RESOURCE CONSERVATION AND RECOVERY ACT
POST-CLOSURE CARE PERMIT RENEWAL APPLICATION

PERMIT # 4571524095-PC

VANCE AIR FORCE BASE, ENID, OK

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LIST OF ACRONYMS AND ABBREVIATIONS

AETC	Air Education and Training Command
AFB	Air Force Base
AOC	Area of Concern
AST	Aboveground Storage Tank
BCE	Base Civil Engineer
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylenes
CGTF	Central Groundwater Treatment Facility
CMI	Corrective Measures Implementation
COC	chemicals of concern
COMBS	Contractor Owned and Maintained Base Supply
CSM	conceptual site model
DCE	dichloroethene
DEQ	[Oklahoma] Department of Environmental Quality
DoD	Department of Defense
DPE	dual-phase extraction
DRMO	Defense Reutilization and Marketing Office
EESOH-MIS	Enterprise Environmental, Safety and Occupational Health-Management Information System
ERD	enhanced reductive dechlorination
EVO	emulsified vegetable oil
EW	extraction well
FPR	free product recovery
FS	feasibility study
ft	feet
ft/day	feet per day
GAC	granular activated carbon
ICT	Interceptor Collection Trench
ID	identification
IRA	interim remedial action
ITSI	Innovative Technical Solutions Group
IZ	industrial zone
MCL	maximum contaminant level
MW	monitoring well
NFA	No Further Action
OCC	Oklahoma Corporation Commission
OK-DRO	Oklahoma-diesel range organics
OK-GRO	Oklahoma-gasoline range organics

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

PCE	tetrachloroethene
PDI	preliminary design investigation
POTW	publicly owned treatment works
PSET	Paint Stripping Equalization Tank
RA-O	Remedial Actions-Operations
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	remedial investigation
SVE	soil vapor extraction
SVOC	semi-volatile organic compounds
SWMU	Solid Waste Management Unit
TBD	to be determined
TCE	trichloroethylene
TPH	total petroleum hydrocarbons
TSD	transportation, storage and disposal
URS	URS Group Inc.
USAF	United States Air Force
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USGS SCS	United States Geological Survey Soil Conservation Service
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compounds

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RESOURCE CONSERVATION AND RECOVERY ACT POST-CLOSURE CARE PERMIT RENEWAL APPLICATION

VANCE AFB, OKLAHOMA

1.0 APPLICATION DESCRIPTION AND CERTIFICATIONS

1.1 INTRODUCTION

The purpose of this permit renewal application is for continued post-closure care and groundwater monitoring at Vance Air Force Base (AFB) as described herein. The current Post-Closure Care Permit No. 4571524095-PC, issued by the Oklahoma Department of Environmental Quality (DEQ), as modified, describes the basis of the permit as the requirement of Vance AFB to conduct post-closure care at applicable sites, as well as monitoring and continued corrective action for additional sites under the Special Conditions Pursuant to Hazardous and Solid Waste Amendments under the Resource Conservation and Recovery Act (RCRA). Vance AFB is conducting, or has already conducted, corrective action and remediation at the Solid Waste Management Units (SWMU) and other release areas identified in this application. Through the application of performance standards as described in the permit, Vance AFB and the Oklahoma DEQ will determine whether future releases must be addressed through corrective action, and whether implemented corrective actions are protective of human health and the environment (Oklahoma DEQ, 2019).

1.1.1 BACKGROUND

The location of Vance AFB and the remedial sites addressed by this application are shown in **Figure 1**. The sites at Vance AFB are in three general areas of the installation:

1. Corrective Measures Implementation (CMI) Area: includes Sites SS024, SS025 and ST012;
2. Industrial Zone (IZ): includes Sites LF003, SS007, SS026, SS028, ST008 and ST011; and
3. Southern boundary sites: includes Sites DP005 and FT002.

These areas are referenced throughout this application as a construct for organizing information regarding the Vance AFB groundwater monitoring program, site descriptions and corrective actions.

The original RCRA Post-Closure Permit was issued to Vance AFB in 1996 by the Oklahoma DEQ. The permit was renewed most recently on September 30, 2010. This current permit expires on September 30, 2020. A modification in 2019 was approved by Oklahoma DEQ and addressed the following major changes:

- Changes to the remedial programs at Vance AFB since the previous renewal;
- Discontinuance of the Fall compliance monitoring event;
- Discontinuance of surface water and sediment sampling at Site LF003;
- Removal of select monitoring wells from compliance monitoring;

- Removal of select analytes from compliance monitoring; and
- Realignment of select monitoring wells based on the conceptual site model (CSM) (AECOM, 2018).

As modified, the current permit covers the following:

- Post-closure care at Sites ST008 and ST012;
- Groundwater monitoring at the CMI Area, IZ, and southern boundary sites; and
- Surface water and sediment monitoring at Sites SS007 and DP005.

Site SS028 is a new site, located immediately upgradient of Site ST008. Site ST011 is a site that was previously closed under the storage tank requirements of the Oklahoma Corporation Commission, but was reopened and added to the Permit in the 2019 modification due to the discovery of benzene believed to originate from the site when investigating nearby Site LF003. RCRA Facility Investigations (RFI) have been conducted for both SS028 and ST011; however, the results of the RFIs indicated that an additional Supplemental RFI would be needed for each to fully determine nature and extent of contamination. As such, the mention of SS028 and ST011 in this renewal application is used in the context of placeholder information until further investigation is conducted.

1.1.2 ORGANIZATION OF APPLICATION

This renewal application for RCRA Post-Closure Care Permit No. 4571524095-PC includes information necessary to address the requirements of 40 CFR 264 and 40 CFR 270 as they pertain to post-closure care and continued monitoring at Vance AFB. The renewal application is organized around the specific Oklahoma DEQ checklists required to address conditions at Vance AFB, along with relevant supporting information. The primary document includes the following:

- Section 1 Application Description and Certifications as required by 40 CFR 270 and documented in the accompanying Oklahoma DEQ *Application Review Checklist*
- Section 2 General and Additional Information Requirements as required by 40 CFR 270 and documented in the accompanying Oklahoma DEQ *Application Review Checklist*
- Section 3 Information Requirements for Solid Waste Management Units as required by 40 CFR 264 Subpart F and documented in the accompanying Oklahoma DEQ *Application Review Checklist for Releases from Solid Waste Management Units*
- Section 4 Information Requirements for Landfills as required by 40 CFR 264 Subpart N and documented in the accompanying Oklahoma DEQ *Application Review Checklist for Landfills*
- Section 5 References
- Attachment 1 Post-Closure Care Plan for ST008
- Attachment 2 Post-Closure Care Plan for ST012
- Attachment 3 Groundwater Monitoring Well Information
- Attachment 4 Groundwater Monitoring Data

- Attachment 5 Sampling and Analysis Plan

A note on site identifications: this application refers to sites by their Air Force Enterprise Environmental, Safety and Occupational Health-Management Information System (EESOH-MIS) designation, for example ST008. The corresponding site identifications under the current permit (e.g., ST-08) are provided in **Table 1**.

1.2 REAPPLICATION AND RECORDKEEPING [40 CFR 270.10(h), 270.10(i)]

The existing Permit is in effect for 10 years and will expire on September 30, 2020. The permit requires a renewal application to be submitted to the Oklahoma DEQ at least one-hundred eighty (180) days before the current expires. This permit renewal application will be submitted by Vance AFB to Oklahoma DEQ prior to April 2, 2020 to comply with this requirement.

This permit renewal application provides information available at the time of preparation. However, the specifics of the post-closure care, groundwater monitoring and corrective action programs may change as further information is gathered and/or future studies are completed. Vance AFB will inform, and coordinate with, Oklahoma DEQ regarding these changes and address future changes at the installation and respective sites through the permit modification process as appropriate.

Records of all data used to complete this permit renewal application and any supplemental information submitted under 40 CFR 270.10(d), 270.13, and 270.14 through 270.21, as applicable, will be kept for a period of at least 3 years from the date the application is signed. The information will be stored and maintained in electronic format at Vance AFB by the Vance AFB Remedial Project Manager.

1.3 CERTIFICATIONS

Vance AFB is a Department of Defense (DoD) Air Education and Training Command Base that is a host to a number of DoD components; however, all oversight of maintaining this permit, including post-closure care and corrective action, is the responsibility of Vance AFB.

1.3.1 FACILITY CERTIFICATION [40 CFR 270.11(a)(3)]

This permit renewal application is for continued post-closure care at Vance AFB. The Air Force's RCRA responsibilities include policy, programmatic funding, scheduling decisions, monitoring, recordkeeping, reporting, contingency planning, and general oversight. This certification also designates the position noted within Section 1.3.3 that is authorized to sign the reports submitted on behalf of the facility. For purposes of the certification required by 40 CFR 270.11(d), the following facility certification statement is provided for Vance AFB:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

_____

Corey A. Simmons, Colonel, USAF
Commander, 71st Flying Training Wing

1.3.2 ENGINEERING CERTIFICATION

An engineering certification is not required, as the renewal application is for continued post-closure care at Vance AFB.

1.3.3 SIGNATORIES FOR REPORTS [40 CFR 270.11(b) and (c)]

Reports required by the Permit may be signed by the signatory above, or duly authorized individuals who have been given written authorization from the primary signatory. Notification will be provided to Oklahoma DEQ concerning personnel changes at Vance AFB affecting the facility certification signatory or the duly authorized person(s).

2.0 GENERAL AND ADDITIONAL PERMIT INFORMATION REQUIREMENTS

This section addresses the general and additional permit information requirements under 40 CFR 270.14 identified in the *Application Review Checklist* that accompanies the application. As Vance AFB does not operate an active hazardous waste transportation, storage and disposal (TSD) facility, only the applicable general requirements of the checklist are addressed here.

2.1 GENERAL DESCRIPTION OF FACILITY [40 CFR 270.14(b)(1)]

Vance AFB was established in late 1941 for training aviation cadets and was originally referred to as Air Corps Basic Flying School of Enid, Oklahoma. The installation was officially named the Enid Army Flying School in February 1942, and months later was renamed the Enid Army Flying Field. The Enid Army Flying Field was closed in late January 1947 due to the decreased need for pilots post World War II. The installation was reactivated under the newly formed Air Force Air Training Command as Enid AFB in mid-January 1948. The mission remained pilot training under the U. S. Air Force (USAF), but primarily focused on training advanced students on multi-engine aircraft. Enid AFB was renamed Vance AFB in July 1949 in honor of Lt. Col. Leon R. Vance, Jr. a local World War II hero and Medal of Honor recipient (USAF, 1993).

Vance AFB is currently home to the 71st Flying Training Wing. The installation is the northernmost Specialized Undergraduate Pilot Training base in the Air Education and Training Command (AETC) with a mission to develop professional airmen, deliver world-class United States and Allied pilots, and deploy combat ready warriors (USAF, 2015). The location of Vance AFB is shown in **Figure 1**.

2.2 SECURITY MEASURES [40 CFR 270.14(b)(4)]

Vance AFB is an active military installation. As such, access to the base is restricted by fencing, guards, and a 24-hour security patrol. Entry to the base is restricted to a limited number of gates, all manned by armed Air Force Security Forces personnel or other security personnel.

2.3 FACILITY LOCATION [40 CFR 270.14(b)(11)]

Vance AFB is an active U.S. AFB located in Garfield County in north-central Oklahoma, approximately 5 miles southwest of downtown Enid, Oklahoma (**Figure 1**). All of Vance AFB is within the city limits of Enid. The base occupies approximately 2,122 acres and is surrounded by privately owned agricultural properties. Construction of Vance AFB began in 1941, and the base officially began basic flight training operations in November 1941. Vance AFB is primarily comprised of aircraft taxiways and runways and is currently part of the AETC (ITSI, 2010).

2.3.1 IDENTIFICATION OF POLITICAL JURISDICTION [40 CFR 270.14(b)(11)(i)]

Vance AFB is located in Garfield County. Vance AFB is not subject to the seismic standard because it does not fall within any county, township, or election district listed in 40 CFR 264, Appendix VI.

2.3.2 CLOSURE AND POST-CLOSURE PLANS [40 CFR 270.14(b)(13)]

Vance AFB is not an active TSD facility as defined by 40 CFR 270. Two remediation sites at the facility are managed under post-closure plans: Sites ST008 and ST012. ST008 is the physical location of Underground Storage Tank (UST) No. 106 that was used to manage waste solvents and contaminated fuels during the 1970s and early 1980s. UST No. 106, a 12,000-gallon steel tank, was excavated and removed in 1989 as part of the closure process. ST012, the Paint Stripping Equalization Tank (PSET), was a reinforced concrete UST with a capacity of approximately 10,000 gallons. The PSET was installed in 1967 and had been used solely to hold paint stripping waste; it was taken out of service in 1988 and removed in June 1995 as part of the closure process. There is groundwater and soil contamination associated with releases from both these sites. Groundwater monitoring is required. The post-closure care plans for ST008 and ST012 are included as **Attachment 1** and **Attachment 2**, respectively, to this application.

2.4 TOPOGRAPHIC MAP [40 CFR 270.14(b)(19)]

Vance AFB is located along the eastern edge of the Great Plains in the Redbed Plains section of the Central Lowlands Province (Fenneman, 1938; Swafford, 1967; USDA SCS, 1975). Vance AFB lies in the western portion of Garfield County in the Enid Prairies (URS, 2007). This region is characterized by nearly level prairie that is dissected by drainage ways at intervals of approximately one mile. Elevation on base slopes from approximately 1,310 feet above mean sea level at the southwest corner and 1,300 feet above mean sea level at the southeast corner to 1,260 feet above mean sea level to the north of the main runway. Overall, the terrain generally slopes toward the north except in the southern most portion of the base, which slopes toward the south and southeast (USDOI, 1993). A topographic map of the area is included as **Figure 2**. Note: "facility" as used in the context of 40 CFR 270.14(b)(19) does not apply to Vance AFB, as there are no individual active hazardous waste facilities at the installation. Instead, the map provides a general reference for the entire installation.

2.5 GROUNDWATER MONITORING DATA [40 CFR 270.14(c)(1)]

Groundwater monitoring data at Vance AFB is collected for performance monitoring as described below in **Section 3.3**. A listing of compliance monitoring wells, including information on the site, well type (hydrogeologic zone), location and monitoring frequency, is included in **Attachment 3**. Groundwater monitoring data for Vance AFB for the previous 5 years, current as of the most recent approved Annual Groundwater Monitoring Compliance Report (2018) is included in the data tables in **Attachment 4**.

2.6 HYDROGEOLOGICAL INFORMATION [40 CFR 270.14(c)(2)]

2.6.1 GENERAL HYDROGEOLOGIC DESCRIPTION

The principal aquifers in the Enid quadrangle include alluvium and terrace deposits along the major streams and sandstone units in bedrock. Because of the similarity of the water-bearing properties of alluvium and terrace deposits, they are combined and referred to as the alluvial aquifer (USGS, 1991). The alluvial aquifer is composed of silt, clay, and fine sand, with coarse sand and gravel at the base in some areas. Well yields in the alluvial aquifer are largest in those areas where the saturated coarse sand and gravel are thickest. The saturated coarse sand and

gravel at Enid is 2 to 25 feet thick and yields to drilled wells are 50 to 300 gallons/minute (USGS, 1991).

Along the Cimarron, Chikaskia, Salt Fork of the Arkansas, and Arkansas Rivers, the alluvial aquifer is about 15 to 60 feet thick with a layer of coarse sand and gravel as much as 25 feet thick at the base. Where the basal sand and gravel zone is thick, the aquifer yields 150 to 600 gallons per minute; where the basal coarse sand and gravel zone is thin or absent, well yields are less than 50 gallons per minute (USGS, 1991). The alluvial aquifer located along minor streams is composed of fine-grained sand containing varying amounts of silt and clay; thus, the permeability is generally low. Aquifers in the bedrock are composed of saturated sandstone layers irregularly interbedded with shale, siltstone, and limestone. Most of the sandstone layers are fine grained, thin, and commonly yield only enough water for household use. Locally, however, part of the sandstone is medium to coarse grained and yields as much as 200 gallons per minute to industrial, irrigation, and public-supply wells (USGS, 1991).

The groundwater monitoring program at Vance AFB is comprised of three (3) major components:

(1) CMI Area (Sites SS024, SS025, ST012);

(2) IZ (Sites LF003, SS007, SS026, SS028, ST008, ST011); and

(3) South boundary area sites (Sites DP005 and FT002).

In general, the groundwater monitoring wells for these components are screened in three different transmissive zones present at the facility. The three zones are: the 10 to 30-foot below ground surface (bgs) interval (Shallow), the 35 to 50-foot interval (Intermediate), and the 55 to 75-foot interval (Deep).

2.6.2 GROUNDWATER FLOW GRADIENT AND RATE

Groundwater flow and rate varies with the three primary components. Water levels measured in the CMI Area compliance monitoring wells during the July/August 2018 sampling event conducted for the most recent approved 2018 Annual Groundwater Compliance Monitoring Report indicated the groundwater flow direction within the shallow zone was to the north-northeast. This result was consistent with the trends from previous years. Flow gradient and rate were not calculated for the intermediate and deep zones within the CMI area due to the limited number of wells screened in these zones (AECOM, 2019).

Water levels measured in all IZ compliance monitoring wells during the July/August 2018 event indicated the groundwater flow direction within the shallow zone was to the north-northeast. These results were consistent with the trends from previous years. Flow gradient and rate were not calculated for the intermediate and deep zones due to the limited number of monitoring wells screened in these zones (AECOM, 2019).

In the south boundary area, since only two compliance monitoring wells are present at FT002, potentiometric surface contours used to interpret groundwater flow and rate are created using water levels from both FT002 and DP005 monitoring wells. During July/August 2018, the direction of groundwater flow of the shallow zone within the immediate vicinity of Site DP005 appeared to converge toward the extraction wells and interceptor trench. Flow gradient and rate

are not calculated for FT002 and DP005 intermediate and deep zones due to a limited number of wells screened in these zones (AECOM, 2019).

Groundwater flow rate in the uppermost aquifer is required to be determined at least annually in accordance with the current permit. Flow rate was calculated during the July/August 2018 sampling event in accordance with the permit. The average hydraulic gradient in the shallow zone was 0.00586 feet per foot for July/August 2018. The average groundwater flow velocity calculated for the shallow zone was 1.98 x 10-5 cm/sec (20.45 feet/year) using the July/August 2018 gradient (AECOM, 2019).

2.7 PLUME CONTAMINATION [40 CFR 270.14(c)(4)]

Plume contamination at Vance AFB is localized within the specific groundwater monitoring program components: CMI Area, IZ, and the South Boundary Area. **Figures 3a** through **3g**, as taken from the most recent approved Annual Groundwater Compliance Monitoring Report for 2018 and data submitted for the 2019 permit modification, show the locations and extent of plumes at Vance AFB in the various hydrogeologic zones (shallow, intermediate and deep) in each area. For clarity and convenience in scale, these are not included on the topographic map (**Figure 2**) required by 40 CFR 270.14(b)(19) for the application. The following provide a summary of the contaminants in these areas.

2.7.1 CMI AREA

The CMI Area compliance well network consists of 21 monitoring wells located throughout three associated sites (Sites SS024, SS025 and ST012). The physical monitoring wells at Site WP013 are associated with other sites. Thirteen monitoring wells are screened in the shallow zone, five wells in the intermediate zone, and three in the deep zone. **Figures 3a, 3b**, and **3c** show the well networks and contaminant plumes for the CMI Area groundwater zones. **Attachment 3** presents the compliance wells, associated sites, sampling frequency and contaminants sampled for the CMI Area. The compliance monitoring wells in the CMI Area are sampled and analyzed for volatile organic compounds (VOC) to assess predominantly chlorinated solvent contamination from tetrachloroethene (TCE) and daughter products. Monitoring Wells MW25-07 and MW12-33 are also analyzed annually for the semi-volatile organic compound (SVOC) 1,4-dioxane (AECOM, 2020).

2.7.2 IZ

The IZ compliance well network consists currently of 29 monitoring wells located throughout the associated sites (Sites LF003, SS007, SS026, SS028, ST008 and ST011). Site ST011 currently has no monitoring wells on the permit and is being investigated further to define nature and extent of contamination. Five wells with MCL exceedances in the current RFI are being proposed for addition to the permit for ST011, as listed in **Attachment 3**. Similarly, Site ST028 has only one well listed in the current permit but is also being investigated further to define nature and extent of contamination. Five additional wells with MCL exceedances in the current RFI are being proposed for addition to the permit for ST028, as listed in **Attachment 3**. Nineteen wells are screened in the shallow zone, six wells are screened in the intermediate zone, and four wells are screened in the deep zone. **Figures 3d, 3e**, and **3f** show the well networks and contaminant plumes for the IZ groundwater zones. **Attachment 3** presents the compliance wells,

associated sites, sampling frequency and contaminants sampled for the IZ area. Contaminants sampled vary among sites in the area, and include VOCs [predominantly chlorinated solvent contamination from TCE and daughter products, and benzene, toluene, ethylbenzene and xylene (BTEX)], Oklahoma-gasoline range organics (OK-GRO) and RCRA 8 metals, including arsenic and lead (AECOM, 2020).

2.7.3 SOUTH BOUNDARY AREA SITES

The compliance well network in the south boundary area consists currently of 11 monitoring wells located at Sites DP005 and FT002. Nine wells are screened in the shallow zone, one in the intermediate zone, and one in the deep zone. **Figure 3g** shows the well networks and contaminant plumes for the groundwater zones in the south boundary area. **Attachment 3** presents the compliance wells, associated sites, sampling frequency and contaminants sampled for this area. Contaminants sampled include VOCs (predominantly chlorinated solvent contamination from TCE and daughter products), total petroleum hydrocarbons (TPH), arsenic, and selenium. Monitoring Well MW05-04 is also analyzed annually for the SVOC 1,4-dioxane (AECOM, 2020).

2.8 POINT OF COMPLIANCE [40 CFR 270.14(c)(3)]

As no plume at Vance AFB extends beyond the installation boundary, the point of compliance for contaminated groundwater at Vance AFB is the Base boundary. The purpose of the point of compliance wells, included as part of the monitoring well networks identified in Attachment 3, is to demonstrate that contaminant concentrations are less than federal Maximum Contaminant Levels (MCL) for drinking water at the point of compliance, thereby demonstrating that groundwater exposure within the plume is under the control of Vance AFB.

2.9 GROUNDWATER MONITORING PROGRAM [40 CFR 264.90, 264.101, 270.14(c)(5) AND (c)(7)]

The permitted groundwater monitoring and remediation program satisfies the SWMU groundwater provisions of 40 CFR Part 264 for groundwater compliance monitoring. The groundwater monitoring program is summarized herein to address the informational requirement for RCRA permit applications under 40 CFR 270.14 (c)(5) and (c)(6), as well as 270.14(d) in reference to corrective action for SWMUs. As this permit renewal application is for continued post-closure care and groundwater monitoring at Vance AFB, an engineering report as defined by 40 CFR 264.67 is not required. During the life of the permit, revisions to the groundwater monitoring program will be made as required and appropriate to maintain conditions protective of human health and the environment.

Specific site status and the overall Corrective Action Strategy can be found in **Section 3.0** of this permit application. A description of the hydrogeologic framework, including relevant geologic units and aquifer zones for Vance AFB can be found in **Section 2.6**. The relationship of SWMUs, Air Force Installation Restoration Program sites, and groundwater plumes has been described and reviewed through previous document submittals, including annual reports for performance monitoring and can be found in **Attachment 3**.

2.9.1 DESCRIPTION OF GROUNDWATER MONITORING PROGRAM

Groundwater monitoring at Vance AFB is established to ensure that groundwater remains protective of human health and the environment and maintains compliance with the Groundwater Protection Standard (40 CFR 264.100(d)], which is National Drinking Water Standards, MCLs for contaminated groundwater at the Base boundaries (point of compliance). It is also utilized to measure and assess progress associated with various corrective action activities at the sites.

2.9.2 SAMPLING AND MONITORING PARAMETERS [CFR 264.97(g)]

Attachment 3 identifies the monitoring well networks, sediment and surface water locations for applicable sites, sampling frequencies and monitoring parameters for each unit. Surface water and sediment sampling is required at Sites DP005 and SS007. All points are sampled at the indicated frequencies in accordance with the Sampling and Analysis Plan for Vance AFB, which is included as **Attachment 5** to this application.

2.9.3 GROUNDWATER MONITORING ANALYSIS [CFR 264.97(h)]

Following sample collection during each year, the results of sampling, and analysis of results are documented in an Annual Groundwater Compliance Monitoring Report provided to the Oklahoma DEQ no later than March 1 following each calendar year. Results above MCLs for groundwater and surface water contaminants, and results above regional screening levels for sediment contaminants, are compared and assessed using trend analysis over at least the past 5 years to determine reduction trends and/or identify potential rebound. Because the current groundwater plumes have been reduced significantly relative to contaminant concentration and size, quantitative trend analysis using statistics is not typically conducted. If statistical analysis is required, Vance AFB will utilize a method approved by Oklahoma DEQ.

3.0 INFORMATION REQUIREMENTS FOR SOLID WASTE MANAGEMENT UNITS [40 CFR 264 and 40 CFR 270.14(d)(1)]

This section includes information on post-closure care and corrective action at Vance AFB as it pertains to the requirements for SWMUs as identified in the accompanying Oklahoma DEQ *Application Review Checklist for Releases from Solid Waste Management Units*. As Vance AFB does not operate an active hazardous waste TSD facility, only the applicable requirements of the checklist are addressed here.

This section of the RCRA renewal permit application provides information available at the time of preparation. However, the specifics of the post-closure care and corrective action program may change as further information is gathered and/or additional studies are completed during the Permit period. Vance AFB will inform, and coordinate with, Oklahoma DEQ regarding these changes.

3.1 POST-CLOSURE CARE [40 CFR 264.117 – 264.120]

Post-closure care currently applies to Sites ST008 and ST012 at Vance AFB. As of the most recent September 2019 sampling event, concentrations of contaminants of concern at ST008 have remained below Groundwater Protection Standard levels for contaminants with an MCL for at least three years (AECOM, 2020). As such, Vance AFB is respectfully requesting that the post-closure care period for ST008 be shortened from April 13, 2023 to the date ODEQ issues the new permit. Vance AFB will submit Post-Closure Certification as prescribed in Section 5.2 of Attachment 1, Post-Closure Plan for Site ST-08. **Attachment 1** and **Attachment 2** include the Post-Closure Care Plans for Site ST008 and Site ST012, respectively, for reference.

3.2 CORRECTIVE ACTION STRATEGY FOR SWMUS [40 CFR 264.90, 264.91 – 264.100, 264.101, and 270.14(d)]

3.2.1 BASIS

The purpose of corrective action at Vance AFB is to protect human health and the environment. To this end, Vance AFB has implemented a corrective action program intended to satisfy the requirements of 40 CFR 264 Subpart F for releases from SWMUs at the installation as provided in §§ 264.90 and 264.101, and for achieving compliance with the Groundwater Protection Standard to prevent hazardous constituents in groundwater from exceeding their respective MCLs at the compliance point (the installation boundary) by removing the hazardous constituents or by treating them in place at the sites.

Vance AFB is conducting, or has already conducted, corrective action and remediation at the SWMUs and other release areas identified in **Table 1** (with provisions for any newly discovered releases) in compliance with §§264.90 and 264.101. These corrective actions are reflected in the current permit, as modified, and documented in reports previously submitted to the Oklahoma DEQ. Coupled with groundwater compliance monitoring, corrective action at these sites ensures contaminated groundwater is remediated such that the MCLs are not exceeded at the point of compliance for respective contaminants. Vance AFB will use the current corrective action strategy to the fullest extent practicable for planning and implementing corrective action without superseding existing Federal, State, and local regulations.

3.2.2 APPLICABILITY [40 CFR 264.90]

The corrective action strategy at Vance AFB applies to existing SWMUs that are identified in this Application (as shown in **Table 1**). The CAS will not apply to the former SWMUs and Areas of Concern (AOC) that have reached a No Further Action (NFA) determination (**Table 2**). Newly discovered SWMUs and AOCs will be addressed by the corrective action strategy when identified. The process for implementing the corrective action strategy at existing and newly discovered sites is discussed below in **Section 3.2.3**.

3.2.3 APPROACH

The current permit identifies existing sites at Vance AFB (**Table 1**) located in three primary areas as described previously. Vance AFB will continue managing and conducting corrective action at these sites in accordance with the permit as well as the latest documents submitted to the Oklahoma DEQ to document the activities and results of current corrective actions. The sites are currently being addressed through either a remedy in place and/or long-term monitoring. The primary corrective action performance standard will be containment of groundwater contamination. Remedial activities, including possible source removal activities, will be planned and implemented in support of the primary performance standard.

Vance AFB will address alternative actions that may be necessary in the event that analysis of performance monitoring results from the units shows that a plume is not being contained or is otherwise increasing, either in contaminant concentration or area.

Vance AFB will notify the Oklahoma DEQ in writing of any newly-identified SWMUs or potential AOC(s) (i.e., a unit or area not specifically identified during previous corrective action assessments, RFI, etc.), discovered in the course of groundwater monitoring, field investigations, or other means, no later than thirty (30) calendar days after discovery. In addition, Vance AFB will notify Oklahoma DEQ in writing, no later than fifteen (15) calendar days after discovery, of any release(s) from a SWMU or AOC of hazardous waste or hazardous constituents identified during the course of ground water monitoring, field investigation, or other means. Such newly discovered releases may be from newly identified SWMUs or AOCs or from SWMUs or AOCs for which, based on the findings of the CSM, or investigation of an AOC(s), the Oklahoma DEQ had previously determined no further investigation was necessary. Any newly identified SWMU, AOC or release is subject to the performance standard defined in the corrective action strategy.

3.3 DESCRIPTION OF REGULATED SWMUS AND AOCS AT VANCE AFB

The following sections provide a description of the SWMUs and AOCs at Vance AFB. As necessary, some information may be repeated from Section 2 (groundwater program description) to provide a full description of the sites.

3.3.1 NO FURTHER ACTION SITES

Post closure and/or groundwater monitoring applies only to sites that are identified in this permit renewal application as shown in **Table 1**. Post-closure and monitoring will not apply to the former SWMUs and AOCs that have reached an NFA determination and moved to Table 2b of the permit. **Table 2** shows the NFA sites at Vance AFB for reference only.

3.3.2 FURTHER ACTION SITES [40 CFR 270.14(d)(1), (d)(2)]

The sites in the current permit that require continued regulatory oversight under this RCRA Permit renewal are listed on **Table 1** and shown in **Figure 1**. The following subsections characterize the sites associated with the three primary areas (CMI Area, IZ, South Boundary Area sites) at Vance AFB, as well as define the past and current remedies implemented at these sites, and the current compliance monitoring program. The remedies described below have been implemented at each site and have been documented in regulatory submittals for each individual site including Remedial Design/Corrective Measures Implementation Reports, Construction Completion Reports and Corrective Measures Completion Reports where applicable.

Remedial actions operations activities are conducted at all sites with remedies, which includes periodic sampling to allow for an assessment of progress relative to the remedial goal at each site. Course corrections or additional remedial activities are conducted at the sites on an as needed basis. Course corrections generally involve reinforcement or adaptation of the site remedy using the approved remedial approach for the site to address changing plume morphology. An example of this would be the need for a second round of emulsified vegetable oil (EVO) injections at a site or the need for additional injection wells at a site.

3.3.2.1 CMI Area

The CMI Area includes Sites ST012, SS024, and SS025. Site WP023 contaminants are attributable to Site ST012 and will no longer be monitored as part of Site WP023. As such, Site WP023 is being moved to the NFA table (**Table 2**). The aquifer in the CMI Area has three transmissive zones associated with it, the shallow zone (10-30 feet bgs), intermediate zone (35-50 feet bgs), and deep zone (55-75 feet bgs). These three zones of the aquifer underlying Vance AFB will be referred to herein as the shallow, intermediate, and deep zones (AECOM, 2019).

The compliance well network associated with the CMI Area includes 21 monitoring wells associated with Sites ST012, SS024, and SS025, with 13 wells screened in the shallow zone, five wells in the intermediate zone, and three wells in the deep zone. None of the sites in the CMI Area have surface water or sediment sampling locations associated with it. Historical contaminants of concern (COCs) at the CMI area are tetrachloroethene (PCE), TCE, cis-1,2-DCE, vinyl chloride (VC), 1,2-dichloroethane, 1,1-DCE, acetone, methyl ethyl ketone, and methylene chloride. Groundwater samples collected from the CMI Area wells are analyzed for VOCs, except for Monitoring Wells MW25-07 and MW12-33, which are also analyzed for the parameter 1,4-dioxane. **Figures 3a** through **3c** illustrate the monitoring wells and sampling results as of February 2019 in the shallow, intermediate, and deep zones, respectively, for the CMI Area (AECOM, 2019).

3.3.2.1.1 Site ST012 (Paint Stripping Equalization Tank)

Site ST012, also known as the ST-12 Paint Stripping Equalization Tank, is located near Monitoring Well MW12-09 and extraction well EW12-01. The site was constructed as a concrete vault circa 1967 and operated until 1988. Water and sludge from paint stripping operations flowed into the tank and the liquid effluent was then discharged into the sanitary sewer system. This site is located near Sites WP023, SS024, and SS025 (ITSI, 2010). Historically, the COC at ST012 was methylene chloride. Presently, the primary contaminants at the site are PCE, TCE,

cis-1,2-DCE and VC. Site ST012 is the only site within the CMI Area that has contamination in the intermediate and deep zones (AECOM, 2019). ST012 monitoring well locations are shown on **Figures 3a** through **3c**.

The original remedy documented in the permit at Site ST012 included groundwater extraction from five extraction wells. Groundwater pumped from these wells was previously conveyed to the Central Groundwater Treatment Facility (CGTF) via below grade piping. The treated water was then discharged to the City of Enid Publicly Owned Treatment Works (POTW). Vance AFB has an Industrial User Permit for the City of Enid POTW. The ST012 groundwater extraction system was part of the CMI Area groundwater extraction system, which consisted of a total of 13 shallow zone extraction wells (including the five ST012 extraction wells). Groundwater pumped from these wells was directed to the CGTF. The original CMI Area remedy was installed to collect and treat impacted groundwater and to provide hydraulic control to prevent further plume migration.

During 2014, the Site ST012 remedy was changed to include a more aggressive treatment using EVO injections in the shallow, intermediate, and deep zones. The change in the remedy has been documented through the following documents.

- Interim Corrective Measures Work Plan Site ST012, Vance AFB
- Interim Corrective Measure Construction Completion Report Site ST012, Vance AFB
- Remedial Design/Corrective Measures Implementation Report Site ST012, Vance AFB
- Construction Completion Report Site ST012, Vance AFB

The presence of EVO created conditions conducive to enhanced reductive dechlorination (ERD) in areas with elevated concentrations of chlorinated volatile organic compounds, e.g., "hot spots". The injections were designed to reduce contaminant mass within the three zones and mass flux between the zones. The remedy also includes flow through biobarrier walls (lines of injection wells) to treat the downgradient portions of the plume. All five groundwater extraction wells (EW12-01 through EW12-05) were turned off during injections and have remained offline. Four of the extraction wells (EW12-01, EW12-02, EW12-04, and EW12-05) were retrofitted to operate as soil vapor extraction (SVE) wells to address contaminant mass in shallow subsurface soils. The SVE system also mitigates/prevents soil vapors (methane), generated by the injections, from entering Building 192 through the subslab. The SVE system was turned off on July 27, 2015, as limited contaminant mass was being removed by the SVE system and the system was no longer needed to control methane vapors in the area (AECOM, 2019).

Since the remedy was implemented at Site ST012, two additional rounds of EVO injections have been completed and four additional intermediate zone injection wells have been installed. These efforts were conducted to advance remedial progress at the site and address changing plume morphology. Annual groundwater compliance monitoring at Site ST012 currently includes collection of samples from the monitoring wells listed shown in **Attachment 3**. The wells are monitored on an annual basis, with groundwater samples analyzed for VOCs and SVOCs.

3.3.2.1.2 Site SS024 (Jet Engine Cleaning Shop)

Site SS024 is located at Building 187. Before 1992, hazardous material was transferred from inside the building via piping and an associated manhole outside the building. Prior to 1982, a manhole outside the southeast side of the building was used for the transfer of hazardous

materials generated during jet engine cleaning processes (solvents and petroleum products) from inside the building to a truck awaiting pick up. Low concentrations of VOCs detected in soils and elevated concentrations of VOCs in groundwater indicate that spills did occur during these transfers and could be the source of the site's contamination. The manhole was closed in the late 1980s (AECOM, 2019). SS024 monitoring well locations are shown on **Figures 3a** through **3c**.

The original remedy documented in the permit at Site SS024 included groundwater extraction from five extraction wells. Groundwater pumped from these wells was conveyed to the CGTF for treatment via below grade piping. The treated water is then discharged to the City of Enid POTW. The SS024 groundwater extraction system was part of the CMI area groundwater extraction system, which consisted of a total of 13 shallow zone extraction wells (including the five SS024 extraction wells). Groundwater pumped from these wells was directed to the CGTF. The current CMI remedy was installed to collect and treat impacted groundwater and to provide hydraulic control to prevent further plume migration (AECOM, 2019).

In 2014, the Site SS024 remedy was changed to incorporate an aggressive treatment via *in situ* bioremediation. The site was treated using EVO injections into the subsurface to create conditions conducive to ERD in the source area. EVO injections into the shallow zone were conducted during the period August through October 2014. EVO was injected into a gridded series of injections located over the source area. These injection wells were installed, and injected into, as part of the ICM phase. EVO was also injected into a series of biowall injection wells that were installed in the downgradient portion of the plume during the CM phase. All five extraction wells (EW24-01 through EW24-05) were turned off during the injections and remain offline. Three of the extraction wells (EW24-01, EW24-02 and EW24-05) were retrofitted to operate as SVE wells to mitigate/prevent soil vapors (methane), generated by the injections, from entering Building 187 through the subslab. The change in the remedy has been documented through the following documents.

- Remedial Design/Corrective Measures Implementation Report Site SS024, Vance AFB
- Construction Completion Report Site SS024, Vance AFB

The SVE system was turned off on July 27, 2015 due to the lack of methane in the SVE influent. Since the remedy was implemented at Site SS024, two additional rounds of EVO injections have been conducted and eight additional shallow zone injection wells have been installed. These efforts were conducted to advance remedial progress at the site and address changing plume morphology. Groundwater samples collected from the SS024 monitoring well network are analyzed for VOCs at all wells, and 1,4 dioxane at Monitoring Well 12-33 (AECOM, 2019).

3.3.2.1.3 SS025 (COMBS Warehouse)

Site SS025, also known as the COMBS Warehouse, is located near Site ST012 and adjacent to Hangar 170 (ITSI, 2010). The primary contaminant at the site is TCE. A drain or sump previously associated with Hangar 170 is the probable source of contamination at this site. The groundwater plume at the site, which was historically part of the TCE plume originating from Sites ST012 and SS024, is now segregated from those plumes and is considered its own source area (AECOM, 2019). SS025 monitoring well locations are shown on **Figures 3a** through **3c**.

The original remedy documented in the permit at Site SS025 included three extraction wells. Groundwater pumped from these wells was conveyed to the CGTF for treatment via below grade

piping. The treated water was then discharged to the City of Enid POTW. The SS025 groundwater extraction system was part of the CMI area groundwater extraction system, which consisted of a total of 13 shallow zone extraction wells (including the three SS025 extraction wells). Groundwater pumped from these wells was directed to the CGTF. The current CMI remedy was installed to collect and treat impacted groundwater and to provide hydraulic control to prevent further plume migration (AECOM, 2019).

In 2014, the SS025 remedy was changed to incorporate aggressive treatment via *in situ* bioremediation. The site was treated using EVO injections to create subsurface conditions conducive to ERD in the source area. EVO injections into the shallow zone were conducted during the period of January and July 2014. The EVO was injected into a gridded series of injection wells located over the source area. These wells were installed, and injected into, as part of the ICM phase (AECOM, 2019).

EVO was also injected into a series of biowall injection wells that were installed in the downgradient portion of the plume during the CM phase. EVO was also injected into a series of biowall injection wells that were installed up gradient and downgradient of Monitoring Well MW12-45 during the CMI phase to address the areal extent of the TCE plume (AECOM, 2019).

All three groundwater extraction wells (EW25-01, EW25-02 and EW25-03) were turned off during injections and remain offline. Six SVE wells were installed at the site. The SVE system mitigates/prevents soil vapors (methane) generated by the injections from entering Buildings 525 and 528 through the subslabs. The change in the remedy has been documented through the following documents.

- Remedial Design/Corrective Measures Implementation Report Site SS025, Vance AFB
- Construction Completion Report Site SS025, Vance AFB

The SVE system was taken offline on March 28, 2016, as a result of methane vapor concentrations in the system influent had decreased to levels where the system was no longer needed. Since the remedy was implemented, two additional rounds of EVO injections have been conducted at Site SS025 to advance remedial progress and address changing plume morphology. During August 2017, a course correction was implemented that involved a series of BOS 100 injections at four areas of SS025 that had residual concentrations of TCE remaining above the MCL. These injections were conducted to shorten the remedial lifespan of SS025 (AECOM, 2019).

Groundwater samples collected from the SS025 monitoring well network are analyzed for VOCs at all wells, and 1,4 dioxane at Monitoring Well 25-07 (AECOM, 2019).

3.3.2.2 Industrial Zone (IZ)

Sites LF003, SS007, ST008, ST011, SS026 and SS028 are associated with the IZ. The historical COCs include arsenic, benzene, ethylbenzene, xylene, toluene, naphthalene, OK-GRO, Oklahoma-diesel range organics (OK-DRO), 1,1-DCE, TCE, and VC. COCs vary from site to site. SS028 was validated as a new site in 2016 when an upgradient intermediate well, MW8-18, was determined to not be associated with ST008. Site ST011 is a site that was previously closed under the storage tank requirements of the Oklahoma Corporation Commission, but was reopened and added to the Permit in the 2019 modification due to the discovery of benzene believed to originate at the site when investigating nearby Site LF003. ST011 was previously

moved to Table 2b in the 2010 Permit, and subsequently reopened and moved to Table 2a in the 2019 Permit Modification. However, these sites are presented here as contamination originating at/from these sites directly impacts the other IZ sites. Site SS026 is also included with IZ sites due to its proximity to the other sites, although traditionally it is reported separate. **Figures 4a** through **4c** illustrate the monitoring wells and sampling results as of February 2019 in the shallow, intermediate, and deep zones, respectively, for the IZ area. A description of each of the sites is presented below.

3.3.2.2.1 Site LF003 (Tank Farm Landfill)

Site LF003, located in the northern portion of Vance AFB, was historically utilized as a landfill from 1941 to 1952. General refuse, containerized liquids, and tank sludge were disposed at the landfill using the trench-and-fill method. Free product (composed of leaded gasoline) has been detected during previous groundwater sampling efforts, including as recently as 2015. Free product was also detected during construction of the interceptor collection trench (ICT) associated with Site SS007 in 1994 (AECOM, 2019). LF003 and monitoring well locations included in the current groundwater compliance monitoring program are shown in **Figures 4a** through **4c**.

A free-product recovery (FPR) system was installed at Site LF003 in 2004. The FPR system consists of four recovery wells and a surface facility that housed recovery equipment and a free product tank. The FPR system was never fully operational due to the lack of recoverable free product. Currently, the FPR system remains inactive. A phytoremediation area consisting of 173 poplar trees was planted in 2004 to address contaminated groundwater at the site (ITSI, 2010). The phytoremediation system was removed in October 2017, as it was determined that the phytoremediation plot was no longer needed to address contamination at the site (AECOM, 2019).

