Operable Unit Carbon Tetrachloride Plume Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

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On behalf of:

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Acronyms and Abbreviations

°C	degrees Celsius
ACL	Aquifer Cleanup Level
Ahtna	Ahtna Global, LLC.
Army	U.S. Department of the Army
ASTM	ASTM International (formerly American Standards of Testing and Materials)
bgs	below ground surface
COC	chemical of concern
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
EW	extraction well
FO-SVA	Fort Ord Salinas Valley Aquitard
FONR	Fort Ord Natural Reserve
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
GWMP	groundwater monitoring program
GWTP	groundwater treatment plant
GWTS	groundwater treatment system
HDPE	high density polyethylene
HHRA	Human Health Risk Assessment
HLA	Harding Lawson Associates
IW	injection well
MACTEC	MACTEC Engineering and Consulting, Inc.
µmhos/cm	micromhos per centimeter
msl	mean sea level
NTU	nephelometric turbidity units
O&M	operations and maintenance
ORP	oxidation-reduction potential
OU2	Operable Unit 2
OUCTP	Operable Unit Carbon Tetrachloride Plume
PLC	programmable logic controller
psi	pounds per square inch
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RAWP	Remedial Action Work Plan
RD	Remedial Design
ROD	Record of Decision
RI	Remedial Investigation
SAP	Sample and Analysis Plan
SCADA	supervisory control and data acquisition

SIM	selected ion monitoring
Sites 2/12	Sites 2 and 12
TCE	trichloroethene
USACE	U.S. Army Corps of Engineers
VFD	variable frequency drive
VOC	volatile organic compound

1.0 Introduction

Ahtna Global, LLC (Ahtna) has prepared this Operable Unit Carbon Tetrachloride Plume (OUCTP) Upper 180-Foot Aquifer Remedial Design (RD) Addendum to the *Final Operable Unit Carbon Tetrachloride Plume Upper 180-Foot Aquifer Remedial Design* (OUCTP RD; Shaw, 2010) on behalf of the U.S. Army Corps of Engineers (USACE) Sacramento District, per Contract W91238-19-C-0027. This RD Addendum addresses the remediation of groundwater within the OUCTP in the Upper 180-Foot Aquifer at the former Fort Ord, California (Figure 1).

A Remedial Investigation (RI) was conducted in the vicinity of Lexington Court (Abrams Housing Development) to define the nature and extent of volatile organic compounds (VOCs) in groundwater from an undocumented release of carbon tetrachloride from a former storage area/training facility (MACTEC Engineering and Consulting, Inc. [MACTEC], 2006).

A Human Health Risk Assessment (HHRA) was conducted to evaluate the risk associated with VOCs detected in groundwater. Remedial alternatives for contaminated groundwater within the OUCTP were developed as part of the *Final Operable Unit Carbon Tetrachloride Plume Groundwater Remedial Investigation/Feasibility Study, Former Fort Ord, California* (OUCTP RI/FS; MACTEC, 2006) and the selected remedy was identified in the *Record of Decision Operable Unit Carbon Tetrachloride Plume, Former Fort Ord California* (OUCTP ROD; Army, 2008). The RD presented in this RD Addendum addresses the remediation of the Upper 180-Foot Aquifer within OUCTP. The RDs for the other aquifers within the OUCTP are presented in the OUCTP Remedial Action Work Plan (RAWP; Shaw, 2009).

The carbon tetrachloride plume at the former Fort Ord is believed to result from routine maintenance operations conducted prior to the facility's closure. Carbon tetrachloride is present in groundwater within three aquifer units at OUCTP: the shallow A-Aquifer, the Upper 180-Foot Aquifer, and the Lower 180-Foot Aquifer. The aquifers are impacted primarily by carbon tetrachloride, with the shallow A-Aquifer representing the largest area of groundwater impact. The underlying Upper 180-Foot Aquifer and Lower 180-Foot Aquifer are impacted to a lesser extent (Figure 2 and Figure 3). A complete list of the chemicals of concern (COCs) and aquifer cleanup levels (ACLs) is provided in Table 1.

The remediation of the Upper 180-Foot Aquifer utilizes groundwater extraction and aboveground treatment to minimize further migration of the OUCTP from the Upper 180-Foot Aquifer to the Lower 180-Foot Aquifer and provides contaminant mass reduction in the aquifer. The OUCTP remedy for the Upper 180-Foot Aquifer will be expanded with one additional extraction well (EW-OU2-13-180), which will be connected to the existing groundwater extraction pipeline that conveys water to the OU2 groundwater treatment plant (GWTP). At the OU2 GWTP, the groundwater is treated through liquid-phase granular activated carbon (GAC) to remove the contaminants before the treated water is reinjected into the subsurface through existing aquifer recharge structures. Groundwater capture modeling was conducted as part of this RD Addendum to determine the location and operating conditions for extraction well EW-OU2-13-180 to optimize capture of the OUCTP in the Upper 180-Foot Aquifer.

This RD Addendum presents the basis for the design and the specific requirements for implementation of groundwater extraction from the Upper 180-Foot Aquifer of the OUCTP and treatment within the OU2 GWTP. In addition, this RD Addendum presents a general description of the Upper 180-Foot Aquifer hydrogeology and contaminant distribution.

1.1 Hydrogeology Design Considerations

The information presented in this section outlines the hydrogeologic considerations for the design for expanding the groundwater extraction and treatment remedial action within the Upper 180-Foot Aquifer at OUCTP. The siting and installation of new extraction well EW-OU2-13-180, designed to improve plume capture and contaminant mass removal, were based on hydrogeologic factors outlined below.

The interpretation of the lithologic sequence and associated hydrogeologic characteristics within the area of OUCTP provides a framework necessary to understand groundwater flow. Knowledge of the flow of groundwater provides insight into potential pathways for the migration of carbon tetrachloride and provides the basis for placement of extraction well EW-OU2-13-180 at an optimum location and appropriate depth to remove contaminated groundwater from the Upper 180-Foot Aquifer. The remediation of the Upper 180-Foot Aquifer is designed to minimize the migration of contaminants into the underlying aquifers and, therefore, reduce potential adverse impact to water producing zones.

Previous investigations provide the basic stratigraphic sequence and present a general interpretation of the OUCTP hydrogeology. Early investigations of the general area include the *Final Fort Ord Landfills, Preliminary Hydrologic Investigation* (HLA, 1990), the *Final Remedial Investigation Report, Remedial Investigation/Feasibility Study, Fort Ord Landfills* (Dames and Moore, 1993), and *Final Basewide Remedial Investigation/Feasibility Study, Fort Ord, California, Volume II – Remedial Investigation, Basewide Hydrogeologic Characterization* (HLA, 1995). Investigations addressing the hydrogeology of the OUCTP were discussed in the OUCTP RI/FS (MACTEC, 2006).

Geologic units of interest within the OUCTP area include the aquifers within the dune sands, valley fill deposits, and the Aromas Sand/Paso Robles Formation. The A-Aquifer is located within the recent dune sands and is perched above the regional Fort Ord - Salinas Valley Aquitard (FO-SVA). Below the FO-SVA, the valley fill deposits contain both the Upper and Lower 180-Foot Aquifers, and portions of the 400-Foot Aquifer (locally). The Aromas Sand and Paso Robles Formation contain the majority of the 400-Foot Aquifer and the deep aquifer units.

The 180-Foot Aquifer in the former Fort Ord area is typically subdivided into the Upper and Lower 180-Foot Aquifers. The Upper 180-Foot Aquifer is the primary focus of this RD. The early studies of the area (HLA, 1990 and Dames and Moore, 1993) did not differentiate between the Upper and Lower 180-Foot Aquifers. Regional groundwater studies such as the U.S. Geological Survey publication *Ground-Water Quality Data in the Monterey Bay and Salinas Basins, California 2005* (USGS, 2011) generally discuss the 180-Foot Aquifer as a single unit. Data collected as part of the site investigation activities indicate the presence of the Intermediate 180-Foot Aquitard that isolates the Upper and Lower 180-Foot Aquifers throughout most of the former Fort Ord area.

The presence of carbon tetrachloride in the Upper 180-Foot Aquifer and the Lower 180-Foot Aquifer (Figures 2, 3, and 4) indicates that hydraulic intercommunication occurred between what are otherwise believed to be vertically isolated aquifers. The carbon tetrachloride plume migrated from the A-Aquifer into the Upper 180-Foot Aquifer through two known vertical conduits through the FO-SVA, creating two distinct parallel plumes. These vertical conduits (wells installed with inadequate sanitary seals) were decommissioned in 1999 and 2005. The two parallel plumes commingled and continued to migrate southeastward toward a natural vertical conduit (a discontinuity in the Intermediate 180-Foot Aquitard).

Since implementation of the remedy for OUCTP in the Upper 180-Foot Aquifer in 2011, the single commingled plume has become two distinct plumes (Ahtna, 2023b). The migration of carbon tetrachloride vertically between aquifers and laterally within aquifers is dependent on both the flow properties of the aquifer and the hydrologic gradient. The flow properties of the aquifer units reflect the lithologic composition of the units. The lithologic composition and variability of the aquifer lithologies are discussed below.

1.1.1 Lithologic Description of Remediation Area

A general description of the hydrogeology in the area of the OUCTP is included in Section 3.0 of the OUCTP RAWP (Shaw, 2009). The hydrogeology of the overlying A-Aquifer and underlying Upper and Lower 180-Foot Aquifers is presented in more detail in Appendix A and Appendix C of the OUCTP RAWP, respectively. The design for groundwater extraction and treatment within the Upper 180-Foot Aquifer required the evaluation of the lithology and hydrogeologic character of the aquifer and the intercommunication between the aquifers. The geologic units directly influencing groundwater flow within the Upper 180-Foot Aquifer include the FO-SVA, the Upper 180-Foot Aquifer, the Intermediate 180-Foot Aquitard, and the Lower 180-Foot Aquifer. Cross sections were constructed to assist in the evaluation of lithology on flow within the OUCTP, specifically between the Upper 180-Foot Aquifer and the Lower 180-Foot Aquifer. The cross-section locations are presented on Figure 4. The cross sections are presented on Figure 5 (Cross Section A-A') and Figure 6 (Cross Section B-B').

1.1.1.1 FO-SVA

The FO-SVA separates the overlying A-Aquifer from the Upper 180-Foot Aquifer (hydrologically) over the area of the OUCTP (Figure 5 and Figure 6). The FO-SVA is a thick, dense clay unit deposited in a marine environment and contains significant organic content, occasionally in the form of peat lenses. Even though the FO-SVA represents a significant aquitard that is capable of restricting vertical flow from the A-Aquifer, intercommunication between the aquifers is indicated by the presence of carbon tetrachloride in the Upper and Lower 180-Foot Aquifers. The carbon tetrachloride, which originated in the A-Aquifer, has migrated along with groundwater into the underlying Upper 180-Foot Aquifer as discussed in Section 1.1.2.

1.1.1.2 Upper 180-Foot Aquifer

The Upper 180-Foot Aquifer underlies the relatively impermeable FO-SVA and represents the upper lithologic sequence of the generalized 180-Foot Aquifer. The upper contact of the Upper 180-Foot Aquifer occurs at depths ranging from approximately 140 to 200 feet below ground surface (bgs) which correspond to elevations of 20 to 180 feet below mean sea level (msl).

Depths mostly reflect variations in the area's surface topography. The cross sections (Figure 5 and Figure 6) illustrate the uniform contact surface between the FO-SVA and the Upper 180-Foot Aquifer. The thickness of the Upper 180-Foot Aquifer ranges from 50 feet near the western extent of cross section A-A' to over 120 feet near the eastern end (Figure 5). The variations in thickness of the aquifer are generally the result of variations in the elevation of the underlying Intermediate 180-Foot Aquitard. The lithology of the Upper 180-Foot Aquifer is relatively uniform across the OUCTP area as depicted in the cross sections. The unit is composed primarily of well to poorly graded sand deposited in relatively thick beds with single depositional units comprising a large proportion of the unit's thickness in some locations. Gravel content increases toward the base of the unit, although gravel stringers are present at

shallow depths locally. Silts represent a larger proportion of the section to the southeast of the suspected area of vertical communication through the Intermediate 180-Foot Aquitard (Figure 5), where the thickness of the unit increases to greater than 100 feet.

1.1.1.3 Intermediate 180-Foot Aquitard

The Intermediate 180-Foot Aquitard underlies the Upper 180-Foot Aquifer and separates it from the Lower 180-Foot Aquifer within the OUCTP area. The contact between the Upper 180-Foot Aquifer and the underlying Intermediate 180-Foot Aquitard occurs at approximately between 70 and 100 feet below msl within the area (Figure 5 and Figure 6). This places the contact approximately between 200 and 290 feet bgs depending on ground surface elevation.

The Intermediate 180-Foot Aquitard consists of approximately 50 feet of interbedded clay and clayey sand layers, mixed occasionally with coarse gravel. The aquitard hydraulically isolates the Upper and Lower 180-Foot Aquifers, although the unit pinches out or contains more conductive lithologies in the southern portion of the OUCTP area. The pinch-out is suspected to represent an area of vertical communication between the Upper and Lower 180-Foot Aquifers. The OUCTP RI/FS (MACTEC, 2006) concluded that the Intermediate 180-Foot Aquitard pinches out locally and groundwater from the Upper 180-Foot Aquifer flows downward into the Lower 180-Foot Aquifer/400-Foot Aquifer in these locations. The area where the carbon tetrachloride plumes in the Upper 180-Foot Aquifer and the Lower 180-Foot Aquifer intersect (Figure 4) and the cross sections shown in Figures 5 and Figure 6 support the presence of a zone of vertical communication. The thin layers of the Intermediate 180-Foot Aquitard that are apparent in well MP-BW-42 and well MW-OU2-69-180L (below -70 feet msl) are not present in well MP-BW-49 (Figure 5). The area depicted on Figure 5 represents the bounds of an area of vertical communication that influences (promotes) the vertical migration of groundwater. The lack of continuity of the Intermediate 180-Foot Aquitard is important to vertical groundwater flow and the migration of contaminants in the groundwater.

1.1.1.4 Lower 180-Foot Aquifer

The Lower 180-Foot Aquifer consists of approximately 200 feet of coarse sand and gravel and, along with the 400-Foot Aquifer, is a significant source of potable water for the former Fort Ord and City of Marina. Remedial actions for the Lower 180-Foot Aquifer are discussed in Appendix C of the OUCTP RAWP (Shaw, 2009).

1.1.2 Intercommunication Between Aquifers

Several wells had been installed within the area of the OUCTP near Reservation Road for municipal water supply and environmental investigations before the OUCTP was discovered. A limited number of these wells are believed to have been constructed through the aquitard units (the FO-SVA and/or the Intermediate 180-Foot Aquitard) without adequate annular seals (MACTEC, 2006). The lack of an adequate seal in the aquitard material at the well locations would allow groundwater to migrate between the aquifers. Basin-wide groundwater withdrawal from the deep aquifers has created hydrologic conditions that promote downward migration of groundwater. When these wells were discovered to be potential migration pathways for the OUCTP between the aquifers, the wells were removed and the conduits through the aquitards were filled with cement grout to seal them.

The wells suspected of being vertical migration pathways included water production wells FO-26, FO-27, and FO-28, located at the western Fort Ord boundary south of Reservation Road, which were shut down in 1991 due to concerns about saltwater intrusion and were decommissioned in 1999 (HLA, 1999). Monitoring well MW-B-13-180, where carbon tetrachloride was detected in September 1992 (HLA, 1994), was also suspected as a potential path of vertical migration and was monitored quarterly until it was decommissioned in 2005. A production well installed in 1996 at the Marina Mini-Storage location north of Reservation Road was also a suspected vertical migration route and was being monitored quarterly; however, carbon tetrachloride had not been detected above the ACL at the Mini-Storage well since 2015 and the well was removed from the groundwater monitoring program in 2021.

1.2 Operable Unit 2 Groundwater Extraction and Treatment System

The original OU2 groundwater treatment system (GWTS) commenced operations on October 23, 1995 and consisted of 13 A-Aquifer and two Upper 180-Foot Aquifer extraction wells, the OU2 GWTP, three Upper 180-Foot injection wells, five A-Aquifer infiltration wells, and interconnecting underground groundwater extraction and treated water conveyance pipelines. The OU2 GWTP consisted of two 20,000-pound liquid-phase GAC adsorption vessels; one backwash tank; a 10,000-gallon effluent tank; and ancillary pumps, piping, instrumentation, and system controls. In 1999, an 8-inch pipeline was installed between the OU2 GWTP and the Sites 2 and 12 (Sites 2/12) GWTP, allowing an average of 300 gallons per minute (gpm) of excess treated water from OU2 to be conveyed to Sites 2/12. The combined OU2 and Sites 2/12 treated water was then conveyed west of State Route 1 for aquifer recharge.

In 2001, the OU2 GWTS was upgraded to handle additional flow capacity. Three A-Aquifer and four Upper 180-Foot Aquifer wells were installed and connected to the existing groundwater extraction pipeline. The OU2 GWTP was expanded to include two additional 20,000-pound liquid-phase GAC adsorption vessels and one additional backwash tank. Two treated water infiltration galleries were installed and the five A-Aquifer infiltration wells were decommissioned. These changes roughly doubled the throughput capacity of the OU2 system and the treatment capacity of the GWTP following the installation of the additional GAC vessels exceeded 1,200 gpm.

In 2002, the dual contained pipeline running parallel to the former 12th Street was rerouted when 12th Street was realigned and upgraded into a four-lane street (Imjin Parkway). Although the nominal pipe size was the same for the new pipeline, switching from polyvinyl chloride (PVC) to high-density polyethylene (HDPE) resulted in a decrease of the nominal inside pipe diameter and, therefore, a reduced flow capacity for this section of pipeline.

In 2006 and 2007, a Phase II expansion was completed to address the capture and treatment of the eastern edge of the Upper 180-Foot Aquifer impacted by trichloroethene (TCE). The Phase II expansion included the installation of two Upper 180-Foot Aquifer extraction wells (EW-OU2-07-180 and EW-OU2-08-180), installation of approximately 3,600 feet of conveyance pipeline from the newly installed wells around an existing housing development to the existing extraction conveyance pipeline, relocating approximately 1,100 feet of existing extraction conveyance pipeline around an intersection to minimize proposed transit right-of-way issues, and installing an in-line booster pump at the OU2 GWTP to increase groundwater extraction capacity. Following the Phase II expansion, the OU2 system included 24 extraction wells, the OU2 GWTP, two infiltration galleries, three injection wells, and a treated water pipeline to the Sites 2/12 GWTP.

On October 12, 2018, the original OU2 GWTP located at 296 12th Street in Marina, California was shut down permanently to transition to the new OU2 GWTP located at the Fort Ord Landfills at 11000 Engineering Equipment Road in Marina, California. Full-time operation of the new OU2 GWTP began on November 30, 2018 and the OU2 groundwater remedy currently consists of the GWTP, seven extraction well networks (30 extraction wells total), four injection wells, and two infiltration galleries. Improvements included constructing:

- New extraction wells north of the Fort Ord Landfills.
- A new OU2 GWTP near the Fort Ord Landfills to replace the original GWTP, which was located near the western extraction well network.
- Two new injection wells southeast of the Fort Ord Landfills (IW-OU2-04-180 and IW-OU2-05-180).

The OU2 GWTP is currently operated in accordance with the *Final Operations and Maintenance Manual Revision 4, Operable Unit 2 Groundwater Treatment System, Former Fort Ord, California* (O&M Manual; Ahtna, 2022b) at a nominal flowrate of approximately 1,000 gpm, which is well below the design average flowrate of 1,600 gpm. Sampling and analysis of groundwater are conducted to monitor remediation progress and support systems operations in accordance with the *Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix A, Final Revision 10, Groundwater Remedies and Monitoring at Sites 2 and 12, Operable Unit 2, and Operable Unit Carbon Tetrachloride Plume* (QAPP; Ahtna, 2022a).

1.3 Plume Capture Strategy

Contaminated groundwater within the OUCTP generally migrated from the source area in the A-Aquifer toward the northwest. A portion of the contaminated groundwater migrated downward through the FO-SVA at specific locations into the Upper 180-Foot Aquifer (see Section 1.1.2) creating two distinct parallel plumes. The two parallel plumes commingled starting in 2006 (MACTEC, 2007), but split into separate northern and southern plumes in 2016 (AEI, 2017), likely due to operation of extraction well EW-OU2-09-180 since 2011, which constitutes the remedy for OUCTP in the Upper 180-Foot Aquifer. However, groundwater monitoring data indicate that the plume continues to migrate southeast toward an area of vertical communication through the Intermediate 180-Foot Aquitard. Groundwater appears to be migrating downward into the Lower 180-Foot Aquifer at this location. Within the Lower 180-Foot Aquifer, the contaminated groundwater migrates to the east in the direction of three municipal water production wells (FO-29, FO-30, and FO-31), which are owned and operated by the Marina Coast Water District. In September 2022, contaminated water from the OUCTP in the Upper 180-Foot Aquifer was approximately 3,000 feet from the nearest groundwater production well (FO-29), as shown on Figure 4.

The objective of the remedial action within the OUCTP Upper 180-Foot Aquifer is to minimize further impact to the Lower 180-Foot Aquifer by extracting groundwater from the downgradient edge of the plume in Upper 180-Foot Aquifer to remove contaminant mass and to capture the plume before it reaches the area of vertical communication through the Intermediate 180-Foot Aquitard. The OUCTP ROD (Army, 2008) assumes that existing extraction wells EW-OU2-07-180 and EW-OU2-08-180 would be pumped for capture of the majority of the Upper 180-Foot Aquifer plume in conjunction with potential future extraction wells. These wells were installed primarily as part of the OU2 remedy and not specifically to capture the OUCTP.

Since extraction wells EW-OU2-07-180 and EW-OU2-08-180 are located cross-gradient of the OUCTP in the Upper 180-Foot Aquifer and the edge of the area of vertical communication, they do not provide carbon tetrachloride mass removal nor do they capture the plume prior to it migrating through the Intermediate 180-Foot Aquitard. Therefore, as described in the OUCTP Upper 180-Foot Aquifer Remedial Action Construction Completion Report (Shaw, 2012), extraction well EW-OU2-09-180 was installed in the vicinity of monitoring wells MW-BW-56-180 and MW-OU2-64-180 (Figure 2), where some of the highest carbon tetrachloride concentrations had been measured in the Upper 180-Foot Aquifer, and has been in operation since September 2011. Extraction well EW-OU2-09-180 is installed with a screened interval within the Upper 180-Foot Aquifer to meet the objective of plume capture and is connected to the OU2 GWTS; however, carbon tetrachloride was not detected in this well until 2014. Since then, there have been several estimated detections at concentrations below the ACL, with the historical maximum of 0.21 J micrograms per liter (µg/L) detected in 2016, demonstrating the relative inefficiency of this extraction well over its lifespan.

Groundwater modeling shows extraction well EW-OU2-09-180 only partially captures the carbon tetrachloride plumes in the Upper 180-Foot Aquifer, and this partial capture may also only be seasonal due to changes in groundwater flow induced by downgradient agricultural supply wells. The simulated capture zone appears wide enough to encapsulate the southern part of the carbon tetrachloride plume located upgradient of EW-OU2-09-180, but the average annual flow direction may be somewhat offset from the long axis of the carbon tetrachloride plume in this area and the downgradient portion of the plume, located east of EW-OU2-09-180 and adjacent to the discontinuity in the Intermediate 180-Foot Aquitard, is not being captured (Ahtna, 2023a).

To capture the downgradient carbon tetrachloride plume in the Upper 180-Foot Aquifer before it enters the Lower 180-Foot Aquifer, an additional extraction well (EW-OU2-13-180) will be installed with a screened interval within the Upper 180-Foot Aquifer in the vicinity of monitoring wells MW-OU2-64-180 and MW-OU2-66-180 (Figure 4). This well will be connected by conveyance piping to the OU2 GWTP for groundwater treatment. Minor adjustment will be required in the operation of the OU2 GWTP to incorporate control of extraction well EW-OU2-13-180 and to balance flowrates from EW-OU2-13-180 with existing extraction flowrates.

A groundwater flow and transport simulation was developed to determine the location and design flowrate for the proposed extraction well using the basewide numerical groundwater flow model (the "model"), which is used to simulate groundwater conditions beneath the former Fort Ord. The model was updated in January 2016 (USACE-HEC, 2016) to evaluate hydraulic capture of COCs by the A-Aquifer and Upper 180-Foot Aquifer extraction wells. The model was updated in 2017 to extend the model domain 400 feet vertically and 1,000 feet horizontally to the south. The model was further updated in 2018 to include a "wave-cut terrace" conceptualization to assist in the simulation of observed sharp drops in water levels in the A-Aquifer. Additionally, the number of homogeneous hydraulic conductivity zones was reduced based on limited field data and the concept of appropriate complexity. In the 2022 model update, several boundary conditions (recharge, river boundary, ocean boundary, etc.) were updated based on available data. The number of wells used for calibration was increased to include all applicable monitoring well data. This includes wells in the A-Aquifer, Upper and Lower 180-Foot Aquifers, and the 400-Foot Aquifer. Hydraulic conductivity values in geologic units were adjusted using both manual and automated parameter estimation techniques to obtain a reasonable model calibration.

Additionally, pilot points were used in the A-Aquifer to capture the special variation of hydraulic conductivity in that model layer.

The model simulates backward-tracking groundwater flow paths induced by operation of extraction wells. The simulation was run using the first quarter of 2022 (average period) calibration parameters (Simulation 2a) and the third quarter of 2022 (dry period) calibration parameters (Simulation 2b). Additional simulations assuming a flowrate of 30 gpm were also performed using the first quarter of 2022 (average period) calibration parameters (Simulation 2a30) and the third quarter of 2022 (dry period) calibration parameters (Simulation 2b30). The details of the latest groundwater modeling effort in 2023 are presented in Attachment A and summarized below. The model will be refined and some adjustments may be made to the final system design, construction, and operation as data are collected from well installation and testing activities.

The RD modeling effort included a baseline particle-tracking simulation using the existing regional groundwater flow and transport model to evaluate the current groundwater flow regime. The simulation indicated that the addition of extraction well EW-OU2-13-180 will enhance capture of the carbon tetrachloride plumes in the Upper 180-Foot Aquifer. However, the variations in the regional groundwater flow patterns during the dryer calibration period indicate that extent of capture may be variable due to changes in recharge and regional pumping. These model results are consistent with historical data collected in the field and the current understanding of OUCTP migration.

The proposed location for new extraction well EW-OU2-13-180 is approximately 841 feet east of extraction well EW-OU2-09-180 at the upgradient edge of the discontinuity in the Intermediate 180-Foot Aquitard (Figure 7). This location is in the vicinity of MW-OU2-64-180 where some of the highest carbon tetrachloride concentrations have been measured recently. Placement of the well in this area is expected to remove most of the carbon tetrachloride mass in the plume before it can migrate downward into the Lower 180-Foot Aquifer. Four model scenarios were developed to simulate groundwater plume capture under potential conditions within the new extraction well area. The model scenarios were developed to evaluate potential design and operating parameters based on previously observed site conditions. The four scenarios include:

1. New extraction well EW-OU2-13-180 with:
    a. Pumping at a flowrate of 60 gpm (based on performance of nearby extraction wells EW-OU2-08-180 and EW-OU2-09-180)
    b. Calibration parameters developed from evaluating available data for the first quarter of 2022 (average period)
2. New extraction well EW-OU2-13-180 with:
    a. Pumping at a flowrate of 30 gpm
    b. Calibration parameters developed from evaluating available data for the first quarter of 2022 (average period)
3. New extraction well EW-OU2-13-180 with:
    a. Pumping at a flowrate of 60 gpm
    b. Calibration parameters developed from evaluating available data for the third quarter of 2022 (dry period)
4. New extraction well EW-OU2-13-180 with:
    a. Pumping at a flowrate of 30 gpm

b. Calibration parameters developed from evaluating available data for the third quarter of 2022 (dry period)

Scenario 1: Groundwater modeling indicates that an additional extraction well pumping at 60 gpm would remove most of the mass of carbon tetrachloride from the Upper 180-Foot Aquifer that is not captured by extraction well EW-OU2-09-180 and intercept the carbon tetrachloride before it could migrate downward to the Lower 180-Foot Aquifer. The modeled simulations also indicated that the capture zone of this well would also encompass most of the current plume extent east of extraction well EW-OU2-09-180 and a portion of the current plume extent northwest of extraction well EW-OU2-09-180 during the average period (Attachment A, Figure 1).

Scenario 2: This scenario assumes the flowrate for new extraction well EW-OU2-13-180 is 30 gpm due to limitations in OU2 GWTS capacities (e.g., pipeline back pressure due to operation of EW-OU2-09-180), the aquifer itself, or other factors. Groundwater modeling results are similar to Scenario 1, indicating the additional extraction well pumping at a reduced flow rate during the average period will still be effective in removing the mass of carbon tetrachloride from the Upper 180-Foot Aquifer and preventing carbon tetrachloride mass from entering the Lower 180-Foot Aquifer (Attachment A, Figure 2).

Scenario 3: This scenario assumes the flowrate for new extraction well EW-OU2-13-180 is 60 gpm. Groundwater modeling results indicate a reduced capture area for the southern carbon tetrachloride plume in the Upper 180-Foot Aquifer and no capture of the northern carbon tetrachloride plume in the Upper 180-Foot Aquifer during the dry period; however, continued operation new extraction well EW-OU2-13-180 will still remove carbon tetrachloride mass before it could migrate downward to the Lower 180-Foot Aquifer (Attachment A, Figure 3).

Scenario 4: This scenario assumes the flowrate for new extraction well EW-OU2-13-180 is 30 gpm due to limitations in OU2 GWTS capacities (e.g., pipeline back pressure due to operation of EW-OU2-09-180), the aquifer itself, or other factors. Groundwater modeling results are similar to Scenario 3, but new extraction well EW-OU2-13-180 operating at 30 gpm captures a smaller plume area and may not be as effective at preventing downward migration of the OUCTP to the Lower 180-Foot Aquifer.

The groundwater modeling results indicate the operational flowrate for new extraction well EW-OU2-13-180 should be 60 gpm or greater to most effectively capture the OUCTP in the Upper 180-Foot Aquifer and prevent migration of carbon tetrachloride to the Lower 180-Foot Aquifer. The modeling results also indicate lower flowrates will still effectively remove carbon tetrachloride mass before it can migrate to the Lower 180-Foot Aquifer.

The modeling results also indicate new extraction well EW-OU2-13-180 either only partially captures the northern carbon tetrachloride plume during the average period or does not capture the northern carbon tetrachloride plume during the dry period. However, data for OUCTP in the Upper 180-Foot Aquifer indicate the northern carbon tetrachloride plume is attenuating and will likely migrate into the capture area of new extraction well EW-OU2-13-180 at it moves toward the discontinuity in the Intermediate 180-Foot Aquitard (Ahtna, 2023b). Therefore, analysis of whether additional actions are necessary to address the northern carbon tetrachloride plume will be conducted after implementation of additional groundwater extraction to improve hydraulic control and containment of the OUCTP in the Upper 180-Foot Aquifer before it can migrate to the Lower 180-Foot Aquifer.

The final design and construction of the groundwater extraction and treatment system will depend on field and aquifer conditions encountered during the well installation and testing activities. The implementation strategy for the remedial action will include provisions for adapting the system design as required (e.g., an alternating pumping strategy or optimized flow rates for operating extraction wells in the Bunker Hill network).

Remedial action implementation will proceed as sequential activities that will include sufficient flexibility for site professionals to respond to field conditions. The hydraulic properties of the Upper 180-Foot Aquifer within the proposed extraction area and the ability of extraction well EW-OU2-13-180 to produce water will determine the final configuration of the system. The design and operation of the extraction and conveyance system will depend on extraction rates. The proposed sequence of implementation is as follows:

1. Installation of extraction well EW-OU2-13-180 with a screen interval based on the lithologic sequence encountered.
2. Well development and specific capacity testing to maximize and test well production.
3. Hydrogeologic testing to refine aquifer parameters for additional design.
4. Refinement of the groundwater model (if required).
5. Evaluation of the current design and making adjustments, as necessary, in planned GWTS operations.
6. Redesigning the system only if remediation cannot be achieved as specified in this RD Addendum.

The implementation of the remedial action will proceed through the sequence discussed above to the extent required to install and operate the groundwater extraction and treatment system. The steps required are dependent on each previous step. If installation of the one additional extraction well provides sufficient quantity of water and yields the desired effects upon the aquifer, no further well-performance testing work will be required and the remainder of the system will be installed as specified. If testing results indicate installation of the one additional extraction well cannot achieve remediation goals per this RD Addendum, further well-performance testing work may be conducted to collect additional data to support system redesign.

1.4 Design Basis

The OUCTP ROD (Army, 2008) specifies groundwater extraction and treatment using the OU2 GWTP as the remedial action for the Upper 180-Foot Aquifer. Based on the results of the plume capture model, a single well can be used to extract groundwater from the downgradient edge of the OUCTP Upper 180-Foot Aquifer to minimize further migration into the Lower 180-Foot Aquifer. The proposed location of extraction well EW-OU2-13-180 is shown on the figures. Based on the plume capture model results, a design extraction flowrate of at least 60 gpm is desired for plume capture. Conveyance piping from extraction well EW-OU2-09-180 is located within approximately 841 feet of the proposed extraction well location and conveyance piping from proposed extraction well EW-OU2-13-180 could be connected to the existing conveyance pipeline near EW-OU2-09-180. The construction drawings included in Attachment B show the existing OU2 GWTS construction details.

An electrical panel located near existing extraction well EW-OU2-08-180 includes sufficient capacity for expansion to include power to proposed extraction well EW-OU2-13-180. The electrical equipment

within the panel was originally designed for future expansion and includes a circuit breaker panel with spare slots, and a programmable logic controller (PLC) with spare input and output slots for the instrumentation required for the proposed extraction well. However, the DirectLOGIC 405 PLC at Bunker Hill is obsolete and should be upgraded to an Allen-Bradley MicroLogix 1400 PLC, or similar. The construction drawings included in Attachment B show the existing electrical details. The following sections provide details of the design considerations for extraction well EW-OU2-13-180 and incorporation of the proposed well into the existing OU2 GWTS.

1.4.1 Extraction Well

Extraction well EW-OU2-13-180 will be installed at the location shown on Figure 7 and screened across the Upper 180-Foot Aquifer. Based on historical data in the area, the Upper 180-Foot Aquifer spans approximately 150 to 220 feet bgs. This depth will be targeted for the screen interval for extraction well EW-OU2-13-180, but adjustments may be required in the field based on data collected during the boring construction.

Since several extraction wells have already been installed within the Upper 180-Foot Aquifer in the vicinity of the proposed extraction well, construction of the proposed well will use similar drilling methods and construction materials. The as-built construction drawings from extraction well EW-OU2-09-180 and boring logs monitoring wells MW-OU2-64-180 and MW-OU2-66-180 (Attachment C) will be used as the primary guidance for the design of proposed extraction well EW-OU2-13-180.

Extraction well EW-OU2-13-180 will be located within the Fort Ord Natural Reserve (FONR). Work within the FONR requires specific consideration to minimize impact to listed and endangered plants and animals. The specific requirements for working within the FONR as part of the OUCTP remedial action are addressed in Section 10 of the main OUCTP RAWP (Shaw, 2009).

1.4.2 Treatment Using Operable 2 Groundwater Treatment System

The OU2 GWTP is designed and operated to treat groundwater contaminated with VOCs (primarily TCE). Carbon tetrachloride is included as a COC for OU2 so operation of the system, including sample analysis and evaluation of discharge requirements and GAC changeout frequency, already includes considerations for the COCs found in the OUCTP Upper 180-Foot Aquifer.

Based on the original design, subsequent modifications, and recent operating conditions, the OU2 GWTP has sufficient capacity to accommodate the additional flow from proposed extraction well EW-OU2-13-180. In addition, as described above, the system was designed for future expansion in the area near existing extraction wells EW-OU2-07-180, EW-OU2-08-180 and EW-OU2-09-180. Other than upgrading the Bunker Hill PLC, adding proposed extraction well EW-OU2-13-180 to the existing GWTS should require only minor modification in the system control parameters and balancing of the additional extraction flow with the current extraction flowrates. This balancing of flowrates is common during the normal operation of the OU2 GWTS.

2.0 Remedial Approach

The remediation of the OUCTP Upper 180-Foot Aquifer will be achieved through the application of groundwater extraction and treatment. The groundwater extraction will be achieved from one existing extraction well (EW-OU2-09-180) and one new extraction well (EW-OU2-13-180) located near the downgradient edge of the plume within the Upper 180-Foot Aquifer. The groundwater model will be updated based on data collected during hydrogeologic testing conducted following well installation and start-up activities. The model updates will be used to optimize system operating parameters.

Monitoring will be conducted before, during, and following operation of extraction well EW-OU2-13-180 to optimize GWTS operations, evaluate GWTS effectiveness, overall plume remediation, and plume capture, and support site closure. Monitoring will include sampling and analysis at the GWTP, the extraction wells, and surrounding monitoring wells. Monitoring will also include process measurements and water level measurements to evaluate system operations and plume capture.

The following sections describe the extraction and treatment requirements to achieve remediation. Monitoring requirements are addressed in Section 5.0.

2.1 Extraction Requirements

Extraction well EW-OU2-13-180 will be installed in the location shown on Figure 7 and will be designed to optimize groundwater recovery. A downhole submersible pump of sufficient capacity will be installed in the well to pump groundwater at the design flowrate from the extraction well to the OU2 GWTP through new and existing conveyance piping. The pump will be controlled by a downhole pressure transducer and variable frequency drive (VFD) to minimize cycling.

The extracted groundwater flowrate will be measured and controlled at the wellhead before it enters the groundwater extraction conveyance piping. A flowmeter will be installed at the wellhead to measure instantaneous and cumulative flow from the well. The wellhead piping will also include a pressure switch to shut off the pump if a blockage occurs in the conveyance pipeline resulting in excess pressure in the well pipeline. A globe valve will be installed in the wellhead piping to control the extraction flowrate. A check valve and gate valve will also be installed in the wellhead piping to ensure that untreated water from the main extraction conveyance pipeline does not back up into the extraction well. Components at the wellhead will be installed in a concrete vault for security and to provide secondary containment in case of a leak in the process piping. The vault will be traffic rated and include a lockable lid. The vault will also include a sump to collect water and level switch to notify the operator of a leak in the system piping and shut off the extraction pump to minimize the release of contaminated groundwater in the event of a leak.

Conveyance piping between extraction well EW-OU2-13-180 and existing groundwater extraction piping will be double-contained to minimize the potential for a release if the conveyance pipe were to leak. The conveyance pipe will be sufficiently sized for the pump design capacity and to minimize friction loss. High-point, low-point, and leak detection vaults will be placed along of the length of the new conveyance piping as required. At the location that the well conveyance piping ties into the existing extraction conveyance pipeline, an isolation valve will be installed to allow for extraction well EW-OU2-13-180 to be isolated from the rest of the OU2 GWTS. Power and control for the system will come from

the panel located near extraction well EW-OU2-08-180. Control for proposed extraction well EW-OU2-13-180 will be incorporated into the overall control for the existing GWTS.

2.2 Treatment Requirements

Contaminated groundwater from new extraction well EW-OU2-13-180 will be mixed with contaminated groundwater from the existing OU2 extraction wells in the extraction conveyance pipeline. The mixed groundwater will be treated through liquid-phase GAC at the OU2 GWTP. Since carbon tetrachloride is already a COC for the OU2 system, no additional treatment or monitoring requirements are necessary. Because higher concentrations of carbon tetrachloride may be delivered to the GWTP relative to current levels, breakthrough of carbon tetrachloride in the GAC vessels will be monitored to ensure it does not drive GAC usage or reduce time between GAC changeouts.

3.0 System Components

The remedial system components for the OUCTP Upper 180-Foot Aquifer consist of an extraction well and mechanical equipment (pump, piping, instrumentation, and controls) to extract groundwater and convey it to the OU2 GWTP. Installation of extraction well EW-OU2-13-180 and conveyance piping will be conducted after pre-construction activities are completed in accordance with Section 9.0 of the OUCTP RAWP (Shaw, 2009). Since this work will be completed within the FONR, protection of environmental resources (primarily listed species and species of concern) will be an important part of intrusive activities. Requirements that will be implemented for the protection of listed species and species of concern are described in Section 10.4 the OUCTP RAWP (Shaw, 2009). The following sections provide the requirements for installation of the extraction well and mechanical equipment.

3.1 Extraction Well

A well will be installed to extract groundwater from the Upper 180-Foot Aquifer to support contaminant mass removal and capture of the OUCTP within the Upper 180-Foot Aquifer to minimize further migration into the Lower 180-Foot Aquifer. Well installation includes the following activities:

- Borehole drilling
- Geologic logging of the boring (continuous core, drive samples, or auger returns)
- Installation of well
- Well development and specific capacity testing

The final depth of the boring and position of the well screen shall be determined in the field by the field geologist. Well installation and construction materials will comply with the *California Well Standards, Water Wells, Monitoring Wells, Cathodic Protection Wells, Bulletin 74-90* (Supplement to Bulletin 74-81) (DWR, 1991).

Proposed extraction well EW-OU2-13-180 will be constructed similar to extraction well EW-OU2-09-180 and installed such that the bottom of the extraction well is at the approximate depth of the top of the Intermediate 180-Foot Aquitard. The planned installed depth for the well is approximately 225 feet bgs. Extraction well EW-OU2-13-180 will be screened to extend approximately 40 feet above the top of the Intermediate 180-Foot Aquitard. A piezometer tube will be installed in the same boring to the same depth and with the same screen interval as the extraction well. A diagram of a typical extraction well is provided on Figure 8 and Attachment B, Drawing No. CU6. The materials and specifications for the completion of the extraction well are summarized in Table 2.

3.1.1 Well Drilling and Construction

Extraction well EW-OU2-13-180 will be installed within the Upper 180-Foot Aquifer using a truck-mounted mud rotary, sonic, or air rotary casing hammer drill rig. Regardless of the drilling method, continuous sampling will be performed when the borehole is within the expected depth range of the screen interval (approximately 185 to 225 feet bgs). A diagram of a typical extraction well is presented on Figure 8 and Attachment B, Drawing No. CU6. The specific construction materials and methods of drilling, soil logging, and well installation are summarized in the following sections.

3.1.1.1 Construction Materials

Well construction materials will be in accordance with the *California Well Standards, Water Wells, Monitoring Wells, Cathodic Protection Wells, Bulletin 74-90* (Supplement to Bulletin 74-81) (DWR, 1991). The material specifications for proposed extraction well EW-OU2-13-180, well instrumentation and associated piping are included in Attachment B, Attachment D, and discussed in general below.

Well Casing

Casing for the proposed well and the piezometric tube will consist of flush-joint, threaded, Schedule 80 PVC manufactured per ASTM International (ASTM) F480. The specific casing diameter is included in Table 2 and Attachment B, Drawing No. CU6. Casing will be clean and new and joints between casing and screen will be compatible.

Well Screen

The piezometric tube screen will consist of a new Schedule 80 PVC with a slot size of 0.020 inch. The total piezometric tube screen length (approximately 40 feet) will be comprised of 10-foot sections. The extraction well screen will consist of a new, 40-foot long, Type 316 stainless steel with a slot size of 0.045 inch. Extraction well screen will be wire wrapped, with the wire welded to an internal structure. The wire will be V-shaped in the cross section so the slots between the wires widen inward to minimize clogging. A bottom cap will be installed at the bottom of each well. The specific casing diameter, slot size, and bottom cap length are summarized in Table 2 and Attachment B, Drawing No. CU6.

Centralizers

The well will be constructed with centering guides comprised of stainless steel. Mounting will be provided such that centering guides can be securely attached to the well riser. Centralizers will be positioned to ensure the well screen in the center of the borehole. One centralizer will be placed above the screen and bentonite seal, with the remaining centralizers spaced approximately every 40 feet upward for the remainder of the casing.

Filter Pack and Fine Sand

A filter pack will be placed around the well screen and will extend 5 feet above the top of the well screen. The filter pack will consist of SiLibeads® (or equivalent glass beads) or clean, washed, rounded to subrounded siliceous sand material that is free from calcareous grains or material. The gradation of the filter pack is included in Table 2. The uniformity coefficient of the filter pack material will not exceed 2.5. The well will have 3 feet of fine sand placed directly above the filter pack sand. The fine sand will be well-sorted and have a predominant grain size of between 0.42 millimeter and 0.074 millimeter. Filter pack sand and fine sand will be hard, durable, and have an average specific gravity of not less than 2.50. The sand will be visibly free of clay, dust, micaceous, and organic matter.

Well Seal and Grout

A 5-foot bentonite seal will be placed directly above the fine sand filter pack using a tremie pipe. A bentonite-cement grout seal will be used in the construction of the well and placed directly above the bentonite seal. The well will be grouted to within 36 inches of ground surface. The bentonite-cement grout will be mixed in the ratio of 5 pounds bentonite gel, one 94-pound bag of Type I Portland cement, and 7 gallons of clean, potable water. The grout will have a weight of approximately 15.3 pounds per gallon. Cement will meet requirements of ASTM C150-00. Neither additives nor borehole cuttings shall be mixed with the grout.

3.1.1.2 Borings

The boring will be completed under the supervision of the professional geologist who will be responsible for borehole logging, well installation, and development. The logging will be conducted in accordance with the Unified Soil Classification System. The boring will be drilled to the top of the Intermediate 180-Foot Aquitard, which is anticipated to be approximately 225 feet bgs. Continuous core sampling will be conducted over intervals of interest as required to determine aquifer lithology and depth of the Intermediate 180-Foot Aquitard. A core sample will be collected from the bottom of the boring to confirm the highly plastic clay common to the Intermediate 180-Foot Aquitard is encountered. The final depth of the boring and position of the well screen shall be determined in the field by the field geologist.

Drilling methods must prevent the collapse of formation material against or within 2 inches of the well screen and casing during installation and development of the well. If necessary, a temporary well casing of either iron or steel may be used to support the sides of the hole during drilling and placement of the screen, riser filter pack, and grout. Temporary casing shall have an internal diameter large enough to provide a 2-inch minimum annular space entirely around the well for sufficient thickness to retain its shape and maintain a true section throughout its depth.

The use of drilling mud during the rotary drilling operations requires careful management of drilling fluids both during drilling and during well installation. The drilling mud physical properties (filter cake thickness, fluid viscosity, sand content, and fluid density) will be monitored during the drilling of the boring. The maintenance of proper drilling mud consistency minimizes the invasion of drilling mud into the formation and reduces well development requirements. The drilling mud parameters will be measured and documented while drilling is in progress. Ideally, the parameters should be taken at intervals of 100 feet drilling progress. Drilling conditions may modify the practicality of measurement at these intervals. Use of additives to drilling mud installation should be avoided and will be pre-approved by the professional geologist. Water from a clean source may be used to assist drilling and well installation. The volume of water used at each well must be monitored and recorded.

3.1.1.3 Assembly of Well

The final position of the well screen shall be determined in the field by the field geologist. Filter pack will be placed around the well within the saturated zone. The filter pack will extend from a minimum of 1 foot beneath the bottom of the well to 5 feet above the top of the well screen. Three feet of fine sand will be placed above the filter pack. A 5-foot bentonite seal will be placed above the fine sand. The annular space from the top of bentonite seal to 36 inches bgs will consist of bentonite-cement grout. A diagram of a typical well is provided on Figure 8 and Attachment B, Drawing No. CU6. Well construction materials will be new, clean, and in good condition. If the protective plastic shipping sleeve is damaged, screen and casing will be decontaminated immediately prior to installation in the boring as described in Section 3.1.1.8. Care will be taken to ensure the pipe does not contact the ground. Joints and other accessory parts will be securely fastened prior to installation in the borehole. The screen and casing will be placed in the hole in such a manner as to avoid jarring impacts and to ensure the assembly is not damaged. Each well screen and casing will be emplaced while the temporary casing (depending on the drilling method used) is still in place in the boring. The well will be plumb, true, and centered in the hole by the use of centralizers. No centralizers shall be placed on the screen sections; one will be placed above the screen and bentonite seal, with the remaining centralizers spaced approximately every 40

feet upward for the remainder of the casing. Excessive misalignment or binding will be corrected before placing the filter pack.

3.1.1.4 Filter Pack Placement

To prevent compression of the well screen, the casing and screen will be suspended in the borehole until the filter pack is placed. The filter pack will be tremied into place, from the bottom of the borehole up, in such a manner as to ensure uniform placement around the screen. Temporary casing will be withdrawn from the boring as the filter pack is placed in a manner that will not cause the well to be displaced. During placement of the sand pack, frequent measurement of the top of the sand pack will be made to assure the bottom of the drive casing is not higher than 2 feet below the top of the sand pack. Water added to the sand during the tremie operation will be from a known clean source. The volume of water added will be monitored and recorded. Filter pack material will be protected from contamination prior to placement by either storing it in plastic-lined bags or in a location protected from the weather and contamination on plastic sheeting. Filter pack materials will be transported to the site in a manner that prevents contamination by other soils, oil and grease, and other chemicals.

3.1.1.5 Bentonite Seal and Grout Placement

The well will have 3 feet of fine sand placed directly above the filter pack and a bentonite seal placed directly above the fine sand. The fine sand and bentonite seal are intended to keep the bentonite-cement grout from infiltrating into the filter pack. Prior to placement of the seal, soundings will be conducted to verify the filter pack extends 5 feet above the top of well screen elevation. If it does not, sufficient filter pack material will be added to bring the pack to the specified level for the given well design. The bentonite seal will be added via a tremie pipe.

The well will be grouted to 36 inches bgs with a bentonite-cement grout. The grout will be placed by tremie pipe submerged in grout after initial placement of grout. The tremie pipe may be raised as the grout is placed as long as the discharge end remains submerged in grout. Additional grout will be added from the surface to maintain the level of grout, as specified, as settlement occurs.

3.1.1.6 Well Development and Sampling

Within one week after the well has been constructed, but no sooner than 48 hours after grouting is completed, the well will be developed using a bailer, vented surge block, and submersible pump. The total depth of the well and the depth to water measurements will be used to calculate the volume of water in the well casing. The well will be developed by alternately bailing and surging with a vented surge block. Care shall be taken so as not to dislodge the end plug or to disturb the well casing and screen. The well will be bailed prior to surging to remove debris.

Following bailing, the well screen will be carefully surged for a minimum of 15 minutes. During well surging, the vented surge plug will be placed at different depths within the screened portion of the well to expedite well development. If this development technique does not produce satisfactory results within one hour, then pumping the well with a submersible pump may be conducted. Care will be taken when developing with a submersible pump so as not to over pump the well and plug the sand pack. Additives and dispersing agents will not be used during well development without express permission of the professional geologist.

During development, the field geologist will monitor well development water for turbidity, pH, temperature, and specific conductance using a hand-held instrument (Horiba U-10 or equivalent). For each casing volume of water removed, measured water quality parameters (temperature, specific conductance, pH, and turbidity) will be recorded on the well development log. Water quality parameters will be measured in the following units:

- pH: standard pH units = -log [H+]
- Temperature: degrees Celsius (°C)
- Specific conductance: micromhos per centimeter (µmhos/cm)
- Turbidity: nephelometric turbidity units (NTU)

A minimum of ten (10) well casing volumes of water plus an additional 1,000 gallons of groundwater will be removed from the well; however, development should continue until water quality parameters have stabilized or the field geologist determines that additional development is not warranted. Stabilization is defined as three successive readings as follows:

- pH has changed less than 0.1 pH units.
- Temperature has changed 1 °C or less and is approximately equal to ambient groundwater temperature.
- Specific conductance has changed less than 10 percent.
- Development water registers less than 5 NTU.

Specific capacity testing will be conducted during well development to evaluate the production capacity of the well. Specific capacity is a term used to express the productivity of a well, and is defined as Q/s, where Q is the discharge rate and s is the drawdown in the well. The observed drawdown in the well is a function of aquifer and well loss; therefore, Q/s is a term incorporating both aquifer and well performance. Water levels and flowrates will be measured during the process of pumping the well. If specific capacity testing indicates the well does not have sufficient capacity to meet project objectives, additional well development measures may be implemented.

3.1.1.7 Groundwater Elevation Monitoring

A minimum of 48 hours after well construction and development activities are completed, the groundwater elevation will be measured at the new well using a hand-held measuring device and recorded.

3.1.1.8 Equipment Decontamination

Drilling, sampling, and support equipment brought to the site will be in operable condition and free of leaks in the hydraulic, lubrication, fuel, and other fluid systems. Drilling and sampling equipment and tools will be cleaned and decontaminated prior to rig mobilization to the well location and will be maintained in a clean condition throughout drilling and sampling activities.

Downhole drilling and development equipment will be: (1) cleaned of caked drill cuttings, soil, or other material using a brush; (2) steam-cleaned using a hot water high-pressure washer; and (3) rinsed with potable water prior to its use downhole and between boreholes. Decontaminated equipment will be kept off the ground by storing on clean metal racks (not wooden pallets) and/or wrapped in plastic.

3.1.1.9 Well Vault and Vault Lid

The extraction well surface completion will include an underground concrete vault to allow for wellhead access and extraction pipe and electrical connections below grade. The interior dimensions of the vault will be approximately 8 feet long by 6 feet wide by 4 feet deep. The vault may be pre-cast or constructed on site. The vault walls and floor will be a minimum 8 inches thick. The vault will have access holes for the wellhead, extraction piping, and electrical conduits. The vault will also include a 36-inch diameter sump that is 18 inches deep and is grouted to the bottom.

Following well installation, the area surrounding the extraction well will be excavated to allow for the construction of the vault and sump. The bottom of the excavation will be covered by a geotextile fabric. An 8-inch layer of class II aggregate base will be placed over the fabric and compacted to 95 percent of maximum compaction. The vault will be constructed of concrete composed of Type I or II Portland cement conforming to ASTM C150; coarse and fine aggregate conforming to ASTM C33; and clean, potable water free of deleterious amounts of oils, acids, alkalis, salts, and organic material. Rebar will be sized and placed within the vault walls and floor to provide H-10 load rating. A construction joint will be installed in the vault between the walls and floor to resist hydrostatic pressure. The top of the vault will be completed to just above the existing grade elevation and accessible through a traffic rated, lockable lid.

A vault lid constructed of corrosion-resistant aluminum will be attached to the concrete vault. The vault lid will be spring-loaded and hinged with a recessed lock box. The hinged lid will have a range of motion from being locked closed to 90 degrees open or greater. Two lids are required to meet the 60 pounds of maximum force to open. The lid will be attached to the well vault by stainless steel type 303 mounting bolts and nuts. Lid frames, mounting hardware, washers, and other fittings will be composed of stainless-steel type 304 or 316. Anchor bolts will be stainless steel type 304 and penetrate the concrete a minimum of 4 inches on the vertical access and at least 3 inches on the horizontal access.

Vault lids will have a rainwater collection tray. When the lid is closed, falling rain will drain away from the vault. A concrete apron will be placed around the vault lid to support the lid and provide protection. The apron will extend a minimum of 12 inches in each horizontal direction, with the surface sloped away from the lid. Typical vault surface completion details are shown in Figure 9 and included in Attachment B, Drawing No. CU8.

3.2 Mechanical Installation

A groundwater extraction pump and motor will be installed in the well to bring contaminated groundwater to the surface. The groundwater flow and pressure will be measured and controlled at the wellhead within the vault and will then be conveyed through underground piping to the OU2 groundwater extraction pipeline near the location of the existing extraction well EW-OU2-09-180. The following sections provide a description of the mechanical equipment within the well and wellhead vault and the extraction conveyance pipeline.

3.2.1 Groundwater Extraction Equipment

A submersible pump will be installed in extraction well EW-OU2-13-180 to pump groundwater to the OU2 GWTP. The specific pump size will be determined by specific capacity testing conducted during well development following extraction well installation. The pump will be installed in the extraction well at a

depth near the bottom of the screened interval to maximize the groundwater recovery from the well. The pump will be suspended by stainless steel type 304 downhole pipe attached to the well cap, which rests on the top of the extraction well casing (Attachment B, Drawing No. CU7). A shroud constructed from PVC will be installed over the pump and motor to direct water flow over the motor to the impeller opening. Power cables with a water-proof termination fitting will be installed from the pump motor to the electrical panel in the well vault. Additional information regarding submersible pump requirements is in Attachment D, Section 11211.

Piping at the wellhead will be Schedule 80 PVC and will include a globe valve to control the flow from the well and a check valve and gate valve to isolate the well from other wells connected to the header piping. Attachment B, Drawing No. CU7 includes an extraction well vault plan. Because of the potential pressure induced by the well pump, the globe valve and components between the well cap and globe valve will be rated for a minimum of 250 pounds per square inch (psi). Components after the globe valve within the well vault will be rated to 160 psi. A sample port will also be installed at the wellhead for system monitoring. A digital output PVC float switch will be installed in the well vault to indicate a high-water level in the vault as a result of a pipeline leak.

3.2.2 Electrical Power and Control Installation

An existing 200-amp, 3-phase, 480Y/277-volt commercial meter service drop is located north of the intersection of Abrams Drive and Bunker Hill Drive. The service drop feeds a Four-Well Power and Control Panel located next to extraction well EW-OU2-08-180. Power is fed through #4/0 wire between the drop and the panel. The panel provides a secure location for both the 480-volt power distribution and low voltage instrumentation control. The panel contains two circuit breakers/motor starters and a PLC. The panel also contains space for two additional circuit breakers/motor starters. The electrical site plan and wiring diagram are shown in Attachment B, Drawing Nos. S7, S8, S9, ELD01, ELD02, and ELD03. The following sections describe how power and control wiring will be distributed from the existing Four-Well Power and Control Panel to new extraction well EW-OU2-13-180.

