

## TECHNICAL MEMORANDUM

**To:** Ms. Diane Agnew, Albuquerque Bernalillo County Water Utility Authority

**From:** INTERA Incorporated

**Date:** November 19, 2021

**Re:** Proposed Monitoring Well Location and Screened Interval for the Water Authority Data Gap Well

---

### 1.0 Introduction

This Technical Memorandum (Tech Memo) describes the data and processes used to identify candidate locations for the proposed Albuquerque Bernalillo County Water Utility Authority (Water Authority) Data Gap Well within the area of interest (AOI). The Data Gap Well is intended to provide groundwater quality data that will constrain the vertical distribution of ethylene dibromide (EDB) contamination in the distal (i.e., north) end of the Kirtland Airforce Base (KAFB) Bulk Fuel Facility's (BFF) groundwater plume. KAFB installed monitoring wells to delineate the extent of the >1-mile-long EDB plume emanating from the BFF source area. Having raised questions about the relatively poor vertical delineation of the EDB plume numerous times in the past, the Water Authority is concerned that the current BFF monitoring well network has not been sufficient to discern the limits of EDB in groundwater either laterally or vertically.

The potential for there to be a data gap was identified in the INTERA (2017) Technical Memorandum that provided review comments on the latest version of the Resource Conservation and Recovery Act (RCRA) Facilities Investigation (RFI) report. INTERA (2017) identified intervals within the aquifer where EDB could potentially escape detection in the existing well network, leading to EDB migration downgradient toward Water Authority groundwater supply wells (e.g., Ridgecrest 5) and KAFB supply well KAFB-003. The AOI (**Figure 1**), within which the Data Gap Well will be installed, was previously defined by the Water Authority in Request for Bid (RFB) P2022000002 (Water Authority, 2021) and was based on the Water Authority RFI Review. Based on the RFI review, published geologic literature, local monitoring well lithologic logs, screen interval data, and EDB analytical data, INTERA proposes a recommended location and completion depth for the Data Gap Well.

The following sections of this Tech Memo describe the background geology and hydrogeology, site-specific geology, hydrogeology, and historical EDB concentration distributions. Finally, this document presents a recommendation for the location and screened interval depth for the Data Gap Well.

### 2.0 Background Geology and Hydrogeology

The following geologic summary is primarily from the early works by Hawley and Hasse (1992); extensive studies by Connell et al. (2004); Connell (2006); Grauch and Connell (2013); and Powell and McKean, (2014); and most recently work of the United States Geological Survey (USGS) publication of Meyers and Friesz (2019). INTERA has found these publications to be the most detailed hydrogeologic works in the

Albuquerque Basin. Figure 2 from the Meyers and Friesz (2019) paper has been modified and included as **Figure 2** in this Tech Memo to provide geologic and hydrogeologic context.

The project site is in the Albuquerque Basin, and the subsurface sediments consist of unconsolidated sand, silt, clay, and occasional gravel zones in the Santa Fe Group of Oligocene to Pleistocene age. The Santa Fe Group has been divided into lower, middle, and upper lithostratigraphic units based on lithology and age. The upper Santa Fe group is of most significance to the Data Gap Well and consists of the Ceja and Sierra Ladrones Formations. The Ceja Formation (older) is interpreted to have been deposited by fluvial processes sourced from west of the basin. The Sierra Ladrones Formation (younger) consists of ancestral Rio Grande axial-fluvial sediments transported from the north and piedmont-slope deposits derived from mountains to the east. Hawley and Hasse (1992) identify the fluvial deposits as the major hydrostratigraphic units: "Coarse-grained channel deposits of the modern and ancestral Rio Grande (lithofacies I and II) are the major components of the upper Santa Fe (USF-w) and river alluvium (RA) hydrostratigraphic units." These deposits form a preferential groundwater flow corridor, as described by Meyers and Friesz (2019), who also reference Powell and McKean (2014):

"The axial-fluvial deposits form an important geologic feature that greatly influences groundwater flow. The axial-fluvial sediments, deposited by the ancestral Rio Grande, form a north-northeast to south-southwest trending corridor of deposits (between the western and eastern limits of axial-fluvial sediments) with relatively higher conductivities. Given the same hydraulic gradients and effective porosities, groundwater within this corridor of higher hydraulic conductivity will flow at a faster volumetric rate than groundwater outside the corridor where hydraulic conductivities are lower. The axial-fluvial sediments, then, form a preferred corridor of flow, within which groundwater near the EDB plume flowed toward the northeast towards a large area of groundwater-level drawdown (Powell and McKean, 2014)."

The axial-fluvial sediments of the Sierra Ladrones Formation interfinger with sediments of the Ceja Formation in the central part of the basin and with the piedmont-slope deposits on the eastern side of the basin. As the channel of the ancestral Rio Grande shifted from the eastern side of the basin towards its present-day position near the center of the basin, piedmont-slope sediments overtopped axial-fluvial sediments and prograded westward as the river retreated. Fault movements on the east side of the basin caused the ancestral Rio Grande to shift to the east side of the basin, resulting in a stacked sequence of braided river-channel sediments in the eastern Middle Rio Grande Basin (Connell, 2004; Grauch and Connell, 2013). The axial-fluvial sediments have been characterized as braided river deposits consisting of coarse channel fill and bar sediments interbedded with silts and clays deposited in overbank and incipient floodplain environments (Agnew et al., 2016).

The result of these processes is a layer of piedmont-slope deposits that are up to approximately 200 feet (ft) thick, underlain by a sequence of fluvial-axial sediments that can be over 1,500 ft thick (Connell, 2006, cross section C-C', Plate 2). Based on a set of select wells chosen by INTERA that are within and proximal to the AOI for the Data Gap Well (**Figure 1**), the historical minimum and maximum depth to groundwater ranged from 433 to 493 ft below ground surface (bgs) (**Table 1**). This indicates that the wells within and proximal to the AOI are completed in the fluvial-axial sediments of the Sierra Ladrones Formation.

Within the Sierra Ladrones Formation are two lithologic units characterized by abundant silt and clay layers, named A1 (lower) and A2 (upper). These units represent periods of lower energy deposition within the basin, and lower hydraulic conductivities, as compared to higher energy deposition of the fluvial-axial sand and gravel deposits, which have higher relative hydraulic conductivities. The elevations of the top and base of these units have been mapped by the USGS, providing structural contours within the study area. Notably, these fine-grained units are absent east of the Eubank Fault (**Figure 2**). The top of the A2 unit is approximately 800 to 900 ft bgs in the study area. These two units are recognized as influencing groundwater flow in the basin, but monitoring wells within and proximal to the AOI are screened above these units.

Interbedded silt and clay deposits are present within the Sierra Ladrones Formation and at depths that are pertinent to the Data Gap Well; however, there is little likelihood that these fine-grained layers are laterally continuous. These fine-grained beds are within the braided axial-fluvial sediments of the ancestral Rio Grande. These types of deposits are well known in the geologic literature and are described by Selley (1982) as “shoestring” silts or clays and are derived from the small amount of silt and/or clay that gets deposited in abandoned channels of braided alluvium. The geometry of these types of deposits tends to be linear and not laterally continuous.

Faults that dip west have been mapped in the study area (**Figure 2**). These faults trend approximately north to south and are spaced approximately 1 mile apart from near the front of the Sandia Mountains to the west side of the basin near Rio Rancho, New Mexico. Many of the water supply wells that are northeast of the KAFB BFF EDB plume (e.g., RC-3, RC-4, and RC-5) are east of the Coronado-Alameda Fault (**Figure 2**), which has approximately 70 ft of displacement (Meyers et al., 2019). Although these faults are well documented in the geologic literature (e.g., Connell, 2006), their possible influence on groundwater flow in the study area is not well known.

In summary, the geologic and hydrogeologic framework of the site vicinity and at the relevant depths for the Data Gap Well consist of braided ancestral Rio Grande axial-fluvial sediments of the Sierra Ladrones Formation of the Santa Fe Group, consisting of unconsolidated sand, silt, clay, and gravel layers, with medium- to coarse-grained sand being the dominant sediment type.

### 3.0 Site-Specific Geology and Hydrogeology

For this Tech Memo, AECOM’s (2015) regional-scale and plume-scale cross sections, and other site-specific data were evaluated. A discussion of hydrogeologic data from these sources and their relevance for selecting the Data Gap Well location and screened interval completion depth is provided below. AECOM’s (2015) T1 cross section was especially useful for this evaluation since it is aligned along the EDB plume’s longitudinal axis, crosses the AOI, and was used in INTERA’s 2017 review of the RFI to illustrate the gap in delineation of the vertical extent of the EDB plume. Regarding this gap, the figure used to support INTERA’s RFI review findings is provided in this Tech Memo as **Figure 3**. **Figure 1** provides the line of section for this cross section. The wells in **Figure 3** are in line from southwest to northeast through the AOI, except for well 106232, which is northwest of the line of section approximately 500 ft and is projected onto the section.

To further aid in the evaluation of the site-specific geology and hydrogeology, INTERA tabulated a list of select wells within and near the AOI and compiled their lithologic logs and historical depth to water (DTW) measurements (**Table 1**). As shown by the highlighted wells on **Table 1**, five wells (106215, 106221, 106224, 106227, and 106230) were drilled by a combination of air rotary casing hammer (ARCH) method (to a depth of approximately 450 ft bgs, which is near the water table) and the roto-sonic method to total depth. A sixth well (106234), which is also highlighted on **Table 1**, was cored while being drilled by mud rotary methods. Other wells included in **Table 1** were drilled entirely by ARCH methods. The sonic- and core-drilled intervals delivered continuous sediment core samples, as compared with the drill cuttings produced and logged from the ARCH drilling method. The lithologic logs from the sonic and mud rotary core resulted in more detailed delineation of all sediment types, but especially the relatively thin fine-grained layers, which are more easily missed in ARCH samples. The bore logs for these select wells are included with this Tech Memo as **Attachment 1**.

Upon inspection of the lithology provided in the cross section presented in **Figure 3**, a gravelly unit (indicated as orange and red) was identified that generally correlates across the cross section in the interval identified by INTERA (2017) as being a EDB data gap. A review of the boring logs for wells on the **Figure 3** cross section and boring logs for nearby wells drilled to depths between 500 and 600 ft bgs support that correlation (**Figure 4**). This coarse-grained unit is likely one of the channel deposits within the ancestral Rio Grande braided deposits that are referenced above. As indicated on the **Figure 3** and **Figure 4** cross section, these units typically have relatively high hydraulic conductivity and transmit large volumes of groundwater and, consequently, are a target interval for the screen of the Data Gap Well.

Descriptions of this unit in the boring logs generated for wells drilled by the ARCH method depict this coarse-grained unit as a fairly homogenous unit of well graded and poorly graded sand with interbedded layers of up to 35% gravel (with no silt or clay logged below 183 ft bgs to total depth of 625 ft bgs). In contrast, the boring logs generated from cores produced by sonic methods show a more heterogeneous mixture that, in addition to the thick sequences of coarse-grained sediments, includes interbeds of finer-grained materials. For example, well 106227 is logged as having eight layers of clay or clayey sand between 484 and 570 ft, averaging about 1 ft thick. Descriptions of this interval for **Figure 3** wells (and their drilling method and screen interval) are as follows:

- KAFB-106037 (ARCH, screened from 507 – 522 ft bgs): predominantly sand and gravel from 480 to 520 ft bgs.
- KAFB-106058 (ARCH, screened from 511.8 – 526.8 ft bgs): predominantly sand and gravel from 495 to 524 ft bgs.
- KAFB-106227 (ARCH and Sonic, screened from 548 – 563 ft bgs): gravel generally present from 495 to 568 ft bgs with interbeds of clay and clayey sand from 561 to 566, well graded sand with clay and gravel at 566; lean clay at 570; etc.
- KAFB-106226 (ARCH, screened from 480 – 495 ft bgs): above the target depth for the Data Gap Well.
- KAFB-106225 (ARCH, screened from 450 – 480 ft bgs): above the target depth for the Data Gap Well.



- KAFB-106234 (Mud rotary and core, screened from 439.7 – 539.7 ft bgs): predominantly sand and gravel from 490 to 556 ft bgs with silt/fine sand layers at 502.7, 520.1, and 525.6 and multiple intervals that were not recovered during the coring.
- KAFB-106206 (ARCH, screened from 593.5 – 608.2 ft bgs): predominantly sand and gravel from 520 to 570 ft bgs.
- KAFB-106232 (ARCH, screened from 503 – 518 ft bgs): predominately sand and gravel from 508 to 555 ft bgs.

Within the intervals cored for these six wells, confidence in the lithologic descriptions may be considered higher as compared to the ARCH-drilled lithologic logs. However, even in these wells, fine-grained layers are scarce and generally very thin. For example, in well 106227, a fine-grained unit is shown on the cross section (T1) from approximately 520 to 525 ft bgs, but the log in this interval shows a 1-ft-thick clay from 519 to 520 ft bgs. Although the cross section may overstate the thickness of this clay, the fact that it is identified in the sonic core lithologic log suggests that the sonic-drilled lithologic logs are the most reliable.

Although **Figure 3** shows fine-grained units correlated between some wells, many of these facies may be “shoestring” deposits (e.g., Selley, 1982) and may not be laterally continuous. During Q4 2020, groundwater elevations ranged from 4,873.94 to 4,871.29 ft above mean sea level (amsl) for monitoring wells located in and proximal to the AOI and screened in multiple zones of the aquifer (**Table 1**). The essentially identical water levels that exist in wells screened at different intervals (i.e., the shallow, middle, and deep screened intervals of a monitoring well cluster) suggest that fine-grained units within the aquifer do not create confined or semi-confined aquifer conditions.

The water table has been on a long-term rising trend as it has recovered from historical drawdown since implementation of the San Juan Chama Drinking Water Project around 2008. Fluctuations of tens of feet in response to regional groundwater pumping may occur, which may vary significantly from year to year as a function of conjunctive management of surface water and groundwater supplies. Locally, extraction wells have been operated since about December 2015 in an attempt to capture the EDB plume.

The Q4 2020 and historical maximum and minimum water levels for wells along the AECOM (2016) cross section have been projected onto **Figure 4**. A key monitoring well in the area, well 106206, had a DTW of 460.55 ft bgs when measured in Q4 2020 (EA, 2021), and the Data Gap Well is expected to have a similar DTW.

## 4.0 EDB Distribution

The BFF plume of detectable EDB is approximately 6,600 ft long, perhaps 2,000 ft or more in width, and tens of feet thick. The Air Force has previously estimated 40 ft in thickness, and historical maximum concentrations on **Figure 4** suggest at least that much vertical extent of contamination below the current water table. The plume delineation is uncertain due to spatial distribution of existing wells and dynamic water table conditions.

Since the RFI Review (INTERA, 2017), continued monitoring of existing wells and installation of additional data gap wells and sentinel wells have added to the knowledge base for the site; however, the horizontal and vertical extent of the distal EDB plume remain uncertain. **Figure 4** updates the AECOM (2016) cross section and was modified by INTERA (2017) to illustrate information gathered through early 2021 and the remaining uncertainty in the area of the proposed Data Gap Well. Maximum concentrations of EDB in monitoring wells in the AOI over the period of record are listed in **Table 1** and posted on **Figure 4** to indicate EDB detections over time. The most downgradient extraction well within the EDB plume, well 106234, reportedly began interim-measure extraction in December 2015 (EA, 2021). Since then, the regional gradient in the unconfined aquifer containing the EDB plume and the distribution of the EDB within the plume have likely been affected by the pumping from nearby extraction wells 106228, 106233, and 106234. As an example, for calendar year 2020, well 106234 reportedly pumped 170 gallons per minute (gpm), with 97.1% run time, and potentiometric surface maps clearly illustrate cones of depression nearby (EA, 2021). While the effect of the extraction wells is significant, it is limited in the downgradient direction, as discussed in Section 6. Therefore, there remains potential for EDB to have migrated downgradient from well 106234 at vertical intervals that are unmonitored by existing well screens.

Over much of the EDB plume area, the highest concentrations appear to correspond to the water table, but this may not be the case at the distal end of the plume. Contours indicating the approximate horizontal extent of EDB within the top 10 ft below the water table in Q4 2020 are shown on **Figure 5**. The outermost contour level of 0.01 micrograms per liter ( $\mu\text{g/L}$ ) is on the order of typical detection limits; hence its precise location is uncertain, but it is intended to more fully delineate the area of historical EDB migration than contours showing only EDB above the Maximum Concentration Limit (MCL) of 0.05  $\mu\text{g/L}$ , e.g., those in **Figure 2**.

The deepest EDB was detected at monitoring wells 106037 and 106058 for a number of years, with concentrations that were historically up to 19 and 17 times the MCL, respectively. A single detection of EDB of 0.041  $\mu\text{g/L}$  occurred in 2017 in the deeper, downgradient well, 106227, but has not been repeated since then. Another deep well further downgradient, well 106206, has consistently had non-detections for EDB, as have the deep sentinel wells at more distant locations. As noted in the RFI Review (INTERA, 2017), the wells with the deepest screened intervals may be isolated from EDB migration by silt-dominated intervals as shown in **Figure 3** and **Figure 4**, provided that the deep, silt-dominated intervals are in fact continuous.

Historical maximum EDB concentrations at clustered wells in the downgradient end of the plume appear to have been highest in wells screened at intermediate depths (**Figure 4**). For example, EDB has never been detected at shallow well 106204 (screened 462.5 to 492.5 ft bgs) nor at deep well 106206 (screened 593.5 to 608.2 ft bgs), whereas intermediate well 106205 (screened 492.5 to 507.5 ft bgs) has had multiple detections, reaching a peak of 0.043  $\mu\text{g/L}$  (87% of the MCL) in January 2018. This suggests the horizontal extent of EDB has been greater (migrated further downgradient) at intermediate depths than at the water table, e.g., beyond the contours shown in **Figure 6**. Recent concentrations in well 106205 have oscillated above and below detection limits – the last available result was a detection of 0.014  $\mu\text{g/L}$  in January 2021. Similarly, the maximum EDB concentration at intermediate well 106226 (screened 480 to 495 ft bgs) was 1.34  $\mu\text{g/L}$  (27 times the MCL) in Q4 2015, when concentrations were an order of magnitude lower in shallow well 106225 (screened 450 to 480 ft bgs) and non-detectable in deep well 106227 (screened 555 to 570 ft bgs). The maximum EDB concentration at well 106226 was also higher than historical maximum

concentrations in well 106225 and 106227, as shown in **Table 1**. There is not an intrinsic property of dilute EDB plumes that would cause them to dive, but it is possible there may downward migration due to hydrostratigraphic effects and tortuosity caused by fine-grained lenses or layers.

Finally, the gap remains in vertical coverage between the screens of the intermediate wells and deep wells discussed above, so INTERA cannot rule out the possibility of a pathway to locations downgradient from well 106234 at depths between roughly 510 and 590 ft bgs (**Figure 3** and **Figure 4**), as discussed further in the following section.

## 5.0 Vertical EDB Data Gap Summary and Interpretations

The RFI Review cross section (**Figure 3**) depicts the EDB plume traveling north through the screened zones in wells 106037 and 106058 at a depth of approximately 507 to 526 ft bgs (green arrows). If the EDB plume continues north past these wells within this interval, it is not detected in well 106227 because that depth is not screened in well 106227. The next well in line at this depth is the extraction well, 106234. EDB has been detected in this well with concentrations gradually decreasing since the initial measurement of 0.112 µg/L in January 2016. Note that the EDB concentrations identified in well 106234 are likely diluted due to extraction across the 100-ft-long screened interval.

As described above, a significant proportion of gravel is logged in well 106234 from 502 to 556 ft bgs, making this interval a zone of high transmissivity. A gravel zone is also identified in well 106206 from 518 to 555 ft bgs, with up to 35% gravel at 555 ft bgs and lower gravel percentages below that depth. This suggests that the 555 ft depth in these wells may be the base of a braided river-channel deposit. Such a channel might be the locus of preferential EDB flow and transport.

In summary, an EDB data gap exists within the current monitoring well network due to the absence of a well or wells screened in the interval of approximately 518 to 555 ft bgs. This is most visually recognizable between wells 106206 and 106205, where the screened intervals are 593 to 608 ft bgs and 492.5 to 507.5 ft bgs, respectively, leaving a nearly 90-ft interval (data gap) that remains untested (**Figure 4**). This interval overlaps with the gravel layer in the wells described above from 518 to 555 ft bgs (37 ft) and possibly correlating with the gravel zones logged to the south in well 106234.

These lithostratigraphic relationships along with maximum historical EDB concentrations are shown on the revised cross section, **Figure 4** of this Tech Memo.

## 6.0 Extraction Well KAFB-106234 Capture Zone

Extraction well 106234 was designed to capture EDB in groundwater at the distal end of the BFF plume from the upper approximately 80 ft of the aquifer. Well 106234 is screened from approximately 440 ft to 540 ft bgs; the depth to the water table at this location was approximately measured at 453.5 ft bgs in late 2020 (EA, 2021). Assuming a pumping rate of 150 gpm, a horizontal hydraulic conductivity (Kh) of 150 ft/day, a Kz to Kh ratio of 0.01, effective porosity of 0.2, and a regional hydraulic gradient of 0.0005 in a direction 11 degrees east of north, extraction well 106234's 6-year capture zone is predicted to extend approximately 600 ft from the extraction well in a direction downgradient to ambient groundwater flow and 900 ft in a direction transverse to ambient groundwater flow. This area is illustrated on **Figure 6** and

is considered conservative since groundwater pumping rates from well 106234 are likely less than what was used in the prediction. Groundwater containing EDB that currently exists (and historically existed) beyond this area and below the bottom of the extraction well screen will continue to flow towards the Ridgecrest Well Field and go undetected if within the unmonitored vertical zone identified above. This area beyond the capture zone of well 106234 presents the greatest risk to the Ridgecrest Well Field and should be considered for the location of the Water Authority's Data Gap Well.

## 7.0 Recommendation for Data Gap Well Location and Screened Interval Depth

The analysis of regional and plume-scale hydrogeologic conditions, the extent and distribution of EDB in the distal end of the BFF plume, and pumping effects of KAFB-106234 revealed the following relative to the location and screen interval depth of the Water Authority Data Gap Well:

- A laterally extensive, high hydraulic conductivity braided stream-channel deposit unit exists in the distal end of the EDB plume within the depth interval not being monitored for EDB; the depth interval in which this unit exists is illustrated in **Figure 4**.
- Roto-Sonic drilling and sampling methods are more likely than ARCH methods to provide the geologic data necessary to identify interbedded fine-grained units that may compartmentalize the transport of EDB. The use of Roto-Sonic drilling and sampling methods are recommended for the coring and installation of the Data Gap Well so that the identification of these fine-grained units during coring can be accomplished.
- An EDB data gap exists within the current monitoring well network. This is most visually recognizable between wells 106206 and 106205, where the screened intervals are 593 to 608 ft bgs and 492.5 to 507.5 ft bgs, respectively, leaving a nearly 90-ft interval that remains unmonitored (**Figure 4**). This interval, which overlaps with the channel deposit highlighted in this same Figure, should be considered for the screen interval of the Water Authority's Data Gap Well. Field methods, such as geophysical logging and discrete interval groundwater sampling, should be used to inform the final design of the Water Authority Data Gap Well. Nested well screens should be considered if these data do not identify a specific 15- to 20-ft interval that the Water Authority Data Gap Well should be screened across.
- The area beyond the predicted capture zone of well 106234, illustrated on **Figure 6**, presents the greatest risk to the Ridgecrest Well Field and should be considered for the location of the Water Authority's Data Gap Well. Two possible areas are illustrated that are located near existing BFF wells are provided on **Figure 6** for the Water Authority's consideration. INTERA's recommended selection is the location within Indiana Street, immediately south of Kathryn Avenue. This location is closest to the well 106234 capture zone without being within it, preliminary utility locate information indicates that subsurface utilities should not be an issue, and overhead utilities and/or trees are not present in this area. This location is also

downgradient of BFF deep monitoring wells in the area of interest that have historically identified elevated concentrations of EDB in groundwater.

- Access limitations caused by underground and aboveground utilities, general property access, and business, residential, and traffic nuisances caused by the drilling operations should be factored into the final decision on the location of the Water Authority Data Gap Well.



## 8.0 REFERENCES

- AECOM. 2015. Regional Geology and Cross Sections. Kirtland Air Force Base, Albuquerque, New Mexico. Technical Memorandum from T. Champion, C. Plank, and M. Shultz, AECOM, to John Gillespie, Air Force Civil Engineering Center. 17 December 2015.
- \_\_\_\_\_. 2016. Plume and Water-Table Scale Cross Sections. Kirtland Air Force Base, Albuquerque, New Mexico. Technical Memorandum from T. Champion and C. Plank, AECOM, to John Gillespie, Air Force Civil Engineering Center. 29 February 2016.
- Agnew, D., Plank, C., Gillespie, J., Bodour, A., and McQuillan, D. 2016. Abstract: Influence of Depositional Environment on Dissolved-Phase Plume Migration at the Kirtland Air Force Base Bulk Fuels Facility Leak Site, New Mexico Geologic Society Spring Meeting.
- Albuquerque Bernalillo County Water Utility Authority (Water Authority). 2021. Kirtland Airforce Base Bulk Fuel Facility Water Authority Data Gap Well. Bid Number P2022000002. July.
- Connell, S.D. 2004. Geology of the Albuquerque Basin and tectonic development of the Rio Grande Rift in north-central New Mexico, in Mack, G.H., and Giles, K. A., eds., The Geology of New Mexico – A Geologic History: New Mexico Geological Society, Special Publication 11, p. 359-388.
- \_\_\_\_\_. 2006. Preliminary Geologic Map of the Albuquerque-Rio Rancho Metropolitan Area and Vicinity, Bernalillo County and Sandoval County, New Mexico: New Mexico Bureau of Geology and Mineral Resources, Open-file Report 496, scale, 1:50,000.
- EA Engineering, Science, and Technology, Inc., PBC (EA). 2021. Periodic Monitoring Report – October-December 2020 and Annual Report for 2020, Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111, Kirtland Air Force Base, New Mexico. Prepared for Kirtland Air Force Base. March.
- Grauch, V.J., and Connell, S.D. 2013. New Perspectives on the Geometry of the Albuquerque Basin, Rio Grande Rift, New Mexico: Insights from Geophysical Models of Rift-fill Thickness, Special Paper of the Geological Society of America # 494.
- Hawley, J.W., and Hasse, C.S. 1992. Hydrogeologic Framework of the Northern Albuquerque Basin: Socorro, New Mexico Bureau of Mines and Mineral Resources Open File Report 387.
- INTERA Incorporated (INTERA). 2016. Key Considerations for Extraction Well System and Monitoring Well Network. Technical Memorandum to R. Shean, Albuquerque Bernalillo County Water Utility Authority. 1 July 2016.
- \_\_\_\_\_. 2017. Review Findings for RCRA Facility Investigation Report Bulk Fuels Facility Release Solid Waste Management Unit ST-106/SS-111. Technical Memorandum to R. Shean, Albuquerque Bernalillo County Water Utility Authority. 29 June 2017.

Meyers, N. C., and Friesz, P. J. 2019. Hydrogeologic Framework and Delineation of Transient Areas Contributing Recharge and Zones of Contribution to Selected Wells in the Upper Santa Fe Group Aquifer, Southeastern Albuquerque, New Mexico, 1900 – 2050. U. S. Geological Survey. Scientific Investigations Report. 2019-5052.

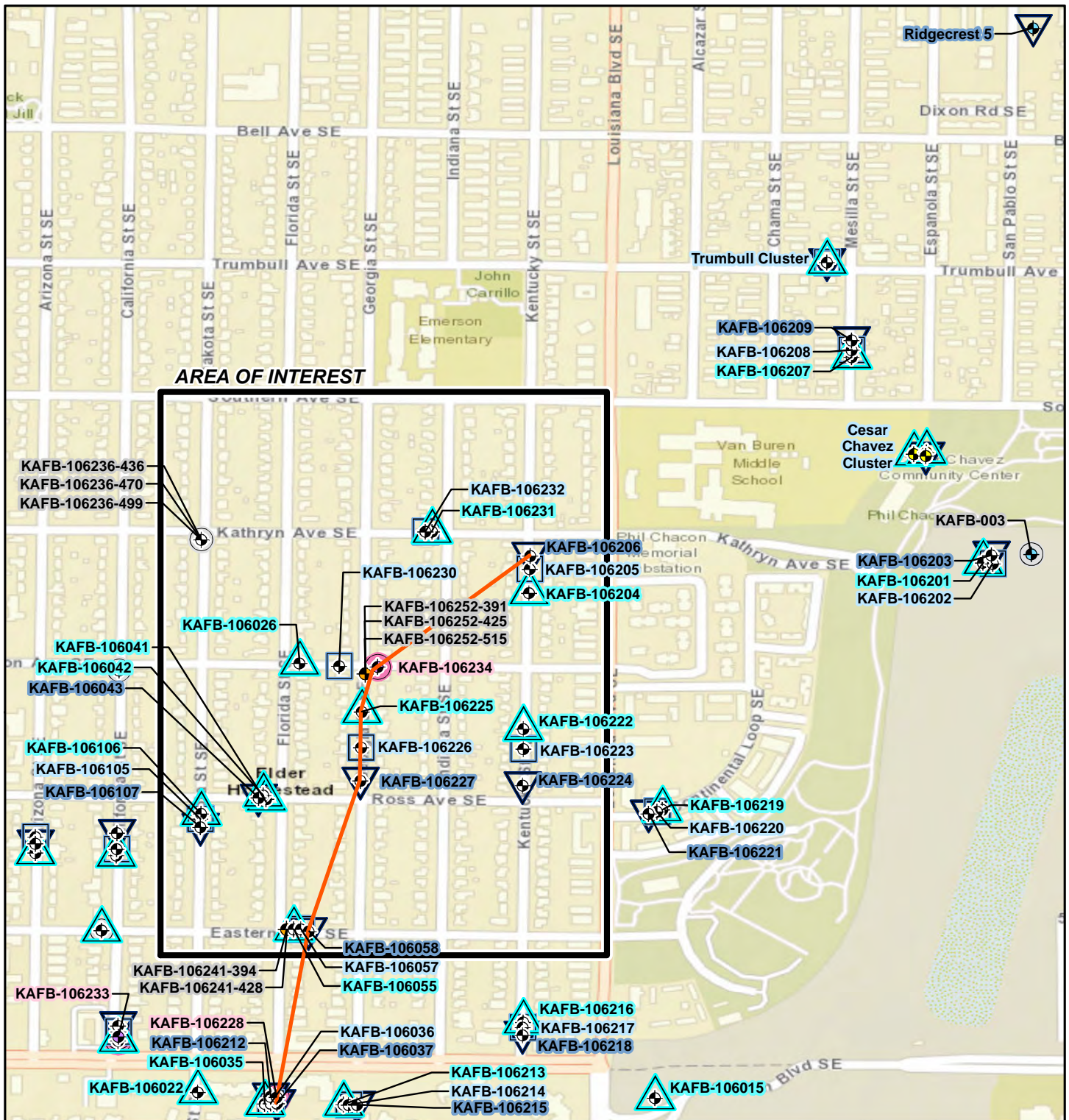
Personal Communication. 2016. Email correspondence from C. Plank, AECOM to J. Sigda, INTERA with transfer of revised T1 cross section. April 15, 2016.

Powell, R.I., and McKean, S.E. 2014. Estimated 2012 Groundwater Potentiometric Surface and Drawdown from Predevelopment to 2012 in the Santa Fe Group Aquifer System in the Albuquerque Metropolitan Area, Central New Mexico: U.S. Geological Survey Scientific Investigations Map 3301, 1 sheet.

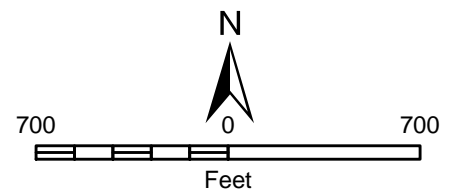
Selley, R.C. 1982. *Ancient Sedimentary Environments*, Second Edition, Cornell University Press, 285 p.



## FIGURES

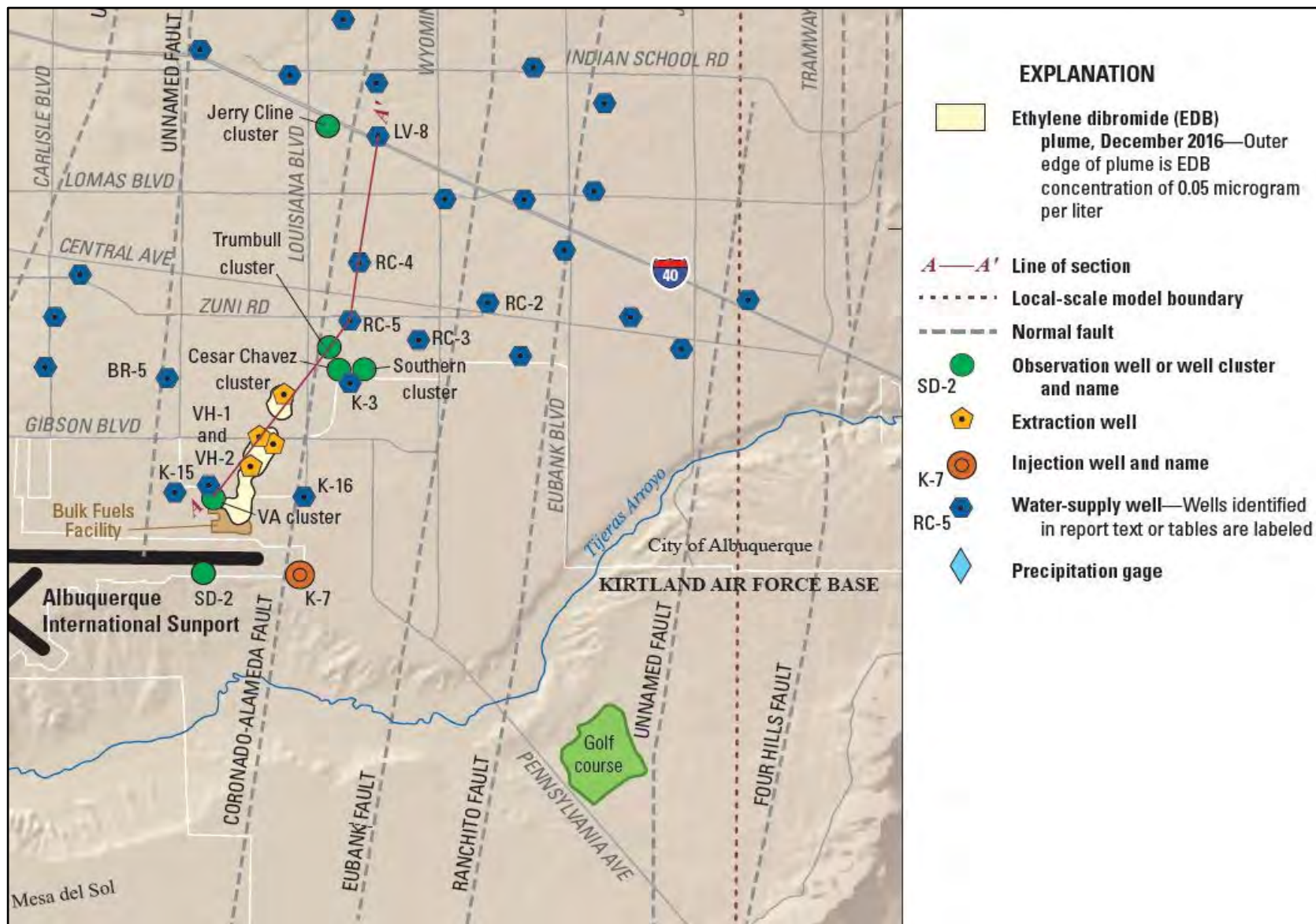


- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li> Monitoring Well (66)</li> <li> Extraction Well (3)</li> <li> Water Supply Well (2)</li> <li> Sentinel Well (5)</li> <li> KAFB Data Gap Well (5)</li> <li> AECOM (2016) Cross Section</li> </ul> | <p><b>Aquifer Zone</b></p> <ul style="list-style-type: none"> <li> Shallow (16)</li> <li> Intermediate (11)</li> <li> Deep (14)</li> <li> Multiple (3)</li> <li> Other (4)</li> </ul> |
|---|---|



**Figure 1**  
**Site Location Map**  
 Water Authority Data Gap Well  
 Bernalillo County, New Mexico, USA



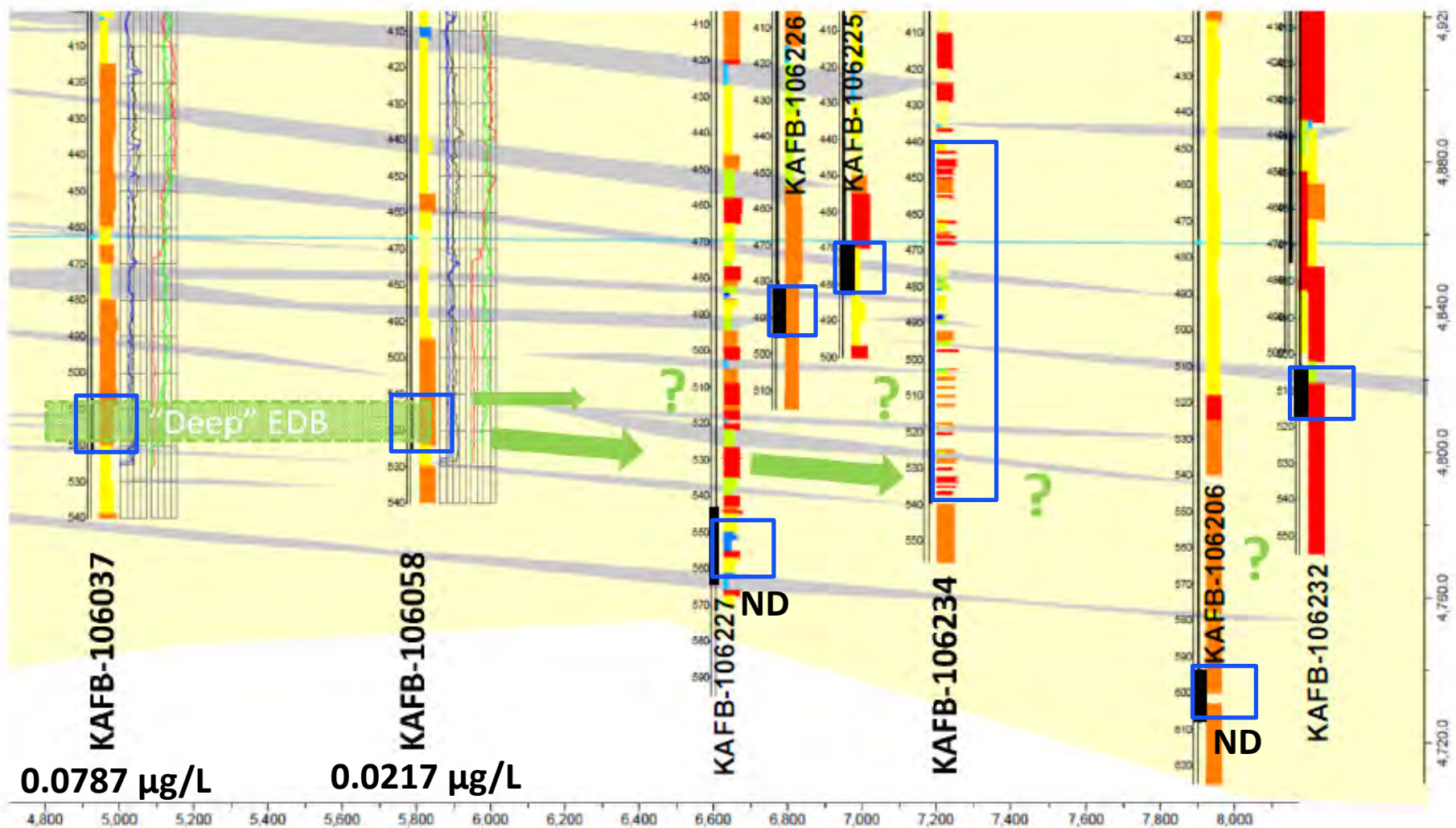


This map has been modified from Myers and Friesz (2019)




Figure 2  
KAFB BFF, Select Wells, EDB  
Plume, and Faults  
Water Authority Data Gap Well  
Bernalillo County, New Mexico, USA










Q4 2015 EDB Concentrations

 Screened intervals

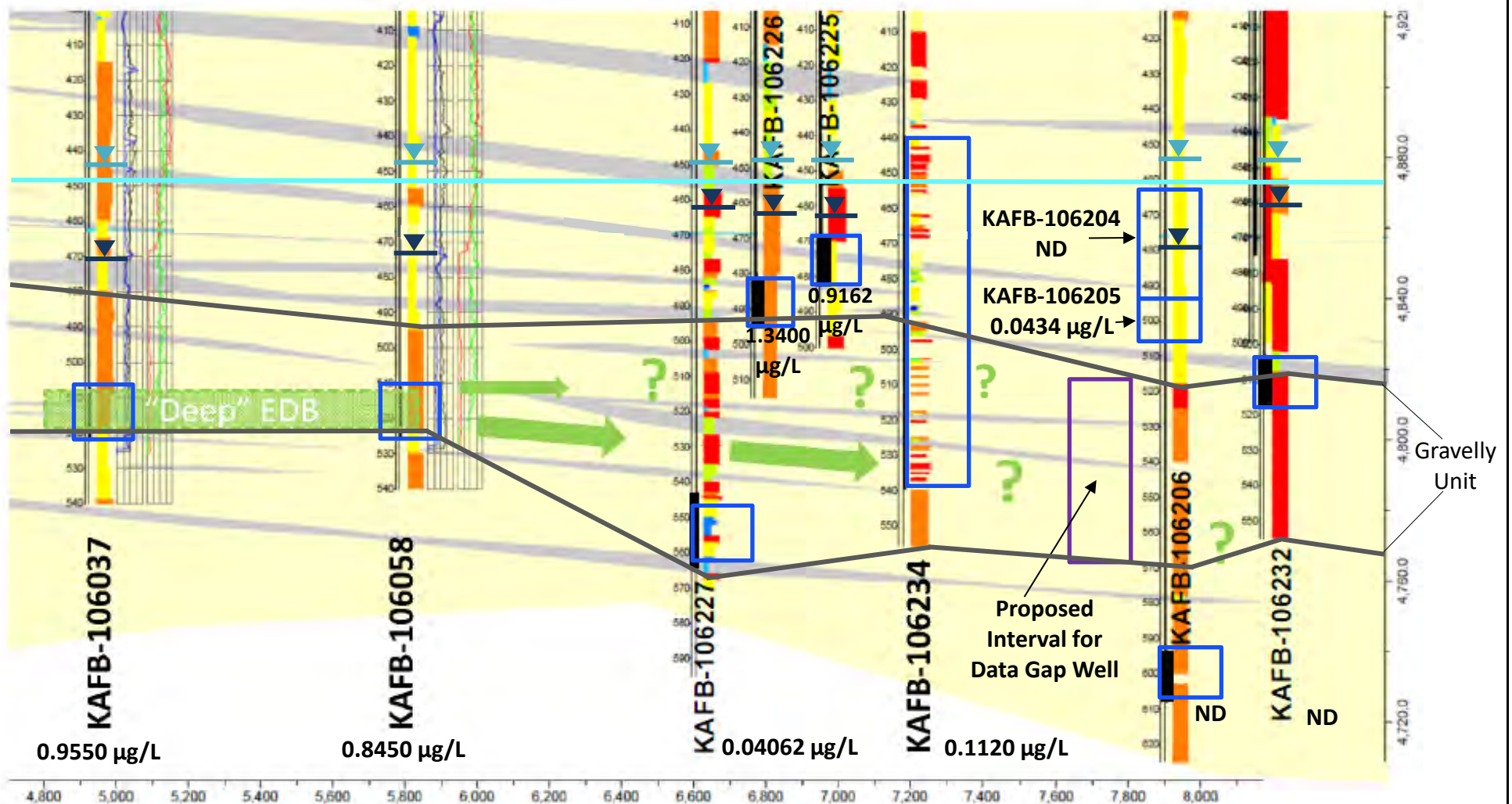


Summarized Grain Size Log Index

-  Clay; Clay with Sand; Clayey Sand
-  Silt; Silt with Sand
-  Sandy Silt; Silty Sand
-  Sand, Silt, or Clay with fine- or medium-grained Gravel
-  Sand, Silt, or Clay with coarse-grained Gravel

Cross-section courtesy of C. Plank, AECOM

Figure 3  
AECOM (2016) Cross Section  
Kirtland Airforce Base Bulk Fuel Facility  
Water Authority Data Gap Well  
Bernalillo County, New Mexico

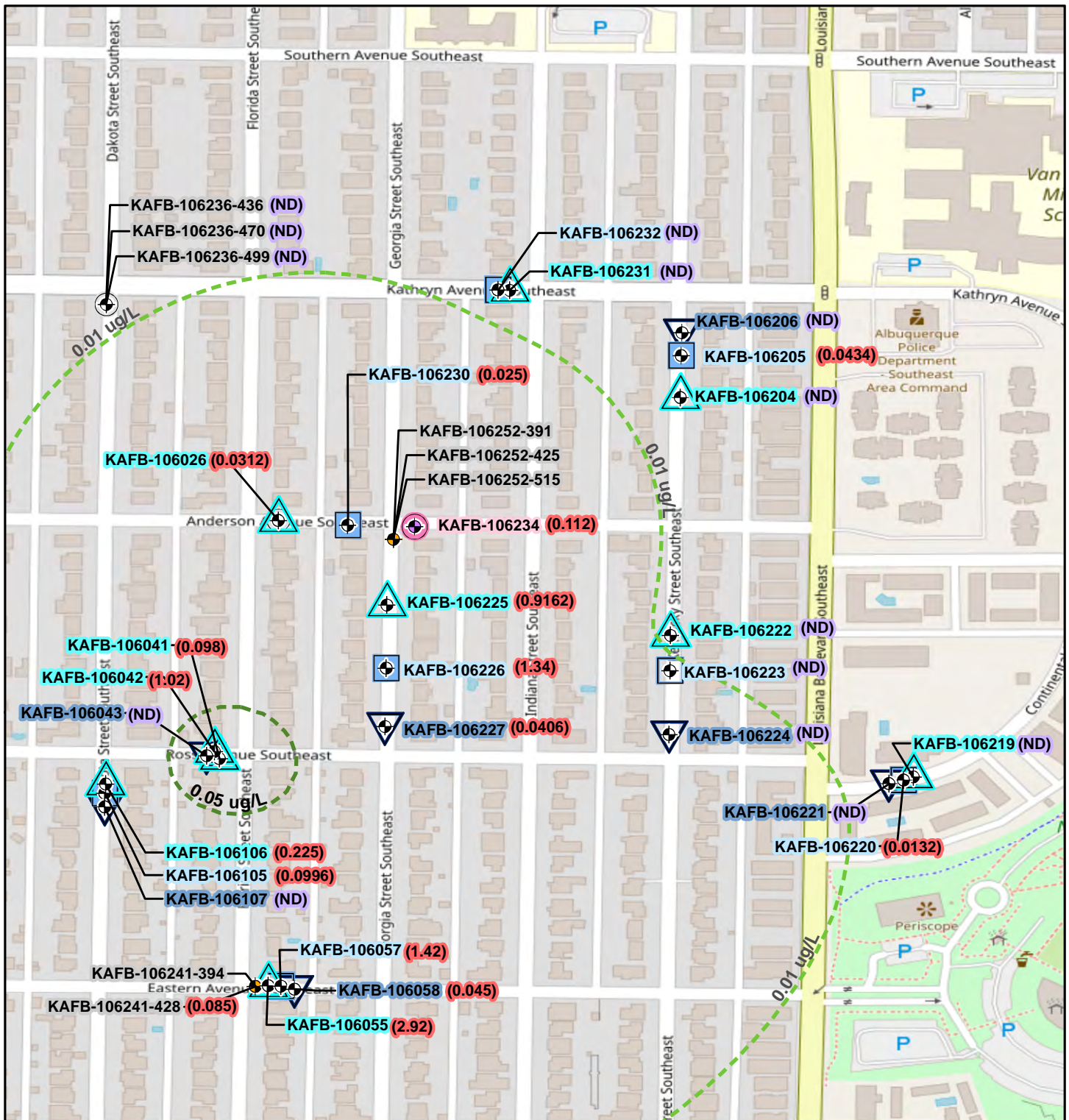


Cross-section courtesy of C. Plank, AECOM

Figure 4  
Modified AECOM (2016) Cross Section  
Kirtland Air Force Base Bulk Fuel Facility  
Water Authority Data Gap Well  
Bernalillo County, New Mexico, USA







- Monitoring Well
- Extraction Well
- KAFB Data Gap Well

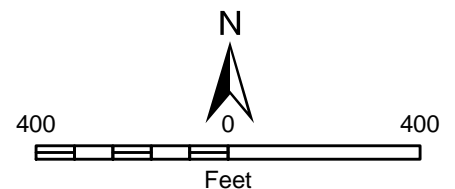
#### EDB Contours for Top 10 ft Below Water Table in 2020 Q4

- 0.01 ug/L
- 0.05 ug/L

#### Aquifer Zone

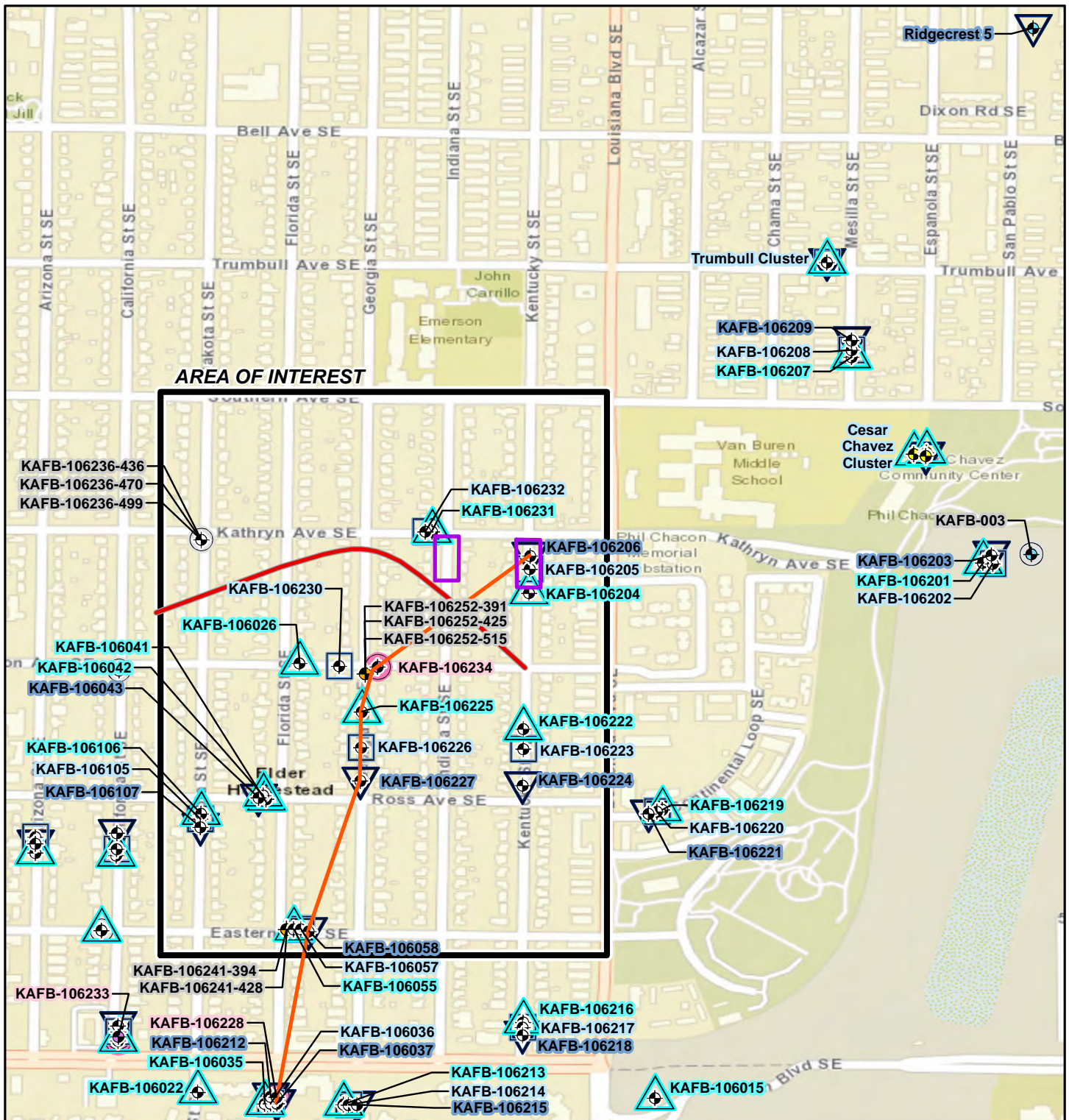
- Shallow
- Intermediate
- Deep
- Multiple
- Other

KAFB-106232 (max EDB in  $\mu\text{g/L}$ )  
**0.0132** = detection  
 ND = non-detection



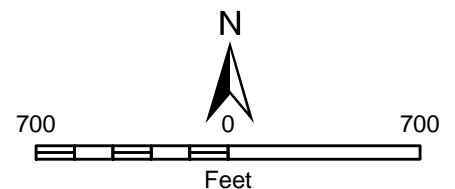
**Figure 5**  
 Maximum EDB Concentrations  
 Water Authority Data Gap Well  
 Bernalillo County, New Mexico, USA





- Monitoring Well (66)
- Extraction Well (3)
- Water Supply Well (2)
- Sentinel Well (5)
- KAFB Data Gap Well (5)
- Estimated Downgradient and Transverse Capture Distance
- Potential Data Gap Well Location
- AECOM (2016) Cross Section

- Aquifer Zone**
- Shallow (16)
  - Intermediate (11)
  - Deep (14)
  - Multiple (3)
  - Other (4)



**Figure 6**  
Proposed Data Gap Well Locations  
Water Authority Data Gap Well  
Bernalillo County, New Mexico, USA



## TABLE



**TABLE 1**  
**Select Monitoring Well Information and Data**

Kirtland Airforce Base Bulk Fuel Facility Water Authority Data Gap Well, Bernalillo County, New Mexico, USA

Well ID*	Aquifer Zone	Ground Surface Elevation (ft amsl)	Top of Screen (ft bgs)	Base of Screen (ft bgs)	Q4 2020 Groundwater Elevaion (ft amsl)	Minimum Groundwater Elevation (ft amsl)	Date of Minimum Groundwater Elevation	Maximum Groundwater Elevation (ft amsl)**	Q4 2020 EDB Concentration (µg/L)	Maximum EDB Concentration (µg/L)	Date of Maximum EDB Concentration
KAFB-106035	Shallow	5321.45	452.0	482.0	4873.70	4852.96	Aug 2011	4888.90	0.06	1.42	Jan 2014
KAFB-106036	Intermediate	5321.76	481.8	496.8	4873.50	4853.20	Aug 2011	4877.17	0.12	0.601	Apr 2014
KAFB-106037	Deep	5322.05	507.0	522.0	4873.10	4853.09	Aug 2011	4876.79	0.09	0.955	Sep 2015
KAFB-106055	Shallow	5325.08	465.8	485.8	4873.87	4852.28	Jul 2011	4878.22	<0.019	2.92	Jan 2013
KAFB-106057	Intermediate	5325.46	484.9	499.9	4873.87	4852.48	Jul 2011	4878.24	<0.019	1.42	Aug 2011
KAFB-106058	Deep	5326.04	511.8	526.8	4873.88	4852.06	Jul 2011	4878.26	<0.019	0.845	Aug 2011
KAFB-106204	Shallow	5332.85	462.5	492.5	4872.92	4854.04	Oct 2012	4878.76	<0.019	ND	-
KAFB-106205	Intermediate	5333.29	492.5	507.5	4872.90	4853.53	Oct 2012	4878.82	<0.019	0.04338	Jan 2018
KAFB-106206	Deep	5333.46	593.5	608.2	4872.91	4853.57	Oct 2012	4878.85	<0.019	ND	-
KAFB-106207	Shallow	5344.25	473.0	503.0	4871.34	4851.82	Oct 2012	4879.35	<0.019	ND	-
KAFB-106208	Intermediate	5343.87	503.0	518.0	4871.29	4851.92	Oct 2012	4879.29	<0.019	ND	-
KAFB-106209	Deep	5343.41	603.0	617.0	4871.51	4851.56	Oct 2012	4879.48	<0.019	ND	-
KAFB-106213	Shallow	5325.28	448.0	478.0	4873.75	4864.00	Apr 2015	4877.55	<0.019	ND	-
KAFB-106214	Intermediate	5325.43	478.2	492.7	4873.87	4863.69	Apr 2015	4877.69	<0.019	ND	-
KAFB-106215 <sup>a</sup>	Deep	5325.78	547.0	562.0	4873.94	4863.98	Jun 2015	4877.78	<0.019	ND	-
KAFB-106219	Shallow	5340.41	462.7	492.7	4872.82	4863.27	Apr 2015	4878.34	<0.019	ND	-
KAFB-106220	Intermediate	5340.34	493.0	508.0	4872.84	4863.13	Apr 2015	4878.34	<0.019	0.01324	Jan 2016
KAFB-106221 <sup>a</sup>	Deep	5340.09	561.0	576.0	4872.85	4863.85	Jun 2015	4878.30	<0.019	ND	-
KAFB-106222	Shallow	5333.24	457.8	487.8	4872.86	4862.49	Feb 2015	4878.37	<0.019	ND	-
KAFB-106223	Intermediate	5333.95	487.8	502.8	4872.95	4863.89	Apr 2015	4878.50	<0.019	ND	-
KAFB-106224 <sup>a</sup>	Deep	5335.07	555.0	570.0	4873.02	4863.97	Jun 2015	4878.47	<0.019	ND	-
KAFB-106225	Shallow	5326.35	450.0	480.0	4873.11	4862.16	Feb 2015	4878.12	0.021	0.91621	Apr 2017
KAFB-106226	Intermediate	5327.30	480.0	495.0	4873.48	4862.84	Mar 2015	4878.46	<0.019	1.34	Oct 2015
KAFB-106227 <sup>a</sup>	Deep	5328.08	548.0	563.0	4873.56	4864.30	Jun 2015	4878.47	<0.019	0.04062	Apr 2017
KAFB-106230 <sup>a</sup>	Intermediate	5324.51	501.0	516.0	4873.51	4864.58	Oct 2015	4878.43	<0.019	0.025	Nov 2015
KAFB-106231	Shallow	5327.56	440.0	475.0	4873.37	4864.40	Oct 2015	4878.90	<0.019	ND	-
KAFB-106232	Intermediate	5327.19	503.0	518.0	4873.47	4864.98	Oct 2015	4878.98	<0.019	ND	-
KAFB-106234 <sup>b</sup>	Extraction	5325.64	439.7	539.7	-	-	-	-	-	0.112	Jan 2016

**Notes:**

ft = feet, amsl = above mean sea level, bgs = below ground surface, ND = no detect.

\* All borings were drilled via Air Rotary Casing Hammer (ARCH) unless noted otherwise.

\*\* All maximum groundwater elevations occurred in Jan 2021

<sup>a</sup> Boring was drilled by ARCH from 0-450 ft bgs and by sonic from 450 ft bgs to total depth.

<sup>b</sup> Boring was drilled mud rotary from 0-435 ft bgs and cored from 435-556 ft bgs.



## APPENDIX A

### Bore Logs for Select Wells

KAFB 106035



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Sandy SILT (ML); strong brown (7.5YR 4/6); dry; very soft; non to low plasticity; 60% silt; 35% very fine to very coarse sand; 5% fine gravel to 1cm.			Hand augered.
5					SILT with Sand (ML); strong brown (7.5YR 4/6); dry; very soft; non to low plasticity; 75% silt; 25% very fine to very coarse sand.	ML		***Note: no headspace requirement at this location.***
10					Sandy SILT (ML); strong brown (7.5YR 4/6); dry; very soft; non to low plasticity; 60% silt; trace clay; 35% very fine to very coarse sand; 5% fine gravel to 1cm.			Began drilling @ 1126 on 8/5/11.
15					Silty SAND (SM); dark yellowish brown (10YR 4/4); moist; very loose; 75% very fine to very coarse sand; 5% fine gravel to 2cm; subangular to subrounded; 20% silt.	SM		
20					Well graded SAND with Silt (SW-SM); brown (10YR 5/3); dry; very loose; 80% very fine to very coarse sand; 10% fine gravel to 3cm; 10% silt.	SW-SM		
25					Poorly graded SAND (SP); strong brown (7.5YR 5/6); moist; very loose; 100% very fine sand; trace medium to very coarse sand; trace fine gravel to 1cm; rounded.	SP		
30								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Well graded SAND with Silt (SW-SM); brown (10YR 5/3); dry; very loose; 80% very fine to very coarse sand; 10% fine gravel to 4cm; 10% silt.	SW-SM	Top of High Solids Bentonite Grout	
40					Poorly graded SAND (SP); strong brown (7.5YR 5/6); moist; very loose; 95% very fine sand; 5% medium to coarse sand; trace fine gravel to 5cm; rounded.	SP		New 20' connection @ 1154. Resumed drilling @ 1253.
45					Sandy lean CLAY (CL); brown (7.5YR 4/4); moist; soft; low to medium plasticity; 70% clay with minor silt; 25% very fine to very coarse sand; 5% fine gravel to 2.2cm.	CL		
50					Sandy SILT (ML); strong brown (7.5YR 4/6); moist; soft; low plasticity; 70% silt with minor clay; 25% fine to very coarse sand; 5% fine gravel to 2.3cm.	ML		
55					Well graded SAND with Silt (SW-SM); yellowish brown (10YR 5/4); dry; very loose; 90% very fine to very coarse sand; trace fine gravel to 9mm; subrounded; 10% silt.	SW-SM		
60					SILT with Sand (ML); strong brown (7.5YR 5/8); dry; soft; low plasticity; 85% silt; trace clay; 15% very fine to medium sand to 1mm.	ML		New 20' connection @ 1302. Resumed drilling @ 1307.





# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 8/5/2011  
Date TD Reached: 8/6/2011  
Date Completed: 8/9/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.5  
Y Coordinate: 1476441.87  
X Coordinate: 1543635.94

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 3 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT with Sand (ML); strong brown (7.5YR 5/8); dry; soft; low plasticity; 85% silt; trace clay; 15% very fine to medium sand; trace fine gravel to 1.3cm.			
65					Same as above (60 ft); no gravel.			
70					Same as above (60 ft); no gravel.			
75					Same as above (60 ft); no gravel; some caliche.	ML	High Solids Bentonite Grout	New 20' connection @ 1321. Resumed drilling @ 1327.
80					Same as above (60 ft); no gravel.			
85					SILT with Sand (ML); strong brown (7.5YR 4/6); moist; stiff; low to medium plasticity; 75% silt; 10% lean clay; 15% very fine sand.			Began adding water to stop clogging.
90								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Lean CLAY (CL); light yellowish brown (10YR 6/4); wet; very stiff; medium to high plasticity; 100% clay.			
100					Lean CLAY with Sand (CL); light yellowish brown (10YR 6/4); wet; very stiff; medium to high plasticity; 75% clay; 20% fine to very coarse sand; 5% fine gravel to 1cm.	CL		Added 50 gallons of water. New 20' connection @ 1339. Resumed drilling @ 1345.
105					Gravelly SILT (ML); light yellowish brown (10YR 6/4); wet; very stiff; nonplastic; 70% silt with clay; 30% fine gravel to 3.7cm.	ML		
110					Lean CLAY with Sand (CL); light yellowish brown (10YR 6/4); wet; very stiff; 85% clay; 15% fine to medium sand to 2mm.	CL	High Solids Bentonite Grout	
115					Well graded SAND (SW); pale brown (10YR 6/3); wet; dense; 95% very fine to very coarse sand; 5% fine gravel to 1cm; subrounded.			
120					Same as above (110 ft); trace lean clay.	SW		Added 90 gallons of water. New 20' connection @ 1356. Resumed drilling @ 1402.



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					SILT with Sand (ML); strong brown (7.5YR 5/8); moist; soft; low plasticity; 85% silt; 15% very fine sand to 0.1mm.			Total depth with 11-3/4" casing @ 1406. Resumed drilling with 9-5/8" casing @ 1635.
125					Same as above (120 ft).			
130					Same as above (120 ft); 80% silt; 5% clay.	ML		
135					Same as above (120 ft); some caliche.		High Solids Bentonite Grout	
140					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; loose; 100% very fine to medium sand to 2mm; subrounded.	SP		Approximate top of Santa Fe Group. New 20' connection @ 1643. Resumed drilling @ 1648.
145					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; loose; 95% very fine to very coarse sand; 5% fine gravel to 2.3cm; rounded.	SW		
150								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 8/5/2011  
Date TD Reached: 8/6/2011  
Date Completed: 8/9/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.5  
Y Coordinate: 1476441.87  
X Coordinate: 1543635.94

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
155					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; loose; 95% very fine to very coarse sand; 5% fine gravel to 2.3cm; rounded.	SW		
160					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 100% fine to medium sand; trace fine gravel to 2.1cm; rounded.			
165					Same as above (155 ft).	SP		New 20' connection @ 1654. End of 8/5/11. Resumed drilling @ 0813 on 8/6/11.
170					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; loose; 100% very fine to very coarse sand; trace fine gravel to 1.5cm; rounded.			
175					Same as above (165 ft); 5% fine gravel.			
180					Same as above (165 ft); trace clay nodules.	SW	High Solids Bentonite Grout	New 20' connection @ 0822. Resumed drilling @ 0827.



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 100% medium sand to 1mm; subrounded.			
185					Same as above (180 ft); trace clay nodules; trace coarse sand to 4mm.			
190					Same as above (180 ft); grading finer.	SP		
195					Same as above (180 ft); yellowish brown (10YR 5/4); no odor.		High Solids Bentonite Grout	Possibly stained. New 20' connection @ 0835. Resumed drilling @ 0841.
200					Same as above (180 ft).			
205					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 95% very fine to very coarse sand; 5% fine gravel to 1.4cm; rounded.	SW		
210								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 95% very fine to very coarse sand; 5% fine gravel to 1.4cm; rounded.			
215					Same as above (210 ft); grading finer.	SW		New 20' connection @ 0849. Resumed drilling @ 0853.
220					Lean CLAY (CL); brown (10YR 5/3); moist; very stiff; medium plasticity; 100% clay.			
225					Same as above (220 ft); 5% fine gravel to 2cm.		High Solids Bentonite Grout	
230					Sandy lean CLAY (CL); brown (10YR 5/3); moist; very stiff; low plasticity; 60% clay; 40% very fine to very coarse sand; trace fine gravel to 1cm.	CL		
235					Sandy lean CLAY with Gravel (CL); brown (10YR 5/3); moist; very stiff; low plasticity; 60% clay; 20% very fine to very coarse sand; 20% fine gravel to 1cm.			New 20' connection @ 0913. Resumed drilling @ 0917.
240								





# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240								
					Sandy lean CLAY (CL); brown (10YR 5/3); moist; very stiff; low plasticity; 60% clay; 40% very fine to very coarse sand; trace fine gravel to 1cm.	CL		
245					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand; trace coarse sand to 3mm; rounded.	SP		
					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 100% very fine to very coarse sand; trace fine gravel to 1cm; subrounded.			
250					Same as above (245 ft); 5% fine gravel to 2cm; grading finer.	SW		
255					Same as above (245 ft); 5% fine gravel.			
260					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand to 1mm; subrounded.			
265					Same as above (260 ft); grading coarser.	SP		
270								

High Solids  
Bentonite  
Grout

New 20' connection @  
0929. Resumed drilling  
@ 0934.



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270								
					SILT with Sand (ML); brown (10YR 5/3); moist; stiff; low plasticity; 75% silt; 5% clay; 20% fine to medium sand to 2mm; subrounded.	ML		
275					Sandy lean CLAY (CL); brown (10YR 5/3); moist; very stiff; low to medium plasticity; 70% clay; 30% very fine to very coarse sand to 4.8mm; rounded.	CL		New 20' connection @ 0945. Resumed drilling @ 0950.
280					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% fine to very coarse sand; 5% fine gravel to 2cm; subrounded.			
285					Same as above (280 ft).			
290					Same as above (280 ft); dry.	SW		
295					Same as above (280 ft).			New 20' connection @ 0959. Replaced bolt at flange. Resumed drilling @ 1007.
300								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% fine to very coarse sand; 5% fine gravel to 2cm; subrounded.			
305					Well graded SAND with Gravel (SW); brown (10YR 5/3); moist; medium dense; 85% fine to very coarse sand; 15% fine gravel to 2.1cm; subrounded.			
310					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% fine to very coarse sand; 5% fine gravel to 2cm; subrounded.	SW		
315					Same as above (310 ft).		- High Solids Bentonite Grout	New 20' connection @ 1021. Resumed drilling @ 1026.
320					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% fine to medium sand; trace coarse sand to 3mm; rounded.			
325					Same as above (320 ft).	SP		
330								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 90% fine to very coarse sand; 10% fine gravel to 1.7cm; subrounded.			
335					Same as above (330 ft); dry.	SW		New 20' connection @ 1037. Resumed drilling @ 1042.
340					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% very fine to medium sand to 2mm; subrounded.			
345					Same as above (340 ft); trace coarse sand to 3mm.	SP	High Solids Bentonite Grout	
350					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; medium dense; 95% very fine to coarse sand; 5% fine gravel to 1.2cm; rounded.	SW		
355					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% very fine to medium sand to 1mm; rounded.	SP		New 20' connection @ 1049. Stopped to fix hammer latch. Resumed drilling @ 1057.
360								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% very fine to medium sand to 1mm; rounded.	SP		
365					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 100% very fine to coarse sand; trace fine gravel to 6mm; subrounded.			
370					Same as above (365 ft); grading coarser.	SW		
375					Well graded SAND with Gravel (SW); brown (10YR 5/3); moist; medium dense; 60% very fine to coarse sand; 40% fine gravel to 2.3cm; subrounded.			
380					Poorly graded SAND (SP); pale brown (10YR 6/3); dry; medium dense; 100% very fine to fine sand to 0.5mm; rounded.			
385					Same as above (378 ft); 100% fine to medium sand to 2mm.	SP		
390								

- High Solids  
Bentonite  
Grout

New 20' connection @  
1104. Resumed drilling  
@ 1109.





# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 9mm; subrounded.			
395					Same as above (390 ft).	SW		New 20' connection @ 1120. Resumed drilling @ 1323.
400					Poorly graded SAND (SP); pale brown (10YR 6/3); dry; medium dense; 100% fine sand to 0.5mm; rounded.	SP		
405					Clayey SAND (SC); brown (10YR 5/3); moist; dense; 80% very fine to medium sand to 2mm; subrounded; 20% clay.			
410					Same as above (402 ft).	SC		
415					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% very fine to fine sand to 0.5mm; rounded.			
420					Same as above (410 ft).	SP		New 20' connection @ 1333. Resumed drilling @ 1338.
							- High Solids Bentonite Grout	
							- Top of Bentonite Seal	



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% fine to medium sand to 1mm; rounded.	SP		
425					Well graded SAND (SW); brown (10YR 5/3); moist; dense; 100% very fine to very coarse sand; trace fine gravel to 6mm; rounded.	SW		
430					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% fine to medium sand to 1mm; rounded.	SP		
435					Well graded SAND (SW); brown (10YR 5/3); moist; dense; 95% very fine to very coarse sand; 5% fine gravel to 1.5cm; subrounded.	SW		New 20' connection @ 1346. Resumed drilling @ 1353.
440					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% very fine to medium sand to 2mm; rounded.			
445					Same as above (440 ft).	SP		
450								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% very fine to medium sand to 2mm; rounded.	SP	Top of 10/20 Sand Top of 5" Schedule 80 PVC 0.010" Slot Screen	
455					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 100% very fine to coarse sand to 4mm; subrounded; trace silt and clay.	SW		New 20' connection @ 1400. Resumed drilling @ 1405.
460					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; dense; 100% fine sand to 0.5mm; rounded.			
465					▽ Same as above (460 ft); damp; 100% fine to medium sand to 1mm. ▼			
470					Same as above (460 ft); damp; 100% fine to medium sand to 1mm.	SP		Began adding water.
475					Same as above (460 ft); damp; 100% fine to medium sand to 1mm.			Added 90 gallons of water. New 20' connection @ 1420. Resumed drilling @ 1427.
480								



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 8/5/2011  
**Date TD Reached:** 8/6/2011  
**Date Completed:** 8/9/2011

**Ground Elevation AMSL (ft):** 5321.5  
**Y Coordinate:** 1476441.87  
**X Coordinate:** 1543635.94

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well graded SAND with Gravel (SW); brown (10YR 5/3); wet; dense; 80% fine to very coarse sand; 20% fine gravel to 7mm; subrounded.			
485					Same as above (480 ft).			
490					Same as above (480 ft); 60% sand; 40% fine gravel.	SW		
495					Same as above (480 ft); 85% sand; 15% fine gravel.			Added 100 gallons of water.
500					Well graded SAND (SW); brown (10YR 5/3); wet; dense; 90% fine to very coarse sand; 10% fine gravel to 7mm; subrounded.			Total depth = 500 ft. Reached @ 1440 on 8/6/11.
505								Water added during drilling (gallons) = 330
								Water added after drilling (gallons) = 1300
510								Water added during



# Borehole ID: KAFB-106035

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 8/5/2011  
Date TD Reached: 8/6/2011  
Date Completed: 8/9/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 465.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.5  
Y Coordinate: 1476441.87  
X Coordinate: 1543635.94

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 18 of 18

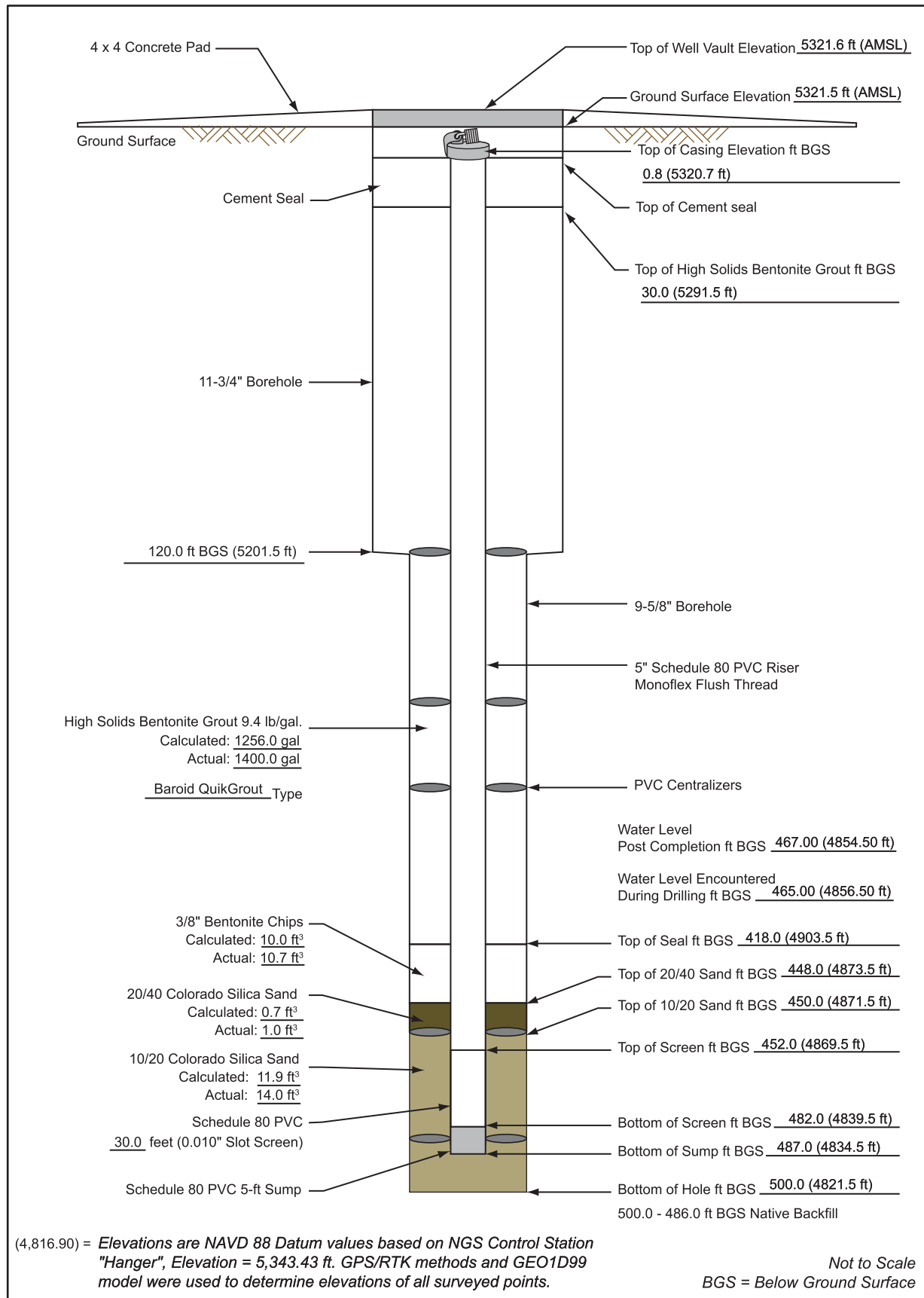
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								construction (gallons) = 40
515								
520								
525								
530								
535								
540								



# Monitoring Well Completion Diagram KAFB-106035

Installation Start Date/Time: 8/8/2011 @ 09:20

Installation End Date/Time: 8/9/2011 @ 16:24



## Well Development Record

**Project Name:** KAFB BFF

**Location:** GW-3

**Personnel:** P. Ostrye

**Date:** 8/16/11

**Samplers:** P. Ostrye

**Well/Piez. No.:** 106035

**Date Installed:** 8/9/11

**Csg. Diameter (I.D.):** 5"

**Total Depth (ft. BGL):** 487

**Method of Development:**

☒ Surging

☐ Bailing

☐ Pumping

☐ Original Development

☐ Redevelopment

☐ Other

**Development Date:** 8/16/11 - 8/17/11

**Depth to Water Before Developing Well (ft. BGL):** 467.57

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:** 19.43 feet = 1545.38 gal. \* 1 = 1545.38

$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 1545.38 \text{ gallons}$

**Depth Purging From:** 475 feet

**Time Purging Begins:** 1135, 8/17/11

**Weather:** Sunny, Warm

**Screened Interval (ft BGL):** 452 - 482

**Equipment Nos.:**      **pH Meter:** YSI 36952

**EC Meter:** YSI 36952

**Turbidity Meter:** LVE 002384

**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐

**Describe:** N/A

**Comment:** 1490 gallons of water introduced during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/16/2011	1035	--	--	--	--	--	--	Begin Bailing
8/16/2011	1115	--	10	--	--	--	--	Continue Bailing
8/16/2011	1300	--	50	--	--	--	--	Bailed
8/16/2011	1312	--	100	--	--	--	--	Continue Bailing
8/16/2011	1326	--	140	--	--	--	--	Continue Bailing
8/16/2011	1410	--	275	--	--	--	--	Bailed
8/17/2011	1135	--	--	--	--	--	--	Begin Pumping at 5 GPM
8/17/2011	1205	469.30	425	21.23	7.77	0.405	2.08	Continue Pumping
8/17/2011	1235	469.27	575	21.30	7.81	0.407	0.83	Continue Pumping
8/17/2011	1305	469.25	725	21.46	7.83	0.410	0.84	Continue Pumping

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1°C

\* Turbidity report in NTU nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

$\phi_s$ = porosity of the sand pack

$r_c$ = radius of the well casing and screen in feet

$L_c$ = length of water column inside the casing and screen in feet

$r_w$ = radius of the well bore in feet

$L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

Project: KAFB BFFWell No: 106035Project Number: 140705Samplers: P. OstryeDate: 8/17/11

Checked By: \_\_\_\_\_

Time Start: 1035, 8/16/11Time Finish: 1615, 8/17/11

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/17/2011	1335	469.25	875	21.54	7.83	0.414	0.65	Continue Pumping
8/17/2011	1405	--	1025	21.26	7.81	0.414	--	Continue Pumping
8/17/2011	1435	--	1175	20.89	7.80	0.416	--	Continue Pumping
8/17/2011	1505	--	1325	20.66	7.77	0.414	--	Continue Pumping
8/17/2011	1535	469.27	1475	20.78	7.76	0.419	0.81	Continue Pumping
8/17/2011	1545	469.27	1525	20.81	7.75	0.419	0.75	Continue Pumping
8/17/2011	1600	469.27	1575	20.82	7.72	0.419	0.53	Continue Pumping
8/17/2011	1615	--	1625	20.80	7.71	0.419	0.53	Stop Pumping; Clear; Total Removed

Was well sampled after development? YES \_\_\_\_\_ NO ☒ X \_\_\_\_\_Sample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106036





# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Sandy SILT (ML); brown (7.5YR 4/4); dry; very soft; low plasticity; 60% silt; 35% very fine to very coarse sand; 5% fine gravel to 8mm.			Hand augered.
5					Same as above (0 ft); 70% silt; 30% sand; no gravel.			***Note: no headspace requirement at this location. ***
10					Same as above (0 ft); 70% silt; 30% sand; no gravel.	ML		Began drilling @ 1038 on 7/20/11.
15					Same as above (0 ft); gravel to 1.8cm.		Cement Seal	
20					Silty SAND (SM); brown (7.5YR 5/4); dry; very loose; 70% very fine to very coarse sand; 5% fine gravel to 2.4cm; subrounded; 25% silt.	SM		
25					Sandy SILT (ML); strong brown (7.5YR 5/8); dry; very soft; low plasticity; 60% silt; 40% very fine to very coarse sand; trace fine gravel to 1.7cm.	ML		
30					Well graded SAND with Silt (SW-SM); brown (7.5YR 5/4); dry; very loose; 85% very fine to very coarse sand; 5% fine	SW-SM		New 20' connection @ 1051. Stopped to tie hoses back in mast and retrieve air compressor. Resumed drilling @ 1121.



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					gravel to 1.8cm; subangular to subrounded; 10% silt.	SW-SM		
40					Sandy SILT (ML); strong brown (7.5YR 5/6); moist; very soft; low plasticity; 70% silt; 25% very fine to very coarse sand; 5% fine gravel to 1.9cm.			New 20' connection @ 1136. Resumed drilling @ 1142.
45					Same as above (35 ft); 70% silt; 30% sand.			
50					Same as above (35 ft); 60% silt; 40% sand.			
55					Same as above (35 ft); 60% silt; 30% sand; 10% fine gravel.	ML		
60					SILT with Sand (ML); strong brown (7.5YR 4/6); moist; very soft; low plasticity; 80% silt; 5% clay; 15% very fine to very coarse sand; trace fine gravel to 1.2cm.			New 20' connection @ 1154. Resumed drilling @ 1253.



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/20/2011  
Date TD Reached: 7/23/2011  
Date Completed: 8/5/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.9  
Y Coordinate: 1476442.74  
X Coordinate: 1543660.33

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 3 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					No cuttings returned.			Added water to prevent clogging.
65					No cuttings returned.			
70					Sandy lean CLAY (CL); light yellowish brown (10YR 6/4); wet; stiff; low to medium plasticity; 70% clay; 30% very fine to medium sand to 2mm.			
75					Same as above (70 ft).			
80					Same as above (70 ft).	CL	High Solids Bentonite Grout	Added 150 gallons of water. New 20' connection @ 1309. Resumed drilling @ 1316.
85					Same as above (70 ft); trace fine gravel to 2.7cm.			
90								



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Lean CLAY with Sand (CL); light yellowish brown (10YR 6/4); wet; stiff; low to medium plasticity; 85% clay; 15% very fine to medium sand to 2mm.			
100					Sandy lean CLAY (CL); light yellowish brown (10YR 6/4); wet; stiff; low to medium plasticity; 70% clay; 30% very fine to medium sand to 2mm.	CL		Added 70 gallons of water. New 20' connection @ 1325. Resumed drilling @ 1414.
105					Sandy SILT (ML); light yellowish brown (10YR 6/4); wet; stiff; low plasticity; 70% silt; 25% very fine to very coarse sand; 5% fine gravel to 2cm.	ML		
110					Lean CLAY with Sand (CL); light yellowish brown (10YR 6/4); wet; stiff; medium plasticity; 85% clay; 15% fine to medium sand to 2mm.		High Solids Bentonite Grout	
115					Same as above (105 ft).	CL		
120					Same as above (105 ft).			Added 70 gallons of water. New 20' connection @ 1424. Resumed drilling @ 1430.



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.00  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120								
125					Sandy SILT with Gravel (ML); light yellowish brown (10YR 6/4); wet; stiff; non to low plasticity; 65% silt; 20% fine to very coarse sand; 15% fine gravel to 2cm.	ML		
					Poorly graded GRAVEL (GP); lense.	GP		
130					SILT with Sand (ML); light yellowish brown (10YR 6/4); wet; stiff; low plasticity; 85% silt; 15% very fine to medium sand; trace fine gravel to 2cm.			
					Same as above (126 ft).	ML		
135								
					Sandy lean CLAY (CL); light yellowish brown (10YR 6/4); wet; stiff; medium to high plasticity; 70% clay; 30% fine to very coarse sand to 4mm.	CL	High Solids Bentonite Grout	Added 80 gallons of water. New 5' connection @ 1439. Resumed drilling @ 1446.
140								
					Well graded SAND with Silt and Gravel (SW-SM); light yellowish brown (10YR 6/4); wet; medium dense; 75% very fine to very coarse sand; 15% fine gravel to 4cm; subangular; 10% silt with minor clay.	SW-SM		Added 30 gallons of water. Total depth with 11-3/4" casing @ 1451. End of 7/20/11. Resumed drilling with 9-5/8" casing @ 0926 on 7/21/11.
145								
					Well graded SAND (SW); brown (10YR 5/3); damp; loose; 95% fine to very coarse sand; 5% fine gravel to 1.8cm; rounded.	SW		Approximate top of Santa Fe Group.
150								





# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/20/2011  
Date TD Reached: 7/23/2011  
Date Completed: 8/5/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.9  
Y Coordinate: 1476442.74  
X Coordinate: 1543660.33

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Well graded SAND (SW); brown (10YR 5/3); damp; loose; 95% fine to very coarse sand; 5% fine gravel to 1.8cm; rounded.			
155					Same as above (150 ft); 10% fine gravel.	SW		New 20' connection @ 0936. Resumed drilling @ 0945.
160					Poorly graded SAND (SP); yellowish brown (10YR 3/4); moist; loose; 95% fine to medium sand; 5% fine gravel to 3.5cm; subrounded.	SP		
165					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% very fine to very coarse sand; trace fine gravel to 1.6cm; subrounded.		High Solids Bentonite Grout	
170					Same as above (165 ft); trace clay nodules.	SW		
175					Same as above (165 ft); grading finer.			New 20' connection @ 0950. Resumed drilling @ 0955.
180								



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% very fine to very coarse sand; trace fine gravel to 1.6cm; subrounded.			
185					Same as above (180 ft).			
190					Same as above (180 ft); grading finer.	SW		
195					Same as above (180 ft); 5% fine gravel.		High Solids Bentonite Grout	New 20' connection @ 1000. Resumed drilling @ 1009.
200					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; loose; 100% fine sand; trace fine gravel to 2.2cm; rounded.	SP		
205					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 95% very fine to very coarse sand; 5% fine gravel to 3.5cm; rounded.	SW		
210								



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/20/2011  
Date TD Reached: 7/23/2011  
Date Completed: 8/5/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.9  
Y Coordinate: 1476442.74  
X Coordinate: 1543660.33

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 95% very fine to very coarse sand; 5% fine gravel to 3.5cm; rounded.			
215					Same as above (210 ft); 10% fine gravel; abundant pumice grains.	SW		New 20' connection @ 1015. Resumed drilling @ 1021.
220					Lean CLAY (CL); brown (10YR 5/3); moist; stiff; medium to high plasticity; 100% clay.			
225					Same as above (220 ft).	CL	High Solids Bentonite Grout	
230					Same as above (220 ft); 10% fine gravel to 3.2cm.			
235					Well graded SAND with Clay and Gravel (SW-SC); brown (10YR 5/3); moist; medium dense; 70% fine to very coarse sand; 20% fine gravel to 1.7cm; subrounded; 10% clay.	SW-SC		New 20' connection @ 1031. Resumed drilling @ 1038.
240					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; loose; 100%	SP		



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					very fine to medium sand to 1mm; rounded; trace clay nodules.			
245					Same as above (238 ft).			
250					Same as above (238 ft); dark yellowish brown (10YR 4/6); damp; no odor.	SP		Possibly stained.
255					Same as above (238 ft).			
260					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 90% very fine to very coarse sand; 10% fine gravel to 1.2cm; rounded.		High Solids Bentonite Grout	New 20' connection @ 1044. Stopped to fix bushing cable. Resumed drilling @ 1121.
265					Same as above (255 ft); no gravel; grading finer.	SW		
270					Same as above (255 ft); no gravel.			



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270								
					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 90% very fine to very coarse sand; 10% fine gravel to 1.2cm; rounded.	SW		
275					Lean CLAY (CL); brown (10YR 5/3); moist; stiff; medium plasticity; 95% clay; 5% very fine sand to 0.2mm.	CL		New 20' connection @ 1128. Resumed drilling @ 1134.
					Same as above (272 ft).			
280					Same as above (272 ft).			
					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 100% very fine to very coarse sand; trace fine gravel to 7mm; subrounded.	SW		
285							High Solids Bentonite Grout	
					Sandy lean CLAY (CL); brown (10YR 5/3); moist; stiff; medium plasticity; 70% clay; 20% fine to very coarse sand; 10% fine gravel to 1.5cm.	CL		
290								
					Well graded SAND with Clay (SW-SC); brown (10YR 5/3); moist; medium dense; 85% fine to very coarse sand; 5% fine gravel to 1.4cm; subrounded; 10% clay.	SW-SC		New 20' connection @ 1150. Resumed drilling @ 1334.
295								
300								





# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/20/2011  
Date TD Reached: 7/23/2011  
Date Completed: 8/5/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.9  
Y Coordinate: 1476442.74  
X Coordinate: 1543660.33

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; medium dense; 100% fine to medium sand; trace coarse sand to 3mm; rounded; trace clay nodules.	SP		
310					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; medium dense; 90% very fine to very coarse sand; 10% fine gravel to 2.1cm; subrounded.			
315					Same as above (305 ft); 5% fine gravel.	SW		
					Sandy lean CLAY (CL); lense.	CL		
320					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 2.1cm; subrounded.			
325					Same as above (316 ft); 10% fine gravel.	SW		
330					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% medium sand; trace fine gravel to 4cm; rounded.	SP		

High Solids  
Bentonite  
Grout

New 20' connection @  
1348. Resumed drilling  
@ 1356.



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.00  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% medium sand.			
335					Same as above (330 ft); trace coarse sand; trace fine gravel to 4cm; rounded.	SP		New 20' connection @ 1407. Resumed drilling @ 1412.
340					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 2cm; rounded.			
345					Same as above (340 ft).	SW	High Solids Bentonite Grout	
350					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; medium dense; 100% fine to medium sand to 1mm; rounded; trace clay nodules.	SP		
355					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 1.3cm; subrounded.	SW		New 20' connection @ 1424. End of 7/21/11. Resumed drilling @ 0831 on 7/23/11.
360								



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/20/2011  
Date TD Reached: 7/23/2011  
Date Completed: 8/5/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▽ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.9  
Y Coordinate: 1476442.74  
X Coordinate: 1543660.33

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360								
					Poorly graded SAND (SP); dark yellowish brown (10YR 4/4); damp; dense; 100% medium sand; trace fine gravel to 2.5cm; rounded.	SP		
365								
					Well graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); moist; dense; 85% fine to very coarse sand; 15% fine gravel to 2.8cm; subrounded.			
370								
					Same as above (365 ft); 20% fine gravel.	SW		
375								
					Well graded SAND (SW); dark yellowish brown (10YR 4/4); moist; dense; 95% fine to very coarse sand; 5% fine gravel to 2.8cm; subrounded.			
380								
					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% fine to medium sand to 0.5mm.			
385						SP		
					Same as above (378 ft); sand to 1mm.			
390								

- High Solids  
Bentonite  
Grout

New 20' connection @  
0848. Resumed drilling  
@ 0855.



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/20/2011  
Date TD Reached: 7/23/2011  
Date Completed: 8/5/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

Ground Elevation AMSL (ft): 5321.9  
Y Coordinate: 1476442.74  
X Coordinate: 1543660.33

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% fine to medium sand to 2mm.	SP		
395					Well graded SAND (SW); brown (10YR 5/3); moist; dense; 100% fine to very coarse sand; trace fine gravel to 2mm; subangular to subrounded.	SW		
400					Poorly graded SAND (SP); brown (10YR 5/3); dry; dense; 100% medium sand to 1mm; rounded.	SP		
405					Lean CLAY with Sand (CL); brown (10YR 4/3); moist; very stiff; medium plasticity; 85% clay; 15% very fine to medium sand to 1mm.	CL		
410					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; dense; 100% fine sand to 0.5mm; rounded.			
					Same as above (407 ft); yellowish brown (10YR 5/4); sand to 1mm.	SP		
415					Same as above (407 ft); yellowish brown (10YR 5/4); sand to 1mm.			
420								

New 20' connection @ 0909. Resumed drilling @ 0919.

High Solids Bentonite Grout

New 20' connection @ 0933. Resumed drilling @ 0938.



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND (SW); brown (10YR 5/3); moist; dense; 100% very fine to coarse sand to 4mm; subrounded.			
425					Same as above (420 ft).	SW		
430					Same as above (420 ft).			
435					Poorly graded SAND (SP); brown (10YR 5/3); dry; dense; 100% very fine to medium sand to 1mm; subrounded; trace silt and clay.	SP		
440					Well graded SAND (SW); brown (10YR 5/3); damp; dense; 100% fine to very coarse sand; trace fine gravel to 1.6cm; rounded.			
445					Same as above (440 ft); 10% fine gravel to 3.6cm.	SW		
450								

- High Solids  
Bentonite  
Grout

New 20' connection @  
0948. Resumed drilling  
@ 0954.

- Top of  
Bentonite Seal



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
455					Well graded SAND (SW); brown (10YR 5/3); damp; dense; 100% fine to very coarse sand; trace fine gravel to 1.6cm; rounded.	SW		
460					Poorly graded SAND (SP); brown (10YR 5/3); moist; dense; 95% fine to medium sand; 5% fine gravel to 2.6cm; rounded.			New 20' connection @ 1006. Resumed drilling @ 1012.
465					Same as above (455 ft); trace coarse sand to 4mm; no gravel.		- Bentonite Seal	
470					Same as above (455 ft); no gravel.	SP	- 5" Schedule 80 PVC Riser	
475					Same as above (455 ft); damp; no gravel.			
480					Same as above (455 ft); damp; no gravel.		- Top of 20/40 Sand - Top of 10/20 Sand	New 20' connection @ 1024. Resumed drilling @ 1030.





# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well graded SAND (SW); brown (10YR 5/3); wet; dense; 100% fine to coarse sand; trace fine gravel to 3cm; rounded.			
485					Well graded SAND with Gravel (SW); brown (10YR 5/3); wet; dense; 80% fine to coarse sand; 20% fine gravel to 3cm; rounded.			
490					Well graded SAND (SW); brown (10YR 5/3); wet; dense; 95% fine to coarse sand; 5% fine gravel to 3cm; rounded.			
495					Same as above (490 ft); trace fine gravel.	SW		
500					Well graded SAND with Gravel (SW); brown (10YR 5/3); wet; dense; 60% fine to coarse sand; 40% fine gravel to 3cm; rounded.			
505					Well graded SAND (SW); brown (10YR 5/3); wet; dense; 100% fine to coarse sand; trace fine gravel to 3cm; rounded.			
510								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/26/11 08:44 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

- Top of 5" Schedule 80 PVC 0.010" Slot Screen

- Bottom of Screen

- Sump

- Bottom of Sump

- Bottom of Filter Pack

New 20' connection @ 1046. Resumed drilling @ 1125.



