DEPARTMENT OF THE AIR FORCE
377TH AIR BASE WING (AFGSC)

Colonel Ryan S. Nye, USAF
Vice Commander
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3 Sep 20

Mr. Kevin Pierard and Mr. Dave Cobrain
Hazardous Waste Bureau
New Mexico Environment Department (NMED)
2905 Rodeo Park Drive East, Building 1
Santa Fe NM 87505

Dear Mr. Pierard

Kirtland Air Force Base (AFB) is pleased to submit the *Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10, Bulk Fuels Facility, Solid Waste Management Units (SWMU) ST-106/SS-111*, Kirtland AFB, New Mexico dated September 2020. This work plan has been revised in response to the NMED July 14, 2020 approval with modifications letter.

If you have any questions or concerns, please contact Mr. Sheen Kottkamp at (806) 463-0811 or email sheen.kottkamp.1@us.af.mil.

Sincerely

RYAN S. NYE, Colonel, USAF
Vice Commander

Attachments:
Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10, September 2020

cc:
NMED-HWB (Pierard, Cobrain), letter, work plan and CD
NMED-RPD (Stringer), letter and CD
EPA Region 6 (King, Ellinger), letter and CD
SAF-IEE (Lynnes), electronic only
AFCEC/CZ (Cash, Kottkamp, Segura,), electronic only
USACE-ABQ District Office (Moayyad, Phaneuf, Dreeland, Cordova, Kunkel) electronic only
Public Info Repository, Administrative Record/Information Repository (AR/IR) and File

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

WORK PLAN FOR DATA GAP MONITORING WELL INSTALLATION KAFB-106248 to KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111

September 2020

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KIRTLAND AIR FORCE BASE

ALBUQUERQUE, NEW MEXICO

Work Plan for Data Gap Monitoring Well Installation
KAFB-106248 to KAFB-106252 and KAFB-106S10
Bulk Fuels Facility
Solid Waste Management Units ST-106/SS-111

September 2020

Prepared for

Kirtland Air Force Base
Environmental Restoration Program
2050 Wyoming Blvd., S.E.
Kirtland AFB, NM 87117

USACE Contract Number: W912PP-17-C-0028

Prepared by

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14. ABSTRACT
This Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10 is provided by Kirtland Air Force Base (AFB). It pertains to the Kirtland AFB Bulk Fuels Facility site at Solid Waste Management Units (SWMUs) ST-106/SS-111, located in Albuquerque, New Mexico. This work plan was prepared in accordance with the corrective action provisions in Part 6 of the Resource Conservation and Recovery Act (RCRA) permit issued to Kirtland AFB by the New Mexico Environment Department (EPA ID No. NM 9570024423). This work plan was prepared in accordance with applicable federal, state, and local laws and regulations. The objective of the work plan is to describe proposed groundwater monitoring (GWM) well installation activities to address existing data gaps and to collect data to further understanding of the contaminant migration pathway beneath the source area. Details on the installation of new wells and the incorporation of those wells into the GWM program are provided in this work plan. The work plan was prepared under Kirtland AFB and U.S. Army Corps of Engineers review. Mr. Scott Clark is the Kirtland AFB Restoration Section Chief.

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Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111, ethylene dibromide, EDB, interim measures, RCRA, groundwater sampling, groundwater well installation

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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 fines and imprisonment for knowing violations.

RYAN S. NYE, Colonel, U.S. Air Force
Vice Commander, 377th Air Base Wing

3 Sep 20
Date

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

2 Sep 20
Date

PREFACE

This Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB106S10 was prepared in response to the New Mexico Environment Department (NMED) letter of November 4, 2019, and revised in response to the NMED approval with modifications of July 14, 2020 (NMED, 2020). This Work Plan was prepared by Sundance Consulting, Inc. (Sundance) for Kirtland Air Force Base (AFB) under U.S. Army Corps of Engineers (USACE) contract number W912PP-17-C-0028. It pertains to the Kirtland AFB Bulk Fuels Facility site at Solid Waste Management Units (SWMUs) ST-106/SS-111, located in Albuquerque, New Mexico. This work plan was prepared in accordance with the Resource Conservation and Recovery Act (RCRA) permit issued to Kirtland AFB under RCRA and applicable federal, state, and local laws and regulations.

This work plan contains data collected by Sundance itself as well as from other entities/sources that are not under Sundance's direct control (collectively "non-Sundance data"). All non-Sundance data reported herein are displayed in the form they were received from their source entity, and Sundance assumes no liability for the accuracy of any non-Sundance data in this report.

The objective of the work plan is to describe proposed groundwater monitoring (GWM) well installation activities to address existing data gaps and to collect data to further understanding of the contaminant migration pathway beneath the source area. Details on the installation of new GWM wells and the incorporation of those wells into the GWM program are provided in this work plan.

The work plan was prepared under Kirtland AFB and USACE review.

Rachel Hobbs

Rachel Hobbs, PG, PMP
Sundance Consulting, Inc.
Project Manager

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ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
AFB	Air Force base
amsl	above mean sea level
ANG	Air National Guard
APP	Accident Prevention Plan
ARCH	air rotary sassing hammer
BFF	Bulk Fuels Facility
bgs	below ground surface
C&D	construction and demolition
DO	dissolved oxygen
DoD	Department of Defense
DRO	diesel range organics
EDB	ethylene dibromide
EDD	electronic data deliverable
ELLE	Eurofins Lancaster Laboratories Environmental
EPA	U.S. Environmental Protection Agency
ERPIMS	Environmental Resources Program Information Management System
eV	electron volt
FFOR	Former Fuel Offloading Rack
GRO	gasoline range organics
GWM	groundwater monitoring
GWTS	groundwater treatment system
IDW	investigation-derived waste
J	estimated concentration
KAFB	Kirtland Air Force Base
kgal	kilogallon
LNAPL	light non-aqueous phase liquid
MCL	maximum contaminant level
mg/kg	milligram per kilogram
NMED	New Mexico Environment Department
O&M	operations and maintenance
PID	photoionization detector
PPE	personal protective equipment
PVC	polyvinyl chloride
Q	quarter

QSM	Quality Systems Manual, version 5.1.1
RCRA	Resource Conservation and Recovery Act
RCRA permit	Hazardous Waste Treatment Facility Operating Permit EPA ID No. NM 9570024423
REI	reference elevation interval
Ridgecrest	Ridgecrest Drive S.E.
SSHP	Site Safety and Health Plan
Sundance	Sundance Consulting, Inc.
SVE	soil vapor extraction
SVM	soil vapor monitoring
SWMU	solid waste management unit
TPH	total petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers
UV	ultraviolet
VOC	volatile organic compound
Water Authority	Albuquerque Bernalillo County Water Utility Authority
Work Plan	Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10

EXECUTIVE SUMMARY

This Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10 (Work Plan) has been prepared in response to the New Mexico Environment Department (NMED) letter of November 4, 2019, (NMED, 2019) and revised in response to the NMED approval with modifications of July 14, 2020 (NMED, 2020). This Work Plan describes activities to be performed at Solid Waste Management Units ST-106/SS-111, Kirtland Air Force Base (AFB), New Mexico, and revised in response to the NMED letter of July 14, 2020 (Appendix D). This Work Plan proposes activities to address data gaps in both the groundwater monitoring (GWM) and gauging network and stratigraphic conditions directly beneath the source area. Data gaps in the GWM and gauging network were identified by the U.S. Air Force following the second quarter 2019 sampling event and are primarily the result of rising groundwater elevations. This Work Plan will become the procedural guidance document for conducting these activities. This Work Plan was written in accordance with Part 6.2.4.2 of the Kirtland AFB Resource Conservation and Recovery Act permit U.S. Environmental Protection Agency ID Number NM 9570024423 (NMED, 2010).

The objective of this Work Plan is to detail well installation activities and groundwater sampling and gauging activities for newly installed wells. The work to be completed is presented under each of the tasks listed below.

- Install five GWM wells—one north of Ridgecrest Drive S.E. (Ridgecrest) and four south of Ridgecrest—to delineate volatile organic compound contamination in groundwater, including ethylene dibromide.
- Perform soil coring in the source area for further stratigraphic analysis and identification of contaminant migration pathways. Complete soil coring location as either a GWM well or a soil vapor monitoring well based on the decision tree provided in comment no. 1 of NMED July 14, 2020, letter.
- Report the data collected for the newly installed wells, including well installation details, groundwater elevations, light non-aqueous phase liquid thickness (if present), and groundwater laboratory analytical data.
- Incorporate sampling, gauging, and maintenance of these wells into the existing groundwater monitoring program.

1 INTRODUCTION

This Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10 (Work Plan) has been prepared in response to the New Mexico Environment Department (NMED) letter of November 4, 2019, (NMED, 2019) and revised in response to the NMED approval with modifications of July 14, 2020 (NMED, 2020). A revised version of this work plan has been provided in lieu of replacement pages per NMED's email of August 11, 2020 (Cobrain, email communication). This Work Plan describes tasks associated with monitoring well installation and inclusion of newly installed wells into the groundwater monitoring (GWM) network at Solid Waste Management Units (SWMUs) ST-106/SS-111, at Kirtland Air Force Base (AFB), New Mexico (Figure 1-1). Additionally, this Work Plan describes data collection activities associated with collecting soil cores and construction of either a soil vapor monitoring (SVM) well or a GWM well to further analyze local stratigraphy and identify migration pathways beneath the source area. This work is being conducted under requirements set forth in Part 6 of the Resource Conservation and Recovery Act (RCRA) permit (RCRA permit - U.S. Environmental Protection Agency [EPA] ID Number NM 9570024423). NMED enforces this permit under delegated authority from EPA.

1.1 Document Purpose and Scope

Tasks outlined in this Work Plan include drilling and installing five new GWM wells, sampling the newly installed wells, drilling and coring one or two wells in the source area and managing investigation-derived waste (IDW). This Work Plan was prepared in accordance with the requirements of section 6.2.4.2 of the RCRA permit, "Investigation Work Plans."

1.2 Work Plan Organization

The Work Plan is divided into the following sections. These sections include the required information for an investigation work plan as described in Part 6.2.4.2 of the RCRA permit.

- Section 1 – Introduces the Work Plan and its purpose.
- Section 2 – Presents the background information.
- Section 3 – Presents the current site conditions.
- Section 4 – Presents the scope of activities.
- Section 5 – Describes the investigation methods.
- Section 6 – Describes the monitoring and sampling associated with well installation.
- Section 7 – Presents the project schedule.
- Section 8 – Provides references cited in the Work Plan.

This Work Plan also includes the following appendices.

- Appendix A Historical Groundwater Information

  Appendix A-1 Water-Level Hydrographs
  Appendix A-2 Historical Groundwater Plume Maps

- Appendix B Field Forms
- Appendix C Laboratory Method Reporting Limits and Screening Criteria
- Appendix D Response to Comments: New Mexico Environment Department, Hazardous Waste Bureau, Approval with Modifications, Dated July 14, 2020.

2 BACKGROUND INFORMATION

Kirtland AFB is in Bernalillo County, in central New Mexico, southeast of and adjacent to the city of Albuquerque and the Albuquerque International Sunport (Figure 1-1). The approximate area of Kirtland AFB is 52,287 acres. SWMUs ST-106/SS-111 are in the northwestern portion of Kirtland AFB.

2.1 Site History

The Bulk Fuels Facility (BFF) operated from 1953 until 1999 and received fuels by railcar and later by truck. The fueling area was separated into two areas: a tank holding area to receive bulk fuel shipments and a fuel loading area to refuel individual trucks. Kirtland AFB removed the underground piping at the facility from service in 1999 due to discovery of underground leakage. The exact history of the leaks or releases is unknown.

Vadose zone investigation activities and interim measures began with an excavation in November 1999 to remove contaminated surface soil and a soil investigation at the Former Fuel Offloading Rack (FFOR) area in early 2000 to investigate the nature and extent of shallow and deep soil contamination. Vadose zone investigation activities continued through 2015 with additional source area investigations, installing and sampling SVM and soil vapor extraction (SVE) locations, and implementing SVE systems as an interim measure.

GWM activities have been ongoing at the site since 2000. Once released jet fuel enters the ground, it is termed light non-aqueous phase liquid (LNAPL). LNAPL includes liquid compounds that are not water, do not dissolve in water, and are less dense than water. In February 2007 an approximately 1.4-foot-thick layer of LNAPL was discovered on the water table at newly installed GWM well KAFB-106005. Following this discovery, additional interim measures were implemented concurrent to the continued investigation of the nature and extent of contamination. These interim measures included expanding the SVE system, additional soil investigations, and other LNAPL and groundwater interim measures. Kirtland AFB learned through these characterization actions that the leaked fuel had reached the groundwater beneath or very near the source area and the dissolved-phase fuel contamination had migrated north and northeast of Kirtland AFB. A skimmer system was installed in well KAFB-106005 and operational from June 2007 through August 2008. During the skimmer operations, approximately 280 gallons of LNAPL were accumulated in the storage vessels at the site and were periodically transported and disposed of off site. To achieve more efficient LNAPL removal, the skimmer system was replaced by modified bioslurping systems with internal combustion engine vacuum extraction units to further the removal of LNAPL from the water table (Kirtland Air Force Base [KAFB], 2018a).

Bioslurping employs vacuum removal systems, differing from SVE in that a small diameter drop pipe is installed to just above the water table to volatilize LNAPL directly from the water table (KAFB, 2018a). Kirtland AFB implemented individual bioslurping systems at KAFB-106005 (August 2008) and at KAFB-106006 and KAFB-106008 (March 2009). The three bioslurping systems were operational at these locations until third quarter (Q3) 2011. Approximately 225,000 equivalent gallons of LNAPL were removed by these systems during their operation from vacuum extraction and biodegradation combined. These units were subsequently moved to other wells to perform SVE activities.

As of second quarter (Q2) 2019, the groundwater monitoring network consisted of 162 wells. Select wells are identified for additional or more frequent monitoring of risk-driving constituents (KAFB, 2019b). GWM data are evaluated in quarterly monitoring reports, which describe current site conditions and assess the performance of interim measures.

Interim measures have been implemented in accordance with Part 6.2.2.2.12 of the RCRA permit for both groundwater and soil, including a groundwater treatment system (GWTS), which was constructed in 2015. The goal of this interim measure was to protect drinking water supply wells and collapse the distal, dissolved-phase ethylene dibromide (EDB) plume north of Ridgecrest Drive S.E. (Ridgecrest; Figure 2-1). EDB is the only constituent detected above its maximum contaminant level (MCL) north of Ridgecrest. South of Ridgecrest, fuel constituents in addition to EDB are detected in exceedance of their respective MCLs including benzene (Figure 2-2).

GWM activities have documented changes in groundwater elevations at SWMUs ST-106/SS-111. When the fuel leak began, the water table was approximately 60 feet higher than current elevations (Rice et al., 2014). Water levels began dropping due to the development of the city of Albuquerque well fields and reached their lowest level at the end of 2009. The San Juan-Chama Project was implemented in 2008 by the Albuquerque Bernalillo County Water Utility Authority (Water Authority). As a result of the San Juan-Chama Project, as well as increased water conservation practices by the Water Authority, withdrawals from Water Authority wells decreased, and groundwater levels have risen in this area since 2009.

Appendix A-1 illustrates groundwater elevations from 2011 through 2018 along two transects through the EDB plume. These time series graphs illustrate that the most pronounced increases in groundwater elevation are in the northern area of the site. The northernmost wells are most responsive to changes in the pumping rates at the Water Authority Ridgecrest well field, the closest Water Authority drinking water supply wells to SWMUs ST-106/SS-111. Groundwater levels continued to rise throughout the GWM network over the course of the year from Q4 2017 to Q4 2018. The average increase in groundwater level during 2018 was 1.79 feet. The average annual rise in water table in 2017 was 1.3 feet, and the calculated annual average of water table rise from Q1 2016 through Q4 2018 was 1.61 feet (Section 3.7.1 of KAFB, 2019a). The Water Authority predicts that based on current and planned conservation practices water levels in Albuquerque's aquifer will continue to rise into the 2020s (Water Authority, 2016).

Due to the rising water table, groundwater elevations have exceeded the tops of well screens that were originally installed to intersect the water table. This is an ongoing phenomenon. Prior to fourth quarter (Q4) 2016, the distribution of groundwater contamination had been described in terms of shallow, intermediate, and deep intervals within the EDB plume. However, the subsequent rise in the water table and the accompanying rise and vertical spread of the EDB plume have complicated these definitions. To address this issue, the concept of the reference elevation interval (REI) was introduced. The three defined REIs correspond to the former "shallow," "intermediate," and "deep" intervals. The REI convention will allow for additional intervals to be added as the water table continues to rise. The uppermost REI, which corresponds to the former "shallow" interval, is REI 4857, so named because the GWM wells comprising this dataset are all screened across the elevation of 4,857 feet above mean sea level (amsl). Data collected from these wells are representative of the hydrogeologic conditions of this zone, bounded by the water table above and a surface below that intercepts the bottom of all REI 4857 well screens, ranging from 4,879 feet amsl down to 4,827 feet amsl.

Appendix A-2 includes compiled potentiometric surface maps, EDB plume maps, and benzene plume maps at REI 4857 from quarterly monitoring reports Q4 2016 through Q4 2018. These figures show which locations have submerged screens and which still have screens that intersect the water table with each passing quarter. The Phase I RCRA Facility Investigation Report identified that that changes in dissolved-phase concentrations and apparent plume configuration could be influenced by the rising water table, and that this would be evaluated with the installation of additional GWM wells (KAFB, 2018a).

2.2 Initial Data Gap Groundwater Wells and Vadose Zone Coring Activities

As a result of the fluctuations in groundwater elevations at the site, Kirtland AFB submitted the Work Plan for Data Gap Monitoring Well Installation (KAFB, 2017d) in December 2017. This work plan proposed installing six groundwater monitoring wells and incorporating six existing wells (i.e., GWM wells and soil vapor monitoring wells that were previously dry and that now have water in the screens due to the rising water table) into the GWM network for quarterly sampling (Figure 2-3). These wells were installed or incorporated into the GWM network in Q4 2018 and Q1 2019 to address this data gap.

The new wells installed under the Work Plan for Data Gap Monitoring Well Installation were designed to address the problem of continued water table rise (Section 3.1.1 of KAFB, 2017d). Wells were constructed with two nested wells in each borehole: a water table well and a contingency well. The water table well was constructed with a 40-foot screen intersecting the water table. The contingency well was constructed with a 25-foot screen, the bottom of which was placed 9 feet above the screen interval of the water table well. This design will allow the GWM wells to remain functional for more than 50 additional feet of increase in groundwater elevation. The installation and incorporation of these GWM wells screened across the water table was reported in Section 3 of the Q4 2018 and Q2 2019 quarterly monitoring reports (KAFB, 2019a and KAFB, 2019b; respectively). Passive sampling techniques were approved for these wells by NMED (NMED, 2018).

The Work Plan for Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling was submitted to NMED in December 2017 to address the data gaps of horizontal and vertical extent of LNAPL caused by the fluctuating water table (Section 1.0 of KAFB, 2017e). A total of 11 continuous core locations (including one background location) were advanced to characterize hydrocarbon concentrations within the vadose and saturated zones. These coring locations were all advanced south of Ridgecrest, where LNAPL had historically been measured associated with SWMUs ST-106/SS-111 (Figure 2-3).

Once cores were collected, the locations were constructed as monitoring wells. Two locations were constructed as SVM locations, and nine were constructed as GWM locations (Figure 2-3). Soil cores collected from the boreholes were screened for the presence of LNAPL (using ultraviolet [UV] light flashlights) and hydrocarbons (using the heated headspace method; Section 4.1.3 of KAFB, 2019c). Selected cores were then sent for laboratory UV analysis to further confirm or deny the presence of LNAPL. This information was used to select sample locations for further laboratory LNAPL analysis (Section 4.1.6 of KAFB, 2019c). The Source Zone Characterization Report (Section 4.1.6 of KAFB, 2019c), currently under revision, not yet approved by NMED, describes the complete suite of analyses performed to characterize LNAPL in the soil cores. The report also describes the conclusions of the LNAPL analyses.

2.3 Recent Hydrology and Dissolved Phase Contaminant Migration

The GWM well network for the Kirtland AFB BFF jet fuel dissolved-phase contamination is screened near the top of the saturated interval of the Santa Fe Group aquifer system. Historically, this aquifer system was the sole water supply for the Albuquerque metropolitan area and the groundwater flow was from north-northeast to south-southwest toward the Rio Grande (Bexfield and Anderholm, 2000). As the population increased, water demand also increased and the Santa Fe Group aquifer system experienced significant stress resulting in water level declines in excess of 100 feet near Kirtland AFB (Powell and McKean, 2014). Furthermore, the groundwater flow changed direction from south-southwest (toward the Rio Grande) to an easterly and northeasterly direction, away from the Rio Grande and toward the city and its drinking water supply wells (Powell and McKean, 2014).

It is important to note that the predominant groundwater flow direction, which the dissolved-phase constituents migrated along, was north-northeast. However, to reduce the use of groundwater while maintaining municipal water supply, the Water Authority began diverting water from the San Juan-Chama Project in 2008. As a result, this surface water diversion has relieved the pumping stress of the Santa Fe Group aquifer system and groundwater levels began rebounding as much as 3 feet to 4 feet per year, with higher rates near historic municipal extraction wells to the north of the site. As a result of this uneven rebound, and the continued operation of Kirtland AFB drinking water wells to the east and southeast, a shift in groundwater gradient to the south/southeast, away from the historic municipal withdrawals has been noted in quarterly monitoring reports (KAFB 2019a; Figure A-2-1 through Figure A-2-5). The five GWM wells to the south and east of the source area have been sited to further confine the current extent of the contaminant plume and monitor for any future southward or eastward expansion.

3 SITE CONDITIONS

Q2 2019 groundwater data identified two data gap areas that this Work Plan intends to address. First, the eastern and southern extent of the EDB and benzene plumes south of Ridgecrest at REI 4857 requires further delineation. REIs are below ground surface elevations that divide the GWM network into datasets comprised of wells that are screened across their respective elevations, allowing for a vertical evaluation of groundwater parameters and contaminant locations. Currently, there are three REIs (4857; 4838; and 4814). A detailed explanation of how the REIs are defined is presented in Section 3.0 of the Q4 2016 Quarterly and Annual Report (KAFB, 2017b).

The Q2 2019 EDB and benzene plumes at REI 4857 (the shallowest reference level evaluated in Q2 2019) are shown on Figure 2-1 and Figure 2-2. The area on base, south of Ridgecrest, is where the highest concentrations of EDB and benzene are detected. It is important to note that the benzene plume is limited to the area south of Ridgecrest as shown on Figure 2-2. As shown on Figure 2-1, the dissolved-phase EDB plume north of Ridgecrest is the target capture zone of the GWTS.

The groundwater elevation graphs shown in Appendix A-1 illustrate that the operation of the Ridgecrest wellfield has a significant influence on the groundwater gradient at SWMUs ST-106/SS-111. Measurements from 2010 to 2015 indicated a north–northeast-oriented hydraulic gradient toward the Ridgecrest wellfield (Section 7.6.1.2 of KAFB, 2018a). However, with changes in Water Authority and Kirtland AFB pumping practices, the hydraulic gradient no longer has a consistent orientation each quarter. As described in the Q2 2018 report (Section 5.4.4.1 of KAFB, 2018b), the observed rise in groundwater levels across the plume area has occurred at the same time as a continual decrease in groundwater extraction at the Ridgecrest wellfield.

Between 2010 and 2017, the yearly extraction volume for the Ridgecrest wellfield has decreased from approximately 2,000,000 kilogallons (kgal) per year to approximately 1,000,000 kgal per year, an average rate decrease of approximately 175,000 kgal per year. Comparatively, total extraction from Kirtland AFB supply wells over the same time period has decreased from approximately 790,000 kgal to 545,000 kgal per year, an average rate decrease of approximately 37,000 kgal per year (Appendix I-7 of KAFB, 2018b). The result is that the total extraction from the two adjacent wellfields has become nearly equal since 2016, creating two equally strong aquifer stresses on the plume area: one northeast of the plume and one east–southeast of the plume. In 2013 and 2014, when Ridgecrest wellfield extraction was significantly greater than Kirtland AFB extraction, the gradient across the plume area was toward the Ridgecrest wellfield; however, as the two extraction centers became more equal in 2015, the gradient flow direction started to shift eastward. In 2016 and 2017, when extraction had nearly equilibrated, the gradient direction shifted to the east–southeast becoming increasingly influenced by Kirtland AFB extraction (KAFB, 2018b). Additional detail on this evaluation of groundwater gradients is presented in Section 5.4.4.1 of the Q2 2018 report (KAFB, 2018b). Additional groundwater monitoring wells in the eastern and southern area of the plume will help determine whether this shift in the hydraulic gradient is affecting EDB and benzene plume extents in this area.

Groundwater samples collected in Q2 2019 at the newly installed/incorporated wells screened across the water table in the eastern and southern extent of the EDB plume (area of the EDB plume south of Ridgecrest) had detections of EDB and benzene that exceeded the MCLs of 0.05 microgram per liter (ug/L) and 5 ug/L respectively (Figure 2-1 and Figure 2-2). Currently, these exceedances of EDB and benzene cannot be accurately bounded because GWM wells with non-detect concentrations of EDB and benzene to the southeast have submerged well screens. The EDB concentrations at wells located within the plume, and the submergence of wells outside the eastern and southern edge of the plume, exaggerate the modeled EDB and benzene plume boundary at the water table to the east and south. Additional well locations screened across the water table will further define the plume boundary in this area. Section 4 discusses the specific well locations and screened intervals necessary to further delineate the EDB plume at REI 4857.

The second data gap area is adjacent to extraction well KAFB-106234. Q2 2019 groundwater monitoring data indicate that EDB exceeding the MCL is no longer present in this area. An additional groundwater monitoring well near this extraction well would help confirm EDB concentrations and help clarify groundwater gradients in this area.

4 SCOPE OF ACTIVITIES

This Work Plan addresses tasks supporting monitoring well installation, drilling and coring in the source area, and baseline water-quality sampling and is the procedural guidance document for these activities to be executed as part of the RCRA corrective action process.

4.1 Proposed Drilling Locations and Justification

The well locations proposed in this Work Plan are shown on Figure 2-1 and Figure 2-2. The specific justification and construction specification for each location is listed on Table 4-1. Construction diagrams are presented on Figures 4-1 -4-3.

4.1.1 GWM Data Gap Wells (KAFB-106248 – KAFB-106251)

Four of the five proposed GWM wells (KAFB-106248 through KAFB-106251) will be constructed as shown on the construction diagram, Figure 4-1. Wells are proposed to be constructed as nested wells, with a well screen that straddles the water table and an additional contingency well screen (a well screened in the vadose zone approximately 9 feet above the top of the water table well screen). The contingency well screen, as listed on Table 4-1, allows the GWM wells to continue to provide EDB concentration data at the water table as groundwater elevations continue to rise. The nested well design will allow wells to continue to provide data throughout the implementation of interim measures, and the selection and implementation of a final remedy.

The objective of these four wells is to better delineate the eastern and southern extent of the EDB and benzene plumes at REI 4857 (area of the EDB plume south of Ridgecrest). As discussed in Section 3, the EDB and benzene plumes at REI 4857 require additional well screens straddling the water table to more accurately delineate the eastern and southern plume extent. Table 4-1 and Figure 2-1 provide more information for the proposed locations described below. Table 4-2 provides EDB and benzene data from Q4 2018 and Q2 2019 for groundwater wells in the vicinity of the proposed locations. The following analytical information was reported in Section 3 of the Quarterly Monitoring Report April-June 2019 (KAFB, 2019b) and is further illustrated on Figure 2-1 and Figure 2-2.

- KAFB-106248 is proposed for installation in Bullhead Park. This location will fill the EDB plume boundary gap at the water table. In Q2 2019, KAFB-106019 was submerged and had an EDB concentration of 0.016 J ug/L. KAFB-106S5-446 is a newly installed unsubmerged location west of KAFB-106019 with a Q2 2019 EDB concentration of 15 ug/L. There are currently no wells east of KAFB-106019 to bound the EDB plume in this area.
- KAFB-106249 is proposed to be installed in the parking lot of the Air National Guard (ANG) adjacent to the existing well KAFB-106046. This location will help to bound both the EDB and benzene plumes in this area. KAFB-106046 was non-detect for both EDB and benzene in Q2 2019 and has a submerged well screen. The GWM well directly west of this location, KAFB-106S2-451, which is screened across the water table, had a detected EDB concentration of 260 µg/L in Q2 2019, and a detected benzene concentration of 8,800 µg/L.
- KAFB-106250 is also proposed for installation on ANG property, adjacent to the boundary with the BFF. KAFB-106S1-447 and KAFB-106S8-451 are screened across the water table west of proposed well KAFB-106250. EDB concentrations at these locations exceeded the MCL in Q2 2019 with detections of 250 µg/L and 96 µg/L, respectively. Benzene concentrations at these locations also exceeded the MCL in Q2 2019 with detections of 6,600 µg/L and 2,100 µg/L; respectively. KAFB-106007 was non-detect for EDB in Q2 2019 and is located near the proposed well location but is submerged. KAFB-106247-450 is not submerged, was non-detect for EDB and benzene in Q2 2019, and is in the southeastern corner of the BFF. However, water table wells

are needed closer to the source area to more accurately delineate the EDB and benzene plumes in this area.

- KAFB-106251 is proposed for installation south of the former fuel tanks in the BFF. This location will provide further delineation for the southern EDB and benzene plume extents. In Q2 2019, EDB concentrations exceeded the MCL at two unsubmerged locations north of the proposed well location: KAFB-106149-484 and KAFB-106S1-447 (36 ug/L and 250 ug/L, respectively). Benzene concentrations also exceeded the MCL at these locations in Q2 2019 (26,000 ug/L and 6,600 ug/L; respectively). Locations KAFB-106007 and KAFB-106027 have formerly delineated the EDB and benzene plumes in this area, but now have submerged screens.

4.1.2 Extraction Assessment Well (KAFB-106252)

KAFB-106252 will primarily serve as an additional data point to assess the performance of the extraction well KAFB-106234 for semiannual plume capture modeling of the EDB plume north of Ridgecrest and the corrective measures evaluation. This location will be constructed with an additional piezometer, as shown on the construction diagram, Figure 4-2. This location was selected to refine evaluation of any residual mass of EDB around extraction well KAFB-106234 (Figure 2-1). The EDB plume was previously present in this area. In Q4 2018 EDB was detected at KAFB-106225 in excess of the MCL at 0.17 µg/L (Section 3.6.1.1 of KAFB, 2019a). In Q2 2019 there were no detections of EDB exceeding the MCL near extraction well KAFB-106234 (Section 3.6.1.1 of KAFB, 2019b). Table 4-3 includes EDB groundwater data from 2017, 2018, and 2019 for wells located near extraction well KAFB-106234.

The piezometer at KAFB-106252 will be screened between 505 feet and 515 feet below ground surface (bgs) to intersect a gravel unit identified on the borehole log for KAFB-106234 (Figure 4-2). Data gathered from KAFB-106248 and the piezometer well will provide more accurate drawdown data for the extraction well and will provide more accurate representation of the groundwater gradients in this area.

4.1.3 Source Area Data Gap Well

Drilling and coring in the source area will serve to further understanding of the stratigraphic assemblage and potential contaminant migration pathways beneath the source area. In order to understand the migration of contaminants through the vadose zone beneath the FFOR, an understanding of the stratigraphy approximately 250 feet to 300 feet bgs is essential. As described by the decision tree in Section 5, an SVM well may be installed in this area in addition to the GWM well. If an SVM well is installed it will be named KAFB-106V3 (Figure 4-3).

The source area contaminants descend essentially vertically from the surface to a depth of approximately 250 feet to 300 feet bgs where a distinct clay layer is present. The clay layer is easily identified in drill cores and on geophysical logs. The thickness, lateral continuity, and geometry of this clay layer changes across the site. Directly below the FFOR, the clay occurs as a single layer at approximately 275 feet to 300 feet bgs (lower clay). East-southeast of the FFOR, the clay occurs as a single layer at approximately 250 feet bgs (upper clay). A vertical offset can be identified in the clay layer directly below the FFOR that likely creates a preferential pathway to vertical migration of contaminants. Once contaminants reach the 250 feet to 300 feet depth range they appear to migrate predominantly downdip (to the east-southeast) on the lower clay layer and then generally vertically to the water table.

Three other datasets support this interpretation of the contaminant migration pathway: the observed lateral offset of elevated volatile organic compound (VOC) concentrations with depth, soil vapor extraction system rebound data, and Pneulog total volatile petroleum hydrocarbons soil gas data. All three datasets show contaminant migration to be predominantly vertical beneath the FFOR to a depth in the 250–300 foot range with a shift in the pathway to the east-southeast before continuing on a vertical downward path to the water table.

5 INVESTIGATION METHODS

Tasks outlined in this Work Plan include drilling and installing new GWM wells, drilling and data collection to further characterize the source area migration pathways, sampling the newly installed wells, and managing IDW. Applicable field forms may be found in Appendix B. These tasks are described in more detail in the sections below. The procedures, methods, and techniques discussed in this Work Plan were presented in the Work Plan for Data Gap Monitoring Well Installation (KAFB, 2017d), approved by NMED in February 2018 (NMED, 2018) and the *Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1*, and approved with conditions by NMED on February 23, 2018 (VZ Work Plan; KAFB, 2017e)

5.1 Pre-Mobilization Activities

Before any mobilization, copies of the right-of-entry agreements will be obtained for the location where work will be performed, and documentation will be on site with the field crew so that it is available for inspection. In addition to access and site clearance, the appropriate permits will be obtained for the various field activities. An effort will be made to time the permitting process such that permit approvals will be received in time to meet the project schedule, but not too early in the process that they expire before work is initiated. All permit expiration dates will be tracked to ensure that no permits expire before work is completed. Permit renewals will be initiated such that the work will proceed without interruption. Depending on the timing, permits may be combined. The project schedule may be impacted if there are delays in permit approvals.

The list of permits/plans required for this project follow.

- New Mexico Office of the State Engineer well drilling permits for each of the new monitoring well locations with no consumptive use of water.
- New Mexico 811 utility clearance.
- City of Albuquerque license for property access for GWM wells; this license is already in place and will be modified to include the wells on city property listed in this Work Plan.
- City of Albuquerque specific plans:
  - Noise Control Plan/Permit for drilling off base
  - Excavation/Barricade permits for each drilling location off base on roadways.
- Kirtland AFB specific permits:
  - Air Force Form 332 Base Civil Engineer Work Request
  - Civil Engineer Digging Permit Request.

Preconstruction inspections will be performed at each proposed well location and will include photo documentation. Each contractor participating in well installation tasks is required to have an Accident Prevention Plan (APP) on site. The APP will be signed by all project personnel who will perform work on site. The APP is a dynamic document that will be revised to cover all activity-specific concerns and will be updated as necessary.

5.2 Mobilization

Contractors (and subcontractors) will maintain laydown areas to support field activities. These laydown areas have been approved with existing agreements and have been coordinated with Kirtland AFB. A field office, equipment laydown yards, and IDW yards for each contractor are located at Kirtland AFB. Secure fenced equipment yards have been established for both heavy machinery and materials; these yards will also hold materials and supplies meant for use on the project locations, as required. Roll-off containers filled with solid waste (soil cuttings and mud) will be kept at the IDW accumulation areas. Due to the large number of roll-off containers required for delivery and transfer during daily drilling activities, waste management support is a key element of mobilization (Section 6.5).

5.3 Drilling Operations

5.3.1 Groundwater Monitoring Wells

All four data gap infill wells and the extraction assessment well will be installed via air rotary casing hammer (ARCH) technology with casing advancement. Table 4-1 summarizes the drilling methodology and design summary for each location. Boreholes will be advanced using 13¾-inch casing diameter to approximately 200 feet bgs, depending on site conditions; thereafter, 11¾-inch casing diameter will be advanced to the total depth of the borehole.

Each borehole will be fully described on boring logs as discussed in Section 5.3.3. Soil cuttings will be screened in the field with a photoionization detector (PID) as discussed in Section 5.3.4. Land surveying will occur after well installation activities as discussed in Section 5.3.5. All IDW generated from drilling activities will be managed in accordance with the procedures outlined in Section 6.5.

5.3.2 Source Area Data Gap Well

The source area data gap well will be drilled with ARCH techniques to a depth of approximately 230 feet bgs, just above the top of the clay described in Section 4.1.3. The borehole will then be continuously cored to the total depth of the borehole and sampled for total petroleum hydrocarbons (TPH), gasoline range organics (GRO) and diesel range organics (DRO) Extended using EPA Method 8015 (modified). The total depth will be 10 feet below any field screening evidence of contamination (e.g., PID readings greater than 10 parts per million volume) to obtain a consistent detailed vertical profile of the migration pathway and to determine the vertical extent of contamination in the source area. A sample for TPH, GRO and DRO Extended will be collected at the total depth of the borehole(s). The borehole will also be geophysically logged (see Section 5.3.3.2). ARCH and continuous core drilling will be carried out as outlined in Section 3.1.1.1, page 3-2 of the VZ Work Plan (KAFB, 2017e).

The temperatures of the core collected below 230 feet bgs will be monitored. The sonic drilling method uses high-frequency vibrations to collect core samples, so the method inherently heats the core samples. Precautions will be taken to minimize heating the samples to the extent possible. During drilling, any one or a combination of the following may be performed.

a) Advancing shorter sampling runs (5–10 feet versus 20 feet)
b) Allowing the core barrel to cool (or pre-cooling the core barrel) before tripping back into the borehole
c) Changing the vibration level and rotation speed
d) Injecting small quantities of potable water between the override casing and the core barrel without compromising sample integrity as described in A5TM International D6914/D6914M-16.
e) Temperature inside the core will be monitored and recorded when returned to the surface.

NMED will be provided notification at certain stages of the drilling process. These stages include but may not be limited to:

1. initiation and cessation of ARCH drilling,
2. initiation of sonic drilling,
3. upon reaching a depth of 300 feet bgs
4. upon reaching the water table, and
5. upon reaching total well depth.

The notification to NMED that the driller has reached a depth of 300 feet bgs will include the actual depth bgs and thickness of the clay layer, if it is encountered. If the clay layer is not encountered, the objective of the well will have been achieved, that is, to identify the possible gap in the clay layer located between 250 feet and 300 feet bgs as described above. Figure 5-1 illustrates a flow chart describing the decision process for well installation upon completion of drilling/coring operations.

If the clay layer is encountered, a determination will be made, in consultation with NMED, whether it is the lower or upper clay. If it is determined that the driller has encountered the lower clay, the driller will stop at 300 feet bgs or just below the bottom of the clay and the borehole will be partially backfilled with a bentonite seal and sand. The bentonite will be emplaced with a tremie pipe to approximately 2 feet below the top of the clay, followed by 1 foot of sand to prevent bentonite from entering the well screen. The borehole will then be completed as an SVM well with the lower end of the screen located across the top of the clay layer. The SVM well will be constructed with a 1-foot sump and a 2-foot screen of an appropriate slot size. The SVM well will be constructed as described in Section 5.5 and the construction diagram, Figure 4-3.

If it is determined that the driller has encountered the upper clay only, the driller will advance the borehole to total depth, below the water table, and the well will be completed in the same manner as the other four GWM wells herein proposed.

If the first borehole is not successful in locating the contamination migration pathway (i.e., lower clay has been encountered), then a second borehole location will be selected based on the findings of the first borehole.

If the first borehole is successful in locating the contamination migration pathway, a determination will be made, in consultation with NMED, whether a second borehole location should be selected to refine the migration pathway or if the borehole should be used to meet the objectives outlined in this Work Plan.

Kirtland AFB will communicate with NMED during drilling at this location and the potential step-out boring. Field information will be provided to NMED within a reasonable timeframe after it is collected to assist with understanding field conditions as they occur.

5.3.3 Borehole Logging

5.3.3.1 *Groundwater Monitoring Wells*

During drilling, each boring will be fully described on the boring log form in accordance with ASTM International D5434 or D2488. Lithology will be logged from cyclone cuttings at a minimum of 5-foot intervals. Boring log forms will include the following information, when applicable.

- Identification number and location of each boring
- A general description of the drilling equipment used, such as rod size, bit type, pump type, rig manufacturer, and model
- Date and time of start and completion of boring
- Name of contractor, driller, and field geologist
- Size and length of casing used in each borehole
- Soil classification in accordance with the Unified Soil Classification System, color, relative density and consistency, soil components, soil moisture, stratification, hardness, grain size and size distribution, and odor
- Depth to water as first encountered during drilling, along with method of determination

- Observations during drilling will be noted, such as bit chatter, rod binding, rod drops, and flowing or heaving sands (if drilling fluid is used, the fluid losses, interval over which they occur, and the quantity lost will be recorded)
- Depth limits, type, and number of each sample taken
- Observations of visible contamination for each sample or from cuttings that appear to be contaminated.

5.3.3.2 *Source Area Data Gap Well*

During ARCH drilling, the boring will be fully described as outlined in Section 5.3.3.1 above. The wellbore will be continually cored from 230 feet bgs to total depth, which will provide undisturbed cores for more accurate lithologic logging.

Core from sonic drilling (if drilling methodology selected) will be extruded into plastic core sleeves at up to 2-foot increments over a 10-foot interval. Following retrieval of the sonic core, it will be labeled with the depth interval and the top of the core will be labeled. Soil samples will be collected for the analyses described in Section 6. Once PID measurements and soil samples have been collected and the core has been logged by the geologist, the core will be placed in core boxes and photographed using a high resolution digital camera.

Upon reaching 300 feet bgs, the first source area wellbore will be geophysically logged with a gamma-neutron tool in an attempt to assess the location of the clay layer. The tool will log within the steel-cased borehole. The tool will be calibrated and operated according to ASTM International standards for geophysical logging and the operation manual of the specific tool utilized. Shop and daily field calibration data will be included in the final report summarizing the investigation results. An electronic copy of raw and processed data will be provided in Excel table format. An electronic visual presentation of the log curve will be presented on a single page in a continuous format rather than as several separate pages. The geophysical log(s) for each well will be displayed with the lithologic log for comparison purposes and a discussion of the results will be included in the main body of the investigation report. This well has been designed with PVC centralizers rather than steel centralizers to accommodate geophysical logging.

5.3.4 Photoionization Detector and Headspace Screening

PIDs will be used for breathing zone monitoring during drilling and sampling activities, as well as for field screening of hydrocarbons in soil cuttings and cores during drilling. This instrument monitors volatile organic compounds using a PID with a 9.8-electron volt (eV), UV lamp. The PID will be calibrated and tested each day that it is used. Headspace field screening will be performed in accordance with the following procedures.

1. Record PID measurements at a minimum of every 10 feet of drill cuttings to the total depth of the borehole, following the process below. PID headspace measurements will be taken from soil cuttings collected from the cyclone separator and bagged.
2. For boreholes that will be continuously cored, PID measurements will be recorded at a minimum of every 10 feet from ground surface to the start of coring and every 5 feet from the start of coring to total depth.
3. Immediately upon the retrieval, collect a representative portion of the sample and place in a clean, dedicated (e.g., single sample) 1-gallon press-and-seal plastic storage bag.
4. Vigorously agitate the sample for at least 15 seconds and then allow a minimum of 10 minutes for the sample to adequately volatilize.

5. During cold weather, warm the samples to room temperature before taking the headspace measurement.
6. Re-agitate the sample bag and quickly insert the vapor sampling probe and record the maximum meter response (this should be within the first 2–5 seconds).
7. Record headspace screening data on the boring log.

5.4 Well Construction

5.4.1 Construction of Groundwater Monitoring Wells

Each well nest will be comprised of two wells within a single borehole, each screened at a different depth interval, beginning with a 40-foot screen across the current water table elevation in the deeper well. A second screen, extending upward to shallower depths, will be completed as a “dry” contingency well to function in the future, if necessary, with rising groundwater elevations. The contingency wells will have a 25-foot screen length that extends above the 40-foot screen interval in the deeper well. The GWM nested wells will each be constructed using 4-inch diameter Schedule 80 polyvinyl chloride (PVC) casing and 10/20 filter pack. Screen slot size and depth will be selected based on lithologic conditions. Details of the annular material are shown on the well construction diagrams, Figure 4-1 and Figure 4-2. The well nests are designed with 5-foot bentonite seals between each screen to ensure adequate hydraulic isolation. A minimum of at least 2 feet of sand will extend above and below the screened intervals; the resulting minimum separation distance between well screens will be 9 feet. Based on the current static water elevation from nearby GWM wells, the final well screen depths were selected with the bottom of the deeper screen at approximately 15 feet below the water table, as listed on Table 4-1.

KAFB-106252 will also be completed with a piezometer well in addition to the water table well and the contingency well. The piezometer well will be constructed using a Schedule 80 PVC casing and 10/20 filter pack. Screen slot size and depth will be determined based on lithologic conditions. KAFB-106248 is designed with a minimum of a 5-foot bentonite seal between the piezometer screen and the other nested wells. A minimum of at least 2 feet of sand will extend above and below the screened intervals.

After installing the new monitoring wells, a construction diagram will be completed following the procedures discussed below and the well will be developed following the procedures discussed in Section 5.4.1.2. All IDW generated from well development will be managed in accordance with the procedures outlined in Section 6.7.

5.4.2 Construction of Soil Vapor Monitoring well

The source area well may be completed as soil vapor monitoring well KAFB-106V3 (Figure 5-1). Upon reaching a depth of 300 feet bgs, NMED will be consulted. If the clay layer is encountered, and determined to be the lower clay, the driller will stop at 300 feet bgs or just below the bottom of the clay. The borehole will be partially backfilled with a bentonite seal to the desired depth determined by lithology and field screening data, and be hydrated in 2-foot lifts. Sand will be placed above the bentonite seal to place the well screen approximately 2 feet below the top of the clay. The borehole will then be completed as a soil SWM well with the lower end of the screen located across the top of the clay layer.

KAFB-106V3 will be completed in a 12-inch diameter borehole and will be a nested construction using Schedule 80 ¾-inch PVC from ground surface to deepest well depth. The screened intervals will each be 2½ feet in length with an appropriate slot size and filter pack. A schematic diagram of the KAFB-106V3 completions are provided in Figure 4-3. Final construction diagrams will be submitted to NMED following installation to accurately document as-built conditions.

5.4.3 Well Construction Diagrams

Construction diagrams will be completed for the new monitoring wells, and well construction will be documented on forms. Each form will include the following.

- Project and site names, well number, and total depth of the well
- Depth of any grouting or sealing, the amount of cement and/or bentonite used, and the total depth of the boring
- Depth and type of well casing
- Static water level upon installation of the well and after well development
- Installation date or dates, and name of the driller and the geologist installing the well; each installation diagram will be signed by the preparer
- All pertinent construction details of the wells, such as depth to and description of backfill materials installed (i.e., gravel pack, bentonite, and grout); gradation of gravel pack; length, location, diameter, slot size, material and manufacturer of well screen(s); position of centralizers; and location of any blank pipe installed in the well
- Description of surface completion, including protective steel casing, protective pipes, and concrete surface seal
- A description of any difficulties encountered during well installation
- Survey coordinates and the elevation of the top of ground and top of well riser.

5.4.4 Well Development

Well development will be performed by surging and bailing. Development will occur within 2–7 days following well and grout installation (i.e., no sooner than 48 hours following grout installation). Well development details follow.

- Initial development will consist of swabbing and bailing until little or no sediment enters the well (approximately 2–4 hours). Development and purge water will be contained in a temporary tank, tote, or drum. If the addition of water is necessary to facilitate surging and bailing, only clean potable water will be used.

- A bailer fitted with a toggle valve will be lowered into the well and used to gently surge the screen interval to remove any sand, silt, and debris accumulated in the well bore. When the bailer is brought to the surface, an Imhoff cone will be used to collect water from the first bailer run to evaluate the amount of silt and sediment in the water. This process will be repeated after each cycle of surging development. Wells will be bailed until the discharge water contains less than 2 milliliters of sediment per 1 liter of water, as measured using an Imhoff cone.

- A minimum of five casing volumes of water will be purged from the well to develop the filter pack. Additional volume will be purged during development to equal the volume of water added during the drilling process (if applicable).

- At the completion of well development, a sample will be collected and immediately photographed to document the results of the procedure.

- Initial groundwater samples will be collected within 10 days after well development, in accordance with Section 6.5.17.3 of the RCRA permit.

The site geologist will monitor field parameters including pH, temperature, turbidity, and specific conductance, and record the results and other pertinent information on the Well Development Record Form (Appendix B).

5.4.5 Survey

Land surveying activities will occur after well installation activities. The surveys will be conducted at locations on Kirtland AFB, adjacent residential neighborhoods, and city of Albuquerque rights-of-way, as required. Surveys will be performed by a New Mexico licensed surveyor. Surveys will be performed to 0.01-foot accuracy. The survey will be tied into the existing well network survey in at least two points plus a benchmark.

The surveys will establish northings, eastings, and elevations at all locations. Daily reports will consist of a tabulation of the location, identification, coordinates, and elevations of each point surveyed that day.

6 MONITORING AND SAMPLING

Newly installed GWM wells will be allowed to recover a minimum of 24 hours following development before gauging, or any applicable water sampling. Initial sampling of each well will occur within 10 days after development, in accordance with Section 6.5.17.3 of the RCRA permit. Wells will then be included in the sitewide GWM network for gauging and sampling beginning in the subsequent quarter following well installation. All wells will be monitored in accordance with the procedures for gauging and sampling described below and will be sampled for the parameters and at the frequency described in Table 6-1. Depth to groundwater and LNAPL (if present) will be recorded following well development. It is unlikely that LNAPL will be encountered at any of the proposed GWM well locations except that in the source area, should it be completed as a GWM well. However, if detected the procedures outlined in Section 6.1 will be followed.

All newly installed wells will be sampled using active sampling techniques for a minimum of eight consecutive quarters to establish baseline concentrations for the parameters listed in Table 6-1. Following eight consecutive quarters of baseline sampling, the wells will be categorized based on analytical results. The wells will then be sampled in accordance with the Work Plan for the Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design Revision 2 (KAFB, 2017a). This work plan was approved with conditions by NMED in May 2017 (NMED, 2017). The anticipated sample frequency based on the proposed locations of the wells is described in Table 6-1.

An estimated timeline for well installation and baseline monitoring is included in Section 7. The analytical parameters listed in Table 6-1 represent the current analytical list for quarterly monitoring (Section 3.3 of KAFB, 2019b). This list was developed based on regulatory correspondence with NMED. On July 17, 2015, NMED approved an initial optimization to the GWM program with the removal of 97 chemicals that had not been detected above regulatory criteria for the previous eight quarters (NMED, 2015). Additional revisions to the groundwater monitoring program were requested in December 2015, and approved by NMED in January 2016 (NMED, 2016) to further reduce redundant methods, and to categorize monitoring wells according to their data benefits.

The sections below describe the procedures that will be employed for groundwater and LNAPL gauging and groundwater sample collection. Liquid IDW will be generated from groundwater sampling and decontamination activities and will be managed, characterized, and disposed of per the procedures outlined in Section 6.7.

6.1 Light Non-Aqueous Phase Liquid and Groundwater Gauging

Once the new wells are completed, they will be added to the gauging event in the subsequent quarter following well installation. Quarterly, all monitoring wells are gauged in approximately 1 field week so that potentiometric surface maps can be prepared that represent a synoptic period. An electronic oil-water interface probe, or similar device, will be used to determine if LNAPL is present in each well. Depth to groundwater and depth to LNAPL, if present, will be measured in each well. LNAPL thickness will be calculated, if present. LNAPL is not anticipated to be present at the wells proposed in this Work Plan.

The sequence of procedures used when measuring depth to LNAPL, depth to water, and LNAPL thickness follow.

- Segregate the wells between potentially contaminated and not contaminated categories. Wells will be gauged with water-level meters designated for “clean” or “contaminated” wells; although water level meters are decontaminated between wells, this approach will further minimize the potential of cross-contamination.

- Identify which wells require barricading for access (if applicable) and ensure the barricade permit is available at the well location.
- Check operation of the PID aboveground. Before opening the well, don personal protective equipment (PPE) as required by the project safety plan.
- Visually examine the exterior of the monitoring well for signs of damage or tampering and record observations on the Monitoring Well Gauging Form (Appendix B).
- Recite the well identification, as labeled on the protective casing, vault cover, or identification tag, and compare to field forms and dedicated equipment tags to ensure appropriate forms and equipment are being utilized. Document this check on the Monitoring Well Gauging Form.
- Unlock the well cap or outer steel casing lid. Visually examine the interior of the monitoring well for signs of damage or tampering and record observations on the Monitoring Well Gauging Form.
- Take organic vapor readings with the PID at the well head immediately upon opening the cap and record information on the Monitoring Well Gauging Form. If high concentrations are detected, the appropriate measures, as outlined in the Site Safety and Health Plan (SSHP), will be taken.
- Lower interface probe into the well and note depth to LNAPL and depth to groundwater; to be consistent with former gauging data, all measurements will be taken from a reference mark located on either the top of the protective casing for wells with aboveground completion or from the top of the vault for wells with flush completion. Measurements are to be made to the nearest 0.01 foot.
- If the interface probe indicates the presence of LNAPL (whether measurable or not with the probe), a clear bailer will be deployed into the well to collect a sample from the top of the water column and confirm the presence of LNAPL. If LNAPL is recovered with the bailer, the thickness will be photo-documented and indicated on the field form, and the LNAPL and water within the bailer will be containerized for proper disposal.
- Once per year, the total well depth will be measured in wells using a tape with weights attached to the end.
- Record all gauging information on the field form.
- Record the time and day of the measurement.
- Decontaminate all groundwater level measurement devices and the weighted tape used for measuring the total well depth before and after each use to prevent cross-contamination of wells.

6.2 Groundwater Sampling Procedures

6.2.1 Preparation for Groundwater Well Purging

Unless the wells are equipped with dedicated pumping systems, wells will be purged and sampled in order of increasing contamination based on historical analytical data. In addition, separate pumps will be used to sample “clean” wells versus “contaminated” wells. This will decrease the possibility of cross-contamination. The following procedures apply to purging monitoring wells.

- Don appropriate PPE, as outlined in the SSHP. In addition, samplers will don new sampling gloves at each individual well before beginning sampling.

- Visually examine the exterior of the monitoring well for signs of damage or tampering and record notes on the Groundwater Well Inspection Form (Appendix B).

- Unlock the well cap or outer steel casing lid. Visually examine the interior of the monitoring well for signs of damage or tampering and record notes on the Groundwater Well Inspection Form.

- Take organic vapor readings with the appropriate meter(s) at the well head immediately upon opening the cap and record information on the Groundwater Well Inspection Form. If high concentrations are detected, the appropriate measures, as outlined in the SSHP, will be taken.

- Measure the static water level and the LNAPL and record on the Well Gauging Form.

6.2.2 Low Flow Groundwater Samples from Wells Equipped with Dedicated Pumps

The procedures described below will be followed to sample wells by low flow. Monitoring wells will be sampled following field parameter stabilization as described in the ASTM International D6452-99 and recommended by the Hydrogeology Working Group on July 13, 2016. This is a variance from the RCRA permit section 6.5.17.4, which stipulates that three quarters of a well volume be purged from the well prior to sampling. In an effort to collect representative groundwater samples and also minimize the amount of IDW produced, reliance on parameter stabilization has been proposed for use at this site utilizing stabilization guidance provided by NMED (2001). The sampling procedures are as follows.

- Begin purging at a rate of approximately 0.5 liter per minute and increase or decrease the flow rate to maintain the water level in the well as specified below. The flow rate will not exceed 1 liter per minute or fall below 0.1 liter per minute during the stabilization and sampling periods.
- Upon initiation of purging, monitor the following field parameters while purging: dissolved oxygen (DO), pH, oxidation reduction potential, turbidity, conductivity, and temperature.
- Continuously monitor the water level and potential subsequent drawdown with an electric water level indicator or oil-water interface probe, if LNAPL is present, by taking a measurement approximately every 5 minutes. If the static water level before purging is within the screened interval, the drawdown will not exceed a distance of 25% of the length of the saturated screened interval. If the water level falls below the 25% drawdown level, the pumping rate will be decreased to stabilize the water level to prevent cascading and potential loss of volatiles, excessive turbidity, and entrapment of air in the filter pack. If the static water level is above the screened interval, acceptable drawdown is defined as the lowering of the water level to the top of the screened interval. If continued drawdown occurs below the top of the screened interval, the pump rate will be decreased to stabilize the water level to prevent atmospheric contact with the filter pack and formation, which could alter redox chemistry of the well.
  NOTE: In wells with slow recharge rates, it may be necessary to stop the pump and allow the well to recharge to remain at or above the drawdown limit. If this is necessary, water in the tubing will not be allowed to back flush into the well when purging recommences.

Purging will be considered complete when the groundwater quality parameters have stabilized within ±10 percent for specific conductivity, DO, temperature, and turbidity (only required when the nephelometric turbidity units are greater than 10) and ± 0.5 standard units for pH for three consecutive measurements. Groundwater quality measurements will be made at a minimum of 5-minute intervals; all measurements will be recorded on the Well Purge and Sampling Log (Appendix B).

- In the event that stabilization has not occurred within an hour of beginning stabilization, the well will be sampled and the deviation will be noted on the Well Purge and Sampling Log (Appendix B).

- In the event the pump seizes and locks up during purging or sampling activities and it is necessary to move the pump within the well, the purging process will be re-initiated beginning with the first step of this procedure.

6.2.3 Collection of Groundwater Samples from Monitoring Wells Not Equipped with Dedicated Pumps Using Active, Low-Flow Sampling Techniques

The following procedures will be followed when sampling wells not equipped with dedicated pumps that require active sampling techniques before the potential conversion to passive sampling techniques.

- Before deploying the pump, the pump and the associated tubing will be decontaminated; dedicated tubing may also be used. Depending on the well having been designated as a “clean” or “contaminated” based on historical data, if available, a separate pump/tubing setup will be used to further minimize the possibility of cross-contamination.
- An equipment blank will be collected from non-dedicated equipment
- If the top of water measured during the preparation for purging is within the screened interval, the pump intake will be set 2 feet above the bottom of the screened interval. If the top of the water is above the screened interval, the pump intake will be set 2 feet below the top of the screened interval.
- After the pump is set, purging and sampling will be performed as described in Section 6.2.2.

6.3 Soil Sample Selection Criteria

During ARCH drilling, all cuttings will be logged and PID measurements will be recorded at a minimum of every 10 feet, as described in Section 3.2.10 of the VZ Work Plan (KAFB, 2017e).

During continual coring operations, PID readings must be collected every 5 feet. Additional measurements will be collected if qualitative data (e.g. staining, odor) indicate possible LNAPL contamination.

Samples for laboratory analysis will be collected every 10 feet throughout the continuously cored interval (230 feet bgs to total depth). Additional samples for laboratory analyses will be selected based on elevated PID measurements (augmented by lithologic and qualitative data).

Total depth will be 10 feet below any field screening evidence of contamination and a sample for TPH, GRO, and DRO Extended will be collected at total depth of the borehole.

6.4 Sample Packaging and Shipping

Sample packaging and shipping requirements are designed to maintain sample integrity from the time a sample is collected until it is received at the analytical laboratory. All chain-of-custody forms, sample labels, custody seals, and other sample documents will be completed. The following specific procedures for packaging and shipping of environmental samples will be followed.

1. Complete sample label with indelible ink and attach to the sample bottle. Place sample bottles in a cooler for shipping.
2. In preparation for shipping samples, tape the drain plug shut so that no fluids (i.e., melted ice) will drain out of the cooler during shipment. A large plastic bag may be used as a liner for the cooler. Place packing material (i.e., bubble wrap) in the bottom of the liner. Place ice at the bottom of the cooler.

3. Place the containers in the lined cooler. Place cardboard separators or bubble wrap between the containers at the discretion of the shipper.
4. All samples for chemical analysis must be cooled and shipped to arrive at the laboratory at $\leq$6° Celsius with ice. Include a temperature blank in each sample container before shipment.
5. Tape the liner closed, if used, and use sufficient packing material to prevent sample containers from making contact or rolling around during shipment.
6. Place a copy of the chain-of-custody form inside the cooler.
7. Close and tape the cooler shut with strapping tape (filament-type).
8. Place custody seals on the cooler. Place clear tape over the custody seals to help prevent them from being accidentally torn or ripped off.

Ship the cooler of samples via an overnight carrier. A copy of the shipping bill will be retained with the field records and sent electronically to the Project Chemist.

6.5 Analytical Requirements and Quality Control

6.5.1 Laboratory Analyses for Groundwater Samples

Groundwater samples will be collected, labeled, packaged, and shipped to Eurofins Lancaster Laboratories Environmental (ELLE) in Lancaster, Pennsylvania. ELLE maintains a current U.S. Department of Defense (DoD) Environmental Laboratory Accreditation Program certification for the analyses required under this contract.

Table 6-1 lists the analytes to be investigated and specific analyses to be employed for quarterly monitoring. Table 6-2 lists the laboratory preservation requirements and hold times for each method of analysis. Appendix C includes laboratory detection limits for each chemical to be analyzed during groundwater monitoring and its screening limits.

6.5.2 Laboratory Analyses for Selected Core Samples

Table 6-2 summarizes the laboratory analyses for selected samples and provides information for each of the analyses regarding sample containers, required sample volumes, and sample preservation methods. Appendix C includes laboratory detection limits for each chemical to be analyzed during soil sampling. Samples will be analyzed for TPH-GRO and TPH-DRO extended by EPA Method 8015D.

6.6 Data Analysis

Data analysis, validation, and verification will be performed in accordance with the *Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, version 5.1.1* (QSM 5.1.1; DoD and Department of Energy, 2018). Requirements of the QSM 5.1.1 are more restrictive, and fully comply with the quality assurance/quality control requirements of the Kirtland AFB RCRA permit.

Chemical analytical data will include Level 2B-type data reports. EQuIS version 6.0 electronic data deliverables (EDDs) will be provided by the laboratory for validation and loading into the project database. Environmental Resources Program Information Management System (ERPIMS). Version 6.0 EDDs will be provided by the laboratory for processing and submittal of validated analytical data to the Air Force Civil Engineer Center ERPIMS database.

6.6.1 Data Validation

Following data verification, all sample data will undergo EPA 100% Level 3 data validation by an independent third-party subcontractor, per Section 6.5.18 of the RCRA permit. Data verification is performed on a dataset to ensure method, procedural, and contractual compliance with project-specific requirements and is typically performed by the contractor responsible for data collection. EPA Stage 3 data validation will be conducted by a third-party subcontractor and incorporates the data verification process and further evaluates data quality based on analytical method-specific quality control criteria and QSM requirements. Further detail regarding EPA data verification and validation processes is documented in Figure 2 and Figure 4 of *Guidance on Environmental Data Verification and Data Validation* (EPA, 2002).

Subsequent to performing data validation, the data qualifiers will be uploaded to the EQuIS project database. Data will be further assessed for precision, accuracy, representativeness, comparability, completeness, and sensitivity and determined to achieve the project data quality objectives. Data Quality Assessment Reports will be included as attachments to quarterly reporting documents.

6.6.2 Reporting

Information and data collected during any quarter from drilling, installation, sampling, and gauging activities performed on the newly added monitoring wells will be submitted in SWMUs ST-106/SS-111 quarterly monitoring reports. The information and data collected from all investigation activities related to this work plan will also be submitted to NMED as a separate stand-alone investigation report, in accordance with Section 6.2.2.1.2, Site Investigations, Investigation Reports, and Section 6.2.4.3, Reporting Requirements, Investigation Reports of the Kirtland AFB RCRA permit. These reports present a summary of quarterly field activities performed, analytical data for groundwater samples and data evaluation reports, information associated with the operations and maintenance (O&M) of the GWM network, and a discussion of the hydrogeologic conditions at the site, including a presentation of the potentiometric surface maps for the different REIs. The investigation report will include searchable, sortable, validated laboratory analytical data in native file format, per NMED directive.

6.7 Investigation-Derived Waste

IDW generated during this project will be managed as specified in this Work Plan. Waste volumes will be minimized to the extent practical and to eliminate the potential for exposing the local population to IDW during and after work hours.

Investigation-derived wastewater will be generated at each well location. IDW characterization samples will be collected and analyzed as summarized in Table 6-2.

6.7.1 Nonhazardous Water Investigation-Derived Waste

All water generated during well development or during sampling events will be 100% captured and contained during generation. All water IDW is anticipated to be nonhazardous. The following categories of non-hazardous water are discussed below.

- Development of GWM wells installed under this Work Plan: Although this water is anticipated to be nonhazardous, one composite sample from all containers of development water at each wellsite will be analyzed, as summarized in Table 6-2, for waste profiling before disposal.
- Purge water or excess water from sampling all wells included in this Work Plan will be held in the IDW accumulation area pending receipt of analytical data until at least two consecutive sampling events establish a nonhazardous waste profile (per 40 Code of Federal Regulations Part 261). These samples will be composite samples from all containers of purge water on each GWM site.
- Decontamination water from equipment cleaning across all site activities.

Nonhazardous water generated from well development or groundwater sampling activities may contain concentrations of dissolved iron and manganese that exceed the influent acceptance limits specified in the O&M Plan (Appendix L of KAFB, 2017c). Nonhazardous water will be managed as described below depending on dissolved metals concentrations.

6.7.1.1 *Nonhazardous Water with Dissolved Metal Exceeding Groundwater Treatment System Influent Acceptance Limits*

IDW water that contains dissolved iron and manganese exceeding the GWTS influent acceptance limits (KAFB, 2017c) will be kept segregated by point of origin both during transport and accumulation and will not be discharged directly to the GWTS. Upon generation, the water will be placed in dedicated containers (i.e., drums, totes, or storage tanks) and transported to the “pending analysis” accumulation facility where the drums will be labeled and kept pending laboratory analytical results. This water will be profiled for off-site disposal based on the IDW analytical data, or the analytical data from the sample collected from the well purged.

6.7.1.2 *Nonhazardous Water with Dissolved Metals Less than the Groundwater Treatment System Influent Acceptance Limits*

For IDW waste with dissolved iron and manganese concentrations that meet influent acceptance limits (Appendix L of KAFB, 2017c), the water will be segregated until waste profile analytical data are available. Fluids purged or generated at the wellheads will be placed in dedicated containers (i.e., drums, totes, or storage tanks) and transported to the IDW accumulation area. The quantity of IDW water from each well and the total quantity of water transferred to the GWTS will be recorded. A minimal amount of fines are anticipated to be present in this water and pre-filtering before batching into the GWTS is not anticipated.

