FINAL

Addendum Work Plan for AOC-65 Interim Removal Action

Prepared for:

Camp Stanley Storage Activity
Boerne, Texas

January 2012

TABLE OF CONTENTS

Page

SECTION 1 INTRODUCTION 1-1
1.1 Statement Of Objective 1-1
1.2 Planned Activities 1-1

SECTION 2 WELL ABANDONMENT AND MODIFICATION 2-1
2.1 General 2-1
2.2 Scope Of Work 2-1
2.3 Plugging And Abandoning 2-1
2.4 Well Modifications 2-3

SECTION 3 TRENCHING ACTIVITY 3-1
3.1 General 3-1
3.2 Trench Excavation 3-1
3.3 Photo Mosaic Analysis 3-1
3.4 Isco Infiltration System Installation 3-1
3.5 Gaseous Chemical Tracer Study 3-3

SECTION 4 AOC-65 DRILLING TSW/VEW INSTALLATION 4-1
4.1 General 4-1
4.2 Treatability Study Well Installations 4-1
4.3 Vapor Extraction Well Installations 4-3
4.4 Well Development 4-5
4.5 Geophysical And Video Logging 4-5

SECTION 5 DECONTAMINATION AND INVESTIGATION-DERIVED MEDIA MANAGEMENT 5-1
5.1 General 5-1
5.2 Decontamination Procedures 5-1
5.3 Investigation-derived Media Management 5-2

SECTION 6 SAMPLING REQUIREMENTS 6-1
6.1 General 6-1
6.2 Sampling Requirements 6-1

LIST OF TABLES

Table 2.1 Estimated Quantities of Borehole Abandonment Activities 2-1
Table 4.1 Estimated Quantities of Drilling Requirements 4-1
Table 6.1 Estimated Quantities of Sampling 6-1

LIST OF FIGURES

Figure 1.1 Proposed Trench, TSW, and VEW Locations 1-3
Figure 3.1 Cross Section of Proposed ISCO Trench 3-2
Figure 4.1 Typical Monitoring Well (TSW) Design 4-7
Figure 4.2 Typical Vapor Extraction Well Design 4-8
Figure 4.3 VEW Well Head Design 4-9

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
BGS	Below Ground Surface
BS	Bexar Shale
CC	Cow Creek
CSSA	Camp Stanley Storage Area
DIGW	Discrete Interval Groundwater Sample
DQO	Data Quality Objective
GAC	Granular Activated Carbon
ID	Inside Diameter
IDM	Investigation-Derived Media
IH	Interstate Highway
LGR	Lower Glen Rose
MCL	Maximum Contaminant Level
MW	Monitoring well
OD	Outside Diameter
PCE	Tetrachloroethene
PCL	Primary Contaminant Level
PID	Photoionization Detector
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SOW	Statement of Work
SIW	Steam Injection Well
SP	Spontaneous Potential
SVE	Soil Vapor Extraction
TCE	Trichloroethene
TD	Total Depth
TPDES	Texas Pollution Discharge Elimination System
UGR	Upper Glen Rose
USGS	United States Geological Survey
VEW	Vapor Extraction Well
VOC	Volatile Organic Compound
WB	Westbay™-equipped well

SECTION 1
INTRODUCTION

1.1 STATEMENT OF OBJECTIVE

This document serves as both an addendum to the existing CSSA *Work Plan*, February, 1996 (see CSSA Environmental Encyclopedia (www.stanley.army.mil), Volume 1-1) and work plan addenda contained therein, and an addendum to the existing CSSA *Field Sampling Plan*, February, 1996 (see CSSA Environmental Encyclopedia, Volume 1-4) and sampling and analysis plan addenda contained therein. The interim removal actions and subsequent field investigations will be documented by technical memoranda specific to the activity described below.

1.2 PLANNED ACTIVITIES

This work plan provides a general description of the activities and requirements for completion of an interim removal action at AOC-65 including:

- Plugging and abandoning three vapor monitoring points (VPMs) and one steam injection well (SIW);
- Removal of source area materials along a concrete-lined drainage ditch (creating an excavated trench);
- Installation of plumbing/gravel/and clay into the trench for *in-situ* chemical oxidation (ISCO) injection;
- Injection and subsequent monitoring of a liquid or gaseous chemical tracer, drilling and installation of four treatability study wells (TSW)s; and
- Drilling and installation of four vapor extraction wells (VEWs).

The activities associated with the interim removal action may also require modifying six VEWs and one Westbay (WB) well. Existing work plans and quality control plans for current and previous CSSA task orders fulfilled by Parsons remain in effect and are available in the ***CSSA Environmental Encyclopedia, Volume 1, Work Plans***. General activities to be conducted will follow the provisions of those prior documents, as applicable. General descriptions of site history, geology, and hydrogeology are also found therein. The following paragraphs describe the planned field activities and procedures to be completed.

Prior to initiating interim removal excavation activities at AOC-65 several wells in the vicinity of the proposed trench will be plugged and abandoned or modified to reduce the risk of damage. Wells to be plugged and abandoned include: VMP-4A, -4B, and -6, and SIW-02. VEW-14, -26, -27, -29 and -30 and CS-WB03 may be converted from stick-up style wells to flush-mount wells to protect them from increased traffic associated with excavation activities.

A trench will be excavated along the length of the drainage ditch located west of Building 90 at AOC-65. The trench will be approximately 3 feet wide by 15 to 18 feet deep and no more than 300 feet in length. The final length of the trench will be determined in the field by a supervising Parsons geologist/scientist. Following the removal of source material, the trench will be backfilled with alternating layers of gravel and clay, and high density polyethylene

(HDPE) injection piping to be used for ISCO injection, will be installed within each of the gravel layers and connected to an injection manifold.

TSW construction consists of drilling four Upper Glen Rose (UGR) monitoring wells at on-post locations. These TSWs will aid in the monitoring of injected oxidants and provide a means to monitor reduction of contaminants in groundwater along flowpaths treated by ISCO application. VEW construction consists of drilling four UGR wells at on-post locations. The VEWs will complement the existing soil vapor extraction (SVE) system located at AOC-65. The proposed locations for the trench, TSWs, VEWs, and the location of wells that may be modified and abandoned are depicted in **Figure 1.1**. The overall length of the trench is to be determined in the field. The excavated trench will be inspected with detailed photo documentation in an effort to identify fracture locations and orientations. Final TSW locations will be based on the results of the fracture analysis study and VEW locations will be based on the results of a tracer study.

The scope of work also includes activities associated with the injection of a gaseous chemical tracer into the ISCO injection system and subsequent monitoring of groundwater and soil vapors to positively identify the tracer in vapor and aqueous phases at various monitoring wells, blower intakes, and VEWs within AOC-65.