# Borehole ID: KAFB-106036

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/20/2011  
**Date TD Reached:** 7/23/2011  
**Date Completed:** 8/5/2011

**Ground Elevation AMSL (ft):** 5321.9  
**Y Coordinate:** 1476442.74  
**X Coordinate:** 1543660.33

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 467.00

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

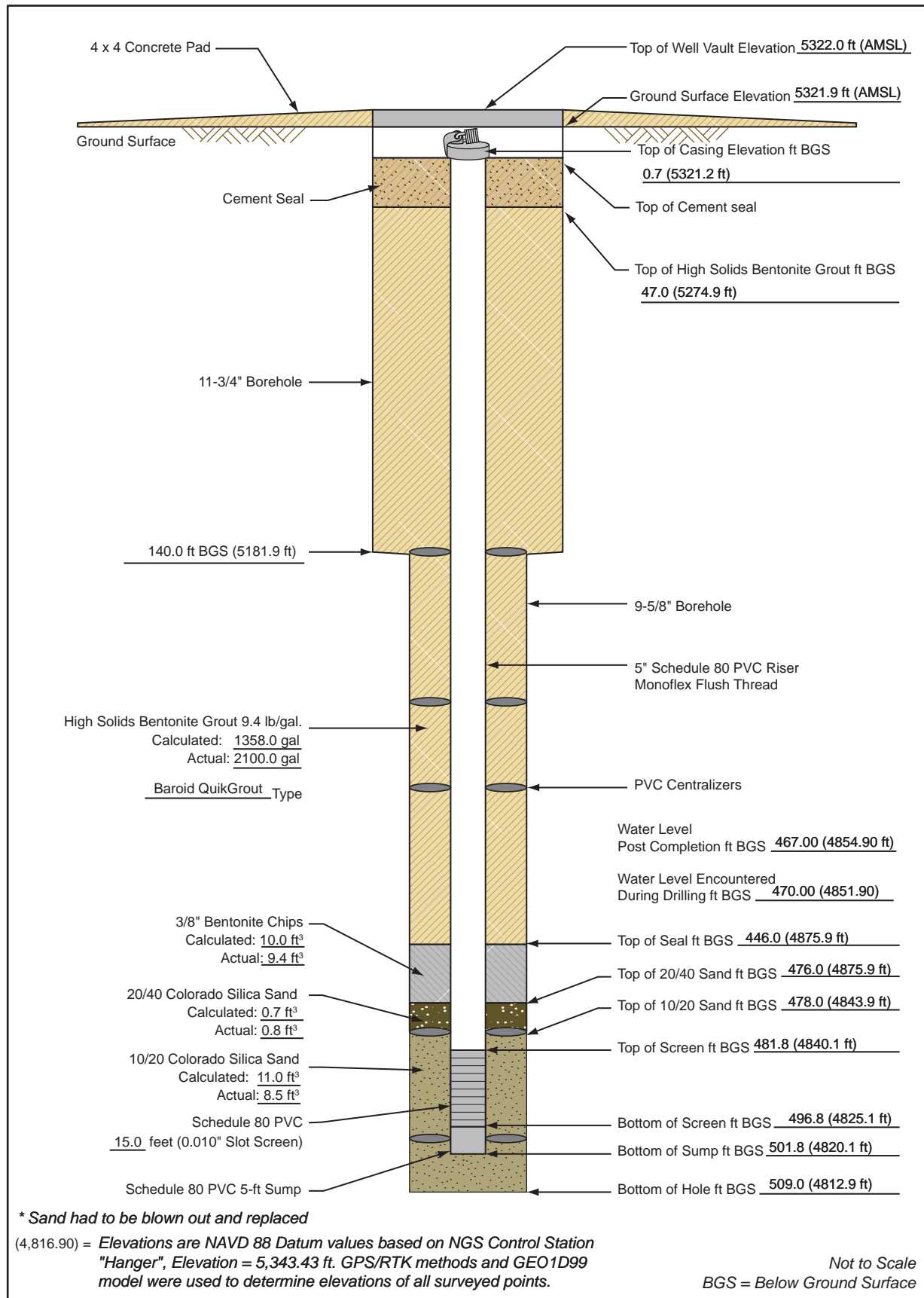
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								
515					Well graded SAND with Gravel (SW); brown (10YR 5/3); wet; dense; 80% fine to coarse sand; 20% fine gravel to 3cm; rounded.			
520					Well graded SAND (SW); brown (10YR 5/3); wet; dense; 100% fine to coarse sand; trace fine gravel to 3cm; rounded.	SW	Native Backfill	
525								Total depth = 520 ft. Reached @ 1143 on 7/23/11.
530								Water added during drilling (gallons) = 1700
535								Water added after drilling (gallons) = 1160
540								Water added during construction (gallons) = 40

# Monitoring Well Completion Diagram KAFB-106036

Installation Start Date/Time: 8/3/2011 @ 10:14

Installation End Date/Time: 8/5/2011 @ 08:00



## Well Development Record

Project Name: KAFB BFF

Location: GW-3

Personnel: P. Ostrye

Date: 8/15/11

Samplers: P. Ostrye

Well/Piez. No.: 106036

Date Installed: 8/5/11

Csg. Diameter (I.D.): 5"

Total Depth (ft. BGL): 501.8

### Method of Development:

X Surging

X Bailing

X Pumping

X Original Development

☐ Redevelopment

☐ Other

Development Date: 8/15/11 - 8/16/11

Depth to Water Before Developing Well (ft. BGL): 467.74

Vol. (V)      Purge Factor      Volume to Purge

Height of Water Column: 34.06 feet = 2617.95 gal. \* 1 = 2617.95

$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 2617.95 \text{ gallons}$

Depth Purging From: 490 feet

Time Purging Begins: 1630, 8/15/11

Weather: Sunny, Warm

Screened Interval (ft BGL): 481.8 - 496.8

Equipment Nos.:      pH Meter: YSI 36952

EC Meter: YSI 36952

Turbidity Meter: LVE 002384

Equipment Decontaminated Prior to Development: Y ☒ X ☐ N ☐

Describe: Steam Cleaned

Collected Sample of Water Added to Well: Y ☐ N ☒ X ☐

Describe: N/A

Comment: 2560 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/15/2011	1345	--	10	--	--	--	--	Begin Bailing
8/15/2011	1358	--	50	--	--	--	--	Bailed
8/15/2011	1432	--	100	--	--	--	--	Bailed
8/15/2011	1600	469.17	--	--	--	--	--	Begin Pumping at 5.3 GPM
8/15/2011	1630	469.17	259	21.14	5.47	0.544	2.07	Stop Pumping for the Day
8/16/2011	0850	469.27	418	20.75	7.17	0.528	0.63	Begin Pumping
8/16/2011	0920	469.27	577	20.83	7.44	0.532	0.49	Continue Pumping
8/16/2011	0950	469.27	736	20.82	7.49	0.533	0.40	Continue Pumping
8/16/2011	1020	469.30	895	21.02	7.49	0.530	0.30	Continue Pumping
8/16/2011	1050	469.31	1054	20.96	7.56	0.536	0.31	Continue Pumping

### Notes:

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1°C

\* Turbidity report in NTU nearest whole #

GPM = Gallons Per Minute

### Where:

B=3.14

$\phi_s$ = porosity of the sand pack

$r_c$ = radius of the well casing and screen in feet

$L_c$ = length of water column inside the casing and screen in feet

$r_w$ = radius of the well bore in feet

$L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

Project: KAFB BFF

Well No: 106036

Project Number: 140705

Samplers: P. Ostrye

Date: 8/16/11

Checked By: \_\_\_\_\_

Time Start: 1345, 8/15/11

Time Finish: 1620, 8/16/11

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/16/2011	1120	--	--	--	--	--	--	Call to D. Flores about 106035
8/16/2011	1150	469.30	1372	21.19	7.61	0.534	0.27	Continue Pumping
8/16/2011	1220	469.29	1531	21.20	7.63	0.533	0.26	Continue Pumping
8/16/2011	1250	469.29	1690	21.30	7.67	0.533	0.26	Continue Pumping
8/16/2011	1320	469.30	1849	21.14	7.70	0.536	0.26	Continue Pumping
8/16/2011	1350	469.30	2008	21.40	7.73	0.533	0.47	Continue Pumping; Recalibrate HACH
8/16/2011	1420	469.30	2167	21.35	7.76	0.537	0.56	Continue Pumping
8/16/2011	1450	469.30	2326	21.15	7.77	0.533	0.35	Continue Pumping
8/16/2011	1520	469.30	2485	21.68	7.77	0.535	0.44	Continue Pumping
8/16/2011	1540	--	2591	21.72	7.77	0.535	--	30 Minute Shut-Down Due to Lightning
8/16/2011	1600	469.30	2697	21.78	7.78	0.535	0.44	Continue Pumping
8/16/2011	1620	469.30	2803	21.43	7.80	0.537	0.30	Stop Pumping; Clear; Total Removed

Was well sampled after development? YES NO ☒ X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106037





# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 1 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
5					Sandy SILT (ML); strong brown (7.5YR 5/8); dry; very soft; low plasticity; 70% silt; 30% very fine to medium sand to 2mm; rounded.			Hand augered.
10					Same as above (0 ft); trace fine gravel to 9mm; rounded.			***Note: no headspace requirement at this location.***
15					Same as above (0 ft).	ML		Began drilling @ 1242 on 7/8/11.
20					Same as above (0 ft); 60% silt; 40% very fine to coarse sand; subrounded.		Cement Seal	New 20' connection @ 1250. Resumed drilling @ 1258.
25					Well graded SAND (SW); brown (7.5YR 5/3); dry; loose; 90% very fine to very coarse sand; 10% fine gravel to 2.2cm; subangular.	SW		
30					SILT with Sand (ML); strong brown (7.5YR 5/8); moist; very soft; low plasticity; 80% silt; 20% very fine to medium sand; trace fine gravel to 1.3cm; rounded.	ML		



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 2 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Silty SAND (SM); strong brown (7.5YR 5/6); dry; very loose; 70% very fine to very coarse sand; 10% fine gravel to 2.5cm; 20% silt.	SM		New 20' connection @ 1309. Resumed drilling @ 1321.
40					SILT with Sand (ML); strong brown (7.5YR 5/8); moist; soft; low plasticity; 80% silt; 20% very fine to coarse sand to 4.8mm.	ML		
45					Same as above (32 ft).			
50					Silty SAND (SM); strong brown (7.5YR 5/6); moist; loose; 60% very fine to very coarse sand; 10% fine gravel to 2.8cm; subangular to subrounded; 30% silt.	SM		
55					Same as above (45 ft); 65% sand; 5% fine gravel; 30% silt.			
60					SILT with Sand (ML); strong brown (7.5YR 4/6); moist; stiff; low to medium plasticity; 80% silt; 5% clay; 15% very fine sand to 0.2mm.	ML		New 20' connection @ 1330. Resumed drilling @ 1336.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 3 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT with Sand (ML); strong brown (7.5YR 4/6); moist; stiff; low to medium plasticity; 85% silt; 15% very fine to medium sand to 2mm; trace clay.			
65					SILT with Sand (ML); brown (7.5YR 5/4); moist; stiff; low to medium plasticity; 80% silt; 5% clay; 15% very fine sand to 0.2mm.			
70					Same as above (65 ft); strong brown (7.5YR 4/6); clay nodules.			
75					Same as above (65 ft); strong brown (7.5YR 4/6); trace fine gravel to 1cm; caliche.	ML	High Solids Bentonite Grout	New 20' connection @ 1349. Resumed drilling @ 1355.
80					SILT with Sand (ML); strong brown (7.5YR 5/6); dry; medium stiff; low plasticity; 75% silt; 25% very fine to coarse sand; trace fine gravel to 8mm.			
85					Same as above (80 ft); moist.			
90								



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 4 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					SILT (ML); strong brown (7.5YR 4/6); moist; medium stiff; low to medium plasticity; 90% silt; 10% clay.			
100					Sandy SILT (ML); yellowish brown (10YR 5/6); moist; medium stiff; low plasticity; 70% silt; 30% very fine to coarse sand; trace fine gravel to 1cm.	ML		New 20' connection @ 1403. Resumed drilling @ 1408.
105					SILT with Sand (ML); strong brown (7.5YR 5/6); dry; medium stiff; low plasticity; 80% silt; 5% clay; 15% very fine sand to 0.2mm.			
110					Same as above (100 ft).			
115					Lean CLAY (CL); brown (7.5YR 4/4); moist; stiff; medium plasticity; 100% clay.	CL		
120					Sandy SILT (ML); brown (7.5YR 5/4); dry; medium stiff; low plasticity; 70% silt; 30% very fine to medium sand to 2mm.			
					Same as above (112 ft).	ML		New 20' connection @ 1419. Resumed drilling @ 1429.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 5 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Sandy SILT (ML); brown (7.5YR 5/4); dry; medium stiff; low plasticity; 70% silt; 30% very fine to coarse sand. Note: some caliche grains.			
125					Sandy SILT (ML); yellowish brown (10YR 5/6); dry; medium stiff; low plasticity; 60% silt; 40% very fine sand to 0.2mm.	ML		
130					Same as above (125 ft); trace caliche grains to 1cm.			
135					Lean CLAY (CL); yellowish brown (10YR 5/6); moist; stiff; low to medium plasticity; 80% clay; 20% silt; trace caliche grains to 1.5cm.	CL	High Solids Bentonite Grout	New 5' connection @ 1437. Resumed drilling @ 1444.
140					Silty SAND (SM); light yellowish brown (10YR 6/4); dry; medium dense; 80% very fine to very coarse sand to 4.8mm; subrounded; 20% silt.	SM		Total depth with 11-3/4" casing @ 1448. End of 7/8/11. Resumed drilling with 9-5/8" casing @ 0906 on 7/9/11.
145					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; medium dense; 95% very fine to medium sand; 5% coarse sand; trace fine gravel to 1.4cm; rounded.	SP		
150								



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 6 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
155					Clayey SAND (SC); dark yellowish brown (10YR 4/4); moist; dense; 65% very fine to very coarse sand; 5% fine gravel to 1.9cm; subrounded to rounded; 30% clay.	SC		
160					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; medium dense; 100% very fine to very coarse sand; trace fine gravel to 1.7cm; subrounded.			New 20' connection @ 0916. Paused drilling to clean cyclone and hose. Resumed drilling @ 0948.
165					Same as above (155 ft); 95% sand; 5% silt. Note: abundant pumice grains.			
170					Same as above (155 ft); 95% sand; 5% silt. Note: abundant pumice grains.			
175					Same as above (155 ft).	SW		
180					Same as above (155 ft); 90% sand; 10% fine gravel to 1.8cm.			New 20' connection @ 0953. Resumed drilling @ 0958.





# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/8/2011  
Date TD Reached: 7/11/2011  
Date Completed: 7/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

Ground Elevation AMSL (ft): 5322.0  
Y Coordinate: 1476442.28  
X Coordinate: 1543685.62

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 7 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; medium dense; 100% very fine to very coarse sand; trace fine gravel to 1.7cm; subrounded.			
185					Same as above (180 ft); 5% fine gravel to 1.7cm; trace clay nodules.	SW		
190					Same as above (180 ft); 5% fine gravel to 1.7cm; trace clay nodules.			
195					Clayey SAND (SC); light olive brown (2.5Y 5/4); moist; loose; 75% very fine to very coarse sand; 5% fine gravel to 2.5cm; subrounded; 20% clay with some nodules; no odor.	SC		
200					Well graded SAND with Gravel (SW); yellowish brown (10YR 5/4); damp; loose; 85% very fine to very coarse sand; 15% fine gravel to 2.8cm; rounded.			
205					Same as above (198 ft); olive brown (2.5Y 4/6).	SW		
210								

High Solids  
Bentonite  
Grout

Appears stained. New 20' connection and resumed drilling @ 1008.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 8 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210								
215					Well graded SAND (SW); yellowish brown (10YR 5/4); damp; loose; 100% very fine to coarse sand; trace fine gravel.	SW		
220					Same as above (210 ft); 5% fine gravel; pumice grains.			New 20' connection @ 1014. Resumed drilling @ 1018.
225					Lean CLAY (CL); dark yellowish brown (10YR 4/4); damp; stiff; medium to high plasticity; 100% clay; trace very fine sand to 0.2mm.	CL		
230					Same as above (219 ft); brown (10YR 5/3).			
235					Same as above (219 ft); 5% fine gravel to 3.5cm; well rounded.			
240					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; loose; 100% very fine to very coarse sand; trace fine gravel to 9mm; rounded.	SW		New 20' connection @ 1025. Resumed drilling @ 1032.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/8/2011  
Date TD Reached: 7/11/2011  
Date Completed: 7/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

Ground Elevation AMSL (ft): 5322.0  
Y Coordinate: 1476442.28  
X Coordinate: 1543685.62

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 9 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand to 1mm; subrounded.	SP		
245					Lean CLAY (CL); lense.	CL		
					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand to 1mm; trace coarse sand; subrounded.	SP		
250					Well graded SAND (SW); dark yellowish brown (10YR 4/4); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 1.5cm; rounded; trace clay.			
255					Same as above (250 ft); no gravel.	SW		
260					Poorly graded SAND (SP); dark yellowish brown (10YR 4/4); moist; medium dense; 100% medium sand to 2mm; rounded; trace clay nodules.			
265					Same as above (260 ft).	SP		
270								

High Solids  
Bentonite  
Grout

New 20' connection @  
1037. Resumed drilling  
@ 1042.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 10 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 1.5cm; rounded.	SW		
275					Lean CLAY (CL); dark yellowish brown (10YR 4/4); moist; stiff; medium plasticity; 100% clay; trace medium sand to 2mm.			
280					Lean CLAY with Sand (CL); dark yellowish brown (10YR 4/4); moist; stiff; medium plasticity; 80% clay; 20% very fine to medium sand to 2mm.	CL		
285					Same as above (273 ft).			
290					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% medium sand to 2mm; subrounded; trace silt.			
295					Same as above (288 ft); 5% coarse sand.	SP		
300								

New 20' connection @ 1051. Resumed drilling @ 1057.

High Solids Bentonite Grout

Cyclone hose came off hammer @ 1112. Resumed drilling @ 1448.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/8/2011  
Date TD Reached: 7/11/2011  
Date Completed: 7/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

Ground Elevation AMSL (ft): 5322.0  
Y Coordinate: 1476442.28  
X Coordinate: 1543685.62

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 11 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% medium sand to 2mm; subrounded; trace silt.			
305					Same as above (300 ft); trace coarse sand to 4mm.	SP		Paused drilling to clean out cyclone hose @ 1500. Resumed drilling @ 1516.
310					Well graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); moist; medium dense; 75% very fine to very coarse sand; 25% fine gravel to 2cm.			
315					Same as above (310 ft); gravel to 3cm.	SW	High Solids Bentonite Grout	New 20' connection @ 1526. Resumed drilling @ 1532.
320					Well graded SAND (SW); dark yellowish brown (10YR 4/4); moist; medium dense; 90% very fine to very coarse sand; 10% fine gravel to 2cm.			
325					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% very fine to medium sand; trace fine gravel to 3cm; rounded.	SP		
330								



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/8/2011  
Date TD Reached: 7/11/2011  
Date Completed: 7/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

Ground Elevation AMSL (ft): 5322.0  
Y Coordinate: 1476442.28  
X Coordinate: 1543685.62

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 12 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330								
					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% very fine to medium sand.	SP		
335					Well graded SAND with Gravel (SW); brown (10YR 4/3); moist; dense; 80% very fine to very coarse sand; 20% fine gravel to 1.8cm; subrounded to rounded.			
340					Same as above (332 ft); gravel to 3.2cm.	SW		New 20' connection @ 1542. Resumed drilling @ 1552.
345					Well graded SAND (SW); brown (10YR 4/3); moist; dense; 100% very fine to very coarse sand; trace fine gravel; subrounded to rounded.		High Solids Bentonite Grout	
350					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand; trace coarse sand; trace fine gravel to 1cm; rounded.			
355					Same as above (350 ft).	SP		New 20' connection @ 1603. Resumed drilling @ 1612.
360								





# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 13 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand; trace coarse sand; trace fine gravel to 1cm; rounded.			
365					Same as above (360 ft); 5% coarse sand.	SP		
370					Well graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); moist; dense; 75% very fine to very coarse sand; 25% fine gravel to 1.7cm; subrounded.			
375					Well graded SAND (SW); dark yellowish brown (10YR 4/4); moist; dense; 90% very fine to very coarse sand; 10% fine gravel to 1.7cm; subrounded.	SW	High Solids Bentonite Grout	New 20' connection @ 1621. Resumed drilling @ 1628.
380					Same as above (375 ft).			
385					Poorly graded SAND (SP); brown (10YR 5/3); moist; dense; 95% medium sand; 5% coarse sand to 4.8mm; subrounded.	SP		
390								



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/8/2011  
Date TD Reached: 7/11/2011  
Date Completed: 7/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

Ground Elevation AMSL (ft): 5322.0  
Y Coordinate: 1476442.28  
X Coordinate: 1543685.62

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 14 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); brown (10YR 5/3); dry; dense; 95% very fine to very coarse sand; 5% fine gravel to 1.3cm; subrounded.			
395					Same as above (390 ft); 10% fine gravel.	SW		
400					Same as above (390 ft); no gravel.			
					Sandy lean CLAY (CL); lense.	CL		
405					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; medium dense; 100% very fine sand to 0.2mm; rounded.			
410					Same as above (403 ft).	SP		
415					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; medium dense; 100% very fine to very coarse sand; trace fine gravel to 6mm; subrounded.	SW		
420								

End of 7/9/11. New 20' connection and resumed drilling @ 0843 on 7/11/11.

High Solids  
Bentonite  
Grout

New 20' connection and resumed drilling @ 0919.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/8/2011  
Date TD Reached: 7/11/2011  
Date Completed: 7/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

Ground Elevation AMSL (ft): 5322.0  
Y Coordinate: 1476442.28  
X Coordinate: 1543685.62

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 15 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 6mm; subrounded.			
425					Same as above (420 ft); trace fine gravel.	SW		
430					Same as above (420 ft); trace fine gravel to 1.7cm.			
435					Poorly graded SAND (SP); brown (10YR 5/3); dry; dense; 100% very fine to medium sand; trace coarse sand; trace fine gravel to 8mm.			
440					Same as above (435 ft); 5% coarse sand.	SP		
445					Well graded SAND (SW); brown (10YR 5/3); dry; dense; 95% very fine to very coarse sand; 5% fine gravel to 1.7cm.	SW		
450								

High Solids  
Bentonite  
Grout

New 20' connection @  
0935. Resumed drilling  
@ 0943.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 16 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
455					Well graded SAND with Gravel (SW); brown (10YR 5/3); dry; dense; 60% very fine to very coarse sand; 40% fine gravel to 1.7cm.	SW		
460					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; dense; 100% fine to medium sand; trace fine gravel to 2.6cm.			New 20' connection @ 1001. Resumed drilling @ 1006.
465					Same as above (455 ft); no gravel.			
470					Same as above (455 ft); gravel to 1.3cm.	SP		
475					Same as above (455 ft); no gravel.			
480					Same as above (455 ft); no gravel.			New 20' connection @ 1023. Resumed drilling @ 1205.



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 7/8/2011  
Date TD Reached: 7/11/2011  
Date Completed: 7/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

Ground Elevation AMSL (ft): 5322.0  
Y Coordinate: 1476442.28  
X Coordinate: 1543685.62

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 17 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well graded SAND with Gravel (SW); yellowish brown (10YR 5/4); wet; dense; 70% fine to very coarse sand; 30% fine gravel to 1.6cm; subrounded; trace silt and clay.	SW		
485					Poorly graded GRAVEL with Sand (GP); yellowish brown (10YR 5/4); wet; dense; 70% fine gravel to 4.4cm; rounded; 30% medium to very coarse sand. Note: gravel is composed of granite.	GP		
490					Poorly graded SAND (SP); brown (10YR 4/3); wet; dense; 90% medium to very coarse sand; 10% fine gravel to 1.7cm; subrounded.	SP	Bentonite Seal	
495					Poorly graded SAND with Gravel (SP); brown (10YR 4/3); wet; dense; 70% medium to very coarse sand; 30% fine gravel to 1.7cm; subrounded.	SP	5" Schedule 80 PVC Riser	New 20' connection @ 1221. Chain broke on hammer, paused drilling to repair. Resumed drilling @ 1311.
500					Well graded SAND (SW); yellowish brown (10YR 5/4); wet; dense; 95% fine to very coarse sand; 5% fine gravel to 2.5cm; subrounded.	SW	Top of 20/40 Sand	
505					Poorly graded GRAVEL with Sand (GP); brown (10YR 4/3); wet; dense; 60% fine gravel to 4.5cm; 40% medium to very coarse sand; subrounded to rounded.	GP	Top of 10/20 Sand	
510					Poorly graded SAND (SP); brown (10YR	SP	Top of 5" Schedule 80 PVC 0.010" Slot Screen	



# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

Page 18 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					5/3; wet; dense; 100% medium sand; trace fine gravel to 7mm; rounded.			
515					Same as above (510 ft); 5% fine gravel.			New 20' connection @ 1330. Resumed drilling @ 1336.
520					Same as above (510 ft); very dense; 100% fine to medium sand.			Hole plugged. Resumed drilling @ 1400.
525					Same as above (510 ft); very dense; 100% fine to medium sand.	SP	- Bottom of Screen - Sump - Bottom of Sump	Rate of penetration was very slow.
530					Same as above (510 ft); very dense; 100% fine to medium sand; grading coarser.		- Bottom of Filter Pack	
535					Same as above (510 ft); very dense; 100% fine to medium sand; grading coarser.		- Native Backfill	
540								





# Borehole ID: KAFB-106037

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 7/8/2011  
**Date TD Reached:** 7/11/2011  
**Date Completed:** 7/14/2011

**Ground Elevation AMSL (ft):** 5322.0  
**Y Coordinate:** 1476442.28  
**X Coordinate:** 1543685.62

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 467.10  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 466.80

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Jason Tarbert

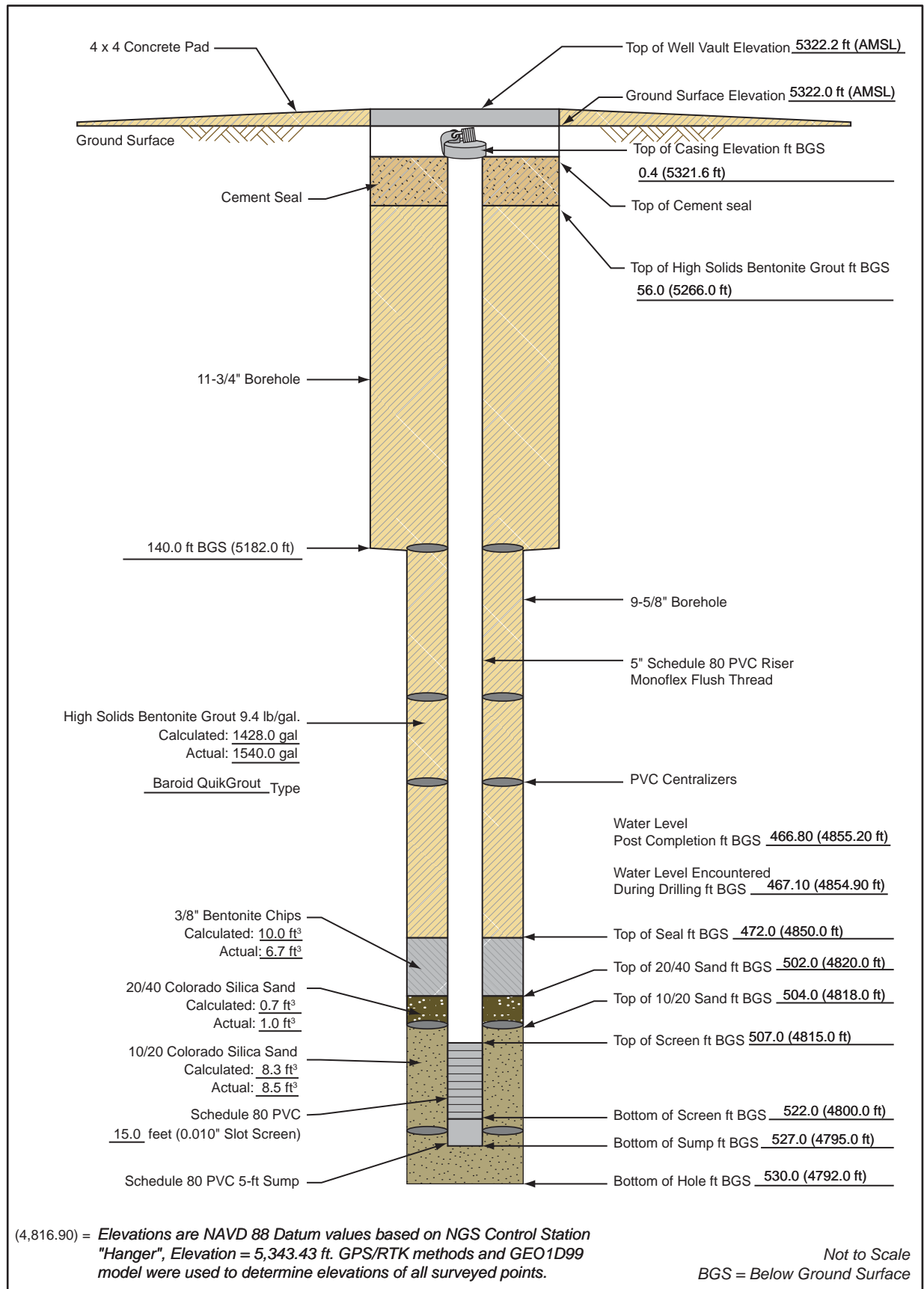
Page 19 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540								
					Well graded SAND with Gravel (SW); brown (10YR 5/3); wet; very dense; 80% fine to very coarse sand; 20% fine gravel to 2cm; subrounded.	SW		Total depth = 540 ft. Reached @ 1425 on 7/11/11.
545								Water added during drilling (gallons): 320
								Water added after drilling (gallons): 1600
550								Water added during construction (gallons): 0
555								
560								
565								
570								

# Monitoring Well Completion Diagram KAFB-106037

Installation Start Date/Time: 7/12/2011 @ 09:22

Installation End Date/Time: 7/14/2011 @ 08:00



## Well Development Record

Project Name: KAFB BFF

Location: GW-3

Personnel: P. Ostrye

Date: 8/12/11

Samplers: P. Ostrye

Well/Piez. No.: 106037

Date Installed: 7/14/11

Csg. Diameter (I.D.): 5"

Total Depth (ft. BGL): 527

### Method of Development:

X Surging

X Bailing

X Pumping

X Original Development

☐ Redevelopment

☐ Other

Development Date: 8/12/11 and 8/15/11

Depth to Water Before Developing Well (ft. BGL): 468.05

Vol. (V)      Purge Factor      Volume to Purge

Height of Water Column: 58.95 feet = 2002.97 gal. \* 1 = 2002.97

$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 2002.97 \text{ gallons}$

Depth Purging From: NR feet

Time Purging Begins: 1122, 8/12/11

Weather: Sunny, Warm

Screened Interval (ft BGL): 507 - 522

Equipment Nos.: pH Meter: YSI 36952

EC Meter: YSI 36952

Turbidity Meter: LVE 002384

Equipment Decontaminated Prior to Development: Y ☒ X ☐ N ☐

Describe: Steam Cleaned

Collected Sample of Water Added to Well: Y ☐ N ☒ X ☐

Describe: N/A

Comment: 1920 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/12/2011	0852	--	10	--	--	--	--	Begin Bailing
8/12/2011	0908	--	50	--	--	--	--	Bailed; Begin Second Bail
8/12/2011	0946	--	100	--	--	--	--	Continue Bailing
8/12/2011	0948	--	110	--	--	--	--	Bailed
8/12/2011	1122	468.10	--	--	--	--	--	Begin Pumping at 5.3 GPM
8/12/2011	1137	468.55	136.5	21.87	5.84	0.351	180.00	Continue Pumping
8/12/2011	1200	468.53	258.4	21.85	5.49	0.350	86.80	Continue Pumping
8/12/2011	1220	468.49	364.4	21.83	5.66	0.348	78.10	Continue Pumping
8/12/2011	1240	468.50	470.4	21.57	5.65	0.347	73.20	Continue Pumping
8/12/2011	1300	468.50	576.4	21.75	6.42	0.346	58.30	Continue Pumping

### Notes:

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1C

\* Turbidity report in NTU nearest whole #

GPM = Gallons Per Minute

### Where:

B=3.14

$\phi_s$ = porosity of the sand pack

$r_c$ = radius of the well casing and screen in feet

$L_c$ = length of water column inside the casing and screen in feet

$r_w$ = radius of the well bore in feet

$L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

Project: KAFB BFF

Well No: 106037

Project Number: 140705

Samplers: P. Ostrye

Date: 8/12/11

Checked By: \_\_\_\_\_

Time Start: 0852, 8/12/11

Time Finish: 1050, 8/15/11

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/12/2011	1320	468.48	682.4	21.55	5.81	0.345	47.20	Continue Pumping
8/12/2011	1340	468.48	788.4	21.53	5.44	0.345	38.70	Continue Pumping
8/12/2011	1400	468.48	894.4	21.65	6.51	0.344	28.80	Continue Pumping
8/12/2011	1420	468.48	910.4	22.16	7.40	0.344	18.80	Continue Pumping
8/12/2011	1440	468.48	1016.4	21.77	7.01	0.343	10.00	Continue Pumping
8/12/2011	1500	468.46	1122.4	21.53	6.29	0.342	7.49	Continue Pumping
8/12/2011	1520	468.44	1228.4	21.49	5.97	0.342	6.05	Continue Pumping
8/12/2011	1540	468.44	1334.4	21.30	5.94	0.341	5.12	Continue Pumping
8/12/2011	1600	468.42	1440.4	21.40	7.31	0.340	4.75	Continue Pumping
8/12/2011	1620	468.42	1546.4	20.96	7.40	0.340	6.83	Stop Pumping for the Day
8/15/2011	0900	468.60	1625.9	20.47	6.42	0.427	2.77	Begin Pumping
8/15/2011	0920	468.60	1731.9	20.62	7.71	0.422	1.31	Continue Pumping
8/15/2011	0940	468.59	1837.9	20.67	7.21	0.421	1.31	Continue Pumping
8/15/2011	1000	468.58	1943.9	20.71	6.43	0.420	0.52	Continue Pumping
8/15/2011	1010	468.58	1996.9	20.73	6.93	0.420	0.49	Continue Pumping

Was well sampled after development? YES NO ☒ X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

## Well Development Record

Project: KAFB BFF

Well No: 106037

Project Number: 140705

Samplers: P. Ostrye

Date: 8/15/11

Checked By:

Time Start: 0852, 8/12/11

Time Finish: 1050, 8/15/11

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/15/2011	1020	468.58	2049.9	20.72	7.04	0.421	0.48	Continue Pumping
8/15/2011	1030	468.58	2102.9	20.71	7.00	0.420	0.59	Continue Pumping
8/15/2011	1040	468.58	2155.9	20.76	7.04	0.421	0.53	Continue Pumping
8/15/2011	1050	468.58	2208.9	20.79	7.06	0.421	0.40	Stop Pumping; Clear; Total Removed

Was well sampled after development? YES NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106055





# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.82  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Asphalt and fill; no description recorded.			Hand augered.
5					Silty SAND (SM); reddish brown (5YR 5/4); dry; medium dense; 70% very fine to fine sand; 30% silt; trace clay; no odor.			***Note: no headspace requirement at this location.***
					Same as above (0.5 ft); no odor.	SM		Spud @ 1330 on 6/20/11.
10					Silty SAND (SM); reddish brown (5YR 5/3); dry; medium dense; 70% very fine to fine sand; trace medium sand; subangular; 30% silt with minor clay; no odor.			
15					Sandy SILT (ML); reddish brown (5YR 4/4); dry to moist; stiff; 70% silt with clay; 30% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	ML	Cement Seal	
20					Same as above (13 ft).			
25					Well graded SAND with Gravel (SW); light reddish brown (5YR 6/3); dry; dense; 85% very fine to coarse sand; subangular; 15% fine to coarse gravel to 3.5cm; subangular; no odor. Note: gravel consists of felsic to intermediate lithics, red sandstone fragments, and trace limestone.	SW		Kelly down @ 1346. New 20' connection @ 1356. Resumed drilling @ 1357.
30								



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well graded SAND with Gravel (SW); light reddish brown (5YR 6/3); dry; dense; 85% very fine to coarse sand; subangular; 15% fine to coarse gravel to 2cm; subangular; no odor.			
35					Same as above (30 ft); no odor.			
40					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); 80% very fine to coarse sand; subangular; 15% fine gravel to 1cm; subangular; 5% silt with minor clay; no odor.			
45					Same as above (40 ft); no odor.	SW		
50					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 95% very fine to coarse sand; subangular; trace fine gravel to 1cm; subangular; 5% silt with minor clay; no odor.			
55					Same as above (50 ft); 90% very fine to coarse sand; subangular; 5% fine to coarse gravel to 2.5cm; subangular; 5% silt with minor clay; no odor.			
60								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 9/27/11 12:00 - X:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Cement Seal

Top of High Solids Bentonite Grout

Kelly down @ 1420. New 20' connection @ 1426. Resumed drilling @ 1427.



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.82  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 3 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 90% very fine to coarse sand; subangular; 5% fine gravel to 1.2cm; subangular; 5% silt with minor clay; no odor.	SW		Kelly down @ 1444. New 20' connection @ 1448. Resumed drilling @ 1452.
65					Lean CLAY (CL); reddish brown (5YR 4/3); dry to moist; stiff; low plasticity; 95% clay with silt; 5% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	CL		
70					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 100% very fine to coarse sand; subangular.	SW		
75					Sandy SILT (ML); yellowish red (5YR 5/6); dry; stiff; 70% silt; trace clay; 30% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	ML	High Solids Bentonite Grout	Stopped drilling @ 1500. Drive head came out of casing top joint. End of 6/20/11. Resumed drilling @ 0820 on 06/21/11.
80					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 100% very fine to coarse sand; subangular to subrounded; no odor.			Kelly down @ 0825. New 20' connection @ 0838. Resumed drilling @ 0839.
85					Same as above (78 ft); 85% very fine to coarse sand; subangular; 10% fine to coarse gravel to 2.5cm; subangular; 5% silt; no odor.	SW		Paused drilling @ 0840. Drive head came out of casing top joint. Resumed drilling @ 0859.
90								



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/20/2011  
Date TD Reached: 6/22/2011  
Date Completed: 6/24/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▽ After Drilling: 470.75

Ground Elevation AMSL (ft): 5325.1  
Y Coordinate: 1477303.10  
X Coordinate: 1543757.07

Drilling Contractor: WDC Exploration and Wells  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 85% very fine to coarse sand; subangular; 10% fine to coarse gravel to 2cm; subangular to subrounded; 5% silt with minor clay; no odor.	SW		
100					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 90% very fine to coarse sand; subangular; 5% fine gravel to 1.5cm; subangular to subrounded; 5% silt with minor clay; no odor.			
105					SILT with Sand (ML); reddish brown (5YR 5/4); dry; stiff; 85% silt; trace clay; 15% very fine to coarse sand; subangular; no odor.			
110					Same as above (99 ft); 75% silt; trace clay; 25% very fine to medium sand; trace coarse sand; subangular; no odor.			
115					SILT (ML); yellowish red (5YR 4/6); dry; stiff; 95% silt; trace clay; 5% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	ML		
120					Same as above (108 ft); no odor.			

Kelly down @ 0912. New 20' connection @ 0921. Resumed drilling @ 0922.

- High Solids Bentonite Grout



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					SILT (ML); yellowish red (5YR 4/6); dry; stiff; 95% silt; trace clay; 5% very fine to fine sand; trace medium to coarse sand; subangular; no odor.			Kelly down @ 0931. New 20' connection @ 0939. Resumed drilling @ 0940.
125					Same as above (120 ft); no odor.			
130					Same as above (120 ft); 95% silt with minor clay; 5% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	ML		
135					Same as above (120 ft); 90% silt; trace clay; 10% very fine to coarse sand; subangular; no odor.		High Solids Bentonite Grout	
140					SILT (ML); reddish brown (2.5YR 4/4); dry; stiff; 100% silt with minor clay; trace very fine to fine sand; no odor.			Kelly down @ 0947. New 20' connection @ 0958. Resumed drilling @ 0959.
145					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); dry; dense; 80% very fine to coarse sand; subangular; 20% fine to coarse gravel to 2cm; subangular; no odor.	SW		
150								



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/20/2011  
Date TD Reached: 6/22/2011  
Date Completed: 6/24/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

Ground Elevation AMSL (ft): 5325.1  
Y Coordinate: 1477303.10  
X Coordinate: 1543757.07

Drilling Contractor: WDC Exploration and Wells  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); dry; dense; 80% very fine to coarse sand; subangular; 20% fine gravel to 2cm; subangular; no odor.	SW		
155					Poorly graded SAND (SP); reddish brown (5YR 5/4); dry; dense; 100% very fine to medium sand; trace coarse sand; subrounded; no odor.			Approximate top of Santa Fe Group.
160					Same as above (154 ft); no odor.			
165					Same as above (154 ft); 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine gravel to 1cm; subrounded; no odor.	SP		Kelly down @ 1011. New 20' connection @ 1023. Resumed drilling @ 1024.
170					Same as above (154 ft); no odor.			
175					Same as above (154 ft); no odor.			
180								





# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.82  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); reddish brown (5YR 5/4); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.	SP		Kelly down @ 1032. Total depth with 11-3/4" casing. New 20' connection @ 1425. Resumed drilling with 9-5/8" casing @ 1426.
185					Well graded SAND (SW); reddish brown (5YR 5/4); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
190					Same as above (185 ft); slight decrease in medium to coarse sand content; no odor.	SW		
195					Poorly graded SAND (SP); reddish brown (5YR 5/4); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine gravel to 0.7cm; subrounded; no odor.			
200					Same as above (195 ft); 100% very fine sand; trace fine sand; no odor.	SP		
205					Sandy lean CLAY (CL); brown (10YR 4/3); dry to moist; stiff; low to medium plasticity; 70% clay; trace silt; 30% very fine to coarse sand; subrounded; no odor.	CL		
210					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to	SP		Kelly down @ 1438. New 20' connection @ 1444. Resumed drilling @ 1445.



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/20/2011  
Date TD Reached: 6/22/2011  
Date Completed: 6/24/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

Ground Elevation AMSL (ft): 5325.1  
Y Coordinate: 1477303.10  
X Coordinate: 1543757.07

Drilling Contractor: WDC Exploration and Wells  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					medium sand; trace coarse sand; subrounded; no odor.	SP		
215					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); dry; dense; 85% very fine to coarse sand; subrounded; 15% fine gravel to 1cm; subrounded; no odor.	SW		
220					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; no odor.	SP		
225					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; trace fine gravel to 1.5cm; subrounded; no odor.			
230					Same as above (225 ft); no gravel; no odor.	SW		
235					Same as above (225 ft); 95% very fine to coarse sand; subrounded; 5% fine gravel to 0.8cm; subrounded; no odor.			
240					Poorly graded SAND (SP); pinkish gray	SP		

Kelly down @ 1448. New 20' connection @ 1459. Resumed drilling @ 1500.

High Solids Bentonite Grout



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					(5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium sand; subrounded; no odor.			
245					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium sand; subrounded; no odor.			
250					Same as above (245 ft); 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.	SP		
255					Same as above (245 ft) no odor.		High Solids Bentonite Grout	
260					Lean CLAY (CL); reddish brown (5YR 4/3); dry to moist; stiff; low to medium plasticity; 95% clay; trace silt; 5% very fine sand; trace fine sand; no odor.	CL		
265					Poorly graded SAND (SP); reddish brown (5YR 5/4); dry; dense; 100% very fine to medium sand; trace coarse sand; subrounded; no odor.			
270					Same as above (261 ft); no odor.	SP		Kelly down @ 1524. New 20' connection @ 1534. Resumed drilling @ 1535.



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.82  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			
275					Same as above (270 ft); 95% very fine sand; trace fine sand; 5% silt; no odor.	SP		
280					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
285					Same as above (280 ft); no odor.	SW		
290					Clayey SAND (SC); reddish brown (5YR 4/3); dry; dense; 70% very fine to coarse sand; subrounded; 10% fine to coarse gravel to 2.2cm; subrounded; 20% clay with silt; no odor.	SC		
295					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 100% very fine to coarse sand; subrounded; trace fine gravel to 0.7cm; subrounded; no odor.			
300					Same as above (291 ft); no odor.	SW		

Kelly down @ 1540. New 20' connection @ 1546. Resumed drilling @ 1547.

High Solids Bentonite Grout



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.82  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded SAND (SP); reddish brown (5YR 5/3); dry; dense; 100% very fine to fine sand; trace medium sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; no odor.			Kelly down @ 1552. New 20' connection @ 1607. Resumed drilling @ 1607.
305					Same as above (300 ft); no odor.	SP		
310					Same as above (300 ft); 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine to coarse gravel to 2.5cm; subrounded; no odor.			
315					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 95% very fine to coarse sand; subrounded; 5% fine to coarse gravel to 2cm; subrounded; no odor.			
320					Same as above (315 ft); no odor.	SW	High Solids Bentonite Grout	Kelly down @ 1614. New 20' connection @ 1620. Resumed drilling @ 1621.
325					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to medium sand; trace coarse sand; subrounded; trace fine to coarse gravel to 2.5cm; subrounded; no odor.	SP		
330								



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.82  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry dense; 100% very fine to fine sand; no odor.			
335					Same as above (330 ft); no odor.			
340					Same as above (330 ft); 100% very fine to medium sand; trace coarse sand; subrounded; no odor.	SP		Kelly down @ 1629. New 20' connection @ 1638. Resumed drilling @ 1639.
345					Same as above (330 ft); 100% very fine to medium sand; trace coarse sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; no odor.		High Solids Bentonite Grout	
350					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
355					Same as above (350 ft); 100% very fine to coarse sand; trace fine gravel to 1.5cm; subrounded; no odor.	SW		
360								





# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 470.82  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 95% very fine to coarse sand; subrounded; 5% fine gravel to 0.8cm; subrounded; no odor.	SW		Kelly down @ 1647. New 20' connection @ 1652. Resumed drilling @ 1652.
365					Poorly graded SAND (SP); reddish brown (5YR 5/3); dry; dense; 100% very fine to fine sand; trace fine to coarse gravel to 2.5cm; subrounded; no odor.	SP		
370					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 100% very fine to coarse sand; subrounded; trace fine gravel to 0.5cm; subrounded; no odor.			
375					Same as above (370 ft); no odor.			
380					Same as above (370 ft); no odor.	SW		Kelly down @ 1659. New 20' connection @ 1705. End of 6/21/11. Resumed drilling @ 0928 on 6/22/11.
385					Same as above (370 ft); 100% very fine to coarse sand; subrounded; no gravel; no odor.			
390								



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 470.82  
▼ **At End of Drilling:** Not Recorded  
▼ **After Drilling:** 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
395					Same as above (390 ft); slight decrease in medium to coarse sand; no odor.			
400					Same as above (390 ft); 100% very fine to coarse sand; subrounded; trace fine gravel to 1cm; subrounded; no odor.	SW		
405					Same as above (390 ft); no gravel; no odor.		High Solids Bentonite Grout	
410					Lean CLAY (CL); dark reddish brown (5YR 3/3); moist; stiff; low to medium plasticity; 95% clay; trace silt; 5% very fine sand; trace fine sand; no odor.	CL		
415					Same as above (409 ft); reddish brown (5YR 4/3); no odor.			
					SILT (ML); reddish brown (5YR 5/4); dry to moist; stiff; 90% silt; 10% very fine sand; trace fine sand; no odor.	ML		
420								

Kelly down @ 0938. New 20' connection @ 0947. Resumed drilling @ 0948.



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); reddish brown (5YR 5/3); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			Kelly down @ 0958. New 20' connection @ 1003. Resumed drilling @ 1004.
425					Same as above (420 ft); no odor.	SP	- High Solids Bentonite Grout	
430					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 100% very fine to coarse sand; subrounded; trace fine gravel to 0.5cm; subrounded; no odor.			
435					Same as above (430 ft); slight decrease in medium to coarse sand content; no odor.	SW	- Top of Bentonite Seal	
440					Poorly graded SAND (SP); reddish gray (5YR 5/2); dry; dense; 100% medium sand; trace fine and coarse sand; subangular to subrounded; no odor.			Kelly down @ 1016. New 20' connection @ 1021. Resumed drilling @ 1042.
445					Same as above (440 ft); no odor.	SP		Driller added water to control dust and aid rate of penetration. Note: added water may remove fine grained fraction from samples.
450								



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND (SP); reddish gray (5YR 5/2); dry; dense; 100% medium sand; trace fine sand; subangular to subrounded; no odor.			
455					Same as above (450 ft); 95% medium to coarse sand; trace fine sand; subangular to subrounded; 5% fine gravel to 1.2cm; subangular to subrounded; no odor.	SP	- Top of 5" Schedule 80 PVC Riser  - Bentonite Seal	
460					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 90% very fine to coarse sand; subrounded; 10% fine to coarse gravel to 2cm; subrounded; no odor.	SW	- Top of 20/40 Sand - Top of 10/20 Sand	Kelly down @ 1056. New 20' connection @ 1104. Resumed drilling @ 1105.
465					Poorly graded SAND (SP); reddish brown (5YR 5/3); dry; dense; 100% very fine to fine sand; trace medium sand; subrounded; no odor.		- Top of 5" Schedule 80 PVC 0.010" Slot Screen	
470					▼ Same as above (464 ft); 100% very fine to fine sand; no odor.	SP		Encountered groundwater while drilling.
475					Same as above (464 ft); no odor.			
480								



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/20/2011  
**Date TD Reached:** 6/22/2011  
**Date Completed:** 6/24/2011

**Ground Elevation AMSL (ft):** 5325.1  
**Y Coordinate:** 1477303.10  
**X Coordinate:** 1543757.07

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well graded SAND (SW); reddish gray (5YR 5/3); moist; dense; 100% very fine to coarse sand; subrounded; trace fine gravel to 0.7cm; subrounded; no odor.			Kelly down @ 1117. New 20' connection @ 1242. Resumed drilling @ 1245.
485					Same as above (480 ft); 95% very fine to coarse sand; subrounded; 5% fine to coarse gravel to 2cm; subrounded; no odor.			
490					Well graded SAND with Gravel (SW); reddish gray (5YR 5/3); wet; dense; 80% fine to coarse sand; subrounded; 20% fine to coarse gravel to 2cm; subrounded; no odor.	SW		
495					Same as above (490 ft); 85% fine to coarse sand; subrounded; 15% fine gravel to 1.2cm; subrounded; no odor.			
500								Total depth = 500 ft. Reached @ 1305 on 6/22/11.
505								Water added during drilling (gallons) = 150
								Water added after drilling (gallons) = 150
510								Water added during



# Borehole ID: KAFB-106055

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/20/2011  
Date TD Reached: 6/22/2011  
Date Completed: 6/24/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 470.82  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.75

Ground Elevation AMSL (ft): 5325.1  
Y Coordinate: 1477303.10  
X Coordinate: 1543757.07

Drilling Contractor: WDC Exploration and Wells  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 18 of 18

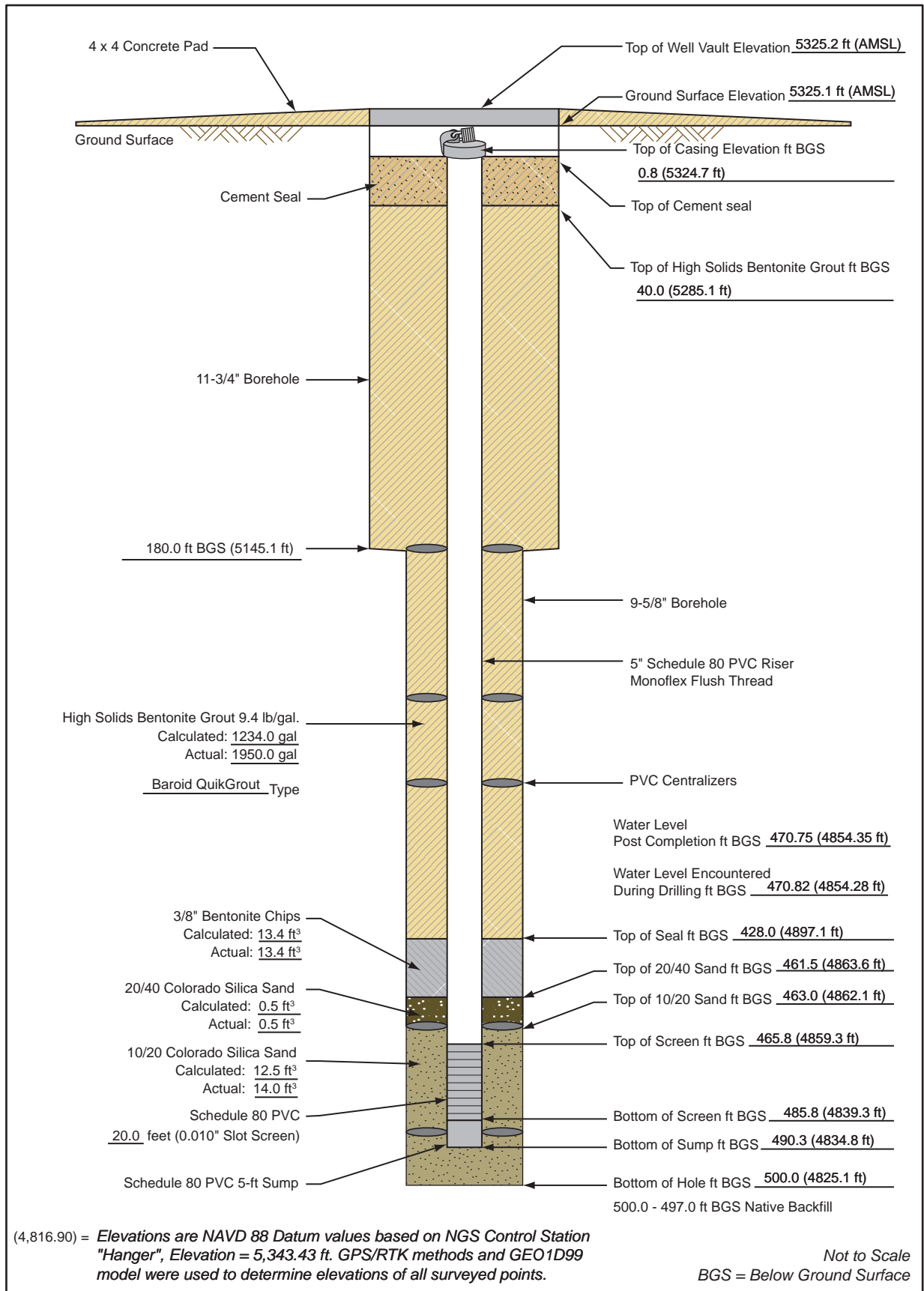
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								construction (gallons) = 40
515								Spud: started drilling from surface.
520								Kelly down: TD the joint and ready to make new connection.
525								
530								
535								
540								



# Monitoring Well Completion Diagram KAFB-106055

Installation Start Date/Time: 6/22/2011 @ 15:15

Installation End Date/Time: 6/24/2011 @ 15:00



## Well Development Record

**Project Name:** KAFB BFF

**Location:** GW-10

**Personnel:** V. Bracht

**Date:** 8/8/11

**Samplers:** V. Bracht

**Well/Piez. No.:** 106055

**Date Installed:** 6/24/11

**Csg. Diameter (I.D.):** 5"

**Total Depth (ft. BGL):** 490.26

**Method of Development:**

☒ Surging

☐ Bailing

☐ Pumping

☐ Original Development

☐ Redevelopment

☐ Other

**Development Date:** 8/8/11 - 8/9/11

**Depth to Water Before Developing Well (ft. BGL):** 471.45, 470.91 (TOC)

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:** 18.81 feet = 345.45 gal. \* 1 = 345.45

$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 345.45$  gallons

**Depth Purging From:** 479.2 feet

**Time Purging Begins:** 0820, 8/9/11

**Weather:** Sunny, Breezy, Warm

**Screened Interval (ft BGL):** 465.82 - 484.82

**Equipment Nos.:**      **pH Meter:** YSI 36952

**EC Meter:** YSI 36952

**Turbidity Meter:** LVE 002384

**Equipment Decontaminated Prior to Development:** Y ☒ N ☐

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y ☐ N ☒

**Describe:** N/A

**Comment:** 300 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/8/2011	1210	470.91	10	21.65	5.65	0.451	756.00	Begin Bailing; Water is Brown
8/8/2011	1220	--	50	--	--	--	--	Bailed
8/8/2011	1225	--	--	--	--	--	--	Begin Swabbing
8/8/2011	1235	--	--	--	--	--	--	Stop Swabbing; Begin Bailing
8/8/2011	1255	--	100	--	--	--	--	Bailed
8/9/2011	0820	470.97	--	--	--	--	--	Begin Pumping at 5 GPM
8/9/2011	0825	471.88	--	18.93	5.41	0.426	235.00	Continue Pumping; Cloudy
8/9/2011	0830	471.93	125	20.18	5.33	0.415	72.60	Continue Pumping; Cloudy
8/9/2011	0835	471.96	150	20.44	5.21	0.417	23.30	Continue Pumping; Slightly Cloudy
8/9/2011	0840	471.97	175	20.54	5.31	0.420	7.47	Continue Pumping; Clear

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1C

\* Turbidity report in NTU nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

$\phi_s$ = porosity of the sand pack

$r_c$ = radius of the well casing and screen in feet

$L_c$ = length of water column inside the casing and screen in feet

$r_w$ = radius of the well bore in feet

$L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

Project: KAFB BFF

Well No: 106055

Project Number: 140705

Samplers: V. Bracht

Date: 8/9/11

Checked By: \_\_\_\_\_

Time Start: 1210, 8/8/11

Time Finish: 0915, 8/9/11

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/9/2011	0845	471.98	200	20.54	5.45	0.420	3.78	Continue Pumping; Clear
8/9/2011	0850	471.99	225	20.57	5.48	0.420	2.90	Continue Pumping; Clear
8/9/2011	0855	472.00	250	20.54	5.54	0.421	2.20	Continue Pumping; Clear
8/9/2011	0900	472.01	275	20.59	5.56	0.421	1.97	Continue Pumping; Clear
8/9/2011	0905	472.02	300	20.59	5.57	0.421	1.93	Continue Pumping; Clear
8/9/2011	0910	472.02	325	20.60	5.54	0.420	1.64	Continue Pumping; Clear
8/9/2011	0915	472.02	350	20.63	5.60	0.420	1.21	Stop Pumping; Clear; Total Removed

Was well sampled after development? YES NO ☒ X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106057



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.80  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Asphalt and fill; no description recorded.			Hand augered.
5					Silty SAND (SM); reddish brown (5YR 5/3); dry; medium dense; 75% very fine to medium sand; trace coarse sand; subangular; 25% silt; trace clay; no odor			***Note: no headspace requirement at this location.***
10					Same as above (0.5 ft); reddish brown (5YR 4/3); 70% very fine to fine sand; trace medium to coarse sand; 30% silt with minor clay; no odor.	SM		Spud @ 1437 on 6/15/11.
15					Same as above (0.5 ft); no odor.			
20					Lean CLAY with Sand (CL); reddish brown (5YR 4/3); dry to moist; stiff; low to medium plasticity; 75% clay as nodules; 25% very fine to coarse sand; subangular; no odor.			
25					Same as above (13 ft); dark reddish brown (5YR 3/3); low plasticity; 85% clay with minor silt; 15% very fine to fine sand; no odor.	CL		Brief discharge of gravel; gravel is predominantly limestone.
30					Same as above (13 ft); no odor.			
					Silty SAND (SM); dark reddish brown (5YR 3/3); dry; dense; 80% very fine to fine sand; trace medium to coarse sand; subangular; 20% silt; trace clay; no odor. Note: thin gravel lenses.	SM		Kelly down @ 1456. New 20' connection @ 1533. Resumed drilling @ 1534.



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

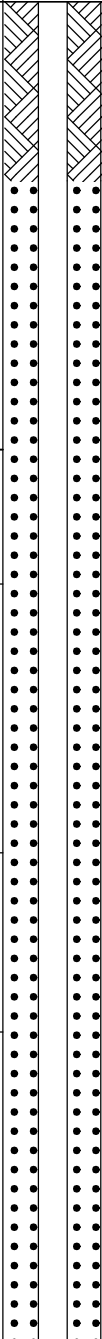
**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Silty SAND (SM); dark reddish brown (5YR 3/3); dry; dense; 80% very fine to fine sand; trace medium to coarse sand; subangular; 20% silt; trace clay; no odor.	SM		Kelly down @ 1555. New 20' connection @ 1607. Resumed drilling @ 1610.
40					Silty SAND (SM); reddish brown (5YR 4/3); dry; dense; 80% very fine to fine sand; trace medium to coarse sand; subangular; 20% silt; trace clay; no odor.	SM		
45					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 95% very fine to coarse sand; subangular; 5% silt; no odor.	SW		
50					SILT with Sand (ML); reddish brown (5YR 4/4); dry; stiff; 85% silt; trace clay; 15% very fine to fine sand; trace medium sand; subangular; no odor.	ML		
55					Well graded SAND (SW); reddish brown (5YR 4/3); dry; dense; 100% very fine to coarse sand; subangular; no odor.	SW		
60					SILT (ML); reddish brown (5YR 5/4); dry; stiff; 90% silt; trace clay; 10% very fine sand; trace fine to medium sand; subangular; no odor.	ML		





# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.80  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 3 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Silty SAND (SM); reddish brown (5YR 4/4); dry; dense; 80% very fine to fine sand; trace medium to coarse sand; subangular; 20% silt; trace clay; no odor.			Kelly down @ 1633. New 20' connection @ 1637. Resumed drilling @ 1638.
65					Same as above (60 ft); 70% very fine to fine sand; 30% silt; no odor.	SM		
70					Same as above (60 ft); 80% very fine to coarse sand; subangular; 20% silt with minor clay; no odor.			
75								
80					SILT with Sand (ML); reddish brown (5YR 4/4); dry; stiff; 85% silt; trace clay; 15% very fine sand; trace fine to medium sand; subangular; no odor.	ML	High Solids Bentonite Grout	
85					Poorly graded SAND (SP); reddish brown (5YR 4/4); dry; dense; 95% very fine to medium sand; trace coarse sand; subangular; 5% silt; no odor.	SP		Kelly down @ 1657. New 20' connection @ 1701. End of 6/15/11. Resumed drilling @ 0852 on 6/16/11.
90					Well graded SAND (SW); reddish brown (5YR 4/4); dry; dense; 95% very fine to coarse sand; subangular to subrounded; 5% silt; no odor.	SW		



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/15/2011  
Date TD Reached: 6/17/2011  
Date Completed: 6/19/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

Ground Elevation AMSL (ft): 5325.5  
Y Coordinate: 1477302.04  
X Coordinate: 1543786.27

Drilling Contractor: WDC Exploration and Wells  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Well graded SAND (SW); reddish brown (5YR 4/4); dry; dense; 95% very fine to coarse sand; subangular to subrounded; trace fine gravel to 0.5cm; subangular to subrounded; 5% silt; no odor.	SW		
100					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 95% medium to coarse sand; trace very fine to fine sand; subangular to subrounded; 5% fine gravel to 1.2cm; subangular to subrounded; no odor.	SP		
105					Clayey SAND (SC); yellowish red (5YR 4/6); dry to moist; dense; 80% very fine to coarse sand; subangular to subrounded; trace fine gravel to 1.5cm; subrounded; 20% clay with minor silt; no odor.	SC		
110					SILT (ML); yellowish red (5YR 4/6); dry to moist; stiff; 90% silt; trace clay; 10% very fine to medium sand; trace coarse sand; subangular; no odor.			
115					SILT with Sand (ML); yellowish red (5YR 4/6); dry to moist; stiff; 85% silt; trace clay; 15% very fine to medium sand; trace coarse sand; subangular; no odor.	ML		
120					Same as above (110 ft); no odor.			

Kelly down @ 0900. New 20' connection @ 0912. Resumed drilling @ 0913.

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					SILT with Sand (ML); yellowish red (5YR 4/6); dry to moist; stiff; 85% silt; trace clay; 15% very fine to medium sand; trace coarse sand; subangular; no odor.			Kelly down @ 0918. New 20' connection @ 0941. Resumed drilling @ 0942.
125					SILT (ML); yellowish red (5YR 4/6); dry to moist; stiff; 90% silt; trace clay; 10% very fine to fine sand; trace medium to coarse sand; subangular; no odor.			
130					Same as above (125 ft); 95% silt with minor clay; 5% very fine to fine sand; trace medium sand; subangular; no odor.	ML		
135					Same as above (125 ft); no odor.			
140					Same as above (125 ft); no odor.			
145					Clayey SAND (SC); dark reddish brown (5YR 3/3); dry to moist; dense; 70% very fine to fine sand; trace medium sand; subangular; 30% clay with minor silt; no odor.	SC		
					Poorly graded SAND with Silt (SP-SM); reddish brown (5YR 4/3); dry; dense; 90% very fine to fine sand; trace medium sand; subangular; 10% silt; no odor.	SP-SM		
150					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium;	SP		Kelly down @ 0950. New 20' connection @ 0958. Resumed drilling @ 0959.



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					subrounded; no odor.			Approximate top of Santa Fe Group.
155					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium sand; subrounded; no odor.			
160					Same as above (155 ft); trace medium to coarse sand; subrounded; no odor.			Kelly down @ 1007. New 20' connection @ 1013. Resumed drilling @ 1017.
165					Same as above (155 ft); no odor.	SP	High Solids Bentonite Grout	
170					Same as above (155 ft); no odor.			
175					Same as above (155 ft); no odor.			
180								



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.80  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			Total depth with 11-3/4" casing @ 1032. New 20' connection @ 1349. Resumed drilling with 9-5/8" casing @ 1350.
185					Same as above (180 ft); 100% medium to coarse sand; trace very fine to fine sand; subrounded; no odor.	SP		
190					Same as above (180 ft); no odor.			
195					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.	SW	High Solids Bentonite Grout	
200					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			Kelly down @ 1400. New 20' connection @ 1409. Resumed drilling @ 1410.
205					Same as above (200 ft); 100% very fine sand; trace fine sand; no odor.	SP		
210								



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND with Gravel (SP); light reddish brown (5YR 6/3); dry; dense; 80% very fine to fine sand; 20% fine gravel to 1cm; subrounded; no odor.	SP		
215					Clayey SAND with Gravel (SC); reddish brown (5YR 4/3); dry to moist; dense; 70% very fine to coarse sand; subrounded; 15% fine gravel to 1.5cm; subrounded; 15% clay with minor silt; no odor.	SC		
220					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 95% very fine to coarse sand; subrounded; 5% clay with silt; no odor.			
225					Same as above (217 ft); 100% sand; trace fine gravel to 1.2cm; subrounded; no odor.			
230					Same as above (217 ft); no odor.	SW		
235					Same as above (217 ft); no odor.			
240								

Kelly down @ 1422. New 20' connection @ 1428. Resumed drilling @ 1429.

- High Solids Bentonite Grout





# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.80  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 95% very fine to coarse sand; subrounded; 5% fine gravel to 0.5cm; subrounded; no odor.	SW		Kelly down @ 1434. New 20' connection @ 1441. Resumed drilling @ 1442.
245					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium sand; subrounded; trace coarse gravel to 2.5cm; subrounded; no odor.	SP		
250					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; trace coarse gravel to 3cm; subrounded; no odor.	SW		
255					Same as above (250 ft); no odor.	SW		
260					Poorly graded SAND (SP); pinkish gray (5YR 5/2); dry; dense; 100% very fine to fine sand; no odor.	SP		Kelly down @ 1446. New 20' connection @ 1452. Resumed drilling @ 1456.
265					Same as above (258 ft); 95% very fine sand; trace fine sand; 5% silt; no odor.	SP		
270								



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP); pinkish gray (5YR 5/2); dry; dense; 100% very fine to fine sand; no odor.			
275					Same as above (270 ft); 100% very fine sand; trace fine sand; no odor.	SP		
280					Lean CLAY (CL); reddish brown (5YR 4/3); moist; stiff; low to medium plasticity; 95% clay; trace silt; 5% very fine sand; no odor.	CL		
285					SILT (ML); light reddish brown (5YR 6/3); dry; stiff; 95% silt; 5% very fine to fine sand; trace medium sand; subrounded; no odor.			
290					Same as above (281 ft); no odor.	ML		
295					Clayey GRAVEL (GC); dark reddish brown (5YR 3/3); dry to moist; dense; 70% fine to coarse gravel to 2cm; subrounded; 10% very fine to coarse sand; subangular; 20% clay with minor silt; no odor.	GC		
300					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to medium sand; trace coarse sand;	SP		

Kelly down @ 1505. New 20' connection @ 1512. Resumed drilling @ 1513.

High Solids Bentonite Grout



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					subrounded; no odor.			Kelly down @ 1530. New 20' connection @ 1535. Resumed drilling @ 1536.
305					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to medium sand; trace coarse sand; subrounded; no odor.	SP		
310					Same as above (305 ft); no odor.			
315					Same as above (305 ft); no odor.			
320					Well graded SAND (SW); dark reddish brown (5YR 3/3); dry to moist; dense; 95% very fine to coarse sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; 5% clay; trace silt; no odor. Note: clay and silt coating on gravel.	SW		Kelly down @ 1544. New 20' connection @ 1552. Resumed drilling @ 1554.
325					Same as above (317 ft); 100% very fine to coarse sand; subrounded; trace fine to coarse gravel to 2.5cm; subrounded; no odor.			
330								



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/15/2011  
Date TD Reached: 6/17/2011  
Date Completed: 6/19/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

Ground Elevation AMSL (ft): 5325.5  
Y Coordinate: 1477302.04  
X Coordinate: 1543786.27

Drilling Contractor: WDC Exploration and Wells  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			
335					Same as above (330 ft); no odor.	SP		
340					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
345					Same as above (340 ft); no odor.			
350					Same as above (340 ft); slight decrease in medium to coarse sand content; no odor.	SW		
355					Same as above (340 ft); no odor.			
360								

Kelly down @ 1602. New 20' connection @ 1608. Resumed drilling.

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); light reddish gray (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
365					Same as above (360 ft); slight decrease in medium to coarse sand content; no odor.	SW		
370					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.	SP		
375					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
380					Same as above (375 ft); 90% very fine to coarse sand; subrounded; 10% fine gravel to 1cm; subrounded; no odor.	SW	High Solids Bentonite Grout	
385					Same as above (375 ft); no odor.			
390								

Kelly down @ 1615. New 20' connection @ 1621. Resumed drilling @ 1622.

Kelly down @ 1629. New 20' connection @ 1633. Resumed drilling @ 1634.



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.	SW		
395					Poorly graded SAND (SP); reddish brown (5YR 5/3); dry; dense; 100% very fine to medium sand; trace coarse sand; subrounded; no odor.			
400					Same as above (395 ft); 100% very fine to fine sand; trace medium sand; subrounded; no odor.	SP		
405					Same as above (395 ft); no odor.			
410					Sandy lean CLAY (CL); reddish brown (5YR 4/3); dry to moist; stiff; low to medium plasticity; 70% clay; trace silt; 30% very fine to fine sand; no odor.	CL		
415					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 95% very fine sand; trace fine sand; 5% silt; no odor.			
420					Same as above (411 ft).	SP		

Kelly down @ 1642. End of 6/16/11. New 20' connection @ 0915 on 6/17/11. Resumed drilling @ 0916.

High Solids Bentonite Grout





# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine sand; trace fine sand; no odor.			Kelly down @ 0928. New 20' connection @ 0936. Resumed drilling @ 0937.
425					Same as above (420 ft); 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			
430					Same as above (420 ft); no odor.	SP	High Solids Bentonite Grout	
435					Same as above (420 ft); 100% very fine to medium sand; trace coarse sand; subrounded; no odor.			
440					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			Kelly down @ 0950. New 20' connection @ 0956. Resumed drilling @ 0956.
445					Same as above (440 ft); 100% sand; trace fine gravel to 0.8cm; subrounded; no odor.	SW	Top of Bentonite Seal	
450								



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.80  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 95% very fine to coarse sand; subrounded; 5% fine to coarse gravel to 3cm; subrounded; no odor.			
455					Same as above (450 ft); no odor.	SW		
460					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 95% very fine to fine sand; trace medium to coarse sand; subrounded; 5% fine gravel to 2cm; subrounded; no odor.			Kelly down @ 1019. New 20' connection @ 1028. Resumed drilling @ 1029.
465					Same as above (460 ft); 100% very fine to medium sand; trace coarse sand; subrounded; trace fine gravel to 0.5cm; subrounded; no odor.		- Bentonite Seal	
470					▼ Same as above (460 ft); reddish brown (5YR 5/4); 100% very fine to fine sand; ▽ trace medium sand; subrounded; no odor. Note: color change at top of water table; slight "oily" feel from sand; no noticable odor.	SP		Stopped drilling due to problems with hammer @ 1040. Hammer repaired; resumed drilling @ 1313.
475					Same as above (460 ft); no odor.		- 5" Schedule 80 PVC Riser	
480								



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

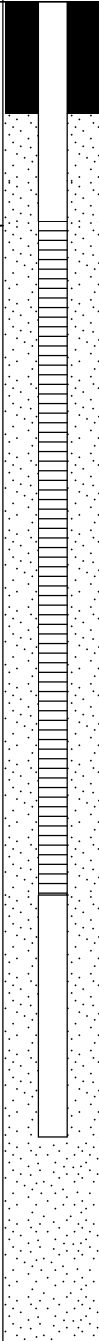

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.80  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); light reddish brown (5YR 6/3); moist; dense; 100% very fine to fine sand; trace medium sand; subrounded; no odor.	SP		Kelly down @ 1317. New 20' connection @ 1325. Resumed drilling @ 1326.
485					Well graded SAND (SW); reddish brown (5YR 4/3); dry to moist; dense; 95% very fine to coarse sand; subrounded; 5% fine gravel to 0.8cm; subrounded; no odor.			
490					Same as above (485 ft); 90% very fine to coarse sand; subrounded; 10% fine gravel to 2.5cm; subrounded; no odor.			
495					Same as above (485 ft); 90% sand; 10% fine gravel to 1.5cm; subrounded; no odor.	SW		
500					Well graded SAND with Gravel (SW); reddish brown (5YR 4/3); moist; dense; 85% very fine to coarse sand; subrounded; 15% fine to coarse gravel to 2cm; subrounded; no odor.			Kelly down @ 1343. New 20' connection @ 1543. Resumed drilling @ 1548.
505					Same as above (500 ft); no odor.			
510								



# Borehole ID: KAFB-106057

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/15/2011  
**Date TD Reached:** 6/17/2011  
**Date Completed:** 6/19/2011

**Ground Elevation AMSL (ft):** 5325.5  
**Y Coordinate:** 1477302.04  
**X Coordinate:** 1543786.27

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.80  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.61

**Drilling Contractor:** WDC Exploration and Wells  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

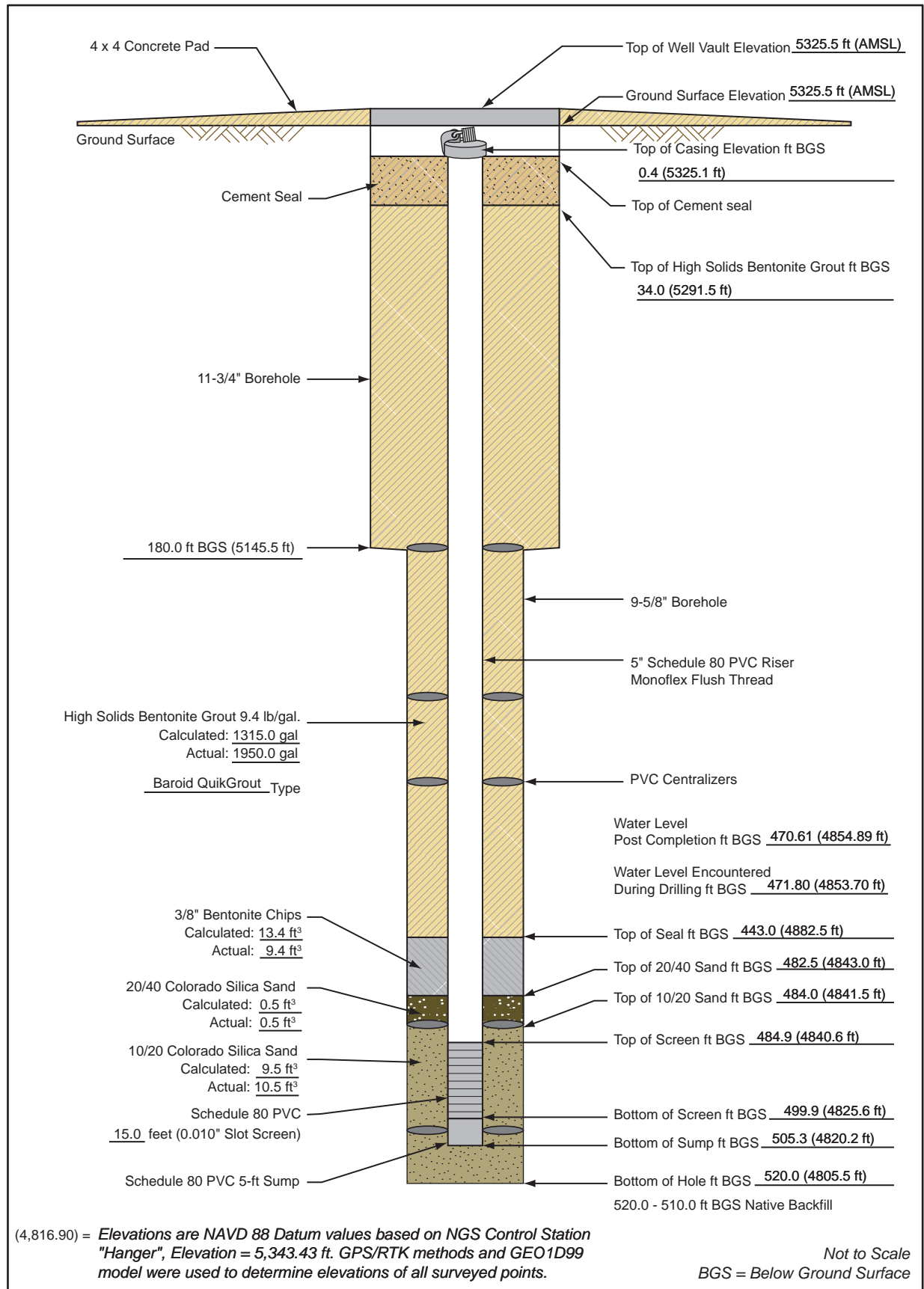
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								
515					Well graded SAND with Gravel (SW); reddish brown (5YR 4/3); moist; dense; 85% very fine to coarse sand; subrounded; 15% fine to coarse gravel to 2.2cm; subrounded; no odor.		Bottom of Filter Pack	
520					Well graded SAND (SW); reddish brown (5YR 4/3); moist; dense; 90% very fine to coarse sand; subrounded; 10% fine gravel to 1cm; subrounded; no odor.	SW	Native Backfill	
525								Total depth = 520 ft. Reached @ 1615 on 6/17/11.
530								Water added during drilling (gallons) = 200
535								Water added after drilling (gallons) = 200
								Water added during construction (gallons) = 40
								Spud: started drilling from surface.
								Kelly down: TD the joint and ready to make new connection.
540								

# Monitoring Well Completion Diagram KAFB-106057

Installation Start Date/Time: 6/18/2011 @ 08:37

Installation End Date/Time: 6/19/2011 @ 16:15



## Well Development Record

**Project Name:** KAFB BFF

**Location:** GW-10

**Personnel:** V. Bracht

**Date:** 8/2/11

**Samplers:** V. Bracht

**Well/Piez. No.:** 106057

**Date Installed:** 6/19/11

**Csg. Diameter (I.D.):** 5"

**Total Depth (ft. BGL):** 505.34

**Method of Development:**

☒ Surging

☐ Bailing

☐ Pumping

☐ Original Development

☐ Redevelopment

☐ Other

**Development Date:** 8/2/11

**Depth to Water Before Developing Well (ft. BGL):** 471.78, 471.36 (TOC)

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:** 33.56 feet = 455.09 gal. \* 1 = 455.09

$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 455.09$  gallons

**Depth Purging From:** 493.3 feet

**Time Purging Begins:** 1505, 8/2/11

**Weather:** Warm, Breezy, Partly Cloudy

**Screened Interval (ft BGL):** 486.17 - 499.94

**Equipment Nos.:** pH Meter: YSI 36952

**EC Meter:** YSI 36952

**Turbidity Meter:** LVE 002384

**Equipment Decontaminated Prior to Development:** Y ☒ N ☐

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y ☐ N ☒

**Describe:** N/A

**Comment:** 400 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/2/2011	1245	471.36	10	23.62	6.08	0.399	193.00	Bailing; Water is Very Cloudy
8/2/2011	1255	--	50	--	--	--	--	Bailed; Muddy Brown
8/2/2011	1300	--	--	--	--	--	--	Begin Swabbing
8/2/2011	1320	--	--	--	--	--	--	Stop Swabbing
8/2/2011	1340	--	100	--	--	--	--	Bailed
8/2/2011	1510	472.50	--	--	--	--	--	Begin Pumping at 5 GPM
8/2/2011	1515	472.10	125	20.87	6.12	0.400	701.00	Continue Pumping; Very Cloudy
8/2/2011	1520	472.12	150	20.78	7.83	0.400	281.00	Continue Pumping; Cloudy
8/2/2011	1525	472.11	170	21.43	7.77	0.400	226.00	Continue Pumping; Cloudy
8/2/2011	1530	472.12	190	21.41	7.66	0.400	137.00	Continue Pumping; Cloudy

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1°C

\* Turbidity report in NTU nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

$\phi_s$ = porosity of the sand pack

$r_c$ = radius of the well casing and screen in feet

$L_c$ = length of water column inside the casing and screen in feet

$r_w$ = radius of the well bore in feet

$L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFF

Well No: 106057

Project Number: 140705

Samplers: V. Bracht

Date: 8/2/11

Checked By: \_\_\_\_\_

Time Start: 1245, 8/2/11

Time Finish: 1635, 8/2/11

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/2/2011	1535	472.12	210	21.41	7.59	0.401	180.00	Continue Pumping; Cloudy
8/2/2011	1540	472.11	240	21.30	7.56	0.401	101.00	Continue Pumping; Cloudy
8/2/2011	1545	472.11	260	21.23	7.57	0.401	76.80	Continue Pumping; Cloudy
8/2/2011	1550	472.11	280	21.26	7.44	0.402	67.50	Continue Pumping; Cloudy
8/2/2011	1555	472.11	310	21.33	7.33	0.401	52.80	Continue Pumping; Cloudy
8/2/2011	1600	472.12	335	21.31	7.31	0.401	42.80	Continue Pumping; Cloudy
8/2/2011	1605	472.11	360	21.32	7.21	0.401	35.10	Continue Pumping; Cloudy
8/2/2011	1610	472.11	385	21.27	7.27	0.401	30.00	Continue Pumping; Cloudy
8/2/2011	1615	472.11	410	21.43	7.08	0.401	18.80	Continue Pumping; Slightly Cloudy
8/2/2011	1620	472.11	435	21.43	7.01	0.401	12.50	Continue Pumping; Slightly Cloudy
8/2/2011	1625	472.11	460	21.45	6.99	0.400	7.23	Continue Pumping; Clear
8/2/2011	1630	472.11	485	21.34	6.93	0.401	4.75	Continue Pumping; Clear
8/2/2011	1635	472.10	510	21.36	7.00	0.400	4.38	Stop Pumping; Clear; Total Removed

Was well sampled after development? YES NO ☒ X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106058



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 1 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Asphalt; no description recorded.			Hand augered.
5					Sandy lean CLAY (CL); dark reddish brown (5YR 3/2); moist; stiff; low plasticity; 65% clay with silt; 30% very fine to coarse sand; subangular; 5% fine gravel to 5mm; subrounded; no odor.			***Note: no headspace requirement at this location.***
					Same as above (0.5 ft); no odor.			Spud @ 1014 on 6/6/11.
10					Same as above (0.5 ft); no odor.			
15					Lean CLAY with Sand (CL); reddish brown (5YR 4/4); dry to moist; stiff; low plasticity; 85% clay with silt; 15% very fine to fine sand; no odor.	CL	Cement Seal	
20					Sandy lean CLAY (CL); reddish brown (5YR 4/4); dry to moist; stiff; low plasticity; 70% clay with silt; 30% very fine to coarse sand; subangular; no odor.			
25					Clayey SAND (SC); reddish brown (5YR 4/4); dry to moist; dense; 75% very fine to fine sand; trace medium to coarse sand; subangular; 25% clay with silt; no odor.	SC		
					Poorly graded SAND (SP); reddish brown (5YR 5/4); dry; dense; 95% very	SP		
30								Kelly down @ 1027. New 20' connection @ 1032. Resumed drilling @ 1037.



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.17  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 2 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					fine to fine sand; trace medium to coarse sand; subangular to subrounded; 5% silt; no odor.	SP		
40					Well graded SAND (SW); reddish brown (5YR 5/4); dry; dense; 100% very fine to coarse sand; subangular; no odor.	SW	Cement Seal	
45					Well graded SAND with Silt (SW-SM); reddish brown (5YR 5/4); dry; dense; 90% very fine to coarse sand; subangular; 10% silt with clay; no odor.	SW-SM	Top of High Solids Bentonite Grout	Kelly down @ 1057. New 20' connection @ 1108. Resumed drilling @ 1115.
50					Well graded SAND (SW); reddish brown (5YR 5/4); dry; dense; 100% very fine to coarse sand; subangular; no odor.	SW		
55					Same as above (45 ft); 100% fine to coarse sand; no odor. Note: minor silt and clay coating on sand.	SW		Rig chatter @ 49'.
60					SILT with Sand (ML); reddish brown (5YR 4/4); dry to moist; stiff; 80% silt with minor clay; 20% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	ML		



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 3 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60								
65					Well graded SAND (SW); reddish brown (5YR 4/3); dry to moist; dense; 95% very fine to coarse sand; subangular to subrounded; trace fine gravel to 5mm; subrounded; 5% clay with minor silt; no odor.	SW		Kelly down @ 1136. New 20' connection @ 1217. Resumed drilling @ 1222.
70					Silty SAND (SM); reddish brown (5YR 4/3); dry to moist; dense; 65% very fine to coarse sand; subangular to subrounded; 35% silt with minor clay; no odor.	SM		
75					SILT (ML); yellowish red (5YR 4/6); dry; stiff; 95% silt; trace clay; 5% very fine to fine sand; no odor.	ML		
80					Silty SAND (SM); yellowish red (5YR 4/6); dry; dense; 85% very fine to coarse sand; subangular; 15% silt; trace clay; no odor.	SM	High Solids Bentonite Grout	Kelly down @ 1235. New 20' connection @ 1242. Resumed drilling @ 1244.
85					Well graded SAND with Silt (SW-SM); reddish brown (5YR 4/4); dry; dense; 90% very fine to coarse sand; subangular; 10% silt; trace clay; no odor.	SW-SM		
90					Well graded SAND (SW); reddish brown (5YR 4/4); dry; dense; 95% very fine to coarse sand; subangular; trace fine gravel to 1cm; subangular; 5% silt; trace clay; no odor.	SW		



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 4 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well graded SAND (SW); reddish brown (5YR 4/4); dry; dense; 95% very fine to coarse sand; subangular; 5% silt; trace clay; no odor.			
95					Same as above (90 ft); no odor.	SW		
100					SILT with Sand (ML); reddish brown (5YR 5/4); dry; stiff; 80% silt; trace clay; 20% very fine to coarse sand; subangular; trace fine to coarse gravel to 2cm; subangular to subrounded; no odor.			
105					Same as above (98 ft); 75% silt; trace clay; 25% sand; trace fine gravel to 1.2cm; subangular; no odor.			
110					Same as above (98 ft); 80% silt; trace clay; 20% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	ML		
115					Same as above (98 ft); no odor.			
120					Lean CLAY (CL); reddish brown (5YR	CL		Kelly down @ 1258. New 20' connection @ 1310. Resumed drilling @ 1311.



**Borehole ID: KAFB-106058**

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011


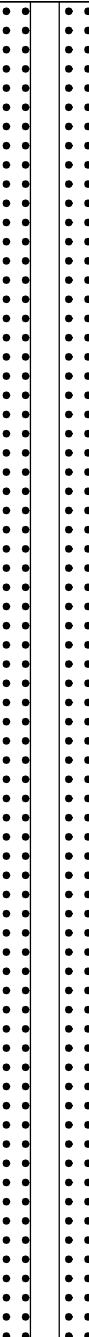

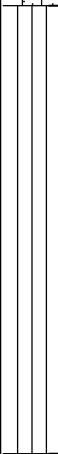
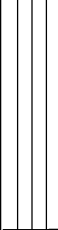


Groundwater Levels BGS (ft):

▽	At Time of Drilling:	471.17
▼	At End of Drilling:	Not Recorded
▼	After Drilling:	471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 5 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120								
					4/4); dry to moist; stiff; low to medium plasticity; 95% clay with minor silt; 5% very fine to fine sand; no odor.	CL	  - High Solids Bentonite Grout	Kelly down @ 1315. New 20' connection @ 1325. Resumed drilling @ 1332.
125					Silty SAND (SM); reddish brown (5YR 5/4); dry; dense; 70% very fine to coarse sand; subangular; 30% silt; trace clay; no odor.	SM		
130					SILT with Sand (ML); reddish brown (5YR 5/4); dry; stiff; 75% silt; trace clay; 25% very fine to fine sand; trace medium to coarse sand; subangular; no odor.	ML		
135					SILT (ML); reddish brown (5YR 5/4); dry; stiff; 90% silt with minor clay; 10% very fine to fine sand; no odor.	ML		
140					No cuttings returned.			Kelly down @ 1346. New 20' connection @ 1540. Resumed drilling @ 1541.
145					No cuttings returned.			
150								



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▽ After Drilling: 471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 6 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
155					Well graded GRAVEL (GW); reddish brown (5YR 4/4); dry; dense; 90% fine to coarse gravel to 2cm; angular to subangular; 5% coarse sand; subangular; 5% clay with minor silt as coating on gravel and sand; no odor.	GW		Sample is from cleaning discharge and is likely not representative.
160					Sandy lean CLAY (CL); reddish brown (5YR 4/4); dry to moist; stiff; low plasticity; 65% clay with silt; 30% very fine to fine sand; trace medium to coarse sand; subangular; 5% fine to coarse gravel to 2.5cm; subangular; no odor.	CL		
165					Well graded SAND (SW); reddish gray (5YR 5/2); dry; dense; 100% very fine to coarse sand; subangular to subrounded; no odor.	SW		Kelly down @ 1550. New 20' connection @ 1608. Resumed drilling @ 1609. Approximate top of Santa Fe Group.
170					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; no odor.		High Solids Bentonite Grout	
175					Same as above (165 ft); 100% very fine to fine sand; trace medium to coarse sand; subangular to subrounded; no odor.	SP		
180					Same as above (165 ft); no odor.			



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 7 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; no odor.	SP		Kelly down @ 1612. Total depth with 11-3/4" casing. End of 6/6/11. New 20' connection with 9-5/8" casing @ 1001 on 6/7/11. Resumed drilling @ 1011.
185					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
190					Same as above (185 ft); slight decrease in medium to coarse sand content; no odor.	SW		
195					Same as above (185 ft); 100% very fine to coarse sand; subrounded; trace fine gravel to 8mm; subrounded; no odor.		High Solids Bentonite Grout	Kelly down @ 1016. New 20' connection @ 1023. Resumed drilling @ 1024.
200					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; no odor.			
205					Same as above (200 ft); 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.	SP		
210								



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 8 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; no odor.			
215					Same as above (210 ft); 100% sand; slight decrease in medium to coarse sand content; no gravel; no odor.	SW		
220					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			
225					Same as above (220 ft); 100% very fine to fine sand; trace medium sand; subrounded; no odor.	SP		
230					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
235					Same as above (228 ft); reddish brown (5YR 5/3); 95% very fine to coarse sand; subangular to subrounded; 5% fine gravel to 1cm; subrounded; no odor.	SW		
240								

Kelly down @ 1033. New 20' connection @ 1052. Resumed drilling @ 1055.

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 9 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 90% very fine to coarse sand; subangular to subrounded; 10% fine to coarse gravel to 2cm; subrounded; no odor.	SW		Kelly down @ 1105. New 20' connection @ 1110. Resumed drilling @ 1115.
245					Same as above (240 ft); 85% very fine to coarse sand; subangular to subrounded; 10% fine to coarse gravel to 2.5cm; subrounded; 5% clay with minor silt as coating on sand and gravel; no odor.			
250					Poorly graded SAND (SP); light reddish brown (5YR 6/3); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine gravel to 1cm; subrounded; no odor.	SP		
255					Same as above (248 ft); no odor.		High Solids Bentonite Grout	
260					SILT (ML); brown (10YR 4/3); dry to moist; stiff; 95% silt; trace clay; 5% very fine to fine sand; no odor.	ML		
					Same as above (257 ft); no odor.			Kelly down @ 1125. New 20' connection @ 1201. Resumed drilling @ 1202.
265					Silty SAND (SM); light reddish brown (5YR 6/3); dry; dense; 70% very fine to medium sand; trace coarse sand; subangular to subrounded; 30% silt; trace clay; no odor.	SM		
270								



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▽ After Drilling: 471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 10 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Silty SAND (SM); light reddish brown (5YR 6/3); dry; dense; 70% very fine to coarse sand; subangular to subrounded; 30% silt; trace clay; no odor.			
275					Same as above (270 ft); no odor.	SM		
280					No cuttings returned.			Discharge hose clogged. Kelly down @ 1210. New 20' connection @ 1213. Resumed drilling @ 1213.
285					No cuttings returned.		High Solids Bentonite Grout	Discharge hose clogged.
290					Clayey SAND (SC); reddish brown (5YR 4/3); dry to moist; dense; 70% very fine to coarse sand; subangular to subrounded; 30% clay with minor silt as coating on sand and as nodules; low to medium plasticity; no odor.	SC		
295					Same as above (290 ft); no odor.			
300					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; no odor.	SW		





# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 11 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			Kelly down @ 1226. New 20' connection @ 1340. Resumed drilling @ 1341.
305					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); dry; dense; 85% very fine to coarse sand; subrounded; 15% fine gravel to 7mm; subrounded; no odor.	SW		
310					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; no odor.	SP		
315					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 95% very fine to coarse sand; subrounded; 5% fine to coarse gravel to 2.2cm; subrounded; no odor.	SW		
320					Same as above (315 ft); 90% very fine to coarse sand; subrounded; 10% fine to coarse gravel to 2cm; subrounded; no odor.	SW		High Solids Bentonite Grout  Kelly down @ 1350. New 20' connection @ 1400. Resumed drilling @ 1401.
325					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; no odor.	SP		
330								





# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

Page 12 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; no odor.			
335					Same as above (330 ft); no odor.			
340					Same as above (330 ft); 100% very fine to medium sand; trace coarse sand; subangular to subrounded; no gravel; no odor.	SP		Kelly down @ 1408. New 20' connection @ 1414. Resumed drilling @ 1415.
345					Same as above (330 ft); slight increase in coarse sand content; no odor.		High Solids Bentonite Grout	
350					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; dense; 95% very fine to coarse sand; subrounded; 5% fine gravel to 8mm; subrounded; no odor.	SW		
355					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine gravel to 5mm; subrounded; no odor.	SP		
360								



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.17  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 13 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; trace fine to coarse gravel to 2.5cm; subrounded; no odor.	SW		Kelly down @ 1422. New 20' connection @ 1430. Resumed drilling @ 1431.
365					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace fine to coarse gravel to 3cm; subrounded; no odor.	SP		
370					Well graded SAND (SW); reddish brown (5YR 5/3); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
375					Same as above (370 ft); no odor.			
380					Same as above (370 ft); no odor.	SW		Kelly down @ 1440. New 20' connection @ 1448. Resumed drilling @ 1448.
385					Same as above (370 ft); slight decrease in medium to coarse sand content; no odor.			
390								



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 14 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine gravel to 1.2cm; subrounded; no odor.			
395					Same as above (390 ft); slight increase in medium to coarse sand content; no odor.			
400					Poorly graded SAND with Gravel (SP); pinkish gray (5YR 6/2); dry; dense; 85% medium to coarse sand; trace very fine to fine sand; angular to subangular; 15% fine to coarse gravel to 2cm; subangular; no odor.	SP		
405					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; trace medium to coarse sand; subrounded; no odor.			
410					Clayey SAND (SC); reddish brown (5YR 5/4); dry to moist; dense; 80% very fine to medium sand; trace coarse sand; subrounded; 20% clay; trace silt; no odor.	SC		
415					Poorly graded SAND (SP); pinkish gray (5YR 7/2); dry; dense; 95% very fine sand; 5% silt; no odor.			
420					Same as above (412 ft); no odor.	SP		

Kelly down @ 1457. New 20' connection @ 1504. Resumed drilling @ 1505.

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 15 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; no odor.			
425					Same as above (420 ft); no odor.			
430					Same as above (420 ft); 100% very fine to fine sand; trace medium sand; subrounded; no odor.	SP		
435					Same as above (420 ft); no odor.		High Solids Bentonite Grout	
440					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; no odor.	SW		
445					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to fine sand; no odor.	SP		
450								

Kelly down @ 1517. New 20' connection @ 1524. Resumed drilling @ 1525.

Kelly down @ 1601. New 20' connection @ 1612. Resumed drilling @ 1613.



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 16 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well graded SAND (SW); pinkish gray (5YR 6/2); dry; dense; 100% very fine to coarse sand; subrounded; no odor.			
455					Same as above (450 ft); 100% very fine to coarse sand; subrounded; trace fine gravel to 7mm; subrounded; no odor.	SW		
460					Poorly graded SAND (SP); pinkish gray (5YR 6/2); dry; dense; 100% very fine to medium sand; trace coarse sand; subrounded; no odor.		High Solids Bentonite Grout	
465					Same as above (460 ft); 100% very fine to fine sand; trace medium to coarse sand; subrounded; trace fine to coarse gravel to 2cm; subrounded; no odor.			
470					Same as above (460 ft); no odor.	SP	Top of Bentonite Seal	
475					Same as above (460 ft); no gravel; no odor.			
480								

Kelly down @ 1627. New 20' connection @ 1638. Resumed drilling @ 1638.



# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 17 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); pinkish gray (5YR 6/2); moist; dense; 100% very fine to fine sand; no odor.			Kelly down @ 1653. End of 6/7/11. New 20' connection @ 0842 on 6/8/11. Resumed drilling @ 0843.
485					Same as above (480 ft); no odor.	SP		
490					Same as above (480 ft); 100% very fine to medium sand; trace coarse sand; subrounded; no odor.		- Bentonite Seal	
495					Well graded SAND (SW); pinkish gray (5YR 6/2); moist; dense; 90% very fine to coarse sand; subrounded; 10% fine gravel to 1.5cm; subrounded; no odor.			
500					Same as above (495 ft); no odor.	SW	- 5" Schedule 80 PVC Riser	Kelly down @ 0907. New 20' connection @ 0931. Resumed drilling @ 0934.
505					Same as above (495 ft); no odor.			
510							- Top of 20/40 Sand - Top of 10/20 Sand	





# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 6/6/2011  
**Date TD Reached:** 6/8/2011  
**Date Completed:** 6/14/2011

**Ground Elevation AMSL (ft):** 5326.1  
**Y Coordinate:** 1477292.74  
**X Coordinate:** 1543818.37

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush mount

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.17  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 471.19

**Drilling Contractor:** WDC Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** Brian Lucero

Page 18 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Well graded SAND with Gravel (SW); pinkish gray (5YR 6/2); wet; dense; 85% very fine to coarse sand; subrounded; 15% fine gravel to 1cm; subrounded; no odor.			
515					Well graded SAND (SW); pinkish gray (5YR 6/2); wet; dense; 95% very fine to coarse sand; subrounded; 5% fine gravel to 8mm; subrounded; no odor.	SW		
520					Well graded SAND with Gravel (SW); pinkish gray (5YR 6/2); wet; dense; 80% very fine to coarse sand; subrounded; 20% fine to coarse gravel to 2.5cm; subrounded; no odor.			
525					Poorly graded SAND (SP); pinkish gray (5YR 6/3); wet; dense; 100% fine to medium sand; trace coarse sand; subrounded; no odor.	SP		
530					Well graded SAND (SW); pinkish gray (5YR 6/2); wet; dense; 100% fine to coarse sand; subrounded; trace fine gravel to 1.5cm; subrounded; no odor.			
535					Same as above (530 ft); trace silt and clay coating on sand; no odor.	SW		
540								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 9/27/11 11:52 - X:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ





# Borehole ID: KAFB-106058

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush mount

Date Started: 6/6/2011  
Date TD Reached: 6/8/2011  
Date Completed: 6/14/2011

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 471.17  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 471.19

Ground Elevation AMSL (ft): 5326.1  
Y Coordinate: 1477292.74  
X Coordinate: 1543818.37

Drilling Contractor: WDC Drilling  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Brian Lucero

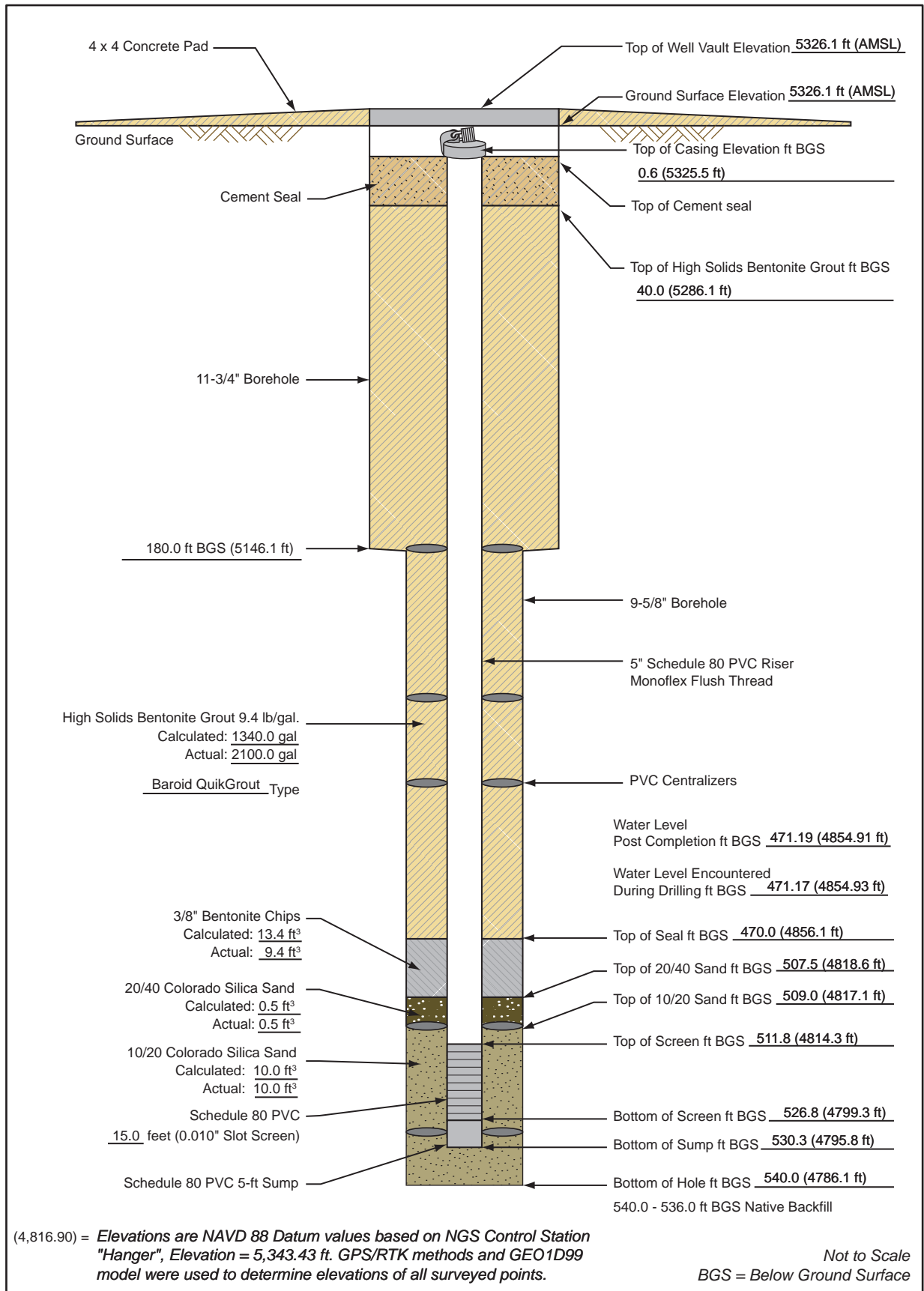
Page 19 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540								Total depth = 540 ft. Reached @ 1325 on 6/8/11.
545								Water added during drilling (gallons) = 300
550								Water added after drilling (gallons) = 300
555								Water added during construction (gallons) = 0
560								Spud: started drilling from surface.
565								Kelly down: TD the joint and ready to make new connection.
570								

# Monitoring Well Completion Diagram KAFB-106058

Installation Start Date/Time: 6/9/2011 @ 08:47

Installation End Date/Time: 6/14/2011 @ 17:00



## Well Development Record

**Project Name:** KAFB BFF

**Location:** GW-10

**Personnel:** G. Peacock (7/18/11), V. Bracht (8/4/11)

**Date:** 8/4/11

**Samplers:** V. Bracht

**Well/Piez. No.:** 106058

**Date Installed:** 6/14/11

**Csg. Diameter (I.D.):** 5"

**Total Depth (ft. BGL):** 530.34

**Method of Development:**

☒ Surging

☐ Bailing

☐ Pumping

☐ Original Development

☐ Redevelopment

☐ Other

**Development Date:** 7/18/11, 8/4/11

**Depth to Water Before Developing Well (ft. BGL):** 471.9 (7/18/11), 472.45 (8/4/11), 471.80 (TOC)

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:** 57.89 feet = 680.29 gal. \* 1 = 680.29

$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 680.29$  gallons

**Depth Purging From:** 521.4 feet

**Time Purging Begins:** 1020, 8/4/11

**Weather:** Sunny, Breezy, Warm

**Screened Interval (ft BGL):** 511.17 - 524.94

**Equipment Nos.:**      **pH Meter:** YSI 36952

**EC Meter:** YSI 36952

**Turbidity Meter:** LVE 002384

**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐

**Describe:** N/A

**Comment:** 600 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
7/18/2011	NR	471.90	60	--	--	--	--	Bailed; Swabbed 20 min.
8/4/2011	0903	471.80	110	20.45	6.21	0.490	252.00	Bailing; Water Cloudy
8/4/2011	1020	471.91	--	--	--	--	--	Begin Pumping at 5 GPM
8/4/2011	1030	472.56	--	23.72	7.36	0.384	Out of Range	Continue Pumping; Light Brown
8/4/2011	1040	472.57	170	21.60	6.10	0.372	197.00	Continue Pumping; Cloudy
8/4/2011	1050	472.57	230	21.86	5.95	0.372	91.60	Continue Pumping; Cloudy
8/4/2011	1100	472.57	290	22.19	6.06	0.373	79.30	Continue Pumping; Cloudy
8/4/2011	1110	472.57	350	23.82	6.53	0.372	62.20	Continue Pumping; Cloudy
8/4/2011	1120	472.55	410	22.88	6.70	0.371	64.00	Continue Pumping; Cloudy
8/4/2011	1130	472.56	460	23.27	6.80	0.372	60.60	Continue Pumping; Cloudy

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1C

\* Turbidity report in NTU nearest whole #

GPM = Gallons Per Minute

**Where:**

$B = 3.14$

$\phi_s$  = porosity of the sand pack

$r_c$  = radius of the well casing and screen in feet

$L_c$  = length of water column inside the casing and screen in feet

$r_w$  = radius of the well bore in feet

$L_s$  = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot = conversion from cubic feet to gallons

## Well Development Record

Project: KAFB BFF

Well No: 106058

Project Number: 140705

Samplers: V. Bracht

Date: 8/4/11

Checked By: \_\_\_\_\_

Time Start: 0903, 8/4/11

Time Finish: 1330, 8/4/11

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
8/4/2011	1140	472.55	510	21.00	5.97	0.369	64.50	Continue Pumping; Cloudy
8/4/2011	1150	472.55	560	21.04	6.07	0.369	59.80	Continue Pumping; Cloudy
8/4/2011	1200	472.55	610	21.15	7.69	0.369	46.80	Continue Pumping; Cloudy
8/4/2011	1210	472.54	670	21.26	7.52	0.370	52.40	Continue Pumping; Cloudy
8/4/2011	1220	472.54	720	21.38	7.46	0.369	40.10	Continue Pumping; Cloudy
8/4/2011	1230	472.54	770	21.26	7.14	0.370	33.40	Continue Pumping; Slightly Cloudy
8/4/2011	1240	472.53	830	21.17	6.88	0.370	24.10	Continue Pumping; Slightly Cloudy
8/4/2011	1250	472.53	890	21.95	7.66	0.371	12.10	Continue Pumping; Fairly Clear
8/4/2011	1300	472.52	950	22.07	7.61	0.371	11.80	Continue Pumping; Fairly Clear
8/4/2011	1310	472.52	1010	21.96	7.31	0.372	10.10	Continue Pumping; Clear
8/4/2011	1320	472.52	1070	22.02	7.21	0.370	9.11	Continue Pumping; Clear
8/4/2011	1330	472.51	1130	21.98	7.00	0.370	8.13	Stop Pumping; Clear; Total Removed

Was well sampled after development? YES ☐ NO ☒

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106204



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No cuttings - disturbed.			Begin drilling @ 0846.
5								
10					Lean CLAY (CL); reddish brown (5YR 4/4); moist; firm; medium plasticity; 90% clay (with some silt); 10% fine to coarse sand; no odor.	CL		
15					SILT (ML); yellowish red (5YR 4/6); moist; soft; low to medium plasticity; 90% silt (with some clay); 10% fine to medium sand; no odor.	ML		
20					Lean CLAY (CL); (reddish brown (5YR 4/4); moist; firm; medium plasticity; 90% clay (with some silt); 10% fine sand; no odor.	CL		Total depth casing @ 0905. Resume @ 0924.
25					SILT (ML); reddish brown (5YR 4/4); moist; soft; low plasticity; 90% silt; 10% coarse sand; no odor.			
30					Same as above (20 ft).	ML		

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 11:15 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Sandy SILT (ML); reddish brown (5YR 5/4); dry; soft; low plasticity; 60% silt; 40% fine to very coarse sand; subrounded; trace gravel to 3.5 cm; no odor.	ML	Cement Seal	Total depth @ 0945. Resume @ 1010. Driller adding H2O for dust suppression.
40					Silty SAND (SM); reddish brown (5YR 5/4); dry; loose; 70% fine to very coarse sand; 5% gravel to 2 cm; subangular; 25% silt; no odor.	SM		
45					Sandy SILT (ML); reddish brown (5YR 5/4); dry; soft; low plasticity; 60% silt; 40% fine to very coarse sand; subrounded; trace gravel to 3.5 cm; no odor.	ML	Top of High Solids Bentonite Grout	
50					Silty SAND (SM); reddish brown (5YR 5/4); dry; loose; 70% fine to very coarse sand; 5% gravel to 2 cm; subangular; 25% silt; no odor.	SM		
55					Well graded SAND (SW); reddish brown (5YR 5/3); wet; loose; 90% fine to very coarse sand; subangular; 5% gravel to 1 cm; 5% silt; no odor.	SW	High Solids Bentonite Grout	Total depth @ 1030. Resume @ 1045.
60					Same as above (48 ft).			





# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 3 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well graded SAND with gravel (SW); pinkish gray (5YR 6/2); wet; loose; 80% medium to very coarse sand; 20% gravel to 1.5 cm; subangular; no odor.	SW		
65					Silty SAND (ML); reddish brown (5YR 5/3); wet; loose; 70% fine to medium sand; subrounded; 30% silt; no odor.	ML		
70					SILT (ML); reddish brown (5YR 4/4); wet; soft; low plasticity; 90% silt; 10% fine to medium sand; no odor.	ML		
75					Well graded SAND with gravel; pinkish gray (5YR 6/2); 80% medium to very coarse sand; 20% gravel to 1.5 cm; subangular; no odor.	SW		
80					Sandy lean CLAY (CL); reddish brown (5YR 4/4); wet; firm; 60% clay with minor silt; 40% fine to coarse sand; subrounded; no odor.	CL		
85					Same as above (80 ft).			
90					SILT (ML); reddish brown (5YR 5/3); soft; wet; low to medium plasticity; 95% silt with minor clay; 5% very fine sand; no odor.	ML		

High Solids Bentonite Grout

Total depth casing @ 1115.  
 Resume @ 1121.



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
   ▽ At Time of Drilling: 477.15  
   ▼ At End Of Drilling: N/A  
   ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					SILT (ML); reddish brown (5YR 5/3); wet; soft; low to medium plasticity ; 95% silt with minor clay; 5% very fine sand; no odor.			
95					Same as above (90 ft); significant clay content.			Total depth @ 1200. Resume @ 1320.
100					Same as above (90 ft).			
105					Same as above (90 ft).	ML	High Solids Bentonite Grout	
110					Same as above (90 ft).			
115					Same as above (90 ft).			Total depth @ 1340. Resume @ 1345.
120								



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
   ▽ At Time of Drilling: 477.15  
   ▼ At End Of Drilling: N/A  
   ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY (CL); reddish brown (5YR 5/3); wet; firm; medium plasticity; 95% clay with minor silt; 5% fine sand; no odor.			
125					Sandy CLAY (CL); reddish brown (5YR 5/3); wet; firm; medium plasticity; 70% clay; 30% fine to coarse sand; subrounded; no odor.			
130					Same as above (125 ft).			
135					Same as above (125 ft).	CL	High Solids Bentonite Grout	Total depth casing @ 1420. Resume @ 1435.
140					Lean CLAY (CL); reddish brown (5YR 5/3); wet; soft; low to medium plasticity; 95% clay with minor silt; 5% fine sand; no odor.			
145					Same as above (140 ft).			
150								



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Lean CLAY (CL); reddish brown (5YR 5/3); soft; wet; low to medium plasticity; 95% clay and silt; 5% very fine sand; no odor.			
155					Same as above (150 ft).	CL		Total depth @ 1500. Resume @ 1520.
160					No cuttings returned.			
165					Poorly graded SAND (SP); brown (10YR 5/3); wet; loose; 100% fine to medium sand; subrounded; no odor.			
170					Same as above (165 ft).	SP		
175					SILT (ML); reddish brown (5YR 5/3); soft; wet; low plasticity; 90% silt; 10% very fine sand; no odor.	ML		Total Depth @ 1615. Resume @ 1625.
180								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 11:15 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

- High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					SILT (ML); reddish brown (5YR 4/4); soft; wet; low plasticity; 90% silt; 10% fine sand; subrounded; no odor.			
185					Same as above (180 ft).	ML		
190					Well graded SAND (SW); brown (10YR 4/3); wet; loose; 90% fine to very coarse sand; 5% gravel to 1.5 cm; subrounded; 5% silt.			
195					Well graded SAND with gravel (SW); brown (10YR 5/3); wet; loose; 75% fine to very coarse sand; 25% gravel to 1.5 cm; subrounded; no odor.			
200					Same as above (195 ft).	SW		Total depth @ 1655. Resume @ 1325 on 8/23/12.
205					Same as above (195 ft); 70% fine to coarse sand; 30% gravel to 1 cm; subrounded; trace clay nodules.			Total Depth with 11 3/4" casing. Begin drilling with 9 5/8" casing.
210								



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 95% fine to medium sand; subrounded; 5% silt.	SP		
215					Same as above (210 ft).			Total depth @ 1535. Resume @ 1544.
220					Well graded SAND with gravel (SW); brown (10YR 4/3); wet; loose; 60% fine to coarse sand; 40% gravel to 3.5 cm; subrounded; no odor.	SW		
225					Poorly graded SAND (SP); brown (10YR 4/3); wet; loose; 100% fine to medium sand; subrounded; no odor.	SP		
230					Well graded SAND with gravel (SW); brown (10YR 5/3); wet; loose; 70% fine to very coarse sand; 30% gravel to 2 cm; subrounded; no odor.			
235					Same as above (225 ft); 75% fine to coarse sand; 25% gravel.	SW		Pumice present.
240					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 95% fine to coarse sand; subrounded; 5% silt; no odor.			Total depth @ 1623. Resume @ 1615.

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 11:15 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 100% fine to very coarse sand; trace gravel to 0.7 cm; subrounded; no odor.			
245					Same as above (240 ft).			
250					Same as above (240 ft).			
255					Same as above (240 ft).	SW		
260					Same as above (240 ft).			
265					Poorly graded SAND (SP); brown (10YR 5/3); wet; loose; 100% fine to medium sand; subrounded; no odor.	SP		
270								

High Solids  
Bentonite  
Grout

Total depth @ 1630.  
Resume @ 1635.





# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well graded SAND with gravel (SW); brown (10YR 5/3); wet; loose; 70% fine to very coarse sand; 30% gravel to 2 cm, subrounded; no odor.			
275					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 100% fine to coarse sand, subrounded; no odor.	SW		Total Depth @ 1700. Resume @ 0847 on 8/24/12.
280					Poorly graded SAND (SP); brown (10YR 5/3); wet; loose; 95% fine to medium sand, trace coarse sand, subrounded; 5% silt.			
285					Same as above (280 ft).			
290					Same as above (280 ft).	SP		
295					Same as above (280 ft).			Total Depth @ 0910. Resume @ 0920.
300								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 11:15 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 100% fine to coarse sand, subangular; no odor	SW		
310					Poorly graded SAND (SP); brown (10YR 4/3); wet; loose; 100% fine to medium sand; trace coarse sand, subrounded.	SP		
315					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 95% fine to very coarse sand, subrounded; 5% gravel to 1.5 cm; no odor.			
320					Same as above (310 ft).			
325					Same as above (310 ft). 100% fine to coarse sand.	SW		
330					Same as above (320 ft).			
							High Solids Bentonite Grout	Total Depth @ 0944. Resume @ 0952.



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND (SW); brown (10YR 4/3); wet; loose; 100% fine to coarse sand, subrounded; no odor.			
335					Well graded SAND with gravel (SW); brown (10YR 4/3); wet; loose; 60% fine to coarse sand; 40% gravel to 2.5 cm, subrounded; no odor			Total Depth @ 1011. Resume @ 1044.
340					Well graded SAND (SW); brown (10YR 4/3); wet; loose; 100% fine to coarse sand; trace gravel to 1 cm, subrounded; no odor.	SW		
345					Same as above (340 ft).			
350					Poorly graded SAND (SP); brown (10YR 4/3); wet; loose; 100% fine to medium sand, subrounded; no odor.			
355					Same as above (350 ft).	SP		Total Depth @ 1103. Resume @ 1111.
360								



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 100% fine to coarse sand, subrounded; no odor.			
365					Same as above (360 ft).			
370					Same as above (360 ft).			
375					Well graded SAND with gravel (SW); brown (10YR 5/3); wet; loose; 70% fine to coarse sand; 30% gravel to 3 cm; subrounded; no odor.	SW		
380					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 100% fine to very coarse sand, subrounded; no odor.			
385					Well graded GRAVEL with sand (GW); wet; loose; brown (10YR 5/3); 70% gravel to 1 cm; 30% coarse sand, subrounded.	GW		
390								

High Solids  
Bentonite  
Grout

Total Depth @ 1135.  
Resume @ 1145.



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); brown (10YR 5/3); wet; loose; 100% fine to coarse sand, subrounded; no odor.			
395					Same as above (390 ft); trace gravel to 1.5 cm.			
400					Well graded SAND (SW); very dark grayish brown (10YR 3/2); wet; loose; 100% very fine to very coarse sand; rounded; no odor.	SW		
405					Same as above (400 ft); dark grayish brown (10YR 4/2); subangular.		High Solids Bentonite Grout	
410					Poorly graded SAND (SP); grayish brown (10YR 5/2); dry; loose; 100% fine to medium sand, subrounded, no odor.			
415					Same as above (400 ft); trace gravel to 1 cm.	SP		
420								

Total Depth @ 1215.  
Resume @ 0832 on 8/27/12.

Total depth @ 0910.  
Resume @ 0919.



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); grayish brown (10YR 5/2); dry; loose; 95% fine to medium sand, subrounded; 5% silt; no odor.	SP		
425					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 90% fine to coarse sand; 10% gravel to 1 cm, subrounded; no odor.	SW		
430					Lean CLAY (CL); reddish brown (5YR 4/4); dry; firm; medium plasticity; 90% clay; 10% coarse sand; subrounded; no odor.	CL		
435					Poorly graded SAND (SP); yellowish brown (10YR 5/4); dry; loose; 95% fine to medium sand; 5% coarse sand; subrounded; no odor.			
					Same as above (431 ft).	SP		Total Depth @ 0958. Resume @ 1018.
440					Same as above (431 ft).			
445					SILT (ML); reddish brown (5YR 4/4); soft; moist; low plasticity; 90% silt; 10% very fine sand; subrounded; no odor.	ML		
					Poorly graded SAND with silt (SP); dry; loose; 90% fine to medium sand; subrounded; 10% silt; no odor.	SP		
450								



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 95% fine to medium sand, subrounded; 5% silt; no odor.			
455					Same as above (450 ft).	SP	- Bentonite Seal - 5" Schedule 80 PVC Riser - Top of 20/40 Sand - Top of 10/20 Sand - Top of 5" Schedule 80 PVC 0.010" Slot Screen	Total Depth @ 1100. Resume @ 1230.
460					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; trace coarse sand; subrounded; no odor.			
465					Well graded SAND (SW); grayish brown (10YR 5/2); dry; loose; 100% fine to coarse sand, subrounded; no odor.			
470					Same as above (465 ft).	SW		
475					Same as above (465 ft).			Total depth @ 1315. Resume @ 1325.
480								





# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well graded SAND (SW); pale brown (10YR 6/3); dry; loose; 100% fine to very coarse sand, subrounded; trace gravel to 1 cm; no odor.			
485					Well graded SAND with gravel (SW); brown (10YR 5/3); dry; loose; 85% fine to very coarse sand; 15% gravel to 3 cm, subrounded; no odor.			
490					Well graded SAND (SW); pale brown (10YR 6/3); dry; loose; 100% fine to very coarse sand, subrounded; trace gravel to 1 cm; no odor.	SW		Driller not adding water. Moisture from water table.
495					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; loose; 85% fine to very coarse sand; 15% gravel to 3 cm, subrounded; no odor.		- Bottom of Screen - Sump - Bottom of Sump	Total Depth @ 1420. 1440 - P. Ostrye takes over as geologist. Begin advancing drive casing @ 1435.
500					No cuttings returned.		- Bottom of Filter Pack	
505					Poorly graded SAND (SP); brown (7.5YR 4/4); wet; medium dense; 95% fine to coarse sand, subangular to subrounded; 5% fines.	SP	- Native Backfill	Cuttings are sporadic. Driller adding ~ 20 gal/min of water @ 1520 to move cuttings to surface. 5 min ~ 100 gal.
510								Stop adding water.



# Borehole ID: KAFB-106204

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/22/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5331.95  
 Y Coordinate: 1478960.18  
 X Coordinate: 1544920.21

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4"  
 Hole Diameter Lower (in.): 9- 5/8"  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: N/A  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly/P.Ostrye

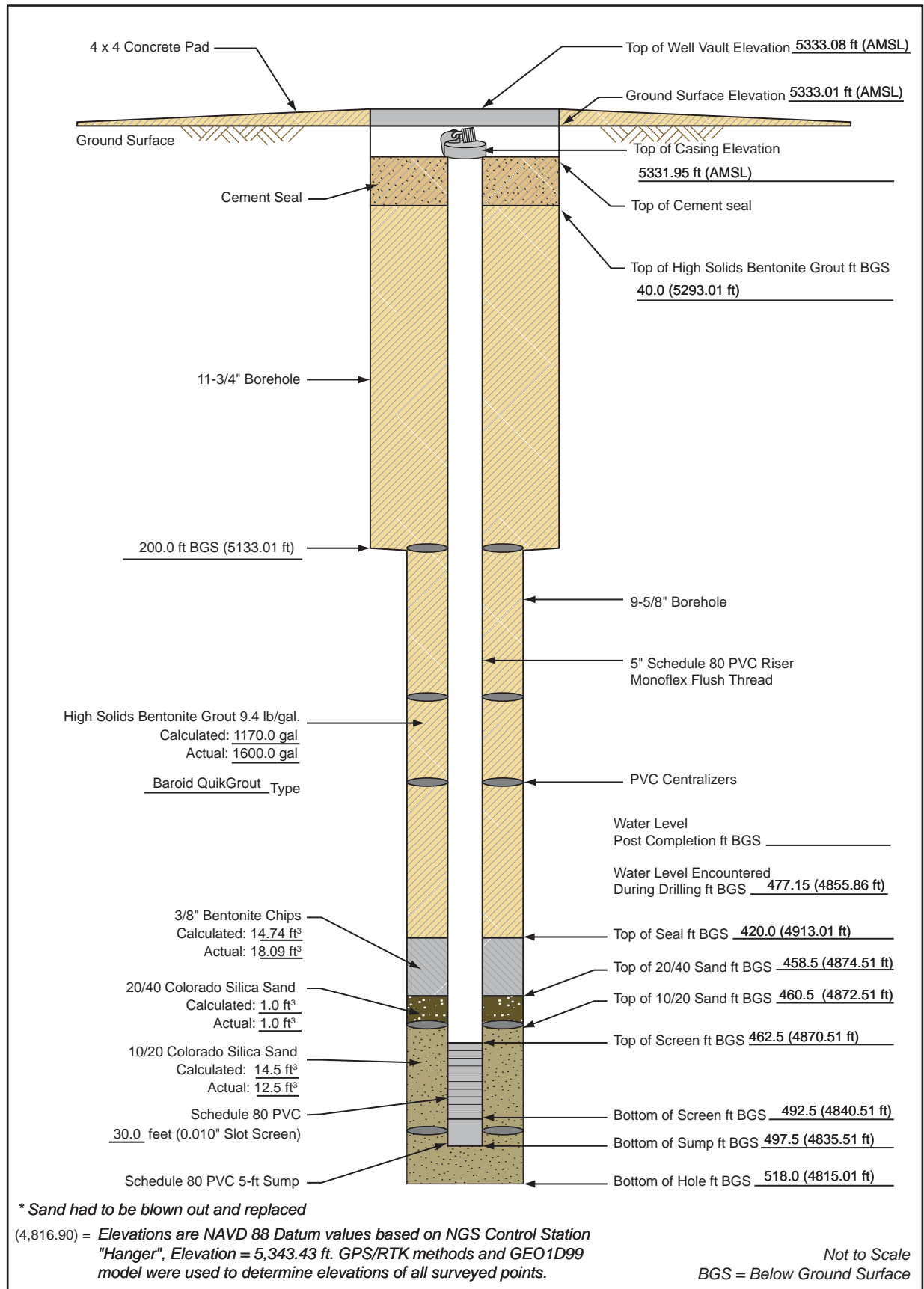
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Same as above (505 ft).	SP		
515					Silty SAND (SM); brown (7.5YR 4/4); saturated; loose; 85% very fine to medium sand, angular to subrounded; 15% silt.	SM	Native Backfill	1545 - Collect 4-1 L amber jars of saturated cuttings @ 513 ft bgs.
520								Total depth of Borehole @ 518 ft. bgs.
525								1555 - Begin adding ~ 30 gal/min of water. 1600 - used 250 gallons of water. Complete setting plug.
530								
535								
540								

# Monitoring Well Completion Diagram KAFB-106204

Installation Start Date/Time: 8/28/2012 @ 09:00

Installation End Date/Time: 8/29/2012 @ 16:15



## Well Development Record

**Project Name:** KAFB BFF
**Location:** Kentucky and Kathryn
**Personnel:** V. Bracht
**Date:** 9/17/12
**Samplers:** N/A
**Well/Piez. No.:** KAFB-106204
**Date Installed:** 8/29/12
**Csg. Diameter (I.D.):** 5"
**Total Depth (ft. BGL):** 497.5
**Method of Development:**
☒ Surging      ☒ Bailing  
☐ Original Development      ☐ Redevelopment

☒ Pumping  
☐ Other

**Development Date:** 9/17/12
**Depth to Water Before Developing Well (ft. BGL):** 477.69

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:**                  feet = 36.65 gal. \* 1 = 36.65

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{886.65 \text{ gallons}}$$
**Depth Purging From:** 486 feet
**Time Purging Begins:** 0950, 9/17/12
**Weather:** Partly Cloudy, Cool to Warm
**Screened Interval (ft BGL):** 462.5 - 492.5
**Equipment Nos.:** **pH Meter:** LVE 002686
**EC Meter:** LVE 002686
**Turbidity Meter:** LVE002384
**Equipment Decontaminated Prior to Development:** Y    X    N   
**Describe:** Steam Cleaned
**Collected Sample of Water Added to Well:** Y    N    X   
**Describe:** N/A
**Comment:** 850 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/17/2012	0950	476.99	15	20.20	6.26	0.001*	>1000	Begin Bailing; Water is Muddy Brown
9/17/2012	1005	--	55	17.90	7.74	0.002*	>1000	Continue Bailing; Water is Brown
9/17/2012	1015	--	90	18.90	7.87	0.002*	>1000	Continue Bailing; Water is Brown
9/17/2012	1020	--	100	--	--	--	--	Bailed
9/17/2012	1125	476.98	--	21.70	7.67	1.280	>1000	Begin Pumping at 10 GPM
9/17/2012	1135	483.70	275	21.30	7.73	1.020	18.00	Water is Fairly Clear
9/17/2012	1145	484.50	375	20.80	7.73	1.000	25.10	Slow Pump Down to 9 GPM
9/17/2012	1155	483.45	475	21.40	7.71	1.030	2.50	Water is Clear
9/17/2012	1205	483.81	575	21.70	7.71	1.040	2.41	Water is Clear
9/17/2012	1215	484.22	675	21.50	7.70	1.060	8.10	Slow Pump Down to 8 GPM

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1°C

\* Turbidity report in NTV nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack

 $r_c$ = radius of the well casing and screen in feet

 $L_c$ = length of water column inside the casing and screen in feet

 $r_w$ = radius of the well bore in feet

 $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

**Project:** KAFB BFF

**Well No:** KAFB-106204

**Project Number:** 140705

**Samplers:** N/A

**Date:** 9/17/12

**Checked By:** N/A

**Time Start:** 0950, 9/17/12

**Time Finish:** 1245, 9/17/12

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/17/2012	1225	483.01	750	21.70	7.69	1.090	1.74	Water is Clear
9/17/2012	1235	483.15	825	21.60	7.69	1.090	1.84	Water is Clear
9/17/2012	1245	483.30	925	21.60	7.68	1.080	1.79	Water is Clear; Pump off; Total Removed

\* Due to sample cup design, the YSI Professional Plus does not accurately measure EC from the cup. Sample cup works well in a flow-through set-up, once pumping begins.

**Was well sampled after development?** YES NO ☒ X

**Sample Method:** N/A

**Sample Name:** N/A

**Analyses:** N/A

KAFB 106205



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/2012  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					disturbed; no description			1147 Begin Drilling.
5					SILT (ML); reddish brown (5YR 4/4); soft; dry; low plasticity; 90% silt (some clay); 10% fine sand; rounded; no odor.	ML		
10					Same as above (5 ft).			
15					Lean CLAY (CL); reddish brown (5YR 4/4); soft; moist; medium plasticity; 90% clay with minor silt; 10% fine sand; rounded; no odor.	CL		
20					SILT (ML); reddish brown (5YR 4/4); soft; moist; low plasticity; 90% silt; 10% fine sand; subrounded; no odor.			
25					SILT with sand (ML); yellowish red (5YR 4/6); soft; dry; low plasticity; 80% silt; 20% fine to coarse sand; subrounded; no odor.	ML		
30					SILT with sand (ML); yellowish red (5YR 4/6) soft; dry; low plasticity; 75% silt w/clay nodules; 20% fine to coarse sand; 5% gravel to 2 cm.			

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 11:21 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ







# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT (ML); yellowish red (5YR 4/6); soft; moist; low plasticity; 90% silt; 10% fine to medium sand; subrounded; no odor.	ML		
65					Same as above (60ft).			
70					Lean CLAY (CL); yellowish red (5YR 4/6); firm; moist, medium plasticity; 90% clay with minor silt; 10% fine to medium sand; subrounded; no odor.	CL		
75					SILT (ML); yellowish red (5YR 4/6); soft; moist; low plasticity; 90% silt; 10% fine to medium sand; subrounded; no odor.	ML		
80					Lean CLAY (CL); yellowish red (5YR 4/6); firm; moist; medium plasticity; 90% clay; 10% fine to coarse sand; subangular; no odor.	CL		
85					SILT (ML); reddish brown (5YR 4/4); soft; moist; low to medium plasticity, 90% silt with minor clay; 10% fine to medium sand.	ML		
90					Same as above (80 ft); significant amount of clay present.			

High Solids Bentonite Grout

Total depth casing @ 1433.  
 Resume @ 0813 on 8/14/12.



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/2012  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					SILT (ML); reddish brown (5YR 4/4); soft; moist; low to medium plasticity; 90% silt with minor clay; 10% fine to medium sand; rounded; no odor; clay content increasing	ML		Driller adding water.
100					Lean CLAY (CL); reddish brown (5YR 4/4); firm; medium plasticity; 85% clay with minor silt; 15% medium to coarse sand; subrounded; no odor.	CL		Total depth casing @ 0855. Resume @ 0940.
105					No cuttings returned			
110					No cuttings returned			
115					No cuttings returned			
120					Lean CLAY (CL); reddish brown (5YR 4/4); firm; medium plasticity; 85% clay with minor silt; 15% medium to coarse sand; subrounded; no odor.	CL		Total depth @ 0953 Resume @ 1000.



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY (CL); reddish brown (5YR 4/4); firm; wet; medium plasticity; 95% clay; 5% medium to coarse sand; subangular; no odor.			
125					Same as above (120 ft)			
130					Same as above (120 ft)			
135					Same as above (120 ft)			
140					Same as above (120 ft)			
145					No cuttings returned.			
150								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 11:21 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

CL

High Solids  
Bentonite  
Grout

Total depth casing @ 1012.  
Resume @ 1022.



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
   ▽ At Time of Drilling: 477.15  
   ▼ At End Of Drilling: N/A  
   ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
155					Sandy SILT (ML); reddish brown (5YR 5/4); soft; wet; low plasticity; 60% silt; 40% fine to very coarse sand; trace gravel to 2 cm; subangular; no odor.	ML		
160					No cuttings returned.			
165					No cuttings returned.			
170					No cuttings returned.			
175					Sandy SILT (ML); reddish brown (5YR 5/4); soft; wet; low plasticity; 60% silt; 40% fine to very coarse sand; trace gravel to 2 cm; subangular; no odor.	ML		
180					Same as above (170 ft).			

Total depth @ 1032.  
Resume @ 1038.

- High Solids  
Bentonite  
Grout

Total depth @ 1053.



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180								
185					Well graded SAND with gravel (SW); reddish brown (5YR 5/3); wet; loose; 80% fine to very coarse sand; subrounded; 20% gravel to 2 cm; no odor.	SW		
190					No cuttings returned.			
195					No cuttings returned.			
200					Well graded SAND with gravel (SW); reddish brown (5YR 5/3); wet; loose; 80% fine to very coarse sand; subrounded; 20% gravel to 2 cm; no odor.	SW		Total depth casing @ 1120. Resume @ 1640.
205					Poorly graded SAND (SP); brown (10YR 5/4); dry; loose; 100% medium to coarse sand; subrounded; no odor.			Total depth with 11 3/4" casing. Begin with 9 5/8" casing.
210					Same as above (200 ft).	SP		



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; trace gravel to 2 cm; subrounded; no odor.			
215					Same as above (210 ft).	SP		Total depth @ 1655. End 8/14/12. Resume @ 0831 on 8/15/12.
220					Same as above (210 ft).			
225					Well graded SAND (SW); brown (10YR 4/3); dry; loose; 95% very fine to very coarse sand; subrounded; 5% silt; no odor.	SW		
230					Poorly graded SAND (SP); brown (10YR 4/3); dry; loose; 100% fine to medium sand; subrounded; no odor.	SP		
235					Well graded SAND (SW); brown (10YR 4/3); dry; loose; 95% very fine to coarse sand; subrounded; 5% silt; no odor.	SW		Total depth @ 0825. Resume @ 0831.
240								





# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND (SP); brown (10YR 4/3); dry; loose; 100% fine to medium sand; subrounded; no odor.			
245					As above (240 ft); trace coarse sand.	SP		
250					As above (240 ft).			
255					Well graded SAND with gravel (SW); brown (10YR 5/3); dry; loose; 80% very fine to very coarse sand; subrounded; 20% gravel to 3 cm; subrounded; no odor. Same as above (252 ft).			
260					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 10% fine to coarse sand; subrounded; no odor.	SW		
265					Same as above (260 ft).			
270								

High Solids  
Bentonite  
Grout

Total depth casing @  
 0838.  
 Resume @ 0843.



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 8/15/2012  
Date TD Reached: 8/15/12  
Date Completed: 8/15/2012  
Ground Elevation AMSL (ft): 5333.4  
Y Coordinate: 1479079.44  
X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 477.15  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.05  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP); brown (10YR 4/3); dry; loose; 100% fine to medium sand; subrounded; no odor.			
275					Same as above (270 ft); trace gravel to 2 cm.			Total depth @ 0850. Resume @ 0857.
280					Same as above (270 ft).			
285					Same as above (270 ft).	SP		
290					Same as above (270 ft).		High Solids Bentonite Grout	
295					Same as above (270 ft).			Total depth @ 0904. Resume @ 0912.
300								



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded SAND (SP); brown (10YR 4/3); dry; loose; 100% fine to medium sand; subrounded; no odor.			
305					Poorly graded SAND with gravel (SP); brown; (10YR 4/3); dry; loose; 85% fine to medium sand; 15% gravel to 1 cm; rounded.	SP		
310					Well graded SAND w/gravel (SW); brown (10YR 4/3); dry; loose; 80% fine to very coarse sand; 20% gravel to 3 cm; subrounded; no odor.			
315					Same as above (307 ft).	SW		
320					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% fine to very coarse sand; subrounded; no odor.			
325					Well graded GRAVEL (GW); grayish brown (10YR 5/2); dry; loose; 90% fine gravel to 4 cm; 10% coarse sand; subrounded; no odor.	GW		
					Well graded SAND w/gravel (SW); brown (10YR 4/3); dry; loose; 70% fine to very coarse sand; 30% gravel to 1 cm; subrounded; no odor.	SW		
330					Poorly graded SAND (SP); brown (10YR 4/3); dry; loose; 100% fine to medium sand; trace gravel to 3 cm; rounded; no odor.	SP		

Total depth @ 0922.  
 Resume @ 0928.



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND w/gravel (SW); brown (10YR 5/3); dry; loose; 60% fine to very coarse sand; 40% gravel to 3 cm; subrounded; no odor.			
335					As above (330 ft); 75% fine to coarse sand; 25% gravel to 3 cm.	SW		Total depth @ 0940. Resume @ 0951.
340					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; subrounded; no odor.	SP		
345					Poorly graded SAND with silt (SP-SM); brown (10YR 5/3); dry; loose; 90% fine sand; subrounded; 10% silt, no odor.	SP-SM		
350					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; subrounded; no odor.			
355					Same as above (350 ft).	SP		Total depth @ 1003. Resume @ 1011.
360								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 11:21 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/2012  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% fine to very coarse sand; subangular; no odor.			
365					Same as above (360 ft).			
370					Well graded SAND with gravel (SW); brown (10YR 4/3); dry; loose; 70% fine to very coarse sand; 30% gravel to 2 cm; no odor.			
375					Same as above (370 ft).	SW	High Solids Bentonite Grout	Total depth @ 1025. Resume @ 1034.
380					Same as above (370 ft).			
385					Well graded SAND (SW); brown (10YR 4/3); dry; loose; 100% fine to coarse sand; no odor.			
390								



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.) 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% fine to very coarse sand; subrounded; no odor.	SW		
395					Gravelly SILT (ML); reddish brown (5YR 5/4); soft; dry; low plasticity; 60% silt; 40% gravel to 6 cm; rounded; no odor.	ML		Total depth @ 1044. Resume @ 1250.
400					Silty SAND (SM); brown (10YR 5/3); dry; loose; 80% fine sand; subrounded; 20% silt; no odor.	SM		
405					Well graded SAND (SW); brown (10YR 4/3); dry; loose; 95% fine to coarse sand; 5% gravel to 1 cm; subrounded; no odor.	SW		
410					Poorly graded SAND (SP); brown (10YR 4/3); dry; loose; 100% fine to medium sand; no odor.	SP	High Solids Bentonite Grout	
415					Well graded SAND (SW); brown (10YR 4/3); dry; loose; 100% fine to coarse sand; trace gravel to 1 cm; subrounded; no odor.	SW		Total depth @ 1305. Resume @ 1317.
420								



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 8/15/2012  
Date TD Reached: 8/15/12  
Date Completed: 8/15/2012  
Ground Elevation AMSL (ft): 5333.4  
Y Coordinate: 1479079.44  
X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 477.15  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.05  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND (SW); brown (10YR 4/3); dry; loose; 100% fine to coarse sand; subrounded; no odor.	SW		
425					Same as above (420 ft).			
430					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 95% fine to medium sand; trace coarse sand; 5% silt; no odor.	SP		
435					Same as above (427 ft).			
440					SILT (ML); reddish brown (5YR 5/4); dry; soft; low plasticity; 90% silt; 10% fine sand; subrounded; trace clay nodules; no odor.	ML		
445					Silty SAND (SM); brown (10YR 5/3); dry; loose; 75% fine to medium sand; 25% silt; no odor.	SM		
450					Same as above (443 ft).			
							High Solids Bentonite Grout	Total depth @ 1335. Resume @ 1345.





# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/2012  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND with silt (SP-SM); brown (10YR 5/3); dry; loose; 90% fine to medium sand; subrounded; 10% silt; no odor.	SP-SM	<p>- Top of Bentonite Seal</p> <p>- 5" Schedule 80 PVC Riser</p>	Total depth @ 1400. Resume @ 1408.
455					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; subrounded; no odor.	SP		
460					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% fine to very coarse sand; subrounded; no odor.	SW		
465					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; subrounded; no odor.	SP		
470					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% fine to very coarse sand; subrounded; no odor. Well graded SAND with GRAVEL (SW); brown (10YR 5/3); dry; loose; 80% fine to very coarse sand; 20% gravel to 2 cm; subrounded; no odor.	SW		
475								Total depth @ 1424. Resume 1432.
480					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 100% fine to medium sand; subrounded; no odor.	SP		Water level @ 477.15' bgs. Water level after drilling.



# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/12  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); brown (10YR 4/3); moist; loose; 95% fine to medium sand; 5% gravel to 2 cm; subrounded; no odor.			
485					Same as above (480 ft); damp.			
490					Same as above (480 ft); damp; 90% sand; 10% gravel to 3 cm.			
495					Same as above (480 ft); damp.	SP	- Top of 20/40 Sand - Top of 10/20 Sand - Top of 5" Schedule 80 PVC 0.010" Slot Screen	
500					Same as above (480 ft); 100% fine to medium sand.			
505					Same as above (500 ft).			
510							- Bottom of Screen - Sump	Total depth @ 1453. Resume @ 1501.




# Borehole ID: KAFB-106205

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/15/2012  
 Date TD Reached: 8/15/2012  
 Date Completed: 8/15/2012  
 Ground Elevation AMSL (ft): 5333.4  
 Y Coordinate: 1479079.44  
 X Coordinate: 1544721.95

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.15  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.05  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

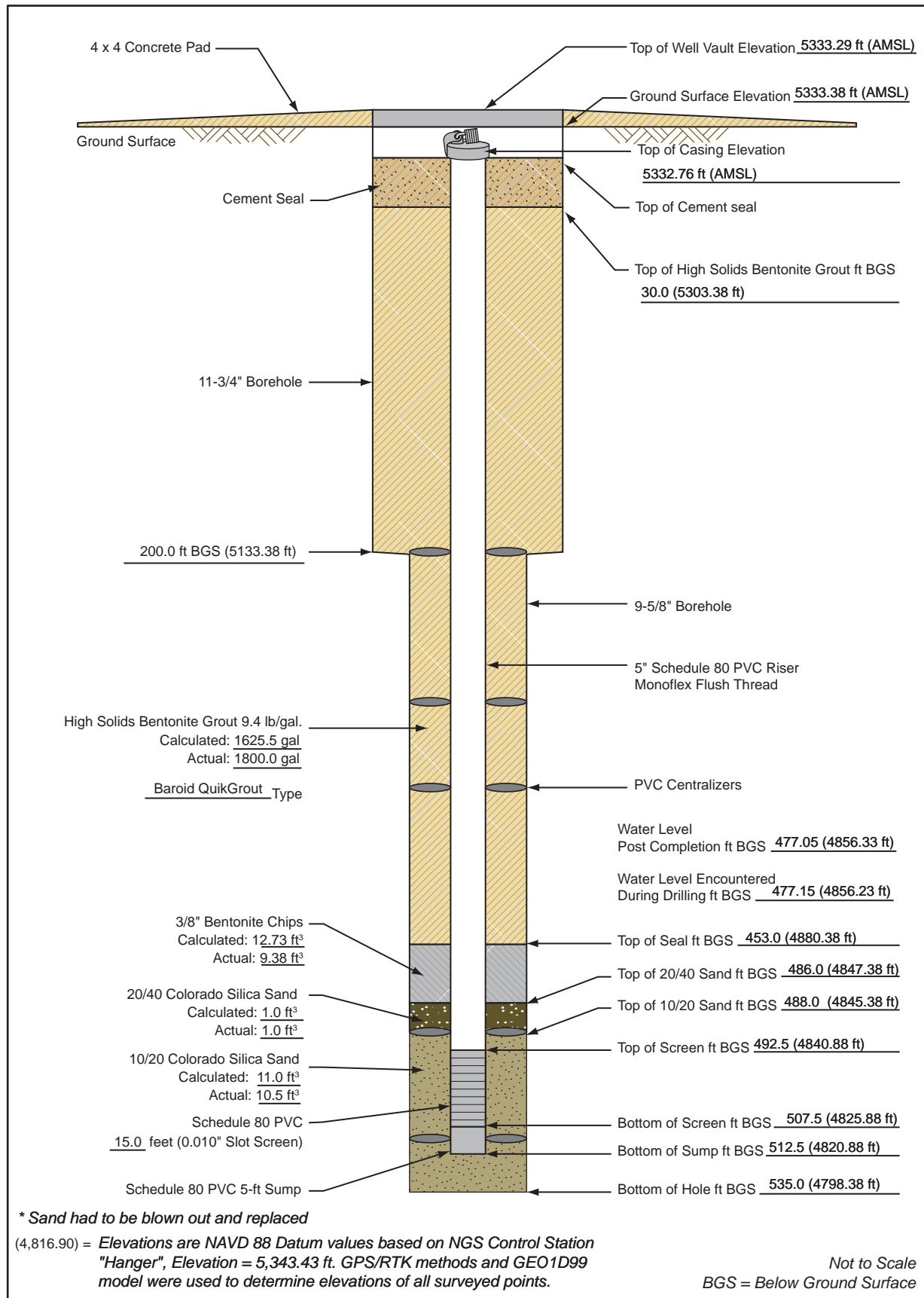
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Poorly graded SAND (SP); brown (10YR 4/3); damp; loose; 100% fine to medium sand; subrounded; no odor.			
515					Same as above (510 ft).	SP	 - Bottom of Sump - Bottom of Filter Pack	Total Depth @ 1517. Resume @ 1525.
520					Well graded SAND w/gravel (SW); brown (10YR 4/3); wet; loose; 70% medium to very coarse sand; 30% gravel to 2.5 cm; subrounded.	SW		
525					Poorly graded SAND (SP); brown (10YR 5/3); wet; loose; 100% fine to medium sand; subrounded; no odor.	SP		
530					No recovery.			
535								Total depth of boring @ 1540.
540								

# Monitoring Well Completion Diagram KAFB-106205

Installation Start Date/Time: 8/16/2012 @ 13:00

Installation End Date/Time: 8/21/2012 @ 11:00



## Well Development Record

**Project Name:** KAFB BFF
**Location:** Kentucky and Kathryn
**Personnel:** V. Bracht
**Date:** 9/14/12
**Samplers:** N/A
**Well/Piez. No.:** KAFB-106205
**Date Installed:** 8/21/12
**Csg. Diameter (I.D.):** 5"
**Total Depth (ft. BGL):** 512.5
**Method of Development:**
☒ Surging      ☒ Bailing  
☐ Original Development      ☐ Redevelopment

☒ Pumping  
☐ Other

**Development Date:** 9/14/12
**Depth to Water Before Developing Well (ft. BGL):** 478.52

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:**                  feet = 51.21 gal. \* 1 = 51.21

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{801.21 \text{ gallons}}$$
**Depth Purging From:** 506 feet
**Time Purging Begins:** 0855, 9/14/12
**Weather:** Partly Cloudy, Cool
**Screened Interval (ft BGL):** 492.5 - 507.5
**Equipment Nos.:** **pH Meter:** LVE 002686
**EC Meter:** LVE 002686
**Turbidity Meter:** LVE002384
**Equipment Decontaminated Prior to Development:** Y    X    N   
**Describe:** Steam Cleaned
**Collected Sample of Water Added to Well:** Y    N    X   
**Describe:** N/A
**Comment:** 750 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/14/2012	0855	477.72	20	17.90	6.52	NR*	>1000	Begin Bailing; Water is Muddy Brown
9/14/2012	0908	--	55	18.20	7.65	NR*	>1000	Continue Bailing; Water is Muddy Brown
9/14/2012	0923	--	100	17.80	7.79	NR*	>1000	Continue Bailing; Water is Brown
9/14/2012	1032	477.74	--	19.40	7.54	0.434	>1000	Begin Pumping at 10 GPM
9/14/2012	1035	479.95	175	19.90	7.64	0.432	123.00	Water is Fairly Clear
9/14/2012	1045	479.99	275	20.30	7.68	0.422	23.80	Water is Fairly Clear
9/14/2012	1055	480.02	375	20.30	7.72	0.420	19.70	Water is Fairly Clear
9/14/2012	1105	480.05	475	20.50	7.72	0.420	9.74	Water is Clear
9/14/2012	1115	479.99	575	20.60	7.72	0.418	18.30	Water is Fairly Clear
9/14/2012	1125	480.05	675	20.60	7.72	0.416	5.77	Water is Clear

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1C

\* Turbidity report in NTV nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack

 $r_c$ = radius of the well casing and screen in feet

 $L_c$ = length of water column inside the casing and screen in feet

 $r_w$ = radius of the well bore in feet

 $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

**Project:** KAFB BFF

**Well No:** KAFB-106205

**Project Number:** 140705

**Samplers:** N/A

**Date:** 9/14/12

**Checked By:** N/A

**Time Start:** 0855, 9/14/12

**Time Finish:** 1145, 9/14/12

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/14/2012	1135	480.10	775	20.50	7.74	0.431	4.41	Water is Clear
9/14/2012	1145	480.11	875	20.50	7.75	0.429	3.38	Water is Clear; Pump off; Total Removed

\* Due to sample cup design, the YSI Professional Plus does not accurately measure EC from the cup. Sample cup works well in a flow-through set-up, once pumping begins.

**Was well sampled after development?** YES ☐ NO ☒

**Sample Method:** N/A

**Sample Name:** N/A

**Analyses:** N/A

KAFB 106206





# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 1 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Disturbed from potholing			1542 Begin drilling.
5								
10					SILT with sand (ML); yellowish red (5YR 5/6); soft, dry, low plasticity; 80% silt; 20% very fine to coarse sand; no odor.			
15					Same as above (5 ft); 75% silt; 25% fine to coarse sand.	ML		
20					Same as above (5 ft); trace gravel to 2 cm			
25					Well graded SAND (SW); light reddish brown (5YR 6/3); dry; soft; no plasticity; 95% fine to very coarse sand, 5% silt; no odor.	SW		
30					Well graded SAND with silt (SW-SM); reddish brown (5YR 5/4); dry; loose; 90% very fine to very coarse sand; trace gravel to 2 cm; 10% silt; no odor.	SW-SM		

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 12:28 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 2 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well graded SAND with gravel (SW); dry; loose; 80% very fine to very coarse sand; 20% gravel to 2.5 cm.			
35					Same as above (30 ft).	SW	- Cement Seal - Top of High Solids Bentonite Grout	Total Depth Casing @ 1630. Resume Drilling @ 0815 on 7/17/12.
40					SILT (ML); yellowish red (5YR 4/6) soft; dry; low plasticity; 90% silt; 10% fine to very coarse sand; trace gravel to 1.5 cm.	ML		
45					Well graded SAND (SW); yellowish red (5YR 4/6); dry; loose; 95% fine to very coarse sand; 5% gravel to 1 cm; no odor.			
50					Same as above (45 ft); 90% medium to very coarse sand; 10% gravel to 2 cm.	SW	- High Solids Bentonite Grout	
55					Lean CLAY (CL); yellowish red (5YR 4/6); firm, moist; medium plasticity; 95% clay; 5%; fine to medium sand; no odor.	CL		
					SILT (ML); yellowish red (5YR 5/6); soft; moist; low plasticity; 95% silt; 5% very fine sand; no odor.	ML		Total Depth Casing @ 0835. Resume @ 0843.
60								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/16/2012  
Date TD Reached: 7/16/2012  
Date Completed: 7/16/2012  
Ground Elevation AMSL (ft): 5333.7  
Y Coordinate: 1479144.25  
X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9- 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 478.50  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.15  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 3 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT with sand (ML); reddish brown (5YR 4/4); soft; dry; low plasticity; 80% silt; 20% fine to medium sand; no odor.			
65					SILT (ML); reddish brown (5YR 5/4); soft; moist; low plasticity; 95% silt; 5% very fine sand; no odor.			
70					Same as above (65 ft).			
75					Same as above (65 ft); 90% silt with minor clay; 10% fine to medium sand.	ML	High Solids Bentonite Grout	Total Depth @ 0920 Resume @ 0926.
80					Same as above (75 ft).			
85					Same as above (75 ft).			
90								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/16/2012  
Date TD Reached: 7/16/2012  
Date Completed: 7/16/2012  
Ground Elevation AMSL (ft): 5333.7  
Y Coordinate: 1479144.25  
X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9- 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 478.50  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.15  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 4 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					SILT (ML); reddish brown (5YR 5/4); soft; dry; low plasticity, 90% silt; 10% fine to medium sand; trace coarse sand to 0.5 cm; no odor.			
95					Same as above (90 ft).			Total Depth @ 0955 Resume @ 1051.
100					Sandy SILT (ML); reddish brown (5YR 4/4); soft; dry; low plasticity; 70% silt; 30% fine to coarse sand; no odor.			
105					SILT (ML); yellowish red (5YR 4/6); soft; dry; low plasticity; 90% silt; 10% fine sand; no odor.	ML	High Solids Bentonite Grout	
110					Same as above (105 ft); 10% fine to medium sand.			
115					Same as above (105 ft); 95% silt; 5% very fine sand.			Total Depth @ 1109 Resume @ 1118.
120								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/16/2012  
Date TD Reached: 7/16/2012  
Date Completed: 7/16/2012  
Ground Elevation AMSL (ft): 5333.7  
Y Coordinate: 1479144.25  
X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9- 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 478.50  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.15  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 5 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					No cuttings returned.			
125					Sandy SILT (ML); light reddish brown (5YR 6/4); soft; (wet/saturated) low to medium plasticity; 70% silt with minor clay; 30% fine to coarse sand.			Driller begins adding water. Cuttings saturated.
130					SILT ( ML); light reddish brown (5YR 6/4); soft; low plasticity; 90% silt; 10% fine sand; no odor.			
135					Same as above (130 ft).			Total Depth@1140. End 7/17/12. Resume @ 1230 on 7/18/12.
140					SILT with sand (ML); light reddish brown (5YR 6/4); soft; saturated; low to medium plasticity; 75% silt with minor clay; 25% fine to medium sand; no odor.	ML	High Solids Bentonite Grout	Driller adding water. Cuttings saturated. Extremely difficult to log accurately.
145					SILT (ML); light reddish brown (5YR 6/4); soft; low plasticity; 95% silt; 5% fine sand.			
150								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
   ▽ At Time of Drilling: 478.50  
   ▼ At End Of Drilling: N/A  
   ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					SILT (ML); light reddish brown (5YR 6/4); soft; low plasticity; 95% silt; 5% very fine sand; no odor.			Cuttings saturated.
155					Same as above (150 ft).	ML		Total Depth @ 1245. Resume @ 1355.
160					No cuttings returned.			
165					No cuttings returned.			
170					Poorly graded SAND (SP); light yellowish brown (10YR 6/4); loose; 90% fine to medium sand; 5% silt; no odor.			
175					Same as above (170 ft).	SP		Total Depth @ 1315. Resume @ 1325.
180								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 7 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Lean CLAY with sand (CL); dark yellowish brown (10YR 4/4); firm; medium plasticity; 80% clay with minor silt; 20% medium to coarse sand; no odor.	CL		
185					Well graded SAND (SW); yellowish brown (10YR 5/4); loose; 90% fine to coarse sand; 10% silt. Same as above (183 ft).	SW		
190					Well graded SAND with gravel (SW); brown (10YR 5/3); loose; 70% sand; medium to very coarse gravel to 3 cm; no odor.	SW		
195					Poorly graded SAND (SP); yellowish brown (10YR 5/4); loose; 95% fine to medium sand; 5% silt; no odor.	SP		Total depth @ 1345.
200					Well graded SAND (SW); brown (10YR 5/3); loose; 90% fine to very coarse sand; 10% gravel to 2 cm; no odor.	SW		@200ft switch to 9 5/8" casing.
205					Same as above (200 ft); 100% fine to coarse sand.	SW		Resume drilling 7-23-12 @ 1435.
210								





# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 8 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well graded SAND (SW); dark yellowish brown (10YR 4/4); moist; loose; 100% very fine to coarse sand; no odor.			
215					Same as above (210 ft); 100% very fine to medium sand; trace coarse sands.			Total Depth casing @ 14:50. Resume drilling @ 1500.
220					Same as above (210 ft); dry; 95% fine to very coarse sand; 5% gravel to 3 cm.	SW		
225					Same as above (210 ft); 90% fine to medium sand; 10% coarse sands.		High Solids Bentonite Grout	
230					Same as above (210 ft).			
235					Poorly graded SAND (SP); pale brown (10YR 6/2); dry; loose; 100% very fine to medium sand; no odor.	SP		Total Depth casing @ 1515. Resume drilling @ 1520.
240								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 9 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND (SP); brown (10YR 5/3); loose; dry; 95% fine to medium sand; 5% silt; no odor.	SP		
245					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% fine to coarse sand; no odor.	SW		
250					Poorly graded SAND (SP); brown (10YR 5/3); loose; dry; 95% fine to medium sand; 5% silt; no odor.	SP		
255					Well graded SAND with gravel (SW); grayish brown (10YR 5/2); dry; loose; 85% fine to very coarse sand; 15% gravel to 1 cm; no odor.	SW		
260					As above (254 ft).	SW		
265					Poorly graded SAND (SP); light yellowish brown (10YR 6/4); dry; loose; 95% fine to medium sand; 5% silt; no odor.	SP		
270								

High Solids  
Bentonite  
Grout

Total Depth casing @ 1530.  
Resume @ 1537.



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/16/2012  
Date TD Reached: 7/16/2012  
Date Completed: 7/16/2012  
Ground Elevation AMSL (ft): 5333.7  
Y Coordinate: 1479144.25  
X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9- 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 478.50  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.15  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 10 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP) pale brown (10YR 6/3) dry; loose; 95% fine to medium sand; 5% silt; no odor.			
275					Same as above (270 ft).			
280					Same as above (270 ft).	SP		
285					Same as above (270 ft); large (5 to 6 cm) chunks of lean clay entrained; trace gravel to 1.5 cm.			
290								
295					Well graded SAND (SW); yellowish brown (10YR 5/4); dry; loose; 100% fine to coarse sand; no odor.			
295					Same as above (291 ft).	SW		
300								

Total Depth casing @ 1550.  
Resume @ 1558.

High Solids  
Bentonite  
Grout

Total Depth casing @ 1610.  
Resume @ 1620.



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% fine to coarse sand; no odor.			
305					Same as above (300 ft).			
310					Same as above (300 ft).			
315					Same as above (300 ft); trace gravel to 2 cm.	SW	High Solids Bentonite Grout	
320					Well graded SAND with gravel (SW); grayish brown (10YR 5/2); dry; loose; 70% fine to very coarse sand; 30% gravel to 4 cm.			
325					Poorly graded SAND (SP); yellowish brown (10YR 5/3); dry; loose; 90% fine to medium sand; 10% gravel to 2 cm.	SP		
330								1630 shut down for lightning. Resume @ 0830 on 7-24-12.



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 12 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND (SW); grayish brown (10YR 5/2); dry; loose; 90% very fine to very coarse sand; 10% gravel to 1 cm; no odor.			
335					Same as above (330 ft); 95% fine to very coarse sand; 5% gravel to 0.8 cm.	SW		Total Depth casing @ 0845. Resume @ 0850.
340					Same as above (330 ft); 70% fine to medium sand; 30% coarse sands; trace gravel to 1.5 cm; no odor.			
345					Well graded GRAVEL (GW); brown (10YR 5/3); dry; loose; 90% gravel to 3 cm; 10% medium sand; no odor.	GW		
					Poorly graded SAND (SP); yellowish brown (10YR 5/4); dry; loose; 100% fine to medium sand; trace gravel to 7 cm.			
350					Same as above (345 ft); 95% fine to medium sand; 5% silt; no odor.	SP		
355					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 95% fine to coarse sand; 5% gravel to 1 cm; no odor.	SW		Total Depth casing @ 0905. Resume @ 0915.
360								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 13 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; trace coarse sand; no odor.	SP		
365					Same as above (360 ft).			
370					Well graded SAND (SW); brown (10YR 4/3); moist; loose; 95% fine to very coarse sand; 5% gravel to 0.8 cm; no odor.	SW		
375					Same as above (367 ft).			
380					Poorly graded SAND (SP); brown (10YR 4/3); moist; loose; 100% fine to medium sand; no odor.	SP		
385					Same as above (374 ft).			
390					Well graded SAND (SW); brown (10YR 4/3); dry; loose; 100% fine to very coarse sand; trace gravel to 1 cm; no odor	SW		

High Solids  
Bentonite  
Grout

Total Depth casing @  
 0930.  
 Resume @ 0940.



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 14 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Poorly graded SAND (SP); brown (10YR 4/3); dry; loose; 95% fine to medium sand; 5% coarse sands; no odor.			
395					Same as above (390 ft).	SP		Total Depth casing @ 1010. Resume @ 1245.
400					Well graded SAND (SW); brown (10YR 5/3); dry; loose 100% fine to very coarse sand; trace gravel to 1 cm; no odor.			
405					Same as above (400 ft).	SW		
410					Same as above (400 ft); 95% fine to very coarse sand; 5% gravel to 3 cm; no odor.		High Solids Bentonite Grout	
415					Poorly graded SAND (SP); yellowish brown (10YR 5/4); dry; loose; 100% fine to medium sand; trace coarse sands; no odor.	SP		Total Depth casing @ 1310. Resume @ 1320.
420								





# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/16/2012  
Date TD Reached: 7/16/2012  
Date Completed: 7/16/2012  
Ground Elevation AMSL (ft): 5333.7  
Y Coordinate: 1479144.25  
X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9- 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 478.50  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.15  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 15 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND (SW); pale brown (10YR 6/3); dry; loose; 100% fine to coarse sand; no odor.			
425					Same as above (420 ft).	SW		
430					Poorly graded SAND (SP); pale brown (10YR 6/3); dry; loose; 100% fine to medium sand; trace coarse; no odor.			
435					Same as above (430 ft); no coarse sand.			
440					Same as above (430 ft); 100% fine to medium sand.	SP		
445					Same as above (440 ft).			
450								

- High Solids  
Bentonite  
Grout

Total Depth casing @  
1345.  
Resume @ 1351.



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 16 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 95% fine to medium sand; 5% silt; no odor.			
455					Same as above (450 ft).	SP		Total Depth @ 1425. Resume @ 1438.
460					Same as above (450 ft).		5" Schedule 80 PVC Riser	
465					Well graded SAND (SW); brown (10YR 5/3); dry; loose; 100% very fine to very coarse sand; no odor.			
470					Same as above (450 ft).	SW	High Solids Bentonite Grout	
475					Same as above (450 ft).			Total Depth @ 1510. Resume @ 1520.
480							Top of Bentonite Seal	Water level after drilling.
								Water level at time of drilling.



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/16/2012  
Date TD Reached: 7/16/2012  
Date Completed: 7/16/2012  
Ground Elevation AMSL (ft): 5333.7  
Y Coordinate: 1479144.25  
X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9- 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 478.50  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.15  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 17 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); brown (10YR 5/3); dry; loose; 100% fine to medium sand; trace coarse sands; no odor.			
485					Same as above (480 ft).	SP		
490					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% fine to very coarse sand; no odor.			
495					Same as above (490 ft); cuttings increasingly moist until damp at ~493 feet; at water table.			
500					Same as above (490 ft); damp.	SW		
505					Same as above (490 ft).			
510								

- Bentonite Seal

Total Depth casing @ 1605.  
Resume @ 1320 on 7/25/12.



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/16/2012  
Date TD Reached: 7/16/2012  
Date Completed: 7/16/2012  
Ground Elevation AMSL (ft): 5333.7  
Y Coordinate: 1479144.25  
X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9- 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 478.50  
▼ At End Of Drilling: N/A  
▽ After Drilling: 477.15  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Rachel Daly

Page 18 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Well graded SAND (SW); brown (10YR 5/3); damp; loose; 100% fine to very coarse sand; no odor.			
515					Same as above (510 ft).			Total Depth casing @ 1412. Resume @ 1445.
520					Well graded SAND with gravel (SW); brown (10YR 5/3); damp; loose; 80% fine to very coarse sand; 20% fine gravel to 5 cm; no odor.			
525					Same as above (520 ft); gravel to 1 cm; gravel decreasing in size.	SW		
530					Well graded SAND (SW); brown (10YR 5/3); damp; loose; 95% fine to coarse sand; 5% gravel to 0.8 cm; no odor.			
535					Well graded SAND with gravel (SW); brown (10YR 5/3); damp; loose; 85% fine to very coarse sand; 15% gravel to 1 cm; no odor.		- Bentonite Seal	Total Depth casing @ 1520. Resume @ 0925 on 7-26-12.
540								



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
   ▽ At Time of Drilling: 478.50  
   ▼ At End Of Drilling: N/A  
   ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 19 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					No cuttings returned.			
545								
550					Well graded SAND (SW); grayish brown (10YR 5/2); damp; loose; 95% fine to very coarse sand; 5% gravel to 1.5 cm; no odor; subangular.			
555					Same as above (545 ft); wet.			
560					Well graded SAND with gravel (SW); dark grayish brown (10YR 4/2); wet; loose; 65% fine to coarse sand; 35% gravel to 1.5 cm; subrounded; no odor.	SW		Total Depth casing @ 1033. Resume @ 1040.
565					Same as above (556 ft); 15% gravel to 2 cm; subrounded; 85% fine to very coarse sand.		- Bentonite Seal	
570					Same as above (560 ft).			



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 20 of 21

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
570					Well graded SAND (SW); dark grayish brown (10YR 4/2); wet; loose; 95% fine to coarse sand; 5% gravel to 3 cm; subrounded; no odor.			
575					Same as above (570 ft).	SW	- Bentonite Seal	At 575 ft, Total Depth casing @ 1240. Resume @ 0855.
580					Poorly graded SAND (SP); dark grayish brown (10YR 4/2); wet; loose; 100% fine to medium sand; trace coarse sand; no odor; subrounded.	SP		
585					Well graded SAND (SW); dark grayish brown (10YR 4/2); wet; loose; 95% medium to very coarse sand; 5% gravel to 2 cm; no odor; subangular.			
590					Same as above (580 ft).			
595					Same as above (580 ft); 95% fine to very coarse sand; 5% gravel to 2 cm.	SW	- Top of 20/40 Sand - Top of 10/20 Sand - Top of 5" Schedule 80 PVC 0.010" Slot Screen	Total Depth casing @ 0935. Resume @ 1005.
600					Same as above (580 ft); 100% fine to coarse sand; trace gravel.			



# Borehole ID: KAFB-106206

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/16/2012  
 Date TD Reached: 7/16/2012  
 Date Completed: 7/16/2012  
 Ground Elevation AMSL (ft): 5333.7  
 Y Coordinate: 1479144.25  
 X Coordinate: 1544723.57

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9- 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 478.50  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 477.15  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Rachel Daly

Page 21 of 21

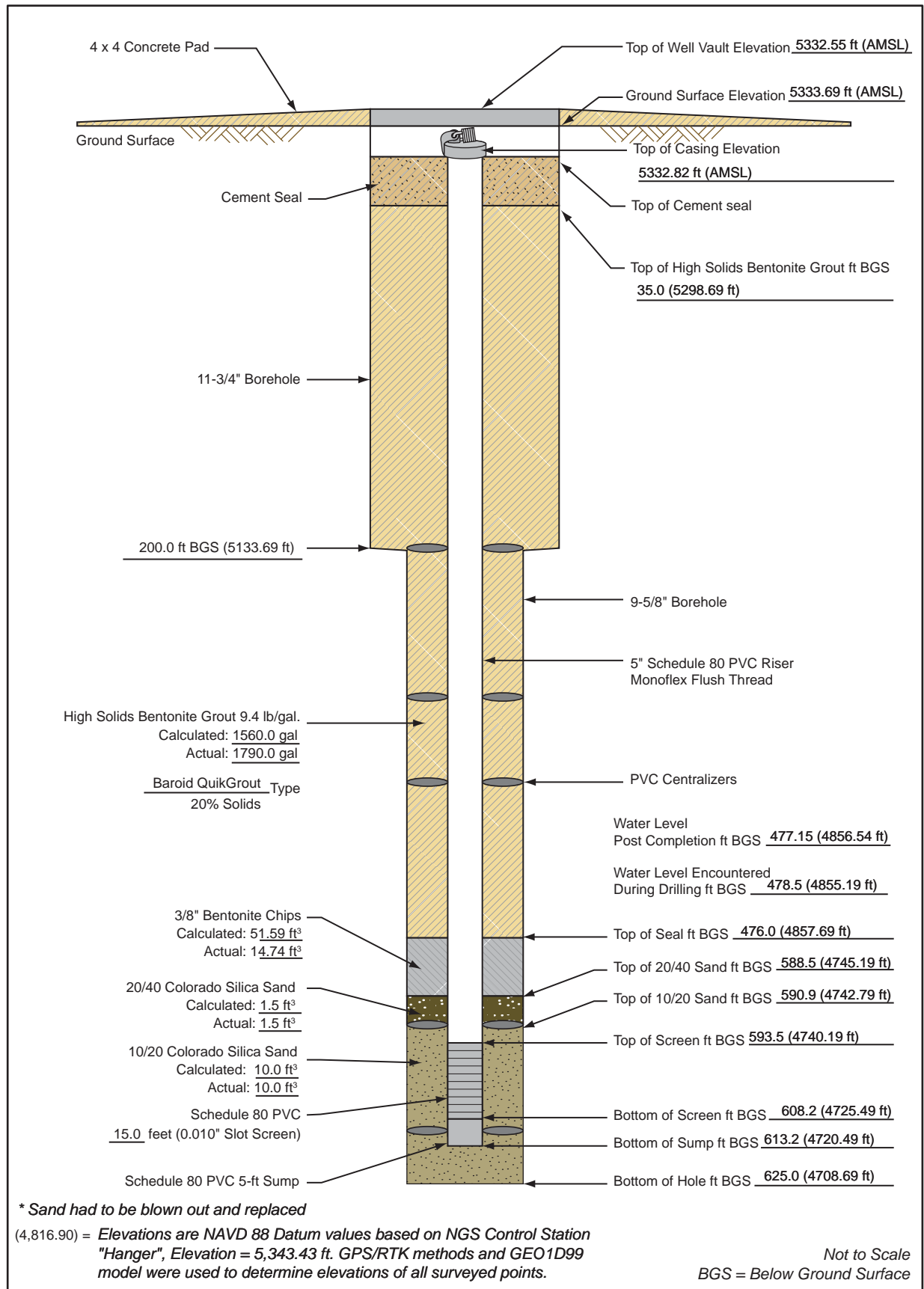
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
600					No cuttings returned.			
605					Well graded SAND (SW); brown (10YR 4/3); wet; loose; 100% medium to very coarse sand; trace gravel to 2 cm; subrounded; no odor.			
610					Same as above (603 ft); trace clay nodules.			
615					Same as above (610 ft).	SW		Total Depth casing @ 1050. Resume @ 1148.
620					Well graded SAND with gravel (SW); brown (10YR 4/3); wet; loose; 70% fine to very coarse sand; 30% gravel to 2 cm; no odor; subrounded.			
625					Same as above (620 ft).			Total Depth Borehole @ 1210.
630								



# Monitoring Well Completion Diagram KAFB-106206

Installation Start Date/Time: 7/31/2012 @ 12:00

Installation End Date/Time: 8/09/2012 @ 12:10



## Well Development Record

**Project Name:** KAFB BFF
**Location:** Kentucky St
**Personnel:** V. Bracht
**Date:** 9/13/12
**Samplers:** N/A
**Well/Piez. No.:** KAFB-106206
**Date Installed:** 8/9/12
**Csg. Diameter (I.D.):** 5"
**Total Depth (ft. BGL):** 613.2
**Method of Development:**
☒ Surging      ☒ Bailing  
☐ Original Development      ☐ Redevelopment

☒ Pumping  
☐ Other

**Development Date:** 9/13/12
**Depth to Water Before Developing Well (ft. BGL):** 478.60

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:**            feet = 153.84 gal. \* 1 = 153.84

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 1253.84 \text{ gallons}$$
**Depth Purging From:** 603 feet
**Time Purging Begins:** 0855, 9/13/12
**Weather:** Cloudy, Cool, Rain
**Screened Interval (ft BGL):** 593 - 608
**Equipment Nos.:** **pH Meter:** LVE 002686
**EC Meter:** LVE 002686
**Turbidity Meter:** LVE002384
**Equipment Decontaminated Prior to Development:** Y    X    N   
**Describe:** Steam Cleaned
**Collected Sample of Water Added to Well:** Y    N    X   
**Describe:** N/A
**Comment:** 1100 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/13/2012	0855	477.80	20	19.10	7.04	NR*	>1000	Begin Bailing; Water is Brown
9/13/2012	0913	--	55	19.20	7.70	NR*	>1000	Continue Bailing; Water is Brown
9/13/2012	0925	--	75	18.90	7.84	NR*	>1000	Continue Bailing; Water is Brown
9/13/2012	0935	--	100	18.90	7.89	0.000*	>1000	Continue Bailing; Water is Brown
9/13/2012	1103	477.97	--	18.70	7.72	0.397	966.00	Begin Pumping
9/13/2012	1105	480.07	175	19.70	7.70	0.426	697.00	Water is Very Cloudy
9/13/2012	1115	480.07	275	19.90	7.69	0.414	38.30	Water is Slightly Cloudy
9/13/2012	1125	480.03	375	19.80	7.70	0.358	44.50	Water is Slightly Cloudy
9/13/2012	1135	480.03	475	20.10	7.70	0.437	32.70	Water is Slightly Cloudy
9/13/2012	1145	480.04	575	20.30	7.70	0.466	6.84	Water is Clear

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1°C

\* Turbidity report in NTV nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack

 $r_c$ = radius of the well casing and screen in feet

 $L_c$ = length of water column inside the casing and screen in feet

 $r_w$ = radius of the well bore in feet

 $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

**Project:** KAFB BFF

**Well No:** KAFB-106206

**Project Number:** 140705

**Samplers:** N/A

**Date:** 9/13/12

**Checked By:** N/A

**Time Start:** 0855, 9/13/12

**Time Finish:** 1335, 9/13/12

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/13/2012	1155	480.04	675	20.30	7.70	0.436	10.60	Water is Clear
9/13/2012	1205	480.04	775	20.30	7.71	0.438	8.97	Water is Clear
9/13/2012	1215	480.03	875	20.30	7.71	0.424	7.57	Water is Clear
9/13/2012	1225	480.03	975	20.30	7.74	0.305	8.89	Water is Clear
9/13/2012	1230	--	1025	--	--	--	--	Shut off Pump to Offload Water
9/13/2012	1305	480.05	1050	20.40	7.69	0.496	370.00	Water is Clear
9/13/2012	1315	480.11	1150	20.80	7.73	0.483	8.21	Water is Clear
9/13/2012	1325	480.12	1250	21.00	7.73	0.493	7.45	Water is Clear
9/13/2012	1335	480.12	1350	21.00	7.71	0.490	6.40	Water is Clear; Pump off; Total Removed

\* Due to sample cup design, the YSI Professional Plus does not accurately measure EC from the cup. Sample cup works well in a flow-through set-up, once pumping begins.

**Was well sampled after development?** YES NO X

**Sample Method:** N/A

**Sample Name:** N/A

**Analyses:** N/A

KAFB 106207



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Well graded SAND (SW); brown (10YR 4/3); moist; very loose; 100% fine to coarse sand; trace fine gravel to 7 mm, rounded.			Begin @ 1040. Fill material.
5					Same as above (0 ft); 10% fine gravel to 1.7 cm.	SW	Top of Cement Seal	Fill material.
10					SILT (ML); strong brown (7.5YR 5/6); dry; soft; 90% silt; 10% very fine sand; trace gravel to 3 cm, nonplastic.			Native.
15					Same as above (10 ft); 15% fine to coarse sand.	ML	Cement Seal	Depth @ 1055. Resume @1102.
20					Well graded SAND with gravel (SW); brown (7.5YR 5/4); dry; loose; 60% very fine to very coarse sand; 40% fine gravel to 2.4 cm, subrounded.			
25					Well graded SAND (SW); brown (7.5YR 5/4); dry; very loose; 95% very fine to very coarse sand; 5% fine gravel to 1 cm, subrounded.	SW		
30								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Well graded SAND with gravel (SW); brown (7.5YR 5/4); dry; loose; 60% very fine to very coarse sand; 40% fine gravel to 2.4 cm, subrounded.	SW		
					Same as above (20 ft); 15% fine gravel; moist; strong brown 7.5YR 4/6.		- Cement Seal	
40					Poorly graded SAND (SP); strong brown (7.5YR 4/6); moist; very loose; 95% very fine to medium sand; 2 mm, rounded; 5% silt.	SP		Depth @ 1119. Resume @ 1126.
45					Well graded SAND with silt (SW-SM); brown (7.5YR 4/4); moist; very loose; 10% silt; 80% very fine to very coarse sand; 10% fine gravel to 2.3 cm, subrounded.	SW-SM	- Top of High Solids Bentonite Grout	
					Lean CLAY lense (CL).	CL		
50					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; loose; 100% very fine to medium sand; 2 mm, subrounded; trace silt.	SP		
55							- High Solids Bentonite Grout	
					Well graded SAND (SW); brown 7.5YR 5/4; moist; loose; 100% very fine to very coarse sand; trace fine gravel to 1.3 cm, subrounded.	SW		Depth @ 1145.
60								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 3 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60								
65					Poorly graded SAND (SP); strong brown (7.5YR 4/6); moist; loose; 100% fine to medium sand; 2 mm, subrounded; trace silt.	SP		Resume @ 1236.
70					Well graded SAND with gravel (SW); brown (7.5YR 4/4); moist; loose; 85% fine to very coarse sand; 15% fine gravel to 1.2 cm.	SW		
75					SILT (ML); strong brown (7.5YR 5/6); moist; soft; nonplastic; 85% silt; 15% very fine sand; trace fine gravel to 8 mm.			
80					Same as above (68 ft); sand fine to very coarse.			
85					Same as above (68 ft); sandy silt (ML); 80% silt; 20% very fine to very coarse sand; trace fine gravel.	ML		
90					Same as above (80 ft).			

High Solids  
Bentonite  
Grout

Depth @ 1247.  
Resume @ 1252.





# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					SILT (ML); strong brown (7.5YR 4/6); moist; soft; low plasticity; 80% silt; 5% lean clay; 15% fine to coarse sand to 4.5 mm.			
95					Same as above (90 ft).			Depth @1304. Resume @ 1308.
100					Same as above (90 ft); trace fine gravel to 9mm.			
105					Same as above (90 ft); 70% silt; 15% lean clay.	ML	High Solids Bentonite Grout	
110					Same as above (90 ft).			
115					Same as above (90 ft).			Depth @ 1324.
120								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					SILT (ML); strong brown (7.5YR 5/6); dry; soft; nonplastic; 90% silt; 10% very fine to coarse sand; 4 mm.			Resume @ 1335.
125					Same as above (120 ft); trace lean clay.	ML		
130					Silty SAND (SM); brown (7.5YR 5/4); moist; loose; 70% very fine to very coarse sand; 30% silt; trace fine gravel to 7 mm, rounded.			
135					Same as above (130 ft).	SM	High Solids Bentonite Grout	Depth @ 1351. Resume @ 1357.
140					Same as above (130 ft).			
145					Poorly graded GRAVEL (GP); brown (7.5YR 5/4); moist; loose; 85% fine gravel to 1.4 cm; 10% medium to coarse sand; subangular; 5% silt.	GP		Cyclone partially clogged. Stop to clean out. End 8/17/12 @ 1407. Resume 8/20/12 @ 0806. Stop to detach & unclog cyclone hose @ 0812. Resume @ 0920. Adding water.
150								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					SILT with gravel (ML); brown (7.5YR 5/4); moist; firm; medium plasticity; 85% silt with trace lean clay; 15% gravel to 2 cm, subrounded.			
155					Same as above (150 ft).			Depth @ 0930. Stop to change flange. Resume @ 1022.
160					SILT (ML); light brown (7.5YR 6/4); wet; firm; low plasticity; 100% silt with trace lean clay nodules, < 0.8 mm.			
165					Same as above (160 ft).	ML	High Solids Bentonite Grout	
170					Same as above (160 ft).			
175					Same as above (160 ft); trace gravel to 3 cm.			Depth @ 1037. Resume @ 1044.
180								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					SILT (ML); light brown (7.5YR 6/4); wet; firm; low plasticity; 100% silt; trace lean clay nodules, < 0.08 mm.			
185					Same as above (160 ft).			
190					Same as above (160 ft); trace medium sand.			
195					Same as above (160 ft); trace fine gravel to 1.3 cm.	ML	High Solids Bentonite Grout	Depth @ 1100. Resume @ 1108.
200					SILT with gravel (ML); brown (7.5YR 5/4); low plasticity; 75% silt; 25% fine gravel to 2 cm.			Depth @ 1115. Total depth with 11 3/4" casing. Resume with 9 5/8" @ 1520.
205					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; very loose; 100% fine to very coarse sand; trace fine gravel to 1 cm, rounded.	SW		
210								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; very loose; 100% fine to very coarse sand; trace fine gravel to 1 cm, rounded.			
215					Same as above (205 ft).			
220					Same as above (205 ft).	SW		Depth @ 1525. Resume @ 1531.
225					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; very loose; 85% very fine to very coarse sand; 15% fine gravel to 2 cm, rounded.			
230					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; very loose; 90% very fine to medium sand; 10% coarse sand as pumice grains; trace clay nodules to 8 mm, rounded.			
235					Same as above (230 ft)	SP		Depth @ 1537.
240								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; very loose; 90% very fine to medium sand; 10% coarse sand as pumice grains; trace clay nodules to 8 mm, rounded.	SP		Resume @ 1541 Predominately pumice grains. 1600-king nipple separated from hammer End 8/20/12 Resume @0930 8/21/12.
245					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; very loose; 80% very fine to very coarse sand; 20% fine gravel to 2.1 cm, rounded. Note: grains are granite again.	SW		
250					Same as above (245 ft).	SW		
255					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; very loose; 90% fine to medium sand; 10% coarse sand; trace fine gravel to 1.9 cm, rounded	SP		Some pumice grains. Depth @ 0933. Resume @ 1000.
260					Same as above (255 ft).	SP		
265					Same as above (255 ft).	SP		
270								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well graded SAND (SW); brown (10YR 5/3); moist; loose 90% very fine to very coarse sand; 10% fine gravel to 1.3 cm, rounded.			
275					Same as above (270 ft); 5% gravel.	SW		Depth @ 1007. Resume @ 1013.
280					Same as above (270 ft); trace gravel.			
285					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 95% fine to medium sand; 5% coarse sand; trace fine gravel to 2.1 cm, rounded.	SP		
290					Well graded SAND (SW); brown (10YR 5/3) moist; loose; 90% very fine to very coarse sand; 10% fine gravel to 1.1 cm, rounded.			
295					Same as above (290 ft); trace fine gravel.	SW		Depth @ 1021.
300								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 12:33 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

High Solids  
Bentonite  
Grout





# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
					Well graded SAND (SW); brown (10YR 5/3) moist; loose; 90% very fine to very coarse sand; 10% fine gravel to 1.1 cm, rounded.	SW		Resume @ 1026.
305					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; loose; 95% fine to medium sand; 5% coarse sand; trace fine gravel to 4 cm, rounded.	SP		
310								
					Well graded SAND (SW); pale brown (10YR 6/3); dry; loose; 100% very fine to very coarse sand; trace fine gravel to 1.3 cm, rounded.	SW		
315								
					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 100% fine to medium sand; trace fine gravel to 2.7 mm, rounded.	SP		Depth @1036. Resume @ 1043.
320								
					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% fine to very coarse sand; trace fine gravel to 9 mm, rounded.			
325								
					Same as above (320ft); 5% fine gravel.	SW		
330								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 90% fine to very coarse sand; 10% fine gravel to 9 mm, rounded. Note: 10% fine gravel at 333 ft, 5% medium gravel to 6 mm.			
335					Same as above (320 ft).			Depth @ 1055. Resume @ 1100.
340					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; medium dense; 80% fine to very coarse sand; 20% fine gravel to 1.3 cm, rounded.	SW		
345					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to coarse sand; 5% fine gravel to 1.1 cm, rounded.		High Solids Bentonite Grout	
350					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% fine to medium sand; 2 mm, subrounded.	SP		
355					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to coarse sand; 5% gravel to 2.8 cm.	SW		Depth @ 1111. Resume @ 1118.
360								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to coarse sand; 5% gravel to 2.8 cm.	SW		Depth @ 1111. Resume @ 1118.
365					Poorly graded GRAVEL with sand (GP); brown (10YR 5/3); moist; medium dense; 60% fine gravel to 2.6 cm; 40% fine to very coarse sand, rounded. Note: gravel is granitic.	GP		1126-flange broke off of hammer. Resume @ 1406.
370					Well graded SAND with gravel (SW); brown (10YR 5/3); dry; medium dense; 85% fine to very coarse sand; 15% fine gravel to 1.3 cm, subrounded.	SW		
375					Poorly graded SAND with gravel (SP); brown (10YR 5/3); moist; medium dense; 80% medium to very coarse sand; 20% fine gravel to 1.2 cm, subrounded.	SP		
380					Poorly graded GRAVEL with sand (GP); brown (10 YR 5/3); 80% fine gravel to 3.3 cm; 20% fine to very coarse sand, rounded. Note: granite fragments. Sand is medium to very coarse at 375 ft.	GP	High Solids Bentonite Grout	Depth @ 1420. Resume @ 1431.
385					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 100% fine to very coarse sand; trace fine gravel to 9 mm, rounded.	SW		
390					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 100% fine to very coarse sand; trace fine gravel to 9 mm, rounded.	SW		



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% fine to very coarse sand; 5% fine gravel to 9 mm, rounded.			
395					Well graded SAND with gravel (SW); brown (10YR 5/3); dry; dense; 85% fine to very coarse sand; 15% fine gravel to 1.7 cm, rounded.			
400					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; dense; 90% fine to very coarse sand; 10% fine gravel to 1 cm, rounded.	SW		
405					Same as above (400 ft); slightly coarser.			
410					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; dense; 95% fine to medium sand; 5% coarse sand; 4 mm, rounded.	SP		
415					Well graded SAND (SW); brown (10YR 5/3); moist; dense; 95% very fine to very coarse sand; 5% fine gravel to 1.8 cm, rounded.	SW		
420								

Depth @ 1445.  
Resume @ 1452.

Depth @ 1511.

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); pale brown (10YR 6/3); dry; very dense; 90% medium to very coarse sand; 10% fine gravel to 1.8 cm, subangular to subrounded.			Resume @ 1521. Hammering down very slowly.
425					Same as above (420 ft); trace fine sand.	SP		
430								
435					Poorly graded GRAVEL (GP); brown (10YR 5/3); dry; very dense; 90% fine gravel to 2.2 cm; 10% coarse sand, rounded. Note: granitic fragments.	GP		
440					Poorly graded SAND with gravel (SP); brown (10YR 5/3); moist; very dense; 85% medium to coarse sand; 15% fine gravel to 1 cm, rounded.	SP		Depth @ 1548. Casing stuck-end 8/21/12. Resume @ 0805 on 8/22/12.
445					Poorly graded GRAVEL with sand (GP); yellowish brown (10YR 5/4); moist; very dense; 60% fine gravel to 3.5 cm, rounded; 40% medium to coarse sand, rounded. Note: granitic fragments.	GP		Adding water to bring cuttings up.
					Poorly graded SAND with gravel (SP); brown (10YR 5/3); moist; very dense; 70% medium to very coarse sand; 30% fine gravel to 2.7 cm, rounded.	SP		
450								



# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND (SP); brown (10YR 5/3); moist; very dense; 95% medium to very coarse sand; 5% fine gravel to 1.1 cm, subrounded.			
455					Poorly graded SAND with gravel (SP); brown (10YR 5/3) moist; very dense; 85% medium to very coarse sand; 15% fine gravel to 2 cm, rounded.	SP	- Bentonite Seal	Added ~ 50gal. Depth @ 0837. Stopped to tighten bolts on flange.
460					Same as above (455 ft).			Resume @ 0903.
465					Poorly graded GRAVEL with sand (GP); yellowish brown (10YR 5/4) moist; very dense; 60% fine gravel to 1.7 cm, rounded; 40% medium to very coarse; sand, subrounded.	GP	- Top of 20/40 Sand	Granitic fragments.
470					Poorly graded SAND with gravel (SP); yellowish brown (10YR 5/4); moist; dense; 70% medium to very coarse sand, rounded; 30% fine gravel to 2 cm, rounded.		- Top of 10/20 Sand	Driving easier.
475					Same as above (470 ft); 85% sand; 15% fine gravel.	SP	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	Depth @ 0921.
480								





# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND with silt (SP-SM); brown (10YR 5/3); wet; dense; 90% fine to medium sand; 10% silt; 2 mm, rounded.	SP-SM		Resume @ 0926. Water level @ 482'.
485					Silty SAND (SM); brown (10YR 5/3); wet; dense; 70% fine to medium sand; 30% silt to 1 mm, rounded.	SM		
490					Same as above (485 ft).			Water Level After Drilling.
495					Well graded SAND (SW); yellowish brown (10YR 5/4); wet; dense; 90% fine to very coarse sand; 10% fine gravel to 1.5 cm, rounded.	SW		
500					Well graded SAND with gravel (SW); yellowish brown (10YR 5/4); wet; dense; 85% fine to very coarse sand; 15% fine gravel to 2 cm, rounded.			Depth @ 0950. Resume @ 0957.
505					Well graded SAND (SW); yellowish brown (10YR 5/4); wet; dense; 95% fine to very coarse sand; 5% fine gravel to 2 cm, rounded.			
510							- Bottom of 5" Schedule 80 PVC 0.010" Slot Screen - Sump  - Bottom of Sump	





# Borehole ID: KAFB-106207

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/17/2012  
 Date TD Reached: 8/22/2012  
 Date Completed: 8/22/2012  
 Ground Elevation AMSL (ft): 5345.16  
 Y Coordinate: 1480123.29  
 X Coordinate: 1546033.69

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 482.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 489.79  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

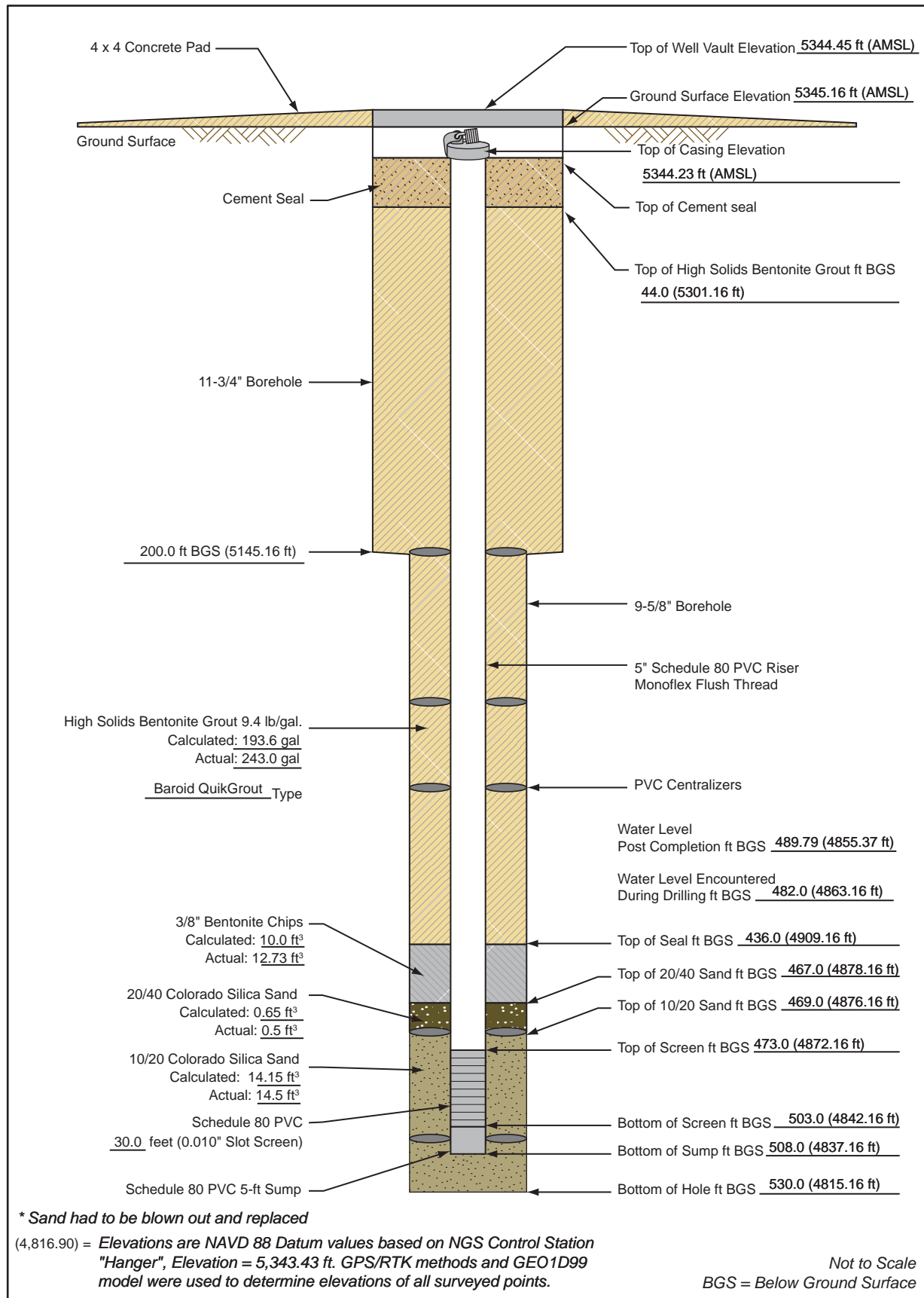
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								
515					Well graded SAND with gravel (SW); brown (10YR 5/3); wet; dense; 80% fine to very coarse sand; 20% fine gravel to 1.3 cm, rounded.			
520					Well graded SAND (SW); brown (10YR 5/3); wet; dense; 100% fine to very coarse sand; trace fine gravel to 1.3 cm, rounded.	SW		Depth @ 1016. Resume @ 1026.
525					Same as above (515 ft); 10% fine gravel			
530					Poorly graded GRAVEL with sand (GP); brown (10YR 5/3); wet; dense; 75% fine gravel to 2.1 cm, well rounded; 25% fine to very coarse sand, rounded; trace silt. Note: granitic fragments.	GP		
535					No recovery.			Total depth @ 530' @ 1042. Added ~ 600 gallons water total.
540								

# Monitoring Well Completion Diagram KAFB-106207

Installation Start Date/Time: 8/17/2012 @ 15:00

Installation End Date/Time: 8/22/2012 @ 11:30



## Well Development Record

**Project Name:** KAFB BFF
**Location:** Mesilla
**Personnel:** V. Bracht
**Date:** 9/12/12
**Samplers:** N/A
**Well/Piez. No.:** KAFB-106207
**Date Installed:** 8/22/12
**Csg. Diameter (I.D.):** 5"
**Total Depth (ft. BGL):** 508
**Method of Development:**
☒ Surging      ☒ Bailing  
☐ Original Development      ☐ Redevelopment

☒ Pumping  
☐ Other

**Development Date:** 9/12/12
**Depth to Water Before Developing Well (ft. BGL):** 491.25

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:**            feet = 30.99 gal. \* 1 = 30.99

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{630.99 \text{ gallons}}$$
**Depth Purging From:** 496 feet
**Time Purging Begins:** 0834, 9/12/12
**Weather:** Cloudy, Cool, Rain
**Screened Interval (ft BGL):** 473 - 503
**Equipment Nos.:** **pH Meter:** LVE 002686
**EC Meter:** LVE 002686
**Turbidity Meter:** LVE002384
**Equipment Decontaminated Prior to Development:** Y    X    N   
**Describe:** Steam Cleaned
**Collected Sample of Water Added to Well:** Y    N    X   
**Describe:** N/A
**Comment:** 600 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/12/2012	0834	490.50	20	19.10	7.10	0.001*	>1000	Begin Bailing; Water is Muddy Brown
9/12/2012	0856	--	60	19.70	7.91	0.001*	>1000	Continue Bailing; Water is Brown
9/12/2012	0912	--	90	19.60	7.84	0.001*	841.00	Continue Bailing; Water is Brown
9/12/2012	0918	--	100	--	--	--	--	Bailed
9/12/2012	1149	490.52	--	--	--	--	--	Begin Pumping at 10 GPM
9/12/2012	1150	493.10	--	19.80	7.59	0.443	58.70	Water is Cloudy
9/12/2012	1155	493.25	150	20.00	7.68	0.441	10.10	Water is Clear
9/12/2012	1200	493.29	200	20.00	7.70	0.439	5.48	Water is Clear
9/12/2012	1205	493.31	250	20.00	7.71	0.438	3.61	Water is Clear
9/12/2012	1210	493.35	300	20.00	7.73	0.435	2.84	Water is Clear

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1C

\* Turbidity report in NTV nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack

 $r_c$ = radius of the well casing and screen in feet

 $L_c$ = length of water column inside the casing and screen in feet

 $r_w$ = radius of the well bore in feet

 $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

Project: KAFB BFF

Well No: KAFB-106207

Project Number: 140705

Samplers: N/A

Date: 9/12/12

Checked By: N/A

Time Start: 0834, 9/12/12

Time Finish: 1250, 9/12/12

### Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/12/2012	1215	493.37	375	20.20	7.75	0.445	2.62	Water is Clear
9/12/2012	1220	493.39	425	20.30	7.75	0.444	2.68	Water is Clear
9/12/2012	1225	493.41	475	20.20	7.75	0.444	2.17	Water is Clear
9/12/2012	1228	--	500	--	--	--	--	Pump off; Tank Full
9/12/2012	1235	493.33	--	21.30	7.82	0.450	1.95	Continue Pumping; Water is Clear
9/12/2012	1240	493.42	550	20.20	7.75	0.436	3.50	Water is Clear
9/12/2012	1245	493.52	600	20.20	7.77	0.434	1.86	Water is Clear
9/12/2012	1250	493.55	650	20.20	7.77	0.433	1.90	Water is Clear; Pump off; Total Removed

\* Due to sample cup design, the YSI Professional Plus does not accurately measure EC from the cup. Sample cup works well in a flow-through set-up, once pumping begins.

Was well sampled after development? YES NO ☒ X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106208



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 1 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Silty SAND (SM); brown (7.5YR 5/4); dry; very loose; 75% very fine to very coarse sand; 20% silt; 5% fine gravel to 2cm.			Begin @ 0908.
5					Same as above (0ft).	SM	Top of Cement Seal	
10					SILT with gravel (ML); brown (7.5YR 4/4); moist; stiff; medium plasticity; 70% silt; 5% lean clay; 25% gravel to 3.4cm.			
15					SILT (ML); reddish brown (5YR 5/4); moist; very soft; low plasticity; 85% silt; 15% very fine to medium sand; trace fine gravel to 8 mm.	ML	Cement Seal	Depth @ 0926. Begin @ 0953.
20					Silty SAND (SM); brown (7.5YR 5/4); moist; very loose; 85% very fine to very coarse sand; 15% silt; trace fine gravel to 3.5 cm, subrounded.	SM		
25					Poorly graded SAND (SP); brown (7.5YR 5/4); dry; very loose; 95% very fine to medium sand; 2 mm, subrounded; 5% silt.	SP		
30								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 2 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Poorly graded SAND (SP); brown (7.5YR 5/4); dry; very loose; 85% very fine to medium sand; 2 mm, subrounded; 10% fine gravel to 2 cm, 5% silt.			
35					Same as above (25 ft); with gravel (SP); 70% sand; 25% gravel; 5% silt.	SP		Depth @ 0952. Resume @ 1001.
40					Same as above (25 ft).			
45					Well graded SAND (SW); brown (7.5YR 5/4); dry; very loose; 90% very fine to very coarse sand; 10% fine gravel to 1.5 cm, trace silt.	SW		
50					Silty SAND (SM); strong brown (7.5YR 4/6); moist; very loose; 80% very fine to coarse sand; trace fine gravel to 1.2 cm, subrounded; 20% silt.	SM		
55					Poorly graded SAND (SP); brown (7.5YR 5/4); dry; very loose; 95% very fine to medium sand; 5% silt; trace fine gravel to 8mm, subrounded.	SP		Depth @ 1024.
60								





# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 3 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60								
65					Well graded SAND (SW); brown (7.5YR 5/4); moist; loose; 90% very fine to very coarse sand; 5% fine gravel to 1.5 cm, rounded; 5% silt.	SW		Resume @ 1030.
70					Same as above (60 ft); well graded sand with gravel; 65% sand; 30% gravel; 5% silt.			
75					SILT (ML); strong brown (7.5YR 5/6); moist; soft; low plasticity; 85% silt; 15% very fine to medium sand; trace fine gravel to 1.4 cm.	ML		
80					Same as above (67 ft)			
85					Silty SAND (SM); brown (7.5YR 5/4); loose; dry; 75% very fine to very coarse sand; 5% fine gravel to 1 cm, subrounded; 20% silt.	SM		
90					SILT with sand (ML); brown (7.5YR 5/4); soft; moist; low plasticity; 80% silt; 20% very fine to very coarse sand; trace fine gravel to 1.3 cm.	ML		Depth @ 1047. Resume @ 1053.



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 8/8/2012  
Date TD Reached: 8/10/2012  
Date Completed: 8/16/2012  
Ground Elevation AMSL (ft): 5344.18  
Y Coordinate: 1480157.63  
X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11 3/4  
Hole Diameter Lower (in.): 9 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 496.00  
▼ At End Of Drilling: N/A  
▽ After Drilling: 488.85  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 4 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					SILT with sand (ML); brown (7.5YR 5/4); soft; moist; low plasticity; 80% silt; 15% very fine to very coarse sand; 5% lean clay; trace fine gravel to 1.3 cm.			
100					Same as above (85 ft).			Depth @ 1111. Resume @ 1118.
105					Same as above (85 ft).			
110					Same as above (85 ft); trace lean clay.			
115					Same as above (85 ft); trace lean clay.			Very fine sediment coming out.
120					No recovery.			Depth @ 1200.



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 5 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120								
125					Poorly graded GRAVEL (GP); brown (7.5YR 5/3); moist; loose; 70% fine gravel to 1.2 cm, 30% medium to coarse sand; subrounded; trace silt. Note: gravel is granitic.	GP		Resume @ 1257. Adding water.
130					Silty GRAVEL with sand (GM); brown (7.5YR 4/4); wet; loose; 50% fine gravel to 1.7 cm, 25% medium to very coarse sand, subrounded; 25% silt; trace lean clay.	GM		
135					Poorly graded GRAVEL (GP); brown (7.5YR 5/3); moist; loose; 85% fine gravel; 2 cm, subrounded; 10% medium to very coarse sand; 5% silt. Note: gravel is granitic.	GP		Limited recovery.
140					Silty SAND (SM); brown (7.5YR 5/4); wet; medium dense; 60% fine to very coarse sand; 10% fine gravel to 1 cm, subrounded; 30% silt; trace lean clay.		High Solids Bentonite Grout	Depth @ 1320. Resume 1327.
145					Same as above (135 ft); 5% gravel; 35% silt.	SM		
150					Same as above (135 ft); no gravel; 40% silt.			



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 6 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Sandy SILT (ML); brown (7.5YR 5/4); wet; soft; low plasticity; 60% silt; 30% fine to very coarse sand; 10% gravel to 3.8 cm.			
155					SILT (ML); brown (7.5YR 5/4); wet; soft; low plasticity; 85% silt; 15% fine to medium sand; 2 mm.			Depth @ 1344. Resume @ 1355.
160					Same as above (155 ft).			
165					Same as above (155 ft); trace lean clay nodules.	ML	High Solids Bentonite Grout	
170					Same as above (165 ft).			
175					Same as above (155 ft).			Depth @ 1416.
180								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 7 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					No recovery.			Resume @ 1424.
185					No recovery.			
190					SILT (ML); 85% silt; wet; medium firm; trace lean clay nodules; 15% very fine to coarse sand.	ML		Impossible to tell what depth this came from.
195					No recovery.			Depth @ 1451. Resume @ 1506.
200					Sandy SILT (ML); pale brown (10YR 6/3); wet; firm; low plasticity; 60% silt with lean clay; 40% fine to medium sand; 2 mm, rounded.	ML		Total depth with 11 3/4" casing. Begin 9 5/8" casing. Depth @1512. End 8/8/12. Resume 8/9/12 @ 0959.
205					Well graded SAND (SW); yellowish brown (10YR 5/4); moist; very loose; 100% fine to very coarse sand; 4 mm, subangular.	SW		
210								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 8 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; loose; 100% very fine to medium sand; trace coarse sand, 3 mm, subrounded.			
215					Same as above (210 ft); slightly coarser.	SP		
220					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% very fine to very coarse sand; trace fine gravel to 1 cm, subrounded.			Depth @ 1008. Resume @ 1013.
225					Same as above (218 ft); 5% fine gravel to 2.1 cm.	SW		
230					Same as above (218 ft). Note: some pumice grains.			
235					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; loose; 95% fine sand; 5% medium sand; 2 mm, rounded. Note: some pumice grains.	SP		Depth @ 1021.
240								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 9 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND (SP); pale brown (10YR 6/3); moist; loose; 90% fine to medium sand; 10% coarse sand as pumice grains; 2 mm, rounded.	SP		Resume.
245					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; loose; 85% very fine to very coarse sand; 15% fine gravel to 1 cm, rounded. Note: grains are granitic.	SW		
250					Same as above (243 ft); fine gravel to 2.8cm.	SW		
255					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 100% fine to medium sand; 2 mm, subrounded.	SP		Depth @ 1034. Resume @ 1041.
260					Well graded SAND (SW); pale brown (10YR 6/3); dry; loose; 95% fine to very coarse sand; 5% fine gravel to 1.5 cm, subrounded.	SW		
265					Same as above (260 ft).	SW		
270								





# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 10 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 95% fine to medium sand; 5% coarse sand; trace fine gravel to 1 cm, rounded.			
275					Same as above (270 ft); finer; no coarse sand or gravel.	SP		Depth @ 1045. Resume @ 1051.
280					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% very fine to very coarse sand; trace fine gravel to 1 cm, rounded.			
285					Same as above (279 ft); slightly finer.			
290					Same as above (279 ft); 5% fine gravel.	SW		
295					Same as above (279 ft); 5% fine gravel.			Depth @ 1058.
300								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 11 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 90% very fine to very coarse sand; 10% fine gravel to 1 cm, rounded.	SW		Resume @ 1105.
305					Poorly graded SAND (SP); pale brown (10YR 6/3); dry; loose; 100% very fine to medium sand; trace fine gravel to 4.7 cm, well rounded.			
310					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; loose; 100% very fine sand; 1 mm rounded; trace silt.	SP		
315					Same as above (310 ft); pale brown (10YR 6/3); fine to medium sand.		High Solids Bentonite Grout	Depth @ 1115. Resume @ 1221.
320					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% very fine to coarse sand; 4 mm, rounded.			
325					Same as above (320 ft).	SW		
330								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 8/8/2012  
Date TD Reached: 8/10/2012  
Date Completed: 8/16/2012  
Ground Elevation AMSL (ft): 5344.18  
Y Coordinate: 1480157.63  
X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11 3/4  
Hole Diameter Lower (in.): 9 5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 496.00  
▼ At End Of Drilling: N/A  
▽ After Drilling: 488.85  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Jason Tarbert

Page 12 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 95% very fine to coarse sand; 5% fine gravel to 1.2 cm, rounded.			
335					Same as above (320 ft); trace fine gravel.			Depth @ 1231. Resume @ 1236.
340					Same as above (320 ft); 5% fine gravel.			
345					Same as above (340 ft).	SW	High Solids Bentonite Grout	
350					Same as above (320 ft); 10% fine gravel.			
355					Same as above (350 ft).			Depth @ 1246.
360								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 13 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); brown (10YR 5/3); moist; loose; 100% very fine to coarse sand; 4 mm, rounded.			Resume @ 1252.
365					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; medium dense; 75% fine to very coarse sand; 25% gravel to 3.6 cm, subrounded.	SW		
370					Poorly graded SAND with gravel (SP); brown (10YR 5/3); moist; medium dense; 85% fine to medium sand; 15% fine gravel to 3.7 cm, well rounded.			
375					Same as above (380 ft); poorly graded sand; no gravel.	SP	High Solids Bentonite Grout	Depth @ 1303. Resume @ 1409.
380					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 100% very fine to coarse sand; trace fine gravel to 3.2 cm, rounded.			
385					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 100% very fine to coarse sand; trace fine gravel to 3.2 cm, rounded. Coarser than above (380 ft).	SW		
390								



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 14 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 100% very fine to coarse sand; trace fine gravel to 3.2 cm, rounded. Coarser than above (380 ft).			
395					Same as above (380 ft).	SW		Depth @ 1424. Resume @ 1435.
400					Same as above (380 ft).			
405					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% fine to medium sand; trace fine gravel to 1.3 cm, rounded.	SP		
410					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 100% fine to very coarse sand; 4 mm, rounded.			
415					Same as above (410 ft); 10% fine gravel to 2.3 cm.	SW		Depth @ 1453. Resume @ 1520.
420								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 12:41 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 15 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420								
425					Poorly graded SAND (SP); yellowish brown (10YR 5/4); dry; medium dense; 100% very fine to medium sand; trace coarse sand to 3 mm, rounded.	SP		
430					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 100% fine to very coarse sand; trace fine gravel, 6 mm, rounded.			
435					Same as above (425 ft); 5% fine gravel.			
440					Same as above (425 ft); 5% fine gravel.	SW		
445					Same as above (425 ft).			
450					Poorly graded SAND (SP); brown (10YR 5/3); moist; dense; 90% very fine to medium sand; 10% fine gravel to 2.5 cm, rounded.	SP		

High Solids Bentonite Grout

Depth @ 1537.  
Resume @ 1546.



# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 16 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well graded SAND (SW); brown (10YR 5/3); moist; dense; 100% fine to very coarse sand; 4.5 mm, rounded.			
455					Same as above (450 ft); 5% fine gravel to 1 cm.	SW		
460					Poorly graded SAND (SP); brown (10YR 5/3); dry; medium dense; 100% fine to medium sand; 2 mm; rounded	SP		
465					Well graded SAND (SW); yellowish brown (10YR 5/4); dry; medium dense; 100% fine to coarse sand; trace fine gravel to 7 mm, rounded.			
470					Same as above (463 ft); 10% fine gravel to 1.6 cm.	SW		
475					Same as above (463 ft).			
480								

Depth @ 1605.  
 End 8/9/12.  
 Begin @ 1025 on  
 8/10/12.

High Solids  
 Bentonite  
 Grout

Depth @ 1046.





# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

Page 17 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480								
					SILT (ML); brown (7.5YR 5/4); moist; firm; non-plastic to low plasticity; 85% silt; 15% very fine to medium sand; 2 mm, rounded.	ML		Resume @ 1054.
485					Poorly graded SAND (SP); yellowish brown (10YR 5/4); moist; medium dense; 100% very fine to medium sand; 2 mm, rounded.			
490					Same as above (483 ft); trace coarse sand to 4mm.	SP		Water level after drilling.
495					Same as above (483 ft); trace fine grave to 1.1 cm, overall coarser fine to medium.			
500					Well graded SAND (SW); brown (10YR 4/3); wet; dense; 95% fine to very coarse sand; 5% fine gravel to 1.2 cm, rounded.			Water level during drilling. Depth @ 1109. Resume @ 1118.
505					Same as above (500 ft); gravel to 4.4 cm.	SW		
510								



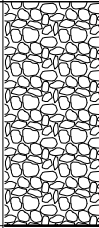


# Borehole ID: KAFB-106208

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 8/8/2012  
 Date TD Reached: 8/10/2012  
 Date Completed: 8/16/2012  
 Ground Elevation AMSL (ft): 5344.18  
 Y Coordinate: 1480157.63  
 X Coordinate: 1546034.11

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11 3/4  
 Hole Diameter Lower (in.): 9 5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 496.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 488.85  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Jason Tarbert

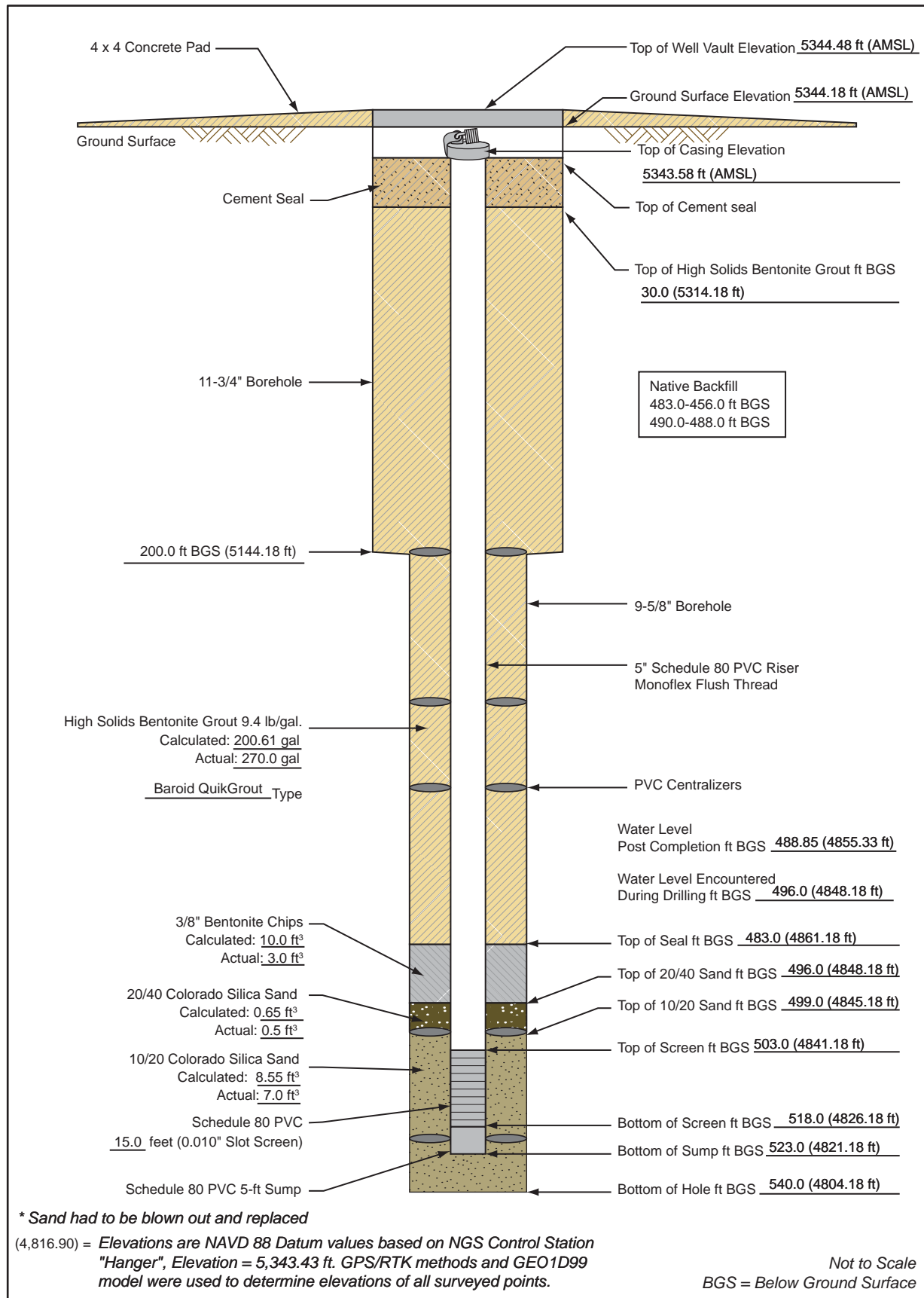
Page 19 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540								
545					Well graded SAND (SW); brown (10YR 5/3); wet; medium dense; 95% fine to very coarse sand; 5% fine gravel to 8mm; rounded.	SW	 - Native Backfill	Total Depth @ 1157. Added ~ 100 gal. during drilling. Added 500 gal. to flood hole. 600 gal. total.
550								
555								
560								
565								
570								

# Monitoring Well Completion Diagram KAFB-106208

Installation Start Date/Time: 8/13/2012

Installation End Date/Time: 8/16/2012



## Well Development Record

**Project Name:** KAFB BFF
**Location:** Mesilla
**Personnel:** V. Bracht
**Date:** 9/11/12
**Samplers:** N/A
**Well/Piez. No.:** KAFB-106208
**Date Installed:** 8/16/12
**Csg. Diameter (I.D.):** 5"
**Total Depth (ft. BGL):** 523
**Method of Development:**
☒ Surging      ☒ Bailing  
☐ Original Development      ☐ Redevelopment

☒ Pumping  
☐ Other

**Development Date:** 9/11/12
**Depth to Water Before Developing Well (ft. BGL):** 490.93

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:**            feet = 49.70 gal. \* 1 = 49.70

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{649.7 \text{ gallons}}$$
**Depth Purging From:** 506 feet
**Time Purging Begins:** 1034, 9/11/12
**Weather:** Sunny, Warm
**Screened Interval (ft BGL):** 503 - 518
**Equipment Nos.:** **pH Meter:** LVE 002686
**EC Meter:** LVE 002686
**Turbidity Meter:** LVE002384
**Equipment Decontaminated Prior to Development:** Y    X    N   
**Describe:** Steam Cleaned
**Collected Sample of Water Added to Well:** Y    N    X   
**Describe:** N/A
**Comment:** 600 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/11/2012	1034	490.13	10	21.30	6.91	0.000*	>1000	Begin Bailing; Water is Muddy Brown
9/11/2012	1045	--	45	21.00	7.75	0.000*	>1000	Continue Bailing; Water is Muddy Brown
9/11/2012	1100	--	75	20.80	7.87	0.003*	>1000	Continue Bailing; Water is Muddy Brown
9/11/2012	1110	--	100	--	--	--	--	Bailed
9/11/2012	1240	490.05	--	21.60	7.54	0.469	924.00	Begin Pumping at 10 GPM
9/11/2012	1245	492.00	200	20.50	7.56	0.450	36.90	Water is Slightly Cloudy
9/11/2012	1250	492.27	275	20.60	7.59	0.438	14.90	Water is Fairly Clear
9/11/2012	1255	492.29	300	20.50	7.59	0.433	12.60	Water is Fairly Clear
9/11/2012	1300	492.31	350	20.60	7.59	0.429	10.40	Water is Fairly Clear
9/11/2012	1305	492.33	400	20.60	7.59	0.424	7.70	Water is Clear

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1C

\* Turbidity report in NTV nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack

 $r_c$ = radius of the well casing and screen in feet

 $L_c$ = length of water column inside the casing and screen in feet

 $r_w$ = radius of the well bore in feet

 $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

**Project:** KAFB BFF

**Well No:** KAFB-106208

**Project Number:** 140705

**Samplers:** N/A

**Date:** 9/11/12

**Checked By:** N/A

**Time Start:** 1034, 9/11/12

**Time Finish:** 1330, 9/11/12

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/11/2012	1310	493.35	450	20.50	7.58	0.422	5.58	Water is Clear
9/11/2012	1315	493.37	500	20.40	7.64	0.419	4.11	Water is Clear
9/11/2012	1320	493.38	550	20.50	7.65	0.415	3.45	Water is Clear
9/11/2012	1325	493.40	600	20.60	7.64	0.413	2.81	Water is Clear
9/11/2012	1330	493.41	650	20.60	7.62	0.408	2.63	Water is Clear; Pump off; Total Removed

\* Due to sample cup design, the YSI Professional Plus does not accurately measure EC from the cup. Sample cup works well in a flow-through set-up, once pumping begins.

**Was well sampled after development?** YES ☐ NO ☒

**Sample Method:** N/A

**Sample Name:** N/A

**Analyses:** N/A

KAFB 106209





# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 1 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Disturbed from air knife utilities check			
5								
10					Poorly graded GRAVEL with silt (GP/GM); reddish brown (5YR 5/4); damp; very loose; 70% gravel; 3 to 60 mm; angular to subrounded; 10% very fine to very coarse sand; 10% fines (silt).	GP-GM		Injecting water for dust control.
15								
20					Silty SAND with gravel (SM); reddish brown (5YR 5/4); wet; very loose; 60% fine to coarse sand; 15% gravel; 3 to 10 mm; subangular to subrounded; max 10 mm; 15% fines (silt).	SM		End @ 0832. Begin @ 0841.
25					Silty SAND (SM); yellowish red (5YR 5/6); wet; very loose; 60% fine to coarse sand; 5% gravel; 3 - 12 mm; angular to subangular; max 12 mm; 25% silt, 10% clay.			0845. Pause - portable air compressor being added. Begin @ 0857.
30					Unable to log 25 - 35 ft bgs.			Driller attempting to dry casing; cuttings retrieved are mixed with wet cuttings from above.



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 2 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Unable to log 25 - 35 ft bgs.			
35					See above			End @ 0927. Begin @ 0935.
40								
45					Well graded SAND (SW); reddish brown (5YR 4/3); moist; loose; 95% sand; 5% gravel; 3 - 5 mm, subangular to subrounded, max 5 mm.	SW		
50					Silty SAND (SM); reddish brown (5YR 5/3); moist; loose; no gravel; 80% fine to coarse sand; 20% fines (silt).			
55					see FADL 0945	SM		
60					Silty SAND (SM); red (2.5YR 4/6); moist; loose; no gravel; 70% very fine to very coarse sand; 30% fines (silt).			End @ 0958. Begin @ 1005.



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/17/2012  
Date TD Reached: 7/25/2012  
Date Completed: 8/7/2012  
Ground Elevation AMSL (ft): 5343.8  
Y Coordinate: 1480204.26  
X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Groundwater Levels BGS (ft):  
    ▽ At Time of Drilling: 488.00  
    ▼ At End Of Drilling: N/A  
    ▽ After Drilling: 487.65  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Patrick Ostrye/Jason Tarbert

Page 3 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Silty SAND (SM); red (2.5YR 4/6); moist; loose; 69% very coarse to very fine sand; 1% gravel; 3 - 8 mm, subangular to subrounded; max 8 mm; 30% fines (silt).			
65					Silty SAND with gravel (SM); red (2.5YR 4/8); moist; loose; 45% very fine to coarse sand (well graded); 15% gravel; 3 - 10 mm, angular to subrounded; max 12 mm; 30% silt; 10% clay.			
70					Silty SAND (SM); red (2.5YR 4/8); moist; loose; 55% very fine to coarse sand; 5% gravel, 3 - 10 mm, angular to subangular; max 12 mm; 25% silt; 15% clay.			
75					Silty SAND (SM); red (2.5YR 4/8); moist; loose; 54% very fine to medium sand; 5% very coarse to coarse sand; 1% gravel; 3 - 8 mm, angular; 25% silt; 15% clay.	SM	- High Solids Bentonite Grout	End @ 1025. Begin @ 1033.
80					Silty SAND (SM); red (2.5YR 4/8); moist; loose; 52% very fine to medium sand; 3% coarse to very coarse sand; 20% silt; 20% clay.			
85					Silty SAND (SM); red (2.5YR 4/6); moist; loose; 60% very fine to coarse sand, 3% very coarse sand; 30% silt; 10% clay.			
90								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 4 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Silty SAND (SM); red (2.5YR 4/6); moist; loose; no gravel; 55% very fine to medium sand; 3% very coarse to coarse sand; 45% fines (silt).			
95					Same as above	SM		End @ 1050. 7-19-2012. Begin @ 1230.
100					Clayey SAND (SC); yellowish red (5YR 4/6); moist; loose; no gravel; 75% fine to medium sand; 10% silt; 15% clay.	SC		
105					Silty SAND (SM); red (2.5 YR 4/6); moist; loose; no gravel; 60% fine to medium sand; 30% silt; 10% clay.			
110					Silty SAND (SM); red (2.5 YR 4/6); moist; loose; no gravel; 60% fine to medium sand; 10% very coarse to coarse sand; 35% silt; 5% clay.	SM		
115					Silty SAND (SM); yellowish red (5YR 4/6); moist; loose; no gravel; 85% very fine to coarse sand; 15% fines (silt).			End @ 1248. Adding water to clean out discharge. hose. Begin @ 1318.
120								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 5 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					No recovery			
125								
130					Silty SAND (SM); no color; wet; loose; 50% very fine to medium sand; 30% silt; 20% clay.	SM		
135					Clayey SAND (SC); no color; wet; loose; 50% very fine to medium sand; 20% silt; 30% clay.	SC		
140					Silty SAND (SM); no color; wet; loose; 49% very fine to medium sand; 1% coarse to very coarse sand; 40% silt; 10% clay.			
145					Silty SAND (SM); no color; wet; loose; 65% very fine to very coarse sand; 25% silt; 10% clay.	SM		
150					Silty SAND (SM); no color; wet; loose; 40% very fine to medium sand; 15% coarse to very coarse sand; 10% gravel; 3 - 40 mm, subangular to rounded; max 50 mm; 30% silt; 5% clay.			

High Solids  
Bentonite  
Grout

End @ 1354.  
Begin @ 1405.



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/17/2012  
Date TD Reached: 7/25/2012  
Date Completed: 8/7/2012  
Ground Elevation AMSL (ft): 5343.8  
Y Coordinate: 1480204.26  
X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 488.00  
▼ At End Of Drilling: N/A  
▽ After Drilling: 487.65  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Patrick Ostrye/Jason Tarbert

Page 6 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Silty SAND (SM); no color; wet; loose; 60% very fine to medium sand; 30% silt; 10% clay.			
155					Silty SAND (SM); no color; wet; loose; 50% very fine to fine sand; 20% medium sand; 40% silt; 10% clay.			
160					Silty SAND (SM); no color; wet; loose; 50% very fine to fine sand; 50% fines (silt).	SM		
165					Same as above		High Solids Bentonite Grout	
170					Clayey SAND (SC); no color; wet; loose; 60% very fine to fine sand; 40% fines (clay); low to medium plasticity.	SC		
175					Silty SAND (SM); no color; wet; loose; 50% very fine to fine sand; 50% fines (silt).	SM		End @ 1420. Begin @ 1432.
180								End @ 1450. Begin @ 1505.





# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
   ▽ At Time of Drilling: 488.00  
   ▼ At End Of Drilling: N/A  
   ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 7 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					No recovery			
185								
190					Clayey SAND (SC); no color; wet; loose; 59% very fine to medium sand; 1% gravel; 3 - 10 mm; subangular; max 10 mm; 30% clay; 10% silt.	SC		
195					No recovery			
200					Silty SAND (SM); no color; wet; loose; 75% very fine to coarse sand; 25% fines (silt).	SM		End @ 1528. Begin @ 1543. Pushing drive casing flush to ground surface 200 ft bgs.
205					Poorly graded SAND (SP); yellowish red (5YR 4/6); moist; loose; 95% fine to coarse sand; 5% fines (coarse fraction is pumice).			7-20-12. Begin @ 1220.
210					Poorly graded SAND (SP); yellowish red (5YR 4/6); moist; loose; 94% fine to coarse sand; 1% gravel; 3 - 10 mm; angular to subrounded; max 12 mm; 5% fines. Note: coarse fraction of sand is pumice.	SP		





# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 8 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND (SP); reddish brown (5YR 5/4); dry; loose; 95% very fine to medium sand; 5% fines.	SP		
215					Well graded SAND with gravel (SW); reddish brown (5YR 5/4); dry; loose; 85% sand; 15% gravel; 3 - 10 mm; angular to subrounded; max 10 mm.	SW		End @ 1230. Begin @ 1236.
220					Well graded SAND with gravel (SW); reddish brown (5YR 4/4); dry; loose; 75% sand; 25% gravel; 3 - 10 mm; subangular to subrounded; max 10 mm.	SW		
225					Poorly graded SAND (SP); reddish brown (5YR 4/4); dry; loose; 95% very fine to medium sand; 5% fines.	SP		
230					Poorly graded SAND (SP); reddish brown (5YR 4/4); moist; loose; 1% gravel; 3 - 5 mm; subangular; max 5 mm; 94% very fine to medium sand; 1% coarse to very coarse sand; 5% fines.	SP		
235					Poorly graded SAND with silt (SP-SM); reddish brown (5YR 4/3); moist; loose; 90% very fine to medium sand; 10% fines (silt).	SP-SM		End @ 1248. Begin @ 1254.
240								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 9 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND with silt (SP-SM); reddish brown (5YR 4/3); moist; loose; 90% very fine to medium sand; 10% fines (silt).	SP-SM		
245					Poorly graded GRAVEL with sand (GP); dry; loose; 70% gravel; 3 - 20 mm; angular to subrounded; max 22 mm; 30% fine to very coarse sand; Note; gravel contains quartzite; limestone; basalt and granitic clasts.	GP		
250					Poorly graded SAND (SP); reddish brown (5YR 5/4); moist; loose; 100% fine to coarse sand.			
255					Poorly graded SAND with gravel (SP); reddish brown (5YR 5/3); moist; loose; 85% fine to very coarse sand; 15% gravel; 3 - 8 mm; subangular to subrounded; max 8 mm; Note: pumice clasts throughout grain size.			
260					Poorly graded SAND (SP); reddish brown (5YR 5/3); dry; loose; 85% very fine to medium sand; 10% coarse to very coarse sand; 5% fines. Note: coarse fraction is pumice.	SP		
265					Poorly graded SAND (SP); reddish brown (5YR 4/4); moist; loose; 92% very fine to coarse sand; 3% gravel; 3 - 5 mm; subrounded; max 5 mm; 5% fines.			
270								

- High Solids  
Bentonite  
Grout

End @ 1306.  
Begin @ 1311.



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/17/2012  
Date TD Reached: 7/25/2012  
Date Completed: 8/7/2012  
Ground Elevation AMSL (ft): 5343.8  
Y Coordinate: 1480204.26  
X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 488.00  
▼ At End Of Drilling: N/A  
▽ After Drilling: 487.65  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Patrick Ostrye/Jason Tarbert

Page 10 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270								
275					Well graded SAND (SW); reddish brown (5YR 5/4); moist; loose; 90% sand; 10% gravel; 3 - 8 mm; subangular to subrounded; max 8 mm; Note: pumice throughout.	SW		
280					Poorly graded SAND (SP); reddish brown (5YR 4/4); damp; loose; 95% fine to very coarse sand; 5% gravel; 3 - 5 mm; subangular to subrounded; max 8 mm.			End @ 1324. Begin @ 1332.
285					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; loose; 100% fine to coarse sand.			
290					Poorly graded SAND with gravel (SP); reddish brown (5YR 5/4); moist; loose; 80% fine to very coarse sand; 20% gravel; 3 - 10 mm; subangular to rounded; max 10 mm.	SP		
295					Poorly graded SAND (SP); reddish brown (5YR 5/4); moist; loose; 85% very fine to very coarse sand; 10% gravel; 3 - 10 mm; angular to subrounded; max 15 mm; 5% fines.			
300					Same as above (290 ft).			End @ 1343. Begin @ 1350.



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 11 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Poorly graded SAND with gravel (SP); reddish brown (5YR 5/4); moist; loose; 85% fine to very coarse sand; 15% gravel; 3 - 8 mm; subangular to subrounded; max 8 mm.	SP		
310					Poorly graded SAND with silt (SP-SM); brown (7.5YR 5/3); moist; loose; 90% very fine to very coarse sand; 10% fines (silt).			
315					Poorly graded SAND with silt (SP-SM); brown (7.5YR 5/4); moist; loose; 90% very fine to medium sand; 10% fines (silt).	SP-SM		
320					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; loose; 95% fine to coarse sand; 5% fines.			
325					Same as above (315 ft); trace fine gravel to 2 cm.			
330					Same as above (315 ft).	SP		

- High Solids  
Bentonite  
Grout

End of day @ 1408.  
 Begin 7-23-12 @ 0855.  
 J. Tarbert logging.



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 12 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND (SW); pale brown (10YR 6/3); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 1.3 cm; rounded			Adding water for dust control.
335					Same as above (330 ft); 10% fine gravel to 3.1 cm	SW		Depth @ 0921. Begin @ 0931.
340					Poorly graded SAND (SP); brown (7.5YR 4/4); moist; medium dense; 100% very fine to medium sand; 1 mm; rounded	SP		
345					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 90% very fine to very coarse sand; 10% fine gravel to 1 cm; rounded.			
350					Same as above (345 ft); grading finer; 5% fine gravel	SW		
355					Same as above (350 ft).			Depth @ 0945.
360								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/16/12 12:48 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 13 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND (SW); brown (10YR 5/3); dry; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 1 cm, rounded.			Begin @ 0955.
365					Same as above (350 ft); 10% fine gravel to 4 cm.			
370					Well graded SAND with gravel (SW); brown (10YR 5/3); moist; medium dense; 70% very fine to very coarse sand; 30% fine gravel to 3.5 cm, well rounded.	SW		
375					Same as above (370 ft).		High Solids Bentonite Grout	Depth @ 1015. Begin @ 1030.
380					Poorly graded SAND (SP); brown (10YR 5/3); moist; loose; 100% very fine to medium sand; 1.5 mm, rounded.	SP		
385					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 1.2 cm; rounded.	SW		
390								





# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 14 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel to 1.2 cm; rounded.			
395					Same as above (385 ft); gravel to 4 cm.	SW		Depth @ 1052. Begin @ 1058.
400					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand; 2 mm, rounded.	SP		Water for dust control.
405					Well graded SAND with gravel (SW); brown (10YR 4/3); moist; medium dense; 80% very fine to very coarse sand; 20% fine gravel to 1.3 cm; rounded.	SW		
410					No recovery.			
415					Same as above (403 ft); 15% fine gravel.	SW		Depth @ 1123.
420								





# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 15 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND with gravel (SW); brown (10YR 4/3); moist; medium dense; 80% very fine to very coarse sand; 20% fine gravel to 1.3 cm; rounded.			Begin @ 1317.
425					Same as above (403 ft).			
430					Same as above (403 ft).	SW		
435					Same as above (403 ft); overall finer.			
440					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 100% fine to medium sand; trace fine gravel to 8 mm, rounded.	SP		
445					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% fine to very coarse sand; 5% fine gravel to 2.3 cm, rounded.	SW		
450								End @ 1343. Begin @ 1347.



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 16 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% fine to very coarse sand; 5% fine gravel to 2.3 cm, rounded.			
455					Same as above (445 ft); well graded SAND with gravel (SW); 80% sand; 20% gravel to 1.7 cm.			Depth @ 1414. Resume @ 1427.
460					Same as above (455 ft); 25% gravel.	SW		
465					Same as above (455 ft); 25% gravel.		High Solids Bentonite Grout	
470					No recovery			Air line likely clogged with sediment. Pause to clean cyclone.
475					No recovery			Depth @ 1453. Resume @ 1458.
480								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 17 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					No recovery			Adding water to lift cuttings.
485					Well graded SAND (SW); brown (10YR 5/3); moist; medium dense; 95% very fine to very coarse sand; 5% fine gravel.	SW		1600 Hydraulic line to hammer broke, will have to replace. End 7-23-12. Begin 7-24-12 @ 0809. Water level encountered during drilling and after drilling.
490					Poorly graded SAND (SP); brown (10YR 5/3); moist; medium dense; 95% medium to coarse sand; 5% fine gravel to 2.8 cm, rounded.			
495					Same as above (490 ft).	SP		Depth @ 0824. Begin @ 1124.
500					Silty SAND (SM); brown (7.5YR 4/4); wet; medium dense; 85% fine to medium sand; 1 mm, rounded; 15% silt.			
505					Same as above (500 ft).	SM		
510								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 18 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Silty SAND (SM); brown (7.5YR 4/4); wet; medium dense; 85% fine to medium sand; 1 mm, rounded; 15% silt.			
515					Same as above (500 ft).	SM		Depth @ 1146. Resume @ 1312.
520					Same as above (500 ft); coarser; fine to coarse sand.			
525					Well graded SAND (SW); brown (10YR 5/3); wet; medium dense; 95% fine to very coarse sand; 5% fine gravel to 1.3 cm; rounded. Note: gravel lense from 527 to 529 ft.	SW		
530					Silty SAND (SM); brown (10YR 5/3); wet; medium dense; 80% fine to medium sand; 2 mm; rounded; 20% silt.			
535					Same as above (530 ft); trace fine gravel to 3 cm.	SM		Depth @ 1341. Resume @ 1344.
540								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 19 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					Silty SAND (SM); brown (10YR 5/3); wet; medium dense; 80% fine to medium sand; 2 mm; rounded; 20% silt.	SM		Added ~100 gallons water.    Depth @ 1423. Begin @ 1435.
545					Poorly graded SAND with gravel (SP); brown (10YR 5/3); wet; dense; 60% medium to very coarse sand; 40% fine gravel to 2 cm, rounded.	SP		
550					Well graded SAND (SW); brown (10YR 5/3); wet; dense; 90% fine to very coarse sand; 10% fine gravel to 2.2 cm, rounded; trace lean clay nodules.	SW		
555					Silty SAND (SM); brown (10YR 5/3); wet; dense; 70% fine to medium sand; 1 mm, rounded; 30% silt.	SM		
560					Same as above (555 ft).			
565					Well graded SAND with gravel (SW); pale brown (10YR 6/3); wet; dense; 85% fine to very coarse sand; 15% fine gravel to 1.7 cm, rounded.	SW		
570								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
Project Location: KAFB, Albuquerque, NM  
Date Started: 7/17/2012  
Date TD Reached: 7/25/2012  
Date Completed: 8/7/2012  
Ground Elevation AMSL (ft): 5343.8  
Y Coordinate: 1480204.26  
X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
Project Number: 140705  
Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Groundwater Levels BGS (ft):  
    ▽ At Time of Drilling: 488.00  
    ▼ At End Of Drilling: N/A  
    ▽ After Drilling: 487.65  
Drilling Contractor: Yellow Jacket  
Drilling Method: Air Rotary Casing Hammer  
Logged By: Patrick Ostrye/Jason Tarbert

Page 20 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
570								
575					Well graded SAND with gravel (SW); pale brown (10YR 6/3); wet; dense; 85% fine to very coarse sand; 15% fine gravel to 1.7 cm, rounded.			
					Same as above (562 ft); trace silt.	SW		Depth @ 1513. Begin @ 1520.
580								
					Silty SAND (SM); brown (10YR 5/3); wet; dense; 80% fine to medium sand; 1 mm, rounded; 20% silt.	SM	- Bentonite Seal	
585								
					Poorly graded SAND (SP); grayish brown (10YR 5/2); wet; dense; 95% fine to medium sand; 1 mm, rounded; 5% silt.	SP		
590								
					No recovery.			
595								
					Same as above (585 ft); 90% sand; 5% fine gravel to 2.2 cm; 5% silt.	SP	- Top of 20/40 Sand - Top of 10/20 Sand	Depth @ 1600. Begin @ 1608.
600								



# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

Page 21 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
600								
					Silty SAND (SM); grayish brown (10YR 5/2); wet; dense; 70% fine to medium sand; 2 mm, subrounded; 30% silt.	SM		
605					Well graded SAND with gravel (SW); brown (10YR 5/3); wet; dense; 80% fine to very coarse sand; 20% fine gravel to 4.5 cm, subrounded.			
						SW	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	
610					Same as above (602 ft); 5% silt.			Stopped 7-24-12 @ 1645. Resume 7-25-12 @ 0825.
615					Well graded SAND with silt (SW-SM); grayish brown (10YR 5/2); wet; dense; 90% fine to coarse sand; 10% silt; trace fine gravel to 1 cm, rounded.			Depth @ 0900. Resume @ 1102.
							- Bottom of 5" Schedule 80 PVC 0.010" Slot Screen	
620					Same as above (615 ft).		- Sump	
						SW-SM	- Bottom of Sump	
625					Same as above (615 ft).			
630								





# Borehole ID: KAFB-106209

Client: **US Army Corps of Engineers**  
 Project Location: KAFB, Albuquerque, NM  
 Date Started: 7/17/2012  
 Date TD Reached: 7/25/2012  
 Date Completed: 8/7/2012  
 Ground Elevation AMSL (ft): 5343.8  
 Y Coordinate: 1480204.26  
 X Coordinate: 1546034.28

Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705  
 Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 488.00  
 ▼ At End Of Drilling: N/A  
 ▽ After Drilling: 487.65  
 Drilling Contractor: Yellow Jacket  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: Patrick Ostrye/Jason Tarbert

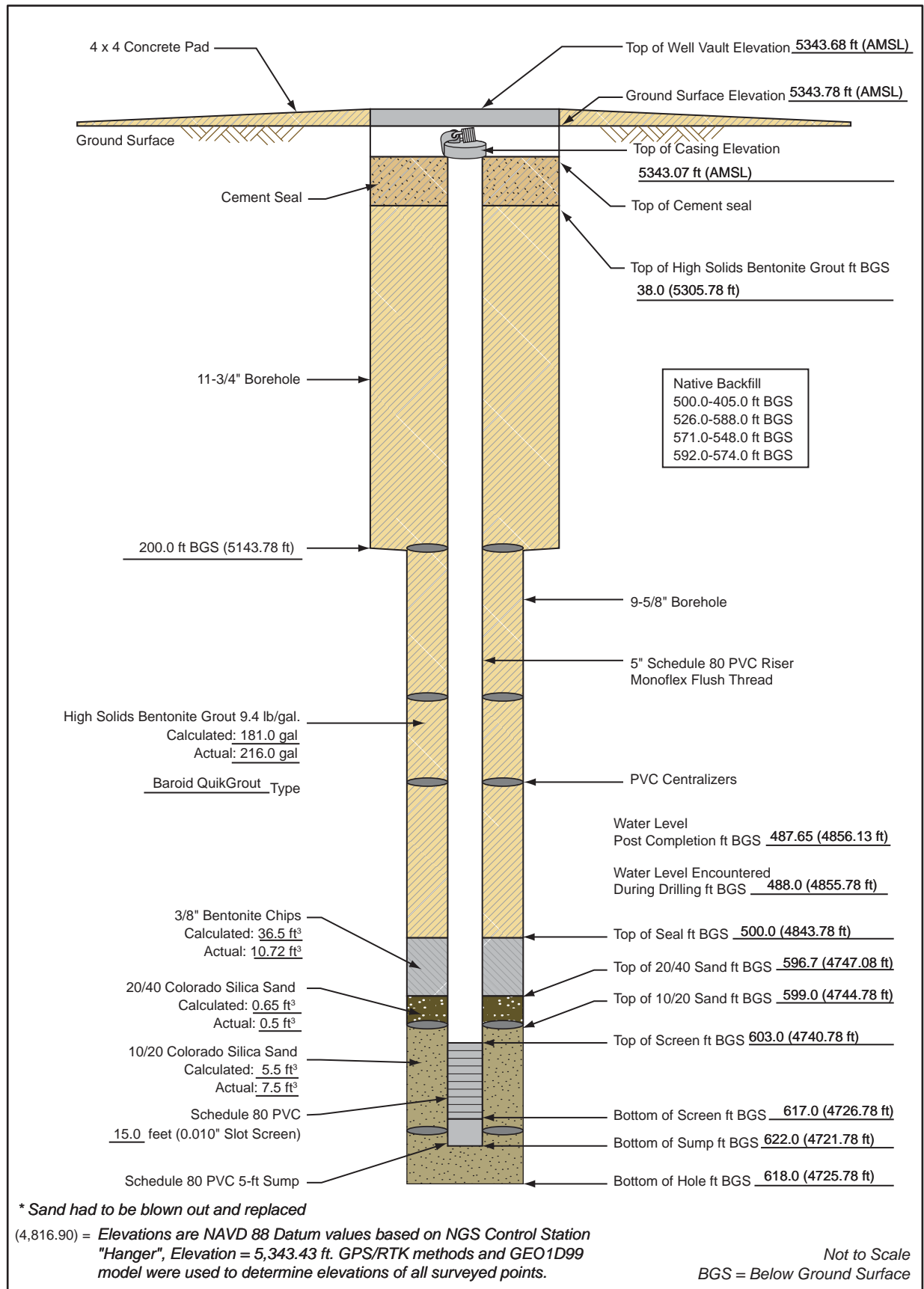
Page 22 of 22

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
630								
635					Well graded SAND with silt (SW-SM); grayish brown (10YR 5/2); wet; dense; 90% fine to coarse sand; trace fine gravel to 1 cm, rounded; 10% silt. Slightly coarser than at 615 ft.			
640					Same as above (615 ft).	SW-SM		
645					Well graded SAND (SW); grayish brown (10YR 5/2); wet; dense; 95% fine to very coarse sand; 5% gravel to 4.5 cm, well rounded; trace silt.	SW		Depth @ 1135.
650								
655								
660								

# Monitoring Well Completion Diagram KAFB-106209

Installation Start Date/Time: 7/26/2012 @ 08:33

Installation End Date/Time: 8/07/2012 @ 12:30



## Well Development Record

**Project Name:** KAFB BFF
**Location:** Mesilla and Southern
**Personnel:** V. Bracht
**Date:** 9/10/12
**Samplers:** N/A
**Well/Piez. No.:** KAFB-106209
**Date Installed:** 8/7/12
**Csg. Diameter (I.D.):** 5"
**Total Depth (ft. BGL):** 622
**Method of Development:**
☒ Surging      ☒ Bailing  
☐ Original Development      ☐ Redevelopment

☒ Pumping  
☐ Other

**Development Date:** 9/10/12
**Depth to Water Before Developing Well (ft. BGL):** 490.80

Vol. (V)      Purge Factor      Volume to Purge

**Height of Water Column:**            feet = 149.54 gal. \* 1 = 149.54

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{1299.54 \text{ gallons}}$$
**Depth Purging From:** 603 feet
**Time Purging Begins:** 0945, 9/10/12
**Weather:** Cloudy, Cool
**Screened Interval (ft BGL):** 603 - 617
**Equipment Nos.:** **pH Meter:** LVE 002686
**EC Meter:** LVE 002686
**Turbidity Meter:** LVE002384
**Equipment Decontaminated Prior to Development:** Y    X    N   
**Describe:** Steam Cleaned
**Collected Sample of Water Added to Well:** Y    N    X   
**Describe:** N/A
**Comment:** 1150 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/10/2012	0945	490.15	15	22.30	7.35	0.005*	393.00	Begin Bailing; Water is Brown
9/10/2012	1012	--	55	21.30	7.90	0.005*	>1000	Continue Bailing; Water is Brown
9/10/2012	1025	--	90	21.00	7.90	0.005*	643.00	Continue Bailing; Water is Very Cloudy; Bubbles
9/10/2012	1030	--	100	--	--	--	--	Bailed
9/10/2012	1304	490.01	--	--	--	--	--	Pump Starts and Shuts off
9/10/2012	1344	491.02	--	23.10	7.61	0.313	69.70	Begin Pumping
9/10/2012	1355	491.02	200	21.70	7.80	0.290	27.80	Water is Cloudy
9/10/2012	1405	491.00	300	21.70	7.64	0.297	16.20	Water is Fairly Clear
9/10/2012	1415	491.03	400	21.40	7.68	0.291	19.20	Water is Fairly Clear
9/10/2012	1425	491.03	500	22.90	7.72	0.298	9.37	Water is Clear

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1°C

\* Turbidity report in NTV nearest whole #

GPM = Gallons Per Minute

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack

 $r_c$ = radius of the well casing and screen in feet

 $L_c$ = length of water column inside the casing and screen in feet

 $r_w$ = radius of the well bore in feet

 $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons

## Well Development Record

**Project:** KAFB BFF

**Well No:** KAFB-106209

**Project Number:** 140705

**Samplers:** N/A

**Date:** 9/10/12

**Checked By:** N/A

**Time Start:** 0945, 9/10/12

**Time Finish:** 1535, 9/10/12

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp °C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
9/10/2012	1435	491.03	600	21.70	7.58	0.292	6.45	Water is Clear
9/10/2012	1445	491.02	725	21.40	7.61	0.287	6.14	Water is Clear
9/10/2012	1455	491.02	850	21.30	7.71	0.270	3.71	Water is Clear
9/10/2012	1510	490.95	1000	21.00	7.79	0.309	7.56	Water is Clear
9/10/2012	1518	491.01	1100	21.10	7.82	0.307	2.66	Water is Clear
9/10/2012	1525	491.00	1200	21.20	7.82	0.301	4.08	Water is Clear
9/10/2012	1535	491.00	1300	21.10	7.82	0.298	2.28	Water is Clear; Pump off; Total Removed

\* Due to sample cup design, the YSI Professional Plus does not accurately measure EC from the cup. Sample cup works well in a flow-through set-up, once pumping begins.

**Was well sampled after development?** YES NO ☒ X

**Sample Method:** N/A

**Sample Name:** N/A

**Analyses:** N/A

KAFB 106213



# Borehole ID: KAFB-106213

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 1/27/2015  
 Date TD Reached: 1/30/2015  
 Date Completed: 2/10/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles



*Virginia Bracht*  
 3/16/15

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 3/6/15 12:26 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					SILT (ML); strong brown (7.5YR 5/8); dry; ~100% silt; trace coarse sand; subangular. Note: unconsolidated.			Borehole was water knifed from 0' to 9' on 1/23/15.
5					Same as above (0 ft).			
10					Same as above (0 ft); yellowish red (5YR 5/6).	ML		Began drilling with 11-3/4" casing @ 1305 on 1/27/15.
15					Same as above (0 ft).			
20					Well-graded GRAVEL (GW); 85% fine to coarse gravel; angular to subangular; trace coarse sand.	GW		Kelly down @ 1315. New 20' connection. Resume drilling @ 1332.
25					Silty SAND with Gravel (SM); light brown (7.5YR 6/4); 60% coarse to very coarse sand; subangular; 25% silt; 15% coarse gravel 3/4" to 2"; subangular to subrounded;	SM		Driller added water.
30					Description on following page.	GW		





# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Well-graded GRAVEL (GW); 60% fine gravel 3/8" to 1/2"; angular to subangular; 40% coarse gravel; subrounded to subangular.	GW	- Cement Seal	
40					Poorly-graded GRAVEL with Sand (GP); 65% fine gravel 3/8" to 1/2"; subangular to subrounded; 30% very coarse sand; subangular to subrounded; 5% silt. Note: gravel is black and red, and sand is generally white or frosted quartz.	GP	- Top of High Solids Bentonite Grout	Kelly down @ 1348. New 20' connection. Resume drilling @ 1430.
45					Well-graded GRAVEL with Silt (GW-GM); reddish yellow (7.5YR 6/6); 80% fine to coarse gravel; angular to subrounded; 10% coarse sand; 10% silt.	GW-GM		
50					Silty GRAVEL (GM); reddish yellow (7.5YR 6/6); 60% fine to coarse gravel; subangular to subrounded; 10% coarse sand; 30% silt.	GM	- High Solids Bentonite Grout	
55					Lean CLAY with Gravel (CL); reddish yellow (7.5YR 7/6); medium plasticity; soft; 80% clay; 15% fine gravel; subrounded; 5% fine sand.			
60					Lean CLAY (CL); reddish yellow (7.5YR 7/6); soft; medium plasticity; 90% clay; 10% medium to coarse sand.	CL		Kelly down @ 1438. New 20' connection. Resume drilling @ 1447.





# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 3 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT (ML); strong brown (7.5YR 5/6); 100% silt; low plasticity.			Cuttings are partly saturated.
65					Same as above (60 ft).			Cuttings are partly saturated.
70					Same as above (60 ft).	ML		Cuttings are partly saturated.
75					Same as above (60 ft).		High Solids Bentonite Grout	Kelly down @ 1507. New 20' connection. Resume drilling @ 1515.
80					Lean CLAY (CL); reddish yellow (7.5YR 6/8); 100% clay; slightly firm; medium plasticity.			Cuttings are partly saturated.
85					Same as above (80 ft).	CL		Cuttings are partly saturated.
90								



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Lean CLAY (CL); reddish yellow (7.5YR 6/8); slightly firm; medium plasticity; ~100% clay; trace coarse sand and fine gravel.			Cuttings are partly saturated. Note: unable to determine sand and gravel percentages.
95					Same as above (90 ft).			
100					Same as above (90 ft); trace fine gravel; angular. Note: unable to determine gravel percentage.			Kelly down @ 1532. New 20' connection. Resume drilling @ 1543.
105					Same as above (100 ft).	CL	High Solids Bentonite Grout	Cuttings are partly saturated.
110					Same as above (100 ft).			Cuttings are partly saturated.
115					Same as above (100 ft); occasional coarse gravel; Note: unable to determine gravel percentages.			Kelly down @ 1557. New 20' connection. Resume drilling @ 1605.
120								



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					SILT (ML); strong brown (7.5YR 5/6); low plasticity; 100% silt.			Cuttings are partly saturated.
125					Same as above (120).			Cuttings are partly saturated.
130					Same as above (120).			Cuttings are partly saturated.
135					Same as above (120).	ML	High Solids Bentonite Grout	Added 240 gallons of water.
140					Same as above (120).			Kelly down @ 1620. End of 1/27/15. Resumed drilling @ 0847 on 1/28/15.
145					Same as above (120).			Cuttings are partly saturated. Little recovery.
150								



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					SILT (ML); strong brown (7.5YR 5/6); low plasticity; 100% silt.			
155					Same as above (150 ft); trace fine gravel; subangular. Unable to determine percentage of gravel.	ML		
160					Poorly graded GRAVEL with Silt (GP-GM); light brown (7.5YR 6/4); 80% fine gravel; subangular to subrounded; 10% very coarse sand; subrounded; 10% silt; trace coarse gravel; Note: gravel is black and red.	GP-GM		
165					Well graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 60% very coarse to medium sand; subrounded; 30% fine to coarse gravel; subangular; 10% silt. Note: sand is quartz and black feldspar.	SW-SM		
170					Sandy SILT with Gravel (ML); light brown (7.5YR 7/6); 50% silt; 30% fine to medium sand; 20% coarse gravel; subangular.			
175					Sandy SILT (ML); reddish yellow (7.5YR 7/6); 70% silt; 30% fine to medium sand.	ML		
180								

Kelly down @ 0908. New 20' connection. Resume drilling @ 0918.

High Solids  
Bentonite  
Grout

Kelly down @ 0936. New 20' connection. Resume drilling @ 0948.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Gravelly SILT (ML); strong brown (7.5YR 4/6); 70% silt; 20% fine gravel; 10% fine to medium sand.	ML		
185					Well graded GRAVEL with Sand (GW); 70% fine gravel; subangular to subrounded; 25% medium to coarse sand; subrounded; 5% silt. Note: gravel is black mafics and milky quartz; sand is milky quartz.	GW		
190					Same as above (185 ft).	GW		
195					Same as above (185 ft).	GW		
200					Poorly graded SAND (SP); yellowish brown (10YR 5/6); 100% fine sand; subangular. Note: sand is clear and frosted quartz and black mafics.	SP		
205					Well graded GRAVEL with Sand (GW); reddish yellow (7.5YR 4/6); 50% fine to coarse gravel to 2"; subrounded; 45% fine to coarse sand; subangular; 5% silt. Note: gravel is black and frosted white; sand is white, frosted, and clear quartz with some mica.	GW		
210								Total depth with 11-3/4" casing @ 1120. End of 1/28/15. Resume drilling @ 0940 on 1/29/15 with 9-5/8" casing.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210								
215					Silty GRAVEL with Sand (GM); yellowish brown (10YR 5/4); 70% fine to coarse gravel; subangular to subrounded; 15% fine to coarse sand; 15% silt; Note: gravel is mostly black mafics.			
220					Same as above (210 ft); 50% gravel; 30% fine sand; 20% silt.	GM		
225					Well graded GRAVEL with Silt (GW-GM); brown (7.5YR 4/3); 80% fine to coarse gravel; subangular to subrounded; 10% fine to coarse sand; 10% silt. Note: gravel is black mafics.	GW-GM		
230					SILT (ML); greenish gray (GLE Y1 6/1); medium plasticity; 100% silt; trace black gravel to 3/5"; rounded.			
235					Same as above (225 ft).	ML		
240					Silty SAND with Gravel (SM); light brown (7.5YR 6/4); 60% coarse to very coarse sand; subangular to subrounded; 20% fine gravel; subangular to subrounded; 20% silt. Note: gravel is black mafics with some white material.	SM		

Kelly down @ 0950. New 20' connection. Resume drilling @ 0957.

High Solids Bentonite Grout

Kelly down @ 1008. New 20' connection. Resume drilling @ 1016.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND (SP); yellowish brown (10YR 5/6); 100% medium sand; trace coarse sand; angular to subrounded. Note: sand is clear and frosted quartz and black mica.			
245					Same as above (240 ft); trace fine gravel.	SP		
250								
255					Well graded GRAVEL with Sand (GW); 80% fine to coarse gravel; subangular to subrounded; 15% coarse to very coarse sand; subangular; 5% silt. Note: gravel is black material and red granite.			
260					Same as above (250 ft).	GW	High Solids Bentonite Grout	
265					Poorly graded SAND (SP); yellowish brown (10YR 5/4); 100% medium with a trace of coarse sand; subangular to subrounded. Note: sand is clear and frosted quartz with black mica.			
270					Same as above (260 ft).	SP		Kelly down @ 1027. New 20' connection. Resume drilling @ 1035.





# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 10 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Sandy SILT (ML); brown (7.5YR 5/4); medium plasticity; 55% silt; 45% fine sand. Note: sand is clear quartz and black mica.			
275					Gravelly SILT (ML); brown (7.5YR 5/4); medium plasticity; 60% silt; 40% fine gravel; subangular to angular. Note: gravel is black material.	ML		Saturated cuttings in hopper.
280					SILT (ML); pale brown (10YR 6/3); medium plasticity; 100% silt; occasional flecks of mica or muscovite.			Kelly down @ 1046. New 20' connection. Resume drilling @ 1054.
285								
290					Silty GRAVEL (GM); pale brown (10YR 6/3); unable to determine percentages; coarse to fine gravel; subrounded; ~ 15% silt. Note: gravel is black material.			Saturated cuttings in hopper.
295					Silty GRAVEL with Sand (GM); pale brown (10YR 6/3); unable to determine percentages; fine gravel; subangular; fine sand; ~ 15% silt. Note: gravel is black material.	GM		Saturated cuttings in hopper.
					Silty GRAVEL (GM); unable to determine percentages; fine to coarse gravel; subangular; flat; ~15% silt.			Saturated cuttings in hopper.
300					Description on following page.	GW		Kelly down @ 1104. New 20' connection. Resume drilling @ 1120.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Date Started: 1/27/2015  
 Date TD Reached: 1/30/2015  
 Date Completed: 2/10/2015

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Well graded GRAVEL (GW); reddish yellow (5YR 6/8); 85% fine to coarse gravel to 2"; 10% fine sand; 5% silt. Note: gravel is black mafics and red granite; with some frosted quartz.	GW		
310					Silty GRAVEL (GM); reddish yellow (5YR 6/8); 75% fine to coarse gravel to 1"; 5% fine sand; 20% silt. Note: gravel is black mafics and red granite.	GW		
315					Poorly graded GRAVEL with Silt (GP-GM); reddish yellow (5YR 6/8); 85% fine to coarse gravel; 5% fine sand; 10% silt. Note: gravel is black mafics and reddish granite.	GP-GM		
320					Same as above (310 ft).	GP-GM	High Solids Bentonite Grout	
325					Poorly graded GRAVEL with Silt and Sand (GP-GM); yellowish brown (10YR 5/6); 75% fine gravel; angular to subangular; 15% fine sand; 10% silt. Note: gravel is black mafics and red granite; sand is clear quartz and black mica.	GP-GM		
330					Well graded GRAVEL with Silt and Sand (GW-GM); dark yellowish brown (10YR 4/4); 70% fine to coarse gravel; angular to subrounded; 20% fine sand; 10% silt. Note: gravel is black mafics and red granite; sand is clear quartz and black mica.	GW-GM		Kelly down @ 1138. New 20' connection. Resume drilling @ 1246.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 12 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330								
335					Silty SAND (SM); yellow brown (10YR 5/4); 60% fine to medium sand; subangular to subrounded; 10% fine gravel; subrounded; 30% silt. Note: sand is black mica and quartz.	SM		
340					Well graded GRAVEL with Silt and Sand (GW-GM); yellowish brown (10YR 5/4); 70% fine to coarse gravel to 2"; 20% medium to very coarse sand; 10% silt. Note: gravel is black mafics and red granite, somewhat frosted; sand is clear quartz and black mafics.	GW-GM		
345					Poorly graded SAND (SP); 100% coarse to very coarse sand; trace fine gravel; subangular to subrounded. Note: gravel is black material and red granite.	SP		
350					Well graded GRAVEL with Silt and Sand (GW-GM); yellowish brown (10YR 5/4); 70% fine to coarse gravel; angular to subrounded; 20% medium to coarse sand; subangular to subrounded; 10% silt. Note: gravel is black and red mafics.	GW-GM		
355					Silty SAND with Gravel (SM); yellowish brown (10YR 5/4); 50% fine to medium sand; 20% fine gravel; subrounded; 30% silt. Note: sand is clear and frosted quartz with some black mica.	SM		
360					Silty GRAVEL with Sand (GM); yellowish brown (10YR 5/4); 70% fine gravel; subangular to subrounded; 15% medium to coarse sand; subangular to subrounded; 15% silt. Note: gravel is frosted black and red mafics.	GM		

Kelly down @ 1306. New 20' connection. Resume drilling @ 1323.

High Solids  
Bentonite  
Grout

Kelly down @ 1340. New 20' connection. Resume drilling @ 1405.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 13 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded GRAVEL with Sand (GW); yellowish brown (10YR 5/6); 80% fine to coarse gravel to 2"; subangular to subrounded; 15% medium to coarse sand; subangular to subrounded; 5% silt. Note: gravel is black, white, and red mafics. Larger gravel is rounded to subrounded.			
365					Same as above (360 ft).			
370					Same as above (360 ft).	GW		
375					Poorly graded GRAVEL with Silt (GP-GM); yellowish brown (10YR 5/6); 80% coarse gravel to 3"; subrounded; 10% coarse sand; 10% silt. Note: gravel is black and red mafics; sand is clear and frosted quartz.	GP-GM		
380					Poorly graded SAND with Gravel (SP); 60% medium sand; subrounded; trace fine sand; 40% gravel. Note: sand is clear and frosted quartz with some black mica.	SP		
385					Silty SAND (SM); yellowish brown (10YR 5/6); 80% medium sand; trace fine sand; 15% silt; 5% gravel.	SM		
390								

High Solids  
Bentonite  
Grout

Kelly down @ 1425. New 20' connection. Resume drilling @ 1436.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 14 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Silty SAND (SM); brown (7.5YR 4/4); 70% fine sand; subangular to subrounded; 30% silt. Note: sand is clear quartz and black mica.			
395					Same as above (390 ft).	SM	High Solids Bentonite Grout	
400							Top of Bentonite Seal	Kelly down @ 1455. New 20' connection. Resume drilling @ 1510.
405					Well graded GRAVEL (GW); 100% fine to coarse gravel to 1"; subangular to subrounded. Note: gravel is black, red, gray, and frosted mafics.			
410					Well graded GRAVEL with Sand (GW); 80% fine to coarse gravel to 1"; subangular to subrounded; 20% coarse to very coarse sand; subrounded to subangular.	GW		
415					Well graded SAND with Gravel (SW); 70% fine to coarse sand; 30% coarse gravel; subangular to subrounded; trace very coarse sand. Note: gravel is black mafics; sand is clear quartz with some black mica.			
420					Well graded SAND (SW); 100% fine to coarse sand; trace very coarse sand; subangular to subrounded. Note: sand is clear quartz with some black mica.	SW	Bentonite Seal	Kelly down @ 1525. New 20' connection. Resume drilling @ 1628.



# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 15 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Silty SAND (SM); yellowish brown (10YR 5/4); 65% very fine to fine sand; rounded; 35% silt. Note: sand is "sugar sand."			Sand runs through strainer, collected sample with a shovel.
425					Same as above (420 ft).	SM	- Bentonite Seal	300 gallons of water added.
430					Poorly graded SAND (SP); reddish yellow (7.5YR 6/6); 100% fine to medium sand; subangular to subrounded. Note: sand is clear and frosted quartz.	SP	- Top of 20/40 Sand - Top of 10/20 Sand	End of 1/29/15 @ 1655. Resume drilling @ 0805 on 1/30/15.
435					Sandy SILT (ML); strong brown (7.5YR 5/6); 60% silt; 40% fine to medium sand.	ML		
440					Silty SAND (SM); strong brown (7.5YR 5/6); 60% fine to coarse sand; subangular; 40% silt.	SM		
445					Poorly graded GRAVEL (GP); strong brown (7.5YR 5/6); 70% fine to coarse gravel to 1/2"; subangular to subrounded; 20% coarse gravel to 1"; subangular; 10% very coarse sand. Note: gravel is red granite and black mafics; sand is frosted quartz.	GP	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	Kelly down @ 0848. New 20' connection. Resume drilling @ 0902.
450								





# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015


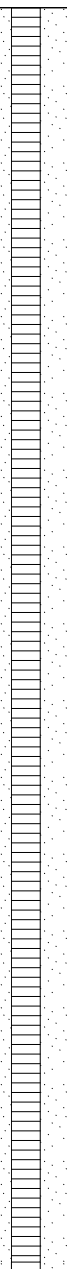

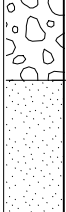


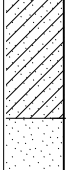
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 16 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
455					Well graded GRAVEL with Sand (GW); 60% fine gravel; subangular to subrounded; 20% coarse gravel; subrounded to rounded; 20% very coarse sand; subangular. Note: gravel is black mafics and red granite with some frosted quartz. Sand is black, red, and frosted.	GW		Kelly down @ 0937. New 20' connection. Resume drilling @ 0950.
460					Poorly graded GRAVEL with Sand (GP); 75% fine gravel; subangular to subrounded; trace coarse gravel; 25% very coarse sand; subangular. Note: gravel is black and gray mafics with some red granite and frosted quartz. Sand is frosted with red and black grains. Same as above (455 ft).	GP		
465					Poorly graded SAND with Gravel (SP); 60% very fine to fine sand; trace medium sand; 40% fine gravel; subrounded. Note: sand is clear and frosted quartz. Gravel is gray.	SP		
470					Clayey SAND (SC); yellowish brown (10YR 5/6); soft; medium plasticity; 75% very fine to fine sand; 25% clay. Same as above (465 ft).	SC		
475					Same as above (465 ft).			Added 250 gallons of water.
480					Poorly graded SAND (SP); brown (7.5YR 4/3); wet; dense; 100% fine to medium sand; trace gravel to 2.2cm; rounded.	SP	Bottom of Screen	Kelly down @ 1040. End of 1/30/15 for Mike Giles. Jason Tarbert resumes logging @ 1102.





# Borehole ID: KAFB-106213

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/27/2015  
**Date TD Reached:** 1/30/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 461.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.29

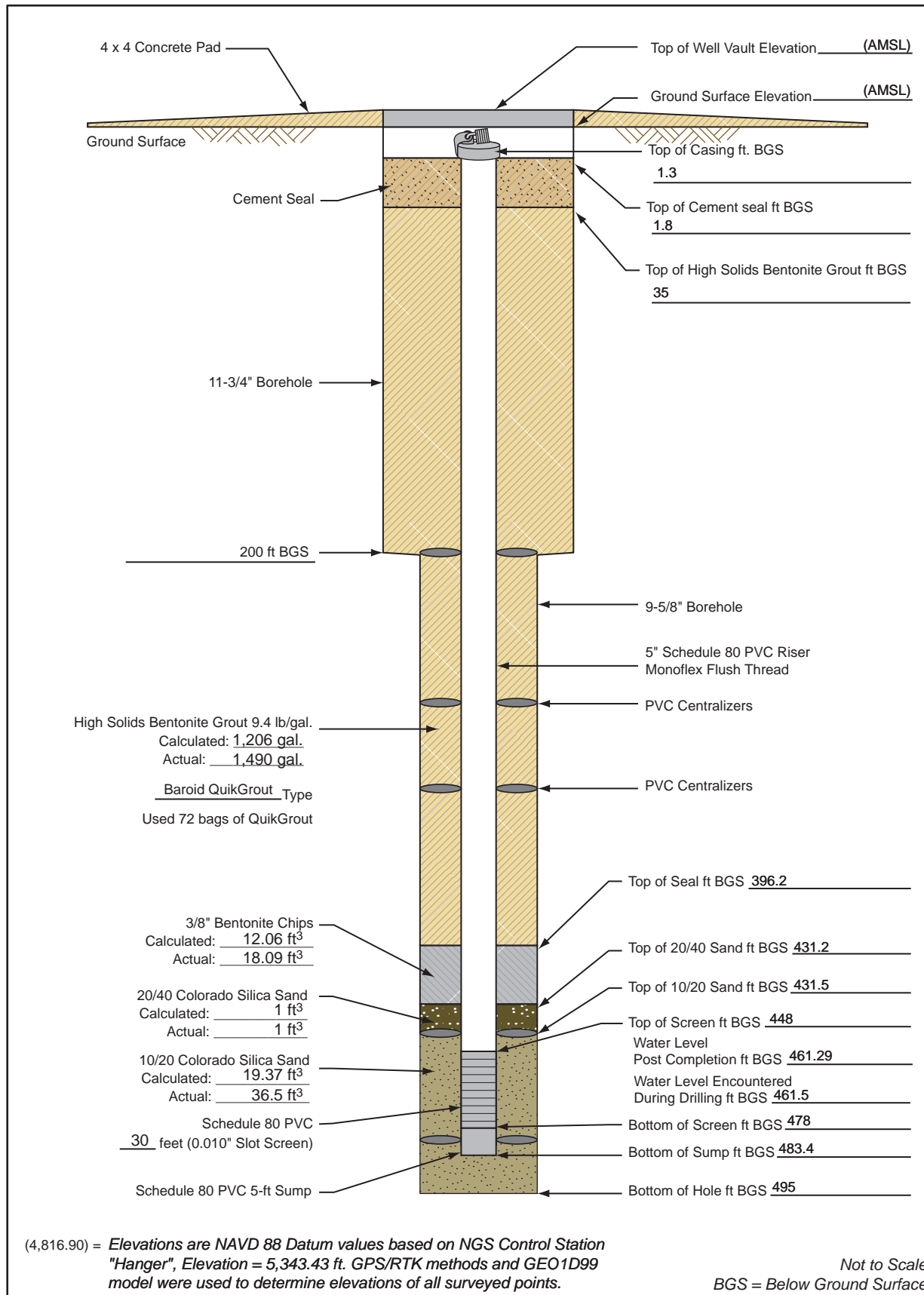
**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480								
					Poorly graded SAND (SP); brown (7.5YR 4/3); wet; dense; 100% fine to medium sand; trace gravel to 2.2cm; rounded.	SP	- Sump	
485					Well graded SAND (SW); brown (7.5YR 5/3); wet; dense; 95% fine to very coarse sand; 5% fine gravel to 3cm; rounded.	SW	- Bottom of Sump	
					Silty SAND (SM); brown (7.5YR 5/3); wet; dense; 85% fine to medium sand; trace fine gravel to 1.5cm; rounded; 15% silt.	SM		Added 100 gallons of water for clean-out of boring.
490					Same as above (485 ft); 80% fine to very coarse sand; 5% gravel to 6cm; 15% silt.			
495					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 5/4); wet; dense; 60% fine gravel to 4.3cm; rounded; 40% coarse to very coarse sand; subrounded. Note: gravel is granite.	GP	- Bottom of Filter Pack	Total depth = 495 ft. Reached @ 1155 on 1/30/15. Flood hole with 300 gallons of water in preparation for well installation.
500								
505								
510								

# Monitoring Well Completion Diagram KAFB-106213

Installation Start Date/Time: 2/2/2015 @ 1345

Installation End Date/Time: 2/10/2015 @ 1775





## Well Development Record

**Project Name:** KAFB BFF

**Location:** \_\_\_\_\_

**Personnel:** E. Perez

**Date:** 2/10/15 - 2/12/15

**Samplers:** N/A

**Method of Development:**

X Surging ☒ Bailing X Pumping

X Original Development ☐ Redevelopment ☐ Other

**Well/Piez. No.:** KAFB-106213

**Date Installed:** 2/10/15

**Csg. Diameter (I.D.):** 5 "

**Total Depth (ft. bgs):** 483.4

**Development Date:** 2/10/2015 - 2/12/2015

**Depth to Water Before Developing Well (ft. btoc):** 461.29

**V**=(B \*  $r_c^2$  \*  $L_c$  \* 7.48)+(B \* ( $r_w^2 - r_c^2$ ) \*  $L_s$  \*  $\phi_s$  \* 7.48)+(H<sub>2</sub>O added during drilling/installation) = 1,226.3 gallons

**Depth Purging From:** 478 feet **Time Purging Begins:** 1054, 2/11/2015

**Weather:** Cloudy **Screened Interval (ft bgs):** 447 - 477

**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q

**Equipment Decontaminated Prior to Development:** Y X N

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y N X

**Describe:** N/A

**Comment:** Approximately 1,190 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/10/2015	1243	461.29	--	--	--	--	--	Total depth tagged at 484.25 ft btoc.
2/10/2015	1305	--	--	--	--	--	--	Begin swabbing.
2/10/2015	1330	--	--	--	--	--	--	Finish swabbing.
2/10/2015	1336	--	--	--	--	--	--	Begin bailing. Water is brown.
2/10/2015	1412	--	--	--	--	--	--	Finish bailing. Water is light brown.
2/10/2015	1415	--	55	--	--	--	--	Begin swabbing.
2/10/2015	1427	--	55	--	--	--	--	Finish swabbing.
2/10/2015	1432	--	55	--	--	--	--	Begin bailing. Water is brown.
2/10/2015	1530	--	150	--	--	--	--	Finish bailing. Water is very light brown.
2/10/2015	1535	--	150	--	--	--	--	Driller finishes surface completion.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot  
pH - Reading rounded to 0.1 pH units  
Water temperature - Reported to nearest 0.1 °C  
°C = Degree Celsius  
EC = Electric Conductivity  
ft bgs = Feet Below Ground Surface  
ft btoc = Feet Below Top of Casing  
gal. = Gallon  
GPM = Gallons Per Minute  
I.D. = Inner Diameter  
N/A = Not Applicable  
NR = Not Recorded  
NTU = Nephelometric Turbidity Unit  
S/m = Seimens per Meter

**Where:**

B=3.14  
 $\phi_s$ = porosity of the sand pack  
 $r_c$ = radius of the well casing and screen in feet  
 $L_c$ = length of water column inside the casing and screen in feet  
 $r_w$ = radius of the well bore in feet  
 $L_s$ = length of saturated portion of the sand pack in feet  
7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106213Project Number: 140705Samplers: N/ADate: 2/10/15 - 2/12/15

Checked By: \_\_\_\_\_

Time Start: 1243, 2/10/2015Time Finish: 1105, 2/12/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/11/2015	0945	--	150	--	--	--	--	Finish dropping pipe. Set pump at 478 ft.
2/11/2015	1054	462.10	150	--	--	--	--	Initial water level reading. Pump on.
2/11/2015	1114	477.50	200	18.56	7.02	389.4	>1000	Pumping at 10 GPM. Water is light brown.
2/11/2015	1124	477.22	300	18.75	7.08	392.0	322	Water is cloudy.
2/11/2015	1134	477.40	375	18.75	7.08	392.0	29.9	Water is slightly cloudy.
2/11/2015	1144	477.41	475	18.75	7.08	392.0	9.83	Water is clear.
2/11/2015	1147	--	525	--	--	--	--	Turn off pump.
2/11/2015	1224	471.23	525	11.30	7.80	410.0	33.5	Resume pumping. Water is clear; many tiny bubbles.
2/11/2015	1234	474.90	650	18.89	7.75	406.0	105	Water is cloudy.
2/11/2015	1244	475.42	725	19.10	7.78	415.2	133	Water is cloudy.
2/11/2015	1254	475.50	825	18.84	7.75	416.2	69.9	Water is slightly cloudy.
2/11/2015	1302	469.60	825	--	--	--	--	Pump raised to 470 ft. Let well recover; stop pump.
2/11/2015	1310	468.52	875	15.96	7.82	408.9	9.23	Resume pumping at 6 GPM. Water is clear.
2/11/2015	1320	NR	950	18.57	7.78	419.6	19.6	Water is clear.
2/11/2015	1330	470.16	1025	18.69	7.81	410.5	16.8	Water is clear.

Was well sampled after development? YES      NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106213Project Number: 140705Samplers: N/ADate: 2/10/15 - 2/12/15

Checked By: \_\_\_\_\_

Time Start: 1243, 2/10/2015Time Finish: 1105, 2/12/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/11/2015	1335	--	1050	--	--	--	--	Stop pumping.
2/11/2015	1415	--	1050	13.20	7.86	409.3	9.40	Resume pumping at 10 GPM. Water is clear.
2/11/2015	1424	--	1150	--	--	--	--	Stop pump. Water level meter tape is stuck.
2/11/2015	1433	463.25	1150	--	--	--	--	Freed water level meter tape.
2/11/2015	1435	--	1150	16.36	7.84	394.7	35	Resume pumping at 10 GPM. Tape is stuck again.
2/11/2015	1441	471.35	1200	--	--	--	--	Freed water level meter tape. Resume pumping.
2/11/2015	1445	474.76	1250	17.81	7.84	402.7	38.7	Water is slightly cloudy.
2/11/2015	1451	--	1300	--	--	--	--	Lower pumping rate to 6 GPM.
2/11/2015	1455	472.35	1350	19.14	7.81	404.5	117	Water is cloudy.
2/11/2015	1505	472.24	1400	18.59	7.82	408.5	30.8	Water is slightly cloudy.
2/11/2015	1515	472.40	1450	19.16	7.81	407.7	4.90	Water is clear.
2/11/2015	1525	472.49	1550	18.87	7.81	406.7	3.35	Water is clear.
2/11/2015	1531	--	1575	--	--	--	--	Stop pumping.
2/12/2015	0826	462.20	1575	--	--	--	--	Initial daily water reading.
2/12/2015	0827	--	1575	--	--	--	--	Start pumping at 6 GPM.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106213Project Number: 140705Samplers: N/ADate: 2/10/15 - 2/12/15

Checked By: \_\_\_\_\_

Time Start: 1243, 2/10/2015Time Finish: 1105, 2/12/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/12/2015	0830	--	1575	--	--	--	--	Pump set at 470 ft.
2/12/2015	0831	469.31	1600	16.19	6.45	407.2	14.9	Water is clear.
2/12/2015	0841	469.90	1675	18.11	7.10	405.1	16.9	Water is clear.
2/12/2015	0851	469.99	1725	18.59	7.42	416.6	2.86	Water is clear.
2/12/2015	0901	470.53	1775	18.64	7.56	415.9	1.92	Water is clear.
2/12/2015	0911	470.75	1825	19.04	7.63	414.9	1.67	Water is clear.
2/12/2015	0912	--	1825	--	--	--	--	Lower pump to 478 ft at 10 GPM.
2/12/2015	0916	474.11	1875	18.81	7.66	413.7	1.76	Water is clear.
2/12/2015	0926	475.70	1975	18.65	7.69	408.2	35.5	Water is slightly cloudy.
2/12/2015	0936	476.30	2075	18.80	7.70	418.4	5.13	Water is clear.
2/12/2015	0939	--	2100	--	--	--	--	Stop pumping.
2/12/2015	1009	462.25	2100	--	--	--	--	Water level reading.
2/12/2015	1012	--	2100	--	--	--	--	Resume pumping at 478 ft at 10 GPM.
2/12/2015	1014	471.09	2125	18.34	7.73	421.3	2.74	Water is clear.
2/12/2015	1024	475.27	2200	19.16	7.75	397.0	26.4	Water is slightly cloudy.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106213Project Number: 140705Samplers: N/ADate: 2/10/15 - 2/12/15

Checked By: \_\_\_\_\_

Time Start: 1243, 2/10/2015Time Finish: 1105, 2/12/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/12/2015	1034	475.35	2300	18.87	7.76	418.6	11.0	Water is clear.
2/12/2015	1044	476.80	2400	18.92	7.75	419.8	4.82	Water is clear.
2/12/2015	1054	475.71	2475	19.33	7.75	420.5	2.15	Water is clear.
2/12/2015	1104	475.69	2575	19.32	7.75	420.4	1.25	Water is clear.
2/12/2015	1105	--	2575	--	--	--	--	Complete well development. Pump off.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



KAFB 106214



Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 2/24/2015  
 Date TD Reached: 3/2/2015  
 Date Completed: 3/13/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

## Borehole ID: KAFB-106214

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 461.60

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles



Page 1 of 18

*Virginia Bracht*  
 3/23/15

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					SILT with Gravel (ML); brown (7.5YR 5/4); dry; low plasticity; 60% silt; 25% clay; 15% fine gravel; angular to subangular. Note: gravel is black mafics, pink granite, and some white grains.		Top of Casing/Top of Cement Seal	Location was water jetted to 9' for utility clearance.
5					Same as above (0 ft).			
10					Same as above (0 ft).	ML		Began drilling @ 1200 on 2/24/15.
15					Same as above (0 ft).		- Cement Seal	
20					Poorly graded SAND (SP); light brown (7.5YR 6/3); dry; 95% very fine sand; trace coarse sand; angular to subangular; 5% silt. Note: sand is black, white, and pink grains. Same as above (17 ft); 90% very fine sand; trace coarse sand; 5% fine gravel to 3/8"; angular to subangular; 5% silt. Note: gravel is black mafics and pink granite.	SP		Kelly down @ 1209. New 20' connection. Resumed drilling @ 1217.
25					Well graded SAND with Gravel (SW); pink (7.5YR 7/4); dry; 75% very fine to very coarse sand; subangular to subrounded; 20% fine to coarse gravel; angular to subrounded; 5% silt. Note: sand is mostly white grains with some pink and black. Gravel is black mafics,	SW		
30								



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

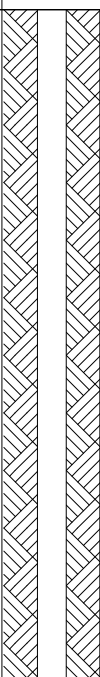
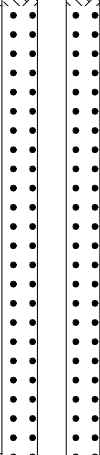
**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					pink granite, and white quartzite. Poorly graded SAND with Gravel (SP); pink (7.5YR 7/4); dry; 75% very fine sand; trace coarse sand; 20% fine gravel; trace coarse gravel; angular to subrounded; 5% silt. Note: gravel is black and gray mafics, pink granite, and white quartzite.	SP	 - Cement Seal	Kelly down @ 1235. New 20' connection. Resumed drilling @ 1310.
40				Poorly graded SAND (SP); brownish yellow (10YR 6/8); dry; 90% very fine sand; trace coarse sand; 5% coarse gravel to 1/2"; 5% silt. Note: gravel is black mafics.  Same as above (35 ft).				
45								
50					Silty SAND (SM); reddish yellow (5YR 6/6); dry; 60% very fine sand; 10% fine to coarse gravel; subangular to subrounded; 30% silt. Note: gravel is black mafics.  Same as above (45 ft); reddish yellow (5YR 6/8); 60% very fine sand; 40% silt.	SM	 - Top of High Solids Bentonite Grout  - High Solids Bentonite Grout	
55					Sandy SILT (ML); yellowish red (5YR 5/8); dry; firm; medium plasticity; 50% silt; 40% very fine sand; 10% clay.	ML		
60								



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60								
65					Sandy SILT (ML); yellowish red (5YR 5/8); dry; firm; medium plasticity; 50% silt; 40% very fine sand; 10% clay.	ML		
70					Silty SAND (SM); reddish yellow (5YR 6/8); dry; 60% very fine sand; 40% silt.	SM		
75					Sandy lean CLAY (CL); brown (7.5YR 4/4); medium plasticity; 60% clay; 40% very fine sand.	CL		
80					Silty SAND (SM); brown (7.5YR 4/4); dry; 85% very fine sand; 15% silt.			
85					Same as above (75 ft); reddish yellow (7.5YR 6/6); 70% very fine sand; trace coarse sand; 5% fine gravel to 3/8"; subangular; 25% silt.	SM		
90					Clayey SAND with Gravel (SC); strong brown (7.5YR 5/8); dry; medium plasticity; 70% very fine sand; trace coarse sand; 15% fine gravel; subangular; 15% clay.	SC		

High Solids  
Bentonite  
Grout

Kelly down @ 1340. New 20' connection. Resumed drilling @ 1350.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▼ **After Drilling:** 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Clayey SAND (SC); strong brown (7.5YR 5/8); dry; medium plasticity; 80% very fine sand; 20% clay.			
95					Same as above (90 ft).	SC		
100					Poorly graded SAND with Silt (SP-SM); reddish yellow (7.5YR 6/8); dry; 90% very fine sand; 10% silt.	SP-SM		
105					Poorly graded SAND with Clay (SP-SC); strong brown (7.5YR 4/6); dry; medium plasticity; 90% very fine sand; 10% clay.	SP-SC		
110					Clayey SAND (SC); strong brown (7.5YR 4/6); dry; medium plasticity; 80% very fine sand; 20% clay.			
115					Same as above (110 ft).	SC		
120								

Kelly down @ 1402. New 20' connection. Resumed drilling @ 1408.

High Solids Bentonite Grout

Kelly down @ 1416. New 20' connection. Resumed drilling @ 1424.





# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Poorly graded SAND with Clay (SP-SC); strong brown (7.5YR 5/6); dry; medium plasticity; 90% very fine sand; trace fine gravel; 10% clay. Note: gravel is white.			
125					Same as above (120 ft); no gravel.			
130					Same as above (120 ft); strong brown (7.5YR 4/6); no gravel.	SP-SC		
135					Same as above (120 ft); strong brown (7.5YR 4/6); no gravel.		High Solids Bentonite Grout	
140					Sandy lean CLAY (CL); strong brown (7.5YR 5/8); medium plasticity; 60% clay; 40% very fine sand; trace coarse sand. Note: sand is white.			
145					Same as above (140 ft).	CL		Kelly down @ 1438. New 20' connection. Driller cleared out block in discharge hose. Resumed drilling @ 1629.
150								



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Poorly graded SAND (SP); strong brown (7.5YR 5/6); dry; medium plasticity; 95% very fine sand; trace coarse sand; 5% clay. Note: coarse sand is black and white grains.	SP		
155					Poorly graded SAND with Clay (SP-SC); strong brown (7.5YR 5/8); dry; soft; medium plasticity; 80% very fine sand; trace medium to coarse sand; 10% fine to coarse gravel; subrounded; 10% clay. Note: fine gravel is black mafics and coarse gravel is pink granite.	SP-SC		
160					Poorly graded SAND (SP); very pale brown (10YR 7/4); dry; 95% fine to medium sand; trace coarse sand; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz.			
165					Same as above (160 ft).	SP		
170					Same as above (160 ft); very pale brown (10YR 8/4); 95% very fine sand; 5% silt.			
175					Well graded SAND (SW); pink (7.5YR 7/4); dry; 95% very fine to coarse sand; 5% silt.	SW		
180								

Kelly down @ 1640. New 20' connection. End of 2/24/15. Resumed drilling @ 0858 on 2/25/15.

High Solids Bentonite Grout

Kelly down @ 0909. New 20' connection. Resumed drilling @ 0917.





# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); light yellowish brown (10YR 6/4); dry; 95% fine sand; trace medium to coarse sand; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz.			
185					Same as above (180 ft).	SP		
190								
195					Well graded SAND (SW); yellowish brown (10YR 5/4); dry; 95% fine to coarse sand; trace very coarse sand; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz, white quartzite, black mafics, and red microcline.			
200					Same as above (190 ft); 100% fine to coarse sand; subangular to subrounded. Note: sand is mostly clear quartz with some frosted quartz, black mafics, and red microcline.	SW	High Solids Bentonite Grout	
205					Well graded SAND with Clay and Gravel (SW-SC); yellowish brown (10YR 5/6); dry; 70% fine to coarse sand; 20% fine gravel to 1/2"; subangular; 10% clay. Note: gravel is black mafics.	SW-SC		
210					Clayey SAND with Gravel (SC); dry; 50% fine to coarse sand; subangular; 35% fine to coarse gravel; subangular to subrounded; 15% clay. Note: sand is clear and frosted quartz, microcline, and black mafics. Gravel is mostly black mafics.	SC		Kelly down @ 1012. Advance 11-3/4" casing to 200 ft. Set 9-5/8" casing at 197 ft @ 1635. End of 2/25/15. Resumed drilling with 9-5/8" casing @ 1045 on 2/26/15. No water added to date.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210								
215					Well graded SAND (SW); light yellowish brown (10YR 6/4); dry; 80% fine sand; trace medium to coarse sand; subangular to subrounded; 15% fine gravel; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz with some black mafics. Gravel is black mafics.	SW		
220					Sandy lean CLAY (CL); brown (7.5YR 5/4); slightly moist; soft; medium plasticity; 70% clay; 30% medium sand.	CL		
225					SILT with Sand (ML); brown (7.5YR 5/4); slightly moist; soft; low plasticity; 80% silt; 20% medium sand; subangular. Note: sand is clear quartz.			
230					Same as above (220 ft).	ML		
235					Poorly graded SAND (SP); light yellowish brown (10YR 6/4); 95% fine sand; trace medium sand; 5% silt. Note: sand is clear and frosted quartz with some black mafics.			
240					Same as above (230 ft).	SP		

Kelly down @ 1058. New 20' connection. Resumed drilling @ 1104.

High Solids Bentonite Grout

Kelly down @ 1112. New 20' connection. Resumed drilling @ 1120.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240								
245					Well graded GRAVEL with Silt and Sand (GW-GM); strong brown (7.5YR 5/6); dry; 50% fine gravel; trace coarse gravel; subangular to subrounded; 40% fine to coarse sand; subangular; 10% silt. Note: gravel is black mafics. Sand is clear quartz with some frosted quartz and black mafics.	GW-GM		
250					Poorly graded SAND (SP); very pale brown (10YR 7/3); dry; 95% very fine to fine sand; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz.	SP		
255					Well graded GRAVEL with Silt and Sand (GW-GM); strong brown (7.5YR 5/6); dry; 50% fine gravel; trace coarse gravel; subangular to subrounded; 40% fine to coarse sand; subangular; 10% silt. Note: gravel is black mafics. Sand is clear quartz with some frosted quartz and black mafics.	GW-GM		
260					Poorly graded SAND (SP); yellow (10YR 7/6); dry; 95% very fine to fine sand; 5% silt.			
265					Same as above (255 ft); very pale brown (10YR 7/3).	SP		
270					Same as above (255 ft); very pale brown (10YR 7/3).			

High Solids  
Bentonite  
Grout

Kelly down @ 1127. New 20' connection. Resumed drilling @ 1135.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP); very pale brown (10YR 7/3); slightly moist; 95% very fine to fine sand; 5% silt.	SP		
275					Lean CLAY (CL); dark yellowish brown (10YR 4/4); medium plasticity; 95% clay; 5% fine gravel; subrounded. Note: gravel is black mafics.	CL		
280					Sandy lean CLAY (CL); light brown (7.5YR 6/4); slightly moist; medium plasticity; 60% clay; 40% fine sand; trace medium to coarse sand.	CL		
285					Poorly graded SAND (SP); pink (7.5YR 7/4); dry; 95% very fine sand; 5% silt. Note: sand is clear and frosted quartz.	SP		
290					Same as above (285 ft); 95% very fine to medium sand; subangular to subrounded; 5% silt. Note: fine sand is clear and frosted quartz. Medium sand is clear and frosted quartz with some black mafics and pink granite.	SP		
295					Same as above (285 ft); 95% very fine to medium sand; subangular to subrounded; 5% silt. Note: fine sand is clear and frosted quartz. Medium sand is clear and frosted quartz with some black mafics and pink granite.	SP		
300								

Kelly down @ 1147. New 20' connection. Resumed drilling @ 1158.

High Solids Bentonite Grout

Kelly down @ 1211. New 20' connection. Resumed drilling @ 1327.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% fine to medium sand; subangular to subrounded; 10% silt. Note: sand is clear and frosted quartz.	SP-SM		Driller added water.
310					Poorly graded GRAVEL with Sand (GP); light brown (7.5YR 6/4); 70% fine gravel; trace coarse gravel; subangular to subrounded; 25% fine to coarse sand; subangular to subrounded; 5% silt. Note: gravel is black mafics, red granite, and white quartzite. Sand is mostly clear and frosted quartz. Same as above (305 ft).	GP		
315					Same as above (305 ft).		High Solids Bentonite Grout	
320					Gravelly SILT with Sand (ML); brown (7.5YR 5/3); soft; low plasticity; 50% silt; 35% fine gravel; subangular to subrounded; 15% medium sand.	ML		Kelly down @ 1352. New 20' connection. Resumed drilling @ 1402.
325					Same as above (320 ft).			Saturated cuttings in hopper.
330								Saturated cuttings in hopper.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▼ **After Drilling:** 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded GRAVEL (GW); brown (7.5YR 5/3); 90% fine to coarse gravel; subangular to subrounded; 5% medium to coarse sand; 5% silt. Note: gravel is mostly black mafics with some red granite.			
335					Same as above (330 ft).	GW		
340					Well graded GRAVEL with Silt (GW-GM); brown (7.5YR 5/3); 80% fine to coarse gravel; subangular to subrounded; 10% medium to very coarse sand; subangular; 10% silt. Note: gravel is black mafics and red granite with some white quartzite and black mafics. Same as above (340 ft).	GW-GM		
345							High Solids Bentonite Grout	
350					Silty SAND (SM); brown (7.5YR 5/3); 80% fine to very coarse sand; 5% fine gravel; 15% silt.			
355					Same as above (350 ft).	SM		
360								Kelly down. New 20' connection.

Kelly down @ 1407. New 20' connection. Resumed drilling @ 1417.





# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Silty GRAVEL (GM); brownish yellow (10YR 6/6); 60% fine to coarse gravel; subangular to rounded; 10% medium to coarse sand; 30% silt. Note: gravel is black mafics. Gravel is predominantly subangular.			
365					Same as above (360 ft).	GM		
370					Silty GRAVEL with Sand (GM); brownish yellow (10YR 6/6); 50% fine to coarse gravel; subangular to subrounded; 30% medium to very coarse sand; subangular; 20% silt. Note: gravel is predominantly black mafics with some red granite. Sand is clear quartz and black mafics.			
375					Well graded GRAVEL (GW); brownish yellow (10YR 6/6); 95% fine to coarse gravel; subangular to rounded; 5% silt. Note: gravel is black mafics, red granite, and white quartzite.	GW		
380					Poorly graded GRAVEL (GP); brownish yellow (10YR 6/6); 95% fine gravel to 3/8"; 5% silt. Note: gravel is black mafics, red granite, and white quartz.	GP		
385					Poorly graded SAND with Gravel (SP); brownish yellow (10YR 6/6); 80% very coarse sand; subangular to subrounded; 20% fine gravel to 3/4"; subangular to subrounded; trace silt. Note: sand is black mafics, red granite, and white quartzite. Gravel is black mafics and red	SP		
390								

High Solids  
Bentonite  
Grout

Kelly down @ 1437. New 20' connection. Resumed drilling @ 1457.





# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					granite.			
395					Poorly graded SAND (SP); yellowish brown (10YR 5/4); 95% very fine to fine sand; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz with some black mica.			
400					Same as above (395 ft).	SP		
405					Silty GRAVEL with Sand (GM); brown (7.5YR 5/4); 50% fine to coarse gravel; subangular to subrounded; 30% fine to coarse sand; 20% silt. Note: gravel is black mafics, red granite, and white quartzite. Sand is predominantly fine grained.	GM		
410					Poorly graded SAND (SP); yellowish brown (10YR 5/4); 95% very fine to fine sand; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz.	SP		
415					Clayey SAND (SC); dark yellowish brown (10YR 4/4); 80% very fine to fine sand; subangular; 20% clay. Note: sand is clear and frosted quartz.			
420					Same as above (410 ft).	SC		

Kelly down @ 1510. New 20' connection. Resumed drilling @ 1518.

- High Solids Bentonite Grout

- Top of Bentonite Seal

Kelly down @ 1535. New 20' connection. Resumed drilling @ 1545.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420								
425					Clayey GRAVEL (GC); brown (7.5YR 5/4); medium plasticity; 65% fine gravel to 1/4"; subangular; 35% clay. Note: gravel is black mafics and white quartz.	GC		Saturated cuttings in hopper.
430					Lean CLAY with Sand (CL); brown (7.5YR 5/4); medium plasticity; 80% clay; 20% fine to medium sand.			Saturated cuttings in hopper.
435					Gravelly lean CLAY (CL); brown (7.5YR 5/4); medium plasticity; 60% clay; 30% fine gravel to 1/4"; subangular to subrounded; 10% coarse sand; subrounded. Note: gravel is black mafics.	CL	- 5" Schedule 80 PVC Riser	Saturated cuttings in hopper.
440					Same as above (430 ft).			Kelly down @ 1610. New 20' connection. Resumed drilling @ 1617.
445					Well graded GRAVEL with Clay (GW-GC); brown (7.5YR 5/4); 90% fine to coarse gravel; angular to subrounded; 10% clay. Note: gravel is predominantly black mafics with red granite and a trace of white quartzite.	GW-GC	- Top of Native Backfill	Saturated cuttings in hopper.
450					Sandy lean CLAY (CL); brown (7.5YR 5/4); medium plasticity; 60% clay; 40% fine to medium sand.	CL	- Native Backfill	Saturated cuttings in hopper.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
455					Well graded GRAVEL with Clay and Sand (GW-GC); brown (7.5YR 5/4); 70% fine to coarse gravel; subangular to subrounded; 20% fine to coarse sand; 10% clay. Note: gravel is black mafics, red granite, frosted quartz, and white quartzite. Sand is predominantly black mafics and frosted quartz. Same as above (450 ft).	GW-GC		
460					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); 70% fine to coarse sand; subangular to subrounded; 30% fine gravel. Note: sand is predominantly frosted quartz and black mafics.	SW		
465					Poorly graded SAND (SP); strong brown (7.5YR 5/6); wet; 95% very fine to fine sand; subangular to subrounded; 5% silt. Note: sand is predominantly frosted and clear quartz, with some black mafics.	SP		
470					Sandy lean CLAY (CL); brown (7.5YR 4/4); wet; medium plasticity; 60% clay; 40% fine to medium sand; subangular. Note: sand is clear and frosted quartz.	CL		
475					Gravelly lean CLAY (CL); brown (7.5YR 4/4); wet; medium plasticity; 60% clay; 30% fine gravel; trace coarse gravel; subangular; 10% fine to medium sand. Note: gravel is black mafics.	CL		
480					Clayey SAND (SC); brown (7.5YR 4/4); wet; low plasticity; 70% fine sand; trace medium sand; subangular to subrounded; 30% clay.	SC		

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 3/23/15 12:15 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Kelly down @ 1640. New 20' connection. End of 2/26/15. Resumed drilling @ 1337 on 2/27/15.

Kelly down @ 1410. New 20' connection. Resumed drilling @ 1505. Broken bolt on hammer.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Silty SAND (SM); strong brown (7.5YR 5/6); wet; 85% fine to medium sand; subangular to subrounded; 15% silt. Note: sand is clear and frosted quartz.	SM		
485					Same as above (480 ft); 70% fine to medium sand; 30% silt.	SM		
490					Well graded SAND with Gravel (SW); strong brown (7.5YR 5/6); wet; 80% fine to very coarse sand; subangular to subrounded; 15% fine gravel to 1/4"; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz, black mafics, and red microcline. Gravel is predominantly frosted quartz with black mafics.	SW		
495					@ 490 ft: Well graded SAND (SW); strong brown (7.5YR 5/6); wet; 95% fine to coarse sand; subangular to subrounded; 5% silt. Note: sand is clear and frosted quartz, black mafics, and red microcline.	SW		
500					Poorly graded GRAVEL with Silt and Sand (GP-GM); strong brown (7.5YR 5/6); 70% fine gravel to 3/8"; subangular to subrounded; 20% fine to coarse sand; subangular to subrounded; 10% silt. Note: gravel is black mafics with some red granite.	GP-GM		
505					Silty SAND with Gravel (SM); gray (7.5YR 5/1); wet; 70% fine to medium sand; subangular to subrounded; 15% coarse gravel; subrounded; 15% silt. Note: sand is clear and frosted quartz, with some red microcline and black mica. Gravel is black mafics.	SM		
510					Poorly graded GRAVEL with Silt (GP-GM); brown (7.5YR 4/2); 80% fine gravel to 3/4"; trace coarse gravel; angular to subrounded; 10% fine to medium sand; subangular to	GP-GM		

- Bottom of Screen

- Sump

- Bottom of Sump

- Bottom of Filter Pack

- Native Backfill

Kelly down @ 1545. New 20' connection. End of 2/27/15. Resumed drilling @ 0904 on 3/2/15.



# Borehole ID: KAFB-106214

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/24/2015  
**Date TD Reached:** 3/2/2015  
**Date Completed:** 3/13/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 461.60

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

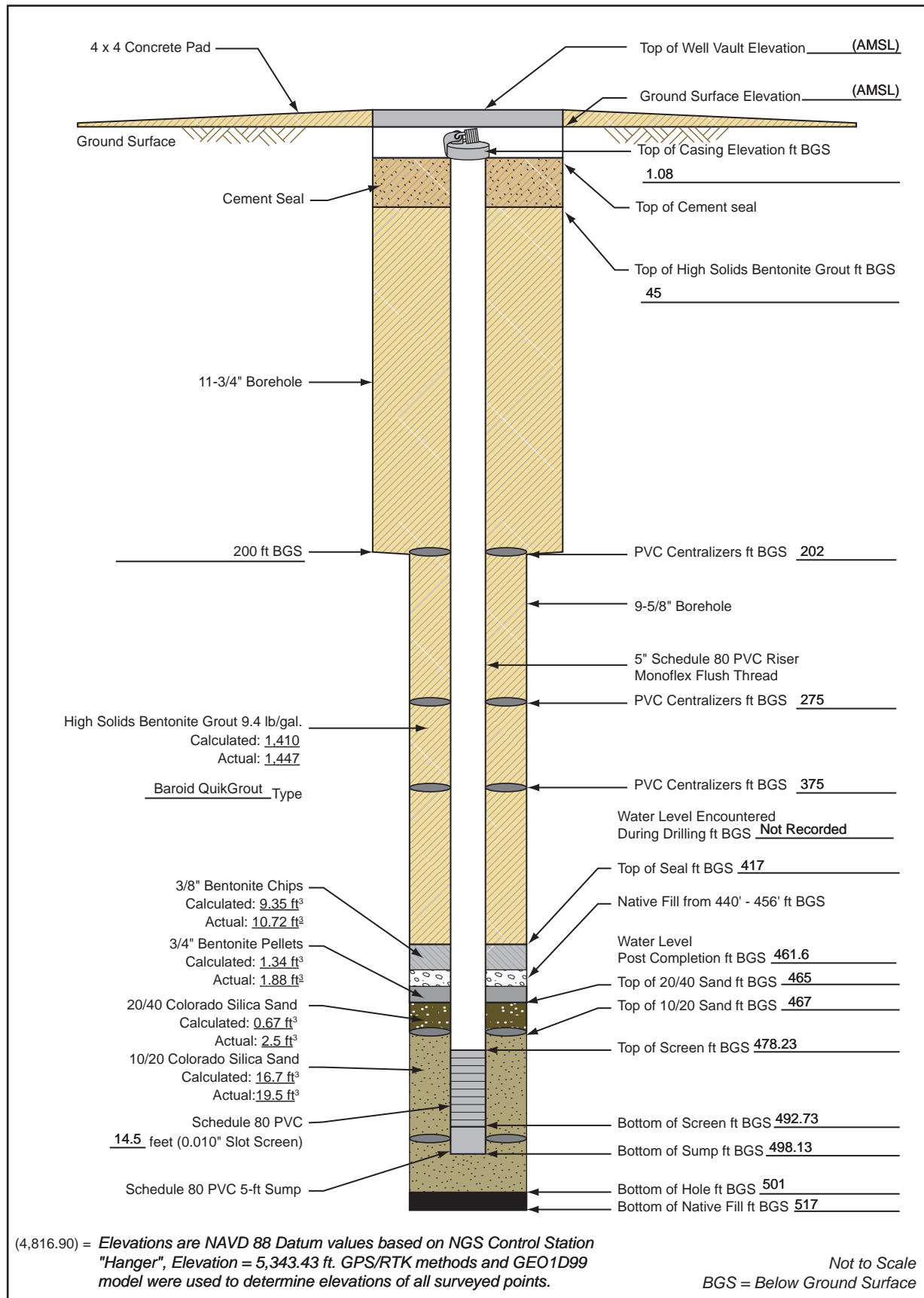
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								
515					subrounded; 10% silt. Note: gravel is black mafics with some red granite. Sand is mostly clear quartz with some red microcline. Well graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/3); 70% fine to coarse gravel; subangular to subrounded; 20% medium to very coarse sand; subangular to subrounded; 10% silt. Note: gravel is black mafics with some clear quartzite and red granite. Sand is black mafic, white quartzite, and red microcline.	GW-GM		
520					Silty SAND with Gravel (SM); brown (7.5YR 5/2); 70% fine to coarse sand; subangular to subrounded; 15% fine gravel; trace coarse gravel; subrounded; 15% silt. Note: sand is clear and frosted quartz. Sand is predominantly medium grained. Gravel is black mafics and frosted quartz.	SM		
525								
530								
535								
540								Total depth = 517 ft. Reached total depth @ 1022 on 3/2/15.

# Monitoring Well Completion Diagram KAFB-106214

Installation Start Date/Time: 2/24/15 12:00

Installation End Date/Time: 3/13/15 17:30







## Well Development Record

**Project Name:** KAFB BFF  
**Location:** Church on Gibson  
**Personnel:** M. Giles  
**Date:** 3/11/15 - 3/13/15  
**Samplers:** N/A  
**Method of Development:**  
☒ Surging ☒ Bailing ☐ Pumping  
☒ Original Development ☐ Redevelopment ☐ Other

**Well/Piez. No.:** KAFB-106214

**Date Installed:** 3/13/15

**Csg. Diameter (I.D.):** 5 "

**Total Depth (ft. bgs):** 498.13

**Development Date:** 3/11/2015 - 3/13/2015

**Depth to Water Before Developing Well (ft. btoc):** 461.60

**V=(B \* r<sub>c</sub><sup>2</sup> \* L<sub>c</sub> \* 7.48)+(B \* (r<sub>w</sub><sup>2</sup> - r<sub>c</sub><sup>2</sup>) \* L<sub>s</sub> \* ϕ<sub>s</sub> \* 7.48)+(H<sub>2</sub>O added during drilling/installation) =** 2,864.66 gallons

**Depth Purging From:** 491 feet

**Time Purging Begins:** 1616, 3/11/2015

**Weather:** Not Recorded

**Screened Interval (ft bgs):** 478.55 - 493.05

**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q

**Equipment Decontaminated Prior to Development:** Y X N

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y N X

**Describe:** N/A

**Comment:** Approximately 2,800 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (µS/cm)	Turbidity (NTU)	Comments
3/11/2015	0936	462.72	0	--	--	--	--	Begin bailing. Water is very cloudy.
3/11/2015	0950	--	20	--	--	--	--	Trace of very fine sand in bucket.
3/11/2015	1012	--	38	--	--	--	--	Trace of very fine sand in bucket.
3/11/2015	1017	--	38	--	--	--	--	Begin surging.
3/11/2015	1145	--	38	--	--	--	--	Finish surging.
3/11/2015	1240	--	38	--	--	--	--	Begin bailing.
3/11/2015	1305	--	58	--	--	--	--	Trace of very fine sand in bucket.
3/11/2015	1616	462.58	58	--	--	--	--	Begin pumping at 6.1 GPM.
3/11/2015	1626	463.69	119	20.11	7.17	0.534	430*	Pump set at 491 ft.
3/11/2015	1636	463.72	180	20.20	7.43	0.419	63.5*	

\* Turbidity readings were collected from YSI, not the turbidity meter.

### Notes:

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Seimens per Meter

### Where:

B=3.14

ϕ<sub>s</sub>= porosity of the sand pack

r<sub>c</sub>= radius of the well casing and screen in feet

L<sub>c</sub>= length of water column inside the casing and screen in feet

r<sub>w</sub>= radius of the well bore in feet

L<sub>s</sub>= length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons





## Well Development Record

Project: KAFB BFFWell No: KAFB-106214Project Number: 140705Samplers: N/ADate: 3/11/15 - 3/13/15

Checked By: \_\_\_\_\_

Time Start: 0936, 3/11/2015Time Finish: 1007, 3/13/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (µS/cm)	Turbidity (NTU)	Comments
3/11/2015	1646	463.74	241	20.43	7.42	0.416	17.40	
3/11/2015	1656	463.75	302	20.17	7.08	0.416	18.10	End of day.
3/12/2015	0816	462.54	302	--	--	--	--	Resume pumping.
3/12/2015	0826	463.65	363	19.54	7.15	0.421	18.8	
3/12/2015	0836	463.65	424	19.67	7.94	0.421	2.10	
3/12/2015	0846	463.65	485	19.81	7.96	0.419	1.47	
3/12/2015	0849	--	503	--	--	--	--	Stop pumping. Poly container full.
3/12/2015	1009	462.55	503	--	--	--	--	Resume pumping.
3/12/2015	1019	463.69	564	20.07	7.62	0.421	2.03	
3/12/2015	1029	463.69	625	19.90	7.62	0.421	1.03	
3/12/2015	1039	463.65	686	20.07	7.68	0.422	1.12	
3/12/2015	1049	463.68	747	19.91	7.67	0.422	0.51	
3/12/2015	1059	463.68	808	19.92	7.74	0.423	0.77	
3/12/2015	1109	463.69	869	20.07	7.75	0.423	0.38	
3/12/2015	1119	463.69	930	20.13	7.77	0.422	0.41	

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106214Project Number: 140705Samplers: N/ADate: 3/11/15 - 3/13/15

Checked By: \_\_\_\_\_

Time Start: 0936, 3/11/2015Time Finish: 1007, 3/13/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (µS/cm)	Turbidity (NTU)	Comments
3/12/2015	1129	463.68	991	19.96	7.76	0.422	0.51	
3/12/2015	1139	463.67	1052	19.99	7.77	0.422	0.75	
3/12/2015	1149	463.67	1113	19.94	7.78	0.423	0.71	
3/12/2015	1209	463.67	1174	20.23	7.78	0.423	1.00	Stop pumping.
3/12/2015	1325	462.61	1174	--	--	--	--	Raise pump to 480 ft.
3/12/2015	1335	462.61	1174	--	--	--	--	Resume pumping.
3/12/2015	1345	463.58	1235	20.18	7.58	0.428	31.9	
3/12/2015	1355	463.60	1296	19.98	7.59	0.426	16.7	
3/12/2015	1405	463.60	1357	19.94	7.60	0.424	4.08	
3/12/2015	1415	463.59	1418	20.29	7.64	0.424	0.61	
3/12/2015	1425	463.58	1479	20.30	7.66	0.426	0.38	
3/12/2015	1445	463.58	1601	20.19	7.68	0.425	0.54	
3/12/2015	1455	463.59	1662	20.28	7.70	0.426	0.54	
3/12/2015	1505	463.59	1723	20.40	7.71	0.425	0.61	
3/12/2015	1515	463.57	1784	20.36	7.73	0.420	0.41	

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106214Project Number: 140705Samplers: N/ADate: 3/11/15 - 3/13/15

Checked By: \_\_\_\_\_

Time Start: 0936, 3/11/2015Time Finish: 1007, 3/13/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (µS/cm)	Turbidity (NTU)	Comments
3/12/2015	1525	463.58	1845	19.96	7.73	0.425	0.46	
3/12/2015	1535	463.57	1906	19.92	7.73	0.425	0.51	Stop pumping. Lower pump to 485 ft.
3/12/2015	1617	462.35	1906	--	--	--	--	
3/12/2015	1627	463.49	1967	19.83	7.85	0.423	3.03	
3/12/2015	1637	463.53	2028	19.84	7.79	0.426	0.76	
3/12/2015	1647	463.57	2089	19.83	7.79	0.427	1.66	
3/12/2015	1700	463.58	2168	19.81	7.80	0.420	0.97	End of day.
3/13/2015	0810	463.57	2186	16.61	7.29	0.423	10.4	Begin pumping.
3/13/2015	0820	463.59	2247	18.88	8.01	0.422	0.80	
3/13/2015	0830	463.65	2308	19.17	8.05	0.424	0.74	
3/13/2015	0840	463.66	2369	19.21	8.05	0.423	0.63	
3/13/2015	0850	463.68	2430	19.34	8.03	0.423	0.49	
3/13/2015	0900	463.69	2491	19.26	8.01	0.422	0.90	
3/13/2015	0910	463.69	2552	19.26	8.00	0.423	1.34	Discharge line submerged.
3/13/2015	0920	463.69	2613	19.29	7.98	0.423	1.76	Discharge line submerged.
3/13/2015	0930	463.70	2674	19.34	7.96	0.422	1.21	Discharge line submerged.
3/13/2015	0940	463.71	2735	19.35	7.95	0.421	0.28	Discharge line submerged.
3/13/2015	0950	463.71	2796	19.39	7.92	0.421	0.28	Brought discharge line above.
3/13/2015	1000	463.71	2857	19.45	7.91	0.424	0.30	Water in tank.
3/13/2015	1007	463.71	2900	19.44	7.90	0.424	0.26	Complete well development. Stop pumping.