3.2.2.1 Electrical Power

Electrical power will be distributed from the Four-Well Power and Control Panel to new extraction well EW-OU2-13-180 through PVC conduit installed between the panel and existing extraction well EW-OU2-09-180 and PVC conduit buried adjacent to the existing and new extraction conveyance pipeline. The wire and conduit will be sized based on the final extraction well pump size in accordance with industry standards and the pump manufacturer's requirements. Pull boxes will be spaced along the length of the new conduit. Power will be terminated in the extraction well vault in a National Electric Manufacturers Association 4X panel with a lockable disconnect switch. The switch will be connected to a motor starter, which will then be connected to the downhole extraction pump through the motor power cable. The disconnect and motor starter will be sized based on the final extraction pump size in accordance with industry standards. The power in the extraction well vault will be grounded in accordance with National Electric Code requirements. Additional information regarding electrical power is in Attachment D, Section 16010 and Section 16410.

3.2.2.2 Instrumentation

Instrumentation within the well vault will include a flow-indicator totalizer, pressure switch with gauge, downhole pressure transducer, level switch (leak detection), and motor-run VFD. The flow indicator

totalizer will be installed at the wellhead to monitor instantaneous flowrate and total gallons extracted from the well. The flowmeter will be a Rosemount magnetic style water meter with 1.5 percent accuracy and a 4- to 20-milliamp output.

A digital pressure switch will also be installed to monitor the pump pressure and ensure safe operation of the extraction system. The switch will be adjustable and provide a digital output. The switch will have a pressure range to 200 psi. The pressure switch will be installed downstream of a pulsation dampener to reduce false high-pressure readings caused by pipeline pressure surges.

A pressure transducer will be installed in the extraction well piezometric tube at a depth near the bottom of the extraction pump to measure the water level within the extraction well and control the operation of the pump to prevent the pump from running dry and cavitating. The pressure transducer will be welded titanium with a sealed gauge, 0 to 60 psi gauge span, ±0.25 percent accuracy, with a 4- to 20-milliamp output.

A digital output stainless PVC float switch will be installed within the well vault to allow for detection of leaks within the well vault and extraction conveyance pipeline that would drain into the vault sump.

The upgraded PLC will control a 24-volt direct current relay to start and stop the extraction pump. The relay will control a 120-volt circuit connected to the motor starter. The relay will be used to start the pump remotely from the OU2 GWTP and to stop the pump under alarm conditions.

Instrumentation wiring will be distributed from the Four-Well Power and Control Panel to new extraction well EW-OU2-13-180 through electrical PVC conduit installed between the panel and existing extraction well EW-OU2-09-180 and PVC conduit buried adjacent to the existing and new extraction conveyance pipeline. The instrumentation conduit will be separate from the power distribution conduit to minimize interference. Pull boxes will be spaced along the length of the new conduit. The instrumentation wiring will be terminated at the upgraded PLC within the panel. Additional information regarding instrumentation is in Attachment B.

3.2.2.3 Supervisory Control and Data Acquisition/Instrumentation Interface

Information to operate the extraction well pump will be locally programmed into both the upgraded Bunker Hill PLC and within the Four-Well Power and Control Panel near EW-OU2-08-180. A separate effort will be required to integrate these signals into the existing supervisory control and data acquisition (SCADA) control system located at the OU2 GWTP. The anticipated effort includes adding an additional well to the existing monitoring screens and to verify data are being received, logged, and properly interpreted. Additional information regarding process control is in Attachment B.

3.2.3 Extraction Conveyance Pipeline

The conveyance piping from the well vault will connect to a main header leading to the OU2 GWTP near extraction well EW-OU2-09-180. The proposed route is shown on Figure 7. Alignment will be field verified to ensure that there is sufficient clearance for the excavation work to be completed. The pipeline routes will be marked for belowground utilities and pipelines in accordance with the OUCTP RAWP (Shaw, 2009). The following sections provide the extraction conveyance pipeline construction details.

3.2.3.1 Trenching

After clearing and grubbing, the trench excavation will be performed using a suitable backhoe or excavator. The excavation will follow the pipe alignment and survey stakes. The side slopes will be laid back at the angle of repose of the *in situ* material if native soil lacks the physical characteristics to support the trench walls. Deeper excavations, if required, will be benched, laid back, or shored. The excavated soil will be placed adjacent to the trench at a minimum distance of 2 feet from the edge to minimize trench wall collapse.

Based on previous trenching in the area, native soil at the bottom of the trench is assumed to be adequate for bedding. If it is not, clean soil will be placed in the trench bottom and on the sides of the installed pipe. Appropriately spaced grade control stakes will be installed along the trench alignment. Grade stakes will be clearly marked as to horizontal offset of alignment, well locations, planned bottom of trench, planned pipe connections, and pipe invert elevations. During construction, grades will be checked to confirm that specified locations and elevations have been achieved. Grade checking will be confirmed by the surveyor under direction of contractor quality control personnel.

Trench backfilling will commence upon completion of conveyance pipeline placement and testing. A partial backfill to restrain the pipeline is allowed prior to the pressure testing. Backfill sand will be placed on both sides of each pipe, the full width of the trench, and up to the spring line. Vibratory plate compactors or water jetting may be used to compact the sand and ensure that the pipe is adequately supported. Fill will then be placed in loose lifts not to exceed 24 inches. Leak detection and electrical conduits will be placed as appropriate. Filling and compaction will continue until the trench is brought up to final grade. A colored, inscribed, metal-impregnated warning tape will be placed at approximately 1 foot below finish grade. Surface restoration will be minimized within the FONR to minimize impact to existing plant species.

3.2.3.2 Conveyance Pipeline

Following the gate valve in the well vault, the piping will transition from Schedule 80 PVC to double-contained HDPE. The extraction conveyance pipeline will include approximately 841 feet of 6-inch by 10-inch double-contained piping. Figure 7 shows the proposed alignment of the pipeline. Pipe lengths may be adjusted based on field routing to avoid utilities or other obstructions. The specified sizes of pipe, tees, elbows, and necessary vents and drains will be installed within the trench and connected per manufacturers' recommendations. Power and control wiring conduit will also be installed within the extraction pipeline trench. Typical layout of piping and conduit within a trench is shown in Figure 10.

3.2.3.3 High and Low Points

The profile for the proposed pipeline and the low and high points are shown in Attachment B, Drawing No. CU5. It is anticipated that the tie-in at the existing conveyance pipeline is the only high point in the proposed pipeline and the existing conveyance pipeline includes sufficient high point vents.

A low-point drain will be installed on the conveyance pipeline to allow water to be drained from the pipeline in case of leaks or for maintenance. The low-point drain will be placed inside a precast concrete vault. The vault will be located in nontraffic areas with the top placed 6 inches above ground to reduce stormwater drainage into the vaults. Covers will be incidental-traffic, H-10 load rated. Covers will be corrosion resistant and installed with a secure locking mechanism. Attachment B, Drawing No. CU8 presents the low-point drain details.

3.2.3.4 Isolation Valve

An isolation valve will be installed in the HDPE pipeline just before the connection to the existing extraction conveyance pipeline. This isolation valve serves to isolate the pipeline to proposed extraction well EW-OU2-13-180. The isolation valve will be placed inside a precast concrete vault. The vault will be located in nontraffic areas with the top placed 6 inches above ground to reduce stormwater drainage into the vaults. Covers will be incidental-traffic, H-10 load rated. Covers will be corrosion resistant and installed with a secure locking mechanism. Attachment B, Drawing No. CU9 presents the vault details.

3.2.3.5 Pressure Testing

The double-contained pipe will be visually checked prior to pressure testing. Carrier pipe will be hydrostatically pressure tested with potable water in sections prior to backfilling the trench. The annular space of the secondary contained pipe will be pressure tested with air in sections prior to backfilling the trench. Welds, fittings, and flanges will be left uncovered during pressure testing. Test pressure and procedures will follow the HDPE pipe manufacturers' instructions, as modified by design limitations of the ancillary connected components and following the recommendations of the field engineer. Additional information regarding pressure testing is in Attachment D, Section 01651.

3.2.3.6 Alignment Marking

A licensed surveyor will survey, prior to backfill, pipeline routes and tops of well vaults. As-built drawings locating the actual pipe alignments and construction details relative to permanent survey monuments will be developed. Horizontal and vertical control will be surveyed to ±0.1 foot.

4.0 Extraction Well Operations

The following sections provide guidance for checkout and startup of extraction well EW-OU2-13-180, initial baseline groundwater sampling, and specific requirements for long-term system operations, maintenance, and monitoring relative to this well.

4.1 System Checkout and Startup

Start-up of extraction well EW-OU2-13-180 will include inspections of the mechanical and electrical equipment to ensure proper installation and operation. Hydrogeologic testing will also be conducted to evaluate recovery and OUCTP capture from the new well operating alone and in conjunction with the OU2 GWTS.

4.1.1 Mechanical and Electrical Completion Check

A mechanical and electrical completion check will be performed to verify the correct installation of the equipment. Installation of all components need not be completed for this inspection to commence. Mechanically moving devices will be individually inspected prior to and immediately following installation. This initial inspection includes a visual check of the moving parts to confirm whether the parts are free to operate as specified after installation.

During the final mechanical check, a visual inspection of the entire system against the construction drawings will be made to confirm that equipment and pipelines are in their proper locations and are appropriately connected, bolts and fittings have been tightened, and supports have been secured to support the intended weight. The mechanical completion checklist for the initial shakedown/startup will be prepared after all mechanical items have been installed.

During the electrical check, electrical equipment and wiring will be visually checked against construction drawings to ensure proper installation and connections. Wiring will be tested with a megohmmeter to ensure the wiring is intact and properly insulated. Instrumentation will be calibrated in accordance with the manufacturers' recommendations and tested to verify proper operation. After the installation of the power system, an operating test will be performed to assure proper rotation of the extraction pump. Following the installation of the control system, the GWTP operator will perform tests to assure proper operating conditions. Alarms and automatic shutdowns will be tested by forcing a failed condition. The SCADA system will integrate the signals from the instruments installed within new extraction well EW-OU2-13-180 and associated extraction conveyance pipeline to the upgraded Bunker Hill PLC.

4.1.2 Hydrogeologic Testing

During the initial stages of continuous operation, extraction well testing will be performed. Static water levels at extraction well EW-OU2-13-180 and nearby monitoring wells will be recorded prior to continuous operation. After the extraction well is started, the flowrate will be maintained at a specific rate and water levels in the extraction well and surrounding wells will be measured and recorded. After a period of time, the flowrate may be adjusted higher or lower and the aquifer response will be evaluated. Results from the tests and analysis will be used to determine aquifer yields and recharge capabilities, determine a long-term operating flowrate for the well, and evaluate OUCTP capture. Extraction flowrates will be adjusted periodically during operation to maintain an appropriate in-well drawdown below the initial static water level.

4.2 Baseline Sampling and Analysis

Baseline groundwater sampling will be conducted as part of the well installation and startup procedure. The baseline sampling will be conducted prior to long-term operation of extraction well EW-OU2-13-180 and will include a comprehensive evaluation of COCs and hydrochemistry. The baseline sampling event will include a single sample from extraction well EW-OU2-13-180 to evaluate the pre-treatment concentrations of COCs and to establish the local *in situ* hydrochemistry of the Upper 180-Foot Aquifer. Baseline sampling will be conducted no sooner than 72 hours after development of the well and will include the following analytical suite:

- Water quality parameters – pH, temperature, conductivity, turbidity, dissolved oxygen (DO), and oxidation reduction potential (ORP)
- VOCs – U.S. Environmental Protection Agency (EPA) Method 8260 selected ion monitoring (SIM)
- Anions – EPA Method 300.0
  - nitrate
  - nitrite
  - sulfate
- Dissolved metals – EPA Method 6010D
  - iron
  - manganese

4.2.1 Groundwater Sampling Procedure

Baseline sampling of extraction well EW-OU2-13-180 will be consistent with QAPP Sampling Standard Operating Procedure (SOP) #5 (Ahtna, 2022a). The sample will be collected from the sample port in the well vault with the pump operating. The standard procedures to be followed when sampling include:

1. Don appropriate personal protective equipment per the Accident Prevention Plan (Ahtna, 2021).
2. Confirm the well identification.
3. Calibrate field instruments in accordance with the manufacturer's directions. Record calibration documentation in the field logbook.
4. Monitor water quality parameters (i.e., DO, conductivity, pH, ORP, and temperature) every 3 to 5 minutes during purging. Record the water quality parameters on the groundwater sampling log form. If the water quality parameters are stable for three consecutive readings, then collect samples for chemical analysis. Stabilization is achieved if successive readings are within ±0.1 pH units, ±1 degree Celsius for temperature, 3 percent conductivity, and 10 percent DO reading. Turbidity and ORP readings will not be used as stabilization criteria. If the water quality parameters have not stabilized, then continue purging until stabilization occurs.
5. Collect samples from the sample port into the appropriate sample containers. Collect field quality control samples (e.g., field duplicates) per QAPP SOP #5.
6. Label, package, and prepare the samples for shipment to the laboratory per QAPP SOP #5. Transfer the samples to cold storage immediately after collection.
7. Document field activities and sample collection per QAPP SOP #5.

4.2.2 Laboratory Analytical Requirements

The baseline groundwater samples will be collected and submitted to an off-site laboratory for selected analysis. The specific analyses that will be completed by the off-site laboratories include:

- VOCs by EPA Method 8260 SIM
- Dissolved metals (iron and manganese) by EPA Method 6010 D
- Anions (nitrate, nitrite, and sulfate) by EPA Method 300.0

The specific requirements for these methods, including sample collection and preservation, laboratory quality control, laboratory quality assurance, laboratory corrective action, data management and quality assurance oversight, are described in the QAPP (Ahtna, 2022a).

4.3 System Operations and Maintenance

New extraction well EW-OU2-13-180 will be incorporated into and operated as part of the OU2 GWTS. The OU2 GWTS is currently operated in accordance with the O&M Manual (Ahtna, 2022b), which provides the specific requirements for startup of the GWTS after major modifications and general guidance for system operations, maintenance, and monitoring. The O&M Manual will be revised following system construction to incorporate necessary changes related to the new equipment, including revisions to system control logic, changes to periodic checklists, and changes to as-built drawings. Future system optimization will consider operation of extraction well EW-OU2-13-180 for capture of the OUCTP in the Upper 180-Foot Aquifer.

5.0 Sampling and Analysis

Monitoring for the operation of the OU2 GWTS is currently conducted in accordance with the QAPP (Ahtna, 2022a). The QAPP will continue to be the governing guidance document for monitoring the OU2 GWTS and will be modified as required to incorporate new extraction well EW-OU2-13-180.

Groundwater monitoring for the OUCTP in the Upper 180-Foot Aquifer is currently conducted as part of the Groundwater Monitoring Program (GWMP) in accordance with the QAPP (Ahtna, 2022a). The GWMP includes quarterly and annual sample collection and analysis from specific monitoring wells located throughout the former Fort Ord property. This sampling and analysis will continue as part of the monitoring of the implementation of the remedial action for OUCTP in the Upper 180-Foot Aquifer in accordance with the QAPP.

The QAPP (Ahtna, 2022a) describes the specific methods that will be used to collect and analyze samples during remediation of the OUCTP Upper 180-Foot Aquifer. Groundwater sampling and analysis will be conducted to determine baseline conditions at the site, monitor long-term changes in the extent of the OUCTP, monitor the effectiveness of groundwater extraction, and support site closure. The following sections describe the specific data quality objectives for the OUCTP Upper 180-Foot Aquifer and specific issues associated with the sampling design, analytical methods, and sampling procedures that will be used in collecting data relative to the existing plans.

The design and implementation of the remedy for OUCTP in the Upper 180-Foot Aquifer will include:

- Baseline sampling and analysis
- Performance monitoring
- Long-term monitoring

Baseline sampling and analysis will precede the long-term operation of extraction well EW-OU2-13-180 (see Section 4.2). Performance monitoring will be conducted as part of the monitoring of groundwater extraction and treatment activities. Long-term monitoring will evaluate the overall impact of the remedial efforts in the Upper 180-Foot Aquifer and to ensure that concentrations of COCs remain below Aquifer Cleanup Levels (ACLs) for a sufficient period of time to support site closure. The GWMP will incorporate pre-existing wells and wells installed during the remediation process.

5.1 Performance Monitoring

Performance monitoring will continue for the OU2 GWTS throughout the Upper 180-Foot Aquifer remediation activities. Extraction well EW-OU2-13-180 will be included in the OU2 GWTS monitoring program and will be monitored for the same analytes and at the same frequency as other extraction wells per the QAPP (Ahtna, 2022a). Performance monitoring will be conducted using samples collected from sample ports located in the process equipment as described in the QAPP. The samples will be analyzed for VOCs by EPA Method 8260 SIM. The criteria for the modification of analytical suites and for changes in sampling frequency are outlined in the QAPP.

5.2 Long-Term Monitoring

Long-term groundwater monitoring will continue for OUCTP throughout the Upper 180-Foot Aquifer remediation activities. The OUCTP monitoring wells currently included in the GWMP will continue to be monitored for the same analytes and at the same frequency as outlined in the QAPP (Ahtna, 2022a).

Long-term monitoring will be conducted using passive diffusion bags set at specific intervals within monitoring wells as described in the QAPP (Ahtna, 2022a). The samples will be analyzed for VOCs by EPA Method 8260 SIM. The criteria for the modification of analytical suites and changes in sampling frequency are outlined in the QAPP.

Long-term monitoring will continue until the concentrations of COCs in all wells are below ACLs in accordance with the decision criteria described in the QAPP (Ahtna, 2022a). If the concentrations of COCs in all wells within the OUCTP remain below the ACLs and all other closure criteria are met, monitoring will be discontinued and a remedial action completion report will be prepared to support site closure.

6.0 Program Evaluation, Modification, and Reporting

The effectiveness of the remediation program for the OUCTP Upper 180-Foot Aquifer will ultimately be measured by a reduction in the extent and concentrations of COCs. The configuration of the remedial treatment system is based on the current understanding of site conditions as derived from previous work.

6.1 Design Modifications

Modifications to the extraction pump size, conveyance pipeline size, wire size, etc. may be required after well installation and initial hydrogeologic testing. The system operating conditions will be constantly reevaluated to optimize OUCTP capture and system O&M requirements. System effectiveness, hydrogeologic conditions, and current trends in plume concentrations will be factored into the re-evaluation. Trend analysis and localized groundwater modeling will be used to evaluate progress and update system operating conditions.

6.2 Reporting

An update to the O&M Manual will be prepared following the system expansion/extraction well installation to document as-built conditions and changes during construction. Reporting for OUCTP Upper 180-Foot Aquifer monitoring and remediation activities is included in regular reports prepared for the OU2 GWTS and groundwater monitoring at OUCTP. This includes:

- OU2 GWTS and OUCTP status updates presented at regular Base Realignment and Closure Cleanup Team Meetings. The information provided includes current analytical data and GWTS operational data.
- Annual OUCTP groundwater monitoring reports that summarize analytical data, evaluate COC distribution and concentration trends, discuss the overall impacts to the plume as a result of treatment, and propose modifications to the GWMP. The annual reports also include an evaluation of the existing monitoring well network and recommend wells for installation and decommissioning per QAPP decision criteria.
- Annual OU2 GWTS reports that describe system operations during the 12-month reporting period, including treatment system configuration, a summary of analytical data, production rates, COC removal rates and effectiveness, recommendations for future action, GAC performance, well performance, and system optimization considerations.
- Quarterly OUCTP and OU2 reports containing analytical data and groundwater elevation measurements collected every three months as part of the ongoing GWMP and a general discussion of changes in COC concentrations and plume configuration over time.

7.0 References[1]

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[1] At the end of references included in the Fort Ord Administrative Record are the Administrative Record Numbers (AR#s) (e.g., BW-1234). To find the referenced document, this number may be typed into the Online Search tool at: http://www.fortordcleanup.com/documents/search/. Please note the referenced documents were available in the Fort Ord Administrative Record at the time this document was issued; however, some may have been superseded by more current versions and were subsequently withdrawn.

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TABLES

Table 1. Chemicals of Concern and Aquifer Cleanup Levels

Chemical of Concern (COC)	OUCTP A-Aquifer ACLs (µg/L)	OUCTP Upper 180-Foot Aquifer ACLs (µg/L)	OUCTP Lower 180-Foot Aquifer ACLs (µg/L)
1,1-Dichloroethene (1,1-DCE)	6.0	-	-
1,2-Dichloroethane (1,2-DCA)	-	-	0.5
Carbon tetrachloride (CT)	0.5	0.5	0.5
Chloroform	2.0	-	-
Methylene chloride	5.0	-	-
Tetrachloroethylene (PCE)	5.0	-	-
Total 1,2-Dichloroethene (total 1,2-DCE)	6.0	-	-
Trichloroethene (TCE)*	5.0	-	-
Vinyl Chloride	0.1	-	-

Notes:

-: not a COC at the specified aquifer

*TCE is not a COC for the Lower 180-Foot Aquifer, but is monitored to evaluate for potential impacts to downgradient Fort Ord supply wells.

Acronyms and Abbreviations:

µg/L: micrograms per liter

ACL: Aquifer Cleanup Level. Groundwater COCs and ACLs are taken from the Record of Decision (Army, 2008).

OUCTP: Operable Unit Carbon Tetrachloride Plume

Table 2. Extraction Well Materials and Construction

Well Type	Casing Type	Casing Diameter (in)	Screen Length (ft)	Screen Type	Screen Slot (in)	Sump	Backfill	Filter Pack[1]	Transition Sand[2]	Bentonite Seal	Grout Seal	Pump Piping Type	Surface Completion
Extraction well EW-OU2-13-180 in 16-inch diameter borehole	Flush-joint threaded Sch 80 PVC; SS centralizers at 40-foot intervals	10	40 (4x 10-foot sections)	Type 304 SS, continuous wire-wrapped	0.045	Type 304 welded SS, 5-feet long blank casing and end cap	bentonite pellets	SiLibeads® or #8/16 silica sand (8 mesh)	#60 sand	3/8-inch pellets or slurry placed by tremie pipe	5 lbs bentonite, 94-lbs Type I Portland cement, 7 gals clean water	2-inch diameter Type 304 SS	8-ft x 6-ft x 4-ft concrete vault with double-hinged aluminum, traffic-rated lid
Piezometer installed in same borehole, offset 1 inch from extraction well casing	Flush-joint threaded Sch 40 PVC	1	40 (4x 10-foot sections)	Sch 40 PVC	0.020	Sch 40 PVC, 1-foot long blank casing and end cap						NA	

Notes:

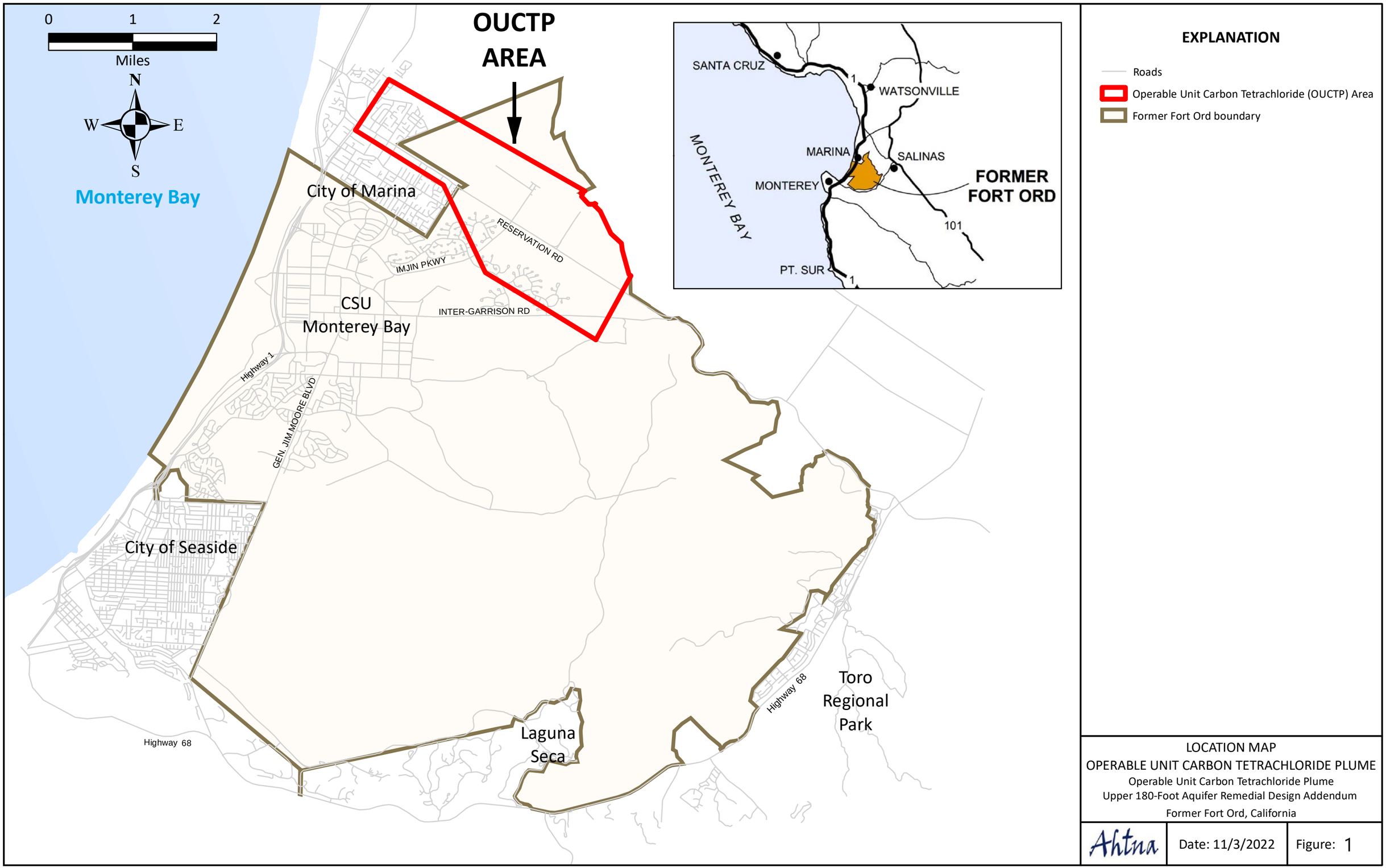
[1] Filter pack sand shall be rounded to subrounded siliceous material free of calcareous grains or material.

[2] Transition sand shall be well sorted with predominant grain size of between 0.42 and 0.074 millimeter.

Acronyms and Abbreviations:

EW = extraction well
ft = feet
gal = gallon
in = inch
lb = pound
NA = not applicable
PVC = polyvinyl chloride
Sch = Schedule
SS = Stainless Steel

FIGURES

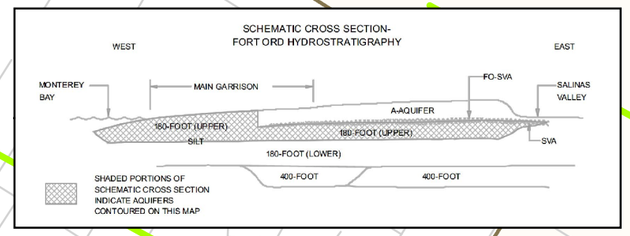


LOCATION MAP

OPERABLE UNIT CARBON TETRACHLORIDE PLUME

Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

Ahtna	Date: 11/3/2022	Figure: 1



0 1,000 2,000

Feet

N W E S

MW-BW-21-180

MW-BW-43-180

MP-BW-33-272

MP-BW-46-170
4.6

RESERVATION RD

MW-BW-52-180
0.79

MW-BW-57-180

PRESTON DR

6

MW-OU2-64-180
2.1

0.5

MW-OU2-30-180

EW-OU2-09-180

Proposed New Upper 180-Foot Aquifer Extraction Well (EW-OU2-13-180)

IMJIN PKWY

MW-BW-58-180

MW-BW-56-180

MW-OU2-67-180

ABRAMS DR

MW-OU2-70-180

SCHOONOVER DR

B C D E F

EXPLANATION

- General groundwater flow direction
- Roads
- Facilities
- Approximate extent of landfill areas (Areas B through F)
- Former Fort Ord boundary

Well Type and CT Detection

- New Upper 180-Foot Aquifer extraction well (EW-OU2-13-180)
- Extraction well with no carbon tetrachloride (CT) detected
- Monitoring well with CT detected
- Monitoring well with no CT detected
- Monitoring well not sampled

Chemical of Concern (COC) Aquifer Cleanup Level (ACL) exceedance contour in µg/L.

0.5 Carbon tetrachloride (CT)

OUCTP Upper 180-Foot Aquifer Hydraulic Zone

6

MW-OU2-64-180 2.1 — Well ID - Bold When Concentration Exceeds the ACL for CT; CT Concentrations (µg/L) and validation/lab qualifier.

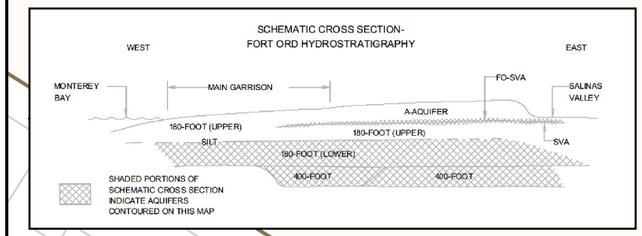
NOTES:

(1) Samples were collected between August 29, 2022 and September 2, 2022.
(2) Contours are based on one interpretation of the data that were available at the time this report was prepared; other interpretations may be possible.
(3) Contours are based on highest value obtained from multiple bags and/or multiple ports were applicable.
(4) Contours near wells not sampled this quarter are inferred from previous analytical data.

CARBON TETRACHLORIDE PLUME
UPPER 180-FOOT AQUIFER
THIRD QUARTER 2022

Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

Ahtna | Date: 7/17/2023 | Figure: 2



MP-BW-50-339
CT: 1.1

Well ID
Concentration in µg/L and validation/lab qualifier.
(blue indicates CT; red indicates TCE)
CT Bold when COC exceeds the ACL.

NOTES:

(1) Samples were collected between August 29, 2022 and September 30, 2022.
(2) Contours are based on one interpretation of the data that were available at the time this report was prepared; other interpretations may be possible.
(3) Contours are based on highest value obtained from multiple bags and/or multiple ports were applicable.
(4) Contours near wells not sampled this quarter are inferred from previous analytical data.

0 1,500 3,000
Feet

N
W E
S

AIRFIELD
CT: 0.44 J

NEESON RD

8

RESERVATION RD

IMJIN RD

Proposed New Upper 180-Foot Aquifer Extraction Well (EW-OU2-13-180)

MP-BW-49-287
CT: 0.70

MP-BW-49-316
CT: 3.2

MP-BW-49-368

MP-BW-49-400

MW-OU2-66-180

MP-BW-50-339
CT: 1.1

MP-BW-50-384

MP-BW-42-345

MW-BW-04-180

FO-30

MP-BW-41-318

MP-BW-41-353

7

0.5

MP-BW-51-405

IMJIN PKWY

EW-OU2-07-180

MW-OU2-78-180

MW-OU2-69-180
CT: 0.91

MW-OU2-72-180

FO-31

B

C

D

E

F

MW-BW-59-180
CT: 0.14 J

MW-OU2-82-180

FO-29

ABRAMS DR

SCHOONOVER DR

EXPLANATION

- General groundwater flow direction
- Roads
- Facilities
- Approximate extent of landfill areas (Areas B through F)
- Former Fort Ord boundary

Well Type and CT Detection

- New Upper 180-Foot Aquifer extraction well (EW-OU2-13-180)
- Extraction well with no carbon tetrachloride (CT) detected
- Monitoring well with CT detected
- Monitoring well with no CT
- Marina Coast Supply well with no CT

Chemical of Concern (COC) Aquifer Cleanup Level (ACL) Exceedance Contour in µg/L.

- 0.5 — Carbon tetrachloride (CT) plume extent

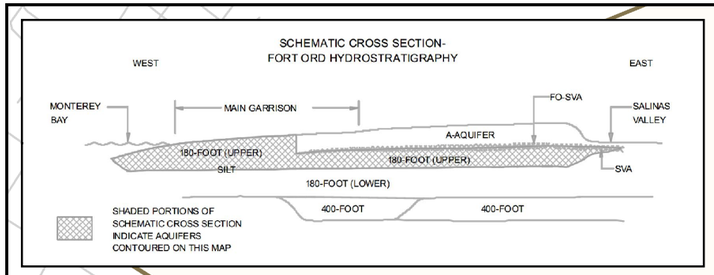
OUCTP Lower 180-Foot Aquifer Hydraulic Zone

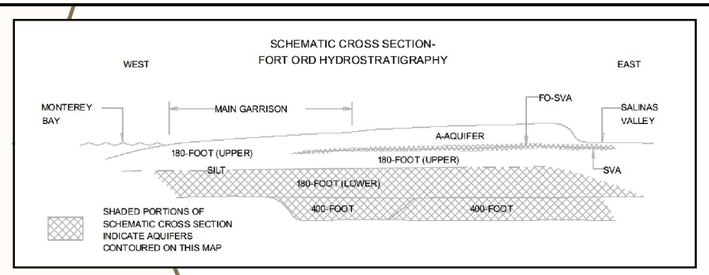
- 7
- 8

CARBON TETRACHLORIDE PLUME LOWER 180-FOOT/400-FOOT AQUIFERS THIRD QUARTER 2022

Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

Ahtna | Date: 7/18/2023 | Figure: 3





MW-B-05-180
MP-BW-38
MP-BW-39
MP-BW-40
AIRFIELD
NEESON RD
MW-BW-54-180
MP-BW-37
MP-BW-31
MCWD-08A
MP-BW-30
MW-BW-26-180
MW-BW-43-180
MP-BW-32
MW-BW-55-180
MW-BW-21-180
MP-BW-33
MP-BW-52
MP-BW-35
B
MP-BW-34
IMJIN RD
MW-BW-45-180
MW-BW-44-180
MP-BW-46
MW-BW-53-180
MW-BW-52-180
0.5
MW-BW-47-180
MP-BW-42
A
MW-BW-57-180
MW-OU2-64-180
MW-OU2-66-180
MW-OU2-07-400
MW-BW-51-180
MW-OU2-30-180
EW-OU2-09-180
MW-BW-50-180
MW-BW-49-180
MW-BW-56-180
ABRAMS DR
MW-BW-58-180
MW-BW-04-180
FO-30
MW-BW-02-180
MP-BW-50
MP-BW-49
MP-BW-51
MP-BW-41
IMJIN PKWY
EW-OU2-07-180
A'
MW-OU2-78-180
B'
MW-OU2-69-180
FO-29
FO-31
SCHOONOVER DR
RESERVATION RD
MW-BW-59-180
MW-OU2-72-180
MW-OU2-28-400
MW-OU2-70-180
MW-OU2-82-180
MW-OU2-67-180
Proposed New Upper 180-Foot Aquifer Extraction Well (EW-OU2-13-180)
N
W
E
S
C
D
E
F
0
1,500
3,000
Feet

EXPLANATION

- Roads
- Facilities
- Former Fort Ord boundary
- Approximate extent of landfill areas (Areas B through F)

Well Type

- New Upper 180-Foot Aquifer extraction well (EW-OU2-13-180)
- Extraction well
- Monitoring well
- Marina Coast active supply well

Cross Sections

- Cross Section A - A'
- Cross Section B - B'

3Q2022 Chemical of Concern (COC) Aquifer Cleanup Level (ACL) Exceedance Contour in µg/L.

- 0.5 Upper 180-Foot aquifer carbon tetrachloride (CT) plume extent
- 0.5 Lower 180-Foot aquifer CT plume

CARBON TETRACHLORIDE PLUME
AND CROSS SECTION MAP
THIRD QUARTER 2022
Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

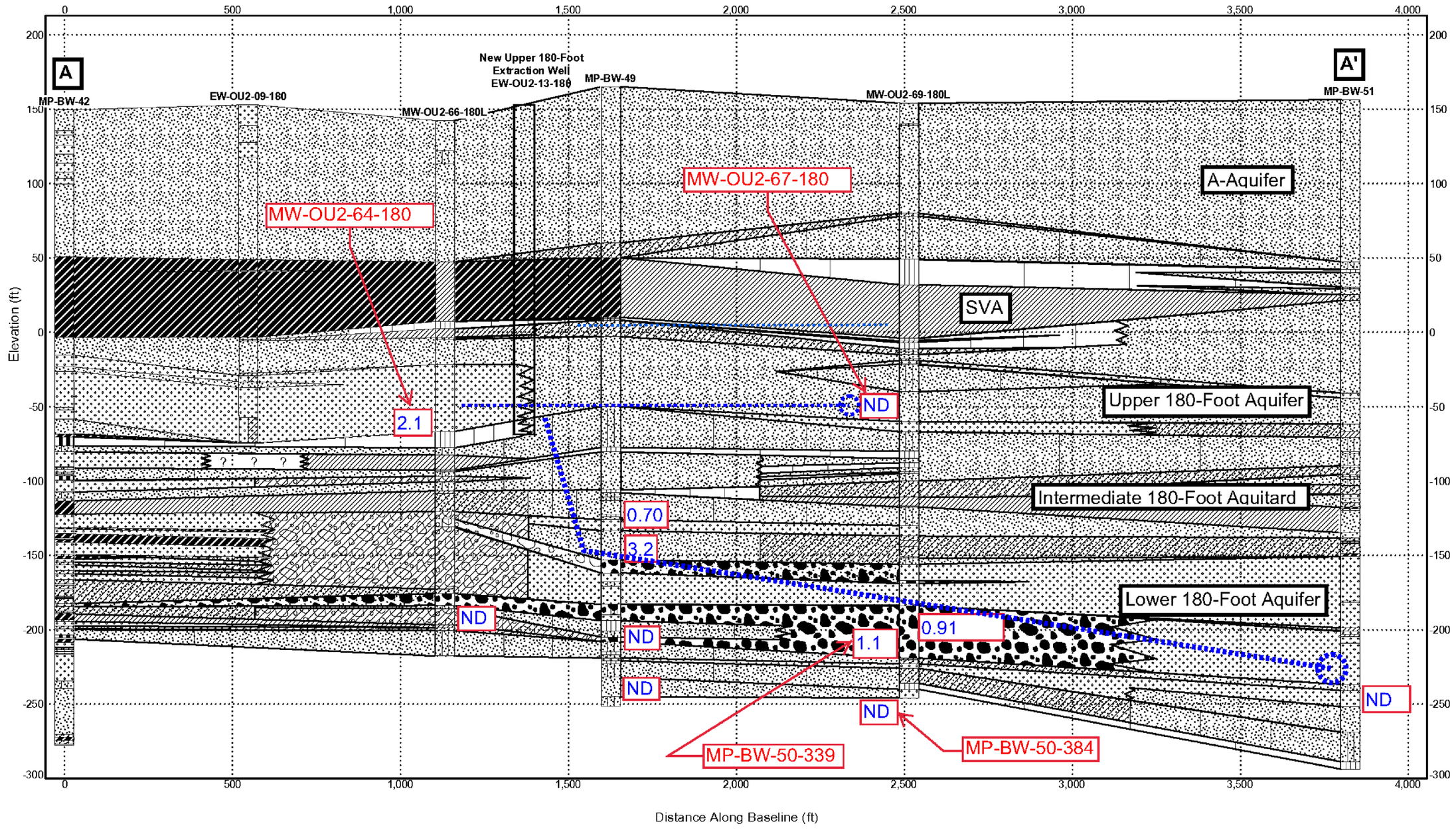
Ahtna | Date: 7/17/2023 | Figure: 4

Project Name: OUCTP Upper 180-Foot Aquifer Remedial Design Addendum
Project Location: Former Fort Ord, California
Client: U.S. Army Corps of Engineers
Project Number: W91238-14-C-0048

SUBSURFACE DIAGRAM
A-A'

Potential Plume migration pathway from Upper 180-foot Aquifer to Lower 180-foot Aquifer

- USCS Well-graded Sand
- USCS Poorly-graded Sand
- USCS High Plasticity Clay
- USCS Low Plasticity Clay
- USCS Clayey Sand
- USCS Well-graded Sand with Clay
- USCS Elastic Silt
- USCS Silty Sand
- USCS Silt
- USCS Poorly-graded Sand with Silt
- USCS Well-graded Gravel
- USCS Well-graded Gravel with Silt



Aptim

Date: 11/5/2022

CROSS SECTION A-A' CARBON TETRACHLORIDE PLUME
THIRD QUARTER 2022
Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

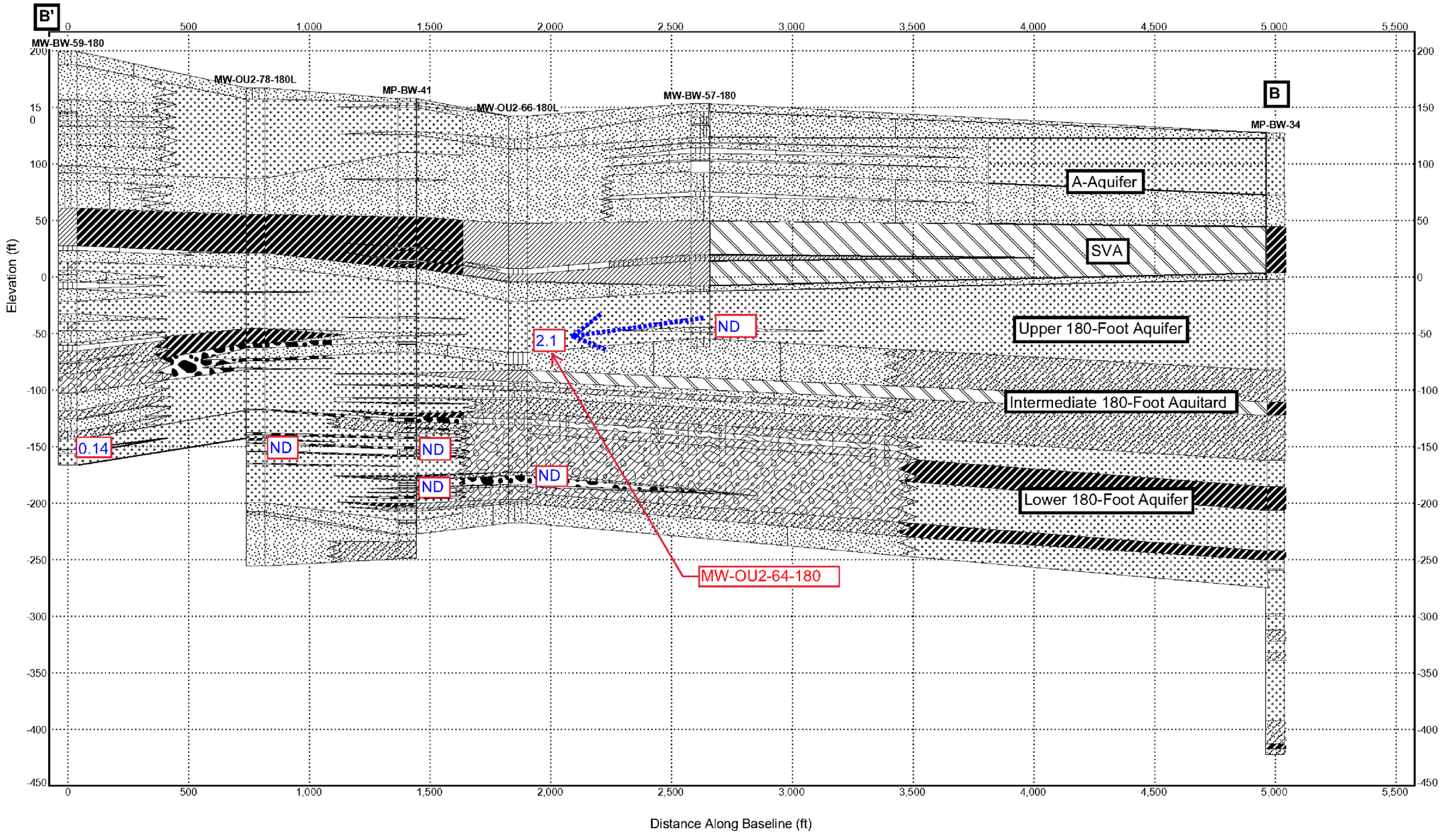
Figure: 5

Project Name: OUCTP Upper 180-Foot Aquifer Remedial Design Addendum
Project Location: Former Fort Ord, California
Client: U.S. Army Corps of Engineers
Project Number: W91238-14-C-0048

SUBSURFACE DIAGRAM
B-B'

Potential Plume migration pathway from Upper 180-foot Aquifer to Lower 180-foot Aquifer

- USCS Silty Sand
- USCS Well-graded Sand
- USCS Poorly-graded Sand
- USCS High Plasticity Clay
- USCS Clayey Sand
- USCS Well-graded Gravel
- USCS Clayey Gravel
- USCS Poorly-graded Sand with Silt
- USCS Silt
- USCS Low Plasticity Clay
- USCS Low Plasticity Silty Clay

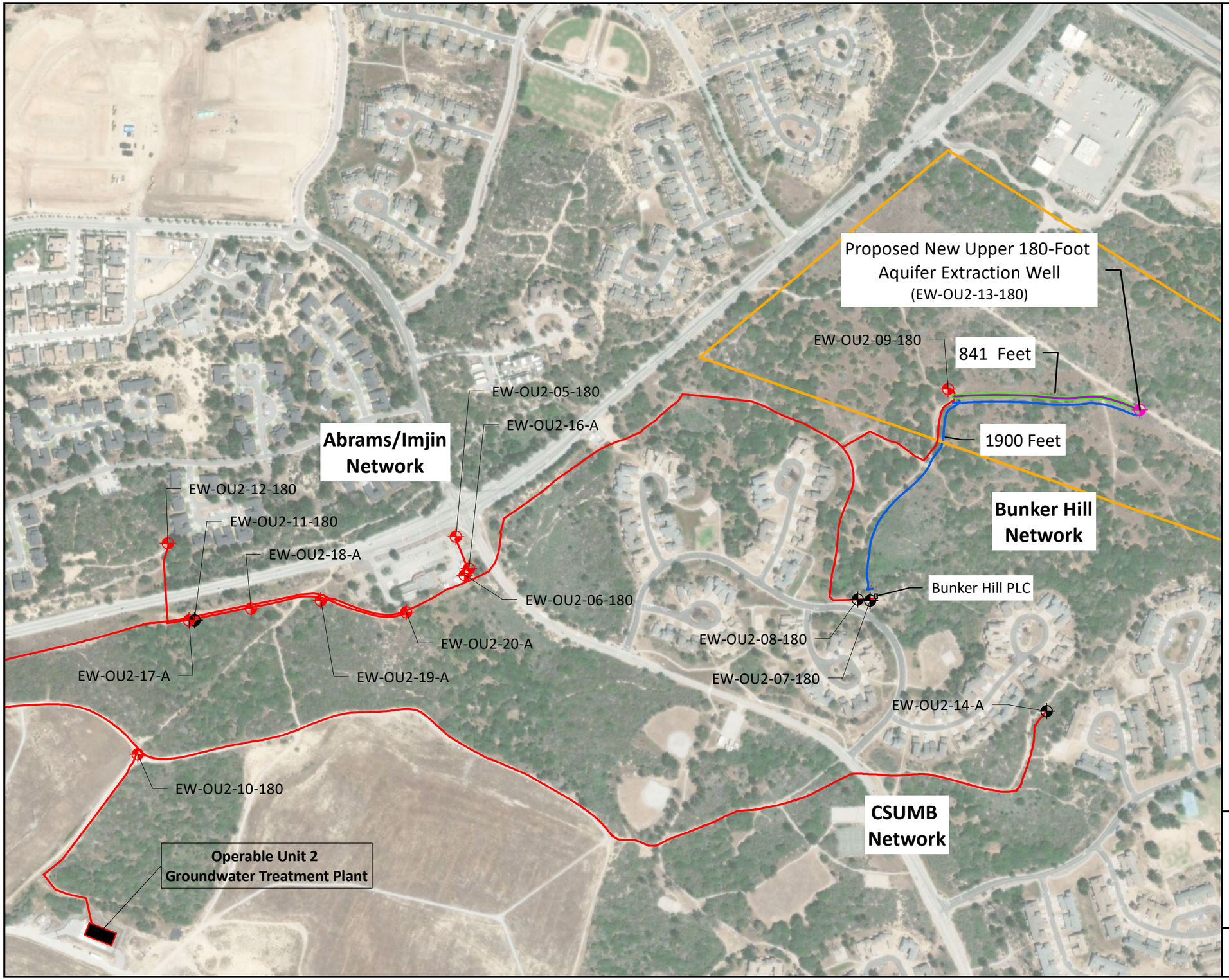


Ahtna

Date: 11/5/2022

CROSS SECTION B-B' CARBON TETRACHLORIDE PLUME
THIRD QUARTER 2022
Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

Figure: 6



EXPLANATION

- New Upper 180-Foot Aquifer extraction well
- Extraction well operated
- Extraction well not operated
- Proposed untreated water conveyance pipeline to connect to EW-OU2-09-180 existing pipeline (Total 841 feet)
- Groundwater collection pipeline
- New Electrical Power and Control Conduits (Total 1900 feet)
- Fort Ord Natural Reserve (South-West)

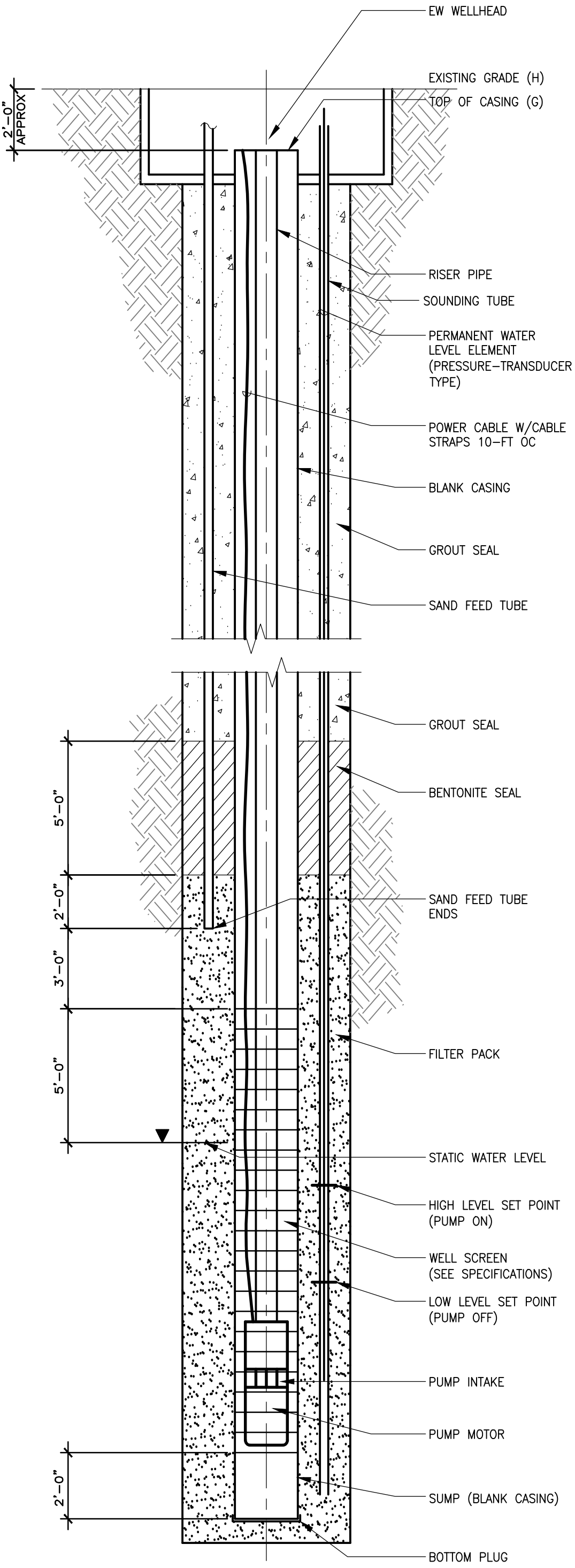
N
W E
S

0 500 1,000
Feet

PROPOSED UPPER 180-FOOT AQUIFER EXTRACTION WELL LOCATION AND CONVEYANCE ROUTE

Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

Ahtna | Date: 9/7/2023 | Figure: 7



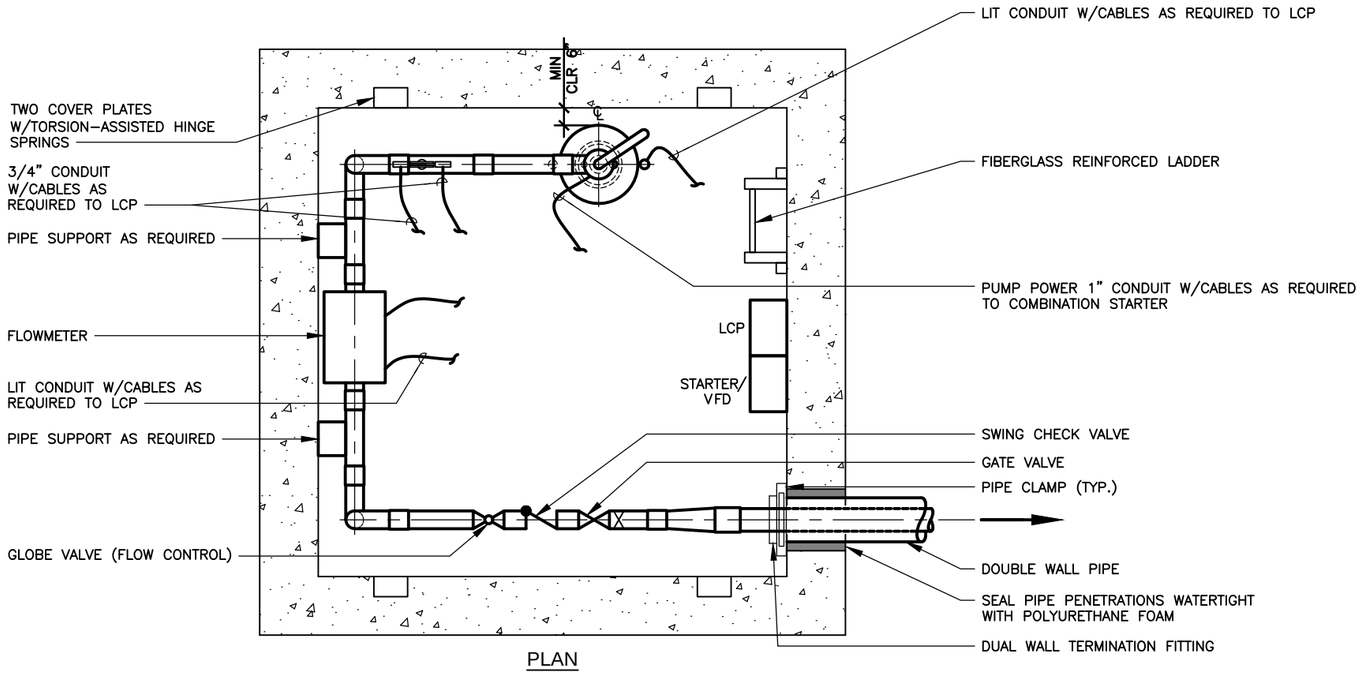
EW SCHEMATIC

Not to Scale

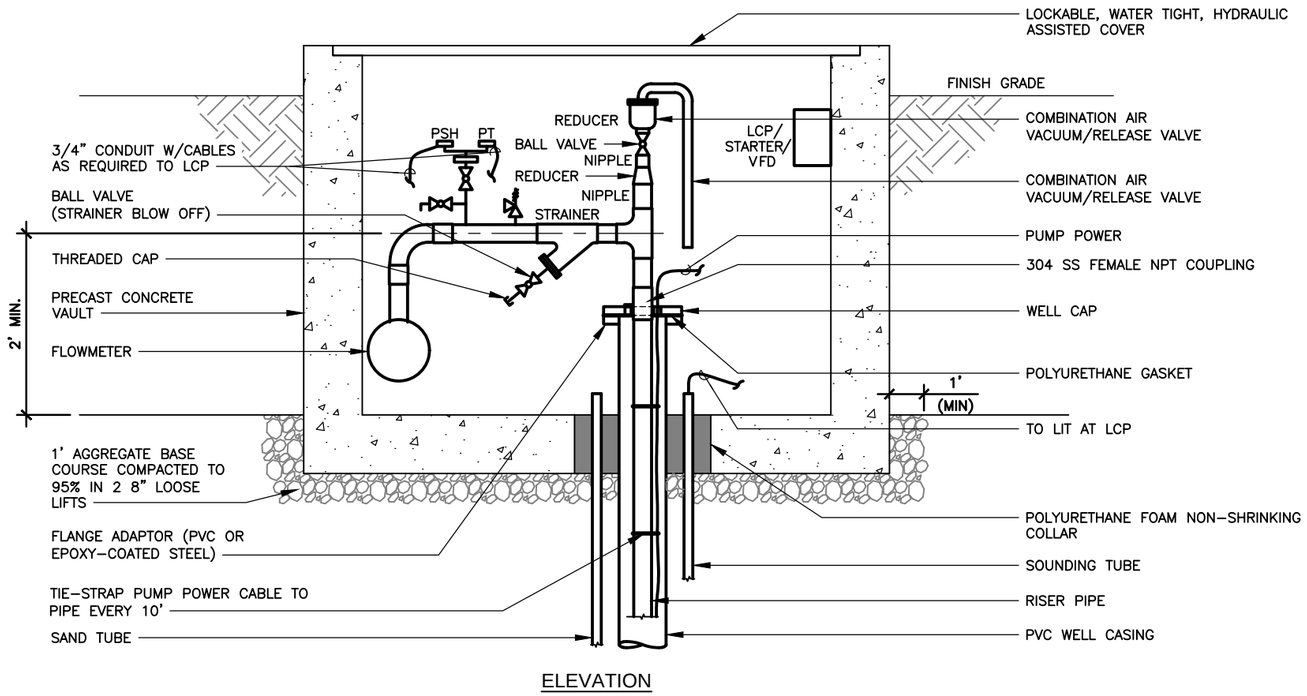
TYPICAL EXTRACTION WELL CONSTRUCTION
CARBON TETRACHLORIDE PLUME
UPPER 180-FOOT AQUIFER

Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

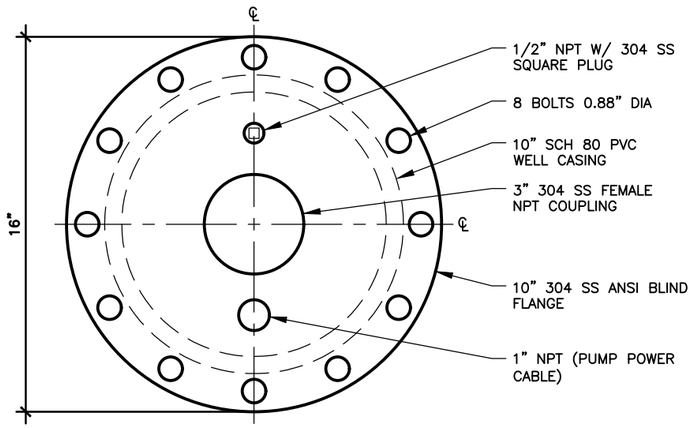
Ahtna | Date: 11/5/2022 | Figure: 8



PLAN



ELEVATION

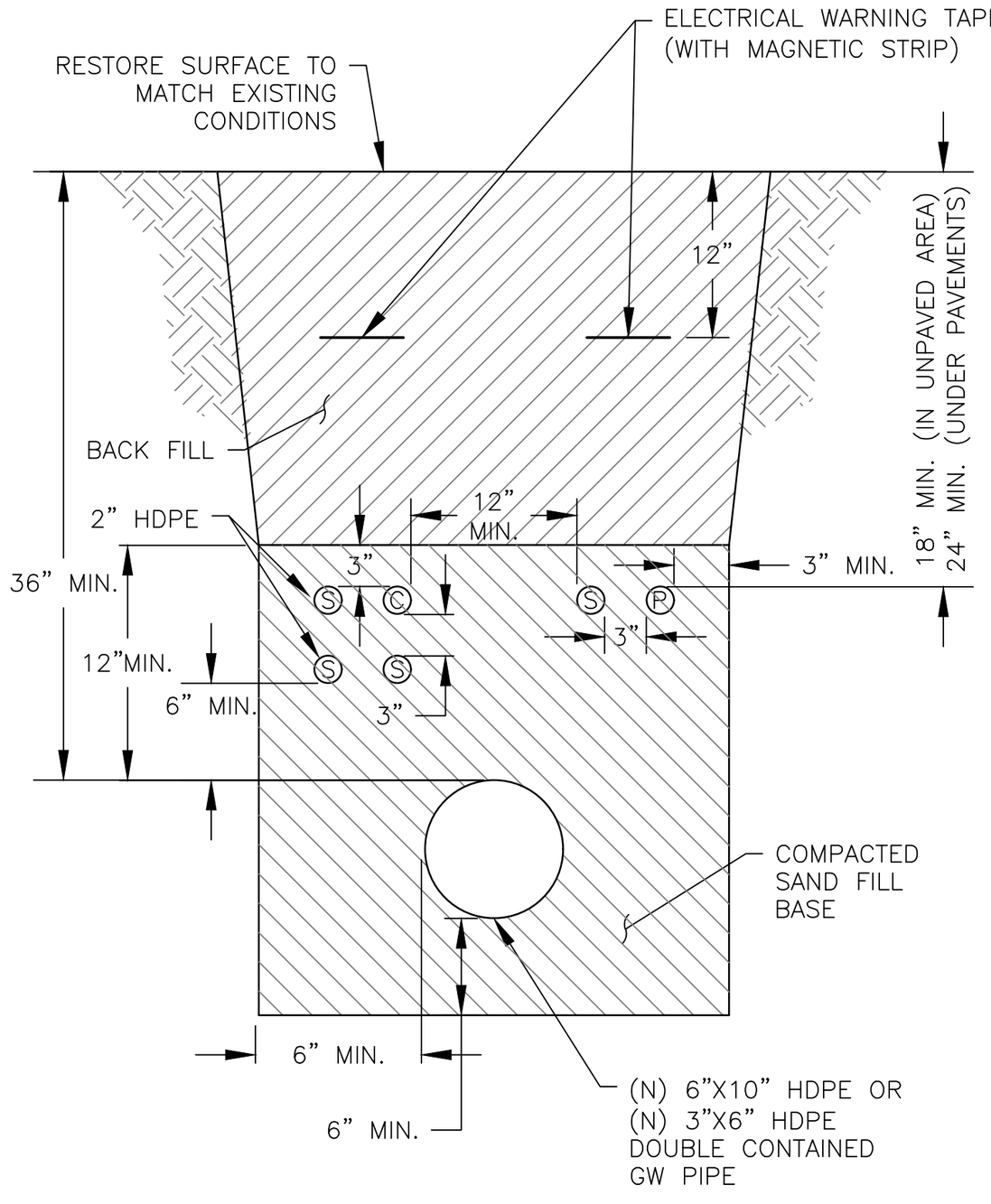


WELL CAP - 180-FT-AQUIFER WELLS

TYPICAL EXTRACTION WELL VAULT CONSTRUCTION

Operable Unit Carbon Tetrachloride Plume
Upper 180-Foot Aquifer Remedial Design Addendum
Former Fort Ord, California

Ahtna	Date: 11/5/2022	Figure: 9



CONDUIT LEGEND

Ⓒ – CONTROL CONDUIT (2" PVC)
Ⓟ – POWER CONDUIT (2" PVC)
Ⓢ – SPARE CONDUIT (2" PVC U.N.O.)