If, for any reason, the GWTS cannot accept the purge water as it is generated (e.g., shut down for maintenance), the water will be temporarily kept in the IDW accumulation area on pallets and properly labeled until it can be discharged to the GWTS.

6.7.2 Hazardous Water Investigation-Derived Waste

Hazardous/potentially hazardous IDW is anticipated to be generated from the activities outlined in this Work Plan, specifically during operations at the source area well, KAFB-106S10. However, water samples will be analyzed at all well sites and if analytical results suggest water is hazardous, it will be segregated. Any characteristically hazardous IDW will be accumulated for no longer than 90 days before disposal.

Characteristically hazardous water generated from any well development or sampling activities will be kept segregated by point of origin both during transport and while accumulated prior to off-site disposal. Upon generation, the water will be placed in dedicated drums and transported to the less-than-90-day accumulation area for hazardous waste where the drums will be labeled pending laboratory analytical results. This water will be profiled for disposal based on the analytical data from the sample collected from the well purged and, if proven hazardous, will be disposed of accordingly within the 90-day hold time. A minimal amount of fines are anticipated to be present in this water.

6.7.3 Soil Investigation-Derived Waste

Soil will be 100% captured and contained at the drill site during well drilling. All necessary equipment will be provided to contain and transport soil IDW back to the IDW accumulation area for further handling (i.e., characterization, temporary storage, and disposal). IDW soil from drilling sites will be collected, secured, and transported in 20-cubic-yard, lined roll-off bins to the IDW accumulation area pending receipt of waste characterization profiling results.

For profiling of solid waste (soil cuttings), each roll-off containing soil will be characterized for disposal at the Kirtland AFB construction and demolition (C&D) landfill with a 5-point composite IDW sample. The soil samples will be analyzed for the suites outlined in Table 6-2 to determine if they meet the waste acceptance criteria for the Kirtland C&D landfill (U.S. Air Force, 2009).

Once the analytical results for soil IDW are received and reviewed, a request for disposal letter will be provided to Kirtland AFB for approval to dispose of the contents of each container. All documentation regarding waste characterization and disposal will be provided in the appendices of the document describing the activities during which waste was generated.

Should the petroleum levels exceed what the Kirtland AFB C&D landfill is allowed to accept (benzene, toluene, ethylbenzene, and toluene >50 milligrams per kilogram [mg/kg], benzene >10 mg/kg, or total petroleum hydrocarbons >100 mg/kg), it will require characterization as “special waste” and disposed of at an off-site permitted landfill.

7 PROJECT SCHEDULE

Work Plan submission to NMED	December 20, 2019
NMED approval with modifications	July 14, 2020
Submittal of revised work plan in lieu of replacement pages per NMED approval	September 15, 2020
Mobilization deadline	October 12, 2020, 90 days from receipt of approval
Field construction complete	February 9, 2021, 120 days from mobilization
Analytical and validation complete	April 10, 2021, 60 days from completion of construction
Draft investigation report submitted to federal team for review	May 10, 2021
Investigation report deadline for submittal to NMED	June 15, 2021

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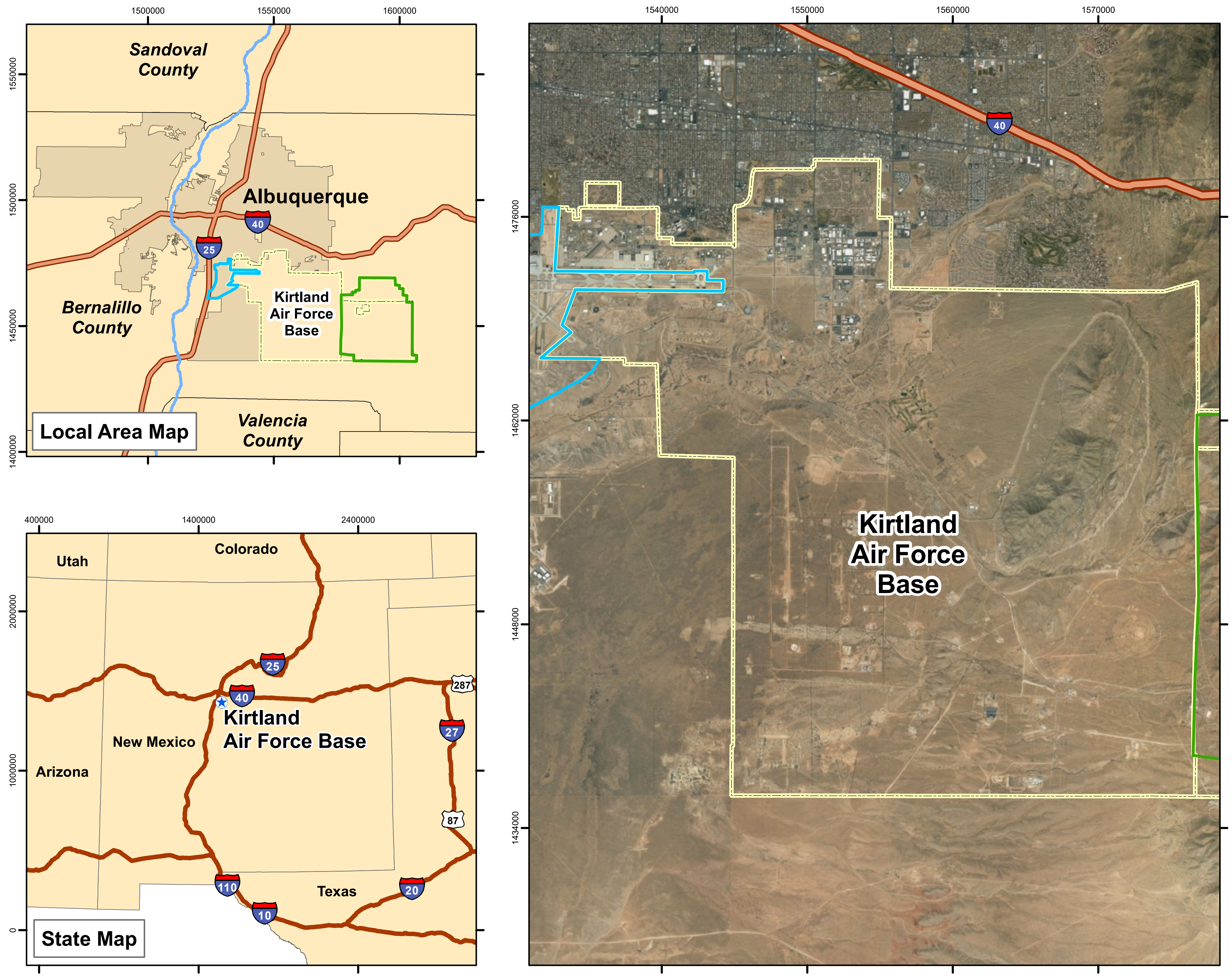
FIGURES



Legend

- Installation Boundary
- USAF Withdrawl Area
- ABQ Sunport Boundary
- Rio Grande
- Interstate
- US Highway
- State/County Highway

Revision Date: 10/17/2019

N

0 2,500 5,000 10,000

Feet

1 inch = 7,193 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP MONITORING WELL
INSTALLATION KAFB-106248 to
KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1-1

SITE VICINITY MAP

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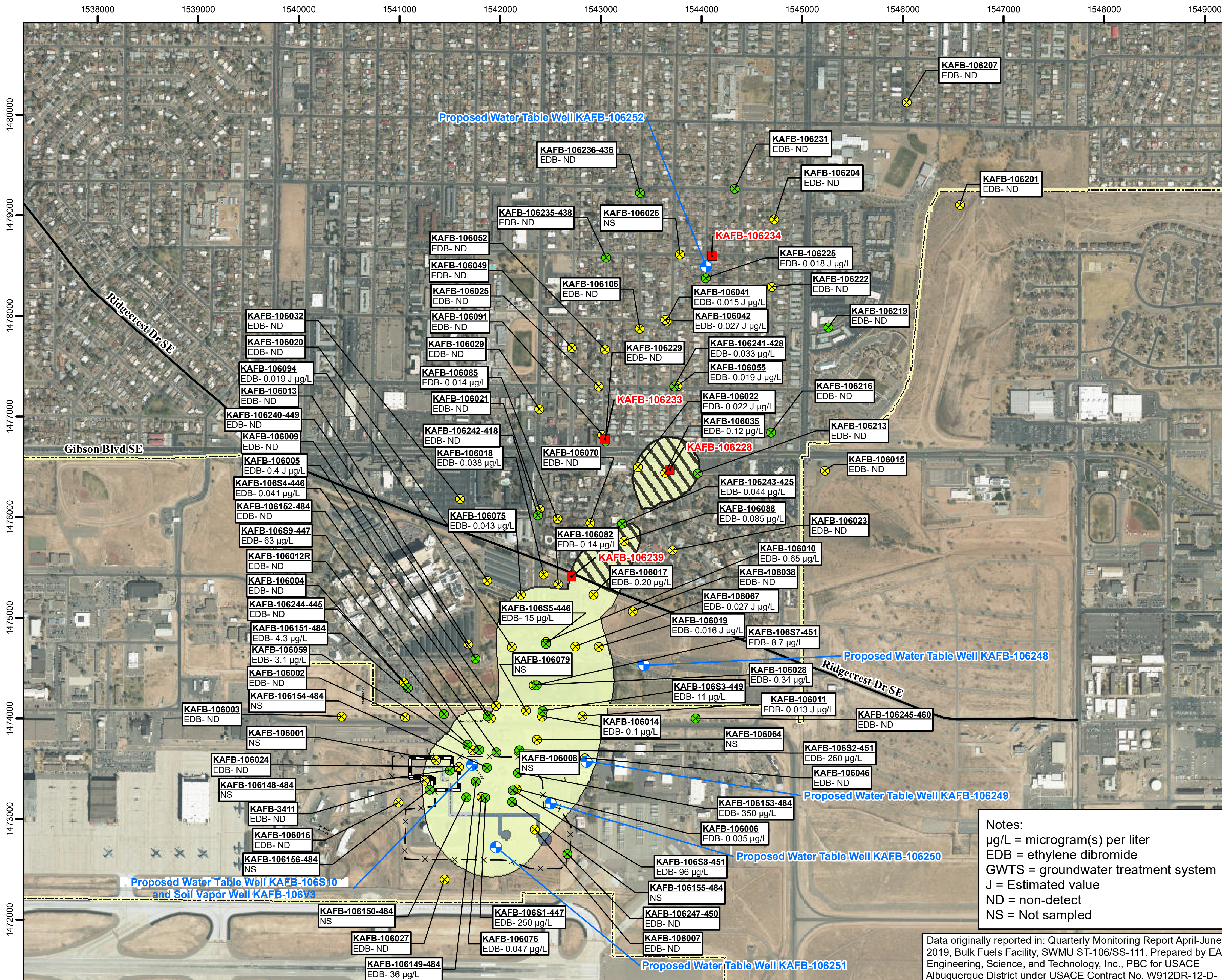
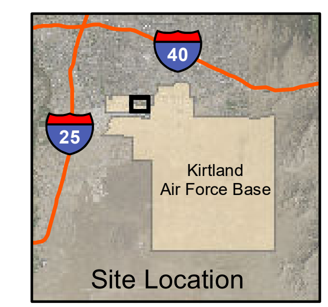


Legend

- Proposed Water Table Wells
- Groundwater Monitoring Well (Screen Not Submerged)
- Groundwater Monitoring Well (Screen Submerged)
- Extraction Well
- Ridgecrest Drive
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Former Aboveground Storage Tank
- Kirtland Air Force Base Installation Area
- Bulk Fuels Facility Area
- Source Area
- EDB Plume Q2 2019 (>0.05 µg/L)
- EDB Plume Q2 2019 (>0.05 µg/L) within target capture zone of GWTS



Site Location

Imagery Source: National Agricultural Imagery Program June 2014

Revision Date: 7/31/2020

N

0 250 500 1,000 1,500 2,000

Feet

1 inch = 1,042 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP MONITORING WELL INSTALLATION KAFB-106248 to KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

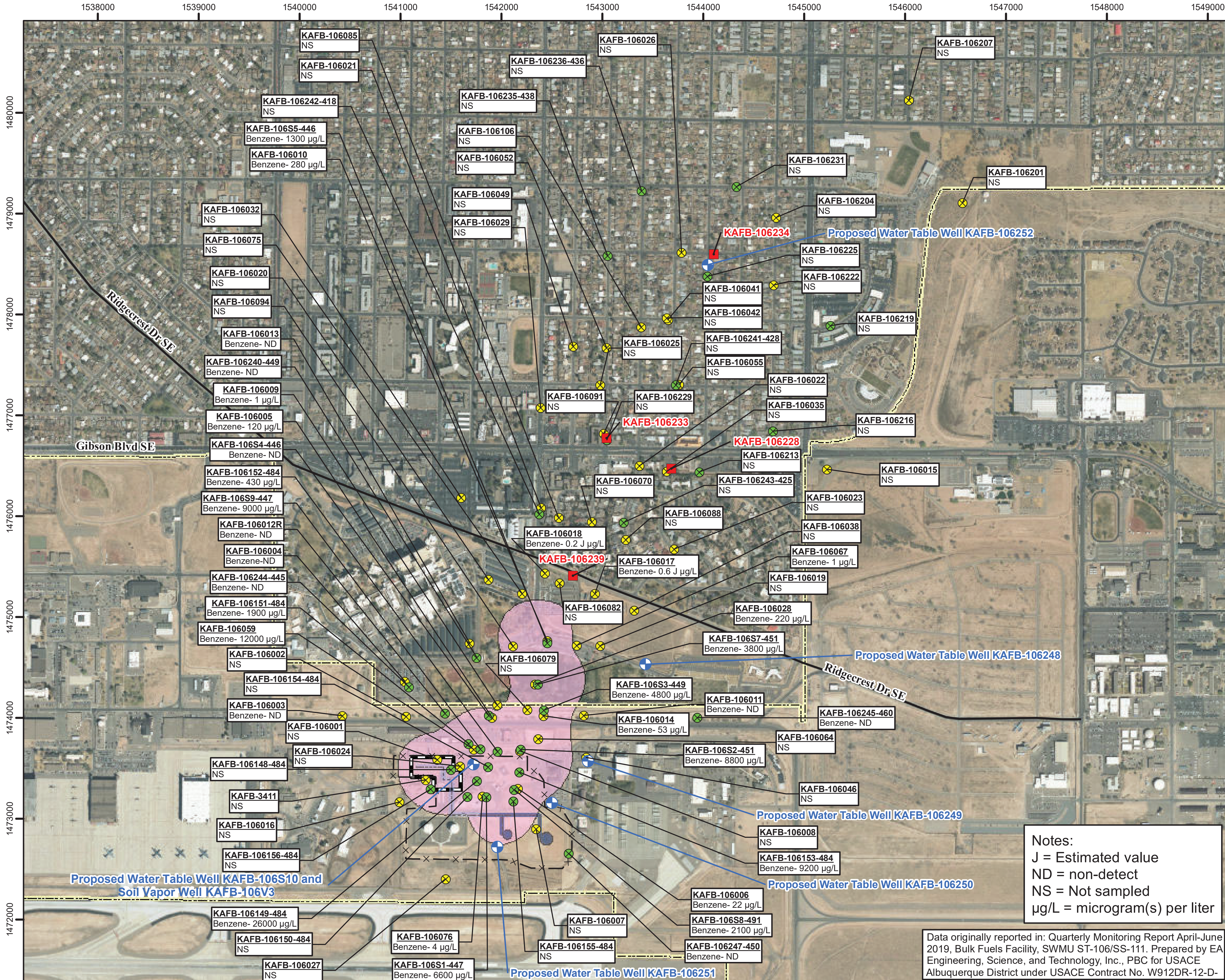
FIGURE 2-1

PROPOSED MONITORING WELL LOCATIONS AND Q2 2019 EDB PLUME MAP

Notes:
µg/L = microgram(s) per liter
EDB = ethylene dibromide
GWTS = groundwater treatment system
J = Estimated value
ND = non-detect
NS = Not sampled

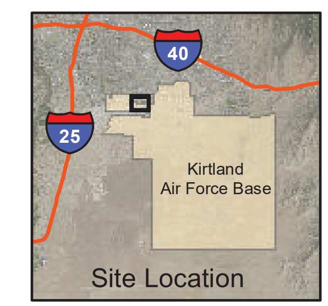
Data originally reported in: Quarterly Monitoring Report April-June 2019, Bulk Fuels Facility, SWMU ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-

Document Path: N:\Kirtland\GIS\GIS_Projects\BFF_new_well_plan\Figure 2-1. Proposed Wells & Q2 EDB Results2.mxd



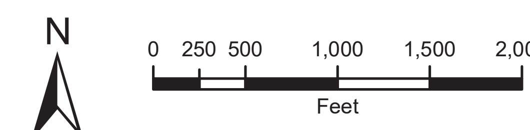
Legend

- Proposed Water Table Wells
- Groundwater Monitoring Well (Screen Not Submerged)
- Groundwater Monitoring Well (Screen Submerged)
- Extraction Well
- Ridgecrest Drive
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Former Aboveground Storage Tank
- Kirtland Air Force Base Installation Area
- Bulk Fuels Facility Area
- Source Area
- Benzene Plume Q2 2019 (>5.0 µg/L)



Imagery Source: National Agricultural Imagery Program June 2014

Revision Date: 7/31/2020



1 inch = 1,042 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
J = Estimated value
ND = non-detect
NS = Not sampled
µg/L = microgram(s) per liter

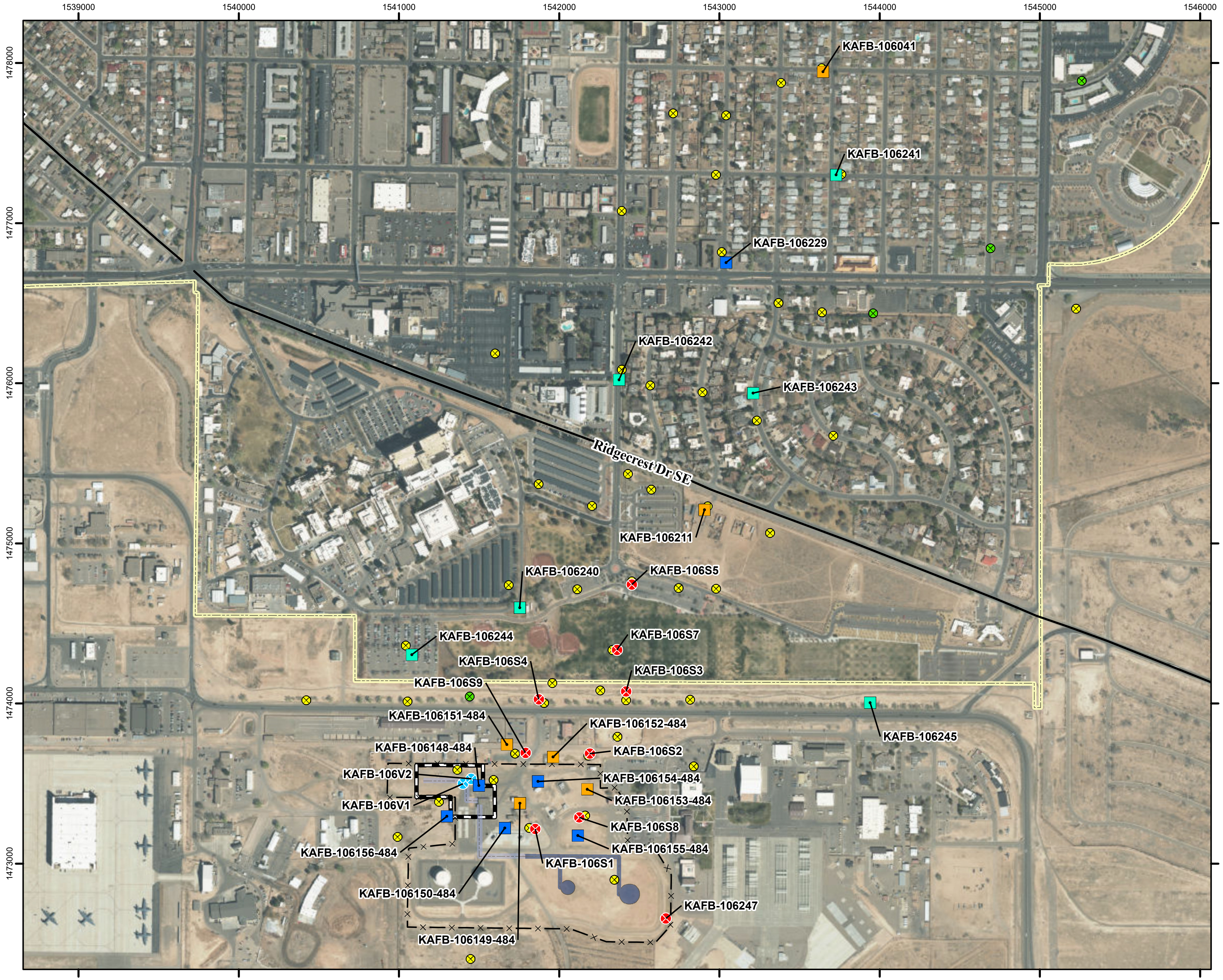
Data originally reported in: Quarterly Monitoring Report April-June 2019, Bulk Fuels Facility, SWMU ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-

WORK PLAN FOR DATA GAP MONITORING WELL INSTALLATION KAFB-106248 to KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-2

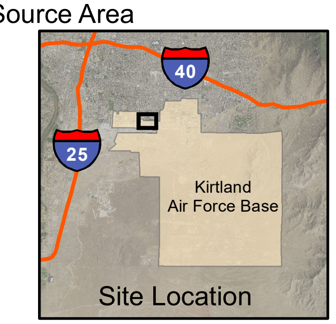
PROPOSED MONITORING WELL LOCATIONS AND Q2 2019 BENZENE PLUME MAP

Document Path: N:\Kirtland\GIS\GIS_Projects\BFF_new_well_plan\Figure 2-2. Proposed Wells & Q2 Benzene Results2.mxd



Legend

- New Monitoring Well in 2018
- Existing Well incorporated for Gauging Only
- Existing Monitoring Well incorporated for Sampling and Gauging
- Coring Locations Completed as SVM Locations
- Coring Locations Completed as GWM Locations
- Groundwater Monitoring Well (Screen Not Submerged)
- Groundwater Monitoring Well (Screen Submerged)
- Ridgecrest Drive
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Former Aboveground Storage Tank
- Kirtland Air Force Base Installation Area
- Bulk Fuels Facility Area
- Source Area



Site Location

Imagery Source: National Agricultural Imagery Program June 2014

Revision Date: 12/13/2019

N

0 250 500 1,000 1,500

Feet

1 inch = 645 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

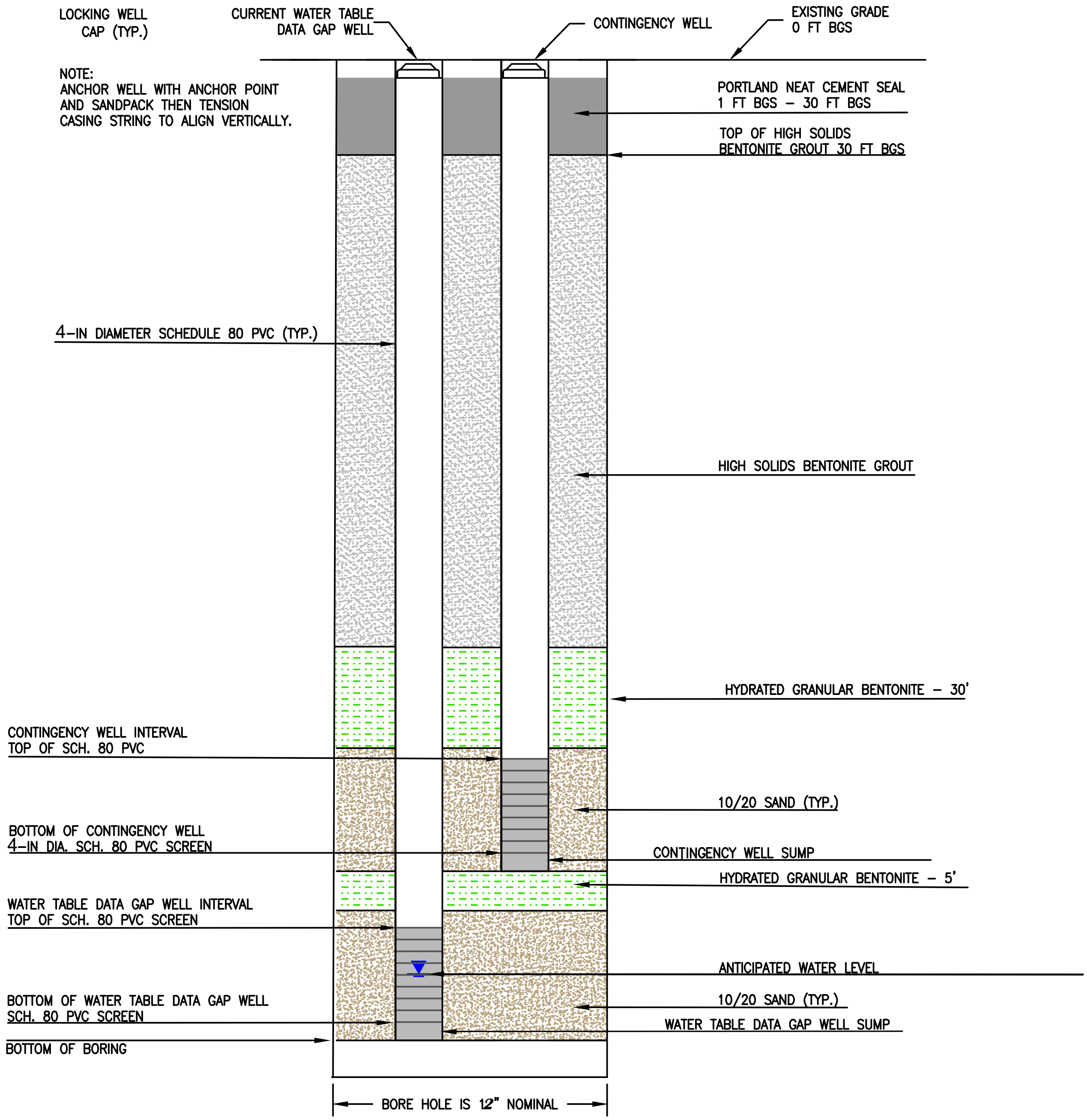
WORK PLAN FOR DATA GAP MONITORING
WELL INSTALLATION KAFB-106248 to
KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-3

PREVIOUS DATA GAP
MONITORING WELL LOCATIONS

Document Path: N:\Kirtland\GIS\GIS_Projects\BFF_new_well_plan\Figure 2-3. Previous Data Gap Locations.mxd

Figure 4-1
Proposed Construction Diagram for Groundwater Monitoring
Well with Contingency Well



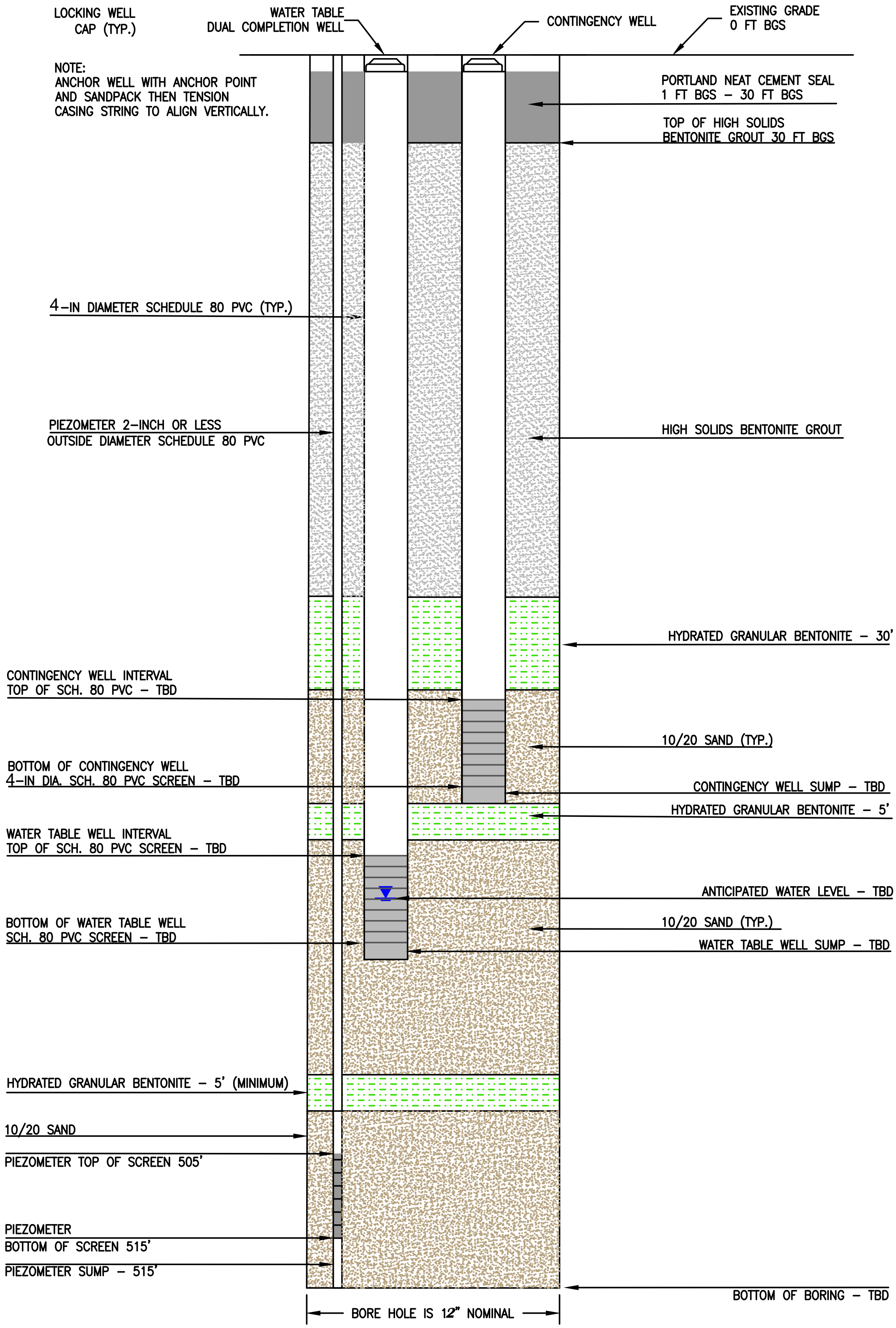
DEPTH INTERVALS MAY BE MODIFIED DURING DRILLING BASED ON OBSERVED CONDITIONS;
WELL SCREENS WILL BE POSITIONED WITH APPROXIMATELY 15' OF WATER COLUMN UPON COMPLETION.

NOT TO SCALE
BGS=BELOW GROUND SURFACE
FT=FEET

KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME:	INSTALLATION END DATE/TIME:
PROJECT NO.:	WELL ID:	GEOLOGIST:	DRILLER:

CAD FILE: Y:\Active Projects\62599DM01 Kirtland BFF_USACE\01_Work Plan\19.0 Data Gap Wells WP\Figures\Natives\Nested Monitoring well_KAFB-106240-245.dwg PLOT DATE/TIME: 12/18/2017 – 4:39pm

FIGURE 4-2
Proposed Construction Diagram for Groundwater
Monitoring Well KAFB-106252



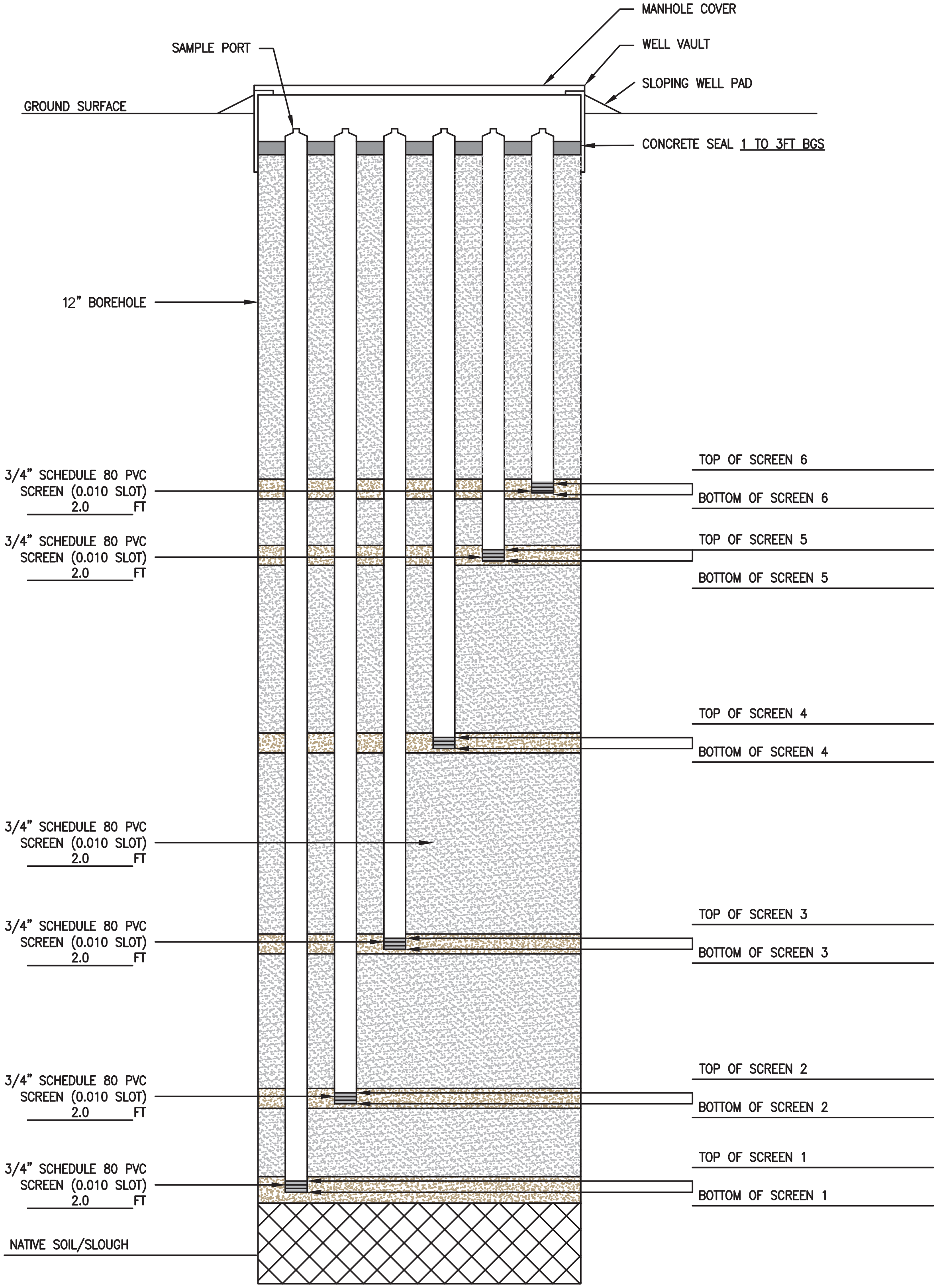
NOTE:
TBD = TO BE DETERMINED
DEPTH INTERVALS MAY BE MODIFIED DURING DRILLING BASED ON OBSERVED CONDITIONS;
WELL SCREENS WILL BE POSITIONED WITH APPROXIMATELY 15' OF WATER COLUMN UPON COMPLETION.

NOT TO SCALE
BGS=BELOW GROUND SURFACE
FT=FEET

KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME:	INSTALLATION END DATE/TIME:
PROJECT NO.:	WELL ID:	GEOLOGIST:	DRILLER:

CAD FILE: Y:\Active Projects\62735DM02 Kirtland Vadose Zone\Sundance data gap work plan\Well Completion Diagram-KAFB-106248.dwg PLOT DATE/TIME: 9/26/2019 – 1:03pm

FIGURE 4-3
Proposed Construction Diagram for
SVM Well KAFB-106V3



(ELEVATION) IS IN ABOVE MEAN SEA LEVEL
ASML = ABOVE MEAN SEA LEVEL
MRP = MEASUREMENT REFERENCE POINT
ALL WELLS HAVE A 0.4 FT SUMP BELOW BOTTOM OF SCREEN

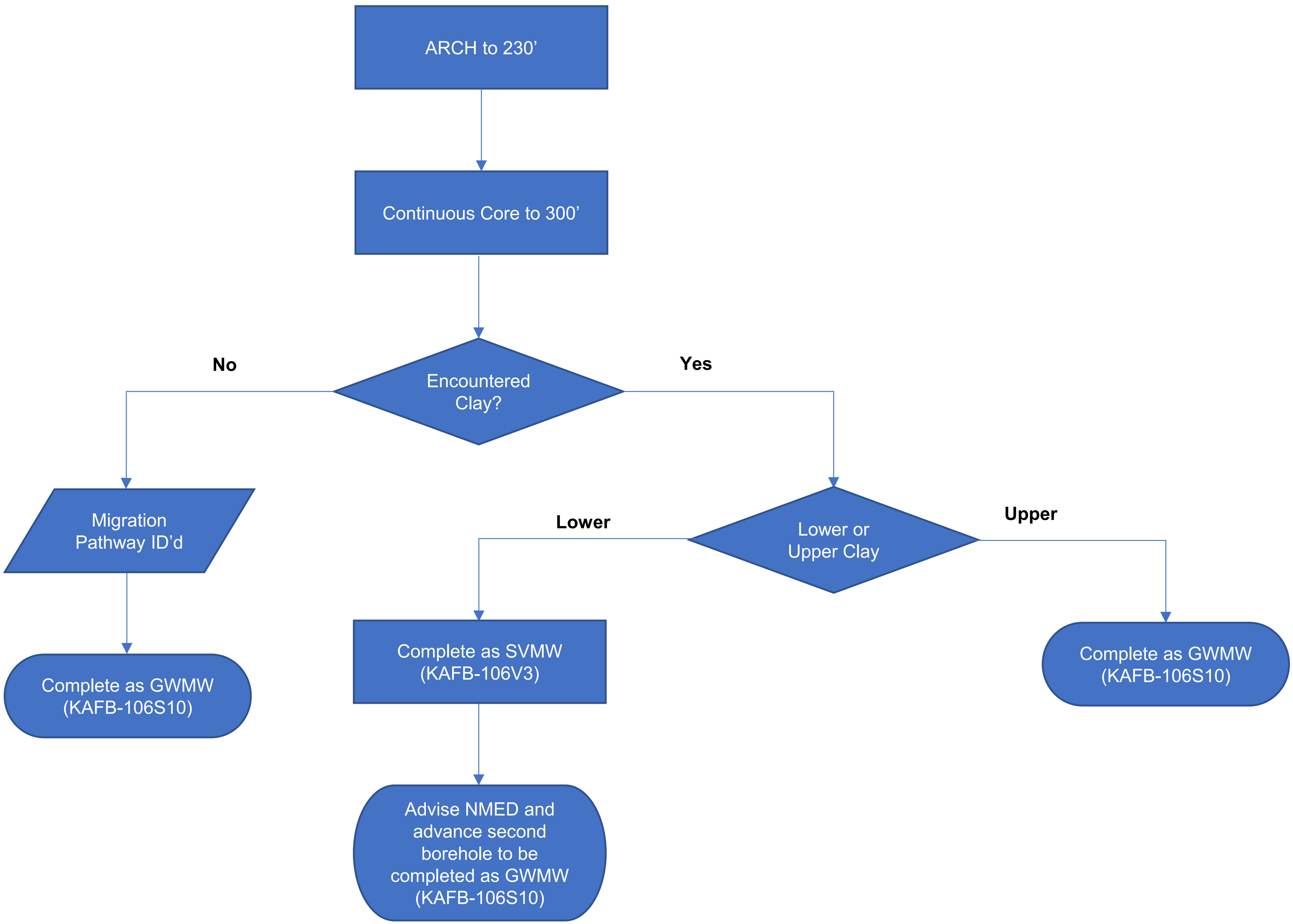
NOT TO SCALE
BGS = BELOW GROUND SURFACE
FT = FEET

KIRTLAND AIR FORCE BASE

Well ID: KAFB-106V3

CAD FILE: P:\Active Projects\62735DM02 Kirtland Vadose Zone\01.1_VZ Coring Work Plan_R0\04_VZ WP Appendices_R0\VZ WP App B_R0- Well Construction\CADD\Well Completion Diagram - KAFB-106V1.dwg PLOT DATE/TIME: 4/12/2019 - 12:38pm

Figure 5-1 Decision Tree for Drilling and Coring in Source Area



TABLES

Table 4-1. Well Justification and Construction Specifications

Proposed Monitoring Well Location Shown (Figure 3-1)	Location Description (Figure 3-1)	Completion	NAD83 State Plane New Mexico Central ft		Approximate Depth to Water[a]	Depth to Water in Nearby Well[b]	Anticipated Water Table Well Screen Interval[c]	Anticipated Contingency Well Screen Interval[d]	Anticipated Piezometer Well Screen Interval	Justification for Well Location
			(X)	(Y)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)	
KAFB-106248	Bullhead Park	Nested - two wells; 4-inch Schedule 80 PVC each	1543624.994	1474458.099	480	479.55 (KAFB-106019)	455-495	421-446	NA	Fills plume boundary gap between KAFB-106019 and KAFB-106011. EDB concentrations are decreasing to the east in this area from KAFB-106067 (0.027J ug/l) to KAFB-106019 (0.016J ug/l), however no ND wells to the east. Better control with bounding the benzene plume: KAFB-106067 (1 ug/l) to the north and KAFB-106011 (ND) to the south. Provides data as the water table decreases in depth.
KAFB-106249	East of BFF, adjacent to/north of Air National Guard	Nested - two wells; 4-inch Schedule 80 PVC each	1542861.024	1473577.172	478	477.22 (KAFB-106046)	453-493	419-444	NA	Assesses eastern extent of the on base EDB plume at the water table. Q2 2019 EDB concentrations exceeded the MCL at KAFB-106153-484 and KAFB-106S2-451. KAFB-106046 well screen is submerged.
KAFB-106250	Southeast of BFF in Air National Guard parking Lot	Nested - two wells; 4-inch Schedule 80 PVC each	1542499.573	1473160.013	476	476.22 (KAFB-106S8-491)	451-491	417-442	NA	Assists with bounding southern extent of the EDB plume at the water table. Q2 2019 EDB concentrations exceeded the MCL at KAFB-106S8-491 and KAFB-106S1-447. KAFB-106007 is both submerged
KAFB-106251	In BFF south of former fuel tanks	Nested - two wells; 4-inch Schedule 80 PVC each	1541958.972	1472724.372	470	469.90 (KAFB-106S1-447)	445-485	411-436	NA	Assists with bounding southern extent of the EDB plume at the water table. Q2 2019 EDB concentrations exceeded the MCL at KAFB-106S1-447 and KAFB-106149-484. KAFB-106027 and KAFB-106007 are submerged and there is no other data in this area to help limit the model in this area.
KAFB-106252	Proximal to extraction well KAFB-106234	Nested - two wells; 4-inch Schedule 80 PVC each and one piezometer well; 1-inch Schedule 80 PVC	1544042.712	1478492.566	451	451.03 (KAFB-106225)	426-466	392-417	505-515	Provides more accurate EDB concentration data to better approximate residual mass. Well should be placed <40 ft away from KAFB-106234 to best represent the EDB concentration collected around the extraction center. Allows for a more accurate drawdown from KAFB-106234 and would help the model in providing a more accurate representation of the groundwater gradients in this area. The well will be placed as close to KAFB-106234 as reasonable to increase the chance of the piezometer intersecting the high permeability gravels seen in the KAFB-106234 logs.
KAFB-106S10	In BFF East of former fueling racks	Nested - two wells; 4-inch Schedule 80 PVC each	1541621.743	1473457.805	472	472.0 (KAFB-106154)	447-487	413-438	NA	Furthers undestanding of contaminant migration pathways beneath the source area. Primarily meant to examine the clay interval at 250-300 feet bgs. Will be completed as either a GWM or SVM well.
KAFB-106V3	In BFF East of former fueling racks	Nested - 6 wells; 3/4 inch Schedule 80 PVC with 2' screen	1541621.743	1473457.805	472	472.0 (KAFB-106154)	NA	NA	NA	Furthers undestanding of contaminant migration pathways beneath the source area. Primarily meant to examine the clay interval at 250-300 feet bgs. Will be completed as either a GWM or SVM well.

a Approximate depth to water as of the submission of this work plan. Depth to water will likely have changed by the time field activities commence. The well will be installed according to the current water table at the time of drilling.

[b] Depth to water measured April 2019

[c] 40-ft screen, 25 ft above water table, 15 ft below. Depth intervals may be modified during drilling based on observed conditions; water table well screens will be positioned with approximately 15-ft water column upon completion

[d] 25-ft screen, bottom 9 ft above top of water table screen, installed "dry"

µg/L = microgram per liter
BFF = Bulk Fuels Facility
bgs = below ground surface
EDB = ethylene dibromide
ft = feet
MCL = maximum contaminant level
NA= not applicable
ND = non-detect
PVC = polyvinyl chloride
Q2 2019 = second quarter of calendar year 2019

Table 4-2
Recent EDB and Benzene Results from Groundwater Wells in the Vicinity of Proposed Locations KAFB-106248 through KAFB-106251

		EDB Data								Benzene Data									
				Q4 2018			Q2 2019					Q4 2018			Q2 2019				
Location	REI	Project Screening Level[a]	Units	Result	Val Qual	LOD	Result	Val Qual	LOD	Project Screening Level[a]	Units	Result	Val Qual	LOD	Result	Val Qual	LOD	Is GWM well submerged? Y/N	Proposed well location assoicated with data
KAFB-106010	4857	0.05	µg/L	**2.1**		0.19	**0.65**		0.19	5	µg/L	**2300**		10	**280**		0.5	Y	KAFB-106248
KAFB-106019	4857	0.05	µg/L	**0.079**		0.019	0.016	J	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106248
KAFB-106067	4857	0.05	µg/L	0.018	J	0.019	0.027	J	0.019	5	µg/L	**5**		0.5	1		0.5	Y	KAFB-106248
KAFB-106S5-446	4857	0.05	µg/L	not installed			**15**		1.9	5	µg/L	not installed			**1300**		25	N	KAFB-106248
KAFB-106S3-449	4857	0.05	µg/L	not installed			**11**		2	5	µg/L	not installed			**4800**		50	N	KAFB-106248
KAFB-106245-460	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	N	KAFB-106248, KAFB-106249
KAFB-106046	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106249
KAFB-106064	4857	0.05	µg/L	**0.25**		0.019	not sampled			5	µg/L	**3600**		50	not sampled			Y	KAFB-106249
KAFB-106006	4857	0.05	µg/L	ND	U	0.019	0.035		0.019	5	µg/L	**17**		0.5	**22**		0.5	Y	KAFB-106250
KAFB-106007	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106250
KAFB-106008	4857	0.05	µg/L	**20**		3.8	not sampled			5	µg/L	**5800**		50	not sampled			Y	KAFB-106249
KAFB-106027	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106251
KAFB-106076	4857	0.05	µg/L	0.013	J	0.019	0.047		0.019	5	µg/L	1		0.5	4		0.5	Y	KAFB-106251
KAFB-106S1-447	4857	0.05	µg/L	not installed			**250**		97	5	µg/L	not installed			**6600**		100	N	KAFB-106251
KAFB-106S2-451	4857	0.05	µg/L	not installed			**260**		95	5	µg/L	not installed			**8800**		100	N	KAFB-106249
KAFB-106S8-451	4857	0.05	µg/L	not installed			**96**		19	5	µg/L	not installed			**2100**		100	N	KAFB-106250
KAFB-106247-450	4857	0.05	µg/L	not installed			ND	U	0.019	5	µg/L	not installed			ND	U	0.5	N	KAFB-106250, KAFB-106251
KAFB-106149-484	4857	0.05	µg/L	**34**		9.5	**36**		3.8	5	µg/L	**11000**		50	**26000**		250	N	KAFB-106249, KAFB-106250, KAFB-106251
KAFB-106152-484	4857	0.05	µg/L	0.017	J	0.019	ND	U	0.095	5	µg/L	**71**		0.5	**430**		5	N	KAFB-106249, KAFB-106250
KAFB-106153-484	4857	0.05	µg/L	**300**		39	**350**		95	5	µg/L	**4700**		25	**9200**		100	N	KAFB-1062549, KAFB-106250
KAFB-106069	4838	0.05	µg/L	0.044		0.019	0.014	J	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106248
KAFB-106044	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106251
KAFB-106047	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106249
KAFB-106063	4838	0.05	µg/L	**3.6**	J	0.38	not sampled			5	µg/L	**6400**		50	not sampled			Y	KAFB-106249
KAFB-106077	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106251
KAFB-106068	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106248
KAFB-106045	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106251
KAFB-106048	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106249, KAFB-106250
KAFB-106062	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106249
KAFB-106078	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106251

[a]EPA National Primary Drinking Water Regulations, MCLs and Secondary MCLs, Title 40CFR Part 141, 143 (May 2018).
EDB = 1,2-dibromoethane (ethylene dibromide)
J = estimated concentration
LOD = limit of detection
ND = non-detect
Q = quarter
REI = reference elevation interval
U = non-detect
Val Qual = validation qualifier
µg/L = microgram per liter
highlighted cell indicates a detection
bolded text indicates the detected concentration exceeds the project screening level

Table 4-3
Groundwater EDB Results from 2017 through 2019 in the Vicinity of KAFB-106234

Location	REI	Project Screening Level[a]	Units	EDB Results Q2 2017			Q4 2017			Q2 2018			Q4 2018			Q2 2019			Bottom of Screen Elevation	Top of Screen Elevation
				Result	Val Qual	LOD	Result	Val Qual	LOD	Result	Val Qual	LOD	Result	Val Qual	LOD	Result	Val Qual	LOD		
KAFB-106041	4857	0.05	µg/L	Not sampled			**0.058**		0.019	0.019	J	0.019	0.013	J	0.0095	0.015	J	0.019	4855	4875
KAFB-106042	4857	0.05	µg/L	ND	U	0.019	0.013	J	0.019	0.017	J	0.02	0.017	J	0.0095	0.027	J	0.019	4841	4855
KAFB-106201	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4837	4867
KAFB-106204	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4840	4870
KAFB-106207	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4841	4871
KAFB-106222	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.02	ND	U	0.019	ND	U	0.019	4845	4875
KAFB-106225	4857	0.05	µg/L	**0.92**		0.38	**0.57**		0.019	**0.12**		0.019	**0.17**		0.019	0.018	J	0.019	4846	4876
KAFB-106231	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4853	4888
KAFB-106236-461	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4855	4880
KAFB-106202	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4823	4838
KAFB-106205	4838	0.05	µg/L	0.041		0.019	ND	U	0.019	0.022	J	0.019	ND	U	0.019	ND	U	0.019	4826	4841
KAFB-106208	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4826	4841
KAFB-106223	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.02	ND	U	0.019	ND	U	0.019	4831	4846
KAFB-106226	4838	0.05	µg/L	ND	U	0.019	**0.33**		0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4832	4847
KAFB-106236-490	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4826	4846
KAFB-106203	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4719	4734
KAFB-106206	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4725	4740
KAFB-106209	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4726	4740
KAFB-106224	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.02	ND	U	0.019	ND	U	0.019	4765	4780
KAFB-106227	4814	0.05	µg/L	0.041		0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4765	4780
KAFB-106232	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4709	4724
KAFB-106236-519	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4817	4837

[a] EPA National Primary Drinking Water Regulations, MCLs and Secondary MCLs, Title 40CFR Part 141, 143 (May 2018).

EDB = 1,2-dibromoethane (ethylene dibromide)
J = estimated concentration
LOD = limit of detection
ND = non-detect
Q = quarter
REI = reference elevation interval
U = non-detect
Val Qual = validation qualifier
µg/L = microgram per liter
highlighted cell indicates a detection
bolded text indicates the detected concentration exceeds the project screening level

Table 6-1
Groundwater Monitoring Sampling Requirements for Data Gap Wells

Analyte	Analysis	Frequency of Baseline Monitoring[a]	Anicipated Frequency of Post-Baseline Monitoring[a,b]
EDB	EPA Method 8011	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Total Metals	EPA Method 6010C (calcium, magnesium, potassium, sodium)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Dissolved Metals	EPA Method 6010C (iron, manganese)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Total Metals	EPA Method 6020A (arsenic, lead)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Anions	EPA Method 300.0A (chloride, bromide, sulfate)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Anions	EPA Method 353.2 (nitrate/nitrite nitrogen)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Alkalinity - Bicarbonate/ Carbonate	Standard Method 2320B	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
VOCs (including BTEX)	EPA Method 8260C	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
TPH-GRO	EPA Method 8015C/D	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
TPH-DRO	EPA Method 8015C/D	Quarterly	To be re-evaluated after 8 quarters of baseline sampling

[a] Six (possibly seven) new wells (KAFB-106248, KAFB-106249, KAFB-106250, KAFB-106251, KAFB-106252, and possibly KAFB-106S10) are proposed to be installed in Q4 2020 and will be sampled within 10 days following well completion.

[b] This is the anticipated frequency, which may change based on monitoring results. Baseline sampling results will allow the wells to be categorized in accordance with the approved Work Plan for The Bulk Fuels Facility Expansion of The Dissolved-Phase Plume Groundwater Treatment System Design Revision 2 (KAFB, 2017a). It is anticipated that the wells will be categorized as "groundwater monitoring wells."

BTEX = benzene, toluene, ethylbenzene, and xylenes
EDB = ethylene dibromide
EPA = U.S. Environmental Protection Agency
VOC = volatile organic compound
GRO = gasoline range organics (C6 - C10)
DRO = diesel range organics (C10 - C28)

Table 6-2
Analytical Parameter, Matrix, Method, Sample Container, Preservation, and Holding Time Requirements

Parameter	Sample Purpose	Matrix	Preparation/ Analysis Method	Bottle Type	Preservative	Preparation Holding Time	Analytical Holding Time
Total petroleum hydrocarbon- diesel range organics[1]	Periodic GWM	Water	SW8015C/D	2 x 250 mL amber glass bottles	HCl to pH < 2; Cool ≤6°C	7 days	40 days
Total petroleum hydrocarbon- gasoline range organics[2]	Periodic GWM	Water	SW8015C/D	3 x 40 mL glass vials	HCl to pH < 2; Cool to 2-6°C	14 days	14 days
Anions (chloride, bromide, sulfate)	Periodic GWM	Water	E300.0A	1 x 250-mL glass or HDPE	None; Cool ≤6°C	NA	28 days
Nitrate/Nitrite nitrogen	Periodic GWM	Water	E353.2	2 x 250-mL glass or HDPE	Sulfuric acid to pH <2; Cool ≤6°C	NA	28 days
Alkalinity – bicarbonate/carbonate	Periodic GWM	Water	SM2320B	1 x 250-mL glass or HDPE	None; Cool ≤6°C	NA	14 days
Volatile organic compounds – benzene, toluene, ethylbenzene, xylenes, naphthalene	Periodic GWM & IDW	Water	SW5030B/8260C	3 x 40-mL glass	HCl to pH < 2; Cool ≤6°C	NA	14 days
Ethylene dibromide	Periodic GWM & IDW	Water	SW8011	2 x 40-mL glass	HCl to pH < 2; Cool ≤6°C	NA	14 days
Total and dissolved metals	Periodic GWM & IDW	Water	SW3005A/6010C SW3020A/6020A	1 x 250-mL HDPE	Nitric acid to pH <2; Cool ≤6°C	180 days	180 days
Flashpoint	IDW	Water	SW1010A	1 x 250-mL HDPE	None; Cool ≤6°C	NA	NA
pH	IDW	Water	SW9040C	1 x 250-mL HDPE	None; Cool ≤6°C	NA	Upon receipt
Total petroleum hydrocarbon- diesel range organics extended[3]	Core Analysis	Soil	SW3546/8015D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Total petroleum hydrocarbon- gasoline range organics	Core Analysis/IDW	Soil	SW5035A/8015D	1 x 4-oz glass	None; Cool ≤6°C	NA	14 days
Total petroleum hydrocarbon- diesel range organics	IDW	Soil	SW3546/8015D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days

Table 6-2
Analytical Parameter, Matrix, Method, Sample Container, Preservation, and Holding Time Requirements

Parameter	Sample Purpose	Matrix	Preparation/ Analysis Method	Bottle Type	Preservative	Preparation Holding Time	Analytical Holding Time
Volatile organic compounds	IDW	Soil	SW5035A/8260C	3 x EnCore/ Terracore samplers; 1 x 4-oz glass	None; Cool ≤6°C	48 hours to preserve or preserved in field	14 days
Semivolatile organic compounds	IDW	Soil	SW3546/8270D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Ethylene dibromide	IDW	Soil	SW8011	1 x 8-oz glass	None; Cool ≤6°C	14 days	14 days
Metals	IDW	Soil	SW6010C	1 x 8-oz glass	None; Cool ≤6°C	180 days	180 days
Mercury	IDW	Soil	SW7471B	1 x 8-oz glass	None; Cool ≤6°C	28 days	28 days
Ignitability	IDW	Soil	SW1020A	1 x 8-oz glass	None; Cool ≤6°C	NA	NA
pH	IDW	Soil	SW9045C	1 x 8-oz glass	None; Cool ≤6°C	NA	NA
Cyanide, Total and/or Amenable	IDW	Soil	SW9012B	1 x 8-oz glass	None; Cool ≤6°C	28 days	28 days
Pesticides	IDW	Soil	SW3546/8081B	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Herbicides	IDW	Soil	SW3550C/8151A	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Toxicity characteristic leaching procedure	IDW	Soil	SW1311	8-oz glass per parameter/method	NA	NA	NA

[1]Total Petroleum Hydrocarbon - Diesel Range Organics: C10 - C28
[2]Total Petroleum Hydrocarbon - Gasooline Range Organics: C6 - C10
[3]Total Petroleum Hydrocarbon - Diesel Range Organics Extended: C10 - C35
°C = degrees Celsius
E = EPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983 and Updates.
HCl = hydrochloric acid
HDPE = high density polyethylene
mL = milliliter
NA = not applicable
oz = ounce
SM = Standard Methods for Examination of Water and Wastewater, 22nd Edition.
SW = EPA SW846 – Test Methods for Evaluating Solid Waste, 3rd Edition, 1986 and Updates.

APPENDICES

APPENDIX A

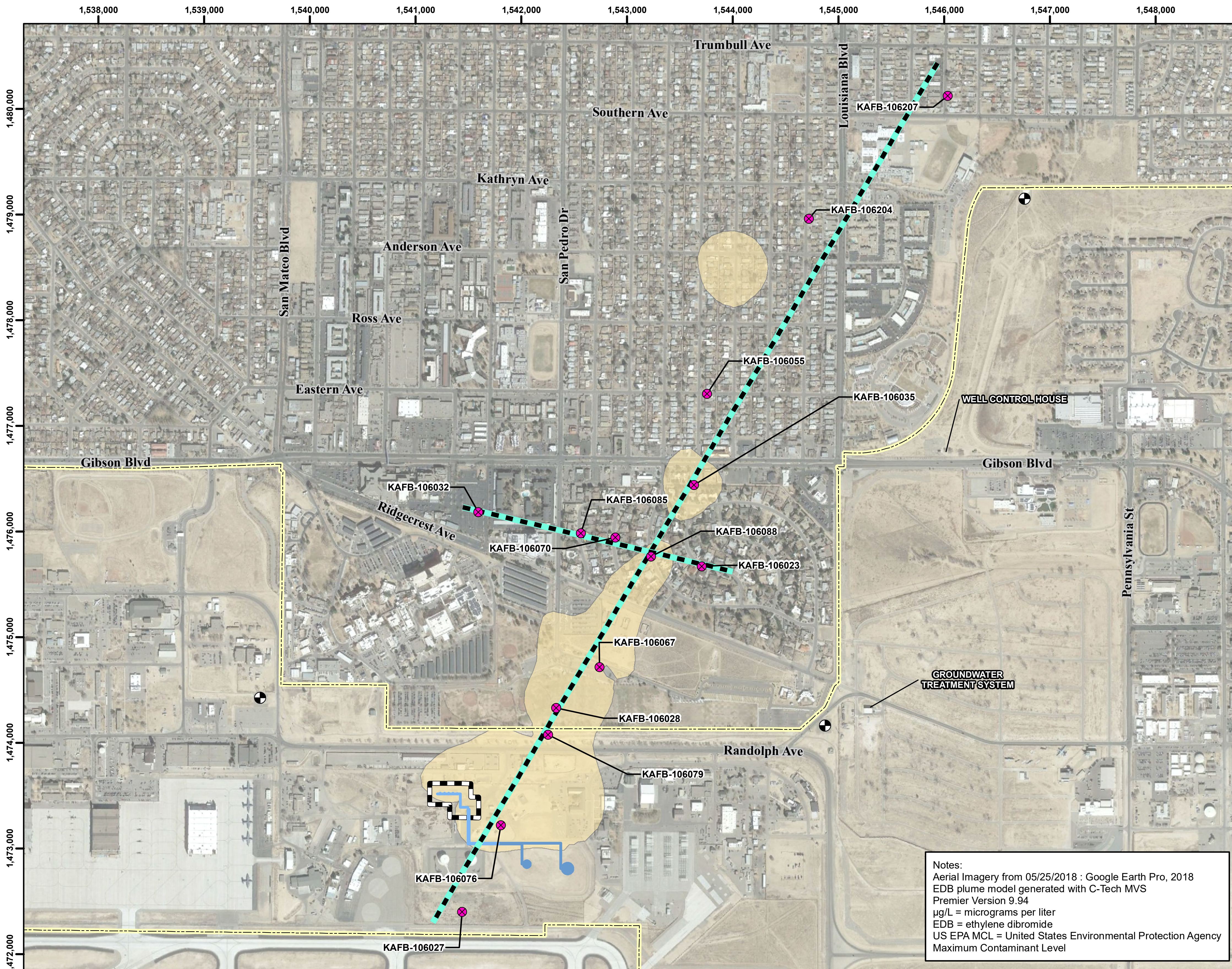
HISTORICAL GROUNDWATER INFORMATION

APPENDIX A-1

WATER-LEVEL HYDROGRAPHS

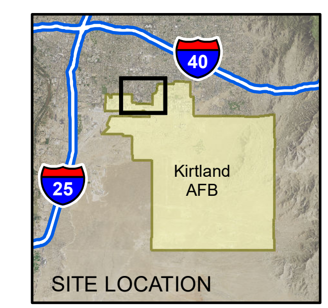
Material reprinted from Appendix L-2 from the following document:

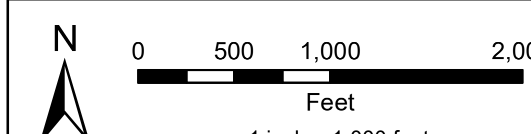
Quarterly Monitoring Report October–December 2018 and Annual Report for 2018, Bulk Fuels Facility, SWMUs ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-006.



Legend

- Groundwater Monitoring Well Used in Cross Section Profile
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Elevation Cross Section
- Installation Fence Boundary
- Q4 2018 EDB Plume with Concentration > 0.05 µg/L (EPA MCL)
- Source Area





1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-1

GROUNDWATER ELEVATION CROSS SECTION

\\abq\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2018_Q4\Section 5\L-2-1 GW Elevation Cross Section.mxd 1/12/2019 EA eomalia

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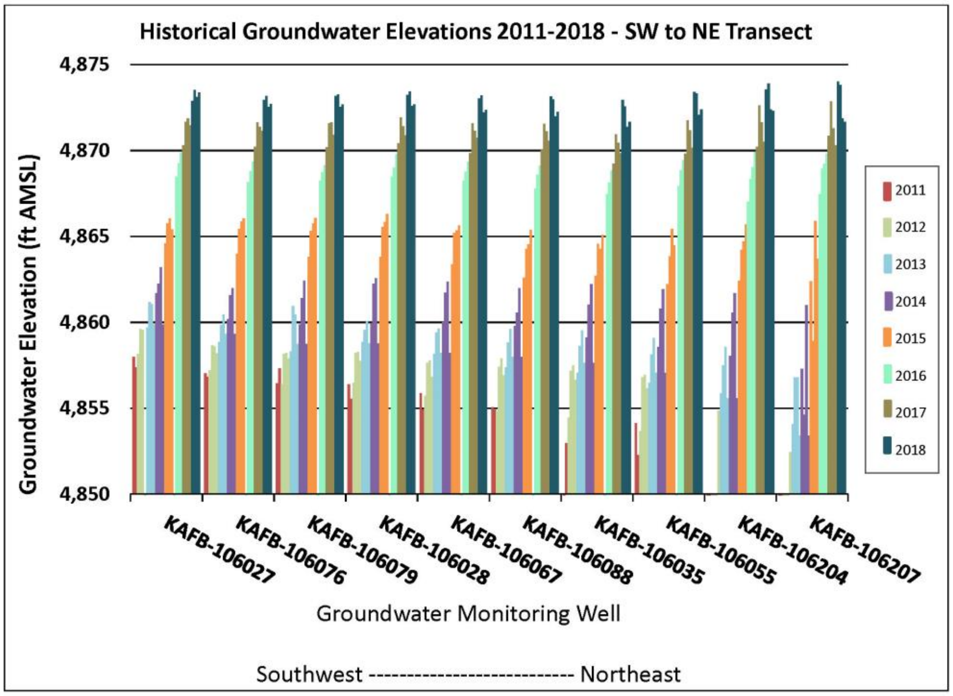
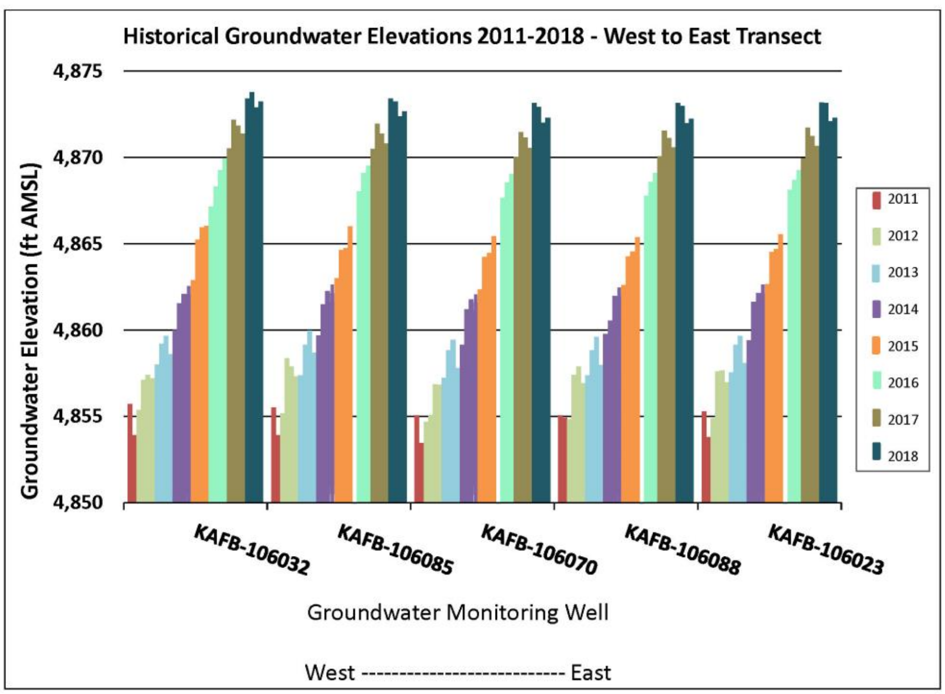
Figure A-2: Water Level Time-Series Graphs, Q4 2018





Published as Appendix L-2 from:
KAFB, 2019a. Quarterly Monitoring Report October–December 2018 and Annual Report for 2018, Bulk Fuels Facility, SWMU ST-106/ SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-006.

