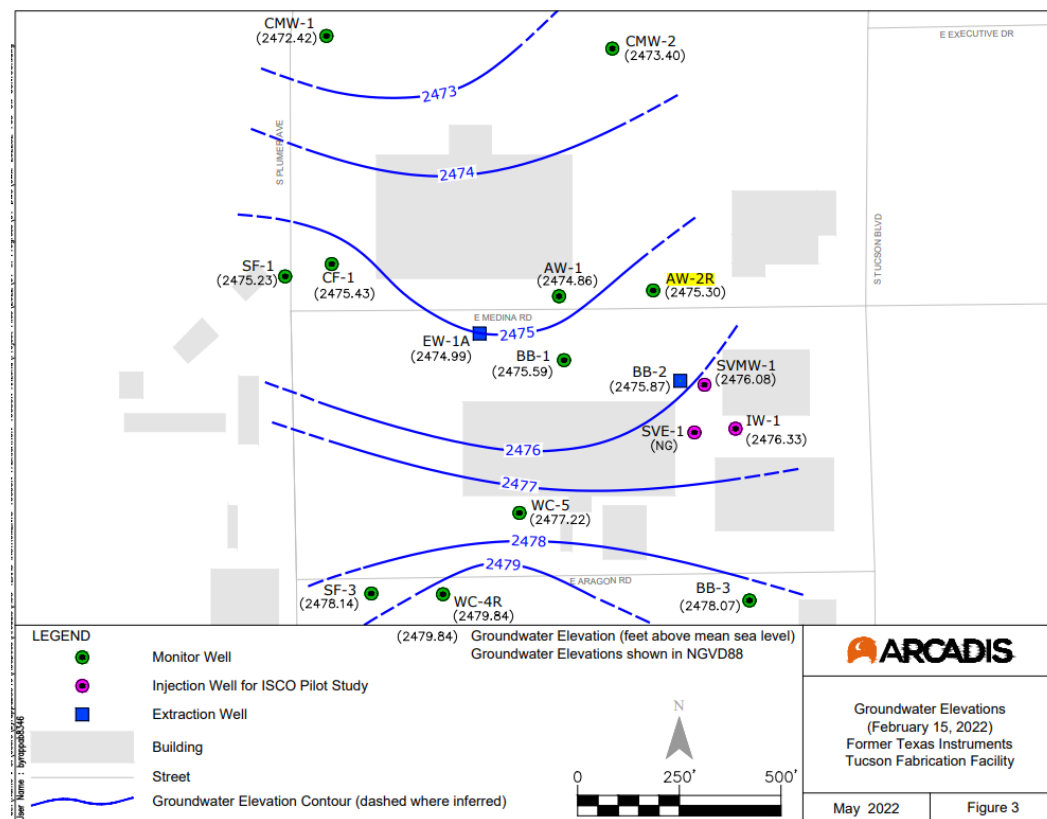


Figure C7. Groundwater elevations at Texas Instruments during May 2022.

USACE performed Mann-Kendall on TCE concentration to assess a trend. It is important to note that many wells did not result in detectable concentrations and trend analysis could not be performed. This lack of detected contaminants is evidence that the remedy is effective in these areas of the aquifer. Trends for four out of five wells evaluated resulted in No trend (3) or decreasing trends (1) with the exception of well AW-2R that resulted in an increasing trend. Mann-Kendall results are presented in Figure C8.

USACE performed Mann-Kendall on total chromium concentrations in three downgradient wells. One well was decreasing, one had no trend, and one was increasing. The wells with no trend and an increasing trend had concentrations of chromium above the cleanup level (up to 33x times above the cleanup level in the well with the increasing concentration).

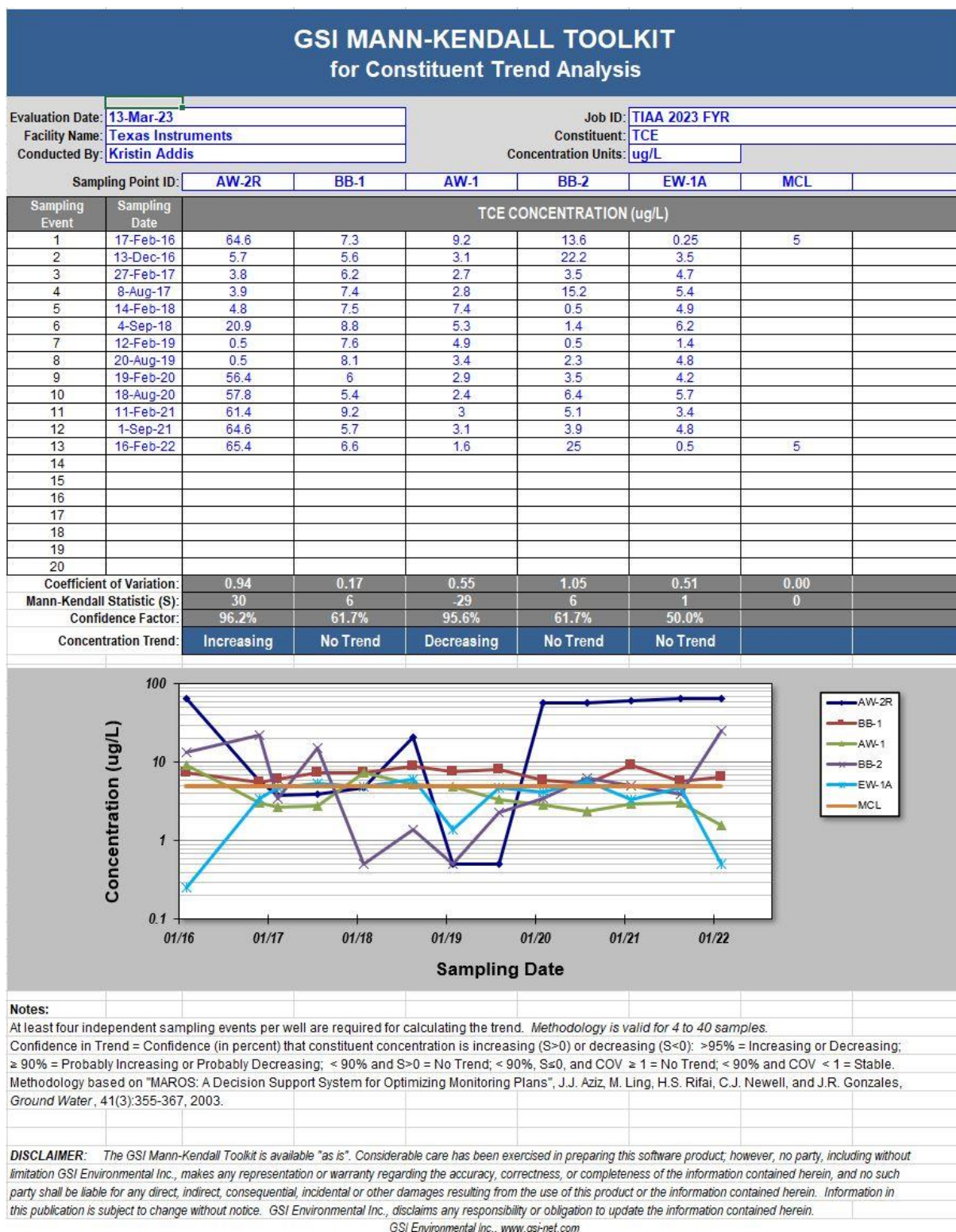
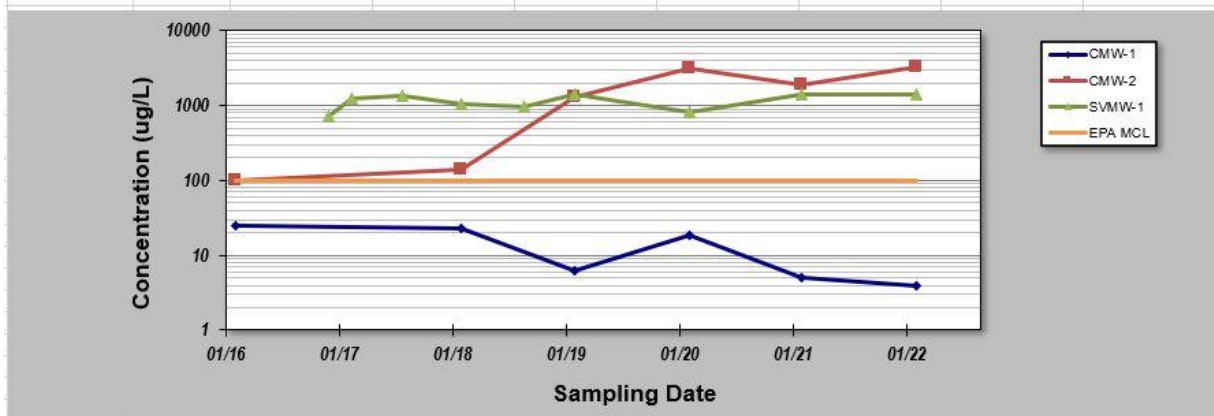


Figure C8 – Mann-Kendall Trend Analysis results for Texas Instruments

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date:	13-Mar-23				Job ID:	TIAA FYR		
Facility Name:	Texas Instruments				Constituent:	Total Chromium		
Conducted By:	Kristin Addis				Concentration Units:	ug/L		
Sampling Point ID:	CMW-1	CMW-2	SVMW-1	EPA MCL				
Sampling Event	Sampling Date	TOTAL CHROMIUM CONCENTRATION (ug/L)						
1	17-Feb-16	24.7	99.6		100			
2	13-Dec-16			733				
3	27-Feb-17			1240				
4	8-Aug-17			1340				
5	14-Feb-18	22.9	141	1040				
6	4-Sep-18			977				
7	12-Feb-19	6.3	1,280	1420				
8	20-Aug-19							
9	19-Feb-20	18.6	3,100	806				
10	18-Aug-20							
11	11-Feb-21	5	1,910	1390				
12	1-Sep-21							
13	16-Feb-22	4	3,300	1420	100			
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:	0.70	0.85	0.23	0.00				
Mann-Kendall Statistic (S):	.13	13	13	0				
Confidence Factor:	99.2%	99.2%	89.0%					
Concentration Trend:	Decreasing	Increasing	No Trend					



Notes:
At least four independent sampling events per well are required for calculating the trend. Methodology is valid for 4 to 40 samples.
Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing;
≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, Ground Water, 41(3):355-367, 2003.

DISCLAIMER: The GSI Mann-Kendall Toolkit is available "as is". Considerable care has been exercised in preparing this software product; however, no party, including without limitation GSI Environmental Inc., makes any representation or warranty regarding the accuracy, correctness, or completeness of the information contained herein, and no such party shall be liable for any direct, indirect, consequential, incidental or other damages resulting from the use of this product or the information contained herein. Information in this publication is subject to change without notice. GSI Environmental Inc., disclaims any responsibility or obligation to update the information contained herein.

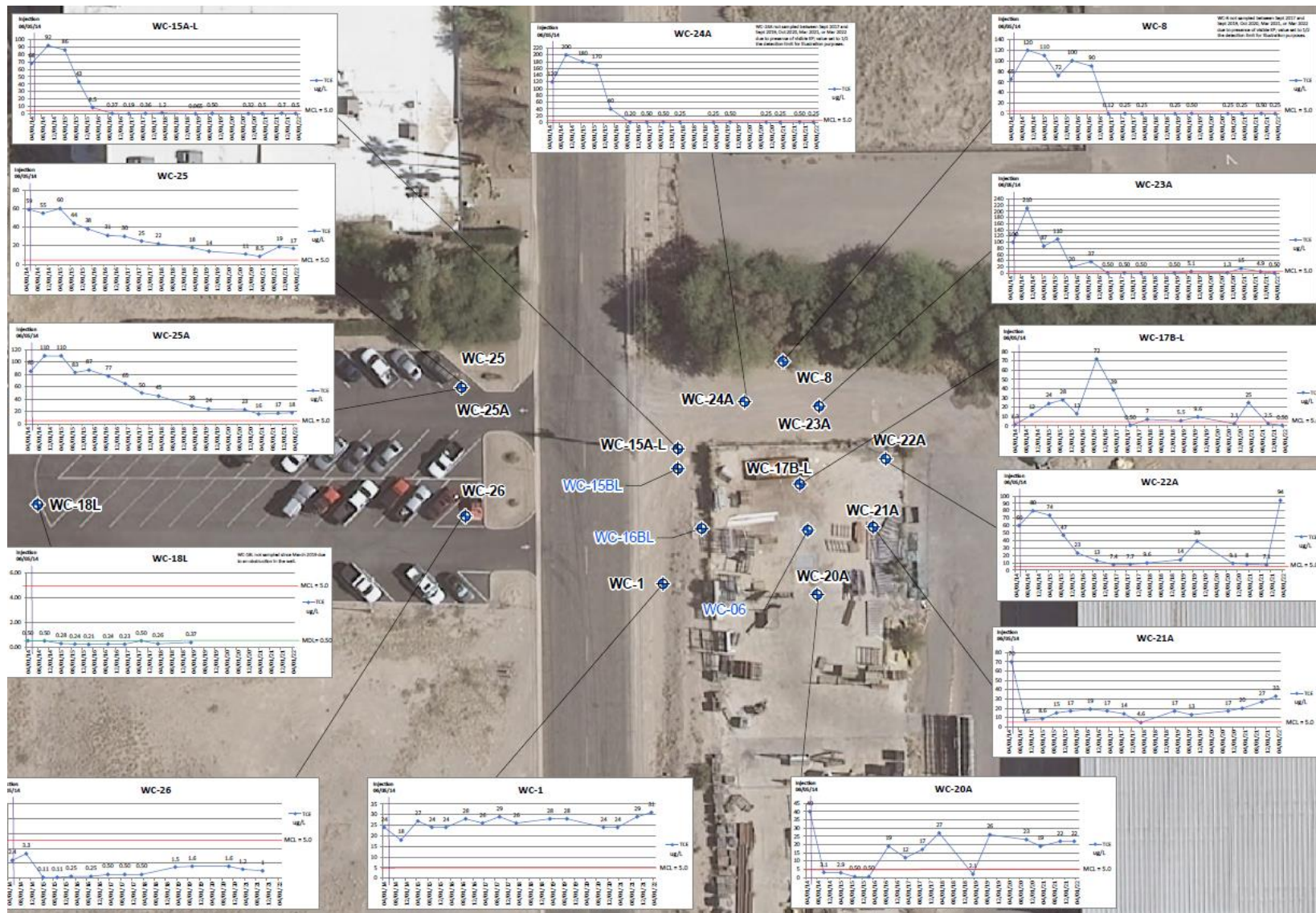
GSI Environmental Inc., www.gsi-net.com

Figure C9 – Total Chromium Concentrations at Texas Instruments.

West Cap

USACE evaluated progress at West Cap and the effectiveness of the In-situ Chemical Oxidation remedy performed in 2014 within the source area. The injections have been successful at reducing volatile contaminants to below regulatory levels in the northern portion of the source area. However, concentrations are rebounding above regulatory levels at the central and southern portions of the source area, as evidenced by increasing TCE concentrations at WC-20A, WC-21A, WC-22A (Figure C10). Further treatment in the southern portion of the Source Area may be necessary to further reduce concentrations to below the regulatory limits make progress towards aquifer restoration.

