BURNS McDONNELL

# Vertical Profiling and Monitor Well Abandonment Report

## Cimarron Environmental Response Trust

Groundwater Remediation Project
Project No. 120832

Revision 0
4/3/2020

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**prepared for**

**Cimarron Environmental Response Trust**
**Groundwater Remediation Project**
**Guthrie, Oklahoma**

**Project No. 120832**

**Revision 0**
**4/3/2020**

**prepared by**

**Burns & McDonnell Engineering Company, Inc.**
**Kansas City, Missouri**

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| **Abbreviation** | **Term/Phrase/Name** |
|---|---|
| µg/l | micrograms per liter |
| Activity Plan | Activity Plan 2019-03 Vertical Profiling and Well Abandonment |
| AEI | Associated Environmental Inc. |
| AHA | Activity Hazard Analysis |
| Alpha-Omega | Alpha-Omega Geotechnical, Inc. |
| amsl | above mean sea level |
| ASTM | American Society for Testing and Materials |
| BA1 | Burial Area #1 |
| bgs | below ground surface |
| Burns & McDonnell | Burns & McDonnell Engineering Company, Inc. |
| CERT | Cimarron Environmental Response Trust |
| $D_{30}$ | 30% passing grain size |
| DEQ | Oklahoma Department of Environmental Quality |
| D-Plan | Cimarron Facility Decommissioning Plan – Rev 1 |
| EC | electroconductivity |
| Enercon | Enercon Services, Inc. |
| EPM | Environmental Properties Management, LLC |
| Field Geologist | task qualified Burns & McDonnell geologist |
| GEL | General Engineering Laboratories LLC |
| GPS | Global Positioning System |
| GSD | grain size distribution |

| **Abbreviation** | **Term/Phrase/Name** |
|---|---|
| GWS | Geoprobe® HPT – Groundwater Sampler |
| HPT | hydraulic profiling tool |
| IDW | investigation derived waste |
| K | hydraulic conductivity |
| mg/l | milligrams per liter |
| ml/min | milliliters per minute |
| mm | millimeters |
| mS/m | milliseimens per meter |
| OWRB | Oklahoma Water Resources Board |
| PES | Plains Environmental Services, Inc. |
| PPE | personnel protective equipment |
| PTA | Pre-Task Analysis |
| S&H Plan | Safety and Health Plan |
| SAP | Cimarron Site Sampling and Analysis Procedure |
| SOP | Standard Operating Procedure |
| Tc-99 | Technitium-99 |
| USEPA | U.S. Environmental Protection Agency |
| WAA | Western Alluvial Area |

# 1.0 INTRODUCTION

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell), on behalf of the Cimarron Environmental Response Trust (CERT) and Environmental Properties Management, LLC (EPM), has prepared this report summarizing the activities and results associated with vertical profiling, physical soil characterization, and well abandonment activities conducted at the Cimarron Remediation Site located at 100 North Highway 74, Guthrie, Oklahoma (Site). These activities were conducted in general accordance with the *Groundwater and Soil Characterization and Well Abandonment Scope of Work* letter submitted to the U.S. Nuclear Regulatory Commission (NRC) and the Oklahoma Department of Environmental Quality (DEQ) on April 16, 2019 (EPM, 2019). The DEQ approved this scope of work in a letter dated August 16, 2019, and the NRC approved this scope of work in an electronic mail message dated August 26, 2019.

In general, vertical profiling activities were conducted to assess the vertical distribution of uranium and nitrate concentrations in groundwater and to assess relative permeability and lithology with depth using direct sensing technology. Additionally, soil samples were collected from select locations for grain size distribution (GSD) analysis and continuous soil sampling and logging were conducted at these GSD borings. The information obtained from these efforts is needed to complete design of groundwater extraction wells to be installed in the Western Alluvial Area (WAA) and alluvial areas within Burial Area 1 (BA1). Well abandonment activities were also conducted to remove monitor wells no longer useful for groundwater characterization or ongoing groundwater monitoring. Burns & McDonnell began vertical profiling and well abandonment activities in December 2019. Well abandonment activities were completed in December 2019 and vertical profiling activities were completed in January 2020.

## 1.1 Objectives

The *Cimarron Facility Decommissioning Plan – Rev 1* (D-Plan), submitted in November 2018 (EPM, 2018) specifies that the screen intervals for extraction wells installed in alluvium at the site will span the zone of highest uranium and/or nitrate concentration, while also spanning the saturated interval over which uranium concentrations exceed the Oklahoma Department of Environmental Quality (DEQ) Criterion of 30 micrograms per liter (µg/l). The DEQ Criterion for nitrate is 22.9 milligrams per liter (mg/l). At WAA extraction locations where uranium groundwater concentrations are low (i.e., near or below the DEQ Criterion) and nitrate concentrations significantly exceed the DEQ Criterion, nitrate was the primary contaminant of concern used to select screen intervals.

The well screen selection criteria and approach described above are intended to maximize the mass of contaminant removed during groundwater remediation efforts while minimizing the recovery and treatment of minimally contaminated groundwater. This will improve operational efficiency and reduce the time required to achieve remediation goals, particularly if zones of relatively low contaminant concentration coincide with zones of higher permeability. Relative permeability and inferred lithological data were collected using hydraulic profiling tool (HPT) and electroconductivity (EC) direct sensing technologies. This data, along with vertical contaminant profiling data, soil boring log observations, and GSD results, were used to select optimal screen intervals and extraction pump intake elevations. The GSD results were also used to finalize extraction well design details, including filter pack gradation and well screen slot size. The updated extraction well design information will be incorporated into the 90-percent design package, included as Appendix J of the D-Plan.

Twenty-seven (27) monitor wells were identified for abandonment in the D-Plan, as well as in the April 16, 2019 submittal. These 27 monitor wells were plugged and abandoned in accordance with Oklahoma Water Resources Board (OWRB) rules and regulations.

## 1.2 Scope of Work

As specified in the scope of work approved by DEQ and NRC in August 2019, vertical profiling borings were conducted at the location of each groundwater extraction well that will be installed in alluvial material. The following sections provide an overview of the scope of work associated with the vertical profiling, physical (GSD) soil sampling and analysis, and well abandonment activities.

### 1.2.1 Vegetation Clearing and Location Staking

Prior to mobilizing to the Site, Enercon Services, Inc (Enercon) personnel installed wooden stakes at each proposed vertical profiling location using a handheld Global Position System (GPS) device. Following location staking, vegetation, including brush and trees, surrounding the proposed vertical profiling boring locations were cleared by Plains Environmental Services, Inc. (PES) of Salina, Kansas to allow access to conduct direct-push probing and sampling activities. In general, direct-push probing locations were relatively close (within 10 to 15 feet) to the staked locations. Direct-push probing at locations that were still inaccessible following clearing was completed as close as practical to the staked location. Those locations were recorded using a handheld GPS device and/or field measurement tape.

### 1.2.2 HPT-GWS Logging and Groundwater Sampling

Vertical profiling was conducted by advancing a Geoprobe® HPT – Groundwater Sampler (GWS) tool in close proximity to each proposed extraction well location in the WAA and alluvial portion of BA1. The

HPT-GWS tool was advanced to generate continuous, real-time logs of hydrostatic pressure and relative permeability and EC, and to collect discrete groundwater samples. At each boring location, groundwater sample collection was attempted at two-foot intervals until direct-push refusal was encountered. The first (shallowest) groundwater sample was collected approximately one foot below the potentiometric surface (as estimated from HPT hydrostatic pressure measurements). However, at several depth intervals, the formation did not yield the water volume required for laboratory analysis (additional discussion is presented in Section 3.0).

The depth-discrete groundwater samples were collected from each boring by a task qualified Burns & McDonnell geologist (Field Geologist) and submitted to General Engineering Laboratories LLC (GEL) of Charleston, South Carolina for laboratory analysis of uranium-235 and uranium-238 (U-235 and U-238) using Method U.S. Environmental Protection Agency (EPA) 200.8, and for some locations nitrate/nitrite as nitrogen using Method EPA 353.2 (see Table 1-1).

### 1.2.3 Direct-Push Soil Sampling

Soil sampling for GSD analysis was conducted during vertical profiling investigation activities to provide data needed to specify filter pack gradation. Soil samples were collected at select extraction well locations to obtain data representative of each remediation area and to assess spatial variation in the dataset. Direct-push borings, separate from the vertical profiling borings, were advanced by PES in close proximity to eight proposed extraction well locations (GE-WAA-01, GE-WAA-05, GE-WAA-06, GE-WAA-09, GE WAA-12, GE-WAA-15, GE-BA1-02, GE-BA1-05, and GE-BA-09). Soil sampling was conducted using a 2.25-inch sample barrel equipped with an acetate sleeve to provide a continuous soil core for logging of subsurface materials encountered. The Field Geologist recorded lithologic information for each sample on a soil boring log form (included as Appendix C) and collected one composite sample for GSD analysis from every 5-foot interval from near the detected potentiometric surface to the base of the alluvium. GSD samples were submitted to Alpha-Omega Geotechnical, Inc. (Alpha-Omega) of Kansas City, Kansas for laboratory testing of GSD using Method American Society for Testing and Materials (ASTM) C136.

Composite GSD soil samples were necessary to obtain the sample volume recommended by Alpha-Omega for laboratory analysis. In general, each GSD sample represents a composite of the material within each 5-foot sampling interval. However, limited (less than five foot) recovery was achieved for several sampling intervals at multiple boring locations. Although the sample volumes obtained from these intervals and locations were less than the minimum recommended by the laboratory, sufficient material was still obtained for GSD analysis. Additional discussion regarding GSD sampling and results is presented in Section 4.0.

### 1.2.4 Monitor Well Abandonment

Twenty-seven (27) monitor wells identified for abandonment (see Table 1-2) in the D-Plan were plugged and abandoned by Associated Environmental Inc. (AEI), of Norman, Oklahoma in accordance with OWRB rules and regulations (OWRB forms are included as Appendix D).

# 2.0 FIELD ACTIVITIES

This section details the vertical profiling and well abandonment field activities conducted from December 17 through 23, 2019 and January 6 through 10, 2020. With the exception of deviations specifically noted in this section, these activities were completed in accordance with the Activity Plan.

## 2.1 Health and Safety

A site-specific Health and Safety Plan (HASP) was prepared for the specific tasks and scope of work performed during vertical profiling, soil sampling, and well abandonment field activities. A bound copy of the HASP was maintained on-site at all times. Prior to performing any site work, all personnel were required to complete safety and radiological orientation training to become familiar with potential hazards, emergency procedures, discipline protocols, the project HASP, and Burns & McDonnell's Corporate Safety & Health Program. In addition to these training activities, Activity Hazard Analysis (AHA) and Pre-Task Analysis (PTA) forms were completed as necessary for specific tasks. The PTA and AHA forms list hazards, precautionary measures, work practices, personnel protective equipment (PPE) requirements, and other information specific to particular tasks or activities.

Radiological monitoring was provided by Enercon. Radiological surveys were performed following the completion of each boring to minimize the potential for cross-contamination between locations. Enercon maintained records of radiological surveys and results of radiological surveys were compared to project-specific action levels. The following radiological monitoring was performed:

- Measurement of general area dose rates during sampling activities
- Scanning of personnel for contamination
- Scanning of fixed and removable contamination of downhole tooling
- Scanning of removable contamination (collected from one sample bottle per location)
- Measurement of sample cooler dose rates
- Equipment release surveys prior to removal from Site

## 2.2 HPT-GWS Logging and Groundwater Sampling

PES advanced the HPT-GWS tool to evaluate the vertical distribution of uranium (and nitrate where applicable), relative permeability, and inferred lithology within the saturated alluvium in BA1 and the WAA. Vertical profile borings were completed in close proximity to 22 proposed groundwater extraction well locations (GE-BA1-02 through GE-BA1-09 and GE-WAA-02 through GE-WAA-15) and one existing extraction well location (GE-WAA-01). Although GE-WAA-01 is already installed, the vertical distribution of uranium was evaluated near this well to assess the optimal submersible pump installation depth. The HPT-GWS tool was used to obtain hydraulic and EC data, and to collect discrete groundwater samples. HPT-GWS sampling locations are presented on Figure 2-1. The EC data generated by the HPT-GWS is used to interpret the lithology of the saturated alluvium and hydraulic data generated by the HPT-GWS is used to develop a vertical log of relative permeability. Detailed descriptions of EC and HPT technologies are presented below. HPT-GWS and EC logging were performed in accordance with the Geoprobe® HPT Standard Operating Procedure (SOP) (Geoprobe, 2015).

### 2.2.1 EC Logging

In general, EC can vary between soils based on the particle size, mineralogy (i.e., clays, sands, gravels), and water saturation; however, EC generally exhibits an inverse relationship with soil particle size (i.e., sand and gravels with larger particle sizes typically exhibit lower EC than silts and clays with smaller particle sizes). The EC data generated during the vertical profiling investigation were used in conjunction with HPT data, soil boring log observations, and GSD results to characterize subsurface stratigraphy and identify more permeable zones or layers within the unconsolidated alluvium that typically represent preferential pathways for the movement of groundwater and contaminants of concern. The EC data were also used to identify less permeable zones or layers of fine-grained sediments that may serve as a source of suspended solids in recovered groundwater. The minimization of suspended solids is important to reduce the quantity of sediment captured by 10-micron filters included in the groundwater treatment process. This sediment could contain detectable concentrations of uranium and Technitium-99 (Tc-99), impacting the cost of waste disposal for this material. Detectable Tc-99 groundwater concentrations are present in the WAA but not in BA-1. Additional considerations associated with EC data interpretation are presented in Section 3.0.

### 2.2.2 HPT Logging

The HPT component of the HPT-GWS tool measures the pressure required to inject a small volume of water into the subsurface as the probe is advanced. The hydraulic data recorded by the HPT include piezometric pressure (in pounds per square inch [psi]), HPT injection pressure (in psi), and injection flow rate (in milliliters per minute [ml/min]). The injection pressure is generally indicative of formation permeability, and therefore can aid the identification of potential contaminant transport pathways (i.e., zones with higher permeability). The HPT pressure data were used in conjunction with EC data, soil boring log observations, and GSD results to characterize subsurface stratigraphy at each vertical profiling location.

In addition to measuring injection pressure, the HPT can also be used to measure hydrostatic pressure, providing a vertical profile of absolute piezometric pressure and a predicted water table elevation. The hydrostatic pressure was estimated by conducting dissipation tests at varying depths at each location. Dissipation tests are conducted by pausing the downward movement of the HPT-GWS tool and measuring the time for pore pressure stabilization (i.e., equilibrium). Once equilibrium has been achieved, information regarding hydrogeologic features (e.g., water table elevation) can be obtained. The depth of each dissipation test was determined based on the HPT data and generally targeted zones of higher permeability. Zones of higher permeability are preferred for these tests to minimize the time required for pressures to reach equilibrium and develop a piezometric pressure profile. Subtracting the piezometric pressure from the recorded injection pressure yields the corrected pressure, which is more directly related to the permeability of the formation. HPT and EC logs, including dissipation testing depths, are provided in Appendix A.

### 2.2.3 Depth-Discrete Groundwater Sampling

In addition to HPT and EC data collection, the HPT-GWS tool can be used to collect discrete groundwater samples without removing the direct-push tooling. Fifteen (15) HPT-GWS borings were advanced near proposed WAA extraction well locations GE-WAA-02 through GE-WAA-15 and existing WAA extraction well GE-WAA-01. Eight (8) HPT-GWS borings were advanced near proposed BA1 extraction well locations GE-BA1-02 through GW-BA1-09. Each boring was advanced to bedrock refusal with total depths ranging from approximately 16 to 32 feet below ground surface (bgs) in WAA borings, and approximately 20 to 30 feet bgs in BA1 borings. During initial advancement of the HPT-GWS at each location, dissipation tests were conducted to determine the approximate depth to groundwater. HPT and EC data were continuously recorded throughout the vertical direct-push interval and groundwater samples were collected at approximately 2-foot intervals, beginning approximately 1-foot below the water table and ending at or near direct-push refusal. Groundwater was purged at each sample interval using new polyurethane tubing and a peristaltic pump and water quality parameters consisting of pH, specific conductance, and temperature were measured using a YSI 556 Multi-Probe System multi-parameter instrument. Groundwater samples were collected at each interval following stabilization of water quality parameters.

Sampling activities were performed in accordance with Sampling and Analysis Procedure (SAP) 121 “HPT-GWS Groundwater Sampling – Rev. 1”. Field parameter forms are included as Appendix B. Samples were packaged and shipped, under proper chain-of-custody, to the laboratory in accordance with SAP-112 “Sample Packaging and Shipping – Rev. 3”. Chain of custody forms specified analysis for isotopic uranium (field filtered using disposable 0.45-micron pore size membrane filters) by EPA Method

200.8 and, where applicable, nitrate/nitrite as nitrogen using EPA Method 353.2. Only samples collected from borings near extraction well locations GE-WAA-07 through GW-WAA-15 were submitted for nitrate/nitrite analysis.

### 2.2.4 Borehole Abandonment

Following completion of each HPT-GWS boring, boreholes were abandoned in accordance with SAP-110, "Monitoring Well Installation, Development, and Abandonment Rev. 4" and OWRB rules by backfilling and plugging the holes with granular bentonite and/or bentonite chips and hydrating the chips with potable water.

## 2.3 Direct-Push Soil Sampling

PES advanced direct-push borings for physical soil sample collection immediately adjacent to the HPT-GWS borings completed near nine extraction well locations (GE-WAA-01, GE-WAA-05, GE-WAA-06, GE-WAA-09, GE WAA-12, GE-WAA-15, GE-BA1-02, GE-BA1-05, and GE-BA-09). Soil samples were continuously collected using a 2.25-inch sample barrel equipped with an acetate sleeve for logging of subsurface materials encountered. The Field Geologist recorded lithologic information for each sample on a soil boring log form in accordance with SAP-106. Copies of soil boring logs are provided in Appendix C. The Field Geologist collected one composite soil sample for GSD analysis from every 5-foot interval from near the estimated water table elevation to the base of the alluvium, as defined by direct-push refusal. However, as discussed above and detailed in Section 4.0, limited (less than 5-foot) recovery was achieved for several soil sampling intervals at multiple boring locations. Soil retrieved from these sample intervals were still composited and submitted for GSD analysis; however, the results may not be representative of the entire 5-foot interval. The soil samples were submitted to Alpha-Omega for laboratory testing of GSD using Method ASTM C136.

Following completion of each boring, boreholes were abandoned in accordance with SAP-110 and OWRB rules by backfilling and plugging the boreholes with granular bentonite and/or bentonite chips and hydrating the bentonite with potable water.

## 2.4 Monitor Well Abandonment

The groundwater monitor wells abandoned during the vertical profiling site investigation are listed on Table 1-2. These wells were abandoned by AEI, an OWRB-licensed driller, in accordance with procedures specified in SAP-110. In accordance with OWRB regulations, monitor wells with a top of screen depth less than 20 feet bgs (Monitor Wells 1334, 1342, 1349, and 1353) were over-drilled to their respective total depths using 8.75-inch hollow-stem augers. Following removal of the well materials, each borehole was plugged with cement grout installed through a tremie pipe to approximately 4 feet bgs. Monitor wells with total depths greater than 30 feet bgs were plugged in-place with cement grout installed through a tremie pipe to approximately 4 feet bgs. Following installation of cement grout, the concrete well pads and protective steel casings were removed and the remaining 4 feet at each well location was backfilled with soil to match the surrounding surface conditions. Following monitor well abandonment activities, abandonment reports were submitted to OWRB. Copies of the OWRB abandonment reports are provided in Appendix D.

## 2.5 Investigation-Derived Waste

Groundwater investigation derived waste (IDW) generated during HPT-GWS sampling was discharged on the ground adjacent to the boring from which it was generated. Soil IDW generated during direct-push soil sampling and monitor well abandonment activities was spread on the ground surface near the boring or monitor well location from which it was generated.

IDW consisting of disposable sampling equipment, PPE, and standard waste was placed in plastic bags and transported offsite for proper disposal. IDW materials resulting from monitor well abandonment (casings, concrete pads, etc.) were decontaminated by pressure washing with potable water. Radiological surveys were completed on these materials to demonstrate compliance with unrestricted release criteria prior to disposal at a municipal waste landfill.