Figure 1.1

AOC-65 Interim Removal Action
Trench, VEW & TSW Locations
Camp Stanley Storage Activity

P a r s o n s

SECTION 2
WELL ABANDONMENT AND MODIFICATION

2.1 GENERAL

The removal effort consists of excavating a trench 32 inches wide, 15 to 18 feet deep and approximately 300 feet long (final length to be determined in the field). Site preparation for trenching will require leveling the path of the trenching equipment on either side of the drainage ditch. Several VMPs and an SIW are within the area that will require leveling, thus will be plugged and abandoned according to applicable state regulations.

2.2 SCOPE OF WORK

To facilitate requirements for a removal action at AOC-65, three VMPs and one SIW will be plugged and abandoned, and one Westbay well and six VEWs may be modified to minimize the risk of damage during excavation efforts. Borehole properties for the wells to be plugged and abandoned are given in **Table 2.1**.

Table 2.1
Estimated Quantities of Borehole Abandonment Activities

Well ID	Borehole Diameter (inches)	Total Depth *(feet)*
SIW-01	8	27
VMP-4A	8	100
VMP-4B	6	88*
VMP-6	8	60
Total:		373 (88*)

* *Total depth of boreholes with different diameters are separated.*

2.3 PLUGGING AND ABANDONING

Plugging and abandoning VMPs and SIWs will follow all applicable state regulations as provided in the Texas Administrative Code (TAC) standards for capping and plugging of wells that penetrate undesirable water or constituent zones (TAC §76.1004):

> ***76.1004. Technical Requirements--Standards for Capping and Plugging of Wells and Plugging Wells that Penetrate Undesirable Water or Constituent Zones****. (Effective January 3, 1999, 23 TexReg 13059; section repealed effective November 8, 2001, 26 TexReg8814; new section effective November 8, 2001, 26 TexReg 8814; amended effective December 1, 2003, 28 TexReg 10468; amended effective December 1, 2006, 31 TexReg 9604)*

(a) All wells which are required to be plugged or capped under Texas Occupations Code Chapters 1901 and 1902 or this Chapter shall be plugged and capped in accordance with the following specifications and in compliance with the local groundwater conservation district rules or incorporated city ordinances:

(1) all removable casing shall be removed from the well;

(2) any existing surface completion shall be removed;

(3) the entire well pressure filled via a tremie pipe with cement from bottom up to the land surface;

(4) In lieu of the procedure in paragraph (3) of this section, the well shall be pressure filled via a tremie tube with clean bentonite grout of a minimum 9.1 pounds per gallon weight followed by a cement plug extending from land surface to a depth of not less than two (2) feet, or if the well to be plugged has one hundred 100 feet or less of standing water the entire well may be filled with a solid column of 3/8 inch or larger granular sodium bentonite hydrated at frequent intervals while strictly adhering to the manufacturers' recommended rate and method of application. If a bentonite grout is used, the entire well from not less than two (2) feet below land surface may be filled with the bentonite grout. The top two (2) feet above any bentonite grout or granular sodium bentonite shall be filled with cement as an atmospheric barrier. Bentonite grout may not be used if a water zone contains chlorides above 1500 ppm or if hydrocarbons are present.

(5) Undesirable water or constituents shall be isolated from the fresh water zone(s) with cement plugs and the remainder of the wellbore filled with neat cement or clean bentonite grout of a minimum 9.1 weight followed by a cement plug extending from land surface to a depth of not less than two (2) feet.

(b) Large hand dug and bored wells 36-inches or greater in diameter to one hundred (100) feet in depth may be plugged by back filling with compacted clay or caliche to surface. All removable debris shall be removed from the well. If the well contains standing water, it shall be chlorinated by adding chlorine bleach at a rate of one (1) gallon of bleach for every five hundred (500) gallons of standing water. The backfill material shall be mounded above the surrounding surface to compensate for settling.

(c) Wells which do not encounter groundwater (dry holes) may be plugged by backfilling with drill cuttings from total depth to the surface. The backfill material shall be mounded above the surrounding surface to compensate for settling.

(d) Drillers may petition the Department, in writing, for a variance from the methods stated in subsection (a) of this section. The variance should state in detail, an alternative method proposed and all conditions applicable to the well that would make the alternative method preferable to those methods stated in subsection (a) of this section.

(e) A non-deteriorated well which contains casing in good condition and is beneficial to the landowner can be capped with a covering capable of preventing surface pollutants from entering the well and sustaining weight of at least four hundred (400) pounds and constructed in such a way that the covering cannot be easily removed by hand.

In accordance with the standard, "all removable casing shall be removed from the well" however, it is unlikely that all materials will be "removable". Portions of the casing or screen will occasionally separate when wells are pulled. When this occurs, the unrecoverable well materials are generally cemented in place. Typically, a hole will be punched through the end cap prior to an attempt to remove the well materials, thus, if the casing does separate, the lower portions of the borehole can still be grouted. In the case of the VMPs, it is not likely that much, if any, of the screen can be easily removed. The VMPs are a series of nested wells, however, not in the traditional sense. These wells consist of five- or ten-foot sections of screen, set in a sand pack, that are attached to tubing which exits the borehole at the surface. Each of the screened intervals has at least five feet of bentonite separating them. It is possible that the tubing will separate from the screens when pulled; in those cases, the hole will have to be drilled out to remove the PVC screens and provide access for the tremie pipe to reach the basal portions of the borehole in order to add grout. Once the well materials are removed, the hole will be filled with a bentonite grout from the bottom up, terminating two feet below ground surface (bgs). The remaining top two feet of the hole will be filled with cement to create an atmospheric barrier.

2.4 WELL MODIFICATIONS

Several wells within AOC-65 have the potential to be damaged during efforts associated with the excavation efforts. To mitigate this risk, modifications to existing wells (CS-WB03, and VEWs-13, -14, -17, -19, -26, -27,) may be completed once the trench path has been prepared, depending on site conditions. These modifications will effectively convert the wells from stick-up to flush-mount style wells. This will include the removal of protective well covers, pads, and bollards, cutting down the well casing to 0.5 feet below ground surface, and installation of a new well pad with 12-inch diameter, traffic-rated, flush-mount vaults. VEW wellheads will be re-completed and reconnected to the SVE system (as required) once the casing has been cut down. Should these modifications be completed, the wells will require resurveying to reflect the new top of casing (TOC).

SECTION 3
TRENCHING ACTIVITY

3.1 GENERAL

One trench shall be excavated at AOC-65 in the vicinity of the concrete-lined drainage ditch (Figure 1.1). The excavation of the trench serves two purposes. First, the drainage ditch is a suspected source of vapor and aqueous phase contamination at AOC-65. Previous activities at the site include the potential release of PCE into the ditch, and the eventual infiltration of contaminants into the matrix and fractures in the subsurface beneath the ditch. Removal of contaminated media beneath the ditch removes one source of contamination at AOC-65, thus reducing the potential impact to receptors. Second, the excavated trench will be used as an infiltration gallery to treat subsurface contamination with ISCO. The trench will be backfilled with alternating layers of gravel and clay, with perforated piping installed within the gravel layers for ISCO delivery. The separate layers of gravel will allow for a more vertically targeted application of ISCO materials.