Was well sampled after development? YES \_\_\_\_\_ NO ☒ X \_\_\_\_\_Sample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106215



# Borehole ID: KAFB-106215

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 4/9/2015  
 Date TD Reached: 4/16/2015  
 Date Completed: 4/22/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

Drilling Contractor: National Drilling  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: T. Richards



Page 1 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
5					SILT with Gravel (ML); Brown (7.5YR 5/3); 70% silt; 15% clay; 15% gravel; angular to subangular; gravel is mafics and pink granite.	ASPHALT ML	Top of Casing/Top of Cement Seal	Borehole cleared with water jet to 10 feet bgs. Began drilling at 1000 on 4/9/15 with 11 3/4" drive casing.
10					Well-Graded SAND with Silt (SW-SM); Light Brown (7.5YR 6/3); dry; loose; 90% very fine to very coarse sand; 5% silt, 5% clay.			PID = 0.0 ppm @ cyclone. 0.1 ppm @ breathing zone.
15							-Cement Seal	
20					Well-Graded SAND with Silt and Gravel (SW-SM); Light Brown (7.5YR 6/3); 70% very fine to very coarse sand; 20% gravel; gravel is mafic to white; subrounded to subangular; 5% silt; 5% clay.	SW-SM		Kelly down @ 1003, new 20' connection. Resumed drilling @ 1010.
25								PID = 0.0 ppm @ cyclone and breathing zone.
					Large boulder from 26 to 28 feet bgs.	BOULDER	-Top of High Solids Bentonite Grout	Hammering.
					Description on next page.	SW-SM		PID = 0.0 ppm @ cyclone and breathing zone.
30								



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 462.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Well-Graded SAND with Silt and Gravel (SW-SM); Light Brown (7.5YR 6/3); dry; loose; 70% very fine to very coarse sand; 20% gravel; rounded to subrounded; gravel is mafic; 5% silt; 5% clay.			
40					Same as above (28 ft).	SW-SM		Kelly down @ 1037, new 20' connection. Resumed drilling @ 1042.
45								PID = 0.0 ppm @ cyclone and breathing zone.
50								No water added to this depth.
55					Lean CLAY with Sand (CL); Yellowish Red (5YR 5/6); moist; low plasticity; 75% clay; 25% fine to coarse sand.	CL	- High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
60								Hammering. Kelly down @ 1123, new 20' connection. Resumed drilling @ 1129.



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 3 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Lean CLAY with Sand (CL); Yellowish Red (5YR 5/6); moist; low plasticity; 75% clay; 25% fine to coarse sand.	CL		PID = 0.0 ppm @ cyclone and breathing zone.
65					Silty GRAVEL (GM); Yellowish Red (5YR 5/6); moist; 70% gravel; subrounded to rounded; 10% fine to coarse sand; 10% silt; 10% clay.	GM		Hammering.
70								PID = 0.0 ppm @ cyclone and breathing zone.
75								No water added to this depth.
80					Poorly Graded GRAVEL with Silt and Sand (GP-GM); Light Brown (7.5YR 6/3); 70% gravel; angular to subangular; 20% very fine to coarse sand; 10% silt.	GP-GM		Kelly down @ 1138, new 20' connection. Resumed drilling @ 1143.
85								PID = 0.0 ppm @ cyclone and breathing zone.
90					Well-Graded SAND with Silt (SW-SM); Strong Brown (7.5YR 5/6); 90% very fine to coarse sand; 10% silt.	SW-SM		





# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 4 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well-Graded SAND with Silt (SW-SM); Strong Brown (7.5YR 5/6); 90% very fine to coarse sand; 10% silt.			PID = 0.0 ppm @ cyclone and breathing zone. Hammering.
95					Same as above (90 ft).	SW-SM		Kelly down @ 1153, new 20' connection. Resumed drilling @ 1225.
100								PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
105					Lean CLAY with Sand (CL); Yellowish Red (5YR 5/6); moist; low to moderate plasticity; 80% clay; 20% fine to medium sand.			
110					Same as above (102 ft).	CL	High Solids Bentonite Grout	PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone. Hammering.
115								Kelly down @ 1233, new 20' connection. Resumed drilling @ 1242.
120								



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

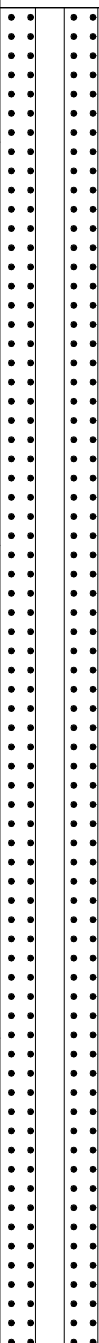
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 5 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY with Sand (CL); Yellowish Red (5YR 5/6); moist; low to moderate plasticity; 80% clay; 20% fine to medium sand.	CL		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. Added ~ 25 gallons of water.
125					Poorly Graded SAND (SP); Reddish Yellow (7.5YR 6/6); 95% very fine to fine sand; 5% silt.	SP		Added ~ 25 gallons of water.
130								
135					Lean CLAY (CL) with Sand (CL); Yellowish Red (5YR 5/6); low plasticity; 80% clay; 20% very fine to coarse sand.	CL		PID = 0.1 ppm @ cyclone and 0.0 ppm @ beathing zone.
140					Same as above (132 ft).			Kelly down @ 1255, new 20' connection. Resumed drilling @ 1259.
145					Poorly Graded SAND (SP); Light Brown (7.5YR 6/4); 100% very fine to fine sand.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
150								



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 462.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Poorly Graded SAND (SP); Light Brown (7.5YR 6/4); 100% very fine to fine sand. Poorly Graded SAND with Gravel (SP); Brown (7.5YR 4/2); 80% very coarse sand; angular; 20% fine gravel; gravel is mafics and sandstone.			PID = 0.0 ppm @ cyclone and breathing zone. Added ~ 100 gallons of water. Hammering.
155								
160					Same as above (151 ft).			Kelly down @ 1410, new 20' connection. Resumed drilling @ 1427. Clay causing problems in casing and discharge line.
165						SP	High Solids Bentonite Grout	
170					Same as above (151 ft).			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
175								
180					Poorly Graded SAND (SP); Light Brown (7.5YR 6/4); 100% fine to medium sand.			Kelly down @ 1500. New 20' connection. Resumed drilling @ 1513.



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 7 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly Graded SAND (SP); Light Brown (7.5YR 6/4); 100% fine to medium sand.	SP		PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone. Added ~ 100 gallons water.
185								
190					Well-Graded SAND (SW); Brown (7.5YR 5/3); loose; 90% fine to very coarse sand; 10% fine gravel; well rounded.	SW		PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
195								
200					Same as above (188 ft).		High Solids Bentonite Grout	Kelly down @ 1528, drill bit @ 200', trip out and change to 9 5/8" drive casing. Resumed drilling @ 0950 on 4/10/15.
205								
210								



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 462.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 8 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-Graded SAND (SW); Brown (7.5YR 5/3); loose; 90% fine to very coarse sand; 10% fine gravel; well rounded.	SW		PID = 0.0 ppm @ cyclone and breathing zone.
215					Poorly Graded SAND (SP); Light Brown (7.5YR 6/3); 100% very fine to fine sand.	SP		No hammering. No water added.
220					Same as above (212 ft). 95% sand; 5% fine gravel; well rounded; gravel is mafic.	SP		Kelly down @ 1000, new 20' connection. Resume drilling @ 1012.
225								PID = 0.0 ppm @ cyclone and breathing zone.
230					Well-Graded SAND with Gravel (SW); Light Brown (7.5YR 6/4); slightly moist to moist; 80% very fine to very coarse sand; 20% fine gravel; rounded; gravel is mafic and white minerals.	SW		No Hammering. No water added.
235								
240								Kelly down @ 1027, new 20' connection. Resume drilling @ 1036.



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-Graded SAND with Gravel (SW); Light Brown (7.5YR 6/4); slightly moist to moist; 80% very fine to very coarse sand; 20% fine gravel; rounded; gravel is mafic and white minerals.			PID = 0.0 ppm @ cyclone and breathing zone.
245								No Hammering. No water added.
250					Same as above (240 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
255						SW	High Solids Bentonite Grout	Kelly down @ 1049, new 20' connection. Resume drilling @ 1059.
260					Same as above (240 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
265								Some hammering. No water added.
270					Poorly Graded SAND (SP); Light Brown (7.5YR 6/4); moist; 100% very fine to fine sand.	SP		



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 10 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly Graded SAND (SP); Light Brown (7.5YR 6/4); moist; 100% very fine to fine sand.			Hammering. PID = 0.0 ppm @ cyclone and breathing zone.
275								
					Same as above (270 feet); 90% sand; 10% fine gravel; rounded; gravel is mafic and white minerals.	SP		Kelly down @ 1110, new 20' connection. Resumed drilling @ 1127.
280								PID = 0.0 ppm @ cyclone and breathing zone.
					Lean CLAY (CL); Reddish Brown (5YR 5/4); moist; non plastic; 100% clay.			
285								
						CL	High Solids Bentonite Grout	
290								PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
					Well-Graded SAND (SW); Strong Brown (7.5YR 4/6); moist; 90% fine to very coarse sand; 10% fine gravel; gravel is mafic.			
295						SW		Kelly down @ 1135, new 20' connection. Resume drilling @ 1141.
300								





# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 462.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 11 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well-Graded SAND (SW); Strong Brown (7.5YR 4/6); moist; 90% fine to very coarse sand; 10% fine gravel; gravel is mafic.			PID = 0.0 ppm @ cyclone and breathing zone.
305								
310					Well-Graded SAND with Gravel (SW); Strong Brown (7.5YR 4/6); moist; 80% fine to very coarse sand, 20% gravel to 1".			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
315						SW	High Solids Bentonite Grout	Kelly down @ 1150, new 20' connection. Resumed drilling @ 1225.
320					Same as above (310 ft).			PID= 0.1 ppm @ cylone and 0.0 ppm @ breathing zone.
325								Hammering. No water added.
330								



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 12 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-Graded SAND with Gravel (SW); Strong Brown (7.5YR 4/6); moist; 80% fine to very coarse sand, 20% gravel to 1".			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
335								
340					Same as above (330 ft).			Kelly down @ 1234, new 20' connection. Resume drilling @ 1239.
345								PID = 0.0 ppm @ cyclone and breathing zone. Dry cuttings.
350					Same as above (330 ft).	SW	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
355								
360								Kelly down @ 1250, new 20' connection. Resume drilling @ 1256.



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 13 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-Graded SAND with Gravel (SW); Strong Brown (7.5YR 4/6); moist; 80% fine to very coarse sand, 20% gravel to 1".			PID = 0.0 ppm @ cyclone and breathing zone. Hammering.
365								No water added.
370					Same as above (360 ft).			PID= 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
375						SW	High Solids Bentonite Grout	Kelly down @ 1306, new 20' connection. Resume drilling @ 1310.
380					Same as above (360 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
385								
390								



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 14 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-Graded SAND with Gravel (SW); Strong Brown (7.5YR 4/6); moist; 80% fine to very coarse sand, 20% gravel to 1".	SW		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. Hammering. No water added.
395								
400					Poorly Graded SAND (SP); Light Brown (7.5YR 6/4); moist; 100% very fine to fine sand.			Kelly down @ 1318, new 20' connection. Resume drilling @ 1323.
405					Same as above (397 ft).	SP		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
410					Well-Graded SAND with Gravel (SW); Brown (7.5YR 5/3); moist; 80% fine to very coarse sand; 20% fine gravel to 1"; subrounded to rounded; gravel is mafic and white quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
415					Same as above (408 ft).	SW		Kelly down @ 1332, new 20' connection. Resume drilling @ 1338.
420								



# Borehole ID: KAFB-106215

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 15 of 25




Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420								
					Well-Graded SAND with Gravel (SW); Brown (7.5YR 5/3); moist; 80% fine to very coarse sand; 20% fine gravel to 1"; subrounded to rounded; gravel is mafic and white quartz.	SW		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
425					Poorly Graded SAND (SP); Light Brown (7.5YR 6/3); moist; 100% fine sand.	SP		
							Top of Bentonite Chip Seal	
430								PID = 0.0 ppm @ cyclone and breathing zone.
435					Well-Graded SAND (SW); moist; Brown (7.5YR 5/3); 90% very fine to very coarse sand; 10% fine gravel; subrounded to rounded; gravel is mafic and quartz.			Kelly down @ 1349, new 20' connection. Resume drilling @ 1354.
440					Same as above (433 ft).	SW		PID = 0.1 ppm @ cyclone and 0.0 ppm breathing zone.
445								
450								PID = 0.0 ppm @ cyclone and breathing zone. Kelly down @ 1359. End ARCH drilling @ 450 ft.

**Borehole ID: KAFB-106215-Sonic**

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush

Date Started: 4/9/2015  
Date TD Reached: 4/16/2015  
Date Completed: 4/22/2015

Groundwater Levels BGS (ft):  
 At Time of Drilling: 462.00  
 At End of Drilling: Not Recorded  
 After Drilling: 461.35

Ground Elevation AMSL (ft): Not Recorded  
Y Coordinate:  
X Coordinate:

Drilling Contractor: National Drilling  
Drilling Method: Sonic Coring  
Logged By: M. Giles

Page 16 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
					@ 450 ft. Well-graded SAND (SW); Brown (7.5YR 4/4); 85% very fine to medium sand; subangular to subrounded; 10% fine to coarse gravel; subrounded; 5% silt. @ 450.6 ft. Silty GRAVEL with Sand (GM); Brown (7.5YR 4/4); 60% fine to coarse gravel; subangular to subrounded; 20% very fine to coarse sand; subangular; 20% silt.	SW    GM	- Bentonite Chip Seal	Begin Sonic coring at 450 feet bgs @ 1525 on 4/14/15. @ 450 ft, sand is mostly fine clear and frosted quartz. Gravel is black mafics and red granite. @ 450.6 ft gravel is black mafic, red granite, and quartzite; grain size decreasing with depth. Sand is clear quartz, red granite, and black biotite.
455								
					@ 456.3 ft. Silty SAND with Gravel (SM); Brown (7.5YR 4/4); 40% very fine to fine sand; trace medium and coarse; subangular to subrounded; 30% fine to coarse gravel; subangular to subrounded; 30% silt. @ 457.6 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); Brown (7.5YR 4/4); 70% coarse gravel; trace fine gravel; subangular to subrounded; 20% fine to coarse sand; subangular to subrounded; 10% silt.	SM  GW-GM	- Top of Bentonite Pellet Seal	@ 456.3 ft sand is clear quartz; gravel is black mafics. @ 457.2 ft core is moist. @ 457.6 ft gravel is black mafics and red granite. sand is clear and frosted quartz and red granite. @458.4 ft core is wet. @ 459.4 ft sand is quartz.
460					@ 459.4 ft. Silty SAND (SM); Brown (7.5YR 4/4); 60% very fine to fine sand; trace medium sand; subangular to subrounded; 10% fine gravel; trace coarse gravel; subrounded; 30% silt. @ 460.1 ft. Silty SAND with Gravel (SM); Brown (7.5YR 4/4); 60% very fine to coarse sand; subangular to subrounded; 20% fine to coarse gravel; subangular to subrounded; 20% silt.	SM		@ 460.1 ft sand is clear quartz. Sand coarseness decreases with depth. Gravel is black mafics with some red granite.
465					@ 464.4 ft. Poorly graded SAND with Silt (SP-SM); Brown (7.5YR 4/4); 90% very	SP-SM		@ 464.4 ft sand is clear and frosted quartz.





# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 17 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
465					fine to fine sand; subangular to subrounded; 10% silt. No recovery from 465 to 465.9 ft. @ 465.9 ft. Poorly graded SAND with Silt (SP-SM); Brown (7.5YR 4/4); 90% very fine to fine sand; subangular to subrounded; 10% silt. @ 466.3 ft. Lean CLAY (CL); reddish brown (2.5YR 4/4); very hard; medium plasticity; 100% clay.	SP-SM    CL		End coring @ 465 ft at 1602 on 4/14/15. Resume coring @ 465 ft at 0825 on 4/15/15. @ 465.9 ft sand is clear and frosted quartz. @ 466.3 clay has blocky structure. Some black and white sand pockets present. @ 467.8 - 468.2 ft some silt observed.
470							Bentonite Pellet Seal	@ 469 ft some silt observed. Trace blocky clay structure. @ 470 ft some black grains and grey patches.
					No recovery from 472 to 472.2 ft. @ 472.2 ft. Clayey SAND (SC); Brown (10YR 4/3); 80% very fine to fine sand; subangular; 20% clay.	SC		@ 472.2 ft sand is clear and frosted quartz.
475					@ 473.5 ft. Poorly graded SAND with Clay (SP-SC); Brown (10YR 4/3); 90% very fine to fine sand; trace medium sand; subrounded; 10% clay.	SP-SC		@ 473.5 sand is clear and frosted quartz, black biotite, and red microcline.
					@ 475.6 ft. Poorly graded SAND with Silt (SP-SM); dark yellowish brown (10YR 4/4); 90% fine to medium sand; mostly medium; subangular to subrounded; trace coarse gravel to 3/4"; subrounded; 10% silt.	SP-SM		@ 475.6 ft sand is clear and frosted quartz, black biotite, and red microcline. Gravel is quartzite.  @ 477.5 to 478.2 ft some coarse sand observed. @ 479.6 ft layer of coarse, flat, black mafic gravel observed.
480								





# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 18 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480								
					@ 475.6 ft. Poorly graded SAND with Silt (SP-SM); dark yellowish brown (10YR 4/4); 90% fine to medium sand; mostly medium; subangular to subrounded; trace coarse gravel to 3/4"; subrounded; 10% silt.	SP-SM CL SC		@ 480.5 ft sand is clear and frosted quartz.
					@ 480.5 ft. Lean CLAY with Sand (CL); yellowish brown (10YR 5/4); hard; medium plasticity; 80% clay; 20% very fine sand; subangular.	SP-SC		@ 480.8 ft sand is clear and frosted quartz.
					@ 480.8 ft. Clayey SAND (SC); Brown (7.5YR 4/3); 70% very fine to fine sand; subangular to subrounded; 30% clay.	SP-SM		@ 481.5 sand is clear and frosted quartz with some black biotite. Gravel is flat, black mafics.
485					@ 481.5 ft. Poorly graded SAND with Clay (SP-SC); Brown (7.5YR 4/3); 85% very fine to fine sand; trace medium and coarse sand; subangular to subrounded; 5% fine to coarse gravel; subrounded; 10% clay.	SP-SC	Bentonite Pellet Seal	@ 483 ft sand is clear and frosted quartz with some microcline.
					@ 483 ft. Poorly graded SAND with Silt (SP-SM); Brown (7.5YR 4/3); 90% fine to medium sand; subangular to subrounded; 10% silt.			@ 484.3 ft sand is clear and frosted quartz with some microcline. Gravel is black mafics and red granite.
					@ 484.3 ft. Poorly graded SAND with Clay and Gravel (SP-SC); Brown (7.5YR 4/3); 50% fine to medium sand; subangular to subrounded; 40% coarse gravel; trace fine gravel; subangular to subrounded; 10% clay.	SM		@ 485.7 ft sand is clear and frosted quartz with some black grains. Gravel is black mafics.
490					@ 485.7 ft. Silty SAND (SM); Brown (7.5YR 5/4); 80% very fine to fine sand; trace medium sand; subangular to subrounded; 5% coarse gravel to 1"; trace fine gravel; subrounded; 15% silt.			@ 487.7 ft some sand is red microcline.
					@ 487.7 ft. Same as above (485.7 ft); 80% very fine to coarse sand.	SP		@ 491.1 ft sand is clear and frosted quartz.
					@ 491.1 ft. Poorly graded SAND (SP); Brown (7.5YR 5/4); 95% very fine to fine sand; trace medium sand; subangular to subrounded; 5% silt.	SW		@ 492 ft sand is clear and frosted quartz, black grains, and red microcline. One clast of coarse, rounded, red granite observed.
					@ 492 ft. Well-graded SAND (SW); Brown (7.5YR 5/4); 95% fine to coarse sand; subangular to subrounded; 5% silt.	SP		@ 492.9 ft sand is clear and frosted quartz.
495					@ 492.9 ft. Poorly graded SAND (SP); Brown (7.5YR 5/4); 95% very fine to fine			



# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 19 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495					sand; trace medium sand; subangular to subrounded; 5% silt.	GP-GC		@ 494.5 ft gravel is black mafics, white quartzite, and red granite. Sand is mostly medium clear and frosted quartz, black grains, and red microcline.
					@ 494.5 ft. Poorly graded GRAVEL with Clay and Sand (GP-GC); Dark Brown (7.5YR 3/4); 50% fine gravel; trace coarse gravel; subrounded; 40% fine to coarse (mostly medium) sand; subangular to subrounded; 10% clay.	CL		@ 496.4 ft gravel is black mafics, white quartzite, and red granite. Sand is mostly medium clear and frosted quartz, black grains, and red microcline.
					@ 495.7 ft. Lean CLAY (CL); Strong Brown (7.5YR 5/6); hard; medium plasticity; 100% clay.	GP-GC		@ 497.1 ft sand is clear and frosted quartz, black and white grains, and red microcline.
					@ 496.4 ft. Poorly graded GRAVEL with Clay and Sand (GP-GC); Dark Brown (7.5YR 3/4); 50% fine gravel; trace coarse gravel; subrounded; 40% fine to coarse sand; subangular to subrounded; 10% clay.	SW		@ 498.0 - 498.2 ft trace fine to coarse gravel observed; subrounded. Gravel is black mafics.
500					@ 497.1 ft. Well-graded SAND (SW); Strong Brown (7.5YR 5/6); 95% very fine to coarse sand; subangular to subrounded; 5% silt.	SW-SC		@ 499.3 ft sand is clear and frosted quartz, black grains, and red microcline. Gravel is black mafics and red granite.
					@ 499.3 ft. Well-graded SAND with Clay and Gravel (SW-SC); dark yellowish brown (10YR 4/4); 50% very fine to coarse sand; subangular to subrounded; 40% coarse gravel; subrounded; 10% clay.	CL		@ 500 ft occasional small patches of white clay.
					@ 500 ft. Lean CLAY (CL); dark yellowish brown (10YR 4/4); medium plasticity; 100% clay.	SC		@ 502.5 ft sand is clear and frosted quartz. Gravel is black mafics, red granite, and white quartzite.
505					@ 502.5 ft. Clayey SAND with Gravel (SC); Brown (7.5YR 4/3); 50% fine to coarse sand; subangular to subrounded; 35% coarse gravel; 15% clay.	GC		@ 503.1 ft gravel is black mafics and some red granite. Sand is clear and frosted quartz.
					@ 503.1 ft. Clayey GRAVEL with Sand (GC); Brown (7.5YR 4/3); 50% fine to coarse gravel to 2"; 30% fine to medium sand; subangular to subrounded; 20% clay.	SP-SC		@ 504.3 ft sand is clear and frosted quartz.
					@ 504.3 ft. Poorly graded SAND with Clay (SP-SC); Brown (7.5YR 4/3); 90% fine to medium sand; subangular to subrounded; 10% clay.	SC		
510					@ 505.3 ft. Description on following page.			

- Bentonite Pellet Seal



# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015


**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 20 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					@ 505.3 ft. Clayey SAND with Gravel (SC); Brown (7.5YR 4/3); 50% fine to coarse sand; subangular to subrounded; 30% fine to coarse gravel; subrounded; 20% clay.	SC		<p>@ 505.3 fine and medium sand is frosted and clear quartz. Coarse sand is white, black, and red microcline, and clear and frosted quartz. Gravel is black mafics, red granite, and clear and frosted quartzite. Coarseness of gravel decreases with depth. @ 510.2 ft coarse gravel increases. @ 511 ft percent of coarse gravel increases. @ 513.2 ft sand is mostly medium and coarse clear and frosted quartz, black biotite, and red microcline. Gravel is black mafics and frosted quartzite. @ 515 ft, end coring at 1549 on 4/15/15. Resume coring at 0836 on 4/16/15. @ 518 ft sand is clear and frosted quartz. Occasional sandy clay patch.</p>
515					@ 513.2 ft. Well-graded SAND with Clay (SW-SC); Brown (7.5YR 4/3); 80% fine to coarse sand; mostly medium and coarse; subangular; 10% coarse gravel to 2"; 10% clay.	SW-SC		
520					@ 518 ft. Clayey SAND (SC); Brown (7.4YR 4/4); 80% fine to medium sand; subangular to subrounded; 20% clay.	SC		
525					@ 522.4 ft. Poorly graded SAND with Silt (SP-SM); Strong Brown (7.5YR 5/6); 80% coarse sand; trace fine sand; subangular to subrounded; 10% coarse gravel; trace fine gravel; 10% silt.	SP-SM		<p>@ 522.4 ft sand is clear and frosted quartz, black biotite, and red microcline. Gravel is black mafics and red granite. @ 523.2 one piece of coarse, flat, partially</p>

**Borehole ID: KAFB-106215-Sonic**

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush

Date Started: 4/9/2015  
Date TD Reached: 4/16/2015  
Date Completed: 4/22/2015

Groundwater Levels BGS (ft):

▽	At Time of Drilling:	462.00
▼	At End of Drilling:	Not Recorded
▼	After Drilling:	461.35

Ground Elevation AMSL (ft): Not Recorded  
Y Coordinate:  
X Coordinate:

Drilling Contractor: National Drilling  
Drilling Method: Sonic Coring  
Logged By: M. Giles

Page 21 of 25

[illegible]





# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 22 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					@ 539.9 ft. Poorly graded SAND (SP); Brown (7.5YR 5/4); 85% fine to medium sand; trace coarse sand; subangular to subrounded; 10% fine to coarse gravel to 1"; subrounded to rounded; 5% silt.	SP	- Top of 20/40 Sand	@ 539.9 ft sand is quartz, black biotite, and red microcline. Gravel is black mafics and red granite.
					@ 540.6 ft. Silty SAND (SM); Brown (7.5YR 5/4); 85% very fine to fine sand; subangular to subrounded; 15% silt.	SM		@ 540.6 ft sand is clear quartz with some black biotite and clear specks. Occasional lenses of clayey silt.
					@ 543 ft. Clayey SAND with Gravel (SC); Brown (7.5YR 5/4); 65% very fine to fine sand; trace medium and coarse sand; subangular to subrounded; 20% coarse gravel to 2"; subangular to subrounded; 15% clay.	SC	- Top of 10/20 Sand	@ 543 ft sand is clear quartz, red microcline, and black biotite. Gravel is black mafics and conglomerate.
545					@ 544.5 ft. Poorly graded SAND with Clay (SP-SC); Brown (7.5YR 5/4); 90% very fine to fine sand; trace medium sand; subangular to subrounded; 10% clay.	SP-SC		@ 544.5 ft sand is clear quartz, red microcline, and black biotite. Occasional pieces of light brown (7.5YR 6/3) clay.
					@ 547.5 ft. Well-graded SAND with Clay and Gravel (SW-SC); Brown (7.5YR 5/4); 50% very fine to medium sand; trace coarse sand; subangular to subrounded; 40% coarse gravel; angular to subangular; 10% clay.	SW-SC	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	@ 547.5 ft sand is clear and frosted quartz and black biotite. Gravel is black mafics.
					@ 548.5 ft. Poorly graded SAND with Clay (SP-SC); Brown (7.5YR 5/4); 90% very fine to fine sand; subangular to subrounded; 10% clay.	SP-SC		@ 548.5 ft sand is clear and frosted quartz and black biotite.
550					@ 549.7 ft. Poorly graded SAND (SP); Brown (7.5YR 5/4); 95% very fine to fine sand; subangular to subrounded; 5% clay.	SP		@ 549.7 ft sand is clear and frosted quartz.
					@ 552.5 ft. Lean CLAY (CL); Pinkish grey (7.5YR 6/2); hard; medium plasticity; 100% clay.	CL		
					@ 553.8 ft. Description is on the following page.	SP		
555								



# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

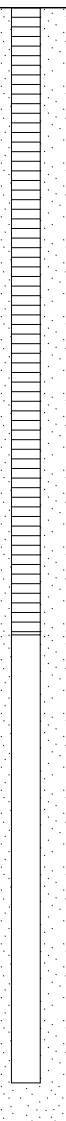

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 23 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
555					@ 553.8 ft. Poorly graded SAND (SP); Strong Brown (7.5YR 5/6); 95% medium sand; trace very fine to fine sand; subangular to subrounded; 5% clay.	SP		@ 553.8 ft sand is clear and frosted quartz, black biotite, and red microcline.  @ 556.5 occasional pockets of clay observed.
					@ 558.2 ft. Clayey SAND (SC); Brown (7.5YR 4/3); 75% very fine to medium sand; subangular to subrounded; 5% gravel; 20% clay; medium plasticity.	SC		@ 558.2 sand is frosted and clear quartz and red microcline. Gravel is partially cemented sandstone.
560					@ 559.6 ft. Lean CLAY (CL); yellowish red (5YR 4/6); firm; medium plasticity; 100% clay.	CL		@ 559.6 ft clay has semi blocky structure.
					@ 560.8 ft. Clayey SAND (SC); Brown (7.5YR 5/2); 80% very fine to medium sand (mostly fine); subangular to subrounded; 20% clay.	SC		@ 559.9 trace coarse gravel of partially cemented sandstone observed.
					@ 562.9 ft. Poorly graded SAND with Clay (SP-SC); Brown (7.5YR 5/2); 90% medium sand; trace very fine to fine sand; subangular to subrounded; 10% clay.	SP-SC SC		@ 560.8 ft sand is frosted and clear quartz, black biotite, and red microcline.
565					@ 563.2 ft. Clayey SAND (SC); Brown (7.5YR 5/2); 80% very fine to medium sand; subangular to subrounded; 20% clay.	SP-SC		@ 562.9 ft sand is frosted and clear quartz.
					@ 564.5 ft. Poorly graded SAND with Clay (SP-SC); Brown (7.5YR 5/2); 90% medium sand; trace very fine to fine sand; subangular to subrounded; 10% clay.	No Core		@ 563.2 ft sand is frosted and clear quartz, black biotite, and red microcline.
					No core recovered from 565 to 595 feet. Overdrill for heaving sand.	No Core		@ 564.5 ft sand is frosted and clear quartz.
570								End collection of continuous coring at 565 feet bgs.



# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 462.00  
▼ **At End of Drilling:** Not Recorded  
▽ **After Drilling:** 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 24 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
570					No core recovered from 565 to 595 feet. Overdrill for heaving sand.			
575								
580						No Core		
585							Bottom of Filter Pack	





# Borehole ID: KAFB-106215-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/9/2015  
**Date TD Reached:** 4/16/2015  
**Date Completed:** 4/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 462.00  
▼ **At End of Drilling:** Not Recorded  
▼ **After Drilling:** 461.35

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles

Page 25 of 25

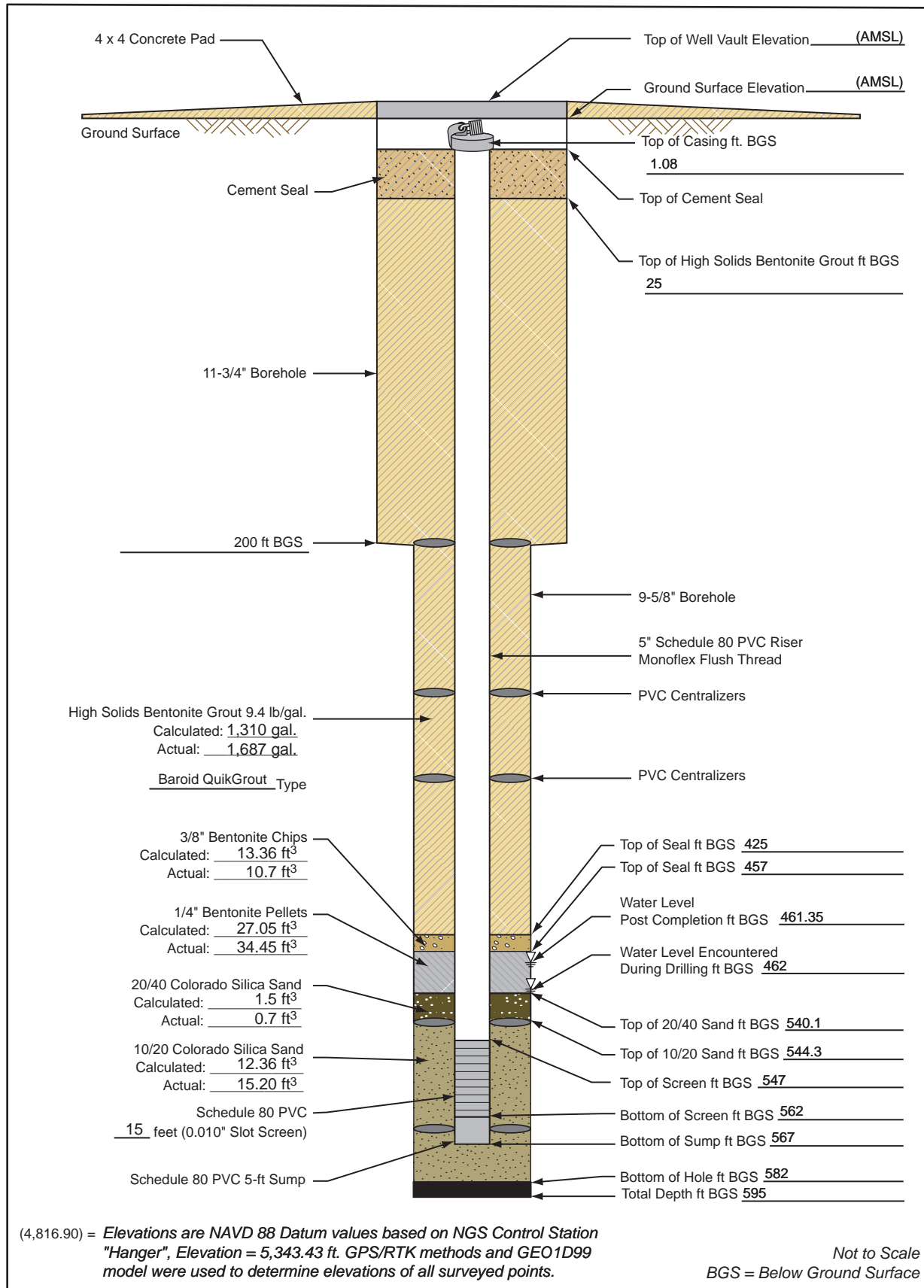
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
585					No core recovered from 565 to 595 feet. Overdrill for heaving sand.			
590						No Core		
595							Bottom of Rat Hole	
600								

# Monitoring Well Completion Diagram KAFB-106215

Installation Start Date/Time: 4/23/2015

Installation End Date/Time: 4/28/2015

Date Completed: 4/22/2015





## Well Development Record

**Project Name:** KAFB BFF**Location:** Georgia and Gibson**Personnel:** R. Wortman**Date:** 5/6/15 - 5/7/15**Samplers:** N/A**Method of Development:**☒ Surging☐ Bailing**Well/Piez. No.:** KAFB-106215**Date Installed:** 4/22/15**Csg. Diameter (I.D.):** 5 "**Total Depth (ft. bgs):** 582☒ Original Development☐ Redevelopment☒ Pumping☐ Other**Development Date:** 5/6/2015 - 5/7/2015**Depth to Water Before Developing Well (ft. btoc):** 461.35**V =  $(B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation})$**  = 460 gallons**Depth Purging From:** 554.5 feet**Time Purging Begins:** 0905, 5/7/2015**Weather:** Clear, hot**Screened Interval (ft bgs):** 547 - 562**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q**Equipment Decontaminated Prior to Development:** Y X N**Describe:** Steam Cleaned**Collected Sample of Water Added to Well:** Y N X**Describe:** N/A**Comment:** Approximately 250 gallons of water added during drilling/well installation activities. Bubbles in YSI and turbidity samples throughout development.

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/6/2015	1000	460.70	0	--	--	--	--	Begin bailing.
5/6/2015	1014	--	25	--	--	--	>1000	Finish bailing.
5/6/2015	1104	--	25	--	--	--	--	Begin swabbing from 562 - 557 feet bgs.
5/6/2015	1124	--	25	--	--	--	--	Continue swabbing from 557 - 552 feet bgs.
5/6/2015	1144	--	25	--	--	--	--	Continue swabbing from 552 - 547 feet bgs.
5/6/2015	1204	--	25	--	--	--	--	Finish swabbing.
5/6/2015	1211	--	25	--	--	--	--	Begin bailing.
5/6/2015	1245	--	190	--	--	--	>1000	Continue bailing.
5/6/2015	1256	--	195	--	--	--	>1000	Finish bailing. Set up pump.
5/6/2015	1315	--	195	--	--	--	--	Begin tripping in pipe.

\* Turbidity readings were collected from YSI, not the turbidity meter.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Siemens per Meter

**Where:**

B=3.14

 $\phi_s$  = porosity of the sand pack $r_c$  = radius of the well casing and screen in feet $L_c$  = length of water column inside the casing and screen in feet $r_w$  = radius of the well bore in feet $L_s$  = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFF

Well No: KAFB-106215

Project Number: 140705

Samplers: N/A

Date: 5/6/15 - 5/7/15

Checked By:

Time Start: 1000, 5/6/2015

Time Finish: 1120, 5/7/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/6/2015	1600	--	195	--	--	--	--	Pipe is ready for pumping tomorrow.
5/7/2015	0830	--	195	--	--	--	--	Set up pump at 561 feet bgs.
5/7/2015	0905	460.22	195	--	--	--	--	Start pumping from 561 feet bgs.
5/7/2015	0915	461.24	205	19.10	7.61	0.407	86.9	Pumping at 4.75 GPM.
5/7/2015	0925	461.24	255	19.49	8.04	0.412	20.20	Continue pumping from 561 feet bgs. Bubbles.
5/7/2015	0935	461.24	302	19.60	8.23	0.409	7.94	Continue pumping from 561 feet bgs. Bubbles.
5/7/2015	0945	461.24	349	19.66	8.28	0.406	5.11	Continue pumping from 561 feet bgs. Bubbles.
5/7/2015	0955	461.25	396	19.70	8.27	0.400	3.35	Continue pumping from 561 feet bgs. Bubbles.
5/7/2015	1005	461.30	443	19.72	8.29	0.429	18.7	Move pump up to 548 feet bgs. Bubbles.
5/7/2015	1015	461.32	490	19.79	8.33	0.394	1.9	Continue pumping from 548 feet bgs. Bubbles.
5/7/2015	1025	461.31	515	19.87	8.28	0.393	1.87	Continue pumping from 548 feet bgs. Bubbles.
5/7/2015	1035	461.32	535	19.86	8.24	0.391	2.02	Continue pumping from 548 feet bgs. Move pump down to 554.5 feet bgs.
5/7/2015	1045	461.29	555	19.86	8.19	0.384	1.70	Continue pumping from 554.5 feet bgs. Bubbles.
5/7/2015	1055	461.29	602	19.88	8.21	0.388	0.99	Continue pumping from 554.5 feet bgs. Bubbles.
5/7/2015	1105	461.28	649	19.91	8.22	0.388	0.99	Continue pumping from 554.5 feet bgs. Bubbles.
5/7/2015	1115	461.29	696	19.93	8.24	0.385	1.17	Continue pumping from 554.5 feet bgs. Bubbles.
5/7/2015	1120	--	715	--	--	--	--	Finish pumping. Well development complete.

Was well sampled after development? YES NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106219



# Borehole ID: KAFB-106219

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 2/18/2015  
 Date TD Reached: 2/25/2015  
 Date Completed: 3/20/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 476.75

Drilling Contractor: National Drilling  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: M. Johnson/T. Richards



Page 1 of 18

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 3/27/15 09:31 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No lithology description (0.4 ft - 10 ft).	ASPHALT	- Top of Casing/ Top of Cement	Location was water jetted to 8.8' for utility clearance.
5								
10					Poorly graded GRAVEL with Silt and Sand (GP-GM); strong brown (7.5YR 4/6); 50% fine gravel; subrounded; 40% fine to coarse sand; 10% silt.	GP-GM		Began ARCH drilling @ 8.8' on 2/18/15.
15					Well graded SAND (SW); brown (7.5YR 5/3); 100% fine to coarse sand; trace fine gravel; subangular to subrounded.	SW	- Cement Seal	PID - 0.0 ppm
20					Silty GRAVEL with Sand (GM); brown (7.5YR 4/3); 50% fine to coarse gravel; subrounded; 30% fine to coarse sand; 20% silt.			
25					Same as above (20 ft); trace fine cobbles; subangular.	GM		
30								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/3); 75% fine to coarse sand; 15% fine gravel; subangular to subrounded; 10% silt.			PID - 0.0 ppm
35					Same as above (30 ft).	SW-SM	Top of High Solids Bentonite Grout	Hard drilling.
40					Well graded SAND (SW); brown (7.5YR 5/3); 100% fine to coarse sand; subangular to subrounded.			
45					Same as above (40 ft); 95% fine to coarse sand; 5% fine gravel; angular to subangular.	SW	High Solids Bentonite Grout	
50					Well graded SAND with Gravel (SW); brown (7.5YR 5/3); 80% fine to coarse sand; 20% fine to coarse gravel; subangular to subrounded.			PID - 0.0 ppm
55					Silty SAND (SM); brown (7.5YR 4/4); 60% fine to coarse sand; 40% silt.	SM		
60								





# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60								
65					Silty SAND (SM); brown (7.5YR 4/4); 60% fine to coarse sand; 40% silt.	SM		
70					Silty GRAVEL with Sand (GM); brown (7.5YR 4/3); 60% fine to coarse gravel; subangular to subrounded; 20% sand; 20% silt.	GM		
75					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 5/3); 50% fine gravel; subangular to subrounded; 50% fine to coarse sand.	GP		PID - 0.0 ppm
80					Poorly graded SAND (SP); brown (7.5YR 5/3); 90% coarse sand; trace medium sand; 10% fine gravel; angular.	SP		
85					Well graded SAND (SW); brown (7.5YR 5/3); 100% fine to coarse sand; angular to subrounded.			
					Same as above (80 ft); brown (7.5YR 4/3); subrounded.	SW		PID - 0.0 ppm
90								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well graded SAND (SW); brown (7.5YR 5/3); 100% fine to coarse sand; angular to subrounded.			
95					Same as above (90 ft); 90% fine to coarse sand; 10% fine gravel; subrounded.			PID - 0.0 ppm
100					Same as above (90 ft).			
105					Same as above (90 ft); subangular to subrounded.	SW		
110					Same as above (90 ft); subrounded.		High Solids Bentonite Grout	
115					Poorly graded SAND (SP); 100% medium to coarse sand; subangular to subrounded; trace fine gravel; angular.	SP		PID - 0.0 ppm
120								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Well graded SAND (SW); 100% fine to coarse sand; subangular to subrounded.			Hard drilling. Some of the sand coming out of the cyclone appears to be broken cobbles.
125					Same as above (120 ft).	SW		
130					No recovery (127.5 ft - 142 ft); gravel to boulder sized rocks. Note: rocks are quartz, quartzite, chert, granite, feldspar, plagioclase, and sandstone.			Refusal @ 127.5 ft. Driller starts tripping out drill stem to change drill bit. Drill down approximately 5 ft to 133 ft. End of 2/19/15.
135					No recovery (127.5 ft - 142 ft); gravel to boulder sized rocks. Note: rocks are quartz, quartzite, chert, granite, feldspar, plagioclase, and sandstone.			Drill a 6.5 ft hole to 140 ft to help retrieve Symmetrix system. Resumed drilling with 9 5/8" casing and Symmetrix system @ 1006 on 2/24/15. T. Richards takes over logging for M. Johnson. Drilled out of boulders @ approximately 137 ft. Hammering.
140								
145					Well graded SAND (SW); reddish brown (5YR 5/4); dry; 100% very fine to very coarse sand; trace fine gravel.	SW		PID - 0.0 ppm @ cyclone and breathing zone. Windy.
150					Elastic SILT (MH); strong brown (7.5YR 5/6); moist; 95% silt; 5% sand.	MH		



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Elastic SILT (MH); strong brown (7.5YR 5/6); moist; 95% silt; 5% sand.	MH		PID - 0.0 ppm @ cyclone and breathing zone. Windy.
155					Clayey SAND with Gravel (SC); brown (7.5YR 5/3); 70% fine to coarse sand; 15% fine gravel; 15% clay.	SC		Kelly down @ 1019. New 20' connection @ 1025.
160					Same as above (155 ft).			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
165					Fat CLAY (CH); brown (7.5YR 5/4); 80% clay; 10% very fine sand; 10% fine gravel.	CH		PID - 0.0 ppm @ cyclone and breathing zone. Windy and snow.
170					Same as above (163 ft); moist; 90% clay; 10% sand.			Kelly down @ 1039. New 20' connection @ 1047. Snowing and windy.
175					Same as above (163 ft); moist; 90% clay; 10% sand.			
180								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015




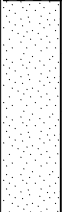














**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram		Remarks
180									
					Fat CLAY (CH); brown (7.5YR 5/4); moist; 90% clay; 10% sand.	CH			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
185					Poorly graded SAND (SP); reddish brown (5YR 5/4); 90% very fine to fine sand; 5% fine gravel; subrounded; 5% silt.	SP			PID - 0.0 ppm @ cyclone and breathing zone. Windy.  Kelly down @ 1107. New 20' connection @ 1202.  Working pipe stuck.
190					Same as above (185 ft).				
195					Same as above (185 ft).				
200					Lean CLAY with Sand (CL); reddish brown (5YR 4/3); moist; low to medium plasticity; 80% clay; 20% fine to medium sand.	CL			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
205					Same as above (197 ft).	SW-SM			
					Well graded SAND with Silt (SW-SM); light reddish brown (5YR 6/4); moist; 90% very fine to coarse sand; 10% silt.				
210									



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well graded SAND with Silt (SW-SM); light reddish brown (5YR 6/4); moist; 90% very fine to coarse sand; 10% silt.			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
215					Same as above (210 ft).			Kelly down @ 1300. New 20' connection. Experienced problems with drive casing and bit. End of 2/24/15. Resumed drilling @ 0848 on 2/25/15.
220					Same as above (210 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
225					Same as above (210 ft).	SW-SM	- High Solids Bentonite Grout	
230					Same as above (210 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
235					Same as above (210 ft).			Kelly down @ 0915. New 20' connection @ 0922.
240								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well graded SAND with Silt (SW-SM); light reddish brown (5YR 6/4); moist; 90% very fine to coarse sand; 10% silt.			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
245					Same as above (240 ft).			No hammering.
250					Same as above (240 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
255					Same as above (240 ft).	SW-SM	High Solids Bentonite Grout	Kelly down @ 0934. New 20' connection @ 0942.
260					Same as above (240 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
265					Same as above (240 ft).			No hammering.
270								





# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well graded SAND with Silt (SW-SM); light reddish brown (5YR 6/4); moist; 90% very fine to coarse sand; 10% silt.			PID - 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone.
275					Same as above (270 ft).			Kelly down @ 0953. new 20' connection @ 1001.
280					Same as above (270 ft).			PID - 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
285					Same as above (270 ft).	SW-SM	High Solids Bentonite Grout	No hammering.
290					Same as above (270 ft).			
295					Same as above (270 ft).			Kelly down @ 1036. New 20' connection @ 1147. Driller tripped out bit.
300								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well graded SAND (SW); light reddish brown (5YR 6/4); moist; 90% fine to very coarse sand; 5% gravel; 5% silt.			PID - 0.0 ppm @ cyclone and breathing zone.
305					Same as above (300 ft).			
310					Same as above (300 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
315					Same as above (300 ft).	SW	- High Solids Bentonite Grout	Kelly down @ 1151. New 20' connection @ 1156.
320					Same as above (300 ft).			PID - 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
325					Same as above (300 ft).			Hammering.
330								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND (SW); light reddish brown (5YR 6/4); moist; 90% fine to very coarse sand; 5% gravel; 5% silt.			PID - 0.0 ppm @ cyclone and breathing zone.
335					Same as above (330 ft).			Kelly down @ 1200. New 20' connection @ 1206.
340					Same as above (330 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
345					Same as above (330 ft).	SW	High Solids Bentonite Grout	Hammering.
350					Same as above (330 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
355					Same as above (330 ft).			Kelly down @ 1210. New 20' connection @ 1219.
360								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND with Gravel (SW); light brown (7.5YR 6/3); moist; 75% fine to very coarse sand; 20% gravel to 1"; subrounded to rounded; 5% silt. Note: gravel is quartz and mafics.			
365					Same as above (360 ft).			
370					Same as above (360 ft).			
375					Same as above (360 ft).	SW	High Solids Bentonite Grout	Kelly down @ 1222. New 20' connection @ 1358. Driller mobs to equipment laydown yard for more pipe.
380					Same as above (360 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
385					Same as above (360 ft).			Hammering. No water added.
390								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND with Gravel (SW); light brown (7.5YR 6/3); moist; 75% fine to very coarse sand; 20% gravel to 1"; subrounded to rounded; 5% silt. Note: gravel is quartz and mafics.			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. Windy.
395					Same as above (390 ft).			Kelly down @ 1404. New 20' connection @ 1409.
400					Same as above (390 ft).			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
405					Same as above (390 ft).	SW	High Solids Bentonite Grout	
410					Same as above (390 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
415					Same as above (390 ft).			Kelly down @ 1415. New 20' connection @ 1422.
420								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND with Gravel (SW); light brown (7.5YR 6/3); moist; 75% fine to very coarse sand; 20% gravel to 1"; subrounded to rounded; 5% silt. Note: gravel is quartz and mafics.			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
425					Same as above (420 ft).			Hammering. No water added.
430					Same as above (420 ft).			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
435					Same as above (420 ft).	SW		Kelly down @ 1429. new 20' connection @ 1434.
440					Same as above (420 ft).			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
445					Same as above (420 ft).			Hammering. No water added.
450					Same as above (420 ft); very moist.			



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well graded SAND with Gravel (SW); light brown (7.5YR 6/3); moist; 75% fine to very coarse sand; 20% gravel to 1"; subrounded to rounded; 5% silt. Note: gravel is quartz and mafics.			PID - 0.0 ppm @ cyclone and breathing zone. Windy.
455					Same as above (450 ft).	SW	- Bentonite Seal	Kelly down @ 1442. New 20' connection @ 1450.
460					Same as above (450 ft).		- Top of 20/40 Sand	
465					Sandy lean CLAY with Gravel (CL); reddish brown (5YR 5/4); moist; 60% clay; 20% very fine to fine sand; 20% gravel; rounded.		- Top of 10/20 Sand	PID - 0.0 ppm @ cyclone and breathing zone. Windy.
470					Same as above (462 ft).	CL	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	Hammering. No water added.
475					Poorly graded SAND (SP); reddish yellow (7.5YR 7/6); moist to wet; 100% fine to medium sand.			PID - 0.0 ppm @ cyclone and breathing zone. Very windy.
480					Same as above (470 ft).	SP		Kelly down @ 1458. New 20' connection @ 1505.





# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); reddish yellow (7.5YR 7/6); moist to wet; 100% fine to medium sand.			
485					Poorly graded SAND with Gravel (SP); reddish yellow (7.5YR 7/6); very moist; 80% very fine to fine; 20% gravel; rounded.	SP		PID - 0.0 ppm @ cyclone and breathing zone. Very windy.
490					Well graded SAND with Gravel (SW); brown (7.5YR 5/4); wet; 80% very fine to very coarse sand; 20% fine gravel; subrounded to rounded. Same as above (488 ft).			PID - 0.0 ppm @ cyclone and breathing zone. Very windy.
495					Same as above (488 ft).	SW	- Bottom of Screen - Sump - Bottom of Sump	Kelly down @ 1515. New 20' connection @ 1525.
500					Same as above (488 ft); grading to Poorly graded SAND.			PID - 0.0 ppm @ cyclone and breathing zone.
505					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); very wet; 80% fine to medium sand; trace coarse sand; 15% gravel; 5% silt.	SP		
510								



# Borehole ID: KAFB-106219

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/18/2015  
**Date TD Reached:** 2/25/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.69  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 476.75

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Johnson/T. Richards

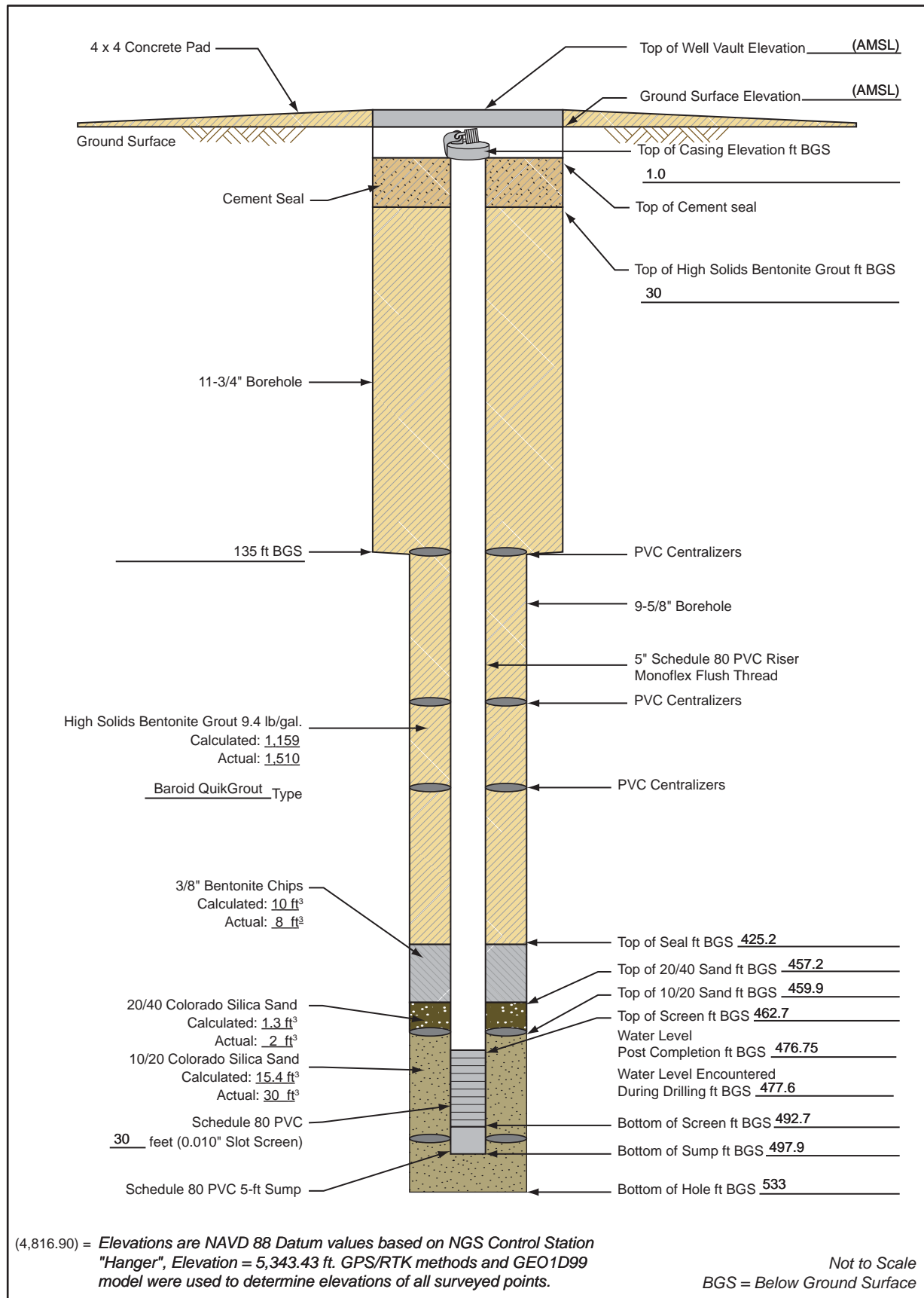
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); very wet; 80% fine to medium sand; trace coarse sand; 15% gravel; 5% silt.			PID - 0.0 ppm @ cyclone and breathing zone.
515					Same as above (510 ft).			Kelly down @ 1535. New 20' connection @ 1545.
520					Same as above (510 ft).	SP		PID - 0.0 ppm @ cyclone and breathing zone.
525					Same as above (510 ft).			
530					Same as above (510 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
535							Bottom of Hole	Total depth = 533 ft. Reached total depth on 2/25/15.
540								

# Monitoring Well Completion Diagram KAFB-106219

Installation Start Date/Time: 2/26/15 12:40

Installation End Date/Time: 3/20/15 14:10





## Well Development Record

**Project Name:** KAFB BFF**Location:** Continental Dr.**Personnel:** T. Richards**Date:** 3/16/15**Samplers:** N/A**Method of Development:**☒ Surging☐ Bailing**Well/Piez. No.:** KAFB-106219**Date Installed:** 3/20/15**Csg. Diameter (I.D.):** 5 "**Total Depth (ft. bgs):** 497.9☒ Original Development☐ Redevelopment☒ Pumping☐ Other**Development Date:** 3/16/15**Depth to Water Before Developing Well (ft. btoc):** 476.28 (476.75 ft. bgs)
$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 265.5 \text{ gallons}$$
**Depth Purging From:** 479 - 491 feet**Time Purging Begins:** 1422, 3/16/15**Weather:** Sunny, Calm, 50s**Screened Interval (ft bgs):** 464.35 - 494.35**Equipment Nos.:** **pH Meter:** YSI 6820 **EC Meter:** YSI 6820 **Turbidity Meter:** HACH 21000Q**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐**Describe:** Steam Cleaned**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐**Describe:** N/A**Comment:** Approximately 200 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
3/16/2015	1000	476.28	0	--	--	--	--	Begin bailing. Water is very cloudy.
3/16/2015	1030	--	20	--	--	--	--	Continue bailing.
3/16/2015	1038	--	20	--	--	--	--	Begin surging.
3/16/2015	1145	--	20	--	--	--	--	Finish surging.
3/16/2015	1148	--	20	--	--	--	--	Begin bailing. Water is very cloudy.
3/16/2015	1220	--	110	--	--	--	--	Continue bailing.
3/16/2015	1422	476.28	110	20.06	8.64	0.476	195	Start pumping at 492 feet.
3/16/2015	1430	477.50	125	19.88	8.09	0.457	38.7	Continue pumping.
3/16/2015	1440	477.51	170	20.37	7.94	0.454	30.4	Continue pumping.
3/16/2015	1450	477.51	212	20.32	7.84	0.450	8.11	Move pump up to 485 feet. Purging at 4.25 GPM

**Notes:**

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Seimens per Meter

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack $r_c$ = radius of the well casing and screen in feet $L_c$ = length of water column inside the casing and screen in feet $r_w$ = radius of the well bore in feet $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106219Project Number: 140705Samplers: N/ADate: 3/16/15

Checked By: \_\_\_\_\_

Time Start: 1000, 3/16/2015Time Finish: 1530, 3/16/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
3/16/2015	1500	477.51	254	20.36	7.73	0.451	4.04	Continue pumping.
3/16/2015	1510	477.50	296	20.26	7.71	0.449	5.20	Continue pumping.
3/16/2015	1515	477.50	317	20.26	7.69	0.449	2.08	Lower pump to 491 feet.
3/16/2015	1520	477.50	338	20.25	7.68	0.447	1.12	Continue pumping.
3/16/2015	1530	477.50	359	20.24	7.68	0.446	0.86	Finish pumping. Well development complete.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106220



# Borehole ID: KAFB-106220

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 3/2/2015  
 Date TD Reached: 3/9/2015  
 Date Completed: 3/20/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

Drilling Contractor: National Drilling  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: T. Richards



Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					Road base (0.25 ft - 2.0 ft).	ASPHALT	- Top of Casing/ Top of Cement	Location was potholed and water jetted to 10'.
5					No lithologic description (2 ft - 10 ft).			
10					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 75% fine to very coarse sand; 25% gravel to 1"; subangular to rounded. Note: gravel is quartz and feldspar.			Kelly down @ 1452. New 20' connection @ 1504.
15					Same as above (10 ft).		- Cement Seal	
20					Same as above (10 ft).	SW		PID - 0.0 ppm @ cyclone and breathing zone. Windy.
25					Same as above (10 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
30								





# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 75% fine to very coarse sand; 25% gravel to 1"; subangular to rounded. Note: gravel is quartz and feldspar.		Top of High Solids Bentonite Grout	Kelly down @ 1512. New 20' connection @ 1529.
35					Same as above (30 ft).			Hammering. No water added.
40					Same as above (30 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
45					Same as above (30 ft).	SW	High Solids Bentonite Grout	PID - 0.0 ppm @ cyclone and breathing zone.
50					Same as above (30 ft).			Kelly down @ 1528. New 20' connection @ 1541.
55					Same as above (30 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
60								



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 3 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 75% fine to very coarse sand; 25% gravel to 1"; subangular to rounded. Note: gravel is quartz and feldspar.			PID - 0.0 ppm @ cyclone and breathing zone.
65					Same as above (60 ft).	SW		
70					Same as above (60 ft).			Kelly down @ 1549. New 20' connection @ 1555.
75					Poorly graded SAND with Gravel (SP); yellowish red (5YR 4/6); moist; 80% very fine to fine sand; 20% fine gravel; rounded.	SP	High Solids Bentonite Grout	PID - 0.0 ppm @ cyclone and breathing zone.
80					Same as above (72 ft).			Downhole hammering. No water added.
85					Well graded SAND (SW); reddish brown (5YR 4/4); moist; 90% fine to very coarse sand; 10% fine gravel.	SW		PID - 0.0 ppm @ cyclone and breathing zone.
90					Same as above (80 ft).			



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 477.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well graded SAND (SW); reddish brown (5YR 4/4); moist; 90% fine to very coarse sand; 10% fine gravel.			Kelly down @ 1604. New 20' connection @ 1609.
95					Same as above (90 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
100					Same as above (90 ft).			No water added.
105					Same as above (90 ft).	SW	High Solids Bentonite Grout	PID - 0.0 ppm @ cyclone and breathing zone.
110					Same as above (90 ft).			Kelly down @ 1619. New 20' connection @ 1625.
115					Same as above (90 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
120								



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 477.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Well graded SAND with Gravel (SW); reddish brown (5YR 4/3); moist; 70% fine to very coarse sand; 30% fine to coarse gravel; angular to rounded. Note: gravel is quartz and feldspar.			
125					Same as above (120 ft).	SW		PID - 0.0 ppm @ cyclone and breathing zone.
130					Same as above (120 ft).			Kelly down @ 1635. new 20' conneciton @ 1646.
135					Well graded SAND (SW); reddish brown (5YR 5/4); moist; 95% very fine to coarse sand; 5% silt.			
					No recovery (135 ft - 139 ft); large boulder obstructing drive casing.		High Solids Bentonite Grout	PID - 0.0 ppm @ cyclone and breathing zone.
140					Well graded GRAVEL (GW); 90% fine to coarse gravel; angular to rounded; 10% medium to coarse sand.	GW		
145					Fat CLAY with Gravel (CH); brown (7.5YR 5/4); moist; 80% clay; 20% fine gravel.	CH		PID - 0.0 ppm @ cyclone and breathing zone.
150								



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
					Fat CLAY with Gravel (CH); brown (7.5YR 5/4); moist; 80% clay; 20% fine gravel.	CH		Kelly down @ 1720. End of 3/2/15. Resumed drilling @ 0800 on 3/3/15. New 20' connection.
155					Well graded SAND (SW); brown (7.5YR 5/4); moist; 100% fine to coarse sand.	SW		
					Fat CLAY (CH); reddish brown (5YR 5/4); moist; medium plasticity; 100% clay.	CH		PID - 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
160								
					Well graded SAND (SW); brown (7.5YR 4/3); moist; 90% fine to very coarse sand; 5% fine gravel; 5% silt.			No water added.
165					Same as above (160 ft).	SW		PID - 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone.
170					Same as above (160 ft).			Kelly down @ 0824. New 20' connection @ 0834.
					Fat CLAY (CH); reddish brown (5YR 4/3); moist; medium plasticity.			
175					Fat CLAY with Gravel (CH); reddish brown (5YR 4/4); medium plasticity; 80% clay; 20% fine gravel; angular to rounded. Note: gravel appears broken.	CH		Lost circulation due to clay plug in drive casing. Will change to 9-5/8" casing. Pull 9-5/8" casing as it won't drop through the bottom of the 11-3/4" casing. Resume drilling
180					Same as above (174 ft).			



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 477.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); strong brown (7.5YR 5/6); moist; 95% fine to medium sand; 5% fine gravel; rounded. Note: approximately 75% of the sand is fine grained.			@ 0808 on 3/5/15 @ 175 ft. No water added.
185					Same as above (180 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
190					Same as above (180 ft).			
195					Same as above (180 ft).	SP	High Solids Bentonite Grout	Kelly down @ 0812. New 20' connection @ 1403.
200					Same as above (180 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
205					Same as above (180 ft).			
210								





# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 477.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 8 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND (SP); strong brown (7.5YR 5/6); moist; 90% fine to medium sand; 10% fine gravel; rounded. Note: approximately 75% of the sand is fine grained.			PID - 0.0 ppm @ cyclone and breathing zone.
215					Same as above (210 ft).	SP		Kelly down @ 1408. New 20' connection @ 1413.
220					Clayey SAND (SC); reddish brown (5YR 4/4); moist; 70% very fine sand; 30% clay.	SC		PID - 0.0 ppm @ cyclone and breathing zone.
225					Same as above (220 ft).		High Solids Bentonite Grout	Hammering. No water added.
230					Well graded SAND (SW); brown (7.5YR 5/4); moist; 95% very fine to coarse sand; 5% fine gravel.			PID - 0.0 ppm @ cyclone and breathing zone.
235					Same as above (227 ft).	SW		Kelly down @ 1435. New 20' connection @ 1441.
240					Same as above (227 ft).			





# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well graded SAND (SW); brown (7.5YR 5/4); moist; 95% very fine to coarse sand; 5% fine gravel.	SW		PID - 0.0 ppm @ cyclone and breathing zone.
245					Poorly graded SAND (SP); light brown (7.5YR 6/4); moist; 95% fine to medium sand; 5% fine gravel.	SP		Hammering.
250					Same as above (242 ft).	SP		PID - 0.0 ppm @ cyclone and breathing zone.
255					Poorly graded GRAVEL (GP); brown (7.5YR 5/4); moist; 95% fine gravel; rounded; 5% sand. Note: gravel is mafics and quartz.	GP	High Solids Bentonite Grout	Kelly down @ 1449. New 20' connection @ 1455.
260					Same as above (253 ft).	GP		PID - 0.0 ppm @ cyclone and breathing zone.
265					Same as above (253 ft).	GP		
270					Same as above (253 ft).	GP		



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded GRAVEL (GP); brown (7.5YR 5/4); moist; 95% fine gravel; rounded; 5% sand. Note: gravel is mafics and quartz.	GP		PID - 0.0 ppm @ cyclone and breathing zone.
275					Poorly graded SAND (SP); light brown (7.5YR 6/3); moist; 95% fine to medium sand; 5% fine gravel; rounded.			
280					Same as above (273 ft).	SP		Kelly down @ 1503. New 20' Connection @ 1601. Driller fixed plugged discharge.
285					Same as above (273 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
290					Well graded SAND with Gravel (SW); brown (7.5YR 4/3); moist; 80% fine to coarse sand; 20% fine to coarse gravel to 1". Note: gravel is mafics and quartz.			
295					Same as above (285 ft).	SW		PID - 0.0 ppm @ cyclone and breathing zone.
300					Same as above (285 ft).			Kelly down @ 1615. New 20' connection @ 1626.



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 477.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well graded SAND with Gravel (SW); brown (7.5YR 4/3); moist; 80% fine to coarse sand; 20% fine to coarse gravel to 1". Note: gravel is mafics and quartz.	SW		PID - 0.0 ppm @ cyclone and breathing zone.
305					Clayey SAND (SC); light reddish brown (5YR 6/4); medium plasticity; 70% fine sand; 30% clay.	SC		Hammering.
310					Same as above (302 ft).			
315					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 80% very fine to coarse sand; 20% fine gravel; rounded.			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
320					Same as above (310 ft).			Kelly down @ 1637. New 20' connection @ 1641.
325					Same as above (310 ft).	SW		PID - 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone.
330					Same as above (310 ft).			



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 477.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 80% very fine to coarse sand; 20% fine gravel; rounded.			End of 3/5/15 @ 1649. Resumed drilling @ 0748 on 3/6/15. PID - 0.0 ppm @ cyclone and breathing zone.
335					Same as above (330 ft).			Kelly down @ 0752. New 20' connection @ 0758.
340					Same as above (330 ft).			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
345					Same as above (330 ft).	SW	High Solids Bentonite Grout	
350					Same as above (330 ft).			PID - 0.4 ppm @ cyclone and 0.0 ppm @ breathing zone.
355					Same as above (330 ft).			Kelly down @ 0828. New 20' connection @ 0834.
360								Driller added 25 gallons of water.



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 80% very fine to coarse sand; 20% fine gravel; rounded.			Hammering. PID - 0.0 ppm @ cyclone and breathing zone.
365					Same as above (360 ft).			Driller added 25 gallons of water.
370					Same as above (360 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
375					Same as above (360 ft).	SW	High Solids Bentonite Grout	Kelly down @ 0904. New 20' connection @ 1341. Casing is tight. Driller pulled up 80' of casing and redrove pipe to free it up.
380					Same as above (360 ft).			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
385					Same as above (360 ft).			
390								



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 477.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 80% very fine to coarse sand; 20% fine gravel; rounded.			PID - 0.0 ppm @ cyclone and breathing zone. Hammering. No water added.
395					Same as above (390 ft).			Kelly down @ 1357. New 20' connection @ 1403.
400					Same as above (390 ft).			PID - 0.4 ppm @ cyclone and 0.0 ppm @ breathing zone.
405					Same as above (390 ft).	SW	High Solids Bentonite Grout	Hammering at approximately 60 times per hour. No water added.
410					Same as above (390 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
415					Same as above (390 ft).			Kelly down @ 1423. New 20' connection @ 1428.
420								



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 80% very fine to coarse sand; 20% fine gravel; rounded.			PID - 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone.
425					Same as above (420 ft).			
430					Same as above (420 ft).			PID - 0.0 ppm @ cyclone and breathing zone.  Driller added 25 gallons of water.
435					Same as above (420 ft).	SW	- High Solids Bentonite Grout	Kelly down @ 1448. New 20' connection @ 1453.
440					Same as above (420 ft).			PID - 0.6 ppm @ cyclone and 0.0 ppm @ breathing zone.  Driller added 25 gallons of water.
445					Same as above (420 ft).		- Top of Bentonite Seal	
450								





# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015


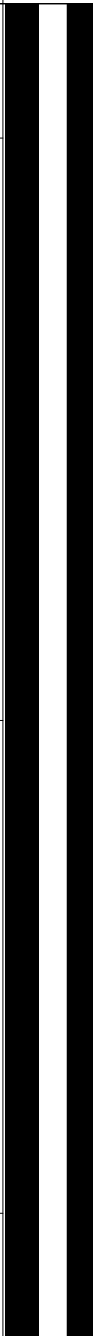




**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
					Well graded SAND with Gravel (SW); brown (7.5YR 4/4); moist; 80% very fine to coarse sand; 20% fine gravel; rounded.	SW		PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
455					Sandy lean CLAY with Gravel (CL); reddish brown (5YR 5/4); moist; 60% clay; 20% very fine sand; 20% gravel; subangular to rounded.	CL		Kelly down @ 1516. New 20' connection @ 1521.
			Same as above (453 ft).					PID - 0.4 ppm @ cyclone and 0.0 ppm @ breathing zone.
460			Same as above (453 ft).					
465					Poorly graded SAND (SP); brown (7.5YR 5/3); moist; 100% fine to medium sand. Note: majority of sand is fine grained.	SP		PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
			Same as above (466 ft).					
470			Same as above (466 ft).					
475					Well graded SAND with Gravel (SW); brown (7.5YR 5/4); moist; 80% very fine to coarse sand; 20% fine gravel; subangular to rounded. Note: gravel is	SW		Kelly down @ 1546. New 20' connection @ 1551.
480								



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					quartz and mafics. Well graded SAND with Gravel (SW); brown (7.5YR 5/4); wet; 80% very fine to coarse sand; 20% fine gravel; subangular to rounded. Note: gravel is quartz and mafics.			PID - 0.4 ppm @ cyclone and 0.0 ppm @ breathing zone.
485					Same as above (480 ft).	SW	- Bentonite Seal - Top of 20/40 Sand - Top of 10/20 Sand	
490					Same as above (480 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
495					Well graded GRAVEL with Silt and Sand (GW-GM); pinkish gray (7.5YR 6/2); 60% gravel; subangular to subrounded; 30% fine to coarse sand; 10% silt. Note: gravel is mafics and quartz. Caliche layer from 494.8 ft - 495.2 ft.	GW-GM	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	Stop drilling @ 1615 on 3/6/15 @ 493'. Run BLN sampler on 3/9/15 from 493 ft - 502.5 ft. End with BLN sampler @ 1042 on 3/9/15.
500					Poorly graded SAND (SP); reddish yellow (7.5YR 6/6); wet; 95% fine sand; 5% silt. Note: mica observed in sand.	SP		
505					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); wet; 70% very fine to coarse sand; 30% gravel to 1.5"; subrounded to rounded. Note: gravel is mafics and quartz. @ 501.2 ft: Well graded SAND (SW); 90% fine to coarse sand; 10% fine gravel; rounded.	SW		Began reaming and drill out borehole to 520' @ 1155.
510					Same as above (501.2 ft).		- Bottom of Screen	



# Borehole ID: KAFB-106220

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 3/2/2015  
**Date TD Reached:** 3/9/2015  
**Date Completed:** 3/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 477.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 477.45

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

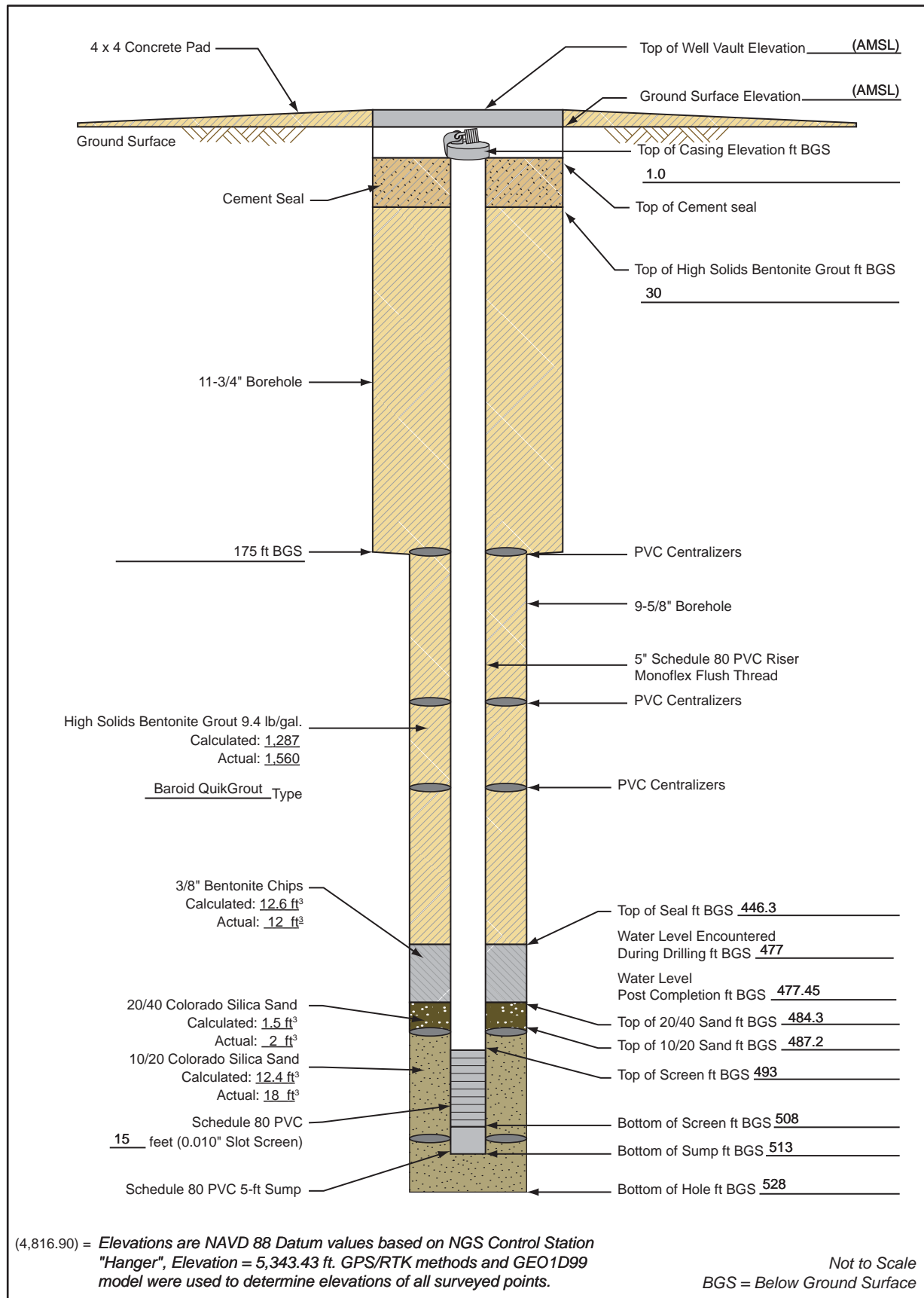
Page 18 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Well graded SAND (SW); 90% fine to coarse sand; 10% fine gravel; rounded.	SW	- Sump	PID - 0.0 ppm @ cyclone and breathing zone.
515					Poorly graded SAND (SP); brown (7.5YR 5/3); wet; 100% fine to medium sand; trace silt. Note: mica observed in sand.		- Bottom of Sump	Kelly down @ 1303. New 10' connection @ 1402. Having issues with drive casing.
520					Same as above (512 ft).	SP		PID - 0.0 ppm @ cyclone and breathing zone.
525					Same as above (512 ft).			Kelly down @ 1418. New 5' connection @ 1428.
530					Same as above (512 ft).		- Bottom of Hole	Total depth = 528 ft. Reached total depth on 3/9/15.
535								
540								

# Monitoring Well Completion Diagram KAFB-106220

Installation Start Date/Time: 3/10/15 09:05

Installation End Date/Time: 3/20/15 14:05





## Well Development Record

Project Name: KAFB BFFLocation: Continental Dr.Personnel: T. RichardsDate: 3/17/15Samplers: N/A

Method of Development:

☒ Surging☐ BailingWell/Piez. No.: KAFB-106220Date Installed: 3/20/15Csg. Diameter (I.D.): 5 "Total Depth (ft. bgs): 513☒ Original Development☐ Redevelopment☐ Pumping☐ OtherDevelopment Date: 3/17/15Depth to Water Before Developing Well (ft. btoc): 476.91 (477.45 ft. bgs) $V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) =$  911 gallonsDepth Purging From: 493 - 510 feetTime Purging Begins: 1208, 3/17/15Weather: Cloudy, Windy, 40sScreened Interval (ft bgs): 493 - 508Equipment Nos.: pH Meter: YSI 6820 EC Meter: YSI 6820 Turbidity Meter: HACH 21000QEquipment Decontaminated Prior to Development: Y X N Describe: Steam CleanedCollected Sample of Water Added to Well: Y  N XDescribe: N/AComment: Approximately 840 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
3/17/2015	0847	476.91	0	--	--	--	--	Begin bailing. Water is very cloudy.
3/17/2015	0917	--	55	--	--	--	--	Finish bailing.
3/17/2015	0920	--	55	--	--	--	--	Begin surging.
3/17/2015	1020	--	55	--	--	--	--	Finish surging.
3/17/2015	1024	--	55	--	--	--	--	Begin bailing. Water is very cloudy; trace of fine sand.
3/17/2015	1054	--	165	--	--	--	--	Finish bailing. Water is slightly cloudy.
3/17/2015	1208	476.91	165	--	--	--	--	Begin pumping at 510 feet (2.6 feet above bottom of well).
3/17/2015	1210	478.35	173	18.92	7.81	0.428	>1000	Continue pumping. Water is very cloudy.
3/17/2015	1220	478.21	215	19.42	7.83	0.420	320	Continue pumping. Water is slightly cloudy.
3/17/2015	1230	478.26	257	19.42	7.92	0.420	127	Continue pumping.

## Notes:

\* Water Levels - Reported to the nearest 0.01 foot

\* pH - Reading rounded to 0.1 pH units

\* Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Siemens per Meter

## Where:

B=3.14

 $\phi_s$ = porosity of the sand pack $r_c$ = radius of the well casing and screen in feet $L_c$ = length of water column inside the casing and screen in feet $r_w$ = radius of the well bore in feet $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106220Project Number: 140705Samplers: N/ADate: 3/17/15

Checked By: \_\_\_\_\_

Time Start: 0847, 3/17/2015Time Finish: 1506, 3/17/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
3/17/2015	1240	478.31	299	19.08	7.95	0.419	91.6	Continue pumping.
3/17/2015	1250	478.29	341	19.05	7.95	0.414	76.1	Continue pumping.
3/17/2015	1300	478.29	383	18.84	7.95	0.413	60.4	Continue pumping.
3/17/2015	1310	478.28	425	18.55	7.95	0.412	57.3	Continue pumping.
3/17/2015	1320	478.28	467	18.83	7.94	0.411	50.2	Continue pumping.
3/17/2015	1340	478.28	551	18.38	7.95	0.410	32.6	Change readings frequency to every 20 minutes.
3/17/2015	1400	478.28	635	18.40	7.96	0.409	7.55	Raise pump to top of screen.
3/17/2015	1420	478.27	719	18.41	7.99	0.410	1.73	Change readings frequency to every 10 minutes.
3/17/2015	1430	478.27	761	18.40	7.99	0.410	1.79	Lower pump to mid-screen.
3/17/2015	1440	478.28	803	18.39	8.00	0.409	1.07	Continue pumping.
3/17/2015	1450	478.29	845	18.38	8.00	0.408	1.14	Continue pumping.
3/17/2015	1500	478.29	887	18.39	8.01	0.408	1.17	Continue pumping.
3/17/2015	1506	478.29	913	18.38	8.01	0.407	1.13	Finish pumping. Well development complete.

Was well sampled after development? YES ☒ NO ☐Sample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106221





Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 5/8/2015  
 Date TD Reached: 5/11/2015  
 Date Completed: 6/18/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

## Borehole ID: KAFB-106221

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

Drilling Contractor: National Drilling  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: M. Giles/K. O'Leary/T. Richards



Page 1 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No lithologic description.			
5								
10					Poorly graded SAND (SP); yellowish brown (10YR 5/6); 95% fine sand; subangular; sand is quartz; 5% silt.			
15					Same as above (10 ft).	SP		
20					Poorly graded GRAVEL with Silt and Sand (GP-GM); reddish yellow (5YR 7/6); 50% fine gravel to 1/2"; subangular; gravel is mafics; 40% fine to medium sand; trace coarse sand; sand is quartz; 10% silt.	GP-GM		
25					Poorly graded SAND (SP); yellowish brown (10YR 5/6); 95% fine sand; subangular; sand is quartz, mafics, and quartzite; 5% silt.	SP		
30								

Top of  
Casing/Top of  
Cement Seal

-Cement Seal

Borehole cleared with water jet to 9 ft. Began drilling @ 0814 on 5/8/15 with 11-3/4" casing.

Kelly down @ 0824, new 20' connection. Resume drilling @ 0827.



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 2 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Silty SAND (SM); reddish brown (5YR 5/4); 90% coarse sand; trace fine and medium sand; subangular; sand is quartz and mafics; 5% fine gravel to 3/8"; subangular to subrounded; gravel is quartzite; 15% silt.	SM	Top of High Solids Bentonite Grout	Kelly down @ 0843, new 20' connection. Resume drilling @ 0850.
40					Poorly graded GRAVEL with Silt and Sand (GP-GM); reddish yellow (7.5YR 6/6); 60% fine gravel to 1/2"; subangular to subrounded; gravel is quartzite and mafics; 30% fine to coarse sand; sand is quartz; 15% silt.	GP-GM		
45					Poorly graded SAND with Silt (SP-SM); reddish yellow (7.5YR 6/6); 90% fine sand; trace medium and coarse sand; subangular; sand is quartz and mafics; 10% silt.	SP-SM		
50					Poorly graded GRAVEL with Silt and Sand (GP-GM); brown (7.5YR 5/4); 50% fine gravel to 3/8"; subangular to subrounded; 40% fine sand; trace medium and coarse sand; subangular; 10% silt; sand and gravel are quartz and quartzite.	GP-GM	High Solids Bentonite Grout	
55					Silty SAND with Gravel (SM); strong brown (7.5YR 5/6); 60% fine to coarse sand; subangular; sand is quartz, quartzite, and mafics; 25% fine gravel; trace coarse gravel; angular to subangular; gravel is mafics; 15% silt.	SM		Kelly down @ 0903, new 20' connection. Resume drilling @ 0908.
60					Same as above (50 ft).			



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 3 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60								
65					Silty SAND with Gravel (SM); strong brown (7.5YR 5/6); 60% fine to coarse sand; subangular; sand is quartz, quartzite, and mafics; 25% fine gravel; trace coarse gravel; angular to subangular; gravel is mafics; 15% silt.	SM		
70					Well-graded SAND with Silt and Gravel (SW-SM); strong brown (7.5YR 5/6); 75% fine to coarse sand; subangular; sand is quartz, quartzite, and mafics; 15% fine gravel to 3/4"; angular to subrounded; gravel is mafics and quartzite; 10% silt.	SW-SM		
75					Same as above (65 ft).			
80					Poorly graded SAND (SP); reddish yellow (7.5YR 6/6); 95% fine sand; subangular; sand is quartz; 5% silt.	SP		
85					Same as above (75 ft).			
90					Poorly graded SAND with Silt (SP-SM); reddish yellow (7.5YR 7/6); 85% fine sand; trace medium and coarse sand; subangular to subrounded; sand is quartz; 5% fine gravel to 3/8"; subangular to subrounded; gravel is quartzite and mafics; 10% silt.	SP-SM		

High Solids  
Bentonite  
Grout

Kelly down @ 0926, new 20' connection. Resume drilling.



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 4 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Poorly graded SAND with Silt (SP-SM); reddish yellow (7.5YR 7/6); 85% fine sand; trace medium and coarse sand; subangular to subrounded; sand is quartz; 5% fine gravel to 3/8"; subangular to subrounded; gravel is quartzite and mafics; 10% silt.	SP-SM		
100					Poorly graded GRAVEL (GP); reddish yellow (7.5YR 7/6); 85% fine gravel to 1/2"; subangular; gravel is black mafics, granite, and quartzite; 10% medium sand; subangular; sand is quartz; 5% silt.	GP		
105					Poorly graded SAND (SP); strong brown (7.5YR 5/8); 90% fine sand; trace medium and coarse sand; subangular; sand is quartz; 5% fine gravel to 3/8"; subangular; gravel is quartz; 5% silt.	SP		
110								
115								
120					Well-graded GRAVEL with Silt and Sand (GW-GM); light brown (7.5YR 6/4); 70% fine to coarse gravel to 1 1/2"; subangular; gravel is mafics; 20% fine sand; trace medium and coarse sand; sand is quartz; 10% silt.	GW-GM		

Kelly down @ 1003, new 20' connection. Resume drilling @ 1007.

High Solids  
Bentonite  
Grout

Kelly down @ 1031, new 20' connection. Resume drilling @ 1036.





# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 5 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120								
125					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); 70% fine to coarse sand; subangular; sand is quartz; 25% fine gravel to 3/8"; subangular to subrounded; gravel is mafics; 5% silt.	SW		
130					Poorly graded SAND (SP); strong brown (7.5 YR 5/6); 95% fine sand; trace medium and coarse sand; subangular; sand is quartz; 5% silt.	SP		
135					Well-graded GRAVEL with Silt and Sand (GW-GM); strong brown (7.5YR 5/6); 50% fine to coarse gravel to 1 1/2"; subangular; gravel is mafics; 40% fine to coarse sand; subangular; sand is quartz; 10% silt.	GW-GM		
140					Same as above (130 ft).	GW-GM		
145					Clayey GRAVEL (GC); dark yellowish brown (10YR 4/4); 75% fine to coarse gravel to 1 1/2"; subangular to subrounded; gravel is mafics; 25% clay; medium plasticity.	GC		
150					Plastic CLAY (CH); yellowish red (5YR 5/6); slightly firm; high plasticity; 100% clay.	CH		

High Solids  
Bentonite  
Grout

Kelly down @ 1057, new 20' connection. Resume drilling @ 1103.

Poor return.



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 6 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Plastic CLAY (CH); yellowish red (5YR 5/6); slightly firm; high plasticity; 100% clay.			Poor return.
155					Same as above (150 ft).	CH		Kelly down @ 1142, new 20' connection. Resume drilling @ 1158.
160					Poorly graded SAND with Silt (SP-SM); strong brown (7.5YR 4/6); 90% fine sand; trace medium and coarse sand; subangular; sand is quartz; 10% silt.	SP-SM		Poor return.
165					Poorly graded GRAVEL with Clay and Sand (GP-GC); strong brown (7.5YR 4/6); 75% fine gravel to 1/2"; subangular; gravel is mafics; 15% fine sand; sand is quartz; 10% clay; low plasticity.			
170					Same as above (165 ft).	GP-GC		
175					Sandy lean CLAY (CL); strong brown (7.5YR 5/6); 60% clay; 40% fine sand.	CL		Kelly down @ 1244, new 20' connection. Resume drilling @ 1249.
180								



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 7 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180								
185					Sandy lean CLAY (CL); strong brown (7.5YR 5/6); 60% clay; 40% fine sand.	CL		
190					Silty SAND (SM); brown (7.5YR 5/4); 80% fine sand; subangular; sand is quartz; 5% fine gravel to 3/8"; gravel is mafics and quartzite; 15% silt.	SM		
195					Well-graded SAND (SW); brown (7.5YR 5/4); 95% fine to coarse sand; subangular; sand is quartz and mafics; 5% silt.	SW		
200					Lean CLAY with Sand (CL); strong brown (7.5YR 4/6); slightly firm; medium plasticity; 75% clay; 20% fine sand; subangular; 5% fine gravel to 1/2"; gravel is quartzite and mafics.	CL	High Solids Bentonite Grout	Kelly down @ 1331.
205					Poorly graded SAND (SP); brown (7.5YR 5/4); slightly moist; 95% fine to medium sand; subangular; 5% clay.	SP		Stop drilling with 11-3/4" casing @ 1530 on 5/8/15. Resume drilling with 9-5/8" casing @ 0930 on 5/9/15.
210					Well-graded SAND (SW); brown (7.5YR 5/3); slightly moist; 95% fine to coarse sand; subangular; 5% fine gravel to 1/2"; trace silt.	SW		





# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 8 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND (SP); light brown (7.5YR 6/3); dry; 100% fine sand; subangular.	SP		Very easy drilling.
215					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); slightly moist; 90% fine to medium sand; subangular; 10% silt.	SP-SM		
220					Well-graded SAND (SW); brown (7.5YR 5/3); slightly moist; 95% fine to coarse sand; subangular; 5% silt.	SW		
225					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); slightly moist; 80% fine to coarse sand; subangular; 20% gravel to 1"; subangular.	SW	High Solids Bentonite Grout	Large cobble retrieved, approximately 2.5".
230					Lean CLAY (CL); brown (7.5YR 5/3); slightly moist; soft; low plasticity; 100% clay; trace fine sand.	CL		
235					Poorly graded SAND (SP); brown (7.5YR 5/4); slightly moist; 95% fine to medium sand; subangular; 5% silt.	SP		Casing hammer repair @ 0955. Resume drilling @ 1100.
240								



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 9 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); slightly moist; 80% sand; subangular; 15% gravel to 2"; subrounded.			PID = 0.0 ppm from hopper.
245					Well-graded SAND (SW); brown (7.5YR 5/4); slightly moist; 95% sand; subangular; 5% gravel to 1"; subrounded.	SW		
250					Same as above (245 ft); 100% sand; trace fine gravel.			
255					Lean CLAY with Sand (CL); brown (7.5YR 5/4); moist; very firm; low plasticity; 75% clay; 20% fine to medium sand; subangular; 5% fine gravel to 1".	CL		
260					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; 100% fine to medium sand; subangular.			
265					Same as above (260 ft).	SP		
270								



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 10 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP); brown (7.5YR 5/4); moist; 100% fine to medium sand; subangular.	SP		PID = 0.0 ppm from hopper.
275					Well-graded SAND (SW); brown (7.5YR 5/4); slightly moist; 90% fine to coarse sand; 10% gravel to 3/4"; subangular to subrounded.			
280					Same as above (275 ft); 100% fine to coarse sand.			
285					Same as above (275 ft); 100% fine to coarse sand.			
290					Same as above (275 ft); 100% fine to coarse sand.	SW		
295					Same as above (275 ft); 100% fine to coarse sand.			
300					Same as above (275 ft); 100% fine to coarse sand.			

- High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 11 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Lean CLAY (CL); brown (7.5YR 5/3); moist; soft; medium plasticity; 95% clay; 5% fine sand.			PID = 0.0 ppm from hopper.
305					Same as above (300 ft).	CL		
310					Well-graded SAND (SW); brown (7.5YR 5/4); moist; 90% fine to coarse sand; subangular; 10% gravel to 1/2"; subangular.	SW		
315					Poorly graded SAND (SP); light brown (7.5YR 6/3); slightly moist; 100% fine sand; subangular.	SP		
320					Well-graded SAND (SW); brown (7.5YR 5/3); slightly moist; 95% fine to coarse sand; subangular; 5% silt.	SW		
325					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/3); slightly moist; 90% fine to coarse sand; subangular; 10% silt.	SW-SM		
330								



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 12 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/3); slightly moist; 90% fine to coarse sand; subangular; 10% silt.			PID = 0.0 ppm from hopper.
335					Same as above (330 ft).	SW-SM		
340					Same as above (330 ft).			
345					Well-graded SAND (SW); brown (7.5YR 5/3); slightly moist; 95% fine to coarse sand; subangular; 5% silt.			
350					Same as above (345 ft); 95% fine to coarse sand; subangular; 5% gravel to 1/2".	SW		High Solids Bentonite Grout
355					Same as above (345 ft); 90% fine to coarse sand; 10% gravel to 1/2"; subangular to subrounded.			
360								



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 13 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/3); slightly moist; 70% fine to coarse sand; 30% gravel to 1"; subrounded.			PID = 0.0 ppm from hopper.
365					Same as above (360 ft).			
370					Same as above (360 ft); 80% fine to coarse sand; 20% gravel.	SW		
375					Same as above (360 ft); 80% fine to coarse sand; 20% gravel.		High Solids Bentonite Grout	
380					Poorly graded SAND (SP); brown (7.5YR 5/3); slightly moist; 100% fine to medium sand; trace silt.	SP		
385					Well-graded SAND (SW); brown (7.5YR 5/3); slightly moist; 100% fine to coarse sand.	SW		
390								



# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 14 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND (SW); brown (7.5YR 5/3); slightly moist; 100% fine to coarse sand; subangular.			PID = 0.0 ppm from hopper.
395					Same as above (390 ft).			
400					Same as above (390 ft).			
405					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/3); slightly moist; 70% fine to coarse sand; subangular; 30% gravel to 3/4"; subrounded.	SW	High Solids Bentonite Grout	
410					Same as above (405 ft); gravel to 1/2".			
415					Same as above (405 ft); 60% fine to coarse sand; 40% gravel to 1 1/2".			
420								





# Borehole ID: KAFB-106221

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/8/2015  
**Date TD Reached:** 5/11/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 15 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/3); 85% fine to coarse sand; 15% gravel to 1"; subrounded.			PID = 0.0 ppm from hopper.
425					Same as above (420 ft); gravel to 1/2".			
430					Same as above (420 ft); gray (7.5YR 6/1); 70% fine to coarse sand; 30% gravel to 1".			
435					Same as above (420 ft); gray (7.5YR 6/1); 80% fine to coarse sand; 20% gravel to 1/2".	SW	High Solids Bentonite Grout	
440					Same as above (420 ft); gravel to 1/2".			
445					Same as above (420 ft); gravel to 3/4".			
450								End of ARCH drilling @ 450 ft.



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 16 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Lean CLAY (CL); reddish brown (5YR 4/3); moist; nonplastic to low plasticity; 90% clay; 10% sand.	CL		Begin Sonic coring @ 450 ft on 5/12/15. 25 gallons of water added at the start.
455					@ 453.4 ft: Same as above (450 ft); reddish brown (5YR 5/4); trace gravel to 0.12'; subangular. @ 454.0 ft: Sandy lean CLAY with Gravel (CL); reddish brown (5YR 4/4); moist; low plasticity; 65% clay; 20% fine sand; 15% fine gravel; subrounded to rounded. SILT (ML); strong brown (7.5YR 4/6); moist; 95% silt; 5% fine sand; trace fine gravel.	ML	High Solids Bentonite Grout	@ 454.0 ft. gravel is mafics, quartz, and feldspar.
460					Lean CLAY (CL); reddish brown (5YR 4/3); slightly moist; 90% clay; 10% fine sand.	CL		@ 460.5 ft. clay is blocky and crumbles. Trace calcareous inclusions.
465					Poorly graded SAND with Silt (SP-SM); pinkish gray (7.5YR 7/2); dry; 90% very	SP-SM		@ 464.3 ft. core is blocky and crumbles.



Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush

Groundwater Levels BGS (ft):

▽	At Time of Drilling:	476.00
▼	At End of Drilling:	Not Recorded
▼	After Drilling:	474.00

Drilling Contractor: National Drilling  
Drilling Method: Sonic Coring  
Logged By: M. Giles/K. O'Leary/T. Richards

Page 17 of 27

KAFB BOREHOLE LOG - SHAW DRILLING.GDT - 7/22/15 07:46 - Z:\KAFB BFF\GINT\KAFB PROJECT\KAFB BFF.GPJ



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 18 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well-graded SAND (SW); brown (7.5YR 5/4); wet; loose; 90% very fine to very coarse sand; 10% fine to coarse gravel; subangular to subrounded; trace clay.	SW		@ 480 ft. gravel is mafics, quartz, and feldspar.
					Well-graded SAND with Clay and Gravel (SW-SC); brown (7.5YR 4/4); wet; loose; 70% very fine to very coarse sand; 20% fine to coarse gravel; subangular to rounded; 10% clay.	SW-SC		@ 482.3 ft. gravel is mafics and quartz. Core has blocky structure.
485					Poorly graded SAND (SP); brown (7.5YR 4/4); wet; loose; 100% medium sand; trace fine and coarse sand.	SP		
					Well-graded SAND (SW); brown (7.5YR 4/3); wet; loose; 100% very fine to very coarse sand.	SW		
					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/4); wet; loose; 65% very fine to very coarse sand; 25% fine to coarse gravel to 1 1/2"; subangular to rounded; 10% silt.	SW-SM	High Solids Bentonite Grout	@ 487.1 ft. gravel is mafics, quartz, and feldspar.
490					Lean CLAY (CL); yellowish red (5YR 4/6); dry; loose; 100% clay.	CL		@ 489.8 ft. clay is in nodules to 0.35' and are coated with powdery layer that is pinkish white (5YR 8/2).
					Poorly graded SAND (SP); brown (7.5YR 4/4); wet; loose; 95% medium sand; trace fine and coarse sand; 5% gravel; subrounded to rounded.	SP		@491.2 ft. gravel is mafics and quartz.
495								



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 19 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495					Poorly graded SAND (SP); brown (7.5YR 4/4); wet; loose; 95% medium sand; trace fine and coarse sand; 5% gravel; subrounded to rounded.	SP		@ 495 ft. gravel is mafics and quartz.
					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/4); wet; loose; 85% medium sand; 5% gravel; subrounded to rounded; 10% silt.	SP-SM		
					Poorly graded SAND (SP); brown (7.5YR 4/4); wet; loose; 95% medium sand; trace gravel; 5% silt.	SP		@ 501.7 ft; gravel is quartz.
500					Well-graded SAND (SW); brown (7.5YR 5/3) wet; loose; 95% fine to coarse sand; 5% fine gravel; subrounded to rounded; trace silt.	SW		
					Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 100% medium sand; trace fine sand; trace silt.	SP		
505					Clayey SAND (SC); reddish brown (2.5YR 4/3); moist; 85% fine to coarse sand; 15% clay.	SC		
					Lean CLAY (CL); olive (5Y 5/3); slightly moist; 100% clay.	CL		
					@ 509.1 ft. See description on next page.	SP		
510								



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 20 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								
					@ 509.1 ft: Poorly graded SAND (SP); brown (7.5YR 4/4); moist to wet; loose; 95% medium sand; trace fine sand; trace fine gravel; 5% clay.	SP	<p>- Top of Bentonite Seal</p> <p>- Bentonite Seal</p>	
					@ 513.8 ft: Same as above (509.1 ft); 95% fine sand; trace medium sand.			
515					@ 515 to 516.4 ft, cuttings were mixed together during core retrieval. Core is a mixture of fine to coarse sand.			
					Poorly graded SAND (SP); brown (7.5YR 4/4); moist to wet; loose; 95% medium sand; trace fine sand; trace fine gravel; 5% clay.	SP		
520					Well-graded SAND (SW); brown (7.5YR 5/3); wet; loose; 100% fine to coarse sand; trace fine gravel; trace silt.	SW		
					Poorly graded SAND (SP); brown (7.5YR 4/4); wet; loose; 100% fine sand; trace medium sand.	SP		
525								





# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015


**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 21 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
525					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); wet; loose; 85% fine to coarse sand; 15% fine to coarse gravel; subrounded to rounded.	SW		@ 525 ft. gravel is mafics and quartz.
					Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 100% medium sand; trace fine sand.	SP		
530					Well-graded SAND (SW); brown (7.5YR 5/3); wet; loose; 100% fine to coarse sand; trace fine gravel; subangular to rounded.	SW		
535					Clayey SAND with Gravel (SC); brown (7.5YR 4/3); moist; loose; 50% fine to coarse sand; 30% fine to coarse gravel to 0.3'; subangular to rounded; 20% clay.	SC		
					Well-graded SAND (SW); brown (7.5YR 5/2); wet; loose; 90% fine to coarse sand; 10% fine to coarse gravel to 0.2'; subangular to rounded.	SW		@ 540 ft. gravel is mafics, quartz, and feldspar.
540								





# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 22 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					Well-graded SAND (SW); brown (7.5YR 5/2); wet; loose; 90% fine to coarse sand; 10% fine to coarse gravel to 0.2'; subangular to rounded.	SW		@ 540 ft. gravel is mafics, quartz, and feldspar.
					Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 100% fine sand; trace medium sand.	SP		@ 542.4 ft. gravel is mafics and quartz.
					Well-graded SAND (SW); brown (7.5YR 4/2); wet; loose; 95% fine to very coarse sand; 5% fine gravel; subrounded to rounded.			
545					@ 545 ft: Same as above (542.4 ft); less coarse sand.			
					@ 546.4 ft: Same as above (542.4 ft).	SW		
					@ 547.9 ft: Same as above (542.4 ft); very wet; trace silt.			
					@ 548.6 ft: Same as above (542.4 ft).			
550					Lean CLAY with Gravel (CL); brown (7.5YR 4/4); moist; low plasticity; 75% clay; 25% fine to coarse gravel; subrounded to rounded.	CL		@ 550.5 ft. gravel is mafics, quartz, and feldspar.
					Well-graded SAND with Gravel (SW); brown (7.5YR 5/2); wet; loose; 80% fine to coarse sand; 20% fine to coarse gravel; subrounded to rounded.	SW		@ 555 ft. gravel is mafics, quartz, and feldspar.
555								



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 23 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
555					Well-graded SAND with Gravel (SW); brown (7.5YR 5/2); wet; loose; 80% fine to coarse sand; 20% fine to coarse gravel; subrounded to rounded. @ 555.8 to 556.9 ft: lense of gravel to 0.3'.			@ 555 ft. gravel is mafics, quartz, and feldspar. @ 555.8 to 556.9 ft. gravel is mafics, sandstone, and feldspar.
560					@ 561 to 562 ft: lense of gravel to 0.3'. Same as above (555 ft).			
565					Same as above (555 ft).	SW	Top of 5" Schedule 80 PVC 0.010" Slot Screen	@ 561 to 562 ft, gravel is mafics, sandstone, quartz, and feldspar.
570								



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

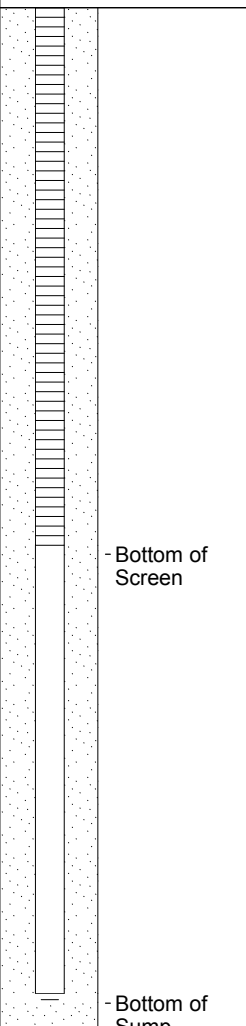
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 476.00  
▼ **At End of Drilling:** Not Recorded  
▼ **After Drilling:** 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 24 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
570					End of continuous coring. No lithologic description.			End continuous coring @ 570 ft on 5/14/15.
575								
580								
585								



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 476.00  
▼ **At End of Drilling:** Not Recorded  
▽ **After Drilling:** 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 25 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
585					No lithologic description.			
590								
595								
600								



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 476.00  
▼ **At End of Drilling:** Not Recorded  
▽ **After Drilling:** 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 26 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
600					No lithologic description.			
605								
610								
615								



# Borehole ID: KAFB-106221-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 5/12/2015  
**Date TD Reached:** 5/14/2015  
**Date Completed:** 6/18/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ At Time of Drilling: 476.00  
▼ At End of Drilling: Not Recorded  
▼ After Drilling: 474.00

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** M. Giles/K. O'Leary/T. Richards

Page 27 of 27

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
615					No lithologic description.			
620								
625								
630								

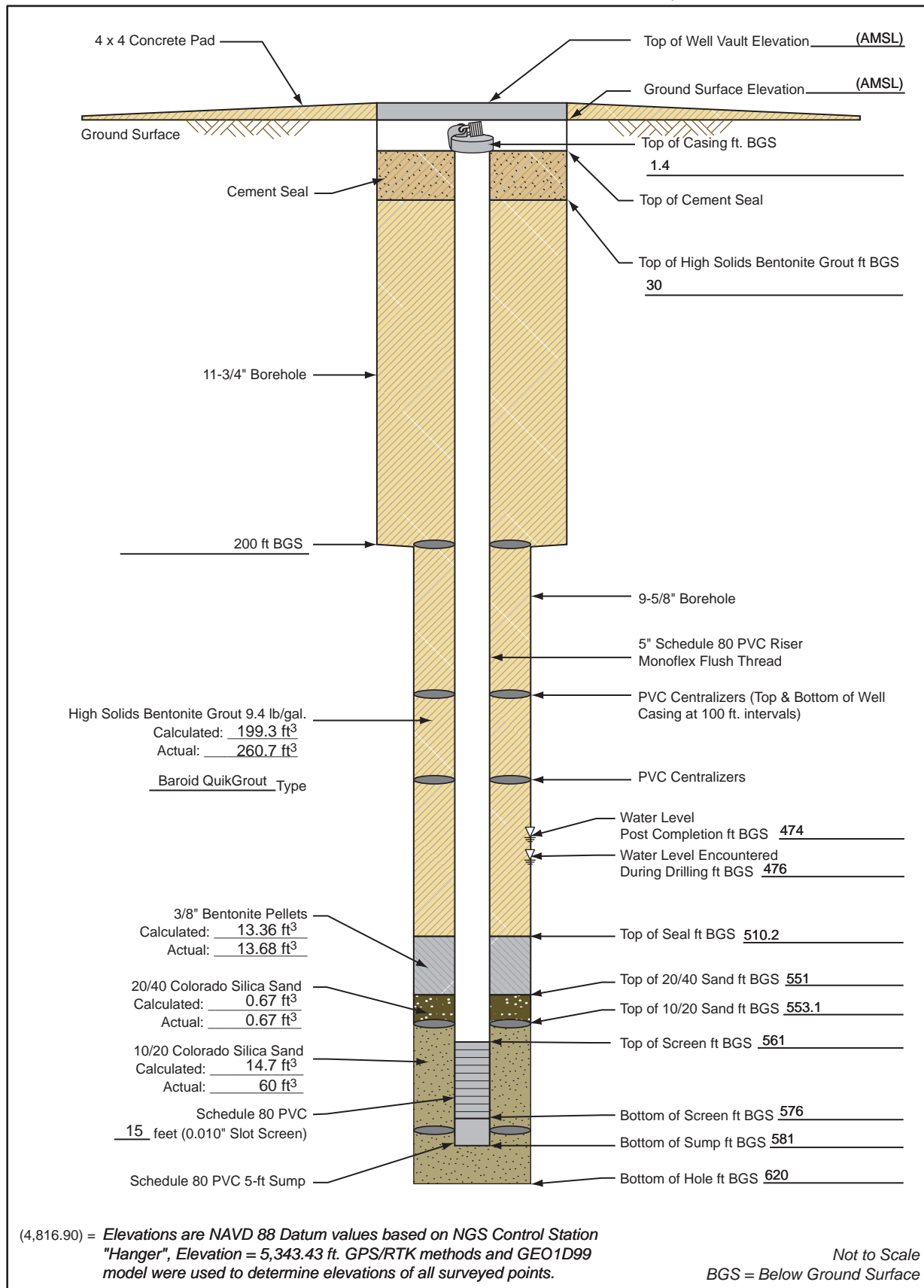
- Bottom of  
Filter Pack/  
Bottom of  
hole.

# Monitoring Well Completion Diagram KAFB-106221

Installation Start Date/Time: 6/1/2015

Installation End Date/Time: 6/5/2015

Date Completed: 6/18/2015







## Well Development Record

**Project Name:** KAFB BFF**Location:** Continental Dr.**Personnel:** T. Richards**Date:** 6/11/15, 6/18/15 - 6/19/15**Samplers:** N/A**Method of Development:**☒ Surging☐ Bailing**Well/Piez. No.:** KAFB-106221**Date Installed:** 6/18/15**Csg. Diameter (I.D.):** 5 "**Total Depth (ft. bgs):** 581☒ Original Development☐ Redevelopment☒ Pumping☐ Other**Development Date:** 6/11/15, 6/18/15 - 6/19/15**Depth to Water Before Developing Well (ft. btoc):** 474**V=(B \* r<sub>c</sub><sup>2</sup> \* L<sub>c</sub> \* 7.48)+(B \* (r<sub>w</sub><sup>2</sup> - r<sub>c</sub><sup>2</sup>) \* L<sub>s</sub> \* ϕ<sub>s</sub> \* 7.48)+(H<sub>2</sub>O added during drilling/installation) =** 2664 gallons**Depth Purging From:** 561 - 576 feet**Time Purging Begins:** 1046, 6/18/2015**Weather:** Clear and Calm, 90s**Screened Interval (ft bgs):** 561 - 576**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐**Describe:** Steam Cleaned**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐**Describe:** N/A**Comment:** Approximately 2,500 gallons of water added during drilling/well installation activities.

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
6/11/2015	1130	473.50	0	--	--	--	--	Begin bailing; water is dark brown/cloudy.
6/11/2015	1155	--	6	--	--	--	--	Finish bailing; very little solids.
6/11/2015	1130	--	6	--	--	--	--	Begin surging; break in surge block.
6/11/2015	1140	--	6	--	--	--	--	Pull surge block and trim.
6/11/2015	1215	--	6	--	--	--	--	Begin surging lower 5 feet of screen.
6/11/2015	1240	--	6	--	--	--	--	Surge middle section of screen.
6/11/2015	1330	--	6	--	--	--	--	Surge upper 5 feet of screen.
6/11/2015	1355	--	6	--	--	--	--	Surge entire 15 feet of screen.
6/11/2015	1405	--	6	--	--	--	--	Finish surging.
6/11/2015	1410	--	6	--	--	--	--	Begin bailing.

\* Turbidity readings were collected from YSI, not the turbidity meter.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Siemens per Meter

**Where:**

B=3.14

ϕ<sub>s</sub>= porosity of the sand packr<sub>c</sub>= radius of the well casing and screen in feetL<sub>c</sub>= length of water column inside the casing and screen in feetr<sub>w</sub>= radius of the well bore in feetL<sub>s</sub>= length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106221Project Number: 140705Samplers: N/ADate: 6/11/15, 6/18/15 - 6/19/15

Checked By: \_\_\_\_\_

Time Start: 1046, 6/18/2015Time Finish: 1235, 6/19/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
6/11/2015	1500	--	20	--	--	--	--	Finish bailing; water is cloudy with little to no fines.
6/18/2015	1046	475.20	50	23.59	6.18	0.441	38.2	Begin pumping @ 575.5 feet bgs; water is slightly cloudy.
6/18/2015	1050	475.79	69	20.95	6.04	0.438	>1,000	Continue pumping.
6/18/2015	1100	475.90	116	21.24	6.79	0.432	20.0	Continue pumping.
6/18/2015	1110	475.90	163	21.38	7.31	0.418	8.29	Continue pumping.
6/18/2015	1120	475.88	210	21.45	7.58	0.409	5.15	Continue pumping.
6/18/2015	1130	475.88	257	21.43	7.70	0.401	4.74	Continue pumping @ 565.5 feet bgs.
6/18/2015	1140	475.88	304	21.42	7.84	0.399	9.75	Continue pumping.
6/18/2015	1150	475.88	351	21.40	7.89	0.394	2.27	Continue pumping.
6/18/2015	1200	475.87	398	21.67	7.94	0.392	1.80	Continue pumping.
6/18/2015	1210	475.86	445	21.76	7.99	0.389	1.60	Move pump to mid-point in screen.
6/18/2015	1220	475.86	492	21.99	8.02	0.388	1.94	Continue pumping.
6/18/2015	1230	475.87	539	22.03	8.02	0.387	1.38	Continue pumping.
6/18/2015	1300	475.88	680	22.00	8.07	0.385	1.46	Continue pumping.
6/18/2015	1330	475.87	821	21.99	8.08	0.382	1.27	Continue pumping.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFF

Well No: KAFB-106221

Project Number: 140705

Samplers: N/A

Date: 6/11/15, 6/18/15 - 6/19/15

Checked By:

Time Start: 1046, 6/18/2015

Time Finish: 1235, 6/19/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
6/18/2015	1430	475.82	1103	22.00	8.02	0.380	1.23	Continue pumping.
6/18/2015	1448	475.82	1188	21.99	8.03	0.379	1.11	Stop pumping; offload water.
6/18/2015	1630	475.73	1292	21.88	8.03	0.379	2.04	Continue pumping.
6/18/2015	1700	475.70	1433	21.82	8.08	0.379	1.20	Continue pumping.
6/18/2015	1715	475.70	1502	21.81	8.18	0.379	1.16	Stop pumping; end of 6/18/15.
6/19/2015	0830	475.87	1528	20.20	8.28	0.377	8.01	Resume pumping on 6/19/15.
6/19/2015	0840	475.99	1575	20.61	8.28	0.374	1.88	Continue pumping.
6/19/2015	0850	475.84	1622	20.72	8.24	0.374	0.80	Continue pumping.
6/19/2015	0900	475.82	1669	20.79	8.26	0.375	0.65	Continue pumping.
6/19/2015	1000	475.87	1951	21.30	8.27	0.375	0.50	Continue pumping.
6/19/2015	1100	475.86	2233	21.43	8.02	0.375	0.38	Continue pumping.
6/19/2015	1200	475.83	2515	21.69	8.12	0.374	0.40	Continue pumping.
6/19/2015	1230	475.82	2656	21.71	8.10	0.375	0.42	Continue pumping.
6/19/2015	1235	475.82	2680	21.70	8.09	0.375	0.36	Finish pumping; well development complete.

Was well sampled after development? YES NO ☒ X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106222



# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

*State of Utah  
 Licensed Professional  
 Geologist*

*8881903-2250*

*Virginia Bracht*

*Vigi Bracht*

Page 1 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/23/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
5					Sandy SILT (ML); reddish yellow (7.5YR 7/6); dry; loose; 80% silt; 20% sand; no odor; occasional gravel (1/2" to 3/4"); subangular; 4.5' - 5.0' cobble layer 2-3"; subrounded.	ASPHALT	<p>Top of Casing Top of Cement Seal Cement Seal Top of High Solids Bentonite Grout</p>	Begin @ 1110 on 12-10-14, hand auger to 8.5'. 0 - 8.5' disrupted from hand auger cutting.
10					Same as above (0.3 ft).	ML		End hand auger @ 8.5' on 12/10/14. Begin drilling ARCH @ 0923 on 12/11/14.
15					Well graded GRAVEL with Silt (GW-GM); reddish yellow (7.5YR 7/6); 90% gravel, 3/8" to 3/4", angular to subangular; 10% silt.	GW-GM		Using water for surface dust control.
20					Well graded GRAVEL with Sand (GW); 80% well graded gravel, 3/8" to 1/2", angular to subrounded, quartz, feldspar fragments; 20% coarse grained sand.			Kelly down @ 0926. Resume 0948.
25					Same as above (20 ft). Occasional cobble, subrounded.	GW		Hard drilling @ 20'.
30								





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 2 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Well graded SAND with Silt (SW-SM); yellowish red (5YR 5/6); loose; subrounded; 90% fine to coarse grained sand; 10% fines.	SW-SM		
40					Silty SAND (SM); yellowish red (5YR 5/6); well graded; loose; subrounded; 75% fine to coarse grained sand; 25% silt.	SM		
45					Poorly graded SAND (SP); dark brown (7.5YR 3/4); 80% coarse grained sand; loose, 20% medium grained sand.	SP		
50					Well graded SAND with Silt (SW-SM); brown (7.5YR 4/4); 90% coarse to fine grained sand; loose; subrounded to angular; 10% silt.	SW-SM		
55					Silty SAND (SM); brown (7.5YR 4/4); 80% coarse to fine grained sand; round to subangular; 20% silt; loose.	SM		
60					Well graded SAND with Gravel (SW); 60% coarse grained to medium grained sand; 40% gravel from 3/8" to 1/2".	SW		

- Bentonite Grout

Kelly down @ 1005.  
Resume @ 1020.

Kelly down @ 1039.  
Resume @ 1048.



# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 3 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Silty SAND (SM); brown (7.5YR 5/3); 80% coarse to fine grained sand; subrounded to subangular; 15% silt; 5% gravel is 1/2' to 3/4", black.	SM		
65					Poorly graded SAND with Gravel (SP); 60% coarse grained sand with trace of medium grained sand; subangular to subrounded; 40% gravel, 3/8" to 3/4", subangular, black.	SP		
70					Same as above (65 ft). Occasional cobble fragment. Granite with quartz seen.	SP		
75					Silty SAND (SM); brown (7.5 YR 4/3); 80% coarse to medium grained sand; subrounded to subangular; 15% silt; 5% gravel, sub angular, black.	SM		
80					Same as above (75 ft).	SM		
85					Well graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/6); 70% coarse grained to fine grained sand, subangular to subrounded; loose; 20% gravel, angular to subangular, flat, quartz and feldspar, 10% silt.	SW-SM		
90								

- Bentonite Grout

Kelly down @ 1108.  
 Resume @ 1121.





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 4 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Well graded GRAVEL with Sand (GW); strong brown (7.5YR 4/6); 60% fine grained gravel, 3/8" to 3/4", subrounded to subangular, flat, feldspar and quartz, 35% coarse to fine grained sand, predominately quartz, subrounded to subangular; 5% trace silt.			
100					Well graded GRAVEL with Sand (GW); strong brown (7.5YR 4/6); 60% coarse to fine grained gravel, subangular, generally flat, quartz and feldspar; 35% coarse to medium grained sand, subangular to subrounded, loose; 5% trace silt.			
105					Same as above (95 ft).	GW		
110					Same as above (95 ft).			
115					Poorly graded SAND with Gravel (SP); 80% coarse grained sand, subrounded to subangular; quartz and feldspar; 20% gravel, flat, angular to sub angular; trace silt.			
120					Same as above (110 ft).	SP		

Kelly down @ 1148.  
 Resume drilling @ 1527.  
 Driller repairs hose.

Kelly down @ 1350.  
 Resume @ 1402.



# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 5 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120								
125					Poorly graded SAND with Gravel (SP); 80% coarse grained sand, subrounded to subangular; quartz and feldspar; 20% gravel, flat, angular to sub angular; trace silt.	SP		
130					SILT with Sand (ML); light yellowish brown (10YR 6/4); 80% silt; 20% coarse grained sand.			
135					Same as above (125 ft).			
140					Same as above (125 ft).			
145					Same as above (125 ft). Some fine gravel. 75% silt; 20% sand; 5% gravel.	ML		
150								

-Bentonite Grout

Kelly down @ 1418.  
 Resume @ 1435.





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▼ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 6 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Lean CLAY with Gravel (CL); light yellowish brown (10YR 6/4); low plasticity; 85% clay; 15% fine to coarse grained gravel, subangular; flat.			Can smear some clay fragments.
155					Same as above (150 ft) with subrounded coarse gravel.			
160					Same as above (150 ft).			
165					Same as above (150 ft).	CL	- Bentonite Grout	Kelly down @ 1502. Resume @ 1512.
170					Same as above (150 ft).			
175					Poorly graded GRAVEL (GP); coarse to fine grained; unable to determine % of fines; larger pieces are generally subrounded, fine pieces are generally subangular; black feldspar.	GP		Driller calls 174'. Fines flush through the strains. Kelly down @ 1524. Resume drilling @ 1534.
180					SILT with Sand (ML); light yellowish brown (10YR 6/4); 80% silt; 20% medium grained sand.	ML		Driller calls the bottom of gravel @ 178'.



# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▼ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 7 of 17

Depth (ft)	Sample Type	Number	Headspace P/D	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					SILT with Sand (ML); light yellowish brown (10YR 6/4); 80% silt; 20% medium grained sand.			
185					Same as above (180 ft).	ML		
190					Silty SAND (SM); light yellowish brown (10YR 6/4); 70% medium to coarse grained sand; black feldspar and clear quartz; 30% silt.			
195					Same as above (190 ft).	SM	- Bentonite Grout	
200					Lean CLAY (CL); brown (10YR 5/3); 90% clay, soft, medium plasticity; 10% medium grained sand; trace gravel.			
205					Same as above (200 ft).	CL		
210								Kelly down @ 1556. 11 3/4" casing to 200'. 9 5/8" drilling from 200' to total depth. 950 gallons of water used. Begin drilling @ 1505 on 12/12/14.





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 8 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210								
215					Lean CLAY with Gravel (CL); brown (10YR 5/3); 80% lean clay; low plasticity; soft; 15% coarse gravel, angular to subangular, black feldspar; 5% trace of coarse sand.	CL		
220					SILT (ML); brownish yellow (10YR 6/6); 90% silt; 10% coarse grained sand; black feldspar sand.	ML		Kelly down @ 1520. Resume @ 1528.
225					Well graded GRAVEL with Silt and Sand (GW-GM); 70% fine to coarse gravel, fine is angular to subangular; coarse is generally subrounded to rounded; some feldspar; larger gravel is granite; 20% coarse to medium grained sand; 10% silt.	GW-GM		
230					Same as above (220 ft).	GW-GM	- Bentonite Grout	
235					Well graded GRAVEL with Sand (GW); 60% fine gravel; angular to subangular; mostly black feldspar; 40% coarse to medium grained sand; subangular to subrounded; black feldspar and quartz and reddish granite.	GW		
240					Same as above (230 ft). Trace coarse, rounded granite.	GW		Kelly down @ 1535. Resume drilling @ 1552.



# Borehole ID: KAFB-106222

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/10/2014  
**Date TD Reached:** 12/16/2014  
**Date Completed:** 1/14/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 476.85  
 ▽ At End of Drilling: 470.88  
 ▽ After Drilling:

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240								
245					Well graded GRAVEL with Sand (GW); 60% fine gravel; angular to subangular; mostly black feldspar; 40% coarse to medium grained sand; subangular to subrounded; black feldspar and quartz and reddish granite.	GW		
250					Well graded SAND with Silt and Gravel (SW-SM); 70% mostly coarse to medium grained sand, black feldspar and clear quartz; 20% fine gravel, subrounded granite; 10% silt.			
255					Same as above (245 ft).	SW-SM	-PVC Centralizer	
260					Same as above (245 ft).		-Bentonite Grout	
265					Well graded GRAVEL with Sand (GW); 60% gravel, fine to coarse, fine is subangular, coarse is subrounded, feldspar and granite; 40% coarse to medium grained sand, subangular, mostly clear quartz sand.			
270					Same as above (260 ft).	GW		Kelly down @ 1558. Stop @ 257' for the day. Used 150 gallons of water today. 1100 gallons to date. Resume drilling @ 0920 on 12.15.14 @ 257'.





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 10 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND with Gravel (SP); 75% sand, very coarse to coarse grained; generally subrounded but some subangular; 25% coarse to fine grained gravel, subangular.			
275					Same as above (270 ft).	SP		
280					Well graded SAND with Silt (SW-SM); dark brown (7.5YR 3/3); 80% coarse to fine grained sand; 10% coarse gravel, subangular to subrounded; 10% silt.	SW-SM		
285					SILT (ML); light yellowish brown (10YR 6/4); 95% silt; 5% medium grained sand.			
290					Same as above (285 ft).	ML		
295					Same as above (285 ft). Trace coarse grained sand.			
300					Some gravel @ 297' to 300'.			

- Bentonite Grout

Kelly down @ 0935.  
 Resume @ 0946.

Kelly down @ 1007.





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 11 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Well graded GRAVEL with Sand (GW); 60% gravel, fine 3/8" to coarse 1/2" granite with some black feldspar, subrounded; 40% coarse to medium grained sand, subangular to subrounded, granite and quartz.	GW		
310					Well graded SAND with Gravel (SW); 85% coarse to fine grained sand, subangular to subrounded, granite, quartz, and feldspar; 15% mostly coarse to fine grained gravel, subangular.	SW		
315					Well graded GRAVEL (GW); 95% gravel, coarse to fine, subangular to subrounded granite, feldspar and some quartz; 5% coarse grained sand.			Driller reports gravel @ 310'.
320					Well graded GRAVEL with Sand (GW); 70% coarse to fine grained gravel, subangular, flat, fine is subrounded; 30% coarse to fine grained sand, subangular to subrounded.	GW		
325					Poorly graded GRAVEL (GP); 100% fine gravel, subangular to subrounded, granite, feldspar and quartz.	GP		
330					Well graded GRAVEL (GW); 100% gravel, mostly fine to coarse grained, subangular to subrounded, granite, feldspar, quartz, some sandstone.	GW		Kelly down @ 1035. Resume at 1041.



# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 12 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330								
335					Well graded GRAVEL (GW); 100% gravel, mostly fine to coarse grained, subangular to subrounded, granite, feldspar, quartz, some sandstone; slightly more coarse gravel. Well graded GRAVEL (GW); 80% coarse reddish granite from 1" to 2", 10% fine grained gravel, 10% coarse grained sand, subangular, clear quartz.			
340						GW		Kelly down @ 1059. Resume @ 1113.
345					Well graded GRAVEL with Sand (GW); 80% gravel; mostly fine with some coarse; subangular, pink quartz, feldspar and granite; 20% coarse grained sand.  Same as above (340 ft). Trace fines.		- Bentonite Grout	
350					Lean CLAY (CL); pale brown (10YR 6/3); soft, low plasticity.  Lean CLAY (CL); pale brown (10YR 6/3); soft to semi firm; medium plasticity; trace gravel.			
355					Lean CLAY (CL); pale olive (5YR 6/3); 90% clay; soft; medium plasticity; 10% of medium grained sand; occasional piece of fine gravel.	CL	- PVC Centralizer	Kelly down @ 1127. Resume @ 1147.
360								





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 13 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded GRAVEL with Sand (GW); 80% fine gravel; subrounded to subangular; feldspar and granite; 20% coarse to medium grained sand; subrounded to subangular; film of clay.			
365					Well graded GRAVEL with Sand (GW); 60% gravel, fine with some coarse, feldspar and granite; 40% coarse to medium grained sand, subangular to subrounded; film of clay.	GW		
370					Well graded SAND with Gravel (SW); 70% well graded coarse to fine grained sand, subrounded with some subangular; 30% gravel, subangular, flat, feldspar with some granite.			
375					Same as above (370 ft).	SW	Bentonite Grout	
380					Poorly graded SAND (SP); brown (7.5YR 5/3); 90% medium to fine grained sand with some coarse, subrounded, quartz and feldspar; 5% trace of fine gravel; 5% trace silt.	SP		
385					Well graded GRAVEL with Sand (GW); 60% fine gravel; subangular to subrounded; black feldspar and reddish granite with occasional quartz; 40% coarse grained sand; subangular; trace silt.	GW		
390								Kelly down @ 1151. Resume @ 1202.



# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 14 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND with Gravel (SW); 60% sand; coarse to fine grained; subangular to subrounded; 40% fine gravel; subangular; feldspar and granite.	SW		
395					Well graded GRAVEL with Sand (GW); 65% mostly fine to coarse gravel; subrounded feldspar and granite; 30% coarse to medium grained sand; subangular to subrounded; 5% silt.	GW	- 5" Schedule 80 PVC Riser - Bentonite Grout	
400					Poorly graded SAND (SP); yellowish brown (10YR 5/4); 100% medium grained sand, clear quartz and black feldspar; trace silt.		- Top of Bentonite Seal	
405					Poorly graded SAND (SP); coarse grained sand; subangular to subrounded; mostly feldspar; granite and some quartz.	SP	- Bentonite Seal	
					Same as above (400 ft).			
410					Well graded GRAVEL with Silt and Sand (GW-GM); 70% gravel; fine; angular to subrounded; generally subangular, feldspar and granite; 20% medium to coarse grained sand; subangular; 10% silt.		- Native Backfill	
415					Same as above (410 ft). Less angular.	GW-GM		
420								Kelly down @ 1212. Resume @ 1336.
								Kelly down @ 1348. Resume @ 1402.





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 15 of 17

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND (SW); 90% coarse to fine grained sand; subangular to subrounded; feldspar, quartz and granite; 10% gravel; subangular; feldspar.	SW		
425					Poorly graded SAND (SP); light yellowish brown (10YR 6/4); medium to fine grained sand, some coarse, generally subrounded with some subangular, clear and frosted quartz with some feldspar; some fines.	SP		
430					Same as above (425 ft).			
435					Silty SAND (SM); yellowish brown (10YR 5/4); 60% poorly graded medium to fine grained sand; 40% silt.	SM		
440					No recovery on SILT (SM) as reported by driller.			
445					Gravelly SILT (ML); light brown (7.5YR 6/4); percentages unknown. Gravel is fine to coarse, subangular.	ML		
450								

- Bentonite Seal

- Native Backfill

- Bentonite Seal

- Top of 20/40 Sand

Kelly down @ 1413.  
Resume @ 1422.

Driller calls @ 438' to 443' as clayey silt. No recovery in strainer. Geologist believes it is silt. Fines washed through strainer.

Silt blown through screen and in the hopper as mush.



# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 16 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
					Gravelly Lean CLAY (CL); light yellowish brown (10YR 6/4); 60% soft to semi firm clay, medium plasticity; 40% fine to coarse gravel, subangular, feldspar and granite.	CL		
455					Sandy SILT (ML); light brown (7.5YR 6/3); percentages unknown; coarse to medium grained sand.		PVC Centralizer Top of 10/20 Sand	Kelly down @ 1442. Resume @ 1502. Fines wash through strainer.
460					SILT (ML); light brown (7.5YR 6/3).	ML	-Top of 5" Schedule 80 PVC 0.010" Slot Screen	Very soupy returns.
465					Same as above (460 ft).			Very soupy returns.
470					Poorly graded SAND with Silt (SP-SM); 90% sand; medium to fine grained; medium grained is mostly clear quartz; fine grained is feldspar; 10% silt.	SP-SM		Water table encountered @ 470.88' after 1 hour static reading.
475								Kelly down @ 1515. Stop @ 477' for 12/15/14.
480								





# Borehole ID: KAFB-106222

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/10/2014  
 Date TD Reached: 12/16/2014  
 Date Completed: 1/14/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 476.85  
 ▼ At End of Drilling: 470.88  
 ▽ After Drilling:

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: M. Giles

Page 17 of 17

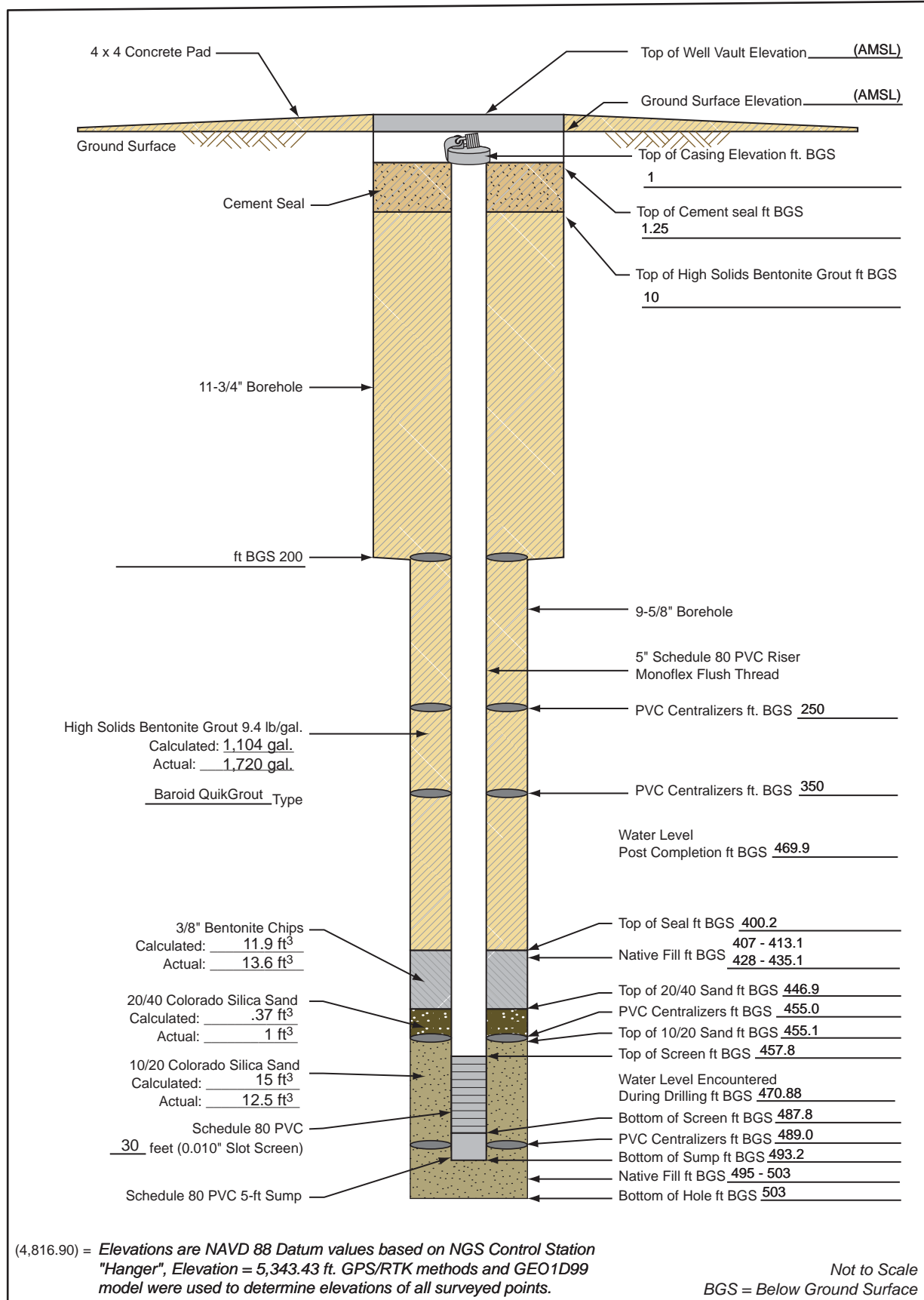
KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 1/29/15 15:04 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well graded SAND (SW); 90% coarse to medium grained sand; subrounded to subangular; feldspar, quartz, mica; 10% fine gravel; angular to subangular; feldspar and quartz.	SW		Fines washed through strainer.
485					Silty SAND (ML); brown (7.5YR 4/3); poorly graded, medium grained sand, subrounded to subangular, mica, quartz. Unable to determine percentages.	ML		
490					Poorly graded GRAVEL (GP); 90% gravel, subangular to subrounded, feldspar, quartz; 10% coarse grained sand, subangular, feldspar, mica and quartz.	GP		
495					Poorly graded SAND (SP); medium grained to fine grained sand; some coarse grained; quartz, mica and feldspar; occasional gravel; subrounded.	SP		
500					Sandy SILT (ML); brown (7.5YR 4/4) unable to determine percentages. Coarse to medium grained sand. Decreased percentage of sand with depth.	ML		Returns run through strainer.
505					TD = 503'			Driller over-drilled to give potential heaving sands a place to fall back into. Used 100 gal from 477' to 503'. Add 500 gal to pull drill stem. Note: When bottom of sump is on bottom we have 10' of heaving sands inside borehole.
510								



## Monitoring Well Completion Diagram KAFB-106222

Installation Start Date/Time: 12/16/2014

Installation End Date/Time: 1/15/2015



## Well Development Record

**Project Name:** KAFB BFF**Location:** Kentucky St.**Personnel:** V. Bracht, E. Perez**Date:** 1/19/15 - 1/21/15**Samplers:** N/A**Well/Piez. No.:** KAFB-106222**Date Installed:** 1/15/15**Csg. Diameter (I.D.):** 5 "**Total Depth (ft. bgs):** 493.2**Method of Development:**☒ Surging☒ Bailing☐ Pumping☐ Original Development☐ Redevelopment☐ Other**Development Date:** 1/19/15**Depth to Water Before Developing Well (ft. btoc):** 470.96
$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{1,743} \text{ gallons}$$
**Depth Purging From:** 486 feet**Time Purging Begins:** 1550, 1/19/15**Weather:** Sunny, 40's**Screened Interval (ft bgs):** 457.8 - 487.8**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q**Equipment Decontaminated Prior to Development:** Y ☒ N ☐**Describe:** Steam Cleaned**Collected Sample of Water Added to Well:** Y ☐ N ☒**Describe:** N/A**Comment:** Approximately 1,700 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bgs)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
1/19/2015	1025	470.96	0	--	--	--	--	Begin bailing. Water is muddy.
1/19/2015	1052	--	20	--	--	--	--	Begin swabbing.
1/19/2015	1120	--	--	--	--	--	--	Finish swabbing.
1/19/2015	1142	--	--	--	--	--	--	Begin bailing. Water is muddy.
1/19/2015	1152	--	35	--	--	--	--	Finish swabbing. Water is muddy.
1/19/2015	1550	--	35	--	--	--	--	Begin Pumping at 8 GPM.
1/19/2015	1600	NR*	100	18.71	7.98	0.496	>1000	Continue pumping. Water is brown.
1/19/2015	1610	NR*	200	18.51	7.92	0.492	1.61	Continue pumping. Water is cloudy.
1/19/2015	1620	NR*	250	18.73	7.96	0.495	28.9	Continue pumping. Water is slightly cloudy.
1/19/2015	1625	NR*	275	19.06	7.57	--	--	Stop pumping. End of day.

\* Water Level tape is stuck. Unable to collect readings.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Siemens per Meter

**Where:**

B=3.14

 $\phi_s$  = porosity of the sand pack $r_c$  = radius of the well casing and screen in feet $L_c$  = length of water column inside the casing and screen in feet $r_w$  = radius of the well bore in feet $L_s$  = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot = conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106222Project Number: 140705Samplers: N/ADate: 1/19/15

Checked By: \_\_\_\_\_

Time Start: 1025, 1/19/2015Time Finish: 1002, 1/21/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. bgs)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
1/20/2015	1040	470.74	275	--	--	--	--	Initial water level reading.
1/20/2015	1049	471.43	275	17.49	7.65	0.518	>1000	Begin pumping at 6 GPM. Pump set at 487 feet.
1/20/2015	1059	471.46	350	18.12	7.90	0.524	64.2	Continue pumping. Water is slightly cloudy.
1/20/2015	1109	471.85	425	18.28	7.79	0.526	9.61	Continue pumping. Water is clear.
1/20/2015	1119	471.70	475	17.50	7.82	0.525	30.5	Continue pumping. Water is slightly cloudy.
1/20/2015	1120	--	475	--	--	--	--	Stop pumping.
1/20/2015	1309	470.64	475	--	--	--	--	Initial water level reading.
1/20/2015	1313	471.32	475	18.31	8.00	0.534	151	Begin pumping at 8 GPM. Pump set at 479 feet.
1/20/2015	1323	471.32	525	19.07	7.95	0.541	4.00	Continue pumping. Water is clear.
1/20/2015	1333	471.34	625	19.31	7.89	0.533	0.91	Continue pumping. Water is clear.
1/20/2015	1343	471.37	725	19.21	7.86	0.531	0.76	Continue pumping. Water is clear.
1/20/2015	1353	471.37	775	19.13	7.85	0.532	0.62	Continue pumping. Water is clear.
1/20/2015	1403	471.37	825	19.22	7.84	0.532	0.25	Continue pumping. Water is clear.
1/20/2015	1413	471.37	900	19.13	7.84	0.532	0.88	Continue pumping. Water is clear.
1/20/2015	1423	471.37	950	19.09	7.85	0.534	0.42	Continue pumping. Water is clear.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106222Project Number: 140705Samplers: N/ADate: 1/19/15

Checked By: \_\_\_\_\_

Time Start: 1025, 1/19/2015Time Finish: 1002, 1/21/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bgs)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
1/20/2015	1428	--	1000	--	--	--	--	Stop pumping.
1/20/2015	1525	470.66	1000	--	--	--	--	Initial water level reading.
1/20/2015	1530	471.36	1000	17.85	7.84	0.537	36.3	Begin pumping at 8 GPM. Pump set at 475 feet.
1/20/2015	1540	471.38	1050	19.15	7.84	0.543	9.47	Continue pumping. Water is clear.
1/20/2015	1550	471.38	1150	19.19	7.83	0.539	2.72	Continue pumping. Water is clear.
1/20/2015	1600	471.38	1250	18.94	7.86	0.538	0.89	Continue pumping. Water is clear.
1/20/2015	1610	471.39	1300	18.93	7.84	0.538	0.5	Continue pumping. Water is clear.
1/20/2015	1620	471.39	1375	18.88	7.86	0.539	0.47	Continue pumping. Water is clear.
1/20/2015	1630	471.41	1425	18.83	7.75	0.539	0.41	Continue pumping. Water is clear.
1/20/2015	1640	471.42	1475	18.74	7.84	0.539	0.34	Continue pumping. Water is clear.
1/20/2015	1643	--	1525	--	--	--	--	Stop pumping. End of day.
1/21/2015	0841	470.65	1525	--	--	--	--	Initial water level reading.
1/21/2015	0846	470.92	1525	15.06	6.51	0.513	61.6	Begin pumping at 8 GPM. Pump set at 487 feet.
1/21/2015	0856	471.29	1600	16.67	7.47	0.548	17.1	Continue pumping. Water is clear.
1/21/2015	0906	471.30	1675	15.87	7.59	0.549	3.30	Continue pumping. Water is clear.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106222Project Number: 140705Samplers: N/ADate: 1/19/15

Checked By: \_\_\_\_\_

Time Start: 1025, 1/19/2015Time Finish: 1002, 1/21/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. bgs)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
1/21/2015	0910	--	1750	--	--	--	--	Raise pump to 479 feet.
1/21/2015	0916	471.33	1750	15.55	7.03	0.545	1.73	Continue pumping. Water is clear.
1/21/2015	0926	471.34	1825	14.40	7.26	0.545	3.33	Continue pumping. Water is clear.
1/21/2015	0936	471.34	1875	15.24	7.73	0.544	0.78	Continue pumping. Water is clear.
1/21/2015	0946	471.34	1950	15.13	5.91	0.545	0.65	Continue pumping. Water is clear.
1/21/2015	0951	471.34	1975	15.05	7.79	0.545	0.71	Continue pumping. Water is clear.
1/21/2015	0956	471.33	2000	14.94	7.58	0.545	0.55	Continue pumping. Water is clear.
1/21/2015	1001	471.34	2025	15.03	7.75	0.546	0.74	Continue pumping. Water is clear.
1/21/2015	1002	--	2030	--	--	--	--	Finish pumping. Well development complete.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106223



# Borehole ID: KAFB-106223

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 2/5/2015  
 Date TD Reached: 2/10/2015  
 Date Completed: 2/20/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ∇ At Time of Drilling: 471.50  
 ∇ At End of Drilling: Not Recorded  
 ∇ After Drilling: 470.59

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: T. Richards



Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
5					No lithologic description (0.5 ft - 10 ft).	ASPHALT	Top of Casing/Top of Cement Seal	Water jetted borehole from 0.5 ft to 9 ft. No lithologic description possible. Began drilling @ 1150 on 2/5/15.
10					Well graded GRAVEL with Silt and Sand (GW-GM); reddish yellow (5YR 6/6); dry; loose; 70% gravel to 3"; subrounded to rounded; 20% fine to medium sand; 10% silt. Note: gravel is sandstone, feldspar, and mafics.			Hammering. No water added.
15					Same as above (10 ft).		-Cement Seal	PID - 0.0 ppm @ cyclone and breathing zone.
20					Same as above (10 ft); reddish brown (5YR 5/4); 70% gravel to 3"; angular to subrounded; 20% very fine to coarse sand; 10% silt.	GW-GM		No hammering. No water added.
25					Same as above (10 ft); reddish brown (5YR 5/4); 70% gravel to 3"; angular to subrounded; 20% very fine to coarse sand; 10% silt.			Kelly down @ 1155. New 20' connection @ 1205.
30								No water added.
								PID - 0.0 ppm @ cyclone and breathing zone.
								Very little hammering. No water added.





# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well graded GRAVEL with Silt and Sand (GW-GM); reddish brown (5YR 5/4); dry; loose; 70% gravel to 3"; angular to subrounded; 20% very fine to coarse sand; 10% silt. Note: gravel is sandstone, feldspar, and mafics.			PID - 0.0 ppm @ cyclone and breathing zone.
35					Same as above (30 ft).			No water added.
40					Same as above (30 ft).			Kelly down @ 1211. New 20' connection @ 1219.
45					Same as above (30 ft).	GW-GM		Driller added 25 gallons of water. PID - 0.0 ppm @ cyclone and breathing zone.
50					Same as above (30 ft).			Driller added 25 gallons of water. Little hammering.
55					Same as above (30 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
60					Same as above (30 ft).			Kelly down @ 1231. New 20' connection @ 1241.



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 471.50  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well graded GRAVEL with Silt and Sand (GW-GM); reddish brown (5YR 5/4); dry; loose; 70% gravel to 3"; angular to subrounded; 20% very fine to coarse sand; 10% silt. Note: gravel is sandstone, feldspar, and mafics.			PID - 0.0 ppm @ cyclone and breathing zone.
65					Same as above (60 ft).			Driller added 25 gallons of water. Little hammering.
70					Same as above (60 ft).			PID - 0.1 ppm @ cyclone and breathing zone.
75					Same as above (60 ft).	GW-GM	High Solids Bentonite Grout	Kelly down @ 1249. New 20' connection @ 1258.
80					Same as above (60 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
85					Same as above (60 ft).			Driller added 25 gallons of water. Hammering.
90								



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well graded GRAVEL with Silt and Sand (GW-GM); reddish brown (5YR 5/4); dry; loose; 70% gravel to 3"; angular to subrounded; 20% very fine to coarse sand; 10% silt. Note: gravel is sandstone, feldspar, and mafics.	GW-GM		PID - 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone. Driller added 25 gallons of water.
95					Same as above (90 ft).			Hammering.
100					Same as above (90 ft).			Kelly down @ 1312. New 20' connection @ 1324.
105					Same as above (90 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
110					Silty SAND (SM); light reddish brown (5YR 6/4); 85% very fine to coarse sand; 15% silt. Note: cuttings are moist due to driller adding water.	SM		Driller added 25 gallons of water. Hammering.
115					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); 75% fine to coarse sand; 25% gravel; rounded; trace silt.	SW		PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
120					Same as above (113 ft).			Kelly down @ 1337. New 20' connection @ 1346. Hammering. Slow drilling.



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Well graded SAND with Gravel (SW); reddish brown (5YR 5/3); 75% fine to coarse sand; 25% gravel; rounded; trace silt.			Driller added 25 gallons of water. PID - 0.0 ppm @ cyclone and breathing zone.
125					Same as above (120 ft).			
130					Same as above (120 ft).	SW		Hammering. Slow drilling.
135					Same as above (120 ft).			Driller added 25 gallons of water. PID - 0.0 ppm @ cyclone and breathing zone.
140					Well graded SAND with Silt (SW-SM); yellowish red (5YR 5/6); moist; 90% fine to coarse sand; 10% silt. Note: cuttings are moist due to driller adding water.			Kelly down @ 1358. New 20' connection @ 1408.
145					Same as above (138 ft).	SW-SM		Driller added 25 gallons of water. Hammering. PID - 0.0 ppm @ cyclone and breathing zone.
150								



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Well graded SAND with Silt (SW-SM); yellowish red (5YR 5/6); 90% fine to coarse sand; 10% silt. Note: cuttings are moist due to driller adding water.			PID - 0.0 ppm @ cyclone and breathing zone.
155					Same as above (150 ft).	SW-SM		Kelly down @ 1417. New 20' connection @ 1425.
160					Same as above (150 ft); trace fine gravel.			Driller added 25 gallons of water. Hammering.
165					Same as above (150 ft).			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
165					Clayey SAND (SC); light reddish brown (5YR 6/4); 70% fine sand; 30% clay. Note: cuttings are moist due to driller adding water.	SC	High Solids Bentonite Grout	Driller added 25 gallons of water.
170					Poorly graded SAND (SP); brown (7.5YR 5/4); 100% fine to medium sand; trace silt.			PID - 0.0 ppm @ cyclone and breathing zone.
175					Same as above (168 ft).	SP		Kelly down @ 1437. End of 2/5/15. Total depth with 11-3/4" casing. Resumed drilling with 9-5/8" casing @ 1330 on 2/6/15.
180					Same as above (168 ft).			Driller added 25 gallons



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); brown (7.5YR 5/4); 100% fine to medium sand; trace silt.			of water. Hammering. PID - 0.0 ppm @ cyclone and breathing zone.
185					Same as above (180 ft).			
190					Same as above (180 ft).	SP		Driller added 25 gallons of water. No hammering.
195					Same as above (180 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
200					Well graded SAND with Gravel (SW); brown (7.5YR 5/3); 85% fine to coarse sand; 15% gravel; rounded. Note: cuttings are moist due to driller adding water. Gravel is mafics.	SW		No hammering.
205					Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/4); 90% fine to medium sand; 10% silt. Note: cuttings are moist due to driller adding water.			Kelly down @ 1344. New 20' connection @ 1356.
210					Same as above (200 ft).	SP-SM		PID - 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
								No hammering.
								Driller added 25 gallons of water.





# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/4); 90% fine to medium sand; 10% silt. Note: cuttings are moist due to driller adding water.			PID - 0.0 ppm @ cyclone and breathing zone.
215					Same as above (210 ft).	SP-SM		Kelly down @ 1405. New 20' connection @ 1415.
220					Same as above (210 ft); trace coarse sand.			No hammering. PID - 0.0 ppm @ cyclone and breathing zone.
225					Poorly graded SAND with Gravel (SP); light brown (7.5YR 6/3); 80% fine to medium sand; 20% fine gravel; rounded. Note: cuttings are moist due to driller adding water.			Driller added 25 gallons of water.
230					Same as above (223 ft).			No hammering.
235					Same as above (223 ft).	SP		PID - 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
240					Same as above (223 ft); 60% fine to medium sand; 40% fine gravel; rounded.			Kelly down @ 1425. New 20' connection @ 1437.



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 471.50  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND with Gravel (SP); light brown (7.5YR 6/3); 60% fine to medium sand; 40% fine gravel; rounded. Note: cuttings are moist due to driller adding water.			PID - 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone.
245					Same as above (240 ft); 80% fine to medium sand; 20% fine gravel.			No hammering.
250					Same as above (240 ft); 80% fine to medium sand; 20% fine gravel.			PID - 0.0 ppm @ cyclone and breathing zone.
255					Same as above (240 ft); 80% fine to medium sand; 20% fine gravel.	SP	High Solids Bentonite Grout	Driller added 25 gallons of water.
260					Same as above (240 ft); 80% fine to medium sand; 20% fine gravel.			Top seal on drill rig is leaking. Driller repairs. Kelly down @ 1441. New 20' connection. End of 2/6/15. Resumed drilling @ 1215 on 2/9/15.
265					Same as above (240 ft); 80% fine to medium sand; 20% fine gravel.			PID - 0.0 ppm @ cyclone and breathing zone.
270					Same as above (240 ft); 80% fine to medium sand; 20% fine gravel.			Driller added 25 gallons of water.
								Hammering, slow drilling.



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND with Gravel (SP); light brown (7.5YR 6/3); 80% fine to medium sand; 20% fine gravel; rounded. Note: cuttings are moist due to driller adding water.	SP		PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
275					Well graded SAND with Gravel (SW); light brown (7.5YR 6/4); 75% fine to coarse sand; 25% fine to medium gravel; rounded. Note: gravel is quartz and feldspar. Cuttings are moist due to driller adding water.			Kelly down @ 1230. New 20' connection @ 1240.
280					Same as above (272 ft).			PID - 0.0 ppm @ cyclone and breathing zone. Driller added 25 gallons of water. Hammering, drilling is hard and slow.
285					Same as above (272 ft).	SW	High Solids Bentonite Grout	Hammering.
290					Same as above (272 ft); higher percentage of coarse gravel to 1".			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
295					Same as above (272 ft); higher percentage of coarse gravel to 1".			Kelly down @ 1250. New 20' connection @ 1300.
300								Driller added 25 gallons of water.



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 471.50  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well graded SAND with Gravel (SW); light brown (7.5YR 6/4); 75% fine to coarse sand; 25% fine to medium gravel; rounded. Note: gravel is quartz and feldspar. Cuttings are moist due to driller adding water.			PID - 0.0 ppm @ cyclone and breathing zone.
305					Same as above (300 ft).			Hammering.
310					Same as above (300 ft); coarse gravel to 1".			PID - 0.0 ppm @ cyclone and breathing zone.
315					Same as above (300 ft); coarse gravel to 1".	SW	High Solids Bentonite Grout	Kelly down @ 1313. New 20' connection @ 1322.
320					Same as above (300 ft); coarse gravel to 1".			PID - 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
325					Same as above (300 ft); coarse gravel to 1".			Driller added 25 gallons of water. Hammering.
330								



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 12 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded SAND with Gravel (SW); light brown (7.5YR 6/4); 75% fine to coarse sand; 25% fine to medium gravel; rounded. Note: gravel is quartz and feldspar. Cuttings are moist due to driller adding water.			PID - 0.0 ppm @ cyclone and breathing zone.
335					Same as above (330 ft).	SW		Kelly down @ 1335. New 20' connection @ 1344.
340					Same as above (330 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
345					Well graded GRAVEL with Sand (GW); light brown (7.5YR 6/4); loose; 70% gravel; rounded; 30% fine to medium sand; trace silt. Note: gravel is quartz, feldspar, and mafics.			Hammering.
350					Same as above (343 ft).	GW	High Solids Bentonite Grout	Driller added 25 gallons of water.
355					Same as above (343 ft).			PID - 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone.
360								Kelly down @ 1359. New 20' connection @ 1413.



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well graded GRAVEL with Sand (GW); light brown (7.5YR 6/4); loose; 70% gravel; rounded; 30% fine to coarse sand; trace silt. Note: gravel is quartz, feldspar, and mafics.	GW		PID - 0.0 ppm @ cyclone and breathing zone.
365					Same as above (360 ft).			Driller added 25 gallons of water. Hammering.
370					Well graded SAND (SW); brown (7.5YR 5/3); 90% fine to coarse sand; 10% fine gravel. Note: cuttings are moist due to driller adding water.	SW		PID - 0.0 ppm @ cyclone and breathing zone. Driller added 25 gallons of water.
					Lean Clay (CL); lense.	CL		
375					Well graded SAND (SW); brown (7.5YR 5/3); 90% fine to coarse sand; 10% fine gravel. Note: cuttings are moist due to driller adding water.	SW	High Solids Bentonite Grout	Driller added 50 gallons of water. Kelly down @ 1440. New 20' connection @ 1450.
380					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% fine sand; trace coarse sand; 10% silt.	SP-SM		PID - 0.0 ppm @ cyclone and breathing zone.
385					Silty SAND with Gravel (SM); brown (7.5YR 5/4); 70% very fine to fine sand; 15% gravel; subrounded; 10% silt; 5% clay.	SM		Driller added 25 gallons of water.
390					Well graded SAND with Gravel (SW); brown (7.5YR 5/3); 70% fine to coarse sand; 30% fine gravel to 1.5"; trace silt.	SW		Driller added 25 gallons of water. Cuttings are very wet.





# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND with Gravel (SW); brown (7.5YR 5/3); 70% fine to coarse sand; 30% fine gravel to 1.5"; trace silt.			PID - 0.0 ppm @ cyclone and breathing zone.
395					Same as above (390 ft).	SW		Driller added 25 gallons of water. Hammering. Slow drilling. Kelly down @ 1521. New 20' connection @ 1535.
400					Same as above (390 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
405					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 5/4); 60% fine to medium gravel; 40% coarse sand; trace silt.			Driller added 25 gallons of water.
410					Same as above (402 ft).			Driller added 25 gallons of water. Very slow drilling.
415					Same as above (402 ft).	GP		Driller added 25 gallons of water.
420					Same as above (402 ft).			Kelly down @ 1606. End of 2/9/15. Resumed drilling @ 0930 on 2/10/15.



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 471.50  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well graded SAND (SW); brown (7.5YR 4/3); 100% very fine to very coarse sand; trace fine gravel; trace silt. Note: cuttings are wet due to driller adding water.			PID - 0.0 ppm @ cyclone and breathing zone.
425					Same as above (420 ft).			Driller added 25 gallons of water. Slow drilling.
430					Same as above (420 ft).			PID - 0.0 ppm @ cyclone and breathing zone. Driller added 50 gallons of water. Slow drilling.
435					Same as above (420 ft).	SW	High Solids Bentonite Grout	Cuttings are very wet from added water. Kelly down @ 1003. New 20' connection @ 1022.
440					Same as above (420 ft).			PID - 0.0 ppm @ cyclone and breathing zone.
445					Same as above (420 ft).			Driller added 25 gallons of water.
450								Driller added 25 gallons



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well graded SAND (SW); brown (7.5YR 4/3); 100% very fine to very coarse sand; trace fine gravel; trace silt. Note: cuttings are wet due to driller adding water.	SW	Top of Bentonite Seal	of water. PID - 0.0 ppm @ cyclone and breathing zone.
455					Poorly graded SAND with Silt (SP-SM); light reddish brown (5YR 6/4); 90% very fine to fine sand; trace gravel; 10% silt. Note: cuttings are very wet due to driller adding water.			Kelly down @ 1058. New 20' connection @ 1108.
460					Same as above (452 ft).	SP-SM		Driller added 25 gallons of water. PID - 0.0 ppm @ cyclone and breathing zone.
465					Same as above (452 ft).		- 5" Schedule 80 PVC Riser	Driller added 25 gallons of water.
470					Well graded SAND with Silt (SW-SM); pinkish gray (5YR 6/2); 90% fine to coarse sand; trace fine gravel; 10% silt.			
					▼ Same as above (467 ft).		- Top of Time Release Pellets	PID - 0.0 ppm @ cyclone and breathing zone.
475					Same as above (467 ft).	SW-SM		Kelly down @ 1152. New 20' connection @ 1212.
480					Poorly graded SAND with Silt (SP-SM); dark reddish gray (5YR 4/2); wet; 90% fine to medium sand; trace fine gravel;	SP-SM		



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 471.50  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					10% silt. Poorly graded SAND with Silt (SP-SM); dark reddish gray (5YR 4/2); wet; 90% fine to medium sand; trace fine gravel; 10% silt.	SP-SM		PID - 0.0 ppm @ cyclone and breathing zone.
485					Well graded SAND (SW); dark reddish gray (5YR 4/2); wet; 100% fine to coarse sand; trace silt.	SW	- Top of 20/40 Sand - Top of 10/20 Sand	No water added.
490					Well graded SAND with Silt (SW-SM); dark reddish gray (5YR 4/2); wet; 90% fine to coarse sand; trace fine gravel; 10% silt.	SW-SM	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	PID - 0.0 ppm @ cyclone and breathing zone.
495					Poorly graded SAND (SP); pink (5YR 7/4); wet; dense; 97% fine to medium sand; 3% silt.			
					Same as above (492 ft).			Kelly down @ 1317. New 20' connection @ 1327.
500					Same as above (492 ft).	SP		No water added.
505					Same as above (492 ft).		- Bottom of Screen	PID - 0.0 ppm @ cyclone and breathing zone.
							- Sump	Driller added 50 gallons of water.
510							- Bottom of Sump	



# Borehole ID: KAFB-106223

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 2/5/2015  
**Date TD Reached:** 2/10/2015  
**Date Completed:** 2/20/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 471.50  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.59

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 18 of 18

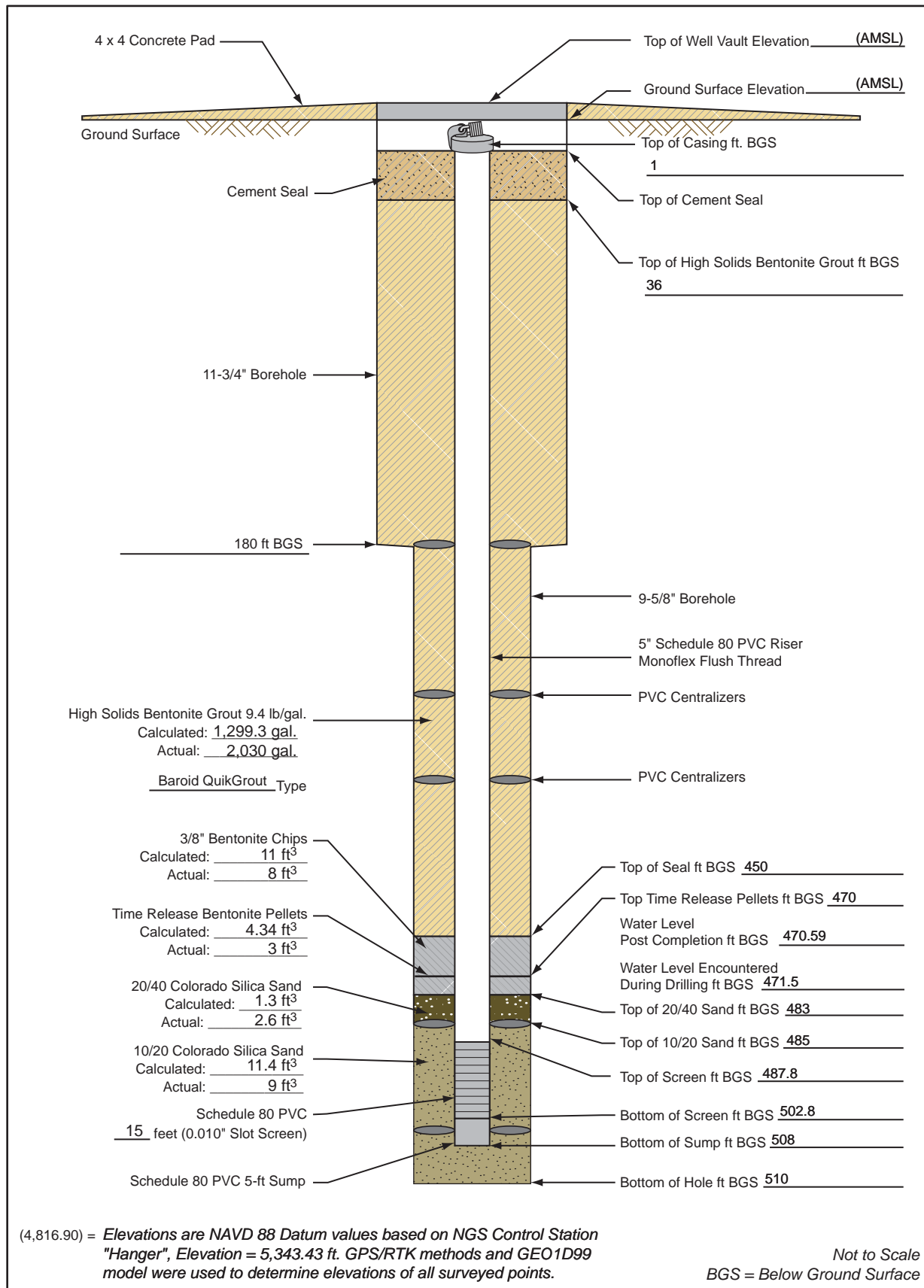
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Poorly graded SAND (SP); pink (5YR 7/4); wet; dense; 97% fine to medium sand; 3% silt.		Bottom of Filter Pack	PID - 0.0 ppm @ cyclone and breathing zone.
515					Same as above (510 ft).	SP	- Native Backfill	Driller added 25 gallons of water.
520								Total depth = 520 ft. Reached total depth @ 1447 on 2/10/15.
525								
530								
535								
540								

# Monitoring Well Completion Diagram KAFB-106223

Installation Start Date/Time: 2/5/2015 @ 1150

Installation End Date/Time: 2/17/2015

Surface Completion Date: 2/20/2015







## Well Development Record

**Project Name:** KAFB BFF
**Location:** Kentucky St.
**Personnel:** R. Wortman
**Date:** 2/26/15
**Samplers:** N/A
**Method of Development:**
☒ Surging

☒ Bailing

**Well/Piez. No.:** KAFB-106223
**Date Installed:** 2/17/15
**Csg. Diameter (I.D.):** 5 "
**Total Depth (ft. bgs):** 508
☒ Original Development

☐ Redevelopment

☒ Pumping

☐ Other

**Development Date:** 2/26/15, 3/2/15
**Depth to Water Before Developing Well (ft. btoc):** 470.59

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{1,087.41 \text{ gallons}}$$
**Depth Purging From:** 502.8 feet
**Time Purging Begins:** 1415, 2/26/15
**Weather:** Windy
**Screened Interval (ft bgs):** 487.8 - 502.8
**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q
**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐
**Describe:** Steam Cleaned
**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐
**Describe:** N/A
**Comment:** Approximately 1,050 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/26/2015	1002	469.98	0	--	--	--	--	Begin bailing.
2/26/2015	1009	469.98	0	--	--	--	--	Continue bailing. Water is dark brown.
2/26/2015	1040	--	100	17.43	7.23	0.494	>1000	Finish bailing and begin swabbing.
2/26/2015	1100	--	100	--	--	--	--	Swab first 5 feet of screen.
2/26/2015	1123	--	100	--	--	--	--	Continue swabbing next 5 feet of screen.
2/26/2015	1140	--	100	--	--	--	--	Continue swabbing last 5 feet of screen.
2/26/2015	1200	--	100	--	--	--	--	Finish swabbing. Set up bailer.
2/26/2015	1205	--	100	--	--	--	--	Begin bailing.
2/26/2015	1220	--	135	17.83	7.75	0.514	>1000	Continue bailing.
2/26/2015	1233	--	190	--	--	--	--	Finish bailing.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Siemens per Meter

**Where:**
 $B=3.14$ 
 $\phi_s$  = porosity of the sand pack

 $r_c$  = radius of the well casing and screen in feet

 $L_c$  = length of water column inside the casing and screen in feet

 $r_w$  = radius of the well bore in feet

 $L_s$  = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot = conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106223Project Number: 140705Samplers: N/ADate: 2/26/15

Checked By: \_\_\_\_\_

Time Start: 1002, 2/26/2015Time Finish: 1045, 3/2/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/26/2015	1257	--	190	--	--	--	--	Begin tripping in pipe.
2/26/2015	1409	470.01	190	--	--	--	--	Pump set at 501.8 feet.
2/26/2015	1415	470.61	200	16.73	7.83	0.526	>1000	Begin pumping at 4 GPM.
2/26/2015	1430	470.70	250	19.80	7.86	0.566	786	Continue pumping.
2/26/2015	1445	470.75	300	20.13	7.79	0.598	331	Continue pumping.
2/26/2015	1452	--	--	--	--	--	--	Stop pumping.
2/26/2015	1500	470.70	325	19.62	7.75	0.616	262	Resume pumping at 501.8 feet.
2/26/2015	1515	470.70	375	20.36	7.73	0.632	203	Continue pumping.
2/26/2015	1530	470.71	420	20.07	7.70	0.651	109	Continue pumping.
2/26/2015	1545	470.82	470	20.16	7.68	0.677	25.1	Continue pumping.
2/26/2015	1600	470.91	500	19.97	7.67	0.691	11.2	Continue pumping.
2/26/2015	1610	470.96	550	19.96	7.66	0.699	10.4	Continue pumping.
2/26/2015	1620	470.93	625	20.03	7.66	0.705	10.1	Continue pumping.
2/26/2015	1626	--	--	--	--	--	--	Stop pumping. End of day.

Was well sampled after development? YES NO X

Sample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106223Project Number: 140705Samplers: N/ADate: 2/26/15

Checked By: \_\_\_\_\_

Time Start: 1002, 2/26/2015Time Finish: 1045, 3/2/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
3/2/2015	0845	469.98	625	--	--	--	--	Set pump at 501.8 feet.
3/2/2015	0850	469.89	625	17.88	7.06	0.667	6.22	Begin pumping at 3.7 GPM.
3/2/2015	0900	469.86	665	19.71	7.67	0.683	1.47	Continue pumping.
3/2/2015	0910	469.89	695	20.00	7.66	0.696	0.59	Raise pump to 487.9 feet.
3/2/2015	0920	470.98	750	20.17	7.53	0.736	2.55	Continue pumping.
3/2/2015	0930	470.97	780	19.90	7.67	0.719	1.04	Continue pumping.
3/2/2015	0940	470.98	805	20.09	7.65	0.723	0.38	Lower pump to 495.4 feet.
3/2/2015	0955	470.99	870	20.11	7.65	0.728	0.68	Continue pumping.
3/2/2015	1005	470.97	925	20.18	7.64	0.732	0.98	Continue pumping.
3/2/2015	1015	470.95	955	20.09	7.64	0.733	0.72	Continue pumping.
3/2/2015	1035	470.94	1030	20.35	7.60	0.736	0.30	Continue pumping.
3/2/2015	1045	470.99	1075	20.24	7.59	0.739	0.76	Finish pumping. Well development complete.
3/2/2015	1050	--	--	--	--	--	--	Start to pull pump and break down equipment.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106224



Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 4/17/2015  
 Date TD Reached: 4/30/15  
 Date Completed: 5/22/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

**Borehole ID: KAFB-106224**

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: N/A  
 ▽ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

Drilling Contractor: National Drilling  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: T. Richards/ M. Giles



Page 1 of 25

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 7/16/15 08:56 - Z:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
					ASPHALT Road Base	SM		
5					Silty SAND with Gravel (SM); strong brown (7.5YR 4/6); 50% fine to coarse sand; 25% fine gravel; subrounded to rounded; 25% silt.		Top of Casing/Top of Cement Seal	Start Drilling @ 1030 on 4/17/15 with 11 3/4" OD casing.
					Silty GRAVEL with Sand (GM); slightly moist; 50% gravel to 3"; subangular to subrounded; gravel is mafics and sandstone; 25% fine to coarse sand; 25% silt	GM		
10					Well-graded SAND with Gravel (SW); 80% very fine to coarse sand; 20% fine gravel; subrounded to rounded.	SW		PID = 0.0 ppm @ cyclone and breathing zone.
15					Well-graded SAND (SW); strong brown (7.5YR 5/8); 90% fine to coarse sand; 10% fine gravel; rounded.			No Hammering. No water added down hole.
					Well-graded GRAVEL with Silt and Sand (GW-GM); yellowish red (5YR 5/6); 70% gravel to 3"; subrounded to rounded; gravel is mafics, sandstone, and quartz; 20% fine to medium sand; trace coarse sand; 10% silt.		-Cement Seal	Kelly down @ 1048, new 20' connection @ 1057.
20					Same as above (13 ft).	GW-GM		PID = 0.0 ppm @ cyclone and breathing zone.
25					Same as above (13 ft).			No hammering. No water added down hole.
30								



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well-graded GRAVEL with Silt and Sand (GW-GM); yellowish red (5YR 5/6); 70% gravel to 3"; subrounded to rounded; gravel is mafics, sandstone, and quartz; 20% fine to medium sand; trace coarse sand; 10% silt.			PID = 0.0 ppm @ cyclone and breathing zone. Hammering.
35					Same as above (30 ft).	GW-GM	- Cement Seal - Top of High Solids Bentonite Grout	No water added down hole.
40					Same as above (30 ft).			Kelly down @ 1124, new 20' connection @ 1133.
45					Poorly graded SAND (SP); yellowish red (5YR 4/6); 100% fine sand.	SP	- High Solids Bentonite Grout	PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
50					Same as above (43 ft).			Some hammering.
55					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); moist to dry; 75% very fine to very coarse sand; 20% fine gravel; subangular to subrounded; gravel is mafics and quartz; 5% silt.	SW		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. Some hammering.
60					Same as above (52 ft).			Kelly down @ 1154, new 20' connection @ 1202.





# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 3 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); moist to dry; 75% very fine to very coarse sand; 20% fine gravel; subangular to subrounded; gravel is mafics and quartz; 5% silt.			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
65					Same as above (60 ft).			
70					Same as above (60 ft).			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
75					Same as above (60 ft).	SW	High Solids Bentonite Grout	Hammeirng.  No water added down hole.  Kelly down @ 1222, new 20' connection @ 1230.
80					Same as above (60 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
85					Same as above (60 ft).			
90								



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 4 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); moist to dry; 75% very fine to very coarse sand; 20% fine gravel; subangular to subrounded; gravel is mafics and quartz; 5% silt.			PID = 0.0 ppm @ cyclone and breathing zone.
95					Same as above (90 ft).			Hammering.
100					Same as above (90 ft).			No water added down hole.
105					Same as above (90 ft).			Kelly down @ 1330, new 20' connection @ 1342.
110					Same as above (90 ft).	SW	High Solids Bentonite Grout	PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
115					Same as above (90 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
120					Same as above (90 ft).			Hammering.
								No water added down hole to this depth.
								Kelly down @ 1401, new 20' connection @ 1423.



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 5 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); moist to dry; 75% very fine to very coarse sand; 20% fine gravel; subangular to subrounded; gravel is mafics and quartz; 5% silt.			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
125					Same as above (120 ft).			Hammering.
130					Same as above (120 ft).	SW		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
135					Same as above (120 ft).		High Solids Bentonite Grout	Hammering. No water added down hole to this depth.
140					Same as above (120 ft).			Kelly down @ 1445, new 20' connection @ 1505.
145					Lean CLAY with Sand (CL); yellowish red (5YR 4/6); low plasticity; moist; 80% clay; 15% fine sand; 5% fine gravel; rounded.	CL		PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
150								



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 6 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Lean CLAY with Sand (CL); yellowish red (5YR 4/6); low plasticity; moist; 80% clay; 15% fine sand; 5% fine gravel; rounded.	CL		PID = 0.0 ppm @ cyclone and breathing zone.
155					SILT (ML); strong brown (7.5YR 4/6); moist; 90% silt; 10% fine sand.	ML		Hammering. No water added to this depth.
160					Same as above (153 ft).			Kelly down @ 1531, new 20' connection @ 1541.
165					Well-graded SAND with Silt (SW-SM); yellowish red (5YR 4/6); 90% very fine to coarse sand; trace fine gravel; rounded; 10% silt.	SW-SM	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
170					Poorly graded SAND (SP); moist; 90% very fine to fine sand; 5% fine gravel; rounded; 5% silt.	SP		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. Hammering.
175					Same as above (171 ft).			No water added down hole to this depth. Kelly down @ 1557, new 20' connection @ 1605.
180								



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 7 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); moist; 90% very fine to fine sand; 5% fine gravel; rounded; 5% silt.			PID = 0.0 ppm @ cyclone and breathing zone.
185					Same as above (180 ft).			Hammering.
190					Same as above (180 ft).			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
195					Same as above (180 ft).	SP	High Solids Bentonite Grout	No water added down hole to this depth.
200					Poorly graded SAND with Gravel (SP); strong brown (7.5YR 5/6); 65% fine to medium sand; trace coarse sand; 30% fine gravel; subangular to subrounded; gravel is mafics and feldspar; 5% silt.			Kelly down @ 1419, add added 10' connection to drive casing flush. Stop drilling for day on 4/17/15. Begin drilling with 9-5/8" OD casing at 1345 on 4/20/15.
205								
210					Poorly graded SAND (SP); pink (7.5YR 7/4); 100% fine sand.			



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

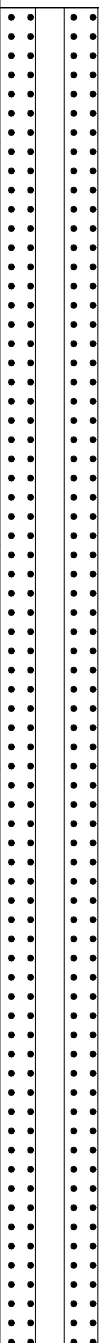
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 8 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND (SP); moist; 90% very fine to fine sand; 5% fine gravel; rounded; 5% silt. Poorly graded SAND (SP); pink (7.5YR 7/4); 100% fine sand.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
215					Lean CLAY with Sand (CL); reddish brown (5YR 5/3); nonplastic to low plasticity; 85% clay; 15% fine sand.	CL		Kelly down @ 1405, new 20' connection.
220								PID = 0.0 ppm @ cyclone and breathing zone.
225					Poorly graded SAND (SP); brown (7.5YR 5/4); 100% fine sand; trace medium sand.	SP		
230					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 85% fine to coarse sand; 15% fine gravel; subangular to subrounded; gravel is mafics, quartz, and feldspar.	SW		
235					Same as above (227 ft).			Kelly down @ 1430, new 20' connection @ 1436.
240								Hammering.





# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 9 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 85% fine to coarse sand; 15% fine gravel; subangular to subrounded; gravel is mafics, quartz, and feldspar.			Hammering.
245					Same as above (240 ft).			
250					Same as above (240 ft).			
255					Same as above (240 ft).	SW		
260					Same as above (240 ft).		High Solids Bentonite Grout	
265					Poorly graded GRAVEL (GP); pale yellow (5Y 8/4); 85% fine gravel to 1/2"; subangular to subrounded; gravel is mafics, quartzite, and granite; 10% fine sand; sand is quartz and biotite; 5% silt.	GP		Kelly down @ 1500, new 20' connection @ 1506.
270								



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 10 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270								
275					Well-graded SAND with Gravel (SW); pale yellow (5Y 8/4); 60% fine to coarse sand; subrounded; sand is quartz and mafics; 35% fine gravel to 3/4"; angular to subrounded; gravel is mafics and sandstone; 5% silt.	SW		
280					Poorly graded SAND with Silt (SP-SM); pale yellow (5Y 8/4); 85% fine sand; trace medium and coarse sand; sand is quartz; 5% fine gravel; subrounded; gravel is mafics; 10% silt.			
285					Same as above (275 ft).	SP-SM		
290					Same as above (275 ft).			
295					Same as above (275 ft).			
300					Poorly graded SAND (SP); light yellowish brown (2.5YR 6/3); 90% fine and coarse sand; trace medium sand; subangular; fine sand is quartz; coarse sand is mafics and granite; 5% fine gravel to 3/8"; gravel is mafics and granite; 5% silt.	SP		



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** N/A  
▼ **At End of Drilling:** Not Recorded  
▼ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 11 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded SAND (SP); light yellowish brown (2.5Y 6/4); 95% fine sand; subangular; sand is quartz; 5% silt.			
305					Same as above (300 ft).			
310					Same as above (300 ft).			
315					Same as above (300 ft); trace coarse sand; sand is quartzite and mafics.	SP	High Solids Bentonite Grout	
320					Same as above (300 ft).			
325					Same as above (300 ft).			
330								



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 12 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330								
335					Poorly graded SAND with Gravel (SP); light yellowish brown (2.5Y 6/3); 65% fine sand; trace medium and coarse sand; subangular; sand is quartz; 30% fine gravel to 3/4"; subrounded; gravel is mafics and quartzite; 5% silt.	SP		
340					Poorly graded GRAVEL with Sand (GP); light yellowish brown (2.5Y 6/4); 70% fine gravel to 1/2"; angular to subangular; gravel is mafics, granite, and quartzite; 25% fine sand; subangular; sand is quartz; 5% silt.	GP		
345					Poorly graded SAND with Gravel (SP); light yellowish brown (2.5Y 6/4); 55% fine sand; subangular; sand is quartz; 40% gravel; angular to subrounded; flat to elongated shape; gravel is mafics; 5% silt.			
350					Poorly graded SAND (SP); light yellowish brown (2.5Y 6/4); 95% fine to medium sand; subangular; sand is quartz; 5% silt.			
355					Same as above (345 ft).	SP		
360					Same as above (345 ft).			

- High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 13 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360								
365					Poorly graded SAND with Gravel (SP); pale yellow (2.5Y 8/4); 50% fine sand; subangular; fine sand is quartz; trace coarse sand; subangular to subrounded; coarse sand is mafics; 45% fine gravel to 1/2"; subangular to subrounded; gravel is mafics and granite; 5% silt.			
370					Poorly graded SAND with Gravel (SP); light yellowish brown (2.5Y 6/3); 80% medium sand; trace fine and coarse sand; angular to subangular; sand is quartz, mafics, and granite; 15% gravel; angular to subrounded; gravel is quartzite and mafics; 5% silt.			
375					Poorly graded SAND (SP); light yellowish brown (2.5Y 6/3); 95% fine to medium sand; trace coarse sand; subangular; sand is quartz, quartzite, and granite; 5% fine gravel to 3/8"; gravel is quartz and granite; 5% silt.	SP		
380					Poorly graded SAND with Gravel (SP); brown (10YR 5/3); 60% fine sand; trace medium and coarse sand; subangular to subrounded; sand is quartz, mafics, and granite; 35% fine gravel to 3/8"; gravel is mafics, quartzite, and granite; 5% silt.			
385					Same as above (375 ft).			
390					Well-graded SAND (SW); light brownish gray (10YR 6/2); 95% fine to coarse sand; subangular to subrounded; sand is quartz, mafics, and granite; 5% silt.	SW		

- High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 14 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Poorly graded GRAVEL with Sand (GP); light brownish gray (10YR 6/2); 80% fine gravel to 1/2"; subangular; gravel is mafics, granite, and quartzite; 15% fine to coarse sand; subangular; sand is quartz; 5% silt.			
395					Same as above (390 ft).	GP		
400					Poorly graded SAND with Gravel (SP); light brownish gray (10YR 6/2); 60% fine sand; trace coarse sand; subangular; sand is quartz, quartzite, and mafics; 35% fine gravel to 3/8"; subangular to subrounded; gravel is mafics and granite; 5% silt.			
405					Same as above (400 ft); very pale brown (10YR 7/3); 35% coarse gravel; subrounded.			
410					Poorly graded SAND with Gravel (SP); pale yellow (2.5Y 7/4); 80% fine sand; trace medium and coarse sand; sand is quartz and mafics; 15% fine gravel to 3/4"; gravel is mafics and quartzite; 5% silt.	SP		
415					Same as above (410 ft).			
420								

- High Solids  
Bentonite  
Grout





# Borehole ID: KAFB-106224

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** N/A  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards/ M. Giles

Page 15 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND with Gravel (SP); pale yellow (2.5Y 7/4); 80% fine sand; trace medium and coarse sand; sand is quartz and mafics; 15% fine gravel to 3/4"; gravel is mafics and quartzite; 5% silt.			
425					Same as above (420 ft); 75% fine sand; trace medium and coarse sand; 20% fine gravel to 3/4".			
430					Same as above (420 ft).	SP		
435					Same as above (420 ft).			
440								
445					SILT (ML); reddish yellow (7.5YR 6/6); hard; 100% silt.	ML		
					Poorly graded SAND (SP); pink (7.5YR 8/4); 95% fine sand; subangular; sand is quartz; 5% silt.	SP		
450								End of ARCH drilling @ 450 ft.



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 16 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					No Recovery.			Begin Sonic coring @ 450 ft.
					Clayey SAND (SC); brown (7.5YR 5/4); dry; dense; 60% fine sand; trace fine gravel; 40% clay.	SC		@ 451.5 ft clay is in lenses.
					Silty SAND (SM); brown (7.5YR 5/4); dry; dense; 80% fine sand; 5% fine gravel; 10% silt; 5% clay.	SM		
455					Clayey SAND (SC); brown (7.5YR 5/4); dry; dense; 70% fine sand; 10% fine to coarse gravel to 3 cm; subangular to subrounded; 10% clay; 10% silt.	SC		@ 454.5 ft gravel is sandstone and mafics.
					Silty SAND (SM); brown (7.5YR 5/4); dry; dense; 80% fine sand; 5% coarse gravel to 3 cm; angular to subrounded; 15% silt.	SM		@ 456 ft gravel is quartzite and mafics.
					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); dry; dense; 75% fine to coarse sand; 20% fine to coarse gravel to 3 cm; angular to subrounded; 5% silt.	SW		@ 459 ft gravel is quartzite, mafics, and sandstone.
460					Silty SAND (SM); brown (7.5YR 5/4); dry; very dense; 85% fine to medium sand; 15% silt.	SM		@ 460 to 465 ft, 30 gallons of water added.
					Poorly graded SAND (SP); brown (7.5YR 4/3); moist; loose; 90% fine to medium sand; trace coarse sand; 5% fine gravel; 5% silt; trace clay.	SP		
					@ 462.5 ft. Same as above (460 ft); 95% fine to medium sand; 5% silt.			
					@ 464.4 ft. See description on next page.	SM		@ 463.5 ft, soil is wet.
465								



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 17 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
465					Silty SAND (SM); brown (7.5YR 4/3); wet; loose; 85% fine to medium sand; 15% silt.	SM		
					Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 100% fine to medium sand.	SP		
470					Silty SAND with Gravel (SM); brown (7.5YR 4/3); wet; medium dense; 65% fine to medium sand; trace coarse sand; 15% fine gravel to 1.5 cm; subangular to subrounded; 20% silt.	SM		@ 469 ft gravel is quartzite and mafics.
					Well-graded SAND with Gravel (SW); brown (7.5YR 5/3); wet; loose; 75% fine to coarse sand; 20% fine to coarse gravel to 4 cm; subrounded; 5% silt.	SW		@ 470 ft gravel is quartzite and granite.
					Clayey GRAVEL with Sand (GC); brown (7.5YR 5/3); wet; medium dense; 55% fine to coarse gravel to 8 cm; subangular to subrounded; 30% fine to coarse sand; 10% clay; 5% silt.	GC		@ 471.8 ft gravel is quartzite, granite, and mafics.
475					Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 95% fine sand; 5% silt.			
					@ 476.3 ft. Same as above (474.5 ft); 95% fine to medium sand. @ 476.9 ft. Same as above (474.5 ft).	SP		
480								



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 18 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 95% fine sand; 5% silt.  Same as above (480 ft); 95% fine to medium sand.	SP		
					Poorly graded SAND with Clay (SP-SC); brown (7.5YR 4/2); wet; loose; 90% fine sand; 10% clay.	SP-SC		
485					Poorly graded SAND (SP); brown (7.5YR 4/2); wet; loose; 95% fine sand; 5% silt. @ 485.9 ft. Same as above (485 ft); 95% fine to medium sand; trace coarse sand. @ 486.5 ft. Same as above (485 ft); trace medium sand.	SP		
					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); wet; loose; 75% fine to coarse sand; 20% fine to coarse gravel to 3 cm; subangular to subrounded; 5% silt.	SW		@ 488.2 ft gravel is mafics and quartzite.
490					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); wet; loose; 80% fine sand; 15% fine to coarse gravel to 3 cm; subrounded; 5% silt. @ 490.5 ft. Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 95% fine sand; trace medium sand; 5% silt.	SP		@ 489.6 ft gravel is mafics and quartzite.
495								



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495					Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 95% fine sand; trace medium sand; 5% silt.	SP		<p>@ 500.6 ft gravel is quartzite and sandstone.</p> <p>@ 506 ft gravel is quartzite.</p>
					Poorly graded SAND with Clay (SP-SC); brown (7.5YR 4/3); wet; loose; 90% fine sand; trace medium sand; 10% clay.	SP-SC		
					Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 95% fine sand; trace medium sand; 5% clay.	SP		
					Poorly graded SAND with Clay (SP-SC); brown (7.5YR 4/3); wet; loose; 90% fine to medium sand; 10% clay.	SP-SC		
500					Clayey SAND with Gravel (SC); brown (7.5YR 4/3); wet; medium dense; 40% fine to coarse sand; 30% fine to coarse gravel to 4 cm; angular to subrounded; 30% clay. @ 501.7 ft. Clayey SAND (SC); brown (7.5YR 4/2); wet; loose; 80% fine sand; 20% clay.	SC		
					Poorly graded SAND (SP); brown (7.5YR 4/2); wet; loose; 95% fine to medium sand; 5% clay.	SP		
					Sandy CLAY (CL); reddish brown (5YR 4/3); wet; stiff; nonplastic to low plasticity; 50% clay; 40% fine to coarse sand; 10% fine gravel to 1.5 cm.	CL		
					Clayey SAND (SC); brown (7.5YR 4/2); wet; medium dense; 75% fine to medium sand; trace coarse sand; 25% clay. @ 505.5 ft. Same as above (505 ft); 55% fine to medium sand; 45% clay.	CL		
						SP		
					Sandy lean CLAY (CL); brown (7.5YR 4/2); wet; stiff; nonplastic to low plasticity; 60% clay; 30% fine to coarse sand; 10% fine gravel to 2 cm; subrounded.	SC		
510					Poorly graded SAND (SP); brown			



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 20 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					(7.5YR 4/2); wet; loose; 95% fine sand; 5% clay. @ 507.5 ft. Clayey SAND (SC); brown (7.5YR 4/3); wet; loose; 80% fine sand; 20% clay. Poorly graded SAND with Clay (SP-SC); 90% fine to medium sand; trace fine gravel; 10% clay. Silty SAND (SM); brown (7.5YR 4/3); wet; medium dense; 70% fine sand; 25% silt; 5% clay.	SP-SC		
515					Same as above (512 ft); 80% fine sand; trace medium sand; 15% silt. @ 515.7 ft. Same as above (512 ft); 85% fine sand; 15% silt.	SM		
					Poorly graded SAND with Silt (SP-SM); wet; loose; 90% fine sand; trace medium sand; 10% silt.	SP-SM		
					@ 518.5 ft. Same as above (517 ft); brown (7.5YR 4/3); 90% fine to medium sand; trace fine gravel.			@ 519 ft gravel is mafics and quartzite.
520					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); wet; loose; 75% fine to medium sand; 25% fine to coarse gravel to 3 cm; angular to subrounded	SP		
					Clayey GRAVEL with Sand (GC); brown (7.5YR 4/3); wet; medium dense; 50% fine to coarse gravel to 4.5 cm; angular to subrounded; 30% fine to coarse sand; 20% clay.	GC		@ 520.5 ft gravel is quartzite, sandstone, and mafics.
					Sandy lean CLAY with Gravel (CL); brown (7.5YR 4/3); stiff; nonplastic; 40% clay; 30% fine to medium sand; 30% fine to coarse gravel to 3 cm; subangular to subrounded.	CL		@ 522 ft gravel is quartzite, mafics, and sandstone.
525								





# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 21 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
525					Poorly graded SAND with Clay (SP-SC); brown (7.5YR 4/3); wet; loose; 85% fine to medium sand; 5% fine gravel to 1.9 cm; subrounded; 10% clay.	SP-SC		@ 526 ft gravel is mafics, granite, and quartzite.
					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); wet; loose; 80% fine to medium sand; 15% fine to coarse gravel to 3 cm; angular to subrounded; 5% clay.	SP		
					Poorly graded SAND with Clay (SP-SC); brown (7.5YR 4/3); wet; loose; 80% fine to medium sand; 10% fine to coarse gravel to 4 cm; subangular to subrounded; 10% clay.	SP-SC		@ 528 ft gravel is mafics and quartzite.
530					@ 529.5 ft. Same as above (528 ft); 90% fine sand; trace medium sand; no gravel.			
					Clayey SAND with Gravel (SC); brown (7.5YR 4/3); wet; dense; 40% fine to coarse sand; 30% fine to coarse gravel to 3 cm; subangular to subrounded; 30% clay.	SC	- Bentonite Seal	@ 530.5 ft gravel is mafics and quartzite.
535					Same as above (530.5 ft); medium dense; 45% fine to coarse sand; 40% fine to coarse gravel to 4 cm; 15% clay.			
					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); wet; loose; 65% fine to medium sand; 30% fine to coarse gravel to 2.5 cm; angular to subrounded; 5% clay.	SP		@ 537 ft gravel is mafics and quartzite.
					@ 538.3 ft. See description on next page.	SC		
540							- Top of 20/40 Sand	



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 22 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					@ 538.3 ft. Clayey SAND with Gravel (SC); brown (7.5YR 4/3); wet; medium dense; 45% fine to coarse sand; 40% fine to coarse gravel to 7 cm; subangular to subrounded; 10% clay; 5% silt.	SC		
					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); wet; loose; 80% fine to medium sand; trace coarse sand; 15% fine to coarse gravel to 6 cm; subangular to subrounded; 5% clay.	SP	- Top of 10/20 Sand	@ 541.9 ft gravel is mafics and quartzite.
545					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); wet; loose; 80% fine to coarse sand; 15% fine to coarse gravel to 3 cm; subrounded; 5% clay.	SW		@ 545.4 ft gravel is mafics and quartzite.
					Sandy lean CLAY (CL); grayish brown (10YR 5.2); wet; stiff; low plasticity; 80% clay; 20% fine sand.	CL		@ 546.5 ft gravel is quartzite and mafics.
					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); wet; loose; 55% fine to coarse sand; 40% fine to coarse gravel to 4 cm; angular to subrounded; 5% clay.	SW		
					Poorly graded SAND (SP); brown (7.5YR 4/3); 90% fine to medium sand; 5% fine gravel; 5% silt.	SP		
550					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); wet; medium dense; 55% fine to coarse sand; 40% fine to coarse gravel to 4 cm; subrounded; 5% silt.	SW		@ 551 ft gravel is mafics and quartzite.
					Clayey SAND with Gravel (SC); brown (7.5YR 4/3); wet; medium dense; 50% fine to coarse sand; 30% fine to coarse gravel to 7 cm; angular to subrounded; 20% clay.	SC		
555								



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: N/A  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 23 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
555					Clayey SAND with Gravel (SC); brown (7.5YR 4/3); wet; medium dense; 50% fine to coarse sand; 30% fine to coarse gravel to 7 cm; angular to subrounded; 20% clay.	SC		@ 555 ft gravel is mafics and quartzite.
					Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 95% fine to medium sand; trace fine gravel; 5% clay.	SP		
					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/3); wet; medium dense; 60% fine to coarse sand; 30% fine to coarse gravel to 5 cm; angular to subrounded; 10% silt.	SW-SM		@ 557.5 ft gravel is mafics, quartzite, and sandstone.
560					Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 95% fine sand; trace medium sand; 5% silt.	SP		
					@ 560.8 ft. Poorly graded SAND with Gravel (SP); brown (7.5YR 5/3); 75% fine sand; trace medium and coarse sand; 20% fine to coarse gravel to 5 cm; subangular to subrounded; 5% clay.			@ 560.8 ft gravel is mafics, quartzite, and granite. @ 561.8 ft gravel is mafics, granite, and quartzite.
					Well-graded SAND with Clay and Gravel (SW-SC); brown (7.5YR 5/3); wet; loose; 70% fine to coarse sand; 20% fine to coarse gravel to 3.5 cm; angular to subrounded; 10% clay.	SW-SC		
565								
					Clayey SAND with Gravel (SC); brown (7.5YR 5/3); wet; medium dense; 60% fine to coarse sand; 20% fine to coarse gravel to 3 cm; angular to subrounded; 20% clay.	SC		@ 566 ft gravel is quartzite and mafics.
					Sandy lean CLAY (CL); brown (7.5YR 5/3); wet; hard; nonplastic to low plasticity; 80% clay; 20% fine to medium sand. Note: sand is a lense.	CL		
					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/3); wet; medium dense; 80% fine to coarse sand; 10% fine to	SW-SM		@ 568.7 ft gravel is mafics and quartzite.
570								



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

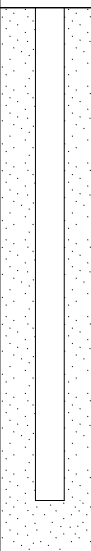
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** N/A  
▼ **At End of Drilling:** Not Recorded  
▼ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 24 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
570					coarse gravel to 3 cm; subrounded; 10% silt. End of continuous coring. No lithologic descriptions.			End continuous coring @ 570 ft on 4/30/15.
575								
580								
585								



# Borehole ID: KAFB-106224-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/17/2015  
**Date TD Reached:** 4/30/15  
**Date Completed:** 5/22/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** N/A  
▼ **At End of Drilling:** Not Recorded  
▼ **After Drilling:** 470.42

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 25 of 25

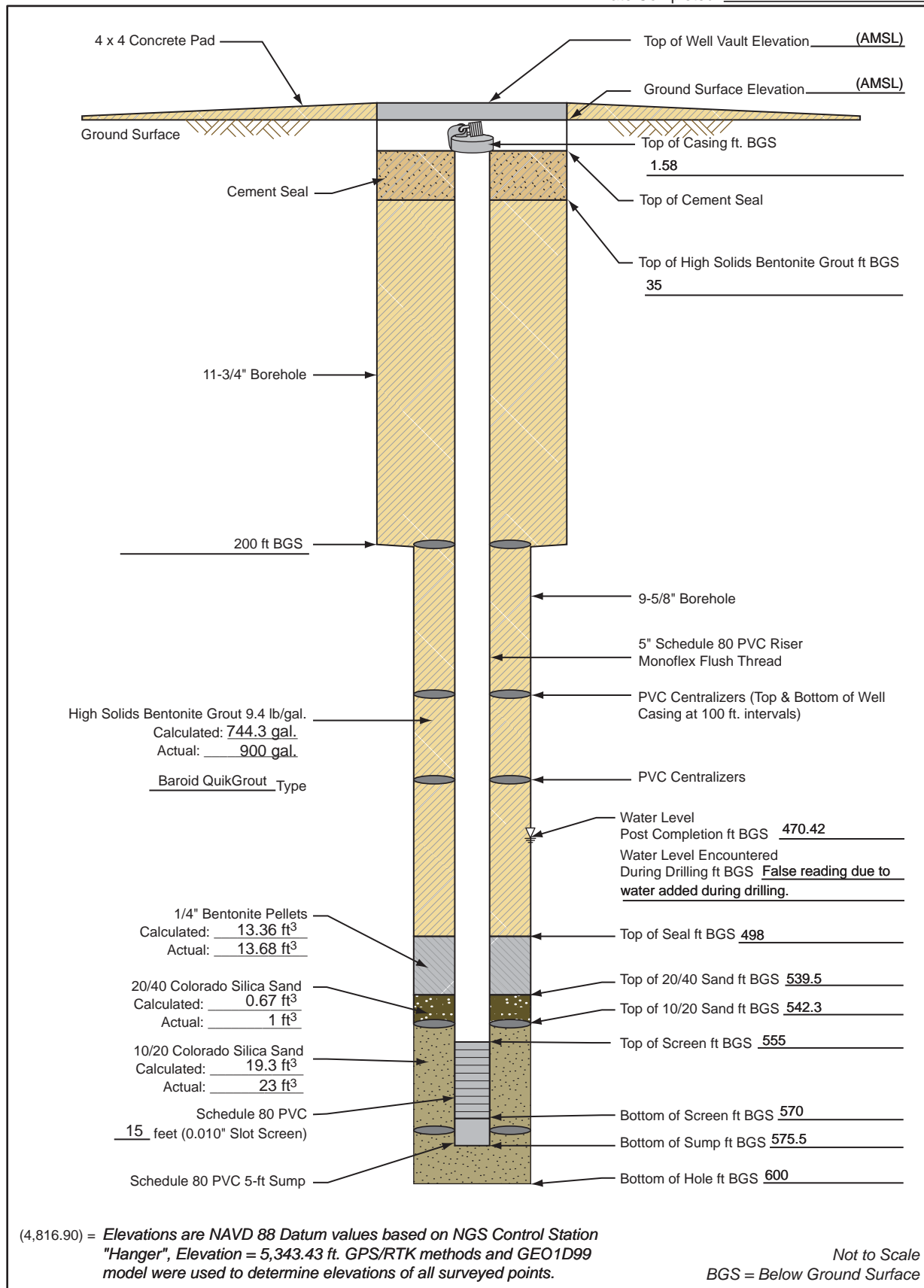
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
585								
590								
595								
600							Bottom of Filter Pack/ Bottom of hole.	

# Monitoring Well Completion Diagram KAFB-106224

Installation Start Date/Time: 5/14/2015

Installation End Date/Time: 5/15/2015

Date Completed: 5/22/2015







## Well Development Record

**Project Name:** KAFB BFF**Location:** Kentucky St.**Personnel:** R. Wortman**Date:** 5-20-15**Samplers:** N/A**Method of Development:**☒ Surging☒ Bailing**Well/Piez. No.:** KAFB-106224**Date Installed:** 2/17/15**Csg. Diameter (I.D.):** 5 "**Total Depth (ft. bgs):** 575.5☒ Original Development☐ Redevelopment☒ Pumping☐ Other**Development Date:** 5/20/15 - 5/22/15**Depth to Water Before Developing Well (ft. btoc):** 470.42**V=(B \* r<sub>c</sub><sup>2</sup> \* L<sub>c</sub> \* 7.48)+(B \* (r<sub>w</sub><sup>2</sup> - r<sub>c</sub><sup>2</sup>) \* L<sub>s</sub> \* Ø<sub>s</sub> \* 7.48)+(H<sub>2</sub>O added during drilling/installation) =** 240 gallons**Depth Purging From:** 569 feet**Time Purging Begins:** 1537, 5/21/15**Weather:** Clear, Sunny**Screened Interval (ft bgs):** 555 - 570**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q**Equipment Decontaminated Prior to Development:** Y X N **Describe:** Steam Cleaned**Collected Sample of Water Added to Well:** Y  N X**Describe:** N/A**Comment:** Approximately 100 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/20/2015	1355	470.42	0	--	--	--	--	Set up bailer.
5/20/2015	1420	--	0	--	--	--	--	Begin bailing.
5/20/2015	1435	--	55	--	--	--	>1,000	Finish bailing.
5/20/2015	1453	--	55	--	--	--	--	Begin swabbing top 5 feet of screen.
5/20/2015	1513	--	55	--	--	--	--	Move swab to middle section of screen.
5/20/2015	1523	--	55	--	--	--	--	Stop swabbing.
5/20/2015	1604	--	55	--	--	--	--	Continue swabbing middle section.
5/20/2015	1614	--	55	--	--	--	--	Swab bottom 5 feet of screen.
5/20/2015	1635	--	55	--	--	--	--	Stop swabbing.
5/20/2015	1640	--	55	--	--	--	--	Swab came off of cable.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Seimens per Meter

**Where:**

B=3.14

Ø<sub>s</sub>= porosity of the sand packr<sub>c</sub>= radius of the well casing and screen in feetL<sub>c</sub>= length of water column inside the casing and screen in feetr<sub>w</sub>= radius of the well bore in feetL<sub>s</sub>= length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106224Project Number: 140705Samplers: N/ADate: 5/20/15 - 5/22/2015

Checked By: \_\_\_\_\_

Time Start: 1537, 5/21/2015Time Finish: 0945, 5/22/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/20/2015	1730	--	55	--	--	--	--	End of 5/20/15.
5/21/2015	1100	--	55	--	--	--	--	Swabber removed from hole.
5/21/2015	1115	--	55	--	--	--	--	Swab bottom 5 feet of screen.
5/21/2015	1140	--	55	--	--	--	--	Finish swabbing.
5/21/2015	1143	--	55	--	--	--	--	Begin bailing.
5/21/2015	1150	--	65	21.58	7.73	0.563	>1,000	Continue bailing; water is brown.
5/21/2015	1212	--	110	19.35	7.18	0.526	>1,000	Continue bailing; water is brown.
5/21/2015	1226	--	165	19.47	7.24	0.526	>1,000	Continue bailing; water is brown.
5/21/2015	1230	--	170	--	--	--	--	Finish bailing.
5/21/2015	1525	469.83	170	--	--	--	--	Pump set @ 569 feet bgs.
5/21/2015	1537	469.83	170	--	--	--	--	Start pump @ 4 gpm.
5/21/2015	1546	NR	180	19.16	7.31	0.489	>1,000	Continue pumping; water is brown.
5/21/2015	1554	470.73	230	19.38	7.30	0.467	299	Continue pumping; water is cloudy.
5/21/2015	1600	470.80	260	19.49	7.36	0.457	164.00	Continue pumping; water is cloudy.