APPENDIX A-2

HISTORICAL GROUNDWATER PLUME MAPS

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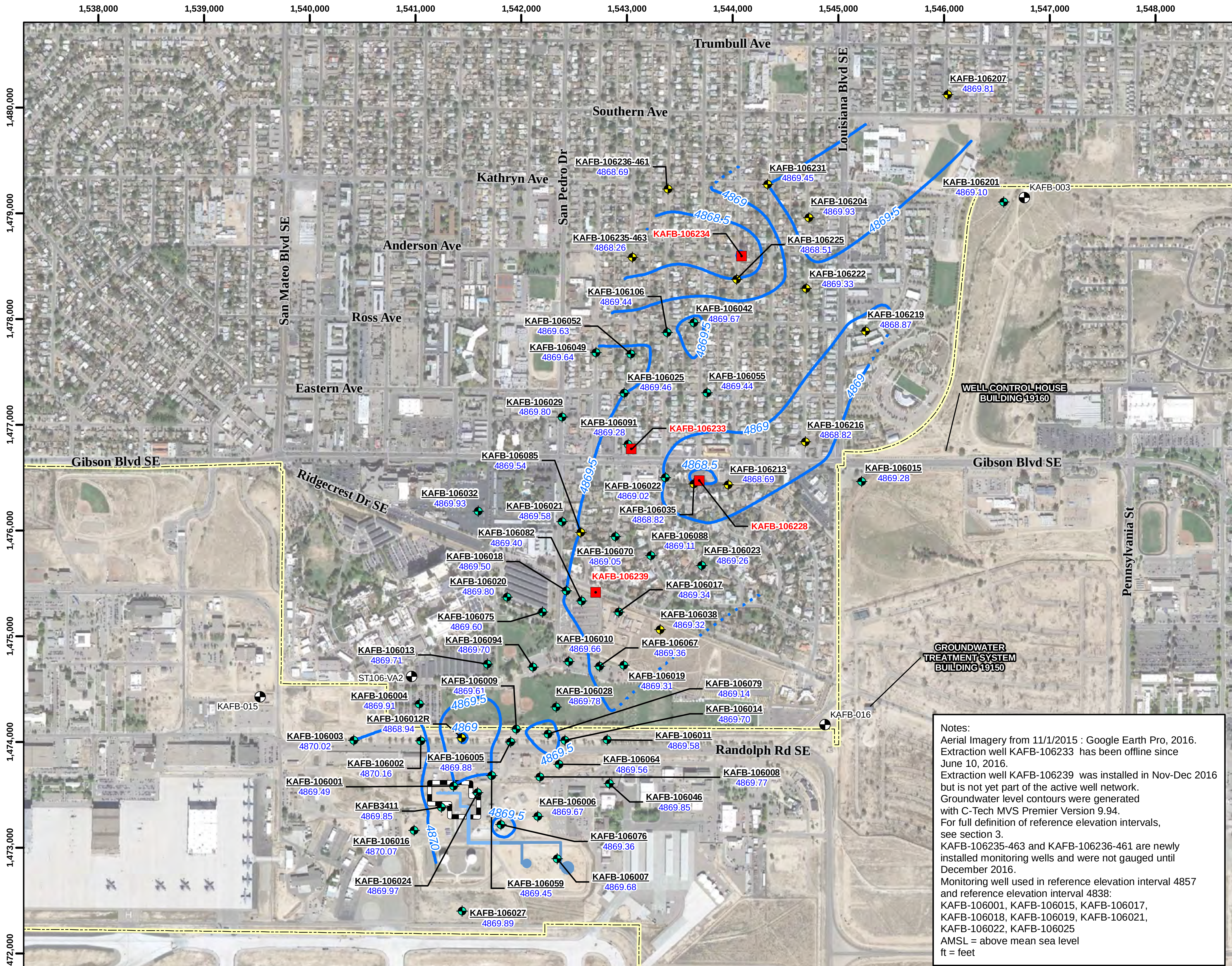
Quarterly Monitoring Report October–December 2016 and Annual Report for 2016, Bulk Fuels Facility, SWMUs ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-006.

Quarterly Monitoring Report April-June 2017, Bulk Fuels Facility, SWMUs ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-006.

Quarterly Monitoring Report October–December 2017 and Annual Report for 2017, Bulk Fuels Facility, SWMUs ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-006.

Quarterly Monitoring Report April-June 2018, Bulk Fuels Facility, SWMUs ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-006.

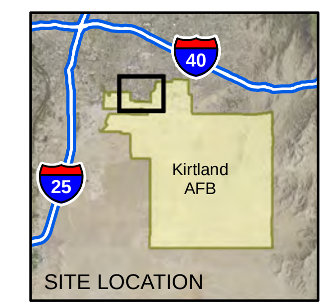
Quarterly Monitoring Report October–December 2018 and Annual Report for 2018, Bulk Fuels Facility, SWMUs ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-006.



Notes:
Aerial Imagery from 11/1/2015 : Google Earth Pro, 2016.
Extraction well KAFB-106233 has been offline since June 10, 2016.
Extraction well KAFB-106239 was installed in Nov-Dec 2016 but is not yet part of the active well network.
Groundwater level contours were generated with C-Tech MVS Premier Version 9.94.
For full definition of reference elevation intervals, see section 3.
KAFB-106235-463 and KAFB-106236-461 are newly installed monitoring wells and were not gauged until December 2016.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025
AMSL = above mean sea level
ft = feet

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Level Contour (ft AMSL)
- Inferred Groundwater Level Contour (ft AMSL)
- Installation Boundary
- Source Area



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-1

POTENTIOMETRIC SURFACE MAP OF REFERENCE ELEVATION INTERVAL 4857, OCTOBER 3-6, 2016

P:\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2016_Q4\Report Figures\Section 3\3-3 Interval 4857 PotentiometricSurfaceQ4.mxd 2/14/2017 EA eomalia

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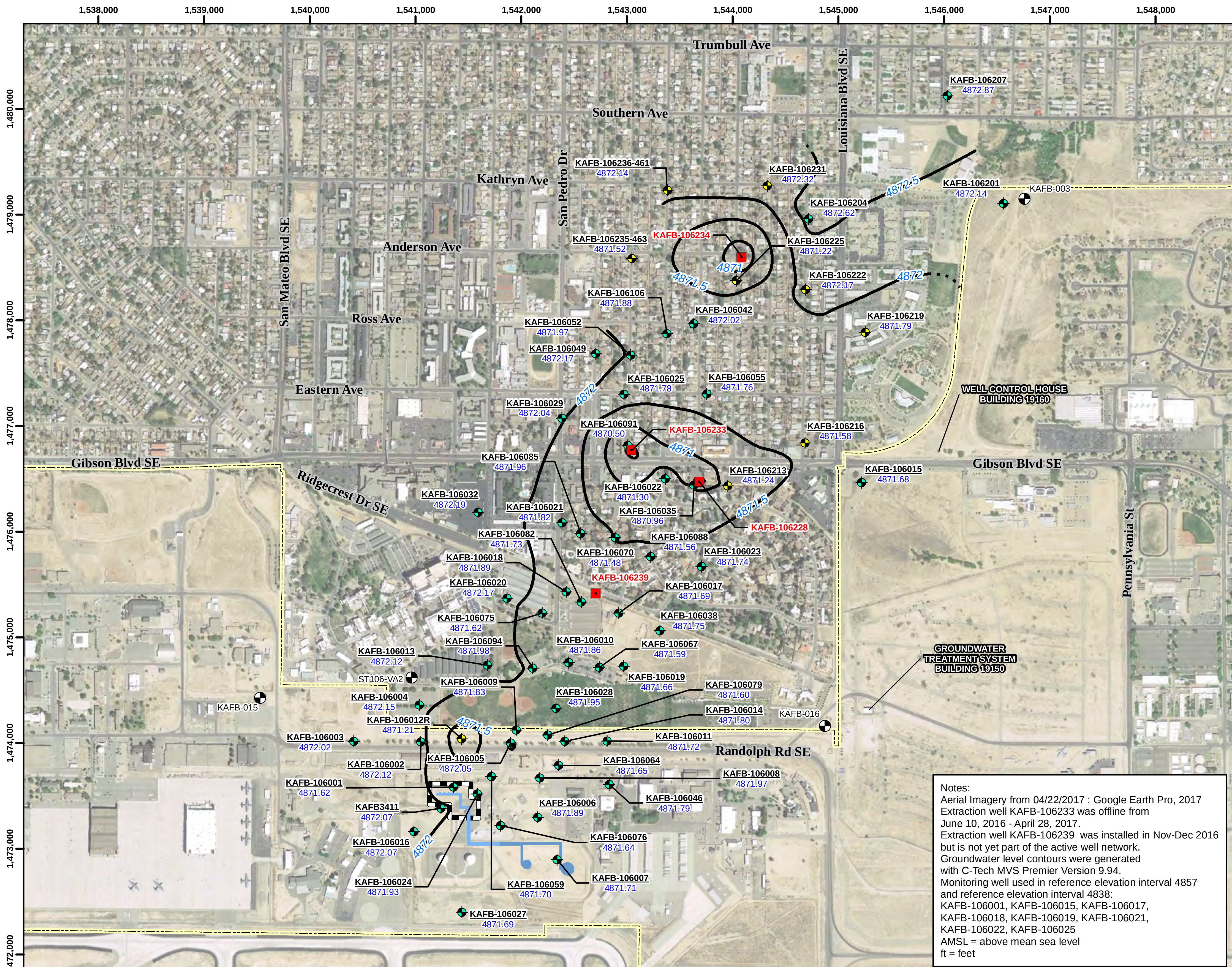

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Level Contour (ft AMSL)
- Inferred Groundwater Level Contour (ft AMSL)
- Installation Boundary
- Source Area

Kirtland AFB

SITE LOCATION

N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
Extraction well KAFB-106233 was offline from June 10, 2016 - April 28, 2017.
Extraction well KAFB-106239 was installed in Nov-Dec 2016 but is not yet part of the active well network.
Groundwater level contours were generated with C-Tech MVS Premier Version 9.94.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017,
KAFB-106018, KAFB-106019, KAFB-106021,
KAFB-106022, KAFB-106025
AMSL = above mean sea level
ft = feet

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FIGURE A-2-2

POTENTIOMETRIC SURFACE MAP OF REFERENCE ELEVATION INTERVAL 4857, MAY 8-11, 2017

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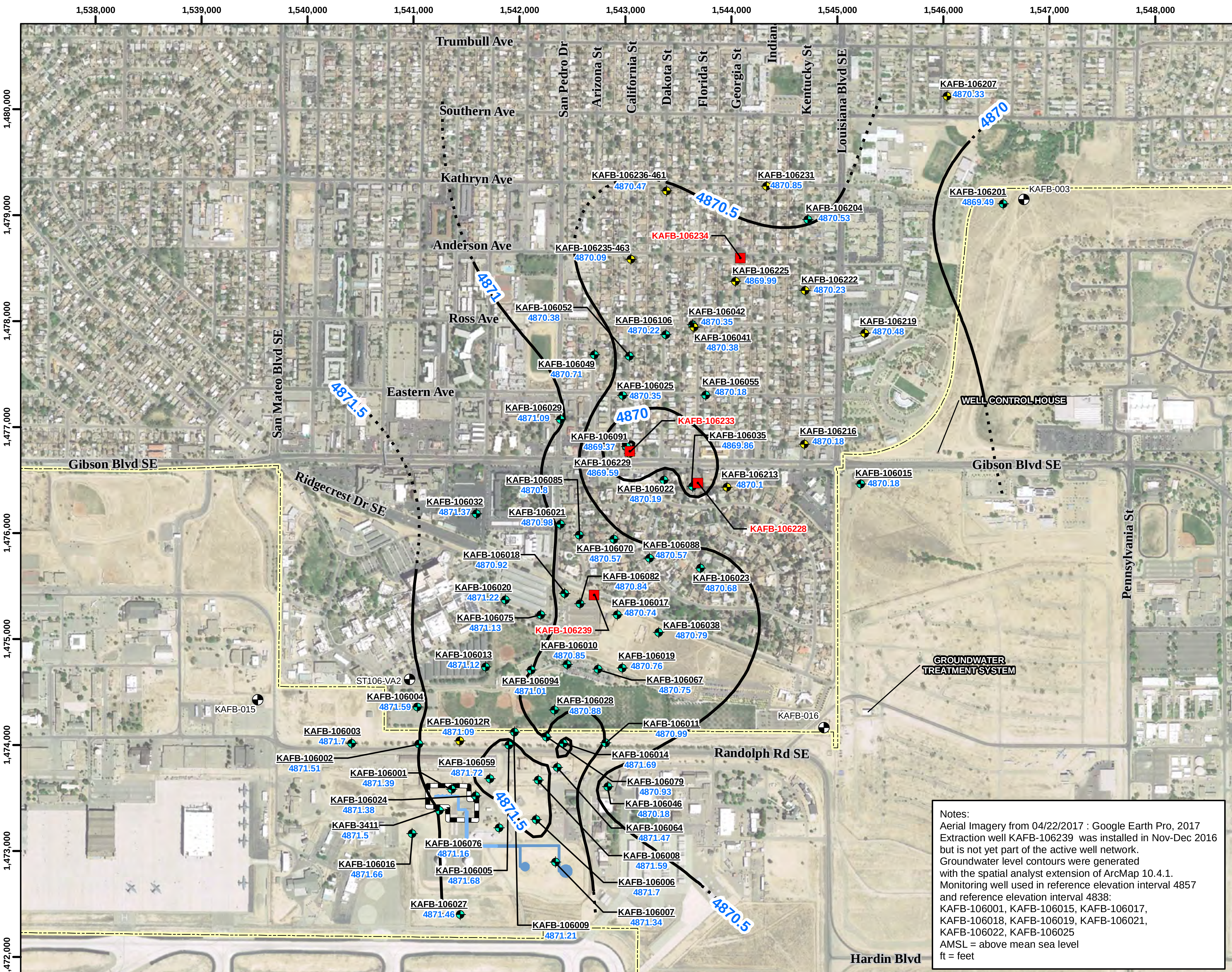
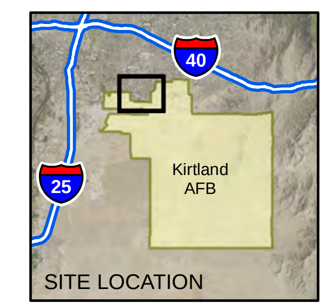


Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
Extraction well KAFB-106239 was installed in Nov-Dec 2016 but is not yet part of the active well network.
Groundwater level contours were generated with the spatial analyst extension of ArcMap 10.4.1.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017,
KAFB-106018, KAFB-106019, KAFB-106021,
KAFB-106022, KAFB-106025
AMSL = above mean sea level
ft = feet

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Level Contour (ft AMSL)
- Inferred Groundwater Level Contour (ft AMSL)
- Installation Boundary
- Source Area



N

0 500 1,000 2,000
Feet
1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-3

POTENTIOMETRIC SURFACE MAP OF REFERENCE ELEVATION INTERVAL 4857, OCTOBER 16-24, 2017

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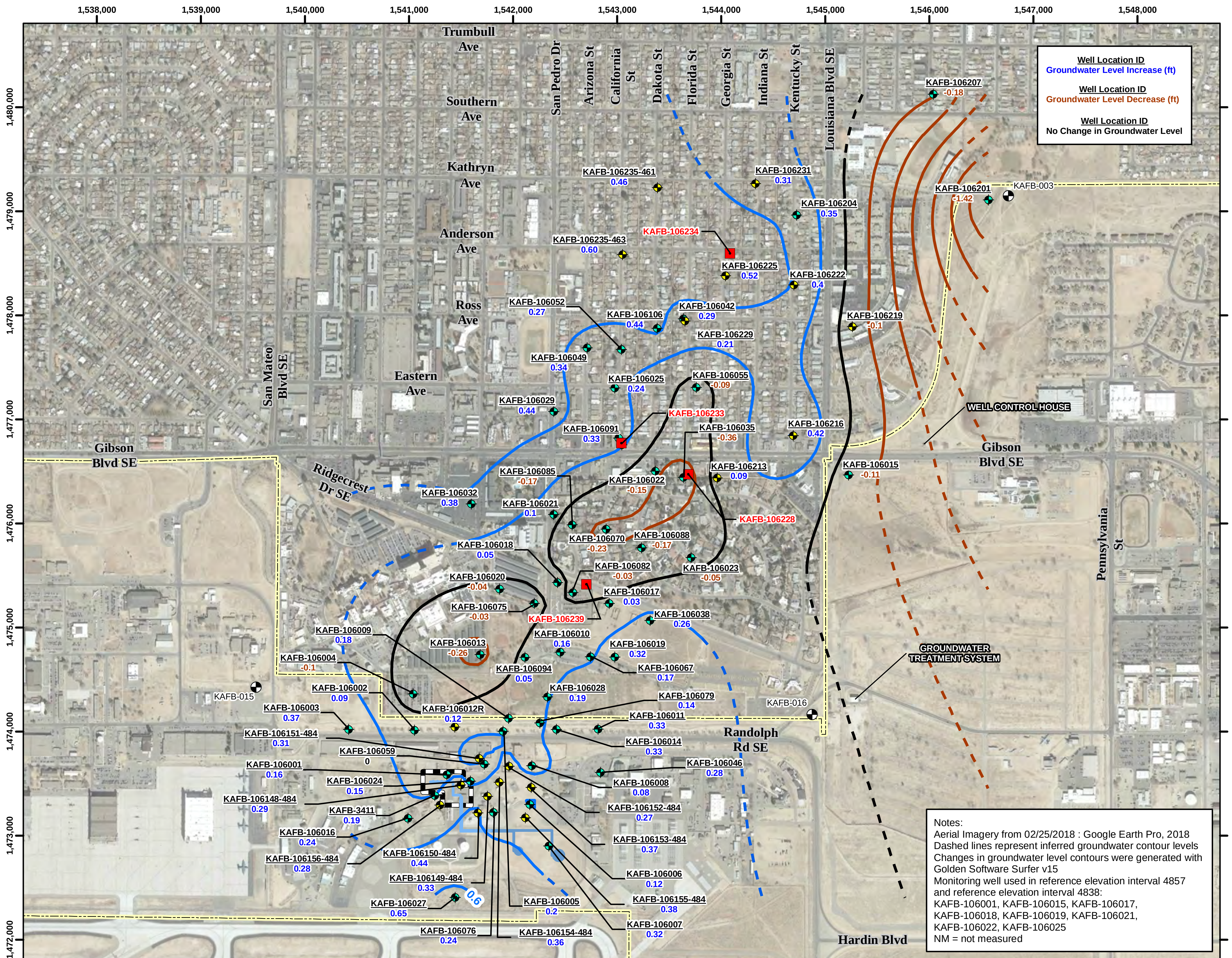
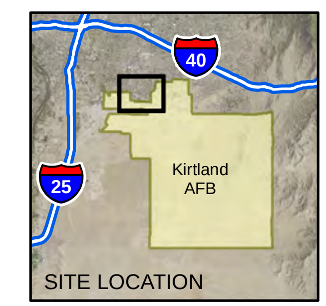


Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Dashed lines represent inferred groundwater contour levels
Changes in groundwater level contours were generated with Golden Software Surfer v15
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025
NM = not measured

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Groundwater contour indicating water table increase from previous quarter
- Groundwater contour indicating water table decrease from previous quarter
- Groundwater contour indicating no change in water table from previous quarter
- Source Area



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-4

CHANGES IN POTENTIOMETRIC SURFACE OF REFERENCE ELEVATION INTERVAL 4857, Q1 2018 - Q2 2018

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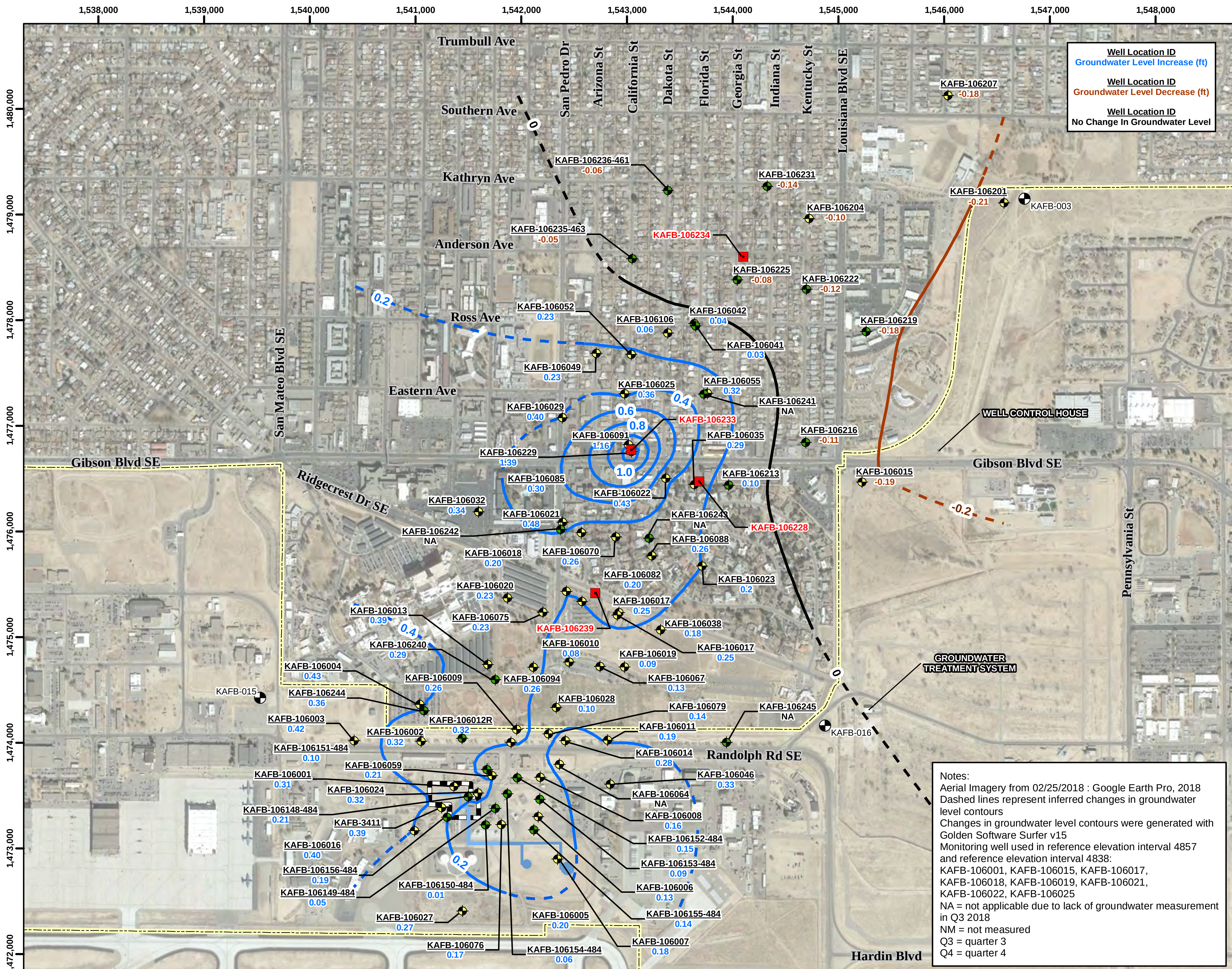
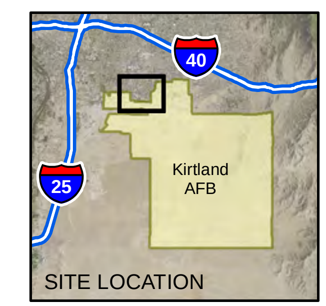
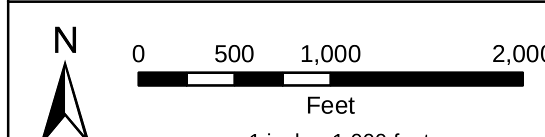


Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Dashed lines represent inferred changes in groundwater level contours
Changes in groundwater level contours were generated with Golden Software Surfer v15
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017,
KAFB-106018, KAFB-106019, KAFB-106021,
KAFB-106022, KAFB-106025
NA = not applicable due to lack of groundwater measurement in Q3 2018
NM = not measured
Q3 = quarter 3
Q4 = quarter 4

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Fence Boundary
- Groundwater contour indicating water table increase from previous quarter
- Groundwater contour indicating water table decrease from previous quarter
- Groundwater contour indicating no change in water table from previous quarter
- Source Area





1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-5

CHANGES IN POTENTIOMETRIC SURFACE OF REFERENCE ELEVATION INTERVAL 4857, Q3 2018 - Q4 2018

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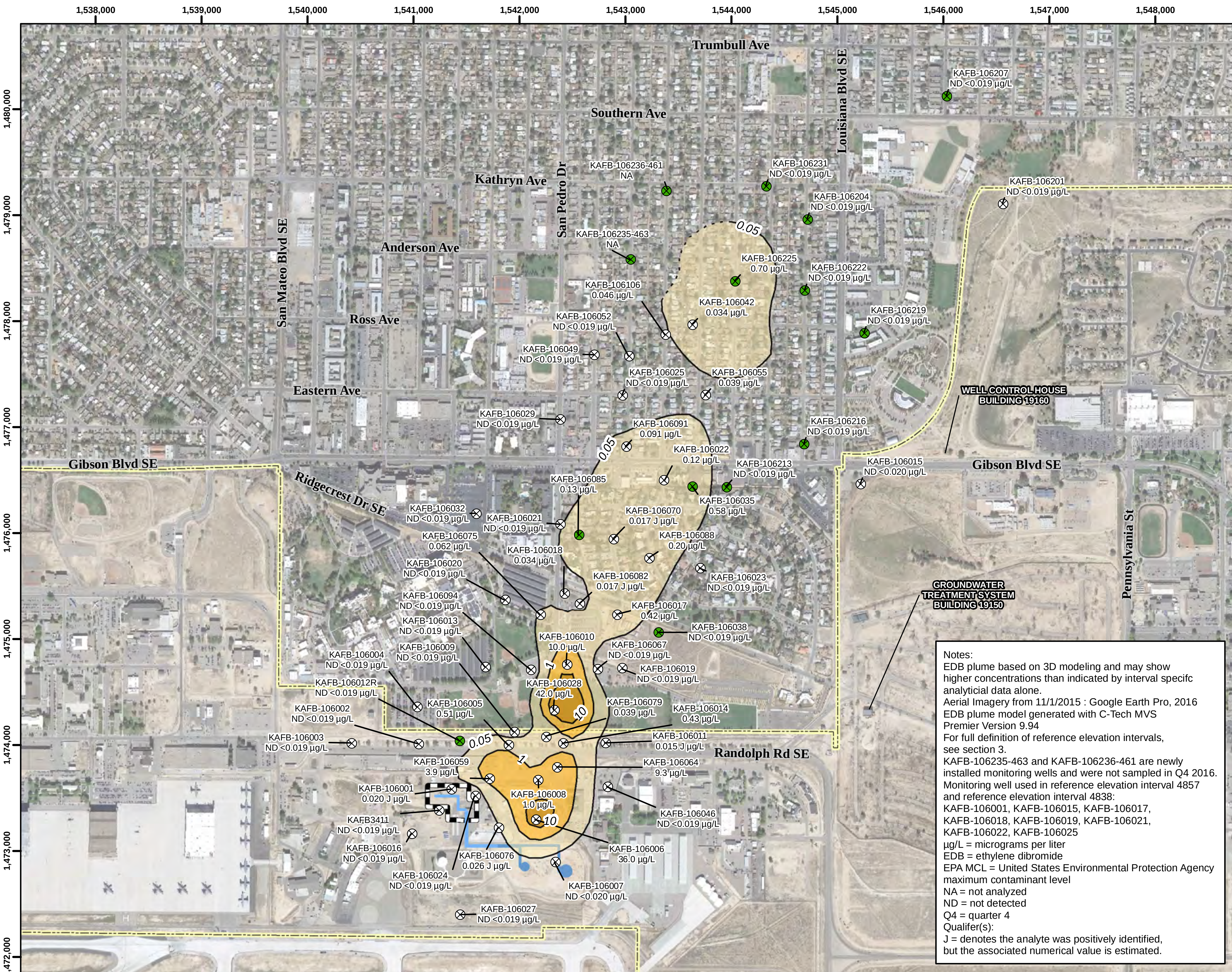
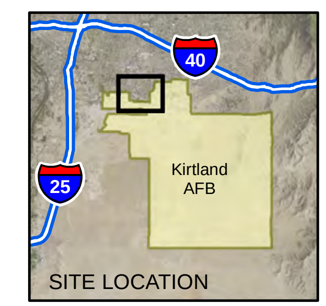


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (µg/L)
- Inferred EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L
- 10 - 50 µg/L



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analyticial data alone.
Aerial Imagery from 11/1/2015 : Google Earth Pro, 2016
EDB plume model generated with C-Tech MVS Premier Version 9.94
For full definition of reference elevation intervals, see section 3.
KAFB-106235-463 and KAFB-106236-461 are newly installed monitoring wells and were not sampled in Q4 2016.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025
µg/L = micrograms per liter
EDB = ethylene dibromide
EPA MCL = United States Environmental Protection Agency maximum contaminant level
NA = not analyzed
ND = not detected
Q4 = quarter 4
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

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FIGURE A-2-6

EDB CONCENTRATIONS IN GROUNDWATER
REFERENCE ELEVATION INTERVAL 4857
Q4 2016

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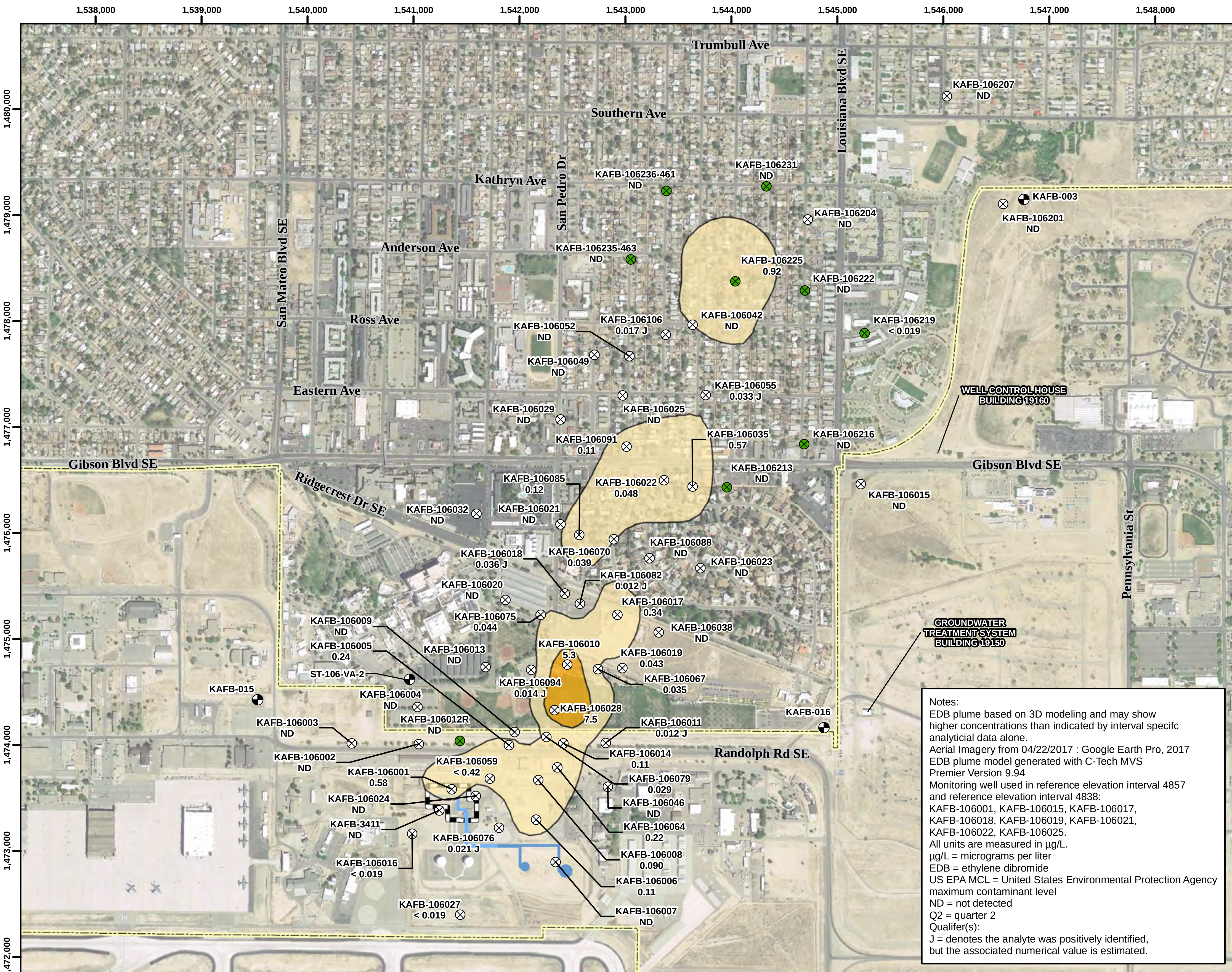


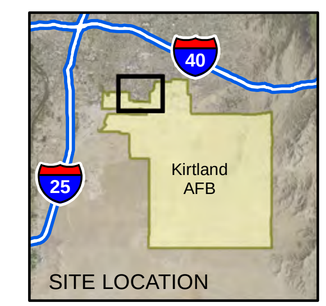
Notes:
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analyticial data alone.
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EDB = ethylene dibromide
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
ND = not detected
Q2 = quarter 2
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (µg/L)
- Inferred EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE A-2-7

EDB CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q2 2017

\\abq\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2017_Q2\Section 3\3-6 Interval 4857 EDB Q2.mxd 9/1/2017 EA eomalia

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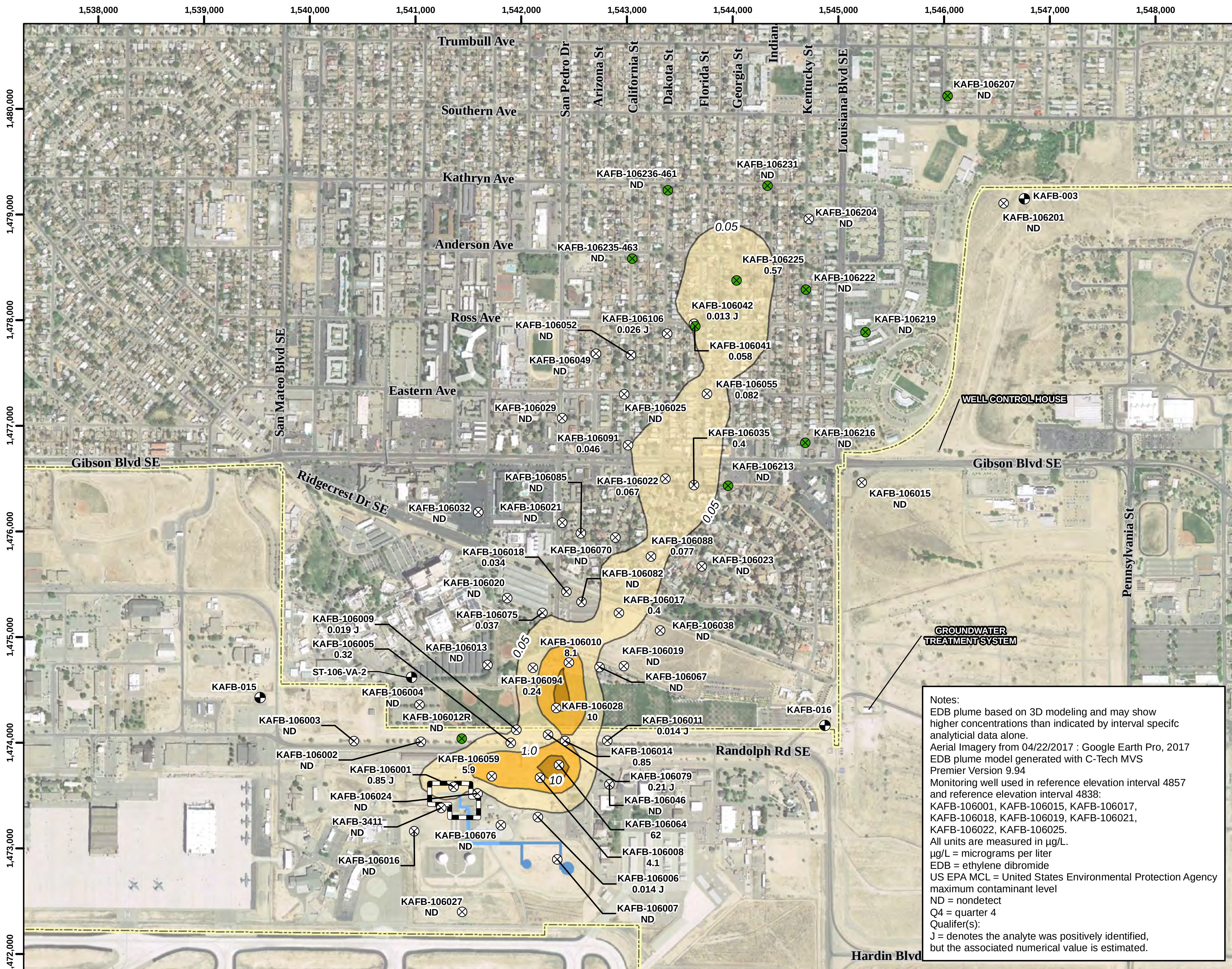


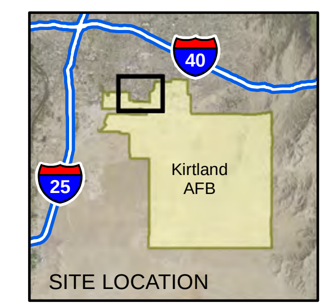
Notes:
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analyticial data alone.
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EDB = ethylene dibromide
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
ND = nondetect
Q4 = quarter 4
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (µg/L)
- Inferred EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L
- 10 - 50 µg/L



N

0 500 1,000 2,000
Feet
1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-8

EDB CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2017

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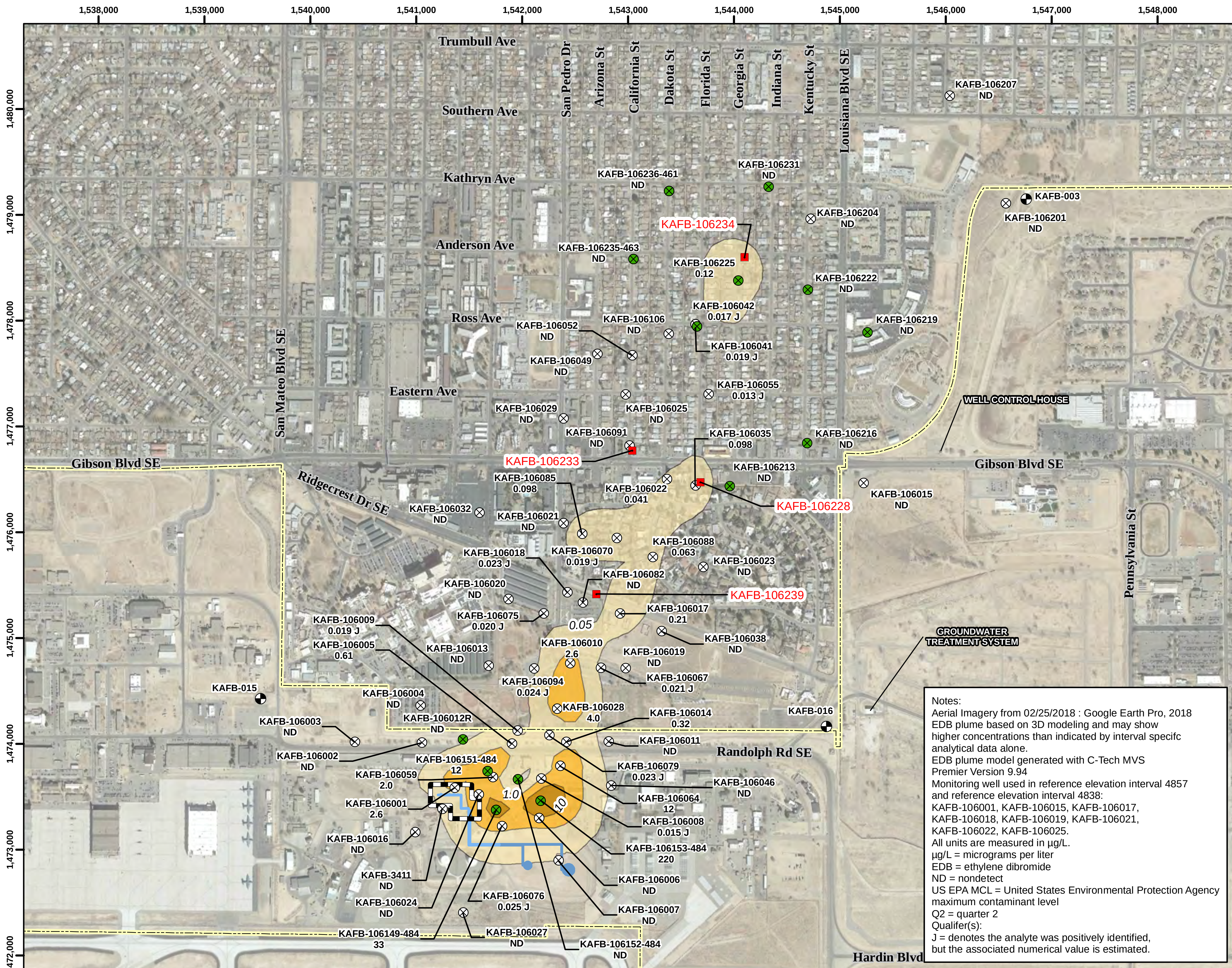


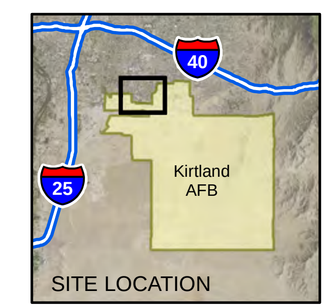
Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analytical data alone.
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838: KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025.
All units are measured in μg/L.
μg/L = micrograms per liter
EDB = ethylene dibromide
ND = nondetect
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
Q2 = quarter 2
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

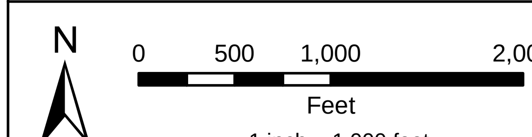
Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (μg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 μg/L
- 1.0 - 10 μg/L
- 10 - 500 μg/L





1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-9

EDB CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q2 2018

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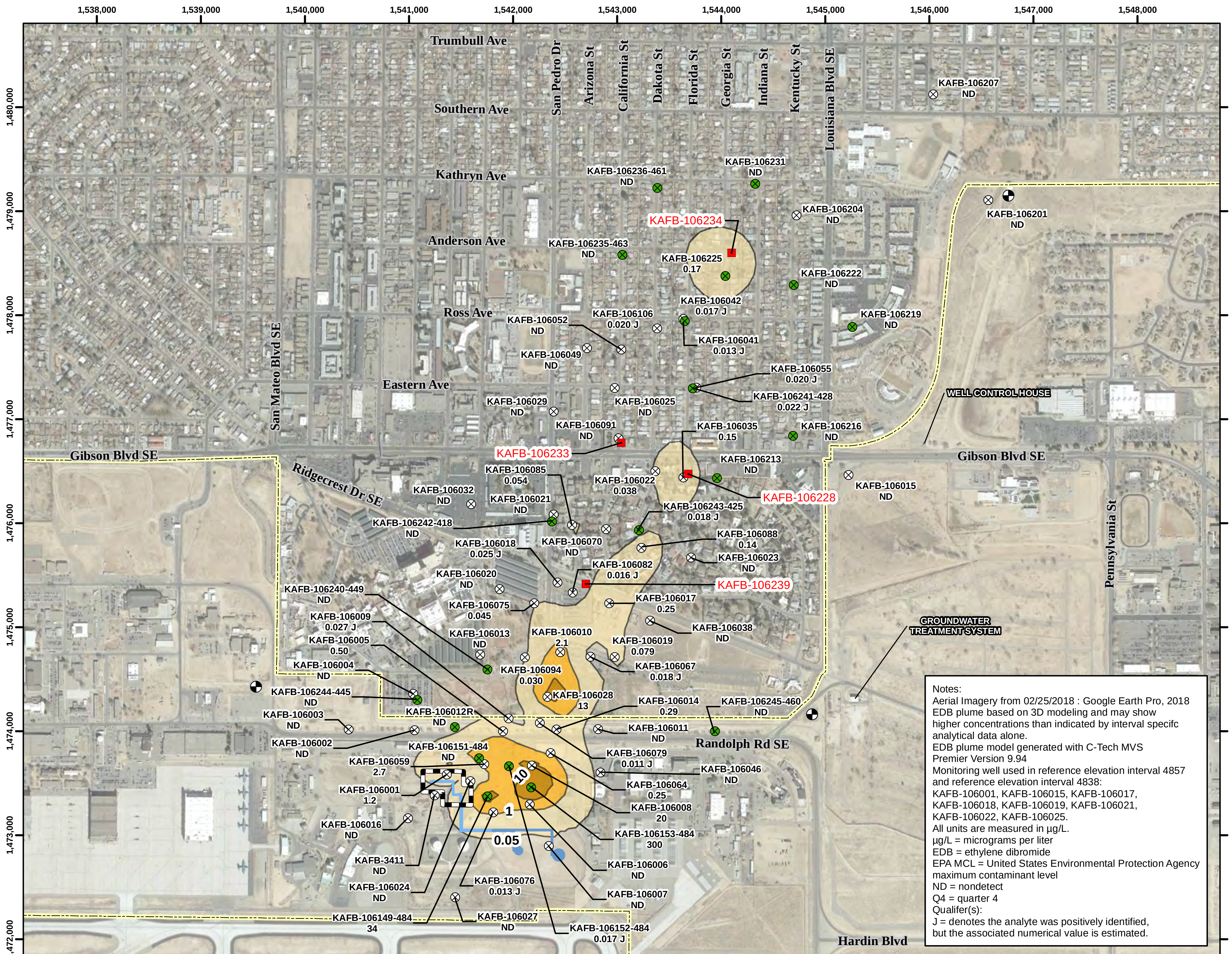
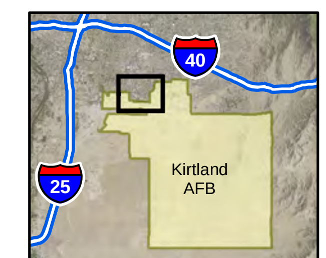


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Fence Boundary
- EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L
- 10 - 500 µg/L



SITE LOCATION

N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analytical data alone.
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017,
KAFB-106018, KAFB-106019, KAFB-106021,
KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EDB = ethylene dibromide
EPA MCL = United States Environmental Protection Agency maximum contaminant level
ND = nondetect
Q4 = quarter 4
Qualifier(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

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FIGURE A-2-10

EDB CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2018

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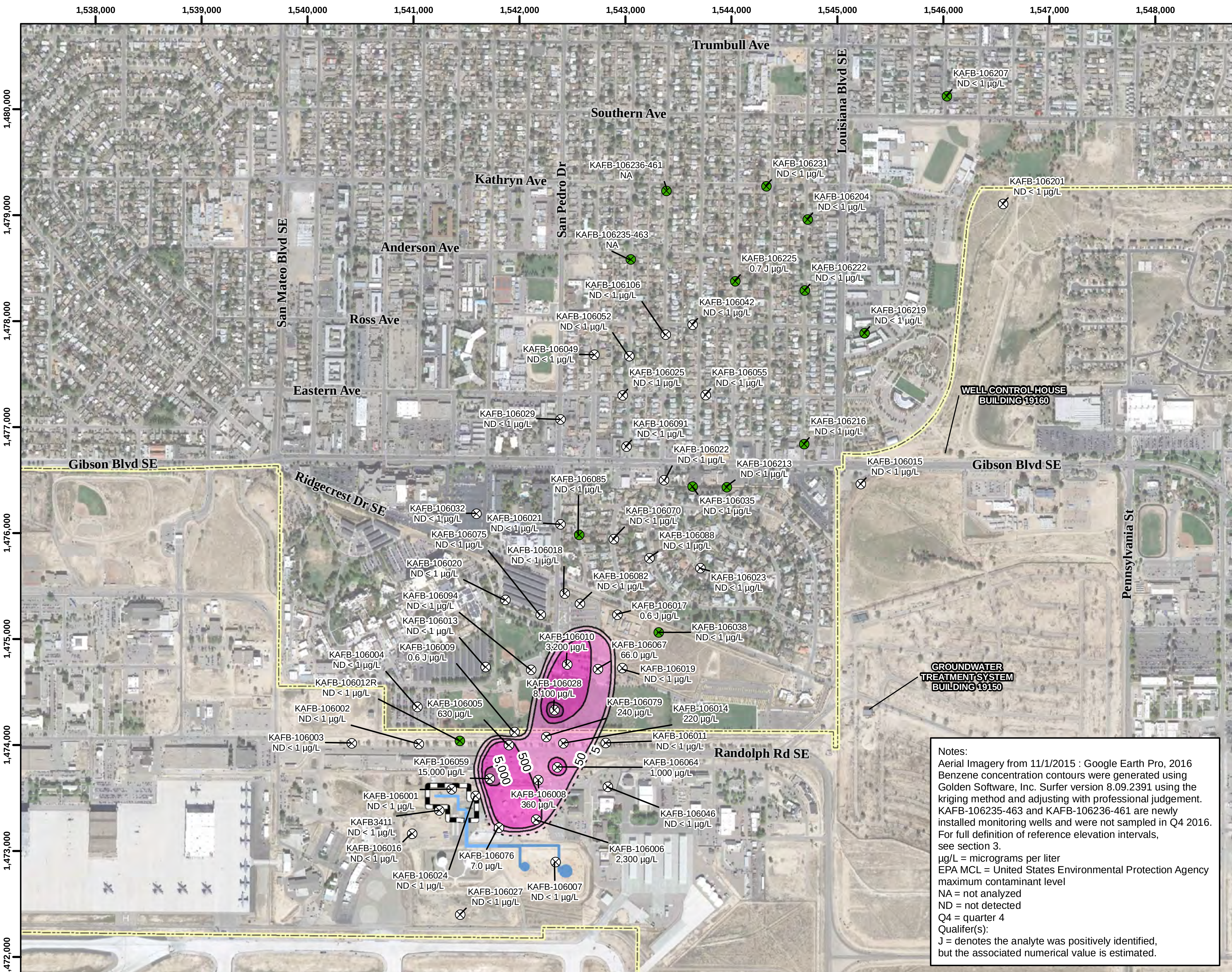


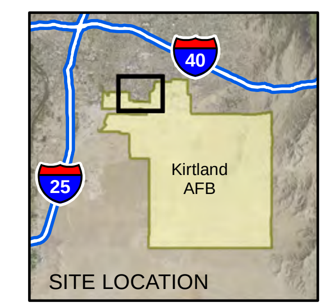
Notes:
Aerial Imagery from 11/1/2015 : Google Earth Pro, 2016
Benzene concentration contours were generated using Golden Software, Inc. Surfer version 8.09.2391 using the kriging method and adjusting with professional judgement.
KAFB-106235-463 and KAFB-106236-461 are newly installed monitoring wells and were not sampled in Q4 2016.
For full definition of reference elevation intervals, see section 3.
µg/L = micrograms per liter
EPA MCL = United States Environmental Protection Agency maximum contaminant level
NA = not analyzed
ND = not detected
Q4 = quarter 4
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Benzene Concentration Isocontour (µg/L)
- Inferred Isocontour (µg/L)
- Source Area

Benzene Concentration Range

- 5.0 (EPA MCL) - 50 µg/L
- 50 - 500 µg/L
- 500 - 5,000 µg/L
- 5,000 - 15,000 µg/L



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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BULK FUELS FACILITY
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FIGURE A-2-11

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2016

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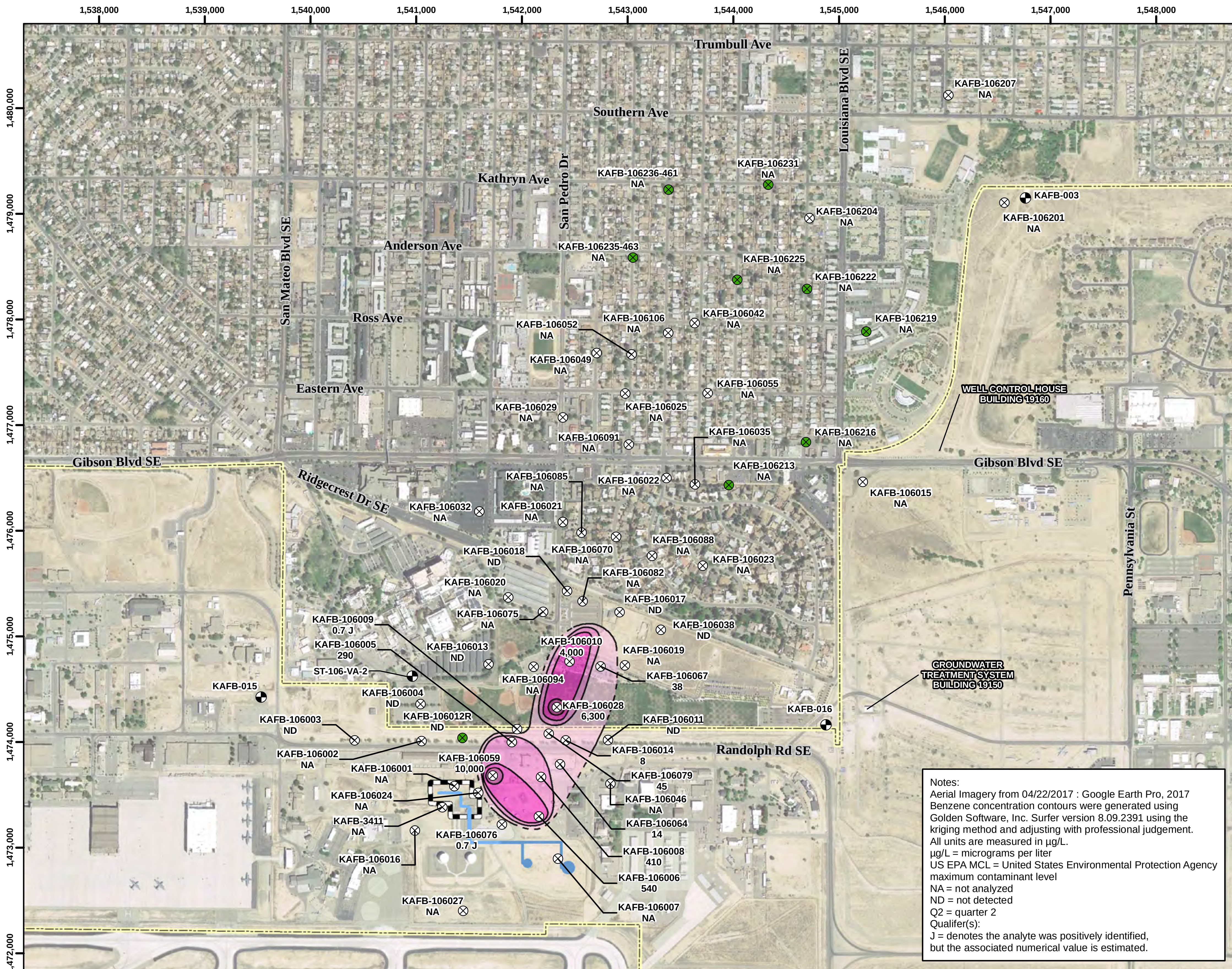

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Benzene Isocontour (µg/L)
- Inferred Isocontour (µg/L)
- Source Area

Benzene Concentration Range

- 5.0 (EPA MCL) - 50 µg/L
- 50 - 500 µg/L
- 500 - 5,000 µg/L
- 5,000 - 15,000 µg/L

40
25
Kirtland AFB
SITE LOCATION

N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
Benzene concentration contours were generated using Golden Software, Inc. Surfer version 8.09.2391 using the kriging method and adjusting with professional judgement.
All units are measured in µg/L.
µg/L = micrograms per liter
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
NA = not analyzed
ND = not detected
Q2 = quarter 2
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

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FIGURE A-2-12

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q2 2017

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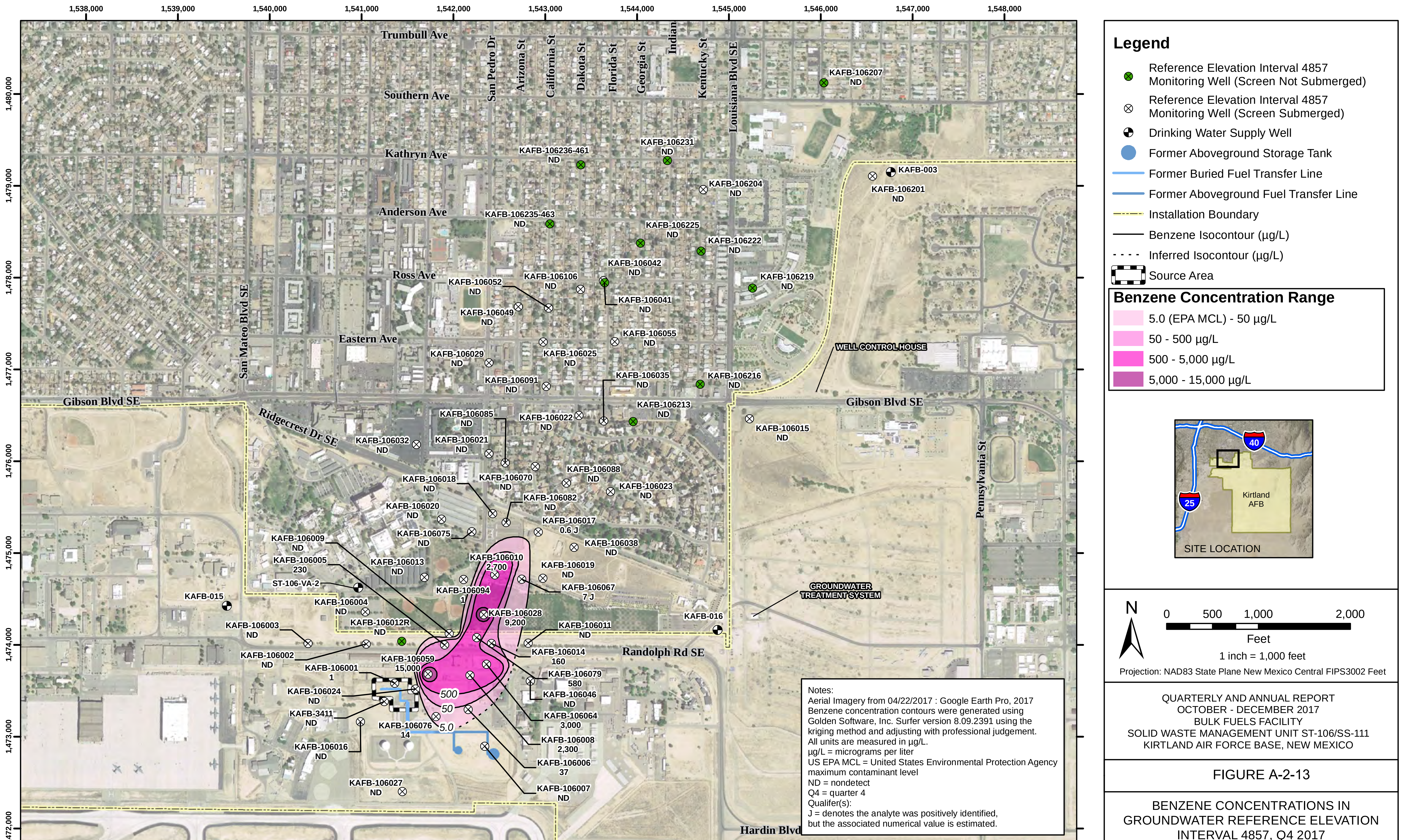

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BULK FUELS FACILITY
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KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE A-2-13

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2017

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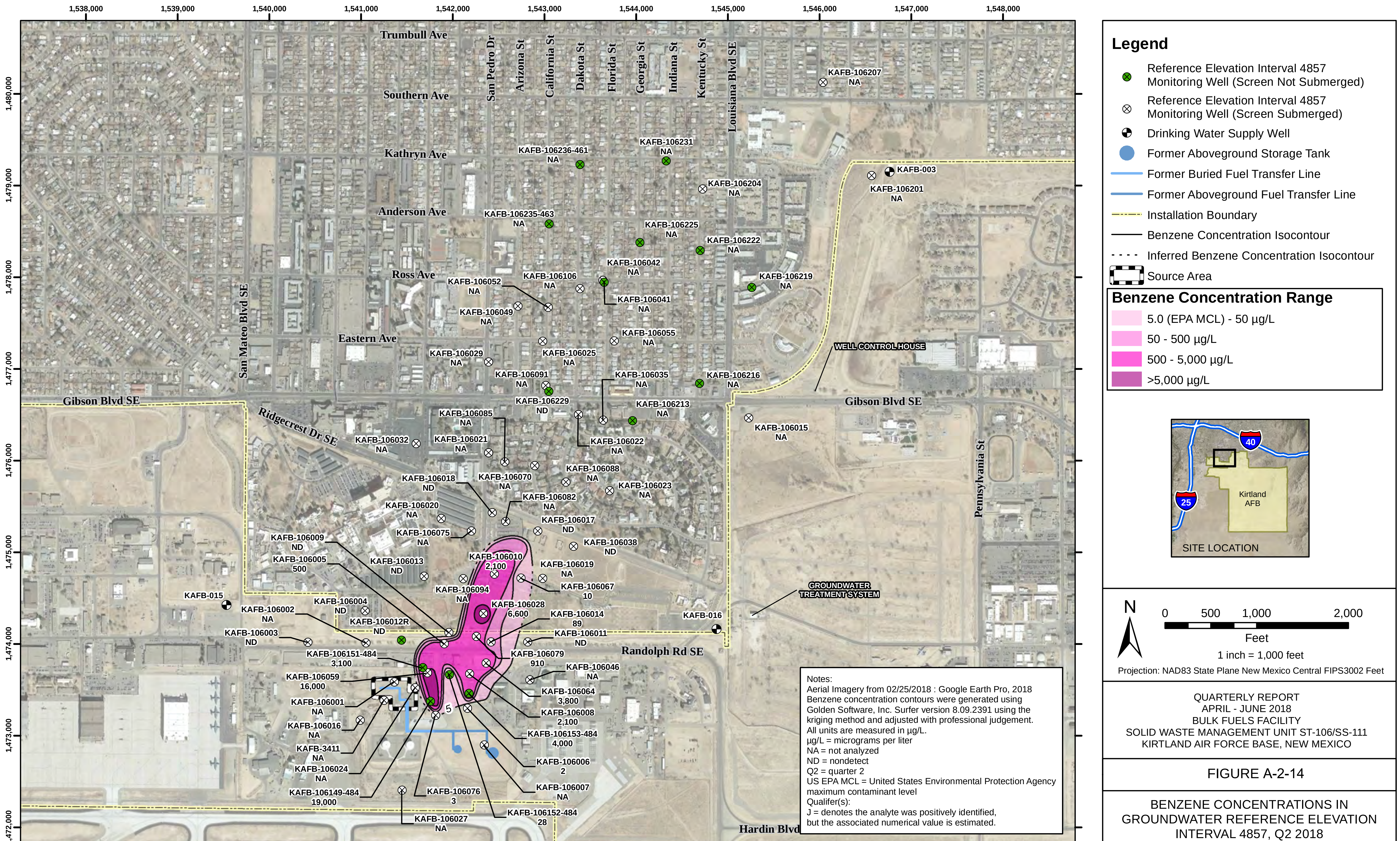