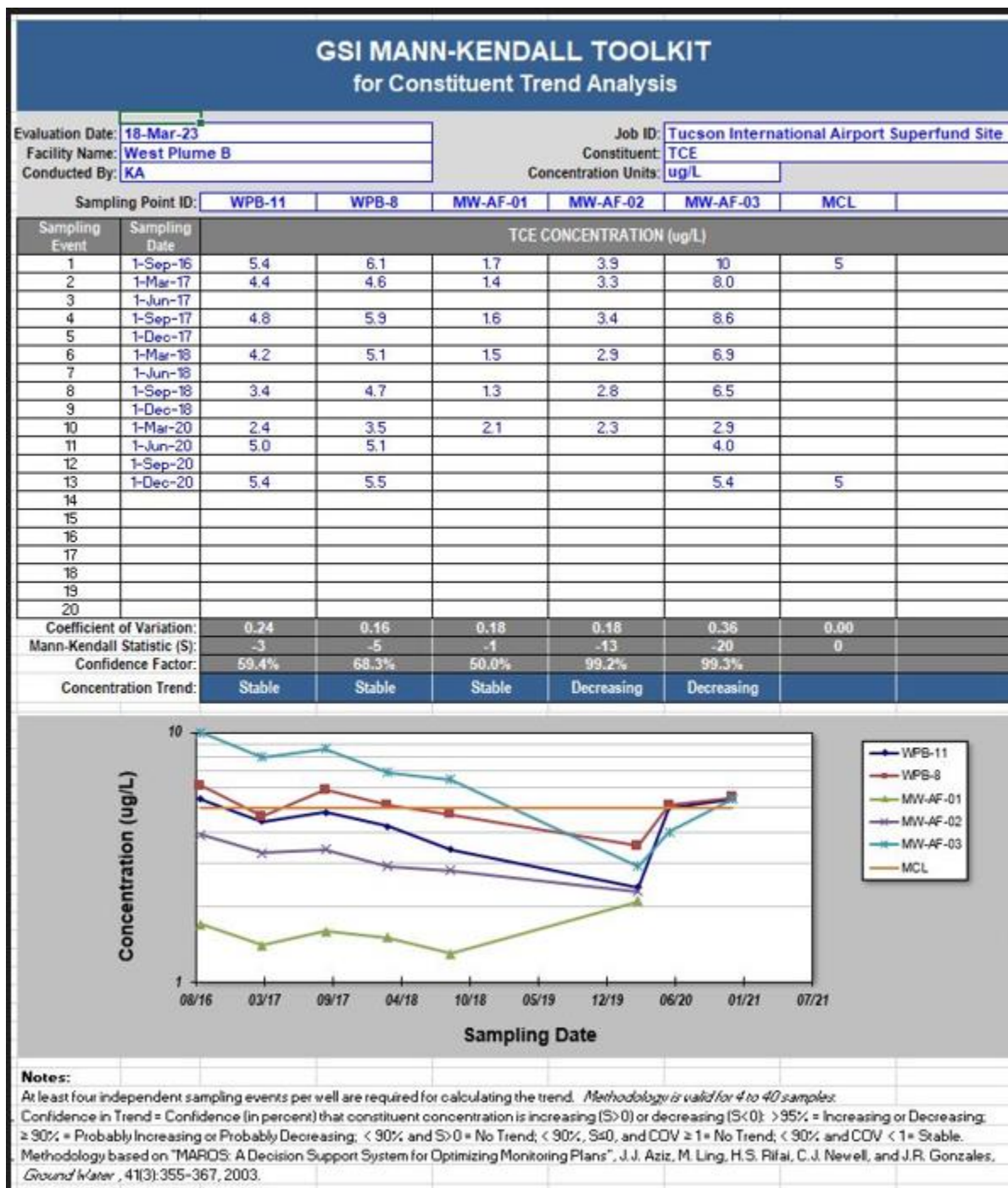
The 2014 injections appear largely successful at preventing migration of TCE concentrations further downgradient, as evidenced by decreases in TCE concentrations since the injections in downgradient wells WC-15A-L, WC-25, WC-25A, and WC-26. However the downgradient well WC-1, which is closer to the source area, on the southern part, did not experience a decrease in TCE concentrations and remains above the cleanup level.



Source: APTIM, 2022.

Figure C10. Time Series Trends for TCE near Source Area (purple line) at West Cap

West Plume B



Arizona Air National Guard

The Arizona Air National Guard conducted In-situ Chemical Oxidation in 2009 to 2010 with associated performance monitoring of select groundwater monitoring wells to track the progress of the remedy. Arizona Air National Guard is located downgradient of the Texas Instruments and West Cap sites and upgradient of West Plume B.

USACE independently evaluated the effectiveness of the remedies at preventing migration of contaminants offsite. Several lines of evidence were utilized in the evaluation including TCE concentrations, groundwater flow and statistical trends. Plume maps demonstrate stable plume margins when compared to the previous review period demonstrating stable conditions horizontally throughout the site.

The Upper subunit contain the majority of the TCE mass at the site near the southeast property boundary. MW-98U contains the greatest concentration of TCE at 36 µg/l and is located upgradient and offsite; however, the TCE concentration is decreasing. Two onsite wells show increasing trends (UP-1 and UP-02), with concentrations exceeding the cleanup level (Figure C11).

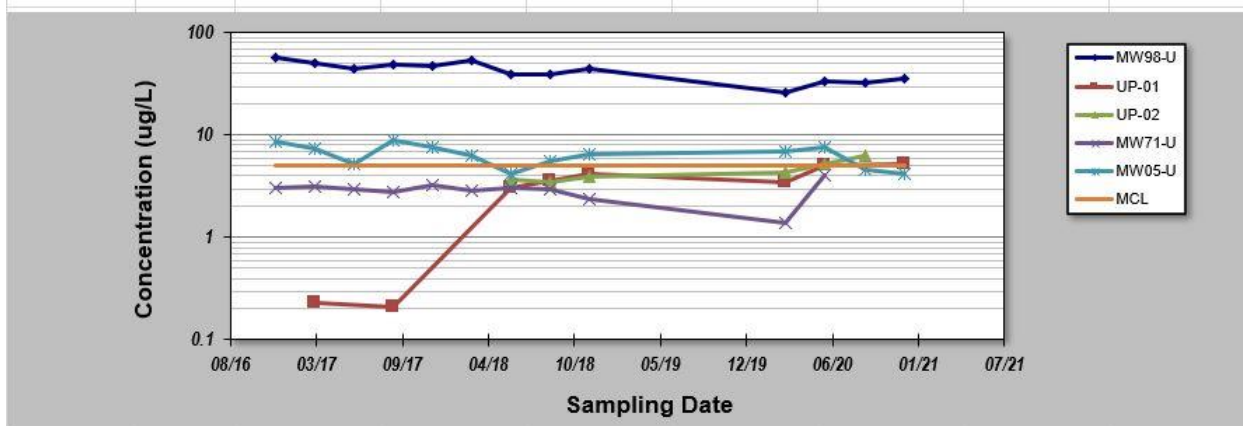
The Lower Subunit resulted in TCE detections in three out of nine wells monitored with concentrations ranging from 0.68 µg/l to 11 µg/l. Well PT-14 resulted in a TCE concentration of 11 µg/l. All other wells in the lower subunit remain near or below the cleanup level.

As previous discussed, the groundwater levels within the Regional Aquifer have risen steadily throughout the last ten years and may be mobilizing contaminants within the vadose zone that are recently resaturated. The concentrations in three wells were evaluated over time in relation to the rising groundwater levels to look for a correlation (MW05-U, MW05-L, and PT-14; Figures C13 and C14). The TCE concentrations in those wells have risen over time in relation to the rising groundwater levels. While those wells are located mid-plume and not at the primary source area, it could represent back diffusion of contaminants from secondary source areas or contamination sorbed in the vadose zone. However it should be noted that the magnitude of the concentration increases is low and may be a result of fluctuation of concentrations for other reasons and the effect of possible mobilization of contaminants to some extent from the in-situ chemical oxidant injections should be considered as well.

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date: **18-Mar-23** Job ID: **Tucson International Airport Superfund Site**
 Facility Name: **AANG** Constituent: **TCE**
 Conducted By: **KA** Concentration Units: **ug/L**

Sampling Point ID:		MW98-U	UP-01	UP-02	MW71-U	MW05-U	MCL	
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)						
1	1-Dec-16	57			3.1	8.7	5	
2	1-Mar-17	50	0.23		3.2	7.5		
3	1-Jun-17	45			3	5.3		
4	1-Sep-17	49	0.21		2.8	8.9		
5	1-Dec-17	48			3.3	7.7		
6	1-Mar-18	54			2.9	6.4		
7	1-Jun-18	39	3.1	3.7	3.1	4.2		
8	1-Sep-18	39	3.6	3.5	3	5.6		
9	1-Dec-18	45	4.2	3.9	2.4	6.5		
10	1-Mar-20	26	3.5	4.3	1.4	6.9		
11	1-Jun-20	34	5.1	5.3	4.1	7.7		
12	1-Sep-20	33		6.3		4.6		
13	1-Dec-20	36	5.3			4.2	5	
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.21	0.62	0.24	0.22	0.25	0.00	
Mann-Kendall Statistic (S):		-50	22	13	-11	-26	0	
Confidence Factor:		99.9%	99.8%	99.2%	77.7%	93.6%		
Concentration Trend:		Decreasing	Increasing	Increasing	Stable	Prob. Decreasing		



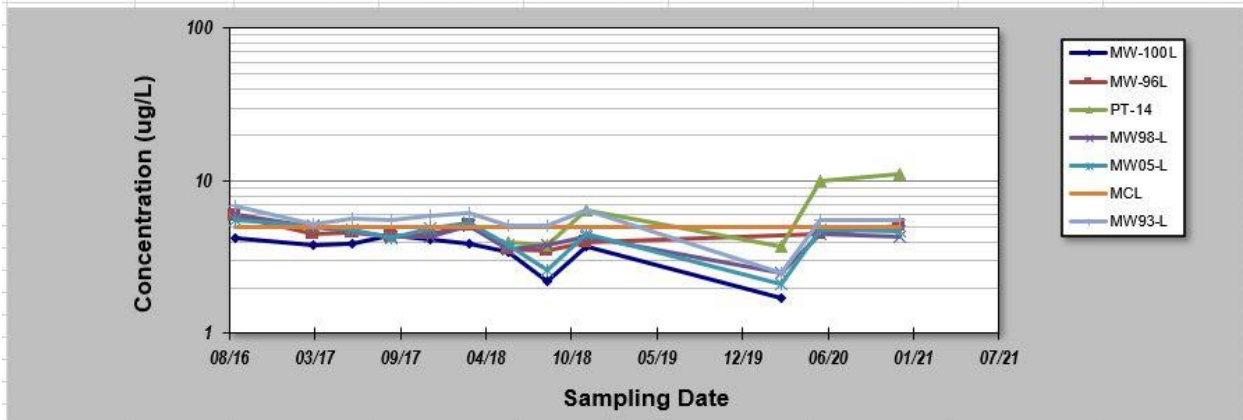
Notes:
 At least four independent sampling events per well are required for calculating the trend. Methodology is valid for 4 to 40 samples.
 Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing;
 ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
 Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales,
 Ground Water, 41(3):355-367, 2003.

DISCLAIMER: The GSI Mann-Kendall Toolkit is available "as is". Considerable care has been exercised in preparing this software product; however, no party, including without limitation GSI Environmental Inc., makes any representation or warranty regarding the accuracy, correctness, or completeness of the information contained herein, and no such party shall be liable for any direct, indirect, consequential, incidental or other damages resulting from the use of this product or the information contained herein. Information in this publication is subject to change without notice. GSI Environmental Inc., disclaims any responsibility or obligation to update the information contained herein.
 GSI Environmental Inc., www.gsi-net.com

Figure C11 Mann-Kendall Trend Results for the Upper Subunit at Arizona Air National Guard

GSI MANN-KENDALL TOOLKIT for Constituent Trend Analysis

Evaluation Date:	18-Mar-23			Job ID:	Tucson International Airport Superfund Site			
Facility Name:	AANG			Constituent:	TCE			
Conducted By:	KA			Concentration Units:	ug/L			
Sampling Point ID:		MW-100L	MW-96L	PT-14	MW98-L	MW05-L	MCL	MW93-L
Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)						
1	1-Sep-16	4.2	5.9		6	5.5	5	6.9
2	1-Mar-17	3.8	4.5		5	5.1		5.2
3	1-Jun-17	3.9	4.6		4.7	4.8		5.7
4	1-Sep-17	4.4	4.3		4.3	4.2		5.6
5	1-Dec-17	4.1	4.5		4.3	4.9		5.9
6	1-Mar-18	3.9	5.1		5.1	5.3		6.2
7	1-Jun-18	3.4	3.6	4	3.6	3.8		5.1
8	1-Sep-18	2.2	3.5	3.8	3.8	2.6		5.1
9	1-Dec-18	3.7	4	6.4	4.3	4.5		6.4
10	1-Mar-20	1.7		3.7	2.5	2.1		2.5
11	1-Jun-20		4.5	10	4.5	4.8		5.5
12	1-Sep-20							
13	1-Dec-20		5.1	11	4.3	4.7	5	5.6
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.25	0.15	0.51	0.20	0.24	0.00	0.20
Mann-Kendall Statistic (S):		.26	-.11	7	-.28	-.27	0	-.14
Confidence Factor:		98.9%	77.7%	86.4%	96.9%	96.3%		81.0%
Concentration Trend:		Decreasing	Stable	No Trend	Decreasing	Decreasing		Stable



Notes:
At least four independent sampling events per well are required for calculating the trend. Methodology is valid for 4 to 40 samples.
Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing;
≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, Ground Water, 41(3):355-367, 2003.

DISCLAIMER: The GSI Mann-Kendall Toolkit is available "as is". Considerable care has been exercised in preparing this software product; however, no party, including without limitation GSI Environmental Inc., makes any representation or warranty regarding the accuracy, correctness, or completeness of the information contained herein, and no such party shall be liable for any direct, indirect, consequential, incidental or other damages resulting from the use of this product or the information contained herein. Information in this publication is subject to change without notice. GSI Environmental Inc., disclaims any responsibility or obligation to update the information contained herein.
GSI Environmental Inc., www.gsi-net.com

Figure C12 Mann-Kendall Trend Results for the Lower Subunit at Arizona Air National Guard

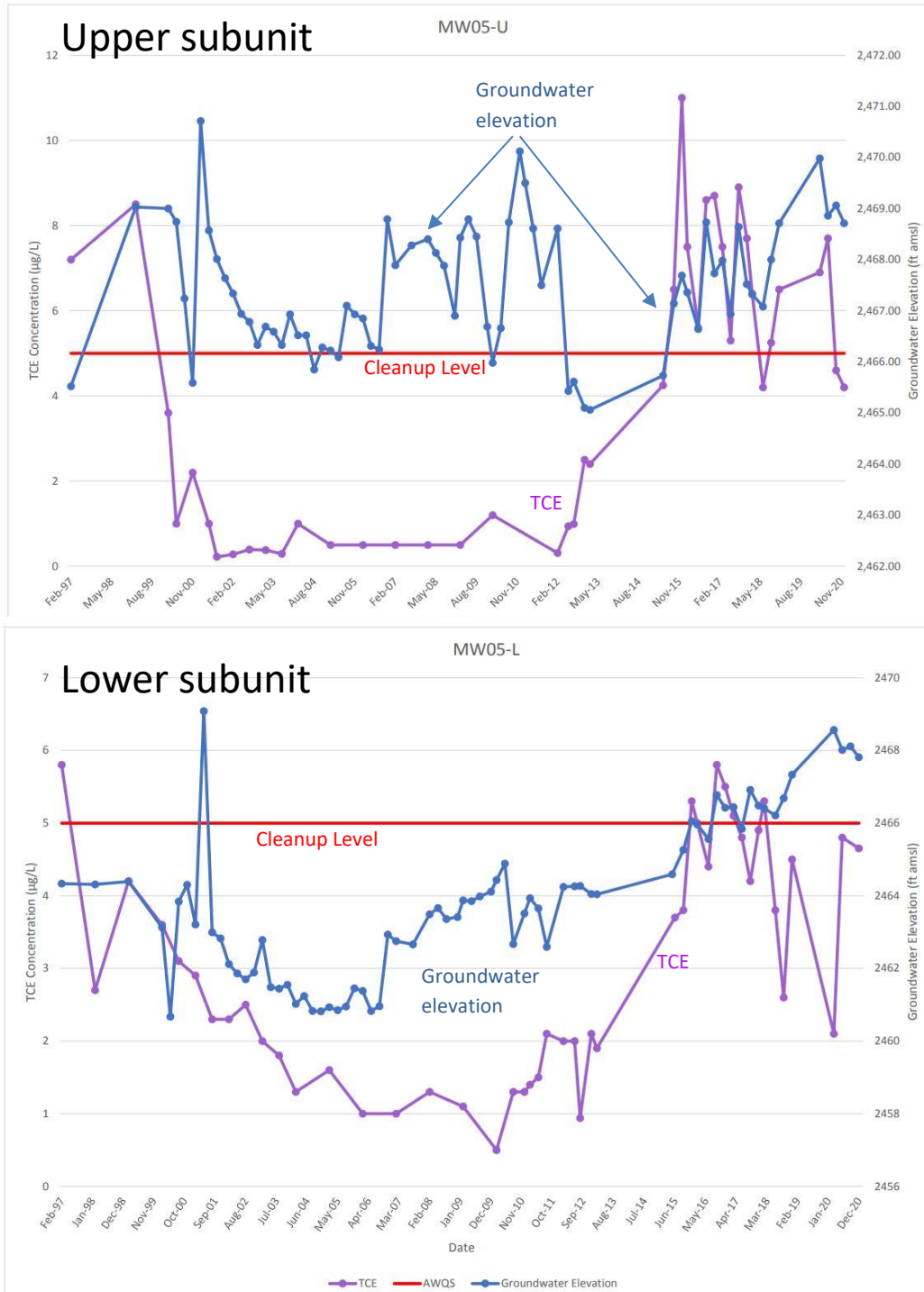


Figure C13 Comparison of TCE Concentrations in Relation to Water Elevation for the upper and lower subunit



Figure C14 TCE Concentrations and Groundwater Elevations at PT-14 Lower Unit

Airport Property

The soil and shallow groundwater remedy at the Airport Property consists of soil vapor extraction for soil remediation, and a groundwater extraction system for control of migration within the Shallow Groundwater Zone and the Gravel Subunit. The Shallow Groundwater Zone includes groundwater in both the Upper Unit 4 and the Gravel subunit. The gravel subunit was deposited as loosely connected paleochannels composed of mainly of gravel interbeds within the clay aquitard. Due to limited permeability of the clay, the permeable GSU exhibits characteristics of a confined aquifer, with varying degrees of upward pressure. The Shallow Groundwater Zone is hydraulically connected to the Gravel Subunit and groundwater flows in the westerly direction. Due to the complex depositional environment of alluvial fan deposits and paleochannels, some Gravel Subunits, while connected to the surrounding Shallow Groundwater Zone may not be hydraulically connected to other isolated areas within the Gravel Subunit. Historically, the Shallow Groundwater Zone/Gravel Subunit transitions to the west into the Regional Aquifer and were distinct from one another. However, due to increasing water levels within the Regional Aquifer these units have similar water levels and are now in communication (Figure C1).