An investigation conducted in 2013 showed that there were no sources of contamination within the landfill and that the free product and petroleum contamination identified at the landfill originates upgradient at Site ST011. The AF reopened Site ST011 and an RFI was conducted. However, due to data gaps a supplemental RFI will occur in the future. There are no current plans to excavate the landfill waste material. Groundwater samples collected from the LF003 monitoring well network are analyzed for BTEX, arsenic and lead. These wells are monitored on an annual or quinquennial basis (AECOM, 2019).

3.3.2.2.2 Site SS007 (Hazardous Waste Accumulation Point)

Site SS007 is located along the former northern perimeter of the base, northeast of the flight line apron and west of the Tank Farm Landfill (LF003). It consists of three discrete areas: The Defense Reutilization and Marketing Office (DRMO); the old Base Civil Engineer (BCE) storage area; and the area north of Fox Drive, commonly known as North Site SS007 (ITSI, 2010). SS007 and monitoring well locations included in the current groundwater compliance monitoring program are shown in **Figures 4a** through **4c**.

From October 1980 to November 1992, the DRMO operated under RCRA Interim Status. Over this duration, drummed waste containing solvents, metal treatment sludge, waste oils, and contaminated fuels were handled at the site prior to transportation and disposal. Although no spills of drummed waste were reported over this period, and hazardous wastes are no longer

being stored or handled at the site, undocumented spills from historical activities are believed to be the origin of soil and groundwater contamination at Site SS007 (AECOM, 2019).

Electrical transformers, with polychlorinated biphenyls that had been removed, were stored at the BCE storage area, prior to disposal. The storage dates are not documented. New solvent products of unknown type were also stored at this site prior to 1980 in drums stored on their sides whose installed spigots typically leaked if not properly turned off. This area is now open space. Fuel and solvent-related VOCs detected in soil and groundwater indicate that spills could have occurred during materials handling at Site SS007. However, a predesign investigation conducted in 2013 confirmed that no soil exceedances above unrestricted use criteria are currently present at SS007 (AECOM, 2019).

The only known historical use of North Site SS007 was agricultural purposes and record searches from prior studies did not uncover any industrial or disposal activities, prior to AF use of this site. Groundwater contamination at North Site SS007 is believed to have migrated from Site SS007, prior to installation of the ICT separating the two sites (as discussed below). The remedy documented in the current permit is groundwater extraction using an ICT and six groundwater extraction wells, which were installed in 1997 to recover contaminants from the DRMO and BCE areas at Site SS007. A second ICT and five extraction wells were installed in 2002 in the northern portion of Site SS007. In 2004, one extraction well was replaced, and an additional extraction well was installed. Groundwater recovered from two ICTs and 11 extraction wells was pumped to the CGTF, located just east of Site SS026, for treatment prior to discharge to the City of Enid POTW (ITSI, 2010).

In 2014, the SS007 remedy was changed to incorporate aggressive treatment via *in situ* bioremediation. The site was treated using EVO injections to create subsurface conditions conducive to ERD in the source area(s). In the northern portion of the site, EVO injections into the shallow zone were conducted during January 2014. In the southern portion of the site, EVO injections into the shallow zone were conducted during January and February 2014. The final remedy also included the installation of a groundwater extraction/recirculation system that incorporated the components of the existing Site SS007 groundwater extraction/treatment system, additional extraction wells, groundwater injection/recirculation wells, an onsite treatment equipment enclosure (trailer) and a treated water injection/recirculation system. As part of the final remedy, eight new groundwater extraction wells and 16 new recirculation wells were added to treatment system. The water treatment process was changed from air stripping (at the CGTF) to granular activated carbon located in the onsite treatment trailer. Treated groundwater is also amended with lactate and reinjected into recirculation wells located on the periphery of the contaminant plume. The change in the remedy has been documented through the following documents.

- Remedial Design/Corrective Measures Implementation Report Site SS007, Vance AFB
- Construction Completion Report Site SS007, Vance AFB

Several course corrections have been implemented at Site SS007 since the remedy was installed in 2014. The first was the conversion of three of the new groundwater extraction wells to recirculation wells. This was done to further segregate contamination within the plume. The second was that several additional rounds of EVO injections were conducted in the former source area to address contaminant rebound in this area (AECOM, 2019).

As part of the permit required compliance monitoring program, 14 monitoring wells installed at the site are currently sampled annually and four monitoring wells are sampled every five years. Groundwater samples collected from the SS007 monitoring well network are analyzed for VOCs, arsenic and lead. Additionally, two sediment samples and two surface water samples are collected annually from the creeks located in the northern portion of Site SS007. These samples are analyzed for VOCs and RCRA metals (AECOM, 2019).

3.3.2.2.3 Site ST008 (Underground Storage Tank (UST) No. 106 at Building 110)

Site ST008 consists of the former USTs at Building 110. ST008 is located near the northern boundary of Vance AFB, due south of Site SS007, west of Elam Drive, and east of the flightline. ST008 had five USTs that were removed during March 1989. The individual tanks were designated as UST No. 106, UST No. 108, UST No. 109, UST No. 112, and UST No. 113. UST No. 106 was the farthest west in the series of tanks. Only one UST, No. 106, was designated as a hazardous waste management unit. The other four tanks were petroleum product tanks only, while Tank No. 106 held a variety of solvents, contaminated fuels, and waste oils from 1970 through 1980. Each tank had a capacity of 12,000 gallons and was constructed of steel (AECOM, 2019). ST008 and monitoring well locations included in the current groundwater compliance monitoring program are shown in **Figures 4a** through **4c**.

Residual wastes were removed and manifested for disposal; the wastes were identified as USEPA Hazardous Waste Codes F001, F002, F003, F005, and D001 in 1989. Some impacted soil associated with UST No. 106 was removed from the site, moved to another location and drummed for disposal, with a small amount left in place. The area was subsequently covered with a concrete RCRA cap in 1991. Cap construction included a compacted aggregate base layer followed by a 10-inch thick layer of reinforced concrete. The cap area is approximately 100 feet by 80 feet with a 3 percent slope to a concrete curb system located along the cap/soil interface (AECOM, 2019).

As noted above, after removal of most contaminated soil, some soil beneath the RCRA cap was impacted above regulatory standards but was left in place. Shallow transmissive zone groundwater beneath the site was impacted above regulatory standards and was believed to be comingled with the Site SS007 contaminant groundwater plume. The remedy documented in the current permit requires sampling of specified monitoring wells at ST008 on an annual basis (AECOM, 2019).

As part of the predesign investigation/confirmation sampling conducted at Site ST008 in 2013, several intermediate monitoring wells were installed in the vicinity of Monitoring Well MW8-18. Data from this investigation indicated that there was contamination upgradient of this well not related to the release at ST008. An additional investigation in the upgradient source area was conducted in February and March 2016 confirming that contamination was present in this upgradient area. Subsequently, the AF has opened a new site, designated as Site SS028, to address the contamination in this area upgradient of SS028 (AECOM, 2019). This site was added to the permit via the 2019 Permit Modification and MW8-18 was transferred to the site from ST008.

In the summer of 2016, the Site ST008 remedy was changed to dual phase extraction (DPE) within the former tank pit area. DPE is a technology that uses a high-vacuum system to remove both contaminated groundwater and soil vapor from the subsurface. The DPE system depresses

the water table and water flow is directed to the extraction well(s). DPE extracts contaminants from above and below the water table. The DPE system install at ST008 consisted of nine 1.5-inch DPE wells, a vacuum pump, and conveyance piping which carry water from ST008 to the CGTF where the extracted water is treated and discharged to the city of Enid POTW. Soil vapor is vented directly to the atmosphere. The remedy was implemented and put into operation in March 2017 (AECOM, 2019). The change in the remedy has been documented through the following documents:

- Remedial Design/Corrective Measures Implementation Report Site ST008, Vance AFB
- Construction Completion Report Site ST008, Vance AFB

As part of the permit required compliance monitoring program, 2 monitoring wells installed at the site are currently sampled annually. Groundwater samples collected from the ST008 monitoring wells are analyzed for VOCs and arsenic. (AECOM, 2019).

3.3.2.2.4 Site ST011 (Former Aqua/Avgas Storage and Distribution System)

Site ST011 is the former Aqua/Avgas Fuel Storage and Distribution System. The system consisted of 10 underground fuel tanks which were closed and removed in July 1990. The site was not listed on the original RCRA Post Closure Permit, as the Oklahoma Corporation Commission had jurisdiction and they closed the site later. During a 2013 pre-design investigation for nearby Site LF003, benzene contamination was found which was determined to not be from historical activities at Site LF003. Benzene was assumed to have come from ST011 which was upgradient at that time. Site ST011 was reopened in 2016 and is now included in the RCRA Post Closure Permit via the 2019 modification. An RFI was conducted ST011 in 2018, the result of which was that an additional Supplemental RFI would be needed to determine full nature and extent of contamination at the site. The Supplemental RFI will be contracted in the near future. At present, Site ST011 has no monitoring wells in the groundwater monitoring program. Site ST011 is being included in the renewal application as a placeholder for future action.

3.3.2.2.5 Site SS026 (Jet Fuel Storage Area)

Site SS026, the Jet Fuel Storage Area, is in the northern portion of Vance AFB, near IZ Sites LF003, SS007, and ST008. Aboveground storage tanks (ASTs) containing jet fuel for Vance AFB operations are located approximately 100 feet west of a concrete-paved area used to store recreational vehicles. According to historical records, contamination at the site resulted from activities in the 1970s and early 1980s. Residual AST fluids, sludge, and/or rainwater, which may have contained JP-4 fuel contamination, were discharged periodically from the diked area surrounding the ASTs onto the ground in the area where the recreational vehicle facility was later constructed. A Remedial Investigation (RI)/Feasibility Study (FS) was performed at the site. Following the RI/FS, an interim remedial action (IRA), which included the removal of 43 tons of soil from the site, was performed in 2007. A remedial action immediately followed the IRA, which included the planting of a phytoremediation area consisting of 60 hybrid poplar trees for passive groundwater treatment and the placement of Oxygen Release Compound® filter socks in five monitoring wells to facilitate the aerobic biodegradation process (ITSI, 2010). SS026 and monitoring well locations included in the current groundwater compliance monitoring program are shown in **Figures 4a** through **4c**.

The original remedy documented in the permit required the continued operation and maintenance of the final remedy, which included annual groundwater compliance sampling and maintenance of a phytoremediation system. This remedy was changed in 2014 to aggressive treatment of residual areas of VOCs, SVOCs and OK-GRO contamination using biosparge technology to enhance biological activity and reduce contaminant mass in the aquifer. The phytoremediation plot was no longer required once the remedy was changed and it was removed in October 2017 (AECOM, 2019).

The biosparge system consists of six biosparge wells skid-mounted biosparge unit (compressor), which is in the CGTF. The system operated for approximately two years at which time two additional biosparge wells were installed to accelerate remediation of the remaining area of the site that exhibited residual contamination above unrestricted use/unrestricted exposure standards. The two new wells were connected to the biosparge system and placed into operation in April 2016 and concurrently; three biosparge wells were taken off-line, as these wells were in areas where contaminant concentrations in groundwater samples had decreased to levels below regulatory standards. The biosparge system operated as designed from the time of startup (June 2014) through September 2016, when the system was turned off based on analytical results of groundwater samples collected from the site, e.g., contaminant concentrations below regulatory standards. In June of 2017 contaminant concentrations in Monitoring Well 24-4 rebounded and the biosparge system was reactivated the system ran from September 2017 through January 2018 when samples collected from this monitoring well again fell below regulatory standards. As part of the permit required compliance monitoring program, 4 monitoring wells installed at the site are currently sampled annually. Groundwater samples collected from the SS026 monitoring wells are analyzed for VOCs and OK-GRO (AECOM, 2019).

3.3.2.2.6 Site SS028 (Solvent Spill Site)

Site SS028 was created as a result of a 2013 pre-design investigation that discovered chlorinated volatile organic compounds in the intermediate zone at a Site ST008 monitoring well. After further investigation, it was determined that concentrations increased hydraulically upgradient, indicating an unknown source not related to Site ST008. An RFI was conducted at SS028 in 2018, the result of which was that an additional Supplemental RFI would be needed to determine full nature and extent of contamination at the site. The Supplemental RFI will be contracted in the near future. Site SS028 is being included in the renewal application as a placeholder for future action. At present, Site SS028 has one monitoring well in the groundwater monitoring program that was transferred from ST008, with anticipated sampling for VOCs and RCRA metals.

3.3.2.3 Southern Boundary Area Sites

3.3.2.3.1 Site FT002 (Fire Training Area)

Site FT002 was used for fire training exercises between approximately 1953 and 2000, when the use of the site was discontinued after a new fire training facility was constructed to the west. Fire training exercises typically consisted of igniting flammable liquids such as fuel, oils, and/or solvents which had been dumped into a shallow depression in the ground surface. The site was upgraded after 1970 with the construction of a berm and aircraft fuselage mock-up serviced by underground fuel supply lines. The pit was drained through lines leading to an underground

oil/water separator. The site was upgraded a second time in 1983 to include one pit with a full-scale aircraft fuselage mock-up, a second pit with a jet engine mock-up, and a fuel distribution head used to simulate automobile fires. Both pits were bermed and filled with gravel to help control drainage from firefighting activities. There were no containment or drainage controls around the fuel distribution head. Fuel for the pits was supplied through underground lines, and following training exercises, the pits were drained through underground lines into an oil/water separator and holding tank. FT002 (the fire training area) is located near the southcentral boundary of the base and covers approximately 2 acres (AECOM, 2019). FT002 and monitoring well locations are shown on **Figure 5**.

In 2013, a PDI/confirmation sampling was conducted at Site FT002 focusing on soils to determine the nature and extent of residual soil contamination. The investigation concluded that there was a small area of soils between 12 and 16 feet bgs that exceeded ODEQ's standard for OK-GRO. In 2014, a remedy was implemented to aggressively treat the remaining residual soil contamination that has COC concentrations above criteria using SVE. The SVE system consisting of four SVE wells was installed to treat soils in the vicinity of the former fire training pit. The system was placed online during August 2014 and taken offline in September 2014 (AECOM, 2019). The change in the remedy has been documented through the following documents.

- Remedial Design/Corrective Measures Implementation Report Site FT002, Vance AFB
- Construction Completion Report Site FT002, Vance AFB

There was also a small area on the site which had low level chlorinated volatile organic compounds that exceeded their respective standards. This area of impacted groundwater was treated using EVO injections to create subsurface conditions conducive to ERD in the area around Monitoring Well MW02-04. EVO injections into the shallow zone were conducted during May 2014 (AECOM, 2019).

As part of the permit required compliance monitoring program, 2 monitoring wells installed at the site are currently sampled annually. Groundwater samples collected from the FT002 monitoring wells are analyzed for TPH, VOCs and selenium (AECOM, 2019).

3.3.2.3.2 Site DP005 (Sludge Disposal Area)

Site DP005 is located between the Flight Line Drainage Creek and the southern boundary of the base, southwest of FT002. A search of Vance AFB records indicates that Site DP005 resulted from a one-time disposal of approximately 1,000 gallons of fuel tank sludge in a shallow pit (or pits) on top of the south bank of FD Creek. Evidence from subsequent investigations at DP005 confirmed the findings that soil and groundwater in the area were contaminated with solvents and fuel related compounds, and that two or more disposal locations may have existed at the site (AECOM, 2019). DP005 and monitoring well locations are shown on **Figure 5**.

In May 2003, Vance AFB implemented an IRA at Site DP005 to remediate shallow groundwater and protect surface water and sediment in FD Creek. During installation of the ICT, contaminated soil and miscellaneous metallic debris (crushed 55-gallon drums and 5-gallon buckets) were encountered in the shallow subsurface. This debris, along with the surrounding soil, was removed and placed in two roll-off containers. Waste characterization samples were collected from the two roll-off containers. The results indicated that the material was hazardous.

The material was subsequently transported to an approved RCRA facility for stabilization and disposal (AECOM, 2019).

Based on the observations made during construction activities in May 2003 and results of the 2004 geophysical surveys and test pit excavations, an IRA was performed to excavate contaminated soils and debris previously encountered during installation of the ICT. The impacted soils were then excavated and disposed of at an approved RCRA landfill. The excavation was backfilled with clean fill. Removal of the source material was performed to enhance cleanup of groundwater contamination by minimizing the leaching of contaminants into groundwater, thereby reducing the operational time of the groundwater extraction and treatment system and the total costs of cleanup (AECOM, 2019).

The original remedy documented in the permit required the operation of the groundwater extraction system coupled with long-term monitoring of groundwater and sediments at Site DP005. In 2014, the Site DP005 remedy was modified to include a more aggressive treatment using injections of EVO to create subsurface conditions conducive to the ERD process. EVO injections into the shallow zone were conducted between the periods of January through April 2014. At the time of the injections, the groundwater extraction system (EW05-01 through EW05-03 and the ICT sump) was taken off-line. EW05-02 and the ICT sump were subsequently placed back online. EW05-01 and EW05-03 will remain offline indefinitely, due to the presence of EVO. In addition, the existing groundwater extraction and treatment system was modified to include a new equipment enclosure (trailer) and a groundwater injection/recirculation system. Treated groundwater was amended with lactate and reinjected into four sets of reinjection wells, located within and upgradient of the plume, to aid in the distribution of a carbon source throughout the plume. An SVE system consisting of four SVE wells was also installed to treat soils adjacent to the groundwater interceptor trench. The system was installed and placed online during November 2014 (AECOM, 2019). The groundwater recirculation system has not been operational since 2017 due to EVO too close to the trench. The change in the remedy has been documented through the following documents:

- Interim Corrective Measures Work Plan Site DP005, Vance AFB
- Interim Corrective Measure Construction Completion Report Site DP005, Vance AFB
- Remedial Design/Corrective Measures Implementation Report Site DP005, Vance AFB
- Construction Completion Report Site DP005, Vance AFB

The skid mounted SVE unit was subsequently removed from DP005 during February 2015 due to limited mass removal rates.

As part of the permit required compliance monitoring program, 9 monitoring wells installed at the site are currently sampled annually. Groundwater samples collected from the DP005 monitoring wells are analyzed for TPH, VOCs and arsenic. Additionally, two sediment samples and two surface water samples are collected annually at Site DP005. Sample location SW05-13/SD05-13 is located on the north eastern corner of DP005 and is representative of potential plume discharge to surface water and sediment at the site. Sample location SW05-14/SD05-14 is located approximately 3,600 feet east. These samples are analyzed for VOCs, SVOCs, RCRA Metals, OK-GRO and OK-DRO (AECOM, 2019).

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4.0 INFORMATION REQUIREMENTS FOR LANDFILLS [40 CFR 244 SUBPART N]

This section includes information on Vance AFB as it pertains to the requirements in 40 CFR 244 Subpart N for landfills that require continued regulatory oversight under this RCRA Permit renewal. The section provides information available at the time of preparation. However, the specifics of the program may change as further information is gathered and/or additional studies are completed during the Permit period. Vance AFB will inform, and coordinate with, Oklahoma DEQ regarding these changes.

Vance AFB has one former landfill that applies under 40 CFR 244.310(a): LF003 (Tank Farm Landfill). Site LF003 is an inactive trench-type landfill without a constructed liner that is approximately 15 feet (ft) deep and covers an area of approximately 3 acres. The landfill was used during the period 1941 through 1952 primarily for disposal of municipal solid waste generated at the installation. However, some containerized liquid waste and fuel tank sludge may have been placed in the unit. LF003 does not include Tanks 265 and 267 (aboveground jet fuel storage tanks) and is located approximately 175 ft downgradient of Site ST011 (Aqua/AVGAS Fuel Distribution System), which consisted of ten 25,000-gallon underground storage tanks and associated fuel conveyance lines, and 400 ft downgradient of Site ST013 (Quartermaster Service Station USTs), which was previously closed.

In 1997 free product (leaded gasoline) was discovered at Site LF003; as a result, an FPR system was installed in 2004. The FPR system consists of four recovery wells and a surface facility that houses recovery equipment and a free product tank. Currently, the FPR system is inactive due to there being no free product or insufficient amounts of free product to recover. Additionally, a phytoremediation plot consisting of 173 poplar trees over 3 acres was planted in 2004 to assist with the cleanup of the site (ITSI, 2010).

In 2013, a preliminary design investigation (PDI) was conducted to address critical data gaps at Site LF003. Between February and August 2013, over 50 soil borings were advanced to a maximum depth of 17 feet bgs. Soil samples were collected from above the water table interface in select borings to analyze for any potential soil contamination and determine the horizontal and lateral extents of waste in place. Groundwater samples were also collected and analyzed for VOCs, OK-DRO and/or OK-GRO. The PDI concluded that there were no sources of contamination within the Site LF003 landfill and the free product and petroleum contamination identified beneath the landfill originates upgradient at Site ST011 (AECOM, 2013). The Air Force re-opened Site ST011 and an RFI was conducted, the result of which was that a Supplemental RFI was needed. The Supplemental RFI will be contracted in the near future. There are no current plans to excavate the landfill waste material.

As a result of the 2013 investigation findings, the trees associated with the phytoremediation system were cut down in July 2016, and removal of the remaining phytoremediation system components was completed in October 2017 (AECOM, 2019).

4.1 LANDFILL AND LANDFILL COVER SYSTEM [40 CFR 244.310(a)(1-5)]

The final cover for the former landfill consists of natural clayey silt soil with granular fill material and topsoil. The ground surface of the landfill is relatively flat and covered with grass.

Following the removal of trees associated with the phytoremediation system in 2016, the surface was reinforced with additional fill material and topsoil; regraded to match the surrounding land contours and promote drainage; and re-seeded with Bermuda grass. The existing cover system serves to minimize migration of liquids through the landfill, prevent erosion/abrasion of the surface of the former unit, and requires minimal maintenance other than routine mowing and inspections. There has been no evidence of settling or subsidence at the site. The cover surface of clayey silt fill material is similar to the soils underlying the site based on previous investigations. In addition, as noted above, a previous investigation shows that no sources of contamination exist within the landfill (AECOM, 2019).

Vance AFB will not allow any use of the area which will disturb the integrity of the final cover, and will continue all applicable inspections and/or maintenance to the area to provide long-term minimization of liquids through the closed site and maintain the effectiveness of the cover through repair as necessary to address settling, subsidence, erosion or other events.

4.2 MAINTENANCE AND MONITORING [40 CFR 244.310(b)(1-6)]

Vance AFB maintains the integrity and effectiveness of the final cover through routine maintenance of vegetation. The former landfill has no leachate removal system. As noted previously, the FPR system that was installed in 2004 is inactive due to there being a lack of free product to recover. Groundwater monitoring continues to be performed under the overall program for the installation as described in **Section 2.0** of this application.

5.0 REFERENCES

AECOM, 2014. *Revised Draft-Final Remedial Design-Corrective Measures Implementation Plan, Site LF003, Vance Air Force Base, Oklahoma*. October.

AECOM, 2018. *Class 2 RCRA Permit Modification Request, Vance Air Force Base, Oklahoma*. July.

AECOM, 2019. *2018 Final Annual Groundwater Compliance Monitoring Report, Vance Air Force Base, Oklahoma*. April.

AECOM, 2020. *2019 Draft-Final Annual Groundwater Compliance Monitoring Report, Vance Air Force Base, Oklahoma*. February.

Fenneman, Nevin M., 1938. *Physiography of Eastern United States. McGraw-Hill Book Company, New York*. 714 p.

IT Corporation, 2001. *Draft Final Supplementary Remedial Investigations Report, Industrial Zone, Vance Air Force Base, Oklahoma*. August.

Innovative Technical Solutions, Inc. (ITSI), 2010. *Project Management Plan, Remedial Action Operations, Operation and Maintenance for Groundwater Treatment Units, and Compliance Monitoring, Vance Air Force Base, Oklahoma*. April.

Oklahoma DEQ, 2019. RCRA Post-Closure Care Permit No. 4571524095-PC for Vance AFB, OK, as modified, September.

Swafford, Bill., 1967. *Soil survey: Garfield County, Oklahoma. United States Agriculture Department; Oklahoma Agricultural Experiment Station*.

URS Group Inc. (URS), 2007. *Final Comprehensive Site Evaluation Phase 1. Vance Air Force Base, Oklahoma*. May.

Unites States Air Force (USAF), 1993. *Installation Restoration Program Management Action Plan, Vance Air Force Base, Oklahoma*. December. AR 264.

USAF, 2015. *Factsheet, Vance AFB Oklahoma.* December.

U.S. Department of Agriculture (USDA), Soil Conservation Service (USDA, SCS), 1975. *Soil Survey of Alfalfa County, Oklahoma*.

U.S. Department of Interior (USDOI), 1993. Cultural Resource *Assessment of Vance Air Force Base, Garfield County, Oklahoma, and Kegelman Auxiliary Field, Alfalfa County, Oklahoma*. Interagency Archeological Services Division of National Preservation Programs, Rocky Mountain Regional Office, National Park Service, U.S. Department of Interior.

United States Geological Survey (USGS). 1991. *Oklahoma Geological Survey, Hydrologic Atlas 7*, Roy H. Bingham and DeRoy L. Bergman.

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TABLES

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Table 1: Sites Included in the Vance AFB RCRA Post-Closure Care Permit

Area	AF EESOH-MIS Site ID	RFI/ Permit ID	Original Site Name	Description/History Summary	Current Status	Chemicals of Concern
CMI Area	ST012	ST-12	Paint Stripping Equalization Tank	Water and sludge from paint stripping operations flowed into the tank and the liquid effluent was then discharged into the sanitary sewer system. Previous remedies include GW extraction with treatment at the CGTF and SVE.	Current remedy augmented with EVO injections to promote ERD. GW compliance monitoring.	VOCs
	SS024	SS-24	Jet Engine Cleaning Shop	Source of contamination was transfers from vats inside the building by underground piping to a manhole outside due to overflows of the manhole. Original remedy was GW extraction with air stripping and hydraulic containment.	Current remedy augmented with EVO injections to promote ERD and to reduce contaminant mass. Included in the remedy was a flow through biobarrier to treat the downgradient portions of the plume. Existing GW extraction system was modified to an SVE system used to control methane concentrations. GW compliance monitoring.	VOCs, 1,4 dioxane
	SS025	SS-25	COMBS Warehouse	Site was an outside washrack near the COMBS warehouse where drain was suspected used to dispose of solvents or spills. The original remedy for the site was GW extraction and treatment at the CGTF. The existing GW extraction system was modified to an SVE system but discontinued in 2016 due to low methane concentrations.	Current remedy augmented with EVO injections to promote ERD and to reduce contaminant mass. Included in the remedy was a flow through biobarrier to treat the downgradient portions of the plume. GW compliance monitoring.	VOCs, 1,4 dioxane
IZ	LF003	LF-03	Tank Farm Landfill	Three acres used from 1941 until 1952 for general refuse, containerized liquids and tank sludge. Free product (gasoline) was found in 1997 and a recovery system was installed but never used due to lack of volume.	During a 2013 PDI, benzene contamination was determined to not be from historical activities at the site and would be addressed under Site ST011. GW compliance monitoring.	BTEX, arsenic, lead
	SS007	SS-07	Hazardous Waste Accumulation Point	Site consists of three different areas: 1) DRMO area; 2) Former BCE storage area; and 3) North Site SS007 It was later discovered that that solvents had leaked from the first/second areas onto North Site 7. ICTs were installed downgradient from the first and second areas and later on North Site 7. A CGTF was constructed. The GW extraction treatment system and ICT extraction wells in the southern portion of the site were turned off.	Current remedy augmented with EVO injections to promote ERD and to reduce contaminant mass in the shallow zone. The existing GW extraction system was modified to a GW recirculation system to reinject GAC amended with lactate upgradient and sidegradient of the plume to dispense the carbon source throughout the plume. The ICT extraction wells on the northern portion of the site remain operational. GW compliance monitoring.	VOCs, arsenic, lead for GW; VOCs, RCRA 8 metals for SW/sediment
	ST008	ST-08	Underground Storage Tank (UST) No. 106 at Building 110	Original site for a mixed waste tank. Original remedy was pump and treat.	Dual Phase Extraction. GW compliance monitoring.	VOCS, arsenic
	ST011	ST-11	Aqua/Avgas Storage and Distribution System	The system consisted of 10 underground fuel tanks which were closed/removed in July 1990. The site was not listed on the original RCRA Post Closure Permit. The OCC closed the site later. During a 2013 Predesign Investigation for nearby Site LF003, benzene contamination was found and assumed to originate from ST011.	To be determined. ST011 was reopened in 2016 and is now included in the RCRA Post Closure Permit. An RFI was conducted in 2018. However, a Supplemental RFI is now required to determine nature and extent. Additional monitoring wells and or borings may be required with a possible permit modification.	TBD
	SS026	SS-26	Jet Fuel Storage Area	Contamination due to past practices of draining fuel and water from AST dikes onto the grass/ground. Original remedy removed contaminated soil and installed Oxygen Releasing Compound in the monitoring wells. Also, a phytoremediation system was installed but was removed in 2017.	Air sparging at the site to enhance monitored natural attenuation. GW compliance monitoring.	VOCs, OK-GRO
	SS028	SS-28	Solvent Spill Site	SS028 was created as a result of a 2013 PDI. Chlorinated VOCs were found in the intermediate zone at a Site ST008 monitoring well and determined to originate upgradient.	To be determined. An RFI was conducted in 2018. However, a Supplemental RFI is now required to determine nature and extent. Additional monitoring wells and or borings may be required with a possible permit modification.	VOCs, RCRA 8 metals

Table 1: Sites Included in the Vance AFB RCRA Post-Closure Care Permit (continued)

Area	AF EESOH-MIS Site ID	RFI/ Permit ID	Original Site Name	Description/History Summary	Current Status	Chemicals of Concern
South Boundary Sites	FT002	FT-02	Fire Training Area	Area used for fire training exercises in the 1950s until 2000. Original remedy for the site was monitoring.	Current remedy changed to include EVO injections and SVE to create conditions conducive to ERD and to reduce contaminant mass. SVE was discontinued in 2016 due to low mass removal rates. GW compliance monitoring.	TPH, VOCs, selenium
	DP005	DP-05	Sludge Disposal Area	Site resulted from a one-time disposal of approximately 1,000 gallons of fuel tank sludge. Multiple investigations to include an ICT, large diameter vertical wells, and water treatment with air stripping. An SVE system was used to treat soils adjacent to the GW ICT. It was discontinued in 2015. The GW extraction treatment is now turned off.	Current remedy changed to EVO injections to create conditions conducive to ERD and to reduce contaminant mass. The existing GW extraction system was modified to a GW recirculation system where extracted GW is treated using GAC amended with lactate and reinjected immediately upgradient of the plume to dispense the carbon source throughout the plume. GW compliance monitoring.	TPH, VOCs, arsenic, 1,4 dioxane for GW; VOCs, SVOCs, TPH/GRO-DRO, RCRA 8 metals for SW/sediment

Notes:

AF – Air Force
AOC – Area of Concern
BTEX – benzene, toluene, ethylbenzene and xylenes
CGTF – Central Groundwater Treatment Facility
COC – contaminant of concern
DRMO – Defense Reutilization and Marketing Office
DRO – diesel range organics
EESOH-MIS – Enterprise Environmental, Safety and Occupational Health – Management Information System
ERD – enhanced reductive dichlorination
EVO – emulsified vegetable oil
GAC – granular activated carbon
GRO – gasoline range organics
GW – groundwater
ICT – interceptor collection trench
ID – identification
OCC – Oklahoma Corporation Commission
RCRA – Resource Conservation and Recovery Act
RFI – RCRA Site Investigation
SVE – soil vapor extraction
SW – surface water
SWMU – Solid Waste Management Unit
TPH – total petroleum hydrocarbons
VOC – volatile organic compounds

Table 2. No Further Action Sites at Vance AFB

Permit/RFI Site ID	AF EESOH-MIS Site ID	Description
SWMU 05	LF004	East Boundary Landfill
SWMU 07	WP001	Chemical Disposal Pit
SWMU 12.1		IWTP – Raw Waste Lift Station #1
SWMU 19		Paint Booth Water Curtain in Building 128
SWMU 20		Paint Booth Water Curtain in Building 297
SWMU 23		Concrete Sump outside Building 128
SWMU 26		Washrack at Building 141
AOC 1		Grit Separator at Building 187
AOC 2		Grit Separator at Building 141
AOC 3		Industrial Wastewater Sewer Lines
AOC 4		Sanitary Wastewater Sewer Lines
AOC 5		Paint Booth Water Curtain in Building 284
AOC 8		List Station East of Building 130
ST-13	ST013	Quartermaster Service Station
ST-14	ST014	Abandoned UST at Building 202
ST-15	ST015	Abandoned UST at Building 1023
ST-16	ST016	Abandoned UST at Building 1024
ST-17	ST017	Abandoned UST at Building 1030
ST-18	ST018	Abandoned UST at Building T-1
ST-19	ST019	Abandoned UST at Building T-2
SS-27	SS027	Entomology Shop
WP-23	WP013	Industrial Waste Pit

Notes:
AF – Air Force;
AOC – Area of Concern
EESOH-MIS – Enterprise Environmental, Safety and Occupational Health – Management Information System
ID - identification
RCRA – Resource Conservation and Recovery Act
SWMU – Solid Waste Management Unit
UST – Underground Storage Tank

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FIGURES

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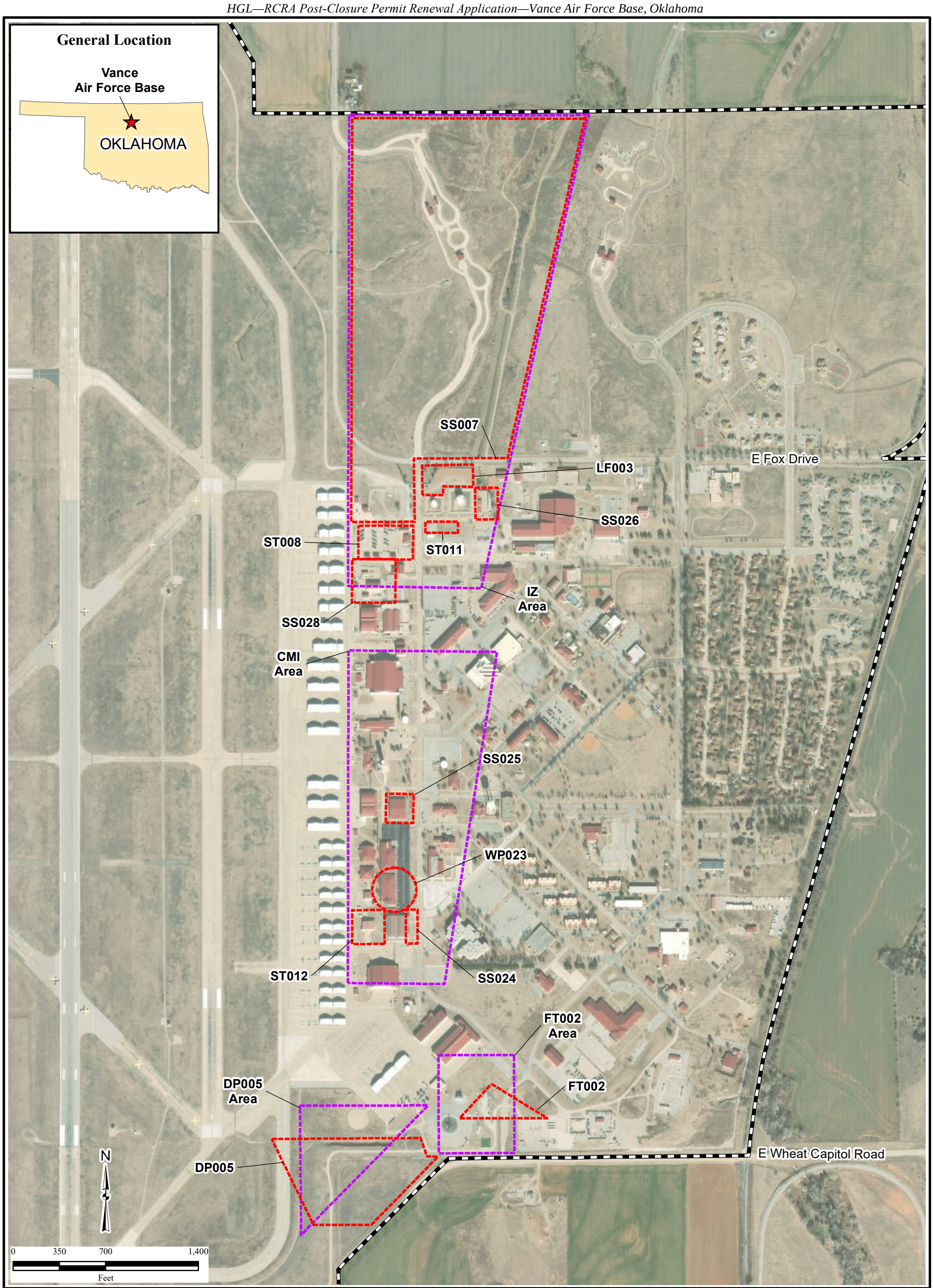


\\Gst-srv-01\HGLGIS\Vance_AFB_AF8014_MSIW\QPP_AWP\(3-01)Further_Action_Sites_bbp.mxd
8/7/2019 JG
Source: HGL
ArcGIS Online Imagery

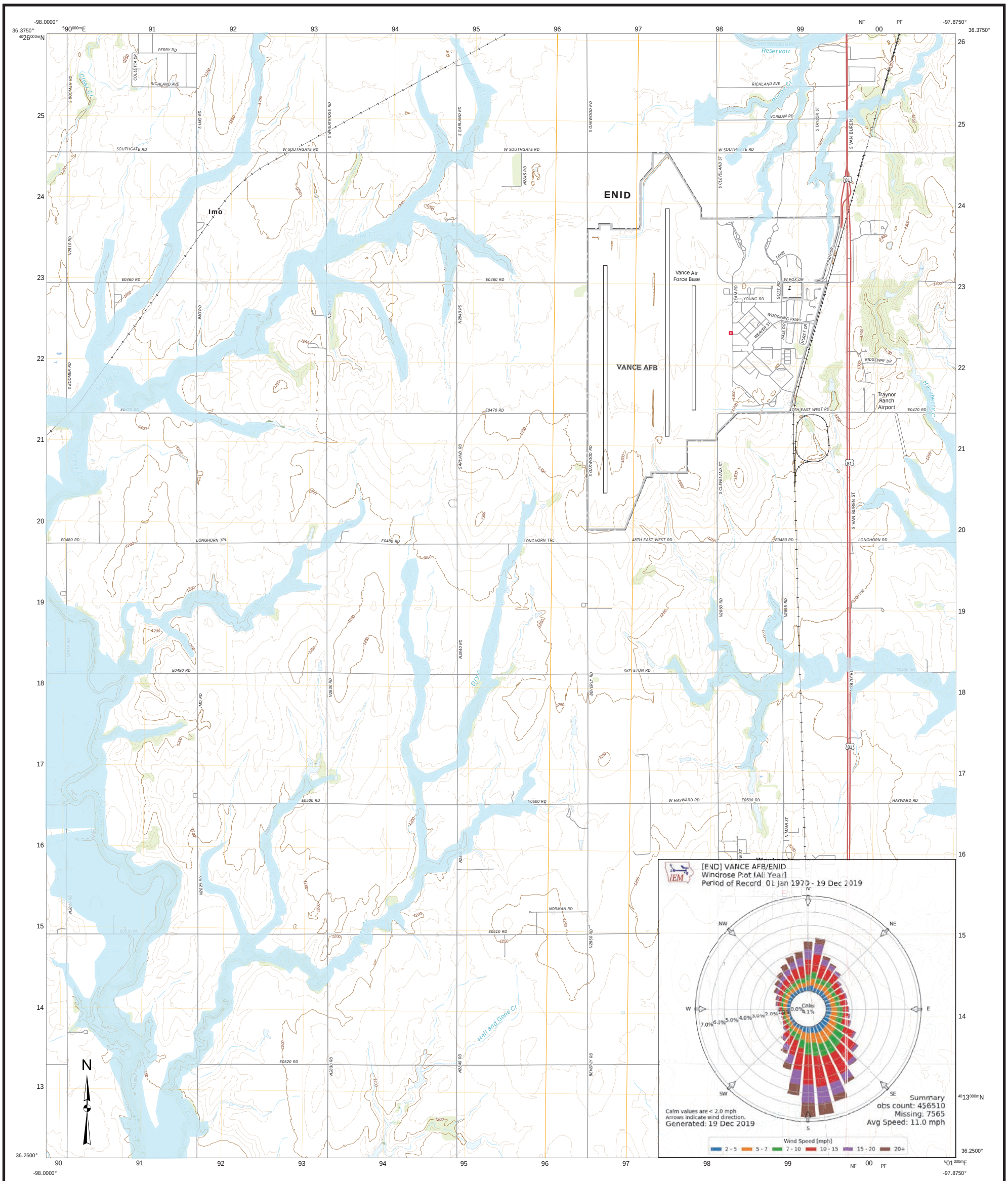
Legend

- Approximate Site Boundary
- Area Boundary
- Vance AFB

Notes:
CMI=Corrective Measures Implementation
IZ=Industrial Zone

HGL HydroGeoLogic, Inc

Figure 1
Site Location Map
Vance Air Force Base
Oklahoma



Legend

1,360 Topographic Contour (ft amsl, interval=10 feet)

Surface Water Course

100-Year Floodplain (FEMA, 2019)

Vance Air Force Base

Notes: or clarity in showing topographic and natural features, certain features, such as access control, wells, buildings/structures, barriers for flood control and location of SWMUs and operational units, are not shown. These are provided via other figures.