3.2 TRENCH EXCAVATION

The exact dimensions of the trench will be determined in the field, however, the maximum depth of the trench shall be 15 feet at the northern most portion of the trench, and the base of the trench shall remain level as trenching proceeds southward. The maximum width of the trench will be determined by the width of the trenching equipment; however, the width shall not exceed 4 feet. The length of the trench shall not exceed 300 feet, and final length of the trench will be determined in the field by a supervising Parsons geologist/scientist. Trench excavation will be completed with an Austin Trencher (AT) 1460 or similar. The AT 1460 has the ability to reach depths up to 18 feet, and the width of the cutting arm is 32 inches.

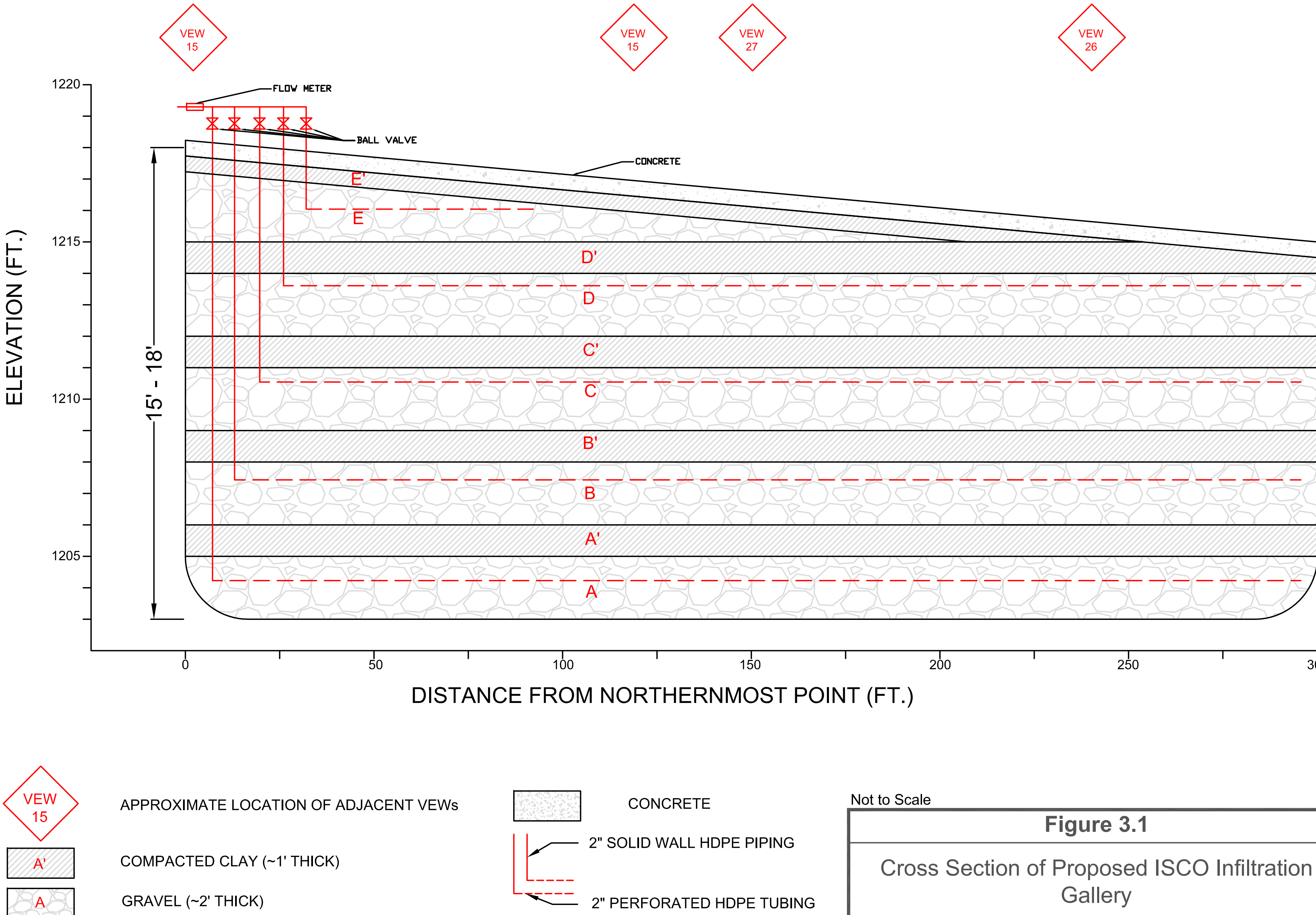
Excavated soils will be sampled for waste characterization and managed appropriately.

3.3 PHOTO MOSAIC ANALYSIS

Once the trench has been excavated photographs of the trench walls will be taken. These photos will be collaged together such that the entire length of the trench wall can be studied. Locations and orientations of fractures and faults will be determined by inspecting the photo collage. Open aperture fractures will be highlighted and targeted for placement of the TSWs, as the migration of infiltrated ISCO solution will likely occur along these fractures.

3.4 ISCO INFILTRATION SYSTEM INSTALLATION

The trench will be backfilled with alternating layers of gravel and clay to create distinct zones in which to apply the ISCO solution (**Figure 3.1**). ISCO injection lines will be installed in each gravel layer. The lines will be constructed of 2-inch HDPE tubing that will be perforated throughout its length and capped on the south end of the trench. Near the north end of the trench, the lines will be connected to an elbow, and will be extended vertically, until they exit the trench, where they will be connected to a manifold. The manifold will include ball-valves such that each gravel layer can be turned on or off when the ISCO solution is applied. Gravel will be applied in layers approximately 2 feet thick along the length of the trench followed by a 1-foot layer of compacted clay. It is anticipated that the upper gravel layer will not be a uniform thick-



Not to Scale

Figure 3.1

Cross Section of Proposed ISCO Infiltration Gallery

Camp Stanley Storage Activity

PARSONS

748402 CSSA–ISCO–INF.DWG 1/6/12

-ness as there is an approximate 3-foot elevation change from the north part of the trench to the south. This upper layer will effectively be a wedge of gravel with the uppermost clay layer capping the trench along its entire length. A new concrete ditch will be installed above the uppermost compacted clay layer to manage runoff.

3.5 GASEOUS CHEMICAL TRACER STUDY

A gaseous chemical tracer test will be performed at AOC-65 by Parsons personnel following the installation of the infiltration gallery. Helium will be used as the tracer, and will be directly injected into the ISCO injection lines. The helium will be continuously monitored at individual SVE blower intakes. When the helium has been positively identified at an intake, each of the individual VEWs will be monitored to determine vadose zone migration pathways from the trench to the SVE system. Water samples will be collected from monitoring wells, TSWs, and VEWs to determine the dissolved phase migration pathways in the saturated portion of the water bearing-zone of the UGR and upper portion of the LGR at AOC-65. Several rounds of groundwater sampling may be required in order to determine arrival times and duration of the tracer.