TYPICAL EXTRACTION CONVEYANCE LINE CONSTRUCTION
Operable Unit 2 Groundwater Treatment System Expansion
Remedial Design/Remedial Action Work Plan Addendum
Former Fort Ord, California

Ahtna	Date: 11/5/2022	Figure: 10

ATTACHMENTS

ATTACHMENT A

Groundwater Capture Model

Legend

- Particle Track Path Lines
- Proposed Upper 180ft Aquifer Well
- Extraction Well Upper 180-Aquifer
- Injection/Infiltration Well Upper 180-Aquifer
- Approx. End of Salinas Valley Aquitard (SVA)
- CT

Notes:

Simulation based on the Steady State simulated heads for Quarter 1 (average period) of 2022 with the addition of one new Upper 180-Aquifer well pumping at 60 gpm

Particle Pathways represent backwards tracking for 15 years (or until particles reach the SVA outcrop)

Background imagery: World Imagery from ArcGIS Pro

SIMULATION 2a- Fort Ord Steady State Model Simulated Groundwater Capture - OU2 (Upper 180-Aquifer) Quarter 1 2022

Figure 1

April 2023

Legend

- Particle Track Path Lines
- Proposed Upper 180ft Aquifer Well
- Extraction Well Upper 180-Aquifer
- Injection/Infiltration Well Upper 180-Aquifer
- Approx. End of Salinas Valley Aquitard (SVA)
- CT

Notes:

Simulation based on the Steady State simulated heads for Quarter 1 (average period) of 2022 with the addition of one new Upper 180-Aquifer well pumping at 30 gpm

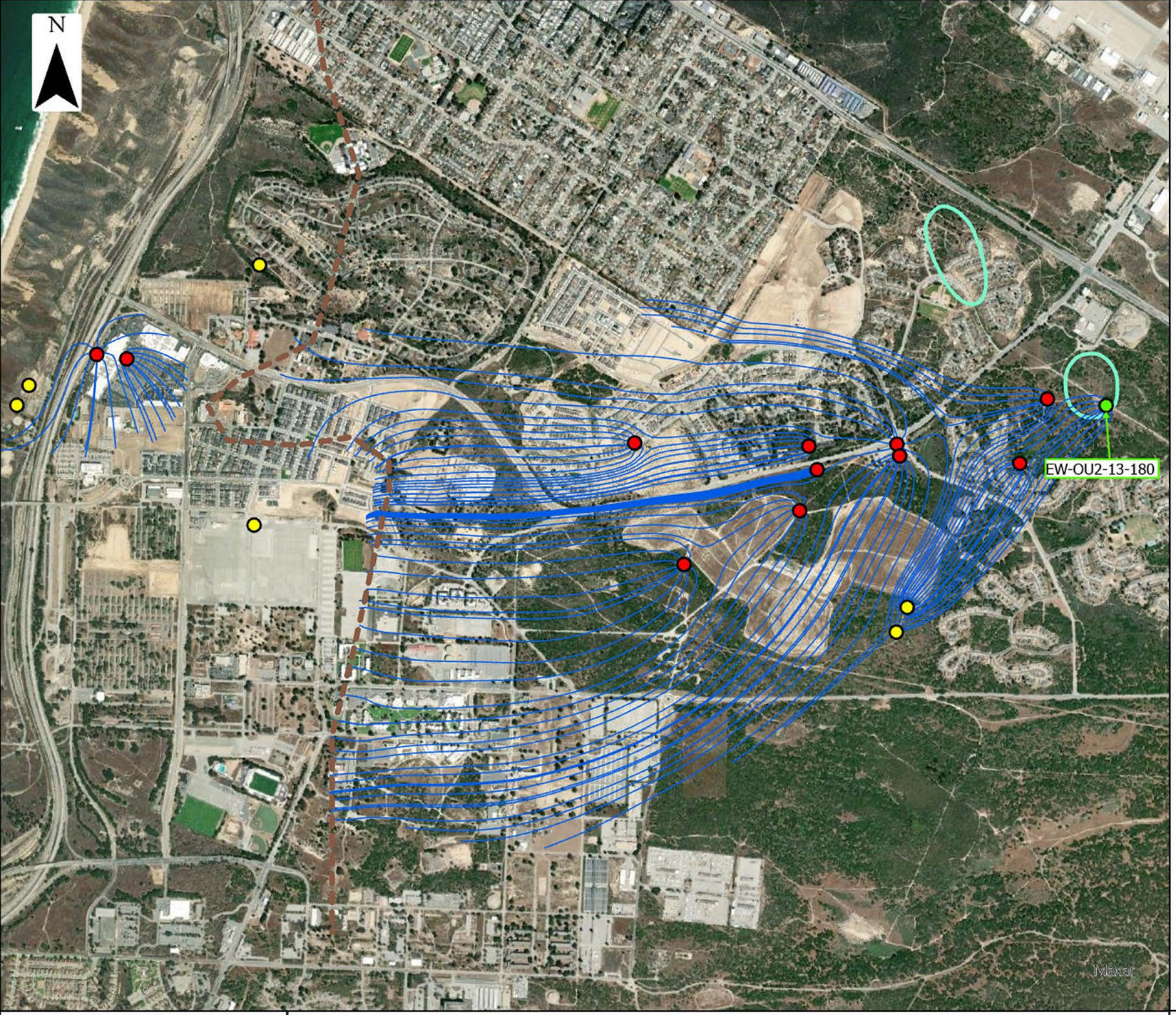
Particle Pathways represent backwards tracking for 15 years (or until particles reach the SVA outcrop)

Background imagery: World Imagery from ArcGIS Pro

SIMULATION 2a_30- Fort Ord Steady State Model Simulated Groundwater Capture - OU2 (Upper 180-Aquifer) Quarter 1 2022

Figure 2

April 2023



Legend

- Particle Track Path Lines
- Proposed Upper 180ft Aquifer Well
- Extraction Well Upper 180-Aquifer
- Injection/Infiltration Well Upper 180-Aquifer
- Approx. End of Salinas Valley Aquitard (SVA)
- CT

Notes:

Simulation based on the Steady State simulated heads for Quarter 3 (dry period) of 2022 with the addition of one new Upper 180-Aquifer well pumping at 60 gpm

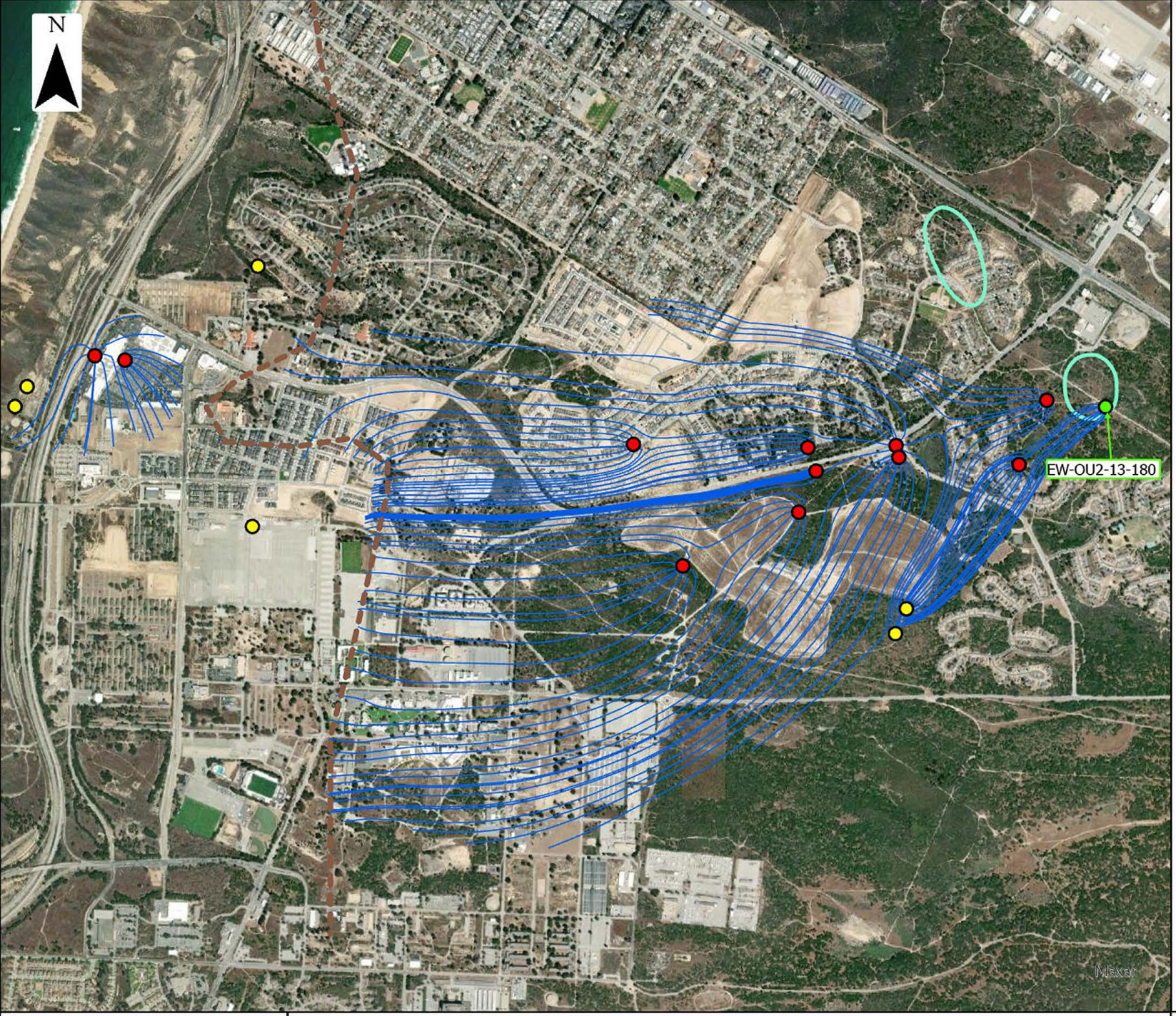
Particle Pathways represent backwards tracking for 15 years (or until particles reach the SVA outcrop)

Background imagery: World Imagery from ArcGIS Pro

SIMULATION 2b- Fort Ord Steady State Model Simulated Groundwater Capture - OU2 (Upper 180-Aquifer) Quarter 3 2022

Figure 3

April 2023



Legend

- Particle Track Path Lines
- Proposed Upper 180ft Aquifer Well
- Extraction Well Upper 180-Aquifer
- Injection/Infiltration Well Upper 180-Aquifer
- Approx. End of Salinas Valley Aquitard (SVA)
- CT

Notes:

Simulation based on the Steady State simulated heads for Quarter 3 (dry period) of 2022 with the addition of one new Upper 180-Aquifer well pumping at 30 gpm

Particle Pathways represent backwards tracking for 15 years (or until particles reach the SVA outcrop)

Background imagery: World Imagery from ArcGIS Pro

SIMULATION 2b_30- Fort Ord Steady State Model Simulated Groundwater Capture - OU2 (Upper 180-Aquifer) Quarter 3 2022

Figure 4

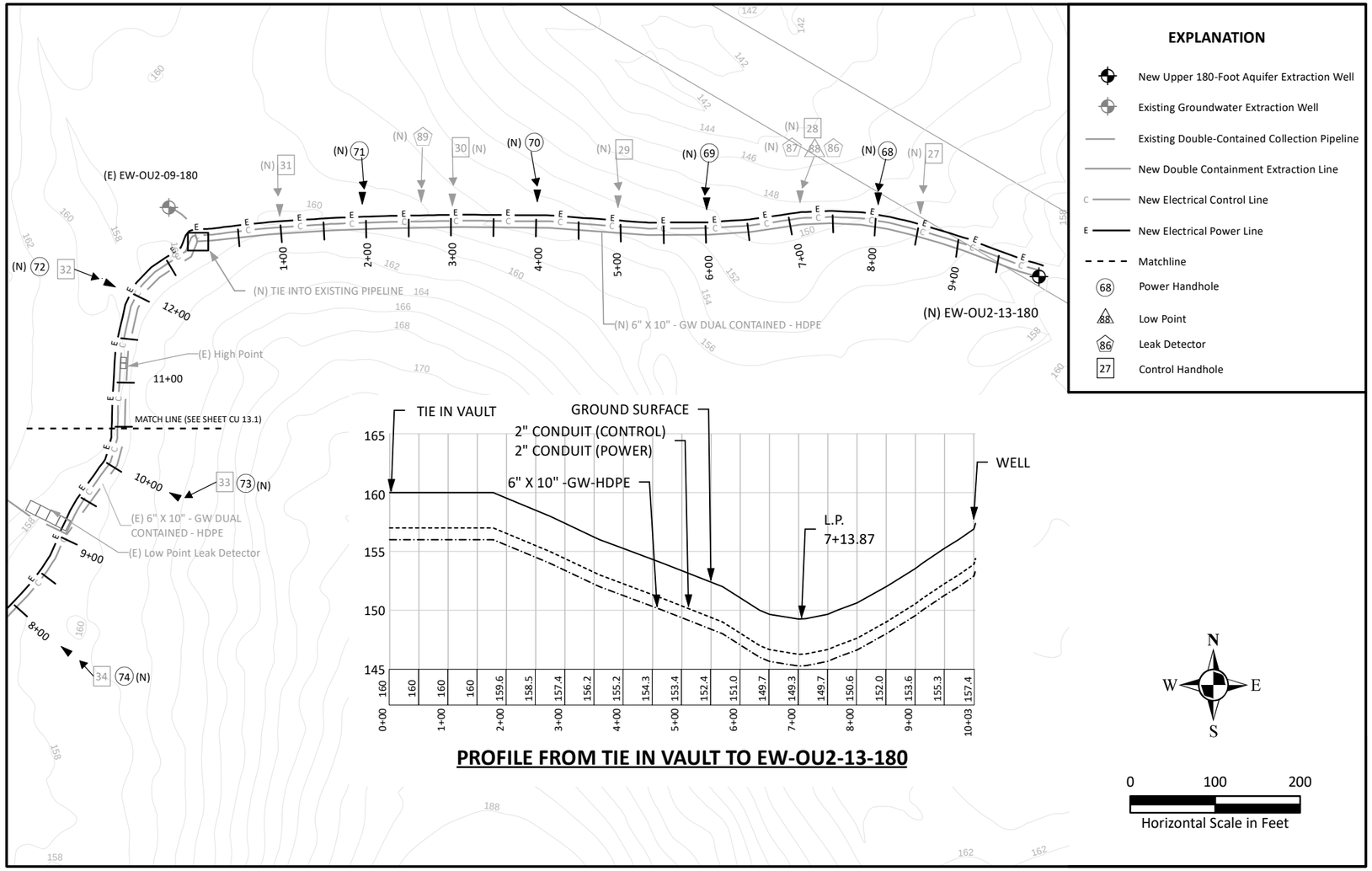
April 2023

ATTACHMENT B

Construction Drawings

UPPER 180-FOOT AQUIFER REMEDIAL DESIGN
CONSTRUCTION DESIGN PLAN

FORMER FORT ORD, CALIFORNIA



PROFILE FROM TIE IN VAULT TO EW-OU2-13-180

INSTRUMENTATION DRAWING INDEX

FORT ORD, CA

SHEET NO.	DRAWING NO.	DRAWING TITLE
1	CU1	COVER SHEET
2	CU2	INSTRUMENTATION SYMBOLS AND ABBREVIATIONS
3	CU3	GWTP FIELD PIPING
4	CU4	BUNKER HILL FIELD PIPING
5	CU5	EW-OU2-13-180 FIELD PIPING
6	CU5.1	EW-OU2-13-180 FIELD PIPING
7	CU6	EXTRACTION WELL SCHEMATIC
8	CU7	EXTRACTION WELLHEAD DETAILS
9	CU8	VAULT DETAILS
10	CU9	VAULT PIPING DETAILS
11	CU10	TRENCH DETAILS
12	CU11	GWTP FIELD ELECTRICAL
13	CU12	BUNKER HILL FIELD ELECTRICAL
14	CU13	EW-OU2-13-180 FIELD ELECTRICAL

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE:
FILE:
DRAWN:
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
CONSTRUCTION DRAWING
COVER SHEET

SCALE: NONE
DRAWING NUMBER: CU1
SHEET NUMBER: 1 OF 13

SINGLE LINE LEGEND:

- NORMALLY OPEN RELAY CONTACT
- NORMALLY CLOSED RELAY CONTACT
- GROUND CONNECTION
- PRESSURE SWITCH OPEN ON INCREASE
- NORMALLY CLOSED FLOAT SWITCH
- SINGLE BREAK SWITCH
- NORMALLY OPEN MOMENTARY PUSH BUTTON
- NORMALLY CLOSED MOMENTARY PUSH BUTTON
- TWO POSITION CONTACT
- THERMAL OVERLOAD DEVICE
- THREE PHASE MOTOR WITH 5HP (5 HP)
- ELECTRONIC METERING AND PROTECTION PANEL (EMP)
- CONTROL RELAY (R)
- PLC PANEL
- FUSE WITH RATING
- DRAW-OUT BREAKER 4,000A FRAME 4,000A TRIP
- TRANSFORMER W/GROUNDED SECONDARY – KVA, SIZE AND VOLTAGE RATIO AS NOTED
- CURRENT TRANSFORMER (IR)
- CURRENT SENSING RELAY (M)
- METER
- CONTROL POWER TRANSFORMER
- "Y" TRANSFORMER, CENTER GROUNDED
- DELTA TRANSFORMER
- EQUIPMENT DISCONNECT
- MOTOR STARTER (COORDINATE WITH MECHANICAL FOR CONTROL)
- TRANSFORMER (MOUNTED ON THE PAD)
- EQUIPMENT ENCLOSURE
- PANEL MOUNTED GROUND BUS BAR
- GROUND ROD
- UFER GROUND
- GROUNDED WATER PIPE
- COMMUNICATION GROUND BAR

400 A
3P LSIG

CIRCUIT BREAKER 400 AMPERE, 3 POLE
L CIRCUIT PROTECTION AGAINST OVERLOAD WITH LONG INVERSE TIME DELAY TRIP
S CIRCUIT PROTECTION AGAINST OVERLOAD WITH SHORT INVERSE OR DEFINITE TIME DELAY TRIP
I CIRCUIT PROTECTION AGAINST INSTANTANEOUS SHORT CIRCUIT ADJUSTABLE TRIP
G CIRCUIT PROTECTION AGAINST EARTH FAULTS

MOLDED CASE CIRCUIT BREAKER

ABBREVIATIONS:

1HA	480/277V PANEL (# INDICATES FLOOR)
1LA	120/208V PANEL (# INDICATES FLOOR)
A	AMPERES
AC	AIR CONDITIONING UNIT
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
AWG	AMERICAN WIRE GAUGE
C	CONDUIT
CB	CIRCUIT BREAKERS
CH	CHILLER
CHW	CIRCULATING PUMP HOT WATER
DWG	DRAWING
(E)	EXISTING
IAC	INTERRUPTABLE ALLOWABLE CURRENT
EF	EXHAUST FAN
ES	EMERGENCY SHOWER
EWH	ELECTRIC WATER HEATER
EWS	EYE WASH STATION
FC	FIRE CONTROL
FSCP	FIRE SPRINKLER CONTROL PANEL
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GW	GROUND WIRE
H	INFRARED HEATER
HDPE	HIGH-DENSITY POLYETHYLENE
HF	HARMONIC FILTER
HOA	HAND-OFF-AUTO SWITCH
HP	HORSE POWER
HZ	HERTZ
IAC	INTERRUPTABLE ALLOWABLE CURRENT
IDC	INDICATOR CONTROL SWITCH
ISH	INDICATOR SWITCH HIGH
J	JUNCTION BOX
LSH	LEVEL SWITCH HIGH
MSB	MAIN SWITCH BOARD
MTG	MOUNTING
(N)	NEW
(O)	OHM CURRENT RESISTANCE IN OHMS
P	PRIMARY CONDUIT
PDSH	PRESSURE DIFFERENTIAL SWITCH HIGH
PH,ø	PHASE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PNL	PANEL
PR	PAIR
PSH	PRESSURE SWITCH HIGH
(RE)	REMOVE
S	SPARE CONDUIT
SHT	SHEET
SPS	SAFETY PRESSURE SWITCH
SUB	SUBSTATION
SW	SWITCH
SWF	SINE WAVE FILTER
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP	TYPICAL
V	VOLTS
VFD	VARIABLE FREQUENCY DRIVE
W	WATTS
W/A	WATTS/AMPS
WP	WATER PROOF
XFRM	TRANSFORMER

GENERAL NOTES:

1. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST NATIONAL ELECTRICAL CODE (NEC), NFPA, IEEE AND APPLICABLE U.S. ARMY REGULATIONS.
2. THE ELECTRICAL INSTALLATION SHALL BE GROUNDED IN ACCORDANCE WITH ARTICLE 250 OF THE NEC.
3. MOUNTING HEIGHTS ABOVE FINISHED FLOOR ARE AS INDICATED BELOW UNLESS OTHERWISE NOTED ON THE DRAWINGS:

PANELBOARD	72" TO TOP OF PANELBOARD
WALL TOGGLE SWITCH	48" TO CENTER OF COVER PLATE
RECEPTACLE	12" TO CENTER OF COVER PLATE
MOTOR STARTER	60" TO CENTER OF COVER PLATE

4. ALL POWER PANELBOARDS AND COMMUNICATIONS CABINETS SHALL BE PROVIDED WITH GROUNDING SYSTEMS PER NEC ARTICLE 250.
5. MINIMUM SIZE CONDUIT/CONDUCTORS IS 3/4" W/ (2) #12ga+12ga GROUND.
6. ALL VDF'S SHALL BE PROVIDED WITH LINE SIDE FILTER AND MANUAL BYPASS SWITCH.

COMMUNICATION LEGEND

- DATACOMM RECEPTACLE
- TELEPHONE/DATA RECEPTACLE
- CCTV INTERNET PROTOCOL (IP) ADDRESSABLE FIXED CAMERA (RATED FOR THE ENVIRONMENT)

TELECOMMUNICATION & CONTROL CONDUIT LEGEND

- CLOSED CIRCUIT TV
- EXISTING TELEPHONE AERIAL
- NEW TELEPHONE AERIAL
- NEW TELEPHONE UNDERGROUND
- CONDUIT TURNING UP
- CONDUIT TURNING DOWN
- NEW CONTROL CONDUIT UNDERGROUND

ELECTRICAL CONDUIT LEGEND

- EXISTING ELECTRICAL AERIAL
- NEW ELECTRICAL AERIAL
- NEW ELECTRICAL UNDERGROUND

LEGEND:

- WALL MOUNTED FIXTURE (SUITABLE FOR OUTDOOR) ("*" REPRESENT TYPE OF FIXTURE; SEE LIGHTING SCHEDULE)
- 2x4 LIGHT FIXTURE
- 2x4 LIGHT FIXTURE WITH BATTERY
- 1x4 LIGHT FIXTURE
- 1x4 LIGHT FIXTURE WITH BATTERY
- FLUORESCENT STRIP LINEAR FIXTURE (SUSPENDED)
- FLUORESCENT STRIP LINEAR FIXTURE (WALL MOUNTED)
- FLUORESCENT STRIP LINEAR FIXTURE (SUSPENDED) EMERGENCY ILLUMINATION
- EMERGENCY LIGHT, BATTERY POWERED
- RECESSED DOWNLIGHT IN HARDLID CEILING
- WALL MOUNTED EXIT SIGN – SINGLE FACE
- POLE MOUNTED FIXTURE (SUITABLE FOR OUTDOORS)
- SURFACE MOUNTED ELECTRICAL PANEL
- FLUSH MOUNTED PANEL BOARD
- SINGLE POLE SWITCH (20A, 120V) ("a" DENOTES LCP CHANNEL)
- 4 SQ. MM. METAL JUNCTION BOX. LEADER REPRESENT CIRCUIT DESIGNATION (TYP)
- WALL MOUNTED JUNCTION BOX
- 20A, 120V DUPLEX RECEPTACLE. LEADER REPRESENT CIRCUIT DESIGNATION (TYP)
- 20A, 120V GFCI RECEPTACLE. (+42" INDICATES MOUNTING HEIGHT)
- 20A, 120V QUAD RECEPTACLE
- WALL MOUNTED PHOTO CELL (SUITABLE FOR OUTDOORS)
- TRAFFIC RATED HANDHOLE
- DULL TECHNOLOGY OCCUPANCY SENSOR
- UTILITY POLE
- THREE PHASE MOTOR
- 20A, SINGLE POLE RELAY, VOLTAGE AS NOTED
- HAND HOLD
- HAND HOLD NUMBER

MECHANICAL EQUIPMENT (REFER TO MECHANICAL DRAWINGS FOR EXACT LOCATION AND DETAILS) LEADER REPRESENT CIRCUIT DESIGNATION (TYP)

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: HR
CHECKED: HR

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

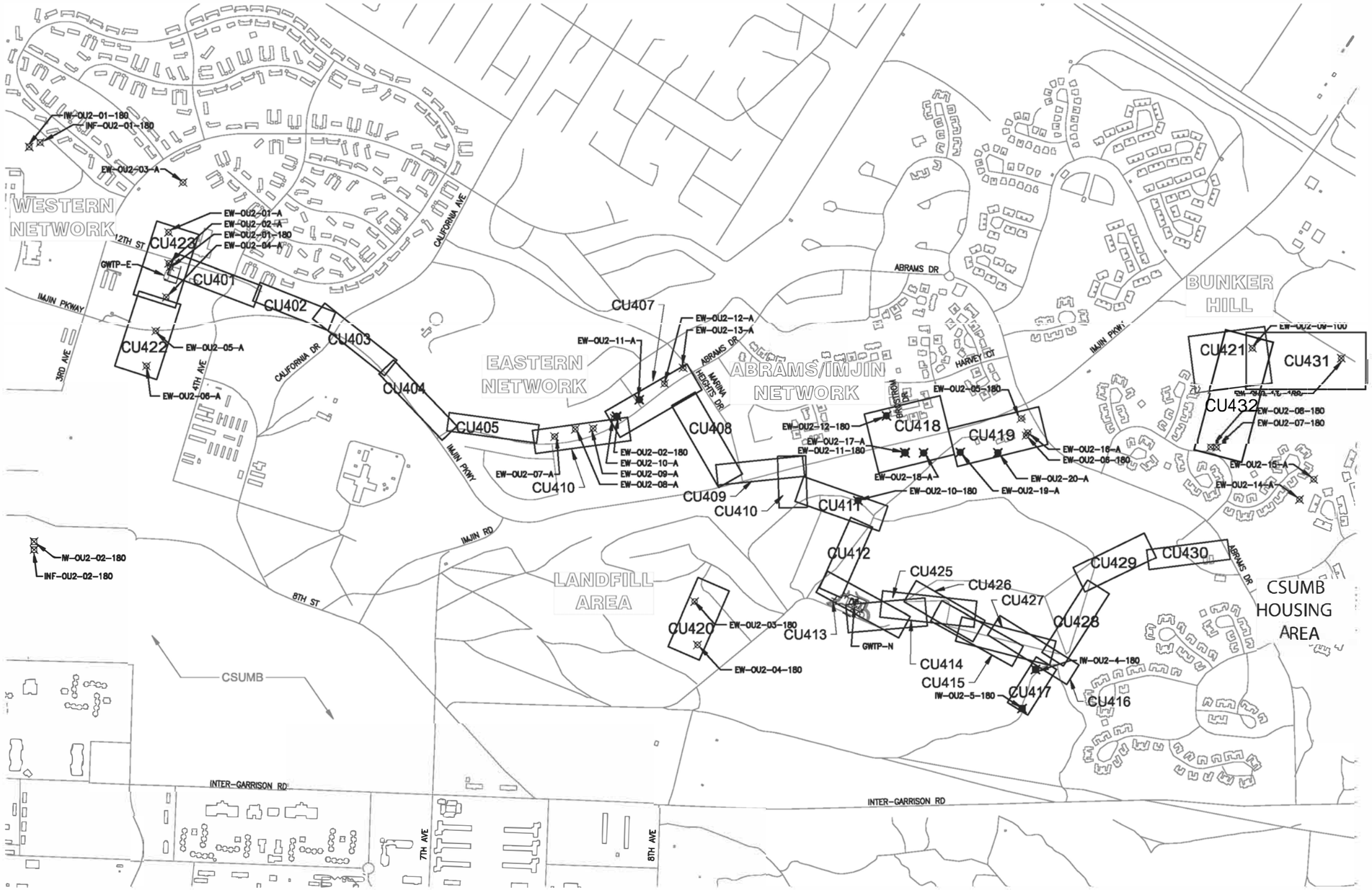
KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD
FORT ORD GWTP
INSTRUMENTATION SYMBOLS & ABBREVIATION

SCALE: NONE
DRAWING NUMBER: CU2
SHEET NUMBER: 2 OF 13



CU431 WILL BE THE LOCATION OF THE NEW EXTRACTION WELL

NOTES.

1. SHEETS CU401 THOUGH CU423 INDICATE THE ALIGNMENTS FOR THE EW AND TW PIPELINES.
2. SHEETS CU425 THROUGH CU430 INDICATE THE ALIGNMENT FOR THE PW PIPELINE.

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

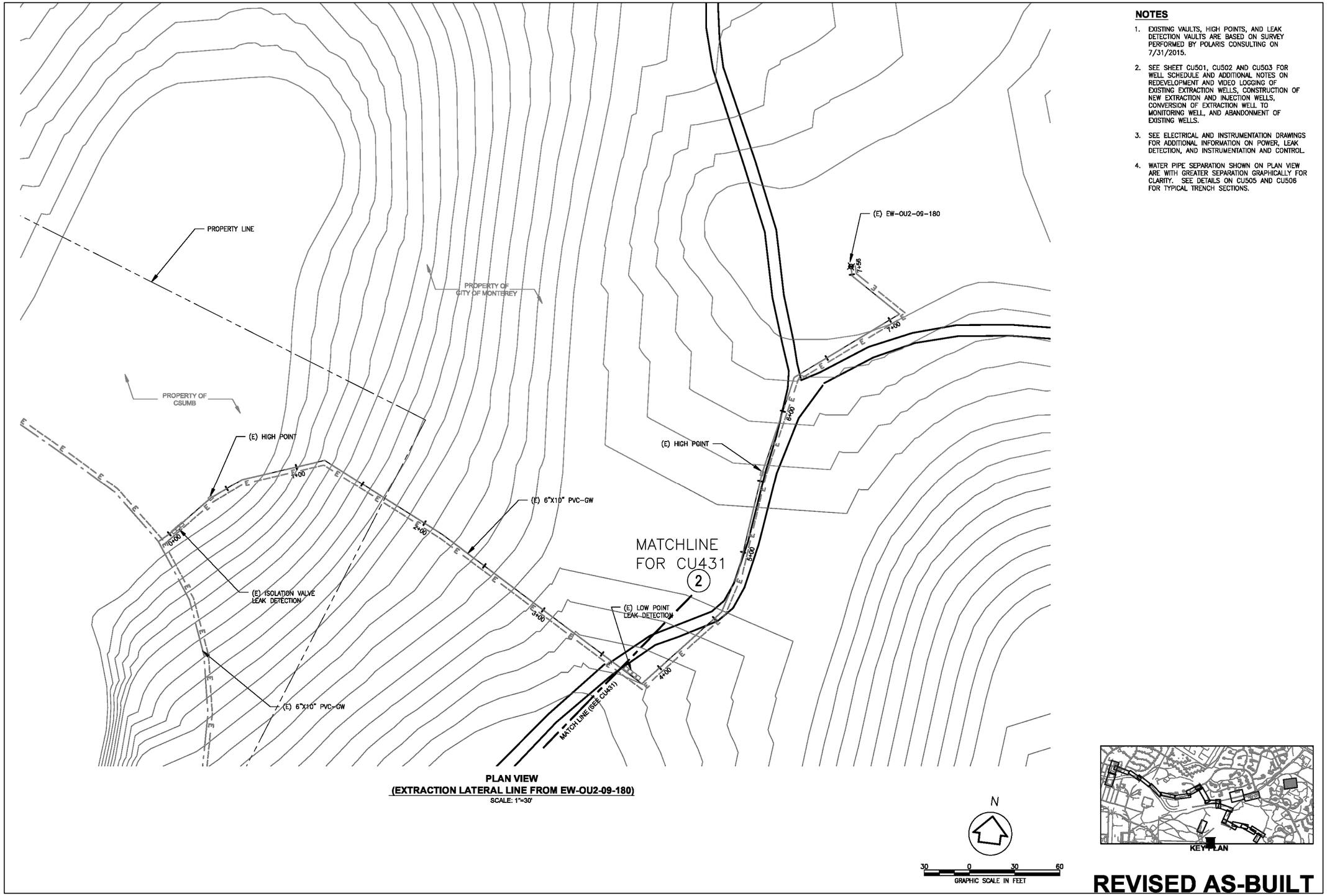
Ahtna

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1				
	2				
	3				
	4				

APPROVAL RECOMMENDED: DATE
APPROVED: DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
FORT ORD GWTP
FIELD PIPING

SCALE: NOT TO SCALE
DRAWING NUMBER: CU3
SHEET NUMBER: 3 OF 13



PLAN VIEW
(EXTRACTION LATERAL LINE FROM EW-OU2-09-180)
SCALE: 1"=30'

NOTES

1. EXISTING VAULTS, HIGH POINTS, AND LEAK DETECTION VAULTS ARE BASED ON SURVEY PERFORMED BY POLARIS CONSULTING ON 7/31/2015.
2. SEE SHEET CU501, CU502 AND CU503 FOR WELL SCHEDULE AND ADDITIONAL NOTES ON REDEVELOPMENT AND VIDEO LOGGING OF EXISTING EXTRACTION WELLS, CONSTRUCTION OF NEW EXTRACTION AND INJECTION WELLS, CONVERSION OF EXTRACTION WELL TO MONITORING WELL, AND ABANDONMENT OF EXISTING WELLS.
3. SEE ELECTRICAL AND INSTRUMENTATION DRAWINGS FOR ADDITIONAL INFORMATION ON POWER, LEAK DETECTION, AND INSTRUMENTATION AND CONTROL.
4. WATER PIPE SEPARATION SHOWN ON PLAN VIEW ARE WITH GREATER SEPARATION GRAPHICALLY FOR CLARITY. SEE DETAILS ON CU505 AND CU506 FOR TYPICAL TRENCH SECTIONS.

KEY PLAN

REVISED AS-BUILT
NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

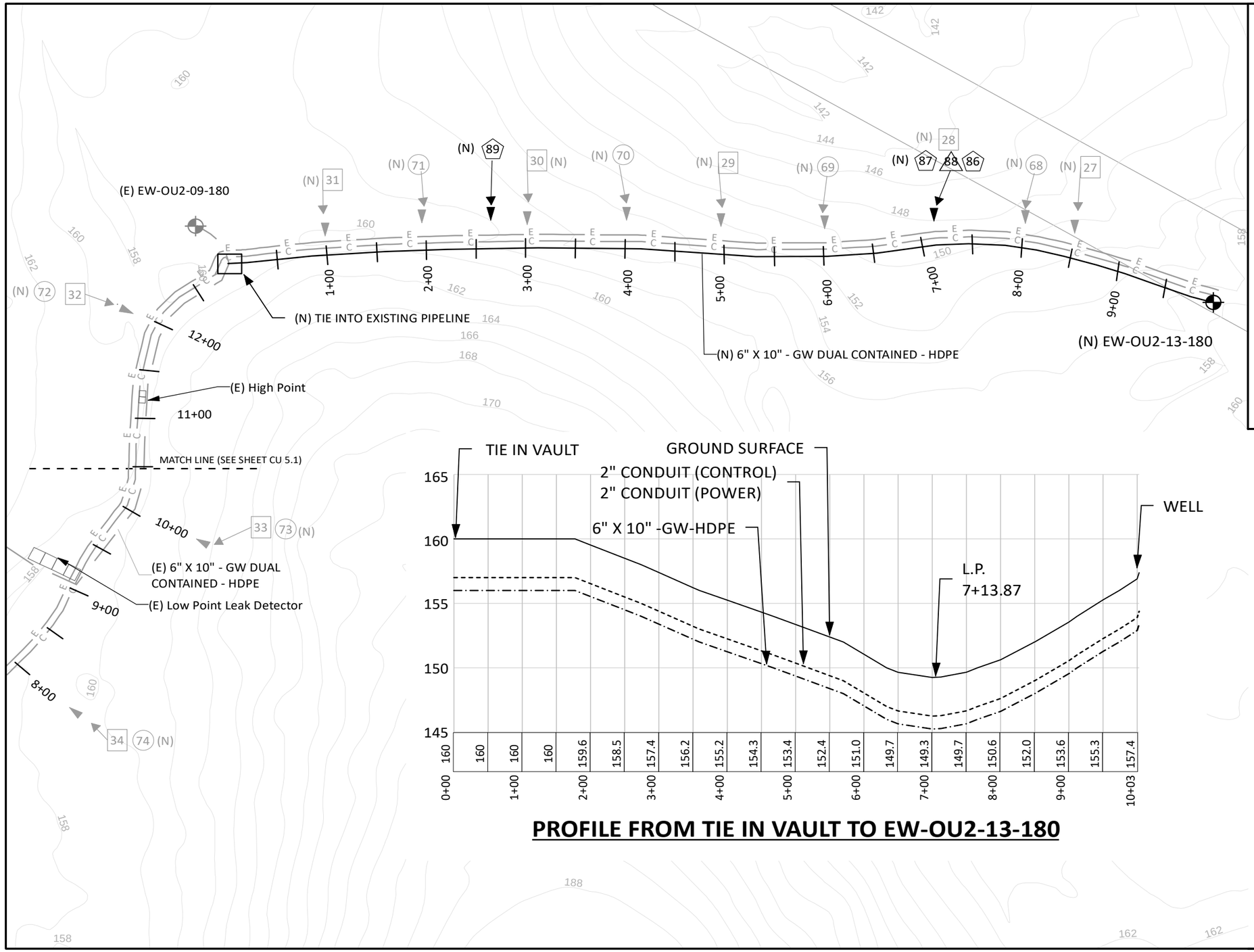
Ahtna

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL NETWORK
FIELD PIPING

SCALE NONE
DRAWING NUMBER CU4
SHEET NUMBER 4 OF 13



PROFILE FROM TIE IN VAULT TO EW-OU2-13-180

EXPLANATION

- New Upper 180-Foot Aquifer Extraction Well
- Existing Groundwater Extraction Well
- Existing Double-Contained Collection Pipeline
- New Double Containment Extraction Line
- C — New Electrical Control Line
- E — New Electrical Power Line
- Matchline
- 68 — Power Handhole
- 88 — Low Point
- 86 — Leak Detector
- 27 — Control Handhole

N W E S

0 100 200

Horizontal Scale in Feet

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
EW-OU2-13-180
FIELD PIPING

SCALE NONE
DRAWING NUMBER CU5
SHEET NUMBER 5 OF 13

MATCH LINE (SEE SHEET CU 5)

10+00

33 73 (N)

(E) 6" X 10" - GW DUAL CONTAINED - HDPE

(E) Low Point Leak Detector

9+00

8+00

34 74 (N)

(N) 75 35

7+00

6+00

5+00

(N) 76 36

4+00

3+00

(N) 77 37

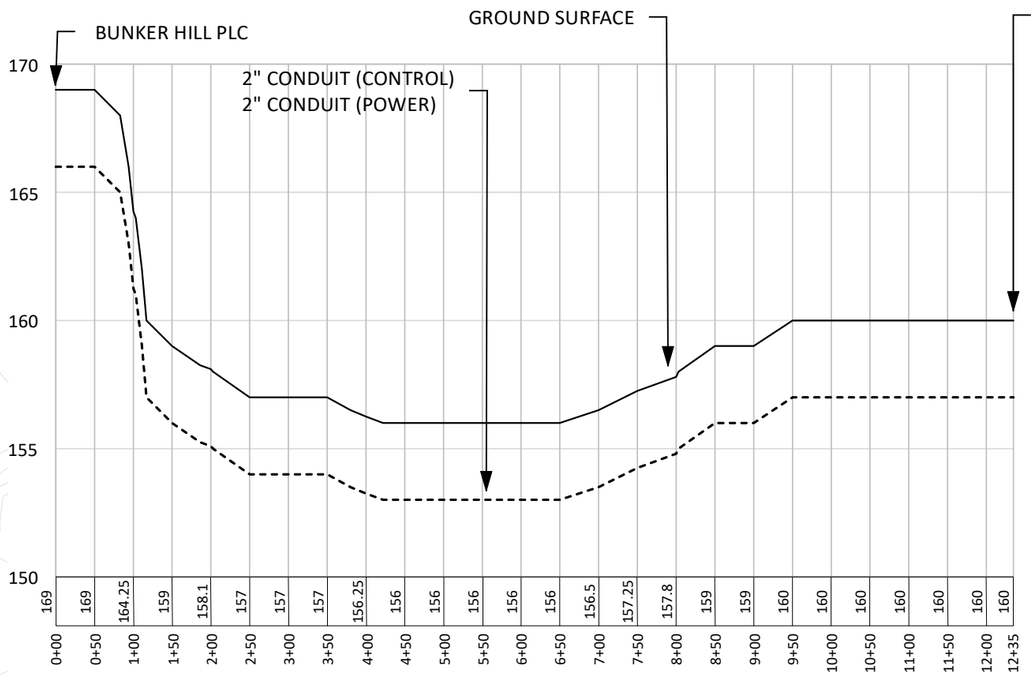
2+00

1+00

Bunker Hill PLC

EXPLANATION

- New Upper 180-Foot Aquifer Extraction Well
- Existing Groundwater Extraction Well
- Existing Double-Contained Collection Pipeline
- New Double Containment Extraction Line
- C — New Electrical Control Line
- E — New Electrical Power Line
- Matchline
- 68 — Power Handhole
- 88 — Low Point
- 86 — Leak Detector
- 27 — Control Handhole



PROFILE FROM BUNKER HILL PLC TO TIE IN VAULT

N W E S

0 100 200

Horizontal Scale in Feet

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"–SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE

APPROVED _____ DATE

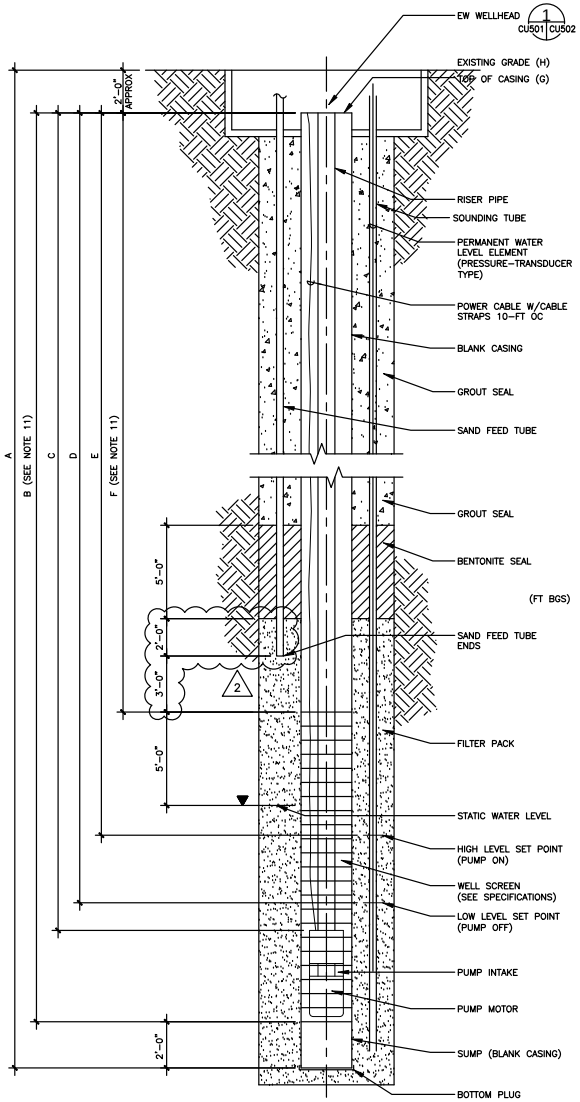
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
EW–OU2–13–180
FIELD PIPING

SCALE NONE

DRAWING NUMBER CU5.1

SHEET NUMBER 5 OF 13



EW SCHEMATIC

NTS

SCHEDULE OF EXISTING EXTRACTION WELLS

	WELL ID	TOTAL CASING DEPTH (FT BGS)	BOTTOM OF SCREEN (FT BGS)	DEPTH TO TOP OF PUMP (FT BTOC)	PUMP-OFF SET PT (FT BTOC)	PUMP-ON SET PT (FT BTOC)	TOP OF SCREEN (FT BGS)	TOC ELEV (FT BTOC)	TOS ELEV (FT BTOC)	NEW PUMP MODEL	FLOW RATE (GPM)	Pressure At Top of Riser (psi)	Pressure At Top of Riser + Surge Pressure (psi)	(E) PUMP HORSE POWER (HP)	(N) PUMP HORSE POWER (HP)	COMMENT
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	
WESTERN NETWORK																
1	EW-OU2-01-A	144	143				113	109.98	-3.02	-	0			5	-	WELL TO BE OFFLINE
2	EW-OU2-02-A	141.5	139.5				109.5	116.26	6.76	-	0			5	-	WELL TO BE OFFLINE
3	EW-OU2-03-A	116	115				75	84.33	9.33	-	0			5	-	WELL TO BE OFFLINE
4	EW-OU2-04-A	136	135				96	109.47	13.47	-	0			5	-	WELL TO BE OFFLINE
5	EW-OU2-05-A	131	130				100	108.99	8.99	90FA1054-PE	50	125	160	10	10	REPLACE EXIST PUMP
6	EW-OU2-06-A	131	130				100	105.57	5.57	90FA1054-PE	50	125	150	10	10	REPLACE EXIST PUMP
7	EW-OU2-01-180	174	173				143	110.79	-32.21	2366169020	160	120	165	30	30	REPLACE EXIST PUMP
EASTERN NETWORK																
8	EW-OU2-07-A	129	128				103	158.56	55.56	-	0			3	-	WELL TO BE OFFLINE
9	EW-OU2-08-A	137	136				106	162.96	56.96	-	0			3	-	WELL TO BE OFFLINE
10	EW-OU2-09-A	137	136				106	162.91	56.91	35FAS54-PE	31	90	165	3	5	VIDEO, RE-DEVELOP, AND RE-VIDEO; REPLACE EXIST PUMP
11	EW-OU2-10-A	142	141				111	167.58	56.58	35FAS54-PE	30	90	165	3	5	VIDEO, RE-DEVELOP, AND RE-VIDEO; REPLACE EXIST PUMP
12	EW-OU2-11-A	141	140				110	170.78	60.78	-	-			3	-	ABANDON
13	EW-OU2-12-A	142	141				106	175.39	68.39	60FAS54-PE	30	80	120	5	5	VIDEO, RE-DEVELOP, AND RE-VIDEO; REPLACE EXIST PUMP
14	EW-OU2-13-A	147	146				116	180.15	64.15	25FA354-PE	25	80	100	5	3	VIDEO, RE-DEVELOP, AND RE-VIDEO; REPLACE EXIST PUMP
15	EW-OU2-02-180	241	240				200	167.28	-32.72	-	-			15	-	ABANDON
ABRAMS/IMJIN NETWORK																
16	EW-OU2-16-A	114.5	109.5				79.5	165.43	87.93	35FAS54	27	90	115	3	5	VIDEO, RE-DEVELOP, AND RE-VIDEO; REPLACE EXIST PUMP
17	EW-OU2-05-180	245	240				180	170.72	-6.78	175STS30D6X-1064	160	90	110	20	30	REPLACE EXIST PUMP
18	EW-OU2-06-180	235.5	230.5				170.5	166.96	-3.54	150ST525DA-0964	135	90	140	20	25	REPLACE EXIST PUMP
BUNKER HILL AREA																
19	EW-OU2-07-180	265	260				210	163.39	-46.61	-	0			-	-	WELL TO BE OFFLINE
20	EW-OU2-08-180	220	215				215	162.31	-12.69	-	0			15	-	WELL TO BE OFFLINE
21	EW-OU2-09-180	220	215				175	149.55	-35.13	100SR15F66-1163	55	95	110	7.5	15	REPLACE EXIST PUMP
CSUMB EAST CAMPUS HOUSING AREA																
22	EW-OU2-14-A	137	129.5				89.5	185.85	96.35	-	0			3	-	WELL TO BE OFFLINE
23	EW-OU2-15-A	142.5	132.5				97.5	194.26	96.76	-	-			3	-	CONVERT TO MONITORING WELL
LANDFILL AREA																
24	EW-OU2-03-180	265	257.5				207	188.39	-18.61	150SR25F66-1163	150	65	95	20	25	REPLACE EXIST PUMP
25	EW-OU2-04-180	302	294.5				244.5	238.55	-5.95	-	0			20	-	WELL TO BE OFFLINE

SCHEDULE OF NEW EXTRACTION WELLS

	WELL ID	TOTAL CASING DEPTH (FT BGS)	BOTTOM OF SCREEN (FT BTOC)	DEPTH TO TOP OF PUMP (FT BTOC)	PUMP-OFF SET PT (FT BTOC)	PUMP-ON SET PT (FT BTOC)	TOP OF SCREEN (FT BTOC)	TOC ELEV (FT BTOC)	TOS ELEV (FT BTOC)	NEW PUMP MODEL	FLOW RATE (GPM)	WELLHEAD SURGE PRES (PSI)	WELLHEAD SURGE PRES (PSI)	(E) PUMP HORSE POWER (HP)	(N) PUMP HORSE POWER (HP)	COMMENT
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)			(K)	(L)	
ABRAMS/IMJIN NETWORK																
1	EW-OU2-17-A	117.5	115	109.5			75			60FAS54-PE	30	85	170	-	5	NEW WELL
2	EW-OU2-18-A	107	104.5	99			64.5			60FAS54-PE	30	90	150	-	5	NEW WELL
3	EW-OU2-19-A	112.5	110	104.5			70			60FAS54-PE	30	85	145	-	5	NEW WELL
4	EW-OU2-20-A	124	121.5	116			81.5			60FAS54-PE	30	85	135	-	5	NEW WELL
5	EW-OU2-10-180	305	302.3	297.12			242.3			150SR20F66-0963	130	40	95	-	20	NEW WELL
6	EW-OU2-11-180	241.3	238.5	232.9			178.5			150SR25F66-1163	130	85	105	-	25	NEW WELL
7	EW-OU2-12-180	231.8	229	221.15			169			150ST525DA-0964	130	90	100	-	25	NEW WELL
EASTERN NETWORK																
8	EW-OU2-11-AR	142.5	140	131.69			100			90FAT54-PE	30	80	105	-	7.5	NEW WELL
9	EW-OU2-02-180R	267.8	265	256.64			205			175STS30D6X-1064	130	85	155	-	30	NEW WELL
BUNKER HILL																
10	EW-OU2-13-180	220	215				175	149.55	-35.13						20.0	NEW WELL (ESTIMATION) TO BE INSTALLED

1

NOTES

1. DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
2. CASINGS AND SCREENS FOR WELLS W/ "A" OR "AR" DESIGNATIONS SHALL BE 6-INCH NOMINAL. CASINGS AND SCREENS FOR WELLS W/ "180" OR "180R" DESIGNATIONS SHALL BE 10-INCH NOMINAL.
3. FOR WELLS TO BE VIDEO LOGGED, SUBCONTRACTOR SHALL PULL ALL EXISTING DOWNHOLE APPURTENANCES BEFORE REHABILITATION AND RE-INSTALL ALL DOWNHOLE APPURTENANCES AFTER REHABILITATION. WELL PUMP AND APPURTENANCES SHALL BE RESTORED TO FULLY OPERATIONAL CONDITION.
4. PUMP MODEL NUMBERS ARE GRUNDFOS.
5. EACH SUBMERSIBLE PUMP SHALL BE INSTALLED WITH SHROUD TO DIRECT INTAKE WATER PAST PUMP MOTOR.
6. RISER PIPES FOR WELLS W/ "A" OR "AR" DESIGNATIONS SHALL BE 1 1/2-INCH NOMINAL PIPES. RISER PIPES FOR WELLS W/ "180" OR "180R" DESIGNATIONS SHALL BE 3-INCH NOMINAL PIPES.
7. CONVERSION OF EW-OU2-15-A TO MONITORING WELL (MW) SHALL INCLUDE REMOVAL OF PUMP, PIPING, ELECTRICAL AND PUMPING APPARATUS FROM WELL AND VAULT AND PLACEMENT OF MONITORING WELL HEAD. EXTEND WELL CASING WITH A 3' STICK-UP ABOVE GROUND SURFACE USING SIMILAR MATERIAL AS WELL CASING. PROVIDE AN ALUMINUM PROTECTIVE CASING WITH A LOCKING HINGED LID OVER THE WELL CASING STICK-UP AND GROUT IN PLACE. A 3'X3'X4" CONCRETE PAD SHALL BE INSTALLED AROUND THE WELL HEAD. INSTALL FOUR BOLLARDS PAINTED SAFETY YELLOW AND FILLED WITH CEMENT. THE BOLLARDS SHALL BE MINIMUM 2" DIAMETER, EXTEND 3' BELOW GROUND SURFACE AND STICKING UP 3' ABOVE GROUND SURFACE. THE WELL ID TAG SHALL INCLUDE WELL ID, WELL DEPTH, SCREENED INTERVAL DEPTH, GROUND SURFACE ELEVATION, AND DATE INSTALLED.
8. TBD DURING WELL DRILLING:
   COLUMN (C): DEPTH TO TOP OF PUMP TBD DURING WELL DRILLING
   COLUMN (D): PUMP – OFF SET POINT
   COLUMN (E): PUMP – ON SET POINT
   COLUMN (G): TOP OF CASING (FOR NEW WELLS)
   COLUMN (H): TOP OF SURFACE (FOR NEW WELLS)
9. SCREENED INTERVAL FOR SOUNDING TUBE SHALL MATCH SCREENED INTERVAL FOR WELL.
10. SEE SPECIFICATIONS FOR WELL CONSTRUCTION MATERIALS.
11. ELEVATIONS OF TOP OF SCREEN AND BOTTOM OF SCREEN ARE ESTIMATED. ACTUAL ELEVATIONS SHALL BE SET IN THE FIELD BY THE PROJECT GEOLOGIST. THE TOP OF SCREENED INTERVAL SHALL BE AT LEAST 5 FEET ABOVE THE STATIC WATER LEVEL.
12. COLUMN (H) SURFACE ELEVATIONS AT EACH EW TBD AFTER DRILLING.
13. ALL PUMP MOTORS ARE 480V/3P.