## 2.6 Quality Assurance/Quality Control

Field duplicate samples were collected during HPT-GWS groundwater sampling as a quality assurance measure of laboratory performance and filed sampling methods. The analytical results for the field duplicates were within quality assurance/quality control limits. Quality assurance/quality control reviews of the groundwater analytical data are provided as Appendix E. All data were found to be valid for use, as qualified.

# 3.0 VERTICAL PROFILING RESULTS

As detailed in Section 2.0, EC, HPT, and depth-discrete groundwater analytical data were collected at a total of 23 locations in the WAA and BA1 via direct-push technology. These vertical profiling data were used to prepare four cross-sections. The alignments for these cross-sections are depicted on Figures 2-1 and 3-1 through 3-3. Figures 3-1 through 3-3 also depict the remediation areas and representative uranium and nitrate concentrations presented in the D-Plan.

Cross-sectional depictions of the vertical profiling results are presented on Figures 3-4 through 3-7. Each cross-section includes EC and HPT pressure curves, depth-discrete groundwater analytical results, and GSD results (refer to Section 4.0 for details). The EC and HPT logs for each location are presented in Appendix A and groundwater analytical results are tabulated on Table 3-1.

In general, the HPT measures the relative hydraulic properties of unconsolidated materials by using a pump to inject a small volume of clean water into the formation and measuring the pressure and flow rate response. Zones of relatively high permeability are represented by the HPT as lower pressures and higher flow rates and lower permeability zones are represented by higher pressures and lower flow rates. An increase in HPT pressure is typically indicative of a finer-grained, low permeability material such as clay, while a decrease in HPT pressure is typically indicative of a coarser-grained, higher permeability material such as sand.

Corrected HPT injection pressures recorded within the alluvium during this investigation generally ranged from less than one to 5 psi for relatively permeable materials, and from 5 to 40 psi for less permeable materials. The corrected HPT pressure data are presented on Figures 3-4 through 3-7.

The soil overburden at the site consists primarily of sand and silt with minor occurrences of clay and gravel. As detailed in Section 2.2, EC generally exhibits an inverse relationship with soil particle size (i.e., sand and gravels with larger particle sizes typically correspond to lower EC than silts and clays with smaller particle sizes). However, it is important to consider that factors such as soil saturation, chemical constituents, etc. may also impact EC. As a result, HPT pressure data may provide a more accurate representation of physical soil properties, particularly within the saturated zone.

As discussed in Sections 1.2.2 and 2.2.3, groundwater samples were generally collected at two-foot intervals, beginning at approximately one-foot below the detected groundwater level and extending to bedrock. However, the formation at several groundwater sampling depth intervals did not yield the volume of water required for sample collection analysis. For these intervals, uranium and/or nitrate concentrations are not available and consequently not presented on Table 3-1 or Figures 3-4 through 3-7.

The EC and HPT pressure data provided were used to characterize the subsurface materials comprising the saturated zone and identify areas of relatively low and high permeability. Combined with the groundwater analytical and GSD results, and geologic observations obtained from direct inspection of soil cores, these data were used to provide high-resolution characterization of hydrogeologic conditions, contaminant distribution, and potential contaminant transport pathways near each proposed alluvial extraction well location. Detailed discussions of EC, HPT, and groundwater analytical results for BA1 and the WAA investigation locations are provided below.

## 3.1 BA1 Vertical Profiling Results

EC, HPT, and groundwater uranium concentration data were collected from eight direct-push borings located near proposed BA1 extraction wells GE-BA1-02 through GE-BA1-09 (see Figure 3-1). EC and HPT pressure data for each location are presented on the cross-section depicted on Figure 3-4 for correlation and analysis. Analytical uranium results for depth-discrete groundwater samples are also presented on the Figure 3-4 cross-section and tabulated on Table 3-1.

### 3.1.1 EC and HPT Results and Interpretation

The EC and HPT pressure data for the southernmost borings (GE-BA1-02 and GE-BA1-03) generally indicate finer-grained material (i.e., elevated conductivity and pressure) within the upper portion of the saturated zone (see Figure 3-4). At the GE-BA1-02 location, EC and HPT pressures are relatively low and consistent below the estimated water table, indicating relatively homogeneous coarse-grained material. At the GE-BA1-03 location, EC and HPT pressures are relatively low and consistent from approximately 924 feet above mean sea level (amsl) (approximately 4.5 feet below the estimated water table), to approximately 919 feet amsl, indicating relatively homogeneous coarse grained material within this vertical interval.

With the exception of GE-BA1-05, the higher magnitude EC and HPT pressures observed within the upper portion of the saturated zone and above the water table at GE-BA1-02 and GE-BA1-03 are generally not observed in borings located downgradient (north) of GE-BA1-02 and GE-BA1-03 (see Figure 3-4). This is indicative of an increase in average grain size within this shallow zone as distance from the finer-grained BA1 transition formation increases. Higher magnitude EC and HPT pressures were observed at GE-BA1-05 from approximately 916 feet amsl to just above the top of bedrock, indicating the presence of finer-grained material within this zone (see Figure 3-4). This finer-grained material appears to comprise an isolated lens or discontinuous channel deposit based on the higher HPT pressure and, to a lesser extent, higher EC compared to adjacent boring locations GE-BA1-04 and GE-BA1-06. The EC and HPT pressures for GE-BA1-08 and GE-BA1-09 also increase slightly near 918 feet amsl; however, these increases are limited to a vertical interval of approximately 1 to 2 feet. These data indicate the presence of a thin, fine-grained material lens or channel extending between these locations, with greater thickness in the vicinity of GE-BA1-08 (see Figure 3-4).

Overall, the EC and HPT data for BA1 indicate relatively consistent (homogeneous), coarse-grained material across most of the saturated zone. This coarse-grained material is generally bound by bedrock and the finer-grained deposits near and above the groundwater surface. The only exceptions are the apparently thin, fine-grained deposit observed near GE-BA1-08 and GE-BA1-09, and the thicker, but apparently discontinuous fine-grained layer observed within the bottom 10 feet of GE-BA1-05 (see Figure 3-4).

### 3.1.2 HPT-GWS Groundwater Sample Results and Interpretation

Data presented on Figure 3-4 and Table 3-1 indicate that the highest uranium concentrations in BA1 are generally present in the most upgradient (southernmost) borings (e.g., GE-BA1-02 through GE-BA1-05). At GE-BA1-02, the sample collected in uppermost interval, near the groundwater surface, exhibited a uranium concentration of 2,228 µg/l. This concentration is significantly higher than any other result obtained during this investigation. The vertical distribution of uranium concentration at GE-BA1-02 is relatively consistent with the results of the detailed subsurface evaluation presented in the Environmental Sequence Stratigraphy (ESS) and Porosity Analysis Memorandum (ESS Memo) dated April 6, 2018 (Burns & McDonnell, 2018). The ESS Memo noted that the majority of uranium mass flux is occurring within the shallow saturated zone, as groundwater discharges from the transition zone into the alluvial floodplain deposits. This transition zone / floodplain alluvium interface occurs in the general vicinity of GE-BA1-02.

The highest uranium concentration at GE-BA1-03 was detected near the midpoint of the higher permeability zone (as indicated by EC and HPT data) extending from approximately 924 to 919 feet amsl (see Figure 3-4). For the GE-BA1-04 location, uranium concentrations generally increase with depth, with the highest concentration (522 µg/l) reported approximately 4 feet above a zone of low permeability material present above the bedrock interface. At GE-BA1-05, uranium concentrations generally increase with depth to the midpoint of the saturated zone, then remained elevated from the midpoint to the bedrock interface. At GE-BA1-06, uranium concentrations generally increase with depth, with the maximum concentration occurring approximately 4 feet above the bedrock interface. At GE-BA1-07 through GE-

BA1-09, the maximum uranium concentrations were detected at the deepest sample interval, just above the bedrock interface. Consistent with the representative uranium concentrations depicted for BA1, as presented in Figure 3-1, the vertical profiling results generally indicate decreasing uranium concentrations with increasing distance north (downgradient of the former BA1 source area). These results are also indicative of a downward vertical gradient within the BA1 alluvium.

## 3.2 WAA Vertical Profiling Results

EC, HPT, and groundwater uranium concentration data were collected from 15 direct-push borings located near proposed WAA extraction wells GE-WAA-01 through GE-WAA-15 (see Figures 3-2 and 3-3). EC and HPT pressure data for each location are presented on the cross-sections depicted on Figures 3-5 to 3-7 for correlation and analysis. Analytical uranium results for depth-discrete groundwater samples are also presented on the cross-sections and tabulated on Table 3-1. The WAA data and interpretation are presented below by remediation area (refer to Figures 3-2 and 3-3). This provides a more appropriate comparison of the datasets with respect to area-specific objectives (discussed further in Section 5.0).

### 3.2.1 EC and HPT Results and Interpretation

**WAA-BLUFF Remediation Area (GE-WAA-06 through GE-WAA-13)**

EC and HPT pressures in borings within the WAA-BLUFF remediation area were generally highest near and above the water table and decreased with depth (see Figure 3-5). This suggests that the upper portion of the alluvium along the bluff includes a higher percentage of fine-grained material, likely consisting of overbank and/or splay silt and clay deposits associated with recent flood events. EC and HPT pressures were relatively low and consistent within the saturated portion of the alluvium, indicating relatively homogeneous and mostly coarse-grained materials within this zone. Minor increases in EC were observed at the base of the alluvium near the bedrock interface (see Figure 3-5). However, as discussed in Section 3.0, EC can be influenced by changes in groundwater chemistry and other factors. Since both the HPT pressure data and boring log observations are indicative of coarse-grained sediments, the elevated EC data near the bottom of these depth intervals are likely due to factors unrelated to geology or grain size.

**WAA-U>DCGL and WAA-WEST Remediation Areas (GE-WAA-01 through GE-WAA-05)**

EC and HPT pressures in borings within the WAA-U>DCGL and WAA-WEST remediation areas indicate relatively coarse-grained materials throughout the saturated alluvium, and fine-grained materials generally limited to depths above the water table (see Figure 3-6). However, relatively slight increases in HPT pressure were observed within the bottom 10 feet of the saturated alluvium at GE-WAA-04 and, to a lesser extent, GE-WAA-01 and GE-WAA-02. These slight increases may be indicative of an increasing percentage of fine-grained materials with depth in the central portion of the WAA-U>DCGL remediation area (see Figures 3-1 through 3-3). Higher EC and HPT pressures for boring locations GE-WAA-01 through GE-WAA-05 were generally observed above the water table. As with the WAA-BLUFF remediation area, these results indicate the presence of shallow, fine-grained overbank and/or splay deposits associated with recent flood events.

**WAA-EAST Remediation Area (GE-WAA-14 and GE-WAA-15)**

EC and HPT pressures in borings within the WAA-EAST remediation area indicate relatively coarse-grained materials throughout most of the saturated alluvium. The EC and HPT pressure data for GE-WAA-14 indicate the presence of a fine-grained zone approximately 25 feet bgs (see Figure 3-7). The conductivity, pressure, and flow rate response data presented on the log provided in Appendix A indicate that the thickness of this zone is likely about 1 foot or less. However, as shown on Figure 3-7 and discussed in Section 3.2.2, the depth-discrete groundwater samples exhibiting the highest uranium and nitrate concentrations were collected near this zone. The EC and HPT pressure data for GE-WAA-15 also indicate the presence of a thin, fine-grained zone approximately 16 feet bgs; however, the highest uranium and nitrate concentrations in this boring were collected beneath this zone.

As with the other WAA borings, the elevated EC and HPT pressures reported at shallow depths for the GE-WAA-14 and GE-WAA-15 boring locations are indicative of shallow, fine-grained overbank and/or splay deposits associated with recent flood events.

### 3.2.2 HPT-GWS Groundwater Sample Results and Interpretation

**WAA-BLUFF Remediation Area (GE-WAA-06 through GE-WAA-13)**

Uranium concentrations for depth-discrete groundwater samples collected within the WAA-BLUFF remediation area range from below laboratory detection limits (GE-WAA-09) to 66.6 µg/L (GE-WAA-06) [see Figure 3-5 and Table 3-1]. Only the samples collected from the shallow intervals at GE-WAA-06 and GE-WAA-07 exceed the DEQ Criterion of 30 µg/L. With a few exceptions, WAA-BLUFF uranium concentrations are relatively low and consistent throughout the saturated zone. These results are generally consistent with the limited uranium DEQ Criterion exceedances exhibited in the representative concentrations presented in the D-Plan (see Figure 3-2).

Nitrate concentrations for depth-discrete groundwater samples collected within the WAA-BLUFF remediation area range from less than one to 287 milligrams per liter (mg/L) [GE-WAA-07]. The data indicate that nitrate concentrations are relatively variable, both in depth and location. The highest nitrate concentrations in this area are generally observed within the lower 5 feet of the saturated zone at GE-WAA-07, with concentrations ranging from approximately 121 to 287 mg/L (see Figure 3-5 and Table 3-

1). Elevated nitrate concentrations were also reported within the shallow saturated zone at GE-WAA-10, with concentrations ranging from approximately 114 to 131 mg/L. These data are generally consistent with the representative WAA-BLUFF nitrate concentrations presented in the D-Plan (see Figure 3-3).

**WAA-U>DCGL and WAA-WEST Remediation Areas (GE-WAA-01 through GE-WAA-05)**

The results for depth-discrete groundwater samples collected within the WAA-U>DCGL and WAA-WEST remediation areas indicate relatively variable uranium concentrations, ranging from below laboratory detection limits to 294 µg/L (both results reported for GE-WAA-04) [see Table 3-1 and Figure 3-6]. Uranium concentrations generally decrease with increasing distance north (from GE-WAA-03 to GE-WAA-05). The highest uranium concentrations in the southernmost borings (GE-WAA-03 through GE-WAA-01) are generally observed near the top of the saturated zone and range from 174 to 192 µg/L. For each boring, the depth of the highest reported uranium concentration generally increases with increasing distance to the north (i.e., further downgradient of the former contamination sources). For the two most downgradient (northernmost) boring locations (GE-WAA-04 and GE-WAA-05), the highest concentrations are generally observed near the bottom of the boring. The maximum concentration reported for GE-WAA-04 (294 µg/L), collected at approximately 22 feet bgs, was the highest concentration reported for all WAA-U>DCGL and WAA-WEST borings. The maximum concentration reported for GE-WAA-05, the most downgradient (northern) boring, was 55 µg/L; this sample was collected at approximately 30.5 feet bgs. These spatial trends in uranium contaminant distribution are indicative of a downward vertical gradient within the WAA. They are also consistent with the nature and extent of uranium in the WAA-U>DCGL and WAA-WEST areas, as defined by the representative uranium concentrations presented in the D-Plan (Figure 3-2).

**WAA-EAST Remediation Area (GE-WAA-14 and GE-WAA-15)**

The results for depth-discrete groundwater samples collected within the WAA-EAST remediation area generally indicate increasing uranium concentrations with depth, with exceedances of the DEQ Criterion (30 µg/L) generally limited to the lower 10 feet of the saturated zone (see Table 3-1 and Figure 3-7). Uranium concentrations reported for the deepest GE-WAA-14 samples (collected at 24.5 and 26.5 feet bgs) were 69.7 µg/L and 82.5 µg/L, respectively. The uranium concentrations reported for the deepest GE-WAA-15 samples (collected at 23.6 and 25.6 feet bgs), were significantly higher – 381 µg/L and 472 µg/L, respectively. Uranium concentrations reported for GE-WAA-14 are generally consistent with the representative uranium concentrations presented for the WAA-EAST remediation area in the D-Plan (see Figure 3-2). However, some of the uranium concentrations reported for GE-WAA-15 are higher than the representative concentrations presented in the D-Plan and exceed the NRC Criterion of 201 µg/L (based on a Derived Concentration Goal Level of 180 picocuries per liter and a uranium-235 enrichment level of

1.3% in the WAA-EAST remediation area). As discussed in Section 5.0, the well screen and pump intake for Extraction Well GE-WAA-15 will be positioned to focus groundwater extraction efforts on the lower portion of the alluvium at this well location (see Figure 3-7).

Nitrate concentrations for depth-discrete groundwater samples collected within the WAA-EAST remediation area range from less than one to approximately 129 mg/L (both reported for GE-WAA-014). [see Table 3-1 and Figure 3-7]. Nitrate concentrations reported for GE-WAA-15 range from 2.51 to 70.0 µg/L. Consistent with uranium concentrations trends (see above), nitrate concentrations in groundwater generally indicate increasing concentrations with depth. These concentrations are relatively consistent with the representative nitrate concentrations presented for the WAA-EAST remediation area in the D-Plan (see Figure 3-3).

# 4.0 GRAIN SIZE DISTRIBUTION

The results of the GSD analysis were used to refine extraction well design details, including screen slot size, filter pack gradation, and screen length/interval placement. GSD laboratory testing reports, including GSD curves, $D_{30}$ values, and material descriptions are included in Appendix G. The diameter on the GSD curve corresponding to the particle size for which 30-percent of the soil grains are finer (i.e., $D_{30}$) was used to select the filter pack gradation and screen slot size for each extraction well. The filter pack gradation was selected based on the smallest $D_{30}$ value within the proposed screen interval (Driscoll, 1986). A $D_{30}$ grain size less than 0.1 millimeter (mm) generally corresponds to a material that is considered non-filterable and/or may result in excessive solids recovery during extraction well operation. Based on the results presented in the following sections, a $D_{30}$ grain size greater than 0.22 mm generally corresponds to fine to coarse-grained sand. $D_{30}$ grain sizes within this range are generally considered favorable for efficient and effective filter pack gradation and screen slot size design. The $D_{30}$ values for each GSD sample interval are included on Figures 3-4 through 3-7. Results of the GSD analysis for each area are presented below.

As discussed in Section 1.2.3, each $D_{30}$ result is representative of a composite of the material collected within the corresponding GSD sample interval. An attempt was made to collect 5 feet of soil core for each GSD composite sample; however, limited direct-push soil sample recovery prevented the collection of 5 feet of soil core at several sample intervals and locations. As a result, the GSD sample intervals depicted on Figures 3-4 through 3-7 have been adjusted to represent the actual approximate intervals over which soil was recovered, composited, and submitted for laboratory analysis. The exact depth interval over which a partially recovered soil core is collected can be difficult to determine, therefore, the soil sample intervals presented on Figures 3-4 through 3-7 should be regarded as estimates.

## 4.1 BA1 Grain Size Distribution Results

Soil samples were collected from GE-BA1-02, GE-BA1-05, and GE-BA1-09 and submitted to Alpha-Omega for analysis. The results are detailed below.

**GE-BA1-02**

Soil samples were collected for GSD analysis at two depth intervals at GE-BA1-02. The shallow sample interval extended from 5 to 7.5 feet bgs and the deep interval extended from 15 to 21 feet bgs (see Figure 3-4). The material obtained in the shallow sample was classified as sandy lean clay, with a $D_{30}$ grain size of approximately 0.04 mm. The material obtained in the deep sample was classified as sand, with a $D_{30}$ grain size of approximately 0.25 mm. In general, the grain size reported for the deep sample is likely more representative of the saturated zone near GE-BA1-02. The shallow soil sample was collected slightly above the water table estimated from HPT data. Additionally, the HPT pressures were relatively low throughout the saturated zone, further indicating the presence of limited fine-grained material near this boring location.

**GE-BA1-05**

Soil samples were collected for GSD analysis at four depth intervals at GE-BA1-05. The shallow sample interval extended from 5 to 8 feet bgs, the intermediate-shallow sample interval extended from 15 to 19.5 feet bgs, the intermediate-deep sample interval extended from 20 to 24 feet bgs, and the deep sample interval extended from 25 to 29 feet bgs (see Figure 3-4). Consistent with the GE-BA1-02 GSD results, the shallow soil sample collected above the water table was classified as sandy lean clay, with a $D_{30}$ grain size of approximately 0.04 mm. The intermediate-shallow and intermediate-deep soil samples were classified as sand and clayey sand, with $D_{30}$ grain sizes of approximately 0.26 and 0.14 mm, respectively. The clayey sand classification and relatively low $D_{30}$ reported for the intermediate-deep sample are consistent with the sand and silty clay soil descriptions documented for this sample interval on the GE-BA1-05 boring log (see Appendix C). These results are also consistent with the elevated HPT and EC pressures recorded within this depth interval (see Figure 3-4).