Table C1 Airport Property Stratigraphic Unit and Remedy

<i>Stratigraphic Unit</i>	<i>Hydrogeologic Unit</i>	<i>Hydrogeologic Subunit</i>
Unit 1	Vadose Zone	(see Section 4 Soils for details on soil vapor extraction remedy within the vadose zone)
Unit 2		
Unit 3		
Unit 4	SGZ	Upper SGZ (Upper Unit 4 Clay)
		Gravel Subunit (GSU)
		Lower Unit 4 Clay
Fort Lowell Formation/ Upper Tinaja Beds	Regional Aquifer	Upper Divided Aquifer
		Lower Divided Aquifer

Soil Vapor Extraction Remedy (TI Zone, RRSs and the Plugin Subsites)

Airport Property operates soil vapor extraction systems that include the Technical Infeasibility Zone, the Remedy-Required Subsites and the Plug-in Subsites. The remedial action objective is to “reduce volatile organic compound vapor concentrations in soil and achieve lateral and vertical vapor containment until contaminant concentrations have been reduced such that ceasing operation of the system will not cause a water quality impact to the Shallow Groundwater Zone outside the Technical Impracticability Zone or to the Regional Aquifer in excess of cleanup standards” (EPA, 2001).

The soil vapor extraction systems are not currently meeting remedial action objectives due to reduced efficiency of the vapor extraction system due to rising water levels. As the groundwater rises and saturates previously open pore space, the efficiency of the system is reduced due to reduced exposure to contaminated soils within the vicinity of the Technical Infeasibility Zone.

Remedy-Required Subsites

USACE evaluated the Remedy-Required Subsites for compliance with the Remedial Action Objections that shall “reduce volatile organic compound vapor concentrations in soil and achieve lateral and vertical vapor containment until contaminant concentrations have been reduced such that ceasing operation of the system will not cause a water quality impact to the Shallow Groundwater Zone outside the Technical Impracticability Zone or to the Regional Aquifer in excess of cleanup standards” (EPA, 2001). The three operating Remedy-Required Subsites are summarized in Table C2.

Table C-2 The Remedy-Required Subsites, Extraction System and Sources

Remedy-Required Subsites Area	Extraction Well	Original source	Contaminants
North of former Structure 27	SVE-5	Two 50,000-gallon underground storage tanks	TCE and petroleum
Former Building 24 & 25	SVE-6	Aircraft maintenance	PCE, TCE
Building D-158 & Hangar 1	SVE-7	Aircraft maintenance	PCE, TCE

The Remedy-Required Subsites are currently meeting the remedial action objectives. Analytical results for SVE-5, SVE-6 and SVE-7 demonstrate soil gas, soil and groundwater analytical results below regulatory levels, respectively (Figures C15, C16 and C17). Vacuum pressure monitoring demonstrates negative pressures observed beyond the compliance wells and at a deeper depth than the known source for all sites. SVE-6 was not operating at the beginning of the review period but started operation due to increasing concentrations in the compliance well. Since startup, concentrations have been reduced to below regulatory levels.

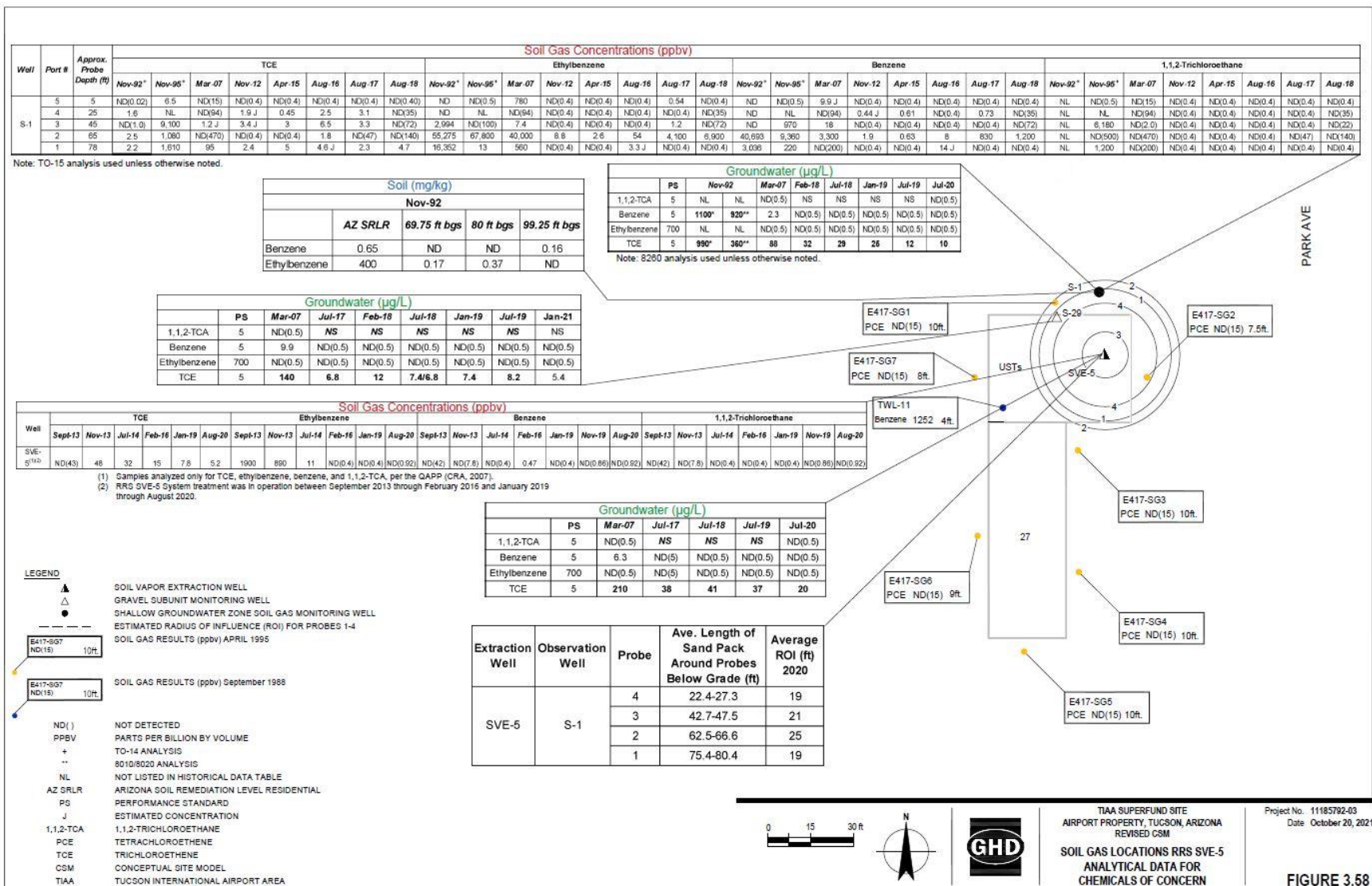
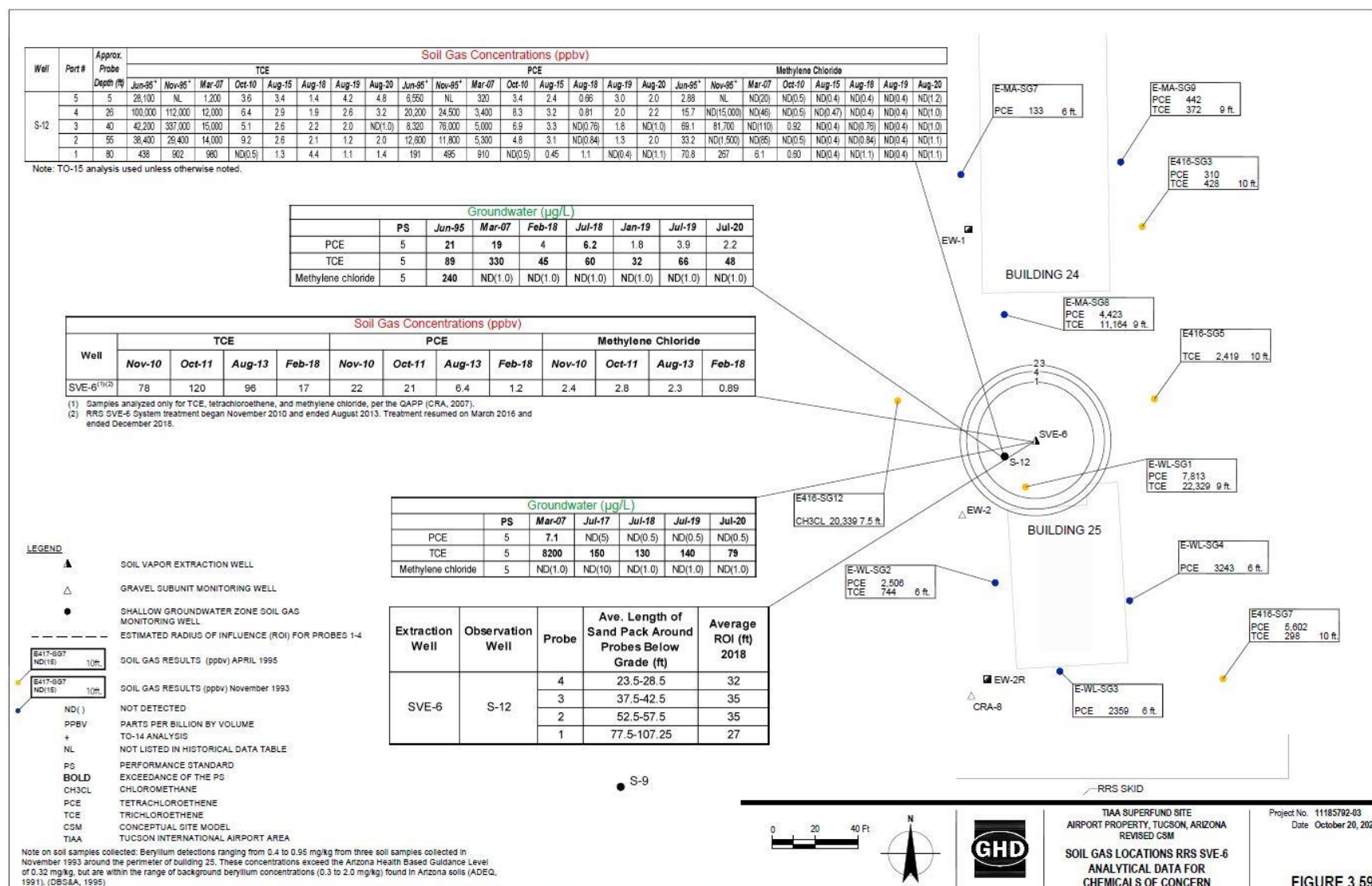


Figure C15. Airport Property Soil Vapor Extraction System 4 at Remedy-Required Site. (Source: GHD, 2023)



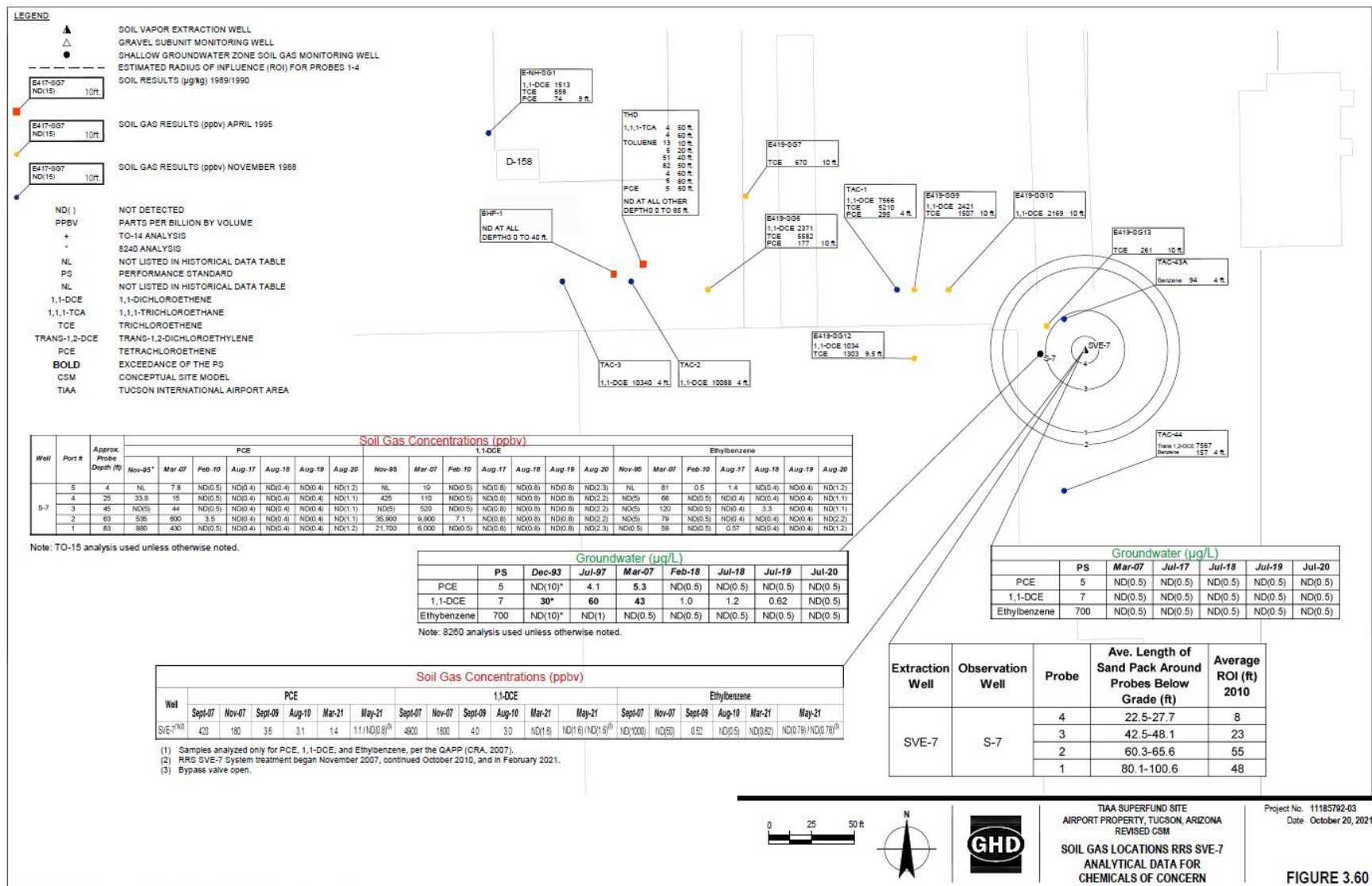


Figure C17 Analytical Results in the Vicinity of SVE-7 (Source: GHD, 2023)

Subsites

USACE evaluated ten soil vapor extraction plug-in subsites at the Airport Property that are monitored on a semi-annual basis, annual basis, or every five years (Figure C18). Five of the ten sites have concentration that are well below performance criteria. The remaining five sites have exceedances in one or more contaminants, but contaminant concentrations do not appear to be migrating. In general, the contaminant concentrations with exceedances at the subsites are stable. The increasing Regional Aquifer water levels complicates the effectiveness of the soil vapor extraction remedy (Table C3).