SECTION 4
AOC-65 DRILLING TSW/VEW INSTALLATION

4.1 GENERAL

A total of eight boreholes will be drilled at AOC-65 in support of two treatability studies (Figure 1.2). Four wells shall be drilled and installed west of Building 90 to monitor groundwater associated with the application of an ISCO solution and serve as monitoring points for a tracer study. Four additional wells will be drilled and installed to broaden the SVE system capture area. While actual drilling depths shall be a function of each well's location and land surface elevation, it is estimated that the drilling depths shall be approximately 40 feet bgs for TSWs and 25 feet bgs for VEWs (**Table 4.1**). Geophysical and video surveys will be completed in each borehole by GeoCam prior to the completion of each well.

Table 4.1
Estimated Quantities of Drilling Requirements

Drilling Location	8" Borehole Depth *(feet)*	4" Well with (Screen) *(feet)*	Geophysical Log	Camera Survey
AOC-65-TSW-01	40	40 (30)	1	1
AOC-65-TSW-02	40	40 (30)	1	1
AOC-65-TSW-03	40	40 (30)	1	1
AOC-65-TSW-04	40	40 (30)	1	1
AOC-65-VEW-34	25	25 (20)	1	1
AOC-65-VEW-35	25	25 (20)	1	1
AOC-65-VEW-36	25	25 (20)	1	1
AOC-65-VEW-37	25	25 (20)	1	1
Totals:	260	260 (200)	8	8

4.2 TREATABILITY STUDY WELL INSTALLATIONS

Four UGR monitoring wells (AOC-65-TSW-01, AOC-65-TSW-02, AOC-65-TSW-03, and AOC-65-TSW-04) shall be constructed at locations determined from analysis of photo collage at on-post locations to monitor for the presence of chemical tracer in groundwater, constituents of ISCO treatment, and contamination in the Middle Trinity Aquifer (**Figure 1.1**). Each single-cased well shall terminate in the UGR portion of the Middle Trinity Aquifer.

4.2.1 Drilling Method

Four eight-inch borings will be drilled for the installation of the four-inch treatability study monitoring wells. It is anticipated that the actual drilling depths will range between 35 and 45 feet bgs, depending on conditions. The actual drilling depths will be a function of the well's specific location, land surface elevation, and proximity to structural features (faults and subsurface stratigraphy). The final depth shall be determined by the on-site geologist based upon the results of the geophysical and video logs, geological formation contacts, and the presence of structural features. If necessary, drilling footage which exceeds the drilling subcontractor's statement of work (SOW) will be addressed with a scope modification as field conditions warrant. The nominal diameter of the boreholes will be 8 inches and no larger than 8.5 inches. The completed wells will have straight-wall, single-cased design with a nominal diameter of 4 inches.

Considering the subsurface material, air rotary drilling with water injection is the preferred method of well borehole advancement. Clean, unchlorinated injection water will be made available from the CSSA water supply system at wells CS-10 and CS-12. The well will be drilled by a licensed well service contractor, and the construction and surface completion will adhere to local and state regulations. The use of "Quickfoam®" is an allowable drilling additive for assisting in cutting removal during the drilling process. The drilling subcontractor will make adequate provisions for the containment, control, and de-foaming of all fluids and solid media exiting the wellhead.

Each well will be drilled to the total depth as determined by the on-site geologist. The drilling subcontractor will remove as much sediment as possible by flushing and jetting with the drill stem before exiting the borehole. Once the borehole has been developed, ample time will be given to allow the water column, if applicable, to clear for the video and geophysical logging (see **Section 4.5**). Once the borehole logging inspections have been completed, the on-site geologist will collect samples for VOC analysis. The samples will be collected in accordance with **Section 6**.

4.2.2 TSW Construction

Once the borehole testing is complete, monitoring well completion will commence. In general, a single-cased monitoring well shall be constructed with a nominal diameter of 4 inches, consisting of a Schedule 40 polyvinyl chloride (PVC) riser coupled with 30 feet of PVC screen (**Figure 4.1**). The well shall be completed within an 8-inch diameter open borehole no larger than 8.5 inches in diameter.

All well casings, screens, and end caps shall be flush-threaded, and shall not require the use of any glues or solvents. All well material shall be certified "clean" by the manufacturer, and shall remain within their original packaging until the time of their downhole installation. The well riser and screen shall consist of nominal 4-inch Schedule 40 PVC with flush-threaded joints. The well screen shall include a slot size of 0.040-inches (40-slot), with no more than a 30-foot intake. The annular space shall be filled with a filter pack from the base of the borehole to a height of 2 feet above the top of the screened interval. The filter pack needs to be sized such that 100 percent retention is maintained by the screen. Commercial sizes of either 8/16 or 4/10 mesh would be acceptable. The filter pack shall be emplaced via tremie pipe from the base of the borehole to the top of the designated screened zone. The height of the filter pack shall be monitored continuously during emplacement using a weighted measuring tape. Prior to the emplacement of the filter pack, the amount of required filter material shall be calculated. Given the well construction parameters (8 inch borehole and 4.5-inch outside diameter [OD] screen), approximately 25.5 pounds of sand shall be required for each foot of the filter pack height. As an example, a filter pack height of 30 feet shall require approximately 765 pounds of silica sand.

A 100 percent sodium bentonite seal with a maximum thickness of 5 feet shall be emplaced within the borehole above the filter pack. The bentonite shall be dropped into the borehole from the surface at a rate sufficient to avoid clumping and bridging, and shall settle through the water column by gravity. The bentonite seal shall be allowed to fully hydrate per the manufacturer's specifications before grouting activities commence.

A Portland grout mixture shall be slowly added to the annular space. The slurry shall be injected until grout flows freely at the surface. The annular space shall be checked periodically for settlement, and shall be topped off as needed to no greater than two foot below ground surface. The grout shall be allowed to cure for at least 48 hours prior to well development.

Wells will be completed with 4-foot square concrete pads and 12-inch diameter traffic rated flush mount boxes. A brass monument will be placed in each monitoring well concrete pad to serve as a permanent benchmark. Monuments will be stamped with each corresponding well's official identification. Each well will be surveyed by a State of Texas registered professional land surveyor. All wells will be secured as soon as possible after drilling with corrosion-resistant locks. The monitoring wells will be developed, as required, by the drilling subcontractor using surging, bailing, and pumping techniques (see **Section 4.4**).

4.3 VAPOR EXTRACTION WELL INSTALLATIONS

Four soil vapor extraction wells (AOC65-VEW34, AOC65- VEW35, AOC65-VEW36, and AOC65-VEW37) will be drilled and constructed at locations determined from results of a gaseous chemical tracer study (**Figure 1.1**) to enhance the current SVE system at AOC-65 and/or replace VEWs abandoned prior to source removal efforts. Each single-cased well shall terminate in the UGR formation.