Was well sampled after development? YES ☐ NO ☒Sample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFF

Well No: KAFB-106224

Project Number: 140705

Samplers: N/A

Date: 5/20/15 - 5/22/15

Checked By:

Time Start: 1537, 5/21/2015

Time Finish: 0945, 5/22/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/21/2015	1610	--	300	--	--	--	--	Shutdown due to high winds.
5/22/2015	0837	469.83	300	--	--	--	--	Begin pump @ 4 gpm.
5/22/2015	0845	470.69	335	18.90	7.22	0.463	49.5	Continue pumping; water is cloudy.
5/22/2015	0850	470.69	360	19.19	7.35	0.443	12.5	Continue pumping; water is fairly cloudy.
5/22/2015	0855	470.69	383	19.34	7.45	0.441	2.90	Continue pumping; water is clear.
5/22/2015	0900	470.78	405	19.46	7.52	0.439	1.84	Continue pumping; water is clear.
5/22/2015	0905	470.67	430	19.50	7.60	0.434	1.41	Continue pumping; water is clear.
5/22/2015	0908	--	444	--	--	--	--	Move pump up to 555 feet bgs.
5/22/2015	0910	470.67	455	19.38	7.64	0.432	1.38	Continue pumping; water is clear.
5/22/2015	0915	470.73	460	19.39	7.62	0.478	2.54	Continue pumping; water is clear.
5/22/2015	0920	470.71	495	19.44	7.59	0.430	3.14	Lower pump; water is clear.
5/22/2015	0925	470.68	520	19.50	7.64	0.426	1.30	Pump set @ 562 feet bgs.
5/22/2015	0935	470.69	555	19.43	7.67	0.422	4.08	Continue pumping; water is clear.
5/22/2015	0945	470.69	630	19.51	7.72	0.42	1.33	Pump off; water is clear. Development complete.

Was well sampled after development? YES NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106225



# Borehole ID: KAFB-106225

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 12/11/2014  
 Date TD Reached: 12/17/2014  
 Date Completed: 1/16/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ∇ At Time of Drilling: 462.00  
 ∇ At End of Drilling: 464.98  
 ∇ After Drilling: 463.61

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: T. Richards



Page 1 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
					Road base. Silty SAND (SM); yellow (10YR 7/6); dry; soft; loose; cohesive; 70% fine sand; 15% silt; 5% clay; 10% gravel; subrounded; no odor; no staining.	ASPHALT		
5					Well graded GRAVEL with Silt and Sand (GW-GM); very pale brown (10YR 7/4); dry; loose; slightly cohesive; 70% fine to coarse gravel to 0.4'; subrounded; 20% fine sand; 10% silt. Note: gravel is quartzite and sandstone	SM		Hand augered to 9'. No headspace requirement at this location. Multiple close underground utilities. Spud well at 1527 on 12/11/14.
10					Same as above (3 ft).	GW-GM		PID - 0.0 ppm @ Cyclone and breathing zone.
15					Silty GRAVEL with Sand (GM); strong brown (7.5YR 5/6); dry; loose; cohesive; 50% gravel; 35% fine sand; 15% silt.	GM		Kelly down. New 20' connection.
20					Well graded GRAVEL with Sand (GW); very pale brown (10YR 7/4); dry; loose; slightly cohesive; 70% fine to coarse gravel; 30% fine sand.			PID - 0.0 ppm @ Cyclone and breathing zone.
25					Same as above (20 ft). Some obsidian seen.	GW		
30								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 2 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
					Well graded GRAVEL with Sand (GW); very pale brown (10YR 7/4); dry; loose; slightly cohesive; 70% fine to coarse gravel; 30% fine sand.	GW	Top of High Solids Bentonite Grout	PID - 0.0 ppm @ cyclone and breathing zone.
35					Poorly graded GRAVEL with Sand (GP); pinkish gray (7.5YR 7/2); dry; loose; slightly cohesive; 80% gravel; 20% fine sand.	GP		
					Well graded GRAVEL with Silt and Sand (GW-GM); very pale brown (10YR 7/4); dry; loose; slightly cohesive; 70% fine to coarse gravel; subrounded; 20% fine sand; 10% silt. Note: gravel is quartzite and sandstone.			Kelly down @ 1553. New 20' connection @ 1603.
40					Same as above (35 ft).			PID - 0.0 ppm @ Cyclone and breathing zone.
					Same as above (35 ft).			
45								
					Same as above (35 ft).		High Solids Bentonite Grout	
50						GW-GM		PID - 0.0 ppm @ Cyclone and breathing zone.
					Same as above (35 ft).			
55								
					Same as above (35 ft).			Kelly down @ 1615. New connection. Stop drilling for day.
60								





# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well graded GRAVEL with Silt and Sand (GW-GM); very pale brown (10YR 7/4); dry; loose; slightly cohesive; 70% fine to coarse gravel; subrounded; 20% fine sand; 10% silt. Note: gravel is quartzite and sandstone.	GW-GM		PID - 0.0 ppm @ Cyclone and breathing zone. Begin drilling @ 0900 on 12/12/14.
65					Same as above (60 ft).			
70					Clayey GRAVEL (GC); brown (7.5YR 5/4); soft; cohesive; sticky to slightly loose; 60% well to poorly graded coarse gravel; 20% clay; 20% silt.	GC		Added 200 gallons of water while drilling at 67' to lift cuttings. PID - 0.0 ppm @ Cyclone and breathing zone.
75					Poorly graded GRAVEL (GP); light brown (7.5YR 6/3); soft; loose; 90% medium to coarse gravel; 10% medium to coarse sand.	GP		
80					Well graded GRAVEL with Silt and Sand (GW-GM); strong brown (7.5YR 5.8); loose; soft; slightly cohesive; 70% fine to coarse gravel; subrounded to subangular; 20% fine sand; 10% silt. Note: gravel is quartzite and sandstone.	GW-GM	High Solids Bentonite Grout	
85					Poorly graded SAND with Silt (SP); strong brown (7.5YR 4/6); soft; loose; slightly cohesive; 90% medium to fine sand; 10% silt.	SP-SM		Kelly down @ 0920. 20' connection @ 0950. (change top seal on hammer). PID = 0.0 ppm @ Cyclone and breathing zone.
90					Same as above (80 ft).			



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 5/3); dry; loose; noncohesive; 70% fine gravel; 30% medium to fine sand. Note: gravel is quartz.	GP		PID - 0.0 ppm @ Cyclone and breathing zone.
100					Poorly graded SAND (SP); reddish yellow (7.5YR 7/6); dense; slightly cohesive; 70% fine and 30% medium sand.	SP		
105					Poorly graded GRAVEL with Sand (GP); strong brown (7.5YR 4/6); loose; soft; non to slightly cohesive; 70% fine gravel; 30% medium to coarse sand.			
110					Same as above (100 ft).	GP	High Solids Bentonite Grout	Hard drilling. Kelly down at 1010. Dump hopper and change whip check. New connection 20'. Start drilling at 1030. PID 0.1 ppm at Cyclone. 0.0 ppm at breathing zone.
115					Same as above (100 ft).			
120					Lean CLAY with Sand (CL); reddish brown; soft to firm; cohesive; 80% clay; 15% fine to coarse sand; 5% fine gravel.	CL		PID = 0.2 ppm @ Cyclone. 0.0 ppm @ breathing zone.



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY with Sand (CL); reddish brown; soft to firm; cohesive; 80% clay; 15% fine to coarse sand; 5% fine gravel.			Kelly down @ 1057. New 20' connection @ 1107. PID = 0.1 ppm @ Cyclone and 0.0 ppm @ breathing zone.
125					Same as above (120 ft).	CL		
130					Lean CLAY (CL); pink (5YR 7/3); soft to firm; low to medium plasticity; 98% clay; 2% fine gravel.			PID = 0.0 ppm @ Cyclone and breathing zone.
135					Same as above (130 ft).	CL	High Solids Bentonite Grout	Added 100 gallons of water, stiff drilling.
140					Poorly graded SAND with Silt (SP-SM); pink (5YR 7/3); soft; 90% fine sand, 10% silt; noncohesive.			Kelly down @ 1130. New 20' connection @ 1150. PID = 0.0 ppm @ Cyclone and in breathing zone.
145					Same as above (140 ft).	SP-SM		
150								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 6 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Poorly graded SAND with Silt (SP-SM); pink (5YR 7/3); soft; 90% fine sand, 10% silt; noncohesive.	SP-SM		PID = 0.0 ppm @ Cyclone and breathing zone.
155					Silty GRAVEL (GM); dark reddish brown (5YR 3/4); soft; loose; non cohesive; 90% fine to coarse gravel, subrounded to subangular; 5% silt; 5% clay. Note: gravel is quartz, feldspar and sandstone.			50 gallons of water added to lift.
160					Same as above (155 ft).			Kelly down @ 1202. New 20' connection @ 1221.
165					Same as above (155 ft).	GM	High Solids Bentonite Grout	50 gallons of water added.
170					Same as above (155 ft).			PID = 0.0 ppm at Cyclone and breathing zone. Water added.
175								50 gallons of water added.
180					Poorly graded SAND with Gravel (SP); yellowish brown (10YR 5/6); loose; non cohesive; 75% fine and coarse sand; 25% gravel; subrounded; trace silt and clay. Note: becoming well graded sand.	SP		Kelly down @ 1236.



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 7 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND with Gravel (SP); yellowish brown (10YR 5/6); loose; non cohesive; 75% fine and coarse sand; 25% gravel; subrounded; trace silt and clay. Note: becoming well graded sand.			New 20' connection @ 1253. PID = 0.0 ppm. Added 100 gallons of water.
185					Same as above (180 ft).			Slow/hard drilling.
190					Same as above (180 ft).	SP		PID = 0.1 ppm at Cyclone and 0.0 ppm at breathing zone.
195					Same as above (180 ft).		High Solids Bentonite Grout	
200					Well graded SAND with Gravel (SW); strong brown (7.5YR 5/6); loose; soft; moist; slightly cohesive; 80% fine to coarse sand; 20% fine gravel; subrounded to rounded.			Kelly down @ 1331. Total depth with 11 3/4" casing. End of 12-12-14. New 20' connection with 9 5/8" casing at 0846 on 12-16-14.
205					Same as above (200 ft).	SW		No water added. Casing dropped - no hammer to 220'. PID = 0.0 ppm @ Cyclone and breathing zone.
210								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 8 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well graded SAND with Gravel (SW); strong brown (7.5YR 5/6); loose; soft; moist; slightly cohesive; 80% fine to coarse sand; 20% fine gravel; subrounded to rounded.			PID = 0.0 ppm at Cyclone and breathing zone.
215					Same as above (210 ft).			
220					Same as above (210 ft).			Kelly down @ 0857. New 20' connection @ 0906. PID = 0.0 @ Cyclone and breathing zone.
225					Same as above (210 ft).	SW	High Solids Bentonite Grout	Soft drilling. No water added. No hammer.
230					Same as above (210 ft).			PID = 0.0 @ Cyclone and breathing zone.
235					Same as above (210 ft).			Kelly down @ 0916. New connection @ 0923.
240								





# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 9 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well graded SAND with Gravel (SW); strong brown (7.5YR 5/6); loose; soft; moist; slightly cohesive; 80% fine to coarse sand; 20% fine gravel; subrounded to rounded.			PID = 0.1 ppm @ Cyclone and 0.0 ppm @ breathing zone.
245					Same as above (240 ft).			
250					Same as above (240 ft).	SW		PID = 0.0 ppm @ Cyclone and 0.0 @ breathing zone.
255					Same as above (240 ft).		High Solids Bentonite Grout	
260					Poorly graded SAND (SP); reddish yellow (7.5YR 7/6); moist; loose; soft; slightly cohesive to noncohesive; 95% medium to fine sand; trace silt; 5% fine gravel; rounded.			Kelly down @ 0932. New 20' connection @ 0947. Dumped bin of cuttings. Soft drilling. No water added.
265					Same as above (260 ft).	SP		PID= 0.0 ppm @ Cyclone and breathing zone.
270								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 10 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND (SP); reddish yellow (7.5YR 7/6); moist; loose; soft; slightly cohesive to noncohesive; 95% medium to fine sand; trace silt; 5% fine gravel; rounded.			PID= 0.0 ppm @ Cyclone and breathing zone.
275					Same as above (270 ft).	SP		Soft drilling. No hammer. No water added.
280					Well graded SAND (SW); light yellowish brown (10YR 6/4); moist; soft; loose; noncohesive; 95% fine to coarse sand; 5% fine gravel; subrounded to rounded. Note: gravel is quartz, feldspar and sandstone.			Kelly down @ 0955. New 20' connection @ 1003. PID = 0.0 ppm at Cyclone and breathing zone.
285					Same as above (280 ft).		High Solids Bentonite Grout	
290					Same as above (280 ft).	SW		PID = 0.0 ppm at Cyclone and breathing zone.
295					Same as above (280 ft).			Soft drilling. No hammer. No water added.
300								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 11 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Well graded SAND (SW); light yellowish brown (10YR 6/4); moist; soft; loose; noncohesive; 95% fine to coarse sand; 5% fine gravel; subrounded to rounded. Note: gravel is quartz, feldspar and sandstone.	SW		Kelly down @ 1014. New 20' connection @ 1021. PID = 0.1 ppm @ Cyclone and 0.0 ppm @ breathing zone.
310					Clayey SAND (SC); brown (7.5YR 5/4); moist; stiff; cohesive; low plasticity; 70% medium to fine sand; 30% clay.	SC		Added 50 gallons of water @ 307'.
315					Well graded GRAVEL (GW); brown (7.5YR 5/2); non cohesive; 95% fine to coarse gravel to 1.5"; subrounded to subangular; 2.5% fine sand; 2.5% silt. Note: gravel is quartz and feldspar.	GW	High Solids Bentonite Grout	PID = 0.0 ppm at Cyclone and breathing zone. Using hammer @ 310'.
320					Same as above (310 ft).			
325					Poorly graded SAND (SP); light brown (7.5YR 6/4); soft; 100% medium to fine sand; non cohesive.	SP		Kelly down @ 1034. New 20' connection @ 1021. PID = 0.2 ppm @ Cyclone and 0.0 ppm @ breathing zone.
330					Well graded GRAVEL (GW); brown (7.5YR 5/2); hard; 95% fine to coarse gravel to 2"; subrounded to subangular; 5% silt.	GW		Using hammer at 325'. Hard drilling. 50 gallons of water added.



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 12 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well graded GRAVEL (GW); brown (7.5YR 5/2); hard; 95% fine to coarse gravel to 2"; subrounded to subangular; 5% silt.			PID = 0.2 ppm @ Cyclone and 0.1 ppm @ breathing zone.
335					Same as above (330 ft).	GW		
340					Poorly graded SAND (SP); dark yellowish brown (10YR 4/4); 98% fine sand; 2% fine gravel; trace medium sand; trace silt; non cohesive.			Kelly down @ 1057. New 20' connection @ 1106. Using hammer, added water. PID = 0.1 ppm at Cyclone and breathing zone.
345					Same as above (340 ft).		High Solids Bentonite Grout	
350					Same as above (340 ft).	SP		PID = 0.0 ppm at Cyclone and breathing zone. Added 100 gallons of water.
355					Same as above (340 ft).			Hammering; slow drilling. Added water.
360								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 13 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Poorly graded SAND (SP); dark yellowish brown (10YR 4/4); 98% fine sand; 2% fine gravel; trace medium sand; trace silt; non cohesive.	SP		Kelly down @ 1124. New 20' connection @ 1137. Empty bin into rolloff.
365					Poorly graded GRAVEL with Silt (GP-GM); gray (7.5YR 5/1); dense; non cohesive; 90% fine gravel to 0.25"; 10% silt; trace clay. Note: gravel is quartz and feldspar.	GP-GM		Added 50 gallons of water.
370					Same as above (365 ft).	GP-GM		PID = 0.1 ppm @ Cyclone and 0.0 ppm @ breathing zone. Hammering. Slow drilling. Water added.
375					Poorly graded SAND (SP); light brown (7.5YR 6/3); loose; 98% fine sand; 2% fine gravel; noncohesive.	SP		PID = 0.2 ppm at Cyclone and 0.0 ppm at breathing zone.
380					Well graded GRAVEL (GW); brown (7.5YR 4/4); dense; non cohesive; 100% fine to coarse gravel; angular to subrounded; trace silt and clay. Note: gravel is quartz and feldspar.	GW		Hammered to 380'. Slow drilling. 50 gallons of water added.
385					Same as above (378 ft).	GW		Kelly down @ 1158. New 20' connection @ 1335. Empty bin into rolloff. PID = 0.1 ppm @ Cyclone and 0.0 ppm @ breathing zone.
390								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 14 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well graded SAND (SW); light brown (7.5YR 6/3); dense; non cohesive; 95% fine to coarse sand; 3% fine gravel; 2% silt. Note: gravel is quartz.			Hard drilling. Hammering. 50 gallons of water added.
395					Same as above (390 ft).			
400					Same as above (390 ft).	SW	Top of Bentonite Seal	Kelly down @ 1356. New connection @ 1410. PID = 0.2 ppm @ Cyclone and 0.0 ppm @ breathing zone.
405					Poorly graded SAND (SP); brown (7.5YR 5/3); dense; non cohesive; 100% fine sand; trace silt and clay.			Slow drilling. Hammering. Added 100 gallons of water.
410					Same as above (405 ft).	SP	Bentonite Seal	PID = 0.0 ppm @ Cyclone and breathing zone.
415					Well graded SAND (SW); brown (7.5YR 4/3); dense; non cohesive; 100% fine to coarse sand; trace silt.			Very slow drilling.
420						SW		Kelly down @ 1447. New connection @ 1502. Empty bin into rolloff.





# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 15 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Fat CLAY (CH); light brown (7.5YR 6/3); dense; stiff; medium plasticity; trace fine sand and silt.			PID = 0.0 ppm @ Cyclone and breathing zone. Hammering. 100 gallons of water added.
425					Same as above (420 ft).	CH		
430					Poorly graded SAND (SP); pinkish gray (7.5YR 6/2); dense; 100% fine sand; noncohesive; rounded to subrounded.			PID = 0.3 ppm @ cyclone and 0.0 ppm @ breathing zone.
435					Same as above (430 ft).		- Bentonite Seal	
440					Poorly graded SAND (SP); brown (7.5YR 5/4); dense; 95% fine sand; 2% fine gravel; 3% silt; non cohesive.	SP		Kelly down @ 1528. New 20' connection @ 1536. PID = 0.1ppm @ Cyclone and 0.0 ppm @ breathing zone. Slow drilling. Hammering. Added 50 gallons of water.
445					Same as above (440 ft).		- Top of 20/40 Sand - Top of 10/20 Sand	PID = 0.0 ppm @ cyclone and breathing zone.
450								



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▼ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 16 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450								
455					Well graded SAND (SW); brown (7.5YR 5/2); dense; 95% fine to coarse sand; 5% fine gravel (quartz, feldspar); non cohesive.	SW	Top of 5" Schedule 80 PVC 0.010" Slot Screen	PID = 0.2 ppm @ Cyclone and 0.0 ppm @ breathing zone.
460					Well graded GRAVEL (GW); brown (7.5YR 5/3), dense; 98% fine to coarse gravel; subangular to subrounded; 2% fine sand; trace silt and clay; noncohesive.			
465					Same as above (455 ft).	GW		Kelly down @ 1602. New 20' connection @ 1609.
470					Same as above (455 ft).			Top of water at 462' at time of drilling. Top of water at 463.61' measured on 1/6/2015. Top of water at 464.8' at end of drilling. Measured on 12/17/14.
475					Poorly graded SAND (SP); brown (7.5YR 5/4); dense; non cohesive; 100% fine sand; trace silt and clay.	SP		PID = 0.0 ppm @ Cyclone and breathing zone.
480					Same as above (470 ft).			Kelly down @ 1634. Stop drilling for 12-16-14. Add 50 gallons of water after 470'.



# Borehole ID: KAFB-106225

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 12/11/2014  
**Date TD Reached:** 12/17/2014  
**Date Completed:** 1/16/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 462.00  
 ▼ At End of Drilling: 464.98  
 ▽ After Drilling: 463.61

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

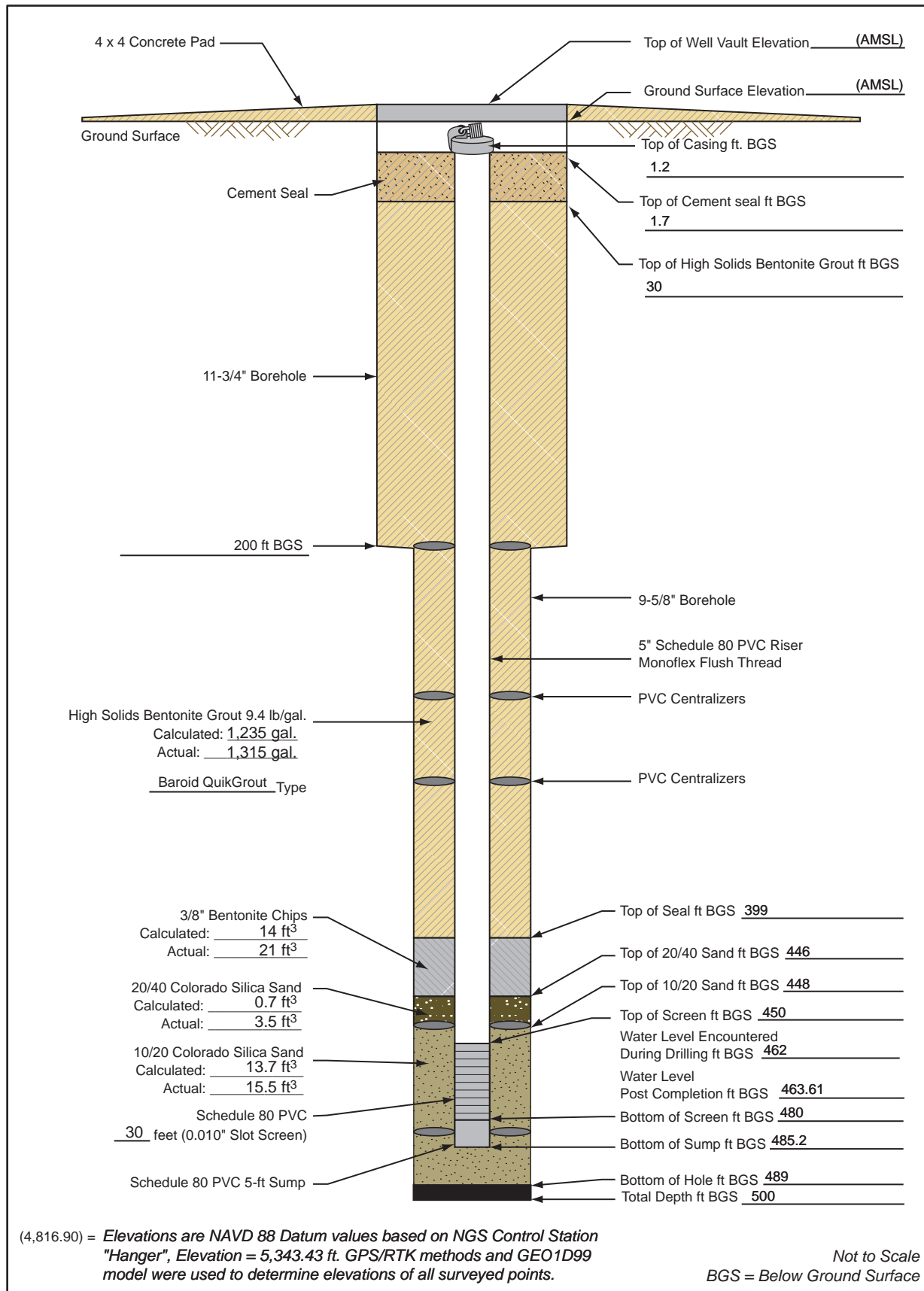
Page 17 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); brown (7.5YR 5/4); dense; non cohesive; 100% fine sand; trace silt and clay.	SP	Bottom of Screen - Sump	Start drilling on 12-17-14. new 20' connection @ 1017. Hammering. Water added, ~ 25 gallons.
485					Well graded SAND (SW); brown (7.5YR 5/2); wet; dense; non cohesive; 100% fine to coarse sand.	SW	- Bottom of Sump	PID = 0.0 ppm @ Cyclone and 0.0 ppm @ breathing zone.
490					Poorly graded SAND (SP); pinkish gray (7.5YR 7/2); dense; wet; non cohesive; 100% fine sand; trace silt and clay.	SP	- Bottom of Filter Pack	Hammering. Hard drilling. Light rain. PID = 0.4 ppm @ Cyclone and 0.1 ppm @ breathing zone.
495					Poorly graded SAND (SP); pinkish gray (7.5YR 6/2); dense; wet; non cohesive; 100% very fine sand (flowing sand).	SP	- Native Backfill	PID = 0.1 ppm at Cyclone and breathing zone.
500					Well graded SAND with Gravel (SW); brown (7.5YR 4/2); dense; wet; non cohesive; 80% fine to coarse sand; 20% fine to coarse gravel to 1.5"; Note: gravel is quartz and feldspar.	SW		Kelly down @ 1100. Prep for measurement of depth to groundwater. end of drilling on 12-17-14 and for well.
505					TD = 500'			
510								

# Monitoring Well Completion Diagram KAFB-106225

Installation Start Date/Time: 1/7/2015 @ 0930

Installation End Date/Time: 1/19/2015 @ 1112





## Well Development Record

**Project Name:** KAFB BFF  
**Location:** Georgia Street  
**Personnel:** V. Bracht, E. Perez  
**Date:** 1/21/15 - 1/23/15  
**Samplers:** N/A  
**Method of Development:**  
☒ Surging ☒ Bailing ☐ Pumping  
☐ Original Development ☐ Redevelopment ☐ Other  
**Development Date:** 1/21/2015 - 1/23/2015  
**Depth to Water Before Developing Well (ft. btoc):** 463.22  

$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = \underline{1,215.6 \text{ gallons}}$$
**Depth Purging From:** 480 feet **Time Purging Begins:** 1207, 1/22/2015  
**Weather:** Partly Cloudy, Windy **Screened Interval (ft bgs):** 450 - 480  
**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q  
**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐  
**Describe:** Steam Cleaned  
**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐  
**Describe:** N/A  
**Comment:** Approximately 1,175 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (µS/cm)	Turbidity (NTU)	Comments
1/21/2015	1515	463.22	0	--	--	--	--	Initial Water Level
1/21/2015	1528	--	0	--	--	--	--	Begin Bailing
1/21/2015	1536	--	0	--	--	--	--	Water is Muddy
1/21/2015	1605	--	25	--	--	--	--	Complete Bailing; Water is Muddy
1/21/2015	1609	--	25	--	--	--	--	Begin Swabbing
1/21/2015	1630	--	25	--	--	--	--	Complete Swabbing. End of Day
1/22/2015	0847	--	25	--	--	--	--	Begin Bailing; Water is Muddy
1/22/2015	0917	--	50	--	--	--	--	Complete Bailing; Water is Muddy
1/22/2015	1200	463.61	50	--	--	--	--	Water Level Prior to Pumping
1/22/2015	1207	--	50	--	--	--	--	Begin Pumping @ 7.5 GPM. Pump Set @ 480 feet bgs. Water is Brown/Muddy

Notes:  
 \* Water Levels - Reported to the nearest 0.01 foot  
 \* pH - Reading rounded to 0.1 pH units  
 \* Water temperature - Reported to nearest 0.1 °C  
 °C = Degree Celsius  
 EC = Electric Conductivity  
 ft bgs = Feet Below Ground Surface  
 ft btoc = Feet Below Top of Casing  
 gal. = Gallon  
 GPM = Gallons Per Minute  
 I.D. = Inner Diameter  
 N/A = Not Applicable  
 NR = Not Recorded  
 NTU = Nephelometric Turbidity Unit  
 S/m = Siemens per Meter

Where:  
 $B = 3.14$   
 $\phi_s$  = porosity of the sand pack  
 $r_c$  = radius of the well casing and screen in feet  
 $L_c$  = length of water column inside the casing and screen in feet  
 $r_w$  = radius of the well bore in feet  
 $L_s$  = length of saturated portion of the sand pack in feet  
 7.48 gallons/cubic foot = conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106225Project Number: 140705Samplers: N/ADate: 1/21/2015 - 1/23/2015

Checked By: \_\_\_\_\_

Time Start: 1528, 1/21/2015Time Finish: 1040, 1/23/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (µS/cm)	Turbidity (NTU)	Comments
1/22/2015	1226	464.78	175	16.27	5.49	0.395	12.40	Continue Pumping; Clear
1/22/2015	1233	464.80	250	14.45	7.13	0.400	11.70	Continue Pumping; Clear
1/22/2015	1240	464.82	300	10.55	7.34	0.400	12.70	Continue Pumping; Clear
1/22/2015	1247	464.82	335	10.10	7.24	0.399	13.90	Continue Pumping; Clear
1/22/2015	1254	464.80	390	12.01	6.97	0.394	8.74	Continue Pumping; Clear
1/22/2015	1300	NR	425	--	--	--	--	Pump Raised to 468 feet bgs
1/22/2015	1301	464.88	450	11.29	6.61	0.396	6.31	Continue Pumping; Clear
1/22/2015	1308	--	450	--	--	--	--	Water Stopped Flowing through YSI
1/22/2015	1311	464.88	490	13.94	6.98	0.398	32.2	Continue Pumping; Slightly Cloudy
1/22/2015	1313	--	500	--	--	--	--	Stopped Pumping; End of Day
1/23/2015	0850	463.56	500	--	--	--	--	Initial Daily Water Level Reading
1/23/2015	0900	--	500	--	--	--	--	Pump Set at 468 feet bgs
1/23/2015	0901	464.76	550	14.72	5.28	0.410	261	Continue Pumping @ 7.5 GPM; Cloudy
1/23/2015	0908	464.81	600	11.76	7.12	0.402	248	Continue Pumping; Cloudy
1/23/2015	0915	464.82	650	11.00	7.31	0.404	160	Continue Pumping; Cloudy

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A





## Well Development Record

Project: KAFB BFF

Well No: KAFB-106225

Project Number: 140705

Samplers: N/A

Date: 1/21/2015 - 1/23/2015

Checked By: \_\_\_\_\_

Time Start: 1528, 1/21/2015

Time Finish: 1040, 1/23/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (µS/cm)	Turbidity (NTU)	Comments
1/23/2015	0922	464.83	700	7.06	4.62	0.402	52.5	Continue Pumping; Slightly Cloudy
1/23/2015	0929	464.83	775	6.40	4.54	0.403	23.9	Continue Pumping; Clear
1/23/2015	0936	464.86	825	5.68	4.79	0.397	13.2	Continue Pumping; Clear
1/23/2015	0943	464.90	875	5.64	5.35	0.397	9.10	Continue Pumping; Clear
1/23/2015	0950	464.92	925	5.85	5.25	0.396	5.75	Continue Pumping; Clear
1/23/2015	0956	NR	925	--	--	--	--	Pump Lowered to 470 feet bgs
1/23/2015	0957	464.91	960	5.40	5.00	0.398	4.39	Continue Pumping; Clear
1/23/2015	1004	464.90	1000	5.61	4.89	0.396	2.61	Continue Pumping; Clear
1/23/2015	1011	464.93	1050	5.44	4.79	0.398	2.04	Continue Pumping; Clear
1/23/2015	1016	--	1050	--	--	--	--	Pump Lowered to 472 feet bgs
1/23/2015	1018	464.94	1110	18.28	5.89	0.402	0.91	Increase Flow Rate due to Freezing Temperatures
1/23/2015	1025	464.88	1150	17.19	7.28	0.404	7.10	Continue Pumping; Clear
1/23/2015	1030	464.87	1200	15.45	7.29	0.401	7.74	Continue Pumping; Clear
1/23/2015	1035	464.88	1250	14.54	7.22	0.401	1.44	Continue Pumping; Clear
1/23/2015	1040	464.88	1275	14.12	7.04	0.401	0.98	Complete Pumping; Water is Clear

Was well sampled after development? YES NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106226



# Borehole ID: KAFB-106226

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 1/21/2015  
 Date TD Reached: 1/26/2015  
 Date Completed: 2/10/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 464.02

Drilling Contractor: Yellow Jacket  
 Drilling Method: ARCH  
 Logged By: T. Richards



Page 1 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No description recorded. Asphalt from 0' - 0.5'.	ASPHALT		Water knife and pothole to 9' on 1/7/15.
					No description recorded. Road Base from 0.5' - 2'.			
					No description recorded. Borehole was water jetted. Silt with sand and gravel were observed down hole.			
5								
10					Well graded GRAVEL with Silt and Sand (GW-GM); very pale brown (10YR 7/4); dry; loose; 70% gravel to 0.4"; subrounded; 20% fine sand; 10% silt and clay. Note: gravel is quartzite and sandstone.			Began ARCH drilling @ 0915 on 1/21/15. PID @ cyclone and breathing zone = 0.0 ppm.
15					Same as above (10 ft).	GW-GM		Kelly down @ 0931 on 1/21/15. New 20' connection @ 0944. No water added and no hammering.
20					Well graded GRAVEL with Sand (GW); very pale brown (10YR 7/4); dry to moist; loose; 70% fine to coarse gravel to 2"; 30% fine sand.			PID @ cyclone and breathing zone = 0.0 ppm.
25					Same as above (20 ft).	GW		
30					Description on following page.	SP		PID @ cyclone and breathing zone = 0.0 ppm. Windy



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 2 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Poorly graded SAND (SP); very pale brown (10YR 7/4); moist; soft; loose; 95% fine to medium sand; 5% fine gravel.		Bentonite Grout	No water added and very little hammering.
35					Same as above (30 ft).	SP		Kelly down @ 1000. New 20' connection @ 1018. PID @ cyclone and breathing zone = 0.0 ppm.
40					Same as above (30 ft).			No water added and very little hammering.
45					Silty GRAVEL with Sand (GM); very pale brown (10YR 7/4); dry to moist; 70% fine to coarse gravel; subrounded; 15% fine sand; 15% silt. Note: gravel is quartzite and sandstone.		High Solids Bentonite Grout	No water added. Began hammering.
50					Same as above (45 ft).	GM		PID @ cyclone and breathing zone = 0.0 ppm.
55					Same as above (45 ft).			Kelly down @ 1026. New 20' connection @ 1039.
60								



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Silty GRAVEL with Sand (GM); very pale brown (10YR 7/4); dry to moist; 70% fine to coarse gravel; subrounded; 15% fine sand; 15% silt. Note: gravel is quartzite and sandstone.			PID @ cyclone and breathing zone = 0.0 ppm.
65					Same as above (60 ft).			No water added, hammering.
70					Same as above (60 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
75					Same as above (60 ft).	GM	High Solids Bentonite Grout	Kelly down @ 1100. New 20' connection @ 1110. No water added, hammering.
80					Same as above (60 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
85					Same as above (60 ft).			No water added, hammering. PID @ cyclone and breathing zone = 0.0 ppm.
90								





# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 4 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Silty GRAVEL with Sand (GM); very pale brown (10YR 7/4); dry to moist; 70% fine to coarse gravel; subrounded; 15% fine sand; 15% silt. Note: gravel is quartzite and sandstone.			
95					Same as above (90 ft).	GM		Kelly down @ 1130. New 20' connection @ 1140. Stop drilling @ 1145.
100					Poorly graded SAND with Gravel (SP); light brown (7.5YR 6/3); 80% very coarse sand; angular; 20% fine to medium gravel.			Added 50 gallons of water due to hard drilling.
105					Same as above (100 ft).	SP	High Solids Bentonite Grout	PID @ cyclone = 0.1 ppm. PID @ breathing zone = 0.0 ppm.
110					Poorly graded SAND with Clay (SP-SC); brown (7.5YR 4/3); 80% fine to medium sand; 10% clay; 5% silt; 5% fine gravel.	SP-SC		PID @ cyclone and breathing zone = 0.0 ppm.
115					Lean CLAY (CL); brown (7.5YR 4/4); moist; soft; low to medium plasticity; 100% clay; trace silt and gravel.	CL		Kelly down @ 1305. New 20' connection @ 1318. Hammering. PID @ cyclone and breathing zone = 0.0 ppm.
120								





# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 465.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 5 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY (CL); brown (7.5YR 4/4); moist; soft; low to medium plasticity; 100% clay; trace silt and gravel.			Added 50 gallons of water.
125					Same as above (120 ft).			Hammering.
130					Same as above (120 ft).			PID @ cyclone = 0.2 ppm. PID @ breathing zone = 0.0 ppm.
135					Same as above (120 ft).	CL	High Solids Bentonite Grout	Kelly down @ 1337. New connection @ 1348.
140					Same as above (120 ft).			PID @ cyclone = 0.1 ppm. PID @ breathing zone = 0.0 ppm. Added 50 gallons of water.
145					Same as above (120 ft).			Hammering.
150								



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 6 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Lean CLAY (CL); brown (7.5YR 4/4); moist; soft; low to medium plasticity; 100% clay; trace silt and gravel.	CL		PID @ cyclone and breathing zone = 0.0 ppm.
155					Poorly graded GRAVEL with Clay and Sand (GP-GC); strong brown (7.5YR 5/6); 75% fine gravel; angular; 15% fine sand; 10% clay.	GP-GC		Kelly down @ 1359. New 20' connection @ 1415.
160					Same as above (152 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
165					Same as above (152 ft).	SW		Added 50 gallons of water.
170					Well graded SAND (SW); light brown (7.5YR 6/3); 95% fine to coarse sand; 5% fine gravel.			PID @ cyclone = 0.3 ppm. PID @ breathing zone = 0.1 ppm.
175					Same as above (165 ft).	SP		Added 100 gallons of water. Kelly down @ 1430. Total depth with 11-3/4" casing. End of 1/21/15. Resumed drilling with 9-5/8" casing @ 1457 on 1/22/15.
180					Poorly graded SAND (SP); light brown (7.5YR 6/4); moist; 95% fine to medium sand; 5% silt.			



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 7 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); light brown (7.5YR 6/4); moist; 95% fine to medium sand; 5% silt.			PID @ cyclone and breathing zone = 0.0 ppm.
185					Same as above (180 ft).	SP		Little hammering. Soft drilling.
190					Clayey SAND (SC); brown (7.5YR 5/3); moist; low plasticity; 60% fine to medium sand; 40% clay.			Added 50 gallons of water. PID @ cyclone and breathing zone = 0.0 ppm.
195					Same as above (190 ft).			Kelly down @ 1504. New 20' connection @ 1517. No water added, soft drilling.
200					Same as above (190 ft).	SC	High Solids Bentonite Grout	PID @ cyclone and breathing zone = 0.0 ppm.
205					Same as above (190 ft).			No water added, soft drilling.
210					Poorly graded SAND (SP); brown (7.5YR 5/3); moist; soft; 95% fine to medium sand; 5% silt.	SP		PID @ cyclone and breathing zone = 0.0 ppm



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); soft; 80% medium sand; 20% fine gravel; rounded. Note: gravel is mafic and white plagioclase.			No water added, soft drilling. No hammer.
215					Same as above (210 ft).			Kelly down @ 1524. New 20' connection @ 1535.
220					Same as above (210 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
225					Same as above (210 ft).	SP	High Solids Bentonite Grout	No water added. Soft drilling, no hammer.
230					Same as above (210 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
235					Same as above (210 ft).			No water added. No hammer, soft drilling. Kelly down @ 1541. new 20' connection @ 1552.
240								



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 9 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); soft; 80% medium sand; 20% fine gravel; rounded. Note: gravel is mafic and white plagioclase.			No water added. No hammer, soft drilling. PID @ cyclone = 0.2 ppm. PID @ breathing zone = 0.0 ppm.
245					Same as above (240 ft).			
250					Same as above (240 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
255					Same as above (240 ft).	SP	High Solids Bentonite Grout	Kelly down @ 1555. New 20' connection @ 1606.
260					Same as above (240 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
265					Same as above (240 ft).			No water added. Soft drilling, little hammering.
270								



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 10 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); soft; 80% medium sand; 20% fine gravel; rounded. Note: gravel is mafic and white plagioclase.			Some hammering. No water added. PID @ cyclone and breathing zone = 0.0 ppm.
275					Same as above (270 ft).			Kelly down @ 1612. New 20' connection @ 1620. No water added. Hammering.
280					Same as above (270 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
285					Same as above (270 ft).	SP	High Solids Bentonite Grout	No water added. Hammering.
290					Same as above (270 ft).			PID @ cyclone and breathing zone = 0.0 ppm.
295					Same as above (270 ft).			Kelly down @ 1631. New 20' connection @ 1638. End of 1/22/15. Resumed drilling @ 0918 on 1/23/15. Hammering. No water added.
300								





# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 11 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); soft; 80% medium sand; 20% fine gravel; rounded. Note: gravel is mafic and white plagioclase.			
305					Poorly graded SAND (SP); dark gray (7.5YR 4/1); moist; 100% medium sand.	SP		Hammering due to hard drilling. No water added. PID @ cyclone and breathing zone = 0.0 ppm.
310					Well graded GRAVEL (GW); 90% fine to very coarse gravel; rounded; 10% medium sand. Note: gravel is quartz, quartzite, and feldspar.	GW		
315					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); moist; 80% fine to medium sand; 20% fine gravel; rounded; trace silt. Note: intervals of very coarse gravel.			Hammering, hard drilling. PID @ cyclone and breathing zone = 0.0 ppm.
320					Same as above (310 ft).		High Solids Bentonite Grout	No water added. Kelly down @ 0942. New 20' connection @ 0955.
325					Same as above (310 ft).	SP		Hammering, hard drilling. No water added. PID @ cyclone and breathing zone = 0.0 ppm.
330					Same as above (310 ft); 30% to 35% gravel.			Hard drilling. No water added.



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 465.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); moist; 80% fine to medium sand; 20% fine gravel; rounded; trace silt. Note: intervals of very coarse gravel.			No water added. PID @ cyclone = 0.3 ppm. PID @ breathing zone = 0.0 ppm.
335					Same as above (330 ft).			Kelly down @ 1013. New 20' connection @ 1043.
340					Same as above (330 ft); gravel to 1".			No water added. PID @ cyclone and breathing zone = 0.0 ppm.
345					Same as above (330 ft); gravel to 1".	SP	High Solids Bentonite Grout	
350					Same as above (330 ft); gray (7.5YR 6/1); dry.			
355					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); moist; 80% fine to medium sand; 20% fine gravel; rounded; trace silt. Note: intervals of very coarse gravel.			No water added, hammering.
360					Same as above (350 ft).			Kelly down @ 1103. New 20' connection @ 1111. Hammering. No water added.



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 13 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Poorly graded SAND (SP) brown (7.5YR 5/4); moist; 100% fine to medium sand; trace silt.			Hammering due to hard drilling. No water added. PID @ cyclone = 0.2 ppm. PID @ breathing zone = 0.0 ppm.
365					Same as above (360 ft).	SP		
370					Same as above (360 ft).			No water added. PID @ cyclone and breathing zone = 0.0 ppm.
375					Well graded SAND (SW); brown (7.5YR 5/2); moist; 100% very fine to very coarse sand; trace silt.	SW		
380					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); moist; 75% fine to medium sand; 25% fine to medium gravel. Note: gravel is quartz and feldspar.		High Solids Bentonite Grout	Kelly down @ 1131. New 20' connection @ 1145. Stop drilling. Began drilling @ 1303. No water added, hammering.
385					Same as above (375 ft).	SP		PID @ cyclone and breathing zone = 0.0 ppm.
390					Same as above (375 ft).			Hard drilling. No water added.



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 14 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); moist; 75% fine to medium sand; 25% fine to medium gravel. Note: gravel is quartz and feldspar.			No water added. PID @ cyclone = 0.3 ppm. PID @ breathing zone = 0.0 ppm.
395					Same as above (390 ft).	SP		Kelly down @ 1332. New 20' connection @ 1342.
400					Well graded SAND with Gravel (SW); brown (7.5YR 5/2); dry to moist; 85% very fine to coarse sand; 15% fine to medium gravel.			PID @ cyclone and breathing zone = 0.0 ppm.
405					Same as above (400 ft).			No water added, hammering.
410					Same as above (400 ft).	SW		PID @ cyclone = 0.4 ppm. PID @ breathing zone = 0.0 ppm.
415					Same as above (400 ft); trace clay.			
420					Lean CLAY with Sand (CL); reddish brown (5YR 5/4); slightly moist; low plasticity; 80% clay; 15% fine sand; 5% silt.	CL		No water added. Hard drilling, hammering. Kelly down @ 1405. New 20' connection. Stop drilling in order to make repairs on drill rig. End of 1/23/15. Resume @



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 15 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND with Silt (SP-SM); reddish yellow (5YR 6/6); dry to slightly moist; 90% fine sand; 10% silt.			1230 on 1/26/15. Hammering and slow drilling. No water added. PID @ cyclone and breathing zone = 0.0 ppm.
425					Same as above (420 ft).	SP-SM	- High Solids Bentonite Grout	
430					Same as above (420 ft); slightly coarser sand.			PID @ cyclone = 0.2 ppm. PID @ breathing zone = 0.0 ppm.
435					Well graded SAND (SW); light reddish brown (5YR 6/4); slightly moist; 100% very fine to very coarse sand.	SW		Kelly down @ 1300. New 20' connection @ 1315. No water added.
440					Poorly graded SAND with Silt (SP-SM); reddish yellow (5YR 6/6); slightly moist; 90% fine sand; 10% silt.			PID @ cyclone and breathing zone = 0.0 ppm.
445					Same as above (440 ft).	SP-SM	- Top of Bentonite Seal	No water added.
450								



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 16 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND with Silt (SP-SM); reddish yellow (5YR 6/6); slightly moist; 90% fine sand; 10% silt.	SP-SM		PID @ cyclone and breathing zone = 0.0 ppm.
455					Well graded SAND with Gravel (SW); light reddish brown (5YR 6/3); dry to slightly moist; 80% very fine to coarse sand; 20% fine gravel; subrounded to round. Note: gravel is quartz and mafics.	SW		Kelly down @ 1338. New 20' connection @ 1355.
460					Well graded GRAVEL with Sand (GW); brown (7.5YR 5/4); moist; loose; 60% fine gravel to 1"; round; 40% fine to medium sand.			No water added. PID @ cyclone and breathing zone = 0.0 ppm.
465					Same as above (459 ft).		- Bentonite Seal	Top of water measured @ 465'.
470					Same as above (459 ft).	GW		No water added. PID @ cyclone and breathing zone = 0.0 ppm.
475					Same as above (459 ft).		- Top of 20/40 Sand - Top of 10/20 Sand	Kelly down @ 1416. New 20' connection @ 1430.
480								





# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 465.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 17 of 18

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND with Gravel (SP); yellowish red (5YR 5/6); moist to wet; 85% fine to medium sand; 15% fine gravel; rounded. Note: gravel is quartz.		- Top of 5" Schedule 80 PVC 0.010" Slot Screen	No water added. PID @ cyclone and breathing zone = 0.0 ppm.
485					Same as above (480 ft).			
490					Same as above (480 ft).			No water added. PID @ cyclone and breathing zone = 0.0 ppm.
495					Same as above (480 ft).	SP	- Bottom of Screen - Sump	Kelly down @ 1500. New 20' connection @ 1524.
500					Same as above (480 ft).		- Bottom of Sump	PID @ cyclone and breathing zone = 0.0 ppm.
505					Same as above (480 ft).		- Bottom of Filter Pack/ Top of Native Backfill	
510								



# Borehole ID: KAFB-106226

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 1/21/2015  
**Date TD Reached:** 1/26/2015  
**Date Completed:** 2/10/2015

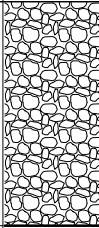
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 465.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 464.02

**Drilling Contractor:** Yellow Jacket  
**Drilling Method:** ARCH  
**Logged By:** T. Richards

Page 18 of 18

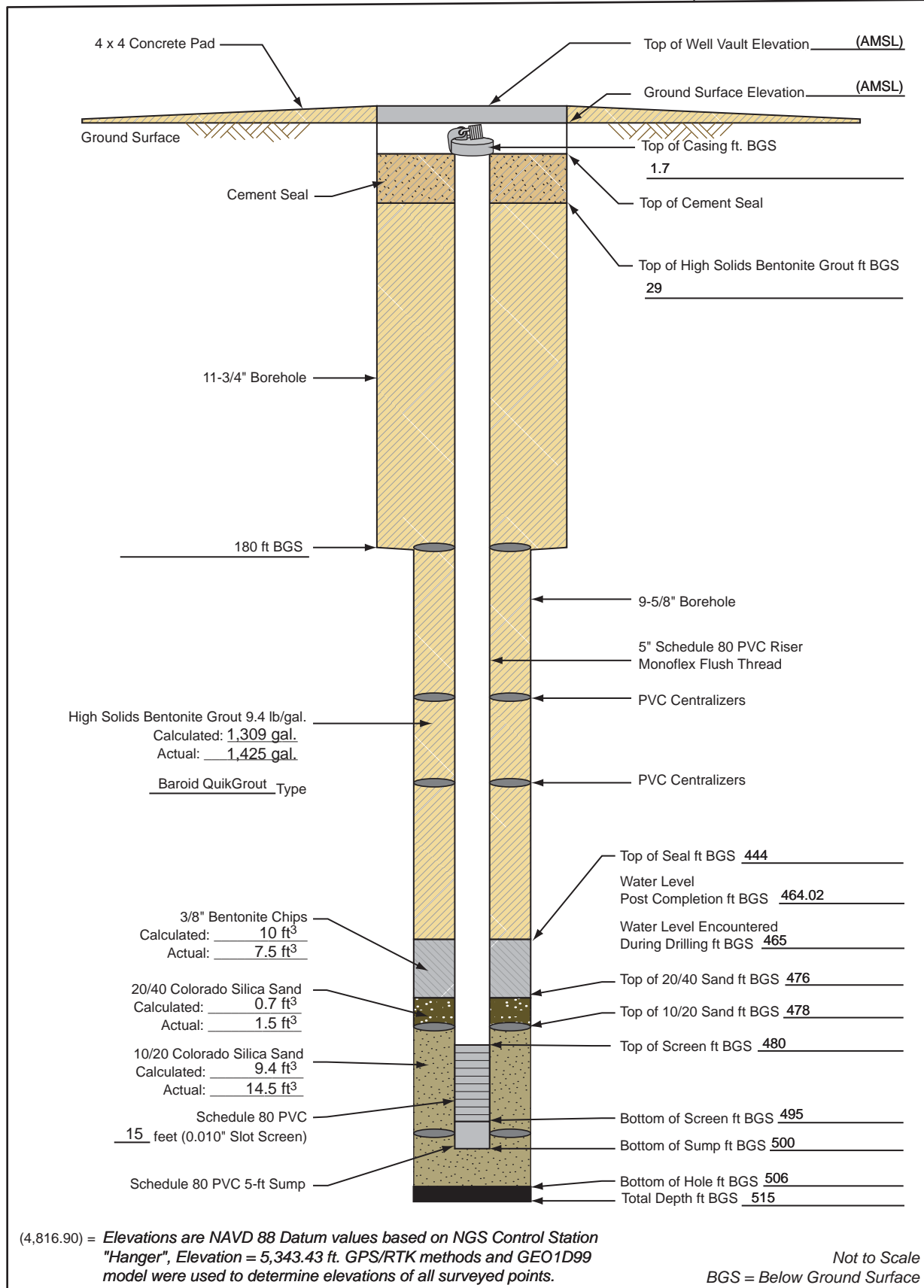
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								
515					Poorly graded SAND with Gravel (SP); yellowish red (5YR 5/6); moist to wet; 85% fine to medium sand; 15% fine gravel; rounded. Note: gravel is quartz.	SP	 Native Backfill	No water added. PID @ cyclone and breathing zone = 0.0 ppm.
520								Total depth = 515 ft reached @ 1600 on 1/26/15. Added 25 gallons of water to prepare hole for well installation.
525								Note: due to the addition of water during drilling, moisture was not logged in those intervals.
530								
535								
540								

# Monitoring Well Completion Diagram KAFB-106226

Installation Start Date/Time: 1/7/2015 @ 0815

Installation End Date/Time: 2/3/2015 @ 1022

Surface Completion Date: 2/19/2015





## Well Development Record

**Project Name:** KAFB BFF**Location:** Georgia St.**Personnel:** E. Perez**Date:** 2/13/15**Samplers:** N/A**Method of Development:**☒ Surging☒ Bailing**Well/Piez. No.:** KAFB-106226**Date Installed:** 2/3/15**Csg. Diameter (I.D.):** 5 "**Total Depth (ft. bgs):** 500☒ Original Development☐ Redevelopment☒ Pumping☐ Other**Development Date:** 2/13/15, 2/17/15**Depth to Water Before Developing Well (ft. btoc):** 463.6**V=(B \* r<sub>c</sub><sup>2</sup> \* L<sub>c</sub> \* 7.48)+(B \* (r<sub>w</sub><sup>2</sup> - r<sub>c</sub><sup>2</sup>) \* L<sub>s</sub> \* Ø<sub>s</sub> \* 7.48)+(H<sub>2</sub>O added during drilling/installation) =** 561.8 gallons**Depth Purging From:** 492 feet**Time Purging Begins:** 1127, 2/17/15**Weather:** Sunny, 50's**Screened Interval (ft bgs):** 480 - 495**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q**Equipment Decontaminated Prior to Development:** Y X N**Describe:** Steam Cleaned**Collected Sample of Water Added to Well:** Y N X**Describe:** N/A**Comment:** Approximately 500 gallons of water added during drilling/well installation activities

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/13/2015	1125	463.60	0	--	--	--	--	Measured total depth = 499.70 ft btoc.
2/13/2015	1138	--	--	--	--	--	--	Begin swabbing.
2/13/2015	1200	--	--	--	--	--	--	Finish swabbing.
2/13/2015	1203	--	--	--	--	--	--	Begin bailing. Water is brown.
2/13/2015	1240	--	55	--	--	--	--	Finish bailing. Water is brown.
2/13/2015	1243	--	55	--	--	--	--	Begin swabbing.
2/13/2015	1300	--	55	--	--	--	--	Finish swabbing.
2/13/2015	1303	--	55	--	--	--	--	Begin bailing. Water is light brown.
2/13/2015	1350	--	125	--	--	--	--	Finish bailing. Water is very light brown.
2/17/2015	1018	--	125	--	--	--	--	Pump set at 492 feet.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Siemens per Meter

**Where:**

B=3.14

Ø<sub>s</sub>= porosity of the sand packr<sub>c</sub>= radius of the well casing and screen in feetL<sub>c</sub>= length of water column inside the casing and screen in feetr<sub>w</sub>= radius of the well bore in feetL<sub>s</sub>= length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106226Project Number: 140705Samplers: N/ADate: 2/13/15

Checked By: \_\_\_\_\_

Time Start: 1125, 2/13/2015Time Finish: 1403, 2/17/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/17/2015	1118	464.20	125	--	--	--	--	Initial water level reading.
2/17/2015	1123	--	125	--	--	--	--	Pump set at 492 feet at 6 GPM.
2/17/2015	1127	465.79	150	16.16	7.93	0.496	57.4	Begin pumping. Water is cloudy and there are bubbles in tubing and YSI. Pump raised to 491 feet.
2/17/2015	1137	465.79	200	18.19	7.79	0.452	16.9	Continue pumping. Water is clear with many small bubbles.
2/17/2015	1147	465.76	250	18.84	7.84	0.467	6.82	Water is clear with many small bubbles.
2/17/2015	1157	465.75	300	18.87	7.87	0.450	4.65	Water is clear with many small bubbles.
2/17/2015	1207	465.75	375	19.01	7.89	0.440	4.03	Water is clear with many small bubbles.
2/17/2015	1211	--	375	--	--	--	--	Pump raised to 482 feet. Continue pumping at 6 GPM.
2/17/2015	1217	465.75	425	18.45	7.87	0.438	2.60	Water is clear with many small bubbles.
2/17/2015	1227	465.75	475	18.60	7.87	0.439	2.54	Water is clear with many small bubbles.
2/17/2015	1237	465.73	525	18.16	7.89	0.438	2.03	Water is clear with few small bubbles.
2/17/2015	1239	--	525	--	--	--	--	Pump lowered to 487 feet. Continue pumping at 6 GPM.
2/17/2015	1247	465.70	575	18.76	7.89	0.441	1.74	Water is clear with few small bubbles.
2/17/2015	1250	--	600	--	--	--	--	Stop pumping.
2/17/2015	1326	464.05	600	--	--	--	--	Water level reading.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFFWell No: KAFB-106226Project Number: 140705Samplers: N/ADate: 2/13/15

Checked By: \_\_\_\_\_

Time Start: 1125, 2/13/2015Time Finish: 1403, 2/17/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
2/17/2015	1327	--	600	--	--	--	--	Pump on.
2/17/2015	1332	465.78	625	17.86	7.86	0.477	13.3	Water is clear with very few small bubbles.
2/17/2015	1342	465.70	700	18.82	7.95	0.460	5.92	Water is clear. No bubbles.
2/17/2015	1352	465.68	750	18.82	7.92	0.462	3.94	Water is clear. No bubbles.
2/17/2015	1402	465.67	800	18.28	7.83	0.462	2.93	Water is clear with very few small bubbles.
2/17/2015	1403	--	800	--	--	--	--	Finish pumping. Well development complete.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



KAFB 106227



# Borehole ID: KAFB-106227

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB BFF SWMU ST-106 and SS-111  
 Project Number: 140705

Date Started: 4/13/2015  
 Date TD Reached: 4/24/15  
 Date Completed: 5/19/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 463.11

Drilling Contractor: National Drilling  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: T. Richards



Page 1 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
5					SILT with Gravel (ML); color not recorded; dry; 70% silt; 15% clay; 15% gravel; angular to subangular; mafics and white quartz.	ASPHALT	Top of Casing/Top of Cement Seal	Location was cleared with a water jet (potholed) to 10 ft bgs prior to drilling. Began drilling at 1520 on 4/15/15 with 11' 3/4" OD casing.
10					STIL (ML); reddish yellow (5YR 6/6); dry; 100% silt.	ML		
15							Cement Seal	
20					Same as above (10 ft).			Kelly down @ 1528; new 20' connection. Resume drilling @ 1533.
25					Well-graded SAND with Gravel (SW); Strong Brown (7.5YR 5/6); dry; 85% very fine to coarse sand; 15% fine gravel; subrounded to rounded.	SW		PID = 0.0 ppm @ cyclone and breathing zone.
30								

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 6/4/15 13:41 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well-graded SAND with Gravel (SW); Strong Brown (7.5YR 5/6); dry; 85% very fine to coarse sand; 15% fine gravel; subrounded to rounded.			PID = 0.0 ppm @ cyclone and breathing zone. Some hammering. No water added.
35								
40					Same as above (30 ft).			Kelly down @ 1545; new 20' connection. Resume drilling @ 1552.
45								PID = 0.0 ppm @ cyclone and breathing zone.
50					Same as above (30 ft).	SW		PID = 0.0 ppm @ cyclone and breathing zone.
55								
60								Kelly down @ 1606, new 20' connection. Resume drilling @ 1611.



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well-graded SAND with Gravel (SW); Strong Brown (7.5YR 5/6); dry; 85% very fine to coarse sand; 15% fine gravel; subrounded to rounded.			PID = 0.0 ppm @ cyclone and breathing zone. Hammering. No water added.
65					Same as above (60 ft). Gravel to 2".			
70					Same as above (60 ft). 80% sand; 20% gravel to 2".			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone. Hammering
75						SW	High Solids Bentonite Grout	Kelly down @ 1623, new 20' connection. Resume drilling @ 1628. No water added.
80					Same as above (60 ft). 80% sand; 20% gravel to 2".			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
85								Hammering, no water added. PID = 0.0 ppm @ cyclone and breathing zone.
90								



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Well-graded SAND with Gravel (SW); Strong Brown (7.5YR 5/6); dry; 80% very fine to coarse sand; 20% fine gravel to 2"; subrounded to rounded. @ 92 ft. Well-graded SAND (SW); Light Brown (7.5YR 6/3); dry; 100% very fine to coarse sand.			Hammering.  No water added to this depth.
100					Well-graded SAND with Gravel (SW); Brown (7.5YR 4/4); 85% fine to very coarse sand; angular; 15% fine gravel; subrounded to rounded.			Kelly down @ 1649; new 20' connection. Resume drilling @ 1653.
105					Same as above (96 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
110						SW	High Solids Bentonite Grout	
115					Same as above (96 ft).			
120								Kelly down @ 1710. End of day on 4/13/15. New 20' connection and resume drilling with 11 3/4" OD casing @ 0800 on 4/14/15.





# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 464.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Well-graded SAND with Gravel (SW); Brown (7.5YR 4/4); 85% fine to very coarse sand; angular; 15% fine gravel; subrounded to rounded.			
125								
130					Same as above (120 ft).			Hammering. PID = 0.2 ppm @ cyclone and 0.0 ppm at breathing zone. No water added down hole at this depth. Water added at cyclone.
135						SW	High Solids Bentonite Grout	Kelly down @ 0810; new 20' connection. Resume drilling @ 0813.
140					Same as above (120 ft).			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
145								Hammering.
150								





# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 6 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Well-graded SAND with Gravel (SW); Brown (7.5YR 4/4); 85% fine to very coarse sand; angular; 15% fine gravel; subrounded to rounded. Note: fraction of fine sand is increasing.			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. No water added down hole.
155								
160					Well-graded SAND (SW); Brown (7.5YR 4/4); moist; 100% very fine to coarse sand.	SW		Kelly down @ 0822, new 20' connection. Resume drilling @ 0828. PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
165					Poorly graded SAND (SP); Strong Brown (7.5YR 5/6); 100% medium to coarse sand; angular.	SP		Hammering.
170					Well-graded SAND (SW); Brown (7.5YR 5/4); 100% fine to coarse sand; subrounded to rounded.	SW		PID = 0.0 ppm @ cyclone and breathing zone. No water added down hole to this depth.
175								
180					Poorly graded SAND (SP); Light Brown (7.5YR 6/3); 100% fine sand.	SP		Kelly down @ 0845, new 20' connection. Resume drilling @ 0856.



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 7 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); Light Brown (7.5YR 6/3); 100% fine sand.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
185								Hammering, no water added down hole to this depth.
190					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4) 75% fine to coarse sand; 25% gravel; subangular to subrounded; gravel is mafics and white quartz.	SW		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
195					Lean CLAY (CL); pink (5YR 7/3); moist; low plasticity; 100% clay.			
200					Same as above (193 ft).	CL		Kelly down @ 0913, change to 9 5/8" OD casing. Resume drilling @ 1349.
205					Gravelly Lean CLAY (CL); Light reddish brown (5YR 6/3); 60% clay; 10% very fine sand; 30% gravel to 1"; subrounded to rounded; gravel is mafics and quartz.			
210					Well-graded SAND with Gravel (SW); pinkish grey (7.5YR 6/2); 80% very fine to coarse sand; 20% fine gravel; subangular to subrounded.	SW		



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 464.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); pinkish grey (7.5YR 6/2); 80% very fine to coarse sand; 20% fine gravel; subangular to subrounded.			PID = 0.0 ppm @ cyclone and breathing zone. No hammering. No water added downhole.
215								
220					Same as above (210 ft).			Kelly down @ 1405; new 20' connection. Resume drilling @ 1413. Added water @ cyclone. PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
225						SW	High Solids Bentonite Grout	No hammering.
230					Same as above (210 ft).			No water added downhole. PID = 0.0 ppm @ cyclone and breathing zone. No hammering.
235								
240								Kelly down @ 1425, new 20' connection. Resume drilling @ 1434.



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); pinkish grey (7.5YR 6/2); 80% very fine to coarse sand; 20% fine gravel; subangular to subrounded.			PID = 0.0 ppm @ cyclone and breathing zone. No hammering.
245								No water added down hole. Begin hammering.
250					Same as above (240 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
255						SW	High Solids Bentonite Grout	Kelly down @ 1456, new 20' connection. Resume drilling @ 1507.
260					Same as above (240 ft).			PID = 0.2 ppm @ cyclone
265								No water added down hole. Hammering.
270								



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 10 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well-graded SAND with Gravel (SW); pinkish grey (7.5YR 6/2); 80% very fine to coarse sand; 20% fine gravel; subangular to subrounded.			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone. Hammering.
275								
280					Same as above (270 ft).	SW		Kelly down @ 1518, new 20' connection. Resume drilling @ 1526.  PID = 0.0 ppm @ cyclone and breathing zone.
285								
290					Poorly graded SAND (SP); Reddish Yellow (7.5YR 6/6); 100% fine to medium sand.			Hammering. No water added down hole. PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
295						SP		
300								Kelly down @ 1534, new 20' connection. Resume drilling @ 1542.

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 6/4/15 13:41 - N:\KAFB BFF\GINT\KAFB\_PROJECT\KAFB\_BFF.GPJ

- High Solids  
Bentonite  
Grout



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 11 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Poorly graded SAND (SP); Reddish Yellow (7.5YR 6/6); 100% fine to medium sand.	SP		PID = 0.0 ppm @ cyclone and breathing zone. Hammering.
310					Well-graded SAND with Gravel (SW); Brown (7.5YR 5/3); 80% fine to very coarse sand; 20% fine gravel to 1/2 "; subrounded to rounded; gravel is mafics and white to rosy quartz.			PID = 0.2 ppm @ cyclone and 0.1 ppm @ breathing zone. No water added down hole.
315								
320					Same as above (308 ft).	SW	High Solids Bentonite Grout	Kelly down @ 1552, new 20' connection. Resume drilling @ 1558.  PID = 0.0 ppm @ cyclone and breathing zone.
325								Hammering. No water added down hole.
330								





# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 464.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 12 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Gravel (SW); Brown (7.5YR 5/3); 80% fine to very coarse sand; 20% fine gravel to 1/2 "; subrounded to rounded; gravel is mafics and white to rosy quartz.			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
335								
340					Same as above (330 ft).			Hammering. Kelly down @ 1626, new 20' connection. Resume drilling @ 1632. PID = 0.0 ppm @ cyclone and breathing zone.
345						SW	High Solids Bentonite Grout	
350					Same as above (330 ft).			PID = 0.0 ppm @ cyclone and breathing zone. Hammering. No water added down hole.
355								
360								Kelly down @ 1647, new 20' connection. Resume drilling @ 1652.



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 464.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 13 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Gravel (SW); Brown (7.5YR 5/3); 80% fine to very coarse sand; 20% fine gravel to 1/2 "; subrounded to rounded; gravel is mafics and white to rosy quartz.			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
365								Hammering.
370					Same as above (360 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
375						SW	High Solids Bentonite Grout	Kelly down @ 1700. End of day on 4/14/15. New 20' connection and resume drilling @ 0800 on 4/15/15.
380					Same as above (360 ft).			
385								Hammering. No water added down hole to this depth.
390								



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 464.00  
▼ **At End of Drilling:** Not Recorded  
▽ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 14 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Gravel (SW); Brown (7.5YR 5/3); 80% fine to very coarse sand; 20% fine gravel to 1/2 "; subrounded to rounded; gravel is mafics and white to rosy quartz.			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. Hammering.
395								
400					Same as above (390 ft).			Kelly down @ 0812, new 20' connection. Resume drilling @ 0820.  PID = 0.0 ppm @ cyclone and breathing zone.
405						SW	High Solids Bentonite Grout	
410					Same as above (390 ft).			Hammering. PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
415								
420								Kelly down @ 0832, new 20' connection. Resume drilling @ 0842.



# Borehole ID: KAFB-106227

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/13/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Air Rotary Casing Hammer  
**Logged By:** T. Richards

Page 15 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420								
					Well-graded SAND with Gravel (SW); Brown (7.5YR 5/3); 80% fine to very coarse sand; 20% fine gravel to 1.5 "; subrounded to rounded; gravel is mafics and white to rosy quartz.	SW		PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone. Hammering.
425					Lean CLAY (CL); reddish brown (5YR 5/3); firm to hard; slightly moist; 90% clay; 10% very fine sand.	CL		
430					Poorly graded SAND (SP); Brown (7.5YR 5/4); moist; 100% fine sand; trace medium sand; trace fine gravel; rounded.			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
435						SP		No water added down hole to this depth.
440					Same as above (427 ft).			Kelly down @ 0853, new 20' connection. Resume drilling @ 0906.
445								PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
450					Well-graded SAND (SW); Brown (7.5YR 4/4); 90% very fine to very coarse sand; 10% fine gravel; subrounded to rounded; gravel is mafics and quartz.	SW		No water added down hole to this depth. Kelly down. End ARCH drilling at 450 feet bgs @ 0912 on 4/15/15.



# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/2015  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 16 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					@ 450 ft. Silty SAND (SM); brown (7.5YR 4/3); dry, dense, 70% fine sand; 5% medium to coarse sand; 20% silt; 5% fine gravel to 2 cm; angular to subrounded.	SM		Begin sonic coring at 450 feet bgs @ 1420 on 4/21/15. @ 450 - 457 ft core disturbed due to 3 attempts made to retrieve this depth.
455								
460					@ 458 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/3); dry; dense; 55% fine to coarse gravel to 5 cm; subangular to rounded; 30% fine sand; 5% medium to coarse sand; 10% silt.	GW-GM	- Bentonite Chip Seal	@ 458 ft gravel is quartz and mafics. Core disturbed.
465					@ 462 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 4/3); moist; very dense; 40% fine to coarse gravel to 5 cm; subangular to subrounded; 25% fine sand; 5% medium to coarse sand; 25% silt; 5% clay.	GM	- Top of Bentonite Pellet Seal	@ 462 ft gravel is quartzite, mafics, and granite. Core slightly disturbed.  @ 464 ft core is wet.



# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

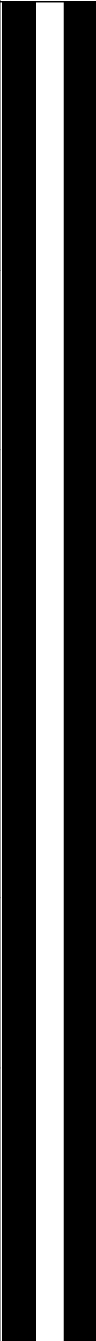
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 17 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
465					@ 465 ft. Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 90% fine to medium sand; 5% coarse sand; 5% coarse gravel to 1 cm; subangular to subrounded.	SP	 Bentonite Pellet Seal	
					@ 468 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/3); wet; loose; 90% fine to medium sand; 10% silt.	SP-SM		
470					@ 470 ft. Poorly graded SAND (SP); brown (7.5YR 4/3); wet; loose; 95% fine to medium sand; 5% silt.	SP		
					@ 475 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); wet; loose; 70% fine sand; 20% medium sand; 10% silt.	SP-SM		
475					@ 476.9 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 5/3); wet; dense; 50% fine to coarse gravel to 4 cm; angular; 30% fine sand; 20% silt.	GM		@ 476.9 ft gravel is quartzite.
480								





# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 18 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					@ 480 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 5/3); wet; dense; 50% fine to coarse gravel to 4 cm; angular; 30% fine sand; 20% silt.	GM		@ 480.6 ft gravel is quartzite.
					@ 480.6 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/2); wet; dense; 50% fine to medium sand; 30% fine to coarse gravel to 4 cm; angular; 20% silt.	SM		@ 482 ft a 1" sandy clay lense is observed.
					@ 481.2 ft. Silty SAND (SM); brown (7.5YR 5/3); wet; medium dense; 80% fine to medium sand; 15% silt; 5% clay.			
					@ 483.4 ft. Same as above (481.2 ft); 80% fine to coarse sand; 20% silt.			
485					@ 484.2 ft. Gravelly Lean CLAY with Sand (CL); reddish brown (5YR 4/4); moist; hard; nonplastic to low plasticity; 50% clay; 30% fine to coarse gravel to 3 cm; subangular; 20% fine to coarse sand.	CL		
					@ 485 ft. Lean CLAY with Sand (CL); reddish brown (5YR 4/4); moist; very stiff; no to low plasticity; 80% clay; 20% fine sand.	SP		
					@ 485.8 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 85% fine to medium sand; trace coarse sand; 15% fine gravel to 1 cm; subrounded.	SW		
					@ 486.3 ft. Well-graded SAND (SW); brown (7.5YR 5/3); wet; loose; 100% fine to coarse sand.	SP		
490					@ 488 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 80% fine sand; 15% medium sand; 5% silt.			
					@ 491 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); wet; loose; 90% fine sand; 10% silt.	SP-SM		
495					@ 494.5 ft. See description on next page.			



# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 19 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495								
					@ 494.5 ft. Poorly graded SAND with Silt and Gravel (SP-SM); brown (7.5YR 5/3); wet; medium dense; 75% fine to medium sand; 15% fine gravel to 1.5 cm; subrounded; 10% silt.	SP-SM		@ 495.5 ft gravel is mafics, quartzite, and sandstone.
					@ 495.5 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/2); wet; medium dense; 45% fine to medium sand; 35% fine to coarse gravel to 4 cm; subrounded; 20% silt.	SM		
					@ 497.6 ft. Poorly graded SAND with Silt and Gravel (SP-SM); wet; medium dense; 75% fine to medium sand; 15% fine to coarse gravel to 2.5 cm; subrounded; 10% silt.	SP-SM		
500					@ 499 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/2); wet; medium dense; 50% fine to coarse sand; 35% fine to coarse gravel to 4 cm; subrounded; 10% silt; 5% clay.	SM		@ 499 ft gravel is mafics, quartzite, and sandstone.
					@ 500 ft. Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/2); wet; medium dense; 65% fine to coarse sand; 25% fine to coarse gravel to 4 cm; subrounded; 10% silt.	SW-SM		@ 500 ft gravel is mafics, quartzite, and sandstone.
					@ 502.4 ft. Lean CLAY (CL); brown (7.5YR 5/3); moist; firm; medium plasticity; 90% clay; 5% fine to coarse gravel to 3 cm; subrounded; 5% fine sand.	CL		@ 503 ft gravel is mafics, quartzite, and sandstone.
505					@ 503 ft. Sandy Lean CLAY with Gravel (CL); brown (7.5YR 5/3); moist; hard; nonplastic to low plasticity; 50% clay; 30% fine to medium sand; 20% fine to coarse gravel to 2.5 cm; subangular to subrounded.			@ 505 ft gravel is mafics, quartzite, and sandstone.
					@ 505 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/3); wet; medium dense; 50% fine to medium sand; 30% fine to coarse gravel to 4 cm; subrounded to rounded; 15% silt; 5% clay.	SM		
					@ 505.7 ft. Same as above (505 ft); 60% fine to medium sand; 25% fine to coarse gravel to 3 cm; subrounded; no clay.			
510					@ 509 ft. See description on next page.	SW-SM		



# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ **At Time of Drilling:** 464.00  
 ▼ **At End of Drilling:** Not Recorded  
 ▽ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 20 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					<p>@ 509 ft. Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/3); wet; medium dense; 50% fine to coarse sand; 40% fine to coarse gravel to 5 cm; subrounded to rounded; 10% silt.</p> <p>@ 512.5. Same as above (509 ft); 75% fine to coarse sand; 15% fine to coarse gravel to 4 cm; subrounded.</p>	SW-SM		@ 509 ft gravel is mafics, quartzite, and sandstone.
515					<p>@ 515 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 4/2); wet; loose 80% fine to coarse sand; 15% fine gravel to 1.5 cm; subrounded; 5% silt.</p> <p>@ 516.5 ft. Same as above (515 ft); 65% fine to coarse sand; 30% fine to coarse gravel to 5 cm; subangular to subrounded.</p>	SW		@ 516.5 ft gravel is quartzite and mafics.
520					@ 519 ft. Lean CLAY with Sand (CL); brown (7.5YR 4/3); moist; firm; medium plasticity; 75% clay; 15% fine to coarse sand; 10% fine to coarse gravel to 5 cm; subrounded.	CL		@ 520 ft gravel is quartzite and mafics.
					@ 520 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 4/2); wet; loose 65% fine to coarse sand; 30% fine to coarse gravel to 5 cm; subangular to subrounded; 5% silt.	SW		
					@ 521.8 ft. Silty SAND (SM); brown (7.5YR 4/3); wet; medium dense; 80% fine to medium sand; 5% fine to coarse gravel to 3 cm; subrounded; 15% silt.	SM		
525								



# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 21 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
525					@ 525 ft. Silty SAND (SM); brown (7.5YR 4/3); wet; medium dense; 80% fine to medium sand; 5% fine to coarse gravel to 5 cm; subrounded; 15% silt.  @ 526.5 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/2); wet; dense; 55% fine to coarse sand; 30% fine to coarse gravel to 4 cm; subangular to subrounded; 10% silt; 5% clay.	SM		@ 526.5 ft gravel is mafics and quartzite.
530					@ 528.5 ft. Clayey SAND with Gravel (SC); brown (7.5YR 4/2); wet; very dense; 55% fine to coarse sand; 25% fine to coarse gravel to 3 cm; subrounded; 15% clay; 5% silt.  @ 529.5 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/2); wet; dense; 65% fine to coarse sand; 20% fine to coarse gravel to 4 cm; subangular to subrounded; 10% silt; 5% clay.	SC SM	Bentonite Pellet Seal	@ 528.5 ft gravel is mafics and quartzite.  @ 529.5 ft gravel is mafics and quartzite.
535					@ 531 ft. Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/3); wet; medium dense; 60% fine to coarse sand; 30% fine to coarse gravel to 6 cm; subangular to subrounded; 10% silt.  @ 533.3 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/3); wet; medium dense; 55% fine to coarse sand; 30% fine to coarse gravel to 4 cm; subangular to subrounded; 15% silt.  @ 535 ft. Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/3); wet; loose; 80% fine to coarse sand; 10% fine to coarse gravel; subangular to subrounded; 10% silt.	SW-SM SM SW-SM	Top of 20/40 Sand Top of 10/20 Sand	@ 531 ft cobbles present. Driller unable to advance "flapper bit" due to cobbles, changed to regular bit. @ 531 ft gravel is quartzite, mafics, and sandstone.  @ 533.3 ft gravel is quartzite, mafics, and sandstone.
540					@ 538 ft. Silty SAND (SM); brown (7.5YR 5/3); wet; medium dense; 75% fine sand; 20% silt; 5% clay. @ 539 ft. See description on next page.	SM		



# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 22 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					@ 539 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/3); wet; medium dense; 60% fine to coarse sand; 20% fine to coarse gravel to 5 cm; subangular to subrounded; 20% silt.	SM		@ 539 ft gravel is quartzite and mafics.
					@ 543 ft. Poorly graded SAND with Gravel (SP); brown (7.5YR 5/3); wet; loose; 80% fine to medium sand; 15% fine to coarse gravel to 5 cm; angular to subrounded; 5% silt.	SP		@ 543 ft gravel is mafics, quartzite, and sandstone.
					@ 544 ft. Well-graded GRAVEL with Sand (GW); brown (7.5YR 5/3); wet; loose; 55% fine to coarse gravel to 4 cm; angular to subrounded; 40% fine to coarse sand; 5% silt.	GW		@ 544 ft gravel is quartzite and mafics.
545					@ 545 ft. Well-graded SAND (SW); brown (7.5YR 4/3); wet; loose; 85% fine to coarse sand; 10% fine to coarse gravel to 3 cm; subrounded to rounded; 5% silt.	SW		@ 545 ft gravel is mafics and quartzite.
					@ 550 ft. Clayey SAND (SC); brown (7.5YR 5/3); wet; medium dense; 65% fine to medium sand; trace coarse sand; 5% fine to coarse gravel; subrounded; 30% clay.	SC		
					@ 551 ft. Well-graded SAND with Clay (SW-SC); brown (7.5YR 5/3); wet; medium dense; 85% fine to coarse sand; 5% fine to coarse gravel to 3 cm; subangular to subrounded; 10% clay.	SW-SC		
					@ 552 ft. Silty SAND (SM); brown (7.5YR 5/3); wet; dense; 70% fine sand; 25% silt; 5% clay.	SM		
555								





# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

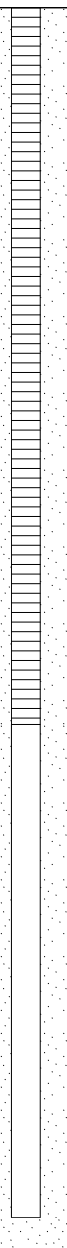
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
 ▽ At Time of Drilling: 464.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 23 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
555					No recovery from 555 to 555.3 ft. @ 555.3 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); wet; loose; 70% fine to coarse sand; 25% fine to coarse gravel to 6 cm; subangular to subrounded; 5% silt. @ 557.2 ft. Well-graded SAND (SW); brown (7.5YR 5/4); wet; loose; 100% fine to coarse sand.	SW		@ 555.3 ft gravel is quartzite and mafics.
560					@ 558.5 ft. Poorly graded SAND (SP); brown (7.5YR 5/4); wet; loose; 95% fine to medium sand; 5% silt. @ 559.8 ft. Same as above (558.5 ft); trace gravel to 4 cm.	SP		
					@ 561.2 ft. Clayey SAND (SC); brown (7.5YR 5/3); 70% fine to medium sand; trace coarse sand; trace fine gravel; 20% clay; 10% silt.	SC		
565					@ 562.5 ft. Sandy Lean CLAY with Gravel (CL); brown (7.5YR 5/3); wet; firm; nonplastic to low plasticity; 40% clay; 30% fine to coarse sand; 20% fine to coarse gravel to 4 cm; subangular to subrounded.	CL		@ 562.5 ft gravel is mafics and quartzite.
					@ 566.1 ft. Well-graded SAND with Clay and Gravel (SW-SC); brown (7.5YR 5/3); wet; medium dense; 50% fine to coarse sand; 40% fine to coarse gravel to 4 cm; subangular; 10% clay.	SW-SC		@ 566 ft flat sandstone cobble fragment observed, 4".
570					@ 567.5 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); wet; loose; 95% fine to medium sand; 5% silt.	SP		@ 567.4 to 567.5 ft flat sandstone cobble fragments observed to 4".





# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

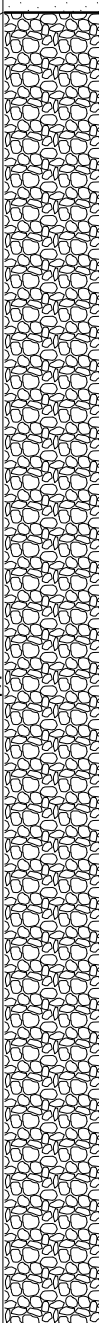
**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 464.00  
▼ **At End of Drilling:** Not Recorded  
▽ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 24 of 25

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
570								
					@ 570.1 ft. Lean CLAY (CL); brown (7.5YR 4/3); hard; low to medium plasticity; 90% clay; 5% silt; 5% fine sand. No core recovered from 570.3 to 595 feet. Overdrill for heaving sand.	CL		@ 570 ft flat sandstone cobble fragment observed, 4". End collection of continuous core at 570.3 feet bgs.
575								
580								
585								



# Borehole ID: KAFB-106227-Sonic

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB BFF SWMU ST-106 and SS-111  
**Project Number:** 140705

**Date Started:** 4/20/2015  
**Date TD Reached:** 4/24/15  
**Date Completed:** 5/19/2015

**Ground Elevation AMSL (ft):** Not Recorded  
**Y Coordinate:**  
**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4  
**Hole Diameter Lower (in.):** 9-5/8  
**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**  
▽ **At Time of Drilling:** 464.00  
▼ **At End of Drilling:** Not Recorded  
▼ **After Drilling:** 463.11

**Drilling Contractor:** National Drilling  
**Drilling Method:** Sonic Coring  
**Logged By:** Chris Buerkle

Page 25 of 25

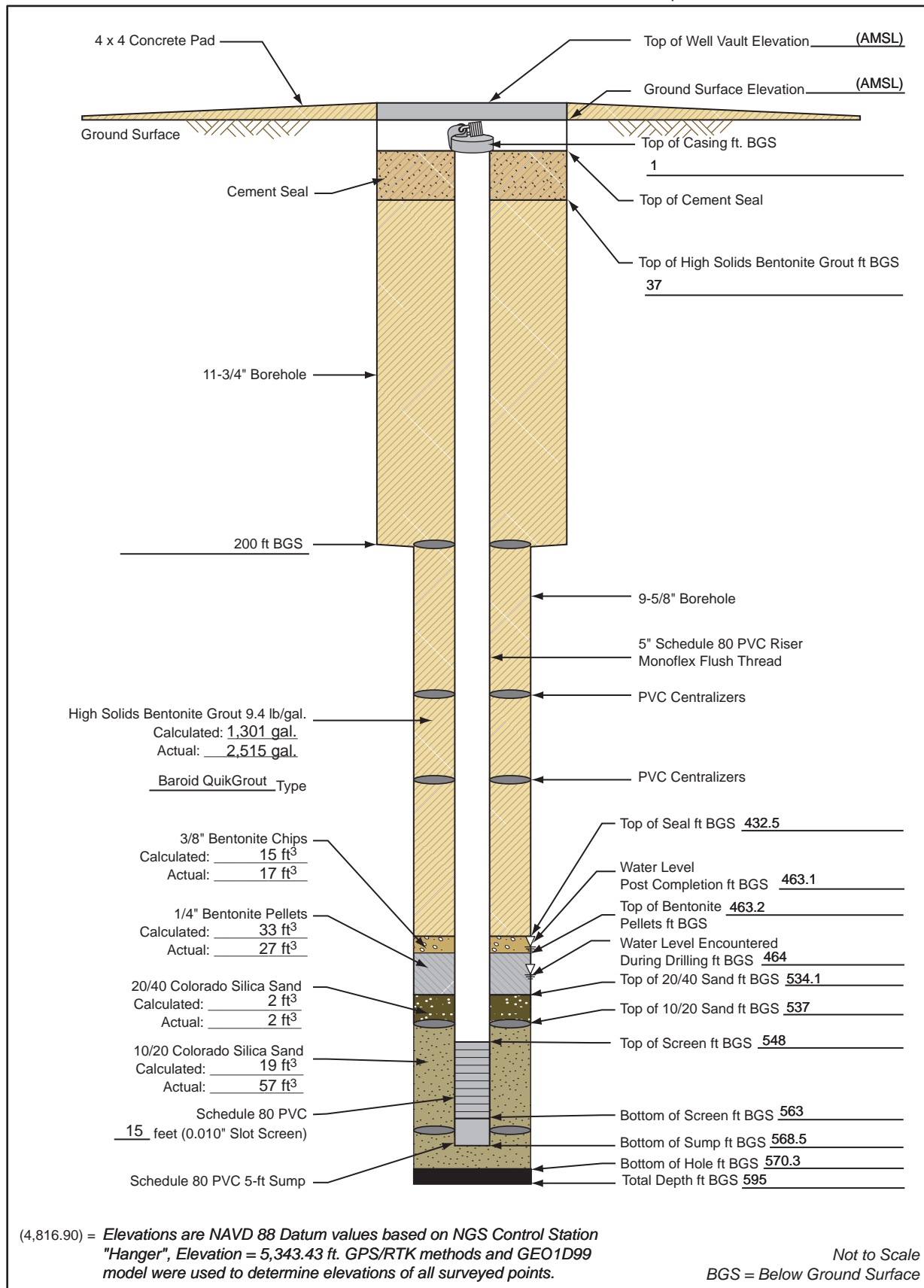
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
585					No core recovered from 570.3 to 595 feet. Overdrill for heaving sand.			
590						NO CORE	Native Backfill	
595							Bottom of Rat Hole	
600								

# Monitoring Well Completion Diagram KAFB-106227

Installation Start Date/Time: 5/4/2015

Installation End Date/Time: 5/6/2015

Date Completed: 4/24/2015





## Well Development Record

Project Name: KAFB BFFLocation: Georgia and RossPersonnel: R. WortmanDate: 5/7/15Samplers: N/A

## Method of Development:

☒ Surging☒ BailingWell/Piez. No.: KAFB-106227

Date Installed: \_\_\_\_\_

Csg. Diameter (I.D.): 5 "Total Depth (ft. bgs): 568.5☒ Original Development☐ Redevelopment☒ Pumping☐ OtherDevelopment Date: 5/7/15, 5/11/15, 5/12/15Depth to Water Before Developing Well (ft. btoc): 463.11 $V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) =$  320 gallonsDepth Purging From: 562 feetTime Purging Begins: 1110, 5/11/15Weather: Clear, SunnyScreened Interval (ft bgs): 548 - 563Equipment Nos.: pH Meter: YSI 650 MDS EC Meter: YSI 650 MDS Turbidity Meter: HACH 21000QEquipment Decontaminated Prior to Development: Y X N \_\_\_\_\_Describe: Steam CleanedCollected Sample of Water Added to Well: Y \_\_\_\_\_ N X \_\_\_\_\_Describe: N/A

Comment: \_\_\_\_\_

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/7/2015	1445	--	--	--	--	--	--	Arrive onsite.
5/7/2015	1500	463.00	--	--	--	--	--	Tagged bottom of well at 568.75 feet bgs.
5/7/2015	1517	--	--	--	--	--	--	Begin bailing.
5/7/2015	1529	--	35	--	--	--	787	Continue bailing.
5/7/2015	1532	--	55	--	--	--	--	Finish bailing.
5/7/2015	1544	--	55	--	--	--	--	Begin swabbing from 563 - 558 feet bgs.
5/7/2015	1604	--	55	--	--	--	--	Begin swabbing from 558 - 553 feet bgs.
5/7/2015	1624	--	55	--	--	--	--	Begin swabbing from 553 - 548 feet bgs.
5/7/2015	1644	--	55	--	--	--	--	Finish swabbing. End of 5/7/15.
5/11/2015	0815	--	55	--	--	--	--	Set up bailer.

## Notes:

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Seimens per Meter

## Where:

B=3.14

 $\phi_s$ = porosity of the sand pack $r_c$ = radius of the well casing and screen in feet $L_c$ = length of water column inside the casing and screen in feet $r_w$ = radius of the well bore in feet $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB BFFWell No: KAFB-106227Project Number: 140705Samplers: N/ADate: 5/7/15, 5/11/15 - 5/12/2015

Checked By: \_\_\_\_\_

Time Start: 1110, 5/11/2015Time Finish: 1048, 5/12/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/11/2015	0850	463.09	55	--	--	--	--	Begin bailing.
5/11/2015	0908	--	100	--	--	--	839	Continue bailing; water is dark brown.
5/11/2015	0935	--	150	--	--	--	>1,000	Finish bailing. Start pump.
5/11/2015	1110	463.10	150	--	--	--	--	Start pumping; pump set @ 562 feet bgs.
5/11/2015	1115	463.74	150	19.07	6.40	0.436	831	Continue pumping; water is dark brown.
5/11/2015	1125	463.70	197	19.64	7.12	0.408	310	Continue pumping @ 4.70 gpm.
5/11/2015	1135	463.71	244	19.74	7.33	0.403	106	Continue pumping; water is light brown.
5/11/2015	1145	463.68	291	19.83	7.43	0.399	75.9	Continue pumping.
5/11/2015	1155	463.68	338	19.86	7.48	0.396	48.9	Continue pumping.
5/11/2015	1205	463.68	385	19.89	7.47	0.395	39.9	Continue pumping.
5/11/2015	1215	463.65	432	19.92	7.51	0.394	32.3	Continue pumping.
5/11/2015	1225	463.66	479	20.01	7.53	0.393	39.4	Continue pumping.
5/11/2015	1235	463.64	526	19.98	7.54	0.392	40.2	Continue pumping.
5/11/2015	1245	463.64	573	20.03	7.53	0.392	40.0	Continue pumping.
5/11/2015	1255	463.64	620	20.05	7.52	0.391	35.5	Continue pumping.

Was well sampled after development? YES \_\_\_\_\_ NO XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB BFF

Well No: KAFB-106227

Project Number: 140705

Samplers: N/A

Date: 5/7/15, 5/11/15 - 5/12/2015

Checked By:

Time Start: 1110, 5/11/2015

Time Finish: 1048, 5/12/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/11/2015	1305	463.65	667	20.08	7.61	0.391	27.7	Continue pumping.
5/11/2015	1315	463.63	714	20.08	7.55	0.390	33.5	Continue pumping.
5/11/2015	1325	463.63	761	20.16	7.52	0.391	27.5	Continue pumping.
5/11/2015	1335	463.61	808	20.18	7.53	0.391	39.0	Continue pumping.
5/11/2015	1345	463.62	855	20.22	7.59	0.391	31.3	Continue pumping.
5/11/2015	1355	463.61	902	20.24	7.56	0.389	34.3	Continue pumping.
5/11/2015	1405	463.58	949	20.22	7.58	0.390	38.0	Continue pumping; set pump @ 548 feet bgs.
5/11/2015	1415	463.59	1006	20.11	7.53	0.392	60.3	Continue pumping.
5/11/2015	1425	463.58	1053	20.12	7.56	0.390	24.0	Continue pumping.
5/11/2015	1435	463.56	1100	20.14	7.56	0.389	22.4	Continue pumping.
5/11/2015	1445	463.58	1147	20.14	7.59	0.389	31.5	Continue pumping.
5/11/2015	1455	463.59	1194	20.21	7.60	0.389	21.2	Continue pumping.
5/11/2015	1505	463.58	1241	20.20	7.55	0.389	21.6	Continue pumping.
5/11/2015	1515	463.59	1288	20.13	7.58	0.390	23.0	Continue pumping.
5/11/2015	1515	--	1288	--	--	--	--	End of 5/11/15.

Was well sampled after development? YES NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A





## Well Development Record

Project: KAFB BFF

Well No: KAFB-106227

Project Number: 140705

Samplers: N/A

Date: 5/7/15, 5/11/15 - 5/12/2015

Checked By: \_\_\_\_\_

Time Start: 1110, 5/11/2015

Time Finish: 1048, 5/12/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
5/12/2015	0805	--	1288	--	--	--	--	Set up at site.
5/12/2015	0850	463.06	1288	--	--	--	--	Tagged water line.
5/12/2015	0905	463.66	1288	17.84	7.03	0.433	25.7	Begin pumping; set pump @ 555.5 feet bgs.
5/12/2015	0915	463.64	1335	19.05	7.47	0.391	1.45	Continue pumping; moved pump to 562 feet bgs.
5/12/2015	0925	463.63	1382	19.16	7.52	0.394	0.64	Continue pumping.
5/12/2015	0935	463.62	1429	19.23	7.59	0.389	0.69	Continue pumping.
5/12/2015	0945	463.63	1476	19.44	7.65	0.389	0.44	Continue pumping; moved pump to 548 feet bgs.
5/12/2015	0955	463.62	1523	19.14	7.55	0.395	2.55	Continue pumping.
5/12/2015	1005	463.61	1570	19.21	7.59	0.389	0.35	Continue pumping.
5/12/2015	1015	463.61	1517	19.34	7.61	0.389	0.38	Continue pumping; moved pump to 555.5 feet bgs.
5/12/2015	1025	463.62	1564	19.40	7.62	0.389	0.32	Continue pumping.
5/12/2015	1035	463.62	1611	19.50	7.62	0.388	0.18	Continue pumping.
5/12/2015	1045	463.62	1658	19.52	7.63	0.389	0.29	Continue pumping.
5/12/2015	1048	--	1665	--	--	--	--	Finish pumping; Well development complete.

Was well sampled after development? YES NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

KAFB 106230



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB RAPID SWMU ST-106 and SS-111  
**Project Number:** 500433

Hole Diameter Upper (in.): 11-3/4  
Hole Diameter Lower (in.): 9-5/8  
Surface Completion Type: Flush

Date Started: 8/11/2015  
Date TD Reached: 8/18/15  
Date Completed: 9/1/2015

Groundwater Levels BGS (ft):  
▽ At Time of Drilling: 456.00  
▼ At End of Drilling: Not Recorded  
▽ After Drilling: 458.67

Ground Elevation AMSL (ft): Not Recorded  
Y Coordinate:  
X Coordinate:

Drilling Contractor: National EWP  
Drilling Method: Air Rotary Casing Hammer  
Logged By: T. Richards



Page 1 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No Lithologic Description.	ASPHALT	Top of Casing/Top of Cement Seal	Borehole was water knifed from 0-10 ft. Silt, sand, gravel, and cobbles observed.
5								
10					SILT (ML); reddish brown (5YR 5/4); 100% silt.	ML	Cement Seal	Large cobble @ 8'. Approximately 10" across. Began drilling @ 1420 on 8/11/15 with 11-3/4" drive casing.
15								
20					Well-graded SAND with Gravel (SW); light reddish brown (5YR 6/4); dry; 60% fine to coarse sand; subangular to rounded; 40% fine to coarse gravel; angular to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		Kelly down @ 1426, new 20' connection @ 1431.
25					Same as above (16 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
30								No water added down hole. Some hammering.

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/19/15 14:41 - Z:\KAFB RAPID\GINT\KAFB\_RAPID.GPJ



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 2 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well-graded SAND with Gravel (SW); light reddish brown (5YR 6/4); dry; 60% fine to coarse sand; subangular to rounded; 40% fine to coarse gravel; angular to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
35								Occasional hammering.
40					Same as above (30 ft).		- Cement Seal	Kelly down @ 1441, new 20' connection @ 1450.
45					Same as above (30 ft).	SW	- Top of High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
50					Same as above (30 ft).		- High Solids Bentonite Grout	Water added in cyclone for dust control. No water down hole.
55					Same as above (30 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
60								No water added down hole.
								Kelly down @ 1501, new 20' connection @ 1507.



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 3 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Well-graded SAND with Gravel (SW); light reddish brown (5YR 6/4); dry; 60% fine to coarse sand; subangular to rounded; 40% fine to coarse gravel; angular to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
65								No water added down hole.
70					Same as above (60 ft). Note: gravel to > 2" across.			PID = 0.0 ppm @ cyclone and breathing zone.
75					Same as above (60 ft). Note: gravel to > 2" across.	SW	High Solids Bentonite Grout	Hammering to 80'.
80					Same as above (60 ft). Note: gravel to > 2" across.			Kelly down @ 1540, new 20' connection @ 1545.
85					Same as above (60 ft). Note: gravel to > 2" across.			PID = 0.0 ppm @ cyclone and breathing zone.
								Bit very hot. Steam coming out of cyclone.
					Same as above (60 ft). Note: gravel to > 2" across.			No water added down hole.
90								Hammering.



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 4 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well-graded SAND with Gravel (SW); light reddish brown (5YR 6/4); dry; dry; 60% fine to coarse sand; subangular to rounded; 40% fine to coarse gravel to 2"; angular to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		PID = 0.0 ppm @ cyclone and breathing zone.
95								Hammering. Hard drilling.
100					Same as above (90 ft).			Kelly down @ 1614, new 20' connection @ 1624.
105					SILT (ML); reddish yellow (5YR 7/6); 90% silt; 10% fine gravel; rounded.	ML		PID = 0.0 ppm @ cyclone and breathing zone.
110					Lean CLAY (CL); reddish yellow (5YR 6/6); moist; non to low plasticity; 90% clay; 10% silt; trace fine sand.	CL		Hammering, stiff drilling.
115					SILT with Gravel (ML); yellowish red (5YR 5/6); 80% silt; 20% fine to medium gravel; subangular to rounded. Note: gravel is quartz and mafics.	ML		PID = 0.0 ppm @ cyclone and breathing zone.
120								Hammering continuously. Kelly down @ 1643, new 20' connection @ 1656.

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/19/15 14:41 - Z:\KAFB RAPID\GINT\KAFB\_RAPID.GPJ





# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 5 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					SILT with Gravel (ML); yellowish red (5YR 5/6); 80% silt; 20% fine to medium gravel; subangular to rounded. Note: gravel is quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
125					Same as above (120 ft).			Hammering continuously.
130					Same as above (120 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
135					Same as above (120 ft).	ML	High Solids Bentonite Grout	Kelly down @ 1702, new 20' connection @ 1708.
140					Same as above (120 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
145								
150					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 60% fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; angular to rounded. Note: sand and gravel are quartz and mafics.	SW		Hammering.



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 6 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 60% fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; angular to rounded. Note: sand and gravel are quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
155								Hammering. No water added down hole.
160					Same as above (150 ft).			Kelly down @ 1734, new 20' connection @ 1739.
165					Same as above (150 ft).	SW	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
170					Same as above (150 ft).			Hammering, stiff drilling.
175					Same as above (150 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
180								Kelly down @ 1748, new 20' connection @ 1753.



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 7 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 60% fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; angular to rounded. Note: sand and gravel are quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
185								Hammering.
190					Same as above (180 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
195					Same as above (180 ft).	SW	High Solids Bentonite Grout	Hammering.
200					Same as above (180 ft).			Kelly down @ 1802. Stop drilling @ 200' with 11-3/4" drive casing on 8/11/15.
205					Same as above (180 ft).			Begin drilling with 9-5/8" drive casing @ 1045 on 8/12/15.
210								No Hammering.
								No water added down hole.