1. IS BEING PROPOSED FOR THE NEW EXTRACTION WELL.

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

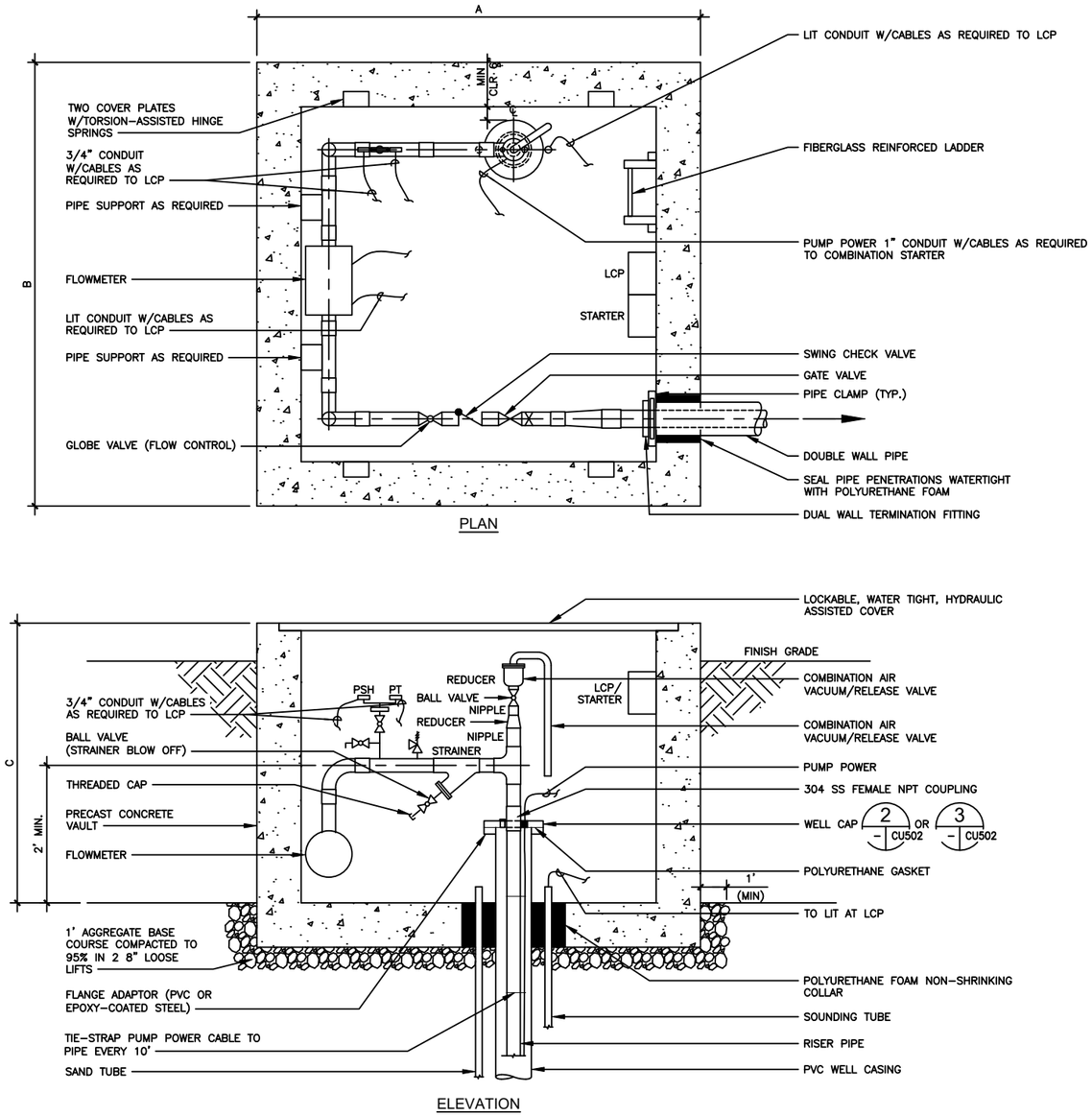
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
		1			
		2			
		3			
		4			

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

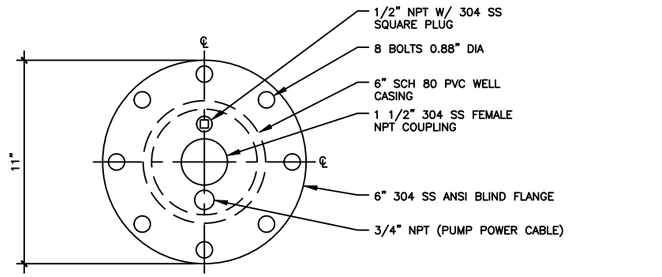
AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL NETWORK
EXTRACTION WELL SCHEMATIC

SCALE: NOT TO SCALE
DRAWING NUMBER: CU6
SHEET NUMBER: 6 OF 13

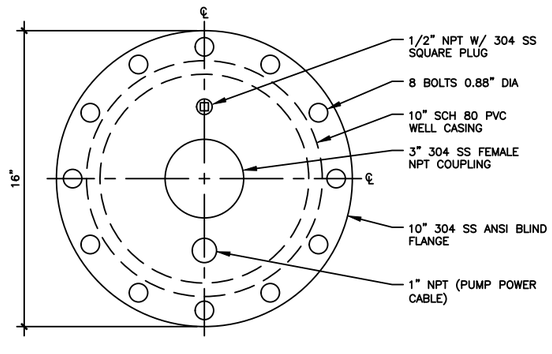


1 CU501 CU502 EW WELLHEAD
NTS



2 CU501 CU502 WELL CAP - A-AQUIFER WELLS
SCALE: 3"=1'-0"

3" 0 3" 6" 9"
SCALE: 3" = 1'-0"



3 CU501 CU502 WELL CAP - 180-FT-AQUIFER WELLS
SCALE: 3"=1'-0"

3" 0 3" 6" 9"
SCALE: 3" = 1'-0"

GRADE LOAD REQUIREMENT – WELL VAULTS

A. 150 PSI
B. H–20 OFF–STREET LOCATION (OCCASIONAL H20 LOADING)

CLASS WATER TIGHTNESS REQUIREMENT – WELL VAULTS

1. NONE – PROVIDE 1 1/2"DIA HOLE 6" FROM EACH CORNER OF EACH LEAF
2. WATER RESISTANT
3. WATER TIGHT

NOTES:

1. DRILLER SHALL INSTALL TEMPORARY CS SLEEVE TO PROTECT WELL CASING EXTENDING APPROXIMATELY 3' ABOVE GRADE.
2. CLASS 2 AND 3 VAULT COVERS SHALL BE EQUIPPED WITH A JOINT GUTTER AND A MOAT TYPE EDGE DRAIN. A 1 1/2" DIA MIN DRAIN CONNECTION SHALL BE PROVIDED.
3. ALL HATCHES SHALL INCLUDE A RECESSED HASP FOR A PADLOCK THAT IS COVERED BY A HINGED LID FLUSH WITH THE SURFACE.
4. COVER SHALL BE GASKET–SEALED AND TORSION–SPRING ASSISTED.
5. ALL HARDWARE FOR THE COVER SHALL BE 304 SS.
6. PRECAST CONCRETE REQUIREMENTS:
   CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 4000 PSI. THE VAULT SHALL BE DESIGNED IN ACCORDANCE WITH ACI 318–89 FOR THE FOLLOWING LATERAL SOIL LOADINGS:
   70 PCF EQUIVALENT FLUID PRESSURE SURCHARGE
   240 PSF FOR WELLHEADS WITH GRADE B OR C COVERS.
7. SEAL ALL PENETRATIONS WITH NON–SHRINKING POLYURETHANE FOAM AND SPECIFICATION.
8. FOR ELECTRICAL REQUIREMENTS SEE ELECTRICAL SHEETS.
9. ALL CABLES EXPOSED TO PHYSICAL DAMAGE SHALL BE RUN IN CONDUIT.
10. SEE SHEET M–501 FOR DETAILS FOR SAMPLE PORTS AND PRESSURE INSTRUMENTS.

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"–SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

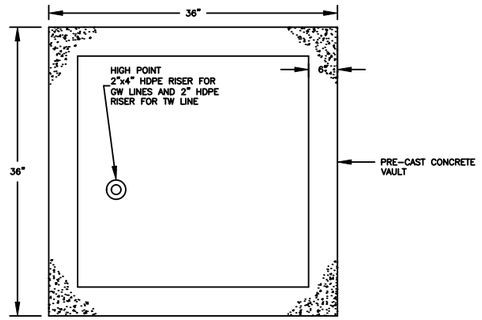
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

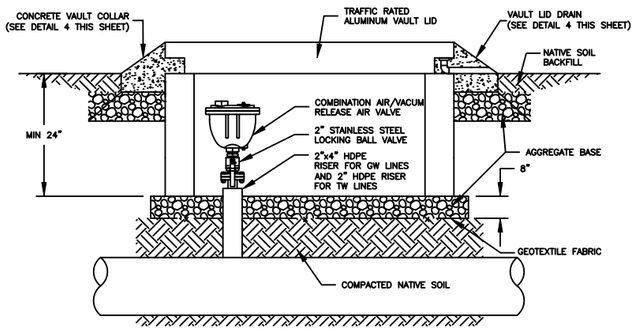
AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL NETWORK
EXTRACTION WELLHEAD DETAILS

SCALE NONE
DRAWING NUMBER CU7
SHEET NUMBER 7 OF 13



PLAN VIEW

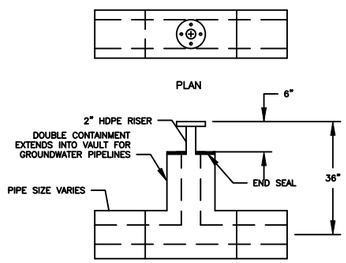


CROSS SECTION

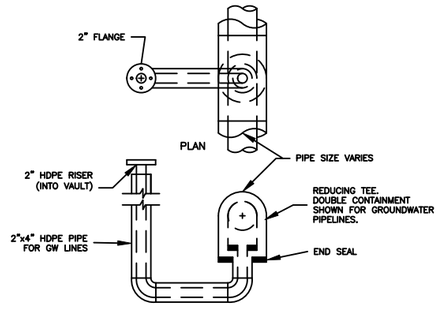
NOTES

1. AT HIGH POINTS INSTALL NON-SHOCK COMBINATION VACUUM BREAK AND PRESSURE RELEASE VALVE ON RISER.

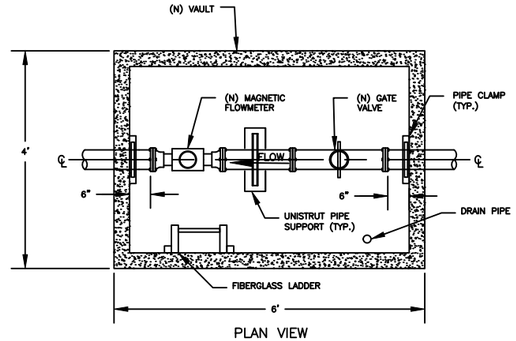
1 HIGH POINT VAULT
CU SHEET | CU507 SCALE: N.T.S.



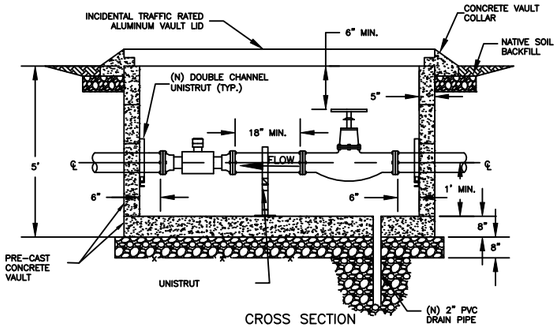
2 HIGH POINT VENT DETAIL
CU SHEETS | CU507 SCALE: N.T.S.



3 LOW POINT DRAIN DETAIL
CU SHEETS | CU507 SCALE: N.T.S.



PLAN VIEW

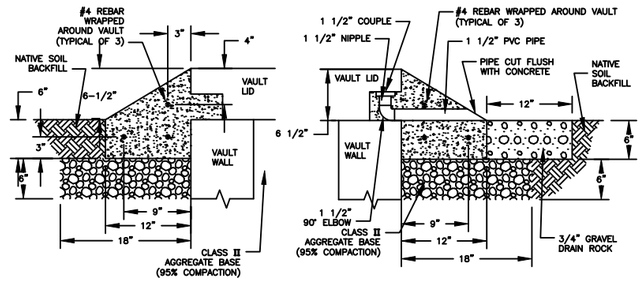


CROSS SECTION

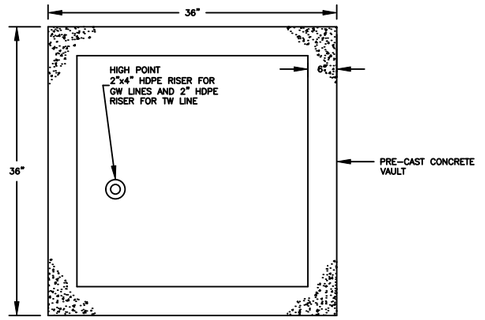
NOTES

1. A MINIMUM OF FIVE (5) PIPE DIAMETERS OF STRAIGHT PIPE MUST BE MAINTAINED FROM THE CENTER OF THE MAGNETIC FLOWMETER ON THE UPSTREAM SIDE.
2. A MINIMUM OF TWO (2) PIPE DIAMETERS OF STRAIGHT PIPE MUST BE MAINTAINED FROM THE CENTER OF THE MAGNETIC FLOWMETER ON THE DOWNSTREAM SIDE.
3. A MINIMUM OF TEN (10) PIPE DIAMETERS OF STRAIGHT PIPE MUST BE MAINTAINED FROM THE CENTER OF THE MAGNETIC FLOWMETER TO ANY PIPE TEE ON THE UPSTREAM SIDE.
4. FOR ADDITIONAL INFORMATION ON THE MAGNETIC FLOWMETER, REFER TO ELECTRICAL, INSTRUMENTATION, AND CONTROLS DRAWINGS.

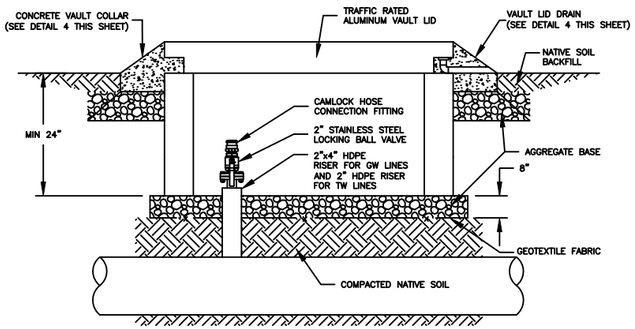
5 FLOW METER VAULT
CU423 | CU507 SCALE: N.T.S.



4 LOW/HIGH POINT VAULT
CU SHEETS | CU507 SCALE: N.T.S.



PLAN VIEW



CROSS SECTION

NOTES

1. AT HIGH POINTS INSTALL NON-SHOCK COMBINATION VACUUM BREAK AND PRESSURE RELEASE VALVE ON RISER.

6 LOW POINT VAULT
CU SHEET | CU507 SCALE: N.T.S.

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

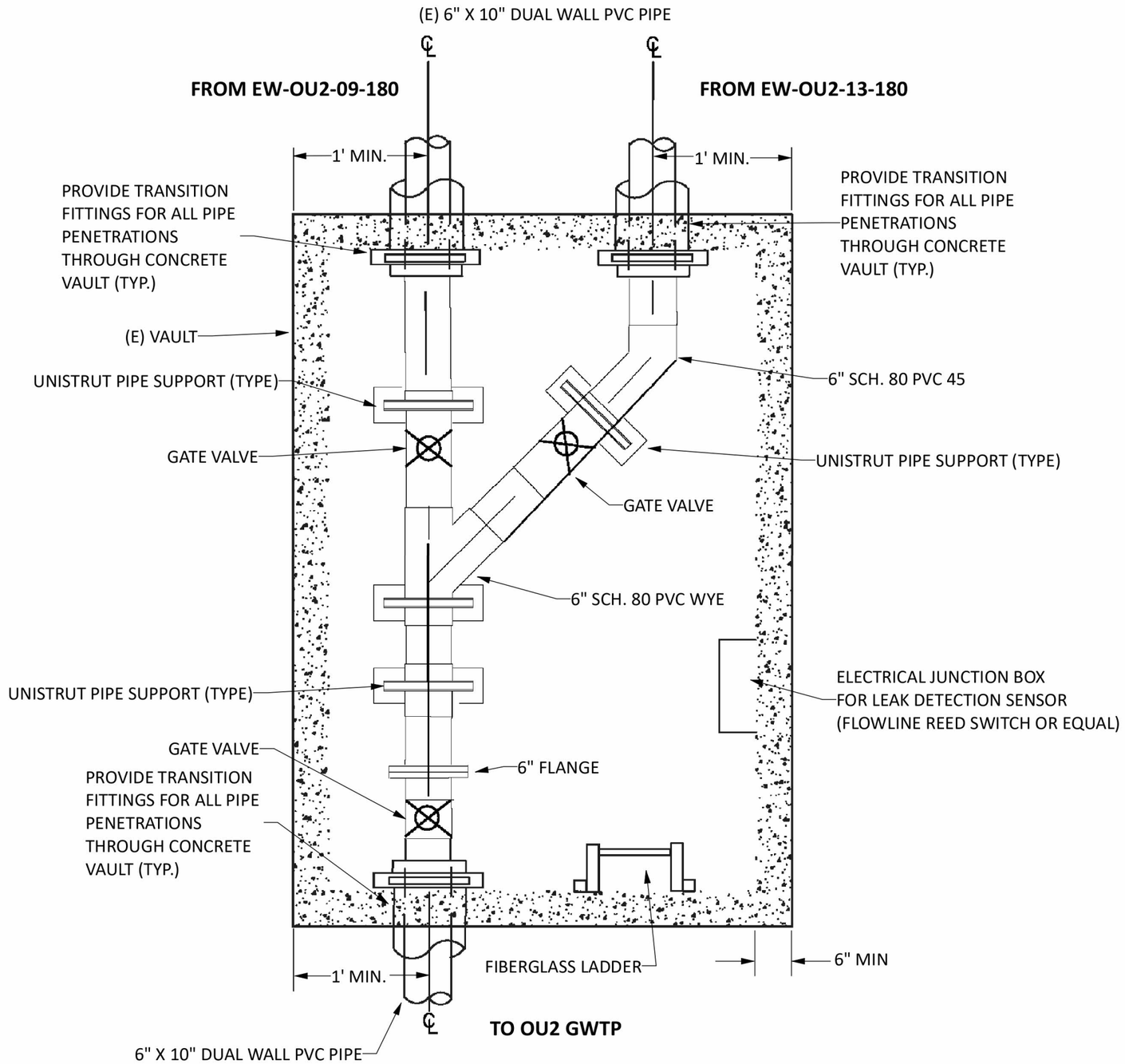
APPROVAL RECOMMENDED DATE
APPROVED DATE

CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL NETWORK
VAULT DETAILS

SCALE
NOT TO SCALE
DRAWING NUMBER
CU8
SHEET NUMBER
8 OF 13



NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

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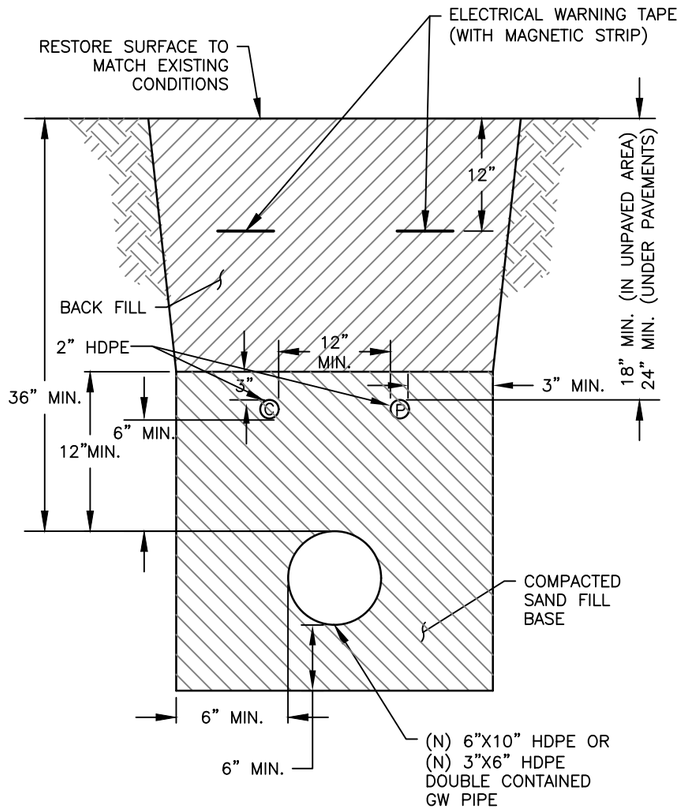
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL NETWORK
VAULT PIPING DETAILS

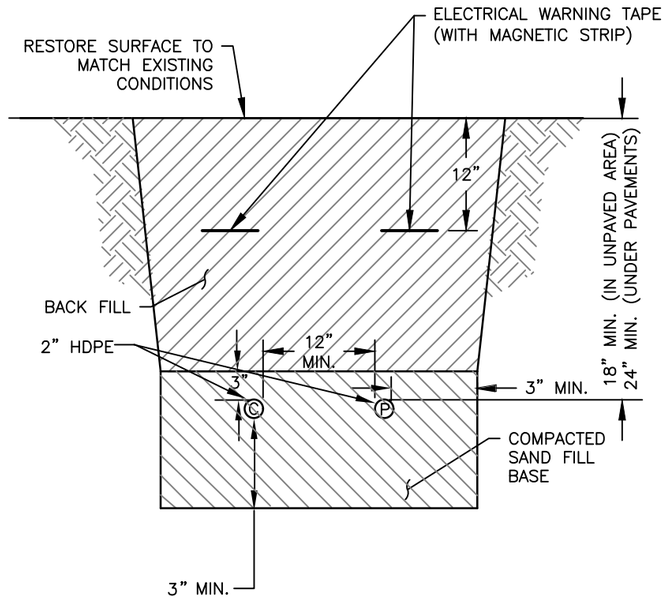
SCALE: NONE
DRAWING NUMBER: CU9
SHEET NUMBER: 9 OF 13



NOTE:
1. FROM EW-OU2-13-180 TO TIE-IN VAULT

1 TRENCH DETAIL
SCALE : N.T.S.

CU5
CU13
S15
CU10



NOTE:
1. FROM TIE-IN VAULT TO BUNKER HILL PLC

2 TRENCH DETAIL
SCALE : N.T.S.

CU5.1
CU12
CU13.1
S14
S15.1
CU10

CONDUIT LEGEND
Ⓒ – CONTROL CONDUIT (2" PVC)
Ⓟ – POWER CONDUIT (2" PVC)

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
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CHECKED:

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SUBMITTAL APPROVED: DATE:

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REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
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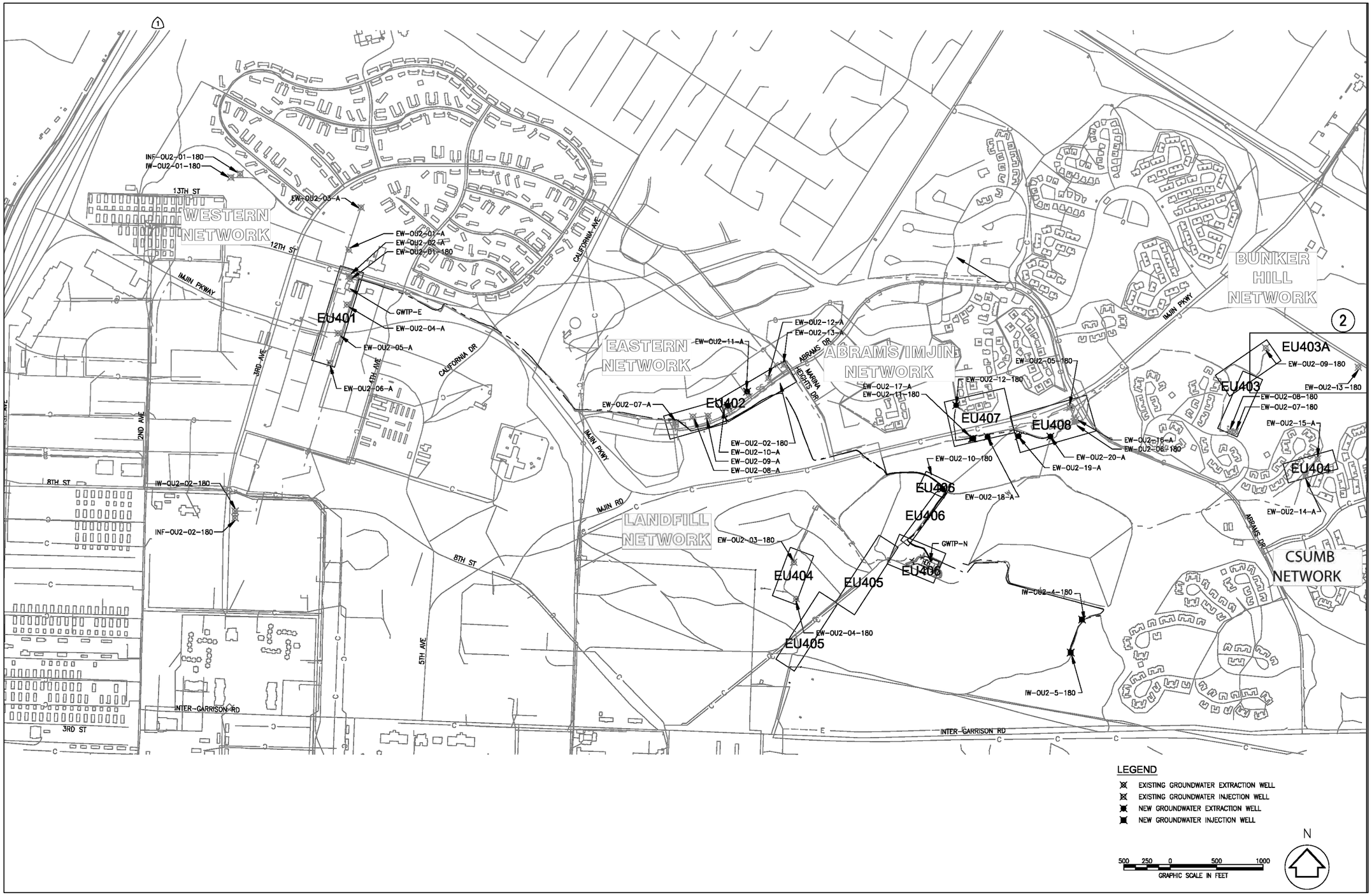
	4				

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL NETWORK
TRENCH DETAILS

SCALE
NOT TO SCALE
DRAWING NUMBER
CU10
SHEET NUMBER
10 OF 13



ADDED KEYBOX EU403A FOR NEW EXTRACTION WELL.

NOT FOR CONSTRUCTION

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REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1				
	2				
	3				
	4				

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

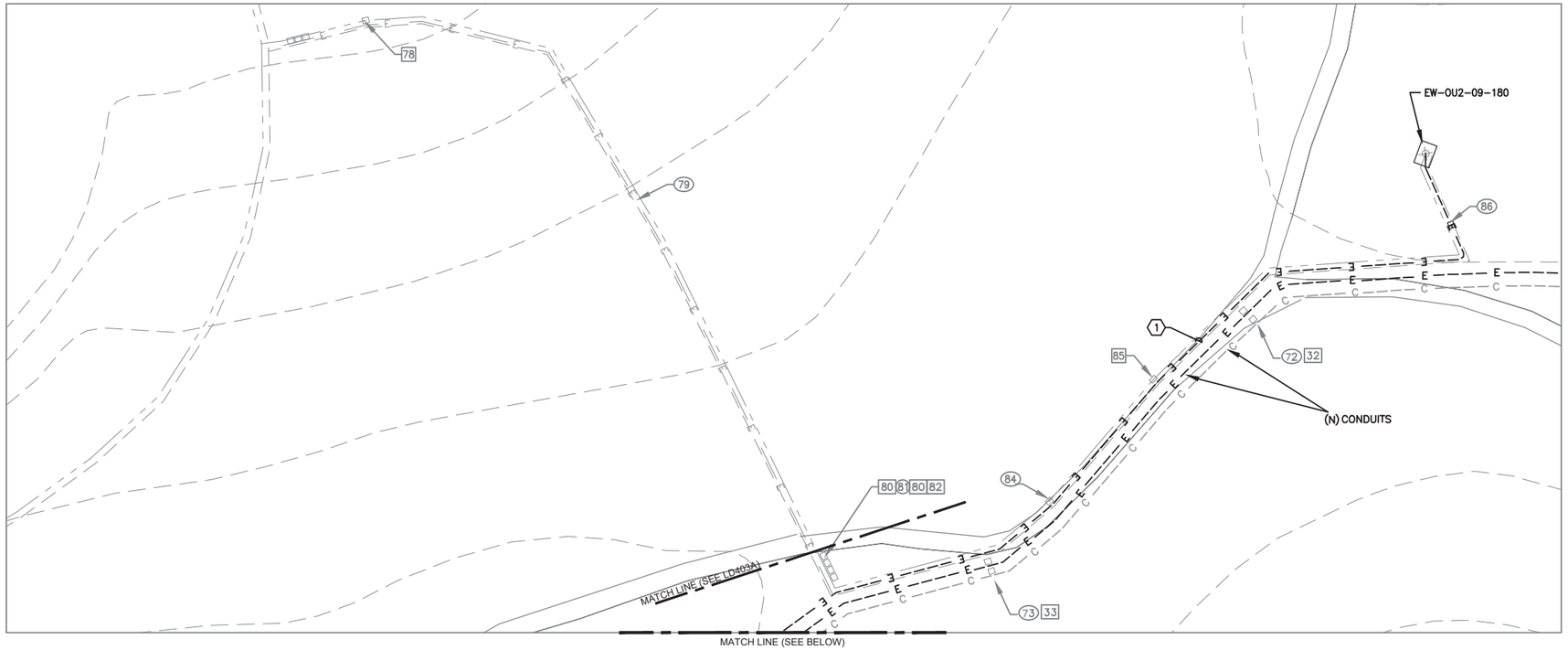
AHTNA GLOBAL, LLC
FORT ORD, CA

FORT ORD GWTP
FIELD ELECTRICAL MAP

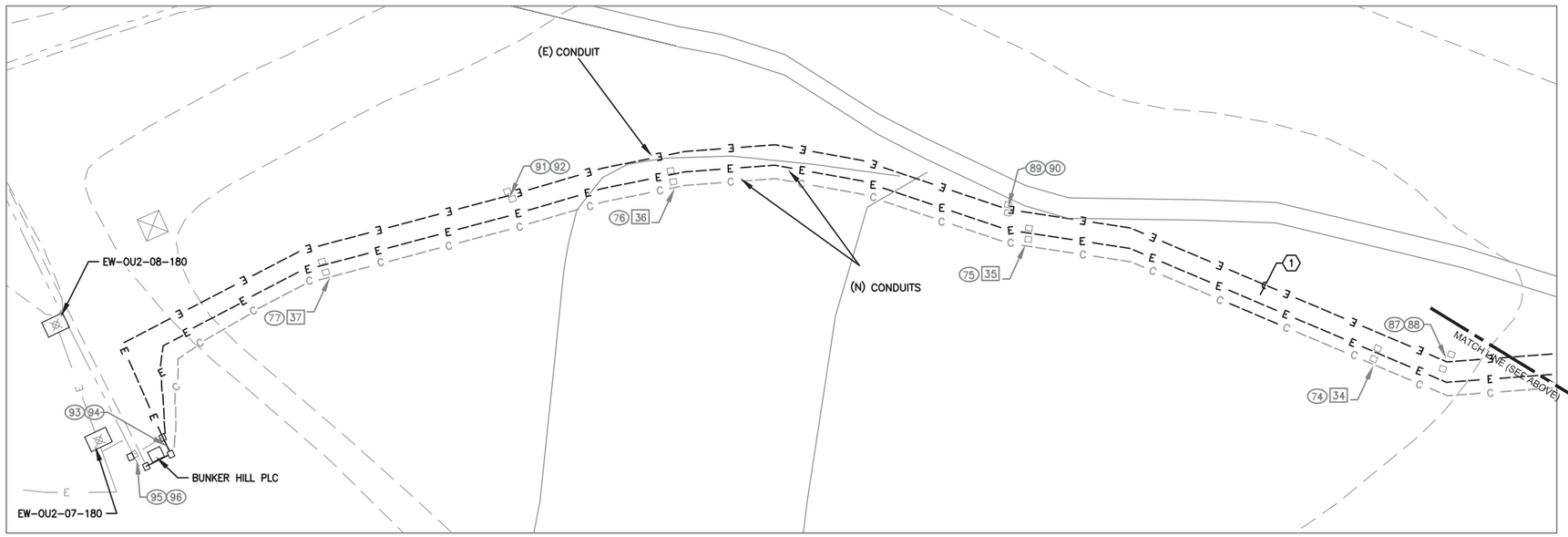
SCALE
NOT TO SCALE

DRAWING NUMBER
CU11

SHEET NUMBER
11 OF 13



1 BUNKER HILL NETWORK
SCALE 1 : 30



2 BUNKER HILL NETWORK
SCALE 1 : 30

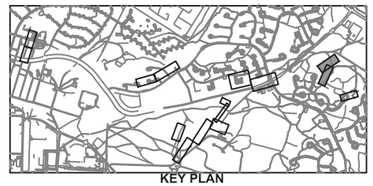
GENERAL NOTES

1. FOR ALL (N) UNDERGROUND METALLIC STRUCTURES PROVIDE CORROSION PROTECTION. THE CONTRACTOR MAY MODIFY THE CATHODIC PROTECTION SYSTEM AS SHOWN IN DETAILS ON E-504 AFTER SITE VERIFICATION AND ANALYSIS.
2. FOR TRAFFIC AND NON-TRAFFIC HANDHOLES SEE DETAIL 1 ON IU501 AND DETAIL 13 ON E-502.
3. SEE CU SHEETS FOR ADDITIONAL TRENCH PROFILES AND DETAILS.

KEYED NOTES

1 (N) CONDUCTORS IN (E) CONDUITS.

30 0 30 60
GRAPHIC SCALE IN FEET



KEY PLAN

NOT FOR CONSTRUCTION

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DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

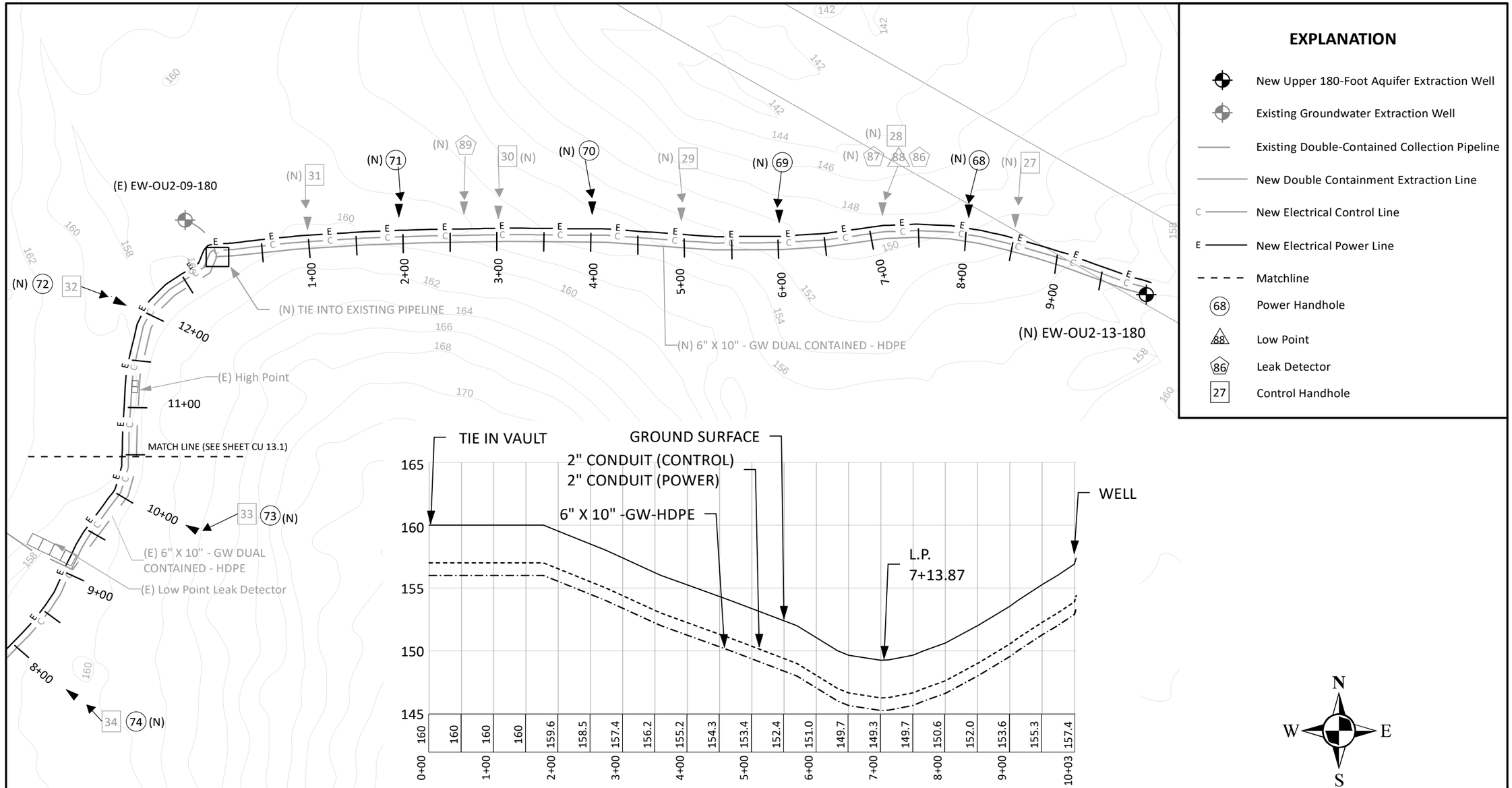
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL
FIELD ELECTRICAL MAP

SCALE NONE
DRAWING NUMBER CU12
SHEET NUMBER 12 OF 13

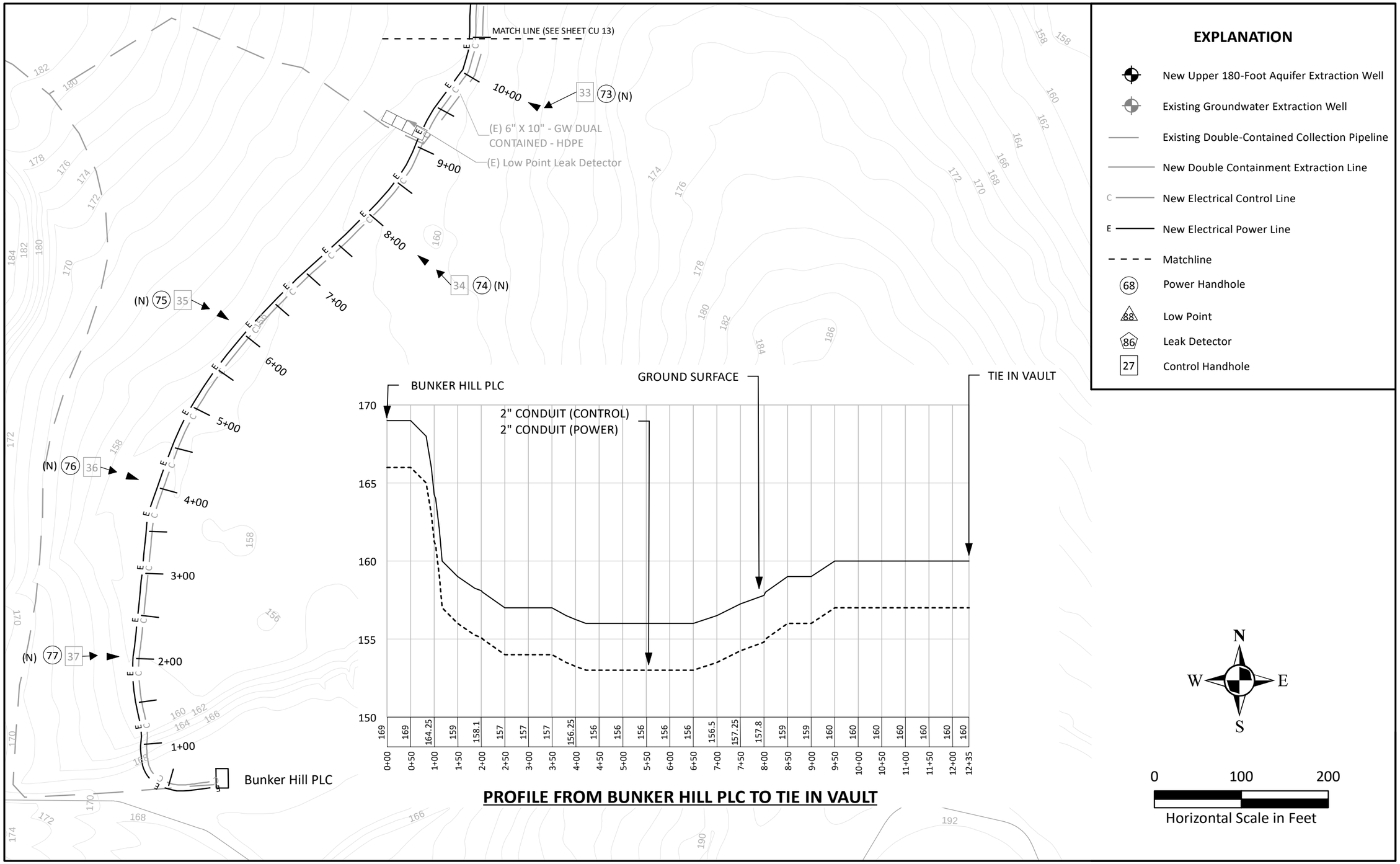


PROFILE FROM TIE IN VAULT TO EW-OU2-13-180

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)	DATE: 01/25/2023 FILE: DRAWN: HR DESIGNED: AHTNA CHECKED:	Ahtna	REVISIONS: ZONE, REV., DESCRIPTION, BY, DATE, APP.	APPROVAL RECOMMENDED ____ DATE APPROVED ____ DATE CONTRACT NUMBER	AHTNA GLOBAL, LLC FORT ORD, CA EW–OU2–13–180 FIELD ELECTRICAL MAP	SCALE: NONE DRAWING NUMBER: CU13 SHEET NUMBER: 13 OF 13

SUBMITTED: _____ DATE: _____
SUBMITTAL APPROVED: _____ DATE: _____



PROFILE FROM BUNKER HILL PLC TO TIE IN VAULT

EXPLANATION

- New Upper 180-Foot Aquifer Extraction Well
- Existing Groundwater Extraction Well
- Existing Double-Contained Collection Pipeline
- New Double Containment Extraction Line
- C — New Electrical Control Line
- E — New Electrical Power Line
- Matchline
- (68) Power Handhole
- 88 Low Point
- (86) Leak Detector
- [27] Control Handhole

N W E S

0 100 200

Horizontal Scale in Feet

NOT FOR CONSTRUCTION

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DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

Ahtna

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

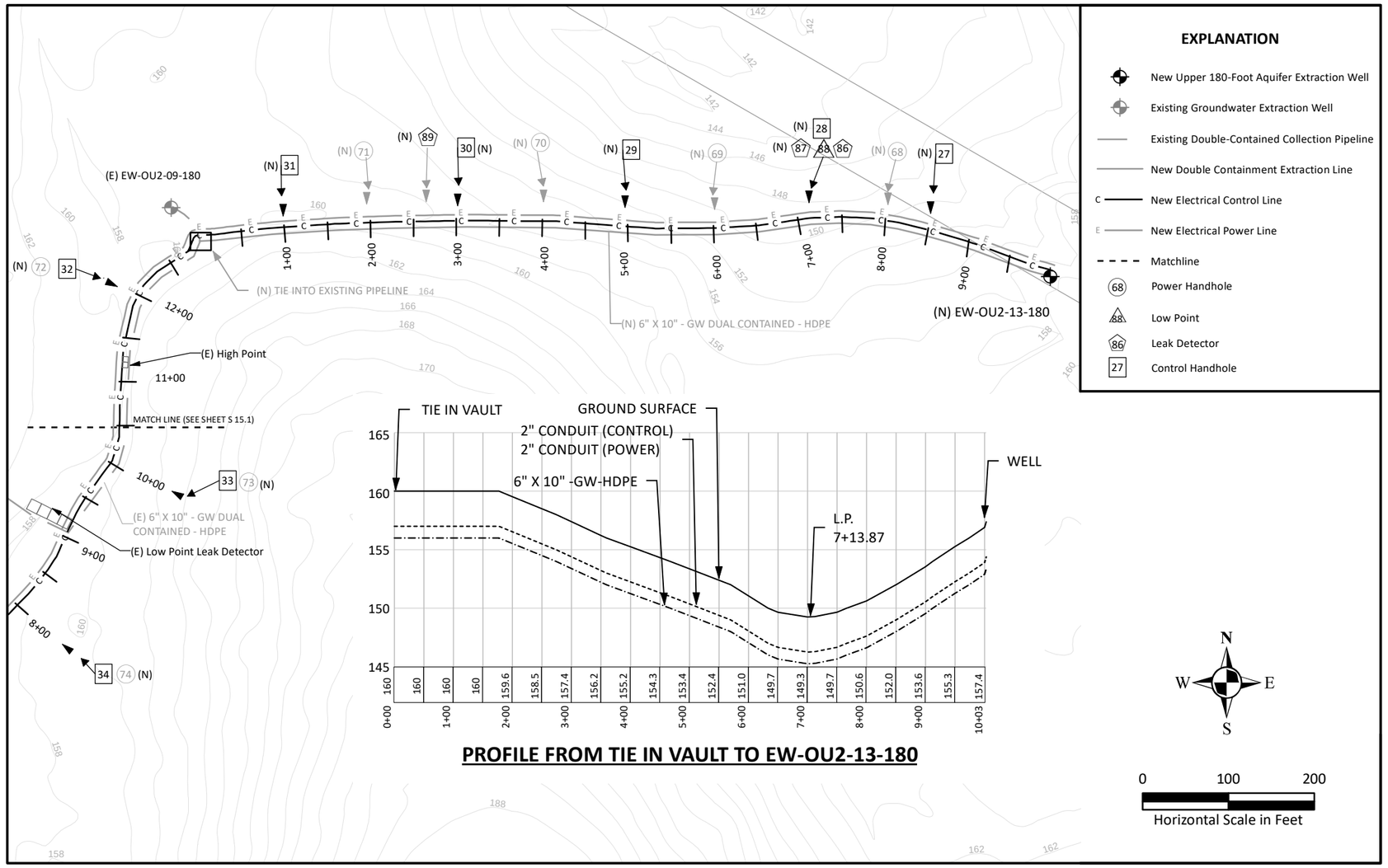
AHTNA GLOBAL, LLC
FORT ORD, CA

EW-OU2-13-180
FIELD ELECTRICAL MAP

SCALE NONE
DRAWING NUMBER CU13.1
SHEET NUMBER 13 OF 13

UPPER 180-FOOT AQUIFER REMEDIAL DESIGN
ELECTRICAL DESIGN PLAN

FORMER FORT ORD, CALIFORNIA



PROFILE FROM TIE IN VAULT TO EW-OU2-13-180

EXPLANATION

- New Upper 180-Foot Aquifer Extraction Well
- Existing Groundwater Extraction Well
- Existing Double-Contained Collection Pipeline
- New Double Containment Extraction Line
- C — New Electrical Control Line
- E — New Electrical Power Line
- Matchline
- (68) Power Handhole
- 88 Low Point
- (86) Leak Detector
- [27] Control Handhole

N
W E
S

0 100 200
Horizontal Scale in Feet

INSTRUMENTATION DRAWING INDEX

FORT ORD, CA

SHEET NO.	DRAWING NO.	DRAWING TITLE
1	S1	COVER SHEET
2	S2	INSTRUMENTATION SYMBOLS AND ABBREVIATIONS
3	S3	ELEMENTARY DIAGRAM
4	S4	P&ID EW-OU2-08-180
5	S5	P&ID EW-OU2-09-180
6	S6	P&ID EW-OU2-13-180
7	S7	LADDER DIAGRAM DIGITAL
8	S8	LADDER DIAGRAM ANALOG
9	S9	ONE LINE
10	S10	INTERNAL PANEL LAYOUT
11	ELD01	FLOW TRANSMITTER LOOP DIAGRAM
12	ELD02	LEVEL TRANSMITTER LOOP DIAGRAM
13	ELD03	PRESSURE TRANSMITTER LOOP DIAGRAM
14	S14	CONDUIT NETWORK ROUTING
15	S15	CONDUIT EXTRACTION WELL ROUTING
16	S15.1	CONDUIT EXTRACTION WELL ROUTING
17	S16	COMMUNICATION HUB
18	S17	LEAK DETECTION DETAILS
19	S18	LEAK DETECTION SCHEMATIC

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE:
FILE:
DRAWN:
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CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL PLC
COVER SHEET

SCALE NONE
DRAWING NUMBER S1
SHEET NUMBER 1 OF 18

PUMP AND BLOWER SYMBOLS

- CENTRIFUGAL PUMP, INCLUDES MOTOR
- SUMP PUMP
- SUBMERSIBLE WELL PUMP
- BLOWER
- METERING PUMP
- WELL VAULT

VALVE SYMBOLS

- BALL VALVE
- BUTTERFLY VALVE, CLOSED
- BUTTERFLY VALVE, OPEN
- CHECK VALVE
- DIAPHRAGM VALVE
- GATE VALVE
- SAMPLE PORT (NORMALLY CLOSED)
- GLOBE VALVE
- AIR VENT/VACUUM VALVE
- THREE WAY VALVE

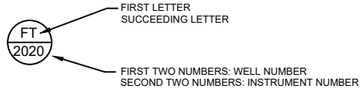
MISCELLANEOUS SYMBOLS

- PROPOSED EXTRACTION WELL
- EXISTING EXTRACTION WELL
- PROPOSED TRANSFORMER
- EXISTING TRANSFORMER
- TREATMENT PLANT
- PULL BOX
- EXTRACTION WELL CONCRETE PAD
- CONDUIT RUN UNDER PAVED AREA

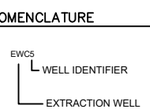
LINE SYMBOLS

- PRIMARY PROCESS FLOW LINE
- UTILITY/SECONDARY PROCESS LINE
- SOFTWARE/COMMUNICATION LINK
- ELECTRIC SIGNAL OR POWER
- INSTRUMENT AIR SUPPLY LINE
- LIMIT LINE
- FENCE
- EXT — **EXISTING EXTRACTION PIPELINE**
- W — **EXISTING WATER LINE**
- E — **EXISTING ELECTRICAL LINE**

DETAIL/SECTION REFERENCE



WELL NOMENCLATURE



ELECTRICAL SYMBOLS

- NORMALLY OPEN RELAY CONTACT
- NORMALLY CLOSED RELAY CONTACT
- GROUND
- CIRCUIT BREAKER
- PRESSURE SWITCH
- FLOAT SWITCH
- ON/OFF SWITCH
- FUSABLE PULLOUT
- NORMALLY OPEN MOMENTARY PUSH BUTTON
- NORMALLY CLOSED MOMENTARY PUSH BUTTON
- OL CONTACTOR
- TRANSFORMER
- THERMAL OVERLOAD DEVICE
- 3#10 — THREE NUMBER 10 CONDUCTORS
- 5 — MOTOR WITH 5 HP
- IR — CURRENT SENSING RELAY
- EMP — ELECTRONIC METERING AND PROTECTION PANEL
- OFF / ON — TWO POSITION CONTACT SWITCH

INPUT/OUTPUT SCHEMATIC LAYOUT

- FIELD INSTRUMENT
- 3 WAY SELECTOR SWITCH
- NORMALLY CLOSED CONTACT
- TERMINAL BLOCK
- FUSE
- FIELD WIRING
- PANEL/VAULT WIRING
- COIL
- PROGRAMMABLE SOLID STATE RELAY

PANEL LAYOUT (S10)

COMPONENT	DESCRIPTION
A	5 PORT MANAGED ETHERNET SWITCH
B	PHOENIX DIN BUSSMANN RAIL FUSED TERM BLOCK 110V
C	TRIPLE LEVEL SCREW TYPE TERMINAL BLOCKS
D	DIN RAIL FUSE TERMINAL BLOCKS
E	24 VDC POWER SUPPLY
F	SINGLE PORT 5-15 OUTLET
G	10A CIRCUIT BREAKER
H	15A CIRCUIT BREAKER
I	3 POLE DIN RAIL MOUNT SWITCH DISCONNECTOR
J	PLC
K	ANALOG INPUT EXPANSION CARD
L	ANALOG OUTPUT EXPANSION CARD
M	24 VDC ISOLATION RELAY
N	FUSED TERMINAL BLOCKS
O	15A CIRCUIT BREAKER
P	VFD
Q	POWER DISTRIBUTION BLOCK
R	480VAC -120VAC TRANSFORMER
S	LEVEL SWITCH

INSTRUMENT ABBREVIATIONS

Instrument Abbreviations

	Alarm L-low H-high	Controller	Control Valve	Detection Element	Glass Guage	Indicator	Integrator	Relay/ Compute	Safety Valve	Switch L-low H-high	Transmitter	Well or Probe	Interlock L-low H-high
Analysis	AAL AAH	AC	AV	AE		AI		AY		ASL ASH	AT	AW	
Flow	FAL FAH	FC	FV	FE	FG	FI	FO	FY		FSL FSH	FT		FAXL FAXH
Hand		HC	HV					HY					
Level	LAL LAH	LC	LV	LE	LG	LI		LY		LSL LSH	LT	LW	LAXL LAXH
Pressure or Vacuum	PAL PAH	PC	PV	PE		PI		PY		PSL PSH	PT		PAXL PAXH
Pressure Differential	PDAL PDAH	PDC	PDV	PDE		PDI		PDY	PSV	PDSL PDSH	PDT		
Speed or Frequency	SAL SAH	SC	SV	SE		SI	SO	SY		SSL SSH	ST		SAXL SAXH
Temperature	TAL TAH	TC	TV	TE		TI		TY	TSV	TSL TSH	TT	TW	TAXL TAXH
Vibration	VAL VAH			VE		VI		VY		VSL VSH	VT		VAXL VAXH
Position	ZAL ZAH	ZC		ZE		ZI		ZY		ZSL ZSH	ZT		
Electrical Current	ISL ISH			IE		II		IY		ISL ISH	IT		IAXL IAXH

INSTRUMENT INDENTIFIERS

Instrument Identification Letters

	FIRST LETTER		SUCCEEDING LETTERS		
	Measured or Initiating Variable	Modifier	Readout or Passive Function	Output Function	Modifier
A	ANALYSIS		ALARM		
B	BURNER FLAME	BY-PASS	USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL) OR USER'S CHOICE			CONTROL	
D	DENSITY (MASS) OR SPECIFIC GRAVITY OR USER'S CHOICE	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	GAGING (DIMENSIONAL)		GLASS		
H	HAND (MANUALLY INITITATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY OR USER'S CHOICE				MIDDLE OR INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)		
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE			
R	RUN OR RADIOACTIVITY	RATIO	RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMITTER	
U	MULTIVARIABLE		MALFUNCTION	MALFUNCTION	MALFUNCTION
V	VISCOSITY OR VIBRATION			ALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	LOGIC / INTERLOCK		UNCLASSIFIED	LOGIC / INTERLOCK	UNCLASSIFIED OR RECEIVER
Y	USER'S CHOICE, EVENTS			RELAY OR COMPUTE	
Z	POSITION			DRIVER, ACTUATOR, UNCLASSIFIED CONTROL ELEMENT	

NOT FOR CONSTRUCTION

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DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: HR
CHECKED: HR