4.3.1 Drilling Method

It is anticipated that the actual drilling depths will be 25 feet bgs, depending on conditions. The actual drilling depths will be a function of the land surface elevation, and proximity to structural features (faults and subsurface stratigraphy). The final depth shall be determined by the on-site geologist based upon the results of the geophysical and video logs, geological formation contacts, and the presence of structural features. If necessary, drilling footage which exceeds the drilling subcontractor's SOW will be addressed with a scope modification as field conditions warrant.

Considering the subsurface material, air rotary drilling with water injection is the preferred method of well borehole advancement. Clean, unchlorinated injection water will be made available from the CSSA water supply system at wells CS-10 and CS-12. The boreholes will be drilled by a licensed well service contractor. The use of "Quickfoam®" is an allowable drilling additive for assisting in cutting removal during the drilling process. The drilling subcontractor will make adequate provisions for the containment, control, and de-foaming of all fluids and solid media exiting the borehole.

The borehole will be drilled to the total depth as determined by the on-site geologist. The drilling subcontractor will remove as much sediment as possible by flushing and jetting with the drill stem before exiting the borehole. Once the borehole has been developed, ample time will be given to allow the water column, if applicable, to clear for the geophysical logging (see **Section 4.5**). Once the borehole logging inspections have been completed, the on-site geologist will collect samples of groundwater for analysis of VOCs. The samples will be collected in accordance with **Section 6**.

4.3.2 VEW Construction

Each of the four VEWs shall be constructed with 4-inch diameter, schedule 40 PVC, 0.040 slot screen and 4-inch diameter, schedule 40 PVC riser. Screened interval lengths shall be limited to 20 feet. Each VEW shall be extended flush-mounted and shall be fitted with a below grade piping that connects the VEW to the SVE blower manifold. Each VEW shall be completed per the procedures outlined below. **Table 4.1** includes the proposed well identification number and screened intervals for each of the four VEWs to be installed as part of the SVE system at AOC-65.

The annular space of each VEW shall be filled with number 8/16 silica sand from the base of the borehole to a height of 0.5 feet above the top of the screened interval. The sand filter pack shall be emplaced via tremie pipe from the base of the borehole to the top of the designated screened zone. The height of the filter pack shall be monitored continuously during emplacement using a weighted measuring device.

A 100 percent sodium bentonite seal approximately 1.5 feet thick shall be placed above the filter pack in each borehole. The bentonite shall be dropped into the borehole from the surface at a rate sufficient to avoid clumping and bridging. The bentonite seal shall be fully hydrated per the manufacturer’s specifications before grouting activities commence.

A Volclay® grout mixture will be slowly pumped into the annular space using a side-discharge tremie pipe. The volume of grout shall be calculated prior to emplacement. The slurry shall be injected until grout flows freely at the surface. The annular space shall be checked periodically for settlement, and shall be topped off as needed to no greater than 2 feet bgs. The grout shall be allowed to cure for at least 48 hours prior to well development. The typical VEW well design is illustrated in **Figure 4.2**.

The surface casing shall be installed such that the top of casing is 6 inches below grade to facilitate the installation of a traffic-rated vault (Section **4.3.3**).

4.3.3 VEW Well Head Completion

Upon conclusion of the drilling activities, each VEW location will be secured with a traffic-rated steel plate until the construction activities commence. The final wellhead installation for the VEWs will be completed by a Construction Subcontractor, not the Drilling Subcontractor. The typical VEW wellhead design is depicted in **Figure 4.3**. Wellhead completion also includes connecting each individual VEW to one of the existing SVE extraction manifolds. Trenching will be required to accommodate the 2 inch HDPE piping tying the new VEWs to one or more manifolds, depending on the final VEW locations. The trenches will be excavated such that a grade is maintained toward the VEW. This will ensure that no condensate will accumulate within the lines, but rather in the VEW.

VEWs will be completed with 4-foot square, 6-inch thick concrete pads and 12-inch diameter traffic rated flush mount boxes. A brass monument will be placed in each monitoring well concrete pad to serve as a permanent benchmark. Monuments will be stamped with each corresponding well's official identification. Each well will be surveyed by a State of Texas registered professional land surveyor. All wells will be secured as soon as possible after drilling with corrosion-resistant locks.

4.4 WELL DEVELOPMENT

All boreholes or wells in which groundwater is encountered will be developed by the Subcontractor using surging, bailing, and pumping techniques. Recovered fluids will be contained for transport to the SWMU B-3 Bioreactor near well CS-MW16. Because of the nature of the aquifer, it is anticipated that the VEWs and SIWs will contain groundwater from time to time. If the VEWs are found to contain groundwater following their installation, they will be developed in a manner consistent with a traditional groundwater well.

The monitor well development requirements are:

(1) all newly installed monitor wells shall be developed no sooner than 48 hours after installation to allow for grout curing;
(2) all drilling fluids used during well construction shall be removed during development;
(3) wells shall be developed using surge blocks and bailers or pumps, and wells shall be developed until:
   a. the turbidity remains within a 10 nephelometric turbidity unit range for at least 30 minutes; and
   b. the Contractor is satisfied that all stabilization criteria are met including:
      i. temperature ± 1°C;
      ii. pH ± 0.1 units; and
      iii. electrical conductivity ± 5 percent;
(4) discharge water color and volume shall be documented;
(5) no sediment shall remain in the bottom of the well;
(6) no detergents, soaps, acids, bleaches, or other additives shall be used to develop a well; and
(7) all development equipment shall be decontaminated according to the specifications of this document.

In the interest of time, development activities may progress in stages while the grouting process is occurring. Often, a well requires numerous events to top off settling grout. This process may take place over a period of several days. Development may begin once more than 50 percent of the grout has been emplaced. However, no development activity shall be engaged within the 48-hour time period after the emplacement of any lifts of grout.

4.5 GEOPHYSICAL AND VIDEO LOGGING

Each borehole drilled under this task order, with exception of soil borings, will be geophysically logged and video surveyed. The downhole logging tools will be used to characterize and correlate the geologic/hydrogeologic conditions relative to similar data collected throughout the base in previous efforts. The logging efforts can also help identify significant production zones and will aid in the construction and casing design of the well. Gamma, resistivity, spontaneous potential (SP), and caliper logging shall be conducted. Gross-count natural gamma ray logging shall also be conducted with both short (16”) and long (64”) resistivity and SP methods to augment identification and correlation of strata or soil/rock types between boreholes, upon the discretion of Parsons geologists. A borehole video camera will be used to inspect and record (analog or digitally) the condition of the well borehole.

4.5.1 Electric Logs (Resistivity and Spontaneous Potential)

The resistivity and SP measuring instruments shall be raised toward the surface at a rate no greater than 10 feet per minute. The scales selected for portraying resistivity or SP readings shall be the same at all boreholes. The appropriate scale shall be determined in the field by conducting offset logs prior to the final survey. Scales to be adjusted are the horizontal (millivolts for SP and ohm-meters for resistivity) and vertical (feet). The resistivity logs shall consist of the short-normal (16-inch) and long-normal (64-inch) configurations.

4.5.2 Natural Gamma Ray Logs

Natural gamma ray logging shall be used in conjunction with SP, resistivity, and caliper logs in fluid-filled boreholes.

4.5.3 Caliper Logs

The geophysical subcontractor shall use a borehole caliper to measure the variations in the borehole diameter.

4.5.4 Optical Televiewer

The geophysical subcontractor shall use an Optical televiewer at the well locations to help identify variations in borehole lithology, fractures, cavity dimensions, and orientation of features. In addition to a hard copy report, the data will be made available electronically for viewing and manipulation in software such as WellCAD Reader or equivalent.

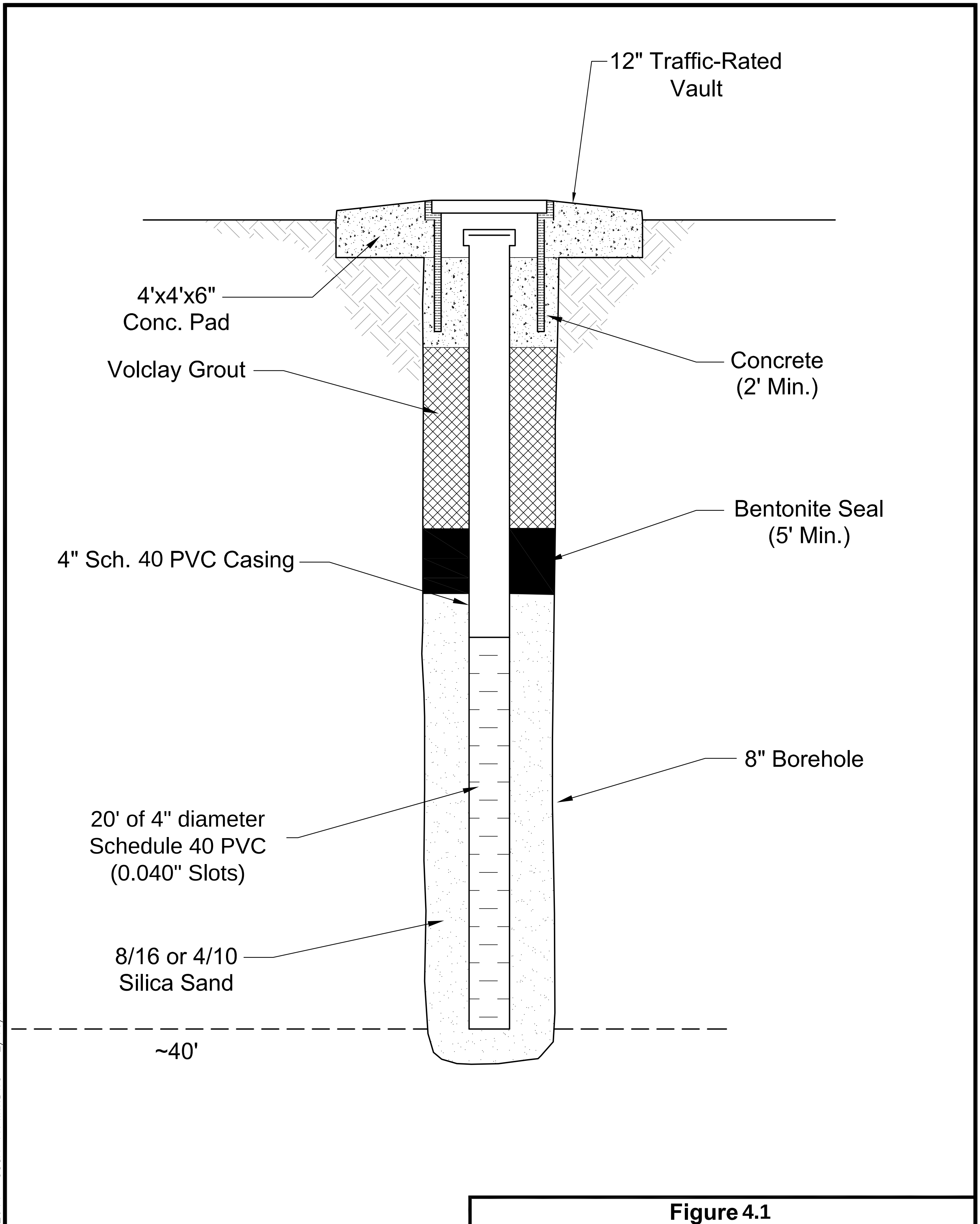
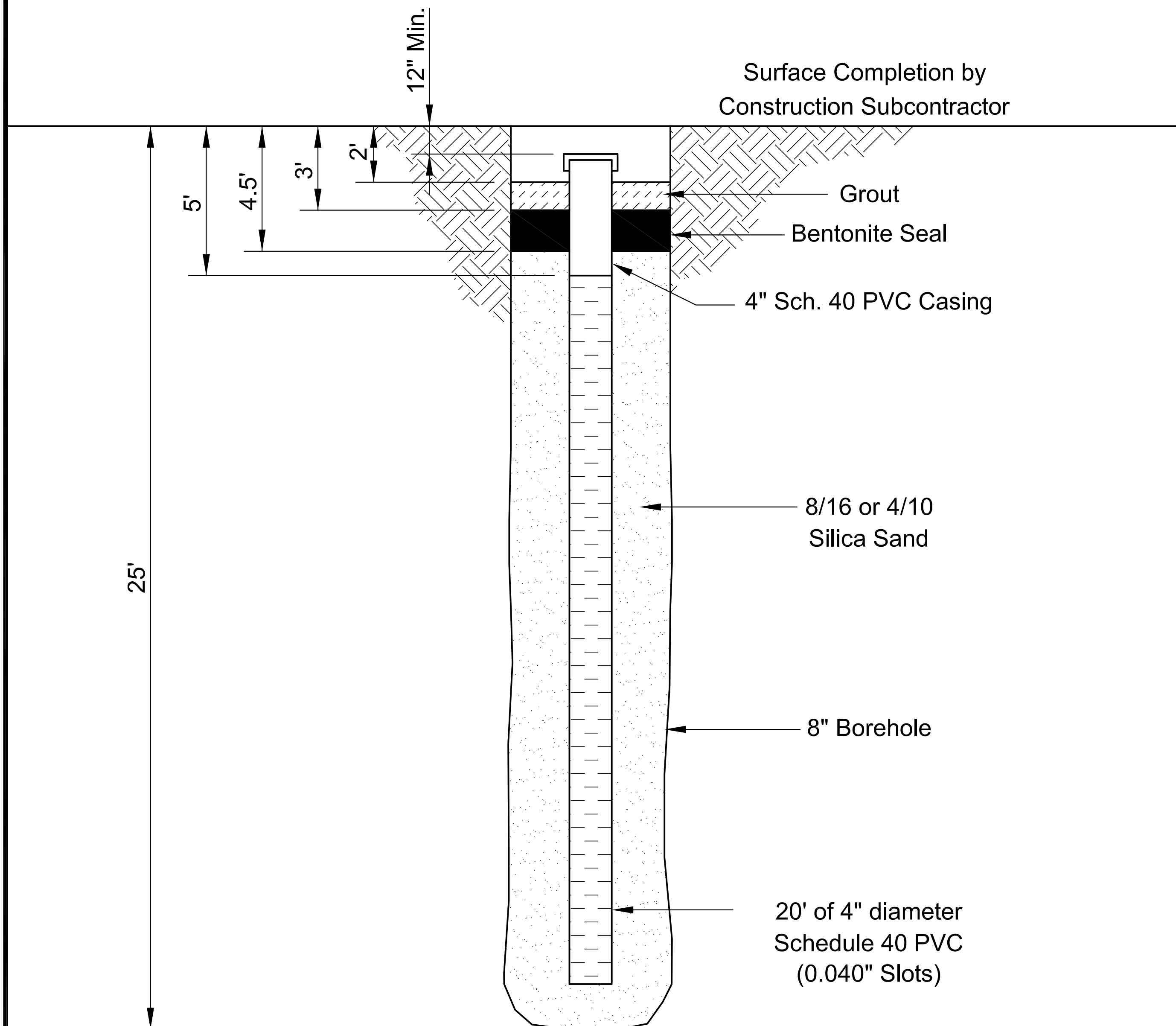