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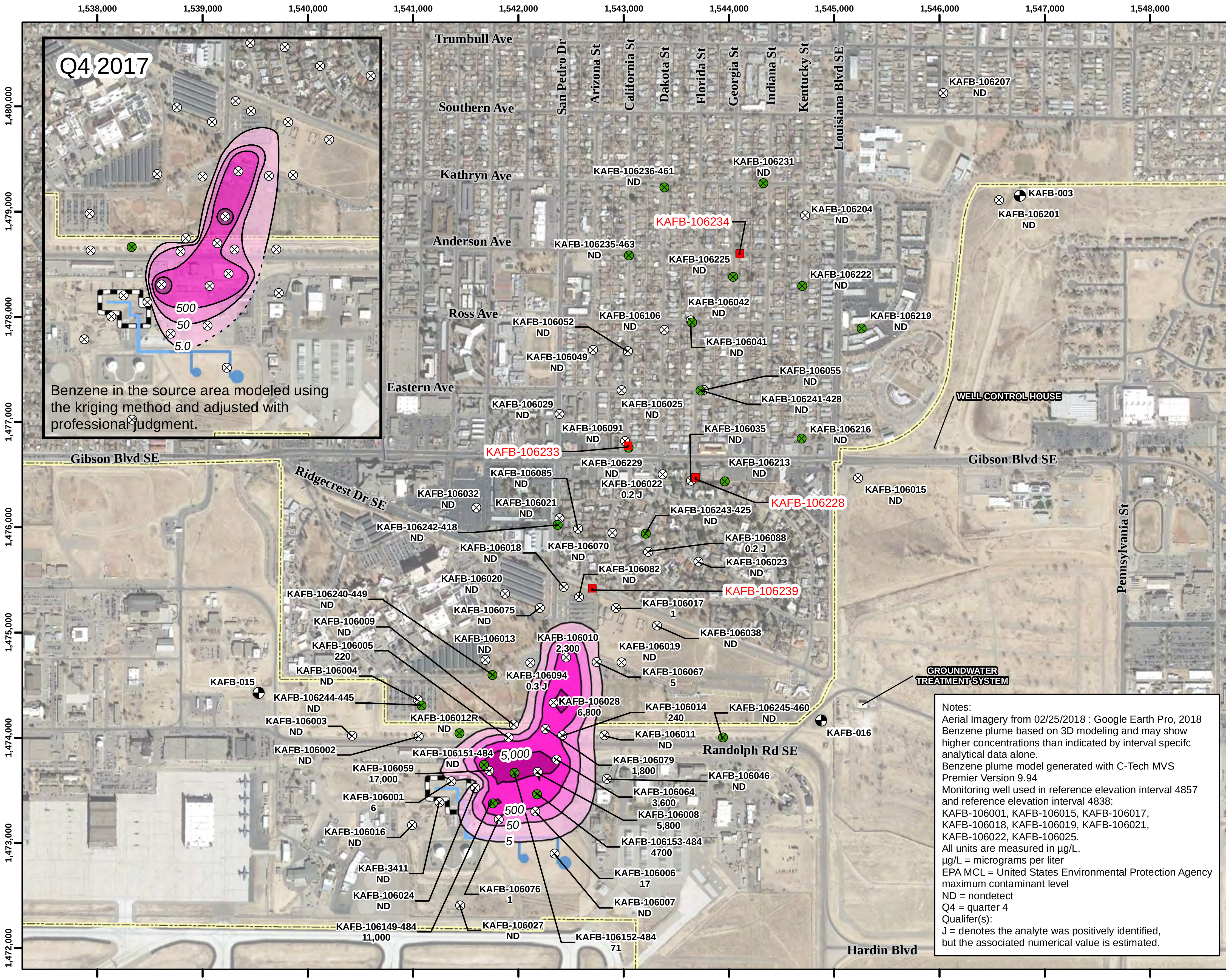


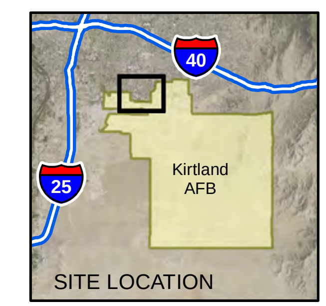
Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Benzene plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analytical data alone.
Benzene plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EPA MCL = United States Environmental Protection Agency maximum contaminant level
ND = nondetect
Q4 = quarter 4
Qualifier(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

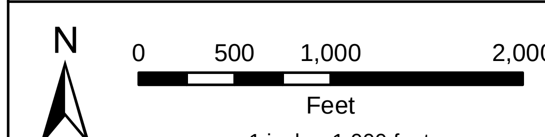
Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Fence Boundary
- Benzene Concentration Isocontour
- Source Area

Benzene Concentration Range

- 5.0 (EPA MCL) - 50 µg/L
- 50 - 500 µg/L
- 500 - 5,000 µg/L
- >5,000 µg/L





1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

QUARTERLY AND ANNUAL REPORT
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BULK FUELS FACILITY
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FIGURE A-2-15

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2018

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APPENDIX B

FIELD FORMS

BORING LOG

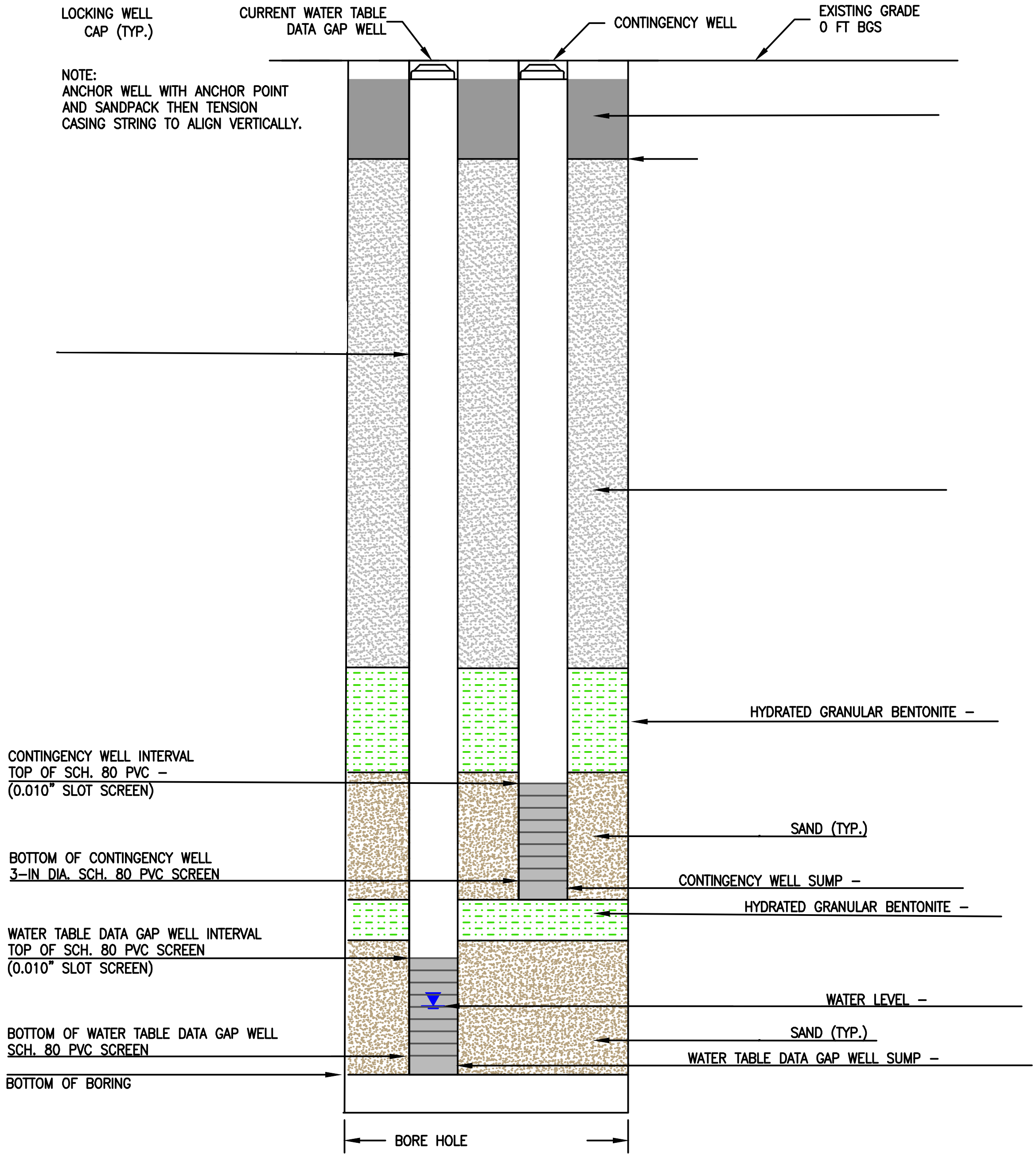
Project: **Kirtland BFF**	Project Number:
Drilling Company:	Start Time/Date:
Lead Driller:	Completion Time/Date:
Drilling Method:	Final Depth:
Casing Diameter OD:	Bit Type and Outer Diameter
Boring/Well ID:	Logged By: Page ____ of ____

		SAND		GRAVEL				
USCS Soil Type	**PID Reading (ppm)**	**Grain Size %(fine, medium, coarse)**	**Mineralogy %(Quartz, Feldspar, Lithic)**	**Angularity, Roundness (R,SR,SA,A)**	**Mineralogy %(Quartz, Feldspar, Lithic)**	**Depth, ft bgs**	**Soil Description** (sample interval, soil type, color, plasticity, moisture, other)	**Other Notes**

Additional Comments:
R=Rounded, SR=Subrounded, SA=Subangular, A=Angular

Well Completion Form

Well Number:____



NOT TO SCALE
BGS=BELOW GROUND SURFACE
FT=FEET

	KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME:	INSTALLATION END DATE/TIME:
	PROJECT NO.:	WELL ID:	GEOLOGIST:	DRILLER:

CAD FILE: Y:\Active Projects\62599DM01 Kirtland BFF_USACE\01_Work Plan\19.0 Data Gap Wells WP\Figures\Natives\Nested Monitoring well_KAFB-106240-245.dwg PLOT DATE/TIME: 12/18/2017 – 4:39pm

FIELD RECORD OF WELL DEVELOPMENT

Project Name:	Project No:	Date/Time:
Personnel:	Development Method:	
Equipment Used:		Equipment Calibrated: Y N
Weather/Temperature/Barometric Pressure:		Date/Time:

Well No.:	Well Condition:
Well Diameter:	Measurement Reference:
Well Volume Calculations	
A. Depth To Water (ft):	D. Well Volume/ft:
B. Total Well Depth (ft):	E. Total Well Volume (gal)[C*D]:
C. Water Column Height (ft):	F. Five Well Volumes (gal):

Parameter	Beginning	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH (Δ<0.2)						
Temperature (°F) (Δ<10%)						
Conductivity (µmhos/cm) (Δ<10%)						
Turbidity (NTU) (<10 NTU*)						
Parameter	**6 Volumes**	**7 Volumes**	**8 Volumes**	**9 Volumes**	**10 Volumes**	**End**
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH (Δ<0.2)						
Temperature (°F) (Δ<10%)						
Conductivity (µmhos/cm) (Δ<10%)						
Turbidity (NTU) (<10 NTU*)						

NOTE: NTU = Nephelometric turbidity unit.
ORP = Oxidation-reduction potential.
* = If <10 NTU is not able to be achieved, <100 NTU is acceptable

Parameter stabilization requires four consecutive readings [four consecutive differences (Δ)] to meet parameter stabilization requirements listed.

COMMENTS AND OBSERVATIONS: ______________________________

Kirtland AFB BFF
Groundwater Well Inspection Form

Well ID: ______________________ **PID:** __________ ppm **Date:** __________

Stick up: ☐ **Flush Mount**: ☐

Well Pad Condition:	Below Grade ☐	Functional ☐	Repair Required ☐
Bollards:	Not Applicable ☐	Functional ☐	Repair Required ☐
Protective Casing:	Not Applicable ☐	Functional ☐	Repair Required ☐
Lock/Cover Bolt:	Not Applicable ☐	Functional ☐	Replacement Required ☐
Vault Threads:	Not Applicable ☐	Functional ☐	Cleaning Required ☐
Vault Cover:	Not Applicable ☐	Functional ☐	Repair Required (Excessive Corrosion on Threads) ☐
Vault Seal:	Missing ☐	Functional ☐	Replacement Required (Excessive Corrosion at Seal Surface) ☐
Water in Vault:	Yes ☐	No ☐	***If yes, Depth of Water***: __________ Ft.
Debris in Vault:	Yes ☐	No ☐	***If yes, Type of Debris***: __________
Pump Present:	Yes ☐	No ☐	***If no pump, J-Plug Present:*** Yes ☐ No ☐

Bennett Pump Inventory:

Drop Pipe Plug:	Missing ☐	Functional ☐	Replacement Required ☐
Exhaust Line Plug:	Missing ☐	Functional ☐	Replacement Required ☐
Pump Line Plug:	Missing ☐	Functional ☐	Replacement Required ☐
Well Sounder Plug:	Missing ☐	Functional ☐	Replacement Required ☐

Additional Comments: ______________________________

____

____

____

____

Work Performed: ______________________________

____

____

Photographs of Damaged/Missing Parts Taken: Yes ☐

Recorded By: ______________________________

For serious problems, contact Earl Morse at (505) 238-4410

	Well Gauging Form						Total Wells		Year
	Project: Kirtland AFB BFF ST-106/SS-111								Quarter :
Well ID	Previous DTW (ft MRP)		Date	PID (ppm)	Depth to NAPL (ft MRP)	DTW (ft MRP)	Initials		Reference Point
	Depth to NAPL	DTW							
									TWV
									TWV
									TWV
									TWV
									TWV
									TWV
									TWV
									TWV
									TWV
									TWV
									TOPC
									TWV

Well Purge and Sampling Log

Well I.D. Number: ______________________

Project:		**Date/Time Sampled:**	
Task Number:		**Totally Influenced:**	Yes No
Project Manager:		**Well Depth in Feet:**	
Field Team:		**Screened Interval in Feet:**	

1. Purging Data/Field Measurements: All Measurements Relative to Top of Casing

Well Depth in Feet:		**Casing Volume in Gallons:**	
Depth of Sediment (DTS) in Feet:		[1" diameter = x .041 gal/ft, 2" d. = x .163 gal/ft, 4" d. = x .653 gal/ft]	
Depth of Water (DTW) in Feet:		**Purge Volume in Gallons:**	
DTS - DTW:		**Actual Purge in Gallons:**	

Time	No. of Gallons Purged	pH	Temp. in °C	Conductivity (mS/cm)	Turbidity	DO (mg/L)	DTW (ft.)	Comments: Quality, Recovery Color, Odor, Sheen, Accumulated Silt/Sand

	Method	Purging Rate in L/min	Depth of Equipment in Feet
Purge			
Sample			

Bails Dry?	Yes No
At Number of Casing Volumes:	
Purge Water Disposal Method/Volume:	

2. Sampling Data

Bottle Type	Number of Containers	Analyses	Preserv.	Filter

Total Number of Bottles:	
Duplicate Sample ID:	
Field Blank ID:	
Rinseate Sample ID:	

3. Field Equipment (Type/Brand/Serial Number/Material/Units)

Pump Type/Tubing Type:		**Temp/pH/E.C./D.O.:**	
Bailer Type:		**Water Level Probe:**	
Filter Type:		**Other:**	

4. Well Conditions

Satisfactory **Unsatisfactory** **Explain:**

YSI Professional Plus Log

Serial # (WH0001)

Year:

Project: Kirtland AFB BFF ST-106/SS-111

Quarter : _

Date	Cal or Bump	pH 4.00	pH 7.00	pH 10.00	ORP (220 mV)	Conductivity (1413 µS/cm)	Measured DO (% Sat)	Barometer (mm Hg)	100% DO Sat Adjusted for Barometric Pressure	Initials
Calibration Tolerances:		+/- 0.2 pH Units			+/- 20 mV Standard	+/- 0.5% of Standard	+/- 2% of the Adjusted DO Value	N/A	N/A	N/A

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

* 100% DO Sat =100 x (Barometric Pressure in mmHg/760)

Rae Systems MiniRAE 3000 PID Log

Serial # (WH0004)

Year:

Project: Kirtland AFB BFF ST-106/SS-111

Quarter : _

Date	Cal or Bump	0 ppm	100 ppm	Initials
Calibration Tolerances:		+/- 3% of standard value		N/A

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

Hach 2100Q Portable Turbidimeter Log

Serial # (WH0007) Year:

Project: Kirtland AFB BFF ST-106/SS-111 Quarter : _

Date	Bump or Cal	20 NTU	100 NTU	800 NTU	10 NTU	Initials
Calibration Tolerance:		+/- 10% of Standard Value				N/A

*Calibrate Instrument every three months, bump check weekly and re-calibrate if values are out of tolerance.

CHAIN-OF-CUSTODY RECORD

PROJECT NAME: **Kirtland AFB Bulk Fuels Facility**	PROJECT NUMBER:	LABORATORY NAME AND CONTACT:	FAX AND MAIL REPORTS/EDD TO: FAX AND MAIL REPORTS/EDD TO:	COC NUMBER YEAR: QUARTER:
PROJECT SITE AND PHASE: ST106/SS110		LAB PO NUMBER:	LAB CONTACT:	

ITEM	SAMPLE IDENTIFIER	DATE COLLECTED	TIME COLLECTED	Total Number of Bottles	VOCs (8260C)	BTEX (8260C)	BTEXN (8260C)	EDB (8011)	Total As,Pb,Ca,K,Na,Mg (6020A/6010C)	Dissolved Fe, Mn (6010C)	Chloride, bromide, sulfate (300.0)	Nitrate-Nitrite (353.2)	Alkalinity (SM2320B)	COMMENTS
				ANALYSIS REQUIRED (Specify number of bottles)										
1										*				
2														
3														
4														
5														
6														

COMMENTS: *Dissolved Fe, Mn aliquot was field filtered.

SAMPLER(S):	COURIER AND SHIPPING NUMBER:

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
Printed Name and Signature:			Printed Name and Signature:		
Printed Name and Signature:			Printed Name and Signature:		
Printed Name and Signature:			Printed Name and Signature:		
Printed Name and Signature:			Printed Name and Signature:		

SAMPLE COOLER

SHIPPING CHECKLIST

Site Name: Kirtland BFF (62599DM01) **Date: ________________________**

Fedex Tracking Number: ____________________

Matrix: Groundwater **Lab:** Eurofins (Lancaster, PA)

Cooler Sealed: ____________ (Time) **Delivered to FedEx:____________(Time)**

Sampler 1 (Initials)		Sampler 2 (Initials)
☐	**Two (2) Plastic Bag Liners Included**	☐
☐	**Temperature Blank Included at Bottom of Cooler Surrounded by Ice**	☐
☐	**Trip Blank Included (2 for EDB, 2 for BTEX if present)**	☐
☐	**Samples Checked Against Chain of Custody**	☐
☐	**Chain of Custody Originals Included**	☐
☐	**All Void Space in Cooler filled with Ice**	☐
☐	**Custody Seals On Plastic Bag Liner And Outside Of Cooler**	☐

(Print)Name:___________________________ **(Print)Name:____________________________**

Signature:_____________________________ **Signature:_____________________________**

Date/Time:____________________________ **Date/Time:____________________________**

COC's in Cooler:

____

____

____

____

APPENDIX C

LABORATORY METHOD REPORTING LIMITS AND SCREENING CRITERIA

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Eurofins Lancaster Laboratories Environmental, LLC

Analyte	Analytical Method	CASRN	Units	NMWQCC[1]	EPA MCL[2]	EPA Tapwater		Project Screening Level[4]	Achievable Laboratory Limits[5]		
						RSL[3]	c/nc		LOQ	LOD	DL
Volatile Organic Compounds/BTEX - Quarterly Water Sampling Analysis											
1,1,1,2-Tetrachloroethane	SW8260C	630-20-6	µg/L	NS	NS	5.7	c	5.7	1.0	0.5	0.2
1,1,1-Trichloroethane	SW8260C	71-55-6	µg/L	200	200	8000	nc	200	1.0	0.5	0.3
1,1,2,2-Tetrachloroethane	SW8260C	79-34-5	µg/L	10	NS	0.76	c	10	1.0	0.5	0.2
1,1,2-Trichloroethane*	SW8260C	79-00-5	µg/L	5	5	2.8	c	5.0	1.0	0.5	0.2
1,1-Dichloroethane	SW8260C	75-34-3	µg/L	25	NS	28	c	25	1.0	0.5	0.2
1,1-Dichloroethene	SW8260C	75-35-4	µg/L	7	7	280	nc	7.0	1.0	0.5	0.2
1,1-Dichloropropene	SW8260C	563-58-6	µg/L	NS	NS	NS	-	NS	5.0	0.5	0.2
1,2,3-Trichlorobenzene	SW8260C	87-61-6	µg/L	NS	NS	7.0	nc	7.0	5.0	1.0	0.4
1,2,3-Trichloropropane	SW8260C	96-18-4	µg/L	NS	NS	0.0075	c	0.0075	5.0	0.5	0.2
1,2,4-Trichlorobenzene	SW8260C	120-82-1	µg/L	70	70	12	c	70	5.0	1.0	0.3
1,2,4-Trimethylbenzene	SW8260C	95-63-6	µg/L	NS	NS	56	nc	56	5.0	2.0	1.0
1,2-Dibromo-3-chloropropane	SW8260C	96-12-8	µg/L	NS	0.2	0.0033	c	0.2	5.0	1.0	0.3
1,2-Dibromoethane (EDB)*	SW8011	106-93-4	µg/L	0.05	0.05	0.075	c	0.05	0.03	0.02	0.01
1,2-Dichlorobenzene	SW8260C	95-50-1	µg/L	600	600	300	nc	600	5.0	0.5	0.2
1,2-Dichloroethane*	SW8260C	107-06-2	µg/L	5	5	1.7	c	5.0	1.0	0.5	0.3
1,2-Dichloropropane	SW8260C	78-87-5	µg/L	5	5	8.5	c	5.0	1.0	0.5	0.2
1,3-Dichloropropane	SW8260C	142-28-9	µg/L	NS	NS	370	nc	370	1.0	0.5	0.2
1,3-Dichlorobenzene	SW8260C	541-73-1	µg/L	NS	NS	NS	-	NS	5.0	0.5	0.2
1,3,5-Trimethylbenzene*	SW8260C	108-67-8	µg/L	NS	NS	130	nc	130	5.0	1.0	0.3
1,4-Dichlorobenzene	SW8260C	106-46-7	µg/L	75	75	4.8	c	75	5.0	0.5	0.2
2-Butanone (Methyl Ethyl ketone)*	SW8260C	78-93-3	µg/L	NS	NS	5600	nc	5600	10	1.0	0.3
2-Chlorotoluene*	SW8260C	95-49-8	µg/L	NS	NS	240	nc	240	5.0	0.5	0.2
2,2-Dichloropropane	SW8260C	594-20-7	µg/L	NS	NS	NS	-	NS	1.0	0.5	0.3
2-Hexanone*	SW8260C	591-78-6	µg/L	NS	NS	38	nc	38	10	1.0	0.3
4-Chlorotoluene	SW8260C	106-43-4	µg/L	NS	NS	250	nc	250	5.0	0.5	0.2
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)*	SW8260C	108-10-1	µg/L	NS	NS	6300	nc	6300	10	1.0	0.5
Acetone*	SW8260C	67-64-1	µg/L	NS	NS	14000	nc	14000	20	2.0	0.7
Acrolein	SW8260C	107-02-8	µg/L	NS	NS	0.042	nc	0.042	100	5.0	2.0
Acrylonitrile	SW8260C	107-13-1	µg/L	NS	NS	0.52	c	0.52	20	1.0	0.3
Benzene*	SW8260C	71-43-2	µg/L	5	5	4.6	c	5.0	1.0	0.5	0.2
Bromobenzene	SW8260C	108-86-1	µg/L	NS	NS	62	nc	62	5.0	0.5	0.2
Bromochloromethane	SW8260C	74-97-5	µg/L	NS	NS	83	nc	83	5.0	0.5	0.2
Bromodichloromethane[6]	SW8260C	75-27-4	µg/L	NS	80	1.3	c	80	1.0	0.5	0.2
Bromoform[6]	SW8260C	75-25-2	µg/L	NS	80	33	c	80	4.0	2.0	1.0
Bromomethane	SW8260C	74-83-9	µg/L	NS	NS	7.5	nc	7.5	1.0	0.5	0.3
Carbon Disulfide*	SW8260C	75-15-0	µg/L	NS	NS	810	nc	810	5.0	0.5	0.2
Carbon Tetrachloride	SW8260C	56-23-5	µg/L	5	5	4.6	c	5.0	1.0	0.5	0.2
Chlorobenzene	SW8260C	108-90-7	µg/L	NS	100	78	nc	100	1.0	0.5	0.2
Chloroethane (Ethyl Chloride)	SW8260C	75-00-3	µg/L	NS	NS	21000	nc	21000	1.0	0.5	0.2
Chloroform[6]	SW8260C	67-66-3	µg/L	100	80	2.2	c	80	1.0	0.5	0.2
Chloromethane*	SW8260C	74-87-3	µg/L	NS	NS	190	nc	190	1.0	0.5	0.2
cis-1,2-Dichloroethene	SW8260C	156-59-2	µg/L	70	70	36	nc	70	1.0	0.5	0.2
cis-1,3-Dichloropropene	SW8260C	10061-01-5	µg/L	NS	NS	NS	-	NS	1.0	0.5	0.2
Dibromochloromethane[6]	SW8260C	124-48-1	µg/L	NS	80	8.7	c	80	1.0	0.5	0.2
Dibromomethane	SW8260C	74-95-3	µg/L	NS	NS	8.3	nc	8.3	1.0	0.5	0.2
Dichlorodifluoromethane*	SW8260C	75-71-8	µg/L	NS	NS	200	nc	200	1.0	0.5	0.2
Ethylbenzene*	SW8260C	100-41-4	µg/L	700	700	15	c	700	1.0	0.8	0.4
Hexachlorobutadiene	SW8260C	87-68-3	µg/L	NS	NS	1.4	c	1.4	5.0	4.0	2.0
Isopropylbenzene (Cumene)*	SW8260C	98-82-8	µg/L	NS	NS	450	nc	450	5.0	0.5	0.2
Methyl tert-Butyl Ether*	SW8260C	1634-04-4	µg/L	NS	NS	140	c	140	1.0	0.5	0.2
Methylene Chloride*	SW8260C	75-09-2	µg/L	5	5	110	c	5.0	1.0	0.5	0.3
n-Butylbenzene*	SW8260C	104-51-8	µg/L	NS	NS	1000	nc	1000	5.0	0.5	0.2

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Eurofins Lancaster Laboratories Environmental, LLC

Analyte	Analytical Method	CASRN	Units	NMWQCC[1]	EPA MCL[2]	EPA Tapwater RSL[3]	EPA Tapwater c/nc	Project Screening Level[4]	Achievable Laboratory Limits[5] LOQ	LOD	DL
n-Propylbenzene*	SW8260C	103-65-1	µg/L	NS	NS	660	nc	660	5.0	0.5	0.2
Naphthalene*[7]	SW8260C	91-20-3	µg/L	30	NS	1.7	c	30	5.0	2.0	1.0
p-Isopropyltoluene*	SW8260C	99-87-6	µg/L	NS	NS	NS	-	NS	5.0	0.5	0.2
sec-Butylbenzene*	SW8260C	135-98-8	µg/L	NS	NS	2000	nc	2000	5.0	0.5	0.2
Styrene	SW8260C	100-42-5	µg/L	100	100	1200	nc	100	5.0	0.5	0.2
tert-Butylbenzene*	SW8260C	98-06-6	µg/L	NS	NS	690	nc	690	5.0	1.0	0.3
Tetrachloroethene	SW8260C	127-18-4	µg/L	5	5	110	c	5.0	1.0	0.5	0.2
Toluene*	SW8260C	108-88-3	µg/L	1000	1000	1100	nc	1000	1.0	0.5	0.2
trans-1,2-Dichloroethene	SW8260C	156-60-5	µg/L	100	100	360	nc	100	1.0	0.5	0.2
trans-1,3-Dichloropropene	SW8260C	10061-02-6	µg/L	NS	NS	NS	-	4.7	1.0	0.5	0.2
Trichloroethene*	SW8260C	79-01-6	µg/L	5	5	4.9	c	5.0	1.0	0.5	0.2
Trichlorofluoromethane*	SW8260C	75-69-4	µg/L	NS	NS	5200	nc	5200	1.0	0.5	0.2
Vinyl Acetate	SW8260C	108-05-4	µg/L	NS	NS	410	nc	410	10.0	2.0	0.7
Vinyl Chloride	SW8260C	75-01-4	µg/L	2	2	0.19	c	2	1.0	0.5	0.2
m,p-Xylene*	SW8260C	179601-23-1	µg/L	NS	10,000	190	nc	10,000	5.0	2.0	1.0
o-Xylene*	SW8260C	95-47-6	µg/L	NS	10,000	190	nc	10,000	1.0	0.8	0.4
Xylene (Total)*	SW8260C	1330-20-7	µg/L	620	10,000	190	nc	620	6.0	2.0	1.0
Metals - Total - Quarterly Water Sampling Analysis											
Arsenic	SW6020A	7440-38-2	mg/L	0.01	0.01	0.00052	c	0.01	0.002	0.0016	0.00068
Lead	SW6020A	7439-92-1	mg/L	0.015	0.015	0.015	nc	0.015	0.0005	0.00025	0.000071
Metals - Dissolved - Quarterly Water Sampling Analysis											
Iron	SW6010C	7439-89-6	mg/L	1.0	0.3	14	nc	0.3	0.2	0.1	0.04
Manganese	SW6010C	7439-96-5	mg/L	0.2	0.05	0.43	nc	0.05	0.01	0.005	0.003
Miscellaneous - Quarterly Water Sampling Analysis											
Alkalinity - Bicarbonate/Carbonate	SM 2320B	NS	mg/L	NS	NS	NS	-	NS	8	6	2.6
Ammonia Nitrogen	SM 4500NH3B/C	7664-41-7	mg/L	NS	NS	NS	-	NS	0.75	0.6	0.25
Bromide	E300.0A	24959-67-9	mg/L	NS	NS	NS	-	NS	2.5	2	1.25
Chloride	E300.0A	16887-00-6	mg/L	250	250	NS	-	250	2	1.5	1
Flashpoint[9]	SW-846 1010A	NS	degrees F	NS	NS	NS	-	<140	50	50	50
Nitrate/Nitrite Nitrogen[10]	E353.2	NS	mg/L	10[10]	10[10]	NS	-	10.00	1	0.09	0.04
pH	SW-846 9040C	NS	S.U.	6-9	6.5-8.5	NS	-	6.5-8.5	0.01	0.01	0.01
Sulfate	EPA 300.0A	18785-72-3	mg/L	600	250	NS	-	250	5	4.5	1.5
Sulfide	SM 4500S2F	18496-25-8	mg/L	NS	NS	NS	-	NS	2	1.5	0.7
Total Petroleum Hydrocarbons - Quarterly Water Sampling Analysis											
GRO (C6 - C10)	SW8015D	PHCG	µg/L	NS	NS	NS	nc	101[11]	50	40	23
DRO (C10 - C28)	SW8015D	PHCDC10C2	µg/L	NS	NS	NS	nc	167[12]	100	90	45
Total Petroleum Hydrocarbons - Soil Core Analysis											
GRO (C6 - C10)	SW8015D_GRO_DO	8006-61-9	mg/Kg	NS	NS	NS	nc	100[13]	1.20	0.33	1.10
DRO Extended (C10 - C35)	SW8015_DRO_DOD	STL00143	mg/Kg	NS	NS	NS	nc	1000[14]	4.00	0.68	2.00

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Eurofins Lancaster Laboratories Environmental, LLC

[1] NMWQCC standards per the New Mexico Administrative Code Title 20.6.2.3101A, Standards for Ground Water of 10,000 mg/L Total Dissolved Solids Concentration or Less (NMAC 2018). For metals, the NMWQCC standard
[2] EPA National Primary Drinking Water Regulations, Maximum Contaminant Levels and Secondary Maximum Contaminant Levels, Title 40CFR Part 141, 143 (June, 2019)).
[3] EPA Regional Screening Levels for Tapwater (Novmeber 2017) for hazard index = 1.0 for noncarcinogens and a 10^{-5} cancer risk level for carcinogens.
[4] The project screening level was selected to satisfy the requirements of the Kirtland AFB Hazardous Waste Permit No. NM9570024423 as the lowest of 1) NMWQCC standard or 2) EPA MCL. If no MCL or NMWQCC standard
[5] Achieveable laboratory limits are for Eurofins Lancaster Laboratories Environmental, LLC, Lancaster PA.
[6] The EPA RSL and MCL for tapwater is for total trihalomethanes.
[7] NMWQCC specifies a standard for the sum of naphthalene and mononaphthalenes (1-methylnaphthalene and 2-methylnaphthalene). Conservatively, this standard is shown for each of the three compounds.
[8] MCL for nitrite is listed; the MCL for nitrate is 10 mg/L.
[9] The project screening level for flashpoint is based on RCRA hazardous waste criteria.
[10] Based on the geochemical equilibrium of the site groundwater and previous site data nalyses, nitrat/nitrite results represent nitrate concentrations
[11] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-4 Groundwater Screening Level for Gasoline
[12] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-2 Groundwater Screening Level for Diesel #2/crankcase oil
[13] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-2 TPH soil screening value for Gasoline
[14] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-2 TPH soil screening value for Diesel #2/crankcase oil
* VOCs included in the Bulk Fuels Facility network groundwater monitoring and treatment system monitoring.
µg/L = Microgram(s) per liter.
AFB = Air Force Base.
BTEX = Benzene, toluene, ethylbenzene, and total xylenes.
c = Carcinogenic.
CASRN = Chemical Abstracts Service Registry Number.
DL = Detection limit.
EPA = U.S. Environmental Protection Agency.
LOD = Limit of detection.
LOQ = Limit of quantitation.
mg/L = Milligram(s) per liter.
MCL = Maximum Contaminant Level.

nc = Noncarcinogenic.
NMAC = New Mexico Administrative Code.
NMWQCC = New Mexico Water Quality Control Commission

NS = Not specified.
RCRA = Resource Conservation and Recovery Act.
RSL = Regional Screening Level.

S.U. = Standard units
VOC = Volatile organic compound.
Cell highlight indicates the LOQ is higher than the project screening level.

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Water IDW

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	SW8260C	µg/L	0.26642556	1
1,1,1-Trichloroethane	SW8260C	µg/L	0.29988297	1
1,1,2,2-Tetrachloroethane	SW8260C	µg/L	0.27276476	2
1,1,2-Trichloroethane	SW8260C	µg/L	0.18810867	1
1,1-Dichloroethane	SW8260C	µg/L	0.27333061	1
1,1-Dichloroethene	SW8260C	µg/L	0.12963215	1
1,1-Dichloropropene	SW8260C	µg/L	0.17906036	1
1,2,3-Trichlorobenzene	SW8260C	µg/L	0.1337266	1
1,2,3-Trichloropropane	SW8260C	µg/L	0.4377035	2
1,2,4-Trichlorobenzene	SW8260C	µg/L	0.2410853	1
1,2,4-Trimethylbenzene	SW8260C	µg/L	0.12170676	1
1,2-Dibromo-3-chloropropane	SW8260C	µg/L	0.58738471	2
1,2-Dibromoethane (EDB)	SW8260C	µg/L	0.30349736	1
1,2-Dibromoethane (EDB)	SW8011	µg/L	0.00661973	0.01
1,2-Dichlorobenzene	SW8260C	µg/L	0.15488466	1
1,2-Dichloroethane (EDC)	SW8260C	µg/L	0.22022606	1
1,2-Dichloropropane	SW8260C	µg/L	0.13385505	1
1,3,5-Trimethylbenzene	SW8260C	µg/L	0.1824473	1
1,3-Dichlorobenzene	SW8260C	µg/L	0.16115299	1
1,3-Dichloropropane	SW8260C	µg/L	0.18045246	1
1,4-Dichlorobenzene	SW8260C	µg/L	0.20790843	1
1-Methylnaphthalene	SW8260C	µg/L	0.84315156	4
2,2-Dichloropropane	SW8260C	µg/L	0.26068818	2
2-Butanone	SW8260C	µg/L	1.11882691	10
2-Chlorotoluene	SW8260C	µg/L	0.13219231	1
2-Hexanone	SW8260C	µg/L	1.7913929	10
2-Methylnaphthalene	SW8260C	µg/L	0.69404444	4
4-Chlorotoluene	SW8260C	µg/L	0.51013241	1
4-Isopropyltoluene	SW8260C	µg/L	0.20218781	1
4-Methyl-2-pentanone	SW8260C	µg/L	1.12810379	10
Acetone	SW8260C	µg/L	2.3399817	10
Benzene	SW8260C	µg/L	0.22664341	1
Bromobenzene	SW8260C	µg/L	0.28392981	1
Bromodichloromethane	SW8260C	µg/L	0.20267676	1
Bromoform	SW8260C	µg/L	0.3145262	1
Bromomethane	SW8260C	µg/L	1.55408408	3
Carbon disulfide	SW8260C	µg/L	0.44427735	10
Carbon Tetrachloride	SW8260C	µg/L	0.1752501	1
Chlorobenzene	SW8260C	µg/L	0.13643228	1
Chloroethane	SW8260C	µg/L	0.37700508	2
Chloroform	SW8260C	µg/L	0.13339525	1
Chloromethane	SW8260C	µg/L	0.40170128	3
cis-1,2-DCE	SW8260C	µg/L	0.38753208	1

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds (continued)				
cis-1,3-Dichloropropene	SW8260C	µg/L	0.3599592	1
Dibromochloromethane	SW8260C	µg/L	0.28352616	1
Dibromomethane	SW8260C	µg/L	0.30859084	1
Dichlorodifluoromethane	SW8260C	µg/L	0.43860584	1
Ethylbenzene	SW8260C	µg/L	0.2128557	1
Hexachlorobutadiene	SW8260C	µg/L	0.32782128	1
Isopropylbenzene	SW8260C	µg/L	0.18266988	1
Methyl tert-butyl ether (MTBE)	SW8260C	µg/L	0.39332816	1
Methylene Chloride	SW8260C	µg/L	0.40025727	3
n-Butylbenzene	SW8260C	µg/L	0.25484172	3
n-Propylbenzene	SW8260C	µg/L	0.18155466	1
Naphthalene	SW8260C	µg/L	0.28182827	2
sec-Butylbenzene	SW8260C	µg/L	0.60651751	1
Styrene	SW8260C	µg/L	0.12902529	1
tert-Butylbenzene	SW8260C	µg/L	0.24440533	1
Tetrachloroethene (PCE)	SW8260C	µg/L	0.35620597	1
Toluene	SW8260C	µg/L	0.1992574	1
trans-1,2-DCE	SW8260C	µg/L	0.48575675	1
trans-1,3-Dichloropropene	SW8260C	µg/L	0.33909857	1
Trichloroethene (TCE)	SW8260C	µg/L	0.20410217	1
Trichlorofluoromethane	SW8260C	µg/L	0.09160495	1
Vinyl chloride	SW8260C	µg/L	0.195513	1
Xylenes, Total	SW8260C	µg/L	0.55450736	1.5
Total Metals				
Aluminum	SW6010B	mg/L	0.00473898	0.02
Antimony	SW6010B	mg/L	0.01372337	0.05
Arsenic	SW6010B	mg/L	0.02200207	0.03
Barium	SW6010B	mg/L	0.0010668	0.002
Beryllium	SW6010B	mg/L	0.00056149	0.003
Boron	SW6010B	mg/L	0.00242131	0.04
Cadmium	SW6010B	mg/L	0.00089973	0.002
Calcium	SW6010B	mg/L	0.03608159	1
Chromium	SW6010B	mg/L	0.00139292	0.006
Cobalt	SW6010B	mg/L	0.00150615	0.006
Copper	SW6010B	mg/L	0.00390292	0.006
Iron	SW6010B	mg/L	0.01278435	0.02
Lead	SW6010B	mg/L	0.01278173	0.02
Magnesium	SW6010B	mg/L	0.02211513	1
Manganese	SW6010B	mg/L	0.00033628	0.002
Molybdenum	SW6010B	mg/L	0.00270888	0.008
Nickel	SW6010B	mg/L	0.00352157	0.01
Potassium	SW6010B	mg/L	0.09030736	1
Selenium	SW6010B	mg/L	0.0213499	0.05

Analyte	Analytical Method	Units	MDL	PQL
Total Metals (continued)				
Silicon	SW6010B	mg/L	0.03044434	0.08
Silver	SW6010B	mg/L	0.00126288	0.005
Sodium	SW6010B	mg/L	0.61473721	1
Strontium	SW6010B	mg/L	0.00027022	0.006
Thallium	SW6010B	mg/L	0.02110005	0.05
Tin	SW6010B	mg/L	0.00374653	0.02
Titanium	SW6010B	mg/L	0.00052741	0.005
Uranium	SW6010B	mg/L	0.02741094	0.1
Vanadium	SW6010B	mg/L	0.0011414	0.05
Zinc	SW6010B	mg/L	0.00165983	0.02
Silica	SW6010B	mg/L	0.06515089	0.1712
Dissolved Metals				
Aluminum	SW6010B	mg/L	0.00473794	0.02
Antimony	SW6010B	mg/L	0.0101365	0.05
Arsenic	SW6010B	mg/L	0.01924201	0.02
Barium	SW6010B	mg/L	0.00041561	0.02
Beryllium	SW6010B	mg/L	0.00050584	0.003
Boron	SW6010B	mg/L	0.00596838	0.04
Cadmium	SW6010B	mg/L	0.00036925	0.002
Calcium	SW6010B	mg/L	0.04591719	1
Chromium	SW6010B	mg/L	0.00118477	0.006
Cobalt	SW6010B	mg/L	0.00191566	0.006
Copper	SW6010B	mg/L	0.00294127	0.006
Iron	SW6010B	mg/L	0.00801103	0.02
Lead	SW6010B	mg/L	0.00966505	0.02
Magnesium	SW6010B	mg/L	0.01936682	1
Manganese	SW6010B	mg/L	0.00020382	0.002
Molybdenum	SW6010B	mg/L	0.00419197	0.008
Nickel	SW6010B	mg/L	0.00222346	0.01
Potassium	SW6010B	mg/L	0.20933244	1
Selenium	SW6010B	mg/L	0.03177226	0.05
Silicon	SW6010B	mg/L	0.01351538	0.08
Silver	SW6010B	mg/L	0.00157158	0.005
Sodium	SW6010B	mg/L	0.26431542	1
Strontium	SW6010B	mg/L	0.00045619	0.006
Thallium	SW6010B	mg/L	0.02395773	0.05
Tin	SW6010B	mg/L	0.00375974	0.02
Titanium	SW6010B	mg/L	0.00075166	0.005
Uranium	SW6010B	mg/L	0.0413263	0.1
Vanadium	SW6010B	mg/L	0.0013731	0.05
Zinc	SW6010B	mg/L	0.00284264	0.02
Silica	SW6010B	mg/L	0.02892292	0.1712

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Soil IDW

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	SW8260C	mg/Kg	0.00437794	0.05
1,1,1-Trichloroethane	SW8260C	mg/Kg	0.01103372	0.05
1,1,2,2-Tetrachloroethane	SW8260C	mg/Kg	0.01617095	0.05
1,1,2-Trichloroethane	SW8260C	mg/Kg	0.0044343	0.05
1,1-Dichloroethane	SW8260C	mg/Kg	0.00836209	0.05
1,1-Dichloroethene	SW8260C	mg/Kg	0.00730664	0.05
1,1-Dichloropropene	SW8260C	mg/Kg	0.00528389	0.1
1,2,3-Trichlorobenzene	SW8260C	mg/Kg	0.00337725	0.1
1,2,3-Trichloropropane	SW8260C	mg/Kg	0.02104668	0.1
1,2,4-Trichlorobenzene	SW8260C	mg/Kg	0.01739618	0.05
1,2,4-Trimethylbenzene	SW8260C	mg/Kg	0.00706101	0.05
1,2-Dibromo-3-chloropropane	SW8260C	mg/Kg	0.02159375	0.1
1,2-Dibromoethane (EDB)	SW8260C	mg/Kg	0.01967498	0.05
1,2-Dibromoethane (EDB)	SW8011	mg/Kg	0.0351922	0.1
1,2-Dichlorobenzene	SW8260C	mg/Kg	0.01039489	0.05
1,2-Dichloroethane (EDC)	SW8260C	mg/Kg	0.0113981	0.05
1,2-Dichloropropane	SW8260C	mg/Kg	0.0085744	0.05
1,3,5-Trimethylbenzene	SW8260C	mg/Kg	0.01122194	0.05
1,3-Dichlorobenzene	SW8260C	mg/Kg	0.00944562	0.05
1,3-Dichloropropane	SW8260C	mg/Kg	0.01098625	0.05
1,4-Dichlorobenzene	SW8260C	mg/Kg	0.01336812	0.05
1-Methylnaphthalene	SW8260C	mg/Kg	0.05734111	0.2
2,2-Dichloropropane	SW8260C	mg/Kg	0.00585642	0.1
2-Butanone	SW8260C	mg/Kg	0.07717635	0.5
2-Chlorotoluene	SW8260C	mg/Kg	0.01035746	0.05
2-Hexanone	SW8260C	mg/Kg	0.009543	0.5
2-Methylnaphthalene	SW8260C	mg/Kg	0.04621485	0.2
4-Chlorotoluene	SW8260C	mg/Kg	0.0316787	0.05
4-Isopropyltoluene	SW8260C	mg/Kg	0.01287838	0.05
4-Methyl-2-pentanone	SW8260C	mg/Kg	0.0583007	0.5
Acetone	SW8260C	mg/Kg	0.04494549	0.75
Benzene	SW8260C	mg/Kg	0.00962254	0.025
Bromobenzene	SW8260C	mg/Kg	0.00399452	0.05
Bromodichloromethane	SW8260C	mg/Kg	0.00463052	0.05
Bromoform	SW8260C	mg/Kg	0.01205577	0.05
Bromomethane	SW8260C	mg/Kg	0.04376392	0.15
Carbon disulfide	SW8260C	mg/Kg	0.01217576	0.5
Carbon tetrachloride	SW8260C	mg/Kg	0.0044256	0.05
Chlorobenzene	SW8260C	mg/Kg	0.00794471	0.05
Chloroethane	SW8260C	mg/Kg	0.01869531	0.1
Chloroform	SW8260C	mg/Kg	0.00689075	0.05
Chloromethane	SW8260C	mg/Kg	0.00480508	0.15
cis-1,2-DCE	SW8260C	mg/Kg	0.02479626	0.05

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds (continued)				
cis-1,3-Dichloropropene	SW8260C	mg/Kg	0.00658169	0.05
Dibromochloromethane	SW8260C	mg/Kg	0.00656147	0.05
Dibromomethane	SW8260C	mg/Kg	0.00760878	0.05
Dichlorodifluoromethane	SW8260C	mg/Kg	0.01534521	0.05
Ethylbenzene	SW8260C	mg/Kg	0.01218082	0.05
Hexachlorobutadiene	SW8260C	mg/Kg	0.01302184	0.1
Isopropylbenzene	SW8260C	mg/Kg	0.00927614	0.05
Methyl tert-butyl ether (MTBE)	SW8260C	mg/Kg	0.00995032	0.05
Methylene chloride	SW8260C	mg/Kg	0.03622655	0.15
n-Butylbenzene	SW8260C	mg/Kg	0.01336161	0.15
n-Propylbenzene	SW8260C	mg/Kg	0.00807367	0.05
Naphthalene	SW8260C	mg/Kg	0.00915431	0.1
sec-Butylbenzene	SW8260C	mg/Kg	0.04121238	0.05
Styrene	SW8260C	mg/Kg	0.00628447	0.05
tert-Butylbenzene	SW8260C	mg/Kg	0.0115733	0.05
Tetrachloroethene (PCE)	SW8260C	mg/Kg	0.01370682	0.05
Toluene	SW8260C	mg/Kg	0.0052276	0.05
trans-1,2-DCE	SW8260C	mg/Kg	0.00854522	0.05
trans-1,3-Dichloropropene	SW8260C	mg/Kg	0.01172169	0.05
Trichloroethene (TCE)	SW8260C	mg/Kg	0.00768123	0.05
Trichlorofluoromethane	SW8260C	mg/Kg	0.01134483	0.05
Vinyl chloride	SW8260C	mg/Kg	0.00417746	0.05
Xylenes, Total	SW8260C	mg/Kg	0.02624796	0.1
Semivolatile Organic Compounds				
1,2,4-Trichlorobenzene	SW8270D	mg/Kg	0.09177166	0.2
1,2-Dichlorobenzene	SW8270D	mg/Kg	0.0809185	0.2
1,3-Dichlorobenzene	SW8270D	mg/Kg	0.07121501	0.2
1,4-Dichlorobenzene	SW8270D	mg/Kg	0.08482738	0.2
1-Methylnaphthalene	SW8270D	mg/Kg	0.09206784	0.2
2,4,5-Trichlorophenol	SW8270D	mg/Kg	0.06374758	0.2
2,4,6-Trichlorophenol	SW8270D	mg/Kg	0.0861744	0.2
2,4-Dichlorophenol	SW8270D	mg/Kg	0.0812905	0.4
2,4-Dimethylphenol	SW8270D	mg/Kg	0.07116475	0.3
2,4-Dinitrophenol	SW8270D	mg/Kg	0.05027902	0.5
2,4-Dinitrotoluene	SW8270D	mg/Kg	0.12151991	0.5
2,6-Dinitrotoluene	SW8270D	mg/Kg	0.10175304	0.5
2-Chloronaphthalene	SW8270D	mg/Kg	0.09480505	0.25
2-Chlorophenol	SW8270D	mg/Kg	0.10707353	0.2
2-Methylnaphthalene	SW8270D	mg/Kg	0.08258592	0.2
2-Methylphenol	SW8270D	mg/Kg	0.08418492	0.4
2-Nitroaniline	SW8270D	mg/Kg	0.10234119	0.2
2-Nitrophenol	SW8270D	mg/Kg	0.08626889	0.2
3+4-Methylphenol	SW8270D	mg/Kg	0.08261285	0.2

Analyte	Analytical Method	Units	MDL	PQL
Semivolatile Organic Compounds (continued)				
3,3´-Dichlorobenzidine	SW8270D	mg/Kg	0.15037372	0.25
3-Nitroaniline	SW8270D	mg/Kg	0.1165158	0.2
4,6-Dinitro-2-methylphenol	SW8270D	mg/Kg	0.08431189	0.4
4-Bromophenyl phenyl ether	SW8270D	mg/Kg	0.1044657	0.2
4-Chloro-3-methylphenol	SW8270D	mg/Kg	0.08438491	0.5
4-Chloroaniline	SW8270D	mg/Kg	0.09736012	0.5
4-Chlorophenyl phenyl ether	SW8270D	mg/Kg	0.0848838	0.2
4-Nitroaniline	SW8270D	mg/Kg	0.12835665	0.4
4-Nitrophenol	SW8270D	mg/Kg	0.08224738	0.25
Acenaphthene	SW8270D	mg/Kg	0.08938772	0.2
Acenaphthylene	SW8270D	mg/Kg	0.09060451	0.2
Aniline	SW8270D	mg/Kg	0.06924821	0.2
Anthracene	SW8270D	mg/Kg	0.09058663	0.2
Azobenzene	SW8270D	mg/Kg	0.09991189	0.2
Benz(a)anthracene	SW8270D	mg/Kg	0.06438737	0.2
Benzo(a)pyrene	SW8270D	mg/Kg	0.09429395	0.2
Benzo(b)fluoranthene	SW8270D	mg/Kg	0.10637566	0.2
Benzo(g,h,i)perylene	SW8270D	mg/Kg	0.10194928	0.2
Benzo(k)fluoranthene	SW8270D	mg/Kg	0.07519968	0.2
Benzoic acid	SW8270D	mg/Kg	0.12507976	0.5
Benzyl alcohol	SW8270D	mg/Kg	0.08201328	0.2
Bis(2-chloroethoxy)methane	SW8270D	mg/Kg	0.07649715	0.2
Bis(2-chloroethyl)ether	SW8270D	mg/Kg	0.10461449	0.2
Bis(2-chloroisopropyl)ether	SW8270D	mg/Kg	0.10164731	0.2
Bis(2-ethylhexyl)phthalate	SW8270D	mg/Kg	0.21522009	0.5
Butyl benzyl phthalate	SW8270D	mg/Kg	0.06088734	0.2
Carbazole	SW8270D	mg/Kg	0.08794382	0.2
Chrysene	SW8270D	mg/Kg	0.08834518	0.2
Di-n-butyl phthalate	SW8270D	mg/Kg	0.27927569	0.4
Di-n-octyl phthalate	SW8270D	mg/Kg	0.12865018	0.4
Dibenz(a,h)anthracene	SW8270D	mg/Kg	0.10503258	0.2
Dibenzofuran	SW8270D	mg/Kg	0.10404737	0.2
Diethyl phthalate	SW8270D	mg/Kg	0.3262925	0.5
Dimethyl phthalate	SW8270D	mg/Kg	0.0925736	0.2
Fluoranthene	SW8270D	mg/Kg	0.08090127	0.2
Fluorene	SW8270D	mg/Kg	0.08925944	0.2
Hexachlorobenzene	SW8270D	mg/Kg	0.08899561	0.2
Hexachlorobutadiene	SW8270D	mg/Kg	0.09384622	0.2
Hexachlorocyclopentadiene	SW8270D	mg/Kg	0.11325564	0.2
Hexachloroethane	SW8270D	mg/Kg	0.08849169	0.2
Indeno(1,2,3-cd)pyrene	SW8270D	mg/Kg	0.11533529	0.2
Isophorone	SW8270D	mg/Kg	0.08170278	0.4
N-Nitrosodi-n-propylamine	SW8270D	mg/Kg	0.09260404	0.2

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Soil IDW

Analyte	Analytical Method	Units	MDL	PQL
Semivolatile Organic Compounds (continued)				
N-Nitrosodiphenylamine	SW8270D	mg/Kg	0.10431985	0.2
Naphthalene	SW8270D	mg/Kg	0.09421475	0.2
Nitrobenzene	SW8270D	mg/Kg	0.08208344	0.4
Pentachlorophenol	SW8270D	mg/Kg	0.08635748	0.4
Phenanthrene	SW8270D	mg/Kg	0.10214929	0.2
Phenol	SW8270D	mg/Kg	0.07709409	0.2
Pyrene	SW8270D	mg/Kg	0.07583465	0.2
Pyridine	SW8270D	mg/Kg	0.16107401	0.4
Total Metals				
Aluminum	SW6010C	mg/L	0.00473898	0.02
Antimony	SW6010C	mg/L	0.01372337	0.05
Arsenic	SW6010C	mg/L	0.02200207	0.03
Barium	SW6010C	mg/L	0.0010668	0.002
Beryllium	SW6010C	mg/L	0.00056149	0.003
Boron	SW6010C	mg/L	0.00242131	0.04
Cadmium	SW6010C	mg/L	0.00089973	0.002
Calcium	SW6010C	mg/L	0.03608159	1
Chromium	SW6010C	mg/L	0.00139292	0.006
Cobalt	SW6010C	mg/L	0.00150615	0.006
Copper	SW6010C	mg/L	0.00390292	0.006
Iron	SW6010C	mg/L	0.01278435	0.02
Lead	SW6010C	mg/L	0.01278173	0.02
Magnesium	SW6010C	mg/L	0.02211513	1
Manganese	SW6010C	mg/L	0.00033628	0.002
Mercury	SW7471B	mg/Kg	0.002618	0.033
Molybdenum	SW6010C	mg/L	0.00270888	0.008
Nickel	SW6010C	mg/L	0.00352157	0.01
Potassium	SW6010C	mg/L	0.09030736	1
Selenium	SW6010C	mg/L	0.0213499	0.05
Silicon	SW6010C	mg/L	0.03044434	0.08
Silver	SW6010C	mg/L	0.00126288	0.005
Sodium	SW6010C	mg/L	0.61473721	1
Strontium	SW6010C	mg/L	0.00027022	0.006
Thallium	SW6010C	mg/L	0.02110005	0.05
Tin	SW6010C	mg/L	0.00374653	0.02
Titanium	SW6010C	mg/L	0.00052741	0.005
Uranium	SW6010C	mg/L	0.02741094	0.1
Vanadium	SW6010C	mg/L	0.0011414	0.05
Zinc	SW6010C	mg/L	0.00165983	0.02
Silica	SW6010C	mg/L	0.06515089	0.1712

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Soil IDW

Analyte	Analytical Method	Units	MDL	PQL
Herbicides				
2,4,5-T	SW8151A	mg/Kg	0.01	0.01
2,4,5-TP (Silvex)	SW8151A	mg/Kg	0.01	0.01
2,4-D	SW8151A	mg/Kg	0.01	0.01
2,4-DB	SW8151A	mg/Kg	0.01	0.01
Dacthal	SW8151A	mg/Kg	0.01	0.01
Dalapon	SW8151A	mg/Kg	0.01	0.01
Dicamba	SW8151A	mg/Kg	0.01	0.01
Dichlorprop	SW8151A	mg/Kg	0.01	0.01
Dinoseb	SW8151A	mg/Kg	0.01	0.01
MCPA	SW8151A	mg/Kg	0.01	0.01
Pentachlorophenol	SW8151A	mg/Kg	0.01	0.01
Picloram	SW8151A	mg/Kg	0.01	0.01
Pesticides				
4,4´-DDD	SW8081B	mg/Kg	0.00104661	0.003
4,4´-DDE	SW8081B	mg/Kg	0.00106566	0.003
4,4´-DDT	SW8081B	mg/Kg	0.0010414	0.003
Aldrin	SW8081B	mg/Kg	0.0015075	0.004
alpha-BHC	SW8081B	mg/Kg	0.0011587	0.004
beta-BHC	SW8081B	mg/Kg	0.00107573	0.004
Chlordane	SW8081B	mg/Kg	0.2	0.2
delta-BHC	SW8081B	mg/Kg	0.00101211	0.004
Dieldrin	SW8081B	mg/Kg	0.00114727	0.003
Endosulfan I	SW8081B	mg/Kg	0.00103656	0.003
Endosulfan II	SW8081B	mg/Kg	0.00106783	0.003
Endosulfan sulfate	SW8081B	mg/Kg	0.00104968	0.004
Endrin	SW8081B	mg/Kg	0.00093084	0.003
Endrin aldehyde	SW8081B	mg/Kg	0.00099484	0.007
gamma-BHC	SW8081B	mg/Kg	0.00108957	0.004
Heptachlor	SW8081B	mg/Kg	0.00123444	0.004
Heptachlor epoxide	SW8081B	mg/Kg	0.00107789	0.004
Methoxychlor	SW8081B	mg/Kg	0.00116688	0.004
Toxaphene	SW8081B	mg/Kg	0.2	0.2
Decachlorobiphenyl	SW8081B	mg/Kg	0	0
Tetrachloro-m-xylene	SW8081B	mg/Kg	0	0
Total Petroleum Hydrocarbons (TPH)				
Gasoline Range Organics (GRO)	SW8015D	mg/Kg	3.95051103	5
Diesel Range Organics (DRO)	SW8015D	mg/Kg	2.93328769	10

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Soil IDW

Analyte	Analytical Method	Units	MDL	PQL
Reactive Cyanide				
Reactive Cyanide	SW9012B	mg/Kg	1	1
TCLP Volatile Organic Compounds				
1,1-Dichloroethene	SW1311	mg/L	0.00401212	0.7
1,2-Dichloroethane (EDC)	SW1311	mg/L	0.00574292	0.5
1,4-Dichlorobenzene	SW1311	mg/L	0.00402815	7.5
2-Butanone	SW1311	mg/L	0.05493877	200
Benzene	SW1311	mg/L	0.00360011	0.5
Carbon Tetrachloride	SW1311	mg/L	0.00251484	0.5
Chlorobenzene	SW1311	mg/L	0.00367929	100
Chloroform	SW1311	mg/L	0.0026578	6
Tetrachloroethene (PCE)	SW1311	mg/L	0.00604063	0.7
Trichloroethene (TCE)	SW1311	mg/L	0.00266794	0.5
Vinyl chloride	SW1311	mg/L	0.00478389	0.2
TCLP Semivolatile Organic Compounds				
2,4,5-Trichlorophenol	SW1311	mg/L	0.03715361	400
2,4,6-Trichlorophenol	SW1311	mg/L	0.0304362	2
2,4-Dinitrotoluene	SW1311	mg/L	0.01755895	0.13
2-Methylphenol	SW1311	mg/L	0.04473895	200
3+4-Methylphenol	SW1311	mg/L	0.12337171	200
Hexachlorobenzene	SW1311	mg/L	0.03944137	0.13
Hexachlorobutadiene	SW1311	mg/L	0.04787594	0.5
Hexachloroethane	SW1311	mg/L	0.05011006	3
Nitrobenzene	SW1311	mg/L	0.05136111	2
Pentachlorophenol	SW1311	mg/L	0.05012942	100
Pyridine	SW1311	mg/L	0.04397144	5
Cresols, Total	SW1311	mg/L	0.16811065	200
TCLP Peticides				
Chlordane	SW1311	mg/L	0.03	0.03
Endrin	SW1311	mg/L	0.02	0.02
gamma-BHC (Lindane)	SW1311	mg/L	0.4	0.4
Heptachlor	SW1311	mg/L	0.008	0.008
Heptachlor epoxide	SW1311	mg/L	0.008	0.008
Methoxychlor	SW1311	mg/L	10	10
Toxaphene	SW1311	mg/L	0.5	0.5
TCLP Herbicides				
2,4,5-TP (Silvex)	SW1311	mg/L	0.01	1
2,4-D	SW1311	mg/L	0.1	10
TCLP Metals				
Arsenic	SW1311	mg/L	0.03123998	5
Barium	SW1311	mg/L	0.00287707	100
Cadmium	SW1311	mg/L	0.00138975	1
Chromium	SW1311	mg/L	0.00203497	5
Lead	SW1311	mg/L	0.00845041	5
Selenium	SW1311	mg/L	0.0576041	1
Silver	SW1311	mg/L	0.01	5

APPENDIX D

RESPONSE TO COMMENTS: NEW MEXICO ENVIRONMENT DEPARTMENT, HAZARDOUS WASTE BUREAU, APPROVAL WITH MODIFICATIONS, JULY 14, 2020

Common Comment and Response Worksheet (Version 3)				
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7/14/20	**NMED HWB**		**This Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10**	**W912PP-17-C-0028**
Item	**Section**	**Page**	**Comment**	**Response**
1	**Address contaminant migration pathway data gaps beneath the source area**		Data gaps remain from the source zone characterization previously performed under the Permittee's Work Plan for Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST- 106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1, dated December 2017 and approved with conditions by NMED on February 23, 2018. The results of the investigation were presented in the Source Zone Characterization Report for the Bulk Fuels Facility Solid Waste Management Unit ST-106/SS-111, received by NMED on October 30, 2019. This Report is currently under NMED review. The review in progress indicates that that the migration pathway has not been adequately characterized beneath the source area. In order to understand the migration of contaminants through the vadose zone beneath the former fuel offloading rack (FFOR), an understanding of the stratigraphy approximately 250- 300 feet below ground surface (ft bgs) is essential. The source area contaminants descend essentially vertically from the surface to a depth of approximately 250-350 ft bgs where a distinct clay layer is present. The clay layer is easily identified in drill cores and on geophysical logs. The thickness, lateral continuity, and geometry of this clay layer changes across the site. Directly below the FFOR the clay occurs as a single layer at approximately 275-300 ft bgs (lower clay). East-southeast of the FFOR the clay occurs as a single layer at approximately 250 ft bgs (upper clay). A vertical offset can be identified in the clay layer directly below the FFOR that likely creates a preferential pathway to vertical migration of contaminants. Once contaminants reach the 250-300 foot depth range they appear to migrate predominantly downdip (to the east-southeast) on the lower clay layer and then generally vertically to the water table. Three other data sets support this interpretation of the contaminant migration pathway: the observed lateral offset of elevated volatile organic compound (VOC) concentrations with depth; soil vapor extraction system rebound data; and Pneulog total volatile petroleum hydrocarbons (TVPH) soil gas data. All three data sets show contaminant migration to be predominantly vertical	**Revised as requested -** One well will be drilled within the source zone to further characterize the migration pathway beneath the source area. This well will be ARCH drilled to 230 ft bgs and then continuously cored to total depth (TD). Cores will be sampled for TPH, GRO and DRO. The Permittee will provide NMED notification at all required drilling stages, per comments provided herein. The Permittee will consult with NMED upon encountering the clay or reaching 300 ft bgs, at which point the determination will be made whether to complete the well as a groundwater monitoring (GWM) or soil vapor monitoring (SVM) well. Work Plan sections 4.1 and 5.3 have been updated to reflect the requested changes in this comment. Figure 5-1 has been added to illustrate the decision

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			beneath the FFOR to a depth in the 250-300 foot range with a shift in the pathway to the east-southeast before continuing on a vertical downward path to the water table. As stated in NMED's November 4, 2019 letter, "NMED met with the Permittee on September 26, 2019 to discuss the potential to utilize some of the proposed wells for multiple purposes to address other data gaps, the most important being the further characterization of the source area migration pathway through the vadose zone east of the former location of the bulk fuels loading racks. The Permittee agreed to evaluate the potential..." Therefore, the Permittee is instructed to relocate one or two of the proposed monitoring wells (KAFB-106250 and KAFB-106251) nearer to source area, as shown in Attachment II. In order to reduce cost and accelerate work, borehole(s) may be drilled with air rotary casing hammer techniques (ARCH) to a depth of approximately 230 ft bgs, just above the top of the clay described above. The boreholes must then be continuously cored to the total depth of the borehole and sampled for total petroleum hydrocarbons (TPH) gasoline range organics (GRO) and diesel range organics (DRO) Extended using United States Environmental Protection Agency (EPA) Method 8015 (modified). The total depth must be 10 feet below any field screening evidence of contamination (e.g., photoionization detector (PID) readings greater than 10 parts per million volume (ppmv)) to obtain a consistent detailed vertical profile of the migration pathway and to determine the vertical extent of contamination in the source area. A sample for TPH GRO and DRO Extended must be collected at the total depth of the borehole(s). The borehole(s) must also be geophysically logged. See Attachment II for NMED's proposed location for source area migration pathway boreholes. The Permittee must provide NMED email notification at certain stages of the drilling process. These stages include but may not be limited to:	process for well installation in the source zone. The source zone GWM well will be named KAFB-106S10. If an SVM well is installed it will be named KAFB-106V3 The Permittee will advance the source area data gap well(s) as described in this comment, but will also retain all original GWM locations for installation as originally proposed in the work plan in order to fully delineate the ethylene dibromide (EDB) plume to the south and east of the source area. Well numbering was adjusted for clarity of discussion in Section 4. However, the change does not impact the technical scope of the Work Plan or compliance with NMED directives.