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE

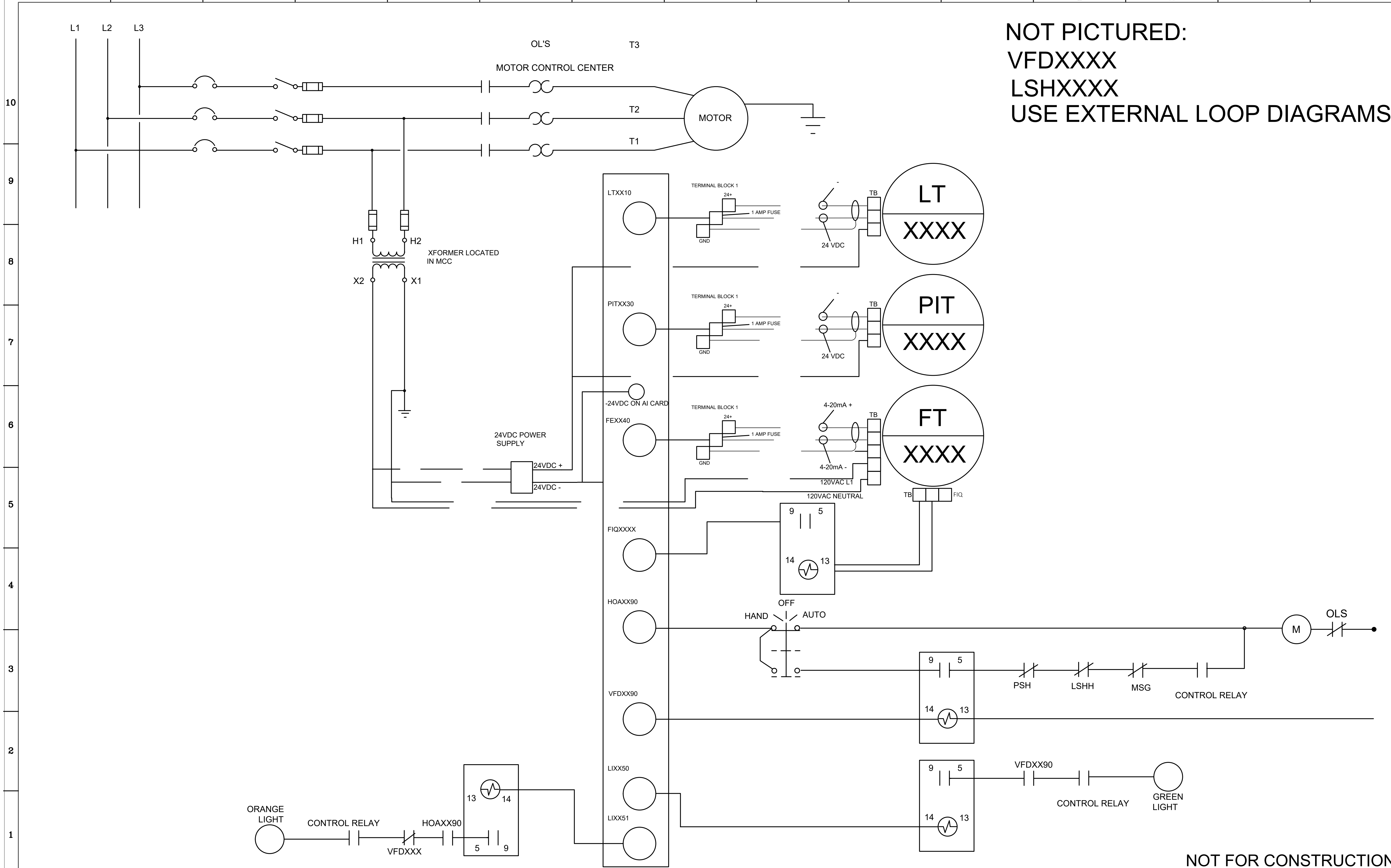
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD

BUNKER HILL PLC
INSTRUMENTATION SYMBOLS & ABBREVIATION

SCALE: NONE
DRAWING NUMBER: S2
SHEET NUMBER: 2 OF 18

NOT PICTURED:
VFDXXXX
LSHXXXX
USE EXTERNAL LOOP DIAGRAMS



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Ahtna Global, LLC

REVISIONS

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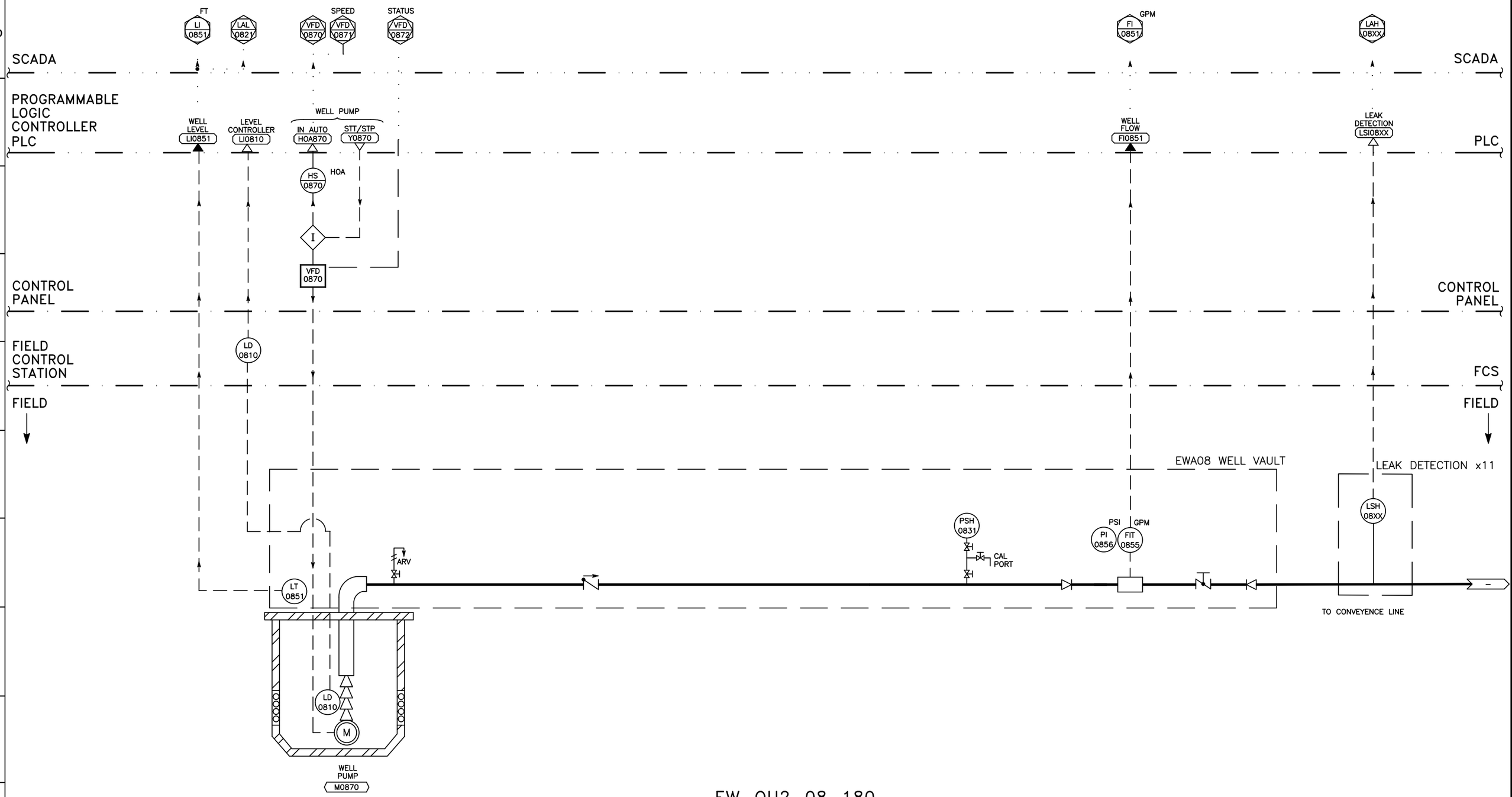
APPROVAL RECOMMENDED ________ DATE
APPROVED ________ DATE

CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL PLC
ELEMENTARY DIAGRAM

SCALE
NOT TO SCALE
DRAWING NUMBER
S3
SHEET NUMBER
3 OF 18



EW-OU2-08-180

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SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

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ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1				
	2				
	2				

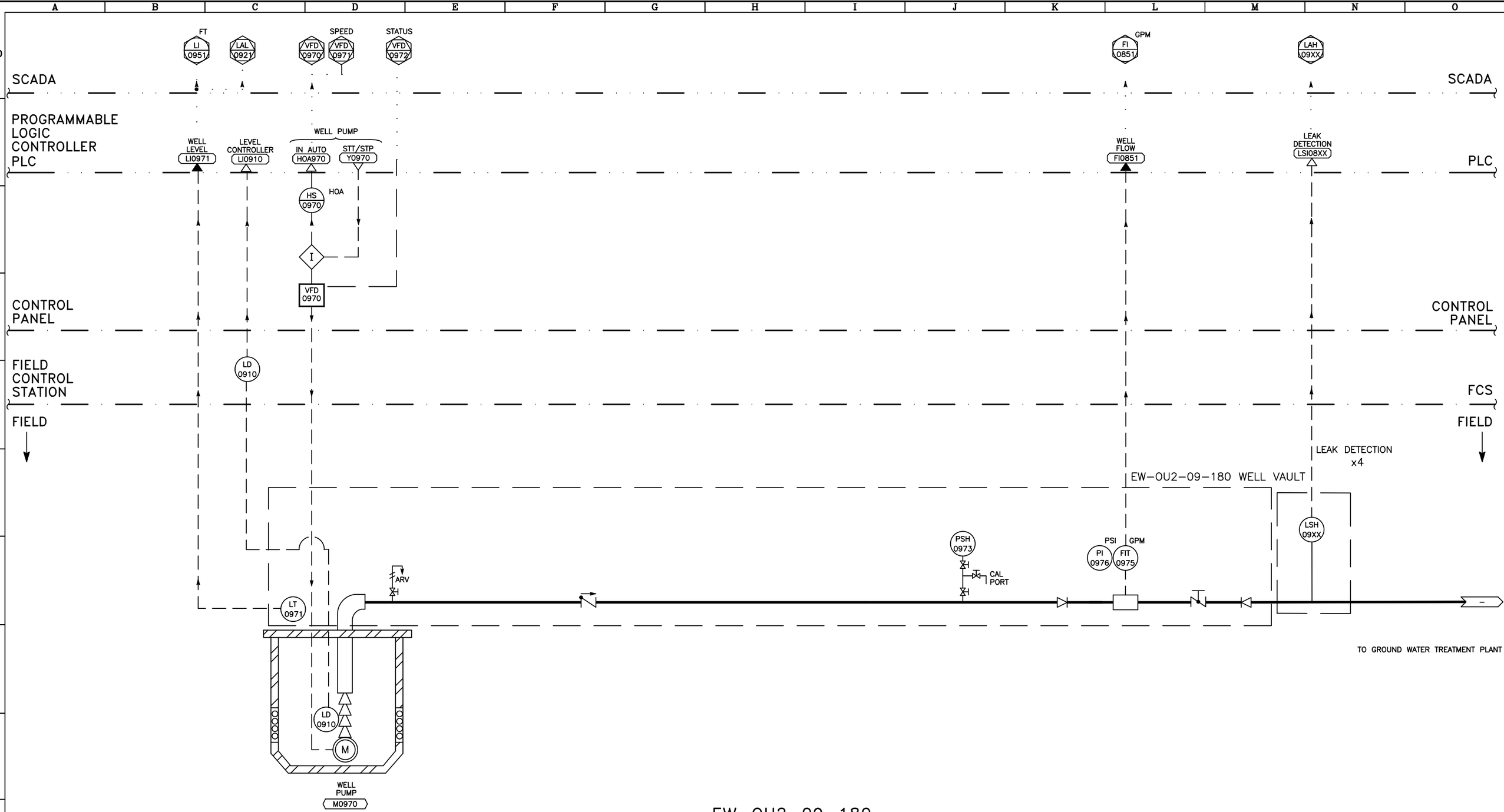
APPROVAL RECOMMENDED _____ DATE
APPROVED _____ CONTROL SYSTEMS ENGINEER DATE

CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

EW-OU2-08-180
P&ID DRAWING

SCALE: NONE
DRAWING NUMBER: S4
SHEET NUMBER: 4 OF 18



EW-0U2-09-180

NOT FOR CONSTRUCTION

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DATE: 01/19/2023
FILE:
DRAWN: FV
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SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1				
	2				
	2				

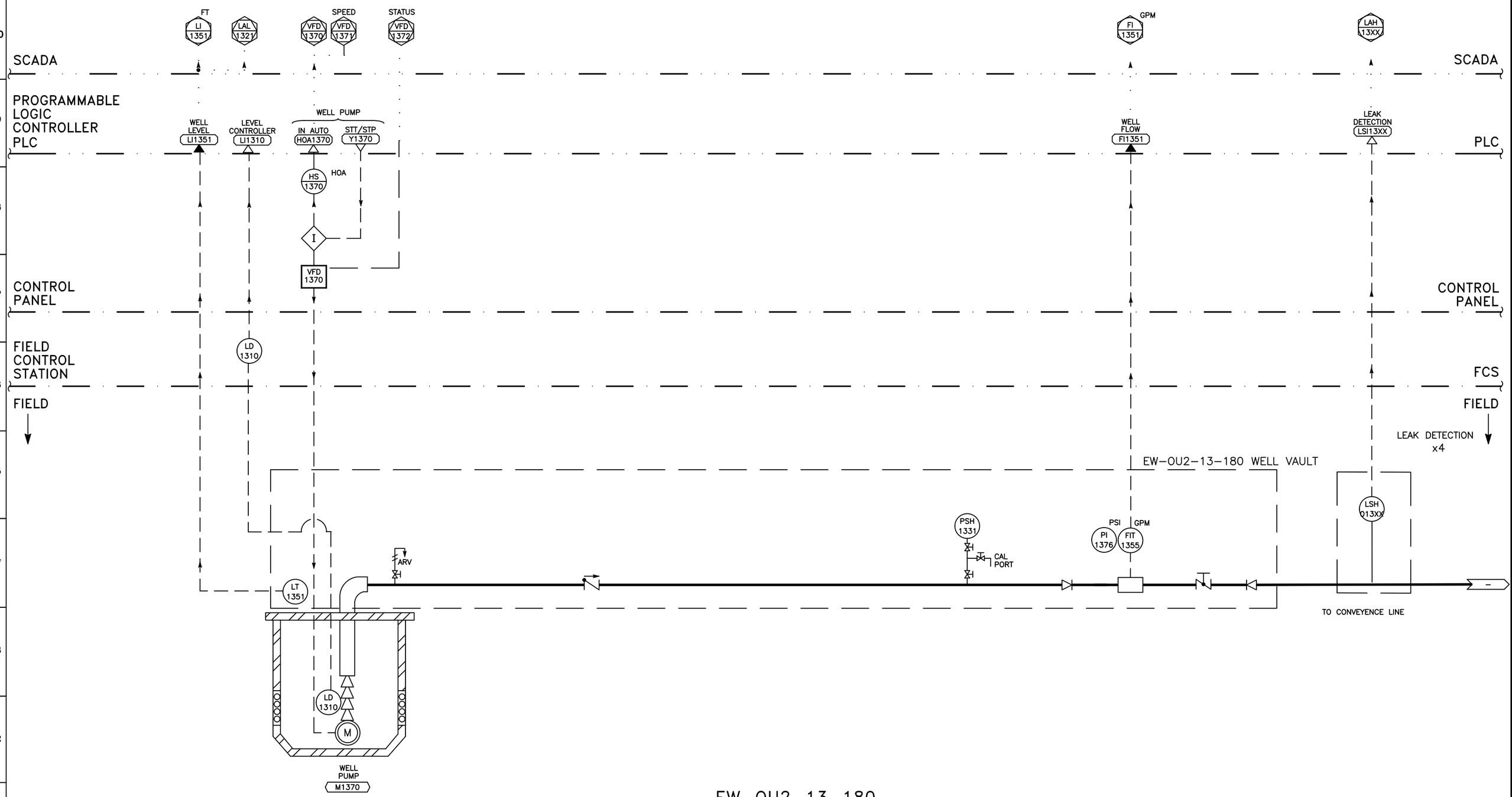
APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTROL SYSTEMS ENGINEER

CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

EW-OU2-09-180
P&ID DRAWING

SCALE: NONE
DRAWING NUMBER: S5
SHEET NUMBER: 5 OF 18



EW-OU2-13-180

NOT FOR CONSTRUCTION

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KORE systems Inc

REVISIONS					
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	1				
	2				
	2				

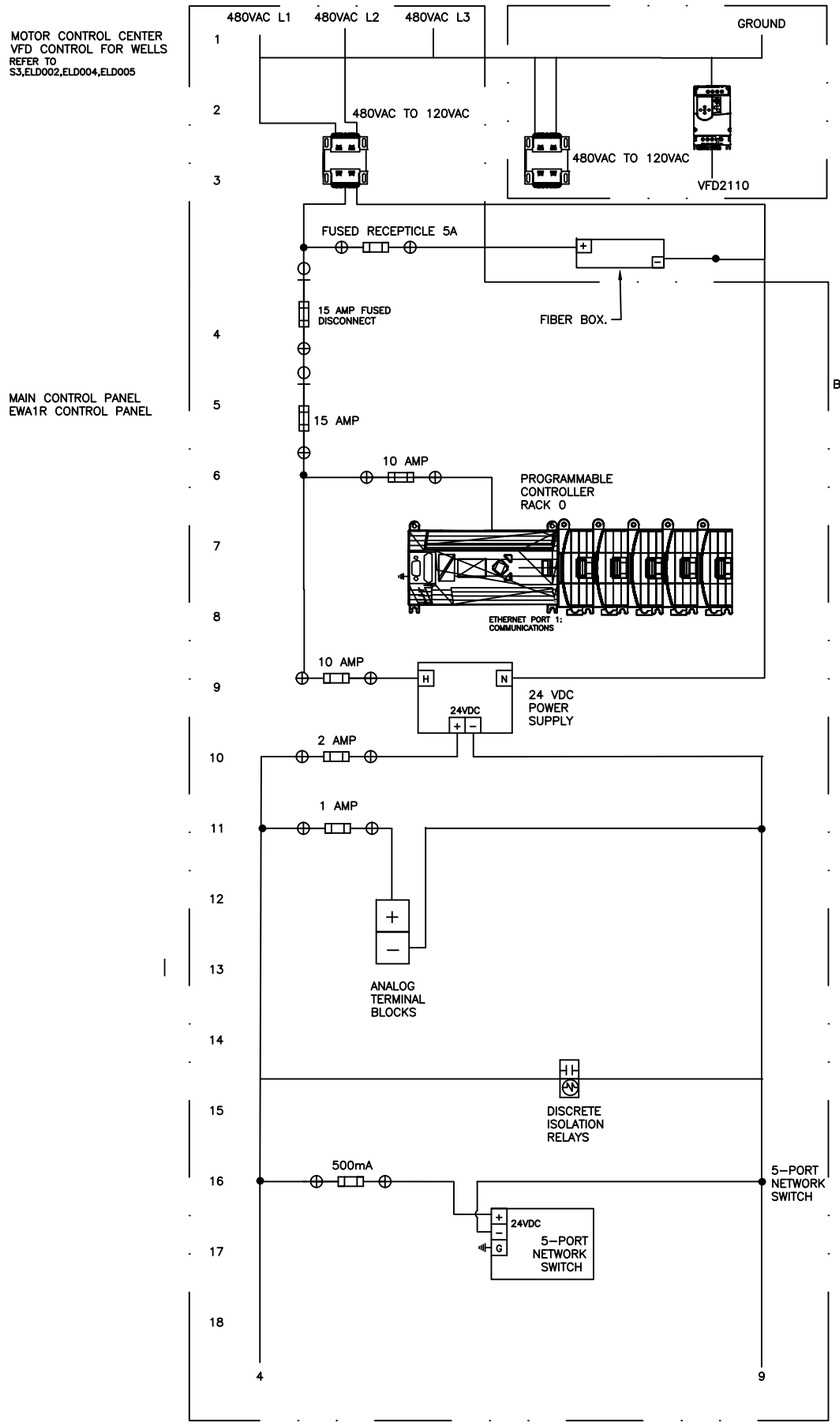
APPROVAL RECOMMENDED _____ DATE
CONTROL SYSTEMS ENGINEER
APPROVED _____ DATE

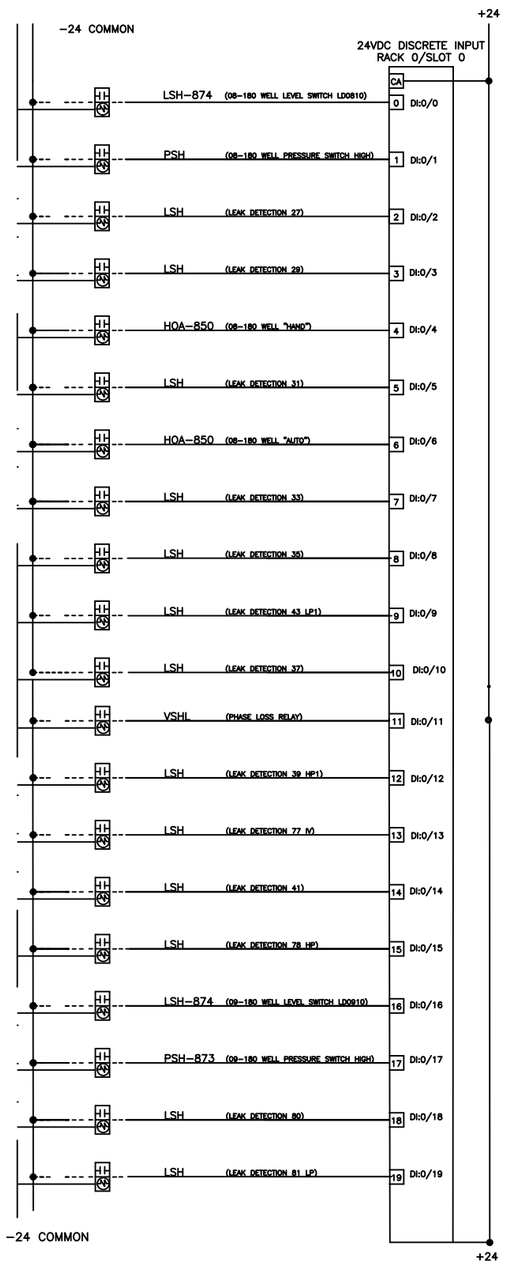
CONTRACT NUMBER

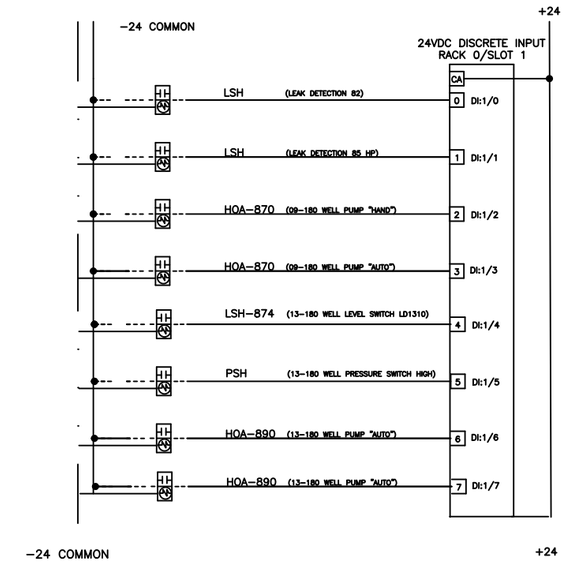
AHTNA GLOBAL, LLC
FORT ORD, CA

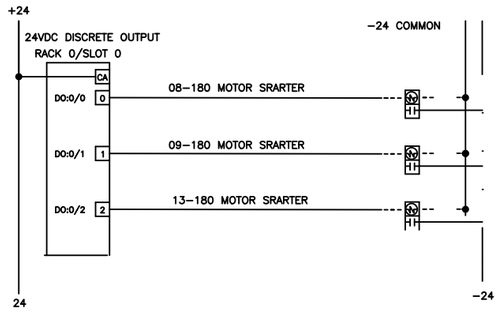
EW-OU2-13-180
P&ID DRAWING

SCALE: NONE
DRAWING NUMBER: S6
SHEET NUMBER: 6 OF 18









NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/24/2023
FILE:
DRAWN: FV
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTROL SYSTEMS ENGINEER

CONTRACT NUMBER

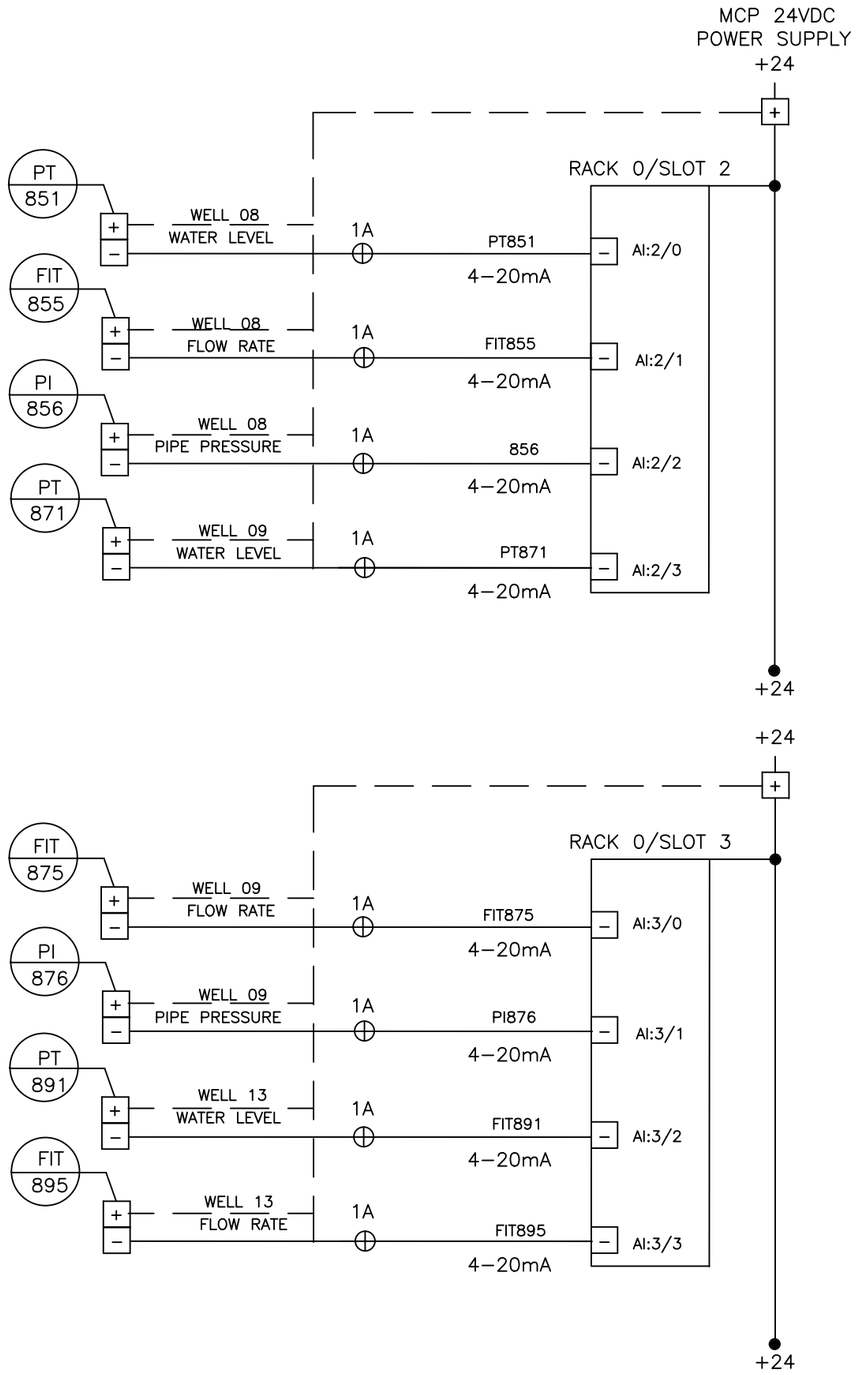
AHTNA GLOBAL, LLC
FORT ORD, CA

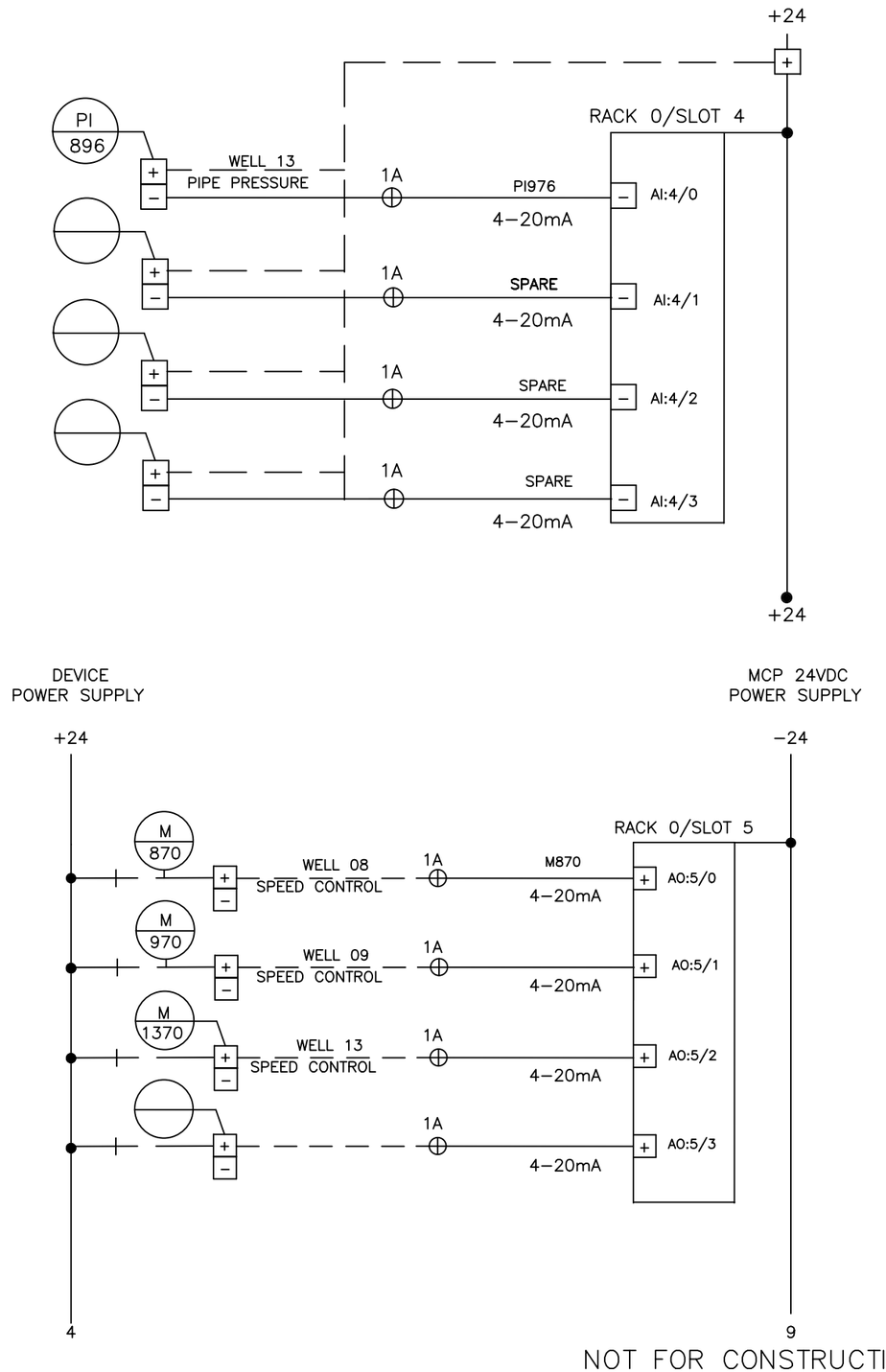
BUNKER HILL PLC
IO SCHEMATIC

SCALE
NONE

DRAWING NUMBER
S7

SHEET NUMBER
7 OF 18





NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"–SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems inc

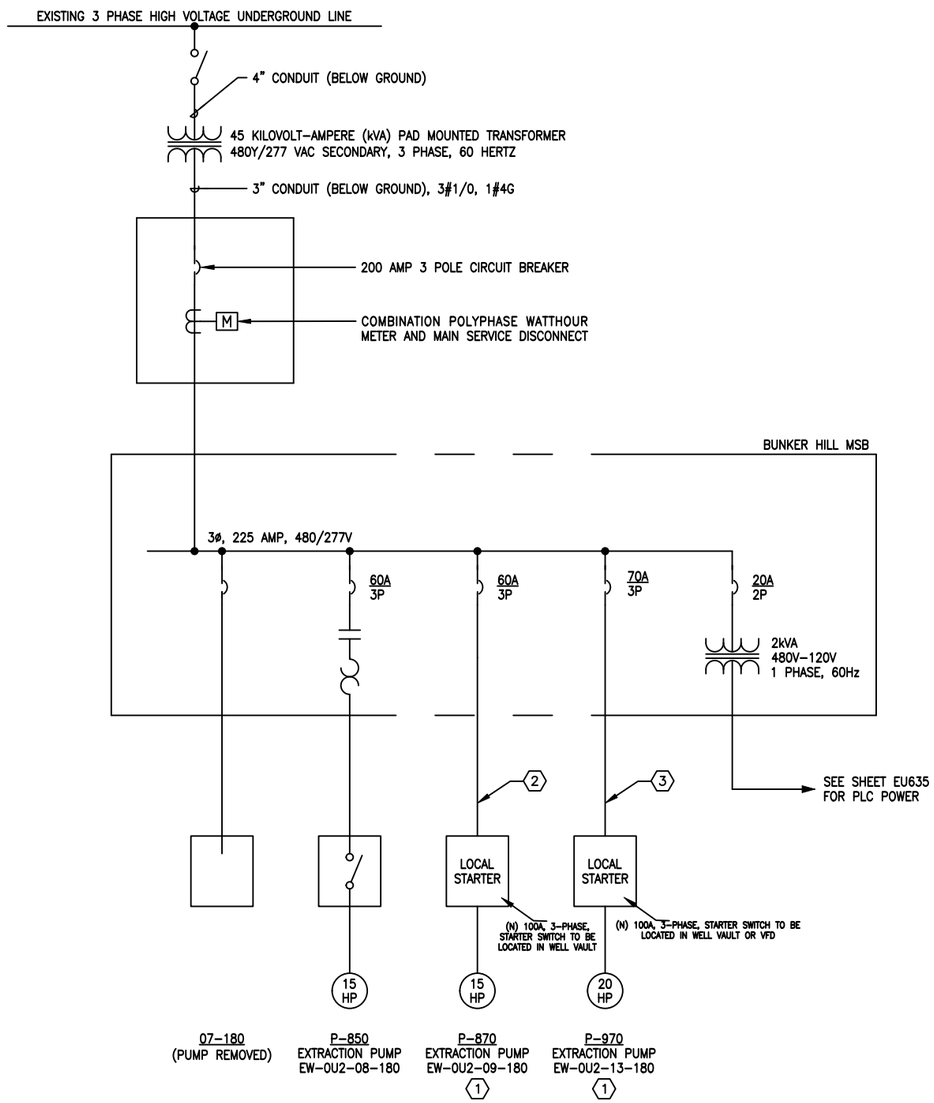
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1				
	2				
	2				

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ CONTROL SYSTEMS ENGINEER DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL PLC
IO SCHEMATIC

SCALE NONE
DRAWING NUMBER S8
SHEET NUMBER 8 OF 18



PLC PANEL LOAD CALCULATOR	LOAD (VA)			
	Aø	Bø	Cø	TOTAL
PLC XFRM (2k XFRM)	1000	1000		60002
EW-OU2-08-180 (15hp motor)	5800	5800	5800	
EW-OU2-09-180 (15hp motor)	5800	5800	5800	
EW-OU2-13-180 (20hp motor)	7734	7734	7734	
Phase Total (VA)	20334	20334	19334	
Phase Balance (%)	33.9%	33.9%	32.2%	

TOTALS	LOAD (VA)	LOAD (A)	LOAD (W)	
Total Demand	60002	72.3	51002	
Total Demand + Spare	75003	90.32	63753	

KEYED NOTES

1. EXTRACTION PUMP SHALL BE FITTED WITH A TEMPERATURE SENSOR, RUN SENSOR WIRES FROM LOCAL STARTER BOX TO VAULT LOW-VOLTAGE CONTROL ENCLOSURE AND WIRE TO MOTOR PROTECTION UNIT THAT IS ALSO INSTALLED IN ENCLOSURE, REFER TO PUMP MANUFACTURER INSTALLATION INSTRUCTIONS.
2. (N) CONDUCTORS IN (E) CONDUIT, VERIFY EXTRACTION PUMP HP & WIRING PRIOR TO INSTALLING (N) CONDUCTORS.
3. (N) CONDUCTORS IN (E) CONDUIT, VERIFY EXTRACTION PUMP HP & WIRING PRIOR TO INSTALLING (N) CONDUCTORS.

ASSUMPTIONS

1. THE 2KVA TRANSFORMER USES 2 WIRES OF THE 3-PHASE POWER.
2. NO EXTRA DEVICES/COMPONENTS ARE ATTACHED TO THIS POWER SOURCE.
3. SPARE LOADS INCLUDE EXTRA 25% CAPACITY.
4. POWER FACTOR = 0.85
5. ADDITIONAL 20 HP MOTOR HAS THE SAME POWER EFFICIENCY AS PREVIOUS 15 HP MOTORS.

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE:
FILE:
DRAWN:
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

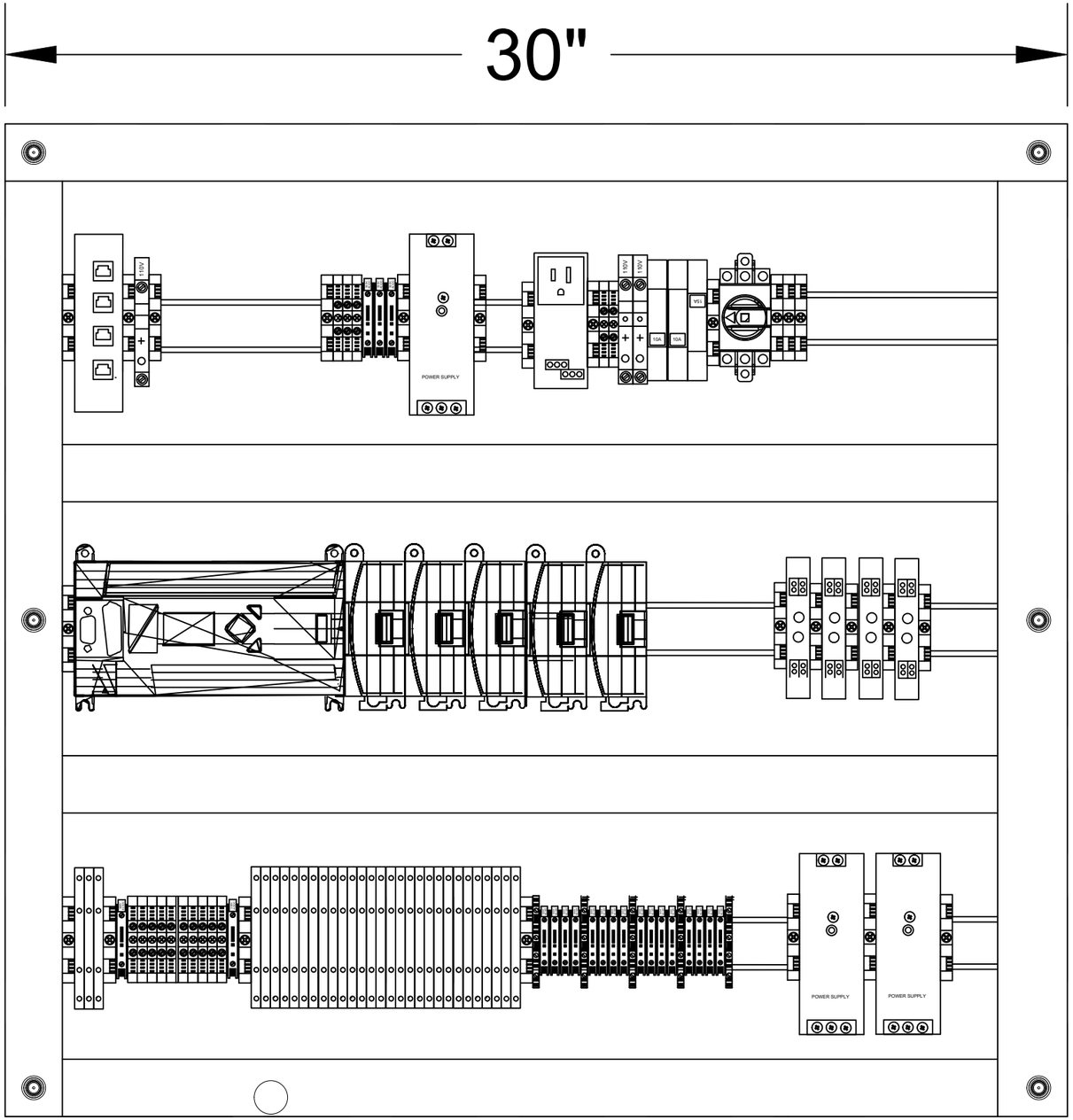
KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

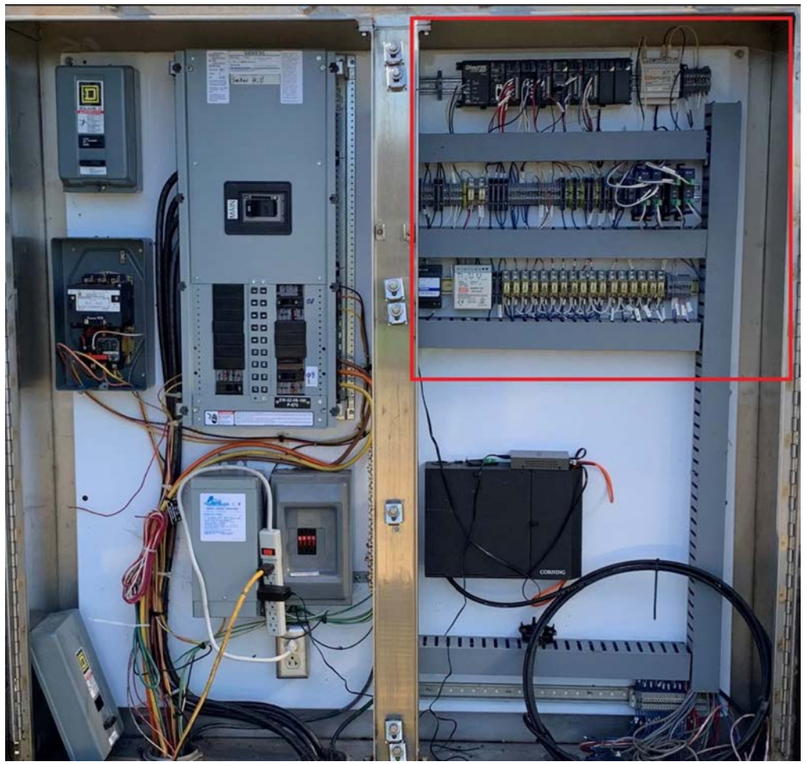
APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL PLC
ONE LINE DRAWING

SCALE: NONE
DRAWING NUMBER: S9
SHEET NUMBER: 9 OF 18



NOTE: PANEL DRAWING IS FOR BACK PANEL
REPLACEMENT OF THE SECTION REDLINED BELOW



LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/24/2023
FILE:
DRAWN: FV
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems inc

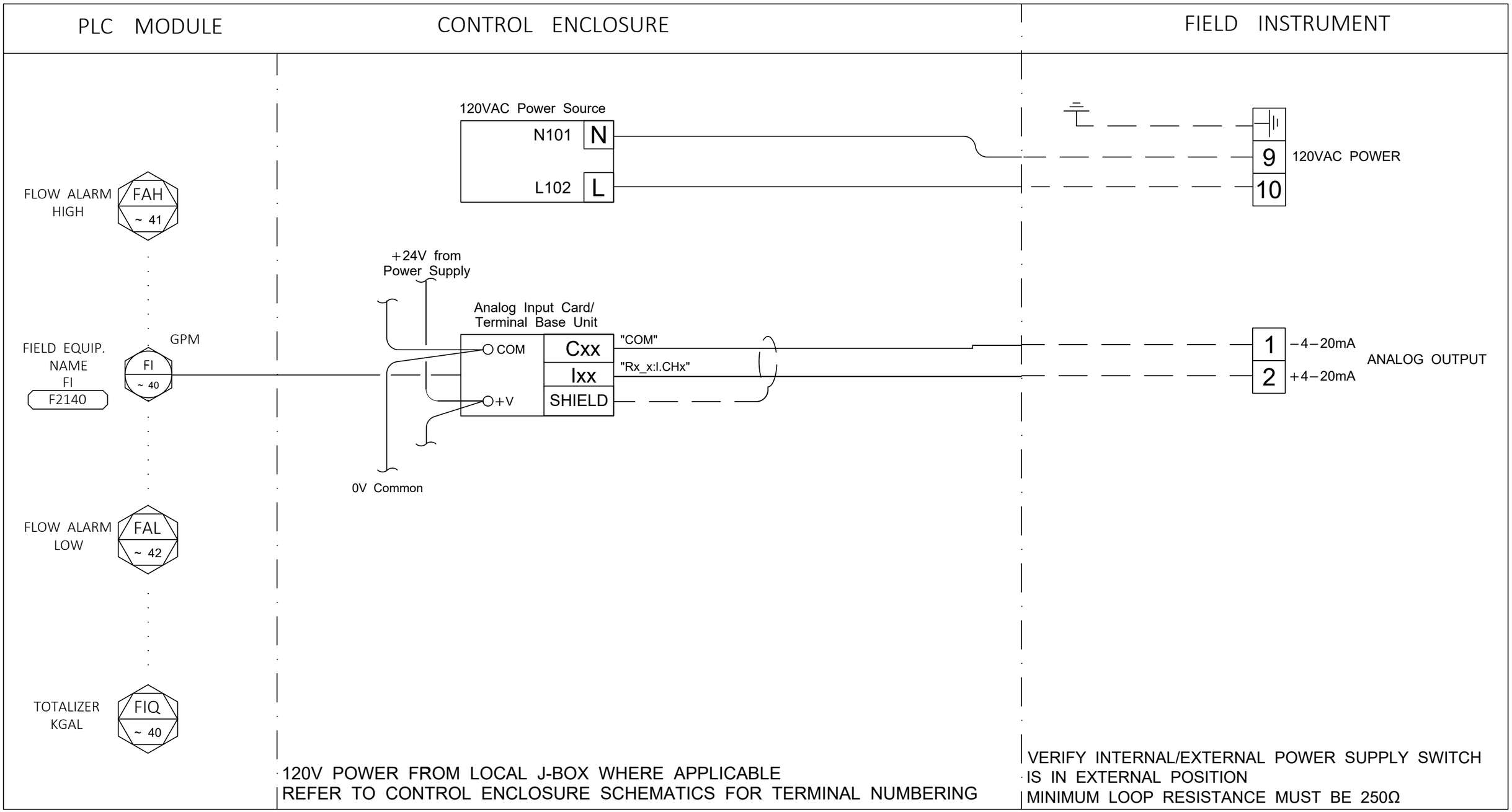
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL PLC
INTERNAL PANEL LAYOUT

SCALE: NONE
DRAWING NUMBER: S10
SHEET NUMBER: 10 OF 18



NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE:
FILE:
DRAWN:
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE

CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL PLC
FLOW INSTRUMENT DIAGRAM

SCALE: NONE
DRAWING NUMBER: ELD01
SHEET NUMBER: 11 OF 18

PLC MODULE | CONTROL ENCLOSURE | FIELD INSTRUMENT

LEVEL ALARM HIGH — LAH ~ 11

FIELD EQUIP. NAME LI — L2110

FT — LI ~ 10

+24V from Power Supply

Analog Input Card/ Terminal Base Unit

COM — Cxx — "COM"

+V — Ixx — "Rx_x:I.CHx"

SHIELD

0V Common

LEVEL ALARM LOW — LAL ~ 12

TB

1	24VDC
2	0VDC
3	
4	
5	(NOT USED)
6	
7	
8	

GROUND IN CONTROL ENCLOSURE ONLY
REFER TO CONTROL ENCLOSURE SCHEMATICS FOR TERMINAL NUMBERING

LOOP POWERED DEVICE

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE:
FILE:
DRAWN:
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE
APPROVED _____ DATE

CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL PLC
LEVEL INSTRUMENT DIAGRAM

SCALE NONE

DRAWING NUMBER ELD02

SHEET NUMBER 12 OF 18

PLC MODULE	CONTROL ENCLOSURE	FIELD INSTRUMENT

PRESSURE ALARM HIGH

PAH

~ xx

FIELD EQUIP. NAME

PIT

PXXXX

PSI

PIT

~ xx

+24V from Power Supply

Analog Input Card/ Terminal Base Unit

COM

+V

Cxx

Ixx

SHIELD

"COM"

"Rx_x:I.CHx"

0V Common

TB

1	24VDC
2	0VDC
3	
4	
5	(NOT USED)
6	
7	
8	

GROUND IN CONTROL ENCLOSURE ONLY
REFER TO CONTROL ENCLOSURE SCHEMATICS FOR TERMINAL NUMBERING

LOOP POWERED DEVICE

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE:
FILE:
DRAWN:
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED _____ DATE

APPROVED _____ DATE

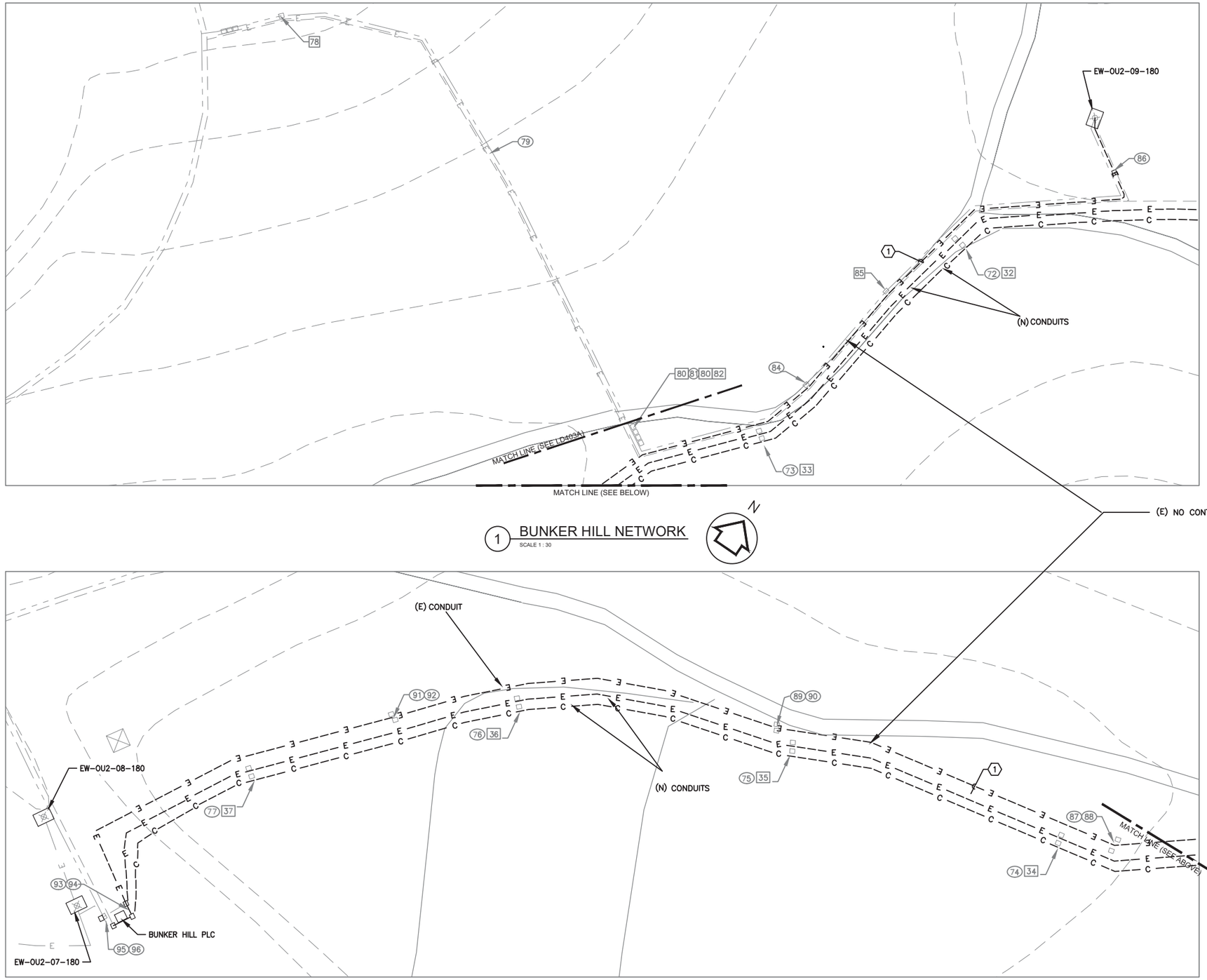
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL PLC
PRESSURE INSTRUMENT DIAGRAM

SCALE NONE

DRAWING NUMBER ELD03

SHEET NUMBER 13 OF 18



1 BUNKER HILL NETWORK
SCALE 1 : 30

2 BUNKER HILL NETWORK
SCALE 1 : 30

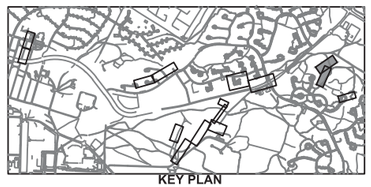
GENERAL NOTES

1. FOR ALL (N) UNDERGROUND METALLIC STRUCTURES PROVIDE CORROSION PROTECTION. THE CONTRACTOR MAY MODIFY THE CATHODIC PROTECTION SYSTEM AS SHOWN IN DETAILS ON E–504 AFTER SITE VERIFICATION AND ANALYSIS.
2. FOR TRAFFIC AND NON–TRAFFIC HANDHOLES SEE DETAIL 1 ON IU501 AND DETAIL 13 ON E–502.
3. SEE CU SHEETS FOR ADDITIONAL TRENCH PROFILES AND DETAILS.

KEYED NOTES

1 (N) CONDUCTORS IN (E) CONDUITS.