The deep soil sample was classified as clayey sand, with a $D_{30}$ grain size of approximately 0.03 mm (see Figure 3-4). This material classification and $D_{30}$ result are consistent with the silty sand and silty clay soil descriptions documented for this sample interval on the GE-BA1-05 boring log (see Appendix C). These results are also consistent with the elevated HPT and EC pressures recorded within this depth interval (see Figure 3-4).

**GE-BA1-09**

Soil samples were collected for GSD analysis at five depth intervals at GE-BA1-09. The shallow sample interval extended from 5 to 8 feet bgs, the intermediate-shallow sample interval extended from 10 to 15 feet bgs, the intermediate sample interval extended from 15 to 19.5 feet bgs, the intermediate-deep sample interval extended from 20 to 24 feet bgs, and the deep sample interval extended from 25 to 27 feet bgs (see Figure 3-4). In general, the GSD results for all GE-BA1-09 samples indicate relatively course grained material throughout the majority of the boring. The four soil samples collected from 5 to 24 feet bgs were classified as sand with $D_{30}$ grain sizes ranging from approximately 0.23 to 0.36 mm (see Figure 3-4). These results are generally consistent with the material descriptions provided on the GE-BA1-09 boring log and the EC and HPT data (see Figure 3-4 and Appendix C).

The lowest $D_{30}$ grain size reported for the intermediate interval (approximately 0.23 mm) was lower than those reported for the shallow, intermediate-shallow, and intermediate-deep intervals. This is likely due to the presence of fine sand material observed from approximately 17 to 19 feet bgs, as indicated by elevated EC and HPT pressures and the material description documented for this interval (see Figure 3-4 and Appendix C). The deep soil sample was classified as sand with silt particles, with a $D_{30}$ grain size of approximately 0.18 mm. The presence of additional fine-grained material within this sample is likely due to sample interval extending beyond the base of the alluvium, into the weathered sandstone bedrock.

## 4.2 WAA Grain Size Distribution Results

**WAA-BLUFF Remediation Area (GE-WAA-06, GE-WAA-09, and GE-WAA-13)**

**GE-WAA-06**

Soil samples were collected for GSD analysis at three depth intervals at GE-WAA-06. The shallow sample interval extended from 5 to 8.5 feet bgs, the intermediate sample interval extended from 10 to 13.4 feet bgs, and the deep sample interval extended from 15 to 17 feet bgs (see Figure 3-5). The shallow sample was classified as sandy lean clay, with a $D_{30}$ grain size of approximately 0.05 mm. This sample material classification and relatively low $D_{30}$ grain size are consistent with the silty soil description documented for this sample interval on the GE-WAA-06 boring log (see Appendix C). These results are also consistent with the elevated HPT pressures recorded within this depth interval.

The intermediate and deep soil samples collected from GE-WAA-06 were classified as sand, with $D_{30}$ grain sizes of approximately 0.23 to 0.24 mm (see Figure 3-5). The sample material classifications and $D_{30}$ grain sizes are consistent with the soil descriptions documented on the GE-WAA-06 boring log (see Appendix C). These results are also consistent with the EC and HPT pressures recorded within these depth intervals.

**GE-WAA-09**

Soil samples were collected for GSD analysis at three depth intervals at GE-WAA-09. The shallow sample interval extended from 5 to 6.5 feet bgs, the intermediate sample interval extended from 10 to 15 feet bgs, and the deep sample interval extended from 15 to 20 feet bgs (see Figure 3-5). The shallow sample was classified as silty sand, with a $D_{30}$ grain size of approximately 0.12 mm. This sample material classification and moderately low $D_{30}$ grain size are consistent with the fine sand description documented for this sample interval on the GE-WAA-09 boring log (see Appendix C). These results are also consistent with the slightly elevated HPT pressures recorded within the upper zone of this depth interval.

The intermediate soil sample was classified as sand, with a $D_{30}$ grain size of approximately 0.28 mm (see Figure 3-5). This sample material classification and $D_{30}$ grain size are consistent with the fine to medium grained sand description documented for most of this sample interval on the GE-WAA-09 boring log (see Appendix C). These results are also consistent with the EC and HPT pressures recorded within this depth interval. The deep soil sample was classified as sand with a $D_{30}$ grain size of approximately 0.01 mm. The low $D_{30}$ result for this sample is consistent with the weathered mudstone material description documented for most of this sample interval on the GE-WAA-09 boring log (see Appendix C). EC and HPT data were not recorded over most of this sample interval and, as discussed in Section 5.0, the screen interval for Extraction Well GE-WAA-09 will not extend into this interval.

**GE-WAA-13**

Soil samples were collected for GSD analysis at three depth intervals within the GE-WAA-13 boring. The shallow sample interval extended from 5 to 8 feet bgs, the intermediate sample interval extended from10 to 15 feet bgs, and the deep sample interval extended from 15 to 18.2 feet bgs (see Figure 3-5). The shallow soil sample was classified as sand with silt, with a $D_{30}$ grain size of approximately 0.16 mm. This sample material classification and moderately low $D_{30}$ grain size are consistent with the fine sand description documented for this sample interval on the GE-WAA-13 boring log (see Appendix C). These results are also consistent with the slightly elevated EC recorded within this depth interval.

The intermediate and deep soil samples were both classified as sand, with $D_{30}$ grain sizes of approximately 0.24 and 0.21 mm, respectively (see Figure 3-5). These sample material classifications and $D_{30}$ grain sizes are consistent with the medium grained sand description documented for most of this sample interval on the GE-WAA-13 boring log (see Appendix C). These results are also consistent with the EC and HPT pressures recorded within this depth interval.

**WAA-U>DCGL and WAA-WEST Remediation Areas (GE-WAA-01 and GE-WAA-05)**

**GE-WAA-01**

Soil samples were collected for GSD analysis at five depth intervals at GE-WAA-01. The shallow sample interval extended from 5 to 6.8 feet bgs, The intermediate-shallow sample interval extended from 10 to 11 feet bgs, the intermediate sample interval extended from 15 to 19.3 feet bgs, the intermediate-deep sample interval extended from 20 to 24.7 feet bgs, and the deep sample interval extended from 25 to 27.3 feet bgs (see Figure 3-6). The shallow soil sample was collected near the estimated water table and was classified as sand, with a $D_{30}$ grain size of approximately 0.16 mm. This sample material classification is consistent with the fine to medium sand description documented for the sample interval on the GE-WAA-01 boring log (see Appendix C) and with the low EC and HPT pressures recorded within this depth interval. The relatively low $D_{30}$ grain size for this sample is likely due to a high percentage of fine sand (see Appendix C).

The intermediate-shallow and intermediate samples were classified as sand and sand with clay, respectively, with $D_{30}$ grain sizes of approximately 0.45 and 0.33 mm, respectively (see Figure 3-6). These sample material classifications and $D_{30}$ grain sizes are consistent with the material descriptions documented for these sample intervals on the GE-WAA-01 boring log (see Appendix C). Slight increases in the percentage of fines within the intermediate sample are evidenced by the minor increases in HPT pressures observed within this interval, and relatively thin silt and clay layers noted on the boring log from approximately 17 to 18.5 feet. However, based on the boring log descriptions and relatively high $D_{30}$ grain size, only a small percentage of material within this interval appears to consist of fine-grained sediments.

The intermediate-deep soil sample was classified as sand with silt, with a $D_{30}$ grain size of approximately 0.21 mm. This sample material classification is consistent with the “fine to coarse sand with clay lenses” description documented for this sample interval on the GE-WAA-01 boring log (see Appendix C). These results are also consistent with the elevated HPT pressures recorded within this depth interval (see Figure 3-6). The deep soil sample was classified as sand, with a $D_{30}$ grain size of approximately 0.53 mm. This is the second highest $D_{30}$ result (i.e., second coarsest material) reported for all GSD samples. This sample material classification and $D_{30}$ grain size are consistent with the medium to coarse sand description documented for this sample interval on the GE-WAA-01 boring log (see Appendix C). These results are also consistent with the EC and HPT pressures recorded within this depth interval.

**GE-WAA-05**

Soil samples were collected for GSD analysis at four depth intervals at GE-WAA-05. The shallow sample interval extended from 10 to 12.5 feet bgs, the intermediate-shallow sample interval extended from 15 to 18 feet bgs, the intermediate-deep sample interval extended from 20 to 25 feet bgs, and the deep sample interval extended from and 25 to 29 feet bgs (see Figure 3-6). The shallow soil sample was collected near the estimated water table and was classified as sand, with a $D_{30}$ grain size of approximately 0.20 mm. This sample material classification and $D_{30}$ grain size are consistent with the material description documented for this sample interval on the GE-WAA-05 boring log (see Appendix C). These results are also generally consistent with the EC and HPT pressures recorded within this depth interval.

The intermediate-shallow and intermediate-deep soil samples were classified as sand and sand with silt, respectively, with $D_{30}$ grain sizes of approximately 0.40 mm and 0.31 mm, respectively. These sample material classifications and $D_{30}$ grain sizes are consistent with the description documented for these sample intervals on the GE-WAA-05 boring log (see Appendix C), and with the low EC and HPT pressures recorded within these depth intervals (see Figure 3-6).

The deep soil sample was classified as sand, with a $D_{30}$ grain size of approximately 0.62 mm. This is the highest $D_{30}$ result (i.e., coarsest material) reported for all GSD samples. This sample material classification and $D_{30}$ grain size are consistent with the medium to coarse sand description documented for this sample interval on the GE-WAA-05 boring log (see Appendix C). These results are also consistent with the low HPT pressures recorded within this depth interval; however, they are not consistent with the slight increase in EC recorded near the bottom of this depth interval (see Figure 3-6). However, as discussed in Section 3.0, EC can be influenced by changes in groundwater chemistry and other factors. Since both the HPT pressure data and boring log observations are indicative of coarse-grained sediments, the elevated EC data near the bottom of this depth interval are likely due to factors unrelated to geology or grain size.

**WAA-EAST Remediation Area (GE-WAA-15)**

**GE-WAA-15**

Soil samples were collected for GSD analysis at five depth intervals at GE-WAA-15. The shallow sample interval extended from 5 to 8 feet bgs, the intermediate-shallow sample interval extended from 10 to 13 feet bgs, the intermediate sample interval extended from 15 to 20 feet bgs, the intermediate-deep sample interval extended from 20 to 25 feet bgs, and the deep sample interval extended from 25 to 27 feet bgs (see Figure 3-7). The shallow soil sample was collected near the estimated water table and was classified as sand, with a $D_{30}$ grain size of approximately 0.23 mm. This sample material classification and $D_{30}$ grain size are consistent with the material description documented for this sample interval on the GE-WAA-15 boring log (see Appendix C), and the EC and HPT pressures recorded within this depth interval.

The intermediate-shallow soil sample was classified as sand, with a $D_{30}$ grain size of approximately 0.26 mm. This sample material classification and $D_{30}$ grain size are consistent with the material description documented for this sample interval on the GE-WAA-15 boring log (see Appendix C), and the EC and HPT pressures recorded within this depth interval (see Figure 3-7). The intermediate soil sample was classified as sand with clay, with a $D_{30}$ grain size of approximately 0.30 mm. This sample material classification and $D_{30}$ grain size are consistent with the material description documented for this sample interval on the GE-WAA-15 boring log (see Appendix C), which described the material encountered within the sample interval as sand, with the exception of a thin (approximately 1 foot) clay layer near 17 feet bgs. These observations are consistent with the EC and HPT pressures recorded within this depth interval which indicate the presence of a thin layer of low permeability material near 17 feet bgs.

The intermediate-deep and deep soil samples were classified as sand with silt and sand with clay, respectively, with $D_{30}$ grain sizes of approximately 0.22 mm and 0.32 mm, respectively. These sample material classifications and $D_{30}$ grain sizes are generally consistent with the material descriptions documented for these sample intervals on the GE-WAA-15 boring log (see Appendix C). These results are also consistent with the EC and HPT pressures recorded within these depth intervals (see Figure 3-7).

# 5.0 DESIGN IMPLICATIONS

This investigation provided an improved understanding of subsurface materials and the distribution of permeability and contaminant concentrations within the saturated zone at each extraction well location. Based on this understanding, the investigation results were used to finalize extraction well design details. The vertical permeability distribution and lithologic data presented in this report generally indicate that the saturated alluvium within the WAA and BA1 areas is primarily comprised of sands with finer-grained materials (silts and clays) occurring within shallow intervals and in various lenses. With a few exceptions, uranium and nitrate groundwater concentrations generally decrease with increasing distance north (downgradient), away from former sources. In addition, elevated uranium and nitrate concentrations generally appear to coincide with vertical intervals coarser grained deposits that exhibit higher relative permeability values; however, the relationship between contaminant concentration and permeability cannot be definitively demonstrated due to a lack of contaminant data for most fine grained intervals.

As discussed in Section 1.1, the primary objective of this investigation was to obtain data related to the vertical distribution of contaminants and permeability at each proposed alluvium extraction well location to select screen intervals that span the saturated interval over which uranium concentrations exceed the uranium DEQ criterion of 30 µg/l, including zones containing the highest contaminant concentrations. These data were also used to specify extraction well pump intake elevations to maximize the mass of contaminant removed while minimizing the recovery and treatment of minimally contaminated groundwater; reducing the time required to achieve remediation goals.

The depth-discrete groundwater contaminant data, EC and HPT vertical profiling data, boring log observations, and GSD results were used to select extraction well screen intervals. As detailed in Section 3.0, corrected HPT injection pressure for relatively permeable materials within the alluvium at the Site generally range from less than one to 5 psi. The GSD results and boring log observations were also used to select the appropriate filter pack gradation and well screen slot size. As detailed in Section 4.0, a $D_{30}$ grain size greater than 0.22 mm is generally considered favorable for effective filter pack and well screen design, while materials exhibiting $D_{30}$ grain sizes of less than 0.10 mm are generally considered non-filterable. To the extent practical, extraction well screen and filter pack intervals were selected to span zones that adhere to the HPT, $D_{30}$, and uranium DEQ criteria listed above. Additional details regarding specific extraction well screen and filter pack design intervals are presented below.

Submersible pump operating requirements were used to select the appropriate pump intake elevation within each proposed extraction well screen interval. The submersible pumps planned for use require a minimum submergence of 24-inches, as measured from the water surface to the top of the pump unit. Additionally, the bottom of the pump unit cannot be allowed to extend below the screened interval or overheating of the pump motor could occur. The position of the pump intake will vary based on pump size and model due to variations in motor and pump end dimensions.

Extraction well efficiency and aquifer solids recovery/accumulation were both considered in the selection of alluvial well screen intervals, pump intake elevations, filter pack gradation, and well screen slot size. Aquifer solids recovery is of particular importance since solids entrained in the influent groundwater streams will requiring filtering prior to treatment and these solids may contain detectable concentrations of radionuclides (e.g., uranium and Tc-99). Uranium concentrations in recovered aquifer solids are expected to be at or below levels commensurate with background soils; however, Tc-99 detections cannot be attributed to background conditions. Detectable Tc-99 groundwater concentrations are present in portions of the WAA but not in BA-1.

**BA1, WAA-U>DCGL, WAA-WEST, and WAA-EAST Remediation Areas**

The primary design objectives of the BA1, WAA-U>DCGL, WAA-WEST, and WAA-EAST remediation area extraction wells are to maximize the mass of contaminant removed while minimizing the recovery and treatment of minimally contaminated groundwater. This will be accomplished by limiting well screen intervals to zones exhibiting elevated contaminant concentrations. The secondary well design objective is to minimize the generation and accumulation of solids by limiting extraction well screen exposure to zones of fine-grained material (i.e., $D_{30}$ grain sizes less than 0.1 mm), and by specifying appropriate well screen and filter pack materials.

The proposed screen intervals and pump intake depths for BA1, WAA-U>DCGL, WAA-WEST, and WAA-EAST extraction wells are presented on Figures 3-4, 3-6, and 3-7. The proposed screen intervals generally span the vertical extent of uranium and nitrate concentrations exceeding DEQ criteria for all but three of these extraction wells – GE-BA1-02, GE-BA1-03, and GE-WAA-15. The screen intervals for GE-BA1-02 and GE-BA1-03 will be terminated immediately below the depths of shallow groundwater samples collected from each of these locations due to the presence of fine-grained material (as evidenced by HPT pressures exceeding 5 psi). However, the filter pack for these wells will extend above the screen, spanning the depth intervals exhibiting concentrations above the uranium DEQ Criterion (see Figure 3-4). This will result in hydraulic communication and recovery of groundwater within the shallow aquifer while limiting excess sediment production.

Similarly, the well screen for GE-WAA-15 will not span the entire saturated interval over which uranium and nitrate concentrations exceed DEQ criteria due to the presence of a clay lens observed at approximately 17 feet bgs (see Section 4.2 and Figure 3-7). The presence of this fine-grained zone would require significant reductions in well screen slot size and filter pack gradation to avoid production of excess sediment. As with the wells discussed above, the GE-WAA-15 filter pack will extend above the screen, spanning the depth interval exhibiting a uranium concentration exceeding the EQ Criterion.

As allowed by equipment specifications, most of the proposed pump intakes will be positioned at depths generally corresponding to zones of highest observed uranium and/or nitrate concentrations. The detection of significantly elevated uranium concentrations at the GE-WAA-15 boring location was unexpected. Uranium concentrations reported for the lower 5 feet of this boring exceed the NRC Criterion and are significantly higher than the representative concentrations presented for the WAA-EAST remediation in the D-Plan. While the representative uranium concentrations presented in the D-Plan exceeded the DEQ Criterion for several WAA-EAST monitor wells, no WAA-EAST monitor well concentrations exceeded the NRC Criterion. The well screen and pump intake for Extraction Well GE-WAA-15 will be positioned to focus groundwater extraction efforts on the lower portion of the alluvium at this well location (see Figure 3-7).

**WAA-BLUFF Remediation Area**

The primary and secondary design objectives for the WAA-BLUFF remediation area extraction wells are the same as those described for the other remediation areas above. However, in addition to remediating contaminants (primarily nitrate) exceeding DEQ criteria, the WAA-BLUFF wells will also be designed and operated to maximize recovery of water injected into the upland areas (see Figure 2-1). Since uranium and nitrate concentrations observed for these wells are relatively low, the well screen lengths, positions, and slot sizes; the pump intake positions; and the filter pack gradations are designed to maximize well efficiency and hydraulic capture. The proposed screen intervals and pump intake depths for extraction wells proposed for this remediation area are presented on Figures 3-5. Although the proposed extraction well screen intervals span uranium and nitrate exceedances of the respective DEQ criteria, the pump intake depths have been selected to maximize both hydraulic control and contaminant removal efficiency. As a result, the proposed pump intakes are positioned within the bottom half of the saturated alluvium. The only exception to this strategy is the proposed pump intake depth for GE-WAA-06. The highest uranium concentration for all samples collected in the WAA-BLUFF remediation area was observed in the shallow interval at this location (see Figure 3-5). As a result, the pump intake at this location will be positioned near the top of the saturated alluvium to maximize contaminant removal efficiency at this location.

The extraction well design details described above will be incorporated into the revised 90-percent design documents, which will comprise Appendix J of the D-Plan. As detailed above, these design details were finalized based on a comprehensive review of the data collected during this investigation.