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 8 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210								
215					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 60% fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; angular to rounded. Note: sand and gravel are quartz and mafics.	SW		PID = 0.0 ppm @ cyclone and breathing zone.
220					Lean CLAY (CL); light reddish brown (5YR 6/4); non plastic to low plasticity; 100% clay.			Hammering for the last 7'.
225					Same as above (216 ft).	CL		Kelly down @ 1054, new 20' connection @ 1107.
230					Same as above (216 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
235					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 70% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		Hammering continuously. No water added down hole.
240								PID = 0.0 ppm @ cyclone and breathing zone.
								Hammering.
								Kelly down @ 1118, new 20' connection @ 1133 working 9-5/8" to prevent sand lock with 11-3/4"



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 9 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 70% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.			drive casing. PID = 0.0 ppm @ cyclone and breathing zone.
245								Hammering continuously.
250					Same as above (240 ft).			No water added down hole.  PID = 0.0 ppm @ cyclone and breathing zone.
255					Same as above (240 ft.)	SW	High Solids Bentonite Grout	Kelly down @ 1145, new 20' connection @ 1155.
260					Same as above (240 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
265					Same as above (240 ft).			Hammering. No water added down hole.
270								



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 10 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 70% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
275								Hammering.
280					Same as above (270 ft).			Kelly down @ 1230, new 20' connection @ 1251. PID = 0.0 ppm @ cyclone and breathing zone.
285					Same as above (270 ft).	SW	High Solids Bentonite Grout	Hammering.
290					Same as above (270 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
295					Same as above (270 ft).			Hammering - slow drilling, no water added down hole.
300								Kelly down @ 1318. End of 8/12/15.





# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 11 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 70% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.			Started drilling @ 1335 on 8/14/15.
305								PID = 0.6 ppm @ cyclone and 0.0 ppm @ breathing zone. Continuous hammering, no water added down hole.
310					Same as above (300 ft); gravel to 2".			PID = 0.2 ppm @ cyclone and 0.0 ppm @ breathing zone.
315					Same as above (300 ft); gravel to 2".	SW	High Solids Bentonite Grout	Kelly down @ 1353, new 20' connection @ 1357.
320					Same as above (300 ft); gravel to 2".			PID = 0.0 ppm @ cyclone and breathing zone.
325					Same as above (300 ft); gravel to 2".			Hammering.
330					SILT (ML); reddish brown (5YR 5/4); dry; 100% silt.	ML		



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 12 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					SILT (ML); reddish brown (5YR 5/4); dry; 100% silt.	ML		PID = 0.0 ppm @ cyclone and breathing zone.
335					Well-graded SAND (SW); light reddish brown (5YR 6/4); dry; 90% fine to coarse sand; angular to rounded; 10% fine to coarse gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.	SW		Hard and slow drilling. No water added down hole.
340					Same as above (331 ft).	SW		Kelly down @ 1419, new 20' connection @ 1531.
345					Same as above (331 ft).	SW	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
350					Poorly graded SAND (SP); light reddish brown (5YR 6/4); dry; 90% fine sand; trace medium to coarse sand; angular to rounded; 10% fine to coarse gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
355					Same as above (348 ft).	SP		Hammering, slow drilling.
360								Kelly down @ 1543, new 20' connection @ 1547.



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 13 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Poorly graded SAND (SP); light reddish brown (5YR 6/4); dry; 90% fine sand; trace medium to coarse sand; angular to rounded; 10% fine to coarse gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
365								Hammering - slow drilling.
370					Same as above (360 ft).	SP		No water added down hole. PID = 0.0 ppm @ cyclone and breathing zone.
375					Same as above (360 ft).		High Solids Bentonite Grout	Kelly down @ 1559, new 20' connection @ 1633.
380					Same as above (360 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
385					Well-graded SAND with Gravel (SW); brown (7.5YR 5/3); dry; 60% fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; angular to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		Hammering.
390								



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 14 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Gravel (SW); brown (7.5YR 5/3); dry; 60% fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; angular to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		PID = 0.0 ppm @ cyclone and breathing zone. Hammering.
395								No water added down hole.
400					Same as above (390 ft).	SP	High Solids Bentonite Grout	Kelly down @ 1644, new 20' connection @ 1647.
405					Poorly graded SAND with Gravel (SP); brown (7.5YR 5/4); dry; 70% fine sand; trace coarse sand; rounded; 30% fine to coarse gravel; subrounded to rounded. Note: gravel is quartz and mafics.			PID = 0.1 ppm @ cyclone and 0.0 ppm @ breathing zone.
410					Same as above (402 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
415					Same as above (402 ft).			Hammering.
420								Kelly down @ 1658, new 20' connection @ 1701.



# Borehole ID: KAFB-106230

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/11/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 15 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); light brown (7.5YR 6/3); dry; 100% fine sand; rounded; trace silt.			PID = 0.0 ppm @ cyclone and breathing zone.
425					Same as above (420 ft).	SP		Hammering.
430							High Solids Bentonite Grout	No water added down hole. PID = 0.0 ppm @ cyclone and breathing zone.
435					Well-graded SAND with Gravel (SW); reddish yellow (7.5YR 6/6); dry; 70% fine to coarse sand; subrounded to rounded; 30% fine gravel; subrounded to rounded. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		PID = 0.0 ppm @ cyclone and breathing zone. Kelly down @ 1712. End of ARCH drilling @ 440' on 8/14/15.
440								
445								
450								



# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

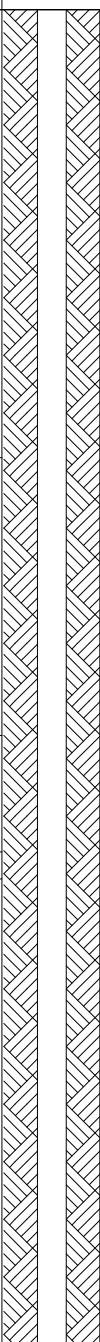
▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 16 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
435								
440								
					@ 440 ft. Poorly graded SAND (SP); brown (7.5YR 4/3); dry; loose; 95% fine sand; subangular; 5% silt; trace clay.	SP	 High Solids Benotomite Grout	Begin sonic coring at 440 feet bgs on 8/16/15.
					@ 443.1 ft. Silty SAND (SM); brown (7.5YR 4/3); 85% fine sand; 15% silt.	SM		@ 440 ft sand is quartz. Silt and clay occur in small pockets, <1/4".
					@ 444.4 ft. Poorly graded SAND (SP); brown (7.5YR 4/3); moist; 95% fine sand; 5% silt.	SP		@ 443.1 to 450 ft, sand is quartz and occasional biotite. @ 443.1 ft driller added water during drilling.
445					@ 444.7 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/3); 90% fine sand; trace medium sand; subangular; 10% silt.	SP-SM		@ 445.3 - 446.1 ft sand is wet possibly from driller adding water.
					@ 445.2 ft. Same as above (444.7 ft); moist; 90% fine to medium sand.			@ 447.8 ft gravel is mafics.
					@ 447.8 ft. Same as above (444.7 ft); trace coarse gravel to 1-1/2"; subrounded.			@ 449 ft sediment is dry.
450								





# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 17 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					<p>@ 450 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/3); 90% fine sand; trace medium sand; subangular; 10% silt.</p> <p>@ 450.4 ft. Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/3); 60% fine to coarse sand; subangular to subrounded; 30% coarse gravel; 10% silt.</p> <p>@ 451.6 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/4); 40% fine to medium sand; 30% fine to coarse gravel; 30% silt.</p>	<p>SP-SM</p> <p>SW-SM</p> <p>SM</p>	<p>- High Solids Benotone Grout</p> <p>- Top of Bentonite Seal</p>	<p>@ 450 to 465 ft, sand is quartz with occasional quartzite, granite, biotite, and microcline.</p> <p>@ 450.4 to 465 ft gravel is mafics with occasional quartz, quartzite, and microcline.</p>
455					<p>@ 454.4 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 5/3); 50% fine to coarse gravel to 2"; angular to subrounded; 20% fine sand; trace medium and coarse sand; 30% silt.</p>	GM		@ 454.6 ft trace reddish silt.
					<p>@ 456.2 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/2); 60% fine to coarse sand; subangular to subrounded; 25% coarse gravel to 1-1/2"; subrounded; 15% silt.</p>	SM		@ 457 ft gravel is elongated.
					<p>@ 457 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 4/4); 60% coarse gravel; occasional cobble to 4"; subrounded; 25% fine to coarse sand; subangular; 15% silt; trace clay.</p>	GM		
					<p>@ 458.4 ft. Poorly graded GRAVEL with Silt and Sand (GP-GM); brown (7.5YR 4/4); 60% fine gravel to 3/8"; 30% fine to coarse sand; 10% silt.</p>	GP-GM		
460					<p>@ 459.1 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/4); 80% fine to medium sand; 10% coarse gravel to 3"; subrounded; 10% silt.</p>	SP-SM		@ 459.8 ft gravel is fining downwards.
					<p>@ 459.8 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/4); 60% fine to coarse gravel to 2-1/2"; subangular to subrounded; 30% fine to coarse sand; 10% silt.</p>	GW-GM		@ 463.7 ft occasional lenses of silt.
465					<p>@ 463.7 ft. Lean CLAY (CL); reddish brown (5YR 4/3); stiff; medium plasticity; 100% clay.</p>	CL		



Hole Diameter Upper (in.): 11-3/4

Hole Diameter Lower (in.): 9-5/8

Surface Completion Type: Flush

Groundwater Levels BGS (ft):

At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

After Drilling: 458.67

Drilling Contractor: National EWP

Drilling Method: Sonic Coring

Logged By: M. Giles

Page 18 of 24

KAFB\_BOREHOLE\_LOG - SHAW\_DRILLING.GDT - 10/19/15 16:36 - Z:\KAFB RAPID\GINT\KAFB\_RAPID.GPJ



# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 19 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					<p>@ 480 ft. Silty SAND (SM); brown (7.5YR 4/3); 70% fine sand; trace medium sand; 30% silt.</p> <p>@ 480.6 ft. Same as above (480 ft); reddish brown (5YR 5/4); 85% fine sand; 15% silt.</p> <p>@ 482.3 ft. Same as above (480 ft); brown (7.5YR 4/4); 85% fine to medium sand.</p>	SM		@ 480 to 495 ft, sand is quartz with occasional biotite.
485					@ 484 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% fine sand; 10% silt.			@ 484 ft Occasional 2" lenses with higher percentages of silt.
490					@ 490 ft. Same as above (484 ft).	SP-SM	<p>- Top of 20/40 Sand</p> <p>- Top of 10/20 Sand</p>	
495					@ 491 ft. Same as above (484 ft); trace medium sand.			@ 493.7 ft occasional thin lense of clayey sand; less than 1/4"; very dark greenish grey (GLEY1 3/1 5GY).



# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 20 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495					@ 495 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% fine sand; trace medium sand; 10% silt.	SP-SM		@ 495 to 510 ft sand is quartz and biotite with occasional microcline and granite.
					@ 496.6 ft. Same as above (495 ft); 90% fine to medium sand.			
					@ 497 ft. No core recovered.			
					@ 497.5 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% fine to medium sand; 10% silt.	SP-SM		
					@ 498.8 ft. Silty GRAVEL with Sand (SM); brown (7.5YR 5/3); 50% fine to coarse gravel to 2"; angular to subrounded; 35% fine to coarse sand; 15% silt.	GM		@ 498.8 to 507 ft gravel is mafics, quartzite, and granite.
500					@ 500.2 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/3); 70% fine to coarse sand; 15% fine to coarse gravel to 3"; angular to subrounded; 15% silt.	SM		
					@ 501.9 ft. Same as above (500.2 ft); 15% coarse gravel to 3".			
					@ 504.4 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 5/3); 50% fine to coarse gravel to 3"; subangular to subrounded; 35% fine to coarse sand; 15% silt.	GM		
505					@ 507 ft. No core recovered.			@ 506.5 ft percentage of gravel decreases.
					@ 507.3 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/4); 90% fine to medium sand; subangular; 10% silt; trace fine gravel.	SP-SM		@ 507.3 ft Occasional thin lense of clay less than 1/4".
510								



# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 21 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					@ 510 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/4); 90% fine to medium sand; subangular; 10% silt; trace fine gravel.	SP-SM		@ 510 to 525 ft sand is quartz with biotite and occasional microcline. @ 510 ft occasional thin lense of clay less than 1/4".
					@ 511.8 ft. Poorly graded SAND (SP); brown (7.5YR 4/4); 95% medium sand; trace fine and coarse sand; trace fine gravel; 5% silt.	SP		@ 511.5 ft trace fine to coarse gravel, subrounded.
					@ 513.3 ft. Well-graded SAND (SW); brown (7.5YR 4/4); 95% fine to coarse sand; subangular to subrounded; 5% silt.	SW		@ 511.8 ft occasional lense of black clay.
515					@ 513.7 ft. Poorly graded SAND (SP); brown (7.5YR 4/4); 95% fine to medium sand; trace coarse sand; subangular; 5% silt.	SP		@ 515 ft gravel is quartz.
					@ 515 ft. Well-graded SAND (SW); brown (7.5YR 5/3); 90% fine to coarse sand; subangular to subrounded; 5% fine to gravel to 3/8"; 5% silt.	SW		
					@ 516.6 ft. Clayey GRAVEL with Sand (GC); pink (7.5YR 7/4); 50% coarse gravel to 3"; trace fine gravel; angular to subrounded; 30% fine sand; 20% clay.	GC		@ 516.6 to 525 ft gravel is mafics with occasional granite and conglomerate.
					@ 517.3 ft. Fat CLAY (CH); light brown (7.5YR 6/4); firm; high plasticity; 100% clay.	CH		
					@ 517.5 ft. Clayey GRAVEL with Sand (GC); pink (7.5YR 7/4); 60% fine to coarse gravel; angular to rounded; 25% fine to coarse sand; subangular; 15% clay.	GC		
520					@ 518 ft. Silty SAND (SM); brown (7.5YR 4/4); 75% fine sand; 25% silt.	SM		
					@ 518.7 ft. Same as above (518 ft); 85% fine sand; 15% silt.			
					@ 520.8 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/4); 70% fine to coarse sand; 15% coarse gravel to 1"; subrounded; 15% silt.			
					@ 521.8 ft. Well-graded SAND (SW); brown (7.5YR 4/4); 85% fine to coarse sand; subangular; 10% coarse gravel; subangular to subrounded; 5% silt.	SW		
525								





# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 22 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
525					@ 525 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/4); 70% fine to coarse sand; subangular; 15% fine to coarse gravel; subangular to subrounded; 15% silt.	SM		@ 525 to 540 ft sand is quartz with biotite and occasional microcline. Gravel is mafics.
					@ 526.1 ft. Lean CLAY (CL); light gray (10YR 7/2); firm; medium plasticity; 100% clay; trace silt.	CL		
					@ 526.6 ft. Well-graded SAND (SW); brown (7.5YR 4/4); 90% fine to coarse sand; subangular; 5% fine gravel to 3/4"; subangular to subrounded; 5% silt.	SW		
					@ 527 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine to medium sand; trace coarse gravel; 10% silt.	SP-SM		
					@ 528.6 ft. Well-graded SAND with Silt (SW-SM); brown (7.5YR 4/4); 85% fine to coarse sand; subangular to subrounded; 5% fine gravel to 3/8"; subangular; 10% silt.	SW-SM		
					@ 529.2 ft. Fat CLAY (CH); light brown (7.5YR 6/4); hard; high plasticity; 100% clay.	CH		
					@ 529.8 ft. Well-graded SAND (SW); brown (7.5YR 4/4); 85% fine to coarse sand; subangular to subrounded; 10% fine gravel to 3/4"; subangular to subrounded; 5% silt.	SW		
					@ 530.9 ft. Lean CLAY with Sand (CL); light brown (7.5YR 6/4); firm; low plasticity; 70% clay; trace silt; 30% fine sand; subangular.	CL		
					@ 532 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/4); 90% fine to medium sand; trace fine gravel; 10% silt.	SP-SM		
					@ 535 ft. Same as above (532 ft); trace coarse sand.			
					@ 538.9 ft. Silty SAND (SM); brown (7.5YR 4/4); 85% fine to medium sand; 15% silt; trace gravel.	SM		





# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 23 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					@ 540 ft. Silty SAND (SM); brown (7.5YR 4/4); 85% fine to medium sand; 15% silt; trace gravel. @ 540.3 ft. Same as above (540 ft); 80% fine to medium sand; 20% silt.	SM		@ 540 ft sand is quartz and biotite.
					No core recovered from 542 to 560 ft. Overdrill for heaving sand.			End of continuous coring @ 542 ft on 8/18/15.
545								
550								
555								

- Bottom of Filter Pack

- Native Backfill



# Borehole ID: KAFB-106230-Sonic

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/17/2015

**Date TD Reached:** 8/18/15

**Date Completed:** 9/1/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 456.00

▼ At End of Drilling: Not Recorded

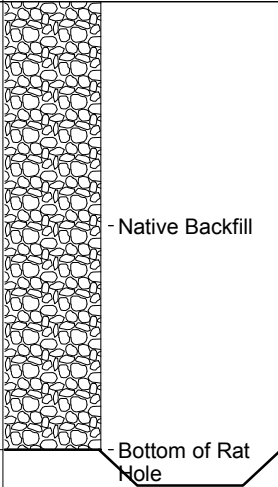
▽ After Drilling: 458.67

**Drilling Contractor:** National EWP

**Drilling Method:** Sonic Coring

**Logged By:** M. Giles

Page 24 of 24

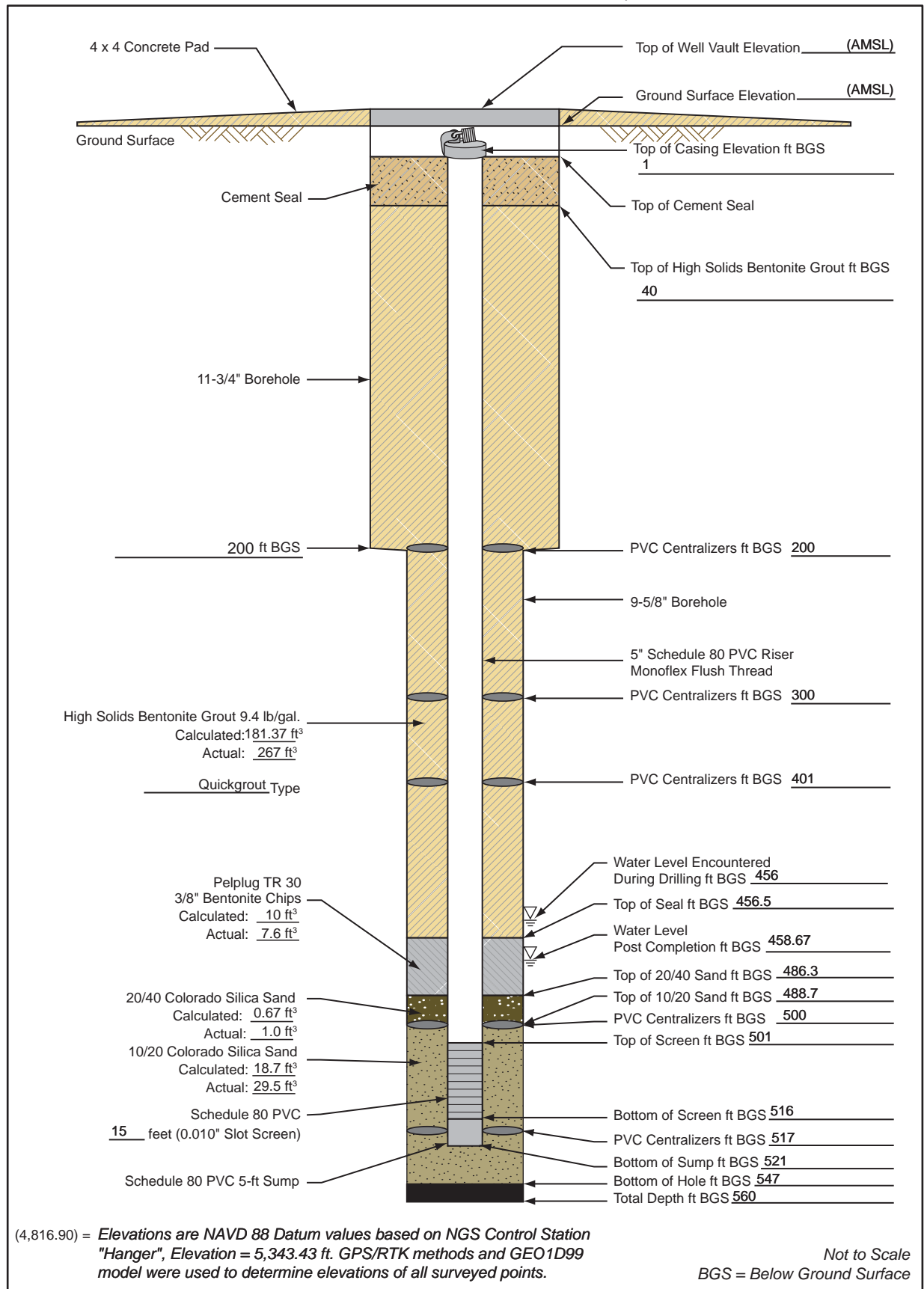
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
555					No core recovered from 542 to 560 ft. Overdrill for heaving sand.			
560								
565								
570								

# Monitoring Well Completion Diagram KAFB-106230

Installation Start Date/Time: 8/24/2015

Installation End Date/Time: 8/25/2015

Completion Date: 9/1/2015





## Well Development Record

**Project Name:** KAFB RAPID

**Location:** Georgia and Anderson

**Personnel:** R. Wortman

**Date:** 8/27/15

**Samplers:** N/A

**Method of Development:**  
☒ Surging ☐ Bailing ☒ Pumping  
☐ Original Development ☐ Redevelopment ☐ Other

**Well/Piez. No.:** KAFB-106230

**Date Installed:** 9/1/15

**Csg. Diameter (I.D.):** 5 "

**Total Depth (ft. bgs):** 521

**Development Date:** 8/27/15

**Depth to Water Before Developing Well (ft. btoc):** 458.67

**V=** $(B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation})$  **=** 1135 gallons

**Depth Purging From:** 514.5 feet **Time Purging Begins:** 1450, 8/27/15

**Weather:** Hot, Clear **Screened Interval (ft bgs):** 501 - 516

**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q

**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐

**Describe:** N/A

**Comment:** \_\_\_\_\_

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
8/27/2015	0859	457.66	15	--	--	--	> 1,000	Begin bailing; water is dark brown; no odor.
8/27/2015	0914	--	55	--	--	--	> 1,000	Stop bailing; set up for swabbing.
8/27/2015	0940	--	55	--	--	--	--	Begin swabbing bottom 5 feet of screen.
8/27/2015	1000	--	55	--	--	--	--	Swab next 5 feet of screen.
8/27/2015	1020	--	55	--	--	--	--	Swab top 5 feet of screen.
8/27/2015	1040	--	55	--	--	--	--	Finish swabbing; set up bailer.
8/27/2015	1050	--	55	--	--	--	--	Resume bailing.
8/27/2015	1135	--	225	--	--	--	> 1,000	Finish bailing.
8/27/2015	1447	457.57	225	--	--	--	--	Set pump at 514.5 feet bgs.
8/27/2015	1450	458.20	225	22.32	6.87	0.521	> 1,000	Start pumping from 514.5 feet bgs.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot  
pH - Reading rounded to 0.1 pH units  
Water temperature - Reported to nearest 0.1 °C  
°C = Degree Celsius  
EC = Electric Conductivity  
ft bgs = Feet Below Ground Surface  
ft btoc = Feet Below Top of Casing  
gal. = Gallon  
GPM = Gallons Per Minute  
I.D. = Inner Diameter  
N/A = Not Applicable  
NR = Not Recorded  
NTU = Nephelometric Turbidity Unit  
S/m = Seimens per Meter

**Where:**

B=3.14  
 $\phi_s$ = porosity of the sand pack  
 $r_c$ = radius of the well casing and screen in feet  
 $L_c$ = length of water column inside the casing and screen in feet  
 $r_w$ = radius of the well bore in feet  
 $L_s$ = length of saturated portion of the sand pack in feet  
7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB RAPIDWell No: KAFB-106230Project Number: 140705Samplers: N/ADate: 8/27/15

Checked By: \_\_\_\_\_

Time Start: 0859, 8/27/2015Time Finish: 1830, 8/27/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
8/27/2015	1500	458.20	270	21.66	6.78	0.510	184	Continue pumping from 514.5 feet bgs.
8/27/2015	1510	458.19	315	22.15	7.27	0.507	89.4	Continue pumping from 514.5 feet bgs.
8/27/2015	1520	458.19	360	22.06	7.33	0.507	80.5	Continue pumping from 514.5 feet bgs.
8/27/2015	1530	458.20	405	22.17	7.41	0.507	75.3	Continue pumping from 514.5 feet bgs.
8/27/2015	1540	458.20	440	21.91	7.44	0.506	71.1	Continue pumping from 514.5 feet bgs.
8/27/2015	1550	458.20	480	21.71	7.47	0.506	75.2	Continue pumping from 514.5 feet bgs.
8/27/2015	1600	458.18	520	21.57	7.52	0.504	78.1	Continue pumping from 514.5 feet bgs.
8/27/2015	1610	458.18	560	21.49	7.53	0.505	74.0	Continue pumping from 514.5 feet bgs.
8/27/2015	1620	458.18	600	21.50	7.59	0.505	76.9	Continue pumping from 514.5 feet bgs.
8/27/2015	1630	458.18	640	21.42	7.62	0.504	55.4	Continue pumping from 514.5 feet bgs.
8/27/2015	1640	458.17	670	21.58	7.63	0.504	56.1	Continue pumping from 514.5 feet bgs.
8/27/2015	1650	458.20	710	21.57	7.65	0.504	45.8	Move pump up to 501.5 feet bgs.
8/27/2015	1700	458.17	750	21.39	7.65	0.503	6.97	Continue pumping from 501.5 feet bgs.
8/27/2015	1710	458.19	790	21.60	7.68	0.504	6.03	Continue pumping from 501.5 feet bgs.
8/27/2015	1720	458.18	835	21.52	7.67	0.504	3.39	Continue pumping from 501.5 feet bgs.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



## Well Development Record

Project: KAFB RAPIDWell No: KAFB-106230Project Number: 140705Samplers: N/ADate: 8/27/15

Checked By: \_\_\_\_\_

Time Start: 0859, 8/27/2015Time Finish: 1830, 8/27/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
8/27/2015	1730	458.18	880	21.30	7.68	0.504	1.02	Move pump back down to 514.5 feet bgs.
8/27/2015	1740	458.18	925	21.29	7.70	0.503	0.64	Continue pumping from 514.5 feet bgs.
8/27/2015	1750	458.18	970	21.36	7.71	0.503	1.35	Continue pumping from 514.5 feet bgs.
8/27/2015	1800	458.18	1015	21.32	7.72	0.500	2.21	Move pump to 508.5 feet bgs.
8/27/2015	1810	458.18	1060	21.19	7.70	0.503	1.02	Continue pumping from 508.5 feet bgs.
8/27/2015	1820	458.18	1105	21.16	7.72	0.503	1.02	Continue pumping from 508.5 feet bgs.
8/27/2015	1830	458.18	1150	21.20	7.73	0.504	0.74	Well development complete. Finish pumping.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A



KAFB 106231



# Borehole ID: KAFB-106231

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB RAPID SWMU ST-106 and SS-111  
 Project Number: 500433

Date Started: 9/2/2015  
 Date TD Reached: 9/3/15  
 Date Completed: 9/15/2015

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 460.00  
 ▽ At End of Drilling: Not Recorded  
 ▽ After Drilling: 461.36

Drilling Contractor: National EWP  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: T. Richards



Page 4 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
5					No lithologic description.		Top of Casing/Top of Cement Seal	Borehole was waterknifed from 0.4' to 10'. No recovery.
10					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/3); dry; 80% fine to coarse sand; subangular to rounded; 15% fine gravel; subrounded to rounded; 5% silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		Began drilling @ 1032 on 9/2/15 with 11-3/4" drive casing. No hammering.
15					SILT with Sand (ML); strong brown (7.5YR 5/6); dry; 80% silt; 20% fine to medium sand; rounded.	ML	-Cement Seal	No water added down hole.
20					Same as above (12 ft).			Kelly down @ 1036, new 20' connection @ 1042.
25					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/4); 70% fine to coarse sand; subangular to rounded; 20% fine gravel; subrounded to rounded; 10% silt. Note: sand is quartz and feldspar. Gravel is quartz and mafics.	SW-SM		PID = 0.0 ppm @ cyclone and breathing zone.
30							Top of High Solids Bentonite Grout	No hammering. No water added down hole.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 2 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/4); 70% fine to coarse sand; subangular to rounded; 20% fine gravel; subrounded to rounded; 10% silt. Note: sand is quartz and feldspar. Gravel is quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
35					Same as above (30 ft).			No hammering. No water added down hole.
40					Same as above (30 ft); 20% fine to coarse gravel to 2".	SW-SM		Kelly down @ 1047, new 20' connection @ 1052.
45					Same as above (30 ft); 20% fine to coarse gravel to 2".		High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
50					Same as above (30 ft); 20% fine to coarse gravel to 2".			PID = 0.0 ppm @ cyclone and breathing zone.
55					SILT with Sand (ML); strong brown (7.5YR 4/6); dry; 80% silt; 20% fine to coarse sand; angular to subrounded. Note: sand is quartz and feldspar.	ML		No hammering. No water added down hole.
60								Kelly down @ 1105, new 20' connection @ 1441. Top seal out for repair.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 3 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT with Sand (ML); strong brown (7.5YR 4/6); dry; 80% silt; 20% fine to coarse sand; angular to subrounded. Note: sand is quartz and feldspar.			PID = 0.0 ppm @ cyclone and breathing zone.
65					Same as above (60 ft).	ML		
70					Same as above (60 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
75					Lean CLAY (CL); reddish brown (5YR 5/4); low to medium plasticity; 90% clay; 10% fine sand.			No hammering.
					Same as above (72 ft).	CL	High Solids Bentonite Grout	No water added down hole.
80					Same as above (72 ft).			Kelly down @ 1446, new 20' connection @ 1452.
85					SILT with Sand (ML); strong brown (7.5YR 5/6); 80% silt; 20% fine sand; trace medium sand; rounded.	ML		PID = 0.0 ppm @ cyclone and breathing zone.
90					Well-graded SAND (SW); reddish yellow (7.5YR 6/6); 90% fine to coarse sand; subrounded to rounded; 10% fine gravel; rounded. Note: sand is quartz and feldspar. Gravel is quartz and mafics.	SW		No hammering.
								No water added down hole.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 4 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well-graded SAND (SW); reddish yellow (7.5YR 6/6); 90% fine to coarse sand; subrounded to rounded; 10% fine gravel; rounded. Note: sand is quartz and feldspar. Gravel is quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
95					Same as above (90 ft).			No hammering.
100					Same as above (90 ft).	SW		Kelly down @ 1456, new 20' connection @ 1502.
105					Same as above (90 ft).		High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
110					Same as above (90 ft).			No hammering.
115					SILT (ML); strong brown (7.5YR 5/8); 90% silt; 10% fine to coarse sand.	ML		No water added down hole.
120					Description on next page.	SW-SM		PID = 0.0 ppm @ cyclone and breathing zone.
								Kelly down @ 1506, new 20' connection @ 1513.





# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 5 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Well-graded SAND with Silt and Gravel (SW-SM); strong brown (7.5YR 5/6); 70% fine to coarse sand; 20% fine gravel; 10% silt.	SW-SM		PID = 0.0 ppm @ cyclone and breathing zone.
125					Sandy SILT with Gravel (ML); strong brown (7.5YR 5/8); 60% silt; trace fat clay; 20% fine to coarse sand; angular to rounded; 20% fine to coarse gravel; rounded. Note: sand is quartz and feldspar. Gravel is quartz and mafics.			No hammering.
130					Same as above (123 ft).			No water added down hole.
135					Same as above (123 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
140					SILT (ML); strong brown (7.5YR 5/6); 90% silt; 10% fine to medium sand.	ML	High Solids Bentonite Grout	Kelly down @ 1520, new 20' connection @ 1525.
145					Same as above (140 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
150								No Hammering.
								No water added down hole.





# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 6 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					SILT (ML); strong brown (7.5YR 5/6); 90% silt; 10% fine to medium sand.			PID = 0.0 ppm @ cyclone and breathing zone.
155					Same as above (150 ft).	ML		No Hammering.  No water added down hole.
160					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/4); 90% fine sand; trace medium sand; 10% silt.	SP-SM		Kelly down @ 1536, new 20' connection @ 1541.  PID = 0.0 ppm @ cyclone and breathing zone.
165					Well-graded SAND (SW); brown (7.5YR 5/4); 90% fine to coarse sand; 5% fine gravel; rounded; 5% silt.			
170					Same as above (170 ft).	SW	High Solids Bentonite Grout	Hammering.  No water added down hole.
175					Lean CLAY with Sand (CL); reddish brown (5YR 4/4); medium plasticity; 80% clay; 10% fine to coarse sand; 10% fine gravel.	CL		PID = 0.0 ppm @ cyclone and breathing zone.  Hammering.
180					Description on next page.	ML		Kelly down @ 1554, new 20' connection @ 1600.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 7 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180								
185					SILT with Sand (ML); reddish brown (5YR 4/4); 85% silt; 15% fine to medium sand.	ML		No water added down hole. PID = 0.0 ppm @ cyclone and breathing zone.
190					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% fine sand; trace medium sand; trace fine gravel; 10% silt.	SP-SM		PID = 0.0 ppm @ cyclone and breathing zone.
195					Well-graded SAND (SW); brown (7.5YR 5/3); 100% fine to coarse sand; subangular to rounded. Note: sand is quartz, feldspar, and mafics.			
200					Same as above (192 ft).	SW	High Solids Bentonite Grout	Kelly down @ 1608. End of 9/2/15. Began drilling @ 1000 on 9/3/15 with 9-5/8" drive casing.
205					Same as above (192 ft).			No hammering.
210								



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 8 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210								
215					Well-graded SAND (SW); brown (7.5YR 5/3); 100% fine to coarse sand; subangular to rounded. Note: sand is quartz, feldspar, and mafics. @ 212 ft. Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 80% fine to coarse sand; angular to rounded; 20% fine to coarse gravel; subrounded to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz, mafics, and red feldspar.			PID = 0.0 ppm @ cyclone and breathing zone.  No hammering.  No water added down hole.  Kelly down @ 1005, new 20' connection @ 1009.
220					Same as above (212 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
225					Same as above (212 ft).	SW	High Solids Bentonite Grout	No hammering. Fast drilling. No water added down hole.
230					Same as above (212 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
235					Same as above (212 ft).			Kelly down at 1013, new 20' connection @ 1019.
240								



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 9 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 80% fine to coarse sand; angular to rounded; 20% fine to coarse gravel; subrounded to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz, mafics, and red feldspar.			PID = 0.0 ppm @ cyclone and breathing zone.
245								No hammering. Fast drilling.
250					Same as above (240 ft); gravel to 2".			No water added down hole.  PID = 0.0 ppm @ cyclone and breathing zone.
255					Same as above (240 ft); gravel to 2".	SW	High Solids Bentonite Grout	No hammering.  Kelly down @ 1025, new 20' connection @ 1029.
260					Same as above (240 ft); gravel to 2".			PID = 0.0 ppm @ cyclone and breathing zone.
265					Same as above (240 ft); gravel to 2".			Hammering intermittently.
270								



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 10 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270								
275					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 80% fine to coarse sand; angular to rounded; 20% fine to coarse gravel; subrounded to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz, mafics, and red feldspar.	SW		PID = 0.0 ppm @ cyclone and breathing zone.  Hammering. No water added down hole.
280					Well-graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 70% fine to coarse sand; subrounded to rounded; 20% fine gravel; trace coarse gravel; subrounded to rounded; 10% silt. Note: sand is quartz, feldspar, and mafics.			Kelly down @ 1033, new 20' connection @ 1036.
285					Same as above (277 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
290					Same as above (277 ft).	SW-SM	High Solids Bentonite Grout	Hammering.
295					Same as above (277 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
300								Hammering.  Kelly down @ 1042, new 20' connection @ 1047.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 11 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well-graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 70% fine to coarse sand; subrounded to rounded; 20% fine gravel; trace coarse gravel; subrounded to rounded; 10% silt. Note: sand is quartz, feldspar, and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
305								Hammering.
310					Same as above (300 ft).			No water added down hole.
315					Same as above (300 ft).	SW-SM		PID = 0.0 ppm @ cyclone and breathing zone.
320					Same as above (300 ft).		High Solids Bentonite Grout	Kelly down @ 1053, new 20' connection @ 1057.
325					Same as above (300 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
330								Steady hammering, stiff drilling. No water added down hole.





# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 12 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 50% fine to coarse sand; subrounded to rounded; 40% fine gravel; trace coarse gravel; subrounded to rounded; 10% silt. Note: sand is quartz, feldspar, and mafics.			PID = 0.0 ppm @ cyclone and breathing zone. Hammering. Stiff and slow drilling.
335								No water added down hole.
340					Same as above (330 ft).			Kelly down @ 1114, new 20' connection @ 1122.
345					Same as above (330 ft).	SW-SM	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
350								Steady hammering.
355					Same as above (330 ft); 70% fine to coarse sand; 20% fine to coarse gravel to 2".			No water added down hole.
360								PID = 0.0 ppm @ cyclone and breathing zone.
								Kelly down @ 1133, new 20' connection @ 1147.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 13 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 70% fine to coarse sand; subrounded to rounded; 20% fine to coarse gravel to 2"; subrounded to rounded; 10% silt. Note: sand is quartz, feldspar, and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
365					Same as above (360 ft).			Hammering steady. Slow drilling.
370					Same as above (360 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
375					Same as above (360 ft).	SW-SM	High Solids Bentonite Grout	No water added down hole.  Kelly down @ 1158, new 20' connection @ 1204.
380					Same as above (360 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
385					Same as above (360 ft).			Hammering. Slow drilling.
390								No water added down hole.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 14 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 70% fine to coarse sand; subrounded to rounded; 20% fine to coarse gravel to 2"; subrounded to rounded; 10% silt. Note: sand is quartz, feldspar, and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
395					Same as above (390 ft).		- High Solids Bentonite Grout	Hammering.
400					Same as above (390 ft).			No water added down hole.
405					Same as above (390 ft).	SW-SM	Top of 3/8" Bentonite Ship Seal	Kelly down @ 1220, new 20' connection @ 1314.
410					Same as above (390 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
415					Same as above (390 ft).		- 3/8" Bentonite Chip Seal	
420								Kelly down @ 1329, new 20' connection @ 1334.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 15 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well-graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 70% fine to coarse sand; subrounded to rounded; 20% fine to coarse gravel to 2"; subrounded to rounded; 10% silt. Note: sand is quartz, feldspar, and mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
425					Same as above (420 ft).	SW-SM	- 3/8" Bentonite Chip Seal	Hammering. Slow drilling.
430					Same as above (420 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
435							- Top of 20/40 Sand	No water added down hole.
440					Poorly graded SAND with Silt (SP-SM); reddish brown (5YR 5/4); 90% fine sand; trace medium sand; 10% silt.		- Top of 10/20 Sand	Kelly down @ 1347, new 20' connection @ 1350.
445					Same as above (436 ft).	SP-SM	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	PID = 0.0 ppm @ cyclone and breathing zone.
450					Well-graded SAND (SW); light brown (7.5YR 6/4); 95% fine to coarse sand; rounded; trace fine gravel; 5% silt.	SW		Hammering.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 16 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well-graded SAND (SW); light brown (7.5YR 6/4); moist; 85% fine to coarse sand; rounded; 10% fine to coarse gravel; 5% silt. Note: gravel is predominantly mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
455					Same as above (450 ft).			Hammering. No water added down hole.
460					▽ Same as above (450 ft); wet; 90% fine to coarse sand; no silt.			Kelly down @ 1405, new 20' connectin @ 1413.
465					Same as above (450 ft); wet; 90% fine to coarse sand; no silt.	SW		PID = 0.1 ppm @ cyclone and 0.0 @ breathing zone. Depth to groundwater measured @ 460 feet bgs.
470					Same as above (450 ft); wet; 90% fine to coarse sand; no silt.			PID = 0.2 ppm @ cyclone and 0.0 @ breathing zone.
475					Same as above (450 ft); wet; 90% fine to coarse sand; no silt.			Hammering. Slow drilling. No water added down hole.
480							- Bottom of Screen	Kelly down @ 1432, new 20' connection.



# Borehole ID: KAFB-106231

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 9/3/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 460.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 461.36

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 17 of 17

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well-graded SAND (SW); light brown (7.5YR 6/4); wet; 90% fine to coarse sand; 10% fine to coarse gravel. Note: gravel is predominantly mafics.	SW	Bottom of Sump	PID = 0.1 ppm @ cyclone and 0.0 @ breathing zone.
485					Poorly graded SAND (SP); brown (7.5YR 4/4); wet; 95% fine sand; trace medium sand; 5% fine to coarse gravel; subrounded to rounded.			
490					Same as above (483 ft).	SP		PID = 0.1 ppm @ cyclone and 0.0 @ breathing zone.
495					Same as above (483 ft).			
500							Bottom of Filter Pack	Total depth = 500 ft. Reached total depth @ 1503 on 9/3/15.
505								
510								

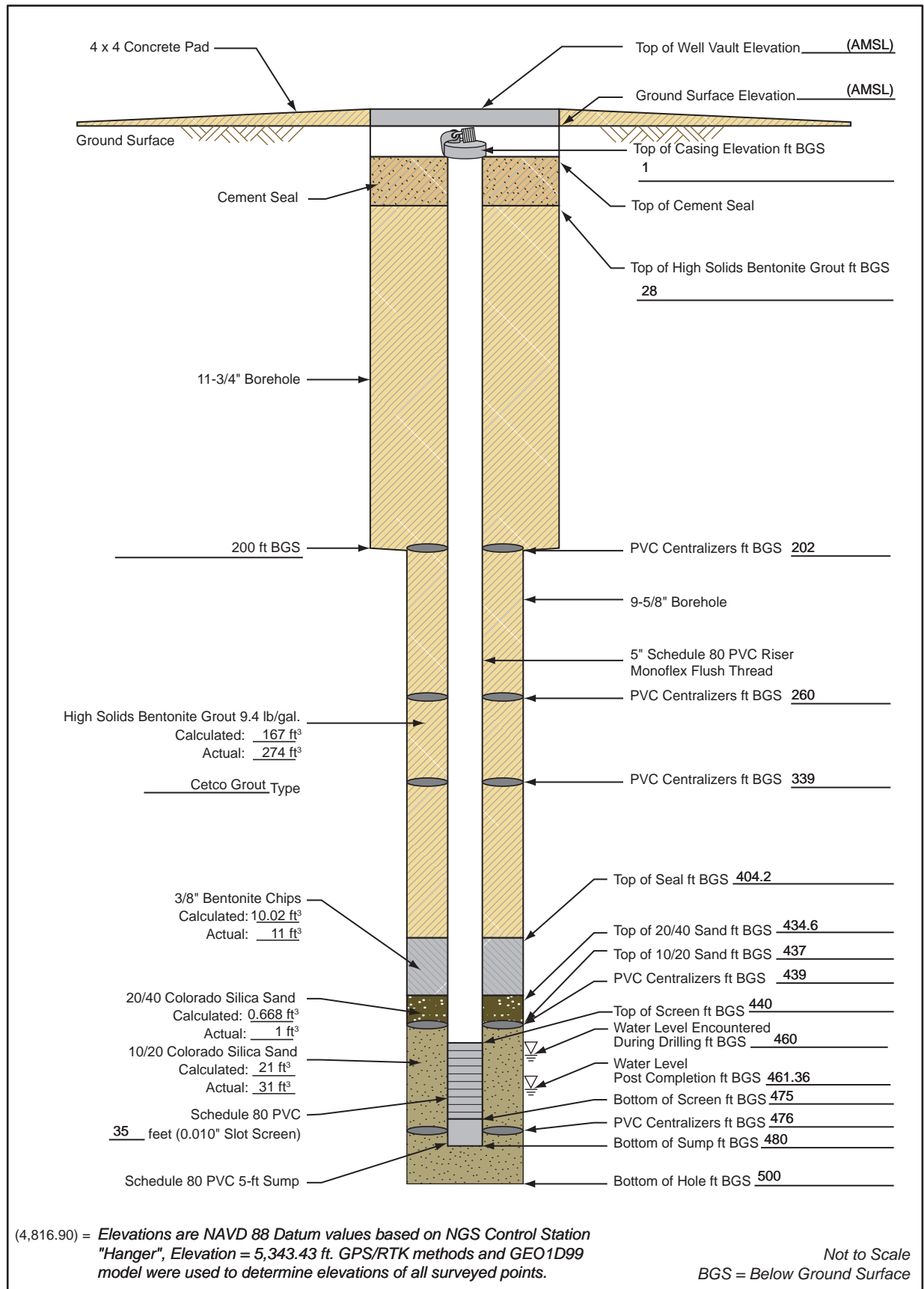


# Monitoring Well Completion Diagram KAFB-106231

Installation Start Date/Time: 9/4/2015

Installation End Date/Time: 9/8/2015

Completion Date: 9/15/2015





## Well Development Record

**Project Name:** KAFB RAPID

**Location:** Kathryn and Indiana

**Personnel:** T. Richards

**Date:** 9/9/15

**Samplers:** N/A

**Method of Development:**  
☒ Surging ☒ Bailing ☒ Pumping  
☐ Original Development ☐ Redevelopment ☐ Other

**Well/Piez. No.:** KAFB-106231

**Date Installed:** 9/15/15

**Csg. Diameter (I.D.):** 5 "

**Total Depth (ft. bgs):** 480

**Development Date:** 9/9/2015 - 9/10/2015

**Depth to Water Before Developing Well (ft. btoc):** 461.36

**V=** $(B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation})$  **=** 467 gallons

**Depth Purging From:** 472.8 feet **Time Purging Begins:** 1007, 9/10/2015

**Weather:** Clear, Cool, Breezy **Screened Interval (ft bgs):** 440 - 475

**Equipment Nos.:** **pH Meter:** YSI 650 MDS **EC Meter:** YSI 650 MDS **Turbidity Meter:** HACH 21000Q

**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N ☐

**Describe:** Steam Cleaned

**Collected Sample of Water Added to Well:** Y ☐ N ☒ X ☐

**Describe:** N/A

**Comment:** \_\_\_\_\_

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
9/9/2015	0802	461.36	--	--	--	--	--	Collect initial water level reading.
9/9/2015	0822	--	--	--	--	--	> 1,000	Begin bailing.
9/9/2015	0852	--	55	--	--	--	> 1,000	Stop bailing. Set up swab.
9/9/2015	0909	--	55	--	--	--	--	Begin swabbing bottom 5 feet of screen.
9/9/2015	0929	--	55	--	--	--	--	Swab next 5 feet of screen.
9/9/2015	0953	--	55	--	--	--	--	Swab top 5 feet of screen.
9/9/2015	1015	--	55	--	--	--	--	Swab entire 15 foot screen.
9/9/2015	1020	--	55	--	--	--	--	Finish swabbing.
9/9/2015	1025	--	55	--	--	--	--	Begin bailing.
9/9/2015	1055	--	150	--	--	--	> 1,000	Finish bailing. Start setting up pump.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot  
pH - Reading rounded to 0.1 pH units  
Water temperature - Reported to nearest 0.1 °C  
°C = Degree Celsius  
EC = Electric Conductivity  
ft bgs = Feet Below Ground Surface  
ft btoc = Feet Below Top of Casing  
gal. = Gallon  
GPM = Gallons Per Minute  
I.D. = Inner Diameter  
N/A = Not Applicable  
NR = Not Recorded  
NTU = Nephelometric Turbidity Unit  
S/m = Siemens per Meter

**Where:**

B=3.14  
 $\phi_s$ = porosity of the sand pack  
 $r_c$ = radius of the well casing and screen in feet  
 $L_c$ = length of water column inside the casing and screen in feet  
 $r_w$ = radius of the well bore in feet  
 $L_s$ = length of saturated portion of the sand pack in feet  
7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB RAPIDWell No: KAFB-106231Project Number: 140705Samplers: N/ADate: 9/9/15 - 9/10/15

Checked By: \_\_\_\_\_

Time Start: 0802, 9/9/2015Time Finish: 1146, 9/10/2015

## Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
9/9/2015	1335	--	150	--	--	--	--	Pump set at 472.8 feet bgs.
9/10/2015	0835	--	150	--	--	--	--	Begin installing sounding tube.
9/10/2015	0950	--	150	--	--	--	--	Finish placing sounding tube.
9/10/2015	1005	461.45	150	--	--	--	--	Sound well.
9/10/2015	1007	461.45	150	--	--	--	--	Begin Pumping at 472.8 feet bgs at 4.5 gpm.
9/10/2015	1015	462.40	175	20.40	6.41	1.052	5.66	Continue pumping from 472.8 feet bgs.
9/10/2015	1025	462.42	220	20.40	6.45	1.052	5.49	Continue pumping from 472.8 feet bgs.
9/10/2015	1035	462.42	265	20.43	6.73	1.065	4.42	Continue pumping from 472.8 feet bgs.
9/10/2015	1045	462.43	310	20.49	6.82	1.194	12.70	Move pump up to 468.8 feet bgs.
9/10/2015	1055	462.39	355	20.58	6.94	1.090	1.44	Continue pumping from 468.8 feet bgs.
9/10/2015	1105	462.41	400	20.68	6.98	1.102	2.02	Move pump up to 464.8 feet bgs.
9/10/2015	1115	462.41	445	20.72	6.99	1.112	0.92	Continue pumping from 464.8 feet bgs.
9/10/2015	1125	462.41	490	20.67	6.96	1.120	4.55	Move pump down to 468.8 feet bgs.
9/10/2015	1135	462.42	535	20.65	6.95	1.130	2.49	Continue pumping from 468.8 feet bgs.
9/10/2015	1145	462.43	580	20.65	6.95	1.130	0.85	Continue pumping from 468.8 feet bgs.
9/10/2015	1146	--	--	--	--	--	--	Well development complete. Turn off pump.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106232



# Borehole ID: KAFB-106232

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB RAPID SWMU ST-106 and SS-111  
 Project Number: 500433

Hole Diameter Upper (in.): 11-3/4  
 Hole Diameter Lower (in.): 9-5/8  
 Surface Completion Type: Flush

Date Started: 8/27/2015  
 Date TD Reached: 8/28/15  
 Date Completed: 9/15/2015

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 458.07  
 ▼ At End of Drilling: Not Recorded  
 ▼ After Drilling: 460.90

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Drilling Contractor: National EWP  
 Drilling Method: Air Rotary Casing Hammer  
 Logged By: T. Richards



Page 1 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0								
5					No lithologic description.	ASPHALT FILL	Top of Casing/Top of Cement Seal	Borehole was waterknifed from 0.4' to 10.3'. No recovery.
10								Began drilling @ 1420 with 11-3/4" drive casing on 8/27/15.
15					Well-graded SAND with Silt (SW-SM); strong brown (7.5YR 4/6); slightly moist; 90% fine to coarse sand; angular to rounded; 10% silt. Note: sand is quartz and mafics.			
20					Same as above (10 ft).			Kelly down @ 1429, new 20' connection @ 1435.
25					Same as above (10 ft).	SW-SM	Cement Seal	PID = 0.0 @ cyclone and breathing zone.
30					Same as above (10 ft).			No hammering. No water added.
					Description on next page.	SW		



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 2 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/3); 80% fine to coarse sand; angular to subrounded; 20% fine to coarse gravel. Note: sand is quartz and mafics, gravel is quartz, feldspar, and mafics.	SW		PID = 0.0 @ cyclone and breathing zone.  No hammering.  No water added.
40					Well-graded SAND with Silt (SW-SM); light brown (7.5YR 6/4); 80% fine to coarse sand; angular to rounded; 10% fine gravel; angular to rounded; 10% silt. Note: sand and gravel are quartz and mafics.			Kelly down @ 1447, new 20' connection @ 1457.
45					Same as above (37 ft).			PID = 0.0 @ cyclone and breathing zone.
50					Same as above (37 ft).	SW-SM		No hammering. Fast drilling.  No water added.
55					Same as above (37 ft).			PID = 0.0 @ cyclone and breathing zone.
60					Description on next page.	CL		Kelly down @ 1458, new 20' connection @ 1504.





# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 3 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Lean CLAY (CL); yellowish red (5YR 4/6); moist; non plastic to low plasticity; 100% clay; trace silt; trace sand.			PID = 0.0 @ cyclone and breathing zone.
65					Same as above (60 ft).			No hammering.
70					Same as above (60 ft).	CL		No water added. PID = 0.0 @ cyclone and breathing zone.
75					Same as above (60 ft).		High Solids Bentonite Grout	Kelly down @ 1509, new 20' connection @ 1513.
80					Same as above (60 ft).			PID = 0.0 @ cyclone and breathing zone.
85					Silty SAND (SM); strong brown (7.5YR 5/6); slightly moist; 80% fine to coarse sand; subrounded to rounded; 20% silt.	SM		
90								



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 4 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Silty SAND (SM); strong brown (7.5YR 5/6); slightly moist; 80% fine to coarse sand; subrounded to rounded; 20% silt.			PID = 0.0 @ cyclone and breathing zone.
95					Same as above (90 ft).			No hammering. No water added down hole.
100					Same as above (90 ft).	SM		Kelly down @ 1520, new 20' connection @ 1526. PID = 0.0 @ cyclone and breathing zone.
105					Same as above (90 ft).		High Solids Bentonite Grout	Fast drilling.
110					Same as above (90 ft).			PID = 0.0 @ cyclone and breathing zone.
115					SILT (ML); strong brown (7.5YR 4/6); moist; 90% silt; 10% medium to coarse sand; trace fine gravel.	ML		Kelly down @ 1530, new 20' connection @ 1538.
120								



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 5 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					SILT (ML); strong brown (7.5YR 4/6); moist; 90% silt; 10% medium to coarse sand; trace fine gravel.			PID = 0.0 @ cyclone and breathing zone.
125					Same as above (120 ft).			Some hammering. No water added.
130					Same as above (120 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
135					Same as above (120 ft); 95% silt; 5% fine sand.	ML	High Solids Bentonite Grout	Kelly down @ 1547, new 20' connection @ 1551.
140					Same as above (120 ft); 95% silt; 5% fine sand.			PID = 0.0 ppm @ cyclone and breathing zone.
145					Poorly graded SAND with Gravel (SP); strong brown (7.5YR 5/8); 80% fine sand; 20% fine gravel; angular to rounded; trace silt.	SP		Hammering intermittently.  No water added.
150								



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 6 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Poorly graded SAND with Gravel (SP); strong brown (7.5YR 5/8); 80% fine sand; 20% fine gravel; angular to rounded; trace silt.			PID = 0.0 ppm @ cyclone and breathing zone.
155					Same as above (150 ft).	SP		Steady hammering.
160					Same as above (150 ft).			No water added.
165					Lean CLAY with Sand (CL); reddish brown (5YR 5/4); low to medium plasticity; 80% clay; 20% fine to medium sand.	CL	High Solids Bentonite Grout	Kelly down @ 1604, new 15' connection @ 1608.
170					Same as above (163 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
175					Poorly graded SAND (SP); brown (7.5YR 5/4); 95% fine sand; trace fine gravel; 5% silt.	SP		Steady hammering.
180								No water added.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 7 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); brown (7.5YR 5/4); 95% fine sand; trace fine gravel; 5% silt.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
185					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 80% fine to coarse sand; angular to rounded; 20% fine to coarse gravel; subrounded to rounded. Note: Sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.			Steady hammering.
190					Same as above (182 ft).			No water added.
195					Same as above (182 ft).	SW	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
200					Same as above (182 ft).			Kelly down @ 1629. Add 5' connection @ 1633.
205					Same as above (182 ft).			PID = 0.0 ppm @ cyclone and breathing zone. Stop drilling @ 1629 on 8/27/15. Reached total depth with 11-3/4" casing. Resumed drilling with 9-5/8" casing @ 0815 on 8/28/15.
210					Same as above (182 ft).			No Hammering and no water added.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 8 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 80% fine to coarse sand; angular to rounded; 20% fine to coarse gravel; subrounded to rounded. Note: Sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
215					Same as above (210 ft).			No hammering, fast drilling.
220					Same as above (210 ft).			Kelly down @ 0821, new 20' connection @ 0826.
225					Same as above (210 ft).	SW	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
230					Same as above (210 ft); 20% fine to coarse gravel to 2".			No hammering; no water added.
235					Same as above (210 ft); 20% fine to coarse gravel to 2".			PID = 0.0 ppm @ cyclone and breathing zone.
240								Kelly down @ 0837, new 20' connection @ 0842.





# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 9 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 80% fine to coarse sand; angular to rounded; 20% fine to coarse gravel to 2"; subrounded to rounded. Note: Sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.			
245					Same as above (240 ft).			No hammering; no water added.
250					Same as above (240 ft). Note: higher percentage of fine sand.			PID = 0.0 ppm @ cyclone and breathing zone.
255					Same as above (240 ft). Note: higher percentage of fine sand.	SW	High Solids Bentonite Grout	Kelly down @ 0848, new 20' connection @ 0853.
260					Same as above (240 ft). Note: higher percentage of fine sand.			PID = 0.0 ppm @ cyclone and breathing zone. Hammering.
265					Same as above (240 ft). Note: higher percentage of fine sand.			No water added.
270								



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 10 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 80% fine to coarse sand; angular to rounded; 20% fine to coarse gravel to 2"; subrounded to rounded. Note: Sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
275					Same as above (270 ft).			Hammering.
280					Same as above (270 ft).			No water added.
285					Same as above (270 ft).	SW	High Solids Bentonite Grout	Kelly down @ 0858, new 20' connection @ 0902.
290					Same as above (270 ft); 20% fine gravel.			PID = 0.0 ppm @ cyclone and breathing zone.
295					Same as above (270 ft); 20% fine gravel.			Steady hammering; fairly quick drilling.
300								No water added.
								PID = 0.0 ppm @ cyclone and breathing zone.
								Kelly down @ 0907, new 20' connection @ 0911.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 11 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 80% fine to coarse sand; angular to rounded; 20% fine gravel; subrounded to rounded. Note: Sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
305					Same as above (300 ft).			Hammering.
310					Same as above (300 ft).			No water added.
315					Same as above (300 ft).	SW		PID = 0.0 ppm @ cyclone and breathing zone.
320					Same as above (300 ft).		High Solids Bentonite Grout	Kelly down @ 0920, new 20' connection @ 0927.
325					Same as above (300 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
330								Hammering.
								No water added.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 12 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 80% fine to coarse sand; angular to rounded; 20% fine gravel; subrounded to rounded. Note: Sand is quartz, feldspar, and mafics. Gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
335					Same as above (330 ft).	SW		Hammering.
340					Same as above (330 ft).			No water added.
345					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; loose; 95% fine sand; subrounded to rounded; 5% silt. Note: sand is quartz, feldspars, and mafics.	SP	High Solids Bentonite Grout	Kelly down @ 0940, new 20' connection @ 0944.
350					Same as above (342 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
355					Well-graded SAND (SW); brown (7.5YR 5/4); loose; 90% fine to coarse sand; subangular to rounded; 10% fine gravel. Note: sand is quartz, feldspar, and mafics. Gravel is mafics.	SW		Hammering.
360								PID = 0.0 ppm @ cyclone and breathing zone.
								Kelly down @ 0958, new 20' conneciton @ 1004.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 13 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND (SW); brown (7.5YR 5/4); loose; 90% fine to coarse sand; subangular to rounded; 10% fine gravel. Note: sand is quartz, feldspar, and mafics. Gravel is mafics.			PID = 0.0 ppm @ cyclone and breathing zone.
365					Same as above (360 ft).			Hammering. No water added.
370					Same as above (360 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
375					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 60% fine to coarse sand; 40% fine to coarse gravel; subrounded to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW	High Solids Bentonite Grout	Hammering.
380					Same as above (376 ft).			Kelly down @ 1016, new 20' connection @ 1021.
385					Same as above (376 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
390								Hammering. No water added.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 14 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 60% fine to coarse sand; 40% fine to coarse gravel to 2"; subrounded to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.			PID = 0.0 ppm @ cyclone and breathing zone. Hammering.
395					Same as above (390 ft).			No water added.
400					Same as above (390 ft).			Kelly down @ 1033, new 20' connection @ 1038.
405					Same as above (390 ft).	SW	High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and breathing zone.
410					Same as above (390 ft).			Hammering.
415					Same as above (390 ft).			No water added.
420								PID = 0.0 ppm @ cyclone and breathing zone.
								Hammering.
								Kelly down @ 1050, new 20' connection @ 1053.





# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 15 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 60% fine to coarse sand; 40% fine to coarse gravel to 2"; subrounded to rounded; trace silt. Note: sand is quartz, feldspar, and mafics. Gravel is quartz and mafics.	SW		PID = 0.0 ppm @ cyclone and breathing zone.
425					Poorly graded SAND (SP); light brown (7.5YR 6/4); 95% fine sand; trace fine to coarse gravel; rounded; 5% silt. Note: gravel is quartz.	SP		Hammering
430					Same as above (423 ft); very moist.	SP		No water added.
435								PID = 0.0 ppm @ cyclone and breathing zone. Possible water zone @ 430'. Water was encountered 27' higher than well installed one block to the south.
					Lean CLAY (CL); reddish yellow (5YR 6/6); moist; low plasticity; 100% clay.	CL		Kelly down @ 1109, new 20' connection @ 1114.
440					Poorly graded SAND (SP); reddish brown (5YR 5/4); very moist to wet; 100% fine sand; trace silt. Same as above (438 ft); trace coarse sand.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
445					Same as above (438 ft); trace coarse sand.	SP		Hammering.
450								



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 16 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND (SP); reddish brown (5YR 5/4); very moist to wet; 100% fine sand; trace coarse sand; trace silt.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
455					Well-graded SAND with Gravel (SW); brown (7.5YR 5/3); wet; 80% fine to coarse sand; subrounded to rounded; 20% fine gravel; trace coarse gravel; subrounded to rounded. Note: sand is quartz, mafics, and feldspar. Gravel is mafics and quartz.	SW		Hammering.
460					Same as above (453 ft).			Kelly down @ 1124, new 20' connection @ 1128.
465					Poorly graded SAND (SP); brown (7.5YR 5/4); wet; 95% fine sand; 5% fine gravel; rounded.	SP		PID = 0.0 ppm @ cyclone and breathing zone.
470					Same as above (463 ft).			Hammering.
475					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); wet; 80% fine to coarse sand; 20% fine to coarse gravel to 2"; subrounded to rounded.	SW		PID = 0.0 ppm @ cyclone and breathing zone.
480								Kelly down @ 1143, new 20' connection @ 1511.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 17 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); wet; 80% fine to coarse sand; 20% fine to coarse gravel to 2"; subrounded to rounded.			PID = 0.0 ppm @ cyclone and breathing zone.
485					Same as above (480 ft).		- 3/8" Bentonite Chip Seal	Steady hammering; slow drilling. No water added.
490					Same as above (480 ft).	SW	- Top of 20/40 Sand - Top of 10/20 Sand	PID = 0.0 ppm @ cyclone and breathing zone.
495					Same as above (480 ft).			Hammering.
500					Same as above (480 ft).			Kelly down @ 1530, new 20' connection @ 1535. Added 25 gallons of water.
505					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); wet; 90% fine sand; trace medium sand; 10% silt.	SP-SM	- Top of 5" Schedule 80 PVC 0.010" Slot Screen	PID = 0.0 ppm @ cyclone and breathing zone.
510					See description on next page.	SW		Hammering.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 18 of 19

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); wet; 80% fine to coarse sand; subrounded to rounded; 20% fine to coarse gravel; subangular to rounded; trace silt. Note: gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
515					Same as above (510 ft).			Hammering; slow drilling.
520					Same as above (510 ft). Note: a larger percentage of the sand is coarse.			Kelly down @ 1555, new 20' connection @ 1602.
525					Same as above (510 ft). Note: a larger percentage of the sand is coarse.			Add 25 gallons of water downhole.
530					Same as above (510 ft).			PID = 0.0 ppm @ cyclone and breathing zone.
535					Same as above (510 ft).			Hammering; slow drilling.
540						SW		Kelly down @ 1622, new 20' connection @ 1627.
								Add 25 gallons of water.



# Borehole ID: KAFB-106232

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 8/27/2015

**Date TD Reached:** 8/28/15

**Date Completed:** 9/15/2015

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 11-3/4

**Hole Diameter Lower (in.):** 9-5/8

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 458.07

▼ At End of Drilling: Not Recorded

▽ After Drilling: 460.90

**Drilling Contractor:** National EWP

**Drilling Method:** Air Rotary Casing Hammer

**Logged By:** T. Richards

Page 19 of 19

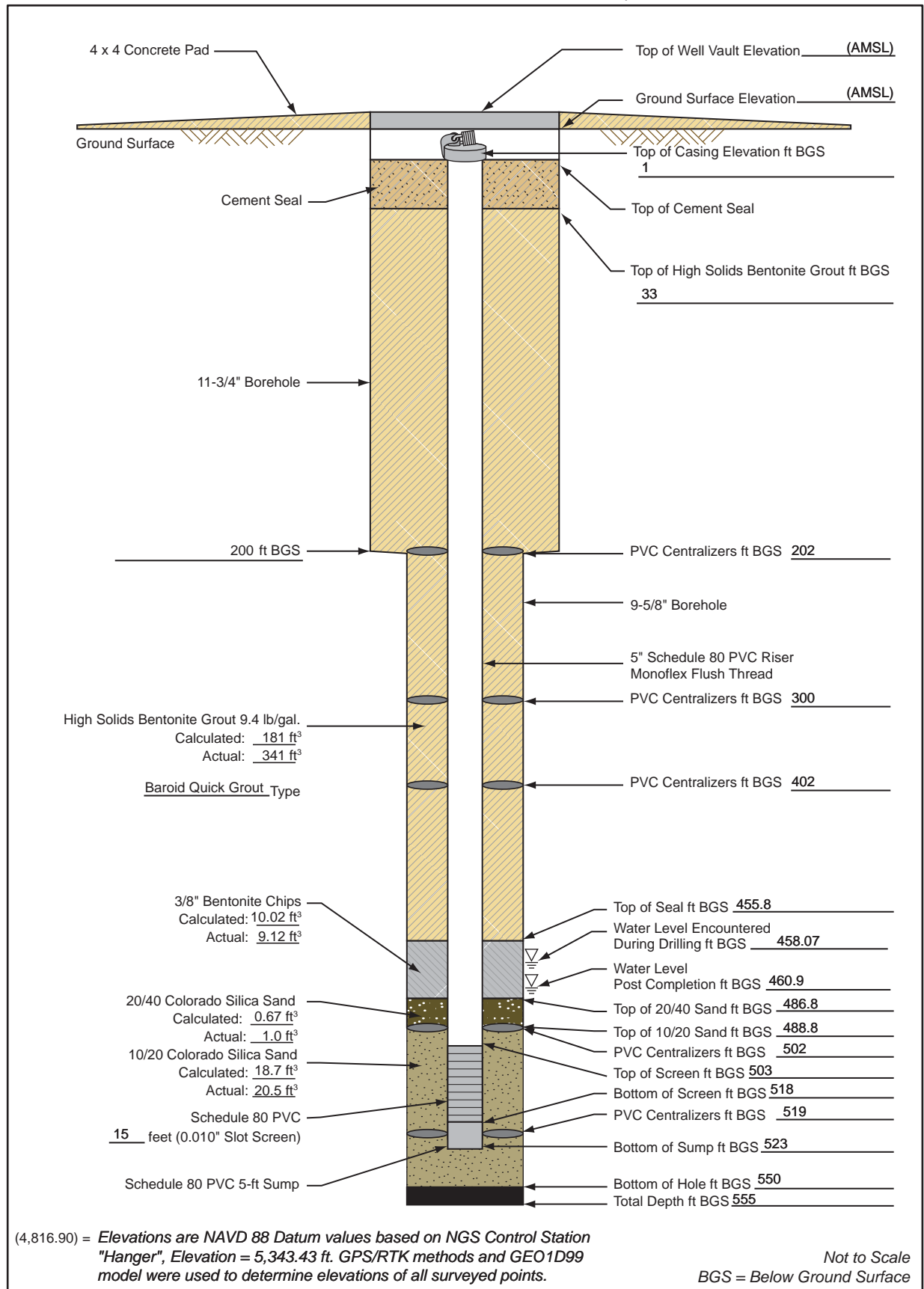
Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); wet; 80% fine to coarse sand; subrounded to rounded; 20% fine to coarse gravel; subangular to rounded; trace silt. Note: gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and breathing zone.
545					Same as above (540 ft).			Hammering; slow drilling.
550					Same as above (540 ft).	SW		PID = 0.0 ppm @ cyclone and breathing zone.
555								Kelly down @ 1652 on 8/28/15. Total depth = 555 ft bgs. Flood borehole with approximately 1,300 gallons of water.
560								
565								
570								

# Monitoring Well Completion Diagram KAFB-106232

Installation Start Date/Time: 8/31/2015

Installation End Date/Time: 9/1/2015

Completion Date: 9/15/15







## Well Development Record

**Project Name:** KAFB RAPID**Location:** Kathryn and Georgia**Personnel:** R. Wortman**Date:** 9/3/15**Samplers:** N/A**Method of Development:**☒ Surging☒ Bailing**Well/Piez. No.:** KAFB-106232**Date Installed:** 9/15/15**Csg. Diameter (I.D.):** 5 "**Total Depth (ft. bgs):** 523☒ Original Development☐ Redevelopment☒ Pumping☐ Other**Development Date:** 9/3/2015 - 9/4/2015**Depth to Water Before Developing Well (ft. btoc):** 460.90
$$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w^2 - r_c^2) * L_s * \phi_s * 7.48) + (H_2O \text{ added during drilling/installation}) = 740 \text{ gallons}$$
**Depth Purging From:** 516.5 feet**Time Purging Begins:** 0945, 9/4/2015**Weather:** Hot, Clear**Screened Interval (ft bgs):** 503 - 518**Equipment Nos.:** **pH Meter:** YSI 650 MDS**EC Meter:** YSI 650 MDS**Turbidity Meter:** HACH 21000Q**Equipment Decontaminated Prior to Development:** Y ☒ X ☐ N**Describe:** Steam Cleaned**Collected Sample of Water Added to Well:** Y ☐ N ☒ X**Describe:** N/A**Comment:** Driller added 600 gallons of water during drilling and well installation.

Date	Time	Water Level (ft bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
9/3/2015	1332	460.95	--	--	--	--	--	Initial water level reading.
9/3/2015	1355	--	--	--	--	--	--	Begin bailing.
9/3/2015	1410	--	55	--	--	--	> 1,000	Stop bailing. Set up swab.
9/3/2015	1440	--	55	--	--	--	--	Begin swabbing bottom 5 feet of screen.
9/3/2015	1500	--	55	--	--	--	--	Swab next 5 feet of screen.
9/3/2015	1520	--	55	--	--	--	--	Swab top 5 feet of screen.
9/3/2015	1540	--	55	--	--	--	--	Finish swabbing. Set up bailer.
9/3/2015	1555	--	55	--	--	--	--	Begin bailing.
9/3/2015	1630	--	150	--	--	--	> 1,000	Continue bailing.

**Notes:**

Water Levels - Reported to the nearest 0.01 foot

pH - Reading rounded to 0.1 pH units

Water temperature - Reported to nearest 0.1 °C

°C = Degree Celsius

EC = Electric Conductivity

ft bgs = Feet Below Ground Surface

ft btoc = Feet Below Top of Casing

gal. = Gallon

GPM = Gallons Per Minute

I.D. = Inner Diameter

N/A = Not Applicable

NR = Not Recorded

NTU = Nephelometric Turbidity Unit

S/m = Seimens per Meter

**Where:**

B=3.14

 $\phi_s$ = porosity of the sand pack $r_c$ = radius of the well casing and screen in feet $L_c$ = length of water column inside the casing and screen in feet $r_w$ = radius of the well bore in feet $L_s$ = length of saturated portion of the sand pack in feet

7.48 gallons/cubic foot= conversion from cubic feet to gallons



## Well Development Record

Project: KAFB RAPIDWell No: KAFB-106232Project Number: 140705Samplers: N/ADate: 9/3/15 - 9/4/15

Checked By: \_\_\_\_\_

Time Start: 1332, 9/3/2015Time Finish: 1141, 9/4/2015

Field Chemistry (cont'd)

Date	Time	Water Level (ft. bTOC)	Volume Removed (gal.)	Temp. (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Comments
9/3/2015	1640	--	240	--	--	--	> 1,000	Finish bailing.
9/4/2015	0805	--	240	--	--	--	--	Start setting up pump.
9/4/2015	0935	460.96	240	--	--	--	--	Set pump at 516.5 feet bgs.
9/4/2015	0945	462.05	240	24.00	7.12	0.554	42.9	Begin pumping at 516.5 feet bgs at 4.8 gpm.
9/4/2015	0955	462.02	288	20.39	6.35	0.551	101	Continue pumping from 516.5 feet bgs.
9/4/2015	1005	462.02	336	20.47	6.71	0.556	48.6	Continue pumping from 516.5 feet bgs.
9/4/2015	1015	462.02	384	20.53	6.91	0.558	36.4	Continue pumping from 516.5 feet bgs.
9/4/2015	1025	462.02	432	20.57	7.02	0.560	4.37	Continue pumping from 516.5 feet bgs.
9/4/2015	1035	462.03	480	20.58	7.09	0.561	2.24	Continue pumping from 516.5 feet bgs.
9/4/2015	1045	462.02	528	20.58	7.13	0.562	2.00	Continue pumping from 516.5 feet bgs.
9/4/2015	1055	462.02	568	20.62	7.17	0.568	7.67	Move pump up to 503.5 feet bgs.
9/4/2015	1105	462.02	608	20.87	7.21	0.565	1.16	Continue pumping from 503.5 feet bgs.
9/4/2015	1110	462.02	658	20.85	7.22	0.565	1.30	Continue pumping from 503.5 feet bgs.
9/4/2015	1120	462.02	706	20.78	7.22	0.564	1.09	Move pump down to 510.5 feet bgs.
9/4/2015	1130	462.02	754	20.67	7.23	0.567	1.29	Continue pumping from 510.5 feet bgs.
9/4/2015	1135	462.02	778	20.68	7.22	0.567	1.02	Continue pumping from 510.5 feet bgs.
9/4/2015	1140	462.02	802	20.71	7.24	0.567	0.98	Continue pumping from 510.5 feet bgs.
9/4/2015	1141	--	806	--	--	--	--	Well development complete. Turn off pump.

Was well sampled after development? YES NO ☒ XSample Method: N/ASample Name: N/AAnalyses: N/A

KAFB 106234



# Borehole ID: KAFB-106234

Client: US Army Corps of Engineers  
 Project Location: KAFB, Albuquerque, NM  
 Project Name: KAFB RAPID SWMU ST-106 and SS-111  
 Project Number: 500433

Date Started: 9/2/2015  
 Date TD Reached: 10/1/2015  
 Date Completed:

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Hole Diameter Upper (in.): 16  
 Hole Diameter Lower (in.): 14-3/4  
 Surface Completion Type: Flush

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 459.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 458.90

Drilling Contractor: National Drilling  
 Drilling Method: Mud Rotary  
 Logged By: David Kessler



Page 1 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No lithologic description.	ASPHALT		Borehole was air knifed from 0.5 - 8.7 ft for utility clearance on 8/31/15. Sand, silt, and gravel observed.
5								
10					SILT (ML); brown (10YR 4/3); hard; 100% silt. SILT with Sand (ML); reddish brown (5YR 5/4); 80% silt; 20% fine sand.	ML		Begin ARCH drilling with 3/4" O.D. bit @ 1715 on 9/2/15. PID = 0.0 ppm @ breathing zone.
15					Same as above (10 ft).			Resume drilling @ 0835 on 9/3/15 @ 12 ft. PID = 0.0 ppm @ cyclone and breathing zone.
20					Silty SAND (SM); dark reddish brown (5YR 3/3); 70% fine to medium sand; subangular to subrounded; 30% silt. Note: sand is biotite. @ 17 ft. Same as above (16 ft); trace gravel. Well-graded SAND with Gravel (SW); reddish brown (5YR 4/3); dry; 75% fine to coarse sand; subangular to rounded; 20% gravel; angular to rounded; 5% silt. Note: sand is quartz, feldspars, and mafics.	SM SW		Injected water to control dust. Depth of stabilization. Begin drilling with mud @ 1705.
25					Same as above (18 ft); sand is subrounded to rounded.			PID = 0.0 ppm @ breathing zone. Rig bouncing and chattering.
30								Color cannot be determined.



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 2 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well-graded SAND with Gravel (SW); 75% fine to coarse sand; subrounded to rounded; 20% gravel; 5% silt. Note: sand is quartz, feldspar, and mafics.			
35					Same as above (30 ft).			Occasional chatter from drill stem. End of 9/3/15 @ 34 ft. Resume drilling @ 0905 on 9/4/15. PID = 0.0 ppm @ breathing zone. Gravel layer observed from 35 - 37 ft. Significant drill chatter.
40					Same as above (30 ft); dark reddish brown (5YR 3/3); 55% fine to very coarse sand; 40% coarse gravel; angular.			
45					Same as above (30 ft); dark reddish brown (5YR 3/3); 55% fine to very coarse sand; 40% coarse gravel; angular.	SW	Portland Bentonite Cement	Hard drilling. Add 150 gallons of water.
50					Same as above (30 ft); dark reddish brown (5YR 3/3); 55% fine to very coarse sand; 40% coarse gravel; angular.			
55					Same as above (30 ft); dark reddish brown (5YR 3/3); dense; 55% fine to very coarse sand; 40% coarse gravel; angular; 5% silt.			PID = 0.0 ppm @ breathing zone. Added stabilizing collar @ 1140. Hole sloughed approximately 8 ft @ 1230. Continuous chatter from 55 - 58 ft.
60								





# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 3 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Poorly graded SAND with Gravel (SP); dark reddish brown (5YR 3/3); 60% fine to medium sand; subrounded to rounded; 35% fine gravel; subangular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.			Collection of very coarse gravel in sieve from mud tub.
65					Same as above (60 ft).			
70					Same as above (60 ft); Note: percentage of mafics in gravel increases.	SP		Stopped drilling due to low circulation.
75					Same as above (60 ft).		Portland Bentonite Cement	Borehole collapsed due to inability to remove fine gravel. Backfill borehole with 8/12-grade sand from 61.7 - 18.1 ft. Added third 20' collar @ 75 ft. Resume drilling with ARCH @ 1430 on 9/12/15.
80					Same as above (60 ft); gravel to 1"; angular.			Very hard drilling from 76 - 84.6 ft. Drill stem bouncing and chattering. PID = 0.0 ppm @ breathing zone.
85								Continue advancing casing using ARCH to 83 ft on 9/14/15. Could not advance any further.
90					Well-graded SAND with Gravel (SW); dark reddish brown (5YR 3/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine gravel; subangular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		





# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 4 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90								
95					Well-graded SAND with Gravel (SW); dark reddish brown (5YR 3/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine gravel; subangular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		Begin drilling using mud @ 0835 on 9/15/15.
					Same as above (90 ft); 50% very fine to coarse sand; 45% coarse gravel to 3 cm; angular. Note: sand is quartz, mafics, and feldspar.			PID = 0.0 ppm @ breathing zone.
100					Well-graded GRAVEL with Sand (GW); dark reddish brown (5YR 3/3); 60% fine to coarse gravel; angular to rounded; 35% very fine to medium sand; subrounded to rounded; 5% silt. Note: gravel is quartz and feldspar. Sand is quartz.	GW		
105					Same as above (97 ft).			
110					Clayey GRAVEL with Sand (GC); dark reddish brown (5YR 3/4); 50% fine to coarse gravel; angular to rounded; 30% very fine sand; rounded; 20% clay. Note: gravel is quartz and feldspar.	GC		
115					Same as above (107 ft); 50% very fine to coarse gravel; 20% very fine sand; 30% clay.			
120					Clayey GRAVEL (GC); strong brown (7.5YR 5/6); 50% gravel; angular to rounded; 10% very fine sand; rounded;			



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers  
**Project Location:** KAFB, Albuquerque, NM  
**Project Name:** KAFB RAPID SWMU ST-106 and SS-111  
**Project Number:** 500433

Hole Diameter Upper (in.): 16  
 Hole Diameter Lower (in.): 14-3/4  
 Surface Completion Type: Flush

Date Started: 9/2/2015  
 Date TD Reached: 10/1/2015  
 Date Completed:

Groundwater Levels BGS (ft):  
 ▽ At Time of Drilling: 459.00  
 ▼ At End of Drilling: Not Recorded  
 ▽ After Drilling: 458.90

Ground Elevation AMSL (ft): Not Recorded  
 Y Coordinate:  
 X Coordinate:

Drilling Contractor: National Drilling  
 Drilling Method: Mud Rotary  
 Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120								
125					40% clay. Note: gravel is quartz and feldspar. Clayey GRAVEL (GC); strong brown (7.5YR 5/6); 50% gravel; angular to rounded; 10% very fine sand; rounded; 40% clay. Note: gravel is quartz and feldspar.	GC		PID = 0.0 ppm @ breathing zone.
130					Gravelly fat CLAY with Sand (CH); strong brown (7.5YR 5/6); 50% clay; 30% fine to coarse gravel; subrounded; 20% very fine sand.  Fat CLAY with Gravel (CH); brown (7.5YR 4/3); 70% clay; 20% fine to coarse gravel; angular to subrounded; 10% very fine sand. Note: sand is quartz.	CH		
135					Fat CLAY (CH); brown (7.5YR 4/3); 90% clay; 10% very fine sand; subrounded to rounded. Clayey SAND (SC); brown (7.5YR 5/4); 60% very fine sand; subrounded; 40% clay.	SC	Portland Bentonite Cement	
140					Same as above (135 ft).			Kelly down, new 20' connection.
145					Sandy fat CLAY (CH); brown (7.5YR 5/3); 60% clay; 40% very fine sand.	CH		PID = 0.0 ppm @ breathing zone.
150								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 6 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Sandy fat CLAY (CH); brown (7.5YR 5/3); 60% clay; 40% very fine sand.			
155					Same as above (150 ft).	CH		
160					Same as above (150 ft).			
165					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; 35% fine to coarse gravel; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.			
170					Same as above (161 ft).		Portland Bentonite Cement	
175					Same as above (161 ft).	SW		PID = 0.0 ppm @ breathing zone.
180					Same as above (161 ft); 35% coarse gravel.			Kelly down @ 1447, new



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

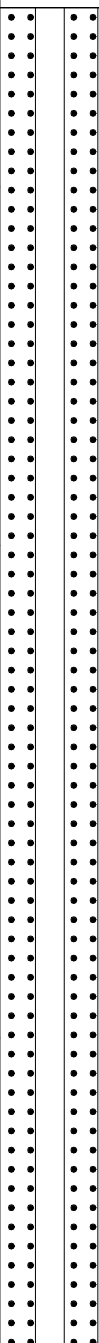
▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 7 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; 35% coarse gravel; angular to rounded; 5% silt. Note: gravel is feldspar and mafics.	SW		20' connection. Bit chatter.
185					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); 55% very fine sand; 40% fine gravel; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	SP		PID = 0.0 ppm @ breathing zone.
190					Same as above (184 ft); 65% very fine sand; 30% fine gravel.			
195					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel; subrounded to rounded; 35% very fine sand; rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	GP		
200					Same as above (192 ft); 60% coarse gravel.			Kelly down @ 1540, new 20' connection.
205					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 60% very fine to coarse sand; 35% medium gravel; subrounded to rounded; 5% clay. Note: sand is quartz. Gravel is quartz and feldspar.	SW		
210								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 8 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 60% very fine to coarse sand; 35% medium gravel; subrounded to rounded; 5% clay. Note: sand is quartz. Gravel is quartz and feldspar.			
215					Same as above (210 ft); 70% very fine to coarse sand; 25% fine to medium gravel. Note: gravel is quartz, feldspar, and mafics.			
220					Same as above (215 ft).			Kelly down @ 1620, new 20' connection.
225					Same as above (215 ft).	SW	Portland Bentonite Cement	
230					Same as above (215 ft).			Hammer chatter.
235					Same as above (215 ft).			
240								Kelly down @ 1719, new



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 9 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% clay. Note: gravel is quartz, feldspar, and mafics.			20' connection.
245					Same as above (240 ft).			
250					Same as above (240 ft); 35% fine gravel.			
255					Same as above (240 ft); 35% fine gravel.	SW	Portland Bentonite Cement	Drill stem chattering.
260					Same as above (240 ft); 35% coarse gravel.			Kelly down, new 20' connection. End of 9/15/15 @ 1817. Resume drilling @ 0820 on 9/16/15.
265					Same as above (240 ft); 35% fine gravel.			PID = 0.0 ppm @ breathing zone.
270								





# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 10 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 55% very fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.			PID = 0.0 ppm @ breathing zone.
275					Same as above (270 ft).	SW		
280					Silty SAND with Gravel (SM); brown (7.5YR 4/2); 50% very fine to coarse sand; subrounded to rounded; 20% fine to coarse gravel; angular to subrounded; 30% silt. Note: gravel is quartz, feldspar, and mafics.	SM		Kelly down @ 281 ft, new 20' connection.
285					Same as above (279 ft).		Portland Bentonite Cement	
290					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine to medium gravel; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.			
295					Same as above (287 ft).	SW		
300								Rig chatter.



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 11 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300								
305					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		Kelly down @ 301 ft, new 20' connection.
310					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% coarse gravel; subrounded to rounded; 35% very fine to coarse sand; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	GP		Constant rig chatter.
315					Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% silt. Note: sand is quartz. Gravel is quartz, feldspar, and mafics.			PID = 0.0 ppm @ breathing zone.
320					Same as above (309 ft).			
325					Same as above (309 ft).	SW		Bit chatter.
330					Same as above (309 ft); 55% very fine to coarse sand; 40% fine gravel.			Kelly down @ 1045, new 20' connection.



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 12 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/4); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; angular to rounded; 5% silt. Note: sand and gravel are quartz, feldspar, and mafics.			PID = 0.0 ppm @ breathing zone.
335					Same as above (330 ft); 35% coarse gravel.			Rig chatter.
340					Same as above (330 ft); 35% coarse gravel.			Kelly down @ 1334, new 20' connection.
345					Same as above (330 ft); 35% coarse gravel.	SW	Portland Bentonite Cement	Rig chatter.
350					Same as above (330 ft); 35% coarse gravel.			Rig chatter; hard cuttings.
355					Same as above (330 ft); 35% coarse gravel.			
360								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 13 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/4); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; angular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		Kelly down @ 1459, new 20' connection.
365					Same as above (360 ft); 35% coarse gravel.			
370					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/2); 60% fine sand; trace coarse sand; subrounded to rounded; 35% fine to coarse gravel; angular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, mafics, and feldspar.			
375					Same as above (368 ft); trace medium to coarse sand.			
380					Poorly graded SAND (SP); brown (7.5YR 4/2); 85% very fine to fine sand; subrounded to rounded; 10% fine gravel; angular to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	SP		End of 9/16/15 @ 379 ft. Begin drilling with 12 1/4" bit mud rotary on 9/17/15 @ 0901. Kelly down @ 381 ft, new 20' connection.
385					Same as above (380 ft).			PID = 0.0 ppm @ breathing zone.
390								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 14 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Poorly graded SAND (SP); brown (7.5YR 4/2); 85% very fine to fine sand; subrounded to rounded; 10% fine gravel; angular to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.			Rig chatter.
395					@ 391 ft. Poorly graded SAND with Gravel (SP); brown (7.5YR 5/3); 70% fine sand; subrounded to rounded; 25% fine to coarse gravel; angular to subangular; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.		- 3/8" Bentonite Chip Seal	
400					Same as above (391 ft); 60% fine sand; 35% fine to coarse gravel.			Rig chatter; slowed drilling rate. PID = 0.0 ppm @ breathing zone. Kelly down @ 1002, new 20' connection.
405					Same as above (391 ft); brown (7.5YR 4/3); 60% fine sand; 35% fine to coarse gravel.	SP		
410					Same as above (391 ft); brown (7.5YR 4/3); 60% fine sand; trace medium to coarse sand; 35% fine to coarse gravel.		- Top of 10/20 Sand	
415					Same as above (391 ft); brown (7.5YR 4/3); 60% fine sand; trace medium to coarse sand; 35% fine to coarse gravel.		- Top of 8/12 Sand	
420								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/2/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud Rotary

**Logged By:** David Kessler

Page 15 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420								
425					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/2); 75% fine sand; subrounded to rounded; 20% fine gravel; subrounded to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, mafics, and feldspar.	SP	- 8/12 Sand	PID = 0.0 ppm @ breathing zone.
430					Well-graded SAND with Gravel (SW); brown (7.5YR 4/2); 65% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; angular to rounded; 5% silt. Note: sand is quartz and mafics.	SW		
435					Silty SAND (SM); 60% fine sand; subrounded to rounded; 10% fine gravel; angular to subrounded; 30% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SM		
440								End of mud rotary drilling @ 435 ft on 9/17/15.
445								
450								





# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 16 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
435					@ 435 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; subrounded to rounded; trace fine gravel; 5% silt.	SP		Begin coring with core barrel on 9/18/15 with 6" O.D. bit. @ 435 - 449 ft
					@ 435.5 ft. Fat CLAY (CH); reddish brown (5YR 5/4); high plasticity; 100% clay.	CH		sand is quartz with occasional mafics.
					@ 436.2 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% very fine to fine sand; subrounded to rounded; 10% silt.	SP-SM		@ 436.6 - 437 ft gravel is quartz, mafics, and feldspar.
					@ 436.6 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 5/3); 60% fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% silt.	SW		
440					@ 437 ft. No recovery.			
					@ 440 ft. Poorly graded SAND (SP); brown (7.5YR 4/4); 95% fine sand; subrounded to rounded; 5% silt.	SP		@ 440 - 442.8 ft sediments are fining upwards and laminated. @ 440.52 ft cobble to 1-5/8"; subangular; sandstone.
					@ 442.8 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/4); 50% fine to coarse gravel; subrounded; 40% fine to coarse sand; angular to rounded; 10% silt.	GW-GM		@ 442.8 - 449 ft gravel is quartz, mafics, and feldspars with occasional granite and quartzite.
445					@ 443.1 ft. No recovery.			
					@ 445 ft. Silty GRAVEL (GM); brown (7.5YR 5/3); 60% fine to coarse gravel; subrounded; 10% fine to coarse sand; subrounded to rounded; 30% silt.	GM		@ 445 - 446.7 ft the percentage of silt decreases with depth.
					@ 446.7 ft. No recovery.			
					@ 447.5 ft. Poorly graded SAND with Gravel (SP); brown (7.5YR 5/3); 80% fine to medium sand; trace coarse sand; subrounded to rounded; 15% fine to coarse gravel; subrounded to rounded; 5% silt.	SP		
450					@ 449 ft. No recovery.			



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

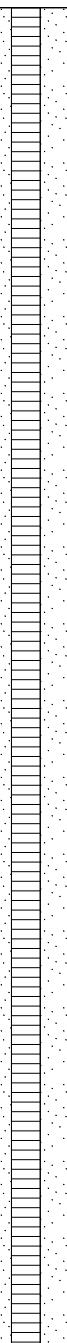
▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 17 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					@ 450 ft. Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/3); 70% fine to coarse sand; 20% coarse gravel; 10% silt.	SW-SM		End of 9/18/15 @ 450 ft. Resume coring @ 1030 on 9/23/15. @ 450 - 464.2 ft sand is quartz with occasional granite, mafics, and feldspar. Gravel is quartz with occasional mafics.
					@ 450.7 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/4); 50% fine to coarse sand; subrounded to rounded; 20% gravel; 30% silt; trace clay.	SM		
					@ 451.7 ft. Same as above (450.7 ft); 20% very coarse gravel to 40 mm; subrounded to rounded.			
					@ 452 ft. Same as above (450.7 ft); brown (7.5YR 4/4); 60% fine to coarse sand; 15% coarse gravel to 40 mm; 25% silt.			
455					@ 453.9 ft. No recovery.			
					@ 455 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/4); 70% fine to coarse sand; subrounded to rounded; 15% coarse gravel to 40 mm; 15% silt.	SM		
					@ 455.8 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine sand; subrounded to rounded; trace fine gravel; 10% silt.	SP-SM		
					@ 456.5 ft. No recovery.			@ 456.5 ft driller states that coring feels like gravel. Gravel was likely pushed aside instead of recovered, causing loss of core sample.
460								
					@ 461.4 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; trace medium sand; subrounded to rounded; 5% silt.	SP		
					@ 461.9 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 5/4); 50% fine to coarse gravel; subrounded to rounded; 35% fine to coarse sand; subrounded to rounded; 15% silt.	GM		
					@ 462.5 ft. Poorly graded SAND (SP); dark brown (7.5YR 3/3); 95% fine sand;	SP		
465								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

Hole Diameter Upper (in.): 16

Hole Diameter Lower (in.): 14-3/4

Surface Completion Type: Flush

Date Started: 9/18/2015

Date TD Reached: 10/1/2015

Date Completed:

Groundwater Levels BGS (ft):

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

Ground Elevation AMSL (ft): Not Recorded

Y Coordinate:

X Coordinate:

Drilling Contractor: National Drilling

Drilling Method: Mud, 94 mm core barrel

Logged By: David Kessler

Page 18 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
465					subrounded to rounded; trace gravel; rounded; 5% silt. @ 464.2 ft. No recovery. @ 465 ft. Poorly graded SAND (SP); brown (7.5YR 4/3); 95% medium sand; trace coarse sand; trace fine gravel; subrounded to rounded; 5% silt. @ 466.2 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/3); 60% fine to coarse gravel; subrounded to rounded; 30% fine to coarse sand; 10% silt. @ 466.5 ft. No recovery. @ 467.5 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 80% fine to coarse sand; 15% fine to coarse gravel; 5% silt. @ 468 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/3); 70% fine to coarse gravel to 40 mm; subrounded to rounded; 20% coarse sand; trace fine and medium sand; 10% silt. @ 468.4 ft. No recovery. @ 472.5 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/3); 90% fine sand; subrounded; trace gravel; 10% silt.	SP GW-GM SW GW-GM		@ 465 - 479.4 ft sand is quartz with occasional mafics. Gravel is quartz with occasional mafics.  @ 468.4 ft driller reported drilling in gravel, which likely caused loss of core.
470								
475					@ 474.7 ft. No recovery. @ 475 ft. Silty SAND (SM); brown (7.5YR 4/3); 80% fine sand; subrounded to rounded; trace coarse gravel; 20% silt. @ 476.6 ft. No recovery. @ 477.5 ft. Silty SAND (SM); brown (7.5YR 4/3); 85% fine sand; subrounded to rounded; 15% silt. @ 478.4 ft. Fat CLAY (CH); yellowish brown (10YR 5/4); hard; medium plasticity; 100% clay. @ 478.7 ft. Lean CLAY (CL); reddish	SP-SM SM SM CH CL SM	- 8" Stainless Steel 0.050 Slot Screen	@ 474.6 - 474.7 ft clay lense. End of 9/23/15 @ 475 ft. Resume drilling on 9/24/15. @ 476.1 ft silt lense, 7 mm thick. @ 476.5 ft silt lense, 5 mm thick. Two 5 mm clay nodules.
480								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 19 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					brown (2.5YR 4/3); low plasticity; 95% clay; 5% gravel. @ 479 ft. Silty SAND (SM); brown (7.5YR 4/3); 80% fine sand; subrounded to rounded; 20% silt. @ 479.4 ft. No recovery. @ 480 ft. Silty SAND (SM); brown (7.5YR 5/3); 80% fine to coarse sand; subrounded to rounded; 20% silt. @ 480.7 ft. Lean CLAY with Sand (CL); reddish brown (5YR 5/4); low plasticity; 80% clay; 20% very fine sand; rounded. @ 480.8 ft. No recovery. @ 482.5 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; subrounded to rounded; 5% silt. @ 484.3 ft. No recovery. @ 485 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; subrounded to rounded; 5% silt. @ 486.1 ft. No recovery. @ 487.6 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine sand; subrounded to rounded; 10% silt. @ 488 ft. Lean CLAY with Sand (CL); reddish brown (2.5YR 4/4); low plasticity; 80% clay; 20% fine sand; trace gravel to 30 mm. @ 489.3 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine sand; subrounded to rounded; 10% silt. @ 489.9 ft. No recovery. @ 490 ft. Silty SAND with Gravel (SM); dark brown (7.5YR 3/3); 65% fine to coarse sand; subrounded to rounded; 15% fine to coarse gravel; rounded; 20% silt. @ 491.8 ft. No recovery. @ 492.5 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/3); 90% fine to medium sand; trace coarse sand; subrounded to rounded; trace gravel to 45 mm; 10% silt.	SM CL  SP  SP  SP-SM CL SP-SM SM  SP-SM		@ 480 - 494.8 ft sand is quartz with occasional mafics.  @ 483.5 - 484 ft sediment is laminated.  @ 485.65 - 485.7 ft laminations observed. @ 486 ft drilling through gravels; weathered sandstone; white (10YR 8/1).  @ 488 ft texture is blocky.  @ 490 - 494.8 ft sediment is fining upward.  @ 492.6 ft cobble.
485								
490								
495								





# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 20 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495					@ 494.8 ft. No recovery. @ 495 ft. Well-graded SAND with Silt (SW-SM); brown (7.5YR 4/2); 90% fine to coarse sand; subrounded to rounded; trace gravel; 10% silt. @ 496.2 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/2); 90% fine sand; subrounded to rounded; trace gravel; 10% silt. @ 496.3 ft. No recovery. @ 497.5 ft. Well-graded GRAVEL (GW); 100% fine to coarse gravel to 24 mm. @ 497.7 ft. No recovery.	SW-SM SP-SM GW		@ 495 - 507.8 ft sand is quartz with occasional mafics.  @ 496.3 ft lost what appeared to be saturated sands.  @ 497.5 ft sand and silt likely washed out from core sample. @ 497.7 ft drilling through gravels. All core lost during core rod and drill stem removal.
500								
505					@ 502.5 ft. Well-graded GRAVEL (GW); 100% gravel; rounded. @ 502.7 ft. SILT (ML); light reddish brown (2.5YR 6/3); hard; low plasticity; 85% silt; trace clay; 10% fine sand; rounded; 5% fine gravel; rounded. @ 503.1 ft. Well-graded SAND with Silt (SW-SM); 90% sand; trace gravel; 10% silt. @ 503.5 ft. Poorly graded SAND (SP); 95% sand; 5% silt. @ 504.1 ft. No recovery. @ 505 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel to 25 mm; subrounded; 35% fine to coarse sand; 5% silt. @ 505.6 ft. No recovery. @ 507.5 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel to 25 mm; subrounded; 35% fine to coarse sand; 5% silt. @ 507.8 ft. No recovery.	GW ML SW-SM SP GP GP	-8" Stainless Steel 0.050 Slot Screen	End of 9/24/15 @ 502.5 ft. Resume drilling on 9/25/15. Silt and sand fraction washed away.  @ 504.1 ft gravel encountered.  @ 505.6 ft gravel encountered.  @ 507.8 ft gravel encountered.
510								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

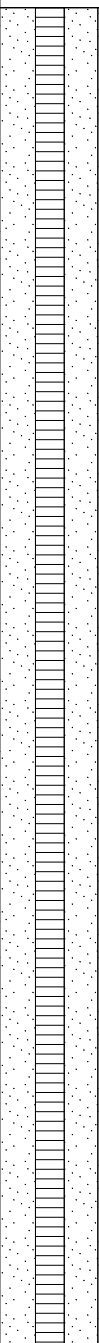
▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 21 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					@ 510 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel; subrounded; 35% fine to coarse sand; 5% silt. @ 510.2 ft. No recovery.	GP		@ 510.2 ft gravel encountered.
					@ 512.5 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel; subrounded; 35% fine to coarse sand; 5% silt. @ 512.8 ft. No recovery.	GP		@ 512.8 ft very coarse pebble in shoe of core barrel.
515								
					@ 517.5 ft. Poorly graded GRAVEL (GP); brown (7.5YR 4/2); 95% fine gravel to 4 mm; subangular to subrounded; 5% silt. @ 518.1 ft. Poorly graded SAND with Silt and Gravel (SP-SM); brown (7.5YR 4/2); 60% fine sand; rounded; 30% coarse gravel; 10% silt. @ 518.3 ft. No recovery.	GP SP-SM		End of 9/25/15 @ 517.5 ft. Resume coring on 9/26/15. @ 518.1 - 520.6 ft sand is quartz.
520					@ 520.1 ft. SILT (ML); brown (7.5YR 4/2); nonplastic; 90% silt; 10% very fine to fine sand. @ 520.2 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 65% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; subangular to subrounded; 5% silt. @ 520.6 ft. No recovery.	ML SW		@ 520 ft gravel encountered. @ 520.6 ft loose, wet sand and gravel encountered.  @ 522.5 ft gravel within coring interval caused core barrel thread sheering.
525								





# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 22 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
525					<p>@ 525 ft. Poorly graded GRAVEL with Silt and Sand (GP-GM); brown (7.5YR 4/2); 60% fine gravel to 8 mm; subangular to subrounded; 30% fine to coarse sand; 10% silt.</p> <p>@ 525.6 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/2); dense; 90% fine sand; subangular to subrounded; 10% silt.</p> <p>@ 525.9 ft. No recovery.</p> <p>@ 527.5 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/2); loose; 70% fine gravel to 4 mm; subrounded to rounded; 25% fine to coarse sand; subrounded to rounded; 5% silt.</p> <p>@ 528.5 ft. No recovery.</p> <p>@ 530 ft. Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/3); 65% very fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel to 35 mm; subrounded; 5% silt.</p> <p>@ 530.4 ft. No recovery.</p> <p>@ 532.5 ft. Well-graded GRAVEL with Sand (GW); gray (7.5YR 6/1); 50% fine to coarse gravel; subrounded to rounded; 45% fine to coarse sand; subrounded to rounded; 5% silt.</p> <p>@ 533.7 ft. No recovery.</p> <p>@ 535 ft. Well-graded GRAVEL with Sand (GW); gray (7.5YR 6/1); 50% fine to coarse gravel; subrounded to rounded; 45% fine to coarse sand; subrounded to rounded; 5% silt.</p> <p>@ 535.2 ft. No recovery.</p> <p>@ 536.5 ft. Well-graded SAND with Silt and Gravel (SW-SM); dark brown (7.5YR 3/2); 60% very fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel to 35 mm; subrounded; 10% silt.</p> <p>@ 537.2 ft. No recovery.</p>	<p>GP-GM</p> <p>SP-SM</p> <p>GP</p> <p>SW</p> <p>GW</p> <p>GW</p> <p>SW-SM</p>	<p>- 8" Stainless Steel 0.050 Slot Screen</p> <p>- Bottom of</p>	<p>@ 525 - 537.2 ft gravel is quartz, mafics, and occasional granite.</p> <p>@ 525.6 - 537.2 ft sand is quartz and mafics.</p> <p>@ 525.9 ft gravel encountered.</p> <p>@ 528.5 ft gravel encountered.</p> <p>@ 530 ft top section of sample shows little sand. Inