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Field Work Variance No. KAFB-FWV-07

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FIELD WORK VARIANCE

Project Name/Number	140705		
Contract No.	USACE Contract No. W912DY-10-D-0014 Delivery Order 0002		
Applicable Document(s)	KAFB Interim Measures Work Plan March 2011	Date	9/1/2011

Problem Description:

Work plan verifications regarding Pneulog well drilling, installation, and sampling techniques. KAFB BFF Interim Measures Work Plan Sections 4.6.2.1, 4.6.2.2, and 4.6.2.4 do not accurately describe methods for installation and sampling of Pneulog wells. The work plan requires clarification in its sampling and installation guidelines for Pneulog wells.

Recommended solution:

The design of the Pneulog wells calls for 3 separate wells with screen intervals for each well separated by five feet of bentonite chips. Ten feet of bentonite grout placed on top of the bentonite chips would allow grout to penetrate the well screens and contaminate the wells. Work plan language outlining the building of Pneulog wells will be clarified to remove this conflict. Work plan language will also be modified to clarify instructions for soil sampling methods for the Pneulog wells.

Impact on present and completed work:

None.

Requested by: Dale Flores,

Recommended solution/disposition:

The Project Geologist will communicate these verifications to field staff, and copies of this FWV will be available on site for field staff.

Clarification ☒ Minor Change ☐ Major Change ☐

Signature Dale J Flores Technical Reviewer Date 6 Sept 2011

Shaw Environmental Inc. Approvals:			If Major Change:		
Signature	Diane Adrian Project/Task Manager	Date 9.1.2011	Signature	Sr. Project Manager	Date 9/1/11
Signature	Project QC System Manager	Date 9/1/11			

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FIELD WORK VARIANCE CONTINUATION SHEET

Continue FWV discussions below by noting section title(s) to be continued (i.e., Problem Description, Solution/disposition, Final Disposition, etc). Use additional continuation sheets as needed.

References:

Shaw Environmental, Inc. (Shaw), March 2011. Final Work Plan, Interim Measures Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111.

4.6.2.1 PneuLog Well Installation, Drilling, Soil Sampling, and Geophysical Logging

Nine new PneuLog well clusters, comprised of three wells with screens intervals positioned at different depths, will be installed. Locations of each of the PneuLog well clusters are shown on Figure 4-4. Soil samples will be collected from each boring, visually logged, and screened for contamination with a PID or similar device every five feet and recorded in the soil boring log. Electromagnetic (EM) induction, neutron, and gamma geophysical logging on the deepest well of each cluster will be performed. The geophysical logging will help characterize the formation around the boring, including porosity, permeability, measurement of fractures, joints, or other discontinuities, and water, clay, or other mineral content.

Each PneuLog well will consist of a single borehole drilled to the water table (approximately 500 ft bgs), with each borehole containing three installed well casings. The deepest well casing will be 3 inches in diameter, in order to accommodate the logging instrumentation (Figure 4-5), flush-threaded, Schedule 80 PVC casing. Each well will contain three screen intervals at 500 to 355, 350 to 205, and 200 to 25 ft bgs utilizing factory-slotted PVC 0.010 slot screen. These screen intervals should screen the entire vadose zone from 25 to 500 ft bgs. Figure 4-5 provides a schematic of the PneuLog well construction.

Each well boring will be tested for utility clearance to 5 ft with a hand-auger or post-hole digger. Borehole advancement (drilling) will be performed using the air-rotary casing hammer (ARCH) method. The ARCH method uses steel insulator casing, advanced with a drill bit/rod, to prevent borehole collapse. Each borehole will be drilled using an 11-¾-inch outside diameter (O.D.) drive casing to a depth of 150 ft bgs. A 9-⅝-inch O.D. casing will be used to complete the borehole to the final depth.

4.6.2.2 Borehole Logging

Each boring will be fully described on a boring log similar or equivalent to that shown in Appendix D, Form 1 and in accordance with ASTM International (ASTM) D5434-09 *(Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock*). Soil samples will be collected every five feet for lithologic description.