The West End Runway 3 and S-17 Area is reported as co-mingled and will be combined for future sampling efforts (GHD, 2022). Further evaluation and discussion are occurring between the Airport Property, their consultant GHD and the regulatory agencies regarding the change in site conditions and its impact on the remedy. GHD acknowledges the difficulties of the existing remedies and are actively engaged in considering alternate remedies.

Table C3. Soil Vapor Extraction Plug-In Subsites Groundwater Analytical Summary and Sampling Frequency

Subsites	Subsurface Unit	Regulatory Exceedances in Review Period (2018-2023)	Contaminant/ Maximum Concentration (µg/l) 2017	Contaminant/ Maximum Concentration (µg/l) 2022	Average Change in Groundwater Elevation (ft)
D-3 Fire Drill Area	SGZ	No	0.66	ND (<0.50)	+1.13
Hamilton Buildings Area	SGZ	No	ND (<0.50)	ND (<0.50)	+3.12
C-294 Burn Pit	SGZ	No	ND (<0.50)	0.64	+0.62
Credit Union Dump	Regional Aquifer	No	TCE/3.9 1,1-DCE/0.99	TCE/3.2 1,1-DCE/0.86	+0.42
North End of Samsonite Building D-167	SGZ	No	1,1-DCE/1.4	1,1-DCE/ ND (<0.50)	+2.83
	GSU	No	1,1-DCE/ ND (<0.50)	1,1-DCE/ ND (<0.50)	+3.26
West End Runway 3 (WER3)	SGZ	Yes	CC4/15 PCE/6.4 TCE/2.4	CC4/29 PCE/5.6 TCE/1.9	+4.14
	GSU	Yes	TCE/12	TCE/8.4	+2.76
	Regional Aquifer	Yes	TCE/6.6	TCE/3.8	+2.64
Former Building 32	SGZ	Yes	TCE/220	TCE/210	+2.83
TAA Landfill	SGZ	No	TCE/9.5	TCE/1.2	+2.10
	Regional Aquifer	Yes (2020&2021)	TCE/3.2	TCE/3.9	+2.08
South Ramp & Drains	SGZ	Yes	TCE/6.5	TCE/9.2	+3.14
Former Building 32 (S-17 Area)	SGZ	Yes	TCE/200 PCE/220	TCE/180 PCE/210	+5.98
	GSU	Yes	TCE ND (<0.50) PCE ND (<0.50)	TCE ND (<0.50) PCE ND (<0.50)	+4.38

Notes:
 CC4- Carbon tetrachloride
 TCE -Trichloroethylene
 PCE- Tetrachloroethene
 SGZ- Shallow groundwater zone
 GSU- Gravel subunit
 ND – Not detected.

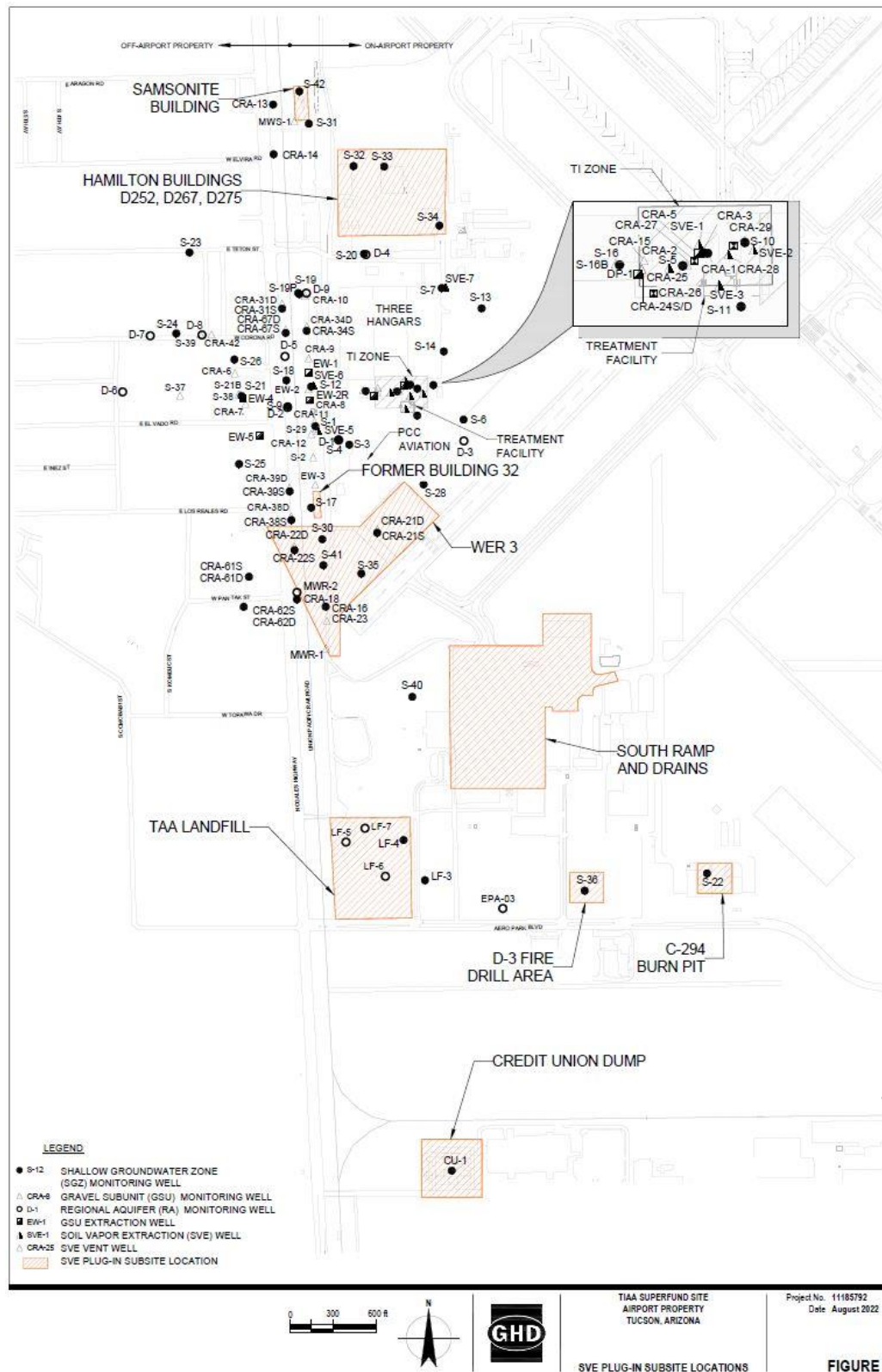


Figure C18. Airport Property Subsites Locations

Appendix D: Applicable or Relevant and Appropriate Requirements Assessment

Section 121 (d)(2)(A) of Comprehensive Environmental Response, Compensation, and Liability Act specifies that Superfund remedial actions must meet any Federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). ARARs are those standards, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Comprehensive Environmental Response, Compensation, and Liability Act site.

Changes (if any) in ARARs, in particular if an ARAR has become more stringent, are evaluated to determine if the changes affect the protectiveness of the remedy. Each ARAR and any change to the applicable standard or criterion are discussed below.

The major statutes and regulations that contribute to the list of chemical-specific ARARs are the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), the Arizona Water Quality Standards (A.A.C Title 18, Chapter 11), and the Arizona Soil Remediation Levels (A.A.C, Title 18, Chapter 7). In 2008, federal MCLs were incorporated by reference into A.A.C. Title 18, Chapter 4. If an Arizona Water Quality Standard (AWQS) does not exist for a specific compound, the ADEQ Human Health-Based Guidance Levels for Contaminants in Drinking Water (HBGL) are To Be Considered (TBC) standards. While the HBGLs are not promulgated and are not, therefore, ARARs, they were taken into consideration during the development of remedial alternatives.

Groundwater - Area A consists of groundwater at the Tucson Airport Remediation Project. There are two decision documents with chemical-specific ARARs for Groundwater - Area A: the 1988 Record of Decision and the 1997 Explanation of Significant Differences. In Attachment #2 of the 1997 Explanation of Significant Differences, EPA clarified that the treated water standards for water intended to be reinjected back into the Regional Aquifer are federal drinking water standards for all Site contaminants. Chemical-specific ARARs identified in the selected remedy within the decision documents for the groundwater at Groundwater - Area A were evaluated (Table D-1). There were no changes to the chemical-specific ARARs within the past five years. The current drinking water standards (state and federal) for total trihalomethanes (the sum of chloroform, bromodichloromethane, dibromochloromethane, and bromoform) is used for chloroform (80 µg/L), which is currently more stringent than the cleanup standard for chloroform for Groundwater - Area A. However, chloroform remains below the drinking water standards in groundwater in Groundwater - Area A, with the highest detection within the past five years being 2.3 µg/L (as of groundwater analytical data as recent as August 2022).

Table D-1. Summary of Groundwater Chemical-Specific ARAR Changes for Groundwater - Area A

Chemical	1988 ROD Cleanup Levels (µg/L)	Basis for Cleanup Level	Current Regulations (µg/L)		ARARs More or Less Stringent than Cleanup Levels?
			State ^(a)	Federal	
Benzene	5	Federal MCL	5	5	No changes
Chloroform	100	Federal MCL	80 ^(b)	80 ^(b)	More stringent
Chromium	50	Federal MCL	100	100	Less stringent
1,1-Dichloroethylene	7	Federal MCL	7	7	No changes
trans-1,2-Dichloroethylene (trans-1,2-DCE)	70	State Action Level ^(c)	100	100	Less stringent
Trichloroethylene (TCE)	5	Federal MCL	5	5	No changes

Notes:

ESD = Explanation of Significant Differences

MCL = Maximum Contaminant Level, which is a federal or state drinking water standard

ROD = Record of Decision

^(a) - The Arizona Department of Environmental Quality adopted the federal drinking water standards.

^(b) - MCL value is for Total Trihalomethanes (TTHM), the sum of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

^(c) - State Action Level set by the Arizona Department of Health Services. These guidance levels are not promulgated but were considered during development of remedial alternatives.

Groundwater - Area B consists of groundwater at several locations: the Texas Instruments property, the 162nd Fighter Group Arizona Air National Guard (AANG) Base, the former West Cap area, and the West Plume B area. There are four decision documents with chemical-specific ARARs for Groundwater - Area B: the 1988 Record of Decision, 1997 Explanation of Significant Differences, 2004 and 2012 Record of Decision Amendments. In the most recent decision document, the 2012 Record of Decision Amendment, EPA updated the contaminants of concern and cleanup levels at Groundwater - Area B. Chemical-specific ARARs identified in the selected remedy within the decision documents for the groundwater at Groundwater - Area B were evaluated (Table D-2). No changes have occurred to the chemical-specific ARARs since the 2012 Record of Decision Amendment.

Table D-2. Summary of Groundwater Chemical-Specific ARAR Changes for Groundwater - Area B

Chemical	2012 ROD Amendment Cleanup Levels (µg/L)	Basis for Cleanup Level	Current Regulations (µg/L)		ARARs More or Less Stringent than Cleanup Levels?
			State ^(a)	Federal	
1,1-Dichloroethylene	7	Federal MCL	7	7	No changes
cis-1,2-Dichloroethylene (cis-1,2-DCE)	70	Federal MCL	70	70	No changes
Tetrachloroethylene (PCE)	5	Federal MCL	5	5	No changes
Trichloroethylene (TCE)	5	Federal MCL	5	5	No changes

Chemical	2012 ROD Amendment Cleanup Levels (µg/L)	Basis for Cleanup Level	Current Regulations (µg/L)		ARARs More or Less Stringent than Cleanup Levels?
			State ^(a)	Federal	
Vinyl chloride	2	Federal MCL	2	2	No changes

Notes:

MCL = Maximum Contaminant Level, which is a federal or state drinking water standard

ROD = Record of Decision

^(a) - The Arizona Department of Environmental Quality adopted the federal drinking water standards.

Soil and shallow groundwater at the Airport Property consists of several locations: the Texas Instruments property, the 162nd Fighter Group AANG Base, and the former West Cap Area. There is one decision document with chemical specific groundwater ARARs for the Airport Property: the 1997 Record of Decision. (The 1996 Record of Decision and 2001 Explanation of Significant Differences apply to soil actions only.) Chemical specific ARARs identified in the selected remedy within the decision documents for the groundwater at the Airport Property were evaluated (Table D-3).

There were no changes to the chemical-specific ARARs within the past five years. The current drinking water standards (state and federal) for total trihalomethanes (the sum of chloroform, bromodichloromethane, dibromochloromethane, and bromoform) remain more stringent than the groundwater cleanup standards for total trihalomethanes and chloroform for the Airport Property. However, chloroform and total trihalomethanes are anticipated to be reduced to below drinking water standards well before TCE is reduced to below cleanup levels as part of treatment system operation. For example, concentrations of chloroform and total trihalomethanes in groundwater were as high as 4.25 times their drinking water standards in select wells in 2022, while TCE concentrations were as high as 1,220 times their cleanup level in 2022. Groundwater samples are not currently analyzed for metals, including arsenic.

Table D-3. Summary of Groundwater Chemical-Specific ARAR Changes for the Airport Property

Chemical	1997 ROD Cleanup Levels (µg/L)	Basis for Cleanup Level	Current Regulations (µg/L)		ARARs More or Less Stringent than Cleanup Levels?
			State ^(a)	Federal	
1,1-Dichloroethane	5	State Guidance Level ^(b)	None	None	No changes
1,1-Dichloroethylene (1,1-DCE)	7	Federal MCL	7	7	No changes
1,1,1-Trichloroethane	200	Federal MCL	200	200	No changes
1,2-Dichloroethane	5	Federal MCL	5	5	No changes
cis-1,2-Dichloroethylene (cis-1,2-DCE)	70	Federal MCL	70	70	No changes
trans-1,2- Dichloroethylene	100	Federal MCL	100	100	No changes
1,2-Dichloropropane	5	Federal MCL	5	5	No changes
Acetone	700	State Guidance Level ^(b)	None	None	No changes
Arsenic	50	Federal MCL	10	10	More stringent

Chemical	1997 ROD Cleanup Levels (µg/L)	Basis for Cleanup Level	Current Regulations (µg/L)		ARARs More or Less Stringent than Cleanup Levels?
			State ^(a)	Federal	
Benzene	5	Federal MCL	5	5	No changes
Bis(2-ethylhexyl)phthalate ^(c)	6	Federal MCL	6	6	No changes
Carbon tetrachloride	5	Federal MCL	5	5	No changes
Chlorobenzene	100	Federal MCL	100	100	No changes
Chloroform	100	Federal MCL	80 ^(d)	80 ^(d)	More stringent
Chloromethane	2.7	State Guidance Level ^(b)	None	None	No changes
Chromium	100	Federal MCL	100	100	No changes
Dichlorodifluoromethane	1400	State Guidance Level ^(b)	None	None	No changes
Ethylbenzene	700	Federal MCL	700	700	No changes
Lead	15	Federal Action Level	None	None ^(e)	No changes
Methyl ethyl ketone	350	State Guidance Level ^(b)	None	None	No changes
Methylene chloride	5	Federal MCL	5	5	No changes
Nitrate (as Nitrogen)	10,000	Federal MCL	10,000	10,000	No changes
Tetrachloroethylene (PCE)	5	Federal MCL	5	5	No changes
Toluene	1,000	Federal MCL	1,000	1,000	No changes
Trichloroethylene (TCE)	5	Federal MCL	5	5	No changes
Trichlorotrifluoroethane (Freon 113) ^(f)	210,000	State Guidance Level ^(b)	None	None	No changes
Trichlorofluoromethane	2,100	State Guidance Level ^(b)	None	None	No changes
Trihalomethanes ^(g)	100	Federal MCL	80	80	More stringent
Xylenes	10,000	Federal MCL	10,000	10,000	No changes
Vinyl chloride	2	Federal MCL	2	2	No changes

Notes:

MCL = Maximum Contaminant Level, which is a federal or state drinking water standard

ROD = Record of Decision

^(a) - The Arizona Department of Environmental Quality adopted the federal drinking water standards.

^(b) - Arizona Department of Environmental Quality Health Based Guidance Level, Human Health Based Guidance Levels for Contaminants in Drinking Water and Soil, ADEQ, March 1996. These guidance levels are not promulgated but were considered during development of remedial alternatives.

^(c) - Also called di(2-ethylhexyl) phthalate.

^(d) - Total trihalomethanes have a MCL of 80 ppb. Total trihalomethanes include – bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

^(e) - The lead cleanup standard was based on the EPA action level of 15 µg/L. There is no MCL for lead.