# 6.0 REFERENCES

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# TABLES

# Table 1-1
# Locations & Analytes
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Extraction Well | U-235 & U-238 by EPA 200.8 (250-ml plastic, filtered, $HNO_3$) | Nitrate/Nitrite by EPA 353.2 (125-ml plastic, $H_2SO_4$) | GSD (1-gal bag, ASTM C136) | Design Coordinates (Oklahoma State Plane North NAD 1983 (Feet)) | |
|---|---|---|---|---|---|
| | | | | Northing | Easting |
| GE-WAA-01 | X | | X | 321952 | 2091715 |
| GE-WAA-02 | X | | | 321789 | 2091724 |
| GE-WAA-03 | X | | | 321503 | 2091815 |
| GE-WAA-04 | X | | | 322114 | 2091709 |
| GE-WAA-05 | X | | X | 323381 | 2092183 |
| GE-WAA-06 | X | | X | 321618 | 2092086 |
| GE-WAA-07 | X | X | | 321748 | 2092330 |
| GE-WAA-08 | X | X | | 321859 | 2092600 |
| GE-WAA-09 | X | X | X | 321941 | 2092819 |
| GE-WAA-10 | X | X | | 322044 | 2093044 |
| GE-WAA-11 | X | X | | 322153 | 2093253 |
| GE-WAA-12 | X | X | | 322256 | 2093441 |
| GE-WAA-13 | X | X | X | 322386 | 2093631 |
| GE-WAA-14 | X | X | | 322918 | 2092955 |
| GE-WAA-15 | X | X | X | 322907 | 2093408 |
| GE-BA1-02 | X | | X | 322970 | 2095385 |
| GE-BA1-03 | X | | | 323068 | 2095357 |
| GE-BA1-04 | X | | | 323176 | 2095373 |
| GE-BA1-05 | X | | X | 323275 | 2095399 |
| GE-BA1-06 | X | | | 323365 | 2095440 |
| GE-BA1-07 | X | | | 323468 | 2095482 |
| GE-BA1-08 | X | | | 323553 | 2095546 |
| GE-BA1-09 | X | | X | 323632 | 2095631 |

**NOTES:**
ASTM = American Society for Testing and Materials
EPA = Environmental Protection Agency
Filtered = field filtered using a 0.45 micrometer filter
GSD = grain size distribution
gal = gallon
$HNO_3$ = nitric acid
$H_2SO_4$ = sulfuric acid
ml = milliliters
NAD = North American Datum
U-235/U-238 = uranium isotopes 235 and 238

**Table 1-2**
**Abandoned Monitoring Wells**
**Vertical Profiling & Well Abandonment**
**Cimarron Site, Oklahoma**

| Monitoring Well | Total Depth (ft bgs) |
|---|---|
| 1319A-1 | 40 |
| 1319A-2 | 40 |
| 1319A-3 | 40 |
| 1319B-2 | 80 |
| 1319B-5 | 82 |
| 1319C-1 | 120 |
| 1319C-2 | 120 |
| 1319C-3 | 116.5 |
| 1322 | 38.8 |
| 1323 | 129.6 |
| 1325 | 48.3 |
| 1326 | 45.1 |
| 1327B | 51.8 |
| 1328 | 137.8 |
| 1329 | 47.8 |
| 1330 | 41.5 |
| 1332 | 118 |
| 1333 | 34.8 |
| 1334 | 22.8 |
| 1339 | 218 |
| 1342 | 24.4 |
| 1349 | 26.5 |
| 1353 | 15 |
| 1374 | 40.7 |
| 1375 | 43.4 |
| 1376 | 40.9 |
| 1380 | 40.4 |

**NOTES:**
ft bgs = Feet below ground surface
1) Highlighted wells were over drilled in accordance with Oklahoma Water Resources Board rules and regulations.

## Table 3-1
## Vertical Profiling Lab Results
## Vertical Profiling & Well Abandonment
## Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| BA1-B | GE-BA1-02/9.8 | 12/23/19 | Uranium-235 | 27.8 | 1.43 | 2,228 | µg/L | | 1.00 |
| | | | Uranium-238 | 2200 | 110 | | | | 6.70 |
| | GE-BA1-02/11.8 | | Uranium-235 | 4.62 | 0.233 | 375 | | | 0.100 |
| | | | Uranium-238 | 370 | 18.5 | | | | 0.670 |
| | GE-BA1-02/13.8 | | Uranium-235 | 3.93 | 0.199 | 326 | | | 0.100 |
| | | | Uranium-238 | 322 | 16.1 | | | | 0.670 |
| | GE-BA1-02/15.8 | | Uranium-235 | 2.52 | 0.130 | 212 | | | 0.100 |
| | | | Uranium-238 | 209 | 10.5 | | | | 0.670 |
| | GE-BA1-02/17.8 | | Uranium-235 | 2.45 | 0.127 | 207 | | | 0.100 |
| | | | Uranium-238 | 205 | 10.2 | | | | 0.670 |
| | GE-BA1-02/17.8DUP | | Uranium-235 | 2.27 | 0.118 | 193 | | | 0.100 |
| | | | Uranium-238 | 191 | 9.56 | | | | 0.670 |
| | GE-BA1-02/19.35 | | Uranium-235 | 2.77 | 0.142 | 236 | | | 0.100 |
| | | | Uranium-238 | 233 | 11.6 | | | | 0.670 |
| BA1-B | GE-BA1-03/12.45 | 12/23/19 | Uranium-235 | 0.598 | 0.0301 | 48.7 | µg/L | | 0.0100 |
| | | | Uranium-238 | 48.1 | 2.41 | | | | 0.0670 |
| | GE-BA1-03/13.4 | | Uranium-235 | 2.27 | 0.118 | 183 | | | 0.100 |
| | | | Uranium-238 | 181 | 9.05 | | | | 0.670 |
| | GE-BA1-03/13.4DUP | | Uranium-235 | 2.22 | 0.116 | 179 | | | 0.100 |
| | | | Uranium-238 | 177 | 8.87 | | | | 0.670 |
| | GE-BA1-03/15.4 | | Uranium-235 | 4.33 | 0.219 | 348 | | | 0.100 |
| | | | Uranium-238 | 344 | 17.2 | | | | 0.670 |
| | GE-BA1-03/17.4 | | Uranium-235 | 3.56 | 0.181 | 291 | | | 0.100 |
| | | | Uranium-238 | 287 | 14.4 | | | | 0.670 |
| | GE-BA1-03/25.0 | | Uranium-235 | 0.0505 | 0.00418 | 7.26 | | J | 0.0100 |
| | | | Uranium-238 | 7.21 | 0.361 | | | | 0.0670 |
| BA1-B | GE-BA1-04/9.5 | 12/23/19 | Uranium-235 | 0.0667 | 0.00472 | 7.01 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 6.94 | 0.348 | | | | 0.0670 |
| | GE-BA1-04/11.5 | | Uranium-235 | 0.0858 | 0.00543 | 7.99 | | | 0.0100 |
| | | | Uranium-238 | 7.90 | 0.395 | | | | 0.0670 |
| | GE-BA1-04/13.5 | | Uranium-235 | 1.71 | 0.0916 | 92.6 | | | 0.100 |
| | | | Uranium-238 | 90.9 | 4.54 | | | | 0.0670 |
| | GE-BA1-04/15.5 | | Uranium-235 | 2.21 | 0.115 | 180 | | | 0.100 |
| | | | Uranium-238 | 178 | 8.88 | | | | 0.670 |
| | GE-BA1-04/17.5 | | Uranium-235 | 3.44 | 0.175 | 280 | | | 0.100 |
| | | | Uranium-238 | 277 | 13.9 | | | | 0.670 |
| | GE-BA1-04/19.5 | | Uranium-235 | 4.74 | 0.239 | 386 | | | 0.100 |
| | | | Uranium-238 | 381 | 19.1 | | | | 0.670 |
| | GE-BA1-04/21.5 | | Uranium-235 | 6.45 | 0.324 | 522 | | | 0.100 |
| | | | Uranium-238 | 516 | 25.8 | | | | 0.670 |
| | GE-BA1-04/23.5 | | Uranium-235 | 5.63 | 0.283 | 450 | | | 0.100 |
| | | | Uranium-238 | 444 | 22.2 | | | | 0.670 |
| | GE-BA1-04/23.5DUP | | Uranium-235 | 5.70 | 0.287 | 461 | | | 0.100 |
| | | | Uranium-238 | 455 | 22.7 | | | | 0.670 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| BA1-C | GE-BA1-05/10.0 | 12/22/19 | Uranium-235 | 0.107 | 0.00631 | 12.7 | µg/L | | 0.0100 |
| | | | Uranium-238 | 12.6 | 0.628 | | | | 0.0670 |
| | GE-BA1-05/12.0 | | Uranium-235 | 0.0686 | 0.00478 | 7.66 | | J | 0.0100 |
| | | | Uranium-238 | 7.59 | 0.38 | | | | 0.0670 |
| | GE-BA1-05/14.0 | | Uranium-235 | 0.326 | 0.0166 | 27.2 | | | 0.0100 |
| | | | Uranium-238 | 26.9 | 1.35 | | | | 0.0670 |
| | GE-BA1-05/16.0 | | Uranium-235 | 0.861 | 0.0435 | 68.5 | | | 0.0200 |
| | | | Uranium-238 | 67.6 | 3.38 | | | | 0.0670 |
| | GE-BA1-05/18.0 | | Uranium-235 | 2.14 | 0.108 | 172 | | | 0.0500 |
| | | | Uranium-238 | 170 | 8.48 | | | | 0.335 |
| | GE-BA1-05/20.0 | | Uranium-235 | 2.74 | 0.138 | 216 | | | 0.0500 |
| | | | Uranium-238 | 213 | 10.7 | | | | 0.335 |
| | GE-BA1-05/20.0DUP | | Uranium-235 | 2.02 | 0.102 | 162 | | | 0.0500 |
| | | | Uranium-238 | 160 | 7.98 | | | | 0.335 |
| | GE-BA1-05/22.0 | | Uranium-235 | 2.04 | 0.103 | 159 | | | 0.0500 |
| | | | Uranium-238 | 157 | 7.85 | | | | 0.335 |
| | GE-BA1-05/28.0 | | Uranium-235 | 2.32 | 0.117 | 191 | | | 0.0500 |
| | | | Uranium-238 | 189 | 9.45 | | | | 0.335 |
| BA1-C | GE-BA1-06/10.0 | 12/22/19 | Uranium-235 | 0.189 | 0.01 | 23.2 | µg/L | | 0.0100 |
| | | | Uranium-238 | 23.0 | 1.15 | | | | 0.0670 |
| | GE-BA1-06/12.0 | | Uranium-235 | 0.287 | 0.0147 | 26.9 | | | 0.0100 |
| | | | Uranium-238 | 26.6 | 1.33 | | | | 0.0670 |
| | GE-BA1-06/14.0 | | Uranium-235 | 0.598 | 0.0301 | 50.2 | | | 0.0100 |
| | | | Uranium-238 | 49.6 | 2.48 | | | | 0.0670 |
| | GE-BA1-06/16.0 | | Uranium-235 | 1.10 | 0.0576 | 83.7 | | | 0.0500 |
| | | | Uranium-238 | 82.6 | 4.13 | | | | 0.0670 |
| | GE-BA1-06/18.0 | | Uranium-235 | 1.53 | 0.0783 | 122 | | | 0.0500 |
| | | | Uranium-238 | 120 | 6.01 | | | | 0.335 |
| | GE-BA1-06/20.0 | | Uranium-235 | 1.26 | 0.0654 | 96.3 | | | 0.0500 |
| | | | Uranium-238 | 95.0 | 4.75 | | | | 0.0670 |
| | GE-BA1-06/22.0 | | Uranium-235 | 1.92 | 0.0975 | 150 | | | 0.0500 |
| | | | Uranium-238 | 148 | 7.42 | | | | 0.335 |
| | GE-BA1-06/22.0DUP | | Uranium-235 | 2.07 | 0.105 | 162 | | | 0.0500 |
| | | | Uranium-238 | 160 | 7.98 | | | | 0.335 |
| | GE-BA1-06/24.0 | | Uranium-235 | 1.91 | 0.0967 | 151 | | | 0.0500 |
| | | | Uranium-238 | 149 | 7.44 | | | | 0.335 |
| | GE-BA1-06/26.0 | | Uranium-235 | 2.49 | 0.126 | 196 | | | 0.0500 |
| | | | Uranium-238 | 194 | 9.7 | | | | 0.335 |
| | GE-BA1-06/28.0 | | Uranium-235 | 1.86 | 0.0944 | 147 | | | 0.0500 |
| | | | Uranium-238 | 145 | 7.27 | | | | 0.335 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| BA1-C | GE-BA1-07/9.7 | 12/22/19 | Uranium-235 | 0.0786 | 0.00515 | 10.0 | µg/L | | 0.0100 |
| | | | Uranium-238 | 9.88 | 0.494 | | | | 0.067 |
| | GE-BA1-07/11.7 | | Uranium-235 | 0.197 | 0.0104 | 21.4 | | | 0.0100 |
| | | | Uranium-238 | 21.2 | 1.06 | | | | 0.067 |
| | GE-BA1-07/13.7 | | Uranium-235 | 0.437 | 0.0221 | 37.9 | | | 0.0100 |
| | | | Uranium-238 | 37.5 | 1.87 | | | | 0.067 |
| | GE-BA1-07/15.7 | | Uranium-235 | 0.569 | 0.0286 | 47.1 | | | 0.0100 |
| | | | Uranium-238 | 46.5 | 2.32 | | | | 0.067 |
| | GE-BA1-07/17.7 | | Uranium-235 | 0.938 | 0.0498 | 77.1 | | | 0.0500 |
| | | | Uranium-238 | 76.2 | 3.81 | | | | 0.067 |
| | GE-BA1-07/19.7 | | Uranium-235 | 0.0103 | 0.00337 | 0.992 | | J | 0.0100 |
| | | | Uranium-238 | 0.982 | 0.054 | | | | 0.067 |
| | GE-BA1-07/21.7 | | Uranium-235 | 0.0678 | 0.00475 | 6.16 | | J | 0.0100 |
| | | | Uranium-238 | 6.09 | 0.306 | | | | 0.067 |
| | GE-BA1-07/21.7DUP | | Uranium-235 | 0.0657 | 0.00468 | 5.94 | | J | 0.0100 |
| | | | Uranium-238 | 5.87 | 0.294 | | | | 0.067 |
| | GE-BA1-07/23.7 | | Uranium-235 | 0.253 | 0.0131 | 20.8 | | | 0.0100 |
| | | | Uranium-238 | 20.5 | 1.02 | | | | 0.067 |
| | GE-BA1-07/25.7 | | Uranium-235 | 0.760 | 0.0415 | 62.2 | | | 0.0500 |
| | | | Uranium-238 | 61.4 | 3.07 | | | | 0.067 |
| | GE-BA1-07/27.7 | | Uranium-235 | 1.23 | 0.0638 | 100 | | | 0.0500 |
| | | | Uranium-238 | 99.1 | 4.96 | | | | 0.067 |
| BA1-C | GE-BA1-08/10.6 | 12/21/19 | Uranium-235 | 0.0621 | 0.00456 | 8.39 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 8.33 | 0.417 | | | | 0.0670 |
| | GE-BA1-08/12.6 | | Uranium-235 | 0.0304 | 0.00366 | 4.14 | | J | 0.0100 |
| | | | Uranium-238 | 4.11 | 0.207 | | | | 0.0670 |
| | GE-BA1-08/14.6 | | Uranium-235 | 0.0135 | 0.0034 | 1.51 | | J | 0.0100 |
| | | | Uranium-238 | 1.50 | 0.0782 | | | | 0.0670 |
| | GE-BA1-08/16.6 | | Uranium-235 | ND | 0.00334 | ND | | U | 0.0100 |
| | | | Uranium-238 | 0.537 | 0.0349 | | | | 0.0670 |
| | GE-BA1-08/18.6 | | Uranium-235 | ND | 0.00334 | ND | | U | 0.0100 |
| | | | Uranium-238 | 0.577 | 0.0365 | | | | 0.0670 |
| | GE-BA1-08/20.6 | | Uranium-235 | 0.191 | 0.0101 | 17.3 | | | 0.0100 |
| | | | Uranium-238 | 17.1 | 0.855 | | | | 0.0670 |
| | GE-BA1-08/22.6 | | Uranium-235 | 0.767 | 0.0389 | 60.9 | | | 0.0200 |
| | | | Uranium-238 | 60.1 | 3.00 | | | | 0.0670 |
| | GE-BA1-08/22.6DUP | | Uranium-235 | 0.729 | 0.0371 | 60.1 | | | 0.0200 |
| | | | Uranium-238 | 59.4 | 2.97 | | | | 0.0670 |
| | GE-BA1-08/24.6 | | Uranium-235 | 0.915 | 0.0463 | 70.8 | | | 0.0200 |
| | | | Uranium-238 | 69.9 | 3.50 | | | | 0.0670 |
| | GE-BA1-08/27.6 | | Uranium-235 | 1.38 | 0.0709 | 113 | | | 0.0500 |
| | | | Uranium-238 | 112 | 5.59 | | | | 0.335 |
| | GE-BA1-08/29.15 | | Uranium-235 | 2.02 | 0.102 | 160 | | | 0.0500 |
| | | | Uranium-238 | 158 | 7.90 | | | | 0.335 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| BA1-C | GE-BA1-09/6.5 | 12/21/19 | Uranium-235 | 0.0320 | 0.0037 | **4.28** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 4.25 | 0.214 | | | | 0.0670 |
| | GE-BA1-09/8.5 | | Uranium-235 | 0.0946 | 0.00579 | **8.70** | | | 0.0100 |
| | | | Uranium-238 | 8.61 | 0.431 | | | | 0.0670 |
| | GE-BA1-09/10.5 | | Uranium-235 | 0.517 | 0.0261 | **41.7** | | | 0.0100 |
| | | | Uranium-238 | 41.2 | 2.06 | | | | 0.0670 |
| | GE-BA1-09/12.5 | | Uranium-235 | 0.231 | 0.012 | **19.3** | | | 0.0100 |
| | | | Uranium-238 | 19.1 | 0.953 | | | | 0.0670 |
| | GE-BA1-09/14.5 | | Uranium-235 | 0.0334 | 0.00373 | **3.39** | | J | 0.0100 |
| | | | Uranium-238 | 3.36 | 0.169 | | | | 0.0670 |
| | GE-BA1-09/16.5 | | Uranium-235 | 0.229 | 0.0119 | **20.4** | | | 0.0100 |
| | | | Uranium-238 | 20.2 | 1.01 | | | | 0.0670 |
| | GE-BA1-09/16.5DUP | | Uranium-235 | 0.212 | 0.0111 | **19.3** | | | 0.0100 |
| | | | Uranium-238 | 19.1 | 0.954 | | | | 0.0670 |
| | GE-BA1-09/18.5 | | Uranium-235 | 0.0312 | 0.00368 | **3.26** | | J | 0.0100 |
| | | | Uranium-238 | 3.23 | 0.163 | | | | 0.0670 |
| | GE-BA1-09/20.5 | | Uranium-235 | ND | 0.00335 | **ND** | | U | 0.0100 |
| | | | Uranium-238 | 1.13 | 0.0606 | | | | 0.0670 |
| | GE-BA1-09/22.5 | | Uranium-235 | 0.0483 | 0.00412 | **4.50** | | J | 0.0100 |
| | | | Uranium-238 | 4.45 | 0.224 | | | | 0.0670 |
| | GE-BA1-09/24.5 | | Uranium-235 | 0.801 | 0.0406 | **65.7** | | | 0.0200 |
| | | | Uranium-238 | 64.9 | 3.24 | | | | 0.0670 |
| WAA U>DCGL | GE-WAA-01/8.7 | 1/6/20 | Uranium-235 | 0.406 | 0.0206 | **18.7** | µg/L | | 0.0100 |
| | | | Uranium-238 | 18.3 | 0.915 | | | | 0.067 |
| | GE-WAA-01/10.7 | | Uranium-235 | 1.82 | 0.097 | **94.6** | | | 0.100 |
| | | | Uranium-238 | 92.8 | 4.64 | | | | 0.067 |
| | GE-WAA-01/12.7 | | Uranium-235 | 3.18 | 0.163 | **171** | | | 0.100 |
| | | | Uranium-238 | 168 | 8.42 | | | | 0.670 |
| | GE-WAA-01/12.7DUP | | Uranium-235 | 3.07 | 0.157 | **166** | | | 0.100 |
| | | | Uranium-238 | 163 | 8.17 | | | | 0.670 |
| | GE-WAA-01/14.7 | | Uranium-235 | 3.00 | 0.154 | **168** | | | 0.100 |
| | | | Uranium-238 | 165 | 8.26 | | | | 0.670 |
| | GE-WAA-01/16.7 | | Uranium-235 | 2.44 | 0.126 | **155** | | | 0.100 |
| | | | Uranium-238 | 153 | 7.63 | | | | 0.670 |
| | GE-WAA-01/18.7 | | Uranium-235 | 2.24 | 0.117 | **147** | | | 0.100 |
| | | | Uranium-238 | 145 | 7.24 | | | | 0.670 |
| | GE-WAA-01/26.6 | | Uranium-235 | 1.60 | 0.0864 | **87.6** | | | 0.100 |
| | | | Uranium-238 | 86.0 | 4.30 | | | | 0.670 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| WAA U>DCGL | GE-WAA-02/8.5 | 1/7/20 | Uranium-235 | 3.10 | 0.158 | 153 | µg/L | | 0.100 |
| | | | Uranium-238 | 150 | 7.49 | | | | 0.670 |
| | GE-WAA-02/10.5 | | Uranium-235 | 3.53 | 0.180 | 174 | | | 0.100 |
| | | | Uranium-238 | 170 | 8.51 | | | | 0.670 |
| | GE-WAA-02/12.5 | | Uranium-235 | 3.05 | 0.156 | 157 | | | 0.100 |
| | | | Uranium-238 | 154 | 7.72 | | | | 0.670 |
| | GE-WAA-02/14.5 | | Uranium-235 | 2.92 | 0.150 | 159 | | | 0.100 |
| | | | Uranium-238 | 156 | 7.78 | | | | 0.670 |
| | GE-WAA-02/16.5 | | Uranium-235 | 0.989 | 0.0596 | 56.5 | | | 0.100 |
| | | | Uranium-238 | 55.5 | 2.78 | | | | 0.0670 |
| | GE-WAA-02/18.5 | | Uranium-235 | 1.33 | 0.0744 | 75.6 | | | 0.100 |
| | | | Uranium-238 | 74.3 | 3.72 | | | | 0.0670 |
| | GE-WAA-02/20.5 | | Uranium-235 | 1.32 | 0.0738 | 78.6 | | | 0.100 |
| | | | Uranium-238 | 77.3 | 3.86 | | | | 0.0670 |
| | GE-WAA-02/26.5 | | Uranium-235 | 0.803 | 0.0522 | 59.0 | | | 0.100 |
| | | | Uranium-238 | 58.2 | 2.91 | | | | 0.0670 |
| | GE-WAA-02/26.5DUP | | Uranium-235 | 0.902 | 0.0481 | 59.5 | | | 0.0500 |
| | | | Uranium-238 | 58.6 | 2.93 | | | | 0.0670 |
| WAA U>DCGL | GE-WAA-03/10.3 | 1/7/20 | Uranium-235 | 3.96 | 0.201 | 192 | µg/L | | 0.100 |
| | | | Uranium-238 | 188 | 9.40 | | | | 0.670 |
| | GE-WAA-03/12.3 | | Uranium-235 | 3.87 | 0.196 | 192 | | | 0.100 |
| | | | Uranium-238 | 188 | 9.42 | | | | 0.670 |
| | GE-WAA-03/14.3 | | Uranium-235 | 2.61 | 0.135 | 137 | | | 0.100 |
| | | | Uranium-238 | 134 | 6.71 | | | | 0.670 |
| | GE-WAA-03/16.3 | | Uranium-235 | 2.33 | 0.121 | 133 | | | 0.100 |
| | | | Uranium-238 | 131 | 6.55 | | | | 0.670 |
| | GE-WAA-03/18.3 | | Uranium-235 | 2.13 | 0.112 | 129 | | | 0.100 |
| | | | Uranium-238 | 127 | 6.38 | | | | 0.670 |
| WAA U>DCGL | GE-WAA-04/8.0 | 1/6/20 | Uranium-235 | 0.239 | 0.0124 | 14.9 | µg/L | | 0.0100 |
| | | | Uranium-238 | 14.7 | 0.736 | | | | 0.0670 |
| | GE-WAA-04/10.0 | | Uranium-235 | 1.47 | 0.0808 | 77.2 | | | 0.100 |
| | | | Uranium-238 | 75.7 | 3.78 | | | | 0.0670 |
| | GE-WAA-04/10.0DUP | | Uranium-235 | 1.49 | 0.0817 | 78.5 | | | 0.100 |
| | | | Uranium-238 | 77.0 | 3.85 | | | | 0.0670 |
| | GE-WAA-04/12.0 | | Uranium-235 | 2.52 | 0.130 | 147 | | | 0.100 |
| | | | Uranium-238 | 144 | 7.19 | | | | 0.670 |
| | GE-WAA-04/16.0 | | Uranium-235 | 2.01 | 0.106 | 71.5 | | | 0.100 |
| | | | Uranium-238 | 69.5 | 3.48 | | | | 0.0670 |
| | GE-WAA-04/18.0 | | Uranium-235 | 0.670 | 0.0337 | 32.3 | | | 0.0100 |
| | | | Uranium-238 | 31.6 | 1.58 | | | | 0.0670 |
| | GE-WAA-04/20.0 | | Uranium-235 | 0.379 | 0.0192 | 29.5 | | | 0.0100 |
| | | | Uranium-238 | 29.1 | 1.46 | | | | 0.0670 |
| | GE-WAA-04/22.0 | | Uranium-235 | 2.06 | 0.108 | 294 | | | 0.100 |
| | | | Uranium-238 | 292 | 14.6 | | | | 0.6700 |
| | GE-WAA-04/25.75 | | Uranium-235 | ND | 0.00336 | ND | | U | 0.0100 |
| | | | Uranium-238 | 1.19 | 0.0637 | | | | 0.0670 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| WAA-WEST | GE-WAA-05/12.5 | 12/19/19 | Uranium-235 | 0.0769 | 0.00509 | 9.86 | µg/L | | 0.0100 |
| | | | Uranium-238 | 9.78 | 0.490 | | | | 0.0670 |
| | GE-WAA-05/14.5 | | Uranium-235 | 0.0617 | 0.00454 | 7.89 | | J | 0.0100 |
| | | | Uranium-238 | 7.83 | 0.392 | | | | 0.0670 |
| | GE-WAA-05/16.5 | | Uranium-235 | 0.0600 | 0.00448 | 7.62 | | J | 0.0100 |
| | | | Uranium-238 | 7.56 | 0.379 | | | | 0.0670 |
| | GE-WAA-05/16.5DUP | | Uranium-235 | 0.0599 | 0.00448 | 7.50 | | J | 0.0100 |
| | | | Uranium-238 | 7.44 | 0.373 | | | | 0.0670 |
| | GE-WAA-05/18.5 | | Uranium-235 | 0.109 | 0.0064 | 12.8 | | | 0.0100 |
| | | | Uranium-238 | 12.7 | 0.637 | | | | 0.0670 |
| | GE-WAA-05/20.5 | | Uranium-235 | 0.255 | 0.0132 | 23.6 | | | 0.0100 |
| | | | Uranium-238 | 23.3 | 1.16 | | | | 0.0670 |
| | GE-WAA-05/22.5 | | Uranium-235 | 0.353 | 0.018 | 28.8 | | | 0.0100 |
| | | | Uranium-238 | 28.4 | 1.42 | | | | 0.0670 |
| | GE-WAA-05/24.5 | | Uranium-235 | 0.582 | 0.0293 | 40.8 | | | 0.0100 |
| | | | Uranium-238 | 40.2 | 2.01 | | | | 0.0670 |
| | GE-WAA-05/26.5 | | Uranium-235 | 0.830 | 0.0447 | 51.2 | | | 0.0500 |
| | | | Uranium-238 | 50.4 | 2.52 | | | | 0.0670 |
| | GE-WAA-05/28.5 | | Uranium-235 | 0.981 | 0.0518 | 54.3 | | | 0.0500 |
| | | | Uranium-238 | 53.3 | 2.66 | | | | 0.0670 |
| | GE-WAA-05/30.5 | | Uranium-235 | 0.963 | 0.051 | 55.0 | | | 0.0500 |
| | | | Uranium-238 | 54.0 | 2.70 | | | | 0.0670 |
| WAA-BLUFF | GE-WAA-06/8.9 | 1/7/20 | Uranium-235 | 1.35 | 0.0753 | 66.6 | µg/L | | 0.100 |
| | | | Uranium-238 | 65.2 | 3.26 | | | | 0.0670 |
| | GE-WAA-06/10.9 | | Uranium-235 | 0.041 | 0.00391 | 4.61 | | J | 0.0100 |
| | | | Uranium-238 | 4.57 | 0.23 | | | | 0.0670 |
| | GE-WAA-06/10.9DUP | | Uranium-235 | 0.0424 | 0.00395 | 4.62 | | J | 0.0100 |
| | | | Uranium-238 | 4.58 | 0.23 | | | | 0.0670 |
| | GE-WAA-06/12.9 | | Uranium-235 | 0.0323 | 0.0037 | 3.99 | | J | 0.0100 |
| | | | Uranium-238 | 3.96 | 0.199 | | | | 0.0670 |
| | GE-WAA-06/14.9 | | Uranium-235 | 0.0235 | 0.00353 | 3.42 | | J | 0.0100 |
| | | | Uranium-238 | 3.40 | 0.171 | | | | 0.0670 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| WAA-BLUFF | GE-WAA-07/8.0 | 1/8/20 | Uranium-235 | 1.48 | 0.0761 | 59.1 | µg/L | | 0.0500 |
| | | | Uranium-238 | 57.6 | 2.88 | | | | 0.0670 |
| | | | Nitrate | 8.33 | | | mg/L | | 0.425 |
| | GE-WAA-07/10.0 | | Uranium-235 | 0.504 | 0.0254 | 20.8 | µg/L | | 0.0100 |
| | | | Uranium-238 | 20.3 | 1.01 | | | | 0.0670 |
| | | | Nitrate | 11.7 | | | mg/L | | 0.425 |
| | GE-WAA-07/12.0 | | Uranium-235 | 0.504 | 0.0254 | 21.7 | µg/L | | 0.0100 |
| | | | Uranium-238 | 21.2 | 1.06 | | | | 0.0670 |
| | | | Nitrate | 93.7 | | | mg/L | | 1.70 |
| | GE-WAA-07/14.0 | | Uranium-235 | 0.217 | 0.0114 | 11.2 | µg/L | | 0.0100 |
| | | | Uranium-238 | 11.0 | 0.551 | | | | 0.0670 |
| | | | Nitrate | 121 | | | mg/L | | 1.70 |
| | GE-WAA-07/16.0 | | Uranium-235 | 0.198 | 0.0105 | 10.7 | µg/L | | 0.0100 |
| | | | Uranium-238 | 10.5 | 0.526 | | | | 0.0670 |
| | | | Nitrate | 179 | | | mg/L | | 8.50 |
| | GE-WAA-07/18.0 | | Uranium-235 | 0.136 | 0.00756 | 8.17 | µg/L | | 0.0100 |
| | | | Uranium-238 | 8.03 | 0.402 | | | | 0.0670 |
| | | | Nitrate | 287 | | | mg/L | | 8.50 |
| WAA-BLUFF | GE-WAA-08/8.7 | 1/8/20 | Uranium-235 | 0.673 | 0.0338 | 28.0 | µg/L | | 0.0100 |
| | | | Uranium-238 | 27.3 | 1.37 | | | | 0.0670 |
| | | | Nitrate | 22.2 | | | mg/L | | 0.425 |
| | GE-WAA-08/10.7 | | Uranium-235 | 0.32 | 0.0164 | 15.0 | µg/L | | 0.0100 |
| | | | Uranium-238 | 14.7 | 0.738 | | | | 0.067 |
| | | | Nitrate | 27.6 | | | mg/L | | 0.850 |
| | GE-WAA-08/10.7DUP | | Uranium-235 | 0.319 | 0.0163 | 15.2 | µg/L | | 0.0100 |
| | | | Uranium-238 | 14.9 | 0.746 | | | | 0.0670 |
| | | | Nitrate | 27.5 | | | mg/L | | 0.850 |
| | GE-WAA-08/12.7 | | Uranium-235 | 0.111 | 0.00647 | 5.58 | µg/L | | 0.0100 |
| | | | Uranium-238 | 5.47 | 0.274 | | | | 0.0670 |
| | | | Nitrate | 36.7 | | | mg/L | | 0.850 |
| | GE-WAA-08/14.7 | | Uranium-235 | 0.0999 | 0.00601 | 5.16 | µg/L | | 0.0100 |
| | | | Uranium-238 | 5.06 | 0.254 | | | | 0.0670 |
| | | | Nitrate | 36.0 | | | mg/L | | 0.850 |
| | GE-WAA-08/16.7 | | Uranium-235 | 0.156 | 0.00849 | 8.11 | µg/L | | 0.0100 |
| | | | Uranium-238 | 7.95 | 0.398 | | | | 0.0670 |
| | | | Nitrate | 22.4 | | | mg/L | | 0.850 |
| | GE-WAA-08/18.7 | | Uranium-235 | 0.0346 | 0.00376 | 4.58 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 4.55 | 0.228 | | | | 0.0670 |
| | | | Nitrate | 1.67 | | | mg/L | | 0.0850 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| WAA-BLUFF | GE-WAA-09/8.0 | 12/19/19 | Uranium-235 | 0.0740 | 0.00498 | **4.73** | µg/L | | 0.0100 |
| | | | Uranium-238 | 4.66 | 0.234 | | | | 0.0670 |
| | | | Nitrate | 31.2 | | | mg/L | | 1.70 |
| | GE-WAA-09/10.0 | | Uranium-235 | 0.0193 | 0.00347 | **1.64** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 1.62 | 0.0842 | | | | 0.0670 |
| | | | Nitrate | 22.3 | | | mg/L | | 0.850 |
| | GE-WAA-09/12.0 | | Uranium-235 | 0.0137 | 0.0034 | **1.39** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 1.38 | 0.0727 | | | | 0.0670 |
| | | | Nitrate | 16.5 | | | mg/L | | 0.425 |
| | GE-WAA-09/12.0DUP | | Uranium-235 | 0.0129 | 0.0034 | **1.41** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 1.40 | 0.0737 | | | | 0.0670 |
| | | | Nitrate | 16.6 | | | mg/L | | 0.425 |
| | GE-WAA-09/14.0 | | Uranium-235 | 0.0103 | 0.00337 | **1.26** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 1.25 | 0.0664 | | | | 0.0670 |
| | | | Nitrate | 6.61 | | | mg/L | | 0.170 |
| | GE-WAA-09/15.0 | | Uranium-235 | ND | 0.00336 | **ND** | µg/L | U | 0.0100 |
| | | | Uranium-238 | 1.13 | 0.0607 | | | | 0.0670 |
| | | | Nitrate | 3.68 | | | mg/L | | 0.0850 |
| WAA-BLUFF | GE-WAA-10/7.5 | 12/20/19 | Uranium-235 | 0.0348 | 0.00376 | **3.59** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 3.56 | 0.179 | | | | 0.0670 |
| | | | Nitrate | 118 | | | mg/L | | 4.25 |
| | GE-WAA-10/9.5 | | Uranium-235 | 0.0585 | 0.00443 | **6.27** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 6.21 | 0.312 | | | | 0.0670 |
| | | | Nitrate | 131 | | | mg/L | | 4.25 |
| | GE-WAA-10/11.5 | | Uranium-235 | 0.0410 | 0.00391 | **4.30** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 4.26 | 0.214 | | | | 0.0670 |
| | | | Nitrate | 114 | | | mg/L | | 4.25 |
| | GE-WAA-10/13.5 | | Uranium-235 | 0.0321 | 0.0037 | **3.55** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 3.52 | 0.178 | | | | 0.0670 |
| | | | Nitrate | 67.5 | | | mg/L | | 4.25 |
| | GE-WAA-10/14.75 | | Uranium-235 | 0.0207 | 0.00349 | **2.09** | µg/L | J | 0.0100 |
| | | | Uranium-238 | 2.07 | 0.106 | | | | 0.0670 |
| | | | Nitrate | 32.5 | | | mg/L | | 4.25 |