Figure 2
Topographic Map
Vance Air Force Base
Oklahoma

LEGEND

- MONITORING WELL (SHALLOW ZONE)
- 2018 VC CONCENTRATION CONTOUR
- 2018 TCE CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
- APPARENT GROUNDWATER FLOW DIRECTION
- CMI AREA BOUNDARY
- PROPOSED WELL TO BE DROPPED FROM CM PROGRAM

NOTES

1. DATE OF LAST SAMPLING EVENT AND COMPOUNDS PRESENT ABOVE MCLs / RSLs PRESENTED IN CALLOUT BOXES.

MW12-17
OCTOBER 2007
ALL COMPOUNDS < MCLs/RCLs

MW12-09
DECEMBER 2018
TCE: 15.3
CIS 1,2-DCE: 233
VC: 366

MW12-11
OCTOBER 2007
ALL COMPOUNDS < MCLs/RCLs

MW23-05
DECEMBER 2018
VC: 8.07

MW12-33
DECEMBER 2018
CIS 1,2-DCE: 181
VC: 82.7

MW12-35
FEBRUARY 2019
TCE: 15
VC: 38.2
NAPHTHALENE: 11.2

MW12-37
ALL COMPOUNDS < MCLs/RCLs

MW12-43
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW12-45
FEBRUARY 2019
ALL COMPOUNDS < MCLs/RCLs

MW23-14
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW25-01
AUGUST 2018
TCE: 25.1

MW25-02
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW25-04
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW25-07
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW25-15
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW25-09
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

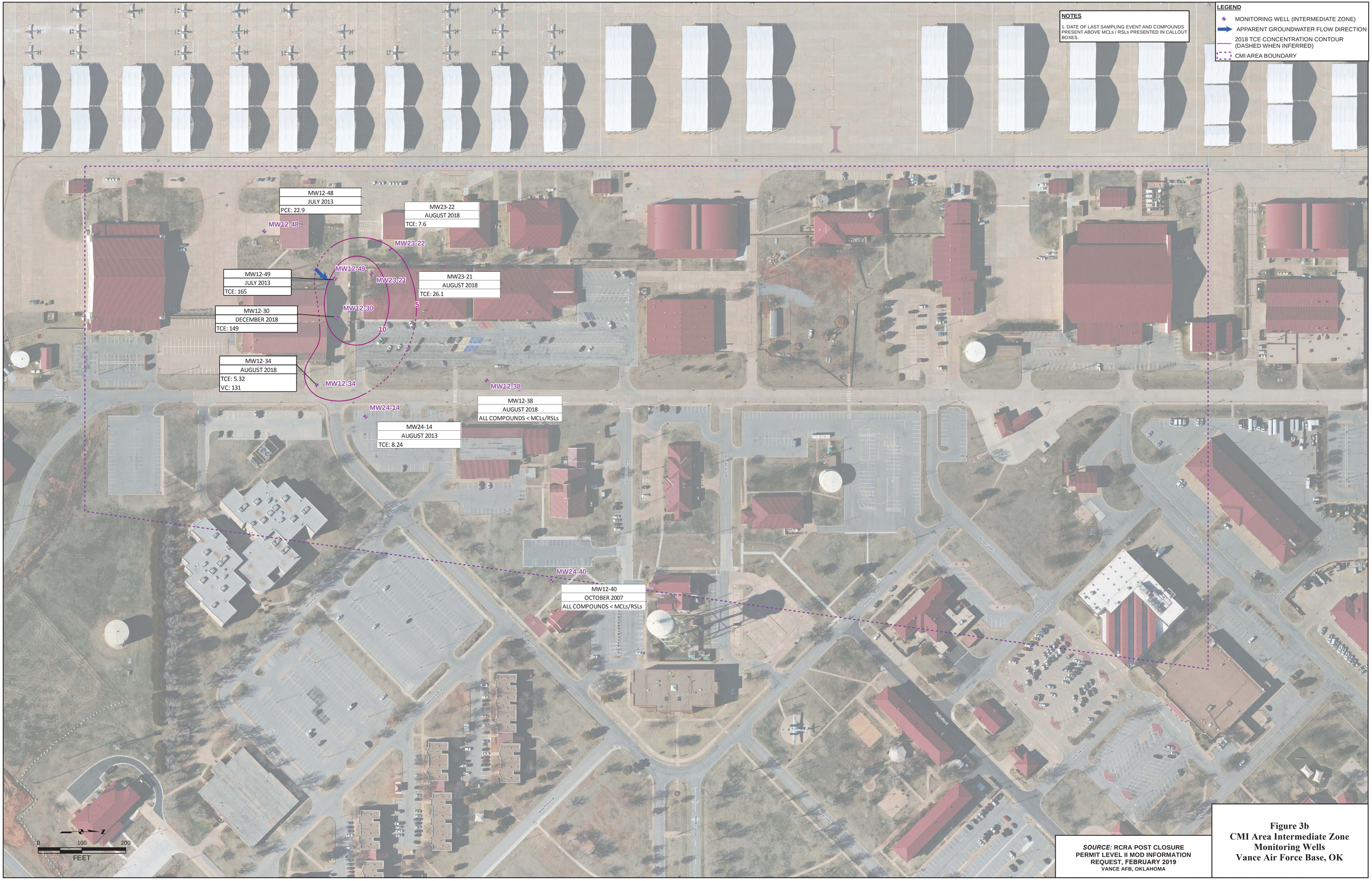
MW25-08
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW24-05
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

0 100 200
FEET

SOURCE: **RCRA POST CLOSURE PERMIT LEVEL II MOD INFORMATION REQUEST, FEBRUARY 2019**
VANCE AFB, OKLAHOMA

Figure 3a
CMI Area Shallow Zone Monitoring Wells
Vance Air Force Base, OK



SOURCE: RCRA POST CLOSURE PERMIT LEVEL II MOD INFORMATION REQUEST, FEBRUARY 2019
VANCE AFB, OKLAHOMA

Figure 3b
CMI Area Intermediate Zone Monitoring Wells
Vance Air Force Base, OK

LEGEND

- DEEP ZONE MONITORING WELL
- 2018 PCE, TCE, CIS 1-2 DCE
- CMI AREA BOUNDARY
- PROPOSED WELL TO BE DROPPED FROM CM PROGRAM

NOTES

1. DATE OF LAST SAMPLING EVENT AND COMPOUNDS PRESENT ABOVE MCLs / RSLs PRESENTED IN CALLOUT BOXES.

2. RELEASE AT MW12-13 IS HIGHLY LOCOLAIZED AROUND MONITORING WELL.

MW12-13
AUGUST 2018
PCE: 11,000
TCE: 890
CIS 1,2-DCE: 1,070

MW12-20
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW12-21
AUGUST 2018
ALL COMPOUNDS < MCLs/RCLs

MW12-13

5

MW12-20

MW12-21 X

0 100 200

FEET

SOURCE: RCRA POST CLOSURE PERMIT LEVEL II MOD INFORMATION REQUEST, FEBRUARY 2019
VANCE AFB, OKLAHOMA

Figure 3c
CMI Area Deep Zone Monitoring Wells
Vance Air Force Base, OK

NOTES

1. DATE OF LAST SAMPLING EVENT AND COMPOUNDS PRESENT ABOVE MCLs / RSLs PRESENTED IN CALLOUT BOXES.

LEGEND

- MONITORING WELL (SHALLOW ZONE)
- 2018 VC CONCENTRATION CONTOUR
- 2018 BENZENE CONCENTRATION CONTOUR
- *2018 TCE CONCENTRATION CONTOUR (DASHED WHERE INFERRED)*
- APPARENT GROUNDWATER FLOW DIRECTION
- INTERCEPTOR COLLECTION TRENCH
- SLURRY WALL
- INTERCEPTOR COLLECTION TRENCH (SEE NOTE 3)
- IZ AREA BOUNDARY
- PROPOSED WELL TO BE DROPPED FROM CM PROGRAM

MW08-16 X
MW08-16 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

MW08-09 | AUGUST 2018 | ARSENIC: 11
MW08-09

MW08-12 X
MW08-12 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

MW07-04 | OCTOBER 2018 | TCE: 1,300 | CIS 1,2-DCE: 1,150 | VC: 191 | 1,1-DCE: 16.6
MW07-04

MW08-05 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs
MW08-05

MW07-15 | AUGUST 2018 | BENZENE: 6,810 | ETHYLBENZENE: 1,720 | TOLUENE: 2,900 | ARSENIC: 44.1 | LEAD: 28.9
MW07-15

MW03-06 X
MW03-06 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

MW03-09 | OCTOBER 2018 | BENZENE: 6,240 | ETHYLBENZENE: 1,190 | ARSENIC: 23.9 | LEAD: 70.9
MW03-09

MW26-04
MW26-04 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

MW26-01
MW26-01 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

MW26-03
MW26-03 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

OB-04
MWOB-04 | OCTOBER 2018 | TCE: 23.4

OB-13
MWOB-13 | DECEMBER 2018 | TCE: 11.4

OB-16
MWOB-16 | AUGUST 2018 | TCE: 23.9 J | CIS 1,2-DCE: 0.723 F

OB-18 X
MWOB-18 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

OB-05
MWOB-05 | DECEMBER 2018 | TCE: 18.2

OB-06
MWOB-06 | OCTOBER 2018 | TCE: 34.3

OB-02
MWOB-02 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

MWOB-19 | AUGUST 2018 | TCE: 58.6
OB-19

OB-03 X
MWOB-03 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

OB-09 X
MWOB-09 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

OB-21
MWOB-21 | OCTOBER 2010 | ARSENIC: 26.9

N7-41
N7-41 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

N7-40 X
N7-40 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs

N7-69
N7-69 | AUGUST 2018 | ALL COMPOUNDS < MCLs/RSLs
N7-69 X

0 100 200
FEET

SOURCE: RCRA POST CLOSURE PERMIT LEVEL II MOD INFORMATION REQUEST, FEBRUARY 2019
VANCE AFB, OKLAHOMA

Figure 4a
IZ Shallow Zone
Monitoring Wells
Vance Air Force Base, OK

Thursday, February 28, 2019, 4:29:04 PM

LEGEND

- INTERMEDIATE ZONE MONITORING WELL
- 2018 TCE CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
- APPARENT GROUNDWATER FLOW DIRECTION
- IZ AREA BOUNDARY
- INTERCEPTOR COLLECTION TRENCH
- SLURRY WALL
- INTERCEPTOR COLLECTION TRENCH
- PROPOSED WELL TO BE DROPPED FROM CM PROGRAM

NOTES

1. DATE OF LAST SAMPLING EVENT AND COMPOUNDS PRESENT ABOVE MCLs / RSLs PRESENTED IN CALLOUT BOXES.

MW08-18
AUGUST 2018
TCE: 988
PCE: 49.8

MW07-10
OCTOBER 2007
ALL COMPOUNDS < MCLs/RSLs

MW26-02
AUGUST 2018
ALL COMPOUNDS < MCLs/RSLs

MWN7-24
OCTOBER 2007
ALL COMPOUNDS < MCLs/RSLs

MW0B-10
OCTOBER 2007
ALL COMPOUNDS < MCLs/RSLs

MW07-74
JULY 2013
TCE: 647
1,1-DCE 17.2

MW07-75
JULY 2013
TCE: 7.8

MWN7-48
DECEMBER 2018
TCE: 181

MWN7-46
OCTOBER 2007
ALL COMPOUNDS < MCLs/RSLs

MW07-76
JULY 2013
ALL COMPOUNDS < MCLs/RSLs

MWN7-50
AUGUST 2018
TCE: 11.1

MW07-77
JULY 2013
TCE: 16.9 J

MWN7-52
OCTOBER 2018
TCE: 111

MW07-79
JULY 2013
TCE: 233

MW07-78
JULY 2013
TCE: 94.1

MWN7-35
OCTOBER 2007
ALL COMPOUNDS < MCLs/RSLs

MWN7-38
AUGUST 2018
ALL COMPOUNDS < MCLs/RSLs

MWN7-58
OCTOBER 2007
ALL COMPOUNDS < MCLs/RSLs

0 100 200 FEET

SOURCE: RCRA POST CLOSURE PERMIT LEVEL II MOD INFORMATION REQUEST, FEBRUARY 2019
VANCE AFB, OKLAHOMA

Figure 4b
IZ Intermediate Zone Monitoring Wells
Vance Air Force Base, OK

Figure 4c
IZ Deep Zone Monitoring Wells
Vance Air Force Base, OK

LEGEND

- SHALLOW ZONE MONITORING WELL
- INTERMEDIATE ZONE MONITORING WELL
- DEEP ZONE MONITORING WELL
- APPARENT GROUNDWATER FLOW DIRECTION
- 2018 VC CONCENTRATION CONTOUR
- 2018 CIS 1,2-DCE CONCENTRATION CONTOUR
- 2018 TCE CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
- INTERCEPTOR COLLECTION TRENCH
- APPROXIMATE EXTEND OF FIRE TRAINING AREA
- DP005 AND FT002 AREA BOUNDARIES
- ** TURBIDITY EXCEED 5 NTU's
- * 1988 SOILD GAS DELINEATION NOTED A SMALL AREA OF ELEVATED TCE AROUND MW02-04.

NOTES

1. DATE OF LAST SAMPLING EVENT AND COMPOUNDS PRESENT ABOVE MCLs / RSLs PRESENTED IN CALLOUT BOXES.

APPROXIMATE EXTENT OF FT002 - FIRE TRAINING AREA

MW02-06 (ABANDONED)
SEPT. 2004
TPH-DRO: 1,000

MW02-06 (ABANDONED)

MW02-01 (ABANDONED)
ALL COMPOUNDS < MCLs/RSLs

MW02-01 (ABANDONED)

MW02-03 (ABANDONED)

MW02-03 (ABANDONED)
SEPT. 2004
ALL COMPOUNDS < MCLs/RSLs

MW02-02 (ABANDONED)

MW02-02 (ABANDONED)
SEPT. 2004
ARSENIC: 23.7**

MW01-01 (ABANDONED)
APRIL 1991
ALL COMPOUNDS < MCLs/RSLs

MW01-01 (ABANDONED)

MW01-02 (ABANDONED)

MW01-02 (ABANDONED)
ALL COMPOUNDS < MCLs/RSLs

MW02-05

MW02-05 (ABANDONED)
AUGUST 2018
ALL COMPOUNDS < MCLs/RSLs

MW02-04

MW02-04
AUGUST 2018
TCE: 5.85
VC: 5.8
OK-DRO: 1,230*

MW05-09
AUGUST 2018
NAPHTHALENE: 20.3

MW05-04
AUGUST 2018
CIS 1,2-DCE: 97,400
TOLUENE: 3,310
NAPHTHALENE: 44.7
OK-DRO: 7,610
OK-GRO: 36,200

MW05-03
AUGUST 2018
TCE: 25.8
CIS 1,2-DCE: 145

MW05-19
AUGUST 2018
NAPHTHALEN: 63.6
VC: 3.92
OK-GRO: 2,430
OK-DRO: 7,480

MW05-06
AUGUST 2018
ALL COMPOUNDS < MCLs/RSLs

MW05-04

MW05-19

MW05-03

MW05-09

MW05-06

MW05-18

MW05-01

MW05-18
AUGUST 2018
TCE: 441

MW05-01
AUGUST 2018
TCE: 12,000
CIS 1,2-DCE: 3,770
OK-GRO: 4,020

MW05-07

MW05-07
AUGUST 2018
BENZENE: 5.93
VC: 53.2

MW05-08

MW05-08
AUGUST 2018
VC: 26.5

Chestnut Street

White Capital Road

N

0 100 200
FEET

P:\602736269000_CAD\040_GIS\Figures\CMI\October 2018\Presentation Maps Large Maps\Final\Figure 7_Dp05 and FT002.mxd Thursday, February 28, 2019 - 2:28:49 PM

SOURCE: **RCRA POST CLOSURE PERMIT LEVEL II MOD INFORMATION REQUEST, FEBRUARY 2019**
VANCE AFB, OKLAHOMA

Figure 5
Southern Boundary Area Monitoring Wells
Vance Air Force Base, OK

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VANCE AIR FORCE BASE
RCRA POST-CLOSURE CARE PERMIT RENEWAL APPLICATION

ATTACHMENT 1

POST-CLOSURE CARE PLAN FOR ST008

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POST-CLOSURE PLAN FOR SITE ST-08
VANCE AIR FORCE BASE, OKLAHOMA

February 2006
Modification July 2019

POST-COSURE PLAN FOR SITE ST-08
VANCE AIR FORCE BASE, OKLAHOMA

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ACRONYMS

AFB	Air Force Base
BGL	Below Ground Level
CFR	Code of Federal Regulation
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DOD	Department of Defense
IRP	Installation Restoration Program
LF	Landfill
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SS	Spill Site
ST	Storage Tank
USAF	United States Air Force
UST	Underground Storage Tank

LIST OF FIGURES

1.0 INTRODUCTION

Vance Air Force Base (AFB) has submitted this Post-Closure Plan in accordance with 40 CFR Code of Federal Regulations (CFR) Part 264.118. It is also intended to fulfill the requirements of the Part B Post-Closure Permit Application for the renewal of the existing permit issued on August 6, 1996 by Oklahoma Department of Environmental Quality (DEQ). Regulations for the Part B Post-Closure Permit include but are not limited to applicable section of 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal, Subpart G, Closure and Post-Closure, 40 CFR 270, Hazardous Waste Permit Program, Subpart B, Permit application, and all Oklahoma Department of Environmental Quality (DEQ) Land Protection Division rules and regulations as applicable.

1.1 Site Location, Description and History

Vance AFB lies in north central Oklahoma, in Garfield County, about 5 miles southwest of downtown Enid, Oklahoma. Figure 1-1 provides a location map. The base covers approximately 2,122 acres and is surrounded by privately owned farming lands. The majority of Vance AFB is dedicated to aircraft runways and taxiways that cover approximately 1,100 acres. Base living quarters for Air Force personnel and their dependent are located on the far northeastern side of base in the military family housing area. In addition to the facilities at Vance AFB, a remote facility known as Kegelman Auxiliary Field (KAux) is used for "touch-and-go" landings. KAux is located 30 miles north-northwest of Vance AFB in Alfalfa County, Oklahoma. Figure 1-1 shows the location of Vance AFB and KAux.

Site ST-08 consists of the former underground storage tanks (USTs) at Building 110. The Site is located in the northern area of Vance AFB, due south of Site SS-07, west of Elam Road, and east of the flight line. Figure 1-2 is a Site ST-08 location map.

Site ST-08 has five (5) USTs that were removed in March 1989. The individual tanks were designated as UST #106, UST #108, UST #109, UST #112 and UST #113. UST #106 was the farthest west in the series of tanks. Each tank had a capacity of 12,000 gallons and was constructed of steel. From 1941 to 1970, USTs #108 and #109 stored lubricating oil, UST #112 stored diesel fuel, UST #113 stored kerosene, and UST #106 stored oil. These USTs were located southeast of Building 116 (Building 110 has been demolished) at the northeast corner of the flight line apron.

From 1970 to 1980, UST #106 stored a variety of solvents, contaminated fuels, and waste oils. UST #106 was removed in 1989; however, contaminants in the soil were left in place during closure and the area was covered with a Resource Conservation and Recovery Act (RCRA) concrete cap. The RCRA Closure Plan was approved in 1990. A summary of that plan is provided in the following paragraphs.

1.2 RCRA Closure Plan

The RCRA Closure Plan, dated April 1990, presented the results of extensive soil and groundwater sampling conducted at the Site, an evaluation of the nature and extent of

contamination and presented “clean” and “landfill” closure plans. The “landfill” closure plan was chosen since the Site could not be “clean closed”. After the removal of the tank and once foot of topsoil, the subgrade was compacted and covered with a compacted aggregate base layer. The top layer of the final landfill cap system consisted of a minimum of 10 inches of reinforced concrete. The final concrete cap was approximately one hundred feed by eighty feet and had a three percent slope to a concrete curb system located along the cap and soil interface. Figure 1-3 is a Site plan of conditions prior to closure. Figure 1-4 is a topographic map. Figure 1-5 is a landfill closure cap plan and Figure 1-6 is a concrete cap section. Closure certification of IRP Site ST-08 was accepted by Oklahoma State Department of Health Hazardous Waste Management Services in a letter dated April 13, 1993. The approved closure plan, modifications, and all correspondence are available for review in the Information Repository at the Enid Public Library.

A RCRA Post-Closure Plan, dated November 1990 was the regulatory mechanism for post-closure activities until the RCRA Post-Closure Care Permit was issued to Vance AFB on August 8, 1996. The Permit incorporated both the Closure and Post-Closure Plans. The Permit identified groundwater and soil contamination associated with releases from former USTs near Building 110. As a results, the Permit required corrective action and monitoring of specified monitoring wells at Site ST-08 on a semi-annual basis, as set forth in Permit Conditions IV.C.2 and IV.C.3.

Site ST-08 is one of five sites known as the Industrial Zone. Even though only ST-08 is the subject of this post-closure plan, information from the other Sites is included because they are all part of one operable unit. Site ST-13 is a petroleum site and is considered closed. There is no ongoing activity at this Site.

Corrective action occurred in 1996 when Site ST-08 and SS-07 were connected to the newly constructed Central Groundwater Treatment Facility (CGTF). In September, 1997 a final work plan for the construction of an interim remedial action was submitted to Oklahoma DEQ for approval. Upon approval, construction of an interceptor collection trench took place in November 1997. Further corrective action took place when a final work plan for an interim remedial action at North Site SS-07, dated November 16, 2001 was approved by DEQ. Another interceptor collection trench was constructed in January 2002. The two trenches collect contaminated groundwater, which is transported via a gathering system to the CGTF. A site map is shown on Figure 2-1. In March, 2003 the monitoring well network for the Industrial Zone was expanded in a permit modification. A list of wells for Site ST-08 is shown in Figure 2-5. Final remedial action for the Industrial Zone took place when a final work plan, dated February, 2003, was approved by DEQ for the installation of a free product recovery system and a phytoremediation system at Site LF-03. Construction was completed in May, 2004.

Additional remediation was initiated in 2017 to address the residual soil contamination as well as residual contamination in the shallow transmissive zone at ST-08 (AECOM, 2015). The remediation will consist of the installation and operation of a dual phase extraction system in the vicinity of the old tank pit. A new site was discovered immediately up-gradient of Site ST-08. The Site has been designated SS-28 and monitoring well MW08-18 has been reassigned to this site.

1.3 Scope of Post-Closure Plan

The scope of appropriate post-closure activities described within this Post-Closure Plan has been developed to satisfy the specific requirements of 40 CFR 264.117 through 264.120. This Post-Closure Plan consists of the following sections:

Section 2 Groundwater Monitoring
Section 3 Inspection and Maintenance Activities
Section 4 Post-Closure Care Implementation and Duration
Section 5 Post-Closure Care Documentation and Certification
Section 6 References

2.0 GROUNDWATER MONITORING

The groundwater monitoring activities discussed in this section provide a description of the following items:

Existing conditions at Site ST-08
Monitoring well network
Evaluation procedures and frequency for groundwater sampling
Types of laboratory analyses

2.1 Existing Conditions

Groundwater occurs at Site ST-08 from six to twelve feet below land surface and flows to the north-northeast. A geologic cross section is shown in Figure 2-2. A potentiometric surface map is shown in Figure 2-3. The CGTF had been operating only 8 hours a day until June 2004, when it began operations 24 hours a day/7 days per week. The increasing distance between the potentiometric contours up-gradient of the two interceptor collection trenches located on Site SS-07 suggests that the shallow transmissive zone is shifting to a new equilibrium state with a broader capture zone and flatter gradients. The hydraulic gradient was last calculated to be 0.005 ft/ft for the shallow transmissive zone in September 2003. The average hydraulic conductivity is estimated to be 6.75×10^{-4} cm/sec for the shallow transmissive zone. The groundwater flow velocity in the shallow zone had an average rate of 17.5 ft/yr. A photograph of the Site is shown in Figure 2-4.

2.2 Monitoring Well Network

The compliance monitoring well network for Site ST-08 consists of two monitoring wells screened in the shallow transmissive zone (10 to 30 feet below ground level (bgl)).

2.3 Evaluation Procedures

All compliance well samples at Site ST-08 are taken annually. During each event, wells are purged and sampled in accordance with the Sampling and Analysis Plan (SAP) provided in Attachment 4-1A to the 2006 Permit Renewal Application.

2.4 Types of Laboratory Analysis

Groundwater is sampled for volatile organic compounds and RCRA metals. Methods and procedures are outlined in detail in the SAP provided in Attachment 4-1.

3.0 INSPECTION AND MAINTENANCE ACTIVITIES

Throughout the post-closure care period, the integrity and effectiveness of the concrete cap and other site features will be monitored and maintained. The appropriate post-closure care inspections and maintenance activities for the concrete cap, run-off and run-on control measures, and monitoring wells equipment are listed in Figure 3-1.

The appropriateness and effectiveness of the groundwater monitoring system will be routinely evaluated and modified throughout the post-closure care period.

Although the final concrete cap is inherently secure, restricted facility assess and other site security measures will help prevent unauthorized disturbance of the final concrete cap and associated site features.

The semi-annual site inspection activities will require approximately two hours of onsite personnel time during each event. United States Air Force (USAF) contractors will conduct site inspections while completing sampling and analysis events. A site inspection will also be conducted after any known earthquake, severe storm, or disturbance in the vicinity of the Site.

Each site inspection will assess the integrity and effectiveness of the concrete cap system and other site features.

Stored equipment and vehicles will be moved as necessary to facilitate site inspections, maintenance activities, and repair efforts.

Qualified personnel will investigate subsided or settled area of the concrete cap system before repair to determine the cause of displacement.

Drainage structures in the vicinity of the Site will be kept free of vegetation and debris. Erosion of soils bermed adjacent to the final cap will be restored to the original contours. Additional surface grading will also be performed as necessary to prevent ponding or run-on conditions.

Records of all maintenance and repair activities conducted during the post-closure care period will be kept at the facility.

4.0 CLOSURE CARE IMPLEMENTATION AND DURATION

4.1 Point of Contact

A copy of the approved Post-Closure Plan will be kept at the facility throughout the post-closure care period. The current point of contact at the facility for matters concerning the post-closure care of the Site is as follows:

Ms. Marilyn Wells
Remedial Project Manager
140 Channel Street, Suite #102
Vance AFB, Oklahoma 73705-5610
(580) 213 - 6306

In addition, the facility contact will be responsible for updating the post-closure plan as needed and ensuring that OSDH and EPA copies are also kept current.

If operations at Vance AFB were to cease before the end of the post-closure care period, another contact point will be provided to DEQ 180 days prior to operations ceasing at Vance. The Tinker Installation Support Section (ISS) would be the secondary contact during the post-closure care period. That point of contact is as follows:

Mr. James Dawson
Tinker ISS
Building 1, Room 221
Tinker AFB, Oklahoma 73145
(405) 736 - 3060

4.2 Site Security

Vance AFB is a Department of Defense facility with restricted access to the property. Vance AFB is fenced, secured, and patrolled by security personnel 24 hours a day. The ongoing security program includes daily inspection of all perimeter fences and gates for damage caused by intruders, accidents, or natural events. Damaged fencing is repaired or replaced as soon as practically possible.

4.3 Duration of Post-Closure Care Period

The post-closure care period will be 30 years from the date of the final closure of the UST#106 Site. In a letter from Oklahoma State Department of Health (now DEQ the acceptance of closure certification was April 13, 1993).

4.4 Modification of Post-Closure Care Period

The Oklahoma DEQ Administrative Authority may shorten or lengthen the post-closure care period applicable to the hazardous waste management unit, or facility in accordance with 40 CFR 264.117(2)(i) and (ii).

Vance AFB may submit a written notification or request to the DEQ Administrative Authority for a permit modification at amend the post-closure plan at any time during the active life of the facility or during the post-closure care period in accordance with 40 CFR 264.118(d)(1)(2).

5.0 POST-CLOSURE CARE DOCUMENTATION AND CERTIFICATION

5.1 Post-Closure Documentation

The post-closure documentation to be retained by the designated point of contact specified in Section 4.1 will include the following items:

- Survey plat from the final closure activities
- Closure certification documents
- Local zoning authority approval and filing of survey plat
- Surveying and recordkeeping information
- Groundwater monitoring records of sampling, analyses, and results
- Copies of all the approved Post-Closure Plans and modifications used during the post-closure care period
- Copies of any field notes, site photographs, survey data, or field reports that have been generated during the semi-annual inspection activities
- Records of all maintenance and repair activities conducted at eh site during the post-closure care period.

5.2 Post-Closure Certification

Semi-annual inspections, to be conducted throughout the 30-year post-closure car period, will results in information associated with 60 inspections. Copies of all the post-closure documentation items listed in Section 5.1 will be made available for review.

Upon completion of the post-closure period, an independent professional engineer registered in Oklahoma and a Vance AFB official will certify that the post-closure care activities have been conducted in accordance with the approved Post-Closure Plan and any approved modifications to the plan.

Certification documents will be submitted to the Oklahoma DEQ Administrative Authority within 60 days of completion of the established post-closure care period. When Vance AFB submits the certification documents, it will request that DEQ confirm the end of the post-closure care period for the UST #106 Site.

6.0 REFERENCES

AECOM, 2015, Draft Final Remedial Design/Corrective Measures Implementation Plan for ST-08, Vance AFB, Oklahoma, July

Title 40 CFR Part 264, Standards for Owners and operators of Hazardous Waste Treatment, Storage, and Disposal

Title 40 CFR Part 270, Hazardous Waste Permit Program

Vance AFB, 1990 Approved Closure Plan UST#106 at Building 106 (IRP Site 8) and all subsequent modifications

Vance AFB, 1990 Approved Post-Closure Plan, UST# 106 at Building 106 (IRP Site 8) and all subsequent modifications

Vance AFB, Final Project Work Plan, Central Groundwater Treatment Facility, June 18, 1996

Vance AFB, Final Project Work Plan, Industrial Zone Interim Remedial Action, September, 1997

Vance AFB, Final Project Work Plan, Industrial Zone Interim Remedial Action, North Site SS-07, November 16, 2001

Vance AFB, Final Project Work Plan, Industrial Zone Remedial Action, November 2003