^(f) - This contaminant of concern was misspelled in the 1997 ROD as “trichlorofluoromethane (Freon 113).”

^(g) - MCL value is for Total Trihalomethanes (TTHM), the sum of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

Federal and State laws and regulations other than the chemical-specific ARARs discussed in Tables D-1 through D-3 that have been promulgated or changed since the completion of the decision documents are described in Table D-4. There have been no revisions to laws or regulations that affect the protectiveness of the remedy.

The following action- or location-specific ARARs have not changed in the past five years, and therefore do not affect protectiveness:

- Federal Aviation Administration Rules. AC 150/5210-24 (replaced AC 150/5380-5B effective November 2010). (2004 Record of Decision Amendment for Areas A and B)
- Federal Aviation Administration Rules AC 150/5370-2G (1997 Record of Decision for Operable Unit 2)
- National Historic Preservation Act, Section 106, 16 U.S.C. §§470 et seq.; 36 Code of Federal Regulations (CFR) Parts 65 and 800. (1997 Record of Decision for Operable Unit 2, 2012 Record of Decision Amendment for Operable Unit 1 Area B)
- Arizona Administrative Code §R18-5-501 (section recodified from §R18-4-501, effective January 2004). (2004 Record of Decision Amendment for Operable Unit 1 Area A and B)
- Archeological Discoveries, Historic Preservation. 41 Arizona Revised Statutes (ARS) §§841-847, 865. (1997 Record of Decision for Operable Unit 2, 2012 Record of Decision Amendment for Operable Unit 1)
- Arizona Aquifer Water Quality Standards. R18-11-405, R18-11-406. (1997 Record of Decision for Operable Unit 2)
- Arizona Water Quality Standards, ARS 49-224. (2004 Record of Decision Amendment for Operable Unit 1)
- Arizona Remedial Action Requirements. ARS 49-282.06(A)(2). (1997 Record of Decision for Operable Unit 2)
- Arizona Groundwater Management Act, ARS 45-454.01 (Also includes 45-494, 45-495, 45-496, 45-600, 45-605). (1997 Record of Decision for Operable Unit 2)
- Safe Drinking Water Act, 42 U.S.C. §300f et seq.; 40 CFR 144.12-144.16. (2004 Record of Decision Amendment for Operable Unit 1, 2012 Record of Decision Amendment for Operable Unit 1)
- Safe Drinking Water Act, 42 U.S.C. §300f et seq.; 40 CFR 144.24, 146. (1997 Record of Decision for Operable Unit 2, 2012 Record of Decision Amendment for Operable Unit 1)
- Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-28, Emissions from Air Strippers. (1997 Record of Decision for Operable Unit 2)
- EPA Office of Solid Waste, RCA Groundwater Monitoring; Draft Technical Guidance, Nov. 1992 (EPA/530-R93-001)
- Endangered Species Act 16 United States Code (U.S.C.) §1531 50 CFR Parts 200 and 402.
- Federal RCRA Subtitle C; 42 USC §6921 et seq. (RCRA Subtitle C); ARS §49-921 et seq. 40 CFR Part 261 and R18- 8-261 (1997 Record of Decision for Operable Unit 2)
- RCRA Subtitle C; ARS §49-921 et seq. 49 CFR Section 262.11 and R18-8-262. (1997 Record of Decision for Operable Unit 2)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264 Subpart X, and R18-8-264. (1997 Record of Decision for Operable Unit 2)

- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264 Subpart AA and BB, and R18-8-264 (1997 Record of Decision for Operable Unit 2)
- Clean Air Act 42 U.S.C. §§ 7401- 7671q 40 CFR Part 61.
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264.1(j)(2-6)(10-12), and R18-8- 264.1(j)(2-6)(10-12). Note: 40 CFR Part 264 incorporated by reference into R18-8-264; there is no longer a standalone R18-8-264.1(j)(2-6)(10-12). (2004 Record of Decision Amendment for Area A and B)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264.18(a & b), and R18-8-264.18(a & b). Note: 40 CFR Part 264 incorporated by reference into R18-8-264; there is no longer a standalone R18-8-264.18(a & b). (2004 Record of Decision Amendment for Area A and B)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264, Subpart G, Sections 264.111(a & b) and 264.114, and R18-8- 264.111(a & b) and 264.114. Note: 40 CFR Part 264 incorporated by reference into R18-8-264; there is no longer a standalone R18-8- 264.111(a & b) and 264.114 (2004 Record of Decision Amendment for Area A and B)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264 Subpart I, and R18-8-264.170 et seq. Note: 40 CFR Part 264 incorporated by reference into R18-8-264; there is no longer a standalone R18-8-264.170. (1997 Record of Decision for Operable Unit 2, 2004 Record of Decision Amendment for Area A and B)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264 Subpart J, and R18-8-264.190 et seq. Note: 40 CFR Part 264 incorporated by reference into R18-8-264; there is no longer a standalone R18-8-264.190. (1997 Record of Decision for Operable Unit 2, 2004 Record of Decision Amendment for Area A and B)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR Part 264.601, and R18-8-264.601 et seq. Note: 40 CFR Part 264 incorporated by reference into R18-8-264; there is no longer a standalone R18-8-264.601. (2004 Record of Decision Amendment for Area A and B)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR 262.34, Federal Clean Air Act, 42 U.S.C. §§7401 et seq. Pima County Bureau of Air Pollution Control Rules and Regulations, Title 17 Pima County Air Quality Code, 17.16.430, Subparagraph F
- Resource Conservation and Recovery Act (RCRA) Subtitle C; ARS §49-921 et seq. 40 CFR part 264 Subpart CC, and R18-8-164 et seq.
- Arizona Surface Water Quality Standards ARS 49- 222, R18-11-101 et seq
- Federal Safe Drinking Water Act, 42 U.S.C. Sec. 300g-1, 40 CFR 141.161 40 CFR Part 141 (Subparts B, C, G), Federal Primary Drinking Water Standards- MCLs (1997 Record of Decision for Operable Unit 2, 2004 Record of Decision Amendment for Area A and B)
- RCRA Subtitle C; ARS §49-921 et seq. 40 CFR 262.34 (1st Five-Year Review)

Table D-4. Summary of ARAR Changes for Site in the Past Five Years

Requirement and Citation	Document	Description	Effect on Protectiveness	Comments	Recent Amendment Date
Federal Aviation Administration Rules. AC 150/5300-13.	1997 Record of Decision for Operable Unit 2	Contains the Federal Aviation Administration's (FAA) standards and recommendations for the geometric layout and engineering design of runways, taxiways, aprons, and other facilities at civil airports.	Changes do not affect protectiveness.	This substantial revision fully incorporates all previous changes to AC 150/5300-13A as well as new standards and technical requirements.	March 31, 2022
Federal Aviation Administration Rules AC/70/7460-1L.	1997 Record of Decision for Operable Unit 2	Establishes marking and lighting requirements for construction equipment or permanent structures near airports.	Changes do not affect protectiveness.	In response to the Safety Risk Assessment of Light Emitting Diode (LED) Lighting in Aircraft Operations report, the FAA has published specifications for LED based red obstruction lights. A paragraph was added that cross-references the new lighting specification and associated Engineering Brief.	September 6, 2018
RCRA Subtitle D 40 CFR Part 257	1997 Record of Decision for Operable Unit 2	Establishes criteria for determining whether a solid waste disposal facility poses a threat to human health and the environment.	Changes do not affect protectiveness.	Changes are related to the impoundment and disposal of coal ash and are not related to the Site.	December 14, 2020; September 28, 2020; January 13, 2021

Appendix E: Toxicity Assessment

The cleanup levels that were based on risk were select groundwater cleanup levels in the 1997 Record of Decision for the Airport Property. Those cleanup levels were evaluated below (Tables E-1 and E-2). EPA Regional Screening Levels (RSLs) are used to evaluate groundwater cleanup levels that are risk-based. EPA's Integrated Risk Information System (IRIS) updates toxicity values used by EPA in risk assessment when newer scientific information becomes available, and the most recent update available used for this analysis was the May 2023 update.

The RSLs for carcinogens are chemical-specific concentrations that correspond to an excess lifetime cancer risk (ELCR) of 1×10^{-6} , which is the lower boundary of the Superfund protective range for cancer risks ($\text{ELCR} = 10^{-6}$ to 10^{-4}) as defined in the National Oil and Hazardous Substances Contingency Plan. RSLs for contaminants posing non-cancer health hazards are concentrations corresponding to a Hazard Quotient = 1.0 (HQ=1). HQ=1 RSLs represent "concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety", as specified in the National Oil and Hazardous Substances Contingency Plan.

Changes have occurred to some RSLs since the 1997 Record of Decision for the Airport Property (Table E-1). The current RSLs for dichlorodifluoromethane and trichlorotrifluoroethane (Freon 113) are more stringent than the groundwater cleanup levels. However, a review of groundwater data for the current reporting period demonstrated that their current concentrations are below their respective Tap Water RSLs. Therefore, the changes to toxicity of the cleanup levels do not call into question the protectiveness of the remedy.

Table E-1. Summary of Water Toxicity Changes for the Airport Property

Chemical	Groundwater Cleanup Level (µg/L)	Basis for Cleanup Level (1997 ROD)	Current Tap Water RSL (µg/L) c = cancer n = noncancer	RSLs More or Less Stringent than Cleanup Levels?
Acetone	700	ADEQ HBGL	1,800 (n)	Less stringent
Chloromethane	2.7	ADEQ HBGL	190 (n)	Less stringent
Dichlorodifluoromethane	1,400	ADEQ HBGL	200 (n)	More stringent
Methyl ethyl ketone	350	ADEQ HBGL	5,600 (n)	Less stringent
Trichlorotrifluoroethane (Freon 113)	210,000	ADEQ HBGL	10,000 (n)	More stringent
Trichlorofluoromethane	2,100	ADEQ HBGL	5,200 (n)	Less stringent

Notes:

c = cancer

n = noncancer

RSL = Regional Screening Level

ROD = Record of Decision

µg/L = micrograms per liter

Appendix F: Public Notice

ARIZONA DAILY STAR

WORLD

WEDNESDAY, MAY 3, 2023 | A11

Fentanyl

From AI

changer. The cartel went from its first makeshift fentanyl lab to a network of labs concentrated in the northern state of Sinaloa in less than a decade.

"These are not super labs, because they give people the illusion that they're like pharmaceutical labs, you know, very sophisticated," said Mike Vigil, former head of international operations for the U.S. Drug Enforcement Administration. "These are nothing more than metal tubs and they use wooden paddles — even shovels — to mix the chemicals."

A single cartel "cook" can press fentanyl into 100,000 counterfeit pills every day to fool Americans into thinking they're taking Xanax, Percocet or oxycodone. The pills are smuggled over the border to supply what son Iván Archivaldo Guzmán Salazar said are "streets of junkies," the indictment said.

Fentanyl is so cheap to make that the cartel reaps massive profits even wholesaling the drug at 50 cents per pill, prosecutors said.

The drug's potency makes it particularly dangerous. The narcotic dose of fentanyl is so close to the lethal dose that a pill meant to ensure a high for a habituated user can easily kill a less experienced person taking something they didn't know was fentanyl.

Between August 2021 and August of last year, more than 107,000 Americans died from drug overdoses, most from synthetic opioids. Last year, the DEA seized more than 57 million fentanyl-laced counterfeit prescription pills, according to the New York indictment.

To protect and expand that business, the "Chapitos," as the sons are known, have turned to grotesque violence, prosecutors said.

Enforcers Ivan Archivaldo Guzmán Salazar and Jesus Alfredo Guzmán Salazar are the lead defendants among 23 associates charged in the New York indictment. Ovidio Guzmán López, alias "the Mouse," who allegedly pushed the cartel into fentanyl, is charged in another indictment in the same district. Mexico arrested him in January and the U.S. government has requested extradition. Joaquín Guzmán López

is charged in the Northern District of Illinois.

According to the Guzmán Salazar indictment, the cartel does some lab testing on its product but conducts more grisly human testing on kidnapped rivals or addicts who are injected until they overdose.

The purity of the cartel's fentanyl "varies greatly depending on the method and skill of the particular manufacturer," prosecutors noted. After a user overdosed on one batch, it was still shipped to the U.S.

When the elder Guzmán and Ismael "El Mayo" Zambada led the Sinaloa cartel, it operated with a certain degree of restraint. But with Guzmán serving a life sentence and Zambada believed to be suffering from health issues, the Chapitos moved aggressively to avoid a power vacuum that could fragment the cartel.

"What was really a unique advantage of the Sinaloa cartel and El Chapo was the ability to calibrate violence," said Vanda Felbab-Brown, a senior fellow in the Strobe Talbott Center for Security, Strategy, and Technology at the Brookings Institute.

Moving Up

Pros with promise.
Sundays in
Arizona Daily Star



3DAYBLINDS®
YOU'LL LOVE THE TREATMENT

CUSTOM BLINDS, SHADES, SHUTTERS & DRAPERY



SAVE 20%*

on Custom Window Treatments

CALL TO SCHEDULE

FREE in-home design
consultation with no obligation!

520-257-1064



WE DESIGN, WE MEASURE, WE INSTALL, YOU RELAX!®

*Offer valid on 3 Day Blinds brand products only, excluding shutters and special orders. Minimum purchase of \$1,000 required, excluding installation, sales tax, shipping and handling. Not valid with any other offer or discount. Offer ends 6/30/23. State Contractor and Home Improvement Licenses: Arizona 571556, California 1005996, Connecticut 9C-0644563, New Jersey 13A06850200, Oregon 20384, Pennsylvania PA02056, Tennessee 10003, Washington 35A18064345. County Licenses: Nassau County, NY H2023701; Rockland County, NY H-0401-34-00-00. Licensed through Great Windows Services, LLC. Virginia 270517678, West Virginia WV060236. Various City Licenses Available Upon Request. © 2023 3 Day Blinds LLC.

Donate your gently used clothing to
support Youth!

SCHEDULE YOUR FREE at home donation pick up today!
Visit www.TucsonBigsPickUp.org or call 520-624-7039
BBBSSA Donation Center proceeds directly benefit our program!



Big Brothers
Big Sisters
OF SOUTHERN ARIZONA

Creates and supports
one-to-one mentoring
relationships that
ignite the power and
promise of youth so
they can reach their
full potential.



EPA WANTS TO HEAR FROM YOU ABOUT THE TUCSON INTERNATIONAL AIRPORT AREA SUPERFUND SITE CLEANUP

The U.S. Environmental Protection Agency (EPA) has started reviewing the cleanup plan for the Tucson International Airport Area (TIAA) Superfund Site. The site is in southeastern Arizona and encompasses sections of southwest Tucson and adjoining lands south of the city. This review will show if the cleanup plan is working as EPA intended. Federal law requires EPA to review its cleanup plans every five years if:

- A cleanup takes more than five years to complete; or
- Hazardous waste is still on-site.

EPA did the last review in 2018 and found the cleanup plan was working as intended.

What is included in the review?

- An inspection of the site and technologies used for the cleanup
- A review of site data and maintenance records
- A review of any new laws or requirements that could affect cleanup

EPA would like to hear from you!

We would like to interview community members about how you think the cleanup is going. If you want to learn more about the site and/or be interviewed, please contact EPA before August 30, 2023:

- Mary Aycock, EPA Remedial Project Manager
(415) 972-3289 or aycock.mary@epa.gov

Where can I learn more?

Visit <https://www.epa.gov/superfund/tucsonairport> for more information about the site. EPA has also set up an information repository with a copy of the site's Administrative Record (which includes key documents and reports for the cleanup) at:

Valencia Public Library, 202 W. Valencia Road, Tucson, Arizona 85706
Phone: (520) 594-5390
Hours: Mon.-Thur. 10:00a.m.- 6:00p.m.; Fri. & Sat. 10:00a.m.- 5:00p.m.

EPA will complete the Five-Year Review report no later than September 30, 2023. When complete, EPA will post a copy on the site's webpage and send a copy to the site information repository listed above.

Background

The ten square-mile TIAA Superfund Site is in southeastern Arizona. It covers sections of southwest Tucson and adjoining lands south of the city. The site includes Tucson International Airport, sections of the Tohono O'odham Nation (San Xavier District), sections of Tucson and South Tucson residential areas, and Air Force Plant 44 Raytheon Missile Systems property. The site has contaminated groundwater and soil from former aircraft and electronics manufacturing, aircraft maintenance, fire drill trainings, and leaking of chemicals from unlined landfills.



Camp Lejeune Toxic Water Contamination Compensation

Many U.S. Marine veterans and their families were exposed to toxic chemicals in drinking water on the Camp Lejeune military base in Jacksonville, North Carolina.

5 Important Facts:

1. The U.S. Government is now allowing U.S. Marines, their families, and civilians to be compensated for injuries arising from the contaminated drinking water at Camp Lejeune.
2. From 1953 to 1987, contaminated water was used in everyday life for bathing, drinking, and more.
3. Water was contaminated with many chemicals that are linked to serious health issues.
4. Health problems from exposure include cancer, neurological injuries, miscarriage, or birth defects.
5. There is no such thing as too long ago, but time is limited under the new law. Contact us today to see if you qualify.

If you or a loved one were exposed to contaminated water, call today for a free legal consultation.

Call us today. Our team is available 24/7, every day.

Call 855-382-4086

This is a paid advertisement for legal services. Sokolove Law, LLC (LLP in certain states), 1330 Boylston St, Chestnut Hill/MA. Ricky LeBlanc admitted in MA only. Members: Paul Dix, Alton, IL, admitted AR, Rich Grabow, 231 Farmington Ave Farmington/CT (860) 904-7789, Paul J. Morgan, Winter Park/ FL, Nick Nighswander, Erlanger/KY, Michael Breaux, Gonzales, admitted LA, Ad No. LA-22-13615, Gregg Hobbie, NJ, Matt Christian, 1007 East Washington Street, Greenville SC. Co-funder/AL: Environmental Litigation Group PC, Birmingham. Co-funder/SC: Bell Legal Group, LLC, Georgetown. Co-funder/NC: Wallace & Graham, Salisbury. This is general information only and should not be taken or relied on as legal, medical, or other advice. No attorney-client or other professional relationship is created by providing or using this information. The choice of a lawyer is an important decision that should not be based solely upon advertisements. No representation is made that the quality of the legal services to be performed is greater than the quality of legal services performed by other lawyers. While this firm maintains joint responsibility, most cases of this type are referred to other attorneys for principal responsibility. Prior results do not guarantee a similar outcome. The Wyoming State Bar does not certify any lawyer as a specialist or expert. Anyone considering a lawyer should independently investigate the lawyer's credentials and ability, and not rely upon advertisements or self-proclaimed expertise. Free background information available upon request. ©2022 Sokolove Law, LL

Appendix G: Interview Forms

Five-Year Review Interview Record				
Site:	Tucson International Airport Area Superfund Site			EPA ID No: AZR000000349
Interview Type: Email				
Date: February 16, 2023				
Time: 1400				
Interviewers				
Name	Title		Organization	
Kristin Addis	Geologist		USACE - FYR	
Interviewees				
Name	Organization	Title	Telephone	Email
Chad Lapora	Tucson Water	Tucson Water Administrator	(520) 419-0821	Chad.lapora@tucsonaz.gov
Tucson International Airport Area Superfund Site – Five Year Review Interview Questionnaire				
1) What is your overall impression of the TARP project? I have been the Tucson Water TARP Project Coordinator for about ten years and my overall impression is positive. The site has been affected by a number of water quality issues, that include both 1,4-dioxane and PFAS, but the project team (both Tucson Water and Carollo) has always responded energetically to the challenge. While plume remediation and containment have always been priorities for the Utility, safe drinking water delivered to our customers has never taken a back seat. Tucson Water has approached Health Advisories (HA) for both 1,4-dioxane and PFAS as if they were Maximum Contaminant Levels (MCLs). The City of Tucson/Tucson Water was the driving force to construct an AOP Plant to ensure that both TCE and 1,4-dioxane were removed from the water prior to delivery to our customers. Due to high concentrations of PFAS in the TARP wellfield and because the TARP/AOP Plant was not designed to treat for PFAS, Tucson Water coordinated with its regulators and began construction to divert TARP treated water into both the Santa Cruz River (with associated AZPDES permit) and Recycled Water System (RWS). At the request of concerned citizens, Tucson Water constructed a tenth remediation well and expanded AOP Plant capacity to expedite contaminant remediation. I believe that the City of Tucson/Tucson Water has been a model for environmental remediation/restoration, public health, and environmental justice issues as it relates to EPA Superfund sites. 2) Is the remedy functioning as expected? Yes, the remedy is functioning as expected. Tucson Water is maintaining plume capture while treating the water coming into the AOP Plant for TCE, 1,4-dioxane and PFAS and maintaining compliance with its AZPDES permit. Tucson Water has protected both the public health of its customers and the environment. The addition of a tenth remediation well (R-127A) will expedite remediation of plume contaminants. 3) Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office? If so, please provide the purpose and results. Tucson Water operations and maintenance staff are present at the AOP Plant M-F (7-3:30) and are able to monitor the Plant remotely at all other times. The Plant has been programmed to shut-down in the event that a component of the treatment process is not functioning properly. Plant Operators inform TW Management when the Plant is not in operation. Operations and maintenance staff perform weekly safety inspections and preventative maintenance at the Plant to ensure continuity of operations. TW Environmental & Regulatory staff coordinate with the regulatory agencies (EPA, ADEQ, PDEQ) for any on-site inspections. TW staff prepare monthly water quality and operations reports to the regulatory agencies per the TARP Consent Decree (CD)/Record of Decision (ROD). Tucson Water also prepares a discretionary TARP Monthly Project Summary Report to the regulatory agencies, City Council offices, City/Water leadership, and interested stakeholders to keep them up to date on water quality, operations, and maintenance, and TARP related construction projects. Tucson Water also provides quarterly updates to the Unified Community Advisory Board (UCAB) in coordination with the EPA, ADEQ, and TARP responsible parties. These quarterly meetings provide water quality, and operations & maintenance updates to the assembled stakeholders.				

Tucson Water prepares an annual Quality Assurance Report to EPA (per CD/ROD) that documents sampling and analysis activities regarding treatment plant and monitoring well activities. Tucson Water also performs annual registration reporting and quarterly generation reporting to ADEQ (via MyDEQ) regarding the carbon that is utilized for PFAS treatment. On a Biennial basis, TW prepares a report to EPA/RCRA summarizing our hazardous waste activities at the site. Tucson Water also reports to ADEQ monthly the parameters associated with the AZPDES permit that allows TW to discharge treated TARP water into either the Santa Cruz River or the TW RWS. Lastly, Tucson Water, in conjunction with its consultant, Carollo, produces Semiannual Status Reports (SASRs) that provide detailed information regarding all activities relating to the TARP Superfund site (north of Los Reales Rd.). Tucson Water, at a minimum meets with EPA and ADEQ on a quarterly basis to discuss project status.

4) Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

There have been no complaints, violations or other incidents related to the site requiring a response by my office.

5) Do you feel well informed about the site's activities and progress?

As Tucson Water's TARP Project Coordinator, it is my responsibility and duty to stay well informed about the site's activities. Please reference my response in question #3 to appreciate and understand all the activities that are built in and require me to stay informed about all matters TARP.

6) Have there been unexpected Operations & Maintenance difficulties at the site in the last five years? If so, please give details.

The O&M difficulties that we have experienced at the site during the last five years have centered around the discovery of PFAS in both the TARP well field and the Plant's influent. In August/September 2018, the TARP/AOP Plant was shut down for about 3 weeks to confirm PFAS levels in the Plant's influent and effluent. TW performed a RSSCT to determine the optimal media to both remove PFAS and continue quenching residual hydrogen peroxide with the existing carbon contactors at the Plant. Beginning in December 2018, TW removed the original quenching carbon and replaced it with carbon that could both quench hydrogen peroxide and remove PFAS. Since December 2018, TW has removed and replaced carbon to ensure PFAS level were below both the current EPA PFAS HA and TW's own stringent PFAS operating guidelines.

The discovery of PFAS and the City's unwillingness to serve our customers PFAS laden water prompted TW to shut down the TARP/AOP Plant from June - November 2021. During this time the City/TW constructed an outfall and obtained an AZPDES permit to discharge TARP treated water to the Santa Cruz River. Tucson Water also began construction on the infrastructure to send TARP treated water into TW's RWS. TW began discharging TARP treated water to the Santa Cruz River in November 2021 and is expected to send water into the RWS in March 2023.

Tucson Water has experienced minor O&M issues over the five-year period to include down time due to issues related to the Uninterruptable Power Supply (UPS) system (battery replacement and fans), construction related to bypassing the original Packed Column Aeration (PCA) towers, and construction activities related to the addition of a tenth remediation well in the north to expedite plume remediation. This construction included additional UV reactors and carbon contactors to treat the increased volume of water coming into the Plant. Plant operation activities are also restricted when carbon is removed/replaced (usually occurs two times/year).

7) Have there been opportunities to optimize Operations & Maintenance or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Due to the impacts of PFAS at the TARP Superfund site, there have been no real opportunities to optimize O&M or sampling efforts. TW has been extremely proactive in monitoring PFAS in the TARP well field and at the AOP treatment plant to ensure removal of PFAS prior to delivery or discharge. TW purchased and developed the methods to analyze for PFAS in-house. PFAS results have a turn-around-time of 2-3 days compared to about 6-8 weeks if we were to use a commercial laboratory.

8) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

Tucson Water is not aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy.

9)Has Tucson Water implemented any preventative measures for emerging contaminants?

Please see previous responses to see the preventative measures that Tucson Water has already implemented for emerging contaminants (PFAS). Please also know that Tucson Water received a \$25M grant from ADEQ to design and construct a PFAS pre-treatment system at the Plant. The grant was awarded in late December 2022, but preliminary planning activities are already underway with initial design including sediment removal and ion exchange (IX) media to remove PFAS. Final design is expected to be complete in early 2024, with construction beginning shortly thereafter.

10) Do you have any comments, suggestions, or recommendations regarding the project?

Tucson Water awaits the issuance of the new ROD sometime this year and to have EPA declare PFAS a CERCLA “Hazardous Substance” so that the Responsible Parties will become “responsible” for the ongoing O&M costs associated with the treatment of both 1,4-dioxane and PFAS. These costs have become a burden for the Tucson Water rate payer.

Additional Comments

None

Five-Year Review Interview Record				
Site:	Tucson International Airport Area Superfund Site		EPA ID No:	AZD980737530
Interview Type: Email				
Date: February 21, 2023				
Time: 1030				
Interviewers				
Name	Title		Organization	
Kristin Addis	Geologist		USACE - FYR	
Interviewees				
Name	Organization	Title	Telephone	Email
Sarah Simmons	Tucson Airport Authority (TAA)	TAA Director of Sustainability & Environmental Services SRP Project Coordinator	520-573-4805	ssimmons@flytucson.com
Tucson International Airport Area Superfund Site – Five Year Review Interview Questionnaire				
1) What is your overall impression of the active remedies at the Airport Properties project? The SGZ Remedy and SVE TI Zone Remedies have been in operation since 2007 and have removed approximately 2220 lbs and 6487 lbs of volatile organic compound (VOC) mass through August 2022, respectively. Both the SGZ Remedy and SVE TI Zone Remedy continue to have high operational run-time rates, with both the SGZ Remedy and the SVE TI Zone Remedy on average at approximately 95% run-time for the last five years. 2) Is the remedy functioning as expected? Please see Section 4 of the Revised Conceptual Site Model (CSM) which provides a summary of the status of the remedies and discussion of the current hydrogeologic conditions. The Revised CSM was included in the Five-Year Review document submittal. 3) Have there been any non-routine activities (site visits, inspections, reporting activities, etc.) conducted by your office? If so, please provide the purpose and results. No non-routine activities have been conducted by TAA. 4) Have there been any complaints, violations, vandalism, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses. There have been a few instances of vandalism including: -At Control Building #2 – a portion of the chain link fence was cut and ground wire from a meter outside of the building was missing. A police report was file and the fence repaired. -At the main gate that leads to the treatment facility – lock and chain missing, which were replaced after discovery. 5) Have there been unexpected Operations & Maintenance difficulties at the site in the last five years? If so, please give details. The Remedy-Required Subsites (RRS) SVE Remedy, that resumed operation at SVE-7 in February 2021, has had communications module challenges and failures in 2022 and 2023. The O&M contractor is working on acquiring replacement parts, but there have been extended delays due to supply chain issues. 6) Have there been opportunities to optimize Operations & Maintenance or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency. The O&M Contractor, GHD, has worked to optimize sampling and data collection efforts, through transitioning to digital field data collection and negotiating favorable sampling analysis rates with the laboratories. 7) Are you aware of any changes in site conditions that may impact the protectiveness of the remedy? Yes, and the site conditions are discussed in detail in the Revised CSM, included in the Five-Year Review document submittal. Please see sections 3 and 4 of the Revised CSM for more detail and discussion.				

8) Do you have any comments, suggestions, or recommendations regarding the project?

I would recommend the continuation of the Technical Working Group meetings between Agencies and their technical support consultants and the Supervising Contractor, GHD to discuss technical questions and next steps that may result from the completion of the revised Conceptual Site Model.

Additional Comments

None

Five-Year Review Interview Record				
Site:	Tucson International Airport Area Superfund Site		EPA ID No:	AZD980737530
Interview Type: Email				
Date: February 21, 2023				
Time: 1030				
Interviewers				
Name	Title		Organization	
Kristin Addis	Geologist		USACE - FYR	
Interviewees				
Name	Organization	Title	Telephone	Email
Manfred Plaschke	GHD	Project Manager	(602) 216-7267	Manfred.Plaschke@ghd.com
Tucson International Airport Area Superfund Site – Five Year Review Interview Questionnaire				
1) What is your overall impression of the active remedies at the Airport Properties project? Volatile Organic Compound (VOC) concentrations in the groundwater in the Shallow Groundwater Zone (SGZ) and Gravel Subunit (GSU) have decreased significantly since the SGZ Remedy's start-up in 2007, as have the overall SGZ and GSU TCE plume sizes and residual plume mass. As an example, the TCE concentration in SGZ monitoring well S-5, located within the center of the TI Zone near former buildings 16/17 and within the cone of depression of the SGZ Remedy extraction wells, has dropped from 47,000 µg/L detected during the 2007 Baseline monitoring to 0.6 µg/L detected in February 2021. Refer to Appendix D of the Revised CSM (GHD, 2022) for historic TCE SGZ concentration figures beginning in 2007 through 2021. Other Chemicals Of Potential Concern (COPC) concentrations in the groundwater in the SGZ have decreased significantly since SGZ Remedy start-up in 2007. As of February 2021, over 474,909,000 gallons of groundwater have been treated by the SGZ remediation system and reinjected in the RA, and over 2,175 pounds of VOCs have been removed from the SGZ (GHD, 2021). The SGZ Remedy operates at approximately 75 gallons per minute (gpm). The SVE remedy in the TI Zone has removed approximately 6,484 pounds of VOCs since 2007 (GHD, 2021). This amount of VOC mass removal indicates a substantial VOC reduction in the source area over 14+ years of SVE remedy operation. The recent analytical soil gas results shown on Figure 3.57 (Revised CSM, GHD 2023) confirm significant reduction of TCE in the vadose zone within and around the Technical Impracticability (TI) Zone. The reductions are evident in both MPSG monitoring wells and in the extracted soil gas from the perimeter SVE wells. The MPSG monitoring wells show a reduction of TCE in and around the TI Zone by three to five orders of magnitude. The reduction in TCE from the perimeter SVE wells range from two orders of magnitude reduction at SVE-4 to four orders of magnitude reduction at SVE-1, SVE-2, and SVE-3. The current extent of VOCs within and around the TI Zone (main source area), in both the vadose zone and SGZ, has been significantly reduced as a result of the SVE and SGZ remediation systems that have been operating in the TI Zone since 2007. TCE soil gas concentrations extracted by the SVE remediation system in the vadose zone have been reduced from 280,000, 75,000, 230,000, and 67,000 part per billion by volume (ppbv) at wells SVE-1, SVE-2, SVE-3, and SVE-4, respectively, at start-up (in 2007) to 28, 2.2, 15, and 200 ppbv in February 2021 (27th PER, GHD 2021). University of Arizona investigations (in 2011 and 2015) confirm significant reductions of the VOC source in the TI Zone and determined in 2015 that the contaminant mass discharge was diffusion rate limited with the remaining mass contained in the Unit 4 Clays (SGZ). Comparison of two sets of soil core data, collected 3.5 years apart, indicated that a significant (approximately 80 percent) reduction in aggregate sediment phase TCE concentrations occurred between sampling events (Brusseau, et.al., 2013, 2015). Likewise, VOC concentrations in the groundwater in the SGZ and GSU have decreased significantly since start up. TCE concentrations at SGZ extraction wells EW 1 and DP 1 (both in the GSU) have decreased from 26,000 and 3,700 micrograms per liter (µg/L), respectively, at start up to 74 and 430/460 µg/L in February 2021 (27th PER, GHD 2021). 2) Is the remedy functioning as expected? Since the Record of Decision (ROD) and its selected remedies were implemented in 2007, the groundwater elevations within the Regional Aquifer (RA) have increased by more than 20 feet associated with regional influences on the Airport Property and water level data indicate a continued upward trend in RA groundwater elevations.				