30 0 30 60
GRAPHIC SCALE IN FEET



KEY PLAN

NOT FOR CONSTRUCTION – PENDING FIELD REVIEW – ALL LENGTHS APPROXIMATE

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"–SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1				
	2				
	3				
	4				

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

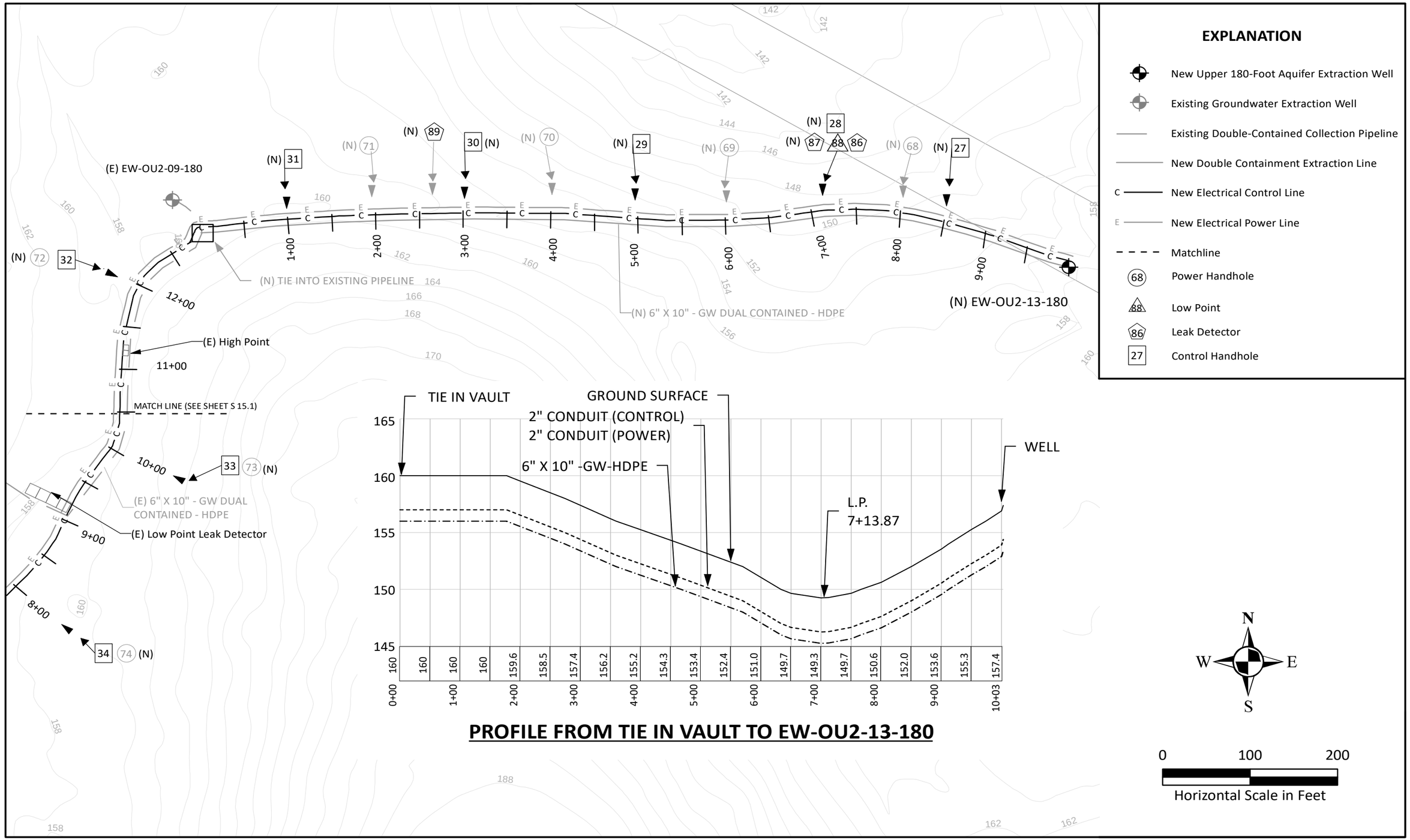
AHTNA GLOBAL, LLC
FORT ORD, CA

BUNKER HILL NETWORK
CONDUIT ROUTING

SCALE
NOT TO SCALE

DRAWING NUMBER
S14

SHEET NUMBER
14 OF 18



PROFILE FROM TIE IN VAULT TO EW-OU2-13-180

NOT FOR CONSTRUCTION – PENDING FIELD REVIEW – ALL LENGTHS APPROXIMATE

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
EW–OU2–13–180
CONDUIT ROUTING

SCALE NONE
DRAWING NUMBER S15
SHEET NUMBER 15 OF 18

MATCH LINE (SEE SHEET S 15)

10+00 — 33 (73) (N)

(E) 6" X 10" - GW DUAL CONTAINED - HDPE

(E) Low Point Leak Detector

9+00

8+00 — 34 (74) (N)

7+00 — (N) (75) 35

6+00

5+00

4+00 — (N) (76) 36

3+00

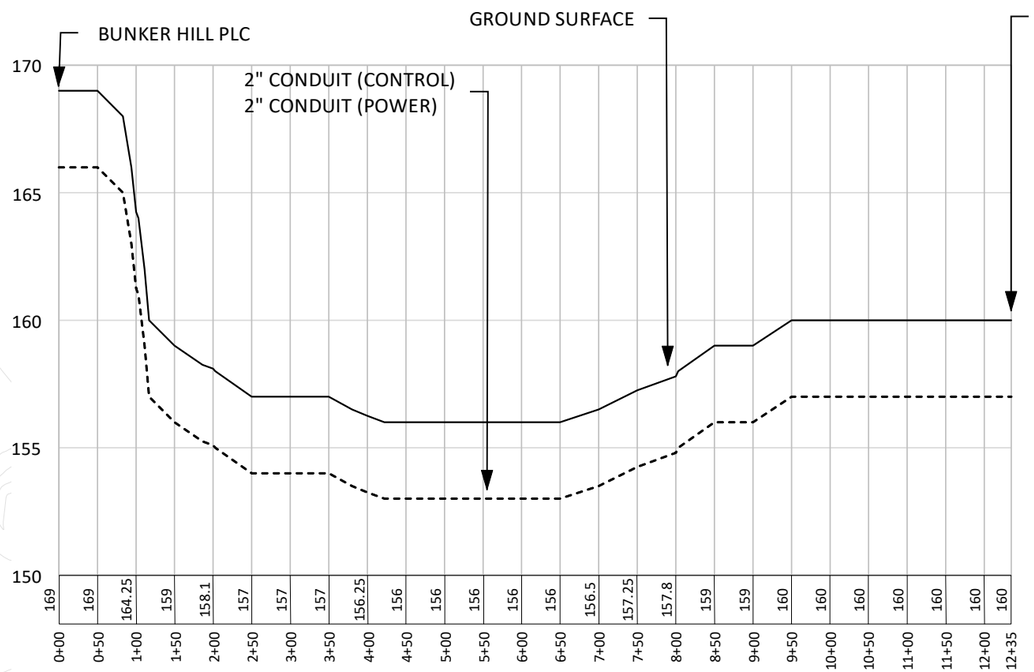
2+00 — (N) (77) 37

1+00

Bunker Hill PLC

EXPLANATION

- New Upper 180-Foot Aquifer Extraction Well
- Existing Groundwater Extraction Well
- Existing Double-Contained Collection Pipeline
- New Double Containment Extraction Line
- C — New Electrical Control Line
- E — New Electrical Power Line
- Matchline
- (68) Power Handhole
- 88 Low Point
- 86 Leak Detector
- [27] Control Handhole



PROFILE FROM BUNKER HILL PLC TO TIE IN VAULT

N W E S

0 100 200

Horizontal Scale in Feet

NOT FOR CONSTRUCTION – PENDING FIELD REVIEW – ALL LENGTHS APPROXIMATE

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

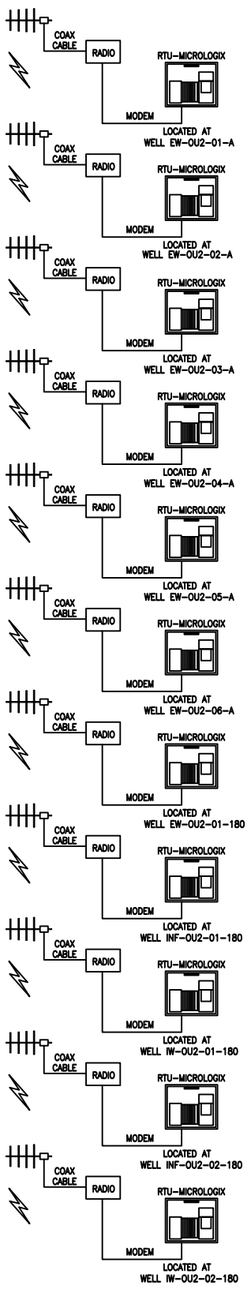
KORE systems Inc

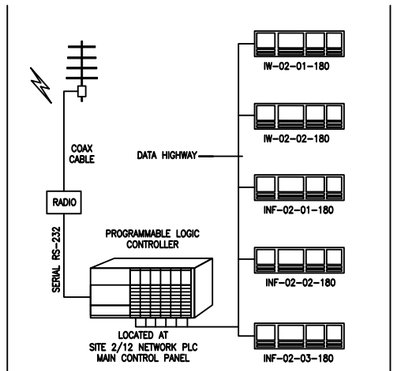
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

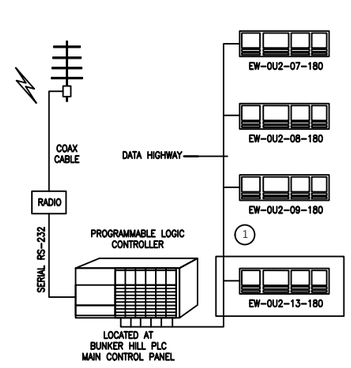
APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

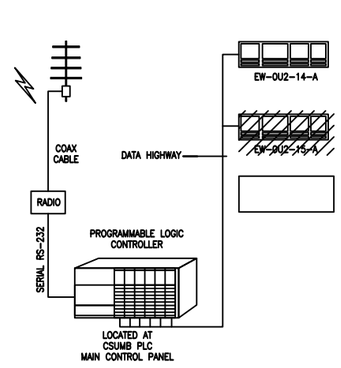
AHTNA GLOBAL, LLC
FORT ORD, CA
EW–OU2–13–180
CONDUIT ROUTING

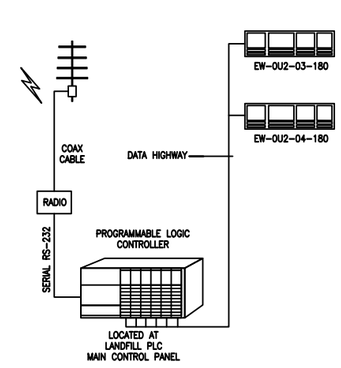
SCALE NONE
DRAWING NUMBER S15.1
SHEET NUMBER 15 OF 18

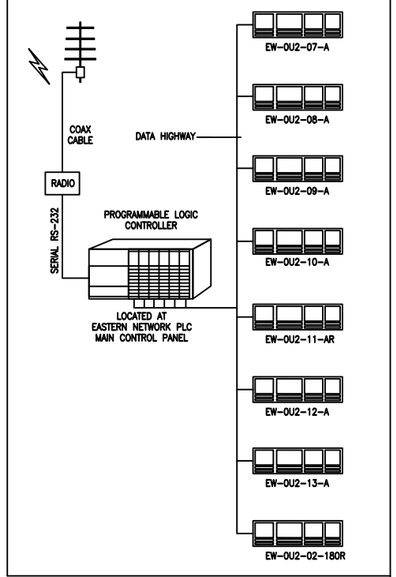


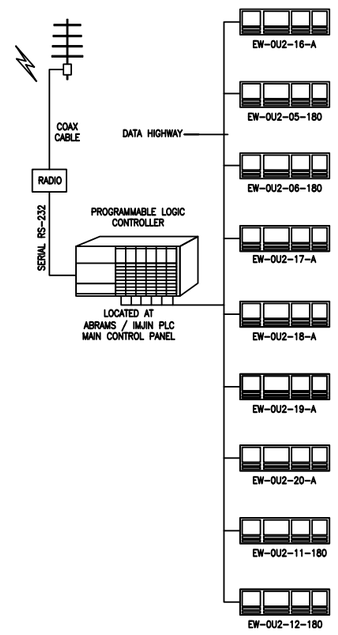


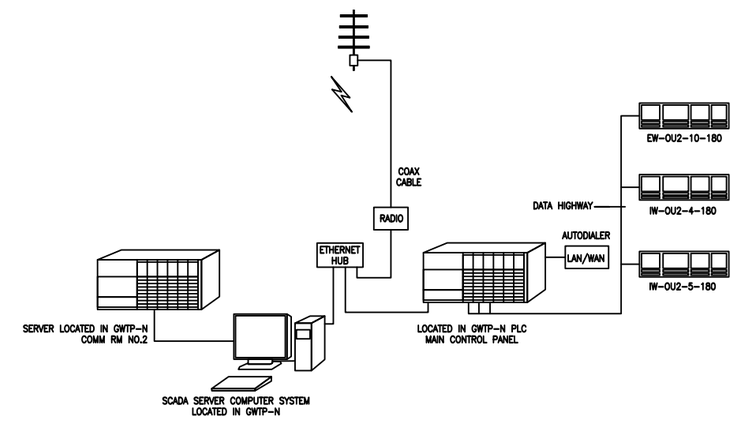


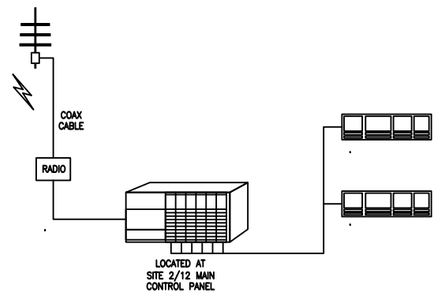


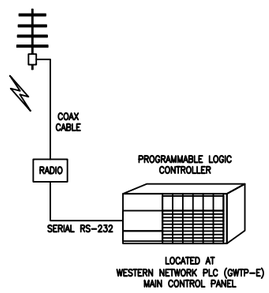












NOTES

1. THE ADDITION OF THE NEW PROPOSED EXTRACTION WELL AT BUNKER HILL.

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE:
FILE:
DRAWN:
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

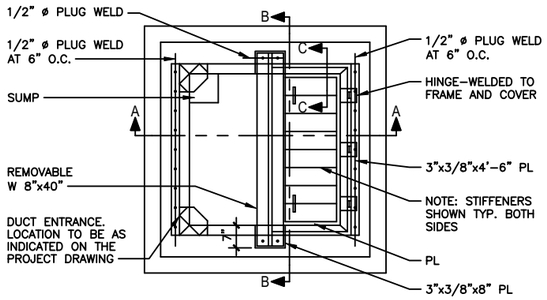
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED DATE
APPROVED DATE

CONTRACT NUMBER

AHTNA GLOBAL, LCC
FORT ORD, CA
BUNKER HILL PLC
COMMUNICATION HUB

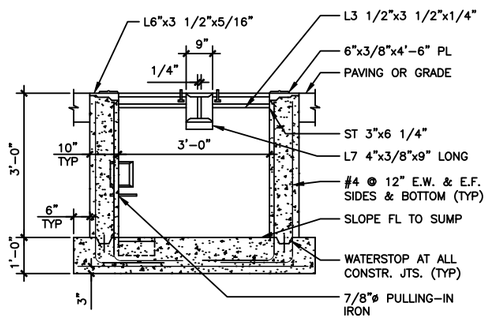
SCALE: NONE
DRAWING NUMBER: S16
SHEET NUMBER: 16 OF 18



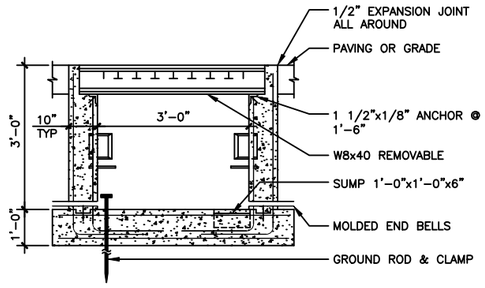
PLAN

NOTES:

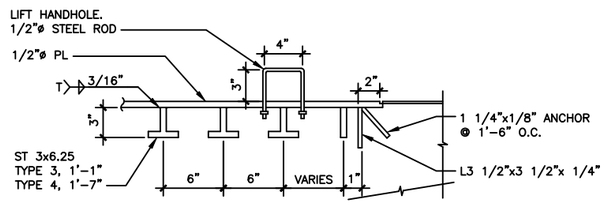
1. ENTRANCE OF DUCTS INTO HANDHOLE MAY BE MADE ON SIDE FACES OR CORNERS AS REQUIRED.
2. FOR DETAILS OF CABLE RACKS, DUCT ENTRANCE AND PULLING-IN IRONS, SEE DETAIL 3, IU501.
3. HANDHOLE AND COVER IS DESIGNED FOR MAXIMUM SINGLE WHEEL LOAD OF 25,000 LB.
4. COVER SHALL BE MADE OF STRUCTURAL STEEL CONFORMING TO ASTM A 36/A 36M.
5. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 3000 PSI.



SECTION A-A



SECTION B-B

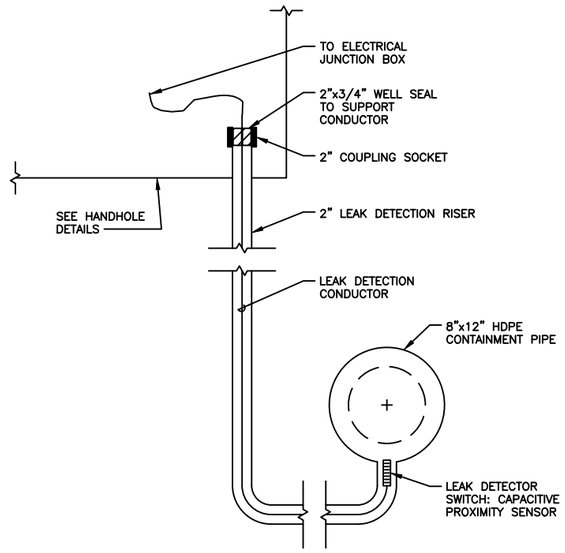


(SEE NOTE 4)

SECTION C-C

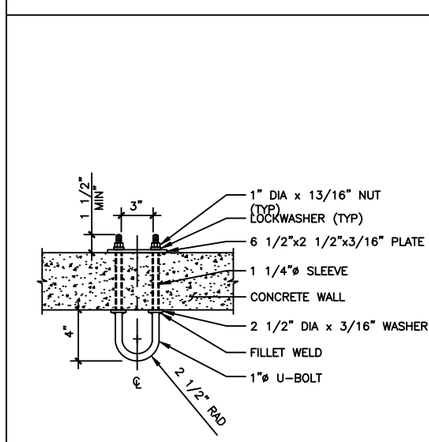
1 STANDARD ELECTRICAL/CONTROL HANDHOLE TRAFFIC RATED
NOT TO SCALE

EU401 TO EU408 | IU501
IU101
IU401 TO IU408

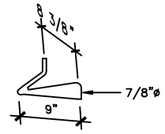


CROSS SECTION

2 LEAK DETECTION STATION
IU406 | IU501 NOT TO SCALE



ALTERED METHOD

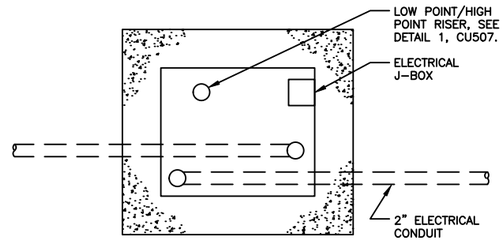


CAST IN PLACE

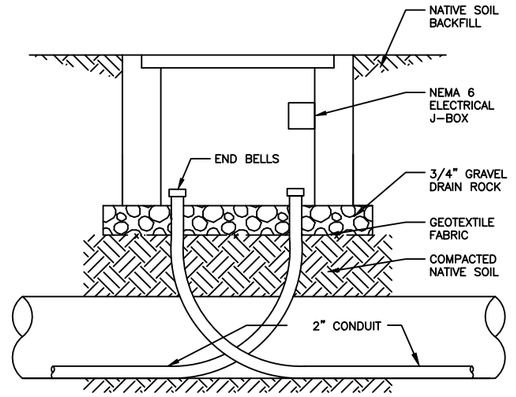
NOTE:

ALL METAL PARTS SHALL BE HOT DIP GALVANIZED

3 PULLING-IN IRON
IU501 | IU501 NOT TO SCALE



PLAN VIEW



CROSS SECTION

NOTES:

1. REFER TO DETAIL 1, THIS PAGE FOR TRAFFIC RATED HANDHOLES OR DETAIL 13, E-502 FOR NON TRAFFIC RATED, AS CONDITIONS DICTATE.

4 HANDHOLE FOR LEAK DETECTION
IU403 | IU501
IU404 NOT TO SCALE

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED:
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

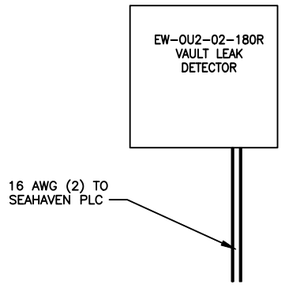
KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

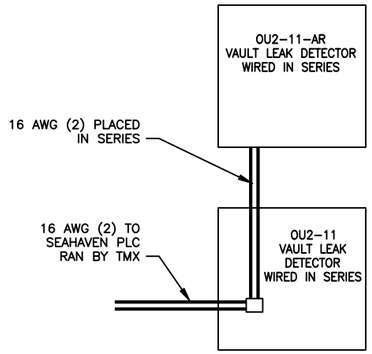
APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA
BUNKER HILL NETWORK
LEAK DETECTION DETAILS

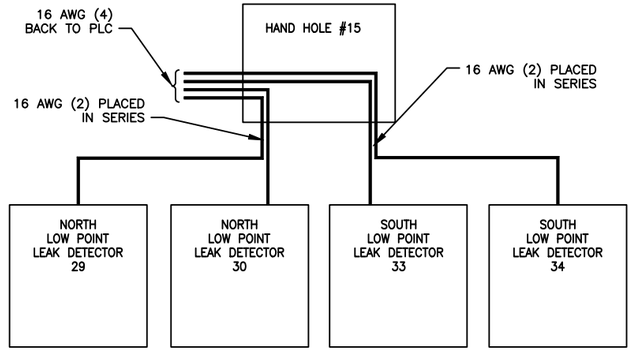
SCALE: NOT TO SCALE
DRAWING NUMBER: S17
SHEET NUMBER: 17 OF 18



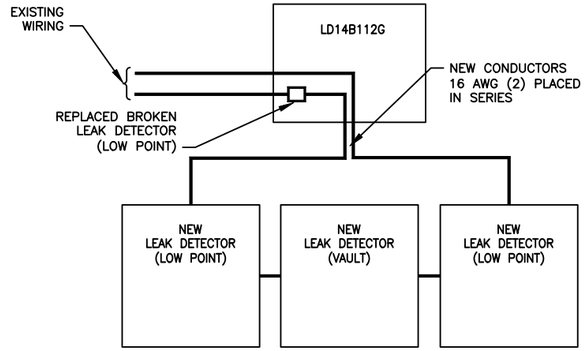
1 CONNECTION SCHEMATIC
LD402 | LD501 NOT TO SCALE



2 CONNECTION SCHEMATIC
LD402 | LD501 NOT TO SCALE

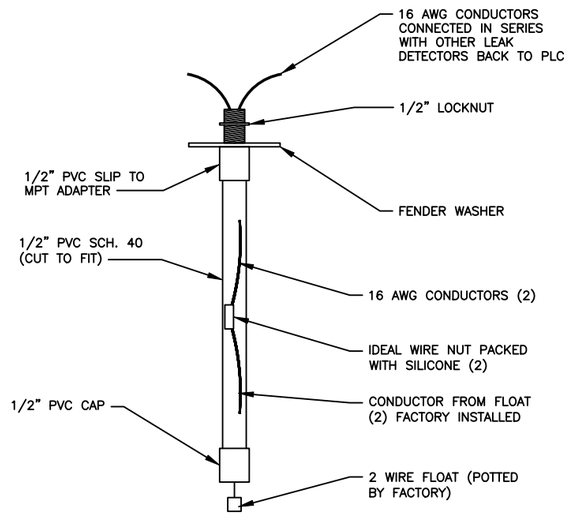


3 CONNECTION SCHEMATIC
LD406 | LD501 NOT TO SCALE



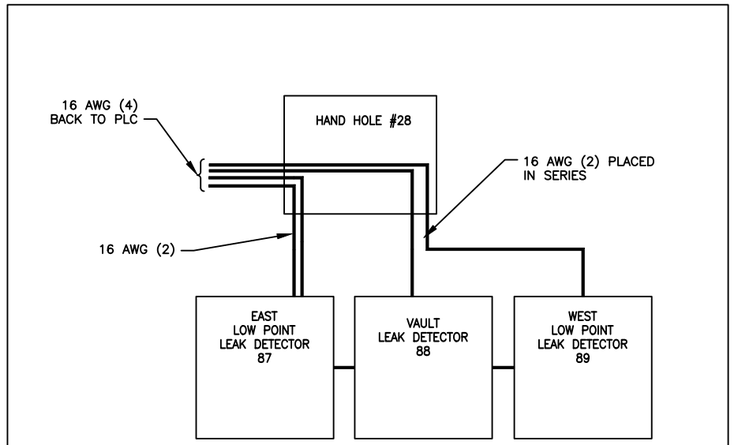
4 CONNECTION SCHEMATIC
LD407 | LD501 NOT TO SCALE

5 TYPICAL VAULT LEAK DETECTOR SCHEMATIC
LD501 | LD501 NOT TO SCALE



6 TYPICAL LOW POINT PIPE LEAK DETECTOR SCHEMATIC
LD501 | LD501 NOT TO SCALE

1



7 CONNECTION SCHEMATIC
LD403 | LD501 NOT TO SCALE

NOTES

1. THE PROPOSED LEAK DETECTORS FOR THE NEW EXTRACTION WELL OU2-13-180.

NOT FOR CONSTRUCTION

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DATE: 01/25/2023
FILE:
DRAWN: HR
DESIGNED: AHTNA
CHECKED:

SUBMITTED: DATE:
SUBMITTAL APPROVED: DATE:

KORE systems Inc

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

APPROVAL RECOMMENDED DATE
APPROVED DATE
CONTRACT NUMBER

AHTNA GLOBAL, LLC
FORT ORD, CA

EW-OU2-13-180
LEAK DETECTION SCHEMATIC

SCALE: NONE
DRAWING NUMBER: S18
SHEET NUMBER: 18 OF 18

ATTACHMENT C

Boring Logs and Well Construction Diagrams, Wells EW-OU2-09-180 and MW- OU2-64-180 and MW-OU2-66-180

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
E. 5749891.44

Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner		TOC ELEV:	152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano		GS ELEV:	155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.		DATE BEGAN:	07/20/2010
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET		DATE FINISHED:	07/29/2010
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)		Piezo. Elev.	151.43
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60		Note 1:	Top of Flange
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304			Units:	feet

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
0.00								Drill Rig: Speedstar 40K Geologic Core:94mm punch
-1.00	1.0						Note: Well installation included 1-inch piezometer (not depicted in graphic image) installed external to 10-inch well casing. Casing: Schedule 40, screen 20 slot PVC, Top of screen 175 ft-bgs, Base 215 ft-bgs. 1 foot sump.	20 inch conductor casing set to 20 ft-bgs
-2.00	2.0							
-3.00	3.0							
-4.00	4.0							Hand Auger to 5'
-5.00	5.0							
-6.00	6.0							
-7.00	7.0							
-8.00	8.0							
-9.00	9.0				SW		9': Well Graded Sand. Dark Yellowish Brown 10yr4/4.	
-10.00	10.0							
-11.00	11.0							
-12.00	12.0							Arch to 20'
-13.00	13.0							
-14.00	14.0				SP		14': Poorly Graded Sand. Yellowish Brown 10yr5/4, , 20% Fine, 70% Medium,10% Coarse Sand Slightly Moist	Annular Seal: Grout 5% Bentonite-Cement
-15.00	15.0							
-16.00	16.0							PVC Well Casing 10" Schedule 80
-17.00	17.0							
-18.00	18.0						18': Poorly Graded Sand. Yellowish Brown 10yr5/6, , 10% Medium, 90% Coarse. Slightly Moist	
-19.00	19.0							
-20.00	20.0							Bottom of 20" conductor
-21.00	21.0				SP			Mud Property (Pilot Boring) Marsh cone: 43 seconds
-22.00	22.0							
-23.00	23.0							
-24.00	24.0							
-25.00	25.0				SW		25': Well Graded Sand, Yellowish Brown 10yr5/6. 30% Fine, 40% Medium, 30% Coarse	
-26.00	26.0							
-27.00	27.0							
-28.00	28.0							
-29.00	29.0							
-30.00	30.0							

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
E. 5749891.44

Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner	TOC ELEV: 152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano	GS ELEV: 155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.	DATE BEGAN: 07/20/2010
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET	DATE FINISHED: 07/29/2010
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)	Piezo. Elev. 151.43
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60	Note 1: Top of Flange
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304		Units: feet

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
-31.00	31.0							
-32.00	32.0							
-33.00	33.0							
-34.00	34.0							
-35.00	35.0				SP		35': Poorly Graded Sand, Brownish Yellow 10yr6/6	
-36.00	36.0						40% Fine, 50% Medium,10% Coarse. Quartzose.	
-37.00	37.0							
-38.00	38.0							
-39.00	39.0							
-40.00	40.0							Mud Property (Pilot Boring)
-41.00	41.0							Marsh cone: 35 seconds
-42.00	42.0				SP		42': Same except: 60% Fine, 40% Medium Sand,	Mud Weight: 9.1 lb/ft^3
-43.00	43.0						Trace Coarse,Trace Silt.	
-44.00	44.0							Annular Seal: Grout
-45.00	45.0							5% Bentonite-Cement
-46.00	46.0						46': Same except: 40% Fine, 60% Medium Sand.	PVC Well Casing 10"
-47.00	47.0							Schedule 80
-48.00	48.0							
-49.00	49.0							
-50.00	50.0							
-51.00	51.0							
-52.00	52.0				SP		52': Same except, 30% Fine, 70% Medium Sand.	
-53.00	53.0							53' Centralizer
-54.00	54.0							
-55.00	55.0							
-56.00	56.0							
-57.00	57.0							
-58.00	58.0							
-59.00	59.0							
-60.00	60.0				SP		60': Same as above	Mud Property (Pilot Boring)
								Marsh cone: 34 seconds

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
E. 5749891.44

Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner		TOC ELEV:	152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano		GS ELEV:	155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.		DATE BEGAN:	07/20/2010
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET		DATE FINISHED:	07/29/2010
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)		Piezo. Elev.	151.43
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60		Note 1:	Top of Flange
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304			Units:	feet

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
-61.00	61.0							
-62.00	62.0							
-63.00	63.0							
-64.00	64.0							
-65.00	65.0				SP		65': Poorly Graded Sand, Brownish Yellow 10yr6/6	
-66.00	66.0						30% Fine, 70% Medium. Quartzose.	
-67.00	67.0							
-68.00	68.0							
-69.00	69.0							
-70.00	70.0							
-71.00	71.0							
-72.00	72.0							
-73.00	73.0							
-74.00	74.0							Annular Seal: Grout
-75.00	75.0		Sieve (Field) < 1% fines		SP		75': Poorly Graded Sand, Yellowish Brown 10YR 6/4,	5% Bentonite-Cement
-76.00	76.0						20% Fine, 70% Medium, 10% Coarse	
-77.00	77.0							PVC Well Casing 10" Schedule 80
-78.00	78.0							
-79.00	79.0							
-80.00	80.0		Sieve (Field) < 1% fines		SP		80': Same as above	
-81.00	81.0							
-82.00	82.0							
-83.00	83.0							
-84.00	84.0							
-85.00	85.0				SP		85': Same as above	
-86.00	86.0							
-87.00	87.0							
-88.00	88.0							
-89.00	89.0							
-90.00	90.0		Sieve (Field) 1.5 fines		SP		90': Same as above	
-91.00	91.0							

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
E. 5749891.44

Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner	TOC ELEV: 152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano	GS ELEV: 155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.	DATE BEGAN: 07/20/2010
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET	DATE FINISHED: 07/29/2010
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)	Piezo. Elev. 151.43
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60	Note 1: Top of Flange
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304		Units: feet

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
-92.00	92.0						92': Same except: Few clay chips (possible clay stringer)	
-93.00	93.0							93' Centralizer
-94.00	94.0							
-95.00	95.0				SP		95': Poorly Graded Sand. Yellowish Brown 10yr6/4	
-96.00	96.0						Fine - Medium	
-97.00	97.0							
-98.00	98.0							
-99.00	99.0							
-100.00	100.0				SP		100': Same as above	Mud Property (Pilot Boring)
-101.00	101.0							Marsh cone: 35 Seconds Mud Weight: 9.0 lb/ft3
-102.00	102.0							
-103.00	103.0							
-104.00	104.0				CH		104': Clay with Fine Sand and Silt. Grey 5y5/1. Soft	
-105.00	105.0							Annular Seal: Grout
-106.00	106.0							5% Bentonite-Cement
-107.00	107.0							PVC Well Casing 10"
-108.00	108.0							Schedule 80
-109.00	109.0							
-110.00	110.0							
-111.00	111.0						111': Thin sand layer	
-112.00	112.0							
-113.00	113.0							
-114.00	114.0							
-115.00	115.0							
-116.00	116.0							
-117.00	117.0							
-118.00	118.0							
-119.00	119.0							
-120.00	120.0				CH		120': Clay, Grey 5y5/1. <5% Fine Sand.	
-121.00	121.0							
-122.00	122.0				CH		122': Clay, Light Olive Gray 5y6/2.	

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
E. 5749891.44

Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner	TOC ELEV: 152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano	GS ELEV: 155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.	DATE BEGAN: 07/20/2010
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET	DATE FINISHED: 07/29/2010
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)	Piezo. Elev. 151.43
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60	Note 1: Top of Flange
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304		Units: feet

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
-123.00	123.0							
-124.00	124.0							
-125.00	125.0							
-126.00	126.0							
-127.00	127.0							
-128.00	128.0							
-129.00	129.0							
-130.00	130.0							
-131.00	131.0							
-132.00	132.0							
-133.00	133.0							133' Centralizer
-134.00	134.0							
-135.00	135.0				CH		135' Clay. Olive Gray - Greenish Gray. Gley1-5/5gy and 5y5/2	
-136.00	136.0							Annular Seal: Grout 5% Bentonite-Cement
-137.00	137.0							
-138.00	138.0							PVC Well Casing 10" Schedule 80
-139.00	139.0							
-140.00	140.0							Mud Property (Pilot Boring) Mud: Weight: 9.0 lb/ft^3 Marsh cone: 33 seconds
-141.00	141.0							
-142.00	142.0							
-143.00	143.0							
-144.00	144.0							
-145.00	145.0							
-146.00	146.0							
-147.00	147.0							
-148.00	148.0							
-149.00	149.0							
-150.00	150.0							
-151.00	151.0							
-152.00	152.0							
-153.00	153.0				CH			Clay <10% (17" Boring)

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
E. 5749891.44

Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner		TOC ELEV:	152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano		GS ELEV:	155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.		DATE BEGAN:	07/20/2010
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET		DATE FINISHED:	07/29/2010
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)		Piezo. Elev.	151.43
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60		Note 1:	Top of Flange
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304			Units:	feet

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
							153': Clay, Same as above	
-154.00	154.0							Drilling rate increases
-155.00	155.0							
-156.00	156.0				SP		156': Poorly Graded Sand, Yellowish Brown 10yr5/6.	Clay <10% (17" Boring)
-157.00	157.0							
-158.00	158.0				CL		158': Clay. Olive Gray - Greenish Gray. Gley1-5/5gy	Clay 40% (17" boring)
-159.00	159.0				SP		and 5y5/2. Thin layer.	
-160.00	160.0							Top of bentonite seal: 159.5'
-161.00	161.0							
-162.00	162.0							
-163.00	163.0							
-164.00	164.0							
-165.00	165.0				SP		165': Poorly Graded Sand, 10yr5/4,	
-166.00	166.0						<5% Very Fine, 15% Medium, 80% Coarse.	166' Top of trans sand
-167.00	167.0							
-168.00	168.0							
-169.00	169.0							169' Top of 8X16 sand
-170.00	170.0							
-171.00	171.0							
-172.00	172.0							Clay decreased (17" boring)
-173.00	173.0							Hard chips in drilling mud 173' Centralizer
-174.00	174.0							
-175.00	175.0				SP		175': Sand, Yellowish Brown, 10yr5/4, 80% Coarse,	175' Top of screen
-176.00	176.0						20% Very Coarse.	Clay in ream-mud: 10% (dark gray chips)
-177.00	177.0							
-178.00	178.0							
-179.00	179.0							
-180.00	180.0							
-181.00	181.0				SC		180': Poorly Graded Clayey Sand , Light Olive Brown 2.5y5/3, Sand: 10% Medium, 75% Coarse. Clay-silt > 15%Silt	Start Punch Core-180 ft-bgs Clay: 5-10 % (17" Boring) (dark gray chips) Natural Gamma Trend
-182.00	182.0			60%				
-183.00	183.0				SW-SC		182': Well Graded Clayey Sand, Grayish Brown,10yr 5/2, Sand: 20% Medium, 30% Coarse, 30% Very Coarse, 5%, Gravel, Layered Clays 15%	70-75 API (Clayey)
-184.00	184.0							

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
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Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner		TOC ELEV:	152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano		GS ELEV:	155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.		DATE BEGAN: 07/20/2010	
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET		DATE FINISHED: 07/29/2010	
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)		Piezo. Elev. 151.43	
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60		Note 1: Top of Flange	
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304			Units: feet	

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
-185.00	185.0		Sieve (Field) <1% fines					
-186.00	186.0				SP		186' Poorly Graded Sand with Gravel. Gravel up to 5/8", >15% Gravel	
-187.00	187.0							
-188.00	188.0			80%				
-189.00	189.0							
-190.00	190.0						190' Well Graded Sand with Clay. 10yr5/4. Sand:	Less Clay (17" Boring)
-191.00	191.0						40% Coarse , 10% Fine, 40% Medium,	Natural Gamma Trend
-192.00	192.0						10% Very Coarse, upper 2-feet firm, loose below,	65-70 API (silty)
-193.00	193.0		Sieve (Field) 3.00% Fines	60%				Mud Property (Pilot Boring) Solids: 3 % Marsh cone: 34 seconds Weight: 9.0 lb/ft3 Filter Cake; 4 mm
-194.00	194.0							
-195.00	195.0				SW		195' to 200' Well Graded Sand. Grayish Brown 10yr5/2.	Clay 5% (17" boring)
-196.00	196.0						Sand: 30% Fine, 30% Medium, 20% Coarse	Dark gray clay
-197.00	197.0						15% Very Coarse, Trace Gravel, Clay 5% dark gray.	
-198.00	198.0		Sieve (Field) 2% fines	10%				No clay (17" Boring)
-199.00	199.0							
-200.00	200.0							Mud Property (Pilot Boring) Mud: Marsh Cone 34 sec.
-201.00	201.0							
-202.00	201.0			0%				
-203.00	203.0				SW			
-204.00	204.0							
-205.00	205.0						205' to 210' Poorly Graded Sand. Grayish Brown 2.5Y5/3,	
-206.00	206.0						Grayish Brown 10YR5/2. 20%Fine, 60% Medium,	
-207.00	207.0		Sieve (Field) 5% fines		SW		15% Coarse and 5% very coarse. Trace Silt, Mica	
-208.00	208.0			10%				
-209.00	209.0							
-210.00	210.0						210'-215' Poorly Graded Clayey-Silty Sand.	
-211.00	211.0						Grayish Brown 2.5Y5/3	Natural Gasmma Trend:
-212.00	212.0						60%Fine,15% Medium 10% Coarse, 5% Very Coarse.	80 API (Clay)
-213.00	213.0		Sieve Field 5% fines	10%	SW-SC		5-10% Clay-Silt, Some Mica.	Mud Property (17" Boring) Mud: Density 9.0 lb/ft[3] 3% solids 1.5% sand Filter cake 3/32"
-214.00	214.0							
-215.00	215.0						215' Possible Gravel stringer	215' End Screen

BORING NO. EW-OU2-09-180

Shaw® Shaw Environmental, Inc.

COORDINATES: N. 2137463.33
E. 5749891.44

Datums NAVD88 & NAD 83-Cal Zone 4

PROJECT	Former Fort Ord	PROJECT NUMBER	783751	FIELD GEOLOGIST: W. Werner		TOC ELEV:	152.31[1]
LOCATION	OUCTP	DRILLING METHOD:	Mud Rotary	CHECKED BY: Melinda Montano		GS ELEV:	155.52
DRILL CO.	WDC	Logging: Cuttings, Core 180-220 ft bgs		APPROVED BY: Tim Ault P.G.		DATE BEGAN: 07/20/2010	
DRILLER	Cliff Rainbolt	Boring Diameter Pilot 8.5", reamed 17"		TOTAL DEPTH: 227 FEET		DATE FINISHED: 07/29/2010	
SCREEN:	Diameter: 10 in.	Length: 40 ft	Type/Size S.Steel, 0.045" slot	Sand Pack: 8x16 (8 Mesh)		Piezo. Elev. 151.43	
CASING	Diameter: 10 in.	Length: 175 ft	Type PVC SCH 80	Transition Sand: #60		Note 1: Top of Flange	
SUMP	Diameter: 10 in.	Length: 5 ft	Type SS 304			Units: feet	

Elevation (ft amsl)	Depth (feet)	Well Completion	Sample	Recovery	USCS Symbol	Profile	Description	Comments
-216.00	216.0						216'-220' Well Graded clayey-Silty Sand. 60% Fine sand With Coarse to Very Coarse and Gravel throughout. Grain sized up to 3/4". >5 %Clay	Mud Property (17" Boring) Mud: Density 9.0 lb/ft^3 3% solids 1% sand Filter cake 2/32"
-217.00	217.0							
-218.00	218.0			80%	SW-SC			
-219.00	219.0						219' Possible Gravel stringer, quartz sand eith mica.	
-220.00	220.0							Sump: welded stainless. 220' Bottom of Sump
-221.00	221.0						220' to 227 ' backfiller with bentonite chips (tremied)	
-222.00	222.0							
-223.00	223.0							
-224.00	224.0							
-225.00	225.0						225' Same except: With Clay fragments. Multiple thin clay layers from 200' to 225'	
-226.00	226.0							
-227.00	227.0						Total Depth: 227'	

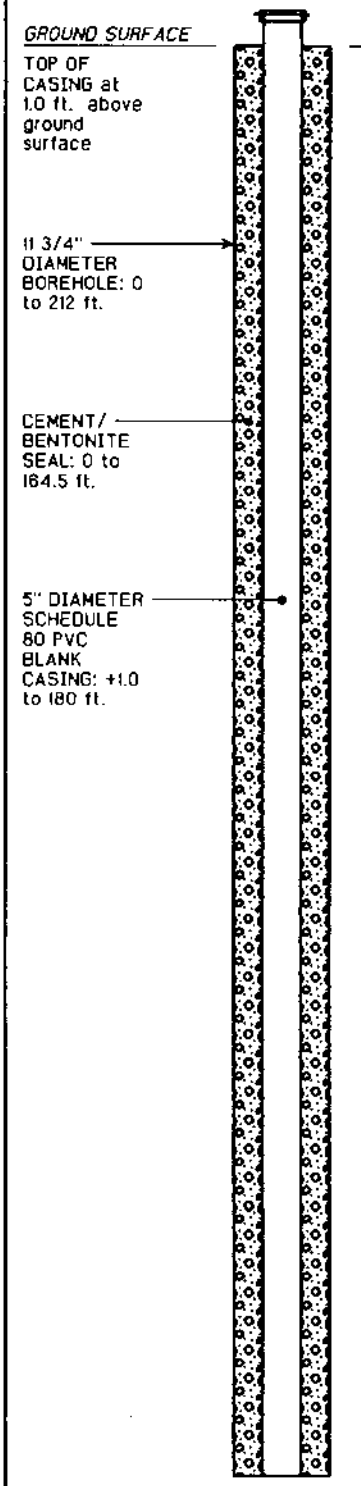
Notes:

1. Mud Property (17" Boring) : Properties measured or observed in drilling mud sampled from well head during reaming of boreole to 17-inches
2. Geophysical logging conducted in 8-inch borehole from ground surface to total depth. Natural Gamma, Caliper, Spontaneous Potential (SP) resistivity (single point, 16-inch and 64 inch normal)
3. Natural Gamma Trend: Visual baseline for natural gamma log over interval of interpreted lithologic zone (e.g. sand, clay, etc).

Top of PVC Casing
Elev. 143.35 ft.

Equipment Speedstar Mud Rotary
11 3/4"-diameter

Elevation 140.30 ft. GS **Date** 02-12-99



Depth (ft.)	Sample	Blows/foot	Recovery (inches)	OVA Reading (ppm)	Sample Number
0					
5					
10					
15					
20				0	
25					
30					
35					
40				0	

BROWNISH YELLOW WELL GRADED SAND (SW) (10YR 6/6)
loose, dry, 90% fine to coarse sand, 10% silt

@ 5 ft: color change to dark grayish brown (10YR 4/2), loose, moist

@ 7 ft: color change to dark yellowish brown (10YR 4/4)

@ 10 ft: similar to above

@ 15 ft: color change to dark yellowish brown (10YR 6/4)

@ 20 ft: color change to yellowish brown (10YR 5/8), wet

@ 25 ft: similar to above

LIGHT OLIVE BROWN POORLY GRADED SAND (SP) (2.5Y 5/3)
medium dense, wet, 90% fine to medium sand, 10% silt

@ 35 ft: similar to above

FTO

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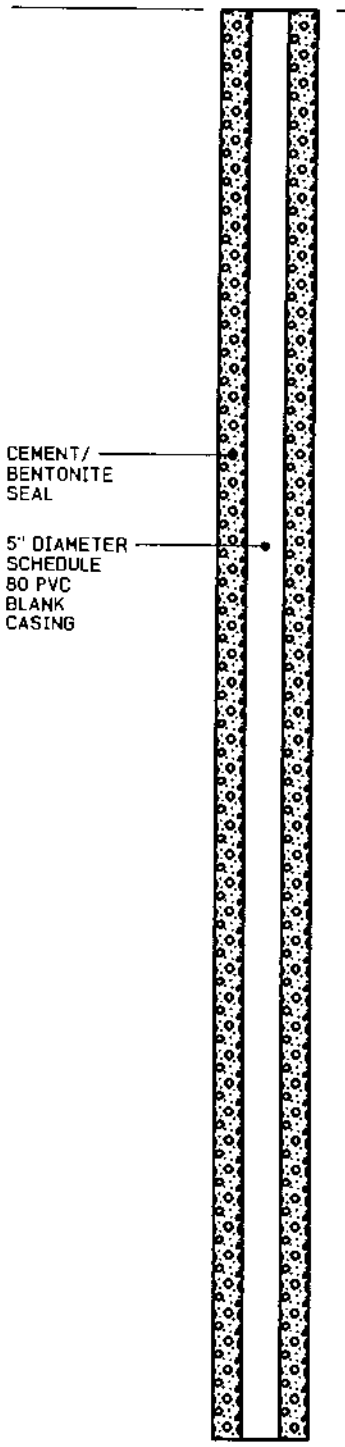
Engineering and Environmental Services

Log of Boring and Well Completion MW-OU2-64-180
OU 2 Plume Delineation
Investigation Report
Fort Ord, California

PLATE **1-5**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar Mud Rotary
11 3/4"-diameter
Elevation 140.30 ft. GS Date 02-12-99



Blows/foot	Recovery (inches)	OVA Reading (ppm)	Sample Number	Depth (ft.)	Sample	
				40		@ 40 ft: similar to above
				45		LIGHT OLIVE BROWN WELL GRADED SAND (SW) (2.5Y 5/3) medium dense, wet, 90% fine to coarse sand, 10% silt
				50		@ 50 ft: similar to above
				55		@ 55 ft: similar to above
		0		60		@ 60 ft: similar to above
				65		@ 65 ft: similar to above
				70		@ 70 ft: similar to above
				75		@ 75 ft: similar to above, decrease in coarse sand
		0		80		

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DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar Mud Rotary
11 3/4"-diameter

Elevation 140.30 ft. GS Date 02-12-99

Depth (ft.)	Sample	Blows/foot	Recovery (inches)	OVA Reading (ppm)	Sample Number
80					
85					
90					
95					
100				0	
105					
110					
115					
120				0	

CEMENT/ BENTONITE SEAL

5" DIAMETER SCHEDULE 80 PVC BLANK CASING

@ 80 ft: similar to above

LIGHT OLIVE BROWN POORLY GRADED SAND (SP) (2.5Y 5/3)
medium dense, wet, 90% fine to medium sand, 10% silt

@ 90 ft: similar to above

LIGHT OLIVE BROWN SILTY SAND (SM) (2.5Y 5/3)
medium dense, wet, 60% fine to medium sand, 40% silt

PALE OLIVE SANDY FAT CLAY (CH) (5Y 6/3)
firm, moist, 60% clay, 40% fine sand

@ 97 ft: color change to olive (5Y 5/3), 80% clay, 20% fine sand

@ 100 ft: color change to dark greenish gray (5BG 4/1)

@ 105 ft: similar to above, decrease in fine sand to 10%, trace coarse sand

@ 110 ft: similar to above

@ 115 ft: similar to above, 90% clay, 10% fine sand

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DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar Mud Rotary
11 3/4"-diameter
Elevation 140.30 ft. GS Date 02-12-99

Blows/foot	Recovery (inches)	OVA Reading (ppm)	Sample Number	Depth (ft.)	Sample
				120	
				125	
				130	
				135	
		0		140	
				145	
				150	
				155	
		0		160	

CEMENT/ BENTONITE SEAL

5" DIAMETER SCHEDULE 80 PVC BLANK CASING

@ 120 ft: similar to above, decrease in sand to 5%

@ 125 ft: color change to olive (5Y 5/3), increase in sand to 10%

@ 130 ft: similar to above

@ 135 ft: similar to above, 80% clay, 20% fine sand

@ 138 ft: Driller notes: drill rods take off, loose drilling
LIGHT OLIVE BROWN SILT (ML) (2.5Y 5/3)
firm, moist, 80% silt, 20% fine sand

@ 145 ft: similar to above

LIGHT OLIVE BROWN CLAYEY SAND (SC) (2.5Y 5/3)
dense, wet, 70% fine to coarse sand, 30% clay

@ 150 ft: similar to above

@ 152 ft: clay decreases to 15%

LIGHT OLIVE BROWN WELL GRADED SAND (SW) (2.5Y 5/3)
dense, wet, 90% fine to coarse sand, 10% silt
Note: lenses of silt and sand from 155 to 160 ft.

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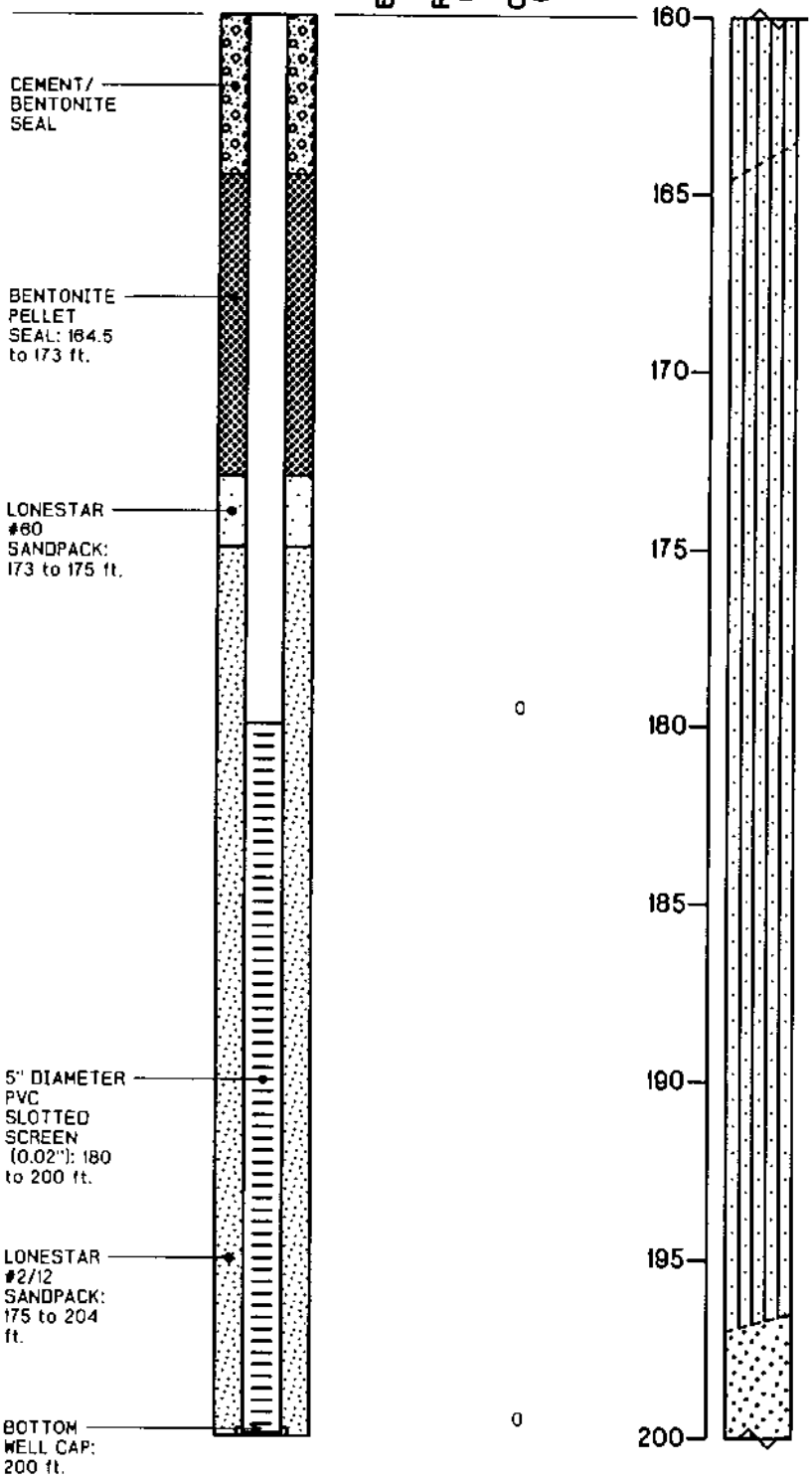
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar Mud Rotary
11 3/4"-diameter
Elevation 140.30 ft. GS Date 02-12-99



LIGHT OLIVE BROWN SILTY SAND (SM) (2.5Y 5/3) dense, wet, 65% fine to coarse sand, 35% silt

@ 165 ft: similar to above, decrease in silt to 15%

@ 170 ft: similar to above

@ 175 ft: similar to above, 80% fine to coarse sand, 20% silt, trace gravel

@ 180 ft: similar to above

@ 185 ft: similar to above, increase in silt to 30%

@ 190 ft: similar to above

@ 195 ft: similar to above

@ 197 ft: increase in clay and silt, interbedded clay, silt and sand between 197 and 205 ft.

FTO

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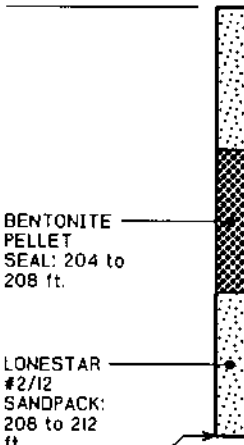
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar Mud Rotary
11 3/4"-diameter
Elevation 140.30 ft. GS Date 02-12-99

Blows/foot	Recovery (inches)	OVA Reading (ppm)	Sample Number	Depth (ft.)	Sample
				200	
				205	
				210	
		0		220	
				225	
				230	
				235	
		0		240	



@ 200 ft: similar to above

@ 203 ft: similar to above, increase in sand to 35%

LIGHT OLIVE BROWN CLAYEY SAND (SC) (2.5Y 5/3)
dense, wet, 60% fine to coarse sand, 30% fat clay, 10% silt

@ 210 ft: similar to above, 75% fine to coarse sand, 25% silt

@ 212 ft: 80% fine to coarse sand, 20% fat clay
Bottom of boring at 212 ft.
backfilled with #2/10 sand to 208 ft, bentonite pellets to 204 ft.