Figure 1-1 Location Map

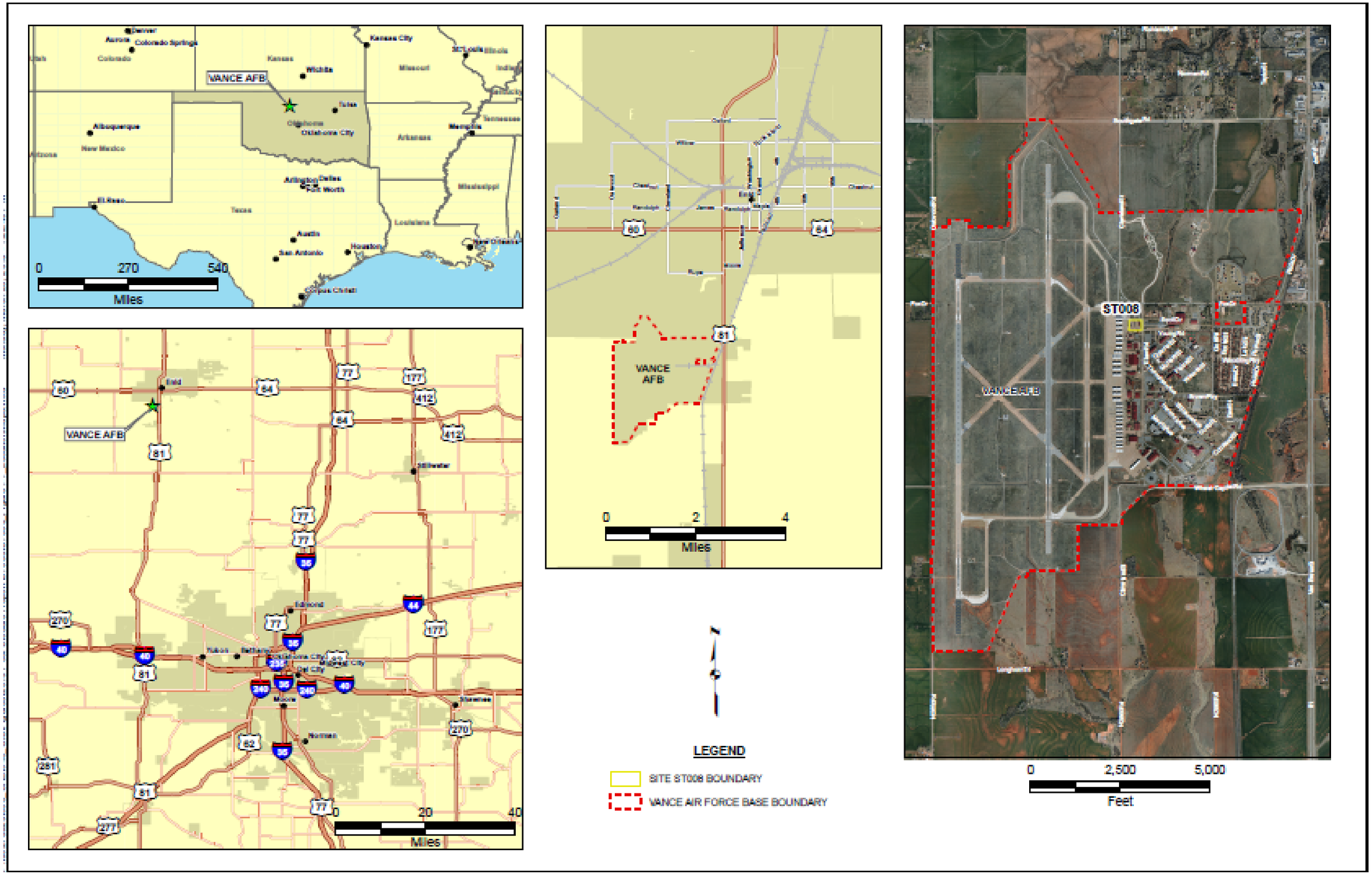

Figure 1-2 Site ST-08 Location

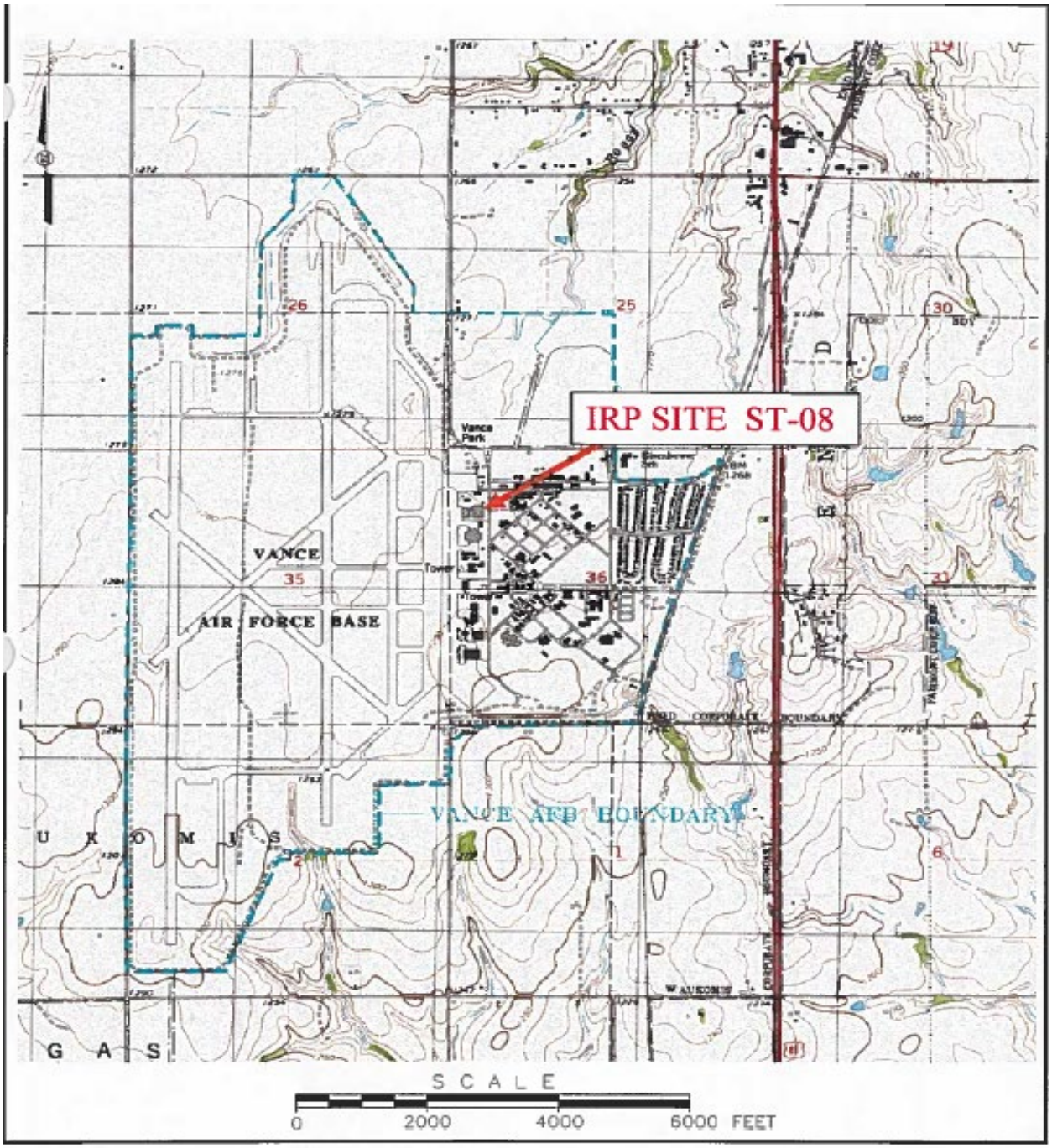

Figure 1-3 Site ST-08 Site Plan

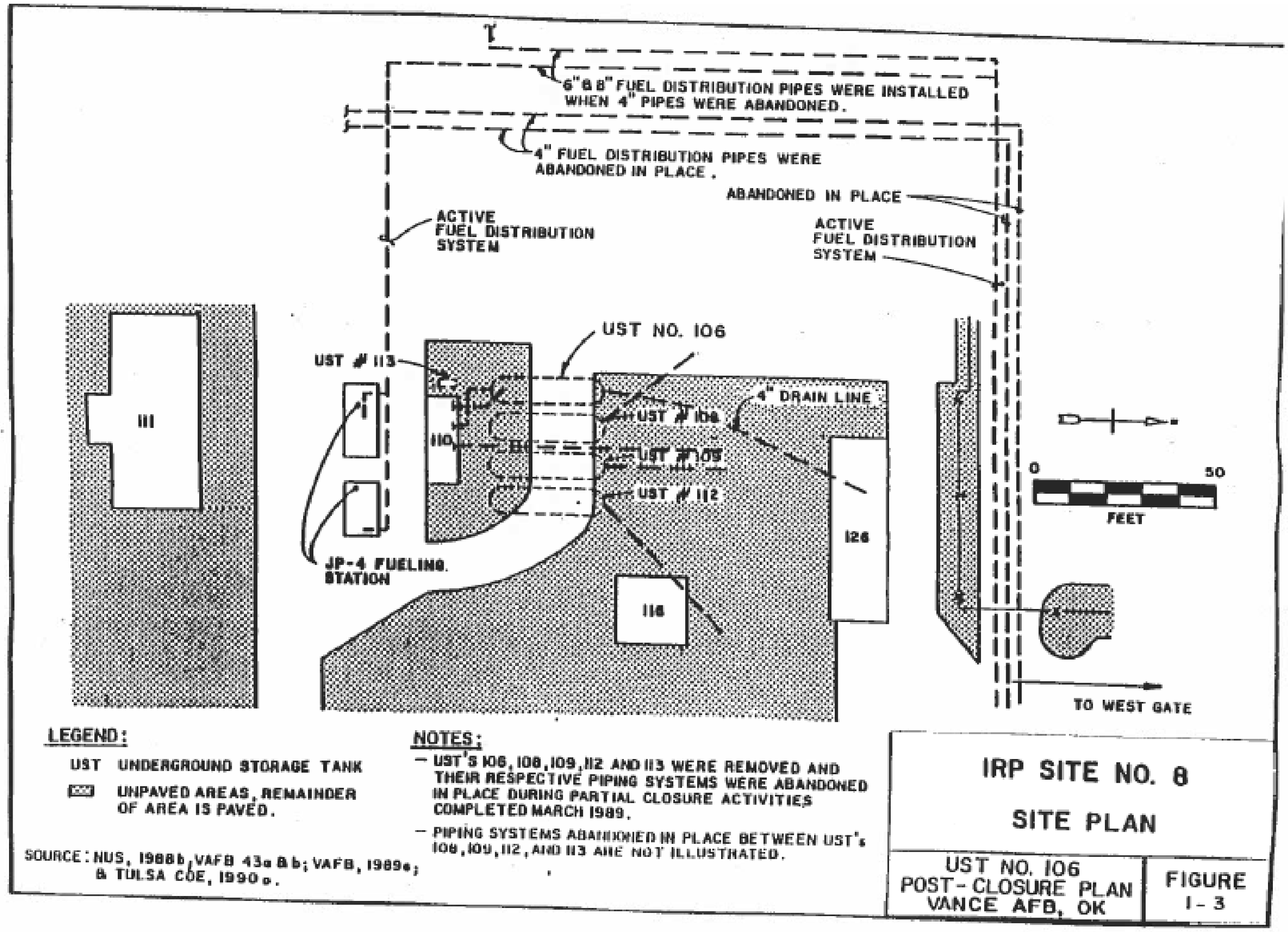

Figure 1-4 Topographic Map

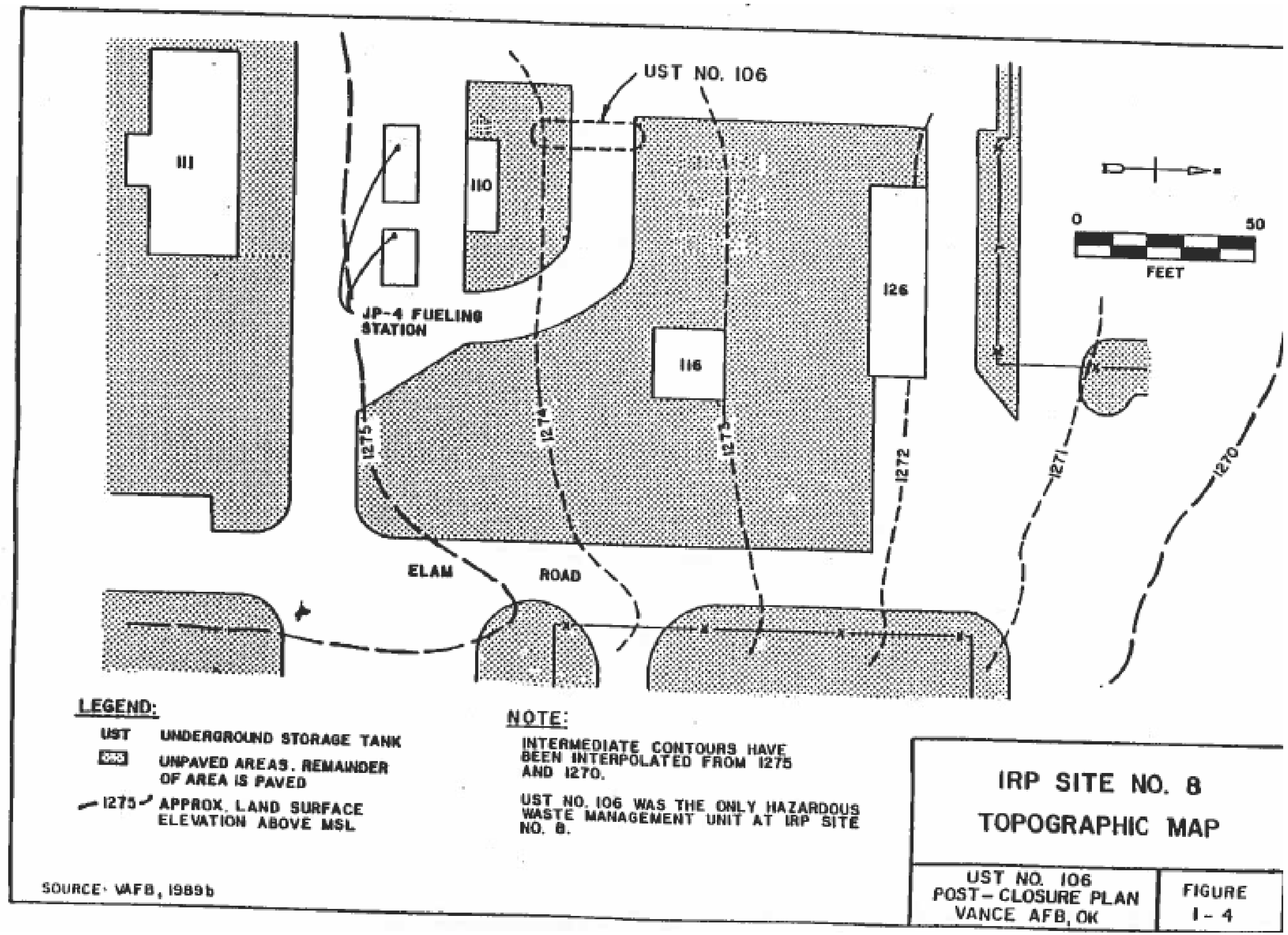

Figure 1-5 Landfill Closure Cap Plan

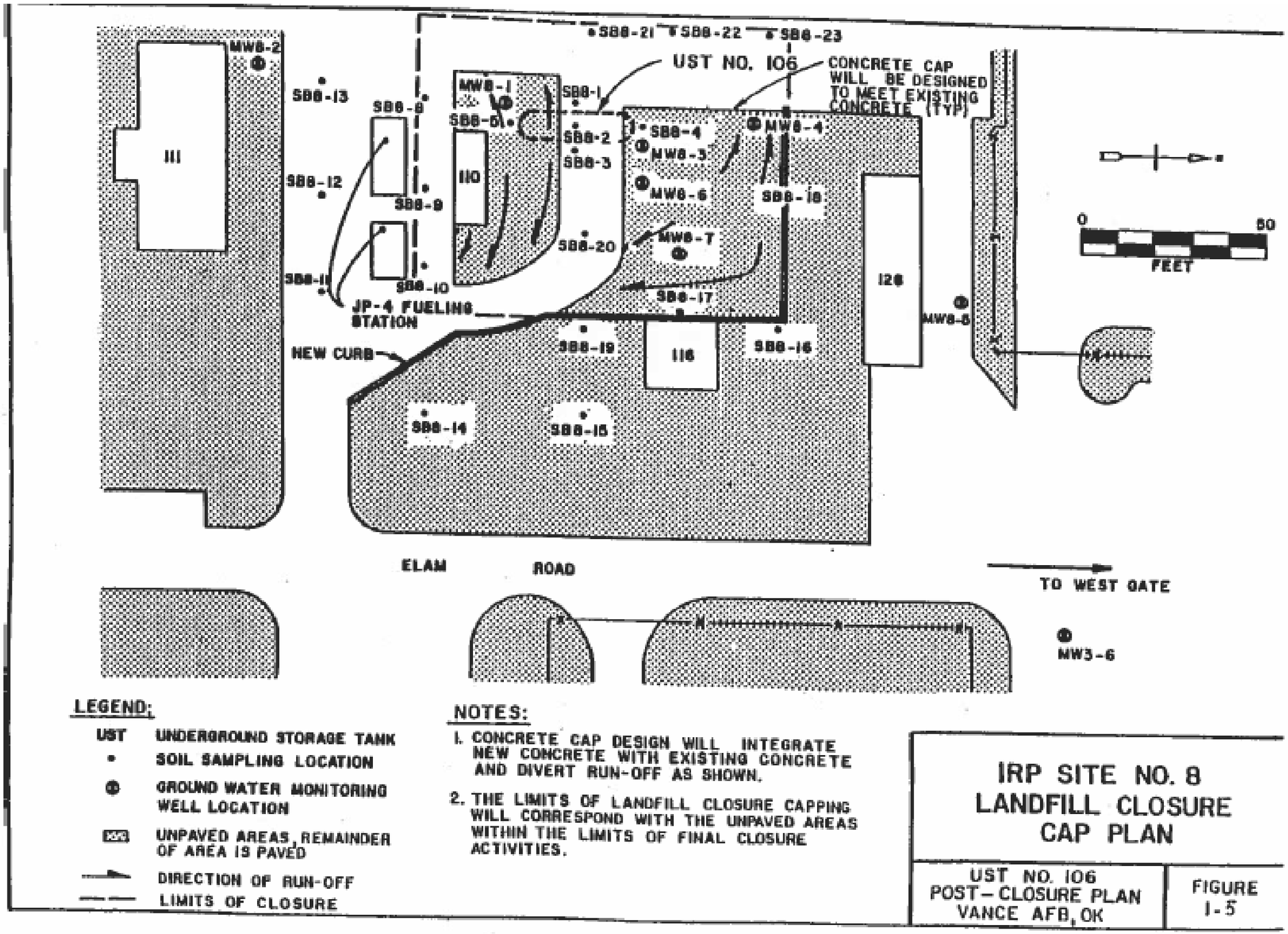

Figure 1-6 Landfill Closure Cap Section

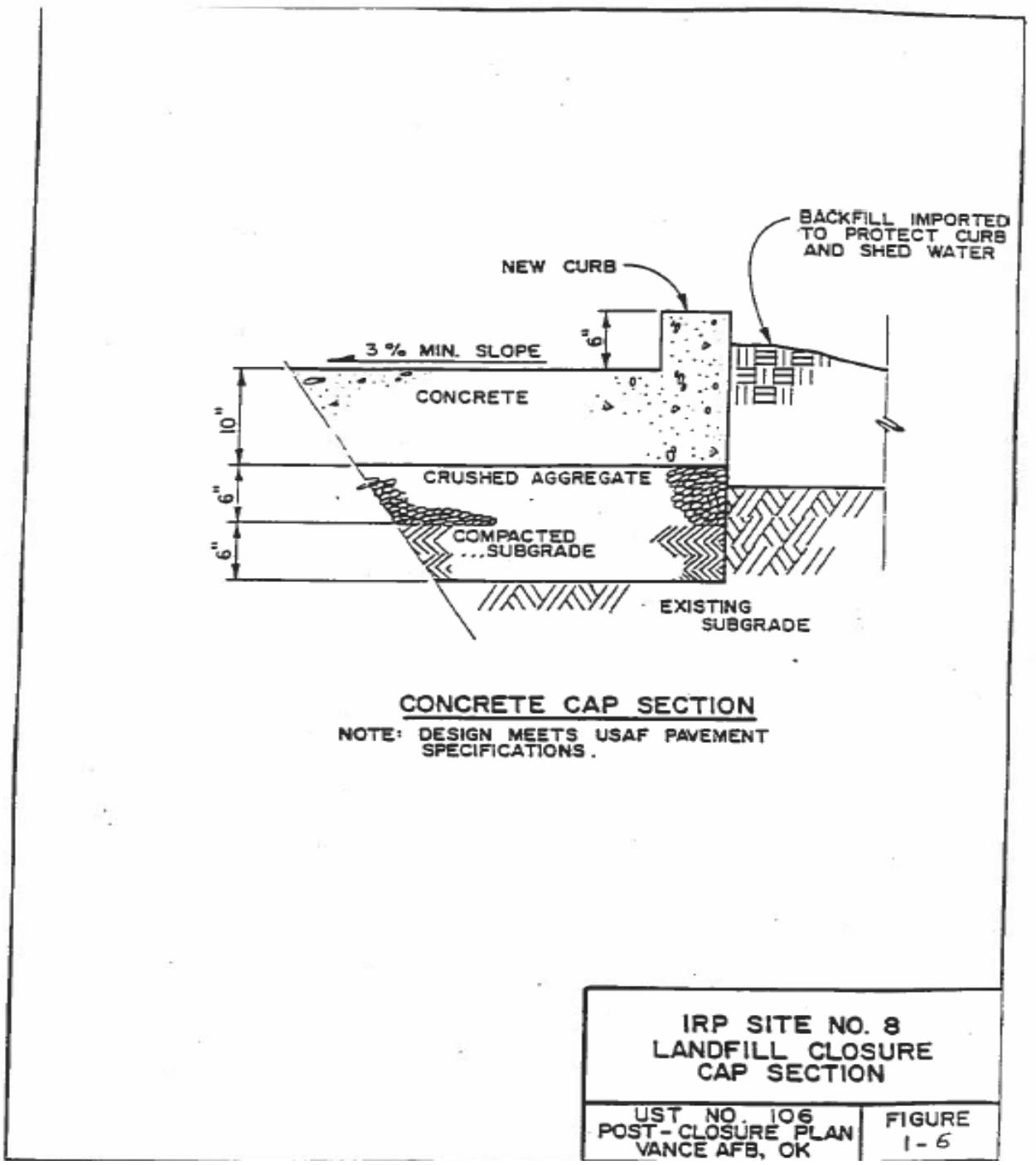

Figure 2-1 Industrial Zone IRP Sites

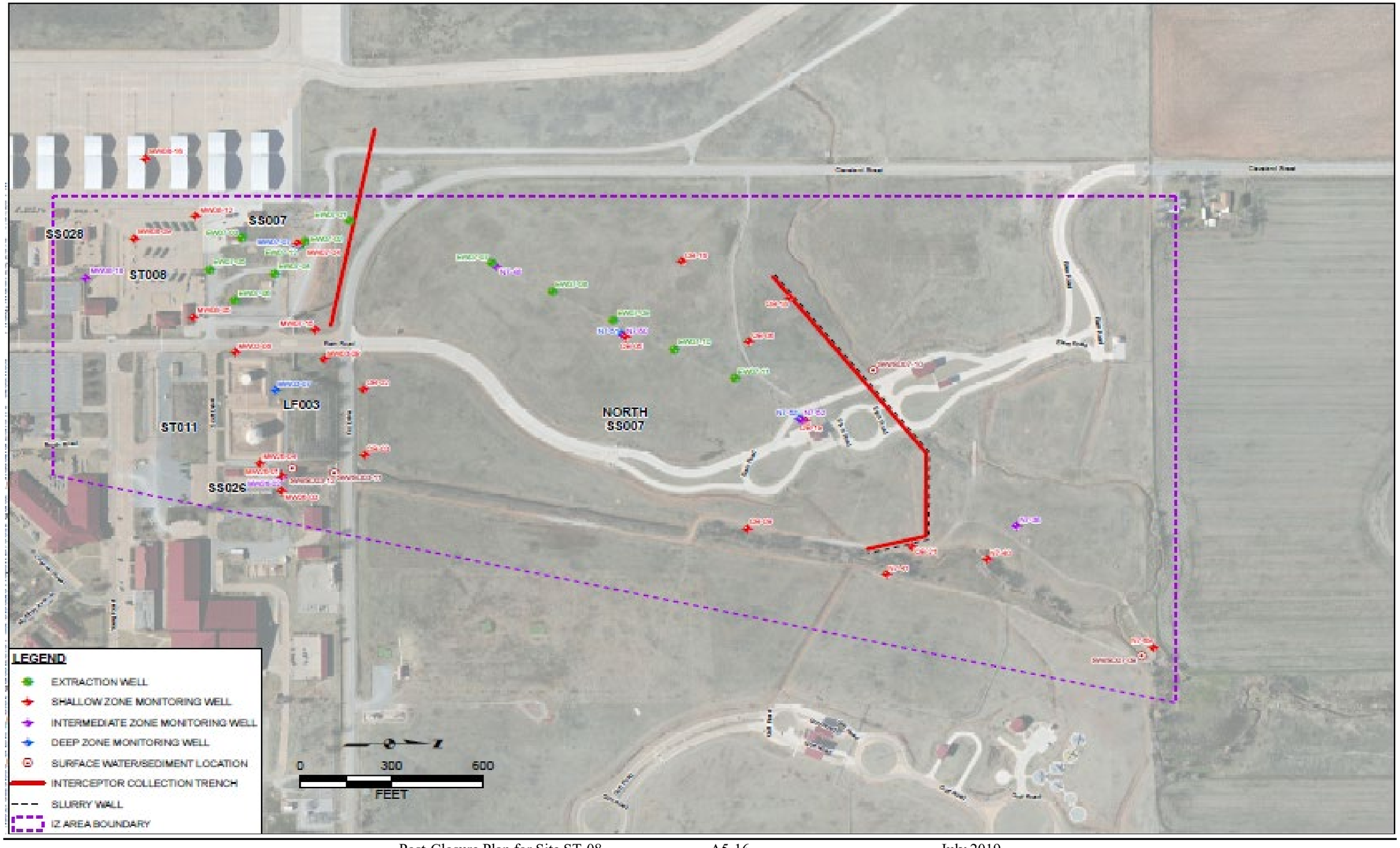

Figure 2-2 Geologic Cross Section

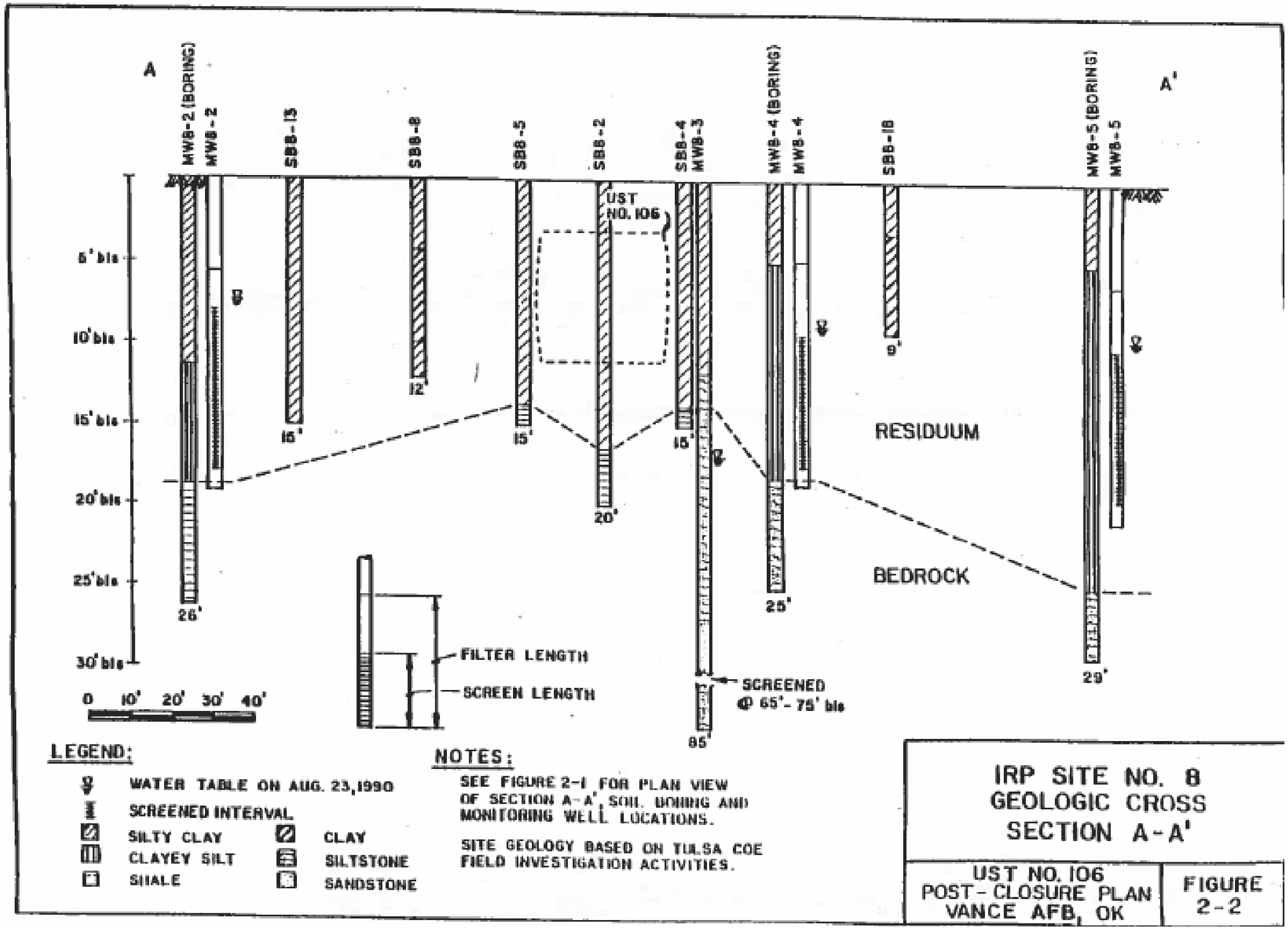

Figure 2-3 Potentiometric Surface Map (2017)

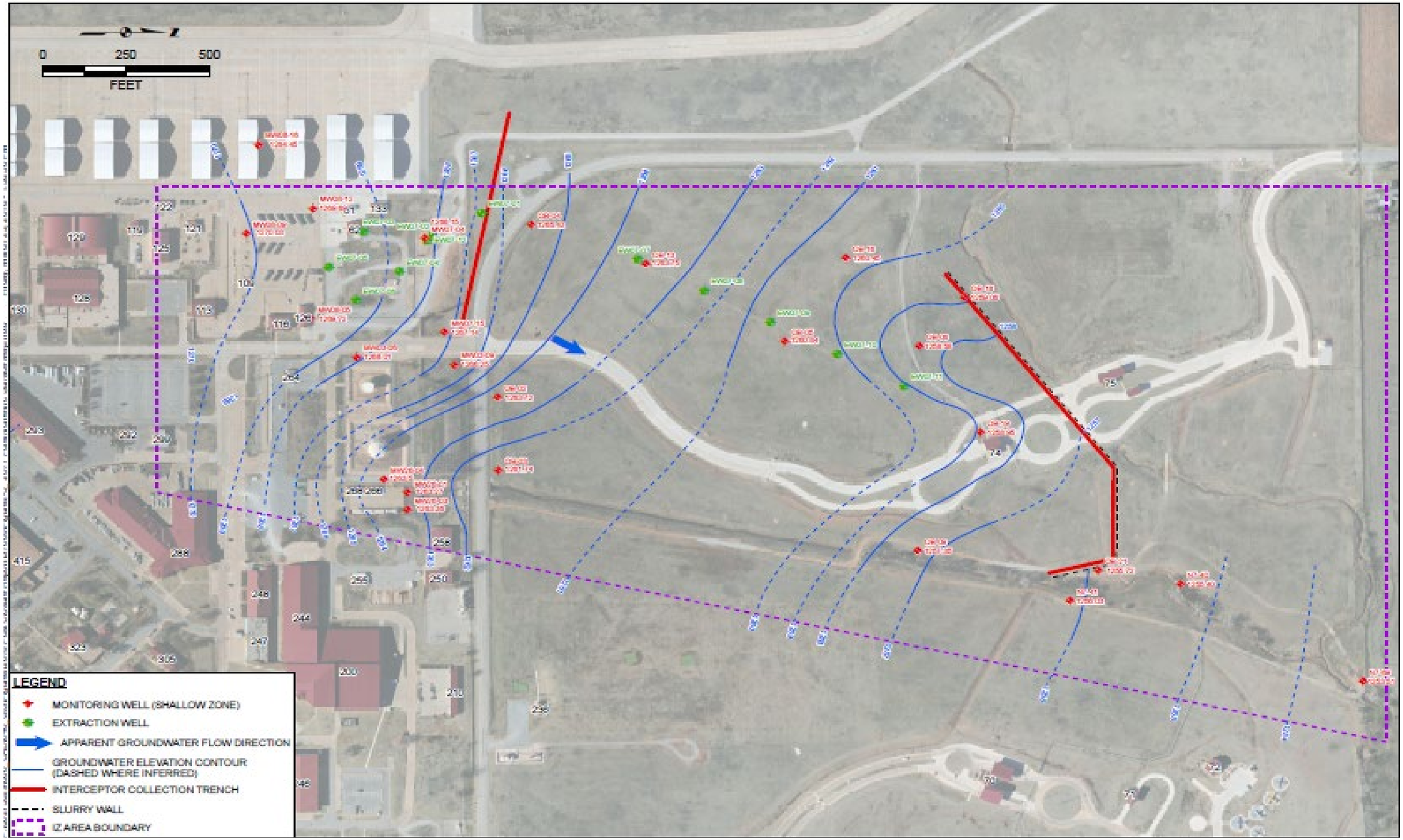

Figure 2-4 Photograph of Site ST-08

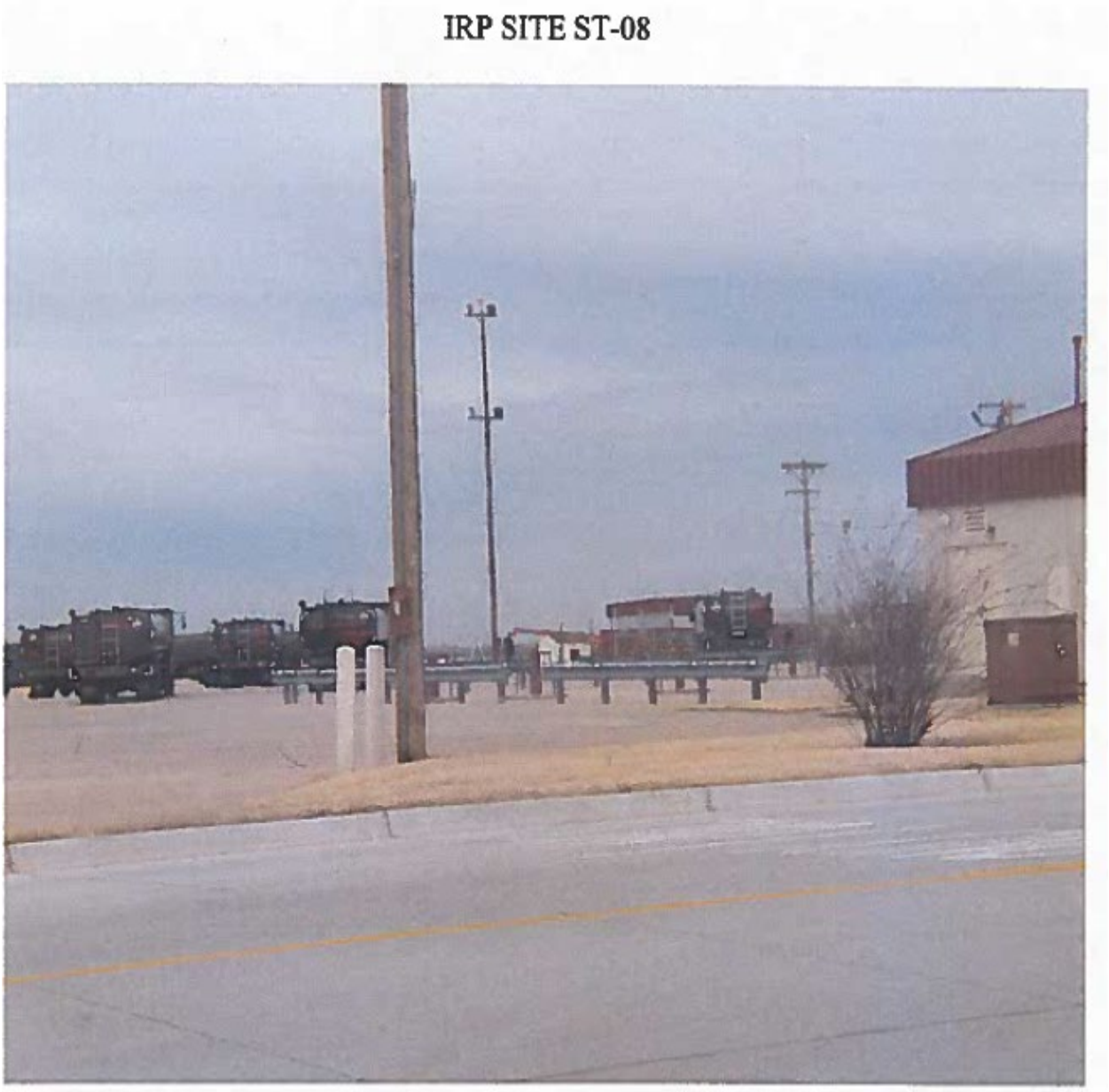

Figure 2-5

COMPLIANCE MONITORING WELL NETWORK
SITE ST-08

The following monitoring wells are sampled as shown:

Well ID	Well Type	Monitoring Frequency
Site ST-08		
8-05	Shallow	Annual
8-09	Shallow	Annual

Wells sampled for volatile organic compounds and RCRA metals in accordance with the Sampling and Analysis Plan.

Figure 2-6 Industrial Zone Monitoring Wells (2017)

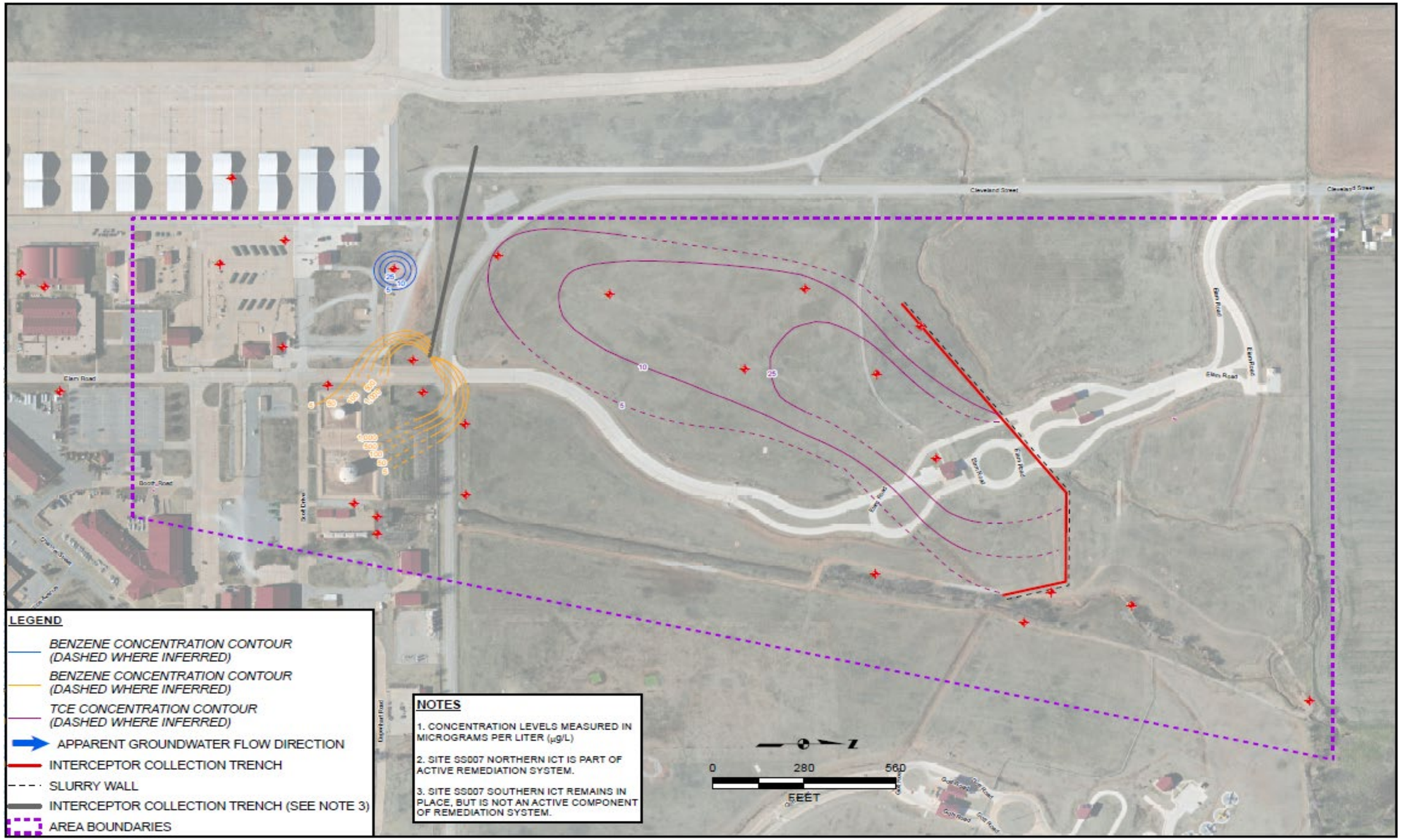

Figure 3-1

INSPECTION AND MAINTENANCE ACTIVITIES

Item	Potential Problems	Maintenance Response
Concrete Cap Surface	Cracking	Seal or Patch
	Vegetative Growth in Cracks	Remove Vegetation/Repair Cracks
	Holes	Seal or Patch
	Structural Damage	Resurface/Replace Portions of Cap
Run-off and Run-on	Surface Ponding	Resurface Cap Depression
	Unsatisfactory Runoff	Resurface Cap
	Downgrade Ponding	Resurface and/or Grade Adj. to Cap
	Erosion of Adj. Soil	Import Additional soil and/or Grading Adjacent to Cap
DPE	Wells not pumping	Repair or replace equipment
	pipes clogged	remove sediment
Monitoring Well Equipment	broken risers	Repair or replace
	tampered, broken or stolen locks	Replace locks
	Broken, stolen or lost bailers	Replace dedicated bailers
	Minimal or no recovery of samples	Replace monitoring well
	Damaged Well cap/casing	Replace well cap or monitoring well
Surveyed Benchmarks Or Markers	Physical Damage	Establish Substitute Benchmark(s)
	Severe Weathering	Establish Substitute Benchmark(s)
	Evidence of Tampering	Establish Substitute Benchmark(s)
	Physically Obstructed	Uncover and provide protection

Note: Vance AFB's perimeter fence is routinely inspected and repaired a necessary.

VANCE AIR FORCE BASE
RCRA POST-CLOSURE CARE PERMIT RENEWAL APPLICATION

ATTACHMENT 2

POST-CLOSURE CARE PLAN FOR ST012

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POST-CLOSURE PLAN SITE ST-12
VANCE AIR FORCE BASE, OKLAHOMA

January 2006
Modification July 2019

POST-CLOSURE PLAN IRP SITE ST-12
VANCE AIR FORCE BASE, OKLAHOMA

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IRP	Installation Restoration Program
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RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SS	Spill Site
ST	Storage Tank
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LIST OF FIGURES

1.0 INTRODUCTION

Vance Air Force Base (VAFB) has submitted this Post-Closure Plan in accordance with 40 Code of Federal Regulations (CFR) Part 264.118. It is also intended to fulfill the requirements of the Part B Post-Closure Permit Application for the renewal of the existing permit issued on August 6, 1996 by Oklahoma Department of Environmental Quality (DEQ). Regulations for the Part B Post-Closure Permit include but are not limited to applicable sections of 40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal, Subpart G Closure and Post-Closure, 40 CFR 270, Hazardous Waste Permit Program, Subpart B, Permit application, and all Oklahoma Department of Environmental Quality (DEQ) Land Protection Division rules and regulations as applicable.

1.1 Site Location, Description, and History

Vance AFB lies in north central Oklahoma, in Garfield County, about 5 miles southwest of downtown Enid, Oklahoma. Figure 1-2 provides a location map. The base covers approximately 1,999 acres and is surrounded by privately owned farming lands. The majority of Vance AFB is dedicated to aircraft runways and taxiways that cover approximately 1,100 acres. Base living quarters for Air Force personnel and their dependents are located on the far northeastern side of the base in the military family housing area. In addition to the facilities at Vance AFB, a remote facility known as Kegelman Auxiliary Field (KAux) is used for "touch-and-go" landings. KAux is located 30 miles north-northwest of Vance AFB in Alfalfa County, Oklahoma.

Site ST-12 consists of a paint stripping equalization tank (PSET) that was used to provide temporary holding and separation of paint stripping wastes from 1967 to 1988. The PSET was located immediately southeast of Building 192 in which aircraft were periodically repainted as part of a maintenance program. In 1988, the tank was taken out of service. Figure 1-2 is a Site ST-12 location map.

The RCRA Closure Plan was approved in January, 1994 and amended in October, 1994. A summary/history of that plan is provided in the following paragraphs.

1.2 RCRA Closure Plan

The RCRA Closure Plan, dated January, 1994 and the amendment dated October, 1994, presented the results of extensive soil and groundwater sampling conducted at the site, an evaluation of the nature and extent of contamination and presented "clean" and "landfill" closure plans. The "landfill" closure plan was chosen since the site could not be "clean closed". The amendment to the closure plan provided details for the tank removal.
In a letter dated March 27, 1995, a project work plan for an interim remedial action at Site ST-12 was approved by Oklahoma DEQ. In May, 1995 the contents of the PSET, approximately 200-300 gallons of water and residual sludge, was removed, tested and disposed of as required. The top five feet of clean soil was removed and later used for backfill. A modular trench box was installed to prevent the need for shoring. The demolition and removal of the PSET occurred on June 5-6, 1995. Concrete debris from demolition of the PSET was classified as RCRA

hazardous waste and transported to a permitted hazardous waste landfill. Soils surrounding the PSET were removed to a depth at which bedrock was encountered at approximately 10 feet below existing ground surface. Excavated oil was tested and disposed of as required.

Geotextile filter fabric was placed and filled against the excavation bottom and side walls. The sump pipe was positioned in place. The excavation was filled with coarse stone to the designed elevation. A section of filter fabric was placed on top. A layer of sand was placed atop the geotextile fabric followed by placement of HDPE liner. A soil cap was placed and compacted on tip of the liner. Concrete pavement was replaced and extended to the west and south. A complete description of the tank removal proves can be found in the Final Quality Control Summary Report for the Interim Remedial Action for the PSET, dated September 13, 1995.

Figure 1-3 is a geologic cross section of Site ST-12. Figure 1-4 is a 1990 potentiometric surface and groundwater flow map. Figure 1-5 is a 2017 potentiometric map.

A RCRA Post-Closure Care Permit was issued to Vance AFB on August 8, 1996. The Permit incorporated the approved Closure Plan and subsequent amendment and a Draft Post-Closure Plan. The Permit required corrective action and monitoring of specified monitoring wells at Site ST-12 on a semi-annual basis, as set forth in Permit Conditions IV.C.2 and IV.C.3. A RCRA Facility Investigation was conducted in 1998 with a final report dated December, 1998. A follow-on corrective measures study was conducted in 1998. A report dated April 28, 1998, five corrective measures alternatives were deployed, evaluated and ranked. Alternative number 2, Groundwater Extraction was selected as the final remedy. Field activity for the final remedy was completed on April 27, 2002 and a final report, dated October 18, 2002 was submitted to DEQ for approval. DEQ approval was obtained in a letter dated November 18, 2002.

In April 2008, the Permit was modified to reduce groundwater monitoring frequency at Site ST-12 from semi-annual to annual.

In 2014, the ST-12 remedy was changed to injections of emulsified vegetable oil creating conditions conductive to enhanced reductive dechlorination of chlorinated volatile organic compound (CVOC) contamination. The groundwater extraction system was turned off and retrofitted to an SVE system in order to efficiently reduce contaminant mass in the subsurface by volatilizing VOCs in the vadose and “smear” zone soils. The use of the SVE was discontinued in 2016 due to low mass removal rates and no significant methane concentrations being extracted by the system.

1.3 Scope of Post-Closure Plan

The scope of appropriate post-closure activities described within the Post-Closure Plan has been developed to satisfy the specific requirements of 40 CFR 264.117 through 264.120. This Post-Closure Plan consists of the following sections:

Section 2 Groundwater Monitoring
Section 3 Inspection and Maintenance Activities
Section 4 Post-Closure Care Implementation and Duration

2.0 GROUNDWATER MONITORING

The groundwater monitoring activities discussed in this provide a description of the following items:

Existing conditions at Site ST-12
Monitoring well network
Evaluation procedures and frequency for groundwater sampling
Types of laboratory analyses

2.1 Existing Conditions

Site ST-12 is one of four sites known as the Corrective Measures Implementation (CMI) sites. Even though only Site ST-12 is the subject of this post-closure plan, information from the other sites is included because they are all part of one operable unit. Site WP-23, the Industrial Waste Pond, is located between building 182 and 183, approximately 250 feet north of the former PSET. It is believed that the waste pond was abandoned when the paint stripping operation moved to Building 192 in 1967. Site SS-24, the Jet Engine Shop, is located approximately 100 feet east of Site ST-12 and was a spill site for hazardous materials. Site SS-25 the COMBS Warehouse is located north and east of Site ST-12. Contaminants from this site may have originated from outside the area since ST-12 and SS-24 are up-gradient.

Historically, recovered groundwater from the ST-12 site was pumped to the Central Groundwater Treatment Facility (CGTF) since May, 1998 via a gathering system. Recovered groundwater from Sites SS-24 and SS-25 was pumped to the CGTF since May 2002. No extraction well was installed at Site WP-23. Treated groundwater was discharged to the sanitary sewer and then to the City of Enid, Publicly Owned Treatment Works, until 2014.

In 2014, the ST-12 remedy was changed to injection of emulsified vegetable oil creating conditions conducive to enhanced reductive dechlorination (ERD) in areas of elevated concentrations (i.e., hot spots) in the shallow, intermediate, and deep zones to reduce contaminant mass and mass flux. The remedy also has flow-through biobarrier walls to treat the down-gradient portions of the plume.

In addition to the ERD, the current groundwater extraction system was retrofitted as a soil vapor extraction (SVE) system to efficiently reduce contaminant mass in the subsurface by volatilizing VOCs in the vadose and “smear” zone soils. The system also created a negative pressure beneath building 192 that mitigates/prevents soil vapors from entering the building through the sub-slab foundation. The use of the SVE was discontinued in 2016 due to loss mass removal rates and no significant methane concentrations being extracted by the system.

The existence of three water-bearing zones in the CMI area was determined by the RCRA Facility Investigation in 1998. These zones are referred to as the shallow, intermediate, and deep transmissive zones. The shallow transmissive zone occupies the lower portion of the unconsolidated overburden and the upper portion of the underlying weathered bedrock. It is the broadest of the three zones, averaging 15 to 20 feet thick. The direction of groundwater

migration, as inferred from the potentiometric surface map, is generally from south to north. The intermediate transmissive zone is similar to the shallow transmissive zone in orientation, elevation and inferred flow direction. The deep transmissive zone is the thinnest of the three units, averaging 5 to 7 feet thick. The orientation of the potentiometric surface of the deep transmissive zone is different. It exhibits high elevations and steep slopes beneath the western portion of the area and much lower elevations and a virtually flat gradient beneath the eastern portion of the CMI area. The difference in water level elevation between the two domains is a great as 25 feet. The inferred flow directions, for potential contaminant migration is from Site ST-12 and WP-23 from the southern portion of Site SS-24 into Site SS-25 and the eastern portion of Site SS-24. The groundwater flow velocities calculated for the shallow transmissive zone in 2004 were 40.29 ft/yr and 54.36 ft/yr respectively for May and November 2004 water level measurements. Potentiometric surface maps of the shallow transmissive zone continues to be to the north-northeast.

2.2 Monitoring Well Network

The compliance monitoring well network for Site ST-12 and the other sites in the CMI area consists of 13 monitoring wells. There are five monitoring wells screened in the shallow transmissive zone (10 to 30 feet below ground level [bgl]), five monitoring wells screened in the intermediate transmissive zone (35 to 50 feet bgl), and three monitoring wells screened in the deep transmissive zone (55 to 75 feet bgl). Multiple investigations at this Site found the contamination to not be from historical activities at Site WP-23 and therefore would be addressed under Site ST-12. As a result, the monitoring well network has been realigned such that all monitoring wells used to monitor groundwater contamination originating from Site ST-12 have been moved under the Site ST-12 heading regardless of previous well designation. To keep the integrity of the historical data intact, the individual monitoring well names will not change.

2.3 Evaluation Procedures

All compliance monitoring well samples are taken semi-annually in the spring and fall. During each sampling event, wells are purged and sampled according to the Sampling and Analysis Plan (SAP) provided in Attachment 4 to this Permit, and updated in 2018.

2.4 Types of Laboratory Analysis

Groundwater is sampled for volatile organic compounds, RCRA metals and semi-volatile organic compounds. Methods and procedures are outlined in detail in the SAP provided in Attachment 4 to this Permit, and updated in 2018.

3.0 INSPECTION AND MAINTENANCE ACTIVITIES

Throughout the post-closure care period, the integrity and effectiveness of the corrective action will be monitored and maintained. Inspection and maintenance activities for the Site ST-12 remedial infrastructure, gathering system, monitoring well equipment, and surveyed benchmarks are listed in Figure 3-1. Monitoring wells/equipment are inspected annually and the remedial infrastructure are checked monthly or on an as needed basis depending on the level of remediation occurring at the site.

The appropriateness and effectiveness of the corrective action will be evaluated every five years and modified throughout the post-closure care period as required.

Records of all maintenance and repair activities conducted during the post-closure car period will be kept at the facility.

4.0 POST-CLOSURE CARE IMPLEMENTATION AND DURATION

4.1 Point of Contact

A copy of the approved Post-Closure plan will be kept at the facility throughout the post-closure car period. The current point of contact at the facility for matters concerning the post-closure care of the site is as follows:

Ms. Marilyn Wells, Remedial Project Manager
140 Channel Street, Suite #102
Vance AFB, OK 73705-5610
(580) 213 - 6303

In addition, the facility contact would be responsible for updating the post-closure plan as needed and ensuring that Oklahoma DEQ copies are kept current.

If operations at Vance AFB were to cease before the end of the post-closure period, another contact point will be provided to DEQ 180 days prior to operations ceasing at Vance.

4.2 Site Security

Vance AFB is a Department of Defense facility with restricted access to the property. Vance AFB is fences, secured, and patrolled by security personnel 24 hours a day. The ongoing security program includes daily inspection of all perimeter fences and gates for damage caused by intruders, accidents, or natural events. Damaged fencing is repaired or replaces as soon as practically possible.

4.3 Duration of Post-Closure Care Period

The post-closure care period will be 30 years from the date of final closure of the PSET which was November 18, 2002. In a letter from Oklahoma DQ the implementation of the corrective was approved.

4.4 Modification of Post-closure Care Period

The Oklahoma DEQ Administrative Authority may shorten or lengthen the post-closure care period applicable to the hazardous waste management unit, or facility in accordance with 40 CFR 264.117(a)(2)(i) and (ii).

Vance AFB may submit a written notification or request to the Oklahoma DEQ Administrative Authority for a permit modification to amend the post-closure plan at any time during the active life of the facility or during the post-closure care period in accordance with 40 CFR 264.118(d)(1) and (2).

5.0 POST-CLOSURE CARE DOCUMENTATION AND CERTIFICATION

5.1 Post-Closure Documentation

The post-closure documentation to be retained by the designated point of contact specified in Section 4.1 will include the following items:

- Groundwater monitoring records of sampling, analyses and results
- Copies of the all approved Post-Closure Plans and modifications used during the post-closure car period
- Copies of any field notes, site photographs, survey data, or field reports that have been generated during the semi-annual/monthly inspection activities
- Records of all maintenance and repair activities conducted at the site during the post-closure care period

5.2 Post-Closure Certification

Inspections, to be conducted throughout the 30-year post-closure care period, will result in information associate with over 30 inspections. Copies of all the post-closure documentation items listed in Section 5.1 will be made available for review.

Upon completion of the post-closure care period, an independent professional engineer registered in Oklahoma and a Vance AFB official will certify that the post-closure care activities have been conducted in accordance with the approved Post-Closure Plan and any approved modifications to the plan.

Certification documents will be submitted to the Oklahoma DEQ Administrative Authority within 60 days of completion of the established post-closure car period. When Vance AFB submits the certification documents, it will request that DEQ confirm the end of the post-closure care period for the PSET.