**Table 3-1**
**Vertical Profiling Lab Results**
**Vertical Profiling & Well Abandonment**
**Cimarron Site, Oklahoma**

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| WAA-BLUFF | GE-WAA-11/7.6 | 12/20/19 | Uranium-235 | 0.0695 | 0.00482 | 9.44 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 9.37 | 0.469 | | | | 0.0670 |
| | | | Nitrate | 3.48 | | | mg/L | | 0.0850 |
| | GE-WAA-11/10.6 | | Uranium-235 | 0.0289 | 0.00363 | 3.79 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 3.76 | 0.189 | | | | 0.0670 |
| | | | Nitrate | 22.9 | | | mg/L | | 0.850 |
| | GE-WAA-11/12.6 | | Uranium-235 | 0.0233 | 0.00353 | 3.05 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 3.03 | 0.153 | | | | 0.0670 |
| | | | Nitrate | 11.6 | | | mg/L | | 0.850 |
| | GE-WAA-11/12.6DUP | | Uranium-235 | 0.0230 | 0.00353 | 2.95 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 2.93 | 0.148 | | | | 0.0670 |
| | | | Nitrate | 11.4 | | | mg/L | | 0.850 |
| | GE-WAA-11/14.6 | | Uranium-235 | 0.0142 | 0.00341 | 1.84 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 1.83 | 0.0943 | | | | 0.0670 |
| | | | Nitrate | 7.42 | | | mg/L | | 0.170 |
| WAA-BLUFF | GE-WAA-12/7.0 | 12/20/19 | Uranium-235 | 0.0319 | 0.0037 | 4.10 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 4.07 | 0.205 | | | | 0.0670 |
| | | | Nitrate | 17.1 | | | mg/L | | 0.850 |
| | GE-WAA-12/9.0 | | Uranium-235 | 0.0299 | 0.00365 | 4.00 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 3.97 | 0.200 | | | | 0.0670 |
| | | | Nitrate | 13.9 | | | mg/L | | 0.170 |
| | GE-WAA-12/11.0 | | Uranium-235 | 0.0371 | 0.00381 | 4.50 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 4.46 | 0.224 | | | | 0.0670 |
| | | | Nitrate | 23.0 | | | mg/L | | 1.70 |
| | GE-WAA-12/13.0 | | Uranium-235 | 0.0312 | 0.00368 | 3.97 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 3.94 | 0.198 | | | | 0.0670 |
| | | | Nitrate | 18.7 | | | mg/L | | 1.70 |
| | GE-WAA-12/15.0 | | Uranium-235 | 0.0348 | 0.00376 | 4.08 | µg/L | J | 0.010 |
| | | | Uranium-238 | 4.05 | 0.204 | | | | 0.0670 |
| | | | Nitrate | 28.2 | | | mg/L | | 1.70 |
| | GE-WAA-12/16.15 | | Uranium-235 | 0.0471 | 0.00408 | 5.36 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 5.31 | 0.266 | | | | 0.0670 |
| | | | Nitrate | 42.0 | | | mg/L | | 1.70 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| WAA-BLUFF | GE-WAA-13/8.0 | 12/21/19 | Uranium-235 | 0.0635 | 0.0046 | 8.56 | µg/L | J | 0.010 |
| | | | Uranium-238 | 8.50 | 0.426 | | | | 0.0670 |
| | | | Nitrate | 0.1490 | | | mg/L | | 0.0170 |
| | GE-WAA-13/10.0 | | Uranium-235 | 0.0206 | 0.00349 | 2.71 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 2.69 | 0.136 | | | | 0.0670 |
| | | | Nitrate | 1.77 | | | mg/L | | 0.0850 |
| | GE-WAA-13/10.0DUP | | Uranium-235 | 0.0213 | 0.0035 | 3.00 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 2.98 | 0.151 | | | | 0.0670 |
| | | | Nitrate | 1.80 | | | mg/L | | 0.0850 |
| | GE-WAA-13/12.0 | | Uranium-235 | 0.0327 | 0.00371 | 4.42 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 4.39 | 0.221 | | | | 0.0670 |
| | | | Nitrate | 1.51 | | | mg/L | | 0.0850 |
| | GE-WAA-13/14.0 | | Uranium-235 | 0.0249 | 0.00356 | 3.41 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 3.39 | 0.171 | | | | 0.0670 |
| | | | Nitrate | 0.538 | | | mg/L | | 0.0170 |
| | GE-WAA-13/15.9 | | Uranium-235 | 0.0322 | 0.0037 | 4.43 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 4.40 | 0.221 | | | | 0.0670 |
| | | | Nitrate | 0.512 | | | mg/L | | 0.0170 |
| WAA-EAST | GE-WAA-14/8.5 | 12/18/19 | Uranium-235 | 0.0696 | 0.00482 | 7.33 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 7.26 | 0.364 | | | | 0.0670 |
| | | | Nitrate | 0.926 | | | mg/L | | 0.0170 |
| | GE-WAA-14/10.5 | | Uranium-235 | 0.0687 | 0.00479 | 6.37 | µg/L | J | 0.0100 |
| | | | Uranium-238 | 6.30 | 0.316 | | | | 0.0670 |
| | | | Nitrate | 6.69 | | | mg/L | | 0.170 |
| | GE-WAA-14/12.5 | | Uranium-235 | 0.0738 | 0.00497 | 6.88 | µg/L | | 0.0100 |
| | | | Uranium-238 | 6.81 | 0.341 | | | | 0.0670 |
| | | | Nitrate | 8.40 | | | mg/L | | 0.170 |
| | GE-WAA-14/14.5 | | Uranium-235 | 0.0954 | 0.00582 | 10.4 | µg/L | | 0.0100 |
| | | | Uranium-238 | 10.3 | 0.513 | | | | 0.0670 |
| | | | Nitrate | 62.2 | | | mg/L | | 1.70 |
| | GE-WAA-14/16.5 | | Uranium-235 | 0.360 | 0.0183 | 49.9 | µg/L | | 0.0100 |
| | | | Uranium-238 | 49.5 | 2.47 | | | | 0.0670 |
| | | | Nitrate | 77.8 | | | mg/L | | 4.25 |
| | GE-WAA-14/24.5 | | Uranium-235 | 0.495 | 0.025 | 69.7 | µg/L | | 0.0100 |
| | | | Uranium-238 | 69.2 | 3.46 | | | | 0.0670 |
| | | | Nitrate | 129 | | | mg/L | | 4.25 |
| | GE-WAA-14/26.5 | | Uranium-235 | 0.592 | 0.0298 | 82.5 | µg/L | | 0.0100 |
| | | | Uranium-238 | 81.9 | 4.09 | | | | 0.0670 |
| | | | Nitrate | 54.2 | | | mg/L | | 1.70 |