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			a) initiation and cessation of ARCH drilling, b) initiation of sonic drilling, c) upon reaching a depth of 300 ft bgs d) upon reaching the water table, and e) upon reaching total well depth. The Permittee's notification to NMED that the driller has reached a depth of 300 ft bgs must include the actual depth bgs and thickness of the clay layer, if it is encountered. If the clay layer is not encountered then the objective of the well will have been achieved, that is, to identify the possible gap in the clay layer located 250 and 300 ft bgs as described above. If the clay layer is encountered, the Permittee, in consultation with NMED, must make a determination about whether it is the lower or upper clay. If it is determined that the driller has encountered the lower clay, the driller should stop at 300 ft bgs or just below the bottom of the clay and the Permittee must partially backfill the borehole with a bentonite seal and sand. The bentonite must be emplaced with a tremie pipe to approximately 2 ft below the top of the clay followed by one foot of sand to prevent bentonite from entering the well screen. The borehole must then be completed as a soil vapor monitoring well (SVMW) with the lower end of the screen located across the top of the clay layer. The SVMW must be constructed with a 1 foot sump and a 2 foot screen of an appropriate slot size. A SVMW design must be submitted to NMED for review with the Work Plan replacement pages. If it is determined that the driller has encountered the upper clay only, the driller should advance the borehole to total depth below the water table and the Permittee must complete the well as a dual screen ground water monitoring well as proposed in the Work Plan. If the first borehole is not successful in locating the contamination migration pathway (i.e., lower clay has been encountered) then a second borehole location should be selected based on the findings of the first borehole. The	

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			proposed second borehole location must be submitted by the Permittee to NMED for approval via electronic mail and approved prior to initiation of drilling. If the first borehole is successful in locating the contamination migration pathway then the Permittee, in consultation with NMED, must make a determination if a second borehole location should be selected to refine the migration pathway or if the borehole should be used to meet the objectives outlined in the Work Plan. See comments below for further detail. Upon completion of drilling the first borehole in the source area, the Permittee must provide NMED a copy of the lithologic log(s) by email. After reviewing the lithologic logs, NMED will provide direction for well installation at that location and direction on drilling a second borehole in the source area. NMED may require the installation of additional groundwater monitoring wells, if the five wells installed pursuant to this Work Plan do not sufficiently address the data gaps.	
2	**Section 6.0 Monitoring and Sampling, page 6-1, line 28**		**Permittee Statement:** "Beginning in 2016 passive sampling techniques were implemented at select GWM [ground water monitoring] well locations. The transition to passive sampling for select GWM well locations was formally approved by NMED on May 31, 2017 (NMED, 2017. A further passive sampling evaluation was performed in Q4 2017 (Section 3.7.7 of KAFB, 2018b). This evaluation demonstrated that analytical results from passive sampling techniques and analytical results from low-flow sampling techniques are generally comparable between the two sampling methods, with no consistent bias identified (i.e., neither method has consistently resulted in higher or lower concentrations)." **NMED Comment:** NMED's May 31, 2017 approval letter approved the change to the use of passive diffusion bags and dual membrane samplers for certain groundwater monitoring wells located north of Ridgecrest Drive in	**Revised as requested** – All planned GWM wells have been redesigned to accommodate low-flow sampling techniques. Figures 4-1 and 4-2 have been revised to reflect the well redesign and changes to well numbering. Additionally, Section 6, Monitoring and Sampling, has been amended to specify a low-

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			residential areas. NMED did not approve the use of passive sampling south of Ridgecrest Drive, particularly in areas with elevated petroleum hydrocarbon contamination. The passive sampling demonstration evaluation performed in Q4 [fourth quarter] 2017 and presented in the Quarterly Monitoring Report October- December 2017 and Annual Report for 2017, dated March 2018, was not reviewed or approved by NMED Hazardous Waste Bureau (HWB). *The Quarterly Monitoring Report-October-December 2018 and Annual Report for 2018*, dated March 2019, states "Field parameters [i.e., turbidity, temperature, dissolved oxygen, specific conductivity, pH, and oxidation reduction potential] were not collected from wells that were sampled using passive sampling methods due to the unreliable field parameter data associated with this technology." Additionally, an email to NMED from KAFB, dated February 28, 2020, provided data from this evaluation. The data indicates that source area monitoring well KAFB-106053 does not produce "high quality and representative sampling that was highly comparable to low-flow sampling," as indicated in the text of the email. Low-flow sampling results indicated a benzene concentration of 15,000 µg/L with duplicate results of 16,000 µg/L, while the passive sampling results for this same well indicated a benzene concentration of 3,700 µg/L with duplicate results of 3,600 µg/L. This demonstrates an order of magnitude difference between the sampling methods for this well located in the source area	flow sampling program on all newly installed wells.
3	**Section 4.0, Scope of Activities, page 4-1**		NMED Comment: The Permittee must revise Section 4.0 of the Work Plan along with corresponding Figures and Tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 4.0 revisions below. The Permittee must submit the revised Section 4.0 and corresponding Figures and Tables as replacement pages.	**Revised as requested** – Section 4 has been revised to reflect the addition of well KAFB-106S10 for source area characterization.
4	**Section 4.0, Scope of Activities, page 4-1,**	**line 6**	**Permittee Statement:** "...well locations proposed in this Work Plan are shown on Figure 2-1 and Figure 2-2."	**Revised as requested** – Section 4 has been revised to reflect the addition of well KAFB-

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			NMED Comment: The Permittee must relocate one or two of the proposed monitoring wells (KAFB-106250 and KAFB-106251) to locations in the source area to determine the source area migration pathway. Propose two new locations within the area identified in Attachment 2. Include a primary location to be drilled first and a secondary location to be drilled should the first borehole not successfully locate the migration pathway.	106S10/KAFB-SV03 for source area characterization. Please see the decision tree added to Section 5 (Figure 5-1). Per Comment #1, a second location will be selected, in collaboration with NMED, as necessary, based on the findings of the first wellbore. The Permittee will advance the source area data gap well(s) as described in this comment, but will also retain all original GWM locations for installation as originally proposed in the work plan to fully delineate the EDB plume to the south and east of the source area.
5	**Section 4.0, Scope of Activities, page 4-1, line 9 and Figure 4-1, Proposed Construction Diagram for Groundwater Monitoring Well with Contingency Well and Figure 4-2, Proposed Construction Diagram for Groundwater**		**Permittee Statement:** "Four of the five proposed GWM wells (KAFB-106249 through KAFB- 106252) will be constructed with the same design employed by the Work Plan for Data Gap Monitoring Well Installation {Section 3.1.1of [Work Plan for Data Gap Well Installation, 2017]) as shown on the construction diagram {Figure 4-1)." **NMED Comment:** All groundwater monitoring wells must be constructed utilizing an appropriate well casing diameter (e.g., four-inch inside diameter) to accommodate equipment, such as low-flow pumps, which can effectively purge wells for active sampling.	**Revised as requested** - All planned GWM wells have been redesigned to accommodate active sampling techniques, including increasing inside diameter to 4 inches. All Sections have been revised to specify active sampling on all newly installed GWM wells. Figures 4-1 and 4-2 have been revised to reflect the well redesign.

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	Monitoring Well KAFB-10624			
6	**Section 4.0, Scope of Activities, page 4-2, lines 1 through 16**		**Permittee Statement:** "KAFB-106250 is proposed to be installed in the parking lot of the Air National Guard (ANG) adjacent to the existing well KAFB-106046. This location will help to bound both the EDB [ethylene dibromide] and benzene plumes in this area...KAFB-106251 is also proposed for installation on ANG property, adjacent to the boundary with the BFF [Bulk Fuels Facility]... However, water table wells are needed closer to the source area to more accurately delineate the EDB and benzene plumes in this area." **NMED Comment:** According to Figures 2-1, Proposed Monitoring Well Locations and Q2 [second quarter] 2019 EDB Plume Map, and Figure 2-2, Proposed Monitoring Well Locations and Q2 2019 Benzene Plume Map, wells KAFB-106245 and KAFB-106247 do not have submerged well screens and neither EDB nor benzene were detected in the second quarter of 2019 (Q2 2019). These wells provide delineation of the plumes to the east and east- southeast of the source area; therefore, proposed wells KAFB-106250 and KAFB-106251 are good candidates to be moved to characterize the source area migration pathway.	**Revised as requested** - Well KAFB-106S10/KAFB-SV03, has been added to characterize the source area migration pathway. While the two wells cited do put eastern/ southeastern bounds on the contaminant plumes, the proposed wells will further constrain the eastern boundaries of the plumes as well as aiding in identification of any shifts in groundwater flow gradient and eastward expansion of the plumes due to reduced pumping from drinking water wells to the north and the resulting uneven rise in the water table across the study area.
7	**Section 5.0, Scope of Activities, page 4-1**		**NMED Comment:** Please revise Section 5.0 of the Work Plan along with corresponding Figures and Tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 5.0 revisions below. The Permittee must submit the revised Section 5.0 and corresponding Figures and Tables as replacement pages.	**Revised as requested** – Section 5, as well as corresponding tables and figures, have been revised to reflect the added source area data gap well.
8	**Section 5.0, Scope of Activities, page 4-1**		**NMED Comment:** The Permittee must incorporate/ reference the relevant scopes of work from the *Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1*, dated December 2017, and approved with conditions by NMED on February 23, 2018 (VZ Work Plan), including, but not limited to, the following:	**Revised as requested** - Section 5 has been amended to include the drilling, coring, sampling and geophysical logging of the added source area data gap well. Reference has been made

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			a) Drilling Approach and Methodology as outlined in Section 3.1.1.1, page 3-2 of the VZ Work Plan: " borings can be cored continuously from ground surface to total depth, these borings will be over-reamed via air rotary casing hammer (ARCH) technique to the nominal 10-inch diameter OR borings can be accomplished using a combination of ARCH drilling to the designated coring depth, followed by sonic drilling [or other continuous core methodology] to obtain undisturbed cores from the designated coring intervals. Upon achieving the top of the designated coring interval depth, the ARCH rig will be moved off each location while leaving the casing downhole, and the sonic [or other continuous core] rigs will be positioned at the cased holes to core the prescribed designated coring intervals and then subsequently reamed with a sufficient size bit with the ARCH drilling rig to provide a large enough borehole for well construction.” b) Core temperatures must be monitored as outlined on page 3-2 in Section 3.1.1.1, page 3-2 of the VZ Work Plan: "Heating during continuous core collection can impact contaminant, geochemical and microbial properties and adversely affect sample representativeness. In addition to advancing the borehole to the designated coring depth with the ARCH rig, to minimize the heating potential, heating of the sonic drilling core barrels in the unsaturated zone can be controlled by any one or combination of the following: i. Advancing shorter sampling runs (5-10 feet versus 20 feet) ii. Allowing the core barrel to cool (or pre-cooling the core barrel) before tripping back into the borehole iii. Changing the vibration level and rotation speed iv. Injecting small quantities of potable water between the override casing and the core barrel without compromising sample integrity as described in A5TM International D6914/D6914M-16.	to the *Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1*, dated December 2017, and approved with conditions by NMED on February 23, 2018 (VZ Work Plan). Lithologic logging, PID field screening and temperature field screening methods for the targeted continuous coring interval have been taken from the approved VZ Work Plan and have been included in this work plan as requested by NMED. Section 5 has not been revised in accordance with part d of this comment. As discussed in the meeting of August 7, 2020, only analysis of TPH DRO/GRO will be performed from soil core samples.

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			v. Temperature inside the core will be monitored when returned to the surface to vi. ensure that heating of the core barrel is not impacting sample selection or integrity. Background soil vapor temperatures in the vadose zone have historically averaged from 20 to 22 degrees Celsius (0 C). Average groundwater temperatures at the site are 19°C. Any core heating over 20°C will require mitigation steps as outlined above. If water is injected, the bottom few inches of the core intervals that are possibly in contact with water accumulating in the bottom of borehole will be discarded prior to collection of samples. Sonic core barrels in the saturated zone are naturally cooled by the presence of formation water; however, similar steps will be implemented as described above to ensure sample representativeness." c) Field Screening for hydrocarbons must be conducted as outlined in Section 3.1.1.3, page 3-3 of the VZ WP, with depths modified as follows: When advancing the borehole to the designated coring interval with ARCH, all cuttings must be logged and PID measurements collected at a minimum of every 10 feet as described in Section 3.2.10 of the VZ WP. Within the designated coring interval, PID readings must be collected every 5 ft. Additional measurements will be collected if qualitative data (e.g., staining, odor, etc.) indicate possible LNAPL. All PID readings shall be recorded on borehole logs d) Laboratory Analyses for Selected Core Samples as outlined in Section 3.1.1.4, page 3-4 of the VZ WP, and modified as follows: Samples for laboratory analyses shall be collected every 10 ft, additional samples shall be selected based on elevated PID measurements (augmented by lithologic and qualitative data) and sampled for TPH GRO/DRO Extended by EPA Method 8015	

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			(modified) from 230 ft bgs to the total depth of the boring(s), to obtain a consistent detailed vertical profile of the migration pathway.	
9	**Section 5.1.2 Drilling of Groundwater Monitoring Wells, page 5-2, line 2**		**Permittee Statement:** "All five new monitoring nested wells will be installed via air rotary casing hammer technology with casing advancement." **NMED Comment:** The two designated boreholes to be used for the investigation of the source area migration pathway must be continuously cored from 230 ft bgs to total depth. This will provide undisturbed cores for more accurate lithologic logging, field screening, and soil sampling. This can be accomplished using a combination of ARCH drilling to the designated coring depth, followed by sonic or other continuous core drilling method to obtain undisturbed cores from the designated coring intervals.	**Revised as requested** – Section 5 has been amended to include the drilling, coring, sampling, and geophysical logging of the added source area data gap well, per specification included in the *Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1*, dated December 2017, and approved with conditions by NMED on February 23, 2018 (VZ Work Plan).
10	**Section 5.1.2.2 Photoionization Detector [PID] and Headspace Screening, page 5-2, line 32**		**Permittee Statement:** "PIDs will be used for breathing zone monitoring during drilling and sampling activities, as well as for field screening of hydrocarbons in soil cuttings during drilling. This instrument monitors volatile organic compounds using a PID with a 9.8- electronvolt (eV), 10.6-eV, or 11.7-eV UV lamp." **NMED Comment:** The Permittee must use either a 9.5 eV or 9.8 eV UV lamp for field screening samples to avoid fouling of the lamp due to dust, moisture, or high concentrations of petroleum vapors. If evidence of lamp fouling is observed during use of a PID with a 9.8 eV lamp, the Permittee must switch to a 9.5 eV UV lamp to obtain the most accurate PID readings possible. The Permittee must have an additional PID with the lower lamp strength readily available. Reliable PID readings will result in	**Revised as requested** – Section 5.1.2.2 (Now Section 5.3.4), has been revised to specify the use of a 9.8-eV ultraviolet (UV) lamp. 9.5 eV lamps are not as commonly commercially available from equipment suppliers. However, photoionization detector (PID) sensors will respond to all gases that have ionization potentials equal to or less than the eV output of their lamps.

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			a consistent detailed vertical profile of the migration pathway. Failure to obtain reliable readings in the potential migration pathway may result in having to drill another boring to obtain accurate readings.	
11	**Section 5.1.2.2 Photoionization Detector and Headspace Screening, page 5-2, line 37**		**Permittee Statement:** "Record PID measurements at a minimum of every 25 ft of drill cuttings down to 450-ft depth, and then every 10 ft of drill cuttings to total depth following the process below..." **NMED Comment:** For boreholes that will be continuously cored, the Permittee must record PID sample measurement, at a minimum, every 10 ft from ground surface to the start of coring and every 5 ft from the start of coring to the total depth of the borehole to obtain a detailed vertical profile of the migration pathway.	**Revised as requested** – Section 5.1.2.2. (now Section 5.3.4) has been revised to specify PID sample measurement be recorded, at a minimum, every 10 ft from ground surface to the start of coring, and every 5 ft from core point to TD in continuously cored wellbores.
12	**Section 5.1.3 Construction of Groundwater Monitoring Wells, page 5-3, line 21**		All wells must be constructed with casing of sufficient diameter to be sampled via active sampling techniques (e.g. 4" ID to accommodate pumps). Tied to Comment #5.	**Revised as requested -** All planned GWM wells have been redesigned to accommodate active sampling techniques, including increasing inside diameter to 4 inches.
13	**Geophysical logging of source area boreholes**		**NMED Comment:** The Permittee must add a section to the Work Plan proposing to geophysically log all source area migration pathway investigation bore holes with a dual induction geophysical logging tool. The Permittee must specify approximate depths of interrogation for the tool they propose to use. The tool must be calibrated and operated according to American Society for Testing and Materials (ASTM) standards for geophysical logging and the operation manual for the specific model of logging tool. In the report summarizing the results of the investigation the Permittee must provide shop calibration and daily field calibration data. An electronic copy of raw and processed data must be provided in Excel table format. A visual presentation of the log curve must be presented on a single page in a continuous format rather than as several separate pages. The geophysical log(s) for each well must be displayed with the lithologic log for comparison purposes and a discussion of the results must be included in the main body of the	**Revised as requested -** Section 5.3.3.2, has been amended to include dual induction geophysical logging of the relocated source area data gap well. Geophysical electronic data will be included with the report as requested.

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			investigation report. Wells that are to be or will be geophysically logged must be designed with PVC centralizers rather than steel centralizers.	
14	**Section 5.1.3.2 Well Development, page 5-4**		**NMED Comment:** The Permittee must measure and record the parameters for pH, temperature, conductivity, and turbidity, as shown on the field form presented in Appendix B, Field Forms. The Permittee must collect groundwater samples within 10 days after well development in accordance with Section 6.5.17.3 of the Permit. Samples must be analyzed in accordance with Table 6-1, Groundwater Monitoring Requirements for Data Gap Wells.	**Revised as requested** – Section 5.1.3.2 (now Section 5.4.4) specifies that pH, temperature, turbidity, and specific conductance will be monitored and recorded on the Well Development Record Form. This section, as well as Section 6, Monitoring and Sampling, have been amended to specify that groundwater sampling will occur within 10 days after well development, in accordance with Section 6.5.17.3 of the RCRA permit. Sampling will continue thereafter on a quarterly basis.
15	**Section 5.1.3.2 Well Development, page 5-4, line 34**		**Permittee Statement:** "The new wells (KAFB-106248 through KAFB-106252) were designed for passive sampling (Section 6), and the 0.010-inch slot size should minimize formation fines in these wells." **NMED Comment:** The new wells must be designed for active sampling techniques. The new wells must be sampled using active sampling (e.g., low-flow sampling) for a minimum of eight consecutive quarters to establish baseline concentrations in order to establish the precision criteria for passive sampling methods for the newly installed wells. While the approved work plans for data gap well installation and vadose zone coring included passive sampling of newly installed wells, the NMED administrative record does not contain documentation that the use of passive sampling south of Ridgecrest Drive, particularly in areas of	**Revised as requested** – Section 5.4 has been revised to reflect that all planned GWM wells have been redesigned to accommodate active sampling techniques. Additionally, Section 6, Monitoring and Sampling, has been amended to specify an active sampling program on all newly installed wells.

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			elevated contaminant concentrations, has been evaluated or approved by NMED.	
16	**Section 6.0 Monitoring and Sampling, page 6-1**		**NMED Comment:** The Permittee must revise Section 6.0 of the Work Plan along with corresponding figures and tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 6.0 revisions below. The Permittee must submit the revised Section 6.0 and corresponding figures and tables as replacement pages.	**Revised as requested** – Section 6, as well as associated tables and figures, have been revised to reflect additional monitoring and sampling requirements associated with the relocated source area data gap well.
17	**Section 6.0 Monitoring and Sampling, page 6-1, line 11**		**Permittee Statement:** "All newly installed wells will be sampled for four consecutive quarters to establish baseline concentrations for the parameters listed in Table 6-1." **NMED Comment:** The Permittee must collect groundwater samples from all newly installed wells within 10 days after well development in accordance with Section 6.5.17.3 of the Permit, at the next quarterly sampling event, and quarterly thereafter for eight consecutive quarters via active sampling methods (e.g., low-flow) to establish baseline concentrations. These data will be used to establish precision criteria for passive sampling methods for the newly installed wells. Groundwater samples must be analyzed for analytes presented in Table 6-1, Groundwater Monitoring Sampling Requirements for Data Gap Wells, of the Work Plan.	**Revised as requested** – Section 6 has been revised to reflect that all newly installed wells will be sampled within 10 days of well development and for 8 consecutive quarters thereafter to establish baseline concentrations before being categorized based on analytical results.
18	**Section 6.0 Monitoring and Sampling, page 6-1, line 35**		**Permittee Statement:** "Groundwater sampling will be performed via passive sampling techniques for all new GWM wells covered in this Work Plan, barring any environmental factors that would preclude the ability to sample with this technology (e.g., significant and continuous LNAPL thickness in the well)." **NMED Comment:** Given the concerns stated above, the Permittee must not use passive sampling in areas with elevated petroleum hydrocarbon contamination (i.e., in the vicinity of the source area).	**Revised as requested** – Section 6 has been revised to indicate that all groundwater sampling on newly installed wells will be performed via active sampling techniques.

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Item	**Section**	**Page**	**Comment**	**Response**
19	**Section 6.2 Preparation for Groundwater Well Sampling, page 6-3, line 2**		**Permittee Statement:** "All wells covered in this Work Plan will be sampled via passive sampling technology and, therefore, well purging will not be required in association with sampling" **NMED Comment:** The Permittee must add active sampling (e.g., low-flow) to relevant portions of Section 6.0. See the preceding comments regarding passive sampling.	**Revised as requested** – Section 6 has been revised to indicate that all groundwater sampling on newly installed wells will be performed via active sampling techniques.
20	**Section 6.2.1 Collection of Groundwater Samples from Monitoring Wells Using Passive Sampling Techniques, page 6-3, line 19**		**Permittee Statement:** "The procedures below will be followed for passive sampling." **NMED Comment:** As stated previously, active sampling techniques are required. Please include a section describing the procedures for active sampling in the modified Section 6.0 replacement pages and remove the description for passive sampling.	**Revised as requested** – Section 6 has been revised to indicate that all groundwater sampling on newly installed wells will be performed via active sampling techniques.
21	**Section 6.3 Analytical Requirements and Quality Control, page 6-4, line 31**		**NMED Comment:** The Permittee must revise Section 6.3 of the Work Plan along with the relevant figures and tables to include the additional sampling required for the modified scopes of work in the modified Section 6.0 replacement pages.	**Revised as requested** – Section 6.3 (now 6.5), along with relevant figures and tables, has been revised to include additional sampling required for the modified scope of work.
22	**Section 6.3 Analytical Requirements and Quality Control, page 6-4, line 31**		**NMED Comment:** The Permittee must include a data validation section of the Report which describes the data validation process outlined in this Section 6.3 of the Work Plan. Data validation shall be conducted in accordance with Permit Section 6.5.18.	**Revised as requested** – A data validation section has been added (Section 6.6.1)
23	**Section 6.5.2 Hazardous Water Investigation-Derived Waste, page 6-6, line 30**		**Permittee Statement:** "No hazardous/potentially hazardous [investigation-derived waste] IDW is anticipated to be generated from the activities outlined in this Work Plan." **NMED Comment:** This statement must be revised in the modified Section 6.0 replacement pages. The modified scope of work requires	**Revised as requested** – Section 6.7 has been amended to reflect the revised scope of work and the potential for generation of hazardous IDW, particularly at

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			drilling and well development activities in the source area which may generate potentially hazardous IDW. Provide a description of the proposed management of hazardous IDW. Alternately, propose to dispose of purge/ development water in the on-site groundwater treatment system that treats groundwater removed from recovery wells located north of Ridgecrest Drive.	the source area data gap well site.
24	**Section 7 Project Schedule, page 7-1, line 1**		**NMED Comment:** The Permittee must revise Section 7.0 of the Work Plan along with corresponding figures and tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 7.0 revisions below. The Permittee must submit the revised Section 7.0 section as replacement pages.	**Revised as requested** – Section 7 has been revised to incorporate the modifications required by NMED to relocate the source area data gap well. Due to the added complexity of the work- the construction completion period has been extended from 60 to 120 days.
25	**Table 6-1, Groundwater Monitoring Sampling Requirements for Data Gap Wells**		**NMED Comment:** Baseline sampling of newly installed wells must include quarterly sampling for GRO, DRO, and volatile organic compounds. The sampling frequency and analytical suite will be re-evaluated after the initial post-development sampling plus eight quarters of baseline sampling.	**Revised as requested** – Table 6-1 has been revised to include quarterly baseline sampling for GRO, DRO and VOCs for 8 quarters following well development.
26	**Table 6-3, Summary of Investigation-Derived Waste Sampling**		**NMED Comment:** Under the portion of the table titled "Water Investigation-Derived Waste from Drilling", the Permittee indicates that post development water will be characterized by a sample taken from "the bailer at end of development". The Permittee is directed to take a composite sample of water from all containers of development water from each well. The contaminant concentrations in the development water may be higher or lower at the start of well development than at the end of development. A composite sample will provide a more accurate representation of contaminant concentrations in the IDW.	**Revised as requested** – IDW sampling has been added to Table 6-2. IDW sampling specifications have been revised to indicate that post-development samples will be a composite of water from all containers of development water from each well.
27	**Appendix B, Field Forms**		**NMED Comment:** The Borehole/Well Construction Log must include well details for all wells to be installed in a single borehole. The example field form shows only one well while the scope of work proposes two	**Revised as requested** – Well construction details for each well will be documented on the

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			wells per borehole. The field form must include well details for installing two wells in each borehole.	construction diagram included in Appendix B. The sample boring log included in Appendix B has been amended to include a column describing “other notes” where notes about depth to water, and documentation of drilling activities can be included.
28	**Appendix C, Eurofins Lancaster Laboratories Environmental [Limited Liability Company] LLC Method Reporting Limits and Screening Criteria**		**NMED Comment:** The Permittee must add a table which presents relevant Method Reporting Limits for soil analyses for the modified scope of work outlined in this Approval with Modifications letter.	**Revised as requested -** A table has been added to Appendix C that includes method reporting limits for soil analyses
29	**Appendix C, Eurofins Lancaster Laboratories Environmental LLC Method Reporting Limits and Screening Criteria**		**NMED Comment:** The Permittee must ensure that the limit of quantitation (LOQ) is less than the project screening levels. If this cannot be achieved by the laboratory due to the dilution of samples or other reason, the new LOQ, and all data qualifiers must be reported. Data tables in the investigation report must present the final limit of detection (LOD), LOQ, sample results, and all laboratory data qualifiers for the analytical results. No revision to Work Plan required.	**Revised as requested** – As illustrated in Appendix C, the achievable LOQ for all additional analyses are less than the project screening levels. However, it is important to note that in areas of high contaminant concentrations, such as the source area, sample dilution may be unavoidable in order to analyze required samples. Sample dilution will raise the detection limits. It is likely that this will occur in the process of analyzing samples

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				from the source area data gap well(s). If sample dilution increases the detection limits of any chemical so that it is higher than the screening limit, this will be discussed in detail in the report.
30	**Section 2.1, Background Information, page 2-1, line 5**		**NMED Comment:** The Permittee must include a more complete site history in the investigation report. The background information/ site history must include a comprehensive summary of the subsurface field investigations that have contributed to the understanding of the site conceptual model and hydrogeology. The Report must also include a more detailed discussion of current water use and the influence of water supply wells on the hydrology and dissolved phase contaminant migration at the site. Discuss the impact these factors may have on projected future use of the water supply wells.	**Revised as requested** – Section 2.1 has been revised to include additional background information on the site, project history, and local hydrogeology.
31	**Section 2, Background Information, page 2-1, line 34**		**Permittee Statement:** "Appendix A-1...illustrates groundwater elevations from 2011 through 2018 along two transects through the [ethylene dibromide] EDB plume. These time series graphs illustrate that the most pronounced increases in groundwater elevation are in the northern area of the site." **NMED Comment:** Appendix A-1, Water Level Hydrographs, does not clearly illustrate this. It is difficult to ascertain trends with the bar graphs presented. Significant differences between the southern and northern portions of the site are not readily apparent. In future documents the Permittee must present data trends in an easy to interpret format. In addition, on Figure L-2-1, Groundwater Elevation Cross Section, three drinking water supply wells are shown on the figure but are not identified in the legend. Other figures had to be consulted to identify these wells. In future documents the Permittee must include all pertinent symbols in the legends of figures. No revision is necessary.	**Comment noted.**

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Item	**Section**	**Page**	**Comment**	**Response**
32	**Section 2, Background Information, page 2-1, line 45 and page 2-2, line 1**		**Permittee Statement:** "Appendix A-1 includes compiled potentiometric surface maps, EDB plume maps, and benzene plume maps at the 4,857 reference elevation interval (REI)..." **NMED Comment:** In the investigation report the Permittee must add a brief explanation of REl's at the site including the depth intervals they represent in both words and numbers (e.g., "the 4,857 REI represents wells screened in the shallow zone at depths ranging from approximately X ft bgs to X ft bgs.") and include a figure/ table for visual clarification of this term.	**Revised as requested** – Section 2 has been amended to include a more detailed explanation of REIs.
33	**Section 2.2, Initial Data Gap Groundwater Wells and Vadose Zone Coring Activities, page 2-2, line 38**		**Permittee Statement:** "The Source Zone Characterization Report...describes the complete suite of analyses performed to characterize LNAPL in the soil cores. The report also describes the conclusions of the LNAPL analyses." **NMED Comment:** The Source Zone Characterization Report is currently in review by NMED and has not yet been approved. In future documents the Permittee must refrain from referencing documents that have not been approved by NMED, as it could be misleading to stakeholders reviewing documents. If referencing such documents is necessary, the Permittee must add a statement stating the official status of the referenced document (e.g., "currently in review by NMED".)	**Revised as requested** – The reference to the Source Zone Characterization Report has been amended to specify that it is currently under revision, and has not yet been approved by NMED.
34	**Section 3.0, Site Conditions, page 3-1, line 14**		**Permittee Statement:** "The groundwater elevation graphs shown in Appendix A-1, illustrate that the operation of the Ridgecrest wellfield has a significant influence on the groundwater gradient at SWMUs ST-106/SS-111. Measurements from 2010 to 2015 indicated a north-northeast-oriented hydraulic gradient toward the Ridgecrest wellfield (Section 7.6.1.2 of KAFB, 2018a). However, with changes in Water Authority and Kirtland AFB pumping practices, the hydraulic gradient no longer has a consistent orientation each quarter. As described in the Q2 2018 report (Section 5.4.4.1 of KAFB, 2018c), the observed rise in groundwater levels across the plume area has occurred at the same time as	**Comment noted.**

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			a continual decrease in groundwater extraction at the Ridgecrest wellfield." **NMED Comment:** Appendix A-1 does not clearly depict this. See Comments 35 and 36.	
35	**Section 3.0, Site Conditions, page 3-1, line 41**		**Permittee Statement:** "Currently, these exceedances of EDB and benzene cannot be accurately bounded because GWM wells with non-detect concentrations of EDB and benzene to the southeast have submerged well screens." **NMED Comment:** According to Figures 2-1, Proposed Monitoring Well Locations and Q2 2019 EDB Plume Map, and Figure 2-2, Proposed Monitoring Well Locations and Q2 2019 Benzene Plume Map, the southeast boundaries of both the benzene and EDB plumes are bounded by groundwater monitoring wells KAFB-106245 and KAFB-106247, neither of which have submerged well screens. According to these figures it appears that the southern and southwestern boundaries of these plumes are not bounded by any wells which do not have submerged well screens. Proposed groundwater monitoring well KAFB-106252 will close the southern data gap, however, additional wells may need to be installed in the future to delineate the southwestern edge of these plumes. No response required.	**Comment noted.**
36	**Section 6.4 Reporting, page 6-5, line 25**		**Permittee Statement:** "Information and data collected during any quarter from drilling, installation, sampling, and gauging activities performed on the newly added monitoring wells will be submitted in SWMUs ST-106/SS-111 Quarterly Monitoring Reports." **NMED Comment:** In accordance with Section 6.2.2.1.2, Site Investigations, Investigation Reports, and Section 6.2.4.3, Reporting Requirements, Investigation Reports of the KAFB Resource Conservation and Recovery Act {RCRA) Permit the information and data collected from all investigation activities related to this Work Plan must be submitted to NMED as a separate stand-alone Investigation Report.	**Revised as requested** – Wording has been added to Section 6.4 (now Section 6.6.2) to specify that information and data collected from all investigation activities related to this Work Plan will be submitted as a stand-alone report to NMED per the Kirtland AFB RCRA permit.

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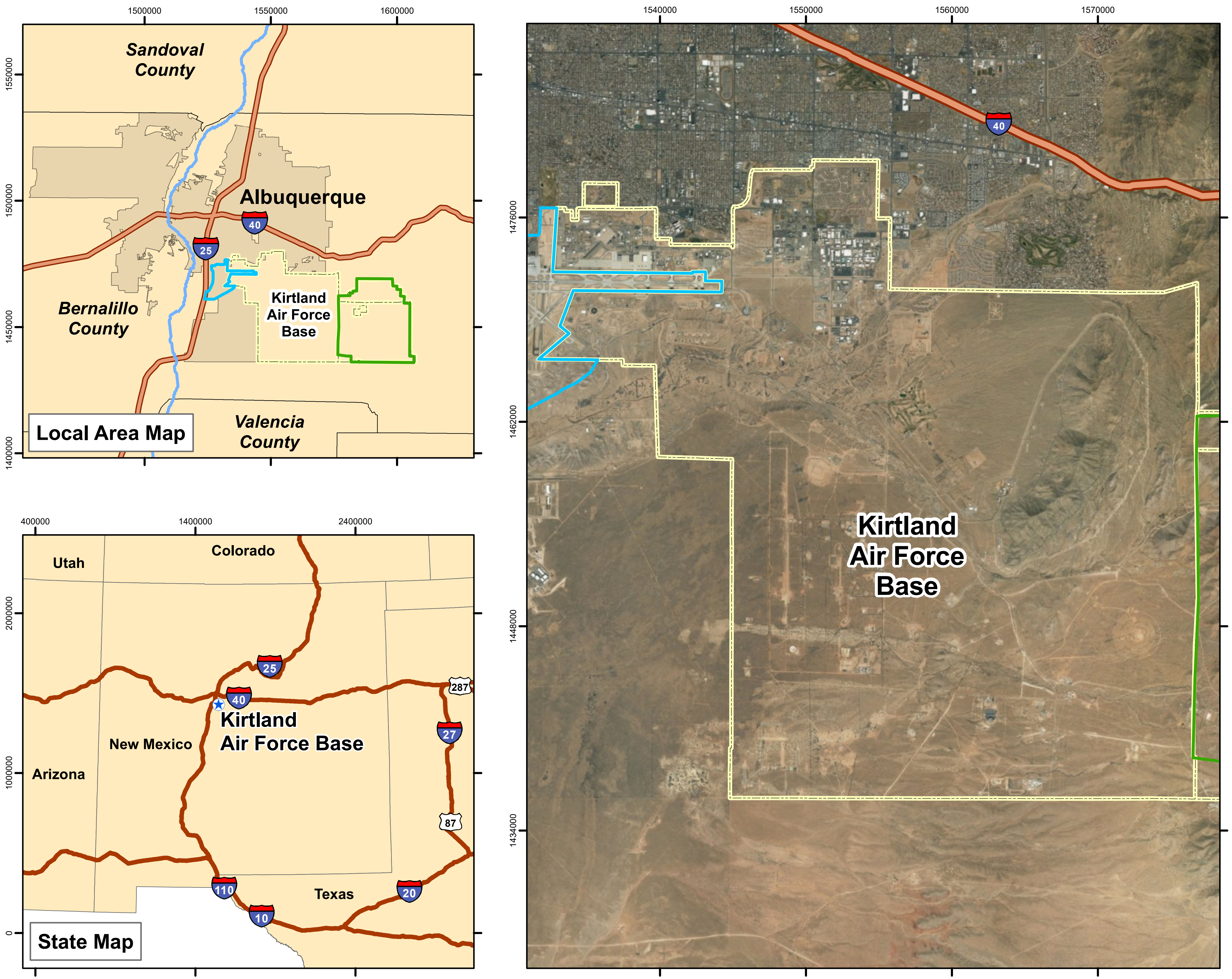
Item	**Section**	**Page**	**Comment**	**Response**
37	**Section 8.0 References, page 8-2, line 1**		**Permittee Statement:** The Permittee cites, "KAFB, 2019c. Source Zone Characterization Report Bulk Fuels Facility, SWMUs ST-106/55-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR- 12-D-006. November." **NMED Comment:** The Permittee is reminded not to include references for documents that have not been approved by NMED.	**Revised as requested** – The reference to the Source Zone Characterization Report has been amended to specify that it is currently under revision and has not yet been approved by NMED.
38	**Appendix A-2 HISTORICAL GROUNDWATER PLUME MAPS**		**NMED Comment:** The Permittee is reminded that all appendices must have properly numbered pages, tables, and figures. For example, the figure numbers presented in Appendix A-2 include five Figure 3-3's, three Figure 3-6's, two Figure 3-7's, three Figure 3-9's, and two Figure 3-lO's. There is no Figure 3-1, Figure 3-2, Figure 3-4, Figure 3-5, or Figure 3-8. In all future submittals all figures, tables, and pages must be renumbered sequentially for the specific appendices they are placed in and include cross-references to corresponding tables and figures in referenced documents.	**Revised as requested** – Figures in Appendix A have been renumbered in sequential order.



Legend

- Installation Boundary
- USAF Withdrawl Area
- ABQ Sunport Boundary
- Rio Grande
- Interstate
- US Highway
- State/County Highway

Revision Date: 10/17/2019

N

0 2,500 5,000 10,000
Feet
1 inch = 7,193 feet

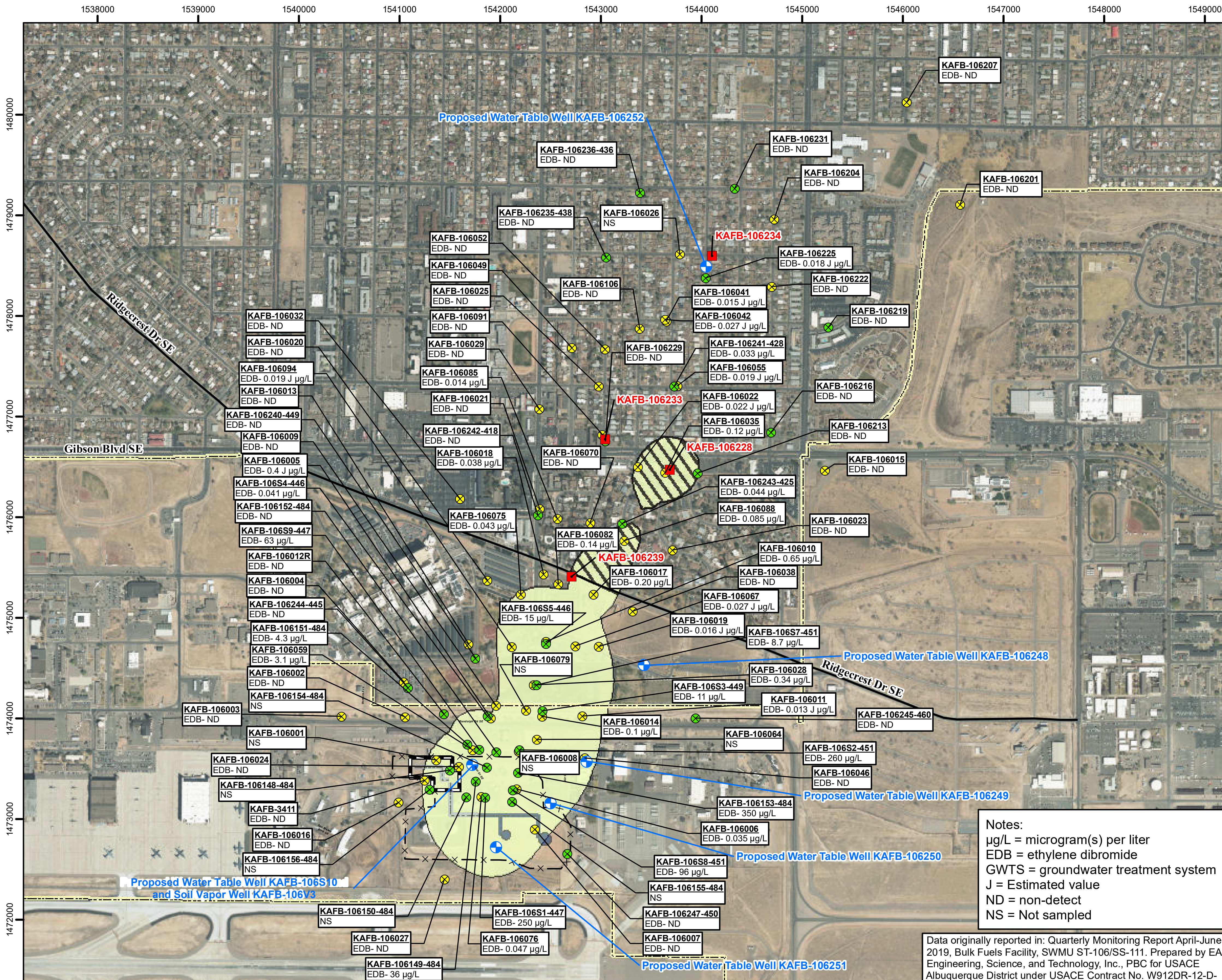
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP MONITORING WELL
INSTALLATION KAFB-106248 to
KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1-1

SITE VICINITY MAP

Document Path: N:\Kirtland\GIS\GIS_Projects\BFF_new_well_plan\Figure 1. Site Location.mxd

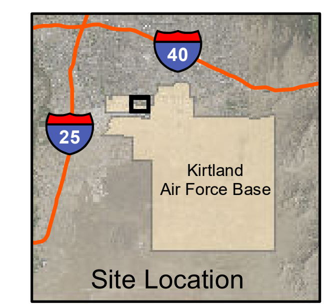


Notes:
µg/L = microgram(s) per liter
EDB = ethylene dibromide
GWTS = groundwater treatment system
J = Estimated value
ND = non-detect
NS = Not sampled

Data originally reported in: Quarterly Monitoring Report April-June 2019, Bulk Fuels Facility, SWMU ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-

Legend

- Proposed Water Table Wells
- Groundwater Monitoring Well (Screen Not Submerged)
- Groundwater Monitoring Well (Screen Submerged)
- Extraction Well
- Ridgecrest Drive
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Former Aboveground Storage Tank
- Kirtland Air Force Base Installation Area
- Bulk Fuels Facility Area
- Source Area
- EDB Plume Q2 2019 (>0.05 µg/L)
- EDB Plume Q2 2019 (>0.05 µg/L) within target capture zone of GWTS



Imagery Source: National Agricultural Imagery Program June 2014

Revision Date: 7/31/2020

N

0 250 500 1,000 1,500 2,000

Feet

1 inch = 1,042 feet

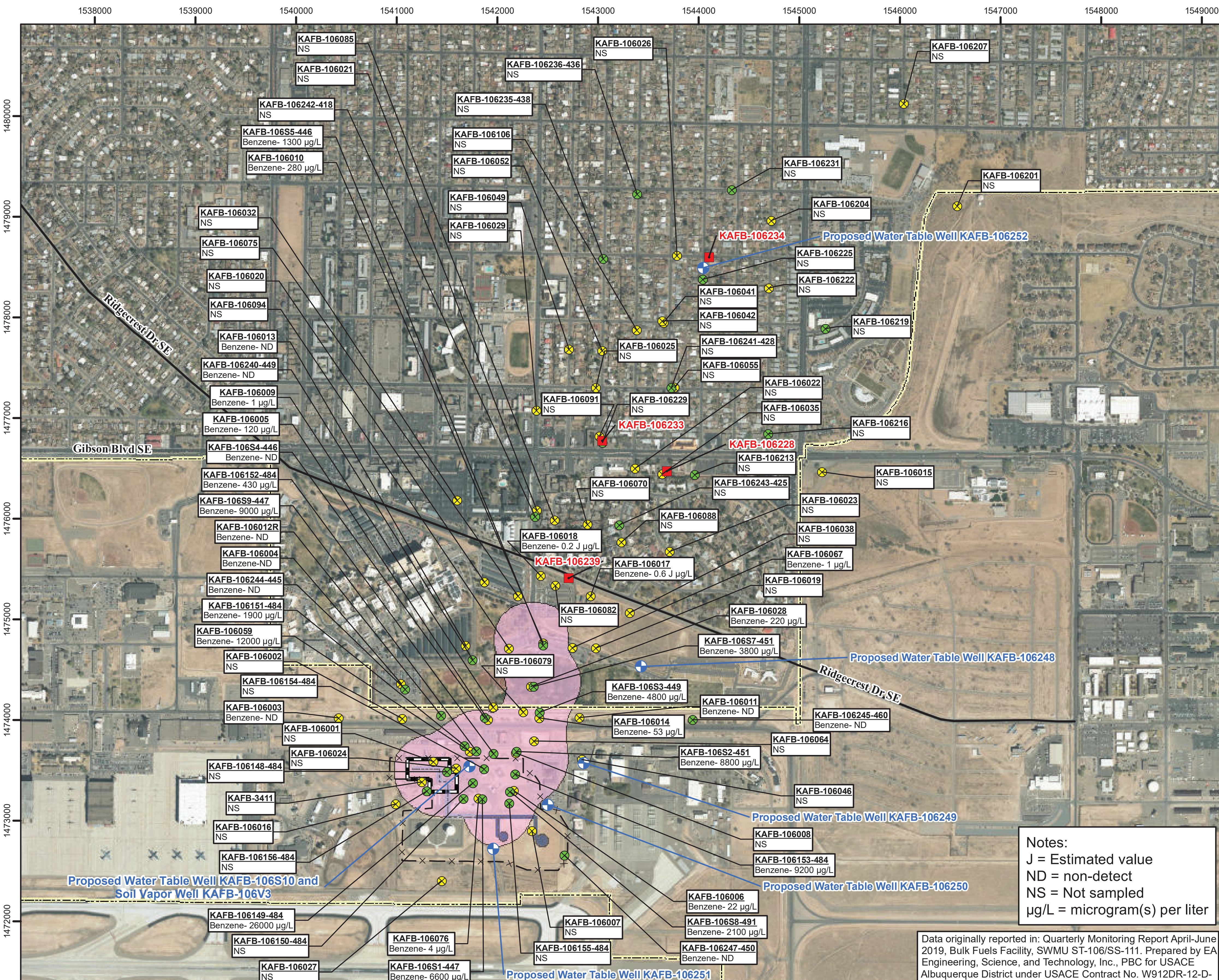
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP MONITORING WELL INSTALLATION KAFB-106248 to KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-1

PROPOSED MONITORING WELL LOCATIONS AND Q2 2019 EDB PLUME MAP

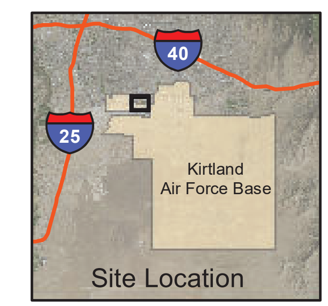
Document Path: N:\Kirtland\GIS\GIS_Projects\BFF_new_well_plan\Figure 2-1. Proposed Wells & Q2 EDB Results2.mxd



Notes:
J = Estimated value
ND = non-detect
NS = Not sampled
µg/L = microgram(s) per liter

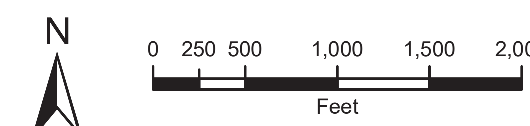
Data originally reported in: Quarterly Monitoring Report April-June 2019, Bulk Fuels Facility, SWMU ST-106/SS-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR-12-D-

Legend
- Proposed Water Table Wells
- Groundwater Monitoring Well (Screen Not Submerged)
- Groundwater Monitoring Well (Screen Submerged)
- Extraction Well
- Ridgecrest Drive
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Former Aboveground Storage Tank
- Kirtland Air Force Base Installation Area
- Bulk Fuels Facility Area
- Source Area
- Benzene Plume Q2 2019 (>5.0 µg/L)



Imagery Source: National Agricultural Imagery Program June 2014

Revision Date: 7/31/2020



1 inch = 1,042 feet

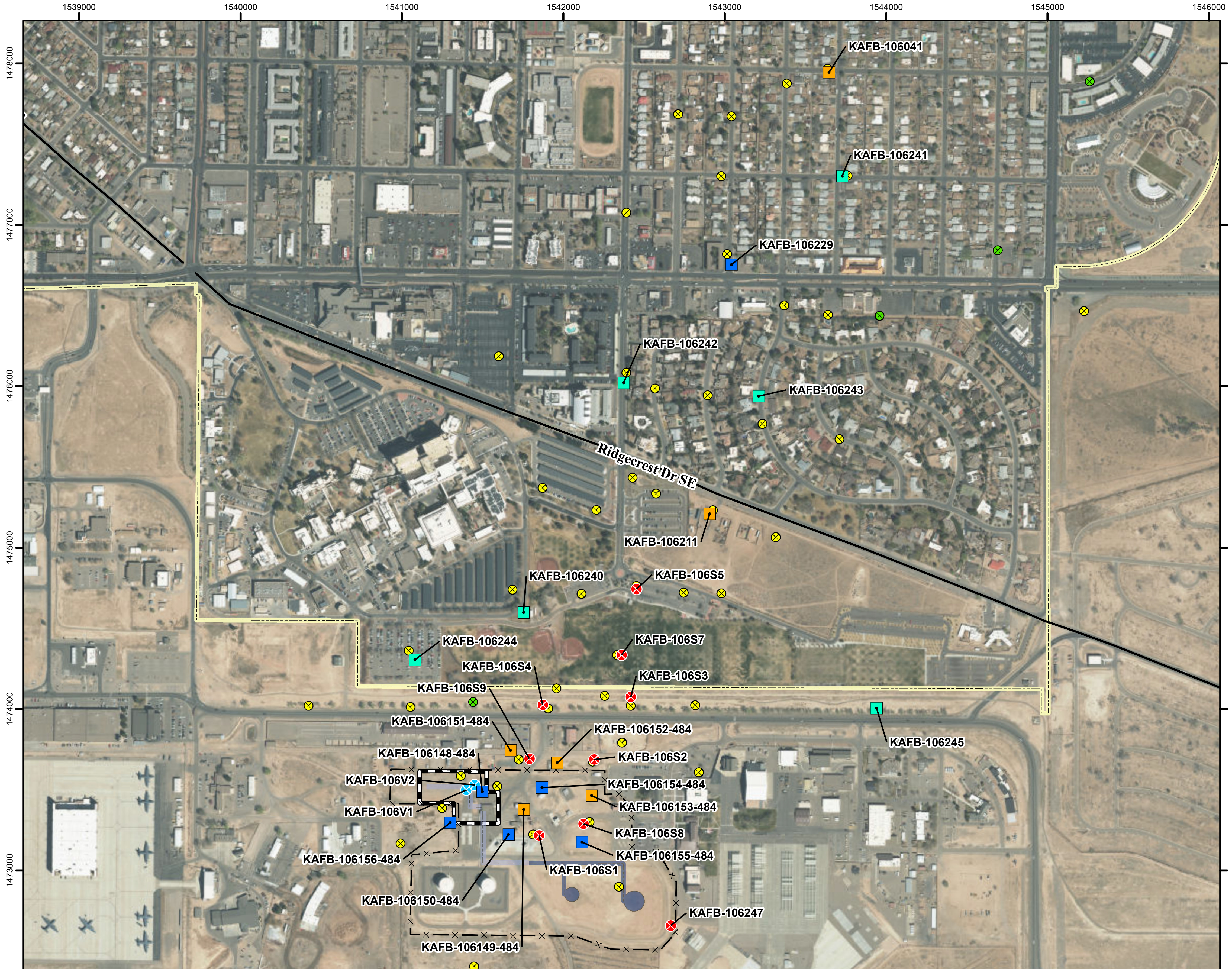
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

WORK PLAN FOR DATA GAP MONITORING WELL INSTALLATION KAFB-106248 to KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-2

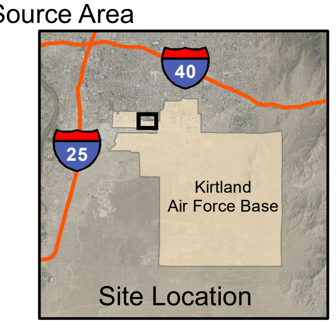
PROPOSED MONITORING WELL LOCATIONS AND Q2 2019 BENZENE PLUME MAP

Document Path: N:\Kirtland\GIS\GIS_Projects\BFF_new_well_plan\Figure 2-2. Proposed Wells & Q2 Benzene Results2.mxd



Legend

- New Monitoring Well in 2018
- Existing Well incorporated for Gauging Only
- Existing Monitoring Well incorporated for Sampling and Gauging
- Coring Locations Completed as SVM Locations
- Coring Locations Completed as GWM Locations
- Groundwater Monitoring Well (Screen Not Submerged)
- Groundwater Monitoring Well (Screen Submerged)
- Ridgecrest Drive
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Former Aboveground Storage Tank
- Kirtland Air Force Base Installation Area
- Bulk Fuels Facility Area
- Source Area



Imagery Source: National Agricultural Imagery Program June 2014

Revision Date: 12/13/2019

N

0 250 500 1,000 1,500

Feet

1 inch = 645 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

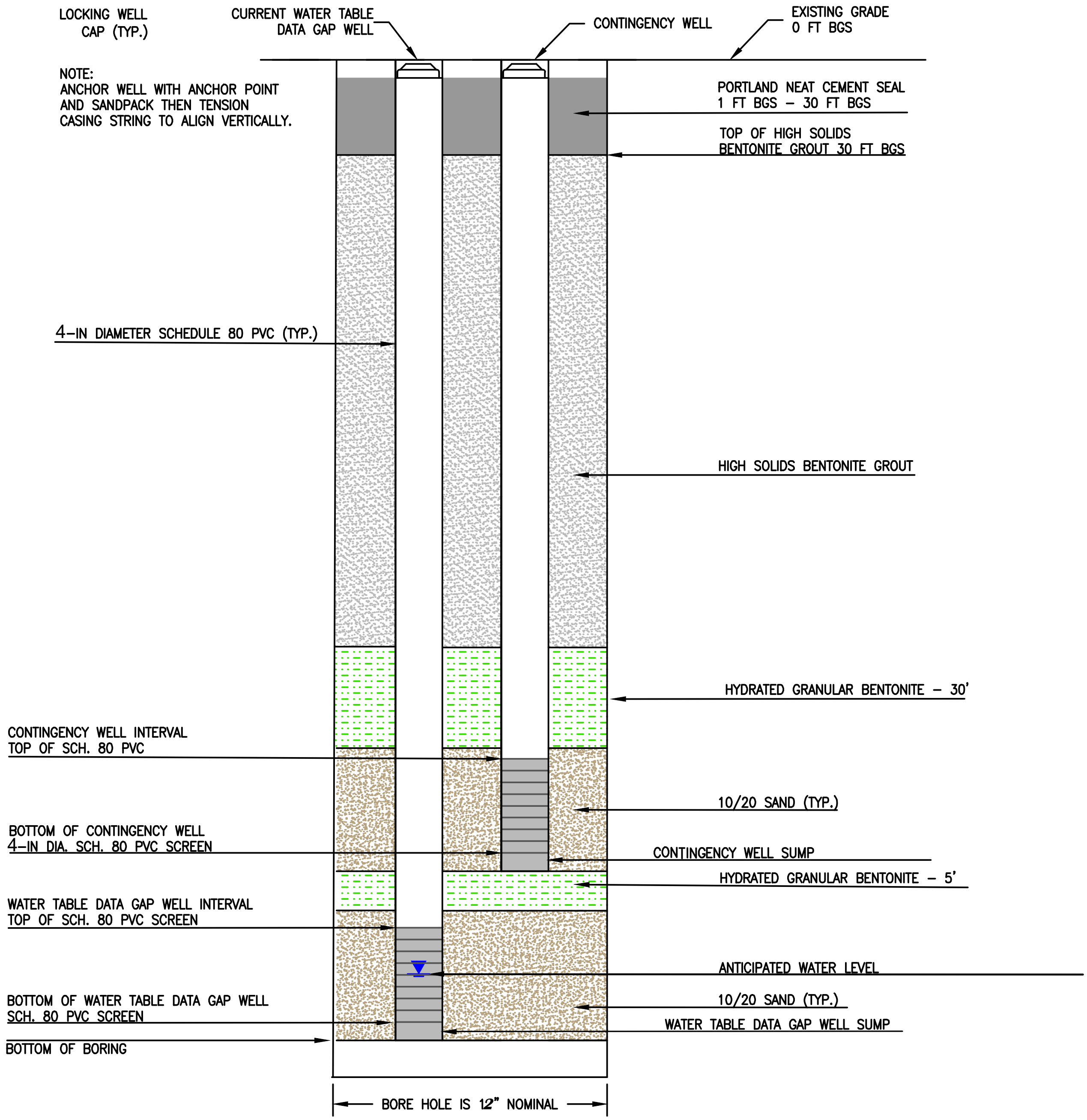
WORK PLAN FOR DATA GAP MONITORING
WELL INSTALLATION KAFB-106248 to
KAFB-106252 and KAFB-106S10
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-3

PREVIOUS DATA GAP
MONITORING WELL LOCATIONS

Document Path: N:\Kirtland\GIS\GIS_Projects\BFF_new_well_plan\Figure 2-3. Previous Data Gap Locations.mxd

Figure 4-1
Proposed Construction Diagram for Groundwater Monitoring Well with Contingency Well



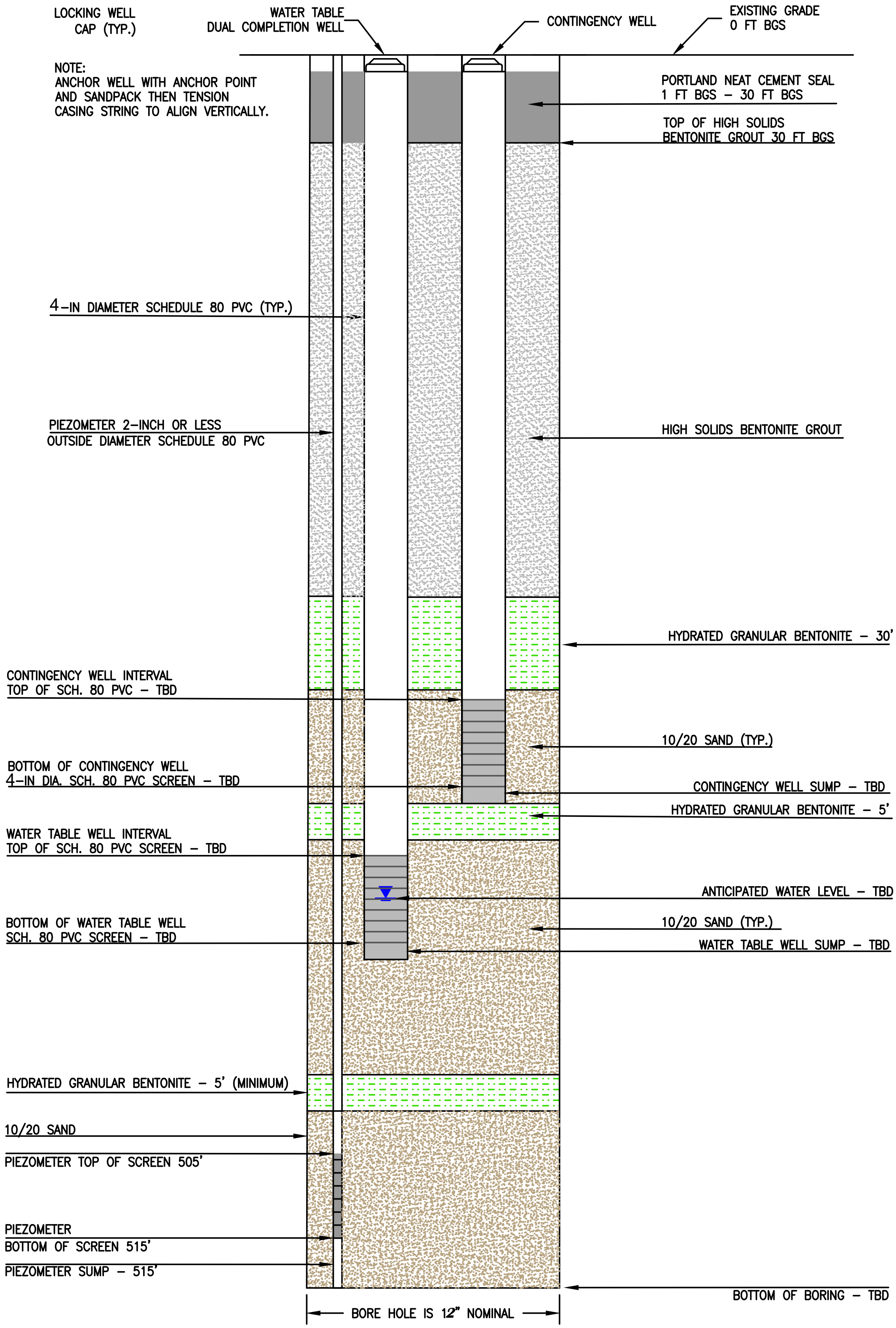
DEPTH INTERVALS MAY BE MODIFIED DURING DRILLING BASED ON OBSERVED CONDITIONS;
WELL SCREENS WILL BE POSITIONED WITH APPROXIMATELY 15' OF WATER COLUMN UPON COMPLETION.

NOT TO SCALE
BGS=BELOW GROUND SURFACE
FT=FEET

KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME:	INSTALLATION END DATE/TIME:
PROJECT NO.:	WELL ID:	GEOLOGIST:	DRILLER:

CAD FILE: Y:\Active Projects\62599DM01 Kirtland BFF_USACE\01_Work Plan\19.0 Data Gap Wells WP\Figures\Natives\Nested Monitoring well_KAFB-106240-245.dwg PLOT DATE/TIME: 12/18/2017 – 4:39pm

FIGURE 4-2
Proposed Construction Diagram for Groundwater
Monitoring Well KAFB-106252



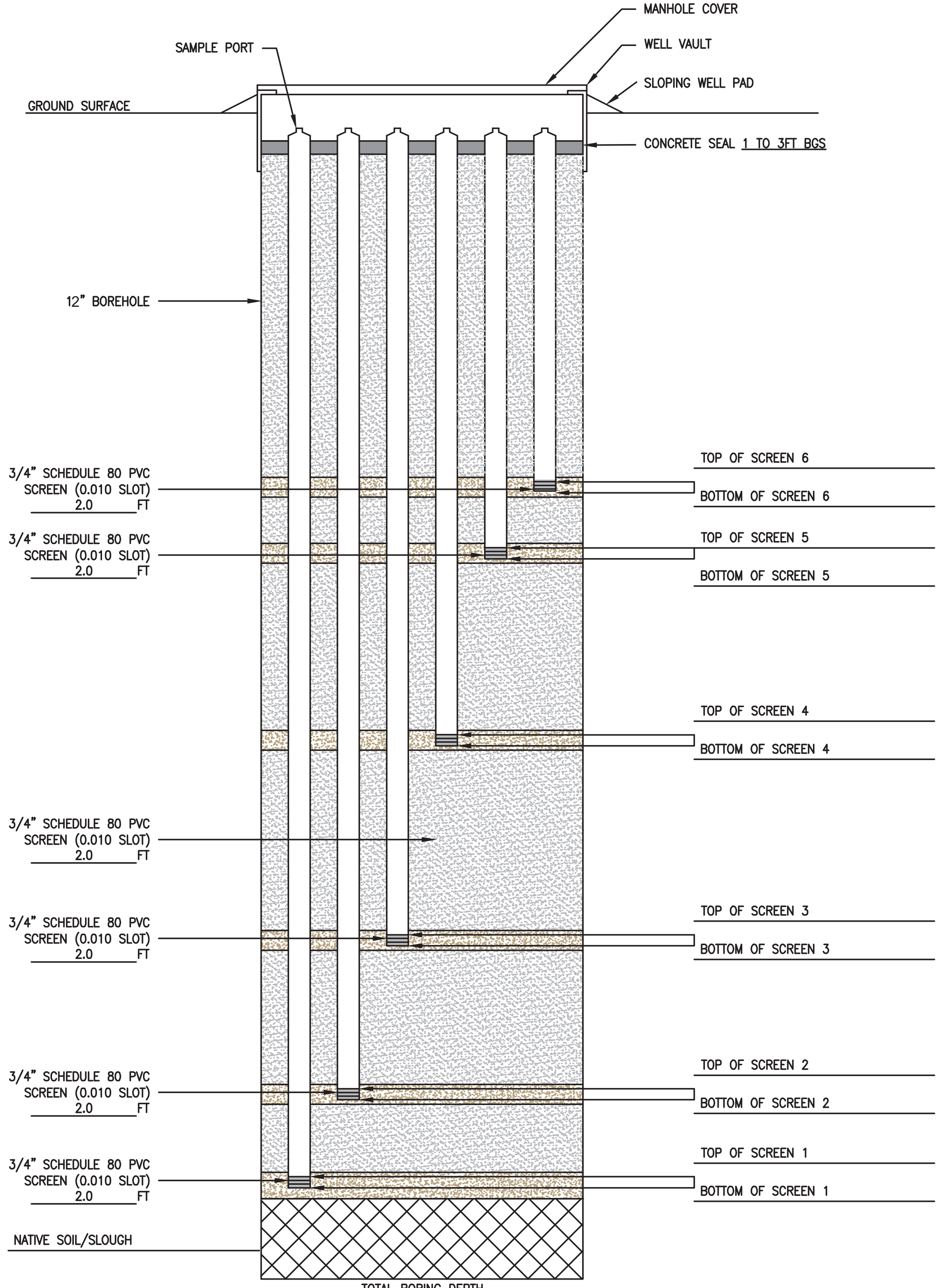
NOTE:
TBD = TO BE DETERMINED
DEPTH INTERVALS MAY BE MODIFIED DURING DRILLING BASED ON OBSERVED CONDITIONS;
WELL SCREENS WILL BE POSITIONED WITH APPROXIMATELY 15' OF WATER COLUMN UPON COMPLETION.