~~Soil samples will be collected using split-spoon samplers at 10-ft intervals to 50 ft bgs. Beyond that depth, samples will be collected at 50-ft intervals and at changes in lithology to the total depth. In addition to visual logging, each sample will be screened for VOCs with a PID or similar device.~~

The rig geologist will log the boring as it is being drilled by recording relevant data, listed below, on the appropriate boring log. Data that will be included in the logs, when applicable, are:

- The identifying number and location of each boring will be noted.
- All measurements will be accurate to one-tenth of a foot.
- Drilling logs and other scaled drawings will be drawn at a scale of 1 inch = 1 ft. For wells deeper than 200 ft bgs, the scale of 1 inch = 5 ft will be used. In addition, if sampling intervals are greater than 10 ft apart, the log can be represented with breaks in order to skip unlogged intervals).
- Soil types will be classified in accordance with the Unified Soil Classification System (USCS). These classifications will be prepared in the field by the geologist and will be subject to revision based on laboratory tests or subsequent review.

- A full description of soil samples will be provided. For split-spoon, thin-wall, soil-core, or otherwise intact samples, the description will include but not be limited to the USCS two-letter classification, plus a more complete verbal description of color, consistency, soil moisture, grain size, and size distribution.

- Depth limits and the type and number of each sample obtained will be indicated. All samples will be numbered consecutively.

- ~~The number of blows required for each 6-inch penetration of split-spoon sampler and for each 12-inch penetration of casing will be indicated, as well as hammer weight and length of fall for split-spoon or driven samplers, and hydraulic pressure used to push thin-wall tubes. If thin-wall tubes are pushed manually, that will be indicated.~~

- ~~Depth to water as first encountered during drilling, along with the method of determination, will be noted. Any distinct water-bearing zones below the first zone also will be noted. Other observations during drilling will be noted, such as bit chatter, rod binding, rod drops, flowing or heaving sands, bit pressure, rod rotations per minute, and water pressure.~~

- If drilling fluid is used, the fluid losses, interval over which they occur, and quantity lost will be recorded.

- A general description of the drilling equipment used will be provided. This description, including such information as rod size, bit type, pump type, rig manufacturer, and model, may be provided in a general legend.

- Dates and times of start and completion of boring will be indicated.

- The names of the contractor, driller, and rig geologist will be noted.

- The size and length of casing or auger used in each borehole will be noted.

- Observations of visible contamination for each sample or from cuttings that appear contaminated will be made.

- Field instrument readings will be noted.

As the boring is drilled, the rig geologist will evaluate adjacent samples recovered, together with observation of the drill cuttings, wash water (if any), and drill performance, to determine appropriate stratigraphic definitions or distinctions within the soil column. Such contacts or breaks between strata must be determined by the rig geologist and indicated on the boring log. In general, a stratigraphic unit contains only similar soil that can be classified within the same two-letter USCS classification category symbol. In some cases, significant differences in soil color, grain size distribution, or strength, would be sufficient to classify soil having the same two-letter USCS classification category symbol into two or more distinct strata.

After the rig geologist has indicated the appropriate stratigraphic breaks on the log, he/she will develop and record an appropriate description for each defined stratigraphic unit. Each description will contain information about the color, grain size distribution, consistency, moisture, etc., and the appropriate two-letter USCS classification category symbol.

- All stainless-steel or steel existing well casings will be completely removed or drilled out to the total depth of the well to avoid groundwater contamination due to corrosion. PVC casings may remain in place.

- A plugging material consisting of one or a combination of the following materials will be used:

  – Neat cement with not more than 5 percent by weight (wt%) of bentonite,
  – Bentonite slurry (which can include polymers designed to retard swelling),
  – High solids grout, or
  – Pelletized medium grade or crushed bentonite.

- Cement and bentonite slurries will be pumped into place in a continuous operation with a grout pipe introducing the plugging material at the bottom of the well and moving the pipe progressively upward as the well is filled. This method will be repeated to within 2 ft bgs unless otherwise specified.

- The well casing will be severed at least 2 ft bgs, if not required to be completely removed, and a cement plug larger in diameter than the well bore will be constructed over the well bore and completed flush with the ground surface.

- When using pelletized or crushed bentonite, the bentonite will be poured down the hole in 3- to 5-ft lifts and hydrated using clean potable water between lifts. This method will be repeated to within 2 ft bgs, unless otherwise noted.