6.0 REFERENCES

AECOM, 2014, Draft Final Remedial Design/Corrective Measures Implementation Plan for ST-12, Vance AFB, Oklahoma, January

Title 40 CFR Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal

Title 40 CFR Part 270, Hazardous Waste Permit Program

Vance AFB, 1996 Post-closure Permit for Hazardous Waste Landfill Units and all subsequent modifications

Vance AFB, 1990 Approved Closure Plan, UST No. 106 at Building 106 (IRP Site ST-08) and all subsequent modifications

Vance AFB, 1990 Approved Post-Closure Plan, UST No. 106 at Building 106 (IRP Site ST-08) and all subsequent modifications

Vance AFB, RCRA Facility Investigation, IRP Sites ST-12, WP-23, SS-24 and SS-25, December 4, 1998

Vance AFB, Corrective Measures Study, IRP Sites ST-12, WP-23, SS-24 and SS-25, April 28, 2000

Vance AFB, Corrective Measures Implementation, IRP Sites ST-12, WP-23, Ss-24 and S-25, October 18, 2002

Figure 1-1 Location Map

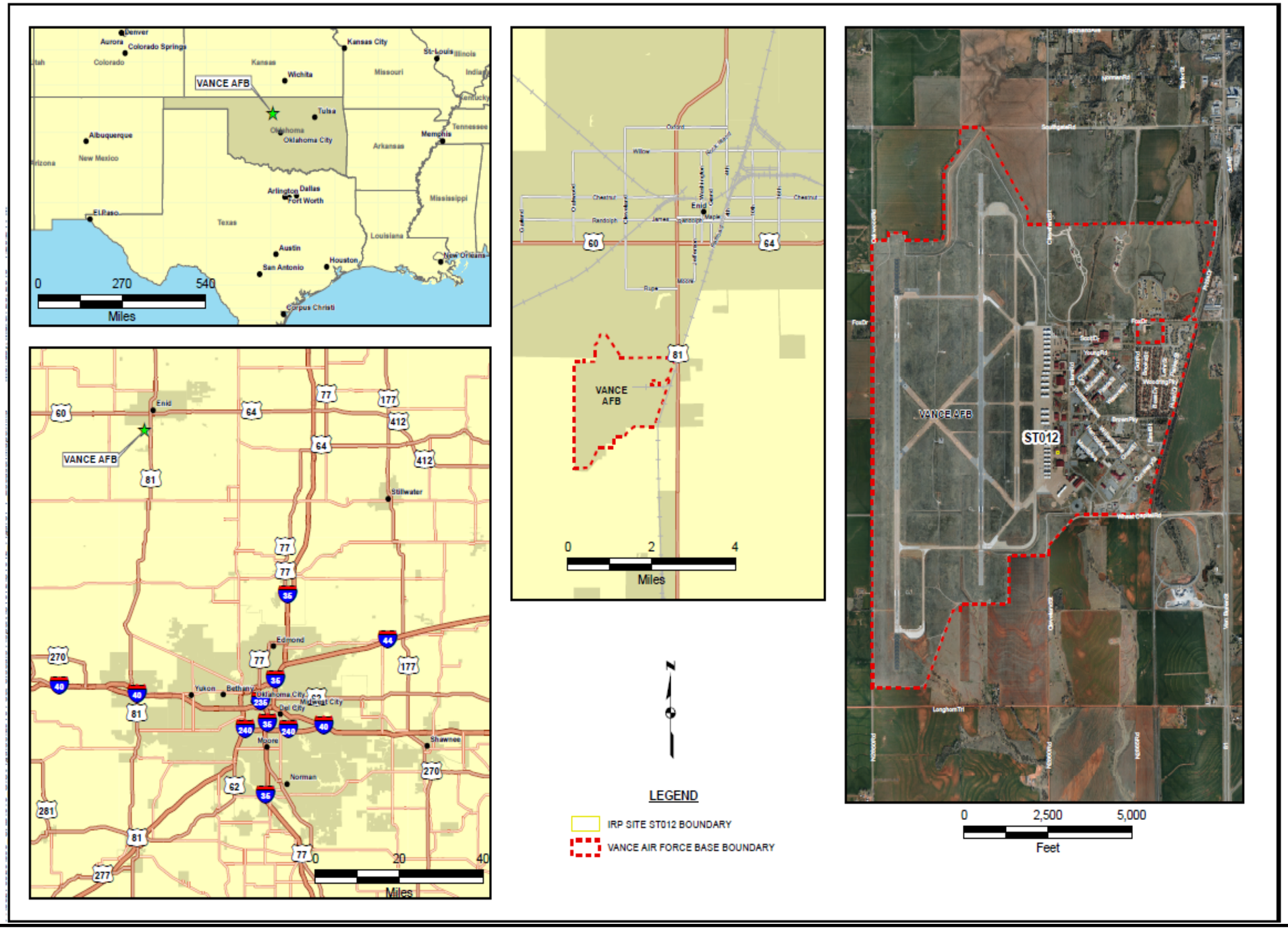

Figure 1-2 Site ST-12 Location

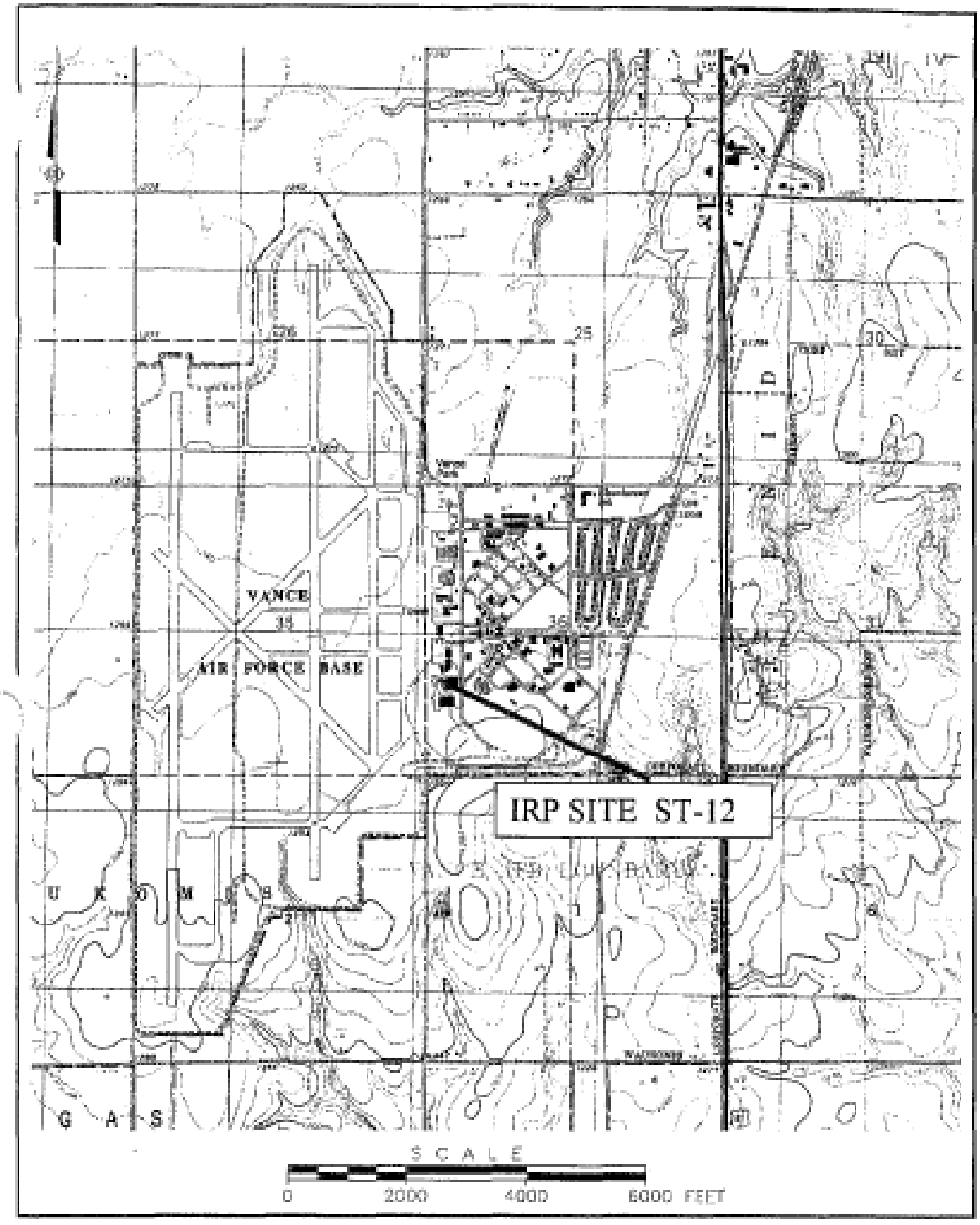

Figure 1-2 IRP Site 12 Location Map

Figure 1-3 Geologic Cross Section

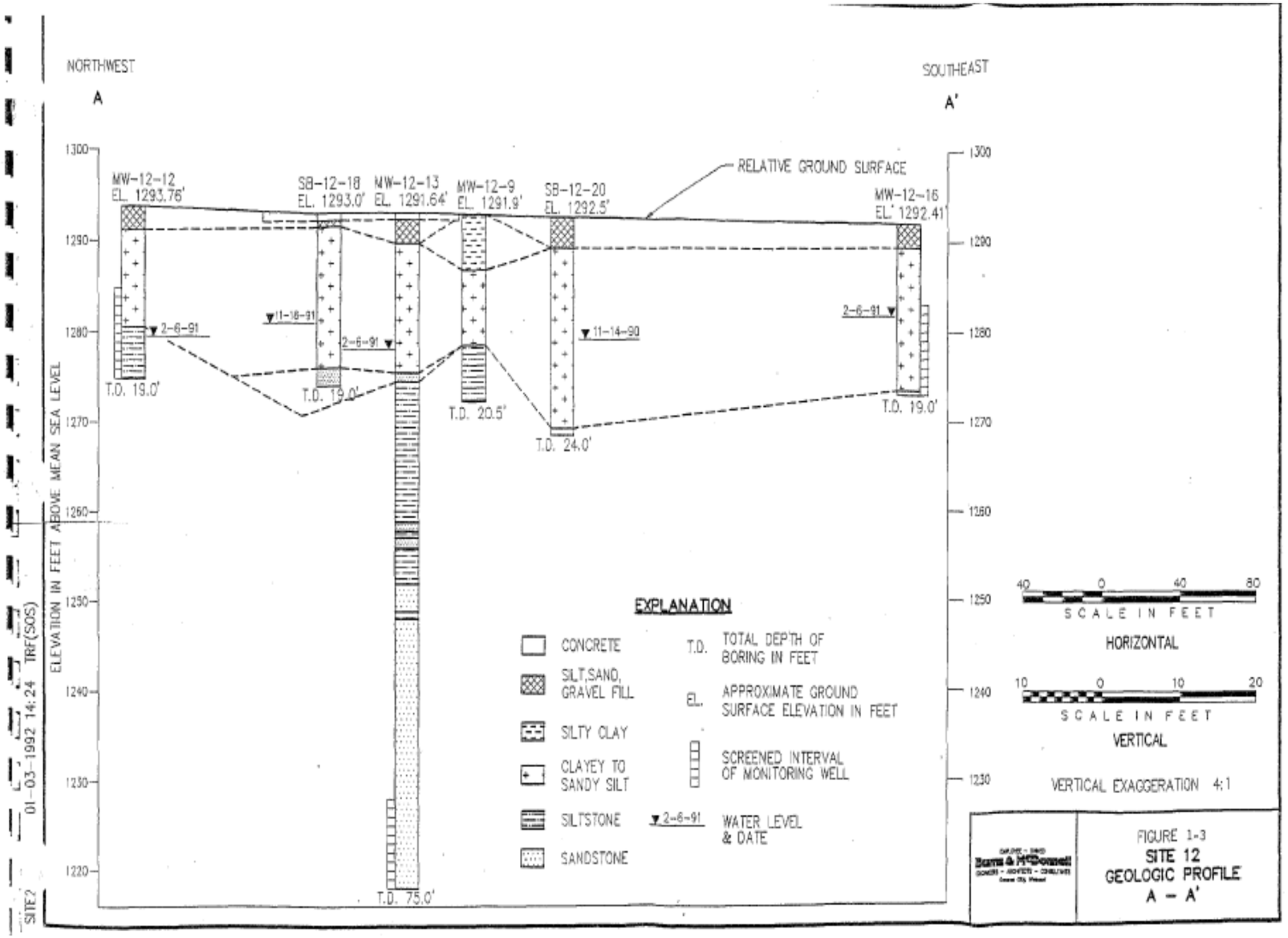

Figure 1-4 Potentiometric Map (1990)

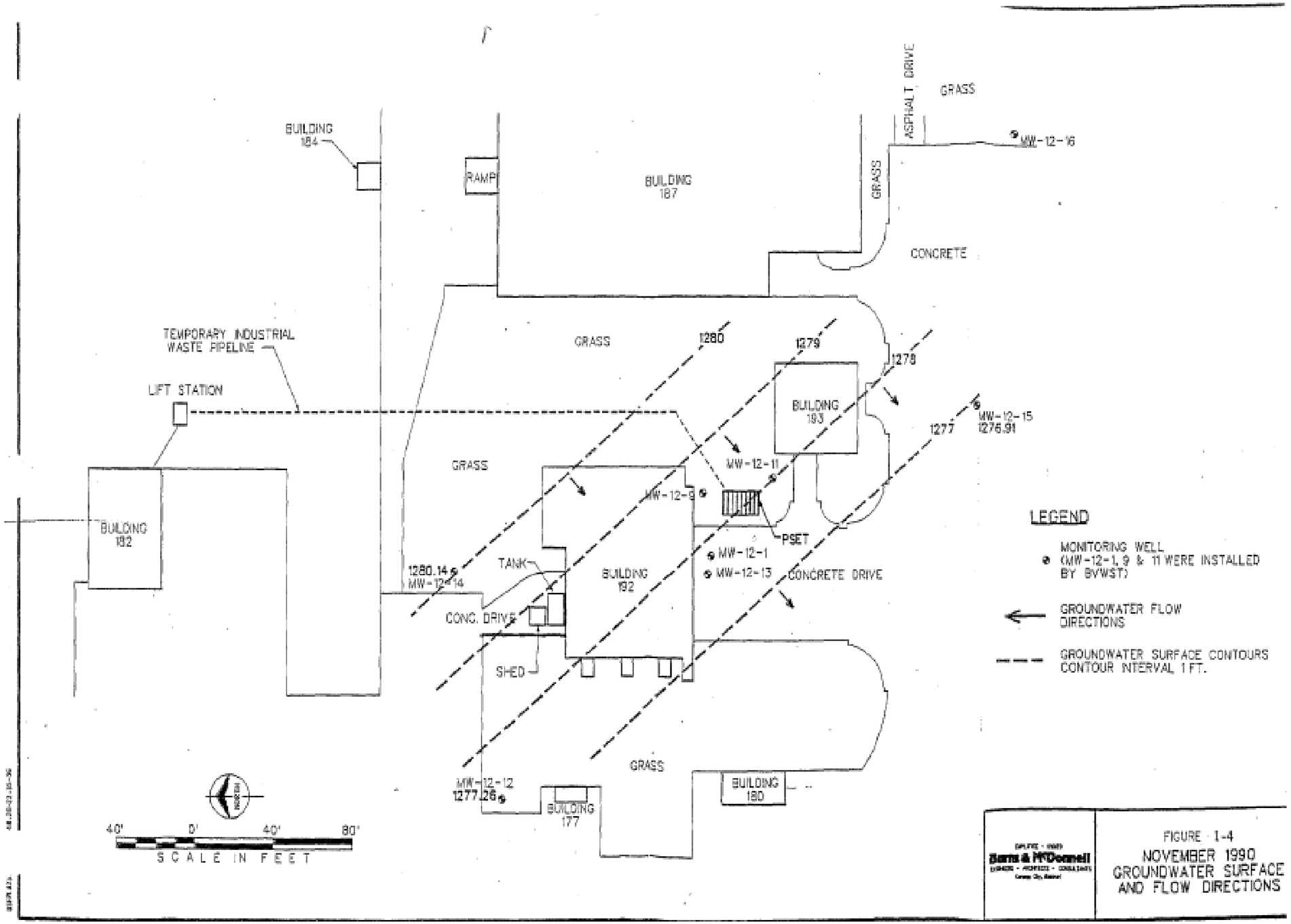

Figure 1-5 Potentiometric Map (2017)

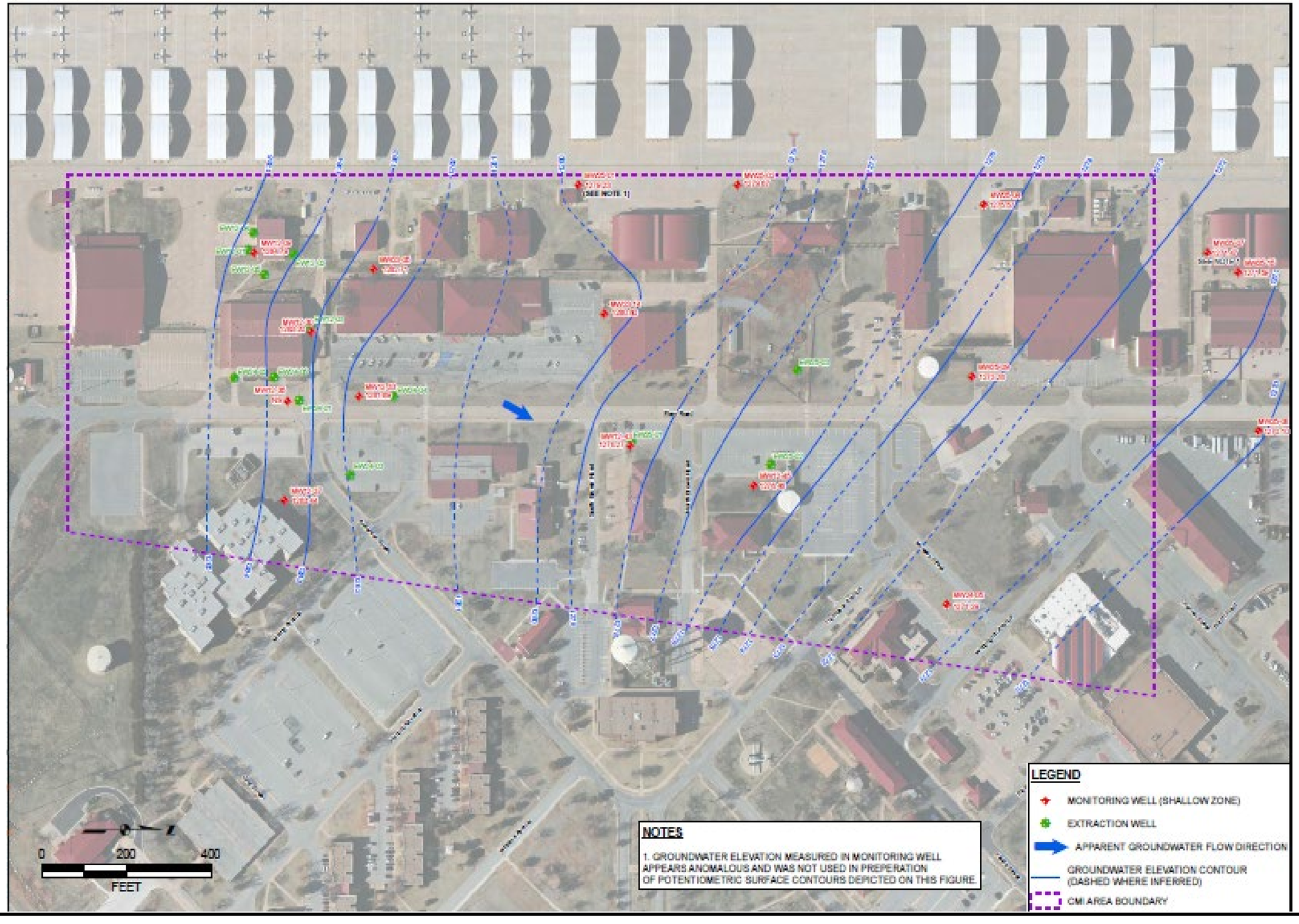

Figure 2-1

COMPLIANCE MONITORING WELL NETWORK
SITE ST-12

The following monitoring wells are sampled as shown:

Well ID	Well Type
Site ST-12	
12-09	Shallow
12-13	Deep
12-20	Deep
12-21	Deep
12-30	Intermediate
12-34	Intermediate
12-38	Intermediate
23-05	Shallow
23-21	Intermediate
23-22	Intermediate
25-01	Shallow
25-02	Shallow
25-04	Shallow

Wells sampled for volatile organic compounds and semi-volatile organic compounds semi-annually in accordance with the SAP

Figure 3-1

INSPECTION AND MAINTENANCE ACTIVITIES

Item	Potential problems	Maintenance Response
Gathering System	Pipes Clogged	Repair or Replace Equipment Remove Sediment
SVE and Injection Wells	Broken Risers well covers	Repair or Replace Equipment
Monitoring Well Equipment	Broken Risers	Repair or Replace
	Tampered, Broken or Stolen Locks	Replace Locks
	Broken, Stolen or Lost Bailers	Replace Dedicated Bailers
	Minimal or no Recovery of Samples	Replace Monitoring Well
	Damaged Well Cap/Casing	Replace Well Cap or Mon. Well
Surveyed Benchmarks	Physical Damage	Establish Substitute Benchmark(s)
	Severe Weathering	Establish Substitute Benchmark(s)
	Evidence of Tampering	Establish Substitute Benchmark(s)
	Physically Obstructed	Uncover and Provide Protection

Note: Vance AFB's perimeter fence is routinely inspected and repaired as necessary

VANCE AIR FORCE BASE
RCRA POST-CLOSURE CARE PERMIT RENEWAL APPLICATION

ATTACHMENT 3

GROUNDWATER AND SURFACE WATER/SEDIMENT MONITORING INFORMATION

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Summary of Groundwater and Surface Water/Sediment Monitoring Information at Vance AFB

Area	AF EESOH-MIS Site ID	RFI/ Permit Site ID	Description	MW/ Surface Water/ Sediment ID	Well Zone	Monitoring Frequency	Contaminant Analytes
CMI Area	ST012	ST-12	Paint Stripping Equalization Tank	12-09	Shallow	Annual	VOCs
				12-13	Deep	Annual	
				12-20	Deep	Annual	
				12-21	Deep	Annual	
				12-30	Intermediate	Annual	
				12-34	Intermediate	Annual	
				12-38	Intermediate	Annual	
				23-05	Shallow	Annual	
				23-21	Intermediate	Annual	
				23-22	Intermediate	Annual	
				25-01	Shallow	Annual	
				25-02	Shallow	Annual	
				25-04	Shallow	Annual	
	SS024	SS-24	Jet Engine Cleaning Shop	12-33	Shallow	Annual	VOCs; 1,4 dioxane for 12-33 only
				12-35	Shallow	Annual	
				12-37	Shallow	Annual	
	SS025	SS-25	COMBS Warehouse	25-07	Shallow	Annual	VOCs; 1,4 dioxane for 25-07 only
				12-43	Shallow	Annual	
				12-45	Shallow	Annual	
				23-14	Shallow	Annual	
				24-05	Shallow	Annual	

Summary of Groundwater and Surface Water/Sediment Monitoring Information at Vance AFB, continued

Area	AF EESOH-MIS Site ID	RFI/ Permit Site ID	Description	MW/ Surface Water/ Sediment ID	Well Zone	Monitoring Frequency	Contaminant Analytes
IZ	LF003	LF-03	Tank Farm Landfill	3-07	Deep	Quinquennial	BTEX, arsenic, lead
				3-09	Shallow	Annual	
				OB-02	Shallow	Annual	
				7-15	Shallow	Annual	
	SS007	SS-07	Hazardous Waste Accumulation Point	7-04	Shallow	Annual	VOCs, arsenic, lead
				7-07	Deep	Quinquennial	
				OB-04	Shallow	Annual	
				OB-05	Shallow	Annual	
				OB-06	Shallow	Annual	
				OB-09	Shallow	Quinquennial	
				OB-13	Shallow	Annual	
				OB-16	Shallow	Annual	
				OB-18	Shallow	Annual	
				OB-19	Shallow	Annual	
				OB-21	Shallow	Annual	
				N7-38	Intermediate	Annual	
				N7-41	Shallow	Annual	
				N7-48	Intermediate	Annual	
				N7-50	Intermediate	Annual	
				N7-51	Deep	Quinquennial	
				N7-52	Intermediate	Annual	
				N7-53	Deep	Quinquennial	
				SW/SD07-9	Surface Water/Sediment	Annual	VOCs, RCRA 8 metals
				SW/SD07-10	Surface Water/Sediment	Annual	
	ST008	ST-08	UST No. 106 at Building 110	8-05	Shallow	Annual	VOCs, arsenic
				8-09	Shallow	Annual	
	ST011	ST-11	Aqua/Avgas Storage and Distribution System	11-01	Shallow	Annual	VOCs, RCRA 8 metals
				11-03	Shallow	Annual	
				11-08	Shallow	Annual	
				11-09	Shallow	Annual	
				11-11	Intermediate	Annual	

Summary of Groundwater and Surface Water/Sediment Monitoring Information at Vance AFB, continued

Area	AF EESOH-MIS Site ID	RFI/ Permit Site ID	Description	MW/ Surface Water/ Sediment ID	Well Zone	Monitoring Frequency	Contaminant Analytes
IZ (cont.)	SS026	ST-26	Jet Fuel Storage Area	26-01	Shallow	Annual	VOCs, OK-GRO
				26-02	Intermediate	Annual	
				26-03	Shallow	Annual	
				26-04	Shallow	Annual	
	SS028	SS-28	Solvent Spill Site	8-18	Intermediate	Annual	VOCs, RCRA 8 metals
				28-01	Intermediate	Annual	
				28-03	Intermediate	Annual	
				28-04	Intermediate	Annual	
				28-05	Intermediate	Annual	
				28-06	Intermediate	Annual	
South Boundary Area Sites	FT002	FT-02	Fire Training Area	2-04	Shallow	Annual	TPH, VOCs, selenium
				2-05	Shallow	Annual	
	DP005	DP-05	Sludge Disposal Area	5-01	Shallow	Annual	TPH, VOCs, arsenic; 1,4 dioxane for 5-04 only
				5-03	Shallow	Annual	
				5-04	Shallow	Annual	
				5-06	Shallow	Annual	
				5-07	Shallow	Annual	
				5-08	Shallow	Annual	
				5-09	Deep	Annual	
				5-18	Intermediate	Annual	
				5-19	Shallow	Annual	
				SW/SD05-13	Surface Water/Sediment	Annual	VOCs, SVOCs, TPH/GRO-DRO, RCRA 8 metals
				SW/SD05-14	Surface Water/Sediment	Annual	

Notes:
AF – Air Force
BTEX – benzene, toluene, ethylbenzene and xylenes
EESOH-MIS – Enterprise Environmental, Safety and Occupational Health-Management Information System
DRO – diesel range organics
GRO – gasoline range organics
ID – identification
MW – monitoring wells
RCRA – Resource Conservation and Recovery Act
RFI – RCRA Facility Investigation
SVOC – semi-volatile organic compounds
TBD – to be determined based on the results of supplement RFIs
TPH – total petroleum hydrocarbons
VOC – volatile organic compounds

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VANCE AIR FORCE BASE
RCRA POST-CLOSURE CARE PERMIT RENEWAL APPLICATION

ATTACHMENT 4

GROUNDWATER MONITORING DATA

(excerpt from *2018 Annual Performance Monitoring Report, Vance AFB, Oklahoma*)

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CMI Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
SS024	MW24-05	Shallow	Acetone	14,000 *	< 5	NS	5.6 F	NS	< 5	NS	4.6 F	NS	< 1 UJ	NS
			Carbon Tetrachloride	5	< 0.5	NS	< 0.5	NS	0.284 F	NS	0.25 F	NS	< 0.5 UJ	NS
			Chloroform	80	0.325 F	NS	0.207 F	NS	0.354 F	NS	0.194 F	NS	< 0.5 UJ	NS
			Trichloroethene (TCE)	5	4.3	NS	3.57	NS	4.92	NS	4.8	NS	4.06 J	NS
SS025	MW25-01	Shallow	1,2-Dichloroethane	5	0.625 F	NS	0.717 F	NS	0.586 F	NS	0.587 F	NS	0.612 F	NS
			Chloroform	80	0.257 F	NS	0.36 F	NS	0.381 F	NS	0.184 F	NS	0.388 F	NS
			cis-1,2-Dichloroethene	70	1.34	NS	1.71	NS	1.44	NS	1.3	NS	1.13	NS
			Trichloroethene (TCE)	5	**11.2**	NS	**13.8**	NS	**16.1**	NS	**18**	NS	**25.1**	NS
	MW25-02	Shallow	Acetone	14,000 *	< 5 UJ	NS	< 5	NS	3.69 F	NS	< 5	NS	< 5 UJ	NS
			Tetrachloroethene (PCE)	5	0.483 F	NS	0.44 F	NS	0.375 F	NS	0.395 F	NS	< 0.5 UJ	NS
			Trichloroethene (TCE)	5	**7.93**	NS	**14.3**	NS	**7.84**	NS	**7.09**	NS	< 0.5 UJ	NS
	MW25-04	Shallow	Carbon Tetrachloride	5	**16.1**	NS	2.1	NS	**5.24**	NS	4.11	NS	2.73	NS
			Chloroform	80	7.21	NS	0.913	NS	2.36	NS	1.49	NS	0.531	NS
			Trichloroethene (TCE)	5	**6.95**	NS	1.97	NS	2.65	NS	2.65	NS	2.1 J	NS
	MW25-07	Shallow	1,1-Dichloroethene	7	5.98	NS	1.71 F	NS	3.45	NS	3.83	NS	2.75	NS
			cis-1,2-Dichloroethene	70	3.15	NS	0.967 F	NS	2.22	NS	1.99	NS	1.47	NS
			Trichloroethene (TCE)	5	1.52	NS	0.545 F	NS	0.932 F	NS	0.919 F	NS	0.909 F	NS
	MW25-08	Shallow	Acetone	14,000 *	< 5 UJ	NS	< 5	NS	< 5	NS	3.06 F	NS	< 5	NS
			Carbon Tetrachloride	5	0.554 F	NS	0.559 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
			Chloroform	80	0.348 F	NS	0.326 F	NS	< 0.25	NS	< 0.25	NS	< 0.25	NS
			Trichloroethene (TCE)	5	1.62	NS	2.51	NS	1.27	NS	0.661 F	NS	1.25	NS
	MW25-09	Shallow	Acetone	14,000 *	< 5	NS	2.87 F	NS	< 5	NS	< 5 UJ	NS	< 5	NS
			Bromodichloromethane	80	2.18	NS	0.265 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
			Chloroform	80	1.78	NS	1.56	NS	0.332 F	NS	0.188 F	NS	< 0.5	NS
			Trichloroethene (TCE)	5	1.04	NS	1.55	NS	1.99	NS	2.61	NS	3.17	NS

CMI Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
SS025	MW25-15	Shallow	1,1-Dichloroethene	7	2.25	NS	1.65 F	NS	0.992 F	NS	0.981 F	NS	0.881 F	NS
			Chloroform	80	< 0.25	NS	0.127 F	NS	< 0.25	NS	< 0.25	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	1.04	NS	0.897 F	NS	0.594 F	NS	0.535 F	NS	0.468 F	NS
			Trichloroethene (TCE)	5	0.518 F	NS	0.534 F	NS	0.272 F	NS	< 0.5	NS	0.281 F	NS
ST012	MW12-09	Shallow	1,1-Dichloroethane	28 *	5.34 F	NS	0.485 F	NS	3.5	NS	2.53	NS	2.79	NS
			1,1-Dichloroethene	7	< 20	NS	< 1	NS	2.02 F	NS	< 5	NS	2.13	NS
			2-Butanone (MEK)	5600 *	< 100	NS	3.22 F	NS	< 12.5	NS	< 25	NS	< 5	NS
			Acetone	14,000 *	< 100	NS	6.98 F	NS	< 12.5	NS	20.9 F	NS	3.59 F	NS
			Benzene	5	< 5	NS	< 0.25	NS	< 0.626	NS	1.15 F	NS	< 0.25	NS
			Chlorobenzene	100	< 5	NS	< 0.25	NS	< 0.626	NS	< 1.25	NS	0.269 F	NS
			cis-1,2-Dichloroethene	70	**926**	NS	**175**	NS	**617**	NS	**320**	NS	**456**	NS
			Ethylbenzene	700	< 10	NS	< 0.5	NS	0.76 F	NS	1.33 F	NS	1.8	NS
			m- & p-Xylenes	10,000	< 20	NS	0.723 F	NS	< 2.5	NS	5.15 F	NS	2.65	NS
			Methylene Chloride	5	< 10	NS	< 0.5	NS	1.63 F	NS	< 2.5	NS	**24.4**	NS
			n-Propylbenzene	660 *	2.69 F	NS	NS	NS	NS	NS	NS	NS	NS	NS
			o-Xylene	10,000	< 10	NS	1.02	NS	3.19	NS	6.86	NS	10.7	NS
			Tetrachloroethene (PCE)	5	**1560**	NS	**18.4**	NS	**54.3**	NS	3.53 F	NS	**71.6**	NS
			Toluene	1000	< 10	NS	0.42 F	NS	3.2	NS	4.11 F	NS	5.08	NS
			trans-1,2-Dichloroethene	100	< 10	NS	< 0.5	NS	2.04 F	NS	2.04 F	NS	3.9	NS
			Trichloroethene (TCE)	5	**717**	NS	4.35	NS	**56.2**	NS	1.31 F	NS	**142**	NS
			Vinyl Chloride	2	< 10	NS	**30.7**	NS	**165**	NS	**583**	NS	**528**	NS
	MW12-33 [2]	Shallow	1,1-Dichloroethane	28 *	1.16	NS	0.503	NS	NS	< 0.25	1.7	NS	1.62 F	NS
			1,1-Dichloroethene	7	5.3	NS	3.27	NS	NS	< 1	**10.2**	NS	**8.76**	NS
			1,2-Dichloroethane	5	< 0.5	NS	< 0.5	NS	NS	< 0.5	0.576 F	NS	< 1	NS
			Acetone	14,000 *	< 5 UJ	NS	< 5	NS	NS	< 5	3.49 F	NS	< 2	NS
			Chloroform	80	0.287 F	NS	< 0.25	NS	NS	< 0.25	< 0.25	NS	< 1	NS
			cis-1,2-Dichloroethene	70	13.7	NS	**148**	NS	NS	12.2	**249**	NS	**266**	NS
			Tetrachloroethene (PCE)	5	**6.1**	NS	< 0.5	NS	NS	< 0.5	< 0.5	NS	< 1	NS
			Toluene	1000	< 0.5	NS	< 0.5	NS	NS	< 0.5	0.537 F	NS	< 1	NS
			trans-1,2-Dichloroethene	100	0.503 F	NS	0.322 F	NS	NS	< 0.5	1.39	NS	< 1	NS
			Trichloroethene (TCE)	5	**422**	NS	**11.9**	NS	NS	0.57 F	**68.2**	NS	**25.5**	NS
			Vinyl Chloride	2	< 0.5	NS	< 0.5	NS	NS	0.411 F	**105**	NS	**108**	NS

CMI Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
ST012	MW12-35 [2]	Shallow	1,1-Dichloroethene	7	0.862 F	NS	NS	NS	NS	< 100 UJ	NS	< 100	< 2.5	NS
			2-Butanone (MEK)	5600 *	< 5	NS	NS	NS	NS	497 F	NS	503 F	497	NS
			4-Methyl-2-Pentanone	6300 *	< 5	NS	NS	NS	NS	< 500 UJ	NS	< 500	62.4	NS
			Acetone	14,000 *	< 5	NS	NS	NS	NS	< 500 UJ	NS	729 F	462	NS
			Chloroform	80	1.17 J	NS	NS	NS	NS	< 25 UJ	NS	< 25	< 2.5	NS
			cis-1,2-Dichloroethene	70	4.96	NS	NS	NS	NS	39.7 F	NS	**76.8 F**	51	NS
			Naphthalene	1.7 *	< 5 UJ	NS	NS	NS	NS	< 1600	NS	**42.3 F**	**28.5**	NS
			Tetrachloroethene (PCE)	5	2.66	NS	NS	NS	NS	< 50 UJ	NS	< 50	< 2.5	NS
			Trichloroethene (TCE)	5	**584**	NS	NS	NS	NS	**134 J**	NS	**27.7 F**	**23.8**	NS
			Vinyl Chloride	2	< 0.5 UJ	NS	NS	NS	NS	<50 UJ	NS	< 50	**42.4**	NS
	MW12-37	Shallow	Acetone	14,000 *	< 5	NS	7.56 F	NS	< 5 UJ	NS	< 5	NS	< 5	NS
			Chloroform	80	0.993	NS	1.09	NS	0.877	NS	0.584	NS	0.756	NS
			Trichloroethene (TCE)	5	1.65	NS	**11.4**	NS	3.01	NS	1.35	NS	3.38	NS
	MW12-43	Shallow	1,1-Dichloroethene	7	0.652 F	NS	< 1	NS	< 1	NS	< 1 UJ	NS	< 1	NS
			Acetone	14,000 *	< 5 UJ	NS	< 5	NS	< 5	NS	3.23 F	NS	< 5	NS
			Chloroform	80	0.6 J	NS	< 0.25	NS	< 0.25	NS	< 0.25 UJ	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	2.24 J	NS	< 0.5	NS	8.57	NS	10.8 J	NS	29.2	NS
			Styrene	100	0.384 B	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Tetrachloroethene (PCE)	5	0.687 F	NS	< 0.5	NS	< 0.5	NS	< 0.5 UJ	NS	< 0.5	NS
			trans-1,2-Dichloroethene	100	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.644 F	NS	1.3	NS
			Trichloroethene (TCE)	5	**103 J**	NS	2.06	NS	3.03	NS	**14 J**	NS	1.34	NS
	MW12-45	Shallow	Acetone	14,000 *	2.81 F	NS	< 25	NS	< 12.5 UJ	NS	< 10	NS	< 1	NS
			Carbon Disulfide	810 *	0.606 F	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Chloroform	80	2.35 J	NS	1.89 F	NS	0.502 F	NS	< 0.5	NS	< 0.5	NS
			cis-1,2-Dichloroethene	70	8.85	NS	**77.8**	NS	**197**	NS	**217**	NS	7.63	NS
			Tetrachloroethene (PCE)	5	0.613 F	NS	< 2.5	NS	< 1.25	NS	< 1	NS	< 0.5	NS
			trans-1,2-Dichloroethene	100	1.16	NS	12.2	NS	**109**	NS	**116**	NS	1.51	NS
			Trichloroethene (TCE)	5	**983**	NS	**1040**	NS	**380**	NS	**20**	NS	**7.18**	NS
			Vinyl Chloride	2	< 0.5 UJ	NS	< 2.5	NS	0.695 F	NS	1.51 F	NS	**2.71**	NS

CMI Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
WP023	MW23-05	Shallow	1,1-Dichloroethane	28 *	< 0.25	NS	0.238 F	NS	0.217 F	NS	< 0.25	NS	0.842	NS
			1,1-Dichloroethene	7	< 1	NS	< 1	NS	< 1	NS	< 1	NS	2.69	NS
			1,2-Dichlorobenzene	600	3.36	NS	5.2	NS	4.61	NS	2.93	NS	4.9	NS
			1,4-Dichlorobenzene	75	0.27 F	NS	0.6	NS	0.581	NS	0.357 F	NS	0.677	NS
			Benzene	5	0.757	NS	2.25	NS	2.11	NS	1.55	NS	2.71	NS
			Chlorobenzene	100	< 0.25	NS	0.177 F	NS	0.169 F	NS	< 0.25	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	0.36 F	NS	1.79	NS	3.36	NS	1.24	NS	58.9	NS
			Ethylbenzene	700	< 0.5	NS	3.5	NS	0.605 F	NS	0.336 F	NS	30.2	NS
			m- & p-Xylene	10,000	< 1	NS	2.19	NS	< 1	NS	< 1	NS	14.9	NS
			o-Xylene	10,000	< 0.5	NS	0.592 F	NS	< 0.5	NS	< 0.5	NS	0.472 F	NS
			Toluene	1000	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.496 F	NS
			trans-1,2-Dichloroethene	100	< 0.5	NS	0.635 F	NS	0.627 F	NS	0.346 F	NS	1.84	NS
			Trichloroethene (TCE)	5	< 0.5	NS	1.15	NS	1.43	NS	< 0.5	NS	4.39	NS
			Vinyl Chloride	2	0.268 F	NS	< 0.5	NS	**2.18**	NS	**3.15**	NS	**7.79**	NS
	MW23-14	Shallow	Acetone	14,000 *	< 5 UJ	NS	< 5	NS	< 5 UJ	NS	3.98 F	NS	< 1	NS
			cis-1,2-Dichloroethene	70	0.338 F	NS	< 0.5	NS	0.536 F	NS	0.486 F	NS	< 0.5	NS
			Trichloroethene (TCE)	5	**7.34**	NS	< 0.5	NS	**16.8**	NS	**15.1**	NS	< 0.5	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05

[2] Wells MW12-33 and MW12-35 were not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. These wells were sampled in September 2016.