NOT TO SCALE
BGS=BELOW GROUND SURFACE
FT=FEET

KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME:	INSTALLATION END DATE/TIME:
PROJECT NO.:	WELL ID:	GEOLOGIST:	DRILLER:

CAD FILE: Y:\Active Projects\62735DM02 Kirtland Vadose Zone\Sundance data gap work plan\Well Completion Diagram-KAFB-106248.dwg PLOT DATE/TIME: 9/26/2019 – 1:03pm

FIGURE 4-3
Proposed Construction Diagram for
SVM Well KAFB-106V3



(ELEVATION) IS IN ABOVE MEAN SEA LEVEL
ASML = ABOVE MEAN SEA LEVEL
MRP = MEASUREMENT REFERENCE POINT
ALL WELLS HAVE A 0.4 FT SUMP BELOW BOTTOM OF SCREEN

NOT TO SCALE
BGS = BELOW GROUND SURFACE
FT = FEET

KIRTLAND AIR FORCE BASE

Well ID: KAFB-106V3

CAD FILE: P:\Active Projects\62735DM02 Kirtland Vadose Zone\01.1_VZ Coring Work Plan_R0\04_VZ WP Appendices_R0\VZ WP App B_R0- Well Construction\CADD\Well Completion Diagram - KAFB-106V1.dwg PLOT DATE/TIME: 4/12/2019 - 12:38pm

Figure 5-1 Decision Tree for Drilling and Coring in Source Area

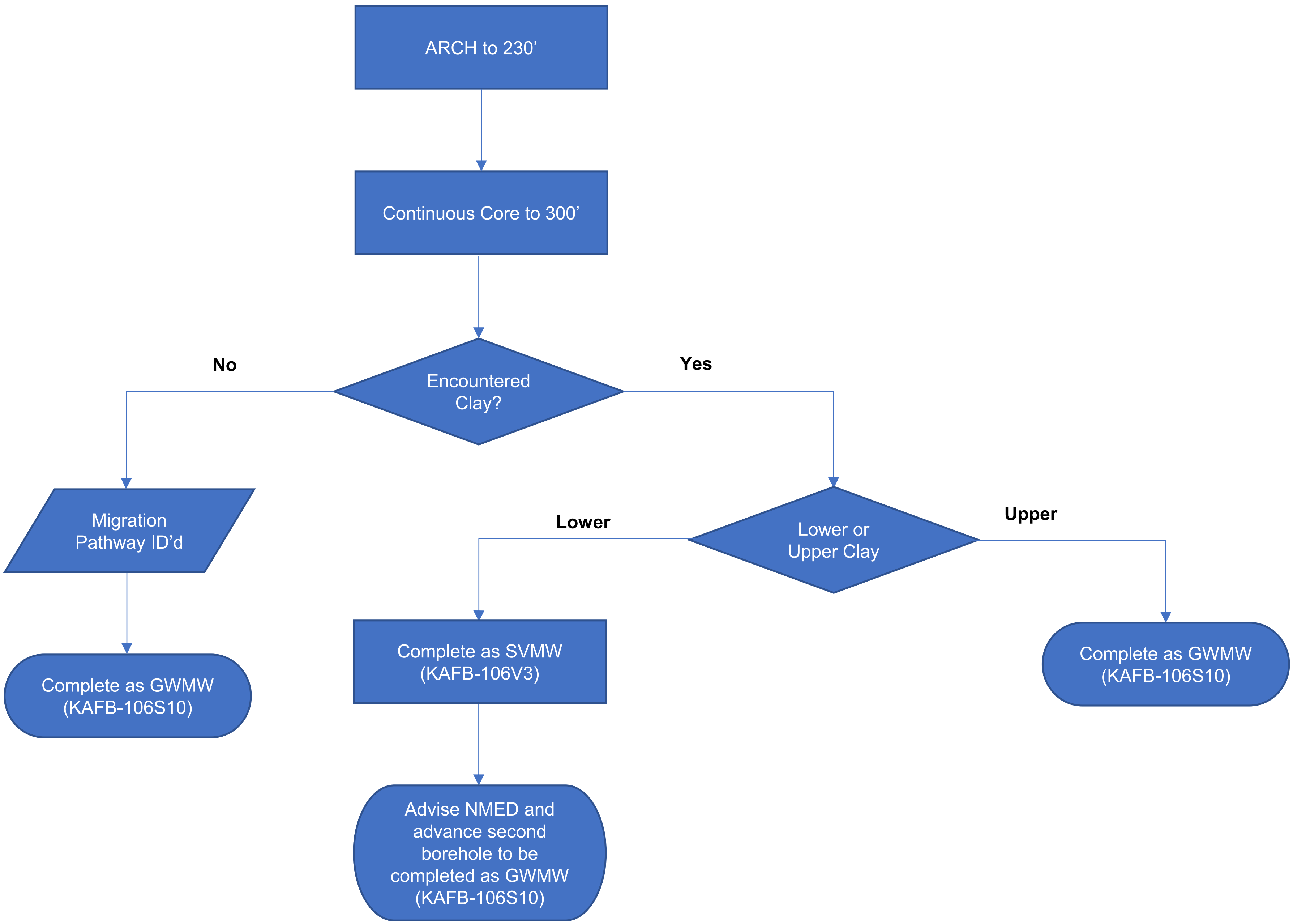


Table 4-1. Well Justification and Construction Specifications

Proposed Monitoring Well Location Shown (Figure 3-1)	Location Description (Figure 3-1)	Completion	NAD83 State Plane New Mexico Central ft		Approximate Depth to Water[a]	Depth to Water in Nearby Well[b]	Anticipated Water Table Well Screen Interval[c]	Anticipated Contingency Well Screen Interval[d]	Anticipated Piezometer Well Screen Interval	Justification for Well Location
			(X)	(Y)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)	
KAFB-106248	Bullhead Park	Nested - two wells; 4-inch Schedule 80 PVC each	1543624.994	1474458.099	480	479.55 (KAFB-106019)	455-495	421-446	NA	Fills plume boundary gap between KAFB-106019 and KAFB-106011. EDB concentrations are decreasing to the east in this area from KAFB-106067 (0.027J ug/l) to KAFB-106019 (0.016J ug/l), however no ND wells to the east. Better control with bounding the benzene plume: KAFB-106067 (1 ug/l) to the north and KAFB-106011 (ND) to the south. Provides data as the water table decreases in depth.
KAFB-106249	East of BFF, adjacent to/north of Air National Guard	Nested - two wells; 4-inch Schedule 80 PVC each	1542861.024	1473577.172	478	477.22 (KAFB-106046)	453-493	419-444	NA	Assesses eastern extent of the on base EDB plume at the water table. Q2 2019 EDB concentrations exceeded the MCL at KAFB-106153-484 and KAFB-106S2-451. KAFB-106046 well screen is submerged.
KAFB-106250	Southeast of BFF in Air National Guard parking Lot	Nested - two wells; 4-inch Schedule 80 PVC each	1542499.573	1473160.013	476	476.22 (KAFB-106S8-491)	451-491	417-442	NA	Assists with bounding southern extent of the EDB plume at the water table. Q2 2019 EDB concentrations exceeded the MCL at KAFB-106S8-491 and KAFB-106S1-447. KAFB-106007 is both submerged
KAFB-106251	In BFF south of former fuel tanks	Nested - two wells; 4-inch Schedule 80 PVC each	1541958.972	1472724.372	470	469.90 (KAFB-106S1-447)	445-485	411-436	NA	Assists with bounding southern extent of the EDB plume at the water table. Q2 2019 EDB concentrations exceeded the MCL at KAFB-106S1-447 and KAFB-106149-484. KAFB-106027 and KAFB-106007 are submerged and there is no other data in this area to help limit the model in this area.
KAFB-106252	Proximal to extraction well KAFB-106234	Nested - two wells; 4-inch Schedule 80 PVC each and one piezometer well; 1-inch Schedule 80 PVC	1544042.712	1478492.566	451	451.03 (KAFB-106225)	426-466	392-417	505-515	Provides more accurate EDB concentration data to better approximate residual mass. Well should be placed <40 ft away from KAFB-106234 to best represent the EDB concentration collected around the extraction center. Allows for a more accurate drawdown from KAFB-106234 and would help the model in providing a more accurate representation of the groundwater gradients in this area. The well will be placed as close to KAFB-106234 as reasonable to increase the chance of the piezometer intersecting the high permeability gravels seen in the KAFB-106234 logs.
KAFB-106S10	In BFF East of former fueling racks	Nested - two wells; 4-inch Schedule 80 PVC each	1541621.743	1473457.805	472	472.0 (KAFB-106154)	447-487	413-438	NA	Furthers undestanding of contaminant migration pathways beneath the source area. Primarily meant to examine the clay interval at 250-300 feet bgs. Will be completed as either a GWM or SVM well.
KAFB-106V3	In BFF East of former fueling racks	Nested - 6 wells; 3/4 inch Schedule 80 PVC with 2' screen	1541621.743	1473457.805	472	472.0 (KAFB-106154)	NA	NA	NA	Furthers undestanding of contaminant migration pathways beneath the source area. Primarily meant to examine the clay interval at 250-300 feet bgs. Will be completed as either a GWM or SVM well.

a Approximate depth to water as of the submission of this work plan. Depth to water will likely have changed by the time field activities commence. The well will be installed according to the current water table at the time of drilling.
[b] Depth to water measured April 2019
[c] 40-ft screen, 25 ft above water table, 15 ft below. Depth intervals may be modified during drilling based on observed conditions; water table well screens will be positioned with approximately 15-ft water column upon completion
[d] 25-ft screen, bottom 9 ft above top of water table screen, installed "dry"

µg/L = microgram per liter
BFF = Bulk Fuels Facility
bgs = below ground surface
EDB = ethylene dibromide
ft = feet
MCL = maximum contaminant level
NA= not applicable
ND = non-detect
PVC = polyvinyl chloride
Q2 2019 = second quarter of calendar year 2019

Table 4-2
Recent EDB and Benzene Results from Groundwater Wells in the Vicinity of Proposed Locations KAFB-106248 through KAFB-106251

		EDB Data								Benzene Data									
				Q4 2018			Q2 2019					Q4 2018			Q2 2019				
Location	REI	Project Screening Level[a]	Units	Result	Val Qual	LOD	Result	Val Qual	LOD	Project Screening Level[a]	Units	Result	Val Qual	LOD	Result	Val Qual	LOD	Is GWM well submerged? Y/N	Proposed well location assoicated with data
KAFB-106010	4857	0.05	µg/L	**2.1**		0.19	**0.65**		0.19	5	µg/L	**2300**		10	**280**		0.5	Y	KAFB-106248
KAFB-106019	4857	0.05	µg/L	**0.079**		0.019	0.016	J	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106248
KAFB-106067	4857	0.05	µg/L	0.018	J	0.019	0.027	J	0.019	5	µg/L	**5**		0.5	1		0.5	Y	KAFB-106248
KAFB-106S5-446	4857	0.05	µg/L	not installed			**15**		1.9	5	µg/L	not installed			**1300**		25	N	KAFB-106248
KAFB-106S3-449	4857	0.05	µg/L	not installed			**11**		2	5	µg/L	not installed			**4800**		50	N	KAFB-106248
KAFB-106245-460	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	N	KAFB-106248, KAFB-106249
KAFB-106046	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106249
KAFB-106064	4857	0.05	µg/L	**0.25**		0.019	not sampled			5	µg/L	**3600**		50	not sampled			Y	KAFB-106249
KAFB-106006	4857	0.05	µg/L	ND	U	0.019	0.035		0.019	5	µg/L	**17**		0.5	**22**		0.5	Y	KAFB-106250
KAFB-106007	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106250
KAFB-106008	4857	0.05	µg/L	**20**		3.8	not sampled			5	µg/L	**5800**		50	not sampled			Y	KAFB-106249
KAFB-106027	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106251
KAFB-106076	4857	0.05	µg/L	0.013	J	0.019	0.047		0.019	5	µg/L	1		0.5	4		0.5	Y	KAFB-106251
KAFB-106S1-447	4857	0.05	µg/L	not installed			**250**		97	5	µg/L	not installed			**6600**		100	N	KAFB-106251
KAFB-106S2-451	4857	0.05	µg/L	not installed			**260**		95	5	µg/L	not installed			**8800**		100	N	KAFB-106249
KAFB-106S8-451	4857	0.05	µg/L	not installed			**96**		19	5	µg/L	not installed			**2100**		100	N	KAFB-106250
KAFB-106247-450	4857	0.05	µg/L	not installed			ND	U	0.019	5	µg/L	not installed			ND	U	0.5	N	KAFB-106250, KAFB-106251
KAFB-106149-484	4857	0.05	µg/L	**34**		9.5	**36**		3.8	5	µg/L	**11000**		50	**26000**		250	N	KAFB-106249, KAFB-106250, KAFB-106251
KAFB-106152-484	4857	0.05	µg/L	0.017	J	0.019	ND	U	0.095	5	µg/L	**71**		0.5	**430**		5	N	KAFB-106249, KAFB-106250
KAFB-106153-484	4857	0.05	µg/L	**300**		39	**350**		95	5	µg/L	**4700**		25	**9200**		100	N	KAFB-1062549, KAFB-106250
KAFB-106069	4838	0.05	µg/L	0.044		0.019	0.014	J	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106248
KAFB-106044	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106251
KAFB-106047	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106249
KAFB-106063	4838	0.05	µg/L	**3.6**	J	0.38	not sampled			5	µg/L	**6400**		50	not sampled			Y	KAFB-106249
KAFB-106077	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106251
KAFB-106068	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106248
KAFB-106045	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106251
KAFB-106048	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	not sampled			Y	KAFB-106249, KAFB-106250
KAFB-106062	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106249
KAFB-106078	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	5	µg/L	ND	U	0.5	ND	U	0.5	Y	KAFB-106251

[a]EPA National Primary Drinking Water Regulations, MCLs and Secondary MCLs, Title 40CFR Part 141, 143 (May 2018).
EDB = 1,2-dibromoethane (ethylene dibromide)
J = estimated concentration
LOD = limit of detection
ND = non-detect
Q = quarter
REI = reference elevation interval
U = non-detect
Val Qual = validation qualifier
µg/L = microgram per liter
highlighted cell indicates a detection
bolded text indicates the detected concentration exceeds the project screening level

Table 4-3
Groundwater EDB Results from 2017 through 2019 in the Vicinity of KAFB-106234

Location	REI	Project Screening Level[a]	Units	EDB Results															Bottom of Screen Elevation	Top of Screen Elevation
				Q2 2017			Q4 2017			Q2 2018			Q4 2018			Q2 2019				
				Result	Val Qual	LOD	Result	Val Qual	LOD	Result	Val Qual	LOD	Result	Val Qual	LOD	Result	Val Qual	LOD		
KAFB-106041	4857	0.05	µg/L	Not sampled			**0.058**		0.019	0.019	J	0.019	0.013	J	0.0095	0.015	J	0.019	4855	4875
KAFB-106042	4857	0.05	µg/L	ND	U	0.019	0.013	J	0.019	0.017	J	0.02	0.017	J	0.0095	0.027	J	0.019	4841	4855
KAFB-106201	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4837	4867
KAFB-106204	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4840	4870
KAFB-106207	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4841	4871
KAFB-106222	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.02	ND	U	0.019	ND	U	0.019	4845	4875
KAFB-106225	4857	0.05	µg/L	**0.92**		0.38	**0.57**		0.019	**0.12**		0.019	**0.17**		0.019	0.018	J	0.019	4846	4876
KAFB-106231	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4853	4888
KAFB-106236-461	4857	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4855	4880
KAFB-106202	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4823	4838
KAFB-106205	4838	0.05	µg/L	0.041		0.019	ND	U	0.019	0.022	J	0.019	ND	U	0.019	ND	U	0.019	4826	4841
KAFB-106208	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4826	4841
KAFB-106223	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.02	ND	U	0.019	ND	U	0.019	4831	4846
KAFB-106226	4838	0.05	µg/L	ND	U	0.019	**0.33**		0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4832	4847
KAFB-106236-490	4838	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4826	4846
KAFB-106203	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4719	4734
KAFB-106206	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4725	4740
KAFB-106209	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4726	4740
KAFB-106224	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.02	ND	U	0.019	ND	U	0.019	4765	4780
KAFB-106227	4814	0.05	µg/L	0.041		0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4765	4780
KAFB-106232	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4709	4724
KAFB-106236-519	4814	0.05	µg/L	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	ND	U	0.019	4817	4837

[a] EPA National Primary Drinking Water Regulations, MCLs and Secondary MCLs, Title 40CFR Part 141, 143 (May 2018).

EDB = 1,2-dibromoethane (ethylene dibromide)
J = estimated concentration
LOD = limit of detection
ND = non-detect
Q = quarter
REI = reference elevation interval
U = non-detect
Val Qual = validation qualifier
µg/L = microgram per liter
highlighted cell indicates a detection
bolded text indicates the detected concentration exceeds the project screening level

Table 6-1
Groundwater Monitoring Sampling Requirements for Data Gap Wells

Analyte	Analysis	Frequency of Baseline Monitoring[a]	Anicipated Frequency of Post-Baseline Monitoring[a,b]
EDB	EPA Method 8011	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Total Metals	EPA Method 6010C (calcium, magnesium, potassium, sodium)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Dissolved Metals	EPA Method 6010C (iron, manganese)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Total Metals	EPA Method 6020A (arsenic, lead)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Anions	EPA Method 300.0A (chloride, bromide, sulfate)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Anions	EPA Method 353.2 (nitrate/nitrite nitrogen)	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
Alkalinity - Bicarbonate/ Carbonate	Standard Method 2320B	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
VOCs (including BTEX)	EPA Method 8260C	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
TPH-GRO	EPA Method 8015C/D	Quarterly	To be re-evaluated after 8 quarters of baseline sampling
TPH-DRO	EPA Method 8015C/D	Quarterly	To be re-evaluated after 8 quarters of baseline sampling

[a] Six (possibly seven) new wells (KAFB-106248, KAFB-106249, KAFB-106250, KAFB-106251, KAFB-106252, and possibly KAFB-106S10) are proposed to be installed in Q4 2020 and will be sampled within 10 days following well completion.

[b] This is the anticipated frequency, which may change based on monitoring results. Baseline sampling results will allow the wells to be categorized in accordance with the approved Work Plan for The Bulk Fuels Facility Expansion of The Dissolved-Phase Plume Groundwater Treatment System Design Revision 2 (KAFB, 2017a). It is anticipated that the wells will be categorized as "groundwater monitoring wells."

BTEX = benzene, toluene, ethylbenzene, and xylenes
EDB = ethylene dibromide
EPA = U.S. Environmental Protection Agency
VOC = volatile organic compound
GRO = gasoline range organics (C6 - C10)
DRO = diesel range organics (C10 - C28)

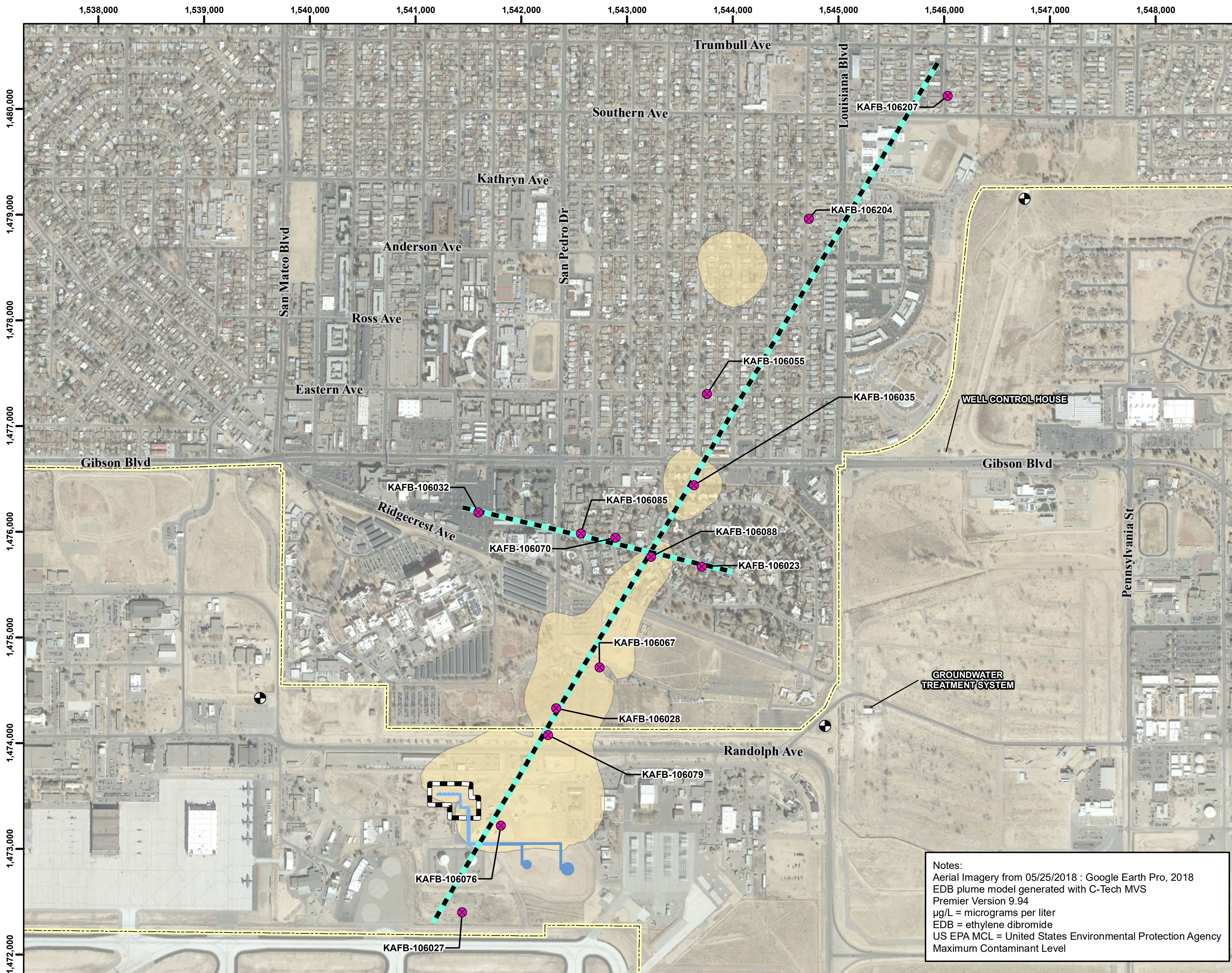
Table 6-2
Analytical Parameter, Matrix, Method, Sample Container, Preservation, and Holding Time Requirements

Parameter	Sample Purpose	Matrix	Preparation/ Analysis Method	Bottle Type	Preservative	Preparation Holding Time	Analytical Holding Time
Total petroleum hydrocarbon- diesel range organics[1]	Periodic GWM	Water	SW8015C/D	2 x 250 mL amber glass bottles	HCl to pH < 2; Cool ≤6°C	7 days	40 days
Total petroleum hydrocarbon- gasoline range organics[2]	Periodic GWM	Water	SW8015C/D	3 x 40 mL glass vials	HCl to pH < 2; Cool to 2-6°C	14 days	14 days
Anions (chloride, bromide, sulfate)	Periodic GWM	Water	E300.0A	1 x 250-mL glass or HDPE	None; Cool ≤6°C	NA	28 days
Nitrate/Nitrite nitrogen	Periodic GWM	Water	E353.2	2 x 250-mL glass or HDPE	Sulfuric acid to pH <2; Cool ≤6°C	NA	28 days
Alkalinity – bicarbonate/carbonate	Periodic GWM	Water	SM2320B	1 x 250-mL glass or HDPE	None; Cool ≤6°C	NA	14 days
Volatile organic compounds – benzene, toluene, ethylbenzene, xylenes, naphthalene	Periodic GWM & IDW	Water	SW5030B/8260C	3 x 40-mL glass	HCl to pH < 2; Cool ≤6°C	NA	14 days
Ethylene dibromide	Periodic GWM & IDW	Water	SW8011	2 x 40-mL glass	HCl to pH < 2; Cool ≤6°C	NA	14 days
Total and dissolved metals	Periodic GWM & IDW	Water	SW3005A/6010C SW3020A/6020A	1 x 250-mL HDPE	Nitric acid to pH <2; Cool ≤6°C	180 days	180 days
Flashpoint	IDW	Water	SW1010A	1 x 250-mL HDPE	None; Cool ≤6°C	NA	NA
pH	IDW	Water	SW9040C	1 x 250-mL HDPE	None; Cool ≤6°C	NA	Upon receipt
Total petroleum hydrocarbon- diesel range organics extended[3]	Core Analysis	Soil	SW3546/8015D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Total petroleum hydrocarbon- gasoline range organics	Core Analysis/IDW	Soil	SW5035A/8015D	1 x 4-oz glass	None; Cool ≤6°C	NA	14 days
Total petroleum hydrocarbon- diesel range organics	IDW	Soil	SW3546/8015D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days

Table 6-2
Analytical Parameter, Matrix, Method, Sample Container, Preservation, and Holding Time Requirements

Parameter	Sample Purpose	Matrix	Preparation/ Analysis Method	Bottle Type	Preservative	Preparation Holding Time	Analytical Holding Time
Volatile organic compounds	IDW	Soil	SW5035A/8260C	3 x EnCore/ Terracore samplers; 1 x 4-oz glass	None; Cool ≤6°C	48 hours to preserve or preserved in field	14 days
Semivolatile organic compounds	IDW	Soil	SW3546/8270D	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Ethylene dibromide	IDW	Soil	SW8011	1 x 8-oz glass	None; Cool ≤6°C	14 days	14 days
Metals	IDW	Soil	SW6010C	1 x 8-oz glass	None; Cool ≤6°C	180 days	180 days
Mercury	IDW	Soil	SW7471B	1 x 8-oz glass	None; Cool ≤6°C	28 days	28 days
Ignitability	IDW	Soil	SW1020A	1 x 8-oz glass	None; Cool ≤6°C	NA	NA
pH	IDW	Soil	SW9045C	1 x 8-oz glass	None; Cool ≤6°C	NA	NA
Cyanide, Total and/or Amenable	IDW	Soil	SW9012B	1 x 8-oz glass	None; Cool ≤6°C	28 days	28 days
Pesticides	IDW	Soil	SW3546/8081B	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Herbicides	IDW	Soil	SW3550C/8151A	1 x 8-oz glass	None; Cool ≤6°C	14 days	40 days
Toxicity characteristic leaching procedure	IDW	Soil	SW1311	8-oz glass per parameter/method	NA	NA	NA

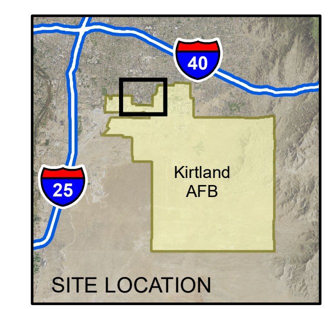
[1]Total Petroleum Hydrocarbon - Diesel Range Organics: C10 - C28
[2]Total Petroleum Hydrocarbon - Gasooline Range Organics: C6 - C10
[3]Total Petroleum Hydrocarbon - Diesel Range Organics Extended: C10 - C35
°C = degrees Celsius
E = EPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983 and Updates.
HCl = hydrochloric acid
HDPE = high density polyethylene
mL = milliliter
NA = not applicable
oz = ounce
SM = Standard Methods for Examination of Water and Wastewater, 22nd Edition.
SW = EPA SW846 – Test Methods for Evaluating Solid Waste, 3rd Edition, 1986 and Updates.



Notes:
Aerial Imagery from 05/25/2018 : Google Earth Pro, 2018
EDB plume model generated with C-Tech MVS
Premier Version 9.94
µg/L = micrograms per liter
EDB = ethylene dibromide
US EPA MCL = United States Environmental Protection Agency
Maximum Contaminant Level

Legend

- Groundwater Monitoring Well Used in Cross Section Profile
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Elevation Cross Section
- Installation Fence Boundary
- Q4 2018 EDB Plume with Concentration > 0.05 µg/L (EPA MCL)
- Source Area



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-1

GROUNDWATER ELEVATION CROSS SECTION

\\abq\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2018_Q4\Section 5\L-2-1 GW Elevation Cross Section.mxd 1/12/2019 EA eomalia

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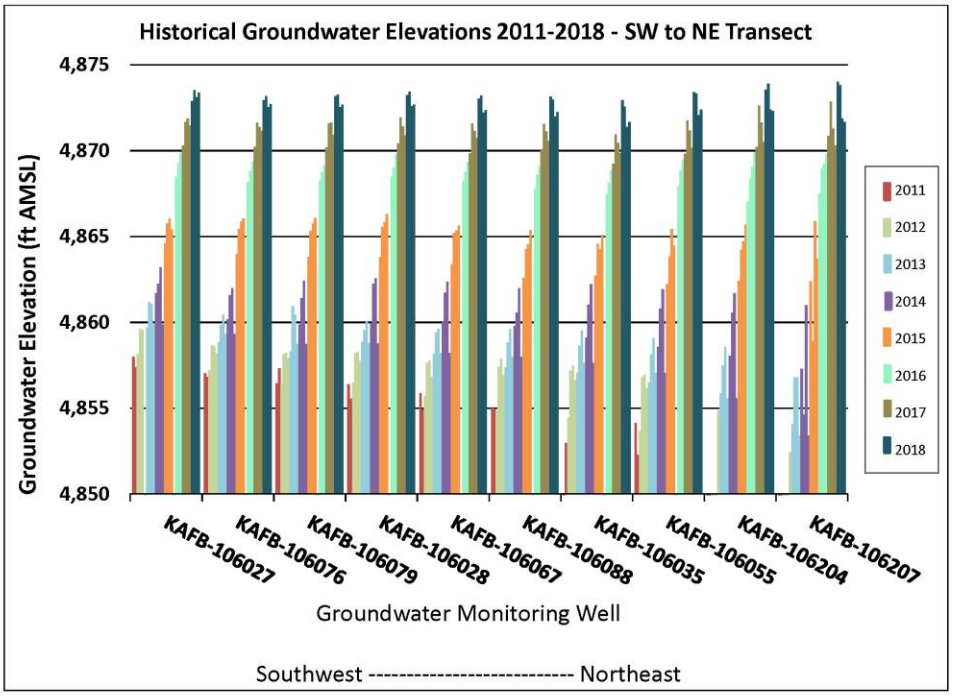
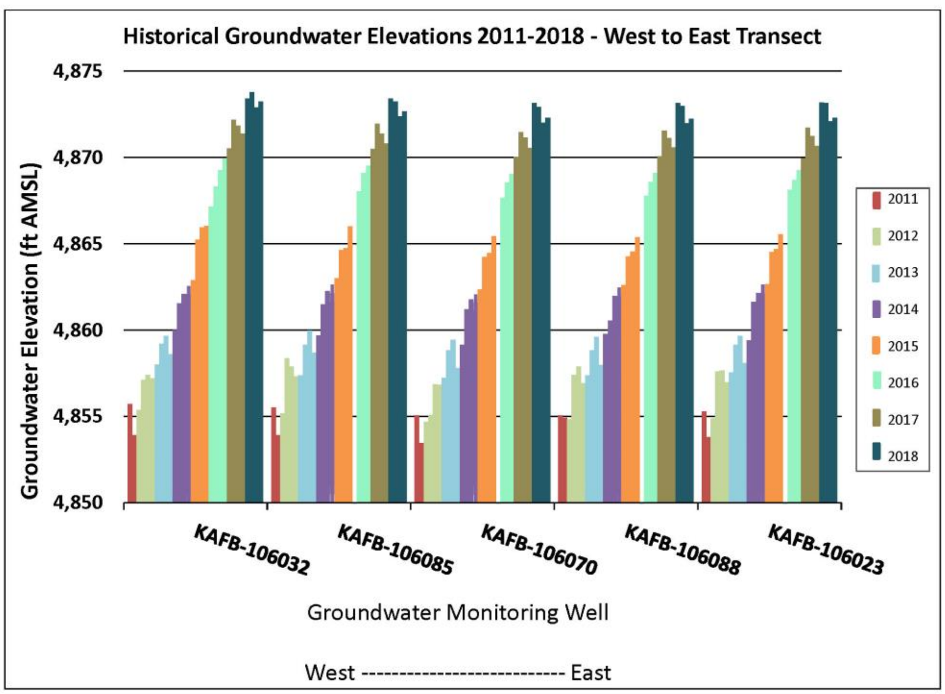
Figure A-2: Water Level Time-Series Graphs, Q4 2018





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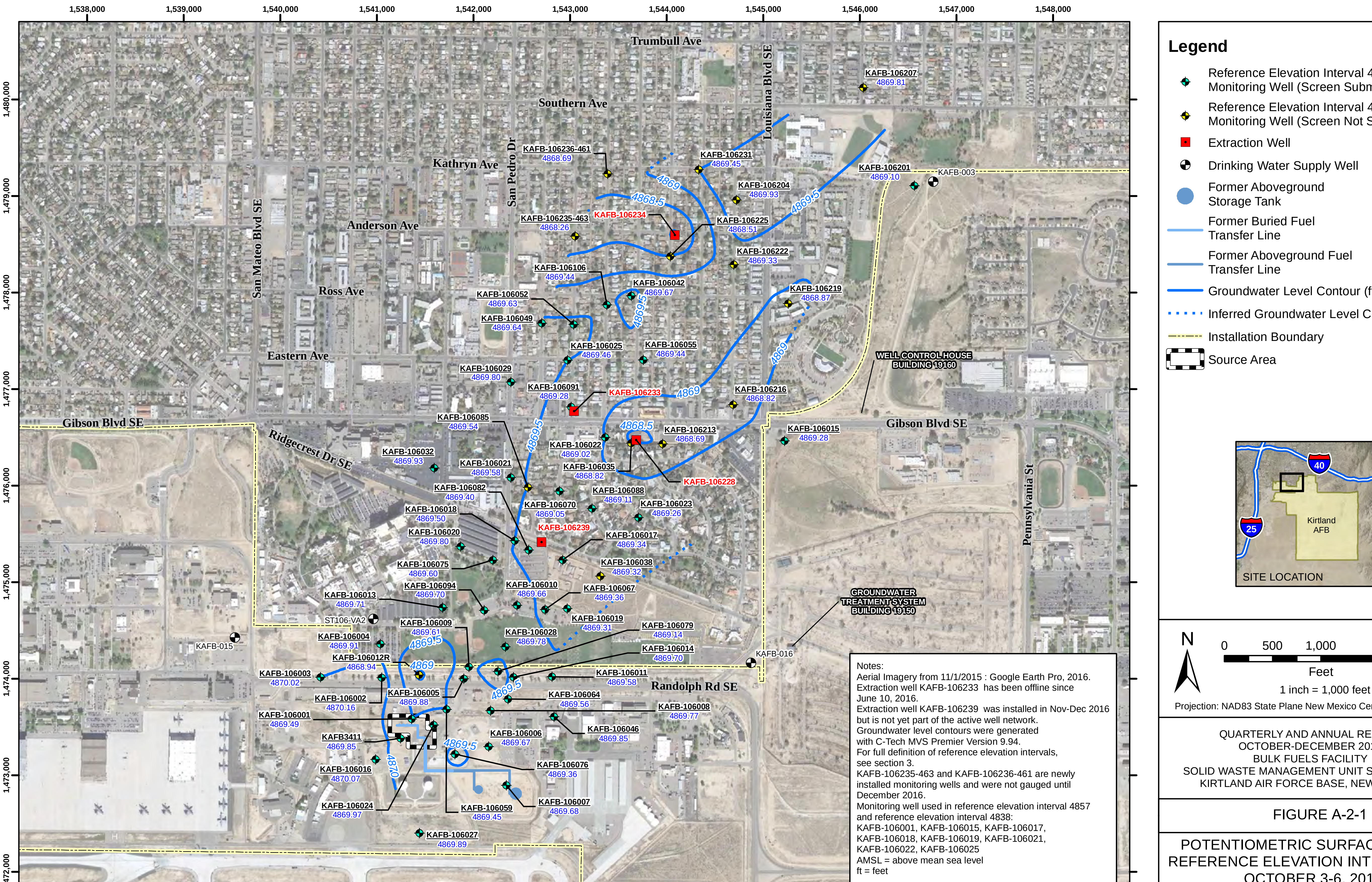

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Level Contour (ft AMSL)
- Inferred Groundwater Level Contour (ft AMSL)
- Installation Boundary
- Source Area

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 11/1/2015 : Google Earth Pro, 2016.
Extraction well KAFB-106233 has been offline since June 10, 2016.
Extraction well KAFB-106239 was installed in Nov-Dec 2016 but is not yet part of the active well network.
Groundwater level contours were generated with C-Tech MVS Premier Version 9.94.
For full definition of reference elevation intervals, see section 3.
KAFB-106235-463 and KAFB-106236-461 are newly installed monitoring wells and were not gauged until December 2016.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025
AMSL = above mean sea level
ft = feet

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FIGURE A-2-1

POTENTIOMETRIC SURFACE MAP OF REFERENCE ELEVATION INTERVAL 4857, OCTOBER 3-6, 2016

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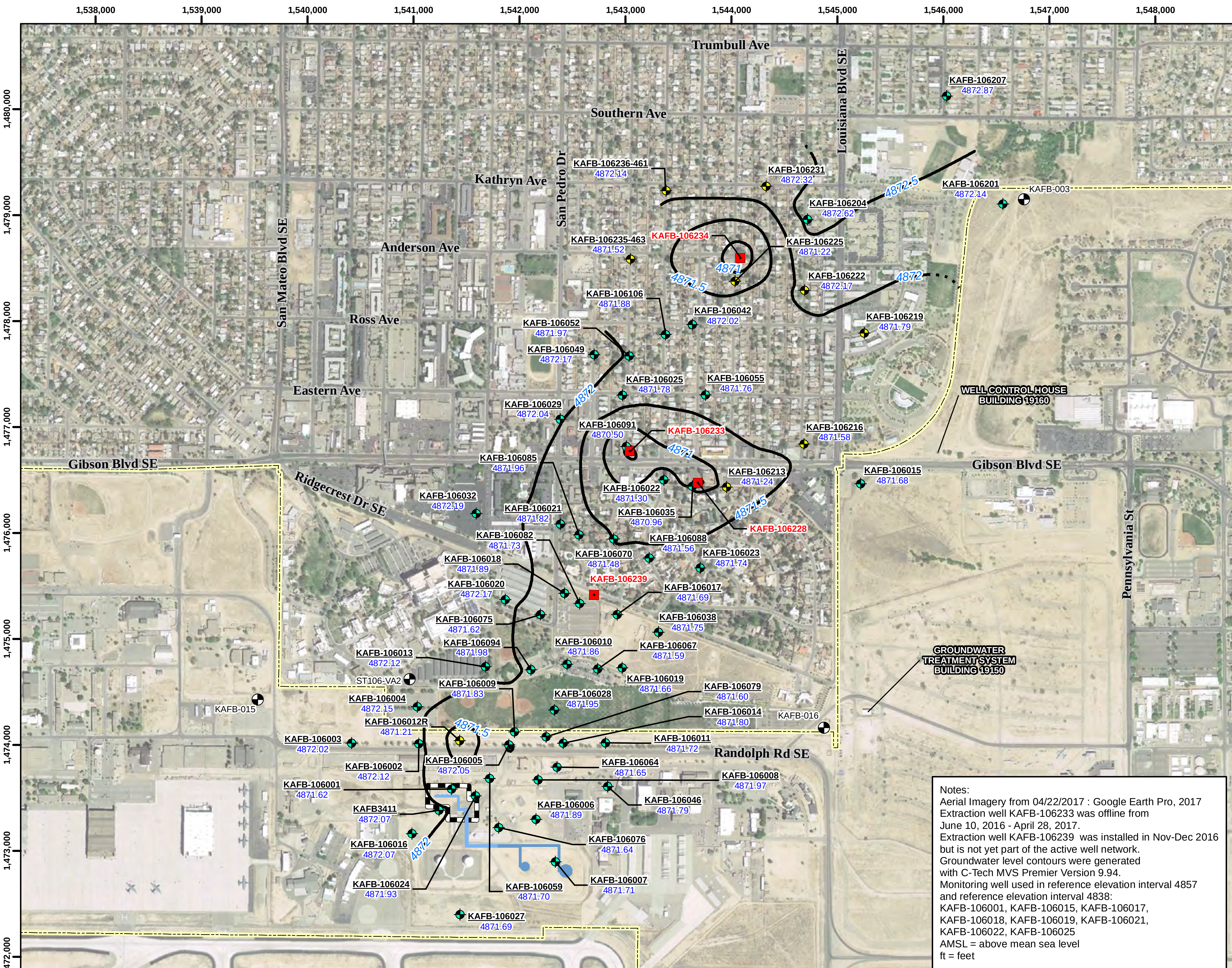
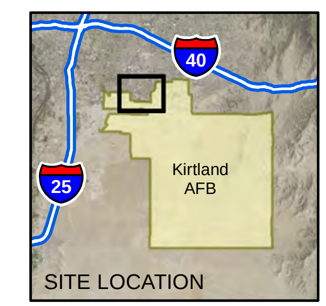


Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
Extraction well KAFB-106233 was offline from June 10, 2016 - April 28, 2017.
Extraction well KAFB-106239 was installed in Nov-Dec 2016 but is not yet part of the active well network.
Groundwater level contours were generated with C-Tech MVS Premier Version 9.94.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025
AMSL = above mean sea level
ft = feet

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Level Contour (ft AMSL)
- Inferred Groundwater Level Contour (ft AMSL)
- Installation Boundary
- Source Area



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-2

POTENTIOMETRIC SURFACE MAP OF REFERENCE ELEVATION INTERVAL 4857, MAY 8-11, 2017

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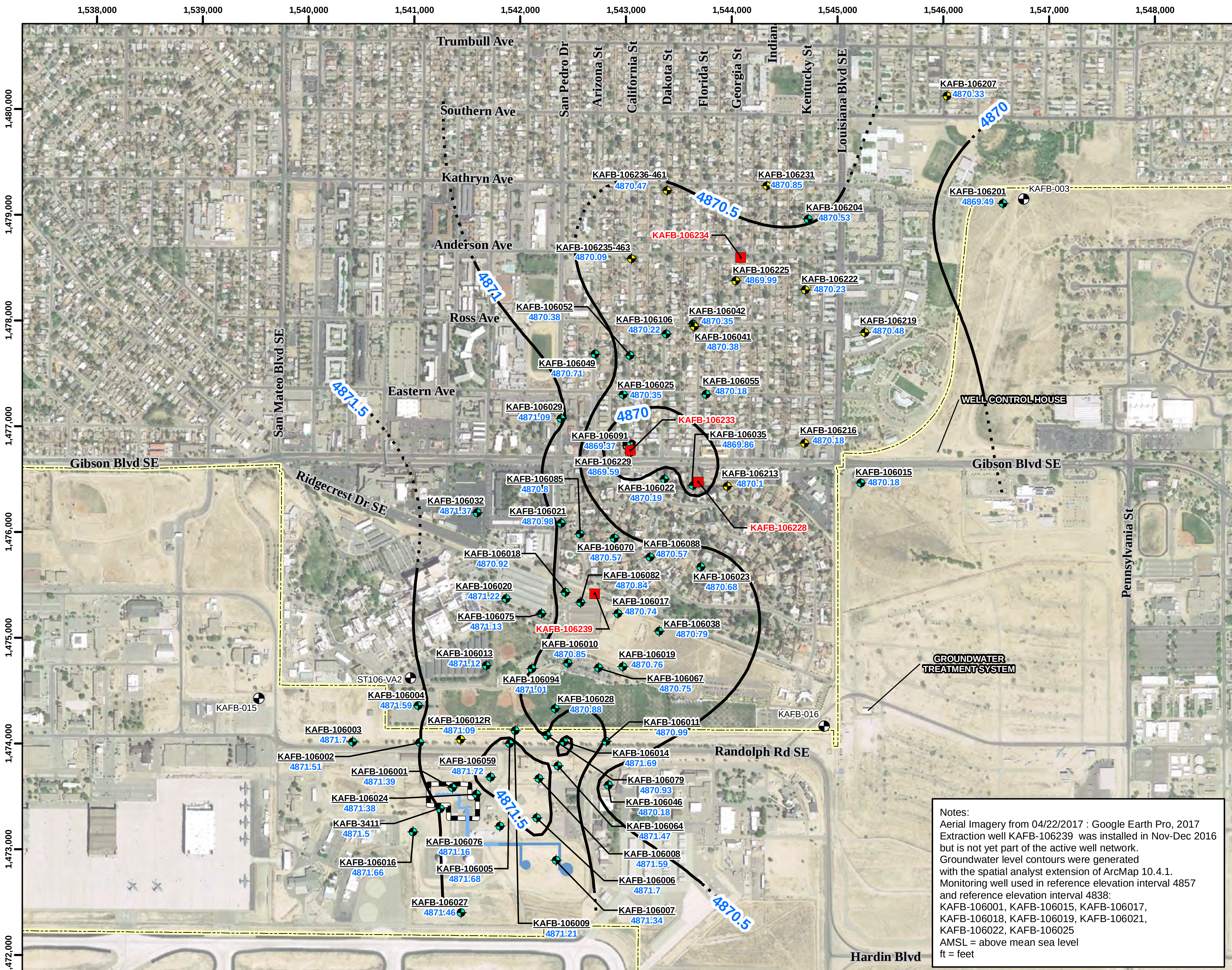

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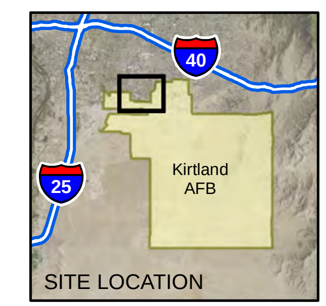
Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Groundwater Level Contour (ft AMSL)
- Inferred Groundwater Level Contour (ft AMSL)
- Installation Boundary
- Source Area



N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
Extraction well KAFB-106239 was installed in Nov-Dec 2016 but is not yet part of the active well network.
Groundwater level contours were generated with the spatial analyst extension of ArcMap 10.4.1.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025
AMSL = above mean sea level
ft = feet

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FIGURE A-2-3

POTENTIOMETRIC SURFACE MAP OF REFERENCE ELEVATION INTERVAL 4857, OCTOBER 16-24, 2017

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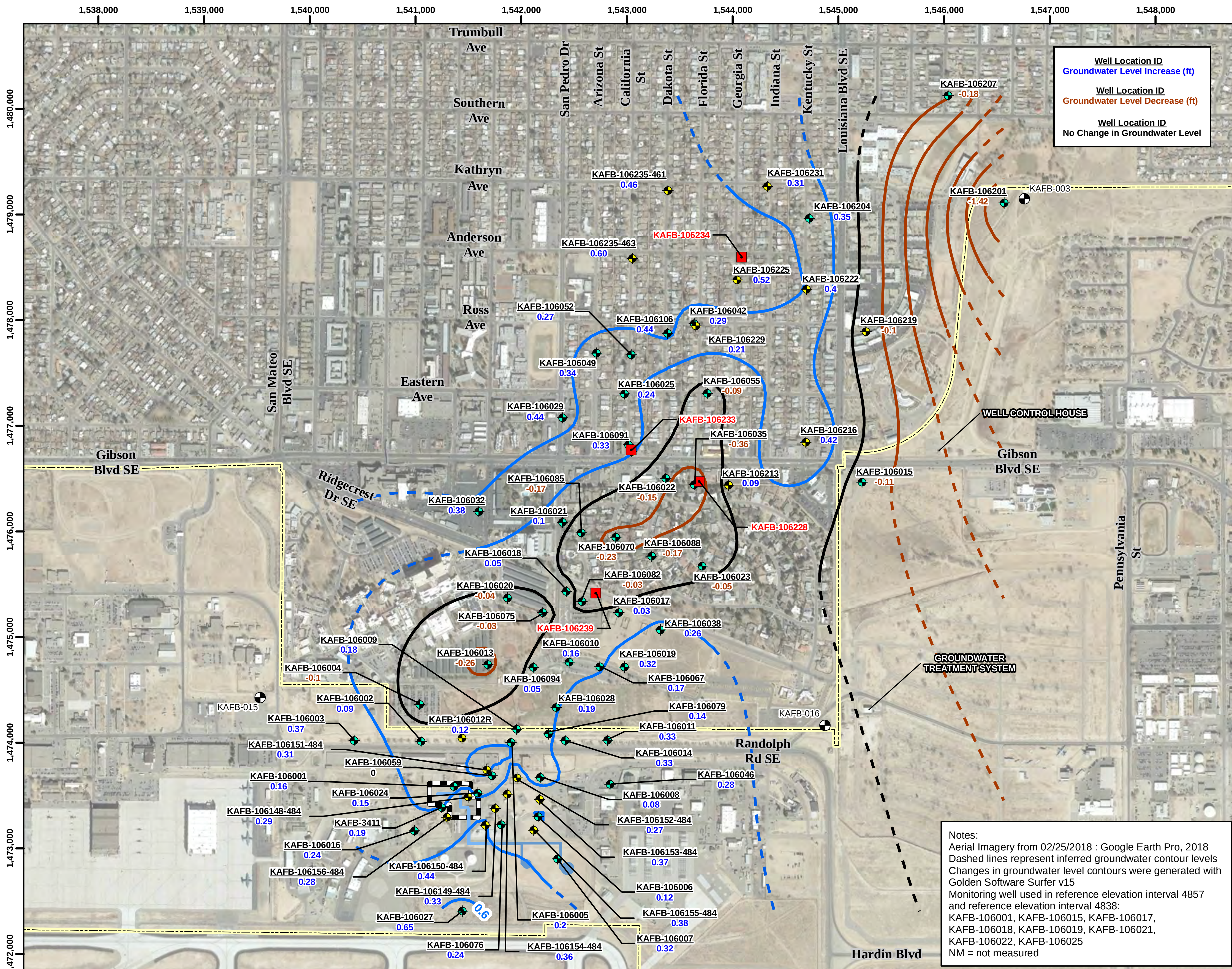
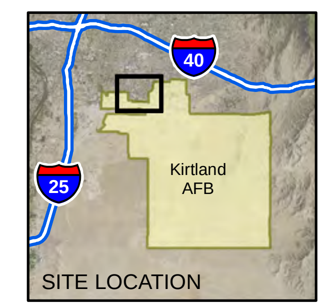


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Groundwater contour indicating water table increase from previous quarter
- Groundwater contour indicating water table decrease from previous quarter
- Groundwater contour indicating no change in water table from previous quarter
- Source Area



N

0 500 1,000 2,000
Feet
1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-4

CHANGES IN POTENTIOMETRIC SURFACE OF REFERENCE ELEVATION INTERVAL 4857, Q1 2018 - Q2 2018

Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Dashed lines represent inferred groundwater contour levels
Changes in groundwater level contours were generated with Golden Software Surfer v15
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025
NM = not measured

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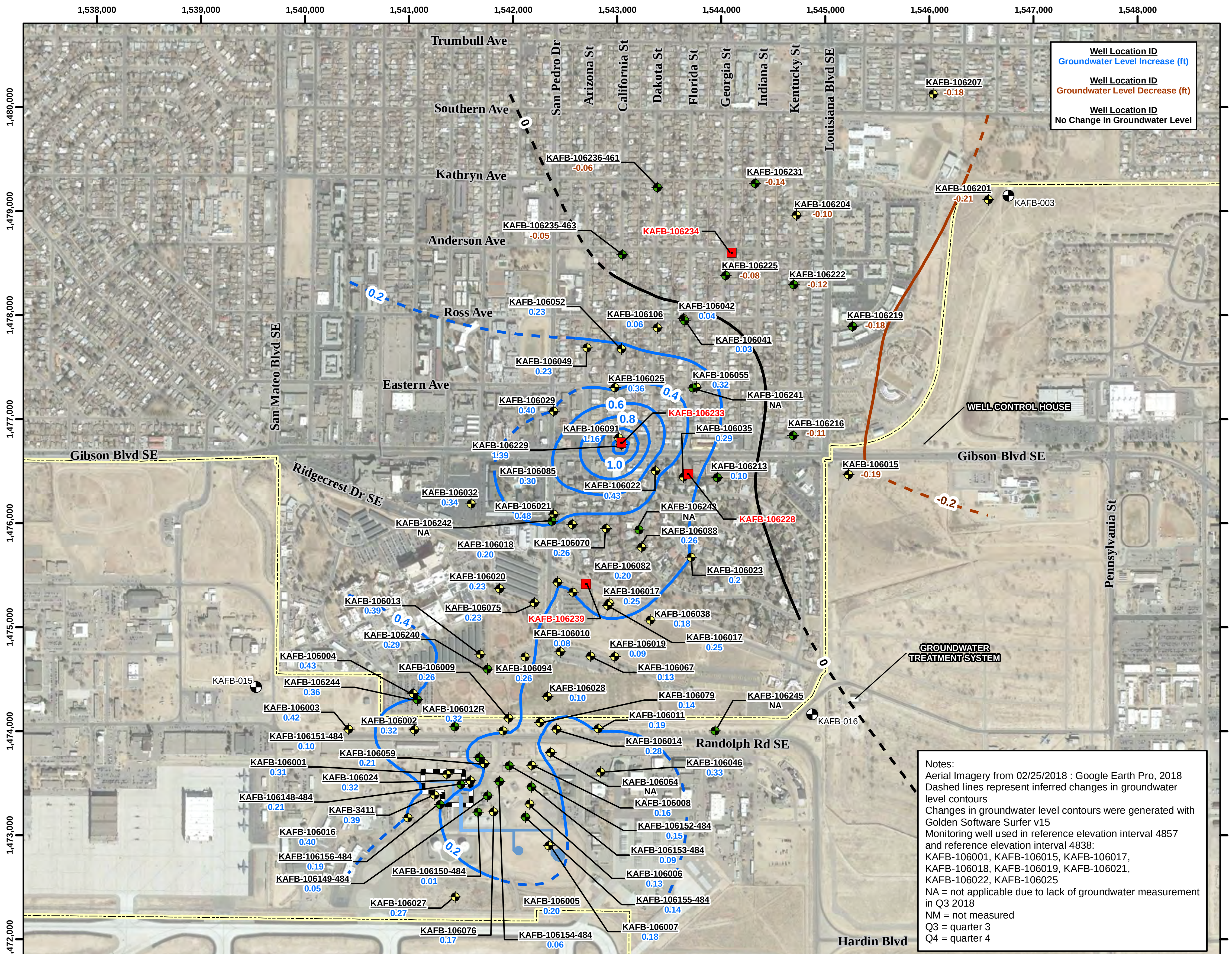
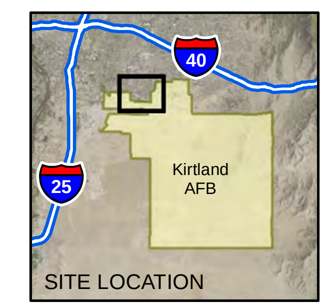


Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Dashed lines represent inferred changes in groundwater level contours
Changes in groundwater level contours were generated with Golden Software Surfer v15
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017,
KAFB-106018, KAFB-106019, KAFB-106021,
KAFB-106022, KAFB-106025
NA = not applicable due to lack of groundwater measurement in Q3 2018
NM = not measured
Q3 = quarter 3
Q4 = quarter 4

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Fence Boundary
- Groundwater contour indicating water table increase from previous quarter
- Groundwater contour indicating water table decrease from previous quarter
- Groundwater contour indicating no change in water table from previous quarter
- Source Area



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-5

CHANGES IN POTENTIOMETRIC SURFACE OF REFERENCE ELEVATION INTERVAL 4857, Q3 2018 - Q4 2018

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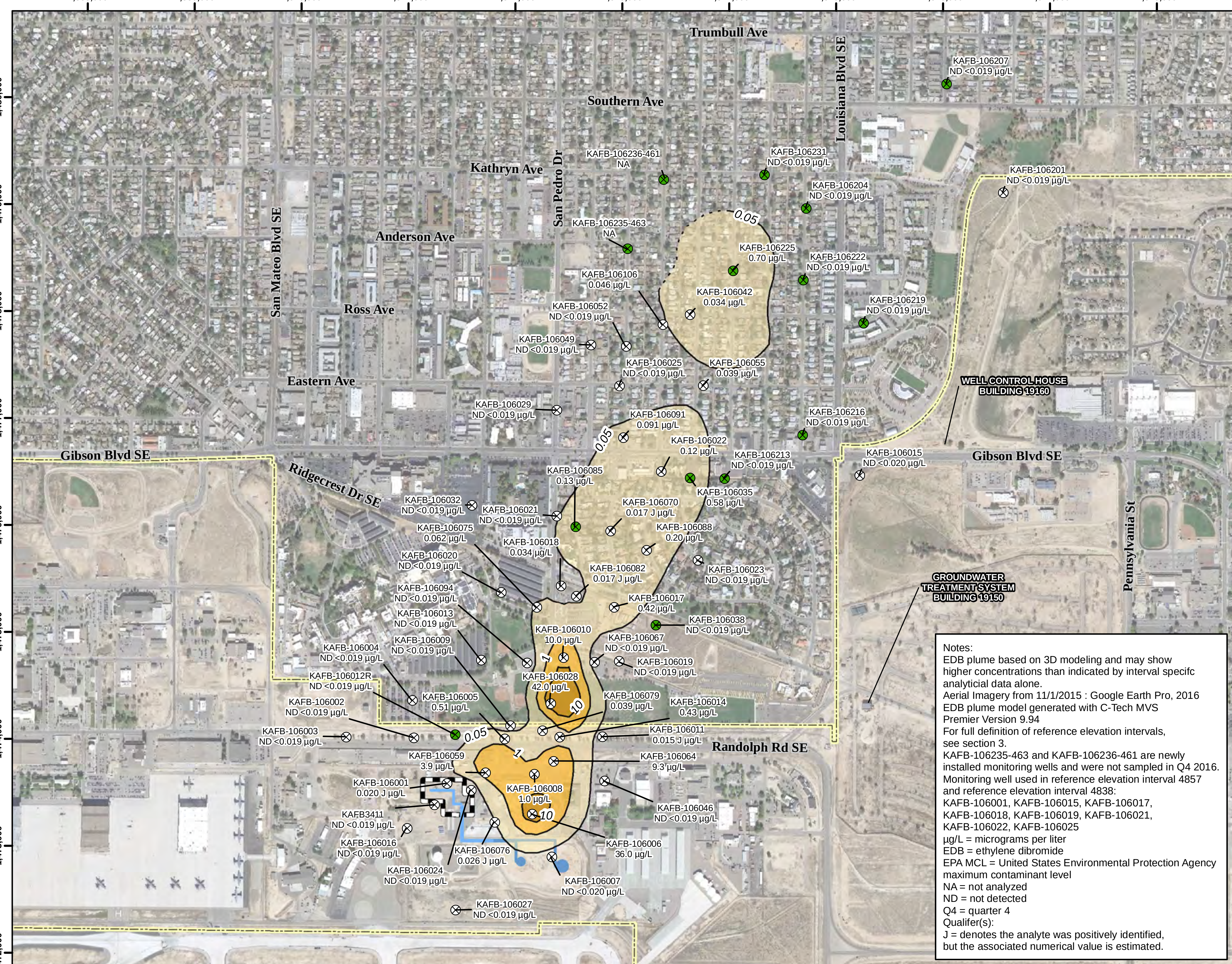


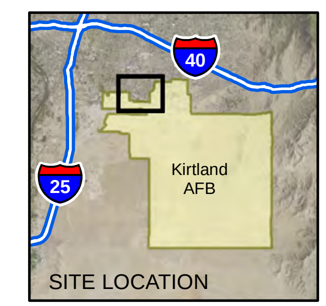
Notes:
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analyticial data alone.
Aerial Imagery from 11/1/2015 : Google Earth Pro, 2016
EDB plume model generated with C-Tech MVS Premier Version 9.94
For full definition of reference elevation intervals, see section 3.
KAFB-106235-463 and KAFB-106236-461 are newly installed monitoring wells and were not sampled in Q4 2016.
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017,
KAFB-106018, KAFB-106019, KAFB-106021,
KAFB-106022, KAFB-106025
µg/L = micrograms per liter
EDB = ethylene dibromide
EPA MCL = United States Environmental Protection Agency maximum contaminant level
NA = not analyzed
ND = not detected
Q4 = quarter 4
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (µg/L)
- Inferred EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L
- 10 - 50 µg/L



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-6

EDB CONCENTRATIONS IN GROUNDWATER
REFERENCE ELEVATION INTERVAL 4857
Q4 2016

P:\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2016_Q4\Report Figures\Section 3\3-6 Interval 4857 EDB Q4.mxd 2/14/2017 EA eomalia

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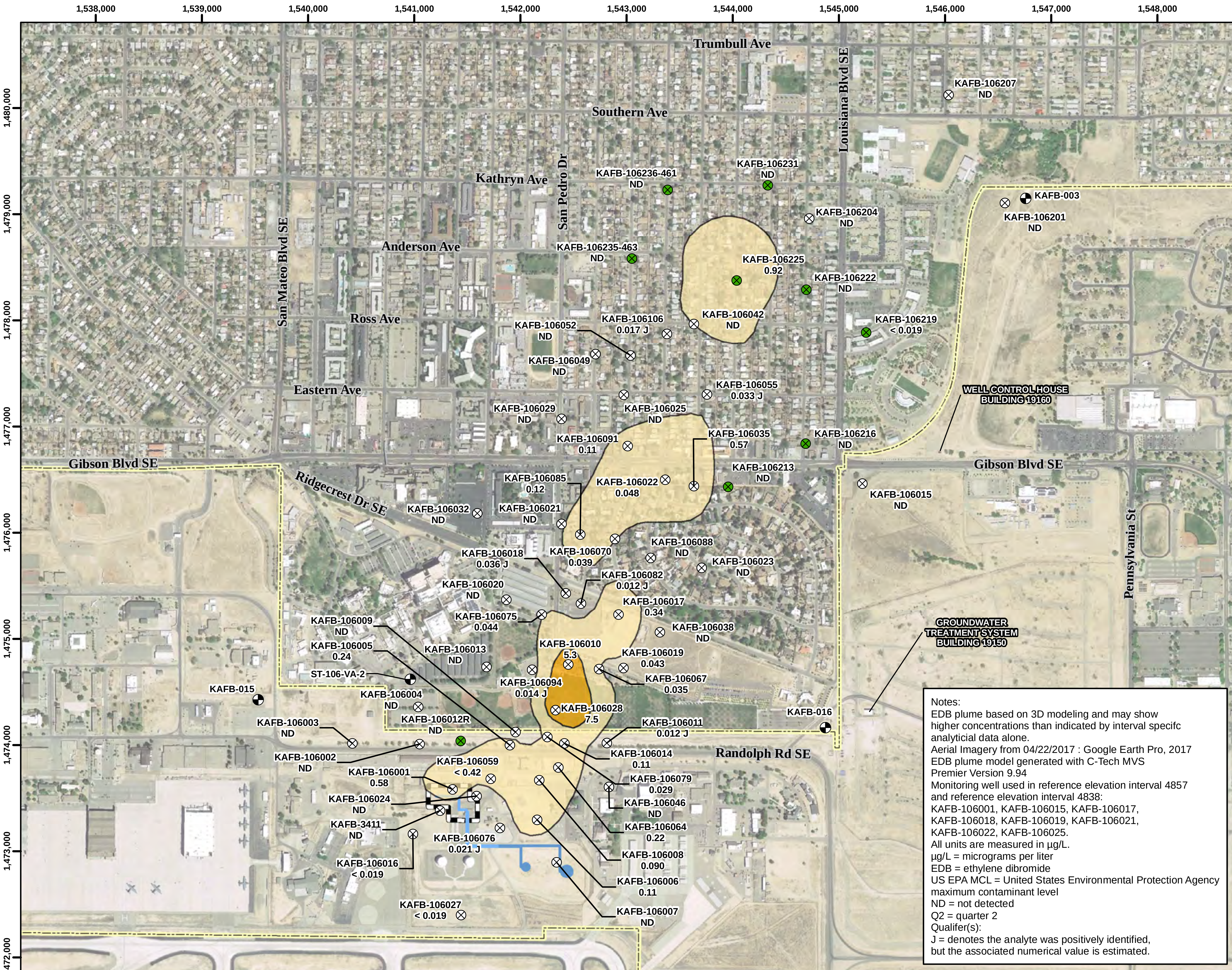


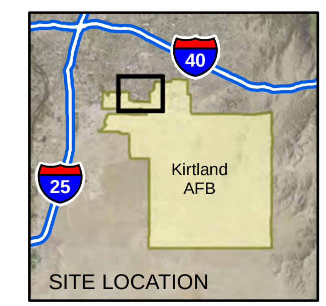
Notes:
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analyticial data alone.
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EDB = ethylene dibromide
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
ND = not detected
Q2 = quarter 2
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (µg/L)
- Inferred EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-7