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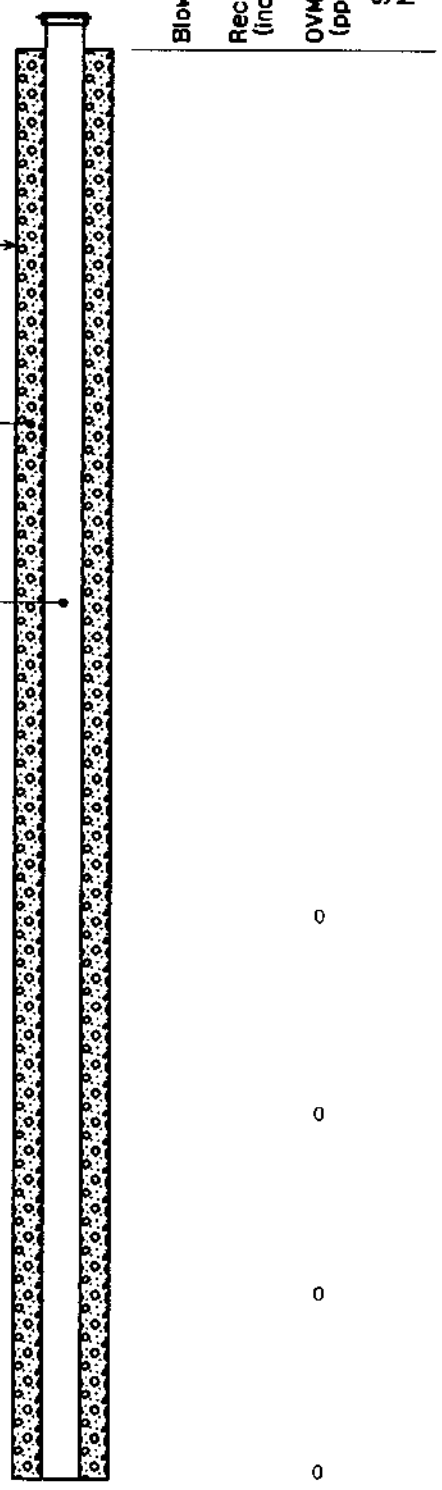
Top of PVC Casing
Elev. 144.27

Equipment Speedstar SS-15 THH
10"-diameter
Elevation 142.30 ft. GS Date 02-03-99



Blows/foot	Recovery (inches)	OVM Reading (ppm)	Sample Number	Depth (ft.)	Sample	
				0		DARK YELLOWISH BROWN POORLY GRADED SAND (SP) (10YR 4/4) loose, moist, 95% fine sand, 5% silt
						@ 4 ft: color change to 10YR 3/4, 5-10% silt
				5		@ 5 ft: color change to dark yellowish brown (10YR 4/6), 5% silt
						@ 7 ft: change to 5-10% silt/fines, trace moist nodules
				10		
						@ 12 ft: similar to above without nodules
				15		
				20		YELLOWISH BROWN SILTY SAND (SM) (10YR 5/6) medium dense, 80% fine sand, 20% silt
		0		25		
		0		30		LIGHT YELLOWISH BROWN POORLY GRADED SAND (SP) (10YR 6/4) medium dense, 90% fine to very fine sand, 10% silt
		0		35		
		0		40		YELLOWISH BROWN POORLY GRADED SAND (SP) (10YR 5/6) loose, 95% fine sand, 5% silt

FTO

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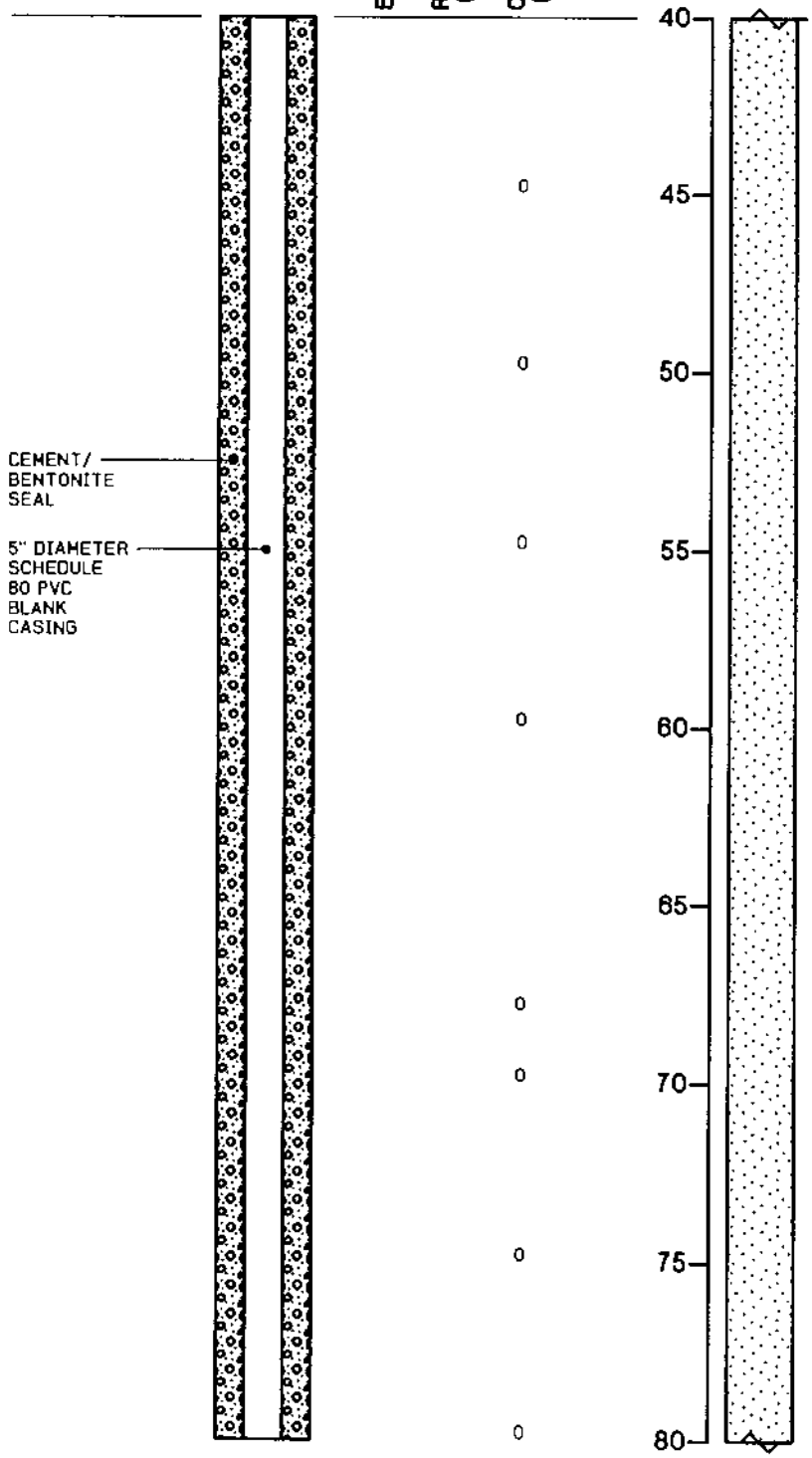
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar SS-15 THH
10"-diameter
Elevation 142.30 ft. GS Date 02-03-99



@ 45 ft: similar to above

@ 50 ft: similar to above

YELLOWISH BROWN POORLY GRADED SAND (SP) (10YR 5/6) medium dense, 90% fine sand, 10% silt

@ 58 ft: color change to yellowish brown (10YR 5/4)

@ 64 ft: similar to above

YELLOWISH BROWN POORLY GRADED SAND (SP) (10YR 5/6) medium dense, 90% very fine to fine sand, 10% silt

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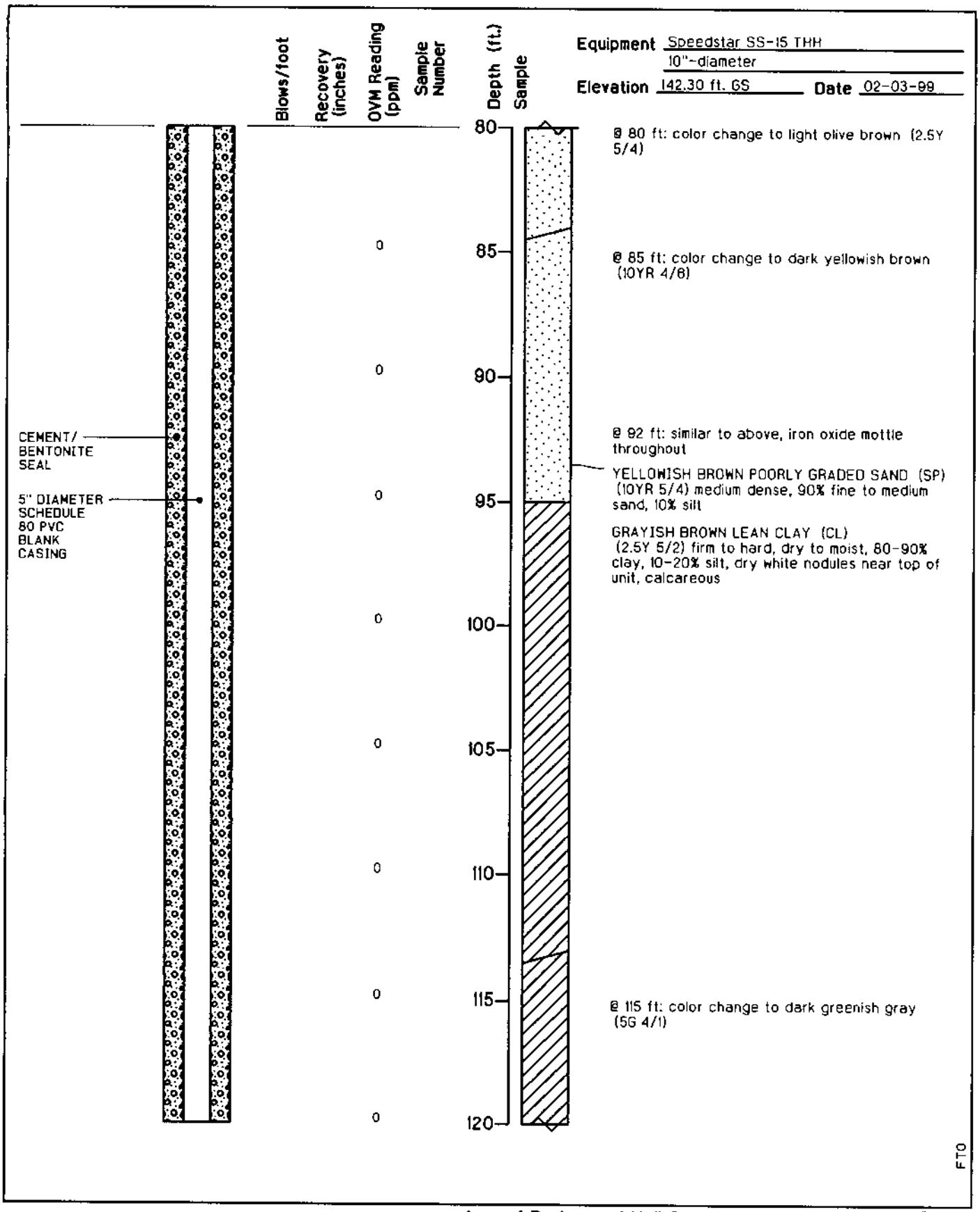

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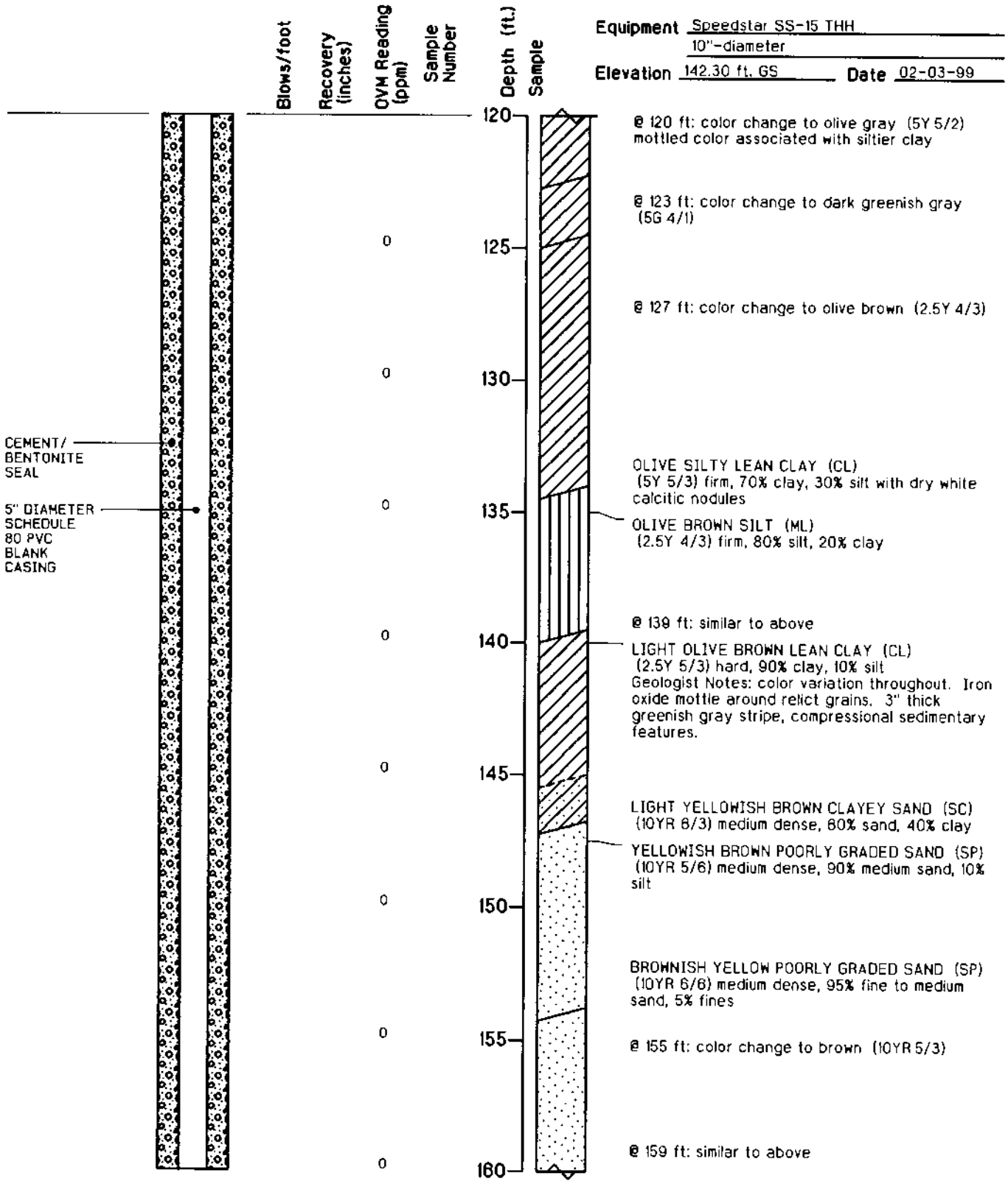
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar SS-15 THH
10"-diameter
Elevation 142.30 ft. GS Date 02-03-99



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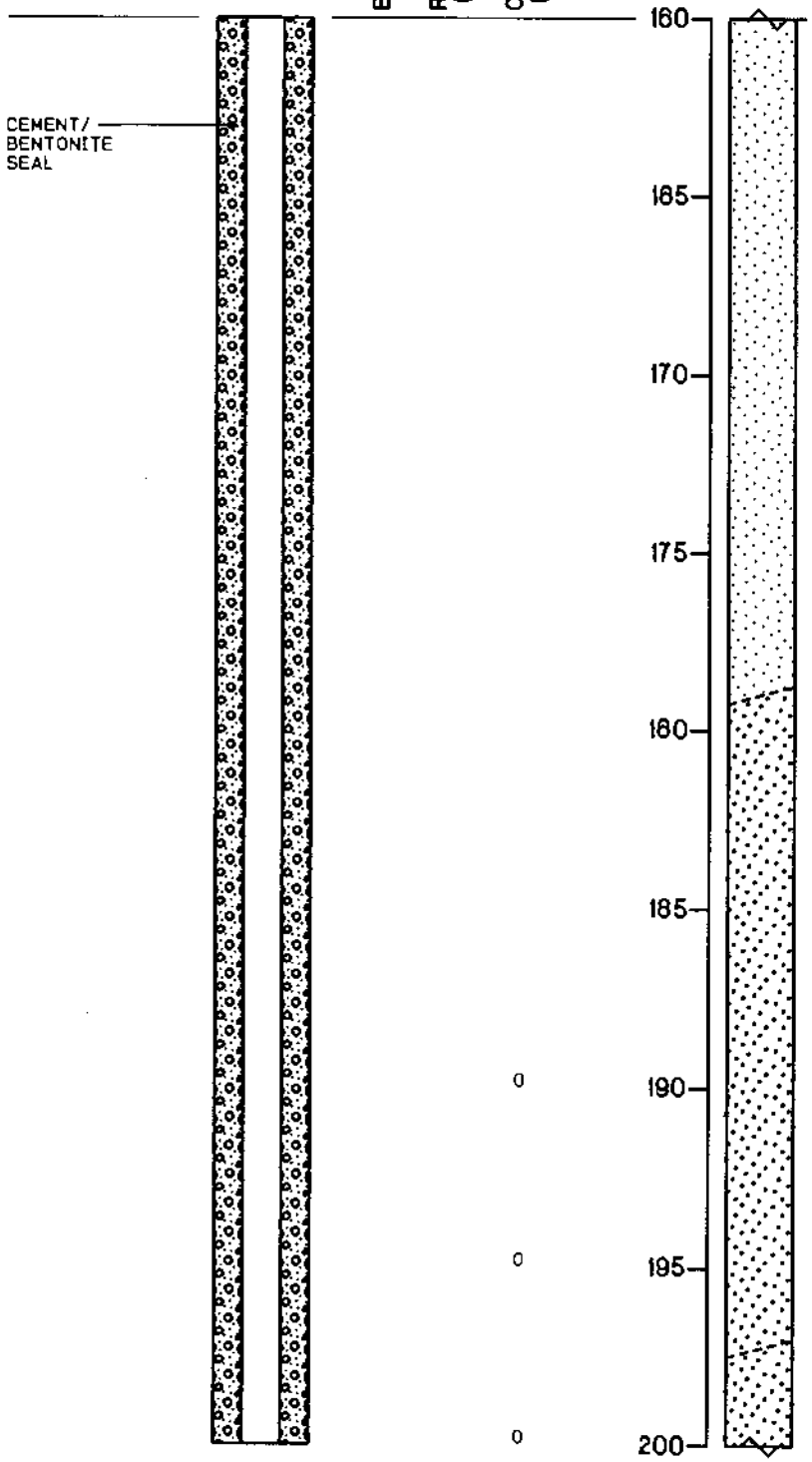
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar SS-15 THH
10"-diameter
Elevation 142.30 ft. GS Date 02-03-99



@ 164 ft: no recovery, cuttings similar to above (>80% sand, <20% fines)

@ 169 ft: no recovery, similar to above

@ 174 ft: no recovery

@ 179 ft: coarser cuttings, no recovery

@ 184 ft: no recovery

@ 189 ft: limited recovery
LIGHT YELLOWISH BROWN WELL GRADED SAND WITH GRAVEL (SW)
(10YR 6/4) medium dense, 100% sand, ~15% of grains blue shale - highly weathered

@ 194 ft: similar to above

@ 197 ft: 80% sand (tan, iron oxide shale), 20% silty clay, (from cuttings only)

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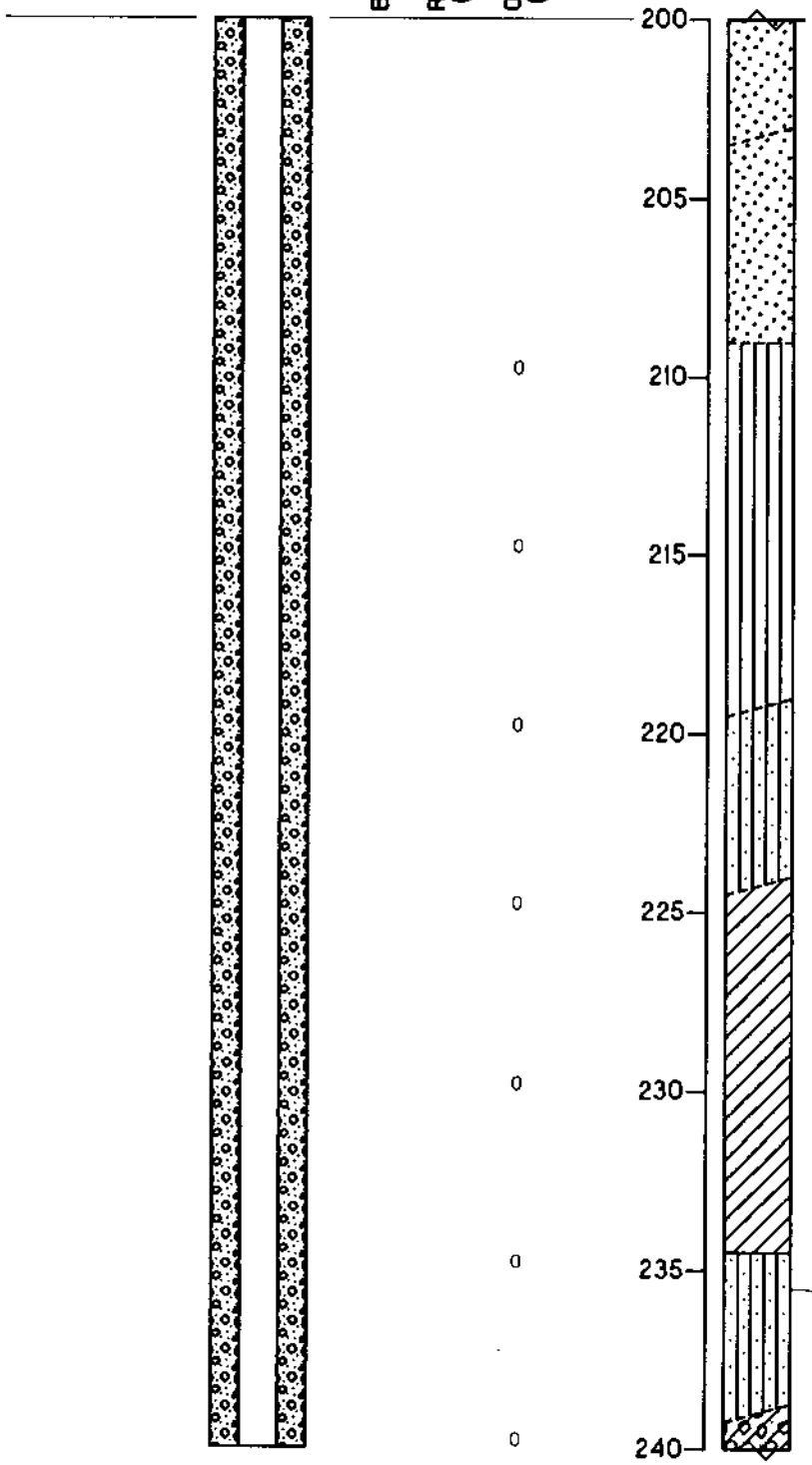
Equipment Speedstar SS-15 THH
10"-diameter
Elevation 142.30 ft. GS Date 02-03-99



DARK BROWN WELL GRADED SAND (SW)
(7.5YR 4/4) medium dense, 95% sand, 5% silt

@ 204 ft: no recovery, cuttings are light yellowish brown well graded sand (SW) (10YR 6/4) 90% sand, 10% gravel, fines fraction unknown. Some material (20-30% shale) weathered to clay consistency.

BROWN SILT (ML)
(10YR 5/3) firm, 90% silt, 10% sand, mica rich

LIGHT OLIVE BROWN SILT (ML)
(2.5Y 5/3) firm, 90% silt, 10% very fine sand

LIGHT OLIVE BROWN SILTY SAND (SM)
(2.5Y 5/3) firm, 60% fine sand, 30% silt, 10% gravel

LIGHT OLIVE BROWN LEAN CLAY WITH SAND (CL)
(2.5Y 5/6) hard, 80% clay, 20% sand

LIGHT OLIVE BROWN SANDY LEAN CLAY (CL)
(2.5Y 5/3) hard, 50% clay, 30% sand, 20% silt

Variable drill rate. Laminations of fines within coarser unit

LIGHT YELLOWISH BROWN (CLAYEY) SILT (ML)
(2.5Y 6/3) very firm, 70% silt, 30% clay

LIGHT YELLOWISH BROWN SILTY SAND (SM)
(2.5Y 6/3) dense, 70% sand, 20% silt, 10% gravel

LIGHT YELLOWISH BROWN CLAYEY GRAVEL WITH SAND (GC)
(2.5Y 6/3) dense, 40% gravel, 30% sand, 30% clay

FTO

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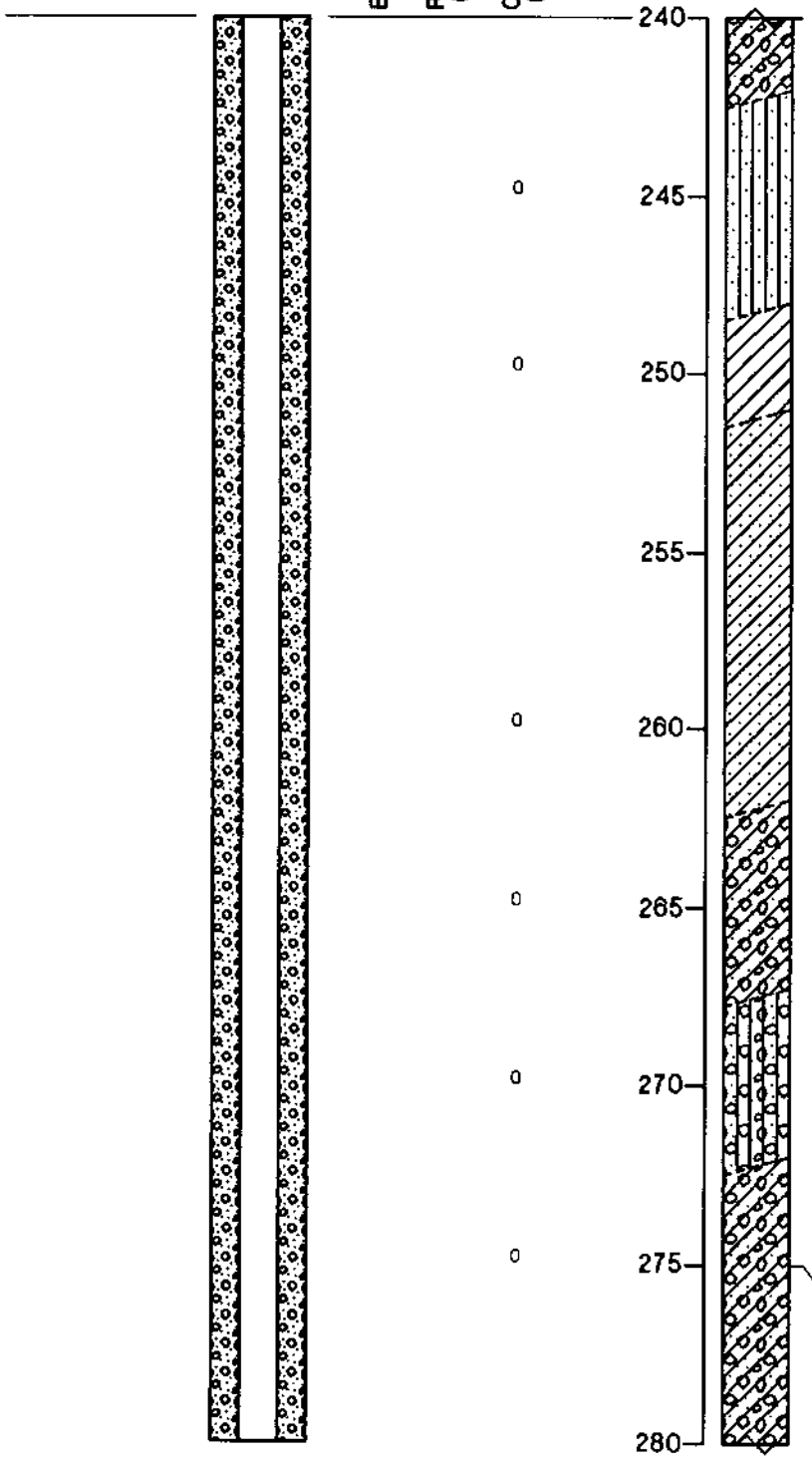
PLATE **1-7**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar SS-15 THH
10"-diameter
Elevation 142.30 ft. GS Date 02-03-99



LIGHT YELLOWISH BROWN SILTY SAND WITH GRAVEL (SM)
(2.5Y 6/3) dense, 50% sand, 30% gravel, 20% silt

LIGHT YELLOWISH BROWN SANDY LEAN CLAY (CL)
(2.5Y 6/3) hard, 70% clay, 30% sand

@ 254 ft: no recovery (rock in shoe), cuttings are light yellowish brown clayey sand, (SC)
(2.5Y 6/3) 80% well graded sand, 20% clay

LIGHT YELLOWISH BROWN CLAYEY SAND WITH GRAVEL (SC)
(2.5Y 6/3) 50% sand, 30% gravel, 20% clay

LIGHT YELLOWISH BROWN CLAYEY GRAVEL (GC)
(2.5Y 6/3) dense, 60-70% gravel, 20-30% clay, 10% sand, (rocks with clay matrix)

LIGHT YELLOWISH BROWN SILTY GRAVEL (GM)
(2.5Y 6/3) dense, 60% gravel, 20% sand, 20% silt, (rocks with silt matrix)
diatomaceous nodules to 1.5 inches long

LIGHT OLIVE BROWN CLAYEY GRAVEL WITH SAND (GC)
(2.5Y 5/3) dense, 50% gravel, 30% clay, 20% sand

@ 275 ft: drill chatters in coarser material

@ 279 ft: no recovery

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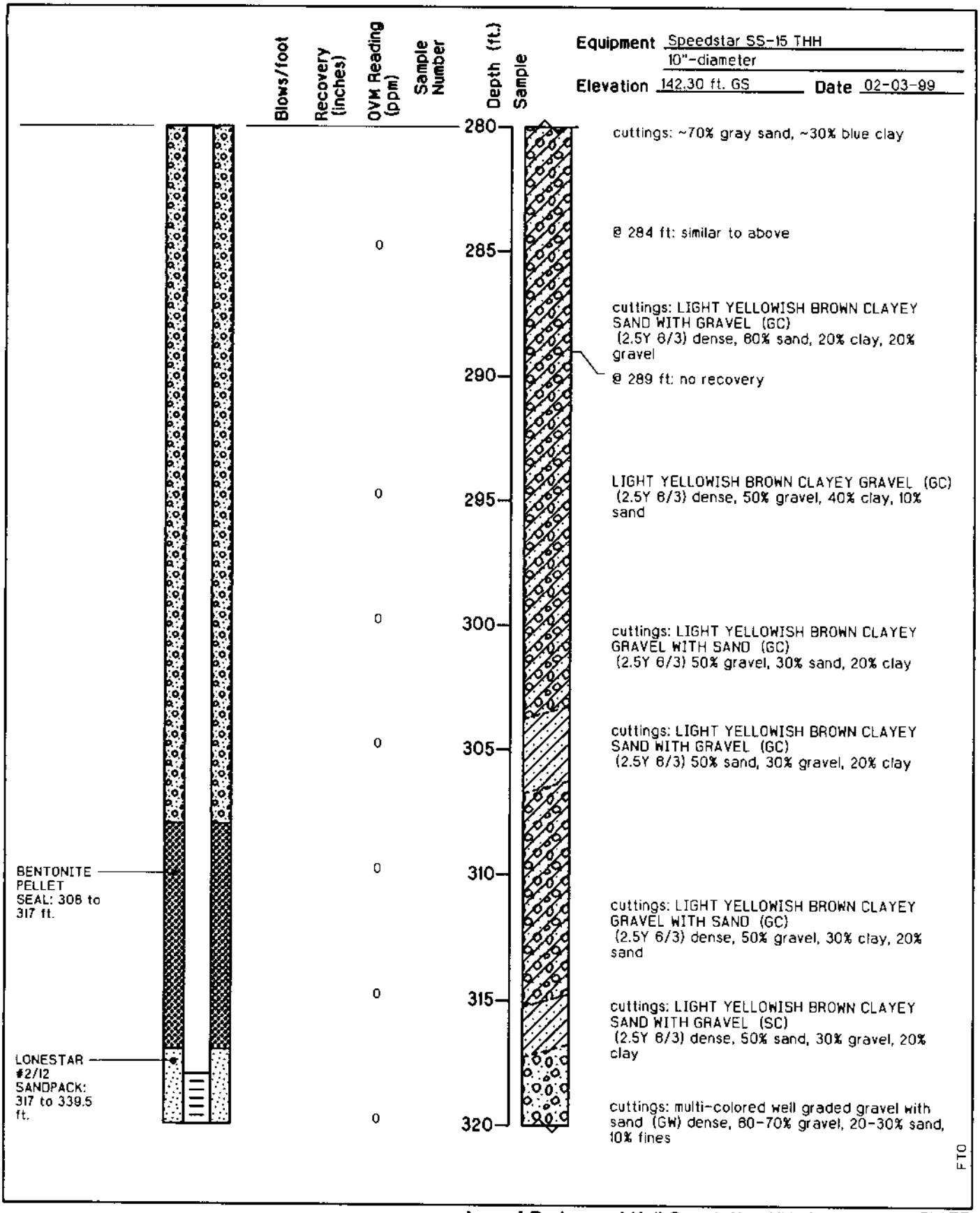
PLATE **1-7**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	



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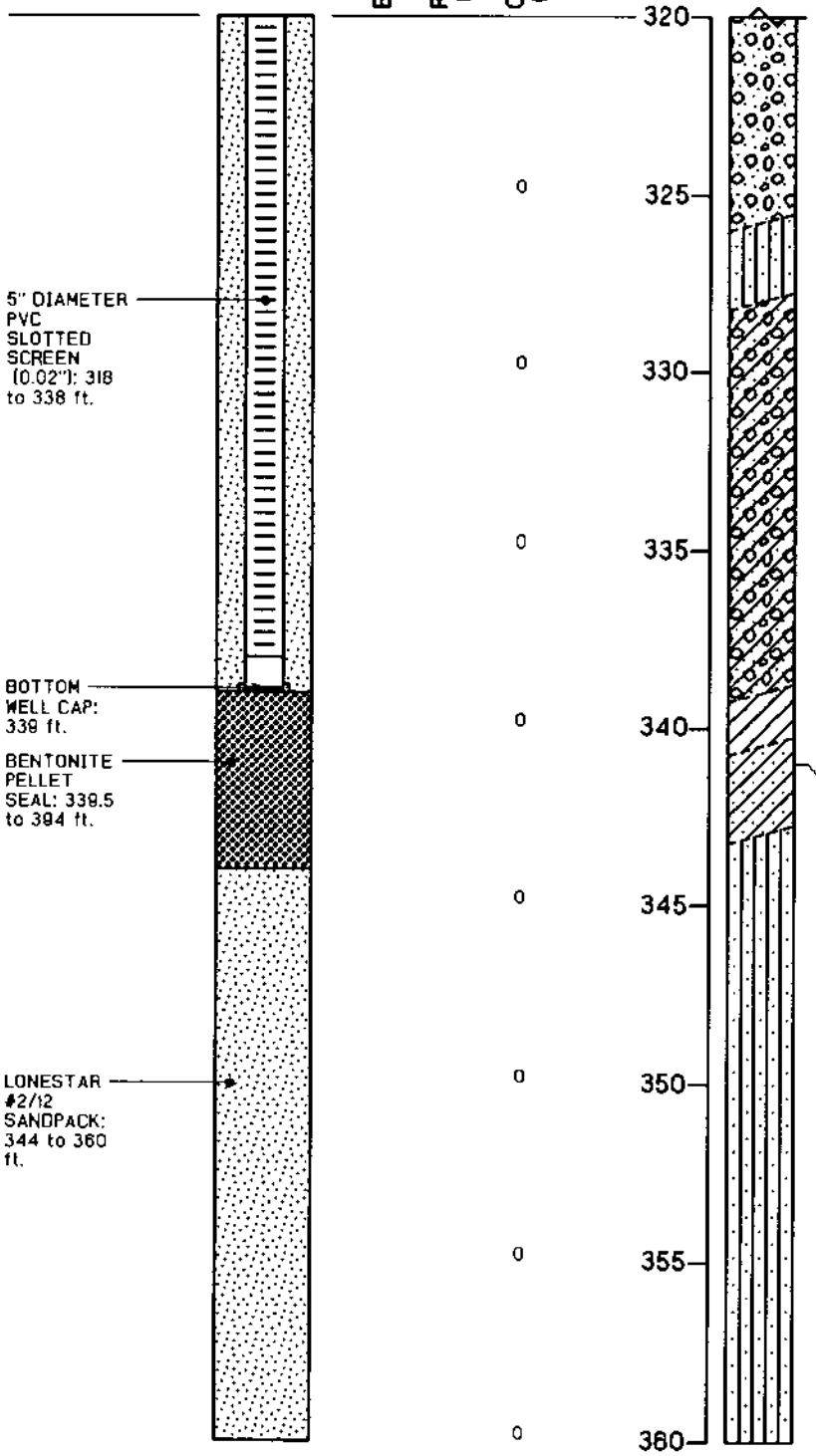
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

Equipment Speedstar SS-15 THH
10"-diameter
Elevation 142.30 ft. GS Date 02-03-99



cuttings: LIGHT YELLOWISH BROWN SILTY SAND WITH GRAVEL (SM)
(2.5Y 6/3) dense, 50% sand, 30% silt, 20% gravel

cuttings: LIGHT YELLOWISH BROWN CLAYEY GRAVEL WITH SAND (GC)
(2.5Y 6/3) 60% gravel, 20% clay, 20% sand

cuttings: LIGHT YELLOWISH BROWN LEAN CLAY (CL)
(10YR 6/4) firm, 60% clay, 40% sand

cuttings: LIGHT YELLOWISH BROWN CLAYEY SAND (SC)
(10YR 6/4) dense, 60% sand, 40% clay

cuttings: LIGHT YELLOWISH BROWN SILTY SAND WITH GRAVEL (SM)
(2.5Y 6/3) dense, 60% sand, 20% silt, 20% gravel

@ 352 ft: similar to above, siltier with depth

@ 356 ft: change to 40% sand, 40% silt, 20% gravel

Bottom of boring at 360 ft.
Continuously cored with 60" tool.

FTO

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion MW-OU2-66-180
OU 2 Plume Delineation Investigation Report
Fort Ord, California

PLATE **1-7**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PCB	42481 00123		3/99	

ATTACHMENT D

Design Specifications

List of Specifications

SECTION 01300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

Section 01300 applies to each Subcontractor/Supplier submittal prepared after contract award, after receipt of a purchase order, or after receipt of a notice to proceed. This section includes the requirements and procedures for the preparation and submission of all submittals required in other related sections or documents.

1.1 DEFINITIONS

Contractor/Buyer	Primary company or individuals who have been contracted to supply and deliver materials, and to perform work as described in the drawing(s), specification(s), and/or Statement of Work (SOW).	
Related sections	Individual specification sections and special clauses in these contract documents contain additional and special submittal requirements.	
Subcontractor	Companies or individuals who have been contracted by the Contractor/Buyer to supply and deliver materials, and to perform work as described in the drawing(s), specification(s), and/or SOW.	
Submittal Designations	SD-01	Data
	SD-02	Manufacturer's Catalog Cuts
	SD-04	Drawings
	SD-05	Design Data
	SD-06	Instructions
	SD-07	Schedules
	SD-08	Statements
	SD-09	Reports
	SD-10	Test Reports
	SD-12	Field Test Reports
	SD-13	Certificates
	SD-17	Manufacturer's Letter
	SD-18	Records
	SD-19	Operations and Maintenance Manuals
Supplier	Company or individual who has been contracted to supply and deliver the materials and/or equipment described in the drawing(s), specification(s), and/or the SOW.	

1.2 DEVIATIONS

The Subcontractor/Supplier shall furnish additional submittals, as necessary, for any deviation(s) from the plans, construction drawings, specifications, and/or Contract Documents. Any deviations must be submitted in writing and approved by the Contractor/Buyer prior to either commencement of work or delivery of items.

1.3 SUBMITTAL EXPENSES

Where a submittal is required by the Specifications, related work performed prior to Contractor/Buyer review and written approval of the pertinent submission would be performed at risk, may not be accepted, and may require removal or rework until contract specifications are met or work is properly approved and accepted. Delays caused by the need for re-submittal shall not constitute basis for claim.

The Contractor/Buyer will not provide engineering or other services for the Subcontractor/Supplier to protect the Subcontractor/Supplier from accruing additional costs.

1.4 CREDITS

The Contractor/Buyer is not precluded, by virtue of review, acceptance, or approval, from obtaining a credit for construction savings resulting from allowed concessions in the work or materials thereof.

1.5 REPORTING PROCEDURES

Submittals processed by the Contractor/Buyer do not become Contract Documents and are not to be considered change orders. The purpose of submittal review is to establish a reporting procedure and is intended for Subcontractor/Supplier's convenience in organizing the work and for the Contractor/Buyer to monitor Subcontractor/Supplier's progress and understanding of the design.

1.6 SUBCONTRACTOR/SUPPLIER RESPONSIBILITY

The Contractor/Buyer 's review of submittals shall not relieve the Subcontractor/Supplier from responsibility for any variation from the requirements of the Contract Documents unless Subcontractor/Supplier has been given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the submittal approval by the Contractor/Buyer. Approval by the Contractor/Buyer does not relieve Subcontractor/Supplier from responsibility for errors or omissions in the submittal or from responsibility for having complied with the provisions herein.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

The Contractor/Buyer reserves the right to modify the procedures and requirements for execution as necessary to accomplish the specific purpose of each submittal.

3.1 SUBCONTRACTOR/SUPPLIER SUBMITTAL PROCEDURES

Following contract award, receipt of the Contractor/Buyer purchase order number, or receipt of a notice to proceed, Subcontractor/Supplier shall furnish the submittals required in applicable specification sections. Submittals detailed in the individual specification sections must be received in the time frame indicated in the SOW and/or purchase order. Submittals shall meet the following requirements:

3.1.1 Subcontractor/Supplier Review of Submittal

Before delivering each submittal, determine and verify quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar data. Apply Subcontractor/Supplier's stamp, signed or initialed certifying that the review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with requirements of the Contract Documents.

Submittals that do not clearly show Subcontractor/Supplier's review stamp or specific written indication of Subcontractor/Supplier review will be returned to Subcontractor/ Supplier for resubmission.

3.1.2 Submittal Size

Submittals shall be in black ink on photo-reproducible 8.5-inch x 11-inch white paper suitable for mass reproduction. Drawing submittals shall be on “A” (8.5 x 11 inches); “B” (11 x 17 inches); or “D” (22 x 34 inches) size paper; and shall be on an easily reproducible medium. Irregular sized or colorized brochures may be submitted provided they are submitted in the quantities required in Section 3.1.6.

3.1.3 Submittal Quality

Original and copies of submittals shall be easily readable and reproducible. Unreadable copies will not be accepted. Faxed submittals may be sent to expedite the approval process, but will be considered draft until the “hard copy” is received.

3.1.4 Submittal Approval and Delivery

On each submittal provide space for the Contractor/Buyer’s approval, 3 inches by 3 inches. Submittals sent for the Contractor/Buyer approval shall be transmitted by next day express mail with morning delivery. All other submittals shall be sent by express mail, not exceeding two-day delivery.

3.1.5 Submittal Numbering

If more than two separate submittals are required, the Subcontractor/Supplier shall establish with the Contractor/Buyer’s Task Manager the method for numbering and

tracking submittals. The submittal forms must be sequentially numbered. Re-submittals shall have the original numbering with consecutive alphabetic suffix.

3.1.6 Letter of Transmittal

Submittals shall be accompanied by a letter of transmittal, on the Subcontractor/Suppliers letter head, listing each submittal included, with the related specification number and signed by an authorized agent of the Subcontractor/Supplier. Include written notice of each variation that the submittal may have from the requirements of the Contract Documents.

3.1.7 Number of Copies

Mail the following number of copies of each submittal accompanied with a letter of transmittal to the Contractor/Buyer.

Submittal Type	Submittals Sent 1) For Information Only (FIO) 2) For Contractor Approval (CA), or 3) Re-submitted For CA Approval	
	Contractor Quality Control Manager	Contractor Project Engineer
8.5-inch x 11-inch white paper OR A, B or D Size Drawings	(1) original and (1) copy	(1) copy
Irregular Size OR Colorized Brochures	(8) originals	(2) originals
Copyrighted Materials	(8) copies	(2) copies

3.1.8 Copyrighted Submittals

Copyrighted submittals not only must contain all stipulations regarding the use of the information, but also authorize the Contractor/Buyer the right to make additional copies of the information, for internal and client use only. Copyrighted information will be considered proprietary and will not be available for general distribution without the consent of the Subcontractor/Supplier. When the copyright for a submittal cannot be obtained, such as may be the case with manufacturer's product literature, the Subcontractor/Supplier shall provide an additional 10 copies.

3.2 SUBMITTAL REVIEW

The Contractor/Buyer's review will only be for conformance with the project construction concept and for compliance with the information given in the Contract Documents. The Contractor/Buyer's review will not, in any way, alleviate the Subcontractor/Supplier's responsibility to perform all work in accordance with applicable codes, regulations and engineering practice standards.

3.2.1 Submittal Review

The individual Specification Sections may include a “for information only” (FIO) designator. FIO submittals are placed in the Contractor’s as-built files, and are not subject to timely reviews. Nonconforming items embedded in the “FIO” submittal shall be clearly marked in the accompanying transmittal letter. Nonconforming items, including adjacent features of work, shall be replaced with conforming items, including adjacent features of work, at no additional cost to the Contractor.

All other requested submittals require Contractor/Buyer acceptance. Nonconforming items embedded in the any submittal shall be clearly marked in the accompanying transmittal letter. Nonconforming items, including adjacent features of work, shall be replaced with conforming items, including adjacent features of work, at no additional cost to the Contractor.

Supplier should allow a minimum of two weeks in the Subcontractor/Supplier’s schedule for review of each submittal requiring Contractor/Buyer approval. After submittals have been reviewed by the Contractor/Buyer, one copy will be returned to the Subcontractor/ Supplier appropriately annotated. If changes or corrections are necessary, the Subcontractor/Supplier shall correct and re-submit the submittal in the same manner and quantity as specified for the original submittal. All changes made since the previous submittal shall be identified on the submittal forms.

3.2.2 Unchecked Submittals

If submittals are submitted that are not required under these Subcontractor/Supplier Documents, the submittal will not be returned to the Subcontractor/Supplier nor reviewed by the Contractor/Buyer, unless specifically requested.

3.2.3 Failure to Obtain Review

Failure to obtain review, acceptance, or approval of submittals, substitutions, schedules, shop drawings, lists of materials, and procedures submitted or requested by the Contractor/Buyer will result in imposing consequences stated in contract conditions, which may include but is not limited to rework, replacement, re-submittal, removal, or withholding of payment until work is properly completed.

3.3 SAMPLES AND TESTS

3.3.1 Sample Size and Quantity

Where required in the Specifications and as determined necessary by the Contractor/Buyer, submit samples of materials to be used or offered for use in connection with the work. Include information as to their sources. Samples shall be properly labeled, prepared, packaged, and shipped prepaid at the Subcontractor/Supplier's sole expense.

3.3.2 Examination of Samples

Unless otherwise specified, submit samples at least 30 days prior to site delivery to enable the Contractor/Buyer to make necessary examination without delay to the work.

3.3.3 Additional Samples

Submit additional samples as required by the Contractor/Buyer to ensure equality with the original approved sample and/or to determine specification compliance.

3.3.4 Independent Labs

Tests required by the Specifications performed by an independent laboratory shall be made by a laboratory licensed or certified in accordance with state statutes and approved by the Contractor/Buyer. Submit original certified test results of specified tests to the Contractor/Buyer.

3.3.5 Sampling, Analytical, and Reporting Expenses

All costs associated with sampling, sample shipment, sample analysis, analytical reporting to the Contractor/Buyer shall be at the expense of Subcontractor/Supplier and included in the prices bid for the associated work.

END OF SECTION

SECTION 01620
PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 – GENERAL

Section 01620 applies to each Subcontractor/Supplier delivery after contract award, after receipt of Contractor/Buyer purchase order, or after receipt of a Contractor/Buyer notice to proceed. This section includes the requirements and procedures for product delivery, storage and handling.

1.1 DELIVERY

1.1.1 Do not deliver products to the project site until related shop drawings and other submittals (*i.e.*, equipment certification, equipment calibrations, operations and maintenance manuals, *etc.*) have been reviewed and approved by the Contractor/Buyer.

1.1.2 Products shall be delivered to site in manufacturer's original, unopened, labeled containers, and include all required documentation (*i.e.*, equipment descriptions, material safety data sheets, *etc.*), as necessary, to verify that they conform to project requirements.

1.1.3 Do not drop, roll, or skid products off delivery vehicles. Hand carry or use suitable material handling equipment.

1.1.4 If the material is perishable, such as concrete, do not deliver until ready for field placement.

1.2 INSPECTION

Delivered materials and equipment will be inspected prior to use at the site. Delivered materials and equipment provided by the subcontractor/supplier are subject to and must comply with the requirements of the Defense Federal Acquisition Regulations 252.225-7001 and the FAR 52.225-5 Buy American Act requirements. Hours for delivery are Monday through Thursday; 6:30am to 4:30pm.

1.3 STORAGE AND PROTECTION

1.3.1 Segregate, store and protect products in accordance with the manufacturer's recommendations and the requirements specified below. Store and protect products to prevent contamination, such as by dirt, dust, oil and grease. Provide for accurate identification of components after shipping bundles and tags are removed. No on-site or existing storage facilities are available for use by the Subcontractor/Supplier unless specifically requested.

1.3.2 Do not store products in or near structures under construction without prior written approval from the Contractor/Buyer. Do not block or restrict the use of access roads with stored material.

1.3.3 Protect stored materials from damage from vandals.

1.3.4 Do not store any product directly on the ground, in drainage ditches, or areas where water may stand. Protect mechanical and electrical equipment from contamination by dirt and dust.

1.3.5 The following types of materials may be stored out-of-doors without cover on wood blocking: masonry units, reinforcing steel, structural steel, piping (dual containment pipe shall be capped on both ends prior to storage), pre-cast concrete, castings, and gratings.

1.3.6 All items not mentioned in Paragraph 1.3.5 above shall be stored in an enclosed area.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01651
PIPELINE PRESSURE TESTING

PART 1 – GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

Manufacturer's Standardization Society of Valve and Fittings Industry (MSS)
American Society of Mechanical Engineers (ASME)
American Water Works Association (AWWA)
ASTM International (ASTM)

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 HYDROSTATIC TESTING OF CARRIER PIPES

Carrier piping shall be visually inspected for mechanical completion and then hydrostatically pressure tested prior to being placed into service. Pressurizing equipment shall be equipped with a high pressure cut-out switch and/or high pressure water release valve that is field adjustable. The switch or valve setting shall be determined by the onsite engineer.

3.1.1 High Density Polyethylene Pipe

Underground pipe composed of high density polyethylene (HDPE) shall be partially covered with backfill. Welds, fittings, and flanges shall be left uncovered during pressure testing where feasible. For double-contained pipes, the annular space shall be left open to the atmosphere during the test sequence. The test sequence shall follow Paragraph 3.1.3 below.

3.1.2 Polyvinyl Chloride and Stainless Steel Pipe

Above-ground pipe composed of polyvinyl chloride (PVC) and/or stainless steel pipe shall be adequately supported and secured with pipe clamps to support the weight and

movement of the pipe and water. The test sequence shall follow Paragraph 3.1.3 below.

3.1.3 Hydrostatic Test Sequence

The hydrostatic test sequence includes the low pressure test, initial expansion, and test phase.

The pipeline, or portion of a pipeline, being tested shall be mechanically isolated and filled with potable water. High point valves shall be bled to minimize air entrainment. The water pressure in the pipe shall be initially raised to between 5 and 10 pounds per square inch gauge (psig). The pressurized section shall be inspected for leaks. Errors or omissions shall be corrected per manufacturer's requirements or the intended use of the pipeline before the isolated section is retested.

After the pipeline passes the low pressure test with zero leaks, the test section will be pressurized to the "Test Pressure" for the duration of "Initial Expansion Time" listed in Table 1. Makeup water may be added at 60-minute intervals for the HDPE and 5-minute intervals for the PVC or stainless steel. The pressurized section shall be inspected for leaks. If the initial expansion duration exceeds the "Maximum Time" allowed, the pipe shall be allowed to rest at zero gauge pressure for at least 12 hours before retesting. If a leak is indicated by pressure or water loss, the isolated pipe section will be corrected per manufacturer's requirements or the intended use of the pipeline before the section is retested. Retesting shall commence with the low pressure test.

Table 1
Test Pressure for Various Piping Systems

Piping Description	Test Pressure (pounds per square inch gauge)	Initial Expansion		Test Phase	
		Time	Maximum Time	Time	Maximum Time
Conveyance Subsystem (Extraction) – HDPE Carrier Pipe	100	2 hours	4 hours	1 hour	3 hours
Extraction Well Vault Pipe – Stainless Steel Well Cap	150	15 minutes	4 hours	15 minutes	4 hours
Extraction Well Vault Pipe – Polyvinyl Chloride Pipe and other Wellhead Fittings	100	60 minutes	4 hours	15 minutes	24 hours

After the pipeline passes the initial expansion time with zero leaks, the test section will be pressurized to the "Test Pressure" and "Test Phase Time" listed in Table 1. The test phase must immediately follow the initial expansion phase. Makeup water is allowed only at the end of the test. The pressurized section shall be inspected for leaks. If the test phase exceeds the "Maximum Time" allowed, the pipe shall be

allowed to rest at zero gauge pressure for at least 12 hours before retesting. If a leak is indicated by pressure or water loss above those specified in Paragraph 3.1.4, the isolated pipe section will be corrected per manufacturer's requirements or the intended use of the pipeline before the section is retested. Retesting shall commence with the low pressure test.

3.1.4 Hydrostatic Pressure Test Passing Criteria

Allowable amounts of makeup water for expansion during the HDPE pressure test are presented in Table 2. The test results may also be adjusted for fluctuations in temperatures and materials of construction. If there are visible leaks or a significant pressure drop (greater than 2 percent) during the final test, the defective equipment shall be repaired or replaced and the pressurized section retested. The mechanical installer shall perform all rework as necessary to correct errors and omissions to bring the work into compliance with the specifications.

Table 2
Allowable Makeup Water Quantities for Expansion of High Density Polyethylene (HDPE) Pipe*

Nominal Pipe Size (Inches)	Allowance for Expansion (U.S. Gallons per 100 Feet of HDPE Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	2.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0

*Values extracted from Driscopipe® HDPE manufacturing catalog. These allowances apply to the test phase and not to the initial expansion phase.

3.2 PRESSURE TESTING OF ANNULAR SPACE

The annular space of the double-containment piping shall be air tested prior to being put into service. This low-pressure air test detects damaged piping or improper jointing by measuring the rate at which air under pressure escapes from an isolated

section of piping. The rate of air loss will indicate the presence or absence of damaged piping and leaking joints.

Before testing the annular space in the double-containment system, the primary piping shall be brought up to and held at 10 to 30 pounds per square inch. This will reduce possible damage or erroneous test results caused by the collapse of the primary piping due to an external pressure differential.

The annular space of the double-containment system will be air pressurized at 10 psig. The pipe shall be brought up to the test pressure and held for 15 minutes or until the pressure stabilizes. The test will begin after the pressure stabilizes and will last for 15 minutes. If there are noticeable leaks or a significant pressure drop (greater than 2 percent) during the final test, the pipeline, joints, or appurtenances shall be repaired or replaced and the entire line retested. The pipeline installer shall perform all rework as necessary to correct errors and omissions so as to bring the work into compliance with the specifications.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

American Concrete Institute (ACI)

ACI 301	1999 Specifications For Structural Concrete
ACI 347R	2003 Guide To Formwork For Concrete

National Forest Products Association (NFPA)

NFPA	National Design Specification for Stress Grade Lumber and Its Fastenings

U.S. Department of Commerce

PS 1	1995 Construction and Industrial Plywood
PS 20	1999 American Softwood Lumber

1.2 QUALITY ASSURANCE

1.2.1 Design Criteria

Formwork shall be designed and constructed in accordance with ACI 347R and with controlling local building code.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

2.1.1 Solid Lumber

Use stress-graded lumber that has adequate strength and properties to safely support anticipated loads and conforms to NFPA Specifications and PS 20. Use dressed and matched boards of uniform thickness and width for exposed concrete surfaces.

2.1.2 Plywood

Use Plyform Class II, 5/8-inch BB-Exterior Type, mill-oiled and edge sealed. Use high density overlay Plyform Class I where rubbed finish is indicated. Plywood shall conform to PS 1.

2.2 ACCESSORIES

2.2.1 Form Ties

Design form ties to provide adequate strength for holding forms. Ties shall be fixed or adjustable in length. Nonremovable ties shall be supplied with conditions for positive breakoff or for internal disconnection. Metal remaining after removal of external tie parts shall not be left closer than 1-1/2 inches to finished concrete surface. Flat ties providing no positive breakoff will not be permitted.

2.2.2 Chamfers

Use polyvinyl chloride, rubber, or wood chamfers to produce uniform, smooth, external corners and tight-edged joints. Use 3/4-inch by 3/4-inch chamfers unless noted otherwise on construction drawings.

2.2.3 Form Coating

Use bond breaking, nonstaining form coating agent conforming to ACI 347R. Form coating agent shall be nontoxic after 30 days for liquid containment structures. Form coating agent shall not soften concrete and shall be compatible with paint, waterproofing material, or damp-proofing material to be applied to finished surface.

PART 3 - EXECUTION

3.1 PREPARATION

Prior to form construction, clean mortar and grout from previously used form surfaces.

3.2 FORM CONSTRUCTION

Forms shall be constructed to conform to required shape, form, line, and grade, and shall have sufficient rigidity to maintain specified tolerances. Form joints shall be leakproof and arranged vertically and horizontally to conform to design pattern, if any. Forms placed on successive units shall be fitted to assure a smooth, completed surface free from irregularities.

Provide positive means for shore and strut adjustments. Settlement shall be taken up during concrete placing operation. Brace forms securely against lateral deflections.

Provide temporary openings in wall and column forms to facilitate cleaning and inspection. Wall sleeves, inserts, wall pipes, anchor bolts, dovetail anchor slots, and openings required in concrete work shall be accurately set in formwork.

Provide exposed external concrete corners with chamfers. Chamfers shall be accurately placed and secured to form uniformly straight lines and shall be mitered at changes in direction. Coat wood and steel forms with form coating agent in accordance with manufacturer's recommendations prior to placing reinforcement. Do not allow excess coating agent to stand inside forms or to come into contact with fresh concrete.

In long spans where intermediate supports are not possible, deflections due to weight of fresh concrete shall be computed. Design forms to account for deflection in order to produce finished concrete members having true surfaces conforming accurately to desired lines, planes, and elevations.

3.3 FORM AND SHORE REMOVAL

Form and shore removal shall be conducted in accordance with ACI 301. Formwork that does not support weight of concrete, such as sides of beams, walls, columns, and similar vertical parts of the work, may be removed 24 hours after placing concrete, provided concrete is sufficiently hard not to be damaged from form removal operations.

Formwork that supports weight of concrete, such as beam soffits, slabs, and similar horizontal parts of the work, shall remain in place at least until the concrete has attained the 28 day design minimum laboratory compressive strength for the applicable concrete class.

Remove forms in a manner to assure complete structural safety. Do not remove shoring until supported member has acquired sufficient strength to support its weight and superimposed loads. Superimposed loads shall not exceed design live load unless members are adequately shored to support both the members and construction loads in a manner to protect members from damage. Formwork may be removed after expiration of time periods listed in ACI 347R, provided concrete will not be injured, damaged, or overstressed.

3.4 ADJUSTMENT AND CLEANING

Forms to be reused shall be maintained clean and in good condition as to accuracy, shape, strength, rigidity, tightness, and surface smoothness. Do not use damaged forms or forms producing work not equal to work resulting from using new materials.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

American Concrete Institute (ACI)

ACI 318/ACI 318R	2002 Building Code Requirements for Structural Concrete and Commentary

ASTM International (ASTM)

ASTM A615/A615M	2004B Specification For Deformed And Plain Carbon Steel Bars For Concrete Reinforcement
ASTM A675/A675M	2003 Specification For Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A706/A706M	2004B Specification For Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, Submittal Procedures.

1.2.1 SD-01, Data

Submit the design analysis and calculations for concrete and for reinforcing and appurtenances, including size, details, and grade of reinforcing. Submit “Approved for Construction” calculations, and as-built calculations, if different from the approved calculations.

1.2.2 SD-04, Drawings

Provide detailed construction drawings showing reinforcing steel schedules, sizes, grades, and splicing and bending details. Drawings shall show support details, including types, sizes, and spacing. Submit “Approved for Construction” drawings, and as-built drawings, if different form the approved drawings.

1.2.3 SD-13, Certificates

Submit mill certificates for all reinforcing steel.

PART 2 - PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A675.

2.2 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A615 or ASTM A706, grades and sizes as indicated.

2.3 WIRE TIES

Wire ties shall be 16-gauge, or heavier, black annealed steel wire.

2.4 SUPPORTS

Precast concrete blocks shall have wire ties and shall not be less than 4 inches square when supporting reinforcement on the ground. Precast concrete blocks shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within ½ inch of concrete surface shall be galvanized, plastic protected, or stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic-coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 - EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown on the approved construction drawings and shall be in accordance with ACI 318. Reinforcement shall be cold bent unless otherwise authorized and shall conform to ASTM A615 grade 60. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger. Wire tie ends shall face away from forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318 at locations shown on the approved construction drawings plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints.

Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated on the approved construction drawings. Splicing shall be by lapping. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches, whichever is less.

3.2 DOWELS

Dowels shall be installed at locations indicated on the approved construction drawings and at right angles to the joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of the dowels shall be coated with a bond breaker.

END OF SECTION

SECTION 03250
ANCHORS, EXPANSION JOINTS, AND CONSTRUCTION JOINTS

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

American Hardboard Association (AHA)

AHA A135.4 2004 Basic Hardboard

ASTM International (ASTM)

ASTM F593 2002E2 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

ASTM F594 2002 Specification for Stainless Steel Nuts

ASTM D1751 1999 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D1752 2004A Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D2628 1991(R1998) Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D2835 1989(R2003) Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

ASTM D5249 1995(R2000) Specification for Backer Material for Use With Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, Submittal Procedures.

1.2.1 SD-02, Manufacturer’s Catalog Data

Provide manufacturer’s technical literature and installation instructions.