4.6.2.4 PneuLog Well Installation Procedures

PneuLog wells are specially designed and consist of a well nest comprised of three wells with long screen intervals. Together, all three wells are designed to screen the entire vadose zone from 25 to 500 ft bgs or to the top of the water column. An engineered filter pack will be installed in the annular space between the well casing/screen and the borehole from the bottom of the borehole to approximately 2 ft above the top of the screened interval, with a minimal amount, approximately 1 to 2 ft, of bentonite ~~grout~~ chip seal between each screen interval. The filter pack will be slurried with clean potable water and tremied into place to prevent bridging and to ensure continuous placement, while the temporary drill casing is slowly removed. ~~A 10-ft hydrated bentonite seal will be emplaced above the sand filter pack incrementally hydrated with potable water in 1-ft lifts. After the final lift has been allowed to hydrate for 2 hours, a high solids (20 wt%) bentonite grout will be emplaced by tremie pipe to within 30 ft of the surface, and a cement/bentonite grout will be emplaced to within 1.5 ft of the surface.~~

The design and construction of each PneuLog well cluster shall comply with the guidelines established in various RCRA guidance documents, including, but not limited to:

- EPA, Office of Waste Programs Enforcement and Office of Solid Waste and Emergency Response (OSWER), *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1 (EPA, 1986); and

- EPA, *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*, EPA 600489034, (EPA, 1991).

PneuLog well installation procedures are detailed as follows:

- Appropriate PPE will be worn in accordance with the SSHP (Shaw, 2011).

- The borehole will be drilled to the total depth for the well to be installed using an ARCH rig. Temporary surface casing to the water table may be used to stabilize the upper portion of the drill hole, but casing must be removed as filter pack and bentonite-cement grout are installed.

- Well construction requires the installation of three separate wells that screen three intervals along the total length of the borehole. Each well will contain three screen intervals at approximately 500 to 355, 350 to 205, and 200 to 25 ft bgs. Actual screen lengths will vary based on depth to water below ground surface. Each well will be constructed with flush-threaded, Schedule 80 PVC casing with a PVC, ~~0.010~~0.050-inch, slotted screen. The deepest well will have 3-inch diameter casing that can accommodate the geophysical logging equipment.

- If the boring is overdrilled beyond the bottom of the proposed sump elevation by more than 10 ft, the borehole will be backfilled with filter pack material to an elevation approximately 5 ft below the proposed bottom of sump elevation.

- While slowly removing the drill casing from the borehole, the borehole annular space will be backfilled from a maximum of 2 ft and a minimum of 0.5 ft below the bottom of the lowest well screen to 2 ft above the well screen with a filter pack (~~10/20~~ Tacna 0.25/8~~silica sand~~). A 1- to 2-ft layer of bentonite ~~grout~~ chips will be place directly above the filter pack. After allowing for the bentonite ~~grout~~ chips to set, the filter pack for the next well will be placed above the bentonite ~~grout~~chips. The process will repeat until the final filter pack is placed around the shallowest well within the nest. A 5-ft layer of bentonite chips will be placed above the uppermost filter pack. Because of the special design of this well, this implies that filter packs will be placed from the bottom of the well to within 23 ft bgs.

- ~~The filter pack will be placed using a tremie pipe to avoid bridging and ensure a continuous filter pack throughout the screened interval of the well. The well may be gently surged to break up bridging and ensure complete placement of the filter pack around the well screen.~~

- ~~Next, a bentonite chip seal will be installed for a thickness of 10 ft. If placed above the water table (i.e., shallow wells), the bentonite chips will be hydrated with potable water for each 1-ft lift to ensure a competent seal. The bentonite seal will be a minimum thickness of 5 ft. Installation of a thicker bentonite seal is currently used for monitoring wells at the Kirtland AFB to ensure that there will be no intrusion of grout from above the seal into the filter pack material below the seal.~~