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ)

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

CMI Area
Detected VOC Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
ST012	MW12-30	Intermediate	1,1-Dichloroethene	7	4.76	NS	**7.23**	NS	6.84	NS	3.96	NS	3.04	NS
			Acetone	14,000 *	< 5	NS	< 5	NS	< 5	NS	5.71 F	NS	3.74 F	NS
			Chloroform	80	0.24 F	NS	0.434 F	NS	0.381 F	NS	< 0.25	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	0.466 F	NS	0.952 F	NS	29.7	NS	26.2	NS	130	NS
			Trichloroethene (TCE)	5	**128**	NS	**240**	NS	**228**	NS	**105**	NS	**13.1**	NS
	MW12-34	Intermediate	1,1-Dichloroethene	7	< 1	NS	< 1	NS	0.799 F	NS	< 1	NS	< 0.5	NS
			Acetone	14,000 *	< 5	NS	< 5	NS	< 125	NS	15.6	NS	< 1	NS
			Benzene	5	< 0.25	NS	< 0.25	NS	< 0.25	NS	2.4 F	NS	< 0.5	NS
			Chloroform	80	< 0.25	NS	< 0.25	NS	0.191 F	NS	< 0.25	NS	< 0.5	NS
			cis-1,2-Dichloroethene	70	< 0.5	NS	< 0.5	NS	2.31	NS	12.8	NS	18.8	NS
			m- & p-Xylene	10,000	< 1	NS	< 1	NS	< 1	NS	7.99 F	NS	< 0.5	NS
			o-Xylene	10,000	< 0.5	NS	< 0.5	NS	< 0.5	NS	3.59 F	NS	< 0.5	NS
			Tetrachloroethene (PCE)	5	< 0.5	NS	0.266 F	NS	3.75	NS	< 0.5	NS	< 0.5	NS
			Toluene	1000	< 0.5	NS	< 0.5	NS	< 0.5	NS	18.7	NS	< 0.5	NS
			trans-1,2-Dichloroethene	100	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.259 F	NS	< 0.5	NS
			Trichloroethene (TCE)	5	**17.2**	NS	**86.1**	NS	**1130**	NS	**7.73**	NS	**5.32**	NS
			Vinyl Chloride	2	< 0.5 UJ	NS	< 0.5	NS	0.507 F	NS	**187**	NS	**131**	NS
	MW12-38 [2]	Intermediate	Acetone	14,000 *	< 5	NS	< 5	NS	NS	9.29 F	4.58 F	NS	< 5	NS
			Chloroform	80	0.237 F	NS	0.21 F	NS	NS	< 0.25	< 0.25	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	0.654 F	NS	0.556 F	NS	NS	6.31	0.935 F	NS	0.281 F	NS
			Trichloroethene (TCE)	5	**19.1**	NS	**18.3**	NS	NS	0.344 F	0.319 F	NS	< 0.5	NS
WP023	MW23-21	Intermediate	Acetone	14,000 *	< 5 UJ	NS	< 5	NS	< 5	NS	3.83 F	NS	3.59 F	NS
			Chloroform	80	0.147 F	NS	0.225 F	NS	0.285 F	NS	< 0.25	NS	0.28 F	NS
			cis-1,2-Dichloroethene	70	< 0.5	NS	< 0.5	NS	0.27 F	NS	< 0.5	NS	0.499 F	NS
			Tetrachloroethene (PCE)	5	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.297 F	NS
			Trichloroethene (TCE)	5	**12.1**	NS	**20**	NS	**30.2**	NS	**17.3**	NS	**26.1**	NS
	MW23-22	Intermediate	1,1-Dichloroethane	28 *	< 0.25	NS	< 0.25	NS	0.126 F	NS	< 0.25	NS	< 1	NS
			Chloroform	80	< 0.25	NS	< 0.25	NS	0.142 F	NS	< 0.25	NS	0.135 F	NS
			cis-1,2-Dichloroethene	70	1.58	NS	2.63	NS	2.44	NS	1.77	NS	2.13	NS
			Trichloroethene (TCE)	5	4.58	NS	**5.18**	NS	**6.59**	NS	**6.01**	NS	**7.76**	NS

CMI Area
Detected VOC Concentrations in the Intermediate Zone
2014 - 2018

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used. RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

[2] Well MW12-38 was not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. This well was sampled in September 2016.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

CMI Area
Detected VOC Concentrations in the Deep Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Nov-17	Aug-18	Oct-18
ST012	MW12-13	Deep	cis-1,2-Dichloroethene	70	**2760**	NS	**1250**	NS	**1090**	**1240**	NS	**1070**	NS
			Tetrachloroethene (PCE)	5	**15500**	NS	**16800**	NS	**18000**	**8220**	NS	**11000**	NS
			Trichloroethene (TCE)	5	**488**	NS	**392**	NS	**1040**	**536**	NS	**890**	NS
			Vinyl Chloride	2	< 50	NS	**130**	NS	**108**	**39.5 F**	NS	< 50	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-0

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-table

CMI Area
Detected SVOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
SS025	MW25-04	Shallow	bis(2-Ethylhexyl)Phthalate	6	< 6	NS	< 6	NS	< 6.12	NS	< 6.52	NS	**1000**	NS
	MW25-07	Shallow	1,4-Dioxane	4.6 *	**15.4**	NS	**4.77**	NS	3.47 J	NS	**5.71 J**	NS	**6.27**	NS
ST012	MW12-09	Shallow	3- & 4-Methylphenol	-	<5 UJ	NS	2.55 F	NS	< 5 UJ	NS	19.8	NS	< 5.1	NS
			Diethyl Phthalate	15,000 *	4.85 F	NS	<5	NS	< 5 UJ	NS	< 5.1 UJ	NS	< 5.1	NS
	MW12-33 [2]	Shallow	1,4-Dioxane	4.6 *	**11.1**	NS	2.13	NS	NS	NS	**15.2 J**	NS	**16**	NS
	MW12-35 [2]	Shallow	3- & 4-Methylphenol	-	< 5 UJ	NS	NS	NS	NS	< 1600	NS	1930	1710	NS
			bis(2-Ethylhexyl)Phthalate	6	< 6	NS	NS	NS	NS	**1560 F**	NS	**1160**	**207 F**	NS
	MW12-43	Shallow	bis(2-Ethylhexyl)Phthalate	6	< 6.46	NS	< 6	NS	< 6 UJ	NS	< 6	NS	**284**	NS
	MW12-45	Shallow	bis(2-Ethylhexyl)Phthalate	6	< 6 UJ	NS	< 6.32	NS	< 6	NS	5.87 F	NS	< 6.06	NS
WP023	MW23-05	Shallow	1,2-Dichlorobenzene	600	3.36	NS	3.7 F	NS	2.65 F	NS	2.58 F	NS	4.63	NS
			1,4-Dichlorobenzene	75	0.27 F	NS	<5.1	NS	< 5.1 UJ	NS	< 5	NS	<5	NS
	MW23-14	Shallow	bis(2-Ethylhexyl)Phthalate	6	**9.87 B**	NS	**12.8**	NS	< 6.12	NS	< 6	NS	< 6.12	NS

Notes:

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[2] Wells MW12-33 and MW12-35 were not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. These wells were sampled in September 2016. MW12-33 was sampled in September 2016, but 1,4-Dioxane was not analyzed.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

R = The result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

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CMI Area
Detected SVOC Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
ST012	MW12-38 [2]	Intermediate	3- & 4-Methylphenol	-	< 5.56	NS	< 5.1	NS	NS	42.6	< 5	NS	< 5.1	NS
			bis(2-Ethylhexyl)Phthalate	6	**88.1 B**	NS	< 6.12	NS	NS	< 6	< 6	NS	< 6.12	NS
			Phenol	5800 *	NS	NS	< 5.1	NS	NS	3.24 F	< 5	NS	< 5.1	NS
WP023	MW23-22	Intermediate	bis(2-Ethylhexyl)Phthalate	6	< 6	NS	4.5 F	NS	< 6 UJ	NS	< 6.12	NS	< 6.52	NS

Notes:

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RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

[2] Well MW12-38 was not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. This well was sampled in September 2016.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

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CMI Area
Detected SVOC Concentrations in the Deep Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Nov-17	Aug-18	Oct-18
ST012	MW12-13	Deep	Naphthalene	1.7 *	< 5	NS	**2.78 F**	NS	< 5.1 UJ	NS	< 5.44	NS	< 5.26	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Industrial Zone Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
LF003	MW03-06	Shallow	1,1,2-Trichloroethane	5	< 0.5	NS	2.01	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
			1,1-Dichloroethane	28 *	0.755	NS	1	NS	1.07	NS	1.14	NS	1.07	NS
			Acetone	14,000 *	< 5	NS	< 5	NS	< 5	NS	3.67 F	NS	< 5	NS
			Bromodichloromethane	80	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.706 F	NS	< 0.5	NS
			Chloroform	80	< 0.25	NS	< 0.25	NS	0.316 F	NS	0.317 F	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	0.852 F	NS	0.661 F	NS	1.42	NS	0.756 F	NS	< 0.5	NS
			Trichloroethene (TCE)	5	0.524 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
			Vinyl Chloride	2	0.387 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
	MW03-09	Shallow	1,2,4-Trimethylbenzene	56 *	**594 J**	**588**	NS	NS	NS	NS	NS	NS	NS	NS
			1,3,5-Trimethylbenzene	60 *	**320 J**	**279**	NS	NS	NS	NS	NS	NS	NS	NS
			Acetone	14,000 *	< 100	< 100	< 125	NS	28.6 F	< 50	< 50	< 100	< 50	< 100
			Benzene	5	**3190**	**9230**	**1290**	NS	**2010**	**3430**	**2120**	**2610 M**	**8690**	**6240 M**
			Ethylbenzene	700	673	**1870**	194	NS	380	**834**	332	669 M	**1070**	**1190 M**
			Isopropylbenzene	450 *	24.3	38.4	NS	NS	NS	NS	NS	NS	NS	NS
			m- & p-Xylene	10,000	6380	7600	4690	NS	2700	2650	1220	1650 M	2490	2220 M
			Methylene Chloride	5	**6.88 F**	< 10	< 12.5	NS	< 5	< 5	< 5	< 10	< 25	< 10
			n-Propylbenzene	660 *	18.7 J	42.2	NS	NS	NS	NS	NS	NS	NS	NS
			o-Xylene	10,000	1290	1360	279	NS	14.6	15.1	5.07 F	9.15 F	28.3 F	17 F
			Tetrachloroethene (PCE)	5	**26.3 B**	< 10	< 12.5	NS	< 5	< 5	< 5	< 10	< 25	< 10
			Toluene	1000	**1630**	**1020**	32.3	NS	18.2	31.4	16.3	30.5	86.3	73.8
			Trichloroethene (TCE)	5	**21**	< 10	< 12.5	NS	< 5	< 5	< 5	< 10	< 25	< 10

Industrial Zone Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
SS007	MW07-04	Shallow	1,1,2-Trichloroethane	5	< 5	NS	< 12.5	NS	< 0.5	NS	< 0.5	NS	0.717 F	NS
			1,1-Dichloroethene	7	**13.7 F**	NS	**44 F**	NS	5.85	NS	2.3	NS	**16.6**	NS
			2-Butanone (MEK)	5600 *	< 50	NS	< 125	NS	< 5	NS	2.8 F	NS	< 5	NS
			Acetone	14,000 *	< 50	NS	< 125	NS	< 5	NS	5.4 F	NS	< 5	NS
			Benzene	5	1.28 F	NS	< 6.26	NS	< 0.25	NS	< 0.25	NS	< 0.25	NS
			Chloroethane	21,000 *	< 10	NS	< 25	NS	3.23	NS	< 1	NS	< 1	NS
			Chloroform	80	< 2.5	NS	< 6.26	NS	< 0.25	NS	< 0.25	NS	0.222 F	NS
			cis-1,2-Dichloroethene	70	**2680**	NS	**4690**	NS	**135**	NS	**74.1**	NS	**1150**	NS
			m- & p-Xylene	10,000	6.47 F	NS	< 25	NS	< 1	NS	< 1	NS	< 1	NS
			Tetrachloroethene (PCE)	5	**62.8 F**	NS	< 12.5	NS	< 0.5	NS	< 0.5	NS	1.37	NS
			Toluene	1000	2.82 F	NS	< 12.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
			trans-1,2-Dichloroethene	100	16.1	NS	38	NS	1.26	NS	1.41	NS	17.4	NS
			Trichloroethene (TCE)	5	**6.66 F**	NS	**3090**	NS	**19.5**	NS	0.605 F	NS	**1300**	NS
			Vinyl Chloride	2	**3210 J**	NS	**715**	NS	**172**	NS	**32.2**	NS	**191 M**	NS
	MW07-15	Shallow	1,2,4-Trimethylbenzene	56 *	**442 J**	NS	NS	NS	NS	NS	NS	NS	NS	NS
			1,3,5-Trimethylbenzene	60 *	**191 J**	NS	NS	NS	NS	NS	NS	NS	NS	NS
			4-Methyl-2-Pentanone (MIBK)	6300 *	< 500	NS	< 500	NS	< 500	NS	< 250	NS	26.2 F	NS
			Benzene	5	**6690**	NS	**8470**	NS	**8970**	NS	**3190 M**	NS	**6810**	NS
			Ethylbenzene	700	**1470**	NS	**1770**	NS	**2120**	NS	**1450 M**	NS	**1720**	NS
			Isopropylbenzene	450 *	26.4 F	NS	NS	NS	NS	NS	NS	NS	NS	NS
			m- & p-Xylene	10,000	8160	NS	10000	NS	**10400**	NS	5820 M	NS	9270	NS
			Methylene Chloride	5	< 50	NS	**28.8 B**	NS	< 50	NS	< 25	NS	< 20	NS
			n-Propylbenzene	660 *	35.2 F	NS	NS	NS	NS	NS	NS	NS	NS	NS
			o-Xylene	10,000	3570	NS	3870	NS	4130	NS	2360 M	NS	2850	NS
			Tetrachloroethene (PCE)	5	**146 J**	NS	< 50	NS	< 50	NS	< 25	NS	< 20	NS
			Toluene	1000	**18800**	NS	**22100**	NS	**18300**	NS	**3600 M**	NS	**2900**	NS
			Trichloroethene (TCE)	5	**89.1 F**	NS	< 50	NS	< 50	NS	< 25	NS	< 20	NS
	MWN7-40	Shallow	Acetone	14,000 *	< 5	< 5	< 5	NS	< 5	< 5	NS	2.56 F	< 5	< 5
	MWN7-41	Shallow	Trichloroethene (TCE)	5	0.391 B	< 0.5	< 0.5	NS	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5 UJ	< 0.5
	MWN7-69	Shallow	Acetone	14,000 *	< 5	< 5	< 5	NS	2.65 F	< 5 UJ	12.7	< 5	< 5	< 5

Industrial Zone Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
SS007	OB-02	Shallow	1,2,4-Trimethylbenzene	56 *	0.33 F	0.423 F	0.632 F	NS	NS	NS	NS	NS	NS	NS
			Acetone	14,000 *	< 5	< 5	< 5	NS	< 5 UJ	< 5	3.72 F	< 0.5	< 5	< 5
			Benzene	5	**89 M**	**117**	**173 M**	NS	< 0.25 UJ	**5.45**	< 0.25	< 0.25	< 0.25	< 0.25
			Carbon Disulfide	810 *	7.2	< 1	< 1 UJ	NS	NS	NS	NS	NS	NS	NS
			Ethylbenzene	700	< 0.5	0.579 F	1.5	NS	< 0.5 UJ	7.16	< 0.5	< 0.5	< 0.5	< 0.5
			Isopropylbenzene	450 *	7.8	9.85	17.1 M	NS	NS	NS	NS	NS	NS	NS
			m- & p-Xylene	10,000	2.21	2.75	4.88	NS	< 1 UJ	26.7	< 1	< 1	< 1	< 1
			n-Propylbenzene	660 *	8.17	12.5	21.7 M	NS	NS	NS	NS	NS	NS	NS
			o-Xylene	10,000	0.305 F	< 0.5	0.47 F	NS	< 0.5 UJ	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
			Toluene	1000	< 0.5	< 0.5	0.444 F	NS	< 0.5 UJ	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
	OB-03	Shallow	1,1-Dichloroethane	28 *	< 0.25	0.276 F	0.463 F	NS	< 0.25	< 0.25	< 0.25	< 0.25	<0.25 UJ	< 0.25
			2-Butanone (MEK)	5600 *	< 5	< 5	< 5	NS	< 5	< 5	< 5	2.69 F	< 5 UJ	< 5
			Acetone	14,000 *	< 5	< 5	< 5	NS	< 5	< 5	4.57 F	4.91 F	< 5 UJ	< 5
			Benzene	5	< 0.25	0.175 F	0.202 F	NS	4.77	< 0.25	< 0.25	< 0.25	< 0.25 UJ	< 0.25
			Bromodichloromethane	80	< 0.5	< 0.5	< 0.5	NS	2.12	< 0.5	< 0.5	< 0.5	< 0.5 UJ	< 0.5
			Isopropylbenzene	450 *	3.59	5.12	NS	NS	NS	NS	NS	NS	NS	NS
			n-Propylbenzene	660 *	4.18	6.16	NS	NS	NS	NS	NS	NS	NS	NS
			sec-Butylbenzene	2000 *	0.637 F	0.837 F	NS	NS	NS	NS	NS	NS	NS	NS
	OB-04	Shallow	Acetone	14,000 *	NS	NS	2.93 F	NS	2.5 F	< 5	3.6 F	< 5	< 5	< 5
			cis-1,2-Dichloroethene	70	NS	NS	< 0.5	NS	< 0.5	0.322 F	< 0.5	0.335 F	0.878 F	0.507 F
			Trichloroethene (TCE)	5	NS	NS	< 0.5	NS	**5.13**	**26.7**	**7.94**	**16**	**48.1**	**23.4**
	OB-05	Shallow	1,1,2-Trichloroethane	5	0.26 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5 UJ	NS
			1,1-Dichloroethane	28 *	0.216 F	NS	< 0.25	NS	< 0.25	NS	< 0.25	NS	< 0.25 UJ	NS
			Acetone	14,000 *	< 5	NS	7.44 F	NS	< 5	NS	5.2 F	NS	< 5 UJ	NS
			Chloroform	80	0.262 F	NS	0.191 F	NS	< 0.25	NS	< 0.25	NS	< 0.25 UJ	NS
			cis-1,2-Dichloroethene	70	7.51	NS	4.54	NS	0.775 F	NS	< 0.5	NS	1.71 J	NS
			Tetrachloroethene (PCE)	5	2.19 B	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5 UJ	NS
			Trichloroethene (TCE)	5	**269**	NS	**185**	NS	**57.9**	NS	**22.9**	NS	**18.5 J**	NS

Industrial Zone Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
SS007	OB-06	Shallow	Acetone	14,000 *	< 5	NS	< 5	NS	< 5	NS	3.1 F	NS	< 5	NS
			cis-1,2-Dichloroethene	70	< 0.5	NS	0.319 F	NS	0.513 F	NS	0.75 F	NS	9.72	NS
			Trichloroethene (TCE)	5	**18.9 M**	NS	**31.6**	NS	**45.9**	NS	**38.2**	NS	**34.3**	NS
	OB-09	Shallow	Acetone	14,000 *	< 5	< 5	4.07 F	NS	< 5	< 5	3.3 F	< 5	< 5	< 5
	OB-13	Shallow	Acetone	14,000 *	NS	< 5	< 5	NS	< 5	NS	5.06 F	NS	< 5	NS
			cis-1,2-Dichloroethene	70	NS	0.656 F	< 0.5	NS	3.93	NS	11.5	NS	14.5	NS
			trans-1,2-Dichloroethene	100	NS	< 0.5	< 0.5	NS	< 0.5	NS	0.902 F	NS	1.14	NS
			Trichloroethene (TCE)	5	NS	**34.1**	**16.3**	NS	**43.1**	NS	**20.2**	NS	**13.1**	NS
	OB-16	Shallow	Acetone	14,000 *	< 5	NS	< 5	NS	2.77 F	NS	4.75 F	NS	< 5 UJ	NS
			cis-1,2-Dichloroethene	70	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.723 F	NS
			Trichloroethene (TCE)	5	**6.63**	NS	**6.73**	NS	**18.8**	NS	**17**	NS	**23.9 J**	NS
	OB-18	Shallow	Acetone	14,000 *	< 5 UJ	< 5	< 5	NS	< 5 UJ	< 5	2.91 F	2.62 F	< 5	< 5
			Trichloroethene (TCE)	5	< 0.5	0.274 F	< 0.5	NS	< 0.5 UJ	< 0.5	< 0.5	< 0.5	0.51 F	0.755 F
	OB-19	Shallow	Acetone	14,000 *	NS	< 0.5	< 0.5	NS	< 0.5	NS	3.79 F	NS	3.06 F	NS
			Benzene	5	1.32 F	NS	< 0.25	NS	< 0.25	NS	0.197 F	NS	< 0.25 UJ	NS
			Chloroform	80	0.337 F	NS	< 0.25	NS	0.136 B	NS	< 0.25	NS	0.356 F	NS
			Chloromethane	190 *	< 1 UJ	NS	< 1	NS	< 1 UJ	NS	< 1	NS	0.564 F	NS
			cis-1,2-Dichloroethene	70	8.07	NS	0.306 F	NS	0.93 F	NS	0.932 F	NS	2.89 J	NS
			Trichloroethene (TCE)	5	**292**	NS	**49.6**	NS	**83.8 M**	NS	**67.5**	NS	**58.6 J**	NS
	OB-21	Shallow	2-Butanone (MEK)	5600 *	8.22 F	< 5	< 5	NS	< 5	< 5	< 5 UR	< 5	< 5 UJ	< 5
			Acetone	14,000 *	25.1	19.5	12.6	NS	< 5	< 5	5.03 F	3.28 F	< 5 UJ	< 5
			Carbon Disulfide	810 *	3.2	0.534 F	NS	NS	NS	NS	NS	NS	NS	NS
			cis-1,2-Dichloroethene	70	< 0.5	4.45	0.672 F	NS	0.826 F	0.547 F	1 J	2.28	3.39 J	3.92
			Trichloroethene (TCE)	5	3.44	0.935 F	0.679 F	NS	0.813 F	0.449 F	0.435 F	< 0.5	0.307 F	< 0.5

Industrial Zone Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
ST008	MW08-05	Shallow	1,1-Dichloroethane	28 *	6.74	NS	3.87	NS	1.83	NS	1.39	NS	1.69	NS
			1,2-Dichlorobenzene	600	0.655	NS	0.353 F	NS	0.21 F	NS	0.176 F	NS	0.193 F	NS
			Acetone	14,000 *	< 5	NS	< 5	NS	< 5	NS	4.06 F	NS	< 5	NS
			Benzene	5	0.391 F	NS	0.26 F	NS	< 0.25	NS	< 0.25	NS	< 0.25	NS
			Chlorobenzene	100	0.574	NS	0.618	NS	0.933	NS	0.813	NS	1.28	NS
			cis-1,2-Dichloroethene	70	21.6	NS	9.51	NS	3.83	NS	2.74	NS	5.32	NS
			Tetrachloroethene (PCE)	5	1.95 B	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
			Vinyl Chloride	2	**8.71 J**	NS	**3.58**	NS	0.916 F	NS	< 0.5	NS	0.541 F	NS
	MW08-09	Shallow	1,1,2-Trichloroethane	5	< 0.5	NS	**8.46**	NS	< 0.5 UJ	NS	< 0.5	NS	< 0.5 UJ	NS
			1,1,2,2-Tetrachloroethane	0.76 *	< 0.4	NS	NS	NS	**1.54 J**	NS	< 0.5	NS	**2.55 J**	NS
			1,2-Dichlorobenzene	600	< 0.25	NS	< 0.25	NS	< 0.25 UJ	NS	< 0.25	NS	0.135 F	NS
			Acetone	14,000 *	< 5	NS	36.9	NS	< 5 UJ	NS	< 5	NS	< 5 UJ	NS
			Benzene	5	0.164 F	NS	< 0.25	NS	< 0.25 UJ	NS	< 0.25	NS	< 0.25 UJ	NS
			Ethylbenzene	700	< 0.5	NS	< 0.5	NS	< 0.5 UJ	NS	0.299 F	NS	0.317 F	NS
			Isopropylbenzene	450 *	47.6	NS	NS	NS	NS	NS	NS	NS	NS	NS
			n-Butylbenzene	1000 *	7.07	NS	NS	NS	NS	NS	NS	NS	NS	NS
			n-Propylbenzene	660 *	53.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Naphthalene	1.7 *	**11**	NS	NS	NS	NS	NS	**4.18 J**	NS	**3.02 J**	NS
			sec-Butylbenzene	2000 *	20.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
			tert-Butylbenzene	690 *	2.78	NS	NS	NS	NS	NS	NS	NS	NS	NS
	MW08-12	Shallow	1,1-Dichloroethane	28 *	1.29	NS	NS	NS	0.289 F	NS	0.293 F	NS	< 0.25	NS
			Chlorobenzene	100	0.158 F	NS	NS	NS	< 0.25 UJ	NS	< 0.25	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	0.913 F	NS	NS	NS	< 0.5 UJ	NS	0.29 F	NS	< 0.5	NS

Industrial Zone Area
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
ST008	MW08-16	Shallow	cis-1,2-Dichloroethene	70	2.21	NS	1.45	NS	0.532 F	NS	0.351 F	NS	1.39	NS
			trans-1,2-Dichloroethene	100	0.305 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.417 F	NS
			Trichloroethene (TCE)	5	< 0.5	NS	0.479 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS
			Vinyl Chloride	2	1.27	NS	< 0.5	NS	0.688 F	NS	0.468 F	NS	1.53	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ)

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy

M = Detected result above the LOQ; a matrix effect was present.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Industrial Zone Area
Detected VOC Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
SS007	MWN7-38	Intermediate	cis-1,2-Dichloroethylene	70	< 0.5	< 0.5	< 0.5	NS	< 0.5	1.74	1.02	1.78	1.02	0.482 F
			Trichloroethene (TCE)	5	0.291 F	< 0.5	< 0.5	NS	< 0.5	1.58	0.981 F	0.818 F	0.669 F	0.579 F
	MWN7-48	Intermediate	Acetone	14,000 *	< 5	NS	< 5	NS	4.67 F	NS	3.84 F	NS	< 1	NS
			cis-1,2-Dichloroethene	70	7.15	NS	6.97	NS	9.64	NS	7.06	NS	6.05	NS
			Trichloroethene (TCE)	5	**247**	NS	**235**	NS	**301 J**	NS	**191**	NS	**197**	NS
	MWN7-50	Intermediate	Acetone	14,000 *	< 5	NS	5.96 F	NS	< 5	NS	3.7 F	NS	< 5	NS
			Naphthalene	1.7 *	< 0.4	NS	NS	NS	NS	NS	NS	NS	0.228 F	NS
			Trichloroethene (TCE)	5	**6.43**	NS	**5.7**	NS	**8.5**	NS	**9.45**	NS	**11.1**	NS
	MWN7-52	Intermediate	Acetone	14,000 *	< 5	< 5	< 5	NS	< 5 UJ	< 5 UJ	7.98 F	< 5	< 5 UJ	< 5
			Chloroform	80	< 0.25	< 0.25	< 0.25	NS	< 0.25 UJ	< 0.25	< 0.25	< 0.25	0.138 F	< 0.25
			cis-1,2-Dichloroethene	70	0.671 F	1.14	0.999 F	NS	1.27 J	1 J	1.78	2.21	6.21 J	5.36
			Trichloroethene (TCE)	5	**26.4**	**37.3**	**28.5**	NS	**46 J**	**40.2**	**59.3**	**83.8**	**198 J**	**111**
ST008	MW08-18	Intermediate	Carbon Tetrachloride	5	3.73	NS	3.08 F	NS	3.95 F	NS	2.53 F	NS	< 5	NS
			Chloroform	80	2.43	NS	2.68	NS	2.61	NS	2.29 F	NS	NS	NS
			cis-1,2-Dichloroethene	70	42.9	NS	45.4	NS	45.5	NS	38.2	NS	42.4	NS
			Methylene Chloride	5	1.02 F	NS	< 2.5	NS	< 2.5	NS	< 2.5	NS	< 5	NS
			Tetrachloroethene (PCE)	5	**41.6**	NS	**41.6**	NS	**46**	NS	**29.8**	NS	**49.8**	NS
			Toluene	1000	1.11 F	NS	< 2.5	NS	< 2.5	NS	< 2.5	NS	< 5	NS
			Trichloroethene (TCE)	5	**833**	NS	**938**	NS	**929**	NS	**791**	NS	**988**	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

M = Detected result above the LOQ; a matrix effect was present.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

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Industrial Zone Area
Detected VOC Concentrations in the Deep Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
SS007	MW07-07	Deep	Trichloroethene (TCE)	5	< 0.5	NS	0.369 F	NS	< 0.5 UJ	NS	< 0.5	NS	< 0.5	NS
	MWN7-51	Deep	Acetone	14,000 *	< 0.5	NS	< 0.5	NS	3.9 F	NS	4.39 F	NS	< 5	NS
			cis-1,2-Dichloroethene	70	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	0.58 F	NS
			Naphthalene	1.7 *	< 0.4	NS	NS	NS	NS	NS	NS	NS	0.237 F	NS
			Trichloroethene (TCE)	5	0.753 B	NS	0.465 F	NS	0.632 F	NS	1.15	NS	1.26	NS
	MWN7-53	Deep	Acetone	14,000 *	< 5	< 5	< 5	NS	< 5	< 5 UJ	4.4 F	< 5	2.71 F	< 5

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ)

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M = Detected result above the LOQ; a matrix effect was present

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

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Industrial Zone Area
Detected Metal Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
LF003	MW03-06	Shallow	Barium	2000	99.3	NS	93.2	NS	113	NS	96.9	NS	90.4	NS
			Lead	15	7 F	NS	10.7 F	NS	6.64 F	NS	9.39 F	NS	< 10	NS
			Selenium	50	6.04	NS	13.9	NS	7.13	NS	6.74	NS	7.88	NS
	MW03-09	Shallow	Arsenic	10	< 100	< 100	**19.9 F**	NS	**17.2 B**	**16.4**	**21.1**	**19.6**	**43.2**	**23.9**
			Barium	2000	313	392	304	NS	275	317	326	346	397	375
			Lead	15	**61.2**	**87.1**	**135**	NS	**73.6**	**106**	**92.8**	**77.2**	**30.2**	**70.9**
			Selenium	50	9.22	18.7 B	12.1	NS	10.9	11.6	12.6	12.6	34.6	28.1
			Silver	94 *	< 10	< 10	5.57 F	NS	< 10	< 10	< 10	< 10	< 10	< 10
SS007	MW07-04	Shallow	Arsenic	10	< 100	NS	**14.6 F**	NS	6.21 F	NS	**12.7**	NS	< 10	NS
			Barium	2000	495	NS	364	NS	262	NS	309	NS	340	NS
			Lead	15	5.54 F	NS	9.77 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	1.7 F	NS	5.42	NS	2.48	NS	3.23	NS	4.11	NS
	MW07-15	Shallow	Arsenic	10	**59.6 F**	NS	**33.3**	NS	**36.6**	NS	8.06 F	NS	**44.1**	NS
			Barium	2000	654	NS	374	NS	483	NS	211	NS	546	NS
			Lead	15	**42.9**	NS	**33.8**	NS	**22.2**	NS	7.93 F	NS	**28.9**	NS
			Selenium	50	**63.7**	NS	46.7	NS	20.5	NS	11.6	NS	20.2	NS
	MWN7-40	Shallow	Barium	2000	113	67.1	96.9	NS	135	118	159	147	155	117
			Lead	15	< 10	< 10	< 10	NS	< 10	< 10	< 10	< 10	< 10	5.28 F
			Selenium	50	2.64	2.38	4.97	NS	4.15	3.37	2.96	1.89 F	2.27	1.42 F
	MWN7-41	Shallow	Barium	2000	113	113	105	NS	87.9	83.6	76.3	97.6	76.6	76.6
			Lead	15	< 10	< 100	8.79 F	NS	< 10	< 10	< 10	< 10	< 10	< 10
			Selenium	50	7.61	7.09	11.1	NS	4.69	4.96	3.76	5.04	4.82	3.8
			Silver	94 *	< 10	< 10	6.8 F	NS	< 10	< 10	< 10	< 10	< 10	< 10
	MWN7-69	Shallow	Arsenic	10	< 100	< 100	< 10	NS	< 10	< 10	5.29 F	5.5 F	< 10	< 10
			Barium	2000	142	134	119	NS	136	133	308	188	223	< 10
			Chromium, Total	100	< 20	< 20	< 20	NS	< 20	< 20	13.2 F	< 20	< 20	< 20
			Lead	15	< 10	< 100	< 10	NS	< 10	5.08 F	**16.5**	< 10	5.01 F	5.11 B
			Selenium	50	2.65	0.931 F	0.995 F	NS	1.21 F	1.36 F	1.13 F	0.958 F	1.38 F	0.659 F
			Silver	94 *	< 10	< 10	< 10	NS	< 10	< 10	< 10	< 10	< 10	7.54 F
	OB-02	Shallow	Arsenic	10	< 100	< 100	**16.7 F**	NS	< 10	< 10	< 10	< 10	5.79 F	< 10
			Barium	2000	154	186	165	NS	90.6	118	83.6	111	139	125
			Selenium	50	4.66	2.74 B	6.32	NS	4.47	1.79	3.45	1.98 F	4.52	2.51
	OB-03	Shallow	Barium	2000	295	316	303	NS	375	397	195	255	188	177
			Lead	15	< 10	< 100	< 10	NS	< 10	< 10	< 10	< 10	< 10	5.71 B
			Selenium	50	4.73	4.5	8.04	NS	9.67	6	9.85	9.72	7.16	4.5
	OB-04	Shallow	Barium	2000	NS	NS	57.4	NS	106	173	106	145	159	134
			Lead	15	NS	NS	< 10	NS	< 10	< 10	< 10	< 10	< 10	5.03 B
			Selenium	50	NS	NS	1.69 F	NS	2.65	4.8	2.73	3.85	4.68	2.51

Industrial Zone Area
Detected Metal Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
SS007	OB-05	Shallow	Arsenic	10	< 100	NS	6.28 F	NS	< 10	NS	< 10	NS	5.05 F	NS
			Barium	2000	24.4	NS	22.8	NS	29.8	NS	28.5	NS	33.6	NS
			Lead	15	< 10	NS	5.99 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	14.9	NS	14.8	NS	16.1	NS	12.8	NS	9.3	NS
			Silver	94 *	< 10	NS	5.72 F	NS	< 10	NS	< 10	NS	< 10	NS
	OB-06	Shallow	Barium	2000	19 F	NS	24.2	NS	28.3	NS	23.2	NS	23	NS
			Lead	15	< 10	NS	9.05 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	23.7 M	NS	29.2	NS	23.7	NS	21.1	NS	12.2	NS
			Silver	94 *	< 10	NS	7.95 F	NS	< 10	NS	< 10	NS	< 10	NS
	OB-09	Shallow	Barium	2000	69.8	57.3	54.7	NS	80.2	85.9	86.3	90.3	90.1	101
			Selenium	50	3.14	2.13	3.98	NS	3.32	3.93	2.85	2.62	4.28	3.19
	OB-13	Shallow	Barium	2000	NS	43.1	37.4	NS	43.1	NS	57.7	NS	66.3	NS
			Selenium	50	NS	7.64	10.1	NS	8.76	NS	5.23	NS	6.67	NS
			Silver	94 *	NS	< 10	5.04 F	NS	< 10	NS	< 10	NS	< 10	NS
	OB-16	Shallow	Barium	2000	23.6	NS	25.3	NS	19.6 F	NS	20.2	NS	23	NS
			Selenium	50	13.8	NS	26.3	NS	17.2	NS	17.7	NS	21.3	NS
			Silver	94 *	< 10	NS	7.06 F	NS	< 10	NS	< 10	NS	< 10	NS
	OB-18	Shallow	Arsenic	10	< 100	< 100	< 10	NS	< 10	6.75 F	< 10	< 10	< 10	< 10
			Barium	2000	16.3 F	13.9 F	29.4	NS	15.2 F	14	14.6	17.4	16.9 F	26.1
			Selenium	50	6.9	3.47	10.7	NS	10.6	9.98	8.68	7.62	12.9	11.8
	OB-19	Shallow	Arsenic	10	< 0.1	NS	< 0.01	NS	< 0.01	NS	< 0.01	NS	6.58 F	NS
			Barium	2000	45.7	NS	64.7	NS	84.4	NS	59.8	NS	36.8	NS
			Selenium	50	26.8	NS	3.12	NS	16.3	NS	15	NS	10.3	NS
	OB-21	Shallow	Arsenic	10	< 100	< 100	< 10	NS	**11.9 F**	**12.5**	**19.8**	**27.1**	**27.2**	**26.9**
			Barium	2000	267	229	206	NS	160	132	132	116	112	91.1
			Lead	15	< 10	< 100	10.2 F	NS	< 10	< 10	< 10	< 10	6.08 F	< 10
			Selenium	50	1.69 F	2.05 B	3.99	NS	3.04	5.61	3.8	3.69	4.56	3.19
			Silver	94 *	< 10	< 10	8.24 F	NS	< 10	< 10	< 10	< 10	< 10	< 10

Industrial Zone Area
Detected Metal Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
ST008	MW08-05	Shallow	Arsenic	10	< 100	NS	**10.8 F**	NS	< 10	NS	< 10	NS	< 10	NS
			Barium	2000	107	NS	102	NS	116	NS	116	NS	103	NS
			Lead	15	< 100	NS	11.2 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	7.17	NS	15.3	NS	7.28	NS	6.95	NS	7.85	NS
	MW08-09	Shallow	Arsenic	10	< 100	NS	< 10	NS	< 10	NS	5.45 F	NS	**11 F**	NS
			Barium	2000	415	NS	407	NS	417	NS	379	NS	377	NS
			Lead	15	5.5 F	NS	< 10	NS	6.75 F	NS	< 10	NS	< 10	NS
			Selenium	50	3.75	NS	4.96	NS	3.13	NS	2.1	NS	2.76	NS
	MW08-12	Shallow	Arsenic	10	< 100	NS	NS	NS	5.01 F	NS	< 10	NS	5.01 F	NS
			Barium	2000	189	NS	NS	NS	224	NS	269	NS	184	NS
			Lead	15	5.86 F	NS	NS	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	5.19	NS	NS	NS	2.97	NS	3.02	NS	3.27	NS
	MW08-16	Shallow	Barium	2000	58.6	NS	159	NS	156	NS	156	NS	181	NS
			Selenium	50	1.54 F	NS	3.74	NS	1.44 F	NS	1.7 F	NS	< 1	NS

Notes:

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Sources:

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Industrial Zone Area
Detected Metal Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
SS007	MWN7-38	Intermediate	Arsenic	10	< 100	< 100	5.8 F	NS	< 10	6.03 F	< 10	< 10	< 10	< 10
			Barium	2000	62.5	56.8	51.3	NS	57.9	145	74.4	74.8	46.6	54.6
			Lead	15	6.44 F	< 100	< 10	NS	< 10	< 10	6.06 F	< 10	< 10	< 10
			Selenium	50	8.88	6.16	11.3	NS	6.77	13.4	8.47	7.56	9.43	6.72
			Silver	94 *	< 10	< 10	7.1 F	NS	< 10	< 10	< 10	< 10	< 10	< 10
	MWN7-48	Intermediate	Arsenic	10	< 100	NS	< 10	NS	< 10	NS	6.4 F	NS	8.65 B	NS
			Barium	2000	23	NS	19.8 F	NS	25.9	NS	22.1	NS	22.2	NS
			Selenium	50	24.9	NS	23	NS	16.4	NS	14.4	NS	14	NS
	MWN7-50	Intermediate	Arsenic	10	< 0.1	NS	< 0.01	NS	< 0.01	NS	< 0.01	NS	6.43 F	NS
			Barium	2000	30.5	NS	26.8	NS	24.3	NS	26.7	NS	25.3	NS
			Lead	15	< 10	NS	10.2 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	36.3	NS	47.2	NS	35.4	NS	36.4	NS	30.4	NS
			Silver	94 *	< 10	NS	8.78 F	NS	< 10	NS	< 10	NS	< 10	NS
	MWN7-52	Intermediate	Arsenic	10	< 100	< 100	< 10	NS	6.01 F	7.49 F	< 10	< 10	< 10	< 10
			Barium	2000	57.4	69	68	NS	75.1	58.4	67.3	71.8	69.4	62.7
			Lead	15	< 10	< 100	6.84 F	NS	< 10	< 10	< 10	< 10	< 10	< 10
			Selenium	50	20.1	19.7	20.9	NS	17.7	20.4	19.5	19.1	23.9	19.9
			Silver	94 *	< 10	< 10	7.22 F	NS	< 10	< 10	< 10	< 10	< 10	< 10
ST008	MW08-18	Intermediate	Arsenic	10	< 100	NS	5.05 F	NS	< 10	NS	< 10	NS	< 10	NS
			Barium	2000	42.9	NS	40.5	NS	48.3	NS	46	NS	46.2	NS
			Lead	15	< 10	NS	8.97 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	10.1	NS	12.5	NS	7.62	NS	8.19	NS	9.53	NS
			Silver	94 *	< 10	NS	5.5 F	NS	< 10	NS	< 10	NS	< 10	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
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Industrial Zone Area
Detected Metal Concentrations in the Deep Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Dec-16	Jun-17	Oct-17	Aug-18	Oct-18
LF003	MW03-07	Deep	Arsenic	10	< 0.1	NS	< 0.01	NS	< 0.01	NS	< 0.01	NS	8.7 F	NS
			Barium	2000	28.6	NS	23.5	NS	32	NS	25.4	NS	24.4	NS
			Selenium	50	21.70	NS	23.5	NS	21.5	NS	22.2	NS	23.7	NS
SS007	MW07-07	Deep	Arsenic	10	< 100	NS	< 10	NS	< 10	NS	< 10	NS	9.15 F	NS
			Barium	2000	25	NS	25	NS	24.1	NS	23.3	NS	19.5 F	NS
			Lead	15	< 10	NS	14.8 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	**146 M**	NS	**86.2**	NS	**74.8**	NS	**59.2**	NS	**92.3**	NS
			Silver	94 *	< 10	NS	22.2	NS	< 10	NS	< 10	NS	< 10	NS
	MWN7-51	Deep	Arsenic	10	< 100	NS	< 10	NS	< 10	NS	7.28 F	NS	**10.2 F**	NS
			Barium	2000	22	NS	19.2 F	NS	24.8 B	NS	18.3	NS	17.2 F	NS
			Lead	15	< 10	NS	10.7 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	39.6	NS	47.2	NS	33.4	NS	38.5	NS	35.1	NS
			Silver	94 *	< 10	NS	8.37 F	NS	< 10	NS	< 10	NS	< 10	NS
	MWN7-53	Deep	Barium	2000	36	78.6	65	NS	65.8	128	79.6	210	55.2	34.8
			Lead	15	< 10	< 100	< 10	NS	< 10	< 10	< 10	< 10	< 10	7.24 B
			Selenium	50	22	0.869 B	0.922 F	NS	0.727 F	14.6	0.718 F	4.93	0.558 F	< 1

Notes:

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Site FT002
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	May-18	Aug-18	Oct-18
FT002	MW02-04	Shallow	1,2-Dichloroethane	5	0.267 F	NS	< 0.5	NS	< 0.5	NS	< 0.5	NS	< 0.5	< 0.5	NS
			2-Butanone (MEK)	5600 *	< 5 UJ	NS	3.78 F	NS	< 5	NS	< 5	NS	< 5	< 0.5	NS
			Acetone	14000 *	< 5 UJ	NS	165	NS	< 5	NS	7.07 F	NS	< 5	< 1	NS
			Benzene	5	0.259 F	NS	< 0.25	NS	< 0.25	NS	< 0.25	NS	< 0.25	< 0.5	NS
			cis-1,2-Dichloroethene	70	7.67	NS	5.38	NS	12.6	NS	11.5	NS	3.16	4.54	NS
			Trichloroethene	5	**13.2**	NS	1.21	NS	2.98	NS	**15.5**	NS	2.14	**5.85**	NS
			Vinyl Chloride	2	0.717 F	NS	0.285 F	NS	< 0.5	NS	**2.06**	NS	< 0.5	**5.8**	NS
	MW02-05	Shallow	Acetone	14000 *	< 5	NS	< 5	NS	< 5 UJ	NS	< 5	NS	< 5	3.71 F	NS
			cis-1,2-Dichloroethene	70	0.511 F	NS	0.301 F	NS	< 0.5 UJ	NS	< 0.5	NS	0.254 J	< 0.5	NS
			sec-Butylbenzene	2000 *	0.323 F	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Tetrachloroethene	5	1.45	NS	1.22	NS	1.31 J	NS	0.814 F	NS	1.06	1.76	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

R = The result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

U = Not detected. The associated number indicates the analyte limit of detection (LOD).

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site FT002
Detected SVOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	May-18	Aug-18	Oct-18
	MW02-04	Shallow	n-Docosane	-	61.8 F	NS	< 50 UJ	NS	NS	NS	NS	NS	NS	NS	NS
			n-Hexacosane	-	49 F	NS	< 50 UJ	NS	NS	NS	NS	NS	NS	NS	NS
			n-Tetracosane	-	61.2 F	NS	< 50 UJ	NS	NS	NS	NS	NS	NS	NS	NS
	MW02-05	Shallow	n-Docosane	-	58.9 F	NS	< 50 UJ	NS	NS	NS	NS	NS	NS	NS	NS
			n-Eicosane	-	40.2 F	NS	< 50 UJ	NS	NS	NS	NS	NS	NS	NS	NS
			n-Octadecane	-	39.7 F	NS	< 50 UJ	NS	NS	NS	NS	NS	NS	NS	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

R = The result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

U = Not detected. The associated number indicates the analyte limit of detection (LOD).

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site FT002
Detected Metals Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Compound Concentrations (µg/L)											
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	May-18	Aug-18	Oct-18
FT002	MW02-04	Shallow	Arsenic	10	< 0.01	NS	< 0.01	NS	< 0.01	NS	< 0.01	NS	5.26 J	< 10	NS
			Barium	2000	145	NS	135	NS	182	NS	253	NS	205	201	NS
			Lead	15	6.87 F	NS	< 10	NS	< 10	NS	< 10	NS	< 10	< 10	NS
			Selenium	50	25.2	NS	34.3	NS	12.5	NS	8.03	NS	7.88	8.96	NS
			Silver	94 *	< 10	NS	6.3 F	NS	< 10	NS	< 10	NS	< 10	< 10	NS
	MW02-05	Shallow	Arsenic	10	< 100	NS	6.95 F	NS	6.3 F	NS	5.56 F	NS	5.18 J	9.08 F	NS
			Barium	2000	282	NS	246	NS	78.1	NS	78.8	NS	177	114	NS
			Lead	15	< 10	NS	8.68 F	NS	< 10	NS	< 10	NS	< 10	< 10	NS
			Selenium	50	47.6	NS	**61.3**	NS	20.7	NS	17.9	NS	35.5	39.7	NS
			Silver	94 *	< 10	NS	5.59 F	NS	< 10	NS	< 10	NS	< 10	< 10	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

R = The result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

U = Not detected. The associated number indicates the analyte limit of detection (LOD).

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site FT002
Detected TPH Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Total Petroleum Hydrocarbon Compound Concentrations (µg/L)											
			Parameter	OK RBCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	May-18	Aug-18	Oct-18
FT002	MW02-04	Shallow	OK DRO (PHC C10-C28)	1000	698	NS	**1890 J**	NS	598 J	NS	**3780 J**	NS	**1520 J**	**1230**	NS
			OK GRO (PHC as Gasoline)	1000	< 160	NS	< 160	NS	< 160	NS	< 160	NS	< 160	85.4 B	NS
	MW02-05	Shallow	OK DRO (PHC C10-C28)	1000	98.3 F	NS	199 F	NS	73 F	NS	< 106.4	NS	249	94.3 F	NS
			OK GRO (PHC as Gasoline)	1000	< 160	NS	< 160	NS	< 160	NS	< 160	NS	< 160	113 B	NS

Notes:

[1] Oklahoma Department of Environmental Quality (ODEQ) Tier 1 Generic Risk Based Cleanup Level for Groundwater (RBCL; October 2012).

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

R = The result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

U = Not detected. The associated number indicates the analyte limit of detection (LOD).

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

OK DRO = Oklahoma Diesel Range Organics

OK GRO = Oklahoma Gasoline Range Organics

PHC = Petroleum hydrocarbons

Sources:

ODEQ, October 2012 accessed at http://www.deq.state.ok.us/factsheets/land/tph.pdf.

Site DP005
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-01	Shallow	1,1,2-Trichloroethane	5	1.01	NS	< 5	NS	< 5	NS	< 25	NS	< 50	NS
			1,1-Dichloroethane	28 *	1.23	NS	< 2.5	NS	< 2.5	NS	< 12.5	NS	< 50	NS
			1,1-Dichloroethene	7	1.62 F	NS	< 10	NS	< 10 UJ	NS	< 50	NS	< 50	NS
			1,2-Dichloroethane	5	0.427 F	NS	< 5	NS	< 5	NS	< 25	NS	< 50	NS
			Benzene	5	1.57	NS	< 2.5	NS	**10.4**	NS	**22.7 F**	NS	< 50	NS
			Chlorobenzene	100	0.16 F	NS	< 2.5	NS	< 2.5	NS	< 12.5	NS	< 50	NS
			Chloroform	80	3.17 J	NS	< 2.5	NS	5	NS	< 12.5	NS	< 50	NS
			cis-1,2-Dichloroethene	70	**740**	NS	**311**	NS	**287**	NS	**2000**	NS	**3770**	NS
			Tetrachloroethene (PCE)	5	3.69	NS	< 5	NS	3.97 F	NS	< 25	NS	< 50	NS
			trans-1,2-Dichloroethene	100	1.12	NS	< 5	NS	< 5	NS	27.3 F	NS	< 50	NS
			Trichloroethene (TCE)	5	**5800**	NS	**1900**	NS	**8170**	NS	**12600**	NS	**12000**	NS
	MW-05-03	Shallow	Acetone	14,000 *	< 5	NS	< 5	NS	< 5	NS	4.19 F	NS	< 5	NS
			Chloroethane	21,000 *	< 1	NS	< 1	NS	< 1	NS	0.685 F	NS	< 1	NS
			cis-1,2-Dichloroethene	70	2.71	NS	21.1	NS	41.6	NS	10.3 J	NS	**145**	NS
			trans-1,2-Dichloroethene	100	< 0.5	NS	< 0.5	NS	0.252 F	NS	< 0.5 UJ	NS	1.02	NS
			Trichloroethene (TCE)	5	**8.41**	NS	**24.6**	NS	**20.1**	NS	**7.97 J**	NS	**25.8**	NS
	MW-05-04	Shallow	1,1,1-Trichloroethane	200	NS	NS	NS	NS	118 J	NS	54.9	NS	< 500	NS
			1,1,2-Trichloroethane	5	NS	NS	NS	NS	**9.7 J**	NS	**7.86**	NS	< 500	NS
			1,1-Dichloroethane	28 *	NS	NS	NS	NS	**79.9 J**	NS	**91.1**	NS	< 500	NS
			1,1-Dichloroethene	7	NS	NS	NS	NS	**31.8 J**	NS	**45.9**	NS	< 500	NS
			1,2-Dichlorobenzene	600	NS	NS	NS	NS	19.3 J	NS	16.4	NS	< 500	NS
			1,3-Dichlorobenzene	600	NS	NS	NS	NS	2.3 J	NS	2.05	NS	< 5.06	NS
			1,4-Dichlorobenzene	75	NS	NS	NS	NS	2.81 J	NS	2.66	NS	< 5.06	NS
			4-Methyl-2-Pentanone	6300 *	NS	NS	NS	NS	11.9 J	NS	7.57 F	NS	< 500	NS
			Acetone	14,000 *	NS	NS	NS	NS	390 J	NS	76.4	NS	< 1000	NS
			Benzene	5	NS	NS	NS	NS	**554**	NS	**479**	NS	< 500	NS
			Chloroform	80	NS	NS	NS	NS	**146**	NS	**91.2**	NS	< 500	NS
			cis-1,2-Dichloroethene	70	NS	NS	NS	NS	**100,000 J**	NS	**87800**	NS	**97400**	NS
			Ethylbenzene	700	NS	NS	NS	NS	206 J	NS	205 F	NS	< 500	NS
			m- & p-Xylene	10,000	NS	NS	NS	NS	1140	NS	898 F	NS	1050 F	NS
			Methylene Chloride	5	NS	NS	NS	NS	**24.3 J**	NS	0.785 F	NS	< 500	NS
			o-Xylene	10,000	NS	NS	NS	NS	574	NS	486 F	NS	644 F	NS
			Tetrachloroethene (PCE)	5	NS	NS	NS	NS	**10.7 J**	NS	3.78	NS	< 500	NS
			Toluene	1000	NS	NS	NS	NS	**3490**	NS	**3220**	NS	**3310**	NS
			trans-1,2-Dichloroethene	100	NS	NS	NS	NS	**339**	NS	**313 F**	NS	< 500	NS
			Trichloroethene (TCE)	5	NS	NS	NS	NS	**1990**	NS	**124**	NS	< 500	NS
			Vinyl chloride	2	NS	NS	NS	NS	**12.3 J**	NS	< 0.5	NS	< 500	NS

Site DP005
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-06 [2]	Shallow	2-Butanone (MEK)	5600 *	18.8 F	NS	3.51 F	NS	NS	< 5	< 5	NS	< 5 UJ	NS
			Acetone	14,000 *	< 25 UJ	NS	58	NS	NS	29.5	3.28 F	NS	4.07 F	NS
			Benzene	5	0.669 F	NS	< 0.25	NS	NS	< 0.25	< 0.25	NS	< 0.25 UJ	NS
			cis-1,2-Dichloroethene	70	29.4 J	NS	11	NS	NS	0.496 F	7.26	NS	1.34 J	NS
			Methylene Chloride	5	2.1 F	NS	< 0.5	NS	NS	< 0.5	< 0.5	NS	< 0.5 UJ	NS
			Toluene	1000	< 2.5 J	NS	< 0.5	NS	NS	0.957 F	< 0.5	NS	< 0.5 UJ	NS
			Trichloroethene (TCE)	5	**39.1 J**	NS	**17.6**	NS	NS	0.445 F	0.605 F	NS	0.427 F	NS
	MW-05-07 [2]	Shallow	1,1-Dichloroethene	7	< 1R	NS	< 1	NS	NS	< 1	0.901 F	NS	< 0.5	NS
			1,2-Dichlorobenzene	600	0.213 R	NS	< 0.25	NS	NS	< 0.25	0.427 F	NS	1.58	NS
			1,3-Dichlorobenzene	600	0.252 R	NS	< 0.5	NS	NS	< 0.5	0.413 F	NS	1.68	NS
			1,4-Dichlorobenzene	75	< 0.25 UR	NS	< 0.25	NS	NS	< 0.25	3.3	NS	1.24	NS
			2-Butanone (MEK)	5600 *	65.9 R	NS	< 5	NS	NS	< 5	< 5	NS	1.27 F	NS
			2-Hexanone	38 *	**59.6 R**	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Acetone	14,000 *	40.3 R	NS	7.08 F	NS	NS	134	10.8 J	NS	< 1	NS
			Benzene	5	1.11 R	NS	< 0.25	NS	NS	< 0.25	2.47	NS	**5.93**	NS
			Chlorobenzene	100	< 0.25 UR	NS	< 0.25	NS	NS	< 0.25	1.37 F	NS	< 0.5	NS
			Chloroethane	21,000 *	< 1 UR	NS	< 1	NS	NS	< 1	< 1	NS	7.27	NS
			cis-1,2-Dichloroethene	70	**152 R**	NS	1.51	NS	NS	1.62	**241**	NS	14.9	NS
			Isopropylbenzene	450 *	0.648 R	NS	NS	NS	NS	NS	NS	NS	NS	NS
			o-Xylene	10,000	< 200 UJ	NS	< 0.5	NS	NS	< 0.5	< 0.5	NS	0.847 F	NS
			sec-Butylbenzene	2000 *	0.434 R	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Toluene	1000	< 0.5 UR	NS	< 0.5	NS	NS	< 0.5	0.739 F	NS	1.3	NS
			trans-1,2-Dichloroethene	100	1.15 R	NS	< 0.5	NS	NS	< 0.5	2.62	NS	3.37	NS
			Trichloroethene (TCE)	5	**43.3 R**	NS	0.971 F	NS	NS	0.64 F	3.42	NS	< 0.5	NS
			Vinyl Chloride	2	**75.7 R**	NS	**7.61**	NS	NS	< 0.5	**260**	NS	**53.2**	NS
	MW-05-08	Shallow	1,1-Dichloroethane	28 *	0.212 F	NS	< 2.5	NS	< 12.5	NS	< 0.25	NS	< 0.5	NS
			1,1-Dichloroethene	7	0.981 F	NS	< 10	NS	< 50 UJ	NS	0.741 F	NS	< 0.5	NS
			1,2-Dichlorobenzene	600	0.226 F	NS	< 2.5	NS	< 12.5	NS	0.475 F	NS	0.812 F	NS
			1,3-Dichlorobenzene	600	< 0.5	NS	< 5	NS	< 25	NS	0.605 F	NS	0.871 F	NS
			1,4-Dichlorobenzene	75	< 0.25	NS	< 2.5	NS	<12.5	NS	0.335 F	NS	0.688 F	NS
			2-Butanone (MEK)	5600 *	< 5	NS	< 50	NS	< 250	NS	12.6	NS	< 0.5	NS
			Acetone	14,000 *	< 5	NS	< 50	NS	< 250	NS	283	NS	< 1	NS
			Benzene	5	0.209 F	NS	< 2.5	NS	< 12.5	NS	1.7	NS	3.84	NS
			Chloroform	80	2.21 J	NS	6.62	NS	< 12.5	NS	< 0.25	NS	< 0.5	NS
			cis-1,2-Dichloroethene	70	**519**	NS	**892**	NS	**1750**	NS	**87.6**	NS	25.2	NS
			Methylene Chloride	5	< 0.5	NS	**15 B**	NS	< 25	NS	< 0.5	NS	< 0.5	NS
			Tetrachloroethene (PCE)	5	0.533 F	NS	< 5	NS	< 25	NS	< 0.5	NS	< 0.5	NS
			trans-1,2-Dichloroethene	100	2.87	NS	3.65 F	NS	< 25	NS	2.52	NS	3.57	NS
			Trichloroethene (TCE)	5	**1950**	NS	**6570**	NS	**7430**	NS	3.95	NS	0.583 F	NS
			Vinyl Chloride	2	< 0.5 UJ	NS	< 5	NS	< 25	**60.1**	**139**	NS	**26.5**	NS

Site DP005
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-19 [2]	Shallow	1,1,1-Trichloroethane	200	< 0.5 UR	NS	< 0.5	NS	NS	< 0.5	0.946 F	NS	< 2.5	NS
			1,1,2,2-Tetrachloroethane	0.76 *	< 0.4 UR	NS	NS	NS	NS	< 0.5	0.308 F	NS	< 2.5	NS
			1,1,2-Trichloroethane	5	< 0.5 UR	NS	0.58 F	NS	NS	< 0.5	< 0.5	NS	< 2.5	NS
			1,1-Dichloroethane	28 *	0.747 R	NS	0.447 F	NS	NS	10.4	4.25	NS	5.71	NS
			1,1-Dichloroethene	7	1.18 R	NS	< 1	NS	NS	1.7 F	< 1	NS	< 2.5	NS
			1,2,4-Trimethylbenzene	15 *	4.77 R	NS	NS	NS	NS	NS	NS	NS	NS	NS
			1,2-Dichlorobenzene	600	0.418 R	NS	0.31 F	NS	NS	0.654	0.432 F	NS	< 2.5	NS
			1,2-Dichloropropane	5	< 0.4 R	NS	< 0.4	NS	NS	0.61 F	< 0.4	NS	< 2.5	NS
			1,3,5-Trimethylbenzene	120 *	0.371 R	NS	NS	NS	NS	NS	NS	NS	NS	NS
			1,3-Dichlorobenzene	600	0.614 R	NS	0.567 F	NS	NS	0.385 F	< 0.5	NS	< 2.5	NS
			1,4-Dichlorobenzene	75	0.524 R	NS	0.491 F	NS	NS	0.307 F	0.2 F	NS	< 2.5	NS
			2-Butanone (MEK)	5600 *	< 5 UR	NS	< 5	NS	NS	< 5	< 5	NS	6.4 F	NS
			4-Methyl-2-Pentanone	6300 *	< 5 UR	NS	< 5	NS	NS	< 5	< 5 UJ	NS	3.93 F	NS
			Acetone	14,000 *	< 5 UR	NS	5.64 F	NS	NS	4.8 F	6.51 F	NS	< 5	NS
			Benzene	5	**7.59 J**	NS	**5.09**	NS	NS	**25.7**	**9.35**	NS	**37**	NS
			Chloroethane	21,000 *	5.79 R	NS	13.7	NS	NS	29	3.84	NS	51.4	NS
			Chloroform	80	< 0.25 UR	NS	0.208 F	NS	NS	< 0.25	0.201 F	NS	< 2.5	NS
			cis-1,2-Dichloroethene	70	**78.6 R**	NS	24.7	NS	NS	**402 J**	32.5	NS	3.3 F	NS
			Ethylbenzene	700	1.66 F	NS	0.873 F	NS	NS	63.7	40.9	NS	113	NS
			Isopropylbenzene	450 *	0.686 R	NS	NS	NS	NS	NS	NS	NS	NS	NS
			m- & p-Xylene	10,000	2.17 F	NS	2.03	NS	NS	203	85.7	NS	398	NS
			Methylene Chloride	5	< 0.5 R	NS	< 0.5	NS	NS	0.341 F	< 0.5	NS	< 2.5	NS
			Naphthalene	1.7 *	0.404 R	NS	NS	NS	NS	NS	NS	NS	**63.6**	NS
			o-Xylene	10,000	2.7 F	NS	2.69	NS	NS	118	98.2	NS	213	NS
			p-Isopropyltoluene	-	0.284 R	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Toluene	1000	3.63 F	NS	4.63	NS	NS	232	56.7	NS	430	NS
			trans-1,2-Dichloroethene	100	1.11 R	NS	0.676 F	NS	NS	2.36	0.658 F	NS	2.26 F	NS
			Trichloroethene (TCE)	5	**155 R**	NS	**195**	NS	NS	**220**	**162**	NS	2.08 F	NS
			Vinyl Chloride	2	**94.3 R**	NS	**8.14**	NS	NS	**213**	**4.72**	NS	**3.92 F**	NS

Notes:

1 USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

[2] Wells MW-05-06, MW-05-07, and MW-05-19 were not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. These wells were sampled in September 2016.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

R = The result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site DP005
Detected VOC Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)									
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-18	Intermediate	Chloroform	80	0.16 F	NS	0.175 F	NS	< 0.25	0.211 F	NS	< 2.5	NS
			cis-1,2-Dichloroethene	70	4.99	NS	10.9	NS	4.5	22.6	NS	33.9	NS
			trans-1,2-Dichloroethene	100	< 0.5	NS	< 0.5	NS	< 0.5	0.28 F	NS	< 2.5	NS
			Trichloroethene (TCE)	5	**254**	NS	**300**	NS	**146**	**309**	NS	**441**	NS

Notes:

1 USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-0

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-table

Site DP005
Detected VOC Concentrations in the Deep Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)									
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-09	Deep	cis-1,2-Dichloroethene	70	4.06	NS	1.09	NS	0.32 F	0.392 F	NS	1.83	NS
			Trichloroethene (TCE)	5	< 0.5	NS	0.303 F	NS	< 0.5	< 0.5 UJ	NS	< 0.5	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-0

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-table

Site DP005
Detected SVOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-01	Shallow	1,2-Dichlorobenzene	600	1.52	NS	< 5	NS	< 5 UJ	NS	< 5	NS	< 5.06	NS
			1,3-Dichlorobenzene	600	< 5	NS	< 5	NS	< 5 UJ	NS	2.68 F	NS	2.6 F	NS
			bis(2-Ethylhexyl)Phthalate	6	< 6	NS	< 6	NS	< 6	NS	**418**	NS	< 6.06	NS
			Diethyl Phthalate	15,000 *	4.16 F	NS	< 5	NS	< 5	NS	< 5	NS	< 5.06	NS
	MW-05-03	Shallow	Diethyl Phthalate	15,000 *	4.41 F	NS	< 5.26	NS	< 5	NS	< 5	NS	< 5	NS
	MW-05-04	Shallow	1,2-Dichlorobenzene	600	NS	NS	NS	NS	19.3 J	NS	7.42 F	NS	12.2	NS
			1,4-Dioxane	4.6 *	NS	NS	NS	NS	3.14	NS	1.89 F	NS	1.12 F	NS
			2,4-Dimethylphenol	360 *	NS	NS	NS	NS	37.1 J	NS	56 J	NS	60.6	NS
			2-Methylnaphthalene	36 *	NS	NS	NS	NS	< 50	NS	< 50	NS	6.54 F	NS
			2-Methylphenol	930 *	NS	NS	NS	NS	57.4 J	NS	52 J	NS	53.9	NS
			3- & 4-Methylphenol	-	NS	NS	NS	NS	723	NS	1120	NS	954	NS
			Naphthalene	1.7 *	NS	NS	NS	NS	**13 J**	NS	**24.1 J**	NS	**44.7**	NS
			Phenol	5800 *	NS	NS	NS	NS	86.6 J	NS	**79.1 J**	NS	48.2	NS
	MW-05-06 [2]	Shallow	3- & 4-Methylphenol	-	< 200	NS	5.42 F	NS	NS	NS	< 5	NS	< 5.26	NS
			bis(2-Ethylhexyl)Phthalate	6	< 240	NS	< 6	NS	NS	**332 J**	< 6	NS	< 6.32	NS
			n-Docosane	-	< 25800	NS	64.4 F	NS	NS	NS	NS	NS	NS	NS
			n-Eicosane	-	< 25800	NS	170 J	NS	NS	NS	NS	NS	NS	NS
			n-Hexacosane	-	16700 F	NS	179 J	NS	NS	NS	NS	NS	NS	NS
			n-Octacosane	-	< 25800	NS	40.3 F	NS	NS	NS	NS	NS	NS	NS
			n-Tetracosane	-	51600 J	NS	37 F	NS	NS	NS	NS	NS	NS	NS

Site DP005
Detected SVOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-07 [2]	Shallow	1,2-Dichlorobenzene	600	0.213 R	NS	< 5	NS	NS	< 5	< 5	NS	< 5	NS
			3- & 4-Methylphenol	-	< 250	NS	3.49 F	NS	NS	< 5	< 5	NS	< 5.32	NS
			n-Decane	-	< 2000 UJ	NS	26 F	NS	NS	NS	NS	NS	NS	NS
			n-Docosane	-	7020	NS	< 50	NS	NS	NS	NS	NS	NS	NS
			n-Hexacosane	-	11800	NS	32.9 F	NS	NS	NS	NS	NS	NS	NS
			n-Tetracosane	-	31700	NS	< 50	NS	NS	NS	NS	NS	NS	NS
	MW-05-08	Shallow	3- & 4-Methylphenol	-	NS	NS	NS	NS	NS	NS	78.6	NS	< 5.1	NS
			Diethyl Phthalate	15,000 *	4.73 F	NS	< 5.62	NS	< 5 UJ	NS	< 5	NS	< 5.1	NS
	MW-05-19 [2]	Shallow	2,4-Dimethylphenol	360 *	< 5	NS	< 5.1	NS	NS	18.5	< 5 UJ	NS	31.3	NS
			2-Methylnaphthalene	36 *	< 5	NS	< 5.1 UJ	NS	NS	13	< 5 UJ	NS	19.5	NS
			2-Methylphenol	930 *	< 5	NS	< 5.1	NS	NS	4.84 F	< 5 UJ	NS	8.22 F	NS
			3- & 4-Methylphenol	-	< 5	NS	< 5.1	NS	NS	28.1	14.3 J	NS	10.3 F	NS
			bis(2-Ethylhexyl)Phthalate	6	3.72 B	NS	**133**	NS	NS	**15.4**	**11.9 J**	NS	5.92 F	NS
			Naphthalene	1.7 *	1.07 F	NS	< 5.1 UJ	NS	NS	**28.8**	**5.63 J**	NS	**48.3**	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

[2] Wells MW-05-06, MW-05-07, and MW-05-19 were not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. These wells were sampled in September 2016

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

R = The result is rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site DP005
Detected SVOC Concentrations in the Deep Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-09	Deep	Naphthalene	1.7 *	< 5 UJ	NS	< 5.1 UJ	NS	< 5 UJ	< 5.1	NS	**20.3**	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-0

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-table

Site DP005
Detected Metal Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metals Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-01	Shallow	Arsenic	10	< 100	NS	< 10 B	NS	< 10	NS	8.49 F	NS	5.9 B	NS
			Barium	2000	33.3	NS	27.5	NS	69.8	NS	64	NS	46.4	NS
			Lead	15	< 10	NS	7.74 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	7.52	NS	15.5	NS	6.62	NS	7.37	NS	8.88	NS
			Silver	94 *	< 10	NS	10.8 F	NS	< 10	NS	< 10	NS	< 10	NS
	MW-05-03	Shallow	Arsenic	10	< 0.1	NS	< 0.01	NS	< 0.01	NS	< 0.01	NS	8.06 F	NS
			Barium	2000	114	NS	148	NS	128	NS	139	NS	157	NS
			Lead	15	20	NS	11.4 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	2.38	NS	3.94	NS	2.16 F	NS	2.19	NS	2.54	NS
	MW-05-04	Shallow	Arsenic	10	IW	IW	NS	NS	**34.2 B**	NS	**22.5**	NS	**12 F**	NS
			Barium	2000	IW	IW	NS	NS	254	NS	244	NS	207	NS
			Selenium	50	IW	IW	NS	NS	3.87	NS	5.29	NS	5.45	NS
	MW-05-06 [2]	Shallow	Arsenic	0.67 *	< 100	NS	**10.5 B**	NS	NS	< 10	< 10	NS	< 10	NS
			Barium	2000	174	NS	300	NS	NS	457	380	NS	375	NS
			Lead	15	< 10	NS	9.06 F	NS	NS	< 10	< 10	NS	< 10	NS
			Selenium	50	0.967 F	NS	2.91	NS	NS	0.732 F	0.834 F	NS	0.848 F	NS
	MW-05-07 [2]	Shallow	Barium	2000	453	NS	194	NS	NS	331	332	NS	427	NS
			Lead	15	< 10	NS	9.03 F	NS	NS	< 10	< 10	NS	< 10	NS
			Selenium	50	1.34 F	NS	0.613 F	NS	NS	0.517 F	0.532 F	NS	1.24 F	NS
			Silver	94 *	< 10	NS	5.37 F	NS	NS	< 10	< 10	NS	< 10	NS
	MW-05-08	Shallow	Arsenic	10	< 100	NS	6.07 B	NS	< 10	NS	7.99 F	NS	< 10	NS
			Barium	2000	51.8	NS	37.3	NS	43.3	NS	254	NS	472	NS
			Lead	15	< 10	NS	5.15 F	NS	< 10	NS	< 10	NS	< 10	NS
			Selenium	50	4.71	NS	6.46	NS	4.12 F	NS	1.52 F	NS	1.79 F	NS
	MW-05-19 [2]	Shallow	Barium	2000	73	NS	57.4	NS	NS	289	44	NS	401	NS
			Lead	15	< 10	NS	10.2 F	NS	NS	< 10	< 10	NS	< 10	NS
			Selenium	50	14.9	NS	20.1	NS	NS	5.05	14.1	NS	4.62	NS
			Silver	94 *	< 10	NS	9.28 F	NS	NS	< 10	< 10	NS	< 10	NS

Site DP005
Detected Metal Concentrations in the Shallow Zone
2014 - 2018

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05

[2] Wells MW-05-06, MW-05-07, and MW-05-19 were not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. These wells were sampled in September 2016.

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

B = Result is judged to be an artifact because of contamination in associated blanks

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

IW = An insufficient volume of groundwater was present in the well for sample collection and analysis

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-table

Site DP005
Detected Metal Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Compound Concentrations (µg/L)									
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-18	Intermediate	Arsenic	10	< 100	NS	< 10	NS	< 10	8.66 F	NS	8.34 F	NS
			Barium	2000	24.3	NS	22.7	NS	21.3	24	NS	24.2	NS
			Lead	15	< 10	NS	10.2 F	NS	< 10	< 10	NS	< 10	NS
			Selenium	50	30.9	NS	28	NS	20.3	26.7	NS	27.1	NS
			Silver	94 *	< 10	NS	7.97 F	NS	< 10	< 10	NS	< 10	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-0

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ

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UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-table

Site DP005
Detected Metal Concentrations in the Deep Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Metal Compound Concentrations (µg/L)									
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-09	Deep	Arsenic	10	< 0.1	NS	< 0.01 UJ	NS	< 0.01	< 0.01	NS	7.2 F	NS
			Barium	2000	11.8 F	NS	12.1 F	NS	11 F	11.8	NS	13.9 F	NS
			Lead	15	< 10	NS	**17.6 F**	NS	< 10	< 10	NS	< 10	NS
			Selenium	50	41.1	NS	37.4	NS	40.3	42.4	NS	46.9	NS
			Silver	94 *	< 10	NS	11 F	NS	< 10	< 10	NS	< 10	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
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NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-table

Site DP005
Detected TPH Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Total Petroleum Hydrocarbon Compound Concentrations (µg/L)										
			Parameter	OK RBCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Sep-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-01	Shallow	OK DRO (PHC C10-C28)	1000	< 102.6	NS	76.1 F	NS	< 102	NS	< 100	NS	< 100	NS
			OK GRO (PHC as Gasoline)	1000	**1910**	NS	550	NS	**2070**	NS	**3960**	NS	**4020**	NS
	MW-05-03	Shallow	OK DRO (PHC C10-C28)	1000	< 100	NS	65 F	NS	< 100	NS	< 101	NS	< 100	NS
	MW-05-04	Shallow	OK DRO (PHC C10-C28)	1000	NS	NS	NS	NS	**7230**	NS	**13700 J**	NS	**7610**	NS
			OK GRO (PHC as Gasoline)	1000	NS	NS	NS	NS	**34200**	NS	**32900**	NS	**36200**	NS
	MW-05-06 [2]	Shallow	OK DRO (PHC C10-C28)	1000	**335000**	NS	**5860 J**	NS	NS	987 F	**3530 J**	NS	231	NS
			OK GRO (PHC as Gasoline)	1000	< 16000 UJ	NS	< 160	NS	NS	< 160	< 160	NS	164 B	NS
	MW-05-07 [2]	Shallow	OK DRO (PHC C10-C28)	1000	**176000**	NS	**3010**	NS	NS	401	81.8 F	NS	< 104.2	NS
			OK GRO (PHC as Gasoline)	1000	< 16000	NS	< 160	NS	NS	< 160	134 F	NS	254 B	NS
	MW-05-08	Shallow	OK DRO (PHC C10-C28)	1000	< 100	NS	84.1 F	NS	< 102	NS	924 J	NS	< 100	NS
			OK GRO (PHC as Gasoline)	1000	661	NS	**1760**	NS	**2380**	NS	380	NS	145 B	NS
	MW-05-19 [2]	Shallow	OK DRO (PHC C10-C28)	1000	< 102	NS	779	NS	NS	**5590**	**2010**	NS	**7480**	NS
			OK GRO (PHC as Gasoline)	1000	104 F	NS	195 F	NS	NS	**1540**	**1140**	NS	**2430**	NS

Notes:

[1] Oklahoma Department of Environmental Quality (ODEQ) Tier 1 Generic Risk Based Cleanup Level for Groundwater (RBCL; October 2012).

[2] Wells MW-05-06, MW-05-07, and MW-05-19 were not sampled in June 2016 due to the presence of Emulsified Vegetable Oil (EVO) in the well. These wells were sampled in September 2016.

Bold value with shaded cell indicates exceedance of listed regulatory criteria

For non-detected results, the limit of detection (LOD) is shown

B = Result is judged to be an artifact because of contamination in associated blanks

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UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies

NS = Not sampled

OK DRO = Oklahoma Diesel Range Organics

OK GRO = Oklahoma Gasoline Range Organics

PHC = Petroleum hydrocarbons

Sources:

ODEQ, October 2012 accessed at http://www.deq.state.ok.us/factsheets/land/tph.pdf

Site DP005
Detected TPH Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Total Petroleum Hydrocarbon Compound Concentrations (µg/L)									
			Parameter	OK RBCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
DP005	MW-05-18	Intermediate	OK DRO (PHC C10-C28)	1000	<100	NS	54.2 F	NS	< 102	< 108.6	NS	< 108.6	NS
			OK GRO (PHC as Gasoline)	1000	<160	NS	106 F	NS	< 160	113 F	NS	190 B	NS

Notes:

[1] Oklahoma Department of Environmental Quality (ODEQ) Tier 1 Generic Risk Based Cleanup Level for Groundwater (RBCL; October 2012).
Bold value with shaded cell indicates exceedance of listed regulatory criteria
For non-detected results, the limit of detection (LOD) is shown
B = Result is judged to be an artifact because of contamination in associated blanks
F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ
J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy
UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies
NS = Not sampled
OK DRO = Oklahoma Diesel Range Organics
OK GRO = Oklahoma Gasoline Range Organics
PHC = Petroleum hydrocarbons

Sources:

ODEQ, October 2012 accessed at http://www.deq.state.ok.us/factsheets/land/tph.pdf

Site SS026
Detected VOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
SS026	MW26-01	Shallow	1,1-Dichloroethane	28 *	0.302 F	NS	< 0.25	NS	< 0.25	< 0.25 UJ	NS	< 0.25	NS
			1,4-Dichlorobenzene	75	1.85	NS	< 0.25	NS	< 0.25	0.203 F	NS	0.269 F	NS
			Acetone	14,000 *	< 5	NS	< 5	NS	< 5	2.72 F	NS	< 5	NS
			Benzene	5	0.519	NS	< 0.25	NS	< 0.25	0.222 F	NS	< 0.25	NS
			Chlorobenzene	100	2.26	NS	< 0.25	NS	< 0.25	0.291 F	NS	0.258 F	NS
			cis-1,2-Dichloroethene	70	8.7	NS	< 0.5	NS	3.68	2.42 J	NS	0.765 F	NS
			Isopropylbenzene	450 *	4.98	NS	NS	NS	NS	NS	NS	NS	NS
			n-Propylbenzene	-	1.3	NS	NS	NS	NS	NS	NS	NS	NS
			sec-Butylbenzene	2000 *	1.27	NS	NS	NS	NS	NS	NS	NS	NS
			tert-Butylbenzene	690 *	0.676 F	NS	NS	NS	NS	NS	NS	NS	NS
			Trichloroethene	5	0.5 F	NS	< 0.5	NS	0.313 F	< 0.5 UJ	NS	< 0.5	NS
			Vinyl Chloride	2	1.64	NS	< 0.5	NS	< 0.5	< 0.5 UJ	NS	< 0.5	NS
	MW26-03	Shallow	1,2-Dichloropropane	5	0.346 F	NS	< 0.4	NS	< 0.4	< 0.4	NS	< 0.4	NS
			Acetone	14,000 *	7.12 F	NS	< 5	NS	< 5	3.28 F	NS	4.14 F	NS
			Benzene	5	0.239 F	NS	< 0.25	NS	< 0.25	< 0.25	NS	< 0.25	NS
			Chlorobenzene	100	1.55	NS	< 0.25	NS	< 0.25	< 0.25	NS	< 0.25	NS
			cis-1,2-Dichloroethene	70	3.6	NS	0.746 F	NS	0.61 F	< 0.5	NS	< 0.5	NS
			Isopropylbenzene	450 *	0.398 F	NS	NS	NS	NS	NS	NS	NS	NS
			Methyl Tert-Butyl Ether	140 *	22.8	NS	NS	NS	NS	NS	NS	NS	NS
			n-Propylbenzene	-	0.314 F	NS	NS	NS	NS	NS	NS	NS	NS
			sec-Butylbenzene	2000 *	0.91 F	NS	NS	NS	NS	NS	NS	NS	NS
	MW26-04	Shallow	1,1-Dichloroethane	28 *	0.33 F	NS	0.685	NS	0.185 F	0.552 J	NS	< 0.5	NS
			1,2-Dichloroethane	5	< 0.5	NS	< 0.5	NS	< 0.5	0.895 F	NS	< 0.5	NS
			Benzene	5	0.474 F	NS	0.885	NS	0.229 F	3.65 J	NS	0.47 F	NS
			Bromodichloromethane	80	< 0.5	NS	< 0.5	NS	< 0.5	2.66 J	NS	< 0.5	NS
			Ethylbenzene	700	< 0.5	NS	0.586 F	NS	< 0.5	0.851 F	NS	< 0.5	NS
			Isopropylbenzene	450 *	3.53	NS	NS	NS	NS	NS	NS	NS	NS
			Methylene Chloride	5	< 0.5	NS	0.432 F	NS	< 0.5	< 0.5 UJ	NS	< 0.5	NS
			n-Propylbenzene	-	4.19	NS	NS	NS	NS	NS	NS	NS	NS
			sec-Butylbenzene	2000 *	0.367 F	NS	NS	NS	NS	NS	NS	NS	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used. RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site SS026
Detected VOC Concentrations in the Intermediate Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Volatile Organic Compound Concentrations (µg/L)									
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
SS026	MW26-02	Intermediate	1,2-Dichloroethane	5	< 0.5	NS	< 0.5	NS	0.36 F	< 0.5	NS	< 0.5	NS
			Acetone	14,000 *	< 5	NS	< 5	NS	< 5	3.42 F	NS	< 5	NS
			Chloroform	80	0.237 F	NS	0.583	NS	0.69	< 0.25	NS	0.494 F	NS
			Trichloroethene	5	< 0.5	NS	0.352 F	NS	< 0.5	< 0.5	NS	< 0.5	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used. RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site SS026
Detected SVOC Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Semivolatile Organic Compound Concentrations (µg/L)										
			Parameter	MCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
SS026	MW26-01	Shallow	Naphthalene	1.7 *	0.878	NS	< 5.32 UJ	NS	< 5.1 UJ	< 5	NS	< 5.1	NS
	MW26-03	Shallow	1,2-Dichlorobenzene	600	0.271 F	NS	< 5 UJ	NS	< 5 UJ	< 5	NS	< 5	NS
			Bis(2-Ethylhexyl)Phthalate	6	4.17 F	NS	< 6	NS	< 6 UJ	< 6	NS	< 6	NS
	MW26-04	Shallow	2-Methylnaphthalene	36 *	< 5.32	NS	14.4 J	NS	< 5 UJ	4.99 F	NS	< 5.06	NS
			Naphthalene	1.7 *	**2.72**	NS	**14.2 J**	NS	< 5 UJ	**6.12 F**	NS	< 5.06	NS
			Phenanthrene	-	< 5.32	NS	3 F	NS	< 5 UJ	< 5	NS	< 5.06	NS

Notes:

[1] USEPA Maximum Contaminant Level (MCL; March 2018). "*" indicates an MCL is unavailable and the USEPA Regional Screening Level (RSL; November 2018) is used.
RSLs are the lower of the noncarcinogen screening level based on an HQ of 1 and the carcinogenic screening level based on a risk level of 1E-05.

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not sampled

Sources:

USEPA, March 2018 accessed at https://www.epa.gov/dwstandardsregulations/drinking-water-contaminant-human-health-effects-information#dw-standards.

USEPA, November 2018 accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Site SS026
Detected TPH Concentrations in the Shallow Zone
2014 - 2018

Site	Sample Location	Water Bearing Zone	Total Petroleum Hydrocarbon Compound Concentrations (µg/L)									
			Parameter	OK RBCL [1]	May-14	Nov-14	May-15	Nov-15	Jun-16	Jun-17	Oct-17	Aug-18	Oct-18
SS026	MW26-01	Shallow	OK DRO (PHC C10-C28)	1000	NS	NS	NS	NS	55.3 F	NS	NS	NS	NS
	MW26-03	Shallow	OK DRO (PHC C10-C28)	1000	NS	NS	NS	NS	87.9 F	NS	NS	NS	NS
			OK GRO (PHC as Gasoline)	1000	NS	< 120	NS	NS	< 160	< 160	NS	129 B	NS
	MW26-04	Shallow	OK DRO (PHC C10-C28)	1000	NS	NS	NS	NS	98.4 F	NS	NS	NS	NS
			OK GRO (PHC as Gasoline)	1000	NS	NS	NS	NS	144 F	**4710 J**	NS	249 B	NS

Notes:

[1] Oklahoma Department of Environmental Quality (ODEQ) Tier 1 Generic Risk Based Cleanup Level for Groundwater (RBCL; October 2012).

Bold value with shaded cell indicates exceedance of listed regulatory criteria.

For non-detected results, the limit of detection (LOD) is shown.

B = Result is judged to be an artifact because of contamination in associated blanks.

F = The analyte was detected at the reported concentration; the quantitation is an estimated value below the limit of quantification (LOQ).

J = The analyte was detected above the LOQ at the reported concentration; the quantitation is an estimate due to an associated QC discrepancy.

UJ = Not detected. The associated number indicates the analyte LOD, which may be inaccurate due to associated QC discrepancies.

NS = Not Sampled. Analyte was not part of the RCRA Permit required sampling criteria. Analyte was added to CM sampling in 2016 at request of ODEQ.

OK DRO = Oklahoma Diesel Range Organics

OK GRO = Oklahoma Gasoline Range Organics

PHC = Petroleum hydrocarbons

Sources:

ODEQ, October 2012 accessed at http://www.deq.state.ok.us/factsheets/land/tph.pdf

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VANCE AIR FORCE BASE
RCRA POST-CLOSURE CARE PERMIT RENEWAL APPLICATION

ATTACHMENT 5

SAMPLING AND ANALYSIS PLAN

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GROUNDWATER SAMPLING AND ANALYSIS PLAN
VANCE AIR FORCE BASE, OKLAHOMA

January 2006
Modification 2019

GROUNDWATER SAMPLING AND ANALYSIS PLAN
VANCE AIR FORCE BASE, OKLAHOMA

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AG	amber glass
˚C	degrees Celsius
CDQAR	Chemical Data Quality Assurance Report
CF	casing factor
CGTF	Central Groundwater Treatment Facility
COC	chain of custody
CRRL	contract required reporting limits
DEQ	Department of Environmental Quality
DOT	Department of Transportation
DQCR	Daily Quality Control Report
DQO	data quality objective
DRO	diesel range organic
DTW	depth-to-water
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
ER	Engineer Regulation
ERPIMS	Environmental Resources Program Information Management System
FTL	field team leader
GC	Gas Chromatograph
GCMS	Gas Chromatograph / Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption
GRO	gasoline range organics
HCl	hydrochloric acid
HDPE	high density polyethylene
HNO_3	nitric acid
ICAP	Inductively Coupled Plasma-Atomic Emission Spectrometry
IRP	Installation Restoration Program
LQMP	Laboratory Quality Management Plan
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
PARCCS	precision, accuracy, representativeness, comparability, completeness and sensitivity

PID	photo ionization detector
PM	project manager
PPE	personal protective equipment
PTFE	polytetrafluoroethylene
QA	quality assurance
QAO	quality assurance officer
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SSHO	site safety and health officer
SVOC	semi-volatile organic compound
TAT	turnaround time
TD	total depth
TM	technical Manager
TPH	Total Petroleum Hydrocarbons
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 Purpose and Scope

This Sampling and Analysis Plan (SAP) presents the procedures required to sample and analyze groundwater samples at Vance Air Force Base (AFB), Oklahoma, and describes the analytical and Quality Assurance/Quality Control (QA/QC) programs. This SAP incudes general procedures and performance requirements for compliance monitoring programs at identified Installation Restoration Program (IRP) sites required by the Oklahoma Department of Environmental Quality (DEQ) Resource Conservation and Recovery Act (RCRA) Post-Closure Permit, signed on August 8, 1996, and subsequent permit modifications. Sampling and analytical requirements for specific sites will be subject to change based on the results of on-going compliance monitoring and achievement of permit goals.

This SAP documents procedures for field screening and monitoring well water level measurements, well purging, groundwater sample collection, sample containerization, preservation, handling, custody, and shipping; field documentation, equipment decontamination, analytical testing, electronic deliverables, and presents an overview of the QA/QC program. The SAP also addresses the process for establishing procedures for the sampling and analysis of other matrices, such as surface water and sediment when required. The SAP was prepared in accordance with the applicable regulations contained in 40 CFR Part 264.97.

The ultimate accuracy of any data generation begins with a sampling and measurement procedure that is fully conceived and implemented. This SAP is designed to delineate the methods that will be used to accomplish the chemical data quality objectives. Data quality objectives include the data quality indicators of precision, accuracy, representativeness, comparability, completeness and sensitivity.

Sampling and analytical activities will be documented in accordance with this plan and Environmental Resources Program Information Management System (ERPIMS) protocols which is the current Air Force system for validation and management of data from environmental projects at all Air Force bases. Analytical methods and target compounds for compliance monitoring activities are provided in Attachment 4-1.

1.2 References

References used in the preparation of the SAP include the following:

(a) U.S. Environmental Protection Agency, December 1996, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846 (Third Edition).*

(b) U.S. Army Corps of Engineers, February 2001, *Engineer Manual EM 200-1-3, Engineering and Design - Requirements for the Preparation of Sampling and Analysis Plans.*

(c) U.S. Army Corps of Engineers, February 2001, Performance *Evaluation (PE) Program.*

(d) U.S. Army Corps of Engineers, April 1998, *Engineer Regulation ER 1110-1-263, Engineering and Design – Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities.*

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project management organization will be based on specific project requirements. Key project personnel and their roles/responsibilities for various aspects of groundwater sampling activities performed at Vance AFB are listed below. Not all of these personnel may be required to support these activities and one individual may serve in dual roles when applicable. Due to the general nature of this document, the project organization and personnel responsibilities will be identified in site-specific work plans or addenda to these work plans required for environmental activities.