As discussed in Section 3.2.4.5 of the Revised CSM (GHD, 2022), the data collectively show that, due to causes beyond the control of the Settling Parties, since the SGZ Remedy was installed, the RA potentiometric surface has been increasing and reducing the downward vertical hydraulic gradients across the Lower Unit 4 Clay. In addition, the rising water levels are encroaching towards the TI Zone from the east and southeast. These rising levels are now affecting the SGZ and re-saturating portions of the Upper Unit 4 Clay that have been unsaturated for decades, even before the ROD was issued. The rising water levels increase the SGZ saturated thickness and its transmissivity. This increased SGZ transmissivity impacts the effectiveness of the SGZ Remedy.

As stated in Section 4 of the Revised CSM (GHD, 2022), the SGZ remediation system was designed to achieve capture of SGZ groundwater using a design minimum hydraulic capacity of 100 gpm or 1.3 times the expected extraction groundwater flow rate of 75 gpm (CRA, 2004a). The SGZ remediation system was not designed for, nor is it technically capable of, remediating the RA, which would require a system comparable to that currently used to remediate the RA (i.e., TARP). However, remediation of the RA is specifically excluded in the language of the Soils Consent Decree and Statement Of Work. This is further discussed in Section 4.3 of the Revised CSM (GHD, 2022). It is technically impossible to use the existing remedy to prevent RA migration into the SGZ. In addition, as the SGZ becomes re-saturated by the RA, a significant modification of the existing system or an entirely new remedial approach will be necessary.

As the rising groundwater levels continue, the SVE system is less effective. As noted in Section 3.4.2 of the Revised CSM (GHD, 2022, the vadose zone was reassessed in 2014 within the TI Zone after 7 years of SVE remediation. The Contaminant Mass Discharge (CMD) study determined that insignificant non-vapor phase contaminant mass remained in the advective domains and that any remaining mass was most probably contained within sediments of low permeability Unit 4 Clay and higher water saturation region in the vicinity of the saturated zone and the capillary fringe. The assessment of the TI Zone SVE performance completed by independent investigators from the University of Arizona documented a very significant (approximately 80 percent) reduction in aggregate sediment-phase TCE concentrations (Brusseau et al., 2013, 2015).

As discussed in Sections 3.3.6 and 3.3.7 of the Revised CSM (GHD, 2022), soil and soil gas sampling have been conducted in the vadose zone and into the SGZ since 1992 to characterize the Site and delineate the lateral extent of the VOC contamination. Most soil borings occurred within and around the TI Zone (main source area), and close to possible sources (RRS) based on historical observations and activities.

3) Have there been any non-routine activities (site visits, inspections, reporting activities, etc.) conducted by your office? If so, please provide the purpose and results.

No non-routine activities have been conducted.

4) Have there been any complaints, violations, vandalism, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

There have been a few instances of vandalism including:

- At Control Building #2 – a portion of the chain link fence was cut and ground wire from a meter outside of the building was missing. A police report was filed and the fence repaired.
- At the main gate that leads to the treatment facility – lock and chain missing, which were replaced after discovery.

5) Have there been unexpected Operations & Maintenance difficulties at the site in the last five years? If so, please give details.

The Remedy-Required Subsites (RRS) SVE Remedy, that resumed operation at SVE-7 in February 2021, has had communications module challenges and failures in late 2022 and 2023. Acquiring replacement parts has led to extended delays.

6) Have there been opportunities to optimize Operations & Maintenance or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Annually, GHD reviews the last year of O&M and process and groundwater sampling analytical results and proposes changes in the PER to the Agencies and SPs.

7) Are you aware of any changes in site conditions that may impact the protectiveness of the remedy?

Yes. Please refer to Sections 3 and 4 of the Revised CSM (GHD, 2022) to a detailed description of current site conditions.

8) Do you have any comments, suggestions, or recommendations regarding the project?

The fundamental Site conditions for which the SGZ Remedy was designed are no longer present. A Focused Feasibility Study (FFS) Work Plan should be prepared to evaluate strategies and/or technologies that would potentially be more effective based on existing Site conditions and/or technologies that did not exist when the ROD was issued.

Additional Comments
<i>None</i>

Five-Year Review Interview Record				
Site:	Tucson International Airport Area Superfund Site		EPA ID No:	AZD980737530
Interview Type: Phone				
Date: April 11, 2023				
Time: 1630				
Interviewers				
Name	Title		Organization	
Dan Carlson	Physical Scientist		USACE	
Interviewees				
Name	Organization	Title	Telephone	Email
Yolanda Herrera	UCAB	Community Co-chair	520-991-3307	acuinteriors@aol.com
Tucson International Airport Area Superfund Site – Five Year Review Interview Questionnaire				
1) What is your overall impression of the TARP project? The city of Tucson has been doing a great job at not only containing contamination and keeping the system running but doing community outreach and gaining community trust. One challenge is that keeping elected city officials informed about the project has been difficult at times due to turnover following elections. 2) Is the remedy functioning as expected? Yes. Because they are trying to remove PFAS from groundwater with the treatment system, the filters need to be replaced more often, which is costly. I agree with the decision to not serve treated water to the community for drinking water purposes, but it is currently wasted by being discharged to the Santa Cruz river. I would like to see the treated water get put to use in other ways, particularly for certain processes that currently draw from the drinking water supply. I think that the responsible parties should be held accountable for PFAS and the public should be educated about the dangers of PFAS. Public trust needs to be maintained. 3) Have there been routine communications or activities conducted by the community? If so, please provide the purpose and results. There are resource fairs to give information out to the general public. The public is also invited regularly to attend quarterly UCAB meetings, either in person or via zoom. 4) Have there been any complaints, violations, or other incidents related to the site requiring a response from UCAB? If so, please give details of the events and results of the responses. No. But sometimes people get concerned about the increased development around the plant and perceived danger from being near it. They are planning on building hotels and apartments around the plant and an area is being considered for rezoning for storage. I recommend that people moving in around the AOP / TARP facility are being proactively educated about the site and that they are aware that they are not exposed to any danger by living near the TARP facility. The plant needs to be extremely secure to protect from the possibility of vandalism or sabotage. 5) Do you feel well informed about the site's activities and progress? Yes, Tucson water is very transparent. I appreciate that they do tours. Not just for the UCAB and government agencies, but also for the schools. I think it's important for the youth to have a good understanding of the site and to have the opportunity to share what they've learned or get more involved.				

6) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

No. Environmental regulations are what make sure the remedy remains in place and is protective and they should not be rolled back.

7) Do you have any concerns regarding the protectiveness for citizens in Tucson?

No.

8) Do you have any comments, suggestions, or recommendations regarding the project?

The EPA used to mail out newsletters to all the residents, which contained regular updates on past concerns and future actions. I haven't seen one since pre-pandemic. It's another way to keep the public informed. I would recommend regular newsletters be published again and to consider doing one for this Five-Year Review.

I have been hoping to get a poster of the plume update for several years to take to outreach events to display side by side the one I have had for years to show the public how far we have progressed in the clean-up efforts.

Additional Comments

None

Appendix H: Site Inspection Report and Photos

Trip Report

Tucson International Airport Area Superfund Site

1. INTRODUCTION

a. Date of Visit: 20 April 2023

b. Location: Tucson, Pima County, AZ

c. Purpose: A site visit was conducted to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the Five-Year Review Report.

d. Participants:

Matthew Masten	USACE	matthew.l.masten@usace.army.mil
Mary Aycock	EPA, Region 9	Aycock.Mary@epa.gov
Michelle Rogow	EPA, Region 9	rogow.michelle@epa.gov
Jon Owens	EPA, Region 9	Owens.Jon@epa.gov
Sarah Simmons	Tucson Airport	ssimmons@flytucson.com
Ken Nichols	Tucson Airport	knichols@flytucson.com
Manfred Plaschke	GHD	Manfred.Plaschke@ghd.com
Tim Fish	GHD	520-240-3352
Karin Harker	ADEQ	Harker.Karin@azdeq.gov
Marc Yalom	ADEQ	yalom.marc@azdeq.gov
Michael Moraga	Tucson Water	michael.moraga@tucsonaz.gov
Rick Motz	Tucson Water	

2. SUMMARY

A site visit to the Tucson International Airport Area (TIAA) Superfund Site was conducted on 20 April 2023. Multiple areas were visited, to include: Airport Properties, Tucson Area Remediation Project (TARP), West Plume B (WPB) area, Former Western Capacitor (West Cap) area, and the Former Texas Instruments (TI) (Former Burr Brown) area. The inspection included visual observation of overall site conditions and inspection of various components of the remedy. The participants received an overview of the site and the remedial history. The inspection evaluated the various groundwater treatment systems, groundwater extraction wells and monitoring wells.

3. DISCUSSION

Airport Properties

On 20 April 2023, Mr. Masten arrived at the Airport Properties site of the TIAA on Tucson International Airport at 0900 hrs. The weather was sunny, calm, and approximately 70 degrees Fahrenheit. The site inspection occurred concurrently with a site visit for Unified Community Advisory Board (UCAB) members. Airport Property is Operable Unit 2, soil and shallow groundwater zone (SGZ) remedy. The site visit included visiting the Groundwater Treatment Plant (GWTP), Three Hangars building area (which includes the hangars, the completed PCB remedy, and the Technical Impracticability [TI] Zone south of the hangars), and extraction wells. All facilities are within fenced areas with limited access.

Tim Fish (site Operator), Manfred Plaschke, and Sarah Simmons led Mr. Masten through the GWTP at the site. Ms. Simmons noted that the SGZ remedy was temporarily offline because “the SGZ Remedy Equalization Tank (EQ) flow meter failed on March 31, 2023. The replacement meter has been ordered from the manufacturer (Badger); however, it is not available to ship until June 16, 2023, due to parts shortages. Shipment could take 1 to 2 weeks and then it needs to be installed by our electrical subcontractor. This flow meter is critical equipment and the SGZ Remedy cannot run safely without it. As a result, the SGZ Remedy will be down until then. GHD has looked into several options for the flow meter replacement, to try to expedite delivery. We will keep the Agencies informed if any changes to the schedule above occur”.

All other parts of the GWTP appeared to be in excellent shape and were said to have been operating normally. Mr. Plaschke noted that the system typically has good uptime. Mr. Fish noted that the air stripper was designed to run at 75 gpm and currently runs at approximately 63 gpm. The system has six extraction wells, two in the TI zone, two on airport property, and two off airport properties. Mr. Fish indicated that there have been no main component switch outs in the last five years, besides the air stripper blower which has been replaced. GHD is using the current down time to rehabilitate extraction wells and mitigate scale buildup and biofouling.

Mr. Fish stated that the air stripper carbon is now changed out every two to three years, due to falling concentrations at the site. The reinjection well is automatically backwashed every 48 hours and was rehabbed approximately five years ago. A new effluent filter differential pressure monitor was noted to have been recently installed.

The SVE system was visited next. The knock-out pots, transfer pumps, blowers, air-to-air cooler, and carbon vessels were inspected. Only one knock-out pot is in use, the other is not needed. The blower is in an insulated sound enclosure to reduce noise. The carbon vessels contain 5000 lbs of carbon and operate in a lead/lag configuration.

The well vault for SVE3 was opened and inspected. Mr. Plaschke explained that it operated at 8 psi of vacuum. The team then left the GWTP enclosure and inspected groundwater extraction well vault CRA-5. This groundwater extraction well operates at 10-12 gpm. Well CRA-3, used for water levels, was also inspected. The well vaults were noted to be secure and free from dirt and debris. The well

vault for CRA-5 had a concrete berm surrounding it, meant to prevent stormwater runoff from entering the vault.

All components of the remedial action for Airport Properties site of the TIAA appear to be in good condition and operate as intended. The GWTP is enclosed within a locked concrete wall, and the entire facility is enclosed with a high security fence. The facility is only accessed via security gates. All systems and wells were found to be well secured and free from vandalism. No issues of concern were noted at the site during the visit.

Tucson International Airport Area Superfund Site Remediation Program (TARP)

Mr. Masten arrived at the TARP portion of the TIAA Superfund Site at 1115, accompanied by Ms. Aycock and Ms. Rogow with EPA, and Ms. Harker and Mr. Yalom with ADEQ. The team met with Mr. Moraga, Water Operations Superintendent with Tucson Water and Mr. Motz, system operator with Tucson Water.

The site visit included visiting the Advanced Oxidation Process (AOP) facility and the original Packed Column Aeration (PCA) treatment system at the facility. The AOP facility is an ultraviolet (UV) – peroxide system to treat TCE and 1,4-dioxane. The team first gathered in the control room of the TARP building. The PCA system was then inspected, and was noted to be offline, as it is no longer required to be used.

The AOP treatment train was systematically inspected next. Mr. Moraga noted that there have been several major changes to the system since the last Five-Year Review. A new pipeline has been installed to discharge effluent from the system to the Santa Cruz River. In addition, a connection to divert effluent to the City of Tucson's recycled water system was about to come online.

The influent pipe was located, a totalizer showed the flowrate was 4,780 gpm. Mr. Moraga stated that four wells from the North well field were currently operating at about 1,200 gpm each. The South well field was not operating at this time.

Three desanding hydrocyclones have been installed to remove gravel from the influent. Mr. Moraga stated these were added about four years prior, and the extraction well casings were fixed at that time. Mr. Motz informed the team that the desanders are maintained quarterly and they have remedied the gravel issue noted in the previous Five-Year Review.

The inlet pipes, silt cartridge filters, booster pumps and 35% peroxide injection point were found under a shaded structure outside the TARP building. The structure has a new pigeon mitigation system installed within the last year.

The advanced oxidation process water treatment system was inspected next. Mr. Motz stated the three new vessels have been added within the last two years to handle greater flowrates. This brings the number of UV PHOX vessels to nine. Mr. Motz noted that each lamp has a 12,000-hour estimated life, and he demonstrated how the lamps are cleaned and maintained.

The team then moved outside to the granular activated carbon vessels. These vessels are used to quench peroxide and scrub per-and polyfluoroalkyl substances (PFAS) from the treated water. There are a total of twelve vessels, eight of which are currently in use. Four of the vessels are newer and operate at 900 gpm, the older vessels run at 600 gpm. The vessels are sampled monthly to monitor for breakthrough. Mr. Morata stated that Tucson Water now has its own state-certified laboratory to run all analytical samples, to include PFAS. Carbon changeouts occur approximately every six to seven months, and only due to PFAS contamination. Mr. Morata indicated that ion exchange vessels will be installed to remove PFAS in the future.

The effluent storage tank was located, as well as four new booster pumps for the connection to the City's recycled water system. These pumps had yet to come online but were scheduled to be completed in the near future. The effluent valve to modulate discharge and the outlet to the river was found.

All components of the remedial action for the TARP portion of the TIAA were found to be in good working order and functioning as intended. The facility is enclosed within a high concrete wall. The facility is only accessed via security gates. All systems and wells were found to be well secured and free from vandalism. No issues of concern were noted at the site during the visit. The team departed the site at approximately 1300 hrs.

Former Texas Instruments

Mr. Masten and Ms. Aycock proceeded to inspect the Former Texas Instruments (TI) portion of the TIAA Superfund Site. They arrived on site at approximately 1415 hrs. There is no current active remedy taking place at the TI facility. No issues of concern were noted at the site during the visit. The facility was noted to now be operated by Materion Corporation, a multinational chemical and specialty material manufacturer. The team was able to drive through the rear yard area, as the gate was open. However, the wells in the courtyard were inaccessible. The building was undergoing active construction activities and a large crane was blocking the entrance. Ms. Aycock noted that the wells on site are still sampled when accessible.

Former Western Capacitor

Mr. Masten and Ms. Aycock then proceeded to the Former Western Capacitor (West Cap) portion of the TIAA Superfund Site. They arrived on site at approximately 1435 hrs. The site visit included visiting the Source Area located at the corner of E. Elvira and S. Plumer roads. No issues of concern were noted at the site during the visit. The Source Area is secure within a fence and maintained by the current company (Glaz-Tech) that owns and operates a glass manufacturing facility on the property. The gate was open at the time of the visit and the team proceeded to inspect the area. There is no current active remedy taking place at the West Cap facility. Four monitoring wells were located: WC-21, WC-22, WC-17B, WC-06. All wells were flush mount and well secured. There was a notable amount of materials and debris in the paved area, compared to images from the previous Five-Year Review. One well was partially covered by wooden timber materials; however, this could be moved with assistance from Glaz-Tech personnel. All other located monitoring wells were noted to be accessible. The site is gated and secured outside of business hours.