EDB CONCENTRATIONS IN GROUNDWATER
REFERENCE ELEVATION INTERVAL 4857,
Q2 2017

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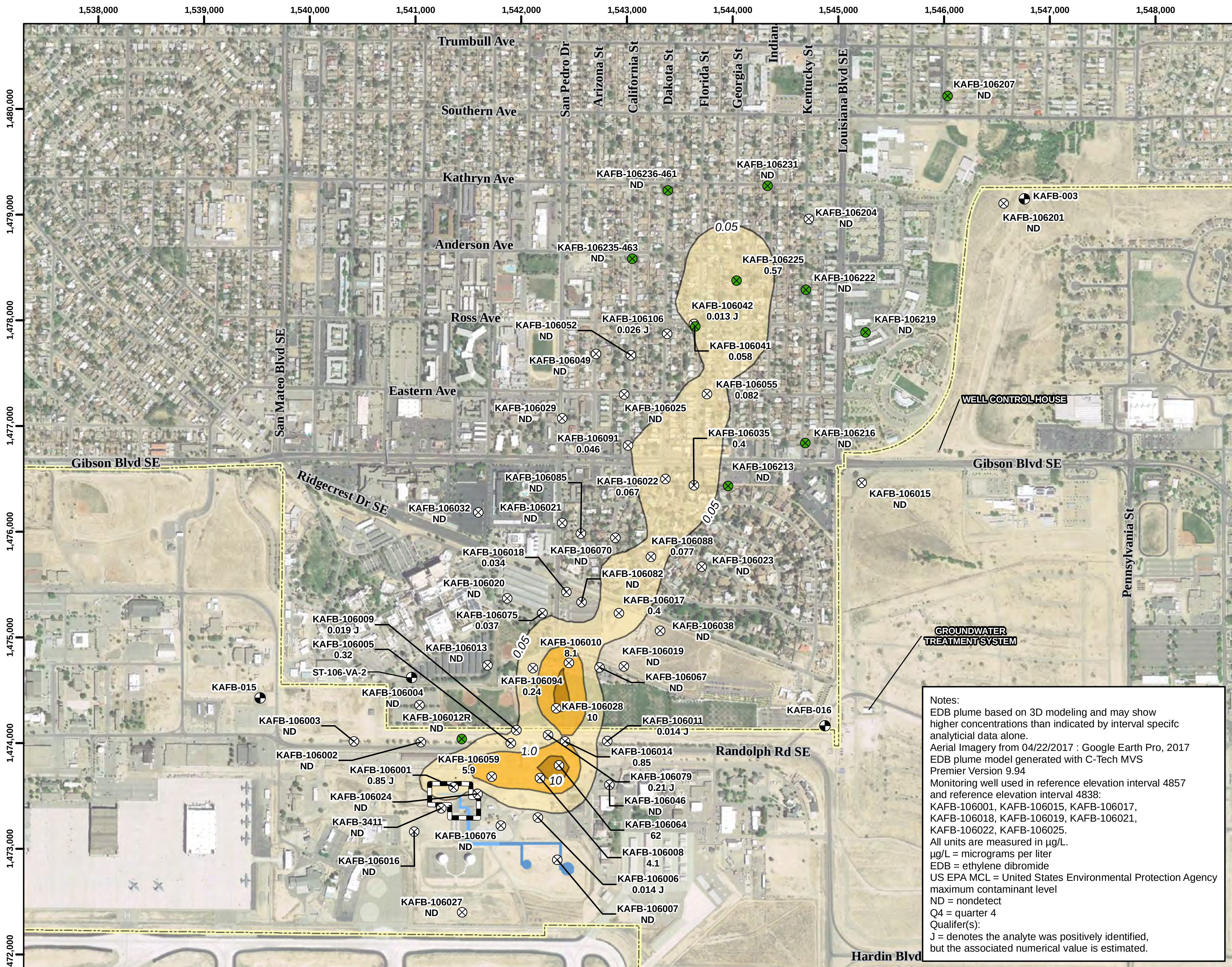
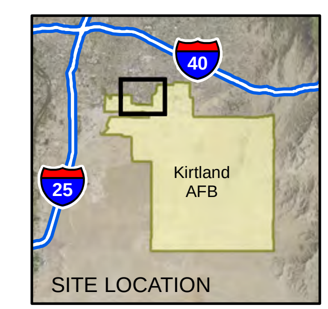


Notes:
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analyticial data alone.
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EDB = ethylene dibromide
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
ND = nondetect
Q4 = quarter 4
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (µg/L)
- Inferred EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range
- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L
- 10 - 50 µg/L



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-8

EDB CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2017

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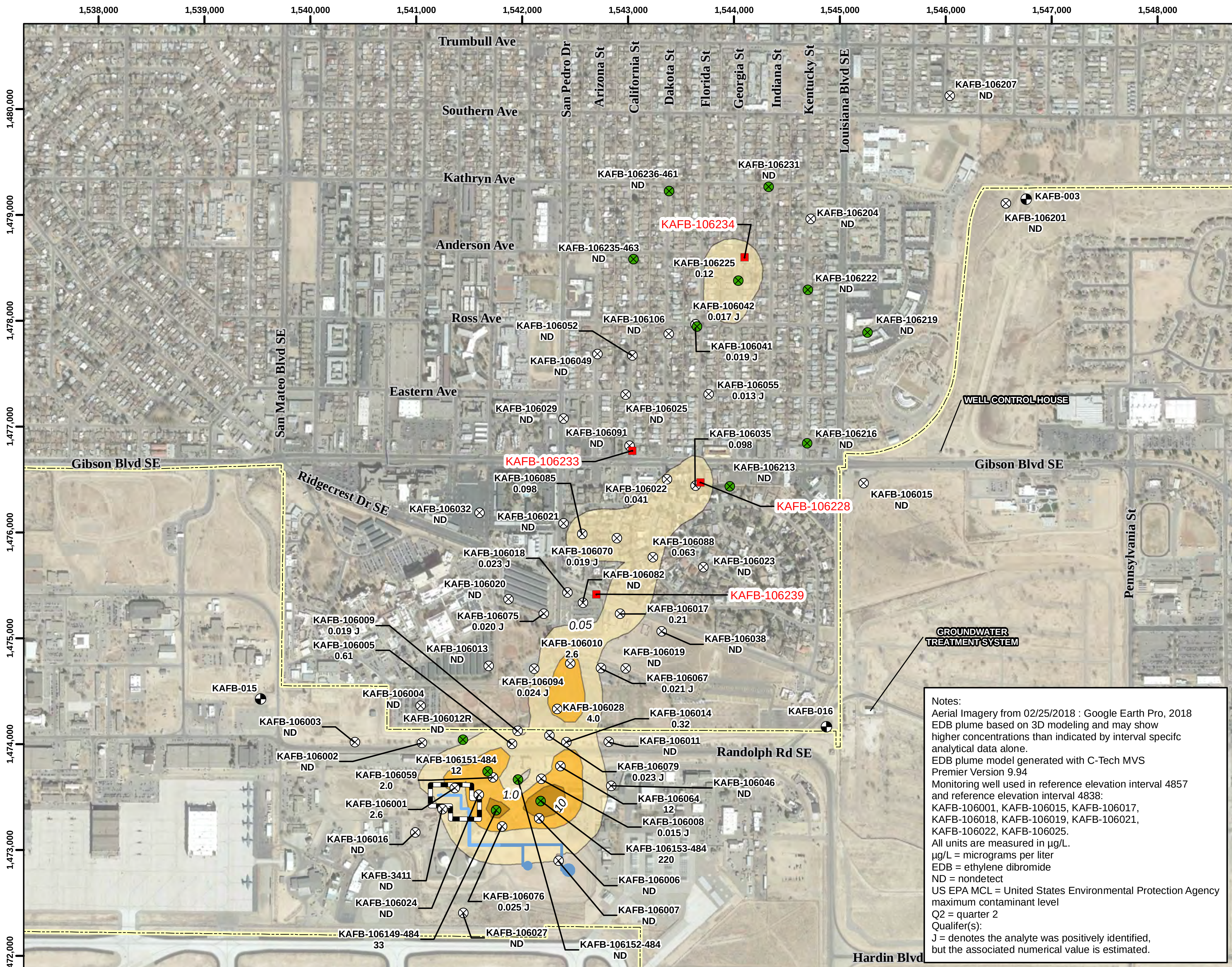
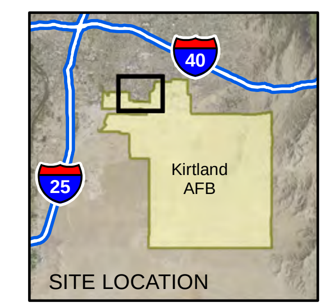


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L
- 10 - 500 µg/L



N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analytical data alone.
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017, KAFB-106018, KAFB-106019, KAFB-106021, KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EDB = ethylene dibromide
ND = nondetect
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
Q2 = quarter 2
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

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FIGURE A-2-9

EDB CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q2 2018

P:\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2018_Q2\Section 3\3-7 Interval 4857 EDB.mxd 7/2/2018 EA eomalia

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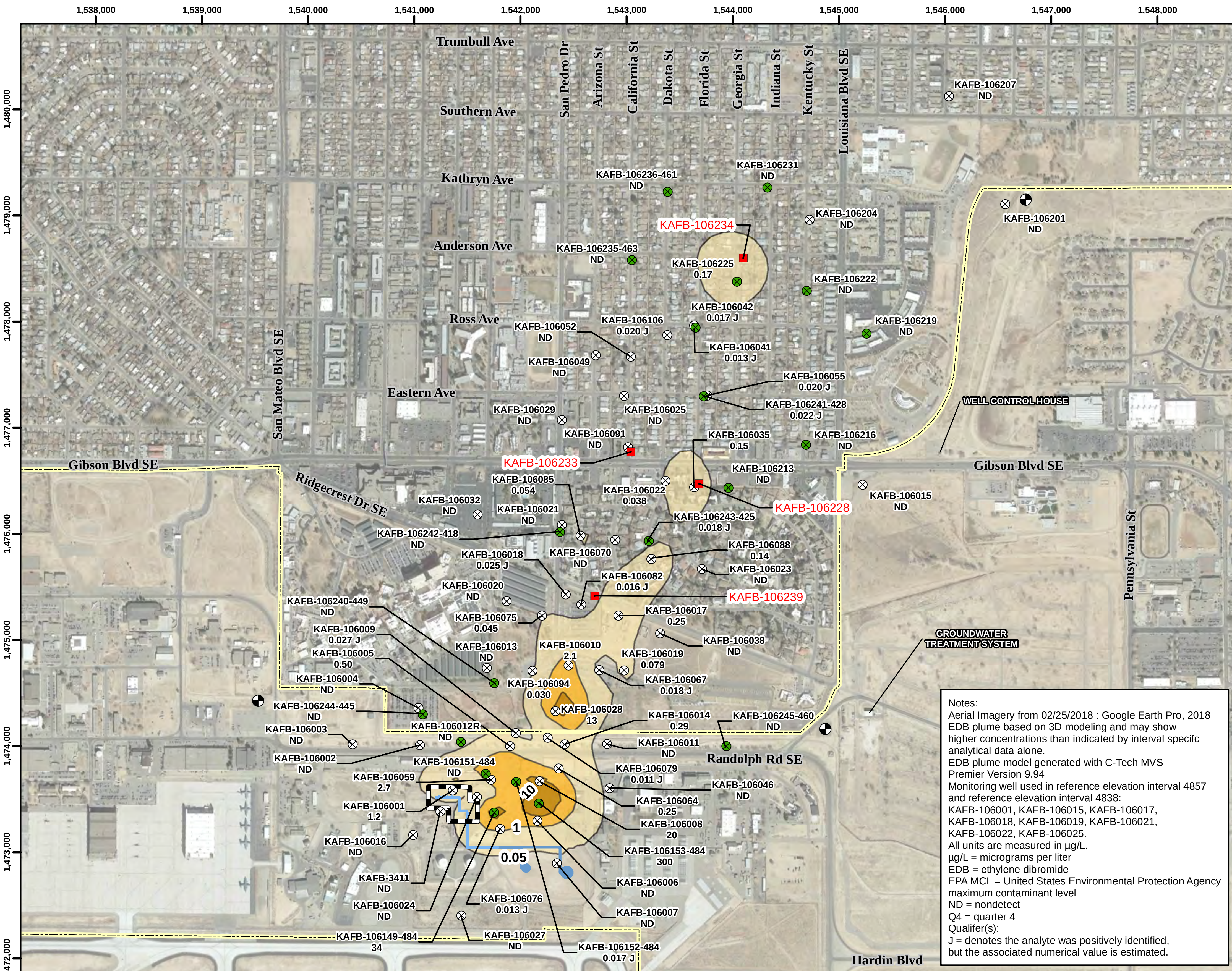
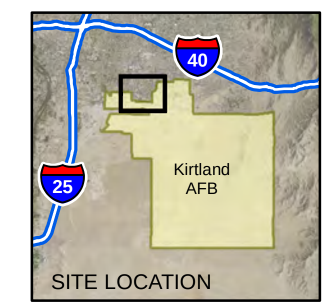


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Extraction Well
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Fence Boundary
- EDB Concentration Isocontour (µg/L)
- Source Area

EDB Concentration Range

- 0.05 (EPA MCL) - 1.0 µg/L
- 1.0 - 10 µg/L
- 10 - 500 µg/L



N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
EDB plume based on 3D modeling and may show higher concentrations than indicated by interval specifc analytical data alone.
EDB plume model generated with C-Tech MVS Premier Version 9.94
Monitoring well used in reference elevation interval 4857 and reference elevation interval 4838:
KAFB-106001, KAFB-106015, KAFB-106017,
KAFB-106018, KAFB-106019, KAFB-106021,
KAFB-106022, KAFB-106025.
All units are measured in µg/L.
µg/L = micrograms per liter
EDB = ethylene dibromide
EPA MCL = United States Environmental Protection Agency maximum contaminant level
ND = nondetect
Q4 = quarter 4
Qualifier(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

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FIGURE A-2-10

EDB CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2018

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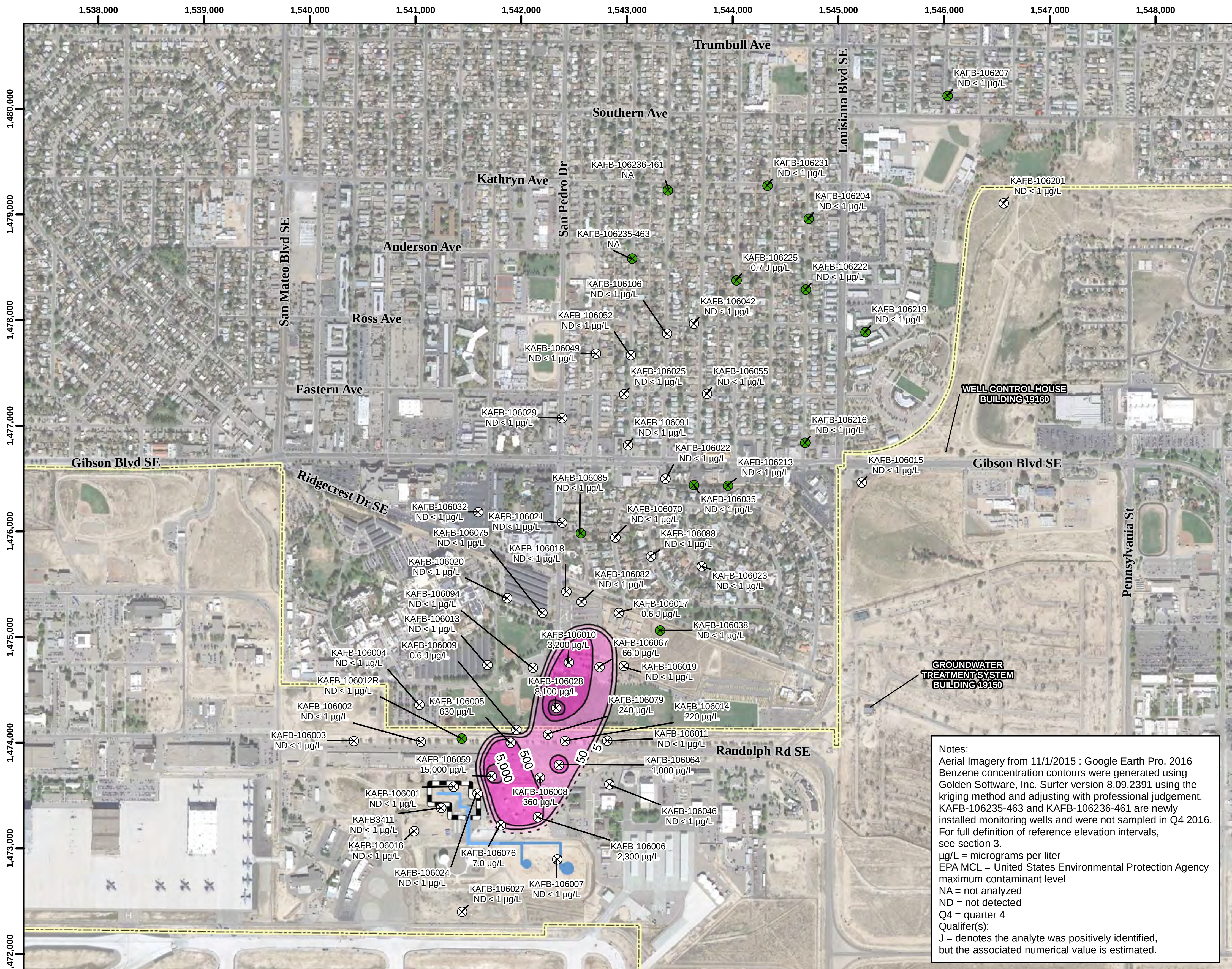
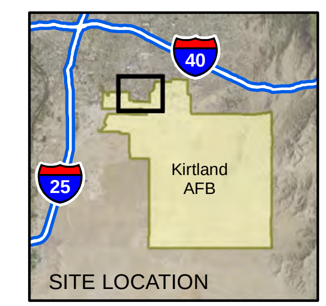


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Benzene Concentration Isocontour (µg/L)
- Inferred Isocontour (µg/L)
- Source Area

Benzene Concentration Range

- 5.0 (EPA MCL) - 50 µg/L
- 50 - 500 µg/L
- 500 - 5,000 µg/L
- 5,000 - 15,000 µg/L



N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 11/1/2015 : Google Earth Pro, 2016
Benzene concentration contours were generated using Golden Software, Inc. Surfer version 8.09.2391 using the kriging method and adjusting with professional judgement.
KAFB-106235-463 and KAFB-106236-461 are newly installed monitoring wells and were not sampled in Q4 2016.
For full definition of reference elevation intervals, see section 3.
µg/L = micrograms per liter
EPA MCL = United States Environmental Protection Agency maximum contaminant level
NA = not analyzed
ND = not detected
Q4 = quarter 4
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

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FIGURE A-2-11

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2016

P:\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2016_Q4\Report Figures\Section 3\3-9 Interval 4857 Benzene Q4.mxd 2/14/2017 EA eomalia

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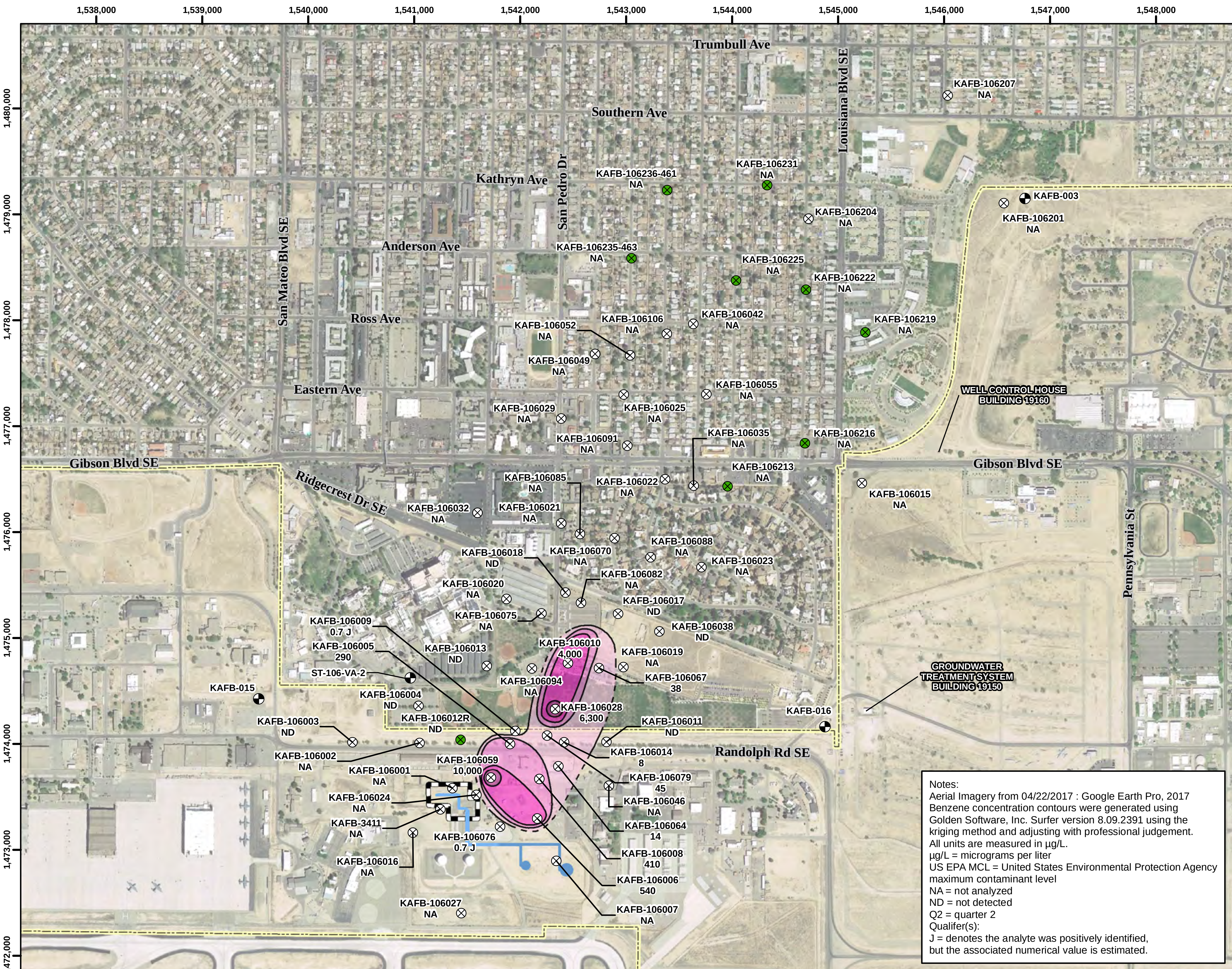
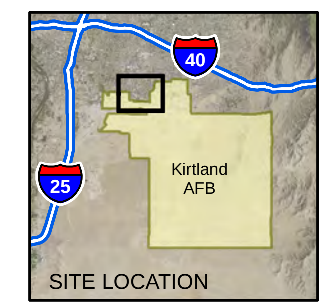


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Benzene Isocontour (µg/L)
- Inferred Isocontour (µg/L)
- Source Area

Benzene Concentration Range

- 5.0 (EPA MCL) - 50 µg/L
- 50 - 500 µg/L
- 500 - 5,000 µg/L
- 5,000 - 15,000 µg/L



N

0 500 1,000 2,000
Feet
1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
Benzene concentration contours were generated using Golden Software, Inc. Surfer version 8.09.2391 using the kriging method and adjusting with professional judgement.
All units are measured in µg/L.
µg/L = micrograms per liter
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
NA = not analyzed
ND = not detected
Q2 = quarter 2
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

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FIGURE A-2-12

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q2 2017

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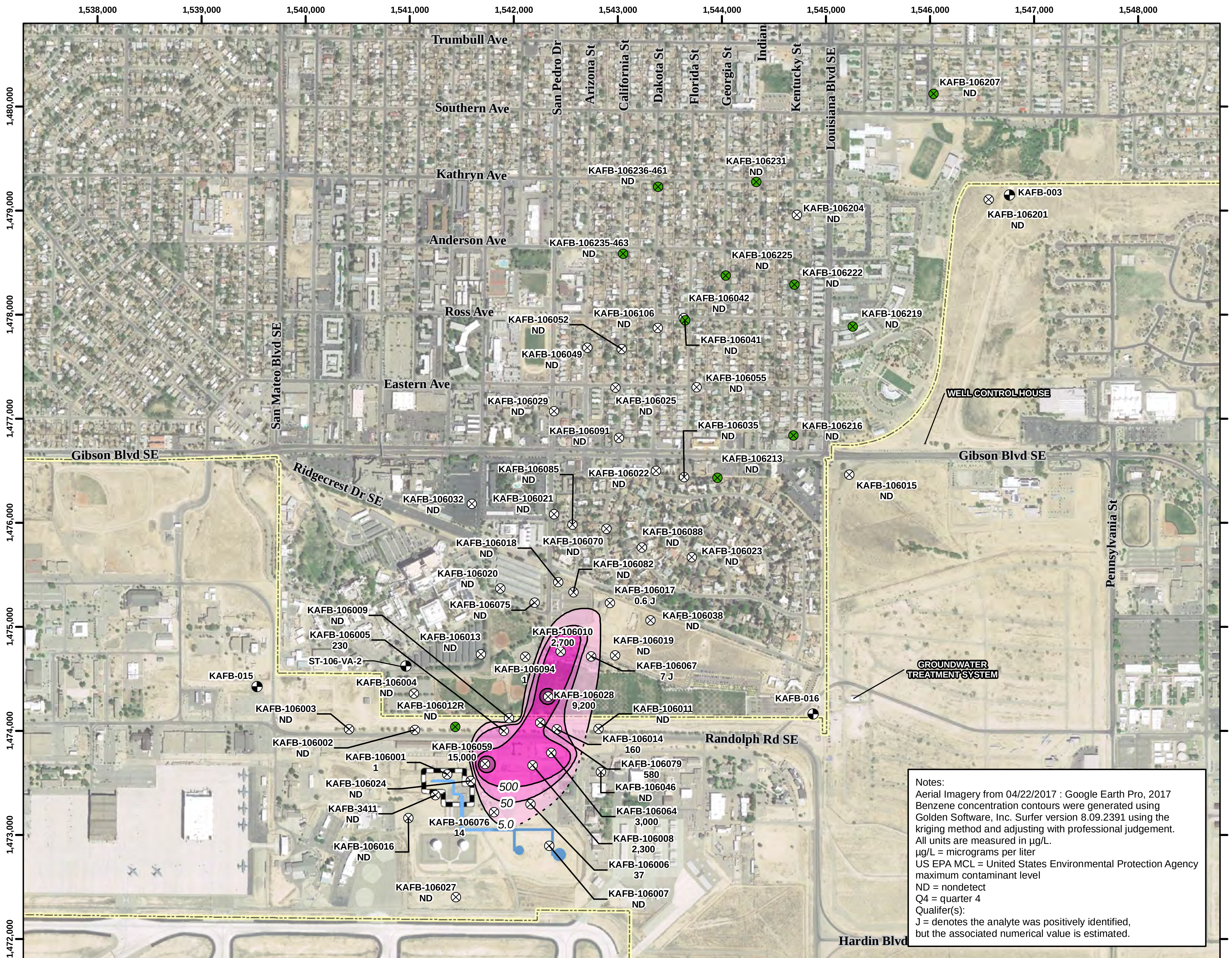
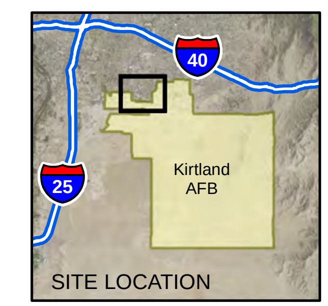


Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Benzene Isocontour (µg/L)
- Inferred Isocontour (µg/L)
- Source Area

Benzene Concentration Range

- 5.0 (EPA MCL) - 50 µg/L
- 50 - 500 µg/L
- 500 - 5,000 µg/L
- 5,000 - 15,000 µg/L



N

0 500 1,000 2,000

Feet

1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-13

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q4 2017

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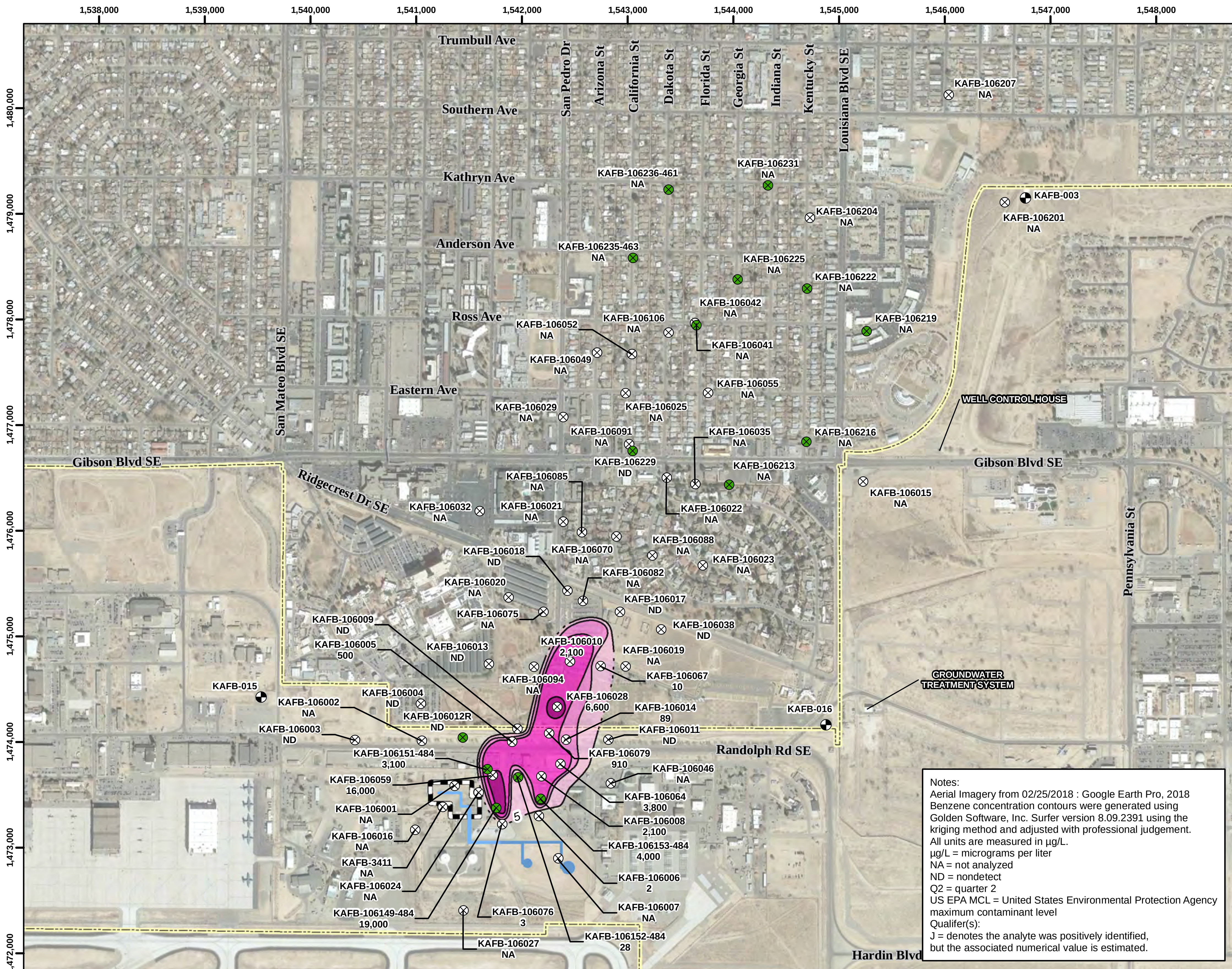


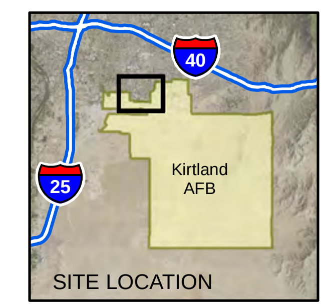
Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Benzene concentration contours were generated using Golden Software, Inc. Surfer version 8.09.2391 using the kriging method and adjusted with professional judgement.
All units are measured in µg/L.
µg/L = micrograms per liter
NA = not analyzed
ND = nondetect
Q2 = quarter 2
US EPA MCL = United States Environmental Protection Agency maximum contaminant level
Qualifer(s):
J = denotes the analyte was positively identified, but the associated numerical value is estimated.

Legend

- Reference Elevation Interval 4857 Monitoring Well (Screen Not Submerged)
- Reference Elevation Interval 4857 Monitoring Well (Screen Submerged)
- Drinking Water Supply Well
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Benzene Concentration Isocontour
- Inferred Benzene Concentration Isocontour
- Source Area

Benzene Concentration Range

- 5.0 (EPA MCL) - 50 µg/L
- 50 - 500 µg/L
- 500 - 5,000 µg/L
- >5,000 µg/L



N
0 500 1,000 2,000
Feet
1 inch = 1,000 feet
Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE A-2-14

BENZENE CONCENTRATIONS IN GROUNDWATER REFERENCE ELEVATION INTERVAL 4857, Q2 2018

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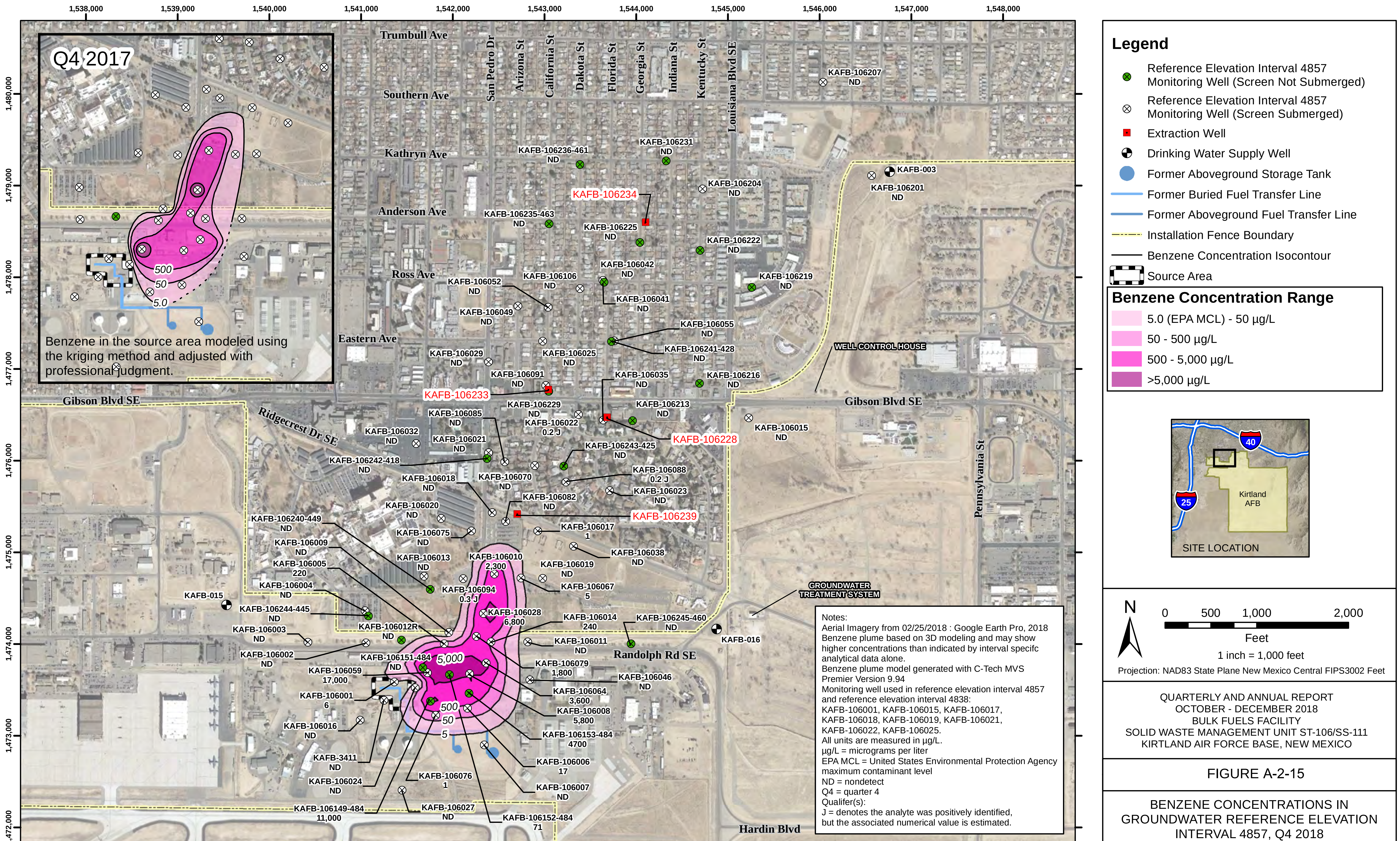

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Material reprinted from:
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BORING LOG

Project: **Kirtland BFF**	Project Number:
Drilling Company:	Start Time/Date:
Lead Driller:	Completion Time/Date:
Drilling Method:	Final Depth:
Casing Diameter OD:	Bit Type and Outer Diameter
Boring/Well ID:	Logged By: Page ____ of ____

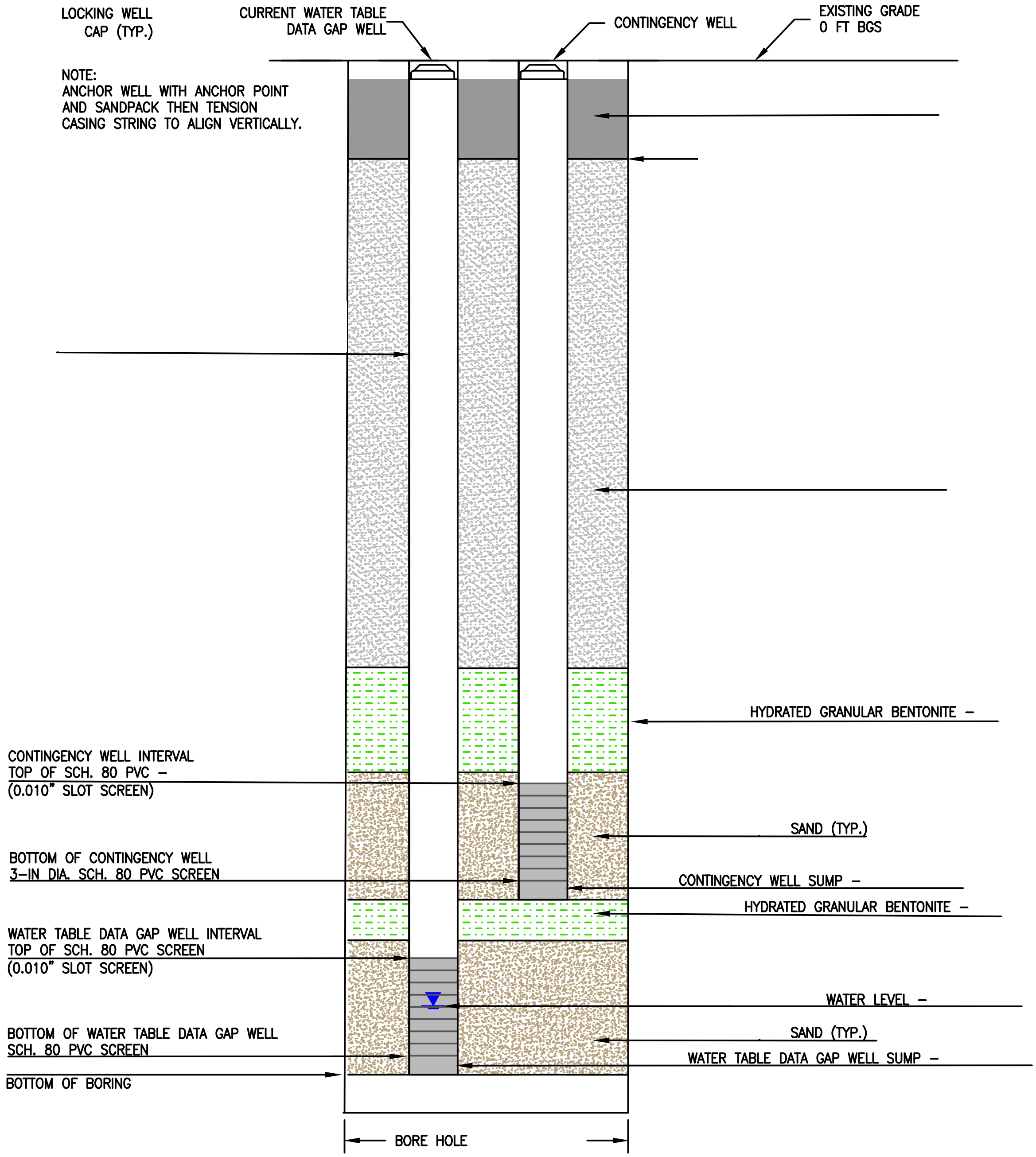
		SAND		GRAVEL				
USCS Soil Type	**PID Reading (ppm)**	**Grain Size %(fine, medium, coarse)**	**Mineralogy %(Quartz, Feldspar, Lithic)**	**Angularity, Roundness (R,SR,SA,A)**	**Mineralogy %(Quartz, Feldspar, Lithic)**	**Depth, ft bgs**	**Soil Description** (sample interval, soil type, color, plasticity, moisture, other)	**Other Notes**

Additional Comments:

R=Rounded, SR=Subrounded, SA=Subangular, A=Angular

Well Completion Form

Well Number:____



NOT TO SCALE
BGS=BELOW GROUND SURFACE
FT=FEET

	KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME:	INSTALLATION END DATE/TIME:
	PROJECT NO.:	WELL ID:	GEOLOGIST:	DRILLER:

CAD FILE: Y:\Active Projects\62599DM01 Kirtland BFF_USACE\01_Work Plan\19.0 Data Gap Wells WP\Figures\Natives\Nested Monitoring well_KAFB-106240-245.dwg PLOT DATE/TIME: 12/18/2017 – 4:39pm

FIELD RECORD OF WELL DEVELOPMENT

Project Name:	Project No:	Date/Time:
Personnel:	Development Method:	
Equipment Used:		Equipment Calibrated: Y N
Weather/Temperature/Barometric Pressure:		Date/Time:

Well No.:	Well Condition:
Well Diameter:	Measurement Reference:
Well Volume Calculations	
A. Depth To Water (ft):	D. Well Volume/ft:
B. Total Well Depth (ft):	E. Total Well Volume (gal)[C*D]:
C. Water Column Height (ft):	F. Five Well Volumes (gal):

Parameter	Beginning	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH (Δ<0.2)						
Temperature (°F) (Δ<10%)						
Conductivity (μmhos/cm) (Δ<10%)						
Turbidity (NTU) (<10 NTU*)						

Parameter	6 Volumes	7 Volumes	8 Volumes	9 Volumes	10 Volumes	End
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH (Δ<0.2)						
Temperature (°F) (Δ<10%)						
Conductivity (μmhos/cm) (Δ<10%)						
Turbidity (NTU) (<10 NTU*)						

NOTE: NTU = Nephelometric turbidity unit.
ORP = Oxidation-reduction potential.
* = If <10 NTU is not able to be achieved, <100 NTU is acceptable

Parameter stabilization requires four consecutive readings [four consecutive differences (Δ)] to meet parameter stabilization requirements listed.

COMMENTS AND OBSERVATIONS: ____________________

Kirtland AFB BFF
Groundwater Well Inspection Form

Well ID: ______________________ **PID:** ________ ppm **Date:** __________

Stick up: ☐ **Flush Mount:** ☐

Well Pad Condition:	Below Grade	☐	Functional	☐	Repair Required	☐
Bollards:	Not Applicable	☐	Functional	☐	Repair Required	☐
Protective Casing:	Not Applicable	☐	Functional	☐	Repair Required	☐
Lock/Cover Bolt:	Not Applicable	☐	Functional	☐	Replacement Required	☐
Vault Threads:	Not Applicable	☐	Functional	☐	Cleaning Required	☐
Vault Cover:	Not Applicable	☐	Functional	☐	Repair Required (Excessive Corrosion on Threads)	☐
Vault Seal:	Missing	☐	Functional	☐	Replacement Required (Excessive Corrosion at Seal Surface)	☐
Water in Vault:	Yes	☐	No	☐	***If yes, Depth of Water:*** ________ Ft.	
Debris in Vault:	Yes	☐	No	☐	***If yes, Type of Debris:*** ________	
Pump Present:	Yes	☐	No	☐	***If no pump, J-Plug Present:*** Yes ☐ No ☐	

Bennett Pump Inventory:

Drop Pipe Plug:	Missing	☐	Functional	☐	Replacement Required	☐
Exhaust Line Plug:	Missing	☐	Functional	☐	Replacement Required	☐
Pump Line Plug:	Missing	☐	Functional	☐	Replacement Required	☐
Well Sounder Plug:	Missing	☐	Functional	☐	Replacement Required	☐

Additional Comments: ____

____

____

____

____

Work Performed: ____

____

____

Photographs of Damaged/Missing Parts Taken: Yes ☐

Recorded By: ____

For serious problems, contact Earl Morse at (505) 238-4410

	Well Gauging Form					Total Wells		Year
	Project: Kirtland AFB BFF ST-106/SS-111							Quarter :
Well ID	Previous DTW (ft MRP)		Date	PID (ppm)	Depth to NAPL (ft MRP)	DTW (ft MRP)	Initials	Reference Point
	Depth to NAPL	DTW						
								TWV
								TWV
								TWV
								TWV
								TWV
								TWV
								TWV
								TWV
								TWV
								TWV
								TOPC
								TWV

Well Purge and Sampling Log

Well I.D. Number: ________________________

Project:		**Date/Time Sampled:**	
Task Number:		**Totally Influenced:**	Yes No
Project Manager:		**Well Depth in Feet:**	
Field Team:		**Screened Interval in Feet:**	

1. Purging Data/Field Measurements: All Measurements Relative to Top of Casing

Well Depth in Feet:		**Casing Volume in Gallons:**	
Depth of Sediment (DTS) in Feet:		[1" diameter = x .041 gal/ft, 2" d. = x .163 gal/ft, 4" d. = x .653 gal/ft]	
Depth of Water (DTW) in Feet:		**Purge Volume in Gallons:**	
DTS - DTW:		**Actual Purge in Gallons:**	

Time	No. of Gallons Purged	pH	Temp. in °C	Conductivity (mS/cm)	Turbidity	DO (mg/L)	DTW (ft.)	Comments: Quality, Recovery Color, Odor, Sheen, Accumulated Silt/Sand

	Method	Purging Rate in L/min	Depth of Equipment in Feet
Purge			
Sample			

Bails Dry?	Yes No
At Number of Casing Volumes:	
Purge Water Disposal Method/Volume:	

2. Sampling Data

Bottle Type	Number of Containers	Analyses	Preserv.	Filter

Total Number of Bottles:	
Duplicate Sample ID:	
Field Blank ID:	
Rinseate Sample ID:	

3. Field Equipment (Type/Brand/Serial Number/Material/Units)

Pump Type/Tubing Type:		**Temp/pH/E.C./D.O.:**	
Bailer Type:		**Water Level Probe:**	
Filter Type:		**Other:**	

4. Well Conditions

Satisfactory **Unsatisfactory** **Explain:**

YSI Professional Plus Log

Serial # (WH0001)

Year:

Project: Kirtland AFB BFF ST-106/SS-111

Quarter : _

Date	Cal or Bump	pH 4.00	pH 7.00	pH 10.00	ORP (220 mV)	Conductivity (1413 µS/cm)	Measured DO (% Sat)	Barometer (mm Hg)	100% DO Sat Adjusted for Barometric Pressure	Initials
Calibration Tolerances:		+/- 0.2 pH Units			+/- 20 mV Standard	+/- 0.5% of Standard	+/- 2% of the Adjusted DO Value	N/A	N/A	N/A

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

* 100% DO Sat =100 x (Barometric Pressure in mmHg/760)

Rae Systems MiniRAE 3000 PID Log

Serial # (WH0004)

Year:

Project: Kirtland AFB BFF ST-106/SS-111

Quarter : _

Date	Cal or Bump	0 ppm	100 ppm	Initials
Calibration Tolerances:		+/- 3% of standard value		N/A

* Calibrate all parameters weekly. Bump check all parameters daily and re-calibrate if values are out of tolerance.

Hach 2100Q Portable Turbidimeter Log

Serial # **(WH0007)** Year:

Project: Kirtland AFB BFF ST-106/SS-111 Quarter : _

Date	Bump or Cal	20 NTU	100 NTU	800 NTU	10 NTU	Initials
Calibration Tolerance:		+/- 10% of Standard Value				N/A

*Calibrate Instrument every three months, bump check weekly and re-calibrate if values are out of tolerance.

CHAIN-OF-CUSTODY RECORD

PROJECT NAME: **Kirtland AFB Bulk Fuels Facility**	PROJECT NUMBER:	LABORATORY NAME AND CONTACT:	FAX AND MAIL REPORTS/EDD TO: FAX AND MAIL REPORTS/EDD TO:	COC NUMBER YEAR: QUARTER:
PROJECT SITE AND PHASE: ST106/SS110		LAB PO NUMBER:	LAB CONTACT:	

ITEM	SAMPLE IDENTIFIER	DATE COLLECTED	TIME COLLECTED	Total Number of Bottles	VOCs (8260C)	BTEX (8260C)	BTEXN (8260C)	EDB (8011)	Total As,Pb,Ca,K,Na,Mg (6020A/6010C)	Dissolved Fe, Mn (6010C)	Chloride, bromide, sulfate (300.0)	Nitrate-Nitrite (353.2)	Alkalinity (SM2320B)	COMMENTS
				ANALYSIS REQUIRED (Specify number of bottles)										
1										*				
2														
3														
4														
5														
6														

COMMENTS: *Dissolved Fe, Mn aliquot was field filtered.

SAMPLER(S):

COURIER AND SHIPPING NUMBER:

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
Printed Name and Signature:			Printed Name and Signature:		
Printed Name and Signature:			Printed Name and Signature:		
Printed Name and Signature:			Printed Name and Signature:		
Printed Name and Signature:			Printed Name and Signature:		

SAMPLE COOLER

SHIPPING CHECKLIST

Site Name: Kirtland BFF (62599DM01) **Date: ________________________**

Fedex Tracking Number: ____________________

Matrix: Groundwater **Lab:** Eurofins (Lancaster, PA)

Cooler Sealed: ____________ (Time) **Delivered to FedEx:____________(Time)**

Sampler 1 (Initials)		Sampler 2 (Initials)
☐	**Two (2) Plastic Bag Liners Included**	☐
☐	**Temperature Blank Included at Bottom of Cooler Surrounded by Ice**	☐
☐	**Trip Blank Included (2 for EDB, 2 for BTEX if present)**	☐
☐	**Samples Checked Against Chain of Custody**	☐
☐	**Chain of Custody Originals Included**	☐
☐	**All Void Space in Cooler filled with Ice**	☐
☐	**Custody Seals On Plastic Bag Liner And Outside Of Cooler**	☐

(Print)Name:____________________________ **(Print)Name:________________________________**

Signature:_____________________________ **Signature:_____________________________**

Date/Time:____________________________ **Date/Time:____________________________**

COC's in Cooler:

____

____

____

____

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Eurofins Lancaster Laboratories Environmental, LLC

Analyte	Analytical Method	CASRN	Units	NMWQCC[1]	EPA MCL[2]	EPA Tapwater		Project Screening Level[4]	Achievable Laboratory Limits[5]		
						RSL[3]	c/nc		LOQ	LOD	DL
Volatile Organic Compounds/BTEX - Quarterly Water Sampling Analysis											
1,1,1,2-Tetrachloroethane	SW8260C	630-20-6	µg/L	NS	NS	5.7	c	5.7	1.0	0.5	0.2
1,1,1-Trichloroethane	SW8260C	71-55-6	µg/L	200	200	8000	nc	200	1.0	0.5	0.3
1,1,2,2-Tetrachloroethane	SW8260C	79-34-5	µg/L	10	NS	0.76	c	10	1.0	0.5	0.2
1,1,2-Trichloroethane*	SW8260C	79-00-5	µg/L	5	5	2.8	c	5.0	1.0	0.5	0.2
1,1-Dichloroethane	SW8260C	75-34-3	µg/L	25	NS	28	c	25	1.0	0.5	0.2
1,1-Dichloroethene	SW8260C	75-35-4	µg/L	7	7	280	nc	7.0	1.0	0.5	0.2
1,1-Dichloropropene	SW8260C	563-58-6	µg/L	NS	NS	NS	-	NS	5.0	0.5	0.2
1,2,3-Trichlorobenzene	SW8260C	87-61-6	µg/L	NS	NS	7.0	nc	7.0	5.0	1.0	0.4
1,2,3-Trichloropropane	SW8260C	96-18-4	µg/L	NS	NS	0.0075	c	0.0075	5.0	0.5	0.2
1,2,4-Trichlorobenzene	SW8260C	120-82-1	µg/L	70	70	12	c	70	5.0	1.0	0.3
1,2,4-Trimethylbenzene	SW8260C	95-63-6	µg/L	NS	NS	56	nc	56	5.0	2.0	1.0
1,2-Dibromo-3-chloropropane	SW8260C	96-12-8	µg/L	NS	0.2	0.0033	c	0.2	5.0	1.0	0.3
1,2-Dibromoethane (EDB)*	SW8011	106-93-4	µg/L	0.05	0.05	0.075	c	0.05	0.03	0.02	0.01
1,2-Dichlorobenzene	SW8260C	95-50-1	µg/L	600	600	300	nc	600	5.0	0.5	0.2
1,2-Dichloroethane*	SW8260C	107-06-2	µg/L	5	5	1.7	c	5.0	1.0	0.5	0.3
1,2-Dichloropropane	SW8260C	78-87-5	µg/L	5	5	8.5	c	5.0	1.0	0.5	0.2
1,3-Dichloropropane	SW8260C	142-28-9	µg/L	NS	NS	370	nc	370	1.0	0.5	0.2
1,3-Dichlorobenzene	SW8260C	541-73-1	µg/L	NS	NS	NS	-	NS	5.0	0.5	0.2
1,3,5-Trimethylbenzene*	SW8260C	108-67-8	µg/L	NS	NS	130	nc	130	5.0	1.0	0.3
1,4-Dichlorobenzene	SW8260C	106-46-7	µg/L	75	75	4.8	c	75	5.0	0.5	0.2
2-Butanone (Methyl Ethyl ketone)*	SW8260C	78-93-3	µg/L	NS	NS	5600	nc	5600	10	1.0	0.3
2-Chlorotoluene*	SW8260C	95-49-8	µg/L	NS	NS	240	nc	240	5.0	0.5	0.2
2,2-Dichloropropane	SW8260C	594-20-7	µg/L	NS	NS	NS	-	NS	1.0	0.5	0.3
2-Hexanone*	SW8260C	591-78-6	µg/L	NS	NS	38	nc	38	10	1.0	0.3
4-Chlorotoluene	SW8260C	106-43-4	µg/L	NS	NS	250	nc	250	5.0	0.5	0.2
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)*	SW8260C	108-10-1	µg/L	NS	NS	6300	nc	6300	10	1.0	0.5
Acetone*	SW8260C	67-64-1	µg/L	NS	NS	14000	nc	14000	20	2.0	0.7
Acrolein	SW8260C	107-02-8	µg/L	NS	NS	0.042	nc	0.042	100	5.0	2.0
Acrylonitrile	SW8260C	107-13-1	µg/L	NS	NS	0.52	c	0.52	20	1.0	0.3
Benzene*	SW8260C	71-43-2	µg/L	5	5	4.6	c	5.0	1.0	0.5	0.2
Bromobenzene	SW8260C	108-86-1	µg/L	NS	NS	62	nc	62	5.0	0.5	0.2
Bromochloromethane	SW8260C	74-97-5	µg/L	NS	NS	83	nc	83	5.0	0.5	0.2
Bromodichloromethane[6]	SW8260C	75-27-4	µg/L	NS	80	1.3	c	80	1.0	0.5	0.2
Bromoform[6]	SW8260C	75-25-2	µg/L	NS	80	33	c	80	4.0	2.0	1.0
Bromomethane	SW8260C	74-83-9	µg/L	NS	NS	7.5	nc	7.5	1.0	0.5	0.3
Carbon Disulfide*	SW8260C	75-15-0	µg/L	NS	NS	810	nc	810	5.0	0.5	0.2
Carbon Tetrachloride	SW8260C	56-23-5	µg/L	5	5	4.6	c	5.0	1.0	0.5	0.2
Chlorobenzene	SW8260C	108-90-7	µg/L	NS	100	78	nc	100	1.0	0.5	0.2
Chloroethane (Ethyl Chloride)	SW8260C	75-00-3	µg/L	NS	NS	21000	nc	21000	1.0	0.5	0.2
Chloroform[6]	SW8260C	67-66-3	µg/L	100	80	2.2	c	80	1.0	0.5	0.2
Chloromethane*	SW8260C	74-87-3	µg/L	NS	NS	190	nc	190	1.0	0.5	0.2
cis-1,2-Dichloroethene	SW8260C	156-59-2	µg/L	70	70	36	nc	70	1.0	0.5	0.2
cis-1,3-Dichloropropene	SW8260C	10061-01-5	µg/L	NS	NS	NS	-	NS	1.0	0.5	0.2
Dibromochloromethane[6]	SW8260C	124-48-1	µg/L	NS	80	8.7	c	80	1.0	0.5	0.2
Dibromomethane	SW8260C	74-95-3	µg/L	NS	NS	8.3	nc	8.3	1.0	0.5	0.2
Dichlorodifluoromethane*	SW8260C	75-71-8	µg/L	NS	NS	200	nc	200	1.0	0.5	0.2
Ethylbenzene*	SW8260C	100-41-4	µg/L	700	700	15	c	700	1.0	0.8	0.4
Hexachlorobutadiene	SW8260C	87-68-3	µg/L	NS	NS	1.4	c	1.4	5.0	4.0	2.0
Isopropylbenzene (Cumene)*	SW8260C	98-82-8	µg/L	NS	NS	450	nc	450	5.0	0.5	0.2
Methyl tert-Butyl Ether*	SW8260C	1634-04-4	µg/L	NS	NS	140	c	140	1.0	0.5	0.2
Methylene Chloride*	SW8260C	75-09-2	µg/L	5	5	110	c	5.0	1.0	0.5	0.3
n-Butylbenzene*	SW8260C	104-51-8	µg/L	NS	NS	1000	nc	1000	5.0	0.5	0.2

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Eurofins Lancaster Laboratories Environmental, LLC

Analyte	Analytical Method	CASRN	Units	NMWQCC[1]	EPA MCL[2]	EPA Tapwater RSL[3]	EPA Tapwater c/nc	Project Screening Level[4]	Achievable Laboratory Limits[5] LOQ	LOD	DL
n-Propylbenzene*	SW8260C	103-65-1	µg/L	NS	NS	660	nc	660	5.0	0.5	0.2
Naphthalene*[7]	SW8260C	91-20-3	µg/L	30	NS	1.7	c	30	5.0	2.0	1.0
p-Isopropyltoluene*	SW8260C	99-87-6	µg/L	NS	NS	NS	-	NS	5.0	0.5	0.2
sec-Butylbenzene*	SW8260C	135-98-8	µg/L	NS	NS	2000	nc	2000	5.0	0.5	0.2
Styrene	SW8260C	100-42-5	µg/L	100	100	1200	nc	100	5.0	0.5	0.2
tert-Butylbenzene*	SW8260C	98-06-6	µg/L	NS	NS	690	nc	690	5.0	1.0	0.3
Tetrachloroethene	SW8260C	127-18-4	µg/L	5	5	110	c	5.0	1.0	0.5	0.2
Toluene*	SW8260C	108-88-3	µg/L	1000	1000	1100	nc	1000	1.0	0.5	0.2
trans-1,2-Dichloroethene	SW8260C	156-60-5	µg/L	100	100	360	nc	100	1.0	0.5	0.2
trans-1,3-Dichloropropene	SW8260C	10061-02-6	µg/L	NS	NS	NS	-	4.7	1.0	0.5	0.2
Trichloroethene*	SW8260C	79-01-6	µg/L	5	5	4.9	c	5.0	1.0	0.5	0.2
Trichlorofluoromethane*	SW8260C	75-69-4	µg/L	NS	NS	5200	nc	5200	1.0	0.5	0.2
Vinyl Acetate	SW8260C	108-05-4	µg/L	NS	NS	410	nc	410	10.0	2.0	0.7
Vinyl Chloride	SW8260C	75-01-4	µg/L	2	2	0.19	c	2	1.0	0.5	0.2
m,p-Xylene*	SW8260C	179601-23-1	µg/L	NS	10,000	190	nc	10,000	5.0	2.0	1.0
o-Xylene*	SW8260C	95-47-6	µg/L	NS	10,000	190	nc	10,000	1.0	0.8	0.4
Xylene (Total)*	SW8260C	1330-20-7	µg/L	620	10,000	190	nc	620	6.0	2.0	1.0
Metals - Total - Quarterly Water Sampling Analysis											
Arsenic	SW6020A	7440-38-2	mg/L	0.01	0.01	0.00052	c	0.01	0.002	0.0016	0.00068
Lead	SW6020A	7439-92-1	mg/L	0.015	0.015	0.015	nc	0.015	0.0005	0.00025	0.000071
Metals - Dissolved - Quarterly Water Sampling Analysis											
Iron	SW6010C	7439-89-6	mg/L	1.0	0.3	14	nc	0.3	0.2	0.1	0.04
Manganese	SW6010C	7439-96-5	mg/L	0.2	0.05	0.43	nc	0.05	0.01	0.005	0.003
Miscellaneous - Quarterly Water Sampling Analysis											
Alkalinity - Bicarbonate/Carbonate	SM 2320B	NS	mg/L	NS	NS	NS	-	NS	8	6	2.6
Ammonia Nitrogen	SM 4500NH3B/C	7664-41-7	mg/L	NS	NS	NS	-	NS	0.75	0.6	0.25
Bromide	E300.0A	24959-67-9	mg/L	NS	NS	NS	-	NS	2.5	2	1.25
Chloride	E300.0A	16887-00-6	mg/L	250	250	NS	-	250	2	1.5	1
Flashpoint[9]	SW-846 1010A	NS	degrees F	NS	NS	NS	-	<140	50	50	50
Nitrate/Nitrite Nitrogen[10]	E353.2	NS	mg/L	10[10]	10[10]	NS	-	10.00	1	0.09	0.04
pH	SW-846 9040C	NS	S.U.	6-9	6.5-8.5	NS	-	6.5-8.5	0.01	0.01	0.01
Sulfate	EPA 300.0A	18785-72-3	mg/L	600	250	NS	-	250	5	4.5	1.5
Sulfide	SM 4500S2F	18496-25-8	mg/L	NS	NS	NS	-	NS	2	1.5	0.7
Total Petroleum Hydrocarbons - Quarterly Water Sampling Analysis											
GRO (C6 - C10)	SW8015D	PHCG	µg/L	NS	NS	NS	nc	101[11]	50	40	23
DRO (C10 - C28)	SW8015D	PHCDC10C2	µg/L	NS	NS	NS	nc	167[12]	100	90	45
Total Petroleum Hydrocarbons - Soil Core Analysis											
GRO (C6 - C10)	SW8015D_GRO_DO	8006-61-9	mg/Kg	NS	NS	NS	nc	100[13]	1.20	0.33	1.10
DRO Extended (C10 - C35)	SW8015_DRO_DOD	STL00143	mg/Kg	NS	NS	NS	nc	1000[14]	4.00	0.68	2.00

[1] NMWQCC standards per the New Mexico Administrative Code Title 20.6.2.3101A, Standards for Ground Water of 10,000 mg/L Total Dissolved Solids Concentration or Less (NMAC 2018). For metals, the NMWQCC standard
[2] EPA National Primary Drinking Water Regulations, Maximum Contaminant Levels and Secondary Maximum Contaminant Levels, Title 40CFR Part 141, 143 (June, 2019)).
[3] EPA Regional Screening Levels for Tapwater (Novmeber 2017) for hazard index = 1.0 for noncarcinogens and a 10^{-5} cancer risk level for carcinogens.
[4] The project screening level was selected to satisfy the requirements of the Kirtland AFB Hazardous Waste Permit No. NM9570024423 as the lowest of 1) NMWQCC standard or 2) EPA MCL. If no MCL or NMWQCC standard
[5] Achieveable laboratory limits are for Eurofins Lancaster Laboratories Environmental, LLC, Lancaster PA.
[6] The EPA RSL and MCL for tapwater is for total trihalomethanes.
[7] NMWQCC specifies a standard for the sum of naphthalene and mononaphthalenes (1-methylnaphthalene and 2-methylnaphthalene). Conservatively, this standard is shown for each of the three compounds.
[8] MCL for nitrite is listed; the MCL for nitrate is 10 mg/L.
[9] The project screening level for flashpoint is based on RCRA hazardous waste criteria.
[10] Based on the geochemical equilibrium of the site groundwater and previous site data nalyses, nitrat/nitrite results represent nitrate concentrations
[11] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-4 Groundwater Screening Level for Gasoline
[12] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-2 Groundwater Screening Level for Diesel #2/crankcase oil
[13] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-2 TPH soil screening value for Gasoline
[14] NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 1 (NMED, 2019) Table 6-2 TPH soil screening value for Diesel #2/crankcase oil
* VOCs included in the Bulk Fuels Facility network groundwater monitoring and treatment system monitoring.
µg/L = Microgram(s) per liter.
AFB = Air Force Base.
BTEX = Benzene, toluene, ethylbenzene, and total xylenes.
c = Carcinogenic.
CASRN = Chemical Abstracts Service Registry Number.
DL = Detection limit.
EPA = U.S. Environmental Protection Agency.
LOD = Limit of detection.
LOQ = Limit of quantitation.
mg/L = Milligram(s) per liter.
MCL = Maximum Contaminant Level.

nc = Noncarcinogenic.
NMAC = New Mexico Administrative Code.
NMWQCC = New Mexico Water Quality Control Commission

NS = Not specified.
RCRA = Resource Conservation and Recovery Act.
RSL = Regional Screening Level.

S.U. = Standard units
VOC = Volatile organic compound.
Cell highlight indicates the LOQ is higher than the project screening level.