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|
| WAA-EAST | GE-WAA-15/7.6 | 12/17/19 | Uranium-235 | 0.0808 | 0.00524 | 10.1 | µg/L | | 0.0100 |
| | | | Uranium-238 | 10.0 | 0.501 | | | | 0.0670 |
| | | | Nitrate | 2.51 | | | mg/L | | 0.850 |
| | GE-WAA-15/9.6 | | Uranium-235 | 0.0784 | 0.00515 | 9.47 | µg/L | | 0.0100 |
| | | | Uranium-238 | 9.39 | 0.47 | | | | 0.0670 |
| | | | Nitrate | 15.7 | | | mg/L | | 1.70 |
| | GE-WAA-15/11.6 | | Uranium-235 | 0.106 | 0.00625 | 14.0 | µg/L | | 0.0100 |
| | | | Uranium-238 | 13.9 | 0.697 | | | | 0.0670 |
| | | | Nitrate | 23.2 | | | mg/L | | 1.70 |
| | GE-WAA-15/13.6 | | Uranium-235 | 0.124 | 0.00702 | 16.2 | µg/L | | 0.0100 |
| | | | Uranium-238 | 16.1 | 0.805 | | | | 0.0670 |
| | | | Nitrate | 24.6 | | | mg/L | | 1.70 |
| | GE-WAA-15/15.6 | | Uranium-235 | 0.203 | 0.0107 | 27.6 | µg/L | | 0.0100 |
| | | | Uranium-238 | 27.4 | 1.37 | | | | 0.0670 |
| | | | Nitrate | 48.8 | | | mg/L | | 4.25 |
| | GE-WAA-15/17.6 | | Uranium-235 | 0.422 | 0.0213 | 58.8 | µg/L | | 0.0100 |
| | | | Uranium-238 | 58.4 | 2.92 | | | | 0.0670 |
| | | | Nitrate | 70.0 | | | mg/L | | 4.25 |
| | GE-WAA-15/19.6 | | Uranium-235 | 1.29 | 0.0665 | 177 | µg/L | | 0.0500 |
| | | | Uranium-238 | 176 | 8.79 | | | | 0.335 |
| | | | Nitrate | 47.8 | | | mg/L | | 4.25 |
| | GE-WAA-15/21.6 | | Uranium-235 | 1.58 | 0.0809 | 220 | µg/L | | 0.0500 |
| | | | Uranium-238 | 218 | 10.9 | | | | 0.335 |
| | | | Nitrate | 45.8 | | | mg/L | | 4.25 |
| | GE-WAA-15/23.6 | | Uranium-235 | 2.73 | 0.14 | 381 | µg/L | | 0.100 |
| | | | Uranium-238 | 378 | 18.9 | | | | 0.670 |
| | | | Nitrate | 50.3 | | | mg/L | | 4.25 |
| | GE-WAA-15/23.6DUP | | Uranium-235 | 2.81 | 0.144 | 393 | µg/L | | 0.100 |
| | | | Uranium-238 | 390 | 19.5 | | | | 0.670 |
| | | | Nitrate | 50.0 | | | mg/L | | 4.25 |
| | GE-WAA-15/25.6 | | Uranium-235 | 3.38 | 0.172 | 472 | µg/L | | 0.100 |
| | | | Uranium-238 | 469 | 23.5 | | | | 0.670 |
| | | | Nitrate | 54.3 | | | mg/L | | 4.25 |

**Notes:**

BA1 = Burial Area 1

DEQ = Department of Environmental Quality

GE = Groundwater Extraction

J = Value is estimated

MDL = method detection limit

mg/L = milligrams per liter

NRC = Nuclear Regulatory Commission

U = Analyte was analyzed for, but not detected above, the MDL

µg/L = micrograms per liter

# Table 3-1
# Vertical Profiling Lab Results
# Vertical Profiling & Well Abandonment
# Cimarron Site, Oklahoma

| Area | Sample ID | Collection Date | Parameter | Lab Result | Uncertainty | Total Uranium | Units (µg/L - mg/L) | Lab or Data Review Qualifier | MDL |
|---|---|---|---|---|---|---|---|---|---|

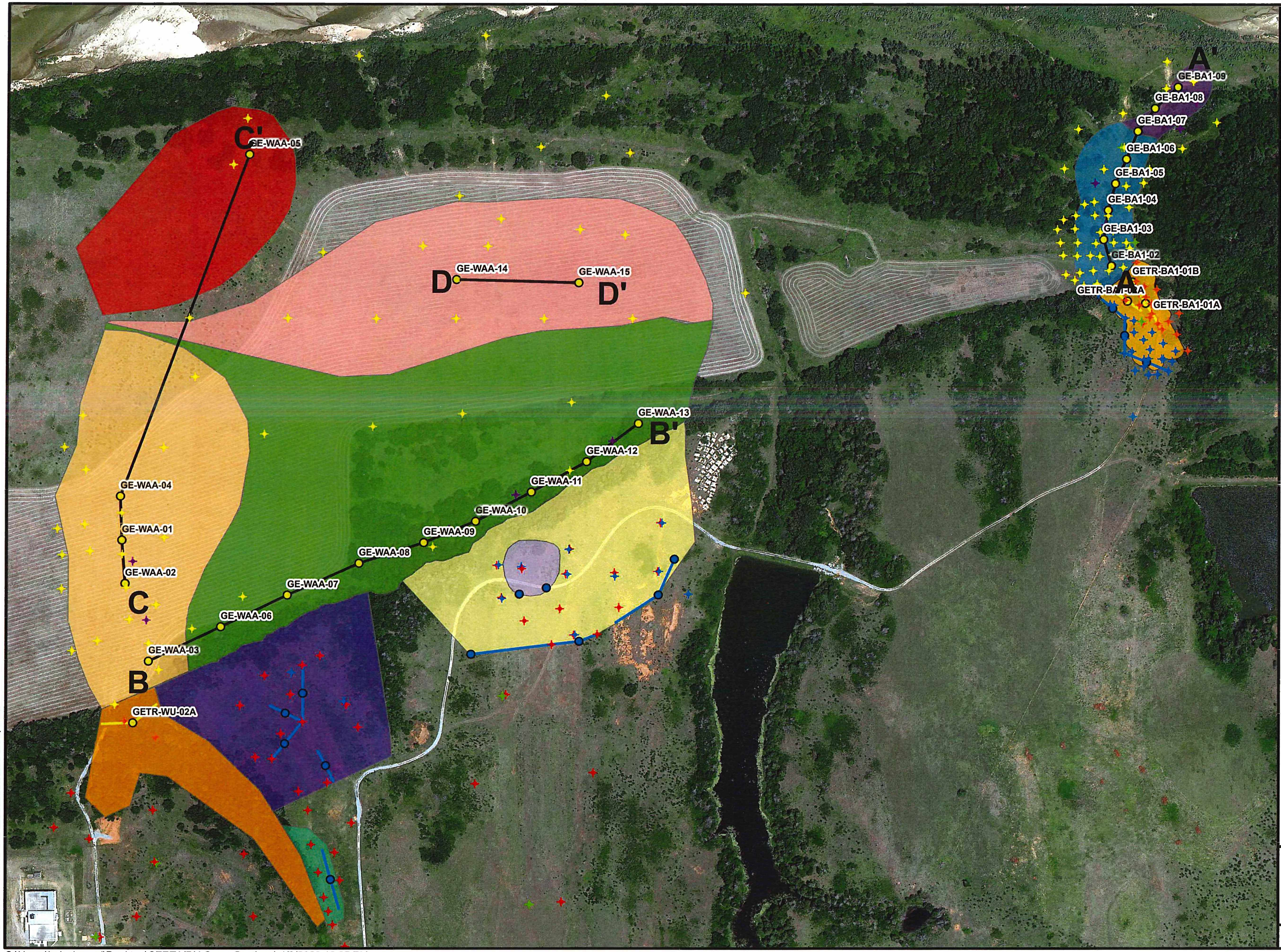
WAA = Western Alluviual Area

1) Highlighted cells indicate results above remediation goals as shown below:

2) Bold red font indicates calculated values.

| | | |
|---|---|---|
| **DEQ Criteria** | Nitrate in WU-PBA: | 52 mg/L |
| | Nitrate elsewhere: | 22.9 mg/L |
| | Uranium: | 30 µg/L |
| **NRC Criteria** | Uranium Activity: | 180 pCi/L |
| | Uranium Concentration: | 119 µg/L in WAA U>DCGL, 1206-NORTH, and WU-BA3 |
| | Uranium Concentration: | 201 µg/L elsewhere |

FIGURES




**LEGEND**

- MONITOR WELL IN ALLUVIUM
- MONITOR WELL IN SANDSTONE A
- MONITOR WELL IN SANDSTONE B
- MONITOR WELL IN SANDSTONE C
- MONITOR WELL IN TRANSITION ZONE
- PROPOSED MONITOR WELL IN ALLUVIUM
- PROPOSED EXTRACTION WELL
- PROPOSED INJECTION WELL
- PROPOSED EXTRACTION TRENCH
- PROPOSED INJECTION TRENCH
- 2020 CROSS SECTION TRANSECTS
- AREA A
- AREA B
- AREA C
- WAA-BLUFF
- WAA-EAST
- WAA-WEST
- WAA U>DCGL
- 1206-NORTH
- WU-UP1
- WU-UP2-SSA
- WU-UP2-SSB
- BURIAL AREA #3

**NOTES**

1) FIELD WORK CONDUCTED BETWEEN DECEMBER 2019 AND JANUARY 2020.
2) BORINGS COMPLETED AT PROPOSED EXTRACTION WELL LOCATIONS.

N

0 350 700

SCALE IN FEET

FIGURE 2-1
CROSS SECTION PLAN VIEW - SITE
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA

BURNS & McDONNELL



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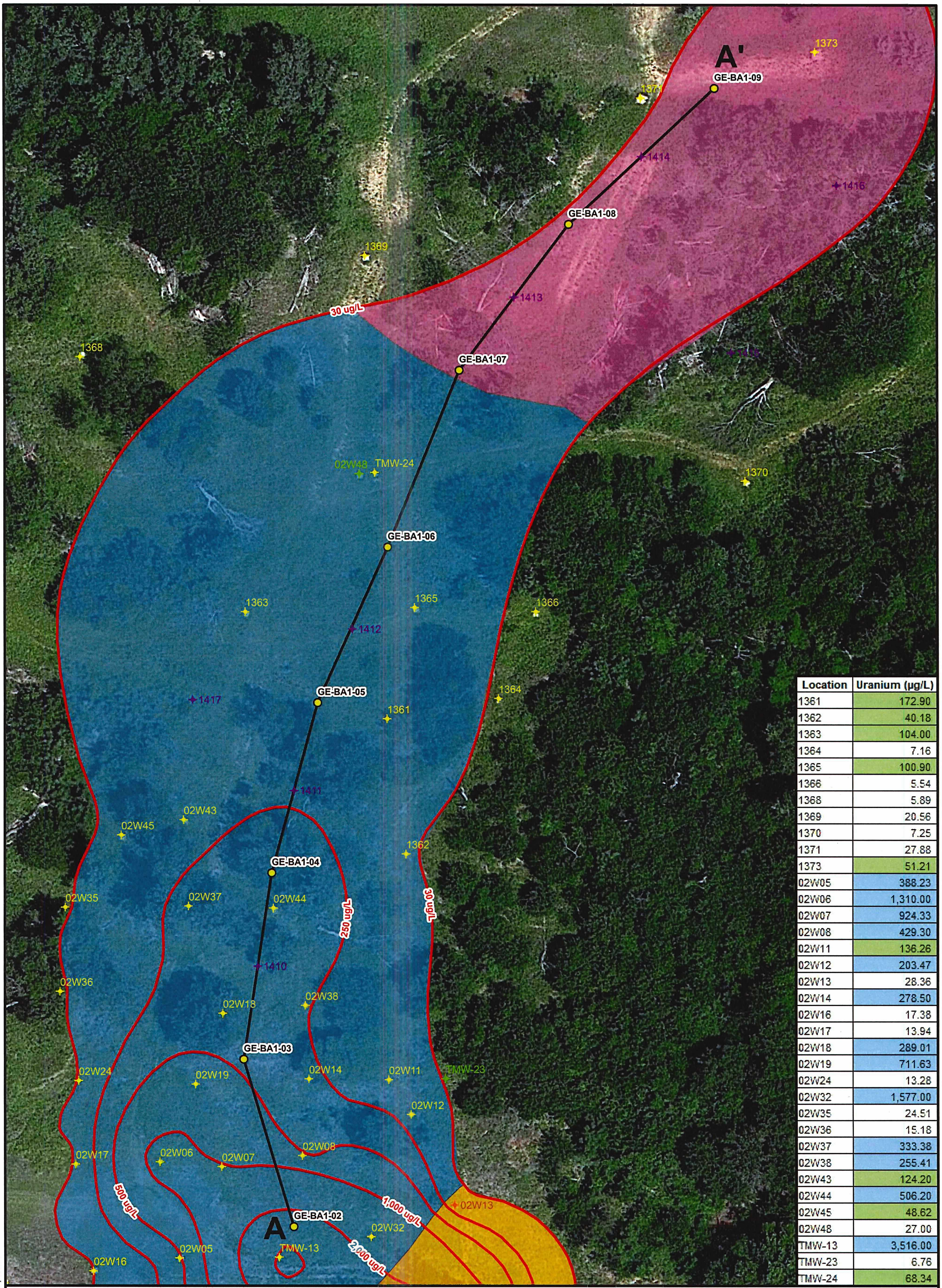



| Location | Uranium (µg/L) |
|---|---|
| 1361 | 172.90 |
| 1362 | 40.18 |
| 1363 | 104.00 |
| 1364 | 7.16 |
| 1365 | 100.90 |
| 1366 | 5.54 |
| 1368 | 5.89 |
| 1369 | 20.56 |
| 1370 | 7.25 |
| 1371 | 27.88 |
| 1373 | 51.21 |
| 02W05 | 388.23 |
| 02W06 | 1,310.00 |
| 02W07 | 924.33 |
| 02W08 | 429.30 |
| 02W11 | 136.26 |
| 02W12 | 203.47 |
| 02W13 | 28.36 |
| 02W14 | 278.50 |
| 02W16 | 17.38 |
| 02W17 | 13.94 |
| 02W18 | 289.01 |
| 02W19 | 711.63 |
| 02W24 | 13.28 |
| 02W32 | 1,577.00 |
| 02W35 | 24.51 |
| 02W36 | 15.18 |
| 02W37 | 333.38 |
| 02W38 | 255.41 |
| 02W43 | 124.20 |
| 02W44 | 506.20 |
| 02W45 | 48.62 |
| 02W48 | 27.00 |
| TMW-13 | 3,516.00 |
| TMW-23 | 6.76 |
| TMW-24 | 68.34 |

**LEGEND**

- MONITOR WELL IN ALLUVIUM
- MONITOR WELL IN SANDSTONE C
- MONITOR WELL IN TRANSITION ZONE
- PROPOSED MONITOR WELL IN ALLUVIUM
- PROPOSED EXTRACTION WELL
- 2020 CROSS SECTION TRANSECTS
- 2018 D-PLAN URANIUM CONTOUR
- AREA A
- AREA B
- AREA C

N

0 50 100

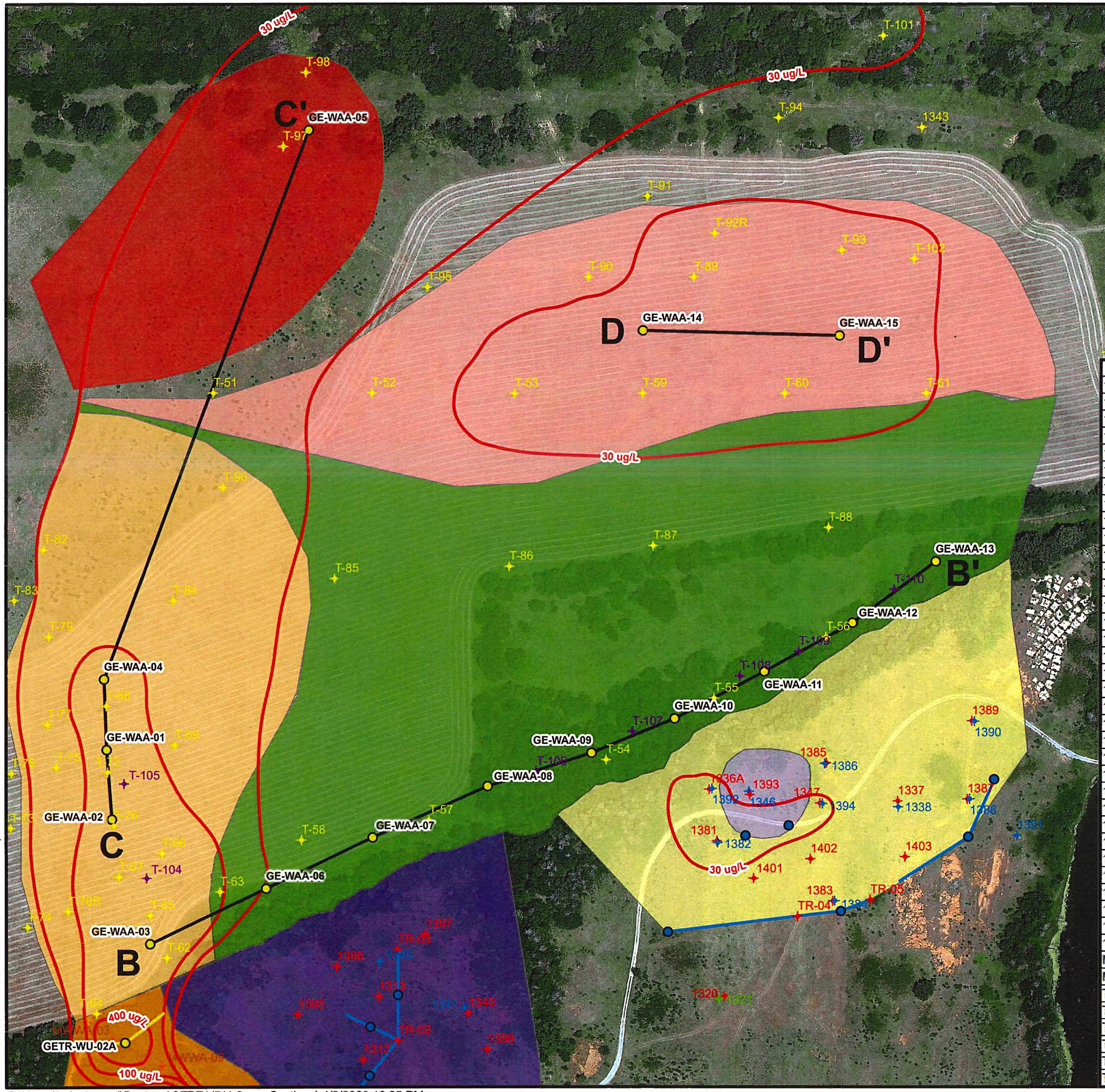
SCALE IN FEET

**NOTES**

1) FIELD WORK CONDUCTED BETWEEN DECEMBER 2019 AND JANUARY 2020.
2) BORINGS COMPLETED AT PROPOSED EXTRACTION WELL LOCATIONS.
3) GREEN HIGHLIGHT IN TABLE INDICATES STATE CRITERION EXCEEDANCE (30 ug/L).
4) BLUE HIGHLIGHT IN TABLE INDICATES STATE AND NRC CRITERION EXCEEDANCE (201 ug/L).
5) CONCENTRATIONS ARE "REPRESENTATIVE CONCENTRATIONS" FROM BASIS OF DESIGN (APPENDIX L) OF THE DECOMMISSIONING PLAN.