1.2.2 SD-04, Drawings

Indicate proposed location of all joints, and anchors in submittals. Provide actual location on as-built construction drawings.

1.2.3 SD-13, Certificates

Provide certificates of compliance stating that the joint filler and sealant materials conform to the requirements specified.

PART 2 - PRODUCTS

2.1 CONSTRUCTION-JOINT STRIPS

Construction-joint strips shall be 1/8-inch thick tempered hardboard conforming to AHA A135.4. In lieu of hardboard strips, rigid polyvinyl chloride (PVC) insert strips, with removable top sections, specifically designed to induce controlled cracking in slabs on grade, may be used.

2.2 EXPANSION-JOINT FILLER

Expansion-joint filler shall be premolded material conforming to ASTM D1751 or ASTM D1752. Unless otherwise indicated, filler material shall be 3/8-inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D5249.

2.3 JOINT SEALANT

Joint sealant shall conform to ASTM D2628 and lubricant to ASTM D2835.

2.4 ANCHOR BOLTS AND EXPANSION ANCHOR BOLTS

All anchor bolts and expansion anchor bolts, including their corresponding nuts and washers, shall be stainless steel type 304, or better, conforming to ASTM F593 and ASTM F594.

PART 3 - EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated on the approved construction drawings.

3.1.1 Construction Joints

Construction joints may be constructed by inserting tempered hardboard strips or rigid PVC insert strips into the plastic concrete or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8-inch wide and shall extend into the slab approximately one-fourth the slab thickness but not less than 1 inch.

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. When required, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC strips shall be discarded and the insert left in place. Means shall be provided to ensure true alignment of the strips is maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be conducted early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete-sawing machines shall be adequate in number and power and with sufficient replacement blades to complete the sawing. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Premolded expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces when required. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8-inch radius, except where a resilient floor surface will be applied. When the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, PVC insert strip temporarily secured to the top thereof to form a recess 3/4-inch deep that will be filled with sealant. The PVC strip shall be removed after the concrete has set. In lieu of the PVC strip, a removable expansion filler cap designed and fabricated for this purpose may be used.

3.1.3 Joint Sealant

Expansion joints in slabs shall be filled with joint sealant, unless otherwise shown on the approved Contractor/Buyer construction drawings. Types and locations of sealants shall be as indicated on the Contractor/Buyer drawings. Joint surfaces shall be clean, dry, and free of oil or other foreign material that would adversely affect the bond between sealant

and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant. Joints sealed with field molded sealant shall be completely filled with sealant.

3.3 ANCHORS

The Contractor/Buyer shall size, shape, and locate anchor bolts and expansion anchors to be placed as shown on the construction drawings. Refer to the certified equipment shop drawings for anchor sizes and locations needed to anchor machinery and equipment. Unless otherwise noted on the construction drawings, locate expansion anchors a minimum of 4.5 times the diameter of the hole away from the face of concrete walls or slabs.

Cast-in-place bolts shall be set so that placement of the concrete does not disrupt their setting. Bolt settings shall be set to provide sufficient threads to permit a nut to be installed on the concrete side of the concrete form or support template.

Bolts that are to be epoxy grouted shall be clean and free of coatings that would weaken the bond with the epoxy.

The expansion anchor shall be installed in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of the hole be less than four bolt diameters. Minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least 4.5 times the diameter of the hole in which the anchor is installed. Unless otherwise indicated on the construction drawings, the minimum distance between the centers of expansion anchors shall be at least 8 times the diameter of the hole in which the anchor is installed.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

American Concrete Institute (ACI)

ACI 117/117R	1990(R2002) Specifications For Tolerances For Concrete Construction And Materials
ACI 301	1999 Specifications For Structural Concrete
ACI 304R	2000 Guide For Measuring, Mixing, Transporting And Placing Concrete
ACI 305R	1999 Hot Weather Concreting
ACI 306R	1988(R2002) Cold Weather Concreting
ACI 306.1	1990(R2002) Standard Specification For Cold Weather Concreting
ACI 318/318R	2002 Building Code Requirements For Structural Concrete and Commentary

ASTM International (ASTM)

ASTM C 31/C31M	2003A Practice For Making And Curing Concrete Test Specimens In The Field
ASTM C 33	2003 Specification For Concrete Aggregates
ASTM C 39/C39M	2004A Test Method For Compressive Strength Of Cylindrical Concrete Specimens
ASTM C 42/C42M	2004 Test Method For Obtaining And Testing Drilled Cores And Sawed Beams of Concrete
ASTM C 94/C94M	2004A Specification For Ready-Mixed Concrete
ASTM C 143/C143M	2003 Test Method For Slump Of Hydraulic Cement Concrete
ASTM C 150	2004A E1 Specification For Portland Cement
ASTM C 172	2004 Practice For Sampling Freshly Mixed Concrete
ASTM C 231	2004 Test Method For Air Content Of Freshly Mixed Concrete By The Pressure Method
ASTM C 260	2001 Specification For Air-Entraining Admixtures For Concrete

ASTM C 494/C494M	2004 Specification For Chemical Admixtures For Concrete
ASTM C 618	1994 Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300, Submittal Procedures.

1.2.1 SD-04, Drawings

Submit drawings indicating construction joint locations not indicated in the construction drawings prior to placing concrete.

1.2.2 SD-05, Design Data

Submit the concrete mix design, including data sheets for cement, admixtures, and aggregate, at least 14 days prior to commencing placement of concrete.

1.2.3 SD-10, Test Results

Concrete test results shall be submitted by an independent testing laboratory.

1.2.4 SD-13, Certificates

Furnish delivery ticket with each concrete load delivered to job site. Ticket shall include strength of concrete, number of pounds of cement, size of coarse aggregate, batching time, slump ordered, and amount and types of admixture.

1.3 GENERAL REQUIREMENTS

Tolerances for concrete construction and materials shall be in accordance with ACI 117. Finish tolerances shall be true planes within 1/8 inch in 10 feet as determined by a 10-foot straight edge placed anywhere on the slab in any direction.

1.3.1 Hot Weather

Hot weather concrete placement shall be in strict accordance with ACI 305R. Maintain moist subgrades or lay waterproof sheathing paper on subgrade to prevent water extraction from concrete. At time of placement, mix temperature shall not exceed 90˚F.

1.3.2 Cold Weather

Cold weather concrete placement shall be in strict accordance with ACI 306. When ambient temperature is below 40˚F, mix temperature shall not be less than 50˚F or more than 70˚F at time of placement.

PART 2 - PRODUCTS

2.1 CONCRETE

2.1.1 Contractor Mix Design

ACI 301, except as modified herein. Unless indicated otherwise, concrete shall have a 28-day compressive strength of 3000 pounds per square inch. Slump shall be between 2 inches and 4 inches in accordance with ASTM C143. Provide ASTM C33 aggregate Size No. 57 or 67.

2.1.2 Ready-Mixed Concrete

ASTM C 94, except as modified herein. Ready-mixed concrete is defined in this specification as concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state.

2.2 MATERIALS

2.2.1 Cement

ASTM C 150, Type I or II, except as modified herein. The blended cement shall consist of a mixture of ASTM C 150 cement and either pozzolan or fly ash. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

2.2.2 Fly Ash and Pozzolan

ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Type N and F. The pozzolan/fly ash content shall not exceed 25 percent or the ground iron blast furnace slag 50 percent by weight of the total cementitious material.

2.2.3 Water

Water shall be potable.

2.2.4 Aggregates

ASTM C 33. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalis in the cement.

2.2.5 Admixtures

ASTM C 494 for water reducing (Type A, D, or E), accelerating (Type C), and retarding (Type B or D), to be used only when approved. Calcium chloride shall not be used as an admixture.

PART 3 - EXECUTION

3.1 PREPARATION

Prepare for the concrete placement, using the listed specifications, as appropriate:

- Surfaces to receive concrete shall be clean and free from frost, ice, mud, water, and any deleterious material that may interfere with the proper bonding between old and new concrete.

- Specification 03100, Concrete Formwork.

- Specification 03200, Concrete Reinforcement.

- Specification 03250, Anchors, Expansion Joints, and Construction Joints.

- Specification 03602, Non-shrink Grout, Concrete Coatings, and Bonding Agents.

- Transporting and conveying equipment shall be in place, ready for use, clean, and free of hardened concrete and foreign material.

- Equipment for consolidating concrete shall be at the placing site and in proper working order.

- Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition, and in sufficient amount for the entire placement.

3.2.1 Preparation of Previously Placed Concrete

Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with nonshrink grout.

3.2.2 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or as required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose cuttings or rust, paint, and scale. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 foot

of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.3 PLACING CONCRETE

ACI 304R, except as modified herein. ASTM C 94; machine mix concrete and provide mandatory batch ticket information for each load of ready mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time to 60 minutes if the air temperature is greater than 85 degrees F. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water

Concrete shall not be dropped freely into forms from more than a 36-inch height. If greater drops are required, a tremie or other approved means must be used. Concrete shall be placed continuously between predetermined expansion, control, and construction joints. Care shall be taken to avoid over vibration to prevent aggregate segregation. Consolidate concrete slabs greater than 4 inches depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by tamping, spading, and settling with a heavy leveling straight edge.

Saw-cut control joints shall be cut within 24 hours of placement or as soon as the blade will not pull the concrete. All construction and control joints for slab-on-grade shall be filled with epoxy or urethane joint filler. These compounds shall be mixed and installed in strict accordance with the directions of the manufacturer.

3.4 REPAIR OF SURFACE DEFECTS

Surface defects, including tie holes, shall be repaired immediately after form removal. Honeycombed and defective concrete shall be removed down to sound concrete. Edges of chipped areas shall be perpendicular to surface or slightly undercut.

The area to be patched and the area at least 6 inches wide surrounding the area to be patched shall be dampened to prevent water absorption from patching mortar. After surface water has evaporated from the area to be patched, a bond coat shall be well brushed into the surface. When the bond coat begins to lose water sheen, premixed patching mortar shall be applied. Mortar shall be thoroughly consolidated into place and struck off to leave a patch slightly higher than the surrounding surface. The patch shall be left undisturbed for 1 hour minimum before being finally finished. Patched area shall be maintained damp for seven days minimum. Metal tools shall not be used in finishing patch in formed wall exposed to view in final structure.

After being cleaned and thoroughly dampened, the holes shall be filled solid with patching mortar.

Bond coat shall consist of approximately 1 part cement to 1 part fine sand passing No. 30 mesh sieve, mixed to consistency of thick cream.

Patching mortar shall be made from same materials and in approximately same proportions as used for concrete, except coarse aggregate shall be omitted and mortar shall contain not more than 1 part cement to 2-1/2 parts sand by damp loose volume and also include a nonmetallic, nonshrink additive. Substitute white portland cement for portion of gray cement on exposed concrete in order to produce color matching surrounding concrete, as determined by trial patch. Use no more water than necessary for mortar handling and placement. Mix mortar in advance and allow mortar to stand. Frequently manipulate mortar with a trowel, without adding water, until mortar has reached stiffest consistency that will permit placing.

3.5 CONCRETE FINISHING

Concrete finishes shall conform to ACI 301, Class A tolerance. Top of concrete shall be brought to a uniform elevation which shall conform to the grade indicated on the drawings and shall be free of waves. The various finished types listed below shall be used unless shown otherwise on the drawings.

3.5.1 Troweled Finish

A troweled finish will be used for all walking surfaces. After concrete has been placed, consolidated, struck off, leveled, the water sheen disappeared, and sufficiently hardened to bear the finisher's weight without deep imprint, float the concrete. During first floating, cut down high spots and fill low spots to produce a slab surface with the required tolerances. The slab shall be refloated immediately to a uniform sandy texture.

After floating is completed and concrete has hardened sufficiently to prevent excess fine material from working to the surface, apply first trowel finish with power driven trowel. Additional troweling shall be done by hand. Final troweling shall be done when a ringing sound is produced as the trowel is moved across concrete surface. The finished surface shall be free of trowel marks, uniform in texture and appearance, and be plane within specified tolerances.

3.5.2 Broom Finish

A broom finish will be used for all sidewalks, exterior platforms, steps, and interior and exterior pedestrian ramps. Float the concrete as described in the trowel finish section. After floating is completed, give the concrete surface a transverse scored texture by drawing a metal tined broom across surface immediately after applying float finish.

3.6 CURING AND PROTECTION

Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Maintain concrete with minimal moisture loss at a relatively constant temperature for a period necessary for hydration of cement and hardening of concrete.

Concrete curing and protection shall conform to ACI 301. For temperature between 40 and 50 less degrees F, increase the curing period by 50 percent. Concrete shall be cured by means of one of the following methods:

- Ponding or Immersion - Maintain 100 percent coverage of water over floor slab areas for at least three days.

- Spraying - Spray water over floor slab areas and maintain wet for seven days.

- Burlap, Cotton Mats, and Rugs - Maintain continuously wet for at least three days.

- Curing Agent-Use water based environmentally compatible curing agent within 30 minutes of completion of performing the concrete finish. Ensure 100 percent coverage of the exposed concrete surface. Curing agents that utilize pigments to ensure 100 percent coverage are acceptable.

- Polyethylene Film - Ensure 4 mils of material are in constant contact with concrete for at least three days with laps and edges secured.

- Form Curing - Leave the forms in place and cure by use of one of the above methods for exposed concrete surfaces.

Curing compounds shall not be used on any surface against which additional concrete or mortar is to be placed nor on surfaces where floor tile or other cemented coverings are to be placed.

3.7 FIELD QUALITY CONTROL

Test specimens are required only if more than two (2) cubic yards of concrete is field placed.

3.7.1 Field-Cured Compression Test Specimens

Four test cylinders for each concrete class placed each day shall be taken not less than once per day, nor less than once for each 100 cubic yards, nor less than once for each 5,000 square feet of surface area for slabs or walls. Additional cylinders shall be made and tested when deemed necessary. Make field-cure compression test specimens in accordance with ASTM C31. Two specimens shall be tested at 28 days for acceptance and 2 at 7 days for information. Compression tests shall be made in accordance with

ASTM C39. Test results shall be the average of 2 specimens tested. Procedures for protecting and curing concrete shall be improved when test results do not exceed minimum requirements. Do not remove shoring or apply appreciable loads to any concrete structure unless strength tests have been completed and results are equal to or greater than minimum required values.

3.7.2 Other Quality Control Requirements

If one specimen in a compression test manifests evidence of improper sampling, molding, or testing, the specimen shall be discarded, and the remaining cylinder strength shall be considered the test result. If both specimens in a compression test manifest evidence of improper sampling, molding, or testing, the entire test shall be discarded.

Air content shall be determined at the same time as the preparation of test cylinders for compression tests. Air content tests at the job site will be performed in accordance with ASTM C231.

Mix consistency shall be controlled by slump tests at the job site in accordance with ASTM C143. Slump tests shall be performed at the same time as preparation of test cylinders for compression tests to confirm required slump.

The Contractor/Buyer shall furnish necessary labor to assist testing agency in obtaining and handling samples. The Contractor/Buyer shall provide and maintain adequate facilities for safely storing and properly curing the compression test specimens on the project site.

END OF SECTION

SECTION 03602
NONSHRINK GROUT, CONCRETE COATINGS, AND BONDING AGENTS

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

ASTM International (ASTM)

ASTM C109/C109M	2002 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-In. Or [50-mm] Cube Specimens)
ASTM C1059	1999 Specification for Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C881/C881	2002 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D6412/D6412M	1999 Standard Specification for Epoxy (Flexible) Adhesive for Bonding Metallic and Nonmetallic Materials

1.2 SUBMITTALS

Submit the following in accordance with Specification 01300, Submittal Procedures.

1.2.1 SD-02, Manufacturer’s Catalog Cuts

Provide manufacturer's current printed product description, material safety data sheets (MSDS), and technical data sheets for each grout, coating, or agent.

1.2.2 SD-06, Instructions

Provide detailed mixing, thinning and application instructions; minimum and maximum application temperature; and curing and drying times.

1.3 GENERAL REQUIREMENTS

1.3.1 Conformance with Applicable Requirements

Each supplied grout, coating, or agent shall be in conformance with all applicable federal, state, regional, and local rules and regulations.

1.3.2 Safety Requirements

Work shall comply with applicable federal, state, and local laws and regulations. Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless adequate warning indicators are employed. Workers having access to an affected work area shall be informed of applicable MSDSs and shall be informed of the potential health and safety hazard and protective controls associated with materials used. An affected work area is one that may receive dusts, mists and/or odors from the operations. Workers involved in preparation, coating, and cleanup shall be trained in the safe handling and application, and the exposure limit, for each material that the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment. Exposure of workers to hazardous chemical substances shall not exceed limits established by the Occupational Safety and Health Administration, or as required by a more stringent applicable regulation.

1.4 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the coating manufacturer, the ambient air temperature shall be between 45˚F and 95˚F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 50˚F and 90˚F.

PART 2 - PRODUCTS

The installer shall follow the manufacturer's recommended procedures for storage, mixing, installation, and cleanup.

2.1 NONSHRINK GROUT

When ambient air temperature exceeds 75˚F, use cold or iced water for mixing. At time of placement, mix temperature shall not exceed 80˚F. In cold weather, store grout in warm place and use warm water for mixing. Warm the equipment and foundation with portable heaters or use a heated enclosure to maintain temperatures above 60˚F.

Age	Plastic Consistency (psi)	Flowable Consistency (psi)
1 Day	3,800	2,400
3 Days	6,000	5,000
7 Days	7,500	6,000
28 Days	10,000	7,000

Nonshrink grout shall be nonmetallic, noncorrosive, nongas-producing. Premixed grout shall require water addition only. Water content shall be as required by the manufacturer. Other cement or aggregate materials shall not be added to grout. Grout shall develop

following the minimum compressive strengths when tested in accordance with ASTM C109.

2.2 WATER

Water shall be potable.

2.3 CONCRETE COATING

Coating systems shall have a design life for intended use of not less than 10 years. All sealants and/or coatings shall be installed in strict accordance with the directions of the manufacturer.

2.4 BONDING AGENT

All bonding agents shall be installed per the manufacturer's recommendations. Bonding agents shall be noncorrosive, nongas-producing, and comply with ASTM C1059 and ASTM C881. Bonding agents used for metallic and nonmetallic adhesion shall comply with ASTM D6412.

PART 3 - EXECUTION

Remove defective or loose concrete from foundation to provide firm, rough surface free of dirt, oil, grease, paint, and dust. Where appropriate, clean underside of equipment and column base plates, other metallic surfaces, and bolts to remove dirt, oil, grease, paint, and dust.

3.1 GROUT

Grout will be installed following the manufacturer's specifications. Ensure that all base plates and equipment are set to proper line and grade before grouting procedure.

3.1.1 Mixing

Mix grout thoroughly in paddle-type mixer for a minimum of 3 minutes. Do not mix by hand. Do not retemper grout after initial mixing. Clean paddle mixer after each batch.

3.1.2 Installation

Place grout into form from one side to avoid entrapping air. Place grout in continuous operation to prevent segregation. Use metal tools to compact grout and to remove voids. Grout reaching initial set or containing water for more than 30 minutes shall not be used. Forms shall be provided where structural components of baseplates or bedplates will not confine the grout. The grout shall be finished smooth in all locations where the edge of the grout will be exposed to view after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate, bedplate, member, or piece of equipment.

Nonshrinking grout shall be protected against rapid loss of moisture by covering with wet rags or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least seven days.

3.2 CONCRETE COATINGS

Items not to be coated which are in contact with or adjacent to coated surfaces shall be removed or protected prior to surface preparation and coating applications. Items removed prior to coating shall be replaced when coating is completed. Following completion of coating, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

Concrete and masonry surface voids shall be filled per manufacturer's guidelines and the intended use of the coated area. The dried filler shall be uniform and free of pinholes; however, surface irregularities need not be completely filled. The filler shall not be applied over caulking compound.

Place concrete coating in continuous operation to prevent segregation. Installation of the concrete coating shall be in strict accordance with the directions of the manufacturer.

3.3 BONDING AGENTS

Place bonding in continuous operation to prevent segregation. Latex bonding agents are suitable for brush, broom, or spray application, to bond fresh concrete to hardened concrete.

Two-component, epoxy-resin bonding systems which are able to cure under humid conditions and bond to damp surfaces may be applied.

END OF SECTION

SECTION 11211
SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

ASTM International (ASTM)

ASTM A182	Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service
ASTM A312	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A492	Stainless and Heat-Resisting Steel Rope Wire

National Electrical Manufacturers Association (NEMA) Standard

NEMA MG-1	Motors and Generators

1.2 SUBMITTALS

Submittals are due prior to the pump delivery. Submit the following in accordance with Section 01300, Submittal Procedures.

1.2.1 SD-02 Manufacturers Catalog Data

Submit manufacturer's descriptive data and technical literature, performance charts and curves, materials of construction, and dimensions for each pump model and flow sleeve. Data shall include a complete list of parts and supplies.

Provide manufacturer’s instructions describing the installation of the pumps, flow sleeves, and any special considerations.

1.2.1 SD-10 Test Reports

Submit manufacturer's performance test reports on each pump delivered. Minimum information shall include the pump and motor serial number, technical pump and motor information, and a chart listing flow versus water column head versus amp draw information.

1.2.2 SD-19 Operations and Maintenance Manuals

Provide operation and maintenance manuals detailing operating conditions, frequency of required maintenance, and spare parts list. Provide operating instructions outlining the step-by-step procedures required for system start up, operation and shutdown. The instructions shall include the manufacture's name, model number, service manual, parts list and source of supply, and a brief description of all equipment and their basic operating features.

Provide maintenance instructions listing routine maintenance procedures, potential breakdown scenarios and repair options, and a troubleshooting guide.

1.3 GENERAL REQUIREMENTS

Pumps and motors shall have a standard nameplate securely affixed in a conspicuous place showing the manufacturer's name, address, type or style, model, and serial number. In addition, the nameplate for each pump shall show the capacity in gallons per minute at rated speed in revolutions per minute and head in feet of water. Nameplate for each electric motor shall show at least the minimum information required by NEMA MG 1. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

1.4 QUALITY ASSURANCE

1.4.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contractor/Buyer, reasonably convenient to the job site. Pumps of the same type shall be the product of one manufacturer.

1.4.2 Conformance With Agency Requirements

Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from

the testing agency shall accompany the materials or equipment and shall be submitted to the Contractor/Buyer stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency, published catalog specification data, accompanied by the manufacturer's certified statement to the effect that the items are in accordance with the applicable requirements of the specifications and the referenced standards, will be considered by the Contractor/Buyer and may be acceptable as evidence that the items conform with agency requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE WELL PUMPS

All wetted parts shall be constructed of materials compatible with both the intended service and the corrosive effects of brackish water. Materials specified as American Iron and Steel Institute (AISI) Type 304 (Type 316 at critical locations) stainless steel shall be deemed as the minimum acceptable.

2.1.1 Pump

The pump will be driven by a motor attached below the pump section. The maximum nominal casing width shall not exceed 4 inches for motor ratings of 5 horsepower and below. The maximum nominal casing width shall not exceed 6 inches for motor ratings above 5 horsepower. Pump shall be supplied with motor, inlet screen, check valve, driver, flow inducer sleeve/shroud, thermal overload device, hanging hook, and associated wires/cables.

2.1.2 Check Valve

The check valve shall be constructed of AISI 304 stainless steel. The check valve seat shall be AISI 304 stainless steel or Buna-N.

2.1.3 Diffuser Chamber

The diffuser chamber shall be AISI 304 stainless steel.

2.1.4 Bearings

Top and intermediate bearings shall be either AISI 304 stainless steel or Buna-N.

2.1.5 Impellers

Impellers shall be constructed of AISI 304 stainless steel and statically and dynamically balanced. All bolts and nuts shall be AISI 302/3 stainless steel. Impellers shall be securely fastened to the drive shaft in such a manner as to make it readily removable.

2.1.6 Impeller Seal Rings

Impeller seal rings shall be AISI 304 stainless steel or Buna-N.

2.1.7 Motor

Each submersible pump shall be driven by a continuous-duty motor designed for underwater operation. Motors shall have normal starting torque, low-starting-current characteristics, and shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. Motor bearings shall provide smooth operations under the conditions encountered for the life of the motor. Adequate thrust bearings shall be provided in the motor to carry the weight of all rotating parts and shall be capable of withstanding upthrust imposed during pump starting. The rating shall be stamped on the nameplate. Motors shall conform to NEMA MG-1.

2.2 FLOW SLEEVE

Pumps shall be installed with flow sleeves that force water intake to the pump's inlet from below the pump's motor. Flow sleeves shall aid in adequate cooling of pump motor when low flow rates are encountered and be constructed of AISI 304 stainless steel or polyvinyl chloride. Flow sleeve inner diameter shall permit adequate flow at design rates, while the outer diameter shall allow placement in a 10-inch well casing for motor ratings of 20 horsepower.

2.3 POWER CABLE FOR SUBMERSIBLE PUMPS

The pump manufacturer shall supply power cable from each pump to reach the local control panel. Power cable length assumes a 10-foot spool piece between the top of the well cap to the control box.

2.4 PIPING AND CONNECTIONS FOR SUBMERSIBLE PUMPS

Wellhead drop pipe shall be threaded and seamless AISI 304 series stainless steel, ASTM A312. Wellhead drop pipe fittings, including all couplers, shall be Schedule 80 and threaded. Other fittings shall be constructed from AISI 304 stainless steel conforming to ASTM A182. Pipe and connections shall be sized as shown in the Pricing Sheet.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

All pumps and flow sleeves shall be installed in accordance with the manufacturer's written instructions. Install pumps with intakes set at elevations approved by the Contractor/Buyer.

3.2 PRE-DELIVERY TEST

Before delivery, each pump and motor shall be factory tested for proper operation. Submit manufacturer's performance test reports on each pump delivered. Minimum information shall include the pump and motor serial number, technical pump and motor information, and a chart listing flow versus water column head and amp draw information.

3.3 POST-DELIVERY TEST

An insulation resistance test of the cable and the motor shall be conducted prior to installation of the pump and after installation is complete. The resistance readings shall not be less than 10 megohms. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise, and that all manual and automatic controls function properly. If a deficiency is revealed during any test, such deficiency shall be corrected and the tests shall be re-conducted. The installer shall perform all rework as necessary to correct errors and omissions to bring the work into compliance with the drawings and this specification.

After installation, operating tests shall be carried out to assure that the pump operates properly. Each pumping unit shall be given a running field test in the presence of the Contractor/Buyer for a minimum of 1/2 hour. Each pumping unit shall be operated at its rated capacity or such other point on its head-capacity curve selected by the Contractor/Buyer. The installer shall provide an accurate and acceptable method of measuring the discharge flow.

END OF SECTION

SECTION 16010
GENERAL ELECTRICAL

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

American National Standards Institute (ANSI)

ANSI C2 National Electrical Safety Code

Code of Federal Regulations (CFR)

29CFR1910.147 Control of Hazardous Energy (Lock Out/Tag Out)

Institute of Electrical and Electronics Engineers, Inc. (IEEE)

IEEE 100 Dictionary of Electrical and Electronics Terms

National Electrical Manufacturer's Association (NEMA)

NEMA ICS 6 Industrial Control and Systems Enclosures
NEMA MG 1 Motors and Generators
NEMA MG 10 Energy Management Guide for Selection and Use of Polyphase Motors
NEMA MG 11 Energy Management Guide for Selection and Use of Single-Phase Motors

National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Submittals required in the sections which refer to this section shall conform to the requirements of Section 01300, Submittal Procedures.

1.3.1 SD-02, Manufacturer's Catalog Data

Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. Handwritten and typed modifications and other notations not part of the manufacturer's preprinted data will result in the rejection of the submittal. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for certificates of compliance.

1.3.2 SD-04, Drawings

Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.3.3 SD-06, Instructions

Where installation procedures or part of the installation procedures are required to be in accordance with manufacturer's instructions, submit printed copies of those instructions prior to installation. Installation of an item shall not proceed until manufacturer's instructions are received. Failure to submit manufacturer's instructions shall be cause for rejection of the equipment or material.

1.3.4 SD-13, Certificates

Submit original, signed manufacturer's certifications as required for products, materials, finishes, and equipment as specified in the technical sections. Certificates from material suppliers are not acceptable. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials, and the applicable codes or standards controlling the quality of that item.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as ANSI, ASTM International (ASTM), NEMA, Underwriters Laboratories Inc. (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

1.3.5 SD-19, Operation and Maintenance Manuals

Submit complete operation and maintenance manuals including detailed descriptions of procedures for startup, operation, and regular maintenance of operating equipment.

1.4 GENERAL REQUIREMENTS

1.4.1 Service Support

The equipment shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract. Submit a list of qualified permanent service organizations for support of the equipment, which includes their addresses and phone numbers.

1.4.2 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.5 QUALITY ASSURANCE

1.5.1 Material and Equipment Qualifications

Provide materials and equipment that are products of recognized manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.5.2 Regulatory Requirements

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70.

1.5.3 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and in accordance with Section 01620, Product Delivery, Storage, and Handling. The Subcontractor shall replace damaged or defective items.

1.7 SAFETY REQUIREMENTS

1.7.1 Equipment Safety

Provide positive means of locking out equipment so that equipment cannot be accidentally started during maintenance procedures. High-temperature equipment and conduit shall be located as not to endanger personnel or create a fire hazard; and shall be properly guarded or covered with insulation of the type specified. Catwalks, maintenance platforms, and guardrails, where required for safe operation and maintenance of equipment, shall be provided. Also, OSHA-approved ladders or stairways to reach catwalks and maintenance platforms shall be installed. The Subcontractor shall ensure that access openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

1.7.2 Lock-out of Energy Sources

Provide appropriate lock-out devices for energy isolating valves and for machine or other equipment to prevent unexpected start-up or release of stored electrical, mechanical, hydraulic, pneumatic, thermal, chemical, or other energy in accordance with 29 CFR 1910.147. Lock-out devices for electrical systems will provide a means of attachment to which, or through which, a lock can be affixed or will have a locking mechanism built into it so that the switch cannot be moved from the lock-out position until the lock is removed.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 PAINTING OF EQUIPMENT

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical sections.

3.2 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

END OF SECTION

SECTION 16410
ELECTRICAL WIRING SYSTEM

PART 1 - GENERAL

1.1 REFERENCES

The publications listed below shall form a part of this specification to the extent referenced and are referenced in the text by abbreviated designation only. Where references are not available, provide material in accordance with the most stringent professional standards applicable. Where two codes or standards do not agree, the more stringent requirement shall apply. The publication current at the time of bid solicitation shall apply.

American National Standards Institute (ANSI)

ANSI C80.1	1994 Rigid Steel Conduit - Zinc Coated (GCR)
ANSI C80.3	1994 Electrical Metallic Tubing, Zinc Coated (EMT)

ASTM International (ASTM)

ASTM B1	2001 Specification for Hard-Drawn Copper Wire
ASTM B8	2004 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

National Electrical Manufacturer's Association (NEMA)

NEMA AB 1	2002 Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures
NEMA FU 1	2002 Low Voltage Cartridges Fuses
NEMA ICS 1	2000 Industrial Control and Systems: General Requirements
NEMA ICS 2	2000 Errata 2003 Industrial Control and Systems: Controllers, Contractors and Overload Relays Rated 600 Volts
NEMA ICS 2-8	1996(R2004) Industrial Control And Systems Controllers, Contactors, And Overload Relays Rated Not More Than 2000 Volts Ac Or 750 Volts Dc- Part 8: Disconnect Devices For Use In Industrial Control Equipment
NEMA ICS 4	2000 Industrial Control and Systems: Terminal Blocks
NEMA ICS 6	1993(R2001) Industrial Control and Systems: Enclosures
NEMA ST 20	1992(R1997) Dry Type Transformers for General Applications
NEMA TC 2	2003 Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
NEMA TC 3	2004 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
NEMA WD 1	1999 General Color Requirements for Wiring Devices

NEMA WD 6	2002 Wiring Devices - Dimensional Requirements

National Fire Protection Association (NFPA)

NFPA 70	2005 National Electrical Code (NEC)

Underwriter's Laboratories, Inc. (UL)

UL 6	13Ed 2004 Electrical Rigid Metal Conduit - Steel
UL 50	11Ed (R2003) Enclosures for Electrical Equipment
UL 67	11Ed (R2003) Panelboards
UL 83	13Ed (R2004) Thermoplastic-Insulated Wire and Cables
UL 360	5Ed (R2003) Liquid-Tight Flexible Steel Conduit
UL 467	8Ed 2004 Grounding and Bonding Equipment
UL 486A-486B	1Ed (R2004) Wire Connectors
UL 486C	5Ed 2004 Splicing Wire Connectors
UL 489	10Ed (R2004) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	14Ed (R2004) Attachment Plugs and Receptacles
UL 506	12Ed (R2004) Specialty Transformers
UL 508	17Ed (R2003) Industrial Control Equipment
UL 510	7Ed (R2004) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	10Ed 2004 Metallic Outlet Boxes
UL 514B	5Ed 2004 Conduit, Tubing, and Cable Fittings
UL 514C	3Ed (R2002) Non-metallic Outlet Boxes, Flush-Device Boxes and Covers
UL 797	8Ed 2004 Electrical Metallic Tubing - Steel
UL 817	11Ed (R2004) Cord Sets and Power-Supply Cords
UL 845	4Ed (R2004) Motor Control Centers
UL 943	3Ed (R2004) Ground-Fault Circuit Interrupters
UL 984	7Ed 1996 Hermetic Refrigerant Motor-Compressors

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, Submittal Procedures.

1.2.1 SD-02, Manufacturer's Catalog Data

Provide the following manufacturer's catalog data:

- Transformers
- Panelboards
- Enclosures
- Wires and cables
- Receptacles
- Motor overcurrent devices
- Conduit and fittings (each type)
- Terminals and terminators
- Electrical boxes and covers
- Motor controllers
- Switches
- Circuit breakers
- Lighting fixtures

- Other pertinent information.

1.2.2 SD-04, Drawings

Submit drawings for the panelboards and transformers.

1.2.3 SD-09, Reports

Submit a summary of testing performed on equipment and wiring installed in field as per Paragraph 3.10 of this specification.

1.2.4 SD-19, Operation and Maintenance Manuals

Provide information pertaining to the operation and maintenance of the electrical distribution system. Include schematic diagram of electrical control systems and updated single line drawings to reflect “as built” conditions.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall meet UL requirements (where UL standards are established for those items) and NFPA requirements.

2.2 CONDUIT AND FITTINGS

2.2.1 Rigid Metal Conduit

Rigid, heavy wall, mild steel, hot dip galvanized, smooth interior, tapered threads and carefully reamed ends. Material shall be UL listed.

2.2.2 Electrical Metallic Tubing

UL 797, ANSI C80.3

2.2.3 Liquid-Tight Flexible Metal Conduit, Steel

UL 360

2.2.4 Fittings for Metal Conduit, Electrical Metallic Tubing, and Flexible Metal Conduit

Ferrous fittings shall be cadmium or zinc-coated in accordance with UL 514B. Fitting shall adapt the conduit to standard threaded connections, shall have an inside diameter not less than that of the corresponding standard conduit size.

2.3 OUTLET BOXES AND COVERS

Outlet boxes and covers shall be cadmium- or zinc-coated, in accordance with UL 5144A, if ferrous metal, or UL 514C, if nonmetallic.

2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

Cabinets, junction boxes, and pull boxes shall be in accordance with UL 50 and shall be hot-dip, zinc-coated, if sheet steel.

2.5 WIRE AND CABLES

Wires and cables shall meet applicable requirements of NFPA and UL for the type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.5.1 Conductors

Conductors, No. 8 American Wire Gauge (AWG) and larger diameter, shall be stranded. Conductors, No. 10 AWG and smaller diameter, shall be either solid or stranded; except conductors for remote-control and signal circuits, classes 1, 2, and 3, shall be stranded. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise.

When manufacturer's equipment requires copper conductors at the termination or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements. Furthermore, all conductors shall be copper and of the minimum size stated in the following paragraph unless specifically stated otherwise.

2.5.2 Minimum Conductor Sizes

Branch power and lighting circuits	No. 12 AWG
Control circuits (field wiring)	No. 14 AWG
Control circuits (interior panel wiring)	No. 16 AWG
Instrumentation - shielded/twisted (field wiring)	No. 16 AWG
Instrumentation - shielded/twisted (interior panel wiring)	No. 18 AWG

2.5.3 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

- 277/480-volt, 3-phase

Phase A – brown; Phase B – orange; Phase C – yellow; and Neutral - gray

- 208/120-volt, 3-phase
  Phase A – black; Phase B – red; Phase C – blue; and Neutral - white

- 120/240-volt, single phase: Black and red

- Three-phase, 4-wire delta system, high leg (stinger) shall be orange, as required by NFPA-70.

2.5.4 Conductor Insulation

Should individual pieces of equipment, to which electrical power and/or control wiring must be connected, be equipped with terminals rated for less than the temperature rating of the wire utilized, or the expected wire temperature, then the wire size shall be increased to assure that the wiring does not exceed the terminal temperature rating.

2.5.5 Bonding Conductors

Bonding conductors shall be ASTM B1, solid bare copper wire, for sizes No. 8 AWG and smaller diameter; and ASTM B8, Class B, stranded bare copper wire, for sizes No. 6 AWG and larger diameter.

2.5.6 Grounding Cables

Grounding cables shall be bare or shall have green insulation as indicated on Drawings.

2.5.7 Cord Sets and Power-Supply Cords

UL 872

2.6 SPLICES AND TERMINATION COMPONENTS

Splices and termination components shall conform to UL 486A for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.7 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. Plates installed in wet locations shall be gasketed and UL listed as raintight while in use.

2.8 RECEPTACLES

Receptacles shall conform to UL 498 and NEMA WD 1, general grade, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory thermosetting plastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. Duplex receptacles shall be 15 amperes, 125 volts, No. 5242.

2.8.1 Weatherproof Receptacles

Receptacle shall be UL listed for use in "wet locations with plug in use."

2.8.2 Ground-Fault Circuit Interrupter Receptacles

Ground-fault circuit interrupter (GFI) receptacles shall conform to UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFI devices.

2.9 PANELBOARDS

Panel boards shall be in accordance with UL 67 and UL 50. Panelboards for use as service disconnecting means shall additionally conform to UL 869. Panelboards shall be circuit breaker-equipped.

2.9.1 Panelboard Buses

Support bus bars independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling or tapping. If neutral circuit conductors are required, provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet. In addition to equipment grounding bus, provide second “isolated” ground bus, where indicated. Provide copper panelboard buses.

2.9.2 Panelboard Circuit Breakers

2.9.2.1 General

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.9.2.2 Multiple Breakers

Common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.9.3 Panelboard Directory

Each panelboard shall have a directory with the name and number of the equipment served by each circuit breaker which shall correspond with the final circuit arrangement. The directory shall also indicate the panel designation, voltage and phase at the top. Each directory shall be mounted inside the panelboard.

2.10 ENCLOSED CIRCUIT BREAKERS

Enclosed circuit breakers shall conform to UL 489. Individual molded case circuit breakers shall have voltage and continuous current ratings, number of poles, overload trip setting and short circuit current interrupting rating as indicated. Enclosure type shall be as indicated.

2.11 FUSES

Fuses shall conform to NEMA FU 1. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers shall be coordinated for proper operation. Fuses shall have voltage rating not less than circuit voltage.

2.12 COMBINATION MOTOR STARTER

Combination starter shall have motor circuit protector type disconnect, with magnetic type motor controller with thermal overload protection. Motor circuit protectors shall conform to NEMA AB 1 and UL 489, and shall consist of an adjustable instantaneous trip circuit breaker in conjunction with a combination motor controller which provides coordinated motor circuit overload and short circuit protection. Motor circuit protectors shall be rated in accordance with NFPA-70.

Dry, indoor locations shall have a NEMA 1 enclosure. In outdoor or damp or wet indoor locations, enclosure shall be NEMA 4X. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

2.13 MOTOR CONTROLLERS

Motor controllers shall be in accordance with UL 508, NEMA ICS 1, and NEMA ICS 2; and shall be magnetic type with thermal overload protection in each phase. Motor

controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with automatic-type maintained-contact PLC control, controller shall have hand/off/automatic selector switch. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit; and include manual reset-type pushbutton on outside of motor controller case.

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide fuses on primary side. One secondary lead shall be fused; other shall be grounded.

2.14 MISCELLANAEOUS

Grounding and bonding equipment shall conform to UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet. Provide nameplates and pullboxes for an integrated design. Pull boxes shall be precast concrete with minimum dimension as required by NFPA 70.

PART 3 - EXECUTION

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

3.1 CABLE AND WIRE INSTALLATION

Control cable and wires, AC cable and wires, and analog signal wires shall be installed in appropriately sized and physically separate conduits. Cables and wires sharing the same conduit shall have the same insulation voltage rating. Cable pulling forces shall not exceed cable manufacturer’s recommended maximum values. Conductors shall be continuous from box to box. Splices shall not be permitted in conduit. Instrumentation cable shall be installed to avoid splices. Grounding conductor shall be separate from electrical system neutral conductor.

3.3 RACEWAY INSTALLATION

Unless an appropriately sized conduit raceway is available, install and use a conduit raceway system. Minimum conduit size shall be 1.25-inch in diameter for power and control circuits, and 0.5-inch diameter for signal wiring. Conduit in concealed and exposed locations where it may be subjected to damage during use shall be rigid

galvanized steel. Flexible conduit will be allowed only at motors and equipment which are subject to vibration or require movement for maintenance purposes.

Conduit runs, burial depths, and sizes shall be as indicated on the Drawings. Conduit shall be installed parallel with or at right angles to ceilings, walls, and structural members unless concealed. Wherever possible conduits shall be run in groups. Conduit shall be supported by pipe straps, wall brackets, hangers, or ceiling trapeze. Conduit support separation shall meet the minimum requirements listed in NFPA 70.

Modifications in conduit material, size, or routing shall require the approval of the on-site engineer.

3.4 BOXES, OUTLETS, AND SUPPORTS

Boxes in wiring and raceway systems shall be provided wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces.

3.5 CONDUCTOR IDENTIFICATION

Conductor identification shall be provided in each enclosure where tap, splice, or termination is made.

3.6 SPLICES

Splices shall be made in accessible locations. Splices in conductors, No. 10 AWG and smaller diameter, shall be made with insulated, pressure-type connector. Splices in conductors, No. 8 AWG and larger diameter, shall be made with solderless connector, and covered with insulation material equivalent to conductor insulation.

3.7 ELECTRICAL PENETRATIONS

Openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings shall be sealed and weathertight.

3.8 EQUIPMENT GROUNDING

Equipment grounding and bonding shall be in accordance with NFPA 70. Ground exposed, noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, and neutral conductor of wiring systems.

3.9 GROUNDING SYSTEM

System grounding shall be installed to limit voltages due to lightning, line surges, unintentional contact with higher voltage lines, and to stabilize voltage to ground during normal operation. System grounding shall meet, at a minimum, the requirements of the NFPA. If not otherwise indicated on the Drawings, system grounding shall consist of a minimum of two grounding electrodes.

3.10. TEST REQUIREMENTS

Each device subject to manual operation shall be operated at least three times, demonstrating satisfactory operation each time.

3.10.1 Cable and Wire Testing

Perform testing with all conductor splices and intermediate terminations completed, with lightning arrestors removed, and disconnections made at points of final termination. Electrical conductors shall be tested to ensure continuity, phasing, proper splicing, freedom from unwanted grounds, and insulation values. Perform insulation resistance tests on all 600V power and control wiring (twisted/shielded instrumentation cable shall not require insulation testing). Insulation resistance shall be performed by an instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. The minimum resistance shall be 250,000 ohms. Apply all insulation resistance testing of multiple conductor cables between one conductor and ground with all other conductors connected to the same ground. Test each conductor in a like manner. If found defective, the Subcontractor shall perform all rework necessary to correct errors and omissions to bring the work into compliance with the specifications.

3.10.2 Ground-Fault Circuit Interrupter Receptacle Test

Test GFI receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.10.3 Grounding System Test

Test each grounding electrode for resistance to ground before making connection to the grounding system. Tie grounding electrodes together and test grounding system to ensure continuity, and that resistance to ground does not exceed 25 ohms.

END OF SECTION

ATTACHMENT E

Responses to U.S. Environmental Protection Agency Comments on the Draft Report

Responses to Comments submitted by the United States Environmental Protection Agency, Region IX[1]

GENERAL COMMENTS

GENERAL COMMENT 1: The text states that new extraction well EW-OU2-13-180 will be installed at an optimum location to improve plume capture and contaminant mass removal, but it appears that there are several other locations where potential extraction wells might improve plume capture if operated in unison with the proposed location. One possibility might be an additional extraction well located near monitoring well MP-BW-46-170 where contaminant concentrations are highest. Installing multiple additional wells should result in more timely mass removal. Please revise the text to clarify why the selected location is superior to other potential locations for plume capture and contaminant mass removal.

RESPONSE TO GENERAL COMMENT 1: *As indicated throughout Section 1.0 of the text, new extraction well EW-OU2-13-180 will be installed to improve plume capture and contaminant mass removal, with the primary purpose of preventing migration of carbon tetrachloride (CT) from the Upper 180-Foot Aquifer to the Lower 180-Foot Aquifer and downgradient drinking water supply wells. An extraction well in any other location, while potentially removing additional contaminant mass in the near term, would not meet this objective. The proposed location for EW-OU2-13-180 at the upgradient edge of the discontinuity in the Intermediate 180-Foot Aquitard accomplishes this. Additionally, currently declining CT concentration trends in the Upper 180-Foot Aquifer indicate upgradient CT mass is becoming depleted, potentially mitigating the need for additional groundwater extraction in the area of MP-BW-46-170. The text in Section 1.3 of the Addendum was revised to include this information. Regardless, analysis of whether additional extraction wells or other actions are necessary is not appropriate at this time because, as stated in Section 3.2 of the Operable Unit Carbon Tetrachloride Plume [OUCTP] Fourth Quarter 2021 through Third Quarter 2022 Groundwater Monitoring Report (Administrative Record No. OUCTP-0105B), progress toward achieving long-term remedy goals should be assessed after implementation of additional groundwater extraction to improve hydraulic control and containment of the OUCTP in the Upper 180-Foot Aquifer.*

GENERAL COMMENT 2: It is unclear why an extraction well is not proposed near the well with the highest carbon tetrachloride (CT) concentrations. The rationale for the location of proposed new extraction well EW-OU2-13-180 is to install the new extraction well at the downgradient edge of the CT plume as it migrates southeastward toward an area where the Upper 180-Foot Aquifer is communicating with the Intermediate 180-Foot Aquifer. The purpose is to control migration and mitigate the potential for downward migration into the intermediate aquifer. However, adding extraction well(s) in the northwestern source area portions of the plume (where concentrations are highest) would have the effect of removing a larger amount of mass centrally, while at the same time lowering the upgradient volume of CT that is advancing at the plume's toe (i.e., at the downgradient plume edge). Also, adding a single extraction well at the downgradient edge of the plume will not provide backup redundancy if the capture zone or well performance are compromised. Please revise the

[1] In a letter dated June 22, 2023 (Administrative Record No. OUCTP-0109.5). The comments are reproduced here as provided to the Army and there have been no changes to spelling, grammar, or punctuation.

text to discuss how the single proposed additional extraction well will produce greater mass removal as well as provide for complete plume capture.

RESPONSE TO GENERAL COMMENT 2: *To clarify, proposed new extraction well EW-OU2-13-180 is intended to prevent migration of CT from the Upper 180-Foot Aquifer through the discontinuity in the Intermediate 180-Foot Aquitard to the Lower 180-Foot Aquifer and downgradient drinking water supply wells. Otherwise, please see the response to General Comment No. 1.*

SPECIFIC COMMENTS

SPECIFIC COMMENT 1: Section 1.3, Implementation Step 3, Hydrogeologic Testing, Page 9: The specific type of hydrogeologic testing to be conducted is not specified. In characterizing the aquifer parameters during this step, it is unclear if there are planning provisions for a multi-cycle step-drawdown test (and produced water storage and characterization) to provide more valuable input data for updating the aquifer model. Please add clarifying text detailing the specific testing procedures to be used in Step 3.

RESPONSE TO SPECIFIC COMMENT 1: *Please note this list presented in Section 1.3 is only the proposed sequence of implementation for the remedial action; therefore, adding clarifying text regarding hydrogeologic testing or any other step in the sequence is not appropriate for Section 1.3. General information regarding hydrogeologic testing is already provided in Section 4.1.2 and a detailed description of testing procedures will be included in a forthcoming Remedial Action Work Plan (RAWP) and Quality Assurance Project Plan (QAPP). The text in Section 1.3 was not revised per the comment.*

SPECIFIC COMMENT 2: Section 1.3, Plume Capture Strategy, Pages 9 and 10: The text states that the steps required to complete this program are dependent on each previous step, but it should be noted throughout this section that site professionals will address deviations from the plan, unrecognized site or ground conditions and other unknowns. The text also states," If installation of the one additional extraction well provides a sufficient quantity of water and yields the desired effects upon the aquifer no further testing work will be required," but the basis for this assumption is unclear. It is unclear what contingency actions were included in the planning effort to demonstrate that unforeseen conditions or situations will be readily addressed as they arise. Specifically, it is unclear how the system will be redesigned if the single additional well does not satisfy all the program objectives (e.g., is not able to sustain a flow rate of 30 to 60 gallons per minute or does not capture enough of the plume). Please revise the text to discuss how the system will be improved if this single extraction well does not satisfy all program objectives.

RESPONSE TO SPECIFIC COMMENT 2: *The text in Section 1.3 was revised to state the sequential activities listed will include sufficient flexibility for site professionals to respond to field conditions and to state further well-performance testing work may be conducted to collect additional data to support system redesign if initial testing results indicate the one additional extraction well cannot achieve remediation goals. Otherwise, discussion about how the system will be improved if a single extraction well does not satisfy program objectives is not within the scope of the remedial design as a redesign would require additional data inputs. As noted in the response to Specific Comment 1, there will be a RAWP/QAPP prepared for this project in the Uniform Federal Policy (UFP) format that will identify project personnel, specific issues that trigger deviations from the plan, and project/data quality objectives, including an analytic approach for decision-making and performance or acceptance criteria.*

SPECIFIC COMMENT 3: Section 3.1.1.6, Well Development and Sampling, Pages 17 and 18: The specific conditions that will be utilized to determine that well development can be successfully concluded are unclear. For example, if water quality parameters have stabilized it is unclear if 10 well volumes plus 1000 gallons will also be removed. It is also not clear what measures will be taken if water quality parameters do not stabilize, which is a critical issue for extraction wells. Please revise the text to clarify the measures that will be taken if well development processes deviate from the proposed plan.

RESPONSE TO SPECIFIC COMMENT 3: *Section 3.1.1.6 was revised to clarify well development procedures and the criteria for successful well development.*

SPECIFIC COMMENT 4 Section 3.2.1, Groundwater Extraction Equipment, Page 18: It is not clear if a temporary submersible pump will be installed for the specific capacity testing to determine the correct production pump size. There are also no details on the specific capacity testing procedures to be used for sizing the production pump. Please revise the text to clarify if a temporary pump will be used and provide the specific capacity testing procedures to be used.

RESPONSE TO SPECIFIC COMMENT 4: *The text in Section 3.2.1 was revised to clarify that specific capacity testing will occur during well development, as described in Section 3.1.1.6. Detailed specific capacity procedures will be provided in the forthcoming RAWP/QAPP.*

SPECIFIC COMMENT 5: Figure 3, Carbon Tetrachloride Plume, Lower 180-Foot/400-Foot Aquifers – Third Quarter 2022: The symbol for well BW-50-339 should be blue because CT was detected at 1.1 micrograms per liter (µg/L), rather than a black symbol that indicates there are no CT detections. Please revise this figure accordingly.

RESPONSE TO SPECIFIC COMMENT 5: *Figure 3 was revised per the comment.*

SPECIFIC COMMENT 6: Attachment A, Groundwater Capture Model, Figures: The legend symbol for extraction wells is a different color than the symbol used on these figures. Please resolve these discrepancies.

RESPONSE TO SPECIFIC COMMENT 6: *The figures in Attachment A were revised per the comment.*

ATTACHMENT F

Responses to California Central Coast Regional Water Quality Control Board Comments on the Draft Report

Responses to Comments submitted by the Central Coast Regional Water Quality Control Board[1]

COMMENT: Based on our review, the Central Coast Water Board concurs with the proposed plan for construction and operation of the new Upper 180-Foot Aquifer extraction well EW-OU2-13-180 and have general comments on the plume capture strategy and remediation of carbon tetrachloride (CT) in the Upper 180-Foot Aquifer at OUCTP.

It is understood that proposed extraction well EW-OU2-13-180 will be used to extract groundwater from the downgradient edge of the Upper 180-Foot Aquifer to improve plume capture, increase contaminant mass removal, and minimize further migration into the Lower 180-Foot Aquifer. Based on a review of the plume capture modeling in the Addendum and the *May 2023 Draft Final OU2 Remedy Monitoring and Operations and Maintenance Report for Fourth Quarter 2021 through Third Quarter 2022* (2023 Draft Final OU2 Annual Report), it appears additional remediation may also be warranted at the northern CT plume in the vicinity of well MP-BW-46-170. Section 1.3, Plume Capture Strategy, indicates that the simulated capture zone for extraction well EW-OU2-09-180 appears wide enough to encapsulate most of the CT plume located upgradient of this well, and this analysis is based on the *March 2022 OU2 Remedy Monitoring and Operations and Maintenance Report for Fourth Quarter 2020 through Third Quarter 2021*. However, the plume capture model provided in the 2023 Draft Final OU2 Annual Report shows that the northern CT plume is not captured with the operation of current extraction well EW-OU2-09-180. Additionally, the plume capture model provided in the Addendum shows that the CT plume in the vicinity of monitoring well MP-BW-46-170 is also outside of the capture area of the proposed extraction well except for a small portion of the southern end of the plume under certain average conditions at a pump rate of 30 and 60 gallons per minute. Therefore, please revise the plume capture discussion in Section 1.3 based on the modeling presented in the 2023 Draft Final OU2 Annual Report that shows the northern CT plume is not captured by the operating extraction well under the current conditions and how this will be addressed either as part of the Addendum or future remediation.

RESPONSE TO COMMENT: *The plume capture discussion in Section 1.3 of the report was revised to state that the northern CT plume is only partially captured by extraction well EW-OU2-09-180 and this capture may only be seasonal due changes in groundwater flow induced by agricultural pumping downgradient (i.e., during the dry period each year). To clarify, the 2023 OU2 Annual Report Figure 47 shows the CT plumes in the Upper 180-Foot Aquifer are not captured by operation of current extraction well EW-OU3-09-180; however, Figure 47 only depicts capture during the Third Quarter (dry period) of 2022. As described in Appendix G and shown on Appendix G Figure 32, operation of current extraction well EW-OU2-09-180 does partially capture the northern CT plume in the Upper 180-Foot Aquifer during the First Quarter (average period) of 2022 (Administrative Record No. OU2-738B). However, analysis of whether an additional extraction well or other actions are necessary to address the northern CT plume is not appropriate at this time because, as stated in Section 3.2 of the OUCTP Annual Report (Administrative Record No. OUCTP-0105B), progress toward achieving long-term remedy goals should be assessed after implementation of additional groundwater extraction to improve hydraulic control and containment of*

[1] In a letter dated June 22, 2023 (Administrative Record No. OUCTP-0109.3). The comments are reproduced here as provided to the Army and there have been no changes to spelling, grammar, or punctuation.

the OUCTP in the Upper 180-Foot Aquifer. Additionally, as noted in the revised text in Section 3.3 of the OUCTP Annual Report, currently declining CT concentration trends in the Upper 180-Foot Aquifer indicate upgradient CT mass is becoming depleted, potentially mitigating the need for additional groundwater extraction in the area of the northern CT plume. The text in Section 1.3 of the Addendum was revised to include this information.

ATTACHMENT G

Responses to Fort Ord Community Advisory Group Comments on the Draft Report

Responses to Comments submitted by Fort Ord Community Advisory Group (FOCAG)[1]

COMMENT 1: Page 6 under 1.3 Plume Capture Strategy; Please identify FO-29 as belonging to the Marina Coast Water District (MCWD). This was one of the three production wells they utilized for years, respectively FO-29, FO-30 and FO-31. These provided drinking water for the residents of Marina. I don't think CT was being tested for at the time. When did CT testing begin?

RESPONSE TO COMMENT 1: *The text was revised per the comment. According to the California State Water Resources Control Board GeoTracker database (https://geotracker.waterboards.ca.gov/), testing for carbon tetrachloride (CT) began in 1985. The following links show CT results for the three wells in GeoTracker:*

FO-29: https://shorturl.ac/7b5x5

FO-30: https://shorturl.ac/7b5x8

FO-31: https://shorturl.ac/7b5x9

COMMENT 2: Wasn't FO-29 taken offline for several years due to not meeting drinking water standards?

RESPONSE TO COMMENT 2: *The U.S. Department of the Army (Army) and MCWD test water supply wells FO-29, FO-30, and FO-31 at least every three months and there has been no indication these wells are not meeting drinking water standards. The Army reports the results of this testing in quarterly groundwater monitoring reports (e.g., see Administrative Record Nos. OUCTP-0108 and OUCTP-0111). MCWD reports the results in an annual consumer confidence report (CCR) found at www.mcwd.org. Water quality data and operational information are available at MCWD. Drinking water supplied by MCWD meets all federal, state, and local regulatory standards. For further information about MCWD water quality, please contact an MCWD representative. Contact information for MCWD is available at https://mcwd.org/contact.php.*

COMMENT 3: Figures 2,3, and 4 need better background definition. It is difficult to visibly establish locations of the various plumes and wells without labeling roadways and nearby housing areas.

RESPONSE TO COMMENT 3: *Road names were added to Figures 2, 3, and 4 per the comment.*

[1] In a letter dated June 6, 2023 (see Administrative Record No. OUCTP-0109.2). The comments are reproduced here as provided to the Army and there have been no changes to spelling, grammar, or punctuation.