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Water IDW

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	SW8260C	µg/L	0.26642556	1
1,1,1-Trichloroethane	SW8260C	µg/L	0.29988297	1
1,1,2,2-Tetrachloroethane	SW8260C	µg/L	0.27276476	2
1,1,2-Trichloroethane	SW8260C	µg/L	0.18810867	1
1,1-Dichloroethane	SW8260C	µg/L	0.27333061	1
1,1-Dichloroethene	SW8260C	µg/L	0.12963215	1
1,1-Dichloropropene	SW8260C	µg/L	0.17906036	1
1,2,3-Trichlorobenzene	SW8260C	µg/L	0.1337266	1
1,2,3-Trichloropropane	SW8260C	µg/L	0.4377035	2
1,2,4-Trichlorobenzene	SW8260C	µg/L	0.2410853	1
1,2,4-Trimethylbenzene	SW8260C	µg/L	0.12170676	1
1,2-Dibromo-3-chloropropane	SW8260C	µg/L	0.58738471	2
1,2-Dibromoethane (EDB)	SW8260C	µg/L	0.30349736	1
1,2-Dibromoethane (EDB)	SW8011	µg/L	0.00661973	0.01
1,2-Dichlorobenzene	SW8260C	µg/L	0.15488466	1
1,2-Dichloroethane (EDC)	SW8260C	µg/L	0.22022606	1
1,2-Dichloropropane	SW8260C	µg/L	0.13385505	1
1,3,5-Trimethylbenzene	SW8260C	µg/L	0.1824473	1
1,3-Dichlorobenzene	SW8260C	µg/L	0.16115299	1
1,3-Dichloropropane	SW8260C	µg/L	0.18045246	1
1,4-Dichlorobenzene	SW8260C	µg/L	0.20790843	1
1-Methylnaphthalene	SW8260C	µg/L	0.84315156	4
2,2-Dichloropropane	SW8260C	µg/L	0.26068818	2
2-Butanone	SW8260C	µg/L	1.11882691	10
2-Chlorotoluene	SW8260C	µg/L	0.13219231	1
2-Hexanone	SW8260C	µg/L	1.7913929	10
2-Methylnaphthalene	SW8260C	µg/L	0.69404444	4
4-Chlorotoluene	SW8260C	µg/L	0.51013241	1
4-Isopropyltoluene	SW8260C	µg/L	0.20218781	1
4-Methyl-2-pentanone	SW8260C	µg/L	1.12810379	10
Acetone	SW8260C	µg/L	2.3399817	10
Benzene	SW8260C	µg/L	0.22664341	1
Bromobenzene	SW8260C	µg/L	0.28392981	1
Bromodichloromethane	SW8260C	µg/L	0.20267676	1
Bromoform	SW8260C	µg/L	0.3145262	1
Bromomethane	SW8260C	µg/L	1.55408408	3
Carbon disulfide	SW8260C	µg/L	0.44427735	10
Carbon Tetrachloride	SW8260C	µg/L	0.1752501	1
Chlorobenzene	SW8260C	µg/L	0.13643228	1
Chloroethane	SW8260C	µg/L	0.37700508	2
Chloroform	SW8260C	µg/L	0.13339525	1
Chloromethane	SW8260C	µg/L	0.40170128	3
cis-1,2-DCE	SW8260C	µg/L	0.38753208	1

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds (continued)				
cis-1,3-Dichloropropene	SW8260C	µg/L	0.3599592	1
Dibromochloromethane	SW8260C	µg/L	0.28352616	1
Dibromomethane	SW8260C	µg/L	0.30859084	1
Dichlorodifluoromethane	SW8260C	µg/L	0.43860584	1
Ethylbenzene	SW8260C	µg/L	0.2128557	1
Hexachlorobutadiene	SW8260C	µg/L	0.32782128	1
Isopropylbenzene	SW8260C	µg/L	0.18266988	1
Methyl tert-butyl ether (MTBE)	SW8260C	µg/L	0.39332816	1
Methylene Chloride	SW8260C	µg/L	0.40025727	3
n-Butylbenzene	SW8260C	µg/L	0.25484172	3
n-Propylbenzene	SW8260C	µg/L	0.18155466	1
Naphthalene	SW8260C	µg/L	0.28182827	2
sec-Butylbenzene	SW8260C	µg/L	0.60651751	1
Styrene	SW8260C	µg/L	0.12902529	1
tert-Butylbenzene	SW8260C	µg/L	0.24440533	1
Tetrachloroethene (PCE)	SW8260C	µg/L	0.35620597	1
Toluene	SW8260C	µg/L	0.1992574	1
trans-1,2-DCE	SW8260C	µg/L	0.48575675	1
trans-1,3-Dichloropropene	SW8260C	µg/L	0.33909857	1
Trichloroethene (TCE)	SW8260C	µg/L	0.20410217	1
Trichlorofluoromethane	SW8260C	µg/L	0.09160495	1
Vinyl chloride	SW8260C	µg/L	0.195513	1
Xylenes, Total	SW8260C	µg/L	0.55450736	1.5
Total Metals				
Aluminum	SW6010B	mg/L	0.00473898	0.02
Antimony	SW6010B	mg/L	0.01372337	0.05
Arsenic	SW6010B	mg/L	0.02200207	0.03
Barium	SW6010B	mg/L	0.0010668	0.002
Beryllium	SW6010B	mg/L	0.00056149	0.003
Boron	SW6010B	mg/L	0.00242131	0.04
Cadmium	SW6010B	mg/L	0.00089973	0.002
Calcium	SW6010B	mg/L	0.03608159	1
Chromium	SW6010B	mg/L	0.00139292	0.006
Cobalt	SW6010B	mg/L	0.00150615	0.006
Copper	SW6010B	mg/L	0.00390292	0.006
Iron	SW6010B	mg/L	0.01278435	0.02
Lead	SW6010B	mg/L	0.01278173	0.02
Magnesium	SW6010B	mg/L	0.02211513	1
Manganese	SW6010B	mg/L	0.00033628	0.002
Molybdenum	SW6010B	mg/L	0.00270888	0.008
Nickel	SW6010B	mg/L	0.00352157	0.01
Potassium	SW6010B	mg/L	0.09030736	1
Selenium	SW6010B	mg/L	0.0213499	0.05

Analyte	Analytical Method	Units	MDL	PQL
Total Metals (continued)				
Silicon	SW6010B	mg/L	0.03044434	0.08
Silver	SW6010B	mg/L	0.00126288	0.005
Sodium	SW6010B	mg/L	0.61473721	1
Strontium	SW6010B	mg/L	0.00027022	0.006
Thallium	SW6010B	mg/L	0.02110005	0.05
Tin	SW6010B	mg/L	0.00374653	0.02
Titanium	SW6010B	mg/L	0.00052741	0.005
Uranium	SW6010B	mg/L	0.02741094	0.1
Vanadium	SW6010B	mg/L	0.0011414	0.05
Zinc	SW6010B	mg/L	0.00165983	0.02
Silica	SW6010B	mg/L	0.06515089	0.1712
Dissolved Metals				
Aluminum	SW6010B	mg/L	0.00473794	0.02
Antimony	SW6010B	mg/L	0.0101365	0.05
Arsenic	SW6010B	mg/L	0.01924201	0.02
Barium	SW6010B	mg/L	0.00041561	0.02
Beryllium	SW6010B	mg/L	0.00050584	0.003
Boron	SW6010B	mg/L	0.00596838	0.04
Cadmium	SW6010B	mg/L	0.00036925	0.002
Calcium	SW6010B	mg/L	0.04591719	1
Chromium	SW6010B	mg/L	0.00118477	0.006
Cobalt	SW6010B	mg/L	0.00191566	0.006
Copper	SW6010B	mg/L	0.00294127	0.006
Iron	SW6010B	mg/L	0.00801103	0.02
Lead	SW6010B	mg/L	0.00966505	0.02
Magnesium	SW6010B	mg/L	0.01936682	1
Manganese	SW6010B	mg/L	0.00020382	0.002
Molybdenum	SW6010B	mg/L	0.00419197	0.008
Nickel	SW6010B	mg/L	0.00222346	0.01
Potassium	SW6010B	mg/L	0.20933244	1
Selenium	SW6010B	mg/L	0.03177226	0.05
Silicon	SW6010B	mg/L	0.01351538	0.08
Silver	SW6010B	mg/L	0.00157158	0.005
Sodium	SW6010B	mg/L	0.26431542	1
Strontium	SW6010B	mg/L	0.00045619	0.006
Thallium	SW6010B	mg/L	0.02395773	0.05
Tin	SW6010B	mg/L	0.00375974	0.02
Titanium	SW6010B	mg/L	0.00075166	0.005
Uranium	SW6010B	mg/L	0.0413263	0.1
Vanadium	SW6010B	mg/L	0.0013731	0.05
Zinc	SW6010B	mg/L	0.00284264	0.02
Silica	SW6010B	mg/L	0.02892292	0.1712

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	SW8260C	mg/Kg	0.00437794	0.05
1,1,1-Trichloroethane	SW8260C	mg/Kg	0.01103372	0.05
1,1,2,2-Tetrachloroethane	SW8260C	mg/Kg	0.01617095	0.05
1,1,2-Trichloroethane	SW8260C	mg/Kg	0.0044343	0.05
1,1-Dichloroethane	SW8260C	mg/Kg	0.00836209	0.05
1,1-Dichloroethene	SW8260C	mg/Kg	0.00730664	0.05
1,1-Dichloropropene	SW8260C	mg/Kg	0.00528389	0.1
1,2,3-Trichlorobenzene	SW8260C	mg/Kg	0.00337725	0.1
1,2,3-Trichloropropane	SW8260C	mg/Kg	0.02104668	0.1
1,2,4-Trichlorobenzene	SW8260C	mg/Kg	0.01739618	0.05
1,2,4-Trimethylbenzene	SW8260C	mg/Kg	0.00706101	0.05
1,2-Dibromo-3-chloropropane	SW8260C	mg/Kg	0.02159375	0.1
1,2-Dibromoethane (EDB)	SW8260C	mg/Kg	0.01967498	0.05
1,2-Dibromoethane (EDB)	SW8011	mg/Kg	0.0351922	0.1
1,2-Dichlorobenzene	SW8260C	mg/Kg	0.01039489	0.05
1,2-Dichloroethane (EDC)	SW8260C	mg/Kg	0.0113981	0.05
1,2-Dichloropropane	SW8260C	mg/Kg	0.0085744	0.05
1,3,5-Trimethylbenzene	SW8260C	mg/Kg	0.01122194	0.05
1,3-Dichlorobenzene	SW8260C	mg/Kg	0.00944562	0.05
1,3-Dichloropropane	SW8260C	mg/Kg	0.01098625	0.05
1,4-Dichlorobenzene	SW8260C	mg/Kg	0.01336812	0.05
1-Methylnaphthalene	SW8260C	mg/Kg	0.05734111	0.2
2,2-Dichloropropane	SW8260C	mg/Kg	0.00585642	0.1
2-Butanone	SW8260C	mg/Kg	0.07717635	0.5
2-Chlorotoluene	SW8260C	mg/Kg	0.01035746	0.05
2-Hexanone	SW8260C	mg/Kg	0.009543	0.5
2-Methylnaphthalene	SW8260C	mg/Kg	0.04621485	0.2
4-Chlorotoluene	SW8260C	mg/Kg	0.0316787	0.05
4-Isopropyltoluene	SW8260C	mg/Kg	0.01287838	0.05
4-Methyl-2-pentanone	SW8260C	mg/Kg	0.0583007	0.5
Acetone	SW8260C	mg/Kg	0.04494549	0.75
Benzene	SW8260C	mg/Kg	0.00962254	0.025
Bromobenzene	SW8260C	mg/Kg	0.00399452	0.05
Bromodichloromethane	SW8260C	mg/Kg	0.00463052	0.05
Bromoform	SW8260C	mg/Kg	0.01205577	0.05
Bromomethane	SW8260C	mg/Kg	0.04376392	0.15
Carbon disulfide	SW8260C	mg/Kg	0.01217576	0.5
Carbon tetrachloride	SW8260C	mg/Kg	0.0044256	0.05
Chlorobenzene	SW8260C	mg/Kg	0.00794471	0.05
Chloroethane	SW8260C	mg/Kg	0.01869531	0.1
Chloroform	SW8260C	mg/Kg	0.00689075	0.05
Chloromethane	SW8260C	mg/Kg	0.00480508	0.15
cis-1,2-DCE	SW8260C	mg/Kg	0.02479626	0.05

Analyte	Analytical Method	Units	MDL	PQL
Volatile Organic Compounds (continued)				
cis-1,3-Dichloropropene	SW8260C	mg/Kg	0.00658169	0.05
Dibromochloromethane	SW8260C	mg/Kg	0.00656147	0.05
Dibromomethane	SW8260C	mg/Kg	0.00760878	0.05
Dichlorodifluoromethane	SW8260C	mg/Kg	0.01534521	0.05
Ethylbenzene	SW8260C	mg/Kg	0.01218082	0.05
Hexachlorobutadiene	SW8260C	mg/Kg	0.01302184	0.1
Isopropylbenzene	SW8260C	mg/Kg	0.00927614	0.05
Methyl tert-butyl ether (MTBE)	SW8260C	mg/Kg	0.00995032	0.05
Methylene chloride	SW8260C	mg/Kg	0.03622655	0.15
n-Butylbenzene	SW8260C	mg/Kg	0.01336161	0.15
n-Propylbenzene	SW8260C	mg/Kg	0.00807367	0.05
Naphthalene	SW8260C	mg/Kg	0.00915431	0.1
sec-Butylbenzene	SW8260C	mg/Kg	0.04121238	0.05
Styrene	SW8260C	mg/Kg	0.00628447	0.05
tert-Butylbenzene	SW8260C	mg/Kg	0.0115733	0.05
Tetrachloroethene (PCE)	SW8260C	mg/Kg	0.01370682	0.05
Toluene	SW8260C	mg/Kg	0.0052276	0.05
trans-1,2-DCE	SW8260C	mg/Kg	0.00854522	0.05
trans-1,3-Dichloropropene	SW8260C	mg/Kg	0.01172169	0.05
Trichloroethene (TCE)	SW8260C	mg/Kg	0.00768123	0.05
Trichlorofluoromethane	SW8260C	mg/Kg	0.01134483	0.05
Vinyl chloride	SW8260C	mg/Kg	0.00417746	0.05
Xylenes, Total	SW8260C	mg/Kg	0.02624796	0.1
Semivolatile Organic Compounds				
1,2,4-Trichlorobenzene	SW8270D	mg/Kg	0.09177166	0.2
1,2-Dichlorobenzene	SW8270D	mg/Kg	0.0809185	0.2
1,3-Dichlorobenzene	SW8270D	mg/Kg	0.07121501	0.2
1,4-Dichlorobenzene	SW8270D	mg/Kg	0.08482738	0.2
1-Methylnaphthalene	SW8270D	mg/Kg	0.09206784	0.2
2,4,5-Trichlorophenol	SW8270D	mg/Kg	0.06374758	0.2
2,4,6-Trichlorophenol	SW8270D	mg/Kg	0.0861744	0.2
2,4-Dichlorophenol	SW8270D	mg/Kg	0.0812905	0.4
2,4-Dimethylphenol	SW8270D	mg/Kg	0.07116475	0.3
2,4-Dinitrophenol	SW8270D	mg/Kg	0.05027902	0.5
2,4-Dinitrotoluene	SW8270D	mg/Kg	0.12151991	0.5
2,6-Dinitrotoluene	SW8270D	mg/Kg	0.10175304	0.5
2-Chloronaphthalene	SW8270D	mg/Kg	0.09480505	0.25
2-Chlorophenol	SW8270D	mg/Kg	0.10707353	0.2
2-Methylnaphthalene	SW8270D	mg/Kg	0.08258592	0.2
2-Methylphenol	SW8270D	mg/Kg	0.08418492	0.4
2-Nitroaniline	SW8270D	mg/Kg	0.10234119	0.2
2-Nitrophenol	SW8270D	mg/Kg	0.08626889	0.2
3+4-Methylphenol	SW8270D	mg/Kg	0.08261285	0.2

Analyte	Analytical Method	Units	MDL	PQL
Semivolatile Organic Compounds (continued)				
3,3´-Dichlorobenzidine	SW8270D	mg/Kg	0.15037372	0.25
3-Nitroaniline	SW8270D	mg/Kg	0.1165158	0.2
4,6-Dinitro-2-methylphenol	SW8270D	mg/Kg	0.08431189	0.4
4-Bromophenyl phenyl ether	SW8270D	mg/Kg	0.1044657	0.2
4-Chloro-3-methylphenol	SW8270D	mg/Kg	0.08438491	0.5
4-Chloroaniline	SW8270D	mg/Kg	0.09736012	0.5
4-Chlorophenyl phenyl ether	SW8270D	mg/Kg	0.0848838	0.2
4-Nitroaniline	SW8270D	mg/Kg	0.12835665	0.4
4-Nitrophenol	SW8270D	mg/Kg	0.08224738	0.25
Acenaphthene	SW8270D	mg/Kg	0.08938772	0.2
Acenaphthylene	SW8270D	mg/Kg	0.09060451	0.2
Aniline	SW8270D	mg/Kg	0.06924821	0.2
Anthracene	SW8270D	mg/Kg	0.09058663	0.2
Azobenzene	SW8270D	mg/Kg	0.09991189	0.2
Benz(a)anthracene	SW8270D	mg/Kg	0.06438737	0.2
Benzo(a)pyrene	SW8270D	mg/Kg	0.09429395	0.2
Benzo(b)fluoranthene	SW8270D	mg/Kg	0.10637566	0.2
Benzo(g,h,i)perylene	SW8270D	mg/Kg	0.10194928	0.2
Benzo(k)fluoranthene	SW8270D	mg/Kg	0.07519968	0.2
Benzoic acid	SW8270D	mg/Kg	0.12507976	0.5
Benzyl alcohol	SW8270D	mg/Kg	0.08201328	0.2
Bis(2-chloroethoxy)methane	SW8270D	mg/Kg	0.07649715	0.2
Bis(2-chloroethyl)ether	SW8270D	mg/Kg	0.10461449	0.2
Bis(2-chloroisopropyl)ether	SW8270D	mg/Kg	0.10164731	0.2
Bis(2-ethylhexyl)phthalate	SW8270D	mg/Kg	0.21522009	0.5
Butyl benzyl phthalate	SW8270D	mg/Kg	0.06088734	0.2
Carbazole	SW8270D	mg/Kg	0.08794382	0.2
Chrysene	SW8270D	mg/Kg	0.08834518	0.2
Di-n-butyl phthalate	SW8270D	mg/Kg	0.27927569	0.4
Di-n-octyl phthalate	SW8270D	mg/Kg	0.12865018	0.4
Dibenz(a,h)anthracene	SW8270D	mg/Kg	0.10503258	0.2
Dibenzofuran	SW8270D	mg/Kg	0.10404737	0.2
Diethyl phthalate	SW8270D	mg/Kg	0.3262925	0.5
Dimethyl phthalate	SW8270D	mg/Kg	0.0925736	0.2
Fluoranthene	SW8270D	mg/Kg	0.08090127	0.2
Fluorene	SW8270D	mg/Kg	0.08925944	0.2
Hexachlorobenzene	SW8270D	mg/Kg	0.08899561	0.2
Hexachlorobutadiene	SW8270D	mg/Kg	0.09384622	0.2
Hexachlorocyclopentadiene	SW8270D	mg/Kg	0.11325564	0.2
Hexachloroethane	SW8270D	mg/Kg	0.08849169	0.2
Indeno(1,2,3-cd)pyrene	SW8270D	mg/Kg	0.11533529	0.2
Isophorone	SW8270D	mg/Kg	0.08170278	0.4
N-Nitrosodi-n-propylamine	SW8270D	mg/Kg	0.09260404	0.2

Analyte	Analytical Method	Units	MDL	PQL
Semivolatile Organic Compounds (continued)				
N-Nitrosodiphenylamine	SW8270D	mg/Kg	0.10431985	0.2
Naphthalene	SW8270D	mg/Kg	0.09421475	0.2
Nitrobenzene	SW8270D	mg/Kg	0.08208344	0.4
Pentachlorophenol	SW8270D	mg/Kg	0.08635748	0.4
Phenanthrene	SW8270D	mg/Kg	0.10214929	0.2
Phenol	SW8270D	mg/Kg	0.07709409	0.2
Pyrene	SW8270D	mg/Kg	0.07583465	0.2
Pyridine	SW8270D	mg/Kg	0.16107401	0.4
Total Metals				
Aluminum	SW6010C	mg/L	0.00473898	0.02
Antimony	SW6010C	mg/L	0.01372337	0.05
Arsenic	SW6010C	mg/L	0.02200207	0.03
Barium	SW6010C	mg/L	0.0010668	0.002
Beryllium	SW6010C	mg/L	0.00056149	0.003
Boron	SW6010C	mg/L	0.00242131	0.04
Cadmium	SW6010C	mg/L	0.00089973	0.002
Calcium	SW6010C	mg/L	0.03608159	1
Chromium	SW6010C	mg/L	0.00139292	0.006
Cobalt	SW6010C	mg/L	0.00150615	0.006
Copper	SW6010C	mg/L	0.00390292	0.006
Iron	SW6010C	mg/L	0.01278435	0.02
Lead	SW6010C	mg/L	0.01278173	0.02
Magnesium	SW6010C	mg/L	0.02211513	1
Manganese	SW6010C	mg/L	0.00033628	0.002
Mercury	SW7471B	mg/Kg	0.002618	0.033
Molybdenum	SW6010C	mg/L	0.00270888	0.008
Nickel	SW6010C	mg/L	0.00352157	0.01
Potassium	SW6010C	mg/L	0.09030736	1
Selenium	SW6010C	mg/L	0.0213499	0.05
Silicon	SW6010C	mg/L	0.03044434	0.08
Silver	SW6010C	mg/L	0.00126288	0.005
Sodium	SW6010C	mg/L	0.61473721	1
Strontium	SW6010C	mg/L	0.00027022	0.006
Thallium	SW6010C	mg/L	0.02110005	0.05
Tin	SW6010C	mg/L	0.00374653	0.02
Titanium	SW6010C	mg/L	0.00052741	0.005
Uranium	SW6010C	mg/L	0.02741094	0.1
Vanadium	SW6010C	mg/L	0.0011414	0.05
Zinc	SW6010C	mg/L	0.00165983	0.02
Silica	SW6010C	mg/L	0.06515089	0.1712

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Soil IDW

Analyte	Analytical Method	Units	MDL	PQL
Herbicides				
2,4,5-T	SW8151A	mg/Kg	0.01	0.01
2,4,5-TP (Silvex)	SW8151A	mg/Kg	0.01	0.01
2,4-D	SW8151A	mg/Kg	0.01	0.01
2,4-DB	SW8151A	mg/Kg	0.01	0.01
Dacthal	SW8151A	mg/Kg	0.01	0.01
Dalapon	SW8151A	mg/Kg	0.01	0.01
Dicamba	SW8151A	mg/Kg	0.01	0.01
Dichlorprop	SW8151A	mg/Kg	0.01	0.01
Dinoseb	SW8151A	mg/Kg	0.01	0.01
MCPA	SW8151A	mg/Kg	0.01	0.01
Pentachlorophenol	SW8151A	mg/Kg	0.01	0.01
Picloram	SW8151A	mg/Kg	0.01	0.01
Pesticides				
4,4´-DDD	SW8081B	mg/Kg	0.00104661	0.003
4,4´-DDE	SW8081B	mg/Kg	0.00106566	0.003
4,4´-DDT	SW8081B	mg/Kg	0.0010414	0.003
Aldrin	SW8081B	mg/Kg	0.0015075	0.004
alpha-BHC	SW8081B	mg/Kg	0.0011587	0.004
beta-BHC	SW8081B	mg/Kg	0.00107573	0.004
Chlordane	SW8081B	mg/Kg	0.2	0.2
delta-BHC	SW8081B	mg/Kg	0.00101211	0.004
Dieldrin	SW8081B	mg/Kg	0.00114727	0.003
Endosulfan I	SW8081B	mg/Kg	0.00103656	0.003
Endosulfan II	SW8081B	mg/Kg	0.00106783	0.003
Endosulfan sulfate	SW8081B	mg/Kg	0.00104968	0.004
Endrin	SW8081B	mg/Kg	0.00093084	0.003
Endrin aldehyde	SW8081B	mg/Kg	0.00099484	0.007
gamma-BHC	SW8081B	mg/Kg	0.00108957	0.004
Heptachlor	SW8081B	mg/Kg	0.00123444	0.004
Heptachlor epoxide	SW8081B	mg/Kg	0.00107789	0.004
Methoxychlor	SW8081B	mg/Kg	0.00116688	0.004
Toxaphene	SW8081B	mg/Kg	0.2	0.2
Decachlorobiphenyl	SW8081B	mg/Kg	0	0
Tetrachloro-m-xylene	SW8081B	mg/Kg	0	0
Total Petroleum Hydrocarbons (TPH)				
Gasoline Range Organics (GRO)	SW8015D	mg/Kg	3.95051103	5
Diesel Range Organics (DRO)	SW8015D	mg/Kg	2.93328769	10

Appendix C
Laboratory Method Reporting Limits and Screening Criteria
Hall Environmental Analysis Laboratories, Inc. - Soil IDW

Analyte	Analytical Method	Units	MDL	PQL
Reactive Cyanide				
Reactive Cyanide	SW9012B	mg/Kg	1	1
TCLP Volatile Organic Compounds				
1,1-Dichloroethene	SW1311	mg/L	0.00401212	0.7
1,2-Dichloroethane (EDC)	SW1311	mg/L	0.00574292	0.5
1,4-Dichlorobenzene	SW1311	mg/L	0.00402815	7.5
2-Butanone	SW1311	mg/L	0.05493877	200
Benzene	SW1311	mg/L	0.00360011	0.5
Carbon Tetrachloride	SW1311	mg/L	0.00251484	0.5
Chlorobenzene	SW1311	mg/L	0.00367929	100
Chloroform	SW1311	mg/L	0.0026578	6
Tetrachloroethene (PCE)	SW1311	mg/L	0.00604063	0.7
Trichloroethene (TCE)	SW1311	mg/L	0.00266794	0.5
Vinyl chloride	SW1311	mg/L	0.00478389	0.2
TCLP Semivolatile Organic Compounds				
2,4,5-Trichlorophenol	SW1311	mg/L	0.03715361	400
2,4,6-Trichlorophenol	SW1311	mg/L	0.0304362	2
2,4-Dinitrotoluene	SW1311	mg/L	0.01755895	0.13
2-Methylphenol	SW1311	mg/L	0.04473895	200
3+4-Methylphenol	SW1311	mg/L	0.12337171	200
Hexachlorobenzene	SW1311	mg/L	0.03944137	0.13
Hexachlorobutadiene	SW1311	mg/L	0.04787594	0.5
Hexachloroethane	SW1311	mg/L	0.05011006	3
Nitrobenzene	SW1311	mg/L	0.05136111	2
Pentachlorophenol	SW1311	mg/L	0.05012942	100
Pyridine	SW1311	mg/L	0.04397144	5
Cresols, Total	SW1311	mg/L	0.16811065	200
TCLP Peticides				
Chlordane	SW1311	mg/L	0.03	0.03
Endrin	SW1311	mg/L	0.02	0.02
gamma-BHC (Lindane)	SW1311	mg/L	0.4	0.4
Heptachlor	SW1311	mg/L	0.008	0.008
Heptachlor epoxide	SW1311	mg/L	0.008	0.008
Methoxychlor	SW1311	mg/L	10	10
Toxaphene	SW1311	mg/L	0.5	0.5
TCLP Herbicides				
2,4,5-TP (Silvex)	SW1311	mg/L	0.01	1
2,4-D	SW1311	mg/L	0.1	10
TCLP Metals				
Arsenic	SW1311	mg/L	0.03123998	5
Barium	SW1311	mg/L	0.00287707	100
Cadmium	SW1311	mg/L	0.00138975	1
Chromium	SW1311	mg/L	0.00203497	5
Lead	SW1311	mg/L	0.00845041	5
Selenium	SW1311	mg/L	0.0576041	1
Silver	SW1311	mg/L	0.01	5

Common Comment and Response Worksheet (Version 3)				
Date	**Reviewer**		**Document Title**	**Contract/TO Number**
7/14/20	**NMED HWB**		**This Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10**	**W912PP-17-C-0028**
Item	**Section**	**Page**	**Comment**	**Response**
1	**Address contaminant migration pathway data gaps beneath the source area**		Data gaps remain from the source zone characterization previously performed under the Permittee's Work Plan for Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST- 106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1, dated December 2017 and approved with conditions by NMED on February 23, 2018. The results of the investigation were presented in the Source Zone Characterization Report for the Bulk Fuels Facility Solid Waste Management Unit ST-106/SS-111, received by NMED on October 30, 2019. This Report is currently under NMED review. The review in progress indicates that that the migration pathway has not been adequately characterized beneath the source area. In order to understand the migration of contaminants through the vadose zone beneath the former fuel offloading rack (FFOR), an understanding of the stratigraphy approximately 250- 300 feet below ground surface (ft bgs) is essential. The source area contaminants descend essentially vertically from the surface to a depth of approximately 250-350 ft bgs where a distinct clay layer is present. The clay layer is easily identified in drill cores and on geophysical logs. The thickness, lateral continuity, and geometry of this clay layer changes across the site. Directly below the FFOR the clay occurs as a single layer at approximately 275-300 ft bgs (lower clay). East-southeast of the FFOR the clay occurs as a single layer at approximately 250 ft bgs (upper clay). A vertical offset can be identified in the clay layer directly below the FFOR that likely creates a preferential pathway to vertical migration of contaminants. Once contaminants reach the 250-300 foot depth range they appear to migrate predominantly downdip (to the east-southeast) on the lower clay layer and then generally vertically to the water table. Three other data sets support this interpretation of the contaminant migration pathway: the observed lateral offset of elevated volatile organic compound (VOC) concentrations with depth; soil vapor extraction system rebound data; and Pneulog total volatile petroleum hydrocarbons (TVPH) soil gas data. All three data sets show contaminant migration to be predominantly vertical	**Revised as requested** - One well will be drilled within the source zone to further characterize the migration pathway beneath the source area. This well will be ARCH drilled to 230 ft bgs and then continuously cored to total depth (TD). Cores will be sampled for TPH, GRO and DRO. The Permittee will provide NMED notification at all required drilling stages, per comments provided herein. The Permittee will consult with NMED upon encountering the clay or reaching 300 ft bgs, at which point the determination will be made whether to complete the well as a groundwater monitoring (GWM) or soil vapor monitoring (SVM) well. Work Plan sections 4.1 and 5.3 have been updated to reflect the requested changes in this comment. Figure 5-1 has been added to illustrate the decision

Common Comment and Response Worksheet (Version 3)				
Date	**Reviewer**		**Document Title**	**Contract/TO Number**
7/14/20	**NMED HWB**		**This Work Plan for Data Gap Monitoring Well Installation KAFB-106248 to KAFB-106252 and KAFB-106S10**	**W912PP-17-C-0028**
Item	**Section**	**Page**	**Comment**	**Response**
			beneath the FFOR to a depth in the 250-300 foot range with a shift in the pathway to the east-southeast before continuing on a vertical downward path to the water table. As stated in NMED's November 4, 2019 letter, "NMED met with the Permittee on September 26, 2019 to discuss the potential to utilize some of the proposed wells for multiple purposes to address other data gaps, the most important being the further characterization of the source area migration pathway through the vadose zone east of the former location of the bulk fuels loading racks. The Permittee agreed to evaluate the potential..." Therefore, the Permittee is instructed to relocate one or two of the proposed monitoring wells (KAFB-106250 and KAFB-106251) nearer to source area, as shown in Attachment II. In order to reduce cost and accelerate work, borehole(s) may be drilled with air rotary casing hammer techniques (ARCH) to a depth of approximately 230 ft bgs, just above the top of the clay described above. The boreholes must then be continuously cored to the total depth of the borehole and sampled for total petroleum hydrocarbons (TPH) gasoline range organics (GRO) and diesel range organics (DRO) Extended using United States Environmental Protection Agency (EPA) Method 8015 (modified). The total depth must be 10 feet below any field screening evidence of contamination (e.g., photoionization detector (PID) readings greater than 10 parts per million volume (ppmv)) to obtain a consistent detailed vertical profile of the migration pathway and to determine the vertical extent of contamination in the source area. A sample for TPH GRO and DRO Extended must be collected at the total depth of the borehole(s). The borehole(s) must also be geophysically logged. See Attachment II for NMED's proposed location for source area migration pathway boreholes. The Permittee must provide NMED email notification at certain stages of the drilling process. These stages include but may not be limited to:	process for well installation in the source zone. The source zone GWM well will be named KAFB-106S10. If an SVM well is installed it will be named KAFB-106V3 The Permittee will advance the source area data gap well(s) as described in this comment, but will also retain all original GWM locations for installation as originally proposed in the work plan in order to fully delineate the ethylene dibromide (EDB) plume to the south and east of the source area. Well numbering was adjusted for clarity of discussion in Section 4. However, the change does not impact the technical scope of the Work Plan or compliance with NMED directives.

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			a) initiation and cessation of ARCH drilling, b) initiation of sonic drilling, c) upon reaching a depth of 300 ft bgs d) upon reaching the water table, and e) upon reaching total well depth. The Permittee's notification to NMED that the driller has reached a depth of 300 ft bgs must include the actual depth bgs and thickness of the clay layer, if it is encountered. If the clay layer is not encountered then the objective of the well will have been achieved, that is, to identify the possible gap in the clay layer located 250 and 300 ft bgs as described above. If the clay layer is encountered, the Permittee, in consultation with NMED, must make a determination about whether it is the lower or upper clay. If it is determined that the driller has encountered the lower clay, the driller should stop at 300 ft bgs or just below the bottom of the clay and the Permittee must partially backfill the borehole with a bentonite seal and sand. The bentonite must be emplaced with a tremie pipe to approximately 2 ft below the top of the clay followed by one foot of sand to prevent bentonite from entering the well screen. The borehole must then be completed as a soil vapor monitoring well (SVMW) with the lower end of the screen located across the top of the clay layer. The SVMW must be constructed with a 1 foot sump and a 2 foot screen of an appropriate slot size. A SVMW design must be submitted to NMED for review with the Work Plan replacement pages. If it is determined that the driller has encountered the upper clay only, the driller should advance the borehole to total depth below the water table and the Permittee must complete the well as a dual screen ground water monitoring well as proposed in the Work Plan. If the first borehole is not successful in locating the contamination migration pathway (i.e., lower clay has been encountered) then a second borehole location should be selected based on the findings of the first borehole. The	

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			proposed second borehole location must be submitted by the Permittee to NMED for approval via electronic mail and approved prior to initiation of drilling. If the first borehole is successful in locating the contamination migration pathway then the Permittee, in consultation with NMED, must make a determination if a second borehole location should be selected to refine the migration pathway or if the borehole should be used to meet the objectives outlined in the Work Plan. See comments below for further detail. Upon completion of drilling the first borehole in the source area, the Permittee must provide NMED a copy of the lithologic log(s) by email. After reviewing the lithologic logs, NMED will provide direction for well installation at that location and direction on drilling a second borehole in the source area. NMED may require the installation of additional groundwater monitoring wells, if the five wells installed pursuant to this Work Plan do not sufficiently address the data gaps.	
2	**Section 6.0 Monitoring and Sampling, page 6-1, line 28**		**Permittee Statement:** "Beginning in 2016 passive sampling techniques were implemented at select GWM [ground water monitoring] well locations. The transition to passive sampling for select GWM well locations was formally approved by NMED on May 31, 2017 (NMED, 2017. A further passive sampling evaluation was performed in Q4 2017 (Section 3.7.7 of KAFB, 2018b). This evaluation demonstrated that analytical results from passive sampling techniques and analytical results from low-flow sampling techniques are generally comparable between the two sampling methods, with no consistent bias identified (i.e., neither method has consistently resulted in higher or lower concentrations)." **NMED Comment:** NMED's May 31, 2017 approval letter approved the change to the use of passive diffusion bags and dual membrane samplers for certain groundwater monitoring wells located north of Ridgecrest Drive in	**Revised as requested** – All planned GWM wells have been redesigned to accommodate low-flow sampling techniques. Figures 4-1 and 4-2 have been revised to reflect the well redesign and changes to well numbering. Additionally, Section 6, Monitoring and Sampling, has been amended to specify a low-

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			residential areas. NMED did not approve the use of passive sampling south of Ridgecrest Drive, particularly in areas with elevated petroleum hydrocarbon contamination. The passive sampling demonstration evaluation performed in Q4 [fourth quarter] 2017 and presented in the Quarterly Monitoring Report October- December 2017 and Annual Report for 2017, dated March 2018, was not reviewed or approved by NMED Hazardous Waste Bureau (HWB). *The Quarterly Monitoring Report-October-December 2018 and Annual Report for 2018*, dated March 2019, states "Field parameters [i.e., turbidity, temperature, dissolved oxygen, specific conductivity, pH, and oxidation reduction potential] were not collected from wells that were sampled using passive sampling methods due to the unreliable field parameter data associated with this technology." Additionally, an email to NMED from KAFB, dated February 28, 2020, provided data from this evaluation. The data indicates that source area monitoring well KAFB-106053 does not produce "high quality and representative sampling that was highly comparable to low-flow sampling," as indicated in the text of the email. Low-flow sampling results indicated a benzene concentration of 15,000 µg/L with duplicate results of 16,000 µg/L, while the passive sampling results for this same well indicated a benzene concentration of 3,700 µg/L with duplicate results of 3,600 µg/L. This demonstrates an order of magnitude difference between the sampling methods for this well located in the source area	flow sampling program on all newly installed wells.
3	**Section 4.0, Scope of Activities, page 4-1**		NMED Comment: The Permittee must revise Section 4.0 of the Work Plan along with corresponding Figures and Tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 4.0 revisions below. The Permittee must submit the revised Section 4.0 and corresponding Figures and Tables as replacement pages.	**Revised as requested** – Section 4 has been revised to reflect the addition of well KAFB-106S10 for source area characterization.
4	**Section 4.0, Scope of Activities, page 4-1,**	**line 6**	**Permittee Statement:** "...well locations proposed in this Work Plan are shown on Figure 2-1 and Figure 2-2."	**Revised as requested** – Section 4 has been revised to reflect the addition of well KAFB-

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			NMED Comment: The Permittee must relocate one or two of the proposed monitoring wells (KAFB-106250 and KAFB-106251) to locations in the source area to determine the source area migration pathway. Propose two new locations within the area identified in Attachment 2. Include a primary location to be drilled first and a secondary location to be drilled should the first borehole not successfully locate the migration pathway.	106S10/KAFB-SV03 for source area characterization. Please see the decision tree added to Section 5 (Figure 5-1). Per Comment #1, a second location will be selected, in collaboration with NMED, as necessary, based on the findings of the first wellbore. The Permittee will advance the source area data gap well(s) as described in this comment, but will also retain all original GWM locations for installation as originally proposed in the work plan to fully delineate the EDB plume to the south and east of the source area.
5	**Section 4.0, Scope of Activities, page 4-1, line 9 and Figure 4-1, Proposed Construction Diagram for Groundwater Monitoring Well with Contingency Well and Figure 4-2, Proposed Construction Diagram for Groundwater**		**Permittee Statement:** "Four of the five proposed GWM wells (KAFB-106249 through KAFB- 106252) will be constructed with the same design employed by the Work Plan for Data Gap Monitoring Well Installation {Section 3.1.1of [Work Plan for Data Gap Well Installation, 2017]) as shown on the construction diagram {Figure 4-1)." **NMED Comment:** All groundwater monitoring wells must be constructed utilizing an appropriate well casing diameter (e.g., four-inch inside diameter) to accommodate equipment, such as low-flow pumps, which can effectively purge wells for active sampling.	**Revised as requested** - All planned GWM wells have been redesigned to accommodate active sampling techniques, including increasing inside diameter to 4 inches. All Sections have been revised to specify active sampling on all newly installed GWM wells. Figures 4-1 and 4-2 have been revised to reflect the well redesign.

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<tr><td></td><td>Monitoring Well KAFB-10624</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Section 4.0, Scope of Activities, page 4-2, lines 1 through 16</td><td></td><td>Permittee Statement: "KAFB-106250 is proposed to be installed in the parking lot of the Air National Guard (ANG) adjacent to the existing well KAFB-106046. This location will help to bound both the EDB [ethylene dibromide] and benzene plumes in this area...KAFB-106251 is also proposed for installation on ANG property, adjacent to the boundary with the BFF [Bulk Fuels Facility]... However, water table wells are needed closer to the source area to more accurately delineate the EDB and benzene plumes in this area."

NMED Comment: According to Figures 2-1, Proposed Monitoring Well Locations and Q2 [second quarter] 2019 EDB Plume Map, and Figure 2-2, Proposed Monitoring Well Locations and Q2 2019 Benzene Plume Map, wells KAFB-106245 and KAFB-106247 do not have submerged well screens and neither EDB nor benzene were detected in the second quarter of 2019 (Q2 2019). These wells provide delineation of the plumes to the east and east- southeast of the source area; therefore, proposed wells KAFB-106250 and KAFB-106251 are good candidates to be moved to characterize the source area migration pathway.</td><td>Revised as requested - Well KAFB-106S10/KAFB-SV03, has been added to characterize the source area migration pathway. While the two wells cited do put eastern/ southeastern bounds on the contaminant plumes, the proposed wells will further constrain the eastern boundaries of the plumes as well as aiding in identification of any shifts in groundwater flow gradient and eastward expansion of the plumes due to reduced pumping from drinking water wells to the north and the resulting uneven rise in the water table across the study area.</td></tr>
<tr><td>7</td><td>Section 5.0, Scope of Activities, page 4-1</td><td></td><td>NMED Comment: Please revise Section 5.0 of the Work Plan along with corresponding Figures and Tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 5.0 revisions below. The Permittee must submit the revised Section 5.0 and corresponding Figures and Tables as replacement pages.</td><td>Revised as requested – Section 5, as well as corresponding tables and figures, have been revised to reflect the added source area data gap well.</td></tr>
<tr><td>8</td><td>Section 5.0, Scope of Activities, page 4-1</td><td></td><td>NMED Comment: The Permittee must incorporate/ reference the relevant scopes of work from the Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1, dated December 2017, and approved with conditions by NMED on February 23, 2018 (VZ Work Plan), including, but not limited to, the following:</td><td>Revised as requested - Section 5 has been amended to include the drilling, coring, sampling and geophysical logging of the added source area data gap well. Reference has been made</td></tr>
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			a) Drilling Approach and Methodology as outlined in Section 3.1.1.1, page 3-2 of the VZ Work Plan: " borings can be cored continuously from ground surface to total depth, these borings will be over-reamed via air rotary casing hammer (ARCH) technique to the nominal 10-inch diameter OR borings can be accomplished using a combination of ARCH drilling to the designated coring depth, followed by sonic drilling [or other continuous core methodology] to obtain undisturbed cores from the designated coring intervals. Upon achieving the top of the designated coring interval depth, the ARCH rig will be moved off each location while leaving the casing downhole, and the sonic [or other continuous core] rigs will be positioned at the cased holes to core the prescribed designated coring intervals and then subsequently reamed with a sufficient size bit with the ARCH drilling rig to provide a large enough borehole for well construction." b) Core temperatures must be monitored as outlined on page 3-2 in Section 3.1.1.1, page 3-2 of the VZ Work Plan: "Heating during continuous core collection can impact contaminant, geochemical and microbial properties and adversely affect sample representativeness. In addition to advancing the borehole to the designated coring depth with the ARCH rig, to minimize the heating potential, heating of the sonic drilling core barrels in the unsaturated zone can be controlled by any one or combination of the following: i. Advancing shorter sampling runs (5-10 feet versus 20 feet) ii. Allowing the core barrel to cool (or pre-cooling the core barrel) before tripping back into the borehole iii. Changing the vibration level and rotation speed iv. Injecting small quantities of potable water between the override casing and the core barrel without compromising sample integrity as described in A5TM International D6914/D6914M-16.	to the *Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1*, dated December 2017, and approved with conditions by NMED on February 23, 2018 (VZ Work Plan). Lithologic logging, PID field screening and temperature field screening methods for the targeted continuous coring interval have been taken from the approved VZ Work Plan and have been included in this work plan as requested by NMED. Section 5 has not been revised in accordance with part d of this comment. As discussed in the meeting of August 7, 2020, only analysis of TPH DRO/GRO will be performed from soil core samples.

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			v. Temperature inside the core will be monitored when returned to the surface to vi. ensure that heating of the core barrel is not impacting sample selection or integrity. Background soil vapor temperatures in the vadose zone have historically averaged from 20 to 22 degrees Celsius (0 C). Average groundwater temperatures at the site are 19°C. Any core heating over 20°C will require mitigation steps as outlined above. If water is injected, the bottom few inches of the core intervals that are possibly in contact with water accumulating in the bottom of borehole will be discarded prior to collection of samples. Sonic core barrels in the saturated zone are naturally cooled by the presence of formation water; however, similar steps will be implemented as described above to ensure sample representativeness." c) Field Screening for hydrocarbons must be conducted as outlined in Section 3.1.1.3, page 3-3 of the VZ WP, with depths modified as follows: When advancing the borehole to the designated coring interval with ARCH, all cuttings must be logged and PID measurements collected at a minimum of every 10 feet as described in Section 3.2.10 of the VZ WP. Within the designated coring interval, PID readings must be collected every 5 ft. Additional measurements will be collected if qualitative data (e.g., staining, odor, etc.) indicate possible LNAPL. All PID readings shall be recorded on borehole logs d) Laboratory Analyses for Selected Core Samples as outlined in Section 3.1.1.4, page 3-4 of the VZ WP, and modified as follows: Samples for laboratory analyses shall be collected every 10 ft, additional samples shall be selected based on elevated PID measurements (augmented by lithologic and qualitative data) and sampled for TPH GRO/DRO Extended by EPA Method 8015	

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			(modified) from 230 ft bgs to the total depth of the boring(s), to obtain a consistent detailed vertical profile of the migration pathway.	
9	**Section 5.1.2 Drilling of Groundwater Monitoring Wells, page 5-2, line 2**		**Permittee Statement:** "All five new monitoring nested wells will be installed via air rotary casing hammer technology with casing advancement." **NMED Comment:** The two designated boreholes to be used for the investigation of the source area migration pathway must be continuously cored from 230 ft bgs to total depth. This will provide undisturbed cores for more accurate lithologic logging, field screening, and soil sampling. This can be accomplished using a combination of ARCH drilling to the designated coring depth, followed by sonic or other continuous core drilling method to obtain undisturbed cores from the designated coring intervals.	**Revised as requested** – Section 5 has been amended to include the drilling, coring, sampling, and geophysical logging of the added source area data gap well, per specification included in the *Vadose Zone Coring, Vapor Monitoring, and Water Supply Sampling Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico, Revision R1*, dated December 2017, and approved with conditions by NMED on February 23, 2018 (VZ Work Plan).
10	**Section 5.1.2.2 Photoionization Detector [PID] and Headspace Screening, page 5-2, line 32**		**Permittee Statement:** "PIDs will be used for breathing zone monitoring during drilling and sampling activities, as well as for field screening of hydrocarbons in soil cuttings during drilling. This instrument monitors volatile organic compounds using a PID with a 9.8- electronvolt (eV), 10.6-eV, or 11.7-eV UV lamp." **NMED Comment:** The Permittee must use either a 9.5 eV or 9.8 eV UV lamp for field screening samples to avoid fouling of the lamp due to dust, moisture, or high concentrations of petroleum vapors. If evidence of lamp fouling is observed during use of a PID with a 9.8 eV lamp, the Permittee must switch to a 9.5 eV UV lamp to obtain the most accurate PID readings possible. The Permittee must have an additional PID with the lower lamp strength readily available. Reliable PID readings will result in	**Revised as requested** – Section 5.1.2.2 (Now Section 5.3.4), has been revised to specify the use of a 9.8-eV ultraviolet (UV) lamp. 9.5 eV lamps are not as commonly commercially available from equipment suppliers. However, photoionization detector (PID) sensors will respond to all gases that have ionization potentials equal to or less than the eV output of their lamps.

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			a consistent detailed vertical profile of the migration pathway. Failure to obtain reliable readings in the potential migration pathway may result in having to drill another boring to obtain accurate readings.	
11	**Section 5.1.2.2 Photoionization Detector and Headspace Screening, page 5-2, line 37**		**Permittee Statement:** "Record PID measurements at a minimum of every 25 ft of drill cuttings down to 450-ft depth, and then every 10 ft of drill cuttings to total depth following the process below..." **NMED Comment:** For boreholes that will be continuously cored, the Permittee must record PID sample measurement, at a minimum, every 10 ft from ground surface to the start of coring and every 5 ft from the start of coring to the total depth of the borehole to obtain a detailed vertical profile of the migration pathway.	**Revised as requested** – Section 5.1.2.2. (now Section 5.3.4) has been revised to specify PID sample measurement be recorded, at a minimum, every 10 ft from ground surface to the start of coring, and every 5 ft from core point to TD in continuously cored wellbores.
12	**Section 5.1.3 Construction of Groundwater Monitoring Wells, page 5-3, line 21**		All wells must be constructed with casing of sufficient diameter to be sampled via active sampling techniques (e.g. 4" ID to accommodate pumps). Tied to Comment #5.	**Revised as requested -** All planned GWM wells have been redesigned to accommodate active sampling techniques, including increasing inside diameter to 4 inches.
13	**Geophysical logging of source area boreholes**		**NMED Comment:** The Permittee must add a section to the Work Plan proposing to geophysically log all source area migration pathway investigation bore holes with a dual induction geophysical logging tool. The Permittee must specify approximate depths of interrogation for the tool they propose to use. The tool must be calibrated and operated according to American Society for Testing and Materials (ASTM) standards for geophysical logging and the operation manual for the specific model of logging tool. In the report summarizing the results of the investigation the Permittee must provide shop calibration and daily field calibration data. An electronic copy of raw and processed data must be provided in Excel table format. A visual presentation of the log curve must be presented on a single page in a continuous format rather than as several separate pages. The geophysical log(s) for each well must be displayed with the lithologic log for comparison purposes and a discussion of the results must be included in the main body of the	**Revised as requested -** Section 5.3.3.2, has been amended to include dual induction geophysical logging of the relocated source area data gap well. Geophysical electronic data will be included with the report as requested.

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			investigation report. Wells that are to be or will be geophysically logged must be designed with PVC centralizers rather than steel centralizers.	
14	**Section 5.1.3.2 Well Development, page 5-4**		**NMED Comment:** The Permittee must measure and record the parameters for pH, temperature, conductivity, and turbidity, as shown on the field form presented in Appendix B, Field Forms. The Permittee must collect groundwater samples within 10 days after well development in accordance with Section 6.5.17.3 of the Permit. Samples must be analyzed in accordance with Table 6-1, Groundwater Monitoring Requirements for Data Gap Wells.	**Revised as requested** – Section 5.1.3.2 (now Section 5.4.4) specifies that pH, temperature, turbidity, and specific conductance will be monitored and recorded on the Well Development Record Form. This section, as well as Section 6, Monitoring and Sampling, have been amended to specify that groundwater sampling will occur within 10 days after well development, in accordance with Section 6.5.17.3 of the RCRA permit. Sampling will continue thereafter on a quarterly basis.
15	**Section 5.1.3.2 Well Development, page 5-4, line 34**		**Permittee Statement:** "The new wells (KAFB-106248 through KAFB-106252) were designed for passive sampling (Section 6), and the 0.010-inch slot size should minimize formation fines in these wells." **NMED Comment:** The new wells must be designed for active sampling techniques. The new wells must be sampled using active sampling (e.g., low-flow sampling) for a minimum of eight consecutive quarters to establish baseline concentrations in order to establish the precision criteria for passive sampling methods for the newly installed wells. While the approved work plans for data gap well installation and vadose zone coring included passive sampling of newly installed wells, the NMED administrative record does not contain documentation that the use of passive sampling south of Ridgecrest Drive, particularly in areas of	**Revised as requested** – Section 5.4 has been revised to reflect that all planned GWM wells have been redesigned to accommodate active sampling techniques. Additionally, Section 6, Monitoring and Sampling, has been amended to specify an active sampling program on all newly installed wells.

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			elevated contaminant concentrations, has been evaluated or approved by NMED.	
16	**Section 6.0 Monitoring and Sampling, page 6-1**		**NMED Comment:** The Permittee must revise Section 6.0 of the Work Plan along with corresponding figures and tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 6.0 revisions below. The Permittee must submit the revised Section 6.0 and corresponding figures and tables as replacement pages.	**Revised as requested** – Section 6, as well as associated tables and figures, have been revised to reflect additional monitoring and sampling requirements associated with the relocated source area data gap well.
17	**Section 6.0 Monitoring and Sampling, page 6-1, line 11**		**Permittee Statement:** "All newly installed wells will be sampled for four consecutive quarters to establish baseline concentrations for the parameters listed in Table 6-1." **NMED Comment:** The Permittee must collect groundwater samples from all newly installed wells within 10 days after well development in accordance with Section 6.5.17.3 of the Permit, at the next quarterly sampling event, and quarterly thereafter for eight consecutive quarters via active sampling methods (e.g., low-flow) to establish baseline concentrations. These data will be used to establish precision criteria for passive sampling methods for the newly installed wells. Groundwater samples must be analyzed for analytes presented in Table 6-1, Groundwater Monitoring Sampling Requirements for Data Gap Wells, of the Work Plan.	**Revised as requested** – Section 6 has been revised to reflect that all newly installed wells will be sampled within 10 days of well development and for 8 consecutive quarters thereafter to establish baseline concentrations before being categorized based on analytical results.
18	**Section 6.0 Monitoring and Sampling, page 6-1, line 35**		**Permittee Statement:** "Groundwater sampling will be performed via passive sampling techniques for all new GWM wells covered in this Work Plan, barring any environmental factors that would preclude the ability to sample with this technology (e.g., significant and continuous LNAPL thickness in the well)." **NMED Comment:** Given the concerns stated above, the Permittee must not use passive sampling in areas with elevated petroleum hydrocarbon contamination (i.e., in the vicinity of the source area).	**Revised as requested** – Section 6 has been revised to indicate that all groundwater sampling on newly installed wells will be performed via active sampling techniques.

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19	**Section 6.2 Preparation for Groundwater Well Sampling, page 6-3, line 2**		**Permittee Statement:** "All wells covered in this Work Plan will be sampled via passive sampling technology and, therefore, well purging will not be required in association with sampling" **NMED Comment:** The Permittee must add active sampling (e.g., low-flow) to relevant portions of Section 6.0. See the preceding comments regarding passive sampling.	**Revised as requested** – Section 6 has been revised to indicate that all groundwater sampling on newly installed wells will be performed via active sampling techniques.
20	**Section 6.2.1 Collection of Groundwater Samples from Monitoring Wells Using Passive Sampling Techniques, page 6-3, line 19**		**Permittee Statement:** "The procedures below will be followed for passive sampling." **NMED Comment:** As stated previously, active sampling techniques are required. Please include a section describing the procedures for active sampling in the modified Section 6.0 replacement pages and remove the description for passive sampling.	**Revised as requested** – Section 6 has been revised to indicate that all groundwater sampling on newly installed wells will be performed via active sampling techniques.
21	**Section 6.3 Analytical Requirements and Quality Control, page 6-4, line 31**		**NMED Comment:** The Permittee must revise Section 6.3 of the Work Plan along with the relevant figures and tables to include the additional sampling required for the modified scopes of work in the modified Section 6.0 replacement pages.	**Revised as requested** – Section 6.3 (now 6.5), along with relevant figures and tables, has been revised to include additional sampling required for the modified scope of work.
22	**Section 6.3 Analytical Requirements and Quality Control, page 6-4, line 31**		**NMED Comment:** The Permittee must include a data validation section of the Report which describes the data validation process outlined in this Section 6.3 of the Work Plan. Data validation shall be conducted in accordance with Permit Section 6.5.18.	**Revised as requested** – A data validation section has been added (Section 6.6.1)
23	**Section 6.5.2 Hazardous Water Investigation-Derived Waste, page 6-6, line 30**		**Permittee Statement:** "No hazardous/potentially hazardous [investigation-derived waste] IDW is anticipated to be generated from the activities outlined in this Work Plan." **NMED Comment:** This statement must be revised in the modified Section 6.0 replacement pages. The modified scope of work requires	**Revised as requested** – Section 6.7 has been amended to reflect the revised scope of work and the potential for generation of hazardous IDW, particularly at

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			drilling and well development activities in the source area which may generate potentially hazardous IDW. Provide a description of the proposed management of hazardous IDW. Alternately, propose to dispose of purge/ development water in the on-site groundwater treatment system that treats groundwater removed from recovery wells located north of Ridgecrest Drive.	the source area data gap well site.
24	**Section 7 Project Schedule, page 7-1, line 1**		**NMED Comment:** The Permittee must revise Section 7.0 of the Work Plan along with corresponding figures and tables to incorporate the modifications required by NMED to characterize the source area migration pathway. See individual comments on Section 7.0 revisions below. The Permittee must submit the revised Section 7.0 section as replacement pages.	**Revised as requested** – Section 7 has been revised to incorporate the modifications required by NMED to relocate the source area data gap well. Due to the added complexity of the work- the construction completion period has been extended from 60 to 120 days.
25	**Table 6-1, Groundwater Monitoring Sampling Requirements for Data Gap Wells**		**NMED Comment:** Baseline sampling of newly installed wells must include quarterly sampling for GRO, DRO, and volatile organic compounds. The sampling frequency and analytical suite will be re-evaluated after the initial post-development sampling plus eight quarters of baseline sampling.	**Revised as requested** – Table 6-1 has been revised to include quarterly baseline sampling for GRO, DRO and VOCs for 8 quarters following well development.
26	**Table 6-3, Summary of Investigation-Derived Waste Sampling**		**NMED Comment:** Under the portion of the table titled "Water Investigation-Derived Waste from Drilling", the Permittee indicates that post development water will be characterized by a sample taken from "the bailer at end of development". The Permittee is directed to take a composite sample of water from all containers of development water from each well. The contaminant concentrations in the development water may be higher or lower at the start of well development than at the end of development. A composite sample will provide a more accurate representation of contaminant concentrations in the IDW.	**Revised as requested** – IDW sampling has been added to Table 6-2. IDW sampling specifications have been revised to indicate that post-development samples will be a composite of water from all containers of development water from each well.
27	**Appendix B, Field Forms**		**NMED Comment:** The Borehole/Well Construction Log must include well details for all wells to be installed in a single borehole. The example field form shows only one well while the scope of work proposes two	**Revised as requested** – Well construction details for each well will be documented on the

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			wells per borehole. The field form must include well details for installing two wells in each borehole.	construction diagram included in Appendix B. The sample boring log included in Appendix B has been amended to include a column describing "other notes" where notes about depth to water, and documentation of drilling activities can be included.
28	**Appendix C, Eurofins Lancaster Laboratories Environmental [Limited Liability Company] LLC Method Reporting Limits and Screening Criteria**		**NMED Comment:** The Permittee must add a table which presents relevant Method Reporting Limits for soil analyses for the modified scope of work outlined in this Approval with Modifications letter.	**Revised as requested -** A table has been added to Appendix C that includes method reporting limits for soil analyses
29	**Appendix C, Eurofins Lancaster Laboratories Environmental LLC Method Reporting Limits and Screening Criteria**		**NMED Comment:** The Permittee must ensure that the limit of quantitation (LOQ) is less than the project screening levels. If this cannot be achieved by the laboratory due to the dilution of samples or other reason, the new LOQ, and all data qualifiers must be reported. Data tables in the investigation report must present the final limit of detection (LOD), LOQ, sample results, and all laboratory data qualifiers for the analytical results. No revision to Work Plan required.	**Revised as requested** – As illustrated in Appendix C, the achievable LOQ for all additional analyses are less than the project screening levels. However, it is important to note that in areas of high contaminant concentrations, such as the source area, sample dilution may be unavoidable in order to analyze required samples. Sample dilution will raise the detection limits. It is likely that this will occur in the process of analyzing samples

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				from the source area data gap well(s). If sample dilution increases the detection limits of any chemical so that it is higher than the screening limit, this will be discussed in detail in the report.
30	**Section 2.1, Background Information, page 2-1, line 5**		**NMED Comment:** The Permittee must include a more complete site history in the investigation report. The background information/ site history must include a comprehensive summary of the subsurface field investigations that have contributed to the understanding of the site conceptual model and hydrogeology. The Report must also include a more detailed discussion of current water use and the influence of water supply wells on the hydrology and dissolved phase contaminant migration at the site. Discuss the impact these factors may have on projected future use of the water supply wells.	**Revised as requested** – Section 2.1 has been revised to include additional background information on the site, project history, and local hydrogeology.
31	**Section 2, Background Information, page 2-1, line 34**		**Permittee Statement:** "Appendix A-1...illustrates groundwater elevations from 2011 through 2018 along two transects through the [ethylene dibromide] EDB plume. These time series graphs illustrate that the most pronounced increases in groundwater elevation are in the northern area of the site." **NMED Comment:** Appendix A-1, Water Level Hydrographs, does not clearly illustrate this. It is difficult to ascertain trends with the bar graphs presented. Significant differences between the southern and northern portions of the site are not readily apparent. In future documents the Permittee must present data trends in an easy to interpret format. In addition, on Figure L-2-1, Groundwater Elevation Cross Section, three drinking water supply wells are shown on the figure but are not identified in the legend. Other figures had to be consulted to identify these wells. In future documents the Permittee must include all pertinent symbols in the legends of figures. No revision is necessary.	**Comment noted.**

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32	**Section 2, Background Information, page 2-1, line 45 and page 2-2, line 1**		**Permittee Statement:** "Appendix A-1 includes compiled potentiometric surface maps, EDB plume maps, and benzene plume maps at the 4,857 reference elevation interval (REI)..." **NMED Comment:** In the investigation report the Permittee must add a brief explanation of REl's at the site including the depth intervals they represent in both words and numbers (e.g., "the 4,857 REI represents wells screened in the shallow zone at depths ranging from approximately X ft bgs to X ft bgs.") and include a figure/ table for visual clarification of this term.	**Revised as requested** – Section 2 has been amended to include a more detailed explanation of REIs.
33	**Section 2.2, Initial Data Gap Groundwater Wells and Vadose Zone Coring Activities, page 2-2, line 38**		**Permittee Statement:** "The Source Zone Characterization Report...describes the complete suite of analyses performed to characterize LNAPL in the soil cores. The report also describes the conclusions of the LNAPL analyses." **NMED Comment:** The Source Zone Characterization Report is currently in review by NMED and has not yet been approved. In future documents the Permittee must refrain from referencing documents that have not been approved by NMED, as it could be misleading to stakeholders reviewing documents. If referencing such documents is necessary, the Permittee must add a statement stating the official status of the referenced document (e.g., "currently in review by NMED".)	**Revised as requested** – The reference to the Source Zone Characterization Report has been amended to specify that it is currently under revision, and has not yet been approved by NMED.
34	**Section 3.0, Site Conditions, page 3-1, line 14**		**Permittee Statement:** "The groundwater elevation graphs shown in Appendix A-1, illustrate that the operation of the Ridgecrest wellfield has a significant influence on the groundwater gradient at SWMUs ST-106/SS-111. Measurements from 2010 to 2015 indicated a north-northeast-oriented hydraulic gradient toward the Ridgecrest wellfield (Section 7.6.1.2 of KAFB, 2018a). However, with changes in Water Authority and Kirtland AFB pumping practices, the hydraulic gradient no longer has a consistent orientation each quarter. As described in the Q2 2018 report (Section 5.4.4.1 of KAFB, 2018c), the observed rise in groundwater levels across the plume area has occurred at the same time as	**Comment noted.**

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<tr><td></td><td></td><td></td><td>a continual decrease in groundwater extraction at the Ridgecrest wellfield."

NMED Comment: Appendix A-1 does not clearly depict this. See Comments 35 and 36.</td><td></td></tr>
<tr><td>35</td><td>Section 3.0, Site Conditions, page 3-1, line 41</td><td></td><td>Permittee Statement: "Currently, these exceedances of EDB and benzene cannot be accurately bounded because GWM wells with non-detect concentrations of EDB and benzene to the southeast have submerged well screens."

NMED Comment: According to Figures 2-1, Proposed Monitoring Well Locations and Q2 2019 EDB Plume Map, and Figure 2-2, Proposed Monitoring Well Locations and Q2 2019 Benzene Plume Map, the southeast boundaries of both the benzene and EDB plumes are bounded by groundwater monitoring wells KAFB-106245 and KAFB-106247, neither of which have submerged well screens. According to these figures it appears that the southern and southwestern boundaries of these plumes are not bounded by any wells which do not have submerged well screens. Proposed groundwater monitoring well KAFB-106252 will close the southern data gap, however, additional wells may need to be installed in the future to delineate the southwestern edge of these plumes. No response required.</td><td>Comment noted.</td></tr>
<tr><td>36</td><td>Section 6.4 Reporting, page 6-5, line 25</td><td></td><td>Permittee Statement: "Information and data collected during any quarter from drilling, installation, sampling, and gauging activities performed on the newly added monitoring wells will be submitted in SWMUs ST-106/SS-111 Quarterly Monitoring Reports."

NMED Comment: In accordance with Section 6.2.2.1.2, Site Investigations, Investigation Reports, and Section 6.2.4.3, Reporting Requirements, Investigation Reports of the KAFB Resource Conservation and Recovery Act {RCRA) Permit the information and data collected from all investigation activities related to this Work Plan must be submitted to NMED as a separate stand-alone Investigation Report.</td><td>Revised as requested – Wording has been added to Section 6.4 (now Section 6.6.2) to specify that information and data collected from all investigation activities related to this Work Plan will be submitted as a stand-alone report to NMED per the Kirtland AFB RCRA permit.</td></tr>
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37	**Section 8.0 References, page 8-2, line 1**		**Permittee Statement:** The Permittee cites, "KAFB, 2019c. Source Zone Characterization Report Bulk Fuels Facility, SWMUs ST-106/55-111. Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE Albuquerque District under USACE Contract No. W912DR- 12-D-006. November." **NMED Comment:** The Permittee is reminded not to include references for documents that have not been approved by NMED.	**Revised as requested** – The reference to the Source Zone Characterization Report has been amended to specify that it is currently under revision and has not yet been approved by NMED.
38	**Appendix A-2 HISTORICAL GROUNDWATER PLUME MAPS**		**NMED Comment:** The Permittee is reminded that all appendices must have properly numbered pages, tables, and figures. For example, the figure numbers presented in Appendix A-2 include five Figure 3-3's, three Figure 3-6's, two Figure 3-7's, three Figure 3-9's, and two Figure 3-lO's. There is no Figure 3-1, Figure 3-2, Figure 3-4, Figure 3-5, or Figure 3-8. In all future submittals all figures, tables, and pages must be renumbered sequentially for the specific appendices they are placed in and include cross-references to corresponding tables and figures in referenced documents.	**Revised as requested** – Figures in Appendix A have been renumbered in sequential order.