Figure 4.1

Typical Treatability Study Well Design

Camp Stanley Storage Activity

PARSONS



RESTORATION/DRILLING 2012 CSSA-TVWELL.DWG 3/8/11

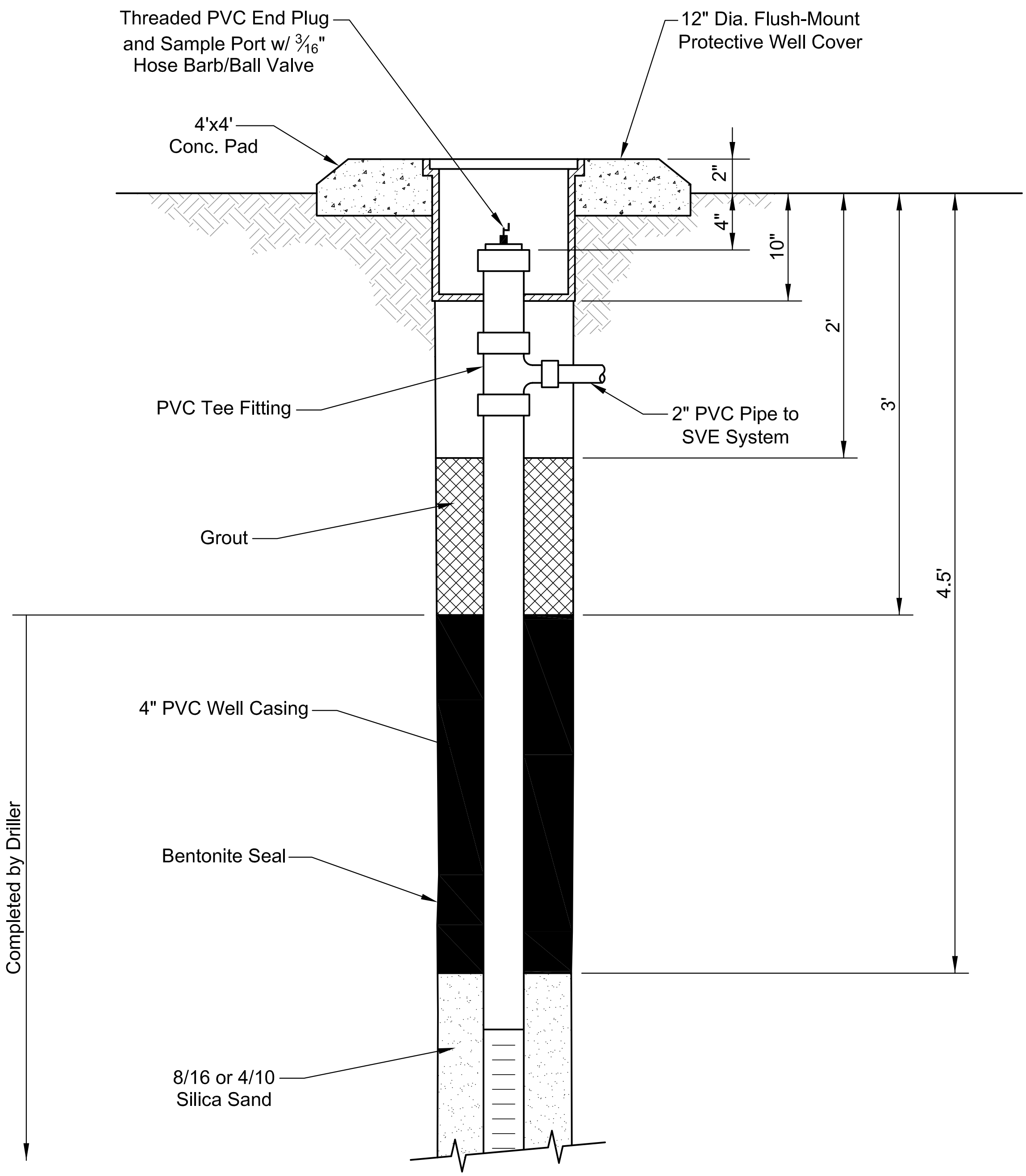
Not to Scale

Figure 4.2

Typical Vapor Extraction Well Design

Camp Stanley Storage Activity

PARSONS



747781 CSSA–TYPVEW.DWG 3/28/11

Not to Scale

Figure 4.3

Typical Vapor Extraction Well
Well Head Design

Camp Stanley Storage Activity

PARSONS

SECTION 5
DECONTAMINATION AND INVESTIGATION-DERIVED MEDIA MANAGEMENT

5.1 GENERAL

This section describes the procedures and requirements for the decontamination of drilling and sampling equipment and the proper management of investigation-derived media (IDM) generated over the course of the environmental investigations.

5.2 DECONTAMINATION PROCEDURES

To prevent sample contamination from the onsite sampling equipment and machinery, decontamination will follow the general procedures outlined in the master CSSA Field Sampling Plan (***CSSA Environmental Encyclopedia, Volume 1.4, Sampling and Analysis Plan)***. A decontamination station will be set up within AOC-65 and fluids generated from decontamination activities will be managed at the SWMU B-3 Bioreactor.

All equipment that may directly or indirectly come into contact with samples will be decontaminated in a designated decontamination area. These include casing, drill bits, drilling rods, auger flights, portions of drill rigs that stand above boreholes, sampling devices, and downhole instruments. In addition, the contractor will take care to prevent the sample from coming into contact with potentially contaminating substances such as tape, oil, engine exhaust, corroded surfaces, and dirt.