West Plume B

Mr. Masten and Ms. Aycock then toured the West Plume B (WPB) area of the TIAA Superfund Site. WPB is part of groundwater Operable Unit (OU) 1, located in Area B at the site. The site visit included visiting the locations of select monitoring wells and typical residential neighborhoods within and near the boundary of the groundwater plume at the site. The WPB area is primarily residential with some light commercial facilities along S. Park Avenue and along E. Drexel Road at the northwest end of the plume.

WPB is a portion of the TIAA site that is currently in a long-term groundwater monitoring phase. There is no active remedy for WPB. Currently, monitoring wells associated with WPB are monitored on a semi-annual basis by the Arizona Air National Guard. All located wells were found to be accessible, well secured and in good shape. No evidence of tampering or issues of concern were noted at the site during the visit.

Arizona Air National Guard

A drive-by was conducted of the Arizona Air National Guard (AANG) portion of the TIAA Superfund Site by Mr. Masten. The site was noted to be well secured. The entire Base is enclosed within secure fencing and military patrols and access gates, with the exception of the flight line which is enclosed by the Tucson International Airport fence.



Figure 1- Entrance to Airport Properties GWTP



Figure 2- Airport Properties GWTP Equalization Tank



Figure 3- Airport Properties GWTP Air stripper



Figure 4- Airport Properties GWTP carbon treatment vessel



Figure 5- Airport Properties GWTP SVE knock-out pot.



Figure 6- Airport Properties GWTP SVE totalizer



Figure 7- Airport Properties GWTP SVE blower cabinet



Figure 8- Airport Properties GWTP SVE air to air cooler



Figure 9- Airport Properties GWTP SVE carbon vessels

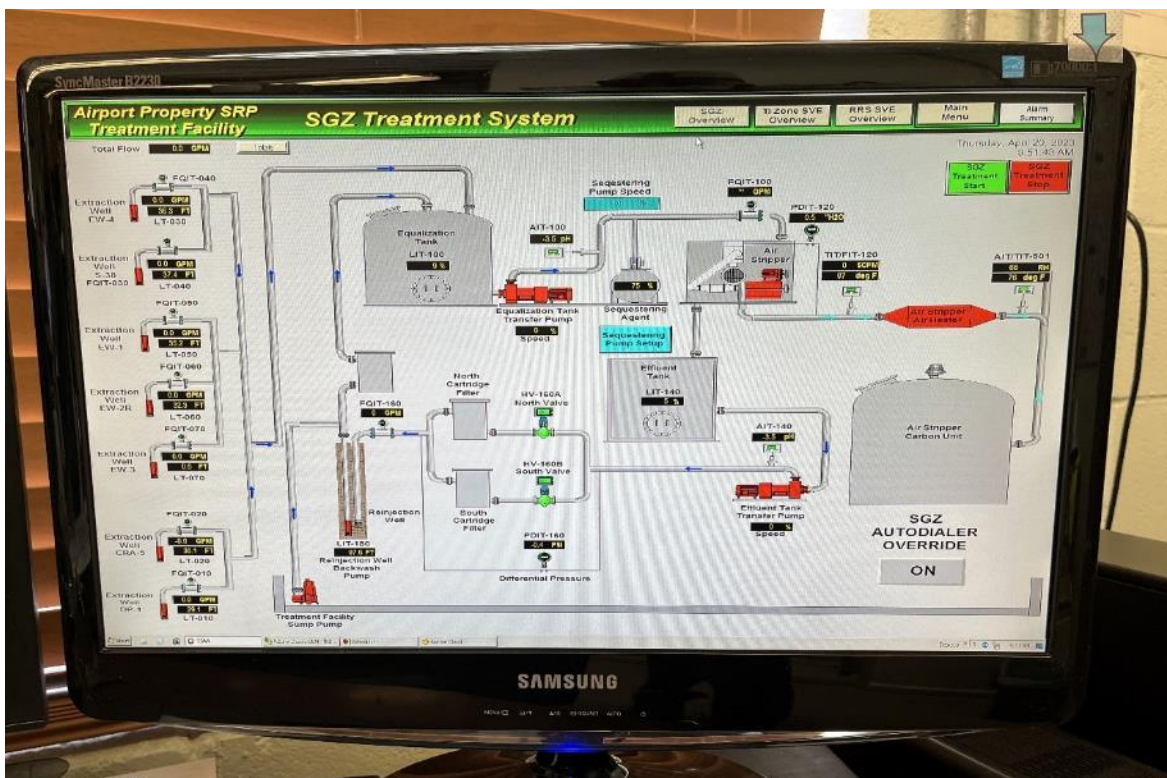


Figure 10- Airport Properties GWTP control screen

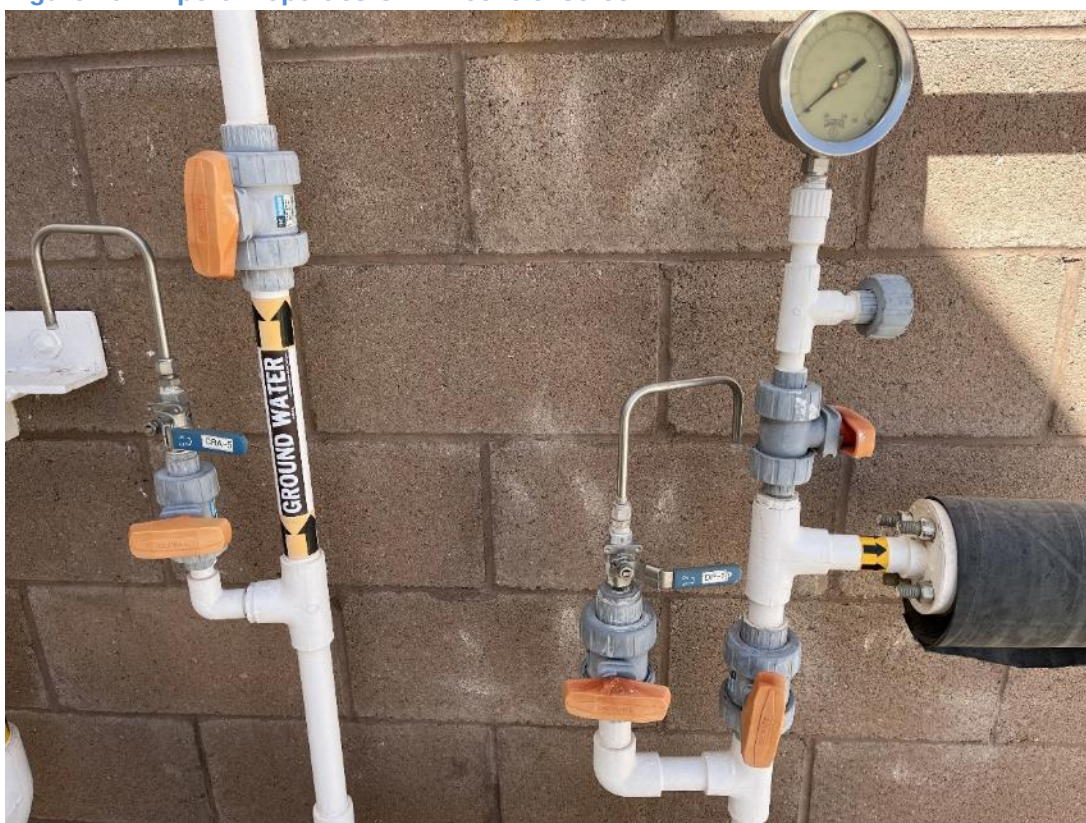


Figure 11- Airport Properties GWTP sample ports



Figure 12- Airport Properties GWTP effluent line



Figure 13- Airport Properties GWTP well vault SVE3

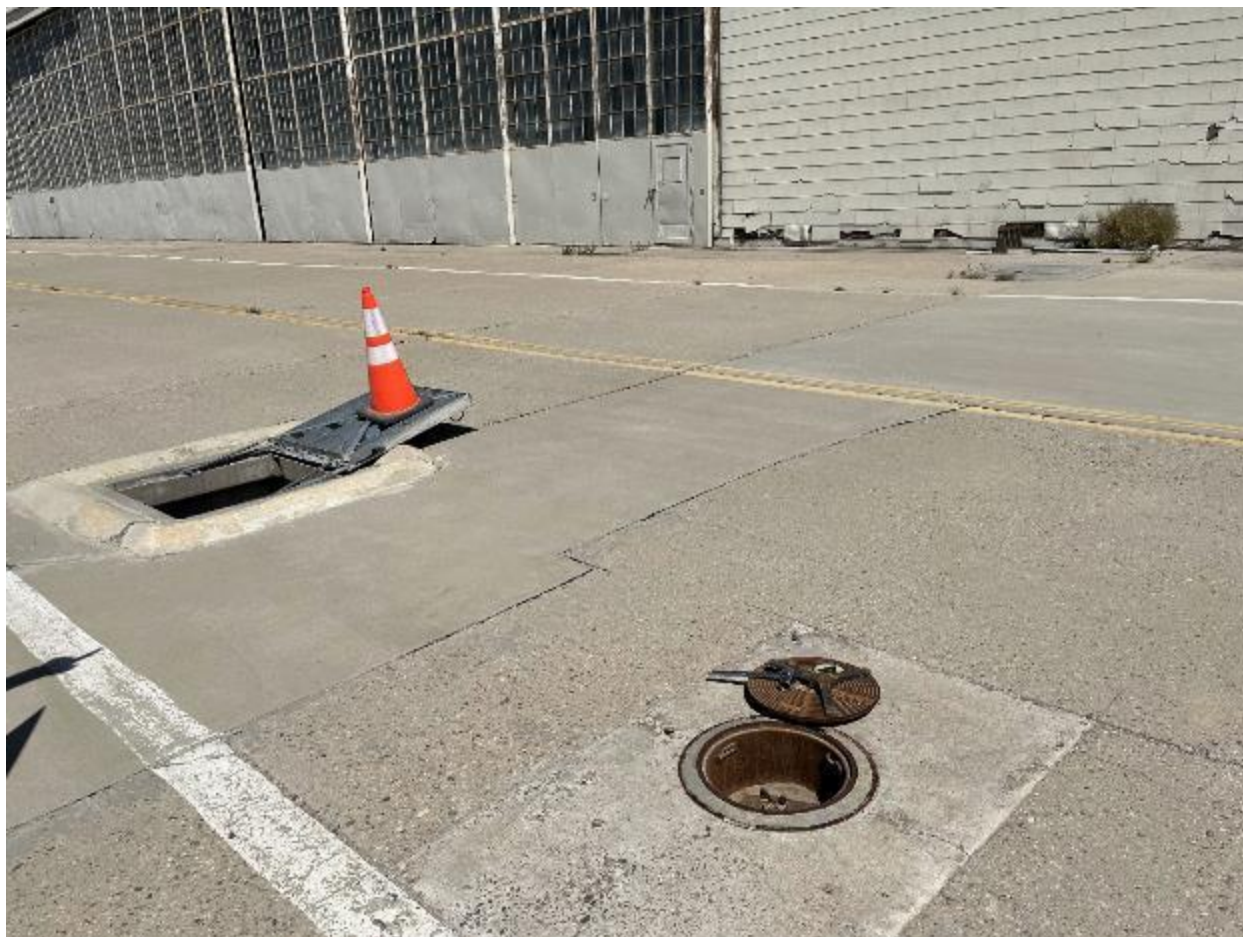


Figure 14- Airport Properties GWTP well vaults CRA-5 (left) CRA-3 (right)



Figure 15- Airport Properties GWTP interior well vault CRA-5



Figure 16- Airport Properties GWTP interior well vault CRA-3

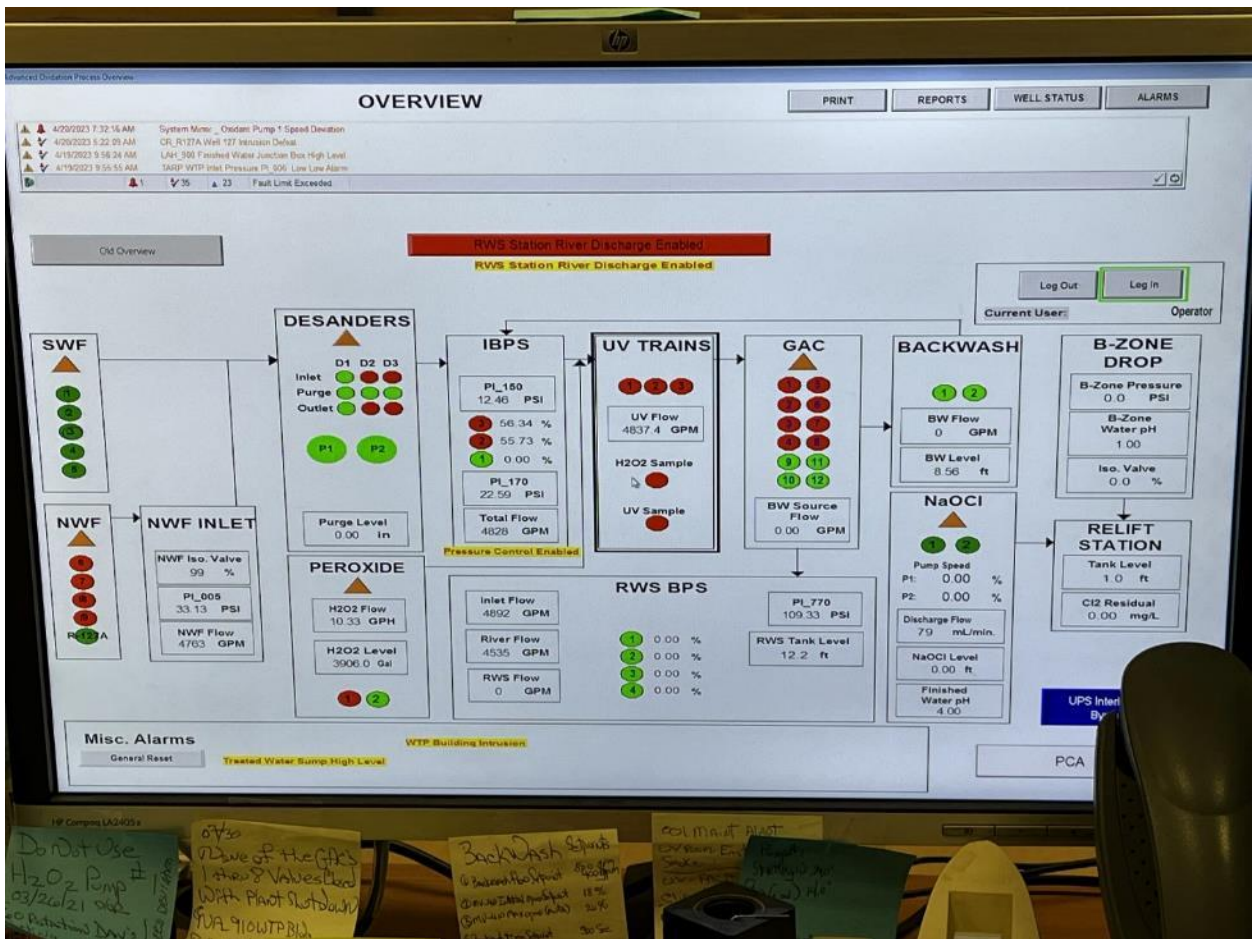


Figure 17- TARP control screen overview



Figure 18- TARP PCA system (inactive)



Figure 19- TARP influent pipe



Figure 20- TARP Desanding Hydrocyclones



Figure 21- TARP inlet pipes



Figure 22- TARP silt cartridge filters



Figure 23- TARP (example of gravel removed from desanders)



Figure 24- TARP system pumps



Figure 25- TARP peroxide injection point



Figure 26- TARP peroxide tank



Figure 27- TARP UV PHOX system



Figure 28- TARP GAC vessels (900 gpm on right)



Figure 29- TARP effluent storage tank



Figure 30- TARP effluent booster pumps



Figure 31- discharge point to river



Figure 32- TARP connection to recycled water system.



Figure 33- TI exterior



Figure 34- TI rear yard



Figure 35- West Cap well WC-21



Figure 36- West Cap well WC-22



Figure 37- West Cap well WC-17B



Figure 38- Overview of West Cap Glaz-Tech yard



Figure 39- West Plume B flush mount well



Figure 40- West Plume B flush mount well