BURNS McDONNELL

FIGURE 3-1
CROSS SECTION PLAN VIEW - BA1
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA




**LEGEND**

- MONITOR WELL IN ALLUVIUM
- MONITOR WELL IN SANDSTONE A
- MONITOR WELL IN SANDSTONE B
- MONITOR WELL IN SANDSTONE C
- MONITOR WELL IN TRANSITION ZONE
- PROPOSED MONITOR WELL IN ALLUVIUM
- PROPOSED EXTRACTION WELL
- PROPOSED INJECTION WELL
- PROPOSED EXTRACTION TRENCH
- PROPOSED INJECTION TRENCH
- 2020 CROSS SECTION TRANSECTS
- 2018 D-PLAN URANIUM CONTOURS
- WAA-BLUFF
- WAA-EAST
- WAA-WEST
- WAA U>DCGL
- 1206-NORTH
- WU-UP1
- WU-UP2-SSA
- WU-UP2-SSB

| Location | Uranium (µg/L) | Location | Uranium (µg/L) |
|---|---|---|---|
| 1312 | 22.11 | T-54 | 3.79 |
| 1313 | 18.80 | T-55 | 7.39 |
| 1320 | 2.20 | T-56 | 5.77 |
| 1321 | 10.73 | T-57 | 13.61 |
| 1337 | 6.69 | T-58 | 19.92 |
| 1338 | 0.76 | T-59 | 92.26 |
| 1340 | 8.46 | T-60 | 48.59 |
| 1341 | 2.36 | T-61 | 30.44 |
| 1343 | 21.28 | T-62 | 177.80 |
| 1345 | 2.08 | T-63 | 104.15 |
| 1346 | 5.46 | T-64 | 125.70 |
| 1347 | 34.45 | T-65 | 152.00 |
| 1381 | 81.92 | T-66 | 121.60 |
| 1382 | 1.26 | T-67 | 159.00 |
| 1383 | 10.04 | T-68 | 150.20 |
| 1384 | 0.63 | T-69 | 77.29 |
| 1385 | 18.98 | T-70R | 97.71 |
| 1386 | 1.23 | T-72 | 141.00 |
| 1387 | 20.36 | T-73 | 10.40 |
| 1388 | 1.35 | T-74 | 13.81 |
| 1389 | 1.40 | T-75 | 76.74 |
| 1390 | 1.54 | T-76 | 173.20 |
| 1391 | 1.66 | T-77 | 86.79 |
| 1392 | 1.05 | T-78 | 17.47 |
| 1393 | 24.20 | T-79 | 62.76 |
| 1394 | 1.00 | T-82 | 34.28 |
| 1395 | 2.31 | T-83 | 14.34 |
| 1396 | 7.17 | T-84 | 48.10 |
| 1397 | 12.90 | T-85 | 27.80 |
| 1398 | 0.99 | T-86 | 22.91 |
| 1401 | 65.70 | T-87 | 21.99 |
| 1402 | 4.05 | T-88 | 9.94 |
| 1403 | 1.70 | T-89 | 50.65 |
| 1336A | 36.14 | T-90 | 24.82 |
| MWWA-03 | 526.60 | T-91 | 27.82 |
| MWWA-09 | 139.80 | T-92R | 38.31 |
| T-101 | 34.78 | T-93 | 32.68 |
| T-102 | 32.34 | T-94 | 20.24 |
| T-103 | 10.18 | T-95 | 29.25 |
| T-51 | 36.37 | T-96 | 34.73 |
| T-52 | 23.21 | T-97 | 64.07 |
| T-53 | 33.60 | T-98 | 53.06 |

**NOTES**

1) FIELD WORK CONDUCTED BETWEEN DECEMBER 2019 AND JANUARY 2020.
2) BORINGS COMPLETED AT PROPOSED EXTRACTION WELL LOCATIONS.
3) GREEN HIGHLIGHT IN TABLE INDICATES STATE CRITERION EXCEEDANCE (30 ug/L).
4) BLUE HIGHLIGHT IN TABLE INDICATES STATE AND NRC CRITERION EXCEEDANCE (201 ug/L).
5) CONCENTRATIONS ARE "REPRESENTATIVE CONCENTRATIONS" FROM BASIS OF DESIGN (APPENDIX L) OF THE DECOMMISSIONING PLAN.

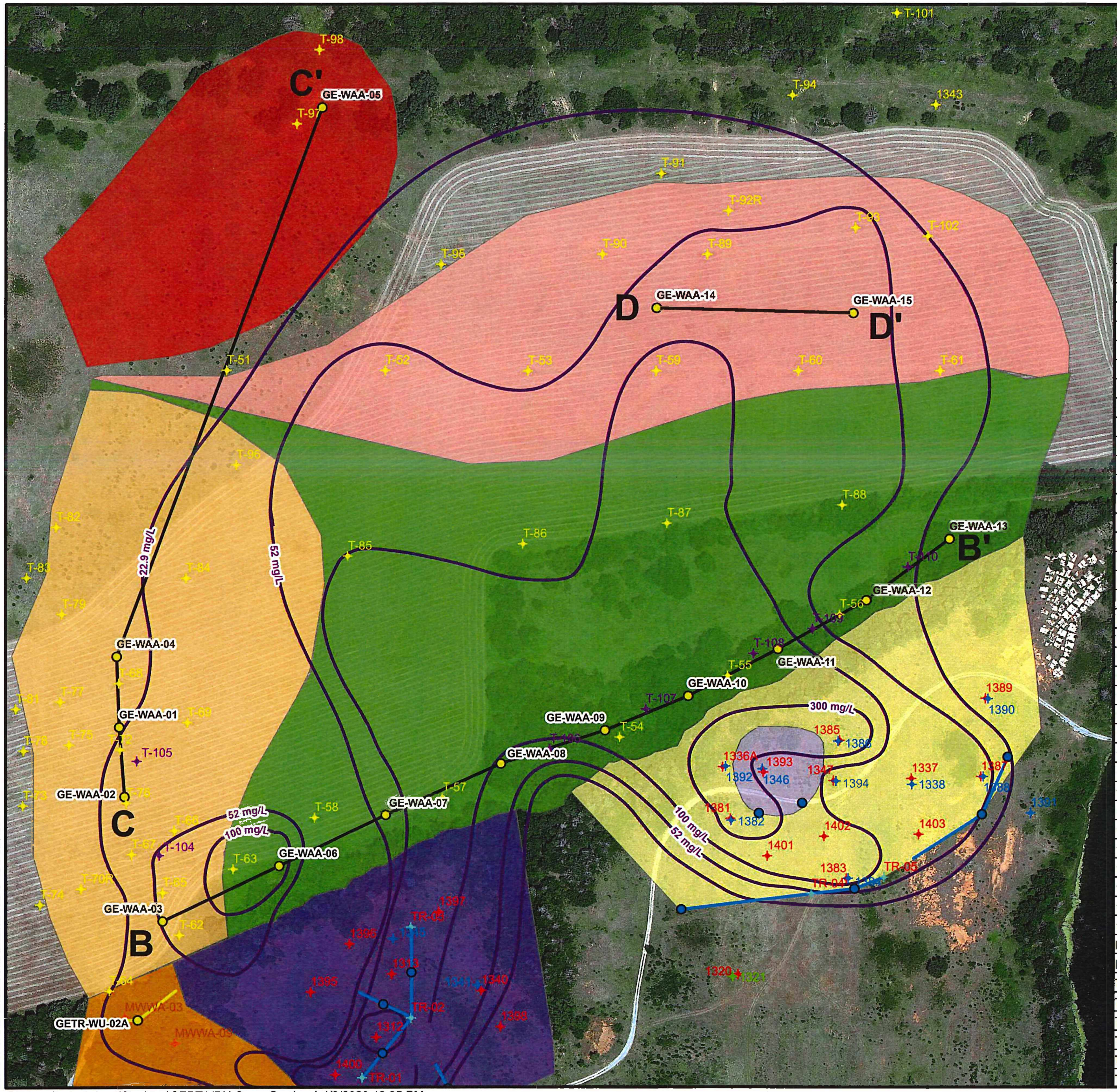
N

0 250 500

SCALE IN FEET

FIGURE 3-2
CROSS SECTION PLAN VIEW - WAA
SHEET 1
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA

BURNS McDONNELL




| Location | Nitrate (mg/L) | Location | Nitrate (mg/L) |
|---|---|---|---|
| 1312 | 379.70 | T-54 | 238.60 |
| 1313 | 240.30 | T-55 | 236.00 |
| 1320 | 18.60 | T-56 | 24.89 |
| 1321 | 0.76 | T-57 | 111.50 |
| 1337 | 53.34 | T-58 | 44.87 |
| 1338 | 7.01 | T-59 | 112.40 |
| 1340 | 53.77 | T-60 | 97.42 |
| 1341 | 28.63 | T-61 | 34.93 |
| 1343 | 6.45 | T-62 | 88.00 |
| 1345 | 7.66 | T-63 | 138.60 |
| 1346 | 406.50 | T-64 | 14.03 |
| 1347 | 64.97 | T-65 | 55.50 |
| 1381 | 839.10 | T-66 | 40.30 |
| 1382 | 2.44 | T-67 | 26.98 |
| 1383 | 226.67 | T-68 | 21.22 |
| 1384 | 0.40 | T-69 | 72.14 |
| 1385 | 1,006.00 | T-70R | 4.41 |
| 1386 | 15.43 | T-72 | 25.80 |
| 1387 | 60.17 | T-73 | 0.03 |
| 1388 | 9.15 | T-74 | 1.47 |
| 1389 | 21.67 | T-75 | 1.66 |
| 1390 | 4.89 | T-76 | 30.35 |
| 1391 | 4.09 | T-77 | 3.07 |
| 1392 | 1.11 | T-78 | 0.16 |
| 1393 | 274.90 | T-79 | 1.26 |
| 1394 | 4.25 | T-82 | 0.07 |
| 1395 | 1.60 | T-83 | 0.05 |
| 1396 | 17.50 | T-84 | 46.54 |
| 1397 | 202.00 | T-85 | 100.40 |
| 1398 | 0.75 | T-86 | 43.88 |
| 1400 | 61.80 | T-87 | 108.40 |
| 1401 | 802.00 | T-88 | 75.36 |
| 1402 | 217.00 | T-89 | 68.53 |
| 1403 | 5.83 | T-90 | 34.50 |
| 1336A | 376.60 | T-91 | 30.87 |
| MWWA-03 | 42.37 | T-92R | 36.25 |
| MWWA-09 | 43.05 | T-93 | 54.50 |
| T-101 | 27.23 | T-94 | 18.70 |
| T-102 | 22.27 | T-95 | 49.00 |
| T-103 | 4.02 | T-96 | 31.58 |
| T-51 | 14.73 | T-97 | 10.22 |
| T-52 | 56.69 | T-98 | 0.86 |
| T-53 | 47.70 | | |

**LEGEND**

- MONITOR WELL IN ALLUVIUM
- MONITOR WELL IN SANDSTONE A
- MONITOR WELL IN SANDSTONE B
- MONITOR WELL IN SANDSTONE C
- MONITOR WELL IN TRANSITION ZONE
- PROPOSED MONITOR WELL IN ALLUVIUM
- PROPOSED EXTRACTION WELL
- PROPOSED INJECTION WELL
- PROPOSED EXTRACTION TRENCH
- PROPOSED INJECTION TRENCH
- 2020 CROSS SECTION TRANSECTS
- 2018 D-PLAN NITRATE CONTOUR
- WAA-BLUFF
- WAA-EAST
- WAA-WEST
- WAA U>DCGL
- 1206-NORTH
- WU-UP1
- WU-UP2-SSA
- WU-UP2-SSB

**NOTES**

1) FIELD WORK CONDUCTED BETWEEN DECEMBER 2019 AND JANUARY 2020.
2) BORINGS COMPLETED AT PROPOSED EXTRACTION WELL LOCATIONS.
3) GREEN HIGHLIGHT IN TABLE INDICATES STATE CRITERION EXCEEDANCE (22.9 mg/L).
4) CONCENTRATIONS ARE "REPRESENTATIVE CONCENTRATIONS" FROM BASIS OF DESIGN (APPENDIX L) OF THE DECOMMISSIONING PLAN.

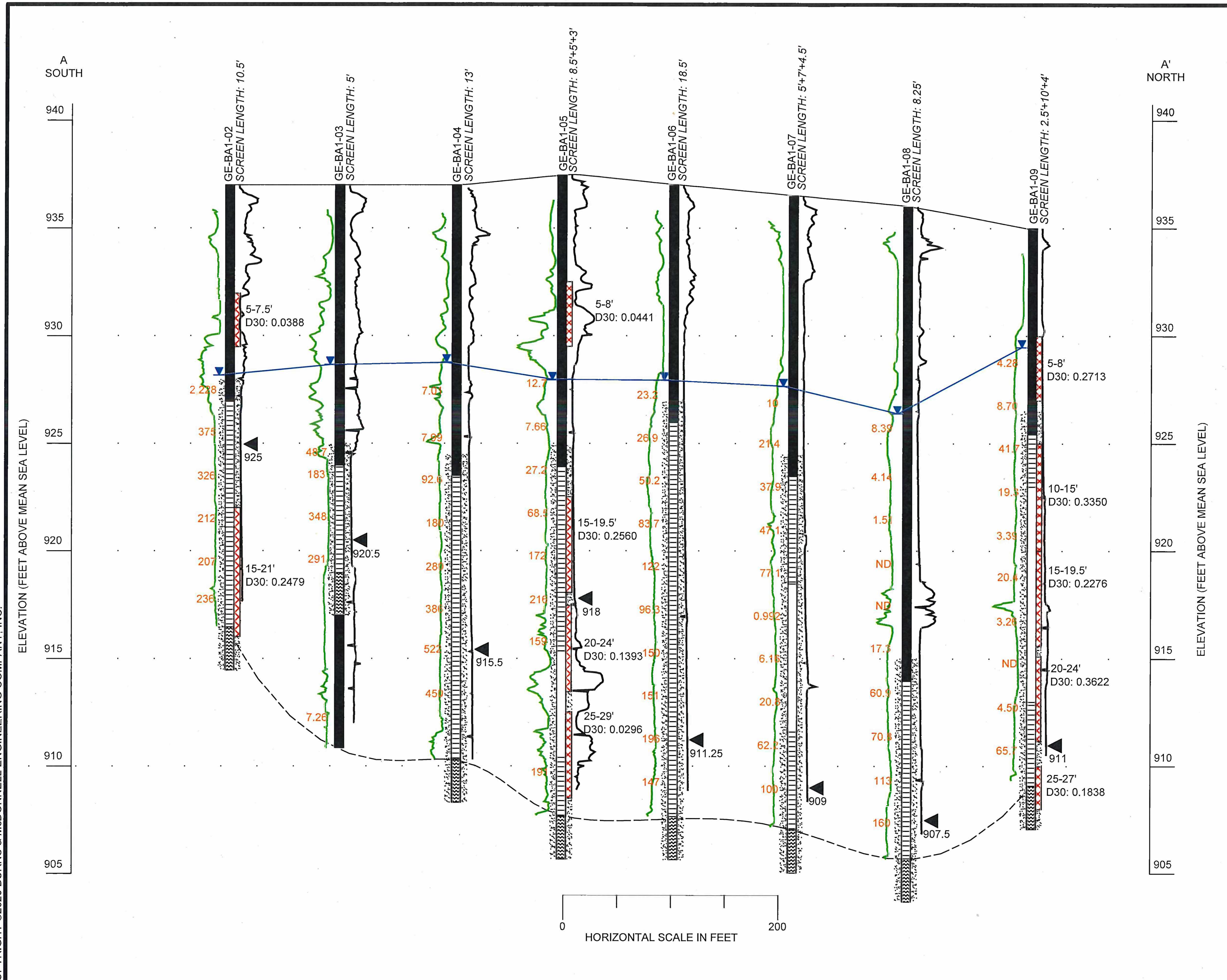
N

0 250 500

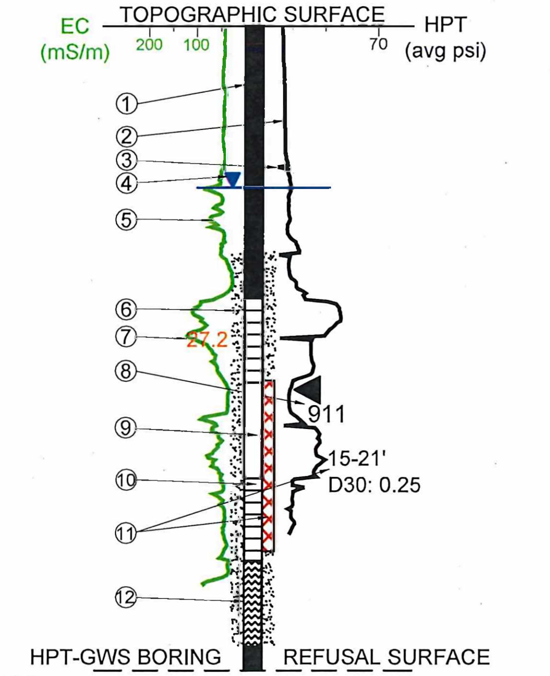
SCALE IN FEET

FIGURE 3-3
CROSS SECTION PLAN VIEW - WAA
SHEET 2
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA

BURNS & McDONNELL




## TYPICAL VERTICAL PROFILING DETAIL




**LEGEND**

1. HPT-GWS BORING.
2. HPT RESPONSE - RANGE 0 to 70 avg. PSI.
3. DROP IN HPT RESPONSE INDICATES DEPTHS WHERE SAMPLES WERE COLLECTED OR ATTEMPTED.
4. APPROXIMATE POTENTIOMETRIC SURFACE FROM HPT-GWS BORINGS.
5. EC RESPONSE - RANGE 0 TO 200 mS/m.
6. PROPOSED EXTRACTION WELL SCREEN FILTER PACK PLACEMENT.
7. DISCRETE GROUNDWATER URANIUM (ug/L) SAMPLE RESULT.
8. PROPOSED GROUNDWATER EXTRACTION LOCATION (FT AMSL).
9. PROPOSED EXTRACTION WELL BLANK CASING INTERVAL.
10. PROPOSED EXTRACTION WELL SCREEN.
11. GRAIN SIZE DISTRIBUTION SAMPLE INTERVAL WITH D30 GRAIN SIZE.
12. 24-INCH SUMP.

**NOTES**

AMSL - ABOVE MEAN SEA LEVEL
EC - ELECTROCONDUCTIVITY
GSD - GRAIN SIZE DISTRIBUTION
GWS - GEOPROBE® HPT - GROUNDWATER SAMPLER
HPT - HYDRAULIC PROFILING TOOL
mS/m - MILLISIEMENS PER METER
ND - NON-DETECT
PSI - POUNDS PER SQUARE INCH
ug/L - MICROGRAMS PER LITER
D30 - 30% PASSING GRAIN SIZE (mm)

1) THE TOPOGRAPHIC AND REFUSAL SURFACES ARE APPROXIMATE.
2) BORING REFUSALS FOR GSD BORINGS EXCEEDED HPT-GWS BORING REFUSALS AT GE-BA1-02 AND GE-BA1-09.