The following procedure will be used to decontaminate large pieces of equipment such as casing, drill bits, pipe and rods, and those portions of the drill rig that may stand directly over a boring or well location or that comes into contact with casing, auger flights, pipe, or rods. The external surfaces of equipment will be washed with high-pressure hot water and if, necessary, scrubbed until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., are removed. The equipment shall then be rinsed with potable water. The inside surfaces of casing, drill rod, and auger flights will also be washed as described.

The following procedure will be used to decontaminate sampling and drilling devices such as split spoons, core barrels, and bailers that can be hand-manipulated. For sampling and smaller drilling devices, the equipment will be scrubbed with a solution of potable water and Alconox, or equivalent laboratory-grade detergent. Then the equipment will be rinsed with copious quantities of potable water followed by distilled water. The equipment will be air dried on a clean surface or rack, such as Teflon®, stainless steel, or oil-free aluminum elevated at least 2 feet above ground.

Drill rigs, drill pipe and other equipment that does not come into contact with the sample medium will be decontaminated with a steam cleaner before initial use and after each borehole is completed. Drill bits will be decontaminated with a steam cleaner prior to use at each boring or monitoring well location. If hot water cleaning alone is found to be ineffective, the equipment may be scrubbed with laboratory-grade detergent, then rinsed with high-pressure steam. All visible dirt, grime, grease, oil, or loose paint will be scrubbed until it has been removed. When possible, drilling will proceed from the “least” to the “most” contaminated sites.

Casing, centralizers, and well screens will either be certified clean by the manufacturers or will be decontaminated by steam cleaning. Prior to well development, equipment such as pumps or surge blocks will be decontaminated by flushing or pumping laboratory-grade detergent solution, potable water, then distilled water through the internal components in the order listed below. The exterior of the pump inlet hose will be steam cleaned.

Sampling equipment includes augers, continuous-core samplers, hand trowels, bailers, pH meters, conductivity meters, shovels, knives, spatulas, and composition bowls that directly contact samples. The following steps must be followed when decontaminating this equipment:

1. Set up a decontamination area at the site. The decontamination area should progress from “dirty” to “clean” and end with an area for drying decontaminated equipment. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. However, sampling equipment to be used for organic sample collection will not come into contact with plastic after the final rinse, and oil-free aluminum foil must be used.
2. Wash the item thoroughly with soapy, laboratory-grade detergent solution. Use a stiff-bristle brush to dislodge any clinging dirt. Disassemble any items that might trap contaminants internally before washing. Do not reassemble until decontamination is complete, and items are dry.
3. Rinse the item in clear potable water. Rinse water should be replaced as needed, generally when cloudy.
4. Rinse the item with distilled water.
5. Rinse equipment with isopropyl alcohol.
6. After drying, wrap the cleaned item in oil-free aluminum foil for storage at least 2 feet above the ground.
7. After decontamination activities are completed, collect disposable gloves, boots, and clothing. Place contaminated items in proper containers for disposal.

5.3 INVESTIGATION-DERIVED MEDIA MANAGEMENT

Investigation-derived media may include soil cuttings, drilling fluids, purged groundwater, well development water, decontamination fluids (water and other fluids), and disposable personal protective equipment (PPE).

Waste management of soil cuttings expected to be generated from trenching activities will be accomplished within 200 cubic yard staging piles to be located within AOC-65. Results of waste characterization will determine management methods for the generated material which may include management off-post at an approved landfill facility or management on-post as appropriate.

For waste management, the drilling subcontractor may use up to 20-yard, transportable roll-off boxes placed at the drilling/excavation location to contain drilling fluids and solid cuttings as necessary. Additional roll-off boxes (covered, lined, and leak-proof) may be placed near the well B3-EX01 at the SWMU B-3 Bioreactor. Sediment-free groundwater generated during drilling activities and well development, as well as decontamination water, will be transported to the bioreactor for management in accordance with State of Texas Class V Injection Permit Authorization number 5X2600431.

The remaining drilling generated solids, fluids or drill cuttings will be containerized in roll-offs or by plastic sheeting at the wellhead, and managed as appropriate. For those solids and fluids determined non-hazardous by analytical results, CSSA may opt for an alternative recycling or reuse method. Otherwise, solids will be transported for disposal at a Class 2 non-hazardous landfill.

5.3.1 Temporary Storage Containers

Due to drilling in a potentially contaminated portion of the aquifer, generated drilling fluids may have to be contained in multiple 20-yard roll-off boxes. Drilling fluids would be placed directly into the containers at the site and allowed to settle before decantation of the water for processing. Once the solid fraction has sufficiently settled, the liquid fraction of a roll-off container can be characterized for short list VOCs and TDS to determine if the water will meet surface discharge requirements (less than MCLs) or be managed within the SWMU B-3 Bioreactor. The liquid fraction of each roll-off is sampled to make the discharge determination.

Once a roll-off container is sampled, the determination to discharge water is based on the analytical results being less than the MCL (or Tier 1 Primary Contaminant Level [PCL]) for a particular compound. The determination of releasing uncontaminated groundwater is made in conjunction (and permission) of the CSSA environmental officer. Discharges to the surface are made to areas that do not have the potential for draining off-post. The roll-off may then be reused to store drilling fluids. Once the roll-off has accumulated approximately 50 percent solids, the container should not be used to store additional fluids until the solid fraction can be characterized and removed from the roll-off.

SECTION 6
SAMPLING REQUIREMENTS

6.1 GENERAL

Analytical samples will be collected from groundwater and IDM waste streams during the course of this task order. The following samples in **Table 6.1** are anticipated to be collected from the following drilling locations:

Table 6.1
Estimated Quantities of Sampling*

Drilling Location	IDM Sampling for VOCs/TDS (Water)	IDM Sampling for VOCs/Metals (Soil)
AOC-65-TSW-01	1	1
AOC-65-TSW-02	1	1
AOC-65-TSW-03	1	1
AOC-65-TSW-04	1	1
AOC-65-VEW-34	1	1
AOC-65-VEW-35	1	1
AOC-65-VEW-36	1	1
AOC-65-VEW-37	1	1
AOC-65 Trenching		5
Totals:	8	13

** Quantities do not include QA/QC samples.*

Additional sampling will be required to characterize IDM from materials associated with the removal action. Analytical samples will be collected from soil piles in 5-part aliquots in a ratio of 1 sample per 200 cubic yards (CY) of material.

6.2 SAMPLING REQUIREMENTS

The planned sampling activities for this project include groundwater collection and IDM sampling for waste characterization. All IDM samples will be definitive data packages to support waste profiling procedures.

IDM for both soils and fluids may be collected for characterization prior to management activities. Fluids generated during drilling may be containerized in transportable 20-yard roll-off boxes. If analytical results indicate that the IDM is contaminated, it will be transported to the SWMU B-3 Bioreactor. The liquid fraction will be managed and discharged in accordance with the CSSA's Class V Injection Permit (Authorization No. 5X2600431). If analytical results indicate that the generated IDM is not contaminated, the material may be reused within CSSA.