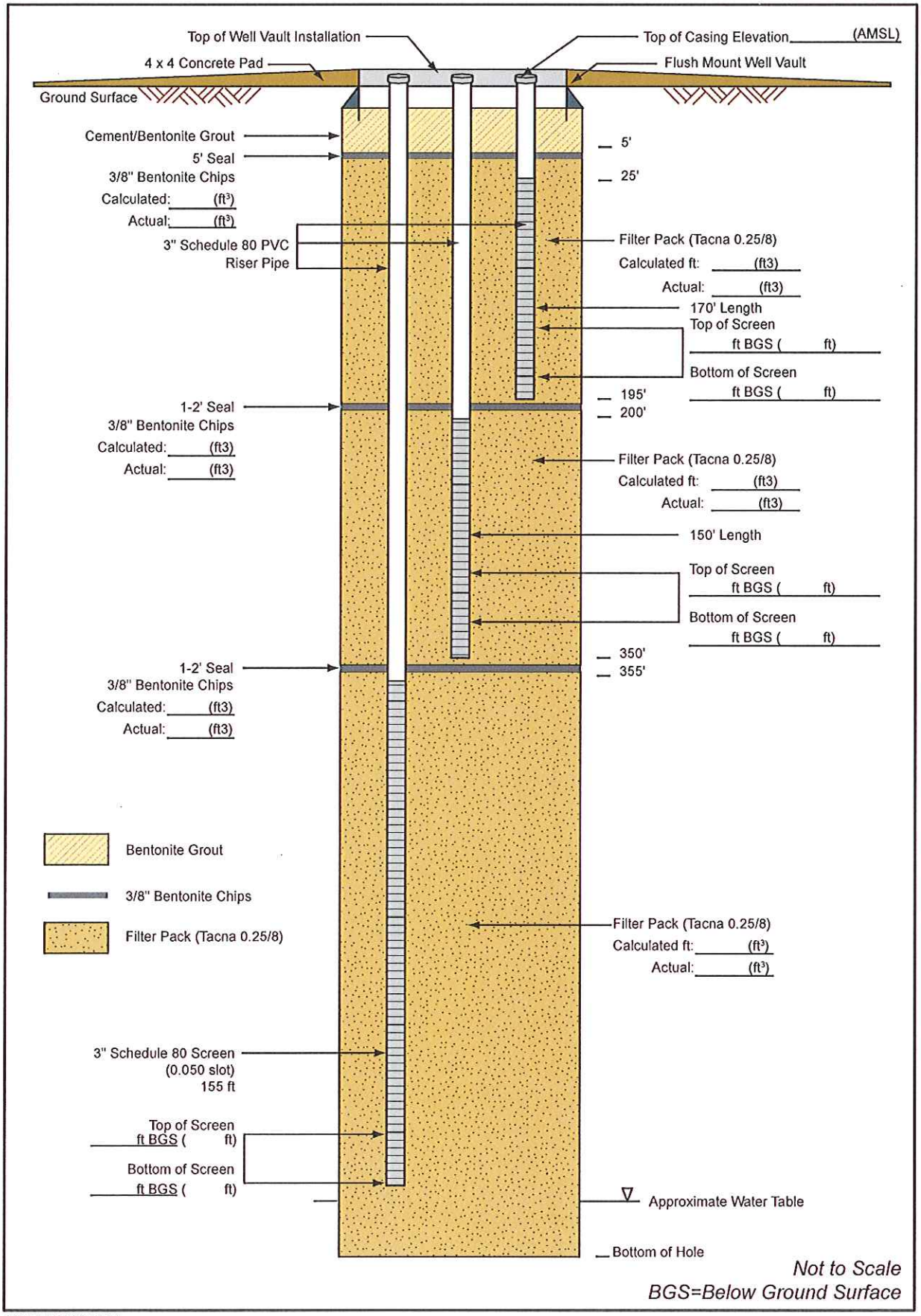
- ~~A 20 percent, high-solids, bentonite grout mixture will be installed over the bentonite seal using a tremie pipe. The mixture will consist of 20 wt% sodium bentonite powder. The bentonite grout will be installed to within 30 to 50 ft of the surface. The high-solids bentonite grout is currently and successfully used for well installation at the base to inhibit intrusion of grout into the well's filter pack and screen.~~

- From 20 feet t~~T~~o the surface, a cement/bentonite grout mixture will be installed over the ~~high-solids bentonite grout~~uppermost bentonite chip seal using a tremie pipe. The mixture will consist of 94 pounds of Portland cement to 7 gallons of approved water and 3 wt% sodium bentonite powder.

- Belowground surface completions will be within steel, flush-mounted protective covers (manholes) with gasketed, bolt-down covers. A concrete surface seal will be placed around the manhole and will extend from the cement/bentonite grout to ground surface. Protective posts will not be required on flush-finished wells.

PneuLog Well Completion Diagram KAFB-_____

Installation Start Date/Time: _____
Installation End Date/Time: _____



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