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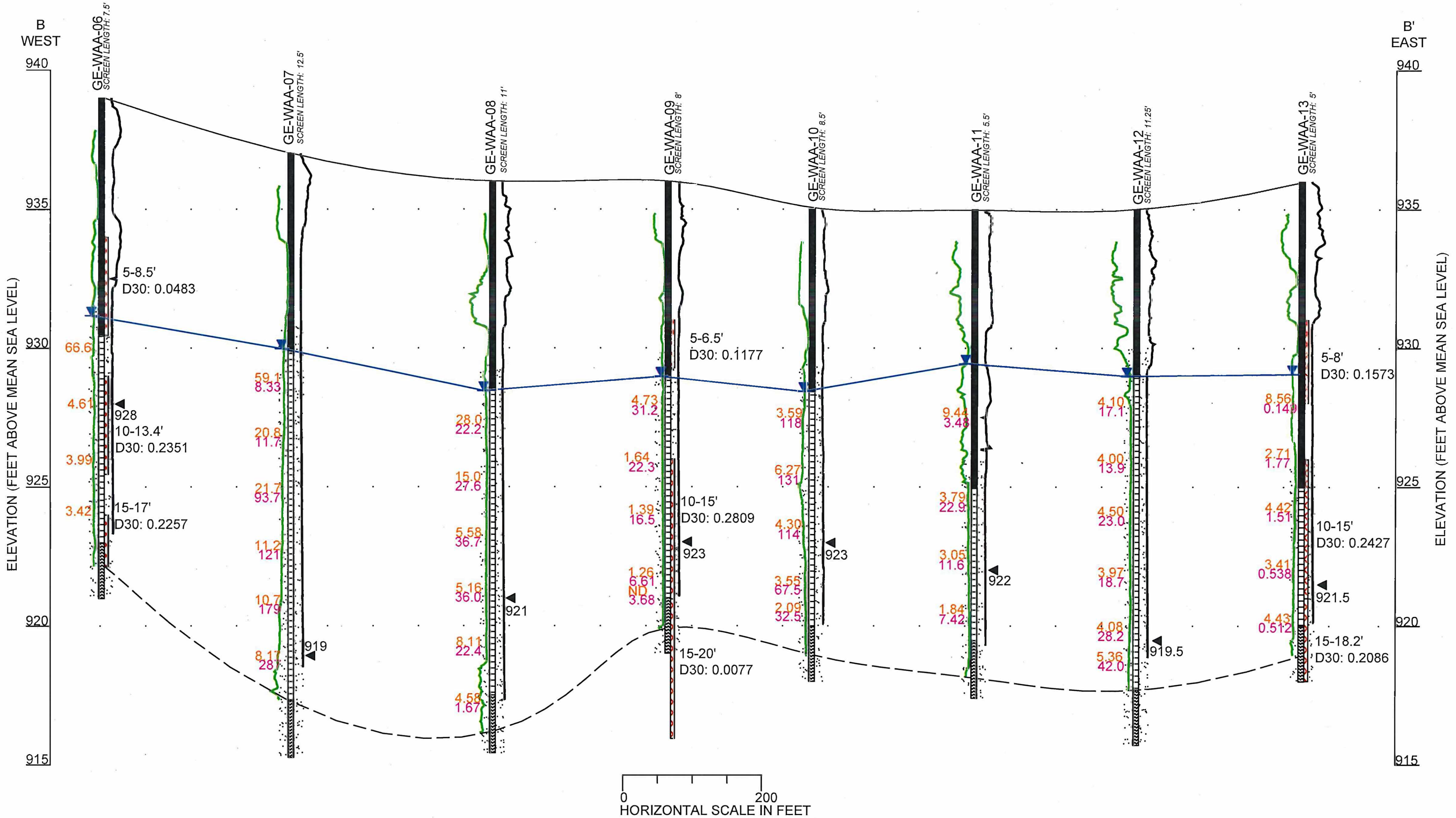
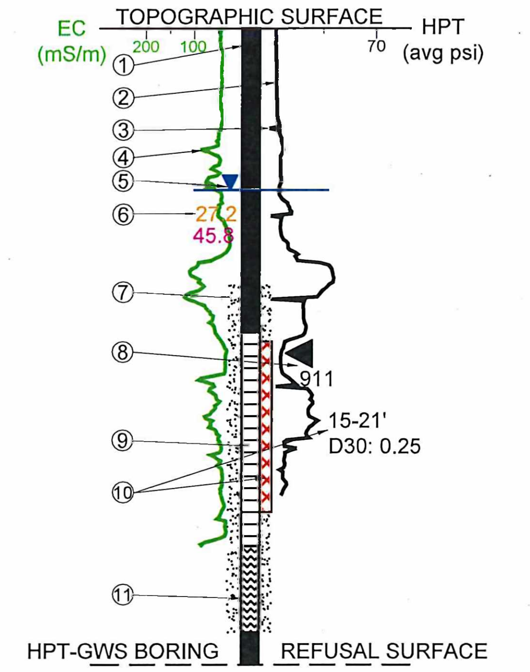
FIGURE 3-4
BA1 CROSS SECTION A-A'
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA




## TYPICAL VERTICAL PROFILING DETAIL




**LEGEND**

1. HPT-GWS BORING.
2. HPT RESPONSE - RANGE 0 to 70 avg. PSI.
3. DROP IN HPT RESPONSE INDICATES DEPTHS WHERE SAMPLES WERE COLLECTED OR ATTEMPTED.
4. EC RESPONSE - RANGE 0 to 200 mS/m.
5. APPROXIMATE POTENTIOMETRIC SURFACE FROM HPT-GWS BORINGS.
6. DISCRETE GROUNDWATER URANIUM (ug/L) AND NITRATE (mg/L) SAMPLE RESULTS.
7. PROPOSED EXTRACTION WELL SCREEN FILTER PACK PLACEMENT.
8. PROPOSED GROUNDWATER EXTRACTION LOCATION (FT AMSL).
9. PROPOSED EXTRACTION WELL SCREEN.
10. GRAIN SIZE DISTRIBUTION SAMPLE INTERVAL WITH D30 GRAIN SIZE.
11. 24-INCH SUMP.

**NOTES**

AMSL - ABOVE MEAN SEA LEVEL
EC - ELECTROCONDUCTIVITY
GSD - GRAIN SIZE DISTRIBUTION
GWS - GEOPROBE® HPT - GROUNDWATER SAMPLER
HPT - HYDRAULIC PROFILING TOOL
mg/L - MILLIGRAMS PER LITER
mS/m - MILLISIEMENS PER METER
ND - NON-DETECT
PSI - POUNDS PER SQUARE INCH
ug/L - MICROGRAMS PER LITER
D30 - 30% PASSING GRAIN SIZE (mm)

1) THE TOPOGRAPHIC AND REFUSAL SURFACES ARE APPROXIMATE.
2) BORING REFUSALS FOR GSD BORINGS EXCEEDED HPT-GWS BORING REFUSALS AT GE-WAA-09 AND GE-WAA-13.

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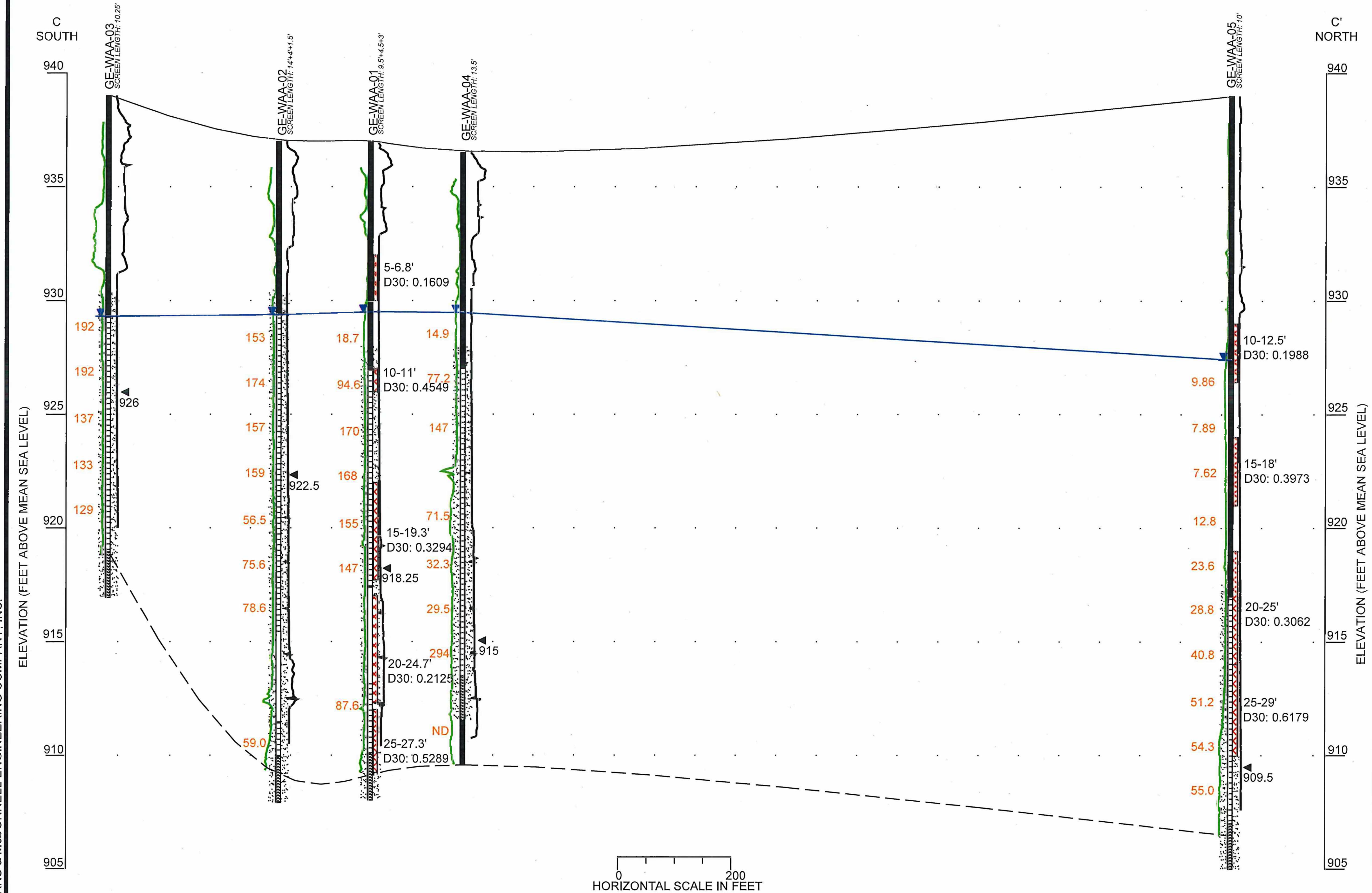
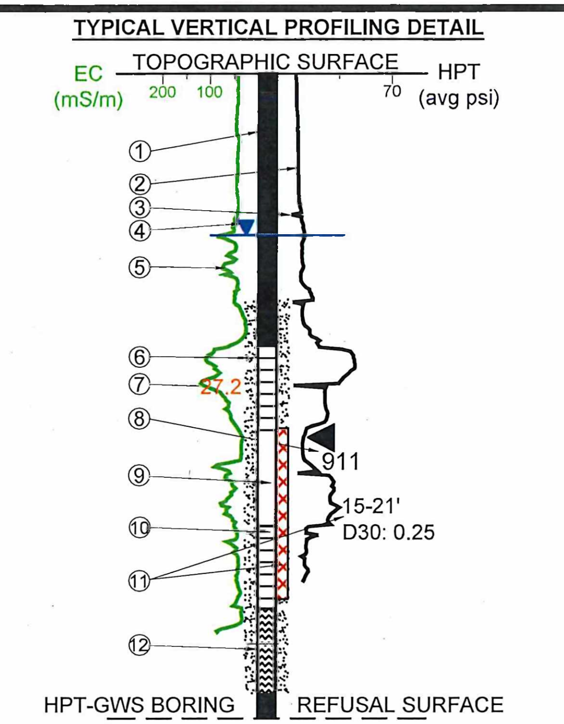
FIGURE 3-5
WAA-BLUFF
CROSS SECTION B-B'
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA




**LEGEND**

1. HPT-GWS BORING.
2. HPT RESPONSE - RANGE 0 to 70 avg. PSI.
3. DROP IN HPT RESPONSE INDICATES DEPTHS WHERE SAMPLES WERE COLLECTED OR ATTEMPTED.
4. APPROXIMATE POTENTIOMETRIC SURFACE FROM HPT-GWS BORINGS.
5. EC RESPONSE - RANGE 0 TO 200 mS/m.
6. PROPOSED EXTRACTION WELL SCREEN FILTER PACK PLACEMENT.
7. DISCRETE GROUNDWATER URANIUM (ug/L) SAMPLE RESULT.
8. PROPOSED GROUNDWATER EXTRACTION LOCATION (FT AMSL).
9. PROPOSED EXTRACTION WELL BLANK CASING INTERVAL.
10. PROPOSED EXTRACTION WELL SCREEN.
11. GRAIN SIZE DISTRIBUTION SAMPLE INTERVAL WITH D30 GRAIN SIZE.
12. 24-INCH SUMP.

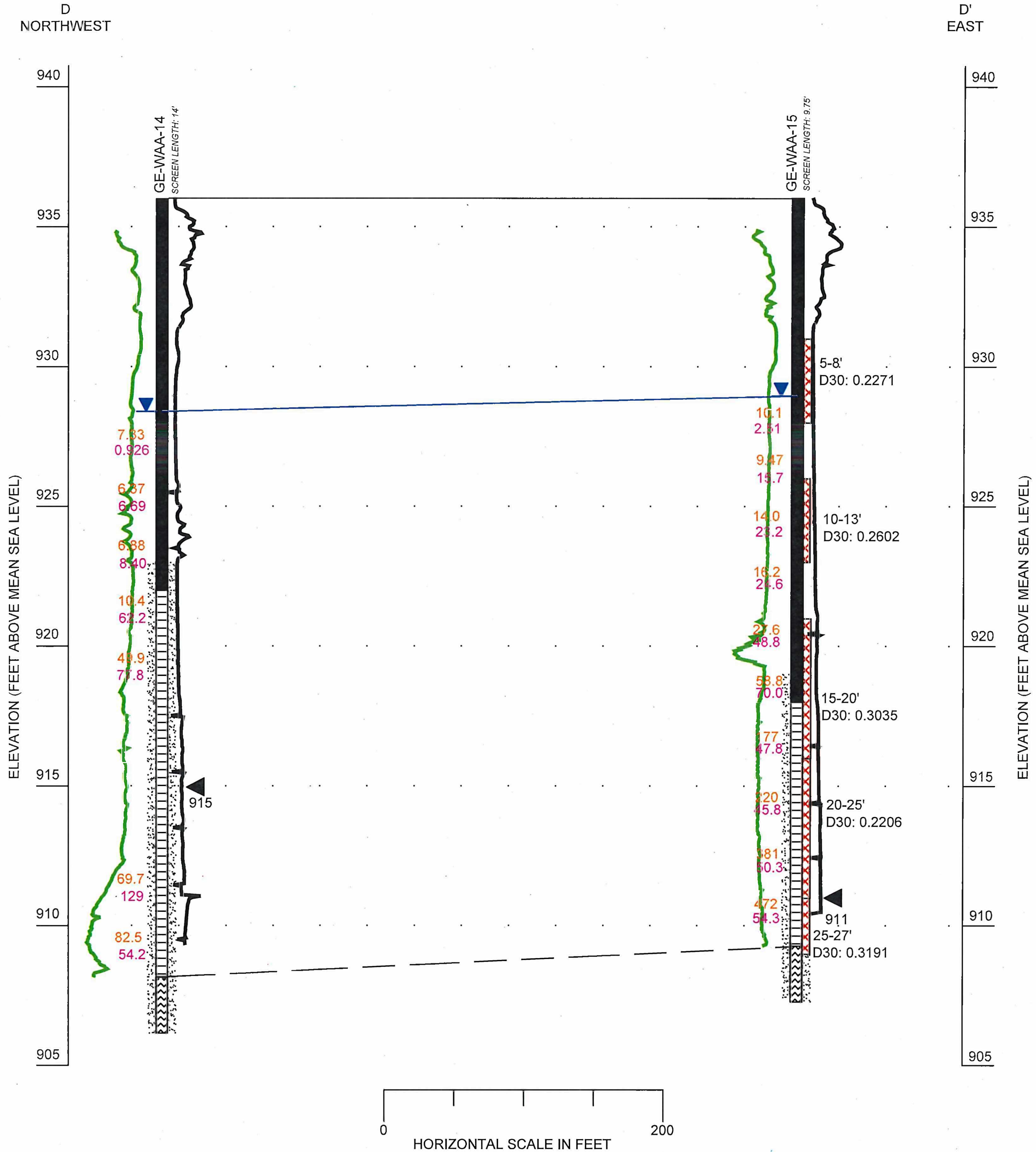
**NOTES**

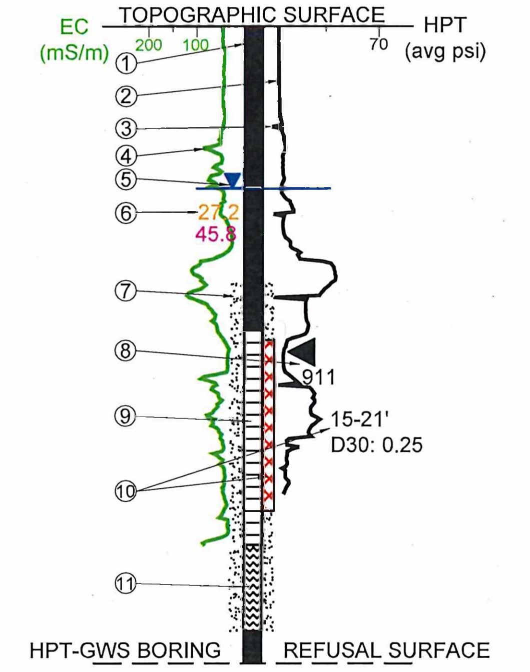
AMSL - ABOVE MEAN SEA LEVEL
EC - ELECTROCONDUCTIVITY
GSD - GRAIN SIZE DISTRIBUTION
GWS - GEOPROBE® HPT - GROUNDWATER SAMPLER
HPT - HYDRAULIC PROFILING TOOL
mS/m - MILLISIEMENS PER METER
ND - NON-DETECT
PSI - POUNDS PER SQUARE INCH
ug/L - MICROGRAMS PER LITER
D30 - 30% PASSING GRAIN SIZE (mm)

1) THE TOPOGRAPHIC AND REFUSAL SURFACES ARE APPROXIMATE.

BURNS McDONNELL

FIGURE 3-6
WAA-U>DCGL AND WAA-WEST
CROSS SECTION C-C'
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA




**LEGEND**

1. HPT-GWS BORING.
2. HPT RESPONSE - RANGE 0 to 70 avg. PSI.
3. DROP IN HPT RESPONSE INDICATES DEPTHS WHERE SAMPLES WERE COLLECTED OR ATTEMPTED.
4. EC RESPONSE - RANGE 0 to 200 mS/m.
5. APPROXIMATE POTENTIOMETRIC SURFACE FROM HPT-GWS BORINGS.
6. DISCRETE GROUNDWATER URANIUM (ug/L) AND NITRATE (mg/L) SAMPLE RESULTS.
7. PROPOSED EXTRACTION WELL SCREEN FILTER PACK PLACEMENT.
8. PROPOSED GROUNDWATER EXTRACTION LOCATION (FT AMSL).
9. PROPOSED EXTRACTION WELL SCREEN.
10. GRAIN SIZE DISTRIBUTION SAMPLE INTERVAL WITH D30 GRAIN SIZE.
11. 24-INCH SUMP.

**NOTES**

AMSL - ABOVE MEAN SEA LEVEL
EC - ELECTROCONDUCTIVITY
GSD - GRAIN SIZE DISTRIBUTION
GWS - GEOPROBE® HPT - GROUNDWATER SAMPLER
HPT - HYDRAULIC PROFILING TOOL
mg/L - MILLIGRAMS PER LITER
mS/m - MILLISIEMENS PER METER
ND - NON-DETECT
PSI - POUNDS PER SQUARE INCH
ug/L - MICROGRAMS PER LITER
D30 - 30% PASSING GRAIN SIZE (mm)

1) THE TOPOGRAPHIC AND REFUSAL SURFACES ARE APPROXIMATE.
2) BORING REFUSALS FOR GSD BORINGS EXCEEDED HPT-GWS BORING REFUSAL AT GE-WAA-15.

BURNS McDONNELL

FIGURE 3-7
WAA-EAST
CROSS SECTION D-D'
2020 VERTICAL DISTRIBUTION
CIMARRON SITE, OKLAHOMA