2.1 Responsibilities of Key Personnel

Project Manager:
The project manager (PM) is responsible for overall control of project schedules, budgets, and technical performance. The project manager is also responsible for identifying the overall project objectives.

Technical Manager:
The technical manager (TM) is responsible for identifying tasks and developing site-specific work plans and procedures for completing these tasks in order to achieve the project objectives.

Field Team Leader:
The field team leader (FTL) is responsible for completing the tasks identified in the work plan as they apply to the field investigation team. The FTL is responsible for documenting the day-to-day activities and notifying the TM and PM whenever deviations to the work plan may occur due to change in site conditions.

Site Safety and Health Officer:
The site safety and health officer (SSHO) is responsible for the development of the Site Safety and Health Plan as it related to the work plan. The SSHO is also responsible for the day-to-day control of health and safety activities.

Project Chemist:
The project chemist is responsible for the development of the Sampling and Analysis Plan as it related to the work plan. The project chemist is also responsible for reviewing field efforts and analytical laboratory deliverables and generating a chemical data quality assurance report (CDQAR), also known as a data validation report.

Project Geologist:
The project geologist is responsible for reviewing and interpreting groundwater data and making recommendations regarding future well locations, monitoring well construction, well rehabilitation, pump configuration, etc.

Quality Assurance Officer:
The quality assurance officer (QAO) is responsible for overseeing the technical aspects of the project and reviews the deliverables for the project to verify that the work meets the objectives established in the work plan.

Field Sampling Personnel:
The field sampling personnel report to the team leader and are responsible for obtaining samples and completing other sampling tasks, and packaging and shipping samples to the designated off-site laboratory.

2.2 Analytical Laboratory

An off-site analytical laboratory will be designated to provide analytical services for each groundwater sampling event. The laboratory will be appropriately certified to perform the project analyses. The contract laboratory will be responsible for receiving, preparing and analyzing samples, and for reporting the results.

A copy of the Laboratory Quality Management Plan (LQMP) from the lab will be supplied to the project chemist as a submittal prior to execution of project work. The designated laboratory will be provided a copy of the SAP or site-specific addenda to the SAP for their reference.

3.0 FIELD ACTIVITIES

3.1 Groundwater

3.1.1 Field Screening Measurements

Each monitoring well will be screened for organic vapors with a photo ionization detector (PID) immediately upon opening the well for water level measurements to determine if appropriate personal protective equipment (PPE) is being used. Any adjustments to PPE will be made at this time.

The SSHO may choose to modify the level of PPE and the frequency at which monitoring wells are screened dependent upon the amount of historical data that are available for each site.

3.1.2 Water Level Measurements

Before a well is purged and samples are collected, the static water level will be measures to the nearest 0.01 foot using an electronic water lever indicator. The total well depth will be measured to the nearest 0.01 foot at least annually. Static water level and any total well depth measurements will be recorded. All site wells should be opened prior to purging to allow for equilibration before water level measurements are made.

3.1.3 Monitoring Well Purging Procedures

Before sampling begins, new plastic sheeting must be placed on the ground surrounding the well. The plastic sheeting must be of sufficient size to keep all equipment from contacting the ground surface.

Before opening the well cap, remove any standing water from around the protective casing. **Do not allow any standing water to enter the well casing.**

Remove the well cap and use PID to check for volatile organic compounds (VOCs) in breathing zone and in the well casing. Record all data on the monitoring well sample collection form. **If well is pressurized, allow at least several minutes for the water level to equilibrate and note this information on the well sampling form.**

Measure depth-to-water from the top of the well casing. Consult previous sample collection form or well database to determine the depth of the screened interval for the well. Record all the information on the monitoring well sample collection form.

Wells with slow recharge (wells unable to yield at least three casing volumes) will be pumped or bailed dry and then sampled as soon as sufficient recharge has occurred to fill the sample

containers. Wells shall be sampled within 24 hours of purging, including those wells that are purged dry. Depth to water at the time of sampling shall also be recorded.

If sediment has accumulated in a monitoring well or if turbidity levels cannot be maintained within acceptable limits during purging, the well may be considered for redevelopment at the discretion of the field team leader or project geologist. Well redevelopment well be accomplished using standard methods and protocols. Well purge and redevelopment fluids will be containerized and subsequently treated at the Central Groundwater Treatment Facility (CGTF).

3.1.3.1 Low-Flow Purging Procedures

When placing the pump in the well to be sampled, lower the pump with one continuous smooth motion to minimize the disturbance of any sediment that may have accumulated in the well. The water level meter probe may be lowered with the pump to monitor the depth. The pump should be placed within three feet of the bottom of the screened interval. **Do not raise and lower the pump in the well.** It is important to minimize mixing of stagnant borehole water and disturbing sediment which may have collected at the bottom of the well. Secure the pump at the well head when it reaches the appropriate depth.

Set up the water quality meter and flow-through cell:

- Attach the pump tubing to the flow-through cell.
- Retract the water level meter to the top of the water and record the water level. If the water level has not changed significantly (< 0.3 feet), the well will likely sustain low-flow sampling. Secure the water level meter at the appropriate depth to monitor draw-down as pumping proceeds.
- Record the pump controller settings.
- Record the time, the depth to water, and estimated pump intake depth.
- Begin pumping. Bypass the flow-through cell and monitor the pump discharge. Adjust the discharge to a rate that is just high enough to pump water to the surface. Attach the flow through cell and adjust the flow rate as necessary to maintain flow through the cell. **The flow rate must be set and maintained constant throughout the purge and sampling process.**
- Monitor the flow rate and draw down. The highest flow rate that produces **NO DRAWDOWN** is ideal. The flow rate must be less than 500 milliliters per minute and create drawdown of no more than half the length of submerged screened portion of the well. **The water level should never be allowed to drop to within 2 feet of the top of the pump.** If the well will not sustain a 40 milliliters per minute purge rate with no drawdown,

the well will be pumped dry and a grab sample will be collected with a disposable Teflon bailer. The standard suite of water quality parameters will be recorded at the time of sample collection.

- While purging, initially measure and record the stabilization parameters every 5 minutes. As the readings begin to stabilize, begin recording the parameters every three minutes. The monitoring well will be considered purged when all parameters are stabilized for three consecutive readings. The three readings should be within:

    - 0.5 degrees C for Temperature
    - 3% for specific conductivity
    - 10% for DO
    - 0.1 for pH
    - 10mv ORP
    - Turbidity as low as possible (<10 NTU ideal)

Once stabilization has been confirmed with three consecutive readings, sample collection may begin. All monitoring wells should be purged for a minimum of 40 minutes before sample collection should be considered.

3.1.3.2 Other Purging Procedures

Wells will be purged prior to sample collection to remove stagnant well water and to ensure that representative samples are collected. Purging of wells will be accomplished using a dedicated purge pump if the well is equipped with a dedicated pump system, a portable purging system, such as a submersible pump with discharge hose, or a bailer. If a submersible pump is used, it will be powered by a portable generator that will not introduce oil constituents or other contaminants into the well during purging operations. If bailers are used, they will be pre-cleaned or new, disposable bailers.

Monitoring wells will be purged by removing approximately three to five casing volumes of water from each well. A casing volume is equal to that amount of water present inside the well. To determine the casing volume, the depth-to-water (DTW) (in feet), the total depth (TD) of the well (feet), and the well casing radius (R) (in inches) must be known. To obtain one casing volume (in gallons), apply the following equation:

$$1 \text{ casing volume (gallons)} = [\pi (R)^2 \times (TD-DTW) \times (7.48)] / 144$$

Alternatively, for typical well casing diameters, the volume can be determined using the casing factor (CF) (in gallons per linear foot) as show below:

Well Diameter (Inches)	Casing Factor (CF) (gallons/foot)
2	0.16
4	0.65
6	1.47
8	2.61
10	4.08
12	5.88

During the purging procedures, groundwater quality parameters consisting of turbidity, pH, temperature, and conductivity, will be measures after each well casing volume has been purged. Well purging data will be recorded.

The well will be sampled after three casing volumes have been purged and the groundwater quality parameters have stabilized (or five casing volumes have been purged, whichever occurs first). Groundwater quality parameters will be considered stabilized when the results of the last three measurements are within ten percent of each other.

3.1.4 Determine Immiscible Layers/Free Product Presence and Sampling

Immiscible layers are not anticipated, but, if present, an electronic interface probe will be used to measure the level of the immiscible surface in order to determine the apparent thickness prior to water level measurements. A sample will be collected using a transparent, pre-cleaned Teflon ® bailer, and the presence of the immiscible layer will be confirmed visually. The collected liquids will be containerized separately from well purge fluids for storage and disposal.

3.1.5 Groundwater Quality Measurement Procedures

Commercially available, field rugged analytical instrumentation will be sued to collect field measurements. Measurements will be taken in accordance with manufacturer specification and guidelines. The instruments will meet or exceed applicable state and federal guidelines associated with groundwater sampling.

3.1.6 Groundwater Monitoring Well Sampling Procedures

Monitoring wells will be sampled with a dedicated Teflon ® bladder or acceptable sample pump if the well is not equipped with a dedicated pump system, or using a Teflon ® bailed with a new nylon or polypropylene cord. Generators used to power sampling pumps will be placed downwind of the well to prevent exhaust fumes from contaminating the sample. For samples intended for volatile organics analysis, the pumping rate will be no greater than 100 milliliters per minute to prevent agitation of the water. Similarly, if bailers are used they will be slowly lowered into the wells. Sampling will progress from the least contaminated well to the most contaminated well, if such information exists. Otherwise, up-gradient wells will be sampled before down-gradient wells. The sampling progression is not as critical for wells with dedicated pump systems.

Pre-cleaned sample containers will be filled directly from the bailer or pump discharge tube. Samples will be preserved prior to shipment to the laboratory for analysis. Groundwater sampling analytical parameters and methods are given in Table 3-1. Individual analytical constituents and associated detection limits are given in Attachment 4-1. The appropriate sample size/containers, preservation methods, and holding times for all required analyses are given in Table 3-2. Samples will be collected (when applicable) in the following sequence:

- Volatile Organic Compounds (VOCs)
- Total Petroleum Hydrocarbons – Gasoline Range Organics (TPH-GRO)
- Semi-Volatile Organic Compounds (SVOCs)
- Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-DRO)
- Metals

3.1.7 Sampling Handling Procedures for Groundwater

Groundwater samples will be collected in appropriate containers, which will be filled, preserved (when required), and chilled as soon as possible. The sampler will wear disposable latex gloves, and will change to new gloves between each monitoring well locations. Groundwater samples will not be filtered. Pre-preservation of sample containers will be performed when applicable.

If high levels of metals results possibly caused by suspended solids in groundwater samples are of concern, consideration may be given to collecting and submitting samples for laboratory analysis for both total and dissolved metals.

3.1.8 Sample Containers and Preservation Techniques

Samples will be containerized and preserved in accordance with current state and federal guidelines. Groundwater, wastewater, travel blank, and rinsate blank sample are anticipated to be collected for this effort. Table 3-1 and Table 3-2 reference information pertaining to sample containers and preservation techniques.

In the absence of any specific sampling or analytical method or technique, the project team will reference the most current edition of EPA's Office of Solid Waste SW-846 analytical method manual.

Table 3-1
Compliance Monitoring – Sampling and analytical Requirements

IRP Site	Matrix	# of samples	QC	Monitoring Parameter	Method*	Turn-Around Time
ST-12, SS-24, SS-25	Groundwater	21	See note	VOCs	SW-846 8260 D	30 days
		21	See note	SVOCs	SW-846 8270 E	30 days
SS-07	Groundwater	18	See note	VOCs	SW-846 8260 D	30 days
		18	See note	RCRA Metals	SW-846 6010 D / 7470	30 days
	Surface Water	2	See note	VOCs	SW-846 8260 D	30 days
		2	See note	RCRA Metals	SW-846 6010 D / 7470	30 days
	Sediment	2	See note	VOCs	SW-846 8260 D	30 days
		2	See note	RCRA Metals	SW-846 6010 D / 7471	30 days
LF-03, ST-08, SS-28	Groundwater	7	See note	VOCs	SW-846 8260 D	30 days
		7	See note	RCRA Metals	SW-846 6010 D / 7470	30 days
SS-26	Groundwater	4	See note	VOCs	SW-846 8260 D	30 days
		4	See note	SVOCs	SW-846 8270 E	30 days
		4	See note	TPH-GRO/DRO	SW-846 8015M	30 days
FT-02	Groundwater	2	See note	VOCs	SW-846 8260 D	30 days
		2	See note	SVOCs	SW-846 8270 E	30 days
		2	See note	RCRA Metals	SW-846 6010 D / 7470	30 days
		2	See note	TPH-GRO/DRO	SW-846 8015M	30 days
DP-05	Groundwater	9	See note	VOCs	SW-846 8260 D	30 days
		9	See note	SVOCs	SW-846 8270 E	30 days
		9	See note	RCRA Metals	SW-846 6010 D / 7470	30 days
		9	See note	TPH-GRO/DRO	SW-846 8015M	30 days
	Surface water	2	See note	VOCs	SW-846 8260 D	30 days
		2	See note	SVOCs	SW-846 8270 E	30 days
		2	See note	TPH-GRO/DRO	SW-846 8015M	30 days
		2	See note	RCRA Metals	SW-846 6010 D / 7470	30 days
	Sediment	2	See note	VOCs	SW-846 8260 D	30 days
		2	See note	SVOCs	SW-846 8270 E	30 days
		2	See note	TPH-GRO/DRO	SW-846 8015M	30 days
		2	See note	RCRA Metals	SW-846 6010 D / 7471	30 days
Drums or poly tank (disposal)	Redevelopment / purge water	1 per site	See note	VOCs	SW-846 8260 D	30 days
			See note	SVOCs	SW-846 8270 E	30 days
			See note	RCRA Metals	SW-846 6010 D / 7470	30 days

*U.S. EPA, 1996 *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) Update III*

DRO – diesel range organics
GRO – gasoline range organics
RCRA – Resource Conservation and Recovery Act
SVOC – semi-volatile organic compounds
TPH – Total Petroleum Hydrocarbons
VOC – volatile organic compounds
Note: a minimum of ten percent (10%) of the groundwater samples collected at each site (or group of sites) and of the additional samples associated with other matrices such as surface water and sediment shall be quality control samples. The groundwater specific analyte list for each well is found in Section IV Part B of the Permit.

Table 3-2
Sample Volume, Containerization, Preservation, and Holding Times

Parameter	Container/Minimum Sample Volume	Holding Time	Preservation
Water (Groundwater, Surface Water, Wastewater, Travel Blanks, Rinsate Blanks)			
VOC	3 x 40 ml Vial with PTFE septa cap	14 days to Analysis	HCl to pH < 2 4˚C with no headspace
SVOC	2 x 1 L AG	7 Days to Extraction 40 Days to Analysis	4˚C
RCRA Metals	1 x 1L HDPE bottle	6 Months, except for Mercury (28) days	HNO_3 to pH < 2 4˚C
TPH-GRO	3 x 40 ml Vial with PTFE septa cap	14 days to Analysis	HCl to pH < 2 4˚C with no headspace
TPH-DRO	2 x 1 L AG	7 Days to Extraction 40 Days to Analysis	4˚C
Sediment			
VOC	1 4oz. wide mouth jar with PTFE septa lid	14 days to Analysis	No preservation
SVOC	1 8oz. wide mouth jar with PTFE septa lid	14 Days to Extraction 40 Days to Analysis	No preservation
RCRA Metals	1 8oz. wide mouth jar with PTFE septa lid	6 Months, except for Mercury (28) days	No preservation
TPH-GRO	1 8oz. wide mouth jar with PTFE septa lid	14 days to Analysis	No preservation
TPH-DRO	1 8oz. wide mouth jar with PTFE septa lid	14 Days to Extraction 40 Days to Analysis	No preservation

The above listed volumes provide an adequate quantity of sample to analyze a matrix spike (MS) and matrix spice duplicate (MSD).

AG – amber glass jug
˚C – degrees Celsius
DRO – diesel range organic
GRO – gasoline range organic
HCl – hydrochloric acid
HDPE – high-density polyethylene
HNO_3 – nitric acid
mL - milliliter
PTFE - polytetrafluoroethylene
RCRA – Resource Conservation and Recovery Act
SVOC – semi-volatile organic compound
TPH – total petroleum hydrocarbons
VOC – volatile organic compound

3.1.9 Field Quality Control Sampling Procedures

Groundwater samples will be collected in duplicate to monitor the accuracy and precision of field and laboratory techniques and methods. Additionally, travel blanks and rinsate blanks will be collected and analyzed for quality control purposes. Discussions regarding these sample types are listed in Section 8.0 of this plan.

3.1.10 Instrumentation and Equipment Decontamination Procedures

Reusable sampling equipment, such as bailers, buckets, funnels, and spoons, will be decontaminated prior to each use. At a minimum, this equipment will be washed using a biodegradable non-phosphate detergent (such as Alconox, Liquinox, or equivalent) and potable water, followed by two deionized water rinses, and allowed to air dry.

Sample locations know to be grossly contaminated as determined by field observation or former analytical testing will require sample equipment to include a final isopropyl alcohol rinse prior to being air-dried.

Equipment used to develop or purge groundwater from a monitoring well will be washed and rinsed as required. The field team leader is responsible for ensuring that all equipment coming into contact with soil or groundwater is free of contamination and will not compromise the validity of the sample results.

The electronic water level indicator used to measure depth to groundwater in monitoring wells will be decontaminated in the field prior to use at each well. The decontamination procedure will be the same as that used for sampling equipment. Decontamination fluids will be containerized and subsequently treated at the CGTF.

3.2 Surface Water and Sediment

Additional samples associated with such matrices as surface water and sediment will be collected during groundwater sampling activities at identified IRP Sites. Sampling and analytical requirements are show in Table 3-1 and sample volume, containerization, preservation, and holding times are shown in Table 3-2. Individual analytical constituents and associated detection limits are given in Attachment 1.

4.0 FIELD OPERATIONS DOCUMENTATION

4.1 Field Logbook and Sample Field Sheets

The field team leader and other team members will maintain bound field logbooks to provide a daily record of significant events, observations, and measurements during sampling. All information pertinent to sampling will be recorded in the logbooks. All entries will be signed and dated and must include at least the following information:

- Name and title of author, date and time of entry, and weather/environmental conditions during the field activity
- Location of sampling activity
- Name and title of field crew
- Name and title of site visitors
- Sample media (i.e., groundwater)
- Sample collection method
- Number and volume of sample(s) taken
- Date and time of collection
- Sample identification number(s)
- Sample distribution (i.e., which laboratory the sample was sent for analysis)
- Field observations
- Field measurements (i.e., groundwater quality parameters)

These notes must be dated and signed (each page) for validity in a court of law. All logbook entries will be made with waterproof ink and legibly written. Field notes will be entered into a bound logbook and the pages will be consecutively numbered. All entries will be chronological order. The language will be factual and objective. No erasures will be permitted. If an incorrect entry is made, the error will be crossed out with a single strikeout mark, initialed and dated.

4.2 Data Quality Control Reports

The field logbook will be used to prepare a Daily Quality Control Report (DQCR) DQCRs will be completed each day of field activities, if required, by the field team leader or other authorized personnel and forwarded to the TM or PM daily or upon request. The report will include the following general information:

- Name of site personnel and visitors
- Summary of field activities and progress of work
- Verbal instructions/recommendations from government personnel
- Change in site conditions
- Safety issues
- General remarks

4.3 Field Measurement Records

The field logbook will be used to document and track the calibration and maintenance of all instrumentation used in the field.

5.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Samples collected during the field activities will be shipped via commercial or government courier to the designated analytical laboratory(s).

Coolers will not be shipped for Saturday delivery unless arrangements have been made with the respective laboratory prior to the shipment. A cooler of suitable strength for packaging and shipping samples will be used and will be manifested to meet U.S. Department of Transportation (DOT) regulations (dangerous goods, etc.). The inside of each cooler will be lined with a plastic commercial grade trash bag or otherwise sealed to prevent leaking, and all samples and sample packing materials will be placed inside the bag. The bottom and sides of each cooler will be lined with bubble wrap, a polyethylene foam insert, or other cushioning material.

All samples will be kept upright in the cooler. Once the samples are in the cooler, ice will be placed in the cooler with the samples. A sufficient amount of ice will be added to the coolers to ensure that they arrive at the laboratory at a temperature of 4° Celsius (°C) (± 2°C).

The original chain-of-custody record will be placed in a watertight plastic bag and taped to the inside lid of the cooler. The cooler will be secured with strapping tape and custody seals will be affixed to or near the seal/lip of the cooler lid. The custody seals will be covered with wide, clear adhesive tape. Appropriate shipping labels will be placed on each cooler. These labels should identify the shipper and the laboratory, points of contact, phone numbers and street addresses.

6.0 DATA ASSESSMENT ORGANIZATION AND RESPONSIBILITIES

Data assessment will begin with the evaluation of the samples received onsite, and will include all relevant and appropriate requirements. The contract laboratory will perform a similar assessment of the received samples. All analyses will be conducted with respect to the laboratory's standard operating procedures, and applicable federal method requirements and guidance. The laboratory will document all concerns encountered with the various analyses with respect to these regulations. The project chemist will prepare an analytical data package, which will substantiate the results reported by the off-site laboratory. The off-site laboratory will prepare a similar analytical data package and deliver it to the project chemist.

7.0 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required from field and laboratory data collection activities to support decisions concerning risk and remediation. DQOs are established prior to data collection and describe what data are needed, why the data are needed, and how the data will be used to address the problems being investigated. DQOs help to ensure that all data collected at legally and scientifically defensible.

7.1 Measurement Quality Objectives for Chemical Data Management

All groundwater samples collected from monitoring wells and samples collected from other matrices will be analyzed off-site. At a minimum, 10% of the samples collected will be collected in duplicate. These samples will be shipped off-site to the same analytical laboratory for analysis as the primary (field) samples. These samples will be identified as QC duplicate samples and labeled accordingly.

One equipment or rinsate blank will be collected and analyzed for 5% of the groundwater samples; whenever the same sampling equipment is used repeatedly. Results from these samples assist in evaluating decontamination procedures and equipment cross-contamination.

Travel blanks will accompany all aqueous sample shipments; specifically with those samples being collected and analyzed for volatile organics. Travel blanks are collected and analyzed to assist with evaluating cross-contamination among each volatile organic sample shipment.

8.0 SAMPLE HANDLING, DELIVERY, AND CUSTODY REQUIREMENTS

Proper sample handing, delivery, and maintenance of a chain of custody are key components to building the documentation and support for data that can be used for decision-making. It is essential that all sample handling and sample chain of custody requirements be performed in a complete, accurate, and consistent manner.

8.1 Sample Handling and Delivery

Samples will be delivered to the designated laboratories by local courier or by a common carrier such as Federal Express. Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. The samples must be cushioned to cause the least amount of damage if such a fall occurs.

All aqueous volatile organic compound sample vials will be shipped in the same cooler on a given day. A travel blank will be included in each cooler with aqueous volatile organic samples (travel blanks are not required for coolers containing volatile organic soil or sediment samples). After packing is complete, the cooler will be strapped closed with strapping tape and with chain of custody seals affixed across the top and bottom joints. Each container will be clearly marked with a sticker containing the originator's address and the address and point of contact for the receiving laboratory.

The following procedures must be used when transferring samples for shipment:

- An original chain of custody (COC) form identifying the contents must accompany all sample coolers/packages. When transferring possession of the samples, the individuals relinquishing and receiving the samples must sign, date and note the time on the record. This record documents transfer of custody samples from the field sampler to another person or to the laboratory. The original chain of custody record must accompany the shipment, and the technician must retain a copy.

- Samples must be property packaged for shipment and delivered to the appropriate laboratory for analysis with a separate signed chain of custody form enclosed in each sample box or cooler.

8.2 Sample Custody

Sample custody and documentation procedures described in this section will be followed throughout all sample collection activities. Components of sample custody procedures include the use the field logbooks, sample labels, custody seals, and chain of custody forms. Each person involved with sampling handling must be trained in chain of custody procedures before the start

of the field project. The original chain of custody form must accompany the samples during shipment from the field to the off-site laboratory.

A sample is under custody under the following conditions:

- It is in one's actual possession
- It is in one's view, after being in one's physical possession
- It was in one's physical possession and that person locks it up to prevent tampering
- It is in a designated and identified secure area

8.2.1 Field Custody

The following procedures must be used to document, establish, and maintain custody of field samples:

- Sample labels must be completed for each sample with waterproof ink, ensuring that the labels are legible and affixed firmly on the sample container.
- All sample-related information must be recorded in the project logbook.
- The field sampler must retain custody of samples until they are transferred or properly dispatched.
- An original chain of custody record will accompany all samples. This record documents the transfer of custody of samples from the field investigator to another person, to the laboratory, or to other organizational entities. An authorized signature for relinquishment and receipt of the samples must accompany each change of possession.
- Completed original chain of custody forms will be enclosed in a plastic cover and placed inside the shipping container used for sample transport from the field to the laboratory.
- When samples are relinquished to a shipping company for transport, the tracking number from the shipping bill or receipt will be recorded on the chain of custody form.
- Custody seals must be affixed on shipping containers when samples are shipped to the laboratory to prevent sample tampering during transportation.

8.2.2 Laboratory Custody

Each laboratory receiving samples must comply with the laboratory sample custody requirements outlined in the subcontract document and its own quality assurance plan. The field team leader or project chemist will notify the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped, and the expected date of arrival.

The laboratory sample custodian will used the following procedures, once the samples have arrived at the laboratory:

- The laboratory will designate a sample custodian who will be responsible for maintaining the custody of the samples and for maintaining all associated records documenting that custody.

- Upon receipt of the samples, the custodian will check the original chain of custody and request-for-analysis documents and compare them with the labeled contents of each sample container for corrections and traceability. The sample custodian will sign the original chain of custody and record the date and time received. The sample custodian also will assign a unique laboratory sample number to each sample.

- Cooler temperature will be checked and recorded.

- Care will be exercised to annotate any labeling or descriptive errors. If discrepancies occur in the documentation, the laboratory will immediately contact the field team leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain of custody procedure.

- If all data and samples are correct and there has been no tampering with the custody seals, the "Received by Laboratory" box will be signed and dated.

- Samples will be stored in a secured area and at a temperature of 4˚C (± 2˚C), if necessary, until analyses are to begin.

- The laboratory will send a sample acknowledgement letter to the project chemist and project manager as a record that the shipment arrived and the condition of the containers upon arrival. Any discrepancy will be identified and corrective actions performed. The project chemist may need to provide guidance concerning additional actions. The project manager will retain a copy of the sample acknowledgement with the chain of custody.

- A chain of custody form will accompany all samples. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time of

the record. This record documents transfer of custody of samples from the field sampler to another person, or to the laboratory. Overnight carriers will be treated as a single entity, and a single signature will be required when samples are delivered to the laboratory.

- A laboratory chain of custody form will accompany the sample or sample fraction through final analysis for control.

- Copies of the chain of custody and request-for-analysis forms will accompany the laboratory report and will become a permanent part of the project records.

- Samples must be properly packaged for shipment and delivered to the appropriate laboratory for analysis with a separate signed chain of custody form enclosed in each sample box or cooler.

- A chain of custody form identifying the contents must accompany all packages. The original record must accompany the shipment, and the field team leader must retain a copy. Additional details about laboratory sample custody will be included in the laboratory comprehensive quality assurance plan.

8.3 Holding Time Requirements

All samples will be processed as required to provide compliance with the holding time limits for preparation and analysis. The sample holding time will be determined from the date and time the sample is collected in the field. Sufficient lead time will also be allowed for the reanalysis of samples within holding times in the event that calibration, method, or quality control failures occur. Noncompliance with the method-specific holding time limits, without proper justification, will be grounds for rejecting the data results.

8.4 Verification/Documentation of Cooler Receipt Condition

The off-site laboratory will submit a tabulation of samples received from the project team within 10 days after the sampling event is completed and will update their records to include any subsequent sampling events. The following information will be provided for each sample received:

- Date sample was received by the lab

- Lab package identification number

- Field sample identification number

- Project site

- Cooler number
- Cooler condition (temperature, packaging, damage, etc.)
- Type of sample media and the parameters listed on the chain-of-custody.

8.5 Corrective Action for Incoming Samples

The off-site laboratory will not be held accountable for any sample deficiencies noted upon arrival at the performing laboratory, such as broken or leaking sample containers, high cooler temperatures, etc. The laboratory will immediately notify the project chemist or technical manager by telephone concerning such deficiencies in order to obtain guidance regarding the appropriate action required.

9.0 ANALYTICAL PROCEDURES

Off-site analyses will be conducted utilizing the latest approved update of the methods stipulated in the field sampling plan and individual contract laboratory task orders. Required target compounds, methods and contract required reporting limits (CRRLs) are listed in Attachment 4-1. The analyses for these parameters will comply with current EPA SW 846 method guidance.

The contract laboratory will maintain written laboratory-specific standard operating procedures for all methods and general operations necessary to perform the requested analytical services. The standard operating procedures will fully detail the actual procedures and documentation used to implement performance-based methods. Simply referencing a given method or method number will not be acceptable. The standard operating procedures will be based on the latest available guidance published by the federal government and other pertinent references.

10.0 DATA REDUCTION AND EVALUATION

The data reduction and evaluation process begins with the receipt of all laboratory data submittals and the associated chemical data quality review reports or case narratives. The off-site laboratory will have been required to meet a list of laboratory deliverables designated specifically for the project prior to start of work. The project chemist then evaluates the data generated by all the laboratories and determines whether the data are reliable, defensible, and complete.

The data shall be evaluated with regards to project specific quality assurance objectives (i.e., Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity); otherwise known as PARCCS. They are defined as follows:

10.1 Precision

Precision examines the distribution of the reported values about their mean. The distribution of reported values refers to how different the individual reported values are from the average reported value. Evaluating spikes sampled recoveries and associated duplicate recoveries are commonly used to assess analytical precision

10.2 Accuracy

Accuracy measures the bias in a measurement system and is difficult to measure for the entire data collection activity. Analytical accuracy is commonly assessed by evaluating known and unknown QC sample and spiked sample recoveries. This includes the evaluation of internal and surrogate standard recoveries. Evaluating travel blank, method blank, and equipment blank results to determine potential concentration contribution from various outside sources (i.e., field or lab activities), is also used to assess accuracy.

10.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely depicts the characteristics of a population of samples. Representativeness is commonly assessed by evaluating, duplicate field and laboratory samples, (i.e., field and QC samples).

10.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability is assessed by evaluating field samples to previous sampling data at a particular site.

10.5 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements compared to the total number of measurements planned.

10.6 Sensitivity

Sensitivity addresses how well selected analytical methods and instruments respond to change in analyte concentration. The appropriate analytical methods must be selected to meet or exceed specific project data requirements. Some methods may not be applicable for the analysis of certain environmental matrices. Sensitivity is assessed by evaluating the reported method detection limits and evaluating calibration information provided by the laboratory.

11.0 LABORATORY OPERATIONS DOCUMENTATION

11.1 Data Reporting Procedures Data Management Procedures

Chemical data quality management and laboratory documentation will fully comply with the latest edition of USACE ER-1110-1-263, "Chemical Data Quality Management for Hazardous Waste Remedial Activities". The off-site analytical laboratory will provide the following data and documentation in the paper and electronic copies of the data packages will comply with the following requirements:

- Complete documentation of all incoming sample shipments by the performing laboratories is required. This will include at a minim, the following: (a) signing for sample shipments; (b) receiving and reviewing all shipments for completeness and accuracy against enclosed letters and forms; (c) signing and dating the enclosed chain-of-custody forms; (d) logging all shipments of samples into appropriate log books and/or computer laboratory information management systems; and (e) contacting the project chemist immediately for resolution of any problems that may have been noted. Individual cooler receipt forms will be used for each shipment to verify and document any problems noted.

- The chain-of-custody form, any shipping documents, completed cooler receipt forms, telephone conversation record forms, and any corrective action forms will be maintained by the laboratory for each shipment and included in the data package when the final results are reported.

- Analytical results will be provided on the performing laboratory's letterhead, dated and signed by the designated laboratory project manager. Results for more than one field sample or more than one parameter will not be combined on the same data results sheet. The data results sheets, will contain the following information at a minimum:

    - Client identification
    - Project site identification and Contract Task Order Number
    - Field sample identification number as written on custody form
    - Laboratory sample identification number
    - Matrix (soil, water, sediment, etc.)
    - Dates sample was collected and received at the laboratory
    - Date and time sample extracted or prepared
    - Date and time sample was analyzed with parameter identification
    - Preparation, extraction and method numbers
    - Preparation, analysis, quality control and other batch number
    - Method quantitation limit for each analyte
    - Method detection limit for each analyte
    - Results reported in consistent units

- Results reported as an actual value, estimated value or value below the method detection limit (i.e., non-detected)
- Applicable data qualifiers
- Tentatively identified compounds for applicable parameters
- Dilution factors for each analyte
- Percent solids for solid media samples with results reported on a dry-weight basis.

- If significant equipment fouling and/or matrix interference can be avoided, samples will initially be analyzed undiluted. Otherwise, serial dilution or screening protocols will be practiced to analyze samples at the lowest possible dilution factor. If the results for one or more analytes exceed their calibration range, when the sample is analyzed near or at a particular dilution, those results should be qualified and the sample diluted and reanalyzed to obtain valid results for those analytes. The desired goal is to report the results for a particular target analyte, either undiluted or at the lowest possible dilution factor, as long as the result falls within its calibration range.

- Standard EPA data qualifiers will be used to indicate: (1) blank contamination; (2) sample-analytical anomalies associated with an analyte; (3) analyte results which fall between the method detection limit and actual sample quantitation limits; (4) data rejected due to exceedance of method-specific holding times, high cooler temperatures, or other signification quality control data deficiencies; and (5) data results which exceed the upper calibration curve limit for that analyte.

- A quality control summary, which provides tabulate results of laboratory blanks, surrogate spikes and recoveries, matrix spike/matrix spike duplicate and laboratory control spike, laboratory duplicates, relative percent differences and field duplicates will be provided. Acceptable surrogate, matrix spike and laboratory control spike recovery ranges and relative percent difference limits will be shown on the field or quality control data packages adjacent to the actual results obtained.
- Sample calibration and internal standard/retention time summaries will be provided for applicable parameters.

- Sample identification numbers will be cross-referenced with laboratory identification numbers and quality control sample numbers. Tables which cross-reference field samples with associated method blanks, matrix spike/matrix spike duplicate, and laboratory control spike samples will be provided.

- A detailed case narrative will be provided for each parameter or parameter set. The case narrative will include analysis/preparation method numbers, batch numbers, standard operating procedures references, statements concerning the validity of the calibration, internal standard and quality control sample results, use of manual integrations, and other technical information concerning holding times, sample preservation-integrity and

conformance with the method standard operating procedures. Recommendations regarding qualification or rejection of the associated data will be provided.

- An electronic deliverable will be provided with each data package.

- Analytical documentation, such as detailed calibration data, mass spectra, chromatograms, method detection limit studies, performance standards, and other laboratory quality control information will not be included in the deliverables, however, these data will be provided if requested.

- The contractor will promptly address comments received from the project chemist regarding the data package deliverables. A copy of any resulting data package revisions will be promptly provided to the project chemist for compliance review.

11.2 Laboratory Turnaround Time

Unless specified otherwise in the analytical services contract, an unbound copy of each completed laboratory data package, including all required quality control documentation, will be provided to the project chemist within a period of 30 calendar days after the associated samples were received by the performing laboratory.

Accelerated data submittals required within three (3) to twenty-one (21) calendar days can be faxed. Electronic copies of the data results with the associated quality control sample results can also be delivered. The performing laboratory will also concurrently provide information regarding any significant quality control deficiencies related to those sample results.

11.3 Data Archival/Retention Requirements

Sufficient and appropriate controlled-access archiving space will be provided by the contract laboratory to store the data and its associated detailed quality control documentation generated by the laboratory for a period of 36 months after the analysis had been completed.

11.4 Electronic Data Deliverable

The contract laboratory will also provide all project analytical data in an electronic data format. The file structure will comply with the latest version of the ERPIMS format. ERPIMS is the current Air Force system for validation and management of data from environmental sites at all Air Force bases. These data contain analytical chemistry samples, test, and results as well as hydrogeological information, site/location descriptions, and monitoring well characteristics. QC data are also required input into the database.

11.5 Review of ERPIMS Electronic Media Deliverable

Upon receipt of the laboratory electronic media deliverable, the media will be reviewed by contractor technical personnel. The review will consist of reviewing the format and files to ensure that they also comply with the format. The review will also consist of a review of the media contents for completeness; all analytical data has been entered correctly. If problems are encountered in the analytical data, the media will be returned to the analytical laboratory for a correction. After the data base review is completed, the files will be converted into ERPIMS files. Unless otherwise instructed by Vance AFB, the ERPIMS format files will be submitted to the Air Force Civil Engineer Center (AFCEC) for addition to the Vance AFB ERPIMS data set.

12.0 DATA ASSESSMENT PROCEDURES

The project chemist shall closely scrutinize field and quality control sample results. Inconsistencies found between these results shall be examined and Federal guidelines employed to judge the validity of the results. Differences in field and quality control results which are greater than five (5) times the sample quantitation limit are noted and reviewed. Duplicate sample result differences that are greater than a factor of two (for aqueous samples) and a factor of five (5) (for soil/sediment samples) are considered to fall outside typical quality control ranges and are reviewed. Differences, which cannot be adequately interpreted by the project chemist, shall be noted and evaluated by the technical team. The data will either be accepted, rejected, or if practical; the sample in question may be reanalyzed.

ATTACHMENT 4-1

ANALYTICAL METHODS AND CONSTITUENT/REPORTING LIMITS

VOLATILE ORGANIC ANALYSES BY GWMS – LIQUID AND SOLID BY METHOD SW 846 8260 D		
Parameter	**Reporting Limit**	
Total Volatile Organics	**Liquid (ug/L)**	**Solid (ug/kg)**
Acetone	20	50
Benzene	1	5
Bromodichloromethane	1	5
Bromoform	1	5
Bromomethane (Methyl Bromide)	1	5
Carbon Tetrachloride	1	5
Chlorobenzene	1	5
Chloroethane	1	5
2-Chloroethylvinyl Ether	5	5
Chloroform	1	5
Chloromethane	1	5
Dibromochloromethane	1	5
1,2-Dichlorobenzene	1	5
1,3-Dichlorobenzene	1	5
1,4-Dichlorobenzene	1	5
1,1-Dichloroethane	1	5
1,2-Dichloroethane	1	5
1,1-Dichloroethene	1	5
cis-1,2-Dichloroethene	1	5
trans-1,2-Dichloroethene	1	5
1,2-Dichloropropane	1	5
cis-1,3-Dichloropropene	1	5
trans-1,3-Dichloropropene	1	5
Ethyl Benzene	1	5
Methylene Chloride	10	10
Methyl Ethyl Ketone (MEK)	10	10
4-Methyl-2-pentenone (MIBK)	10	10
1,1,2,2-Tetrachloroethane	1	5
Tetrachloroethene	1	5
Toluene	1	5
1,1,1-Trichloroethane	1	5
1,1,2-Trichoroethane	1	5
Trichloroethene	1	5
Trichlorfluoromethane	1	5
Vinyl Chloride	2	5
Semi-Volatile Organics	**Liquid (ug/L)**	**Solid (ug/kg)**
o-Xylenes	1	5
m & p-Xylenes	1	5

SEMI-VOLATILE ORGANIC ANALYSES BY GWMS – LIQUID AND SOLID BY METHOD SW 846 8270 E		
Parameter	**Reporting Limit**	
Semi-Volatile Organics	**Liquid (ug/L)**	**Solid (ug/kg)**
Acenaphthene	10	330
Acenaphthylene	10	330
Anthracene	10	330
Benz(a)anthracene	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(g,h)perylene	10	330
Benzo(a)pyrene	10	330
Benzyl alcohol	20	670
Bis(2-chloroethyl)ether	10	330
Bis(2-chloroethoxy)methane	10	330
Bis(2-chloroisopropyl)ether	10	330
Bis(2-ethylhexyl)phthalate	10	330
4-Bromophenyl Phenyl Ether	10	330
Butyl benzyl phthalate	10	330
Carbazole	10	330
4-Chloraniline	20	670
4-Chloro-3-methylphenol	20	670
2-Chloronaphthalene	10	330
2-Chlorophenol	10	330
4-Chlorophenyl Phenyl Ether	10	330
Chrysene	10	330
Dibenz(a,h)anthracene	10	330
Dibenzofuran	10	330
Di-n-butyl Phthalate	10	330
1, 2-Dichlorobenzene	10	330
1, 3-Dichlorobenzene	10	330
1, 4-Dichlorobenzene	10	330
3, 3-Dichlorobenzidine	20	670
2, 4-Dichlorophenol	10	330
Diethylphthalate (DEP)	10	330
2, 4-Dimethyl Phenol	10	330
Dimethylphthalate	10	330
4, 6-Dinitro-2-methylphenol	50	1,700
2, 4-Dinitrophenol	50	1,700
2, 4-Dinitrotoluene	10	330
2, 6-Dinitrotoluene	10	330
Di-n-octyl phthalate	10	330

SEMI-VOLATILE ORGANIC ANALYSES BY GWMS – LIQUID AND SOLID BY METHOD SW 846 8270 E		
Parameter	**Reporting Limit**	
Semi-Volatile Organics	**Liquid (ug/L)**	**Solid (ug/kg)**
Fluoranthene	10	330
Fluorene	10	330
Hexachlorobenzene	10	330
Hexachlorobutadiene	10	330
Hexachlorocyclopentadine	10	330
Hexachloroethane	10	330
Indeno (1,2,3-cd) pyrene	10	330
Isophorone	10	330
2-Methylnaphthalene	10	330
2-Methylphenol	10	330
3-Methylphenol	10	330
4-Methylphenol	10	330
Naphthalene	10	330
2-Nitroaniline	50	1,700
3-Nitroaniline	50	330
4-Nitroaniline	50	1,700
Nitrobenzene	10	330
2-Nitrophenol	10	330
4-Nitrophenol	10	330
N-Nitrosodiphenylamine	10	330
N-Nitroso-di-n-propylamine	10	330
Pentachlorophenol	50	1,700
Phenanthrene	10	330
Phenol	10	330
Pyrene	10	330
Pyridine	10	330
1, 2, 4-Trichlorobenzene	10	330
2, 4, 5-Trichlorophenol	10	330
2, 4, 6-Trichlorophenol	10	330

TOTAL PETROLEUM HYDROCARBONS BY GC – LIQUID AND SOLID BY METHOD SW846 8015M		
Parameter	**Reporting Limit**	
Total Petroleum Hydrocarbons	**Liquid (ml/L)**	**Solid (mg/kg)**
Gasoline Range Organics	0.1	1
Diesel Range Organics	1.0	10

METALLIC (TOTAL) PARAMETERS BY GFAA FURNACE OR ICAP – LIQUID AND SOLID			
Parameter	**Method**	**Reporting Limit**	
Total Metals	**SW-846 7010, 6010 D (ICP) or 6020 B**	**Liquid (ug/L)**	**Solid mg/kg)**
Arsenic	SW-846 6010B, 6020 or 7060A	5.0	1.0
Barium	SW-846 6010B	100	10
Cadmium	SW-846 6010B	5.0	1.0
Chromium	SW-846 6010B	10	1.0
Lead	SW-846 7421	5.0	1.0
Mercury	SW-846 7470A	0.20	0.5
Selenium	SW-846 7740	5	1.0
Silver	SW-846 6010B	10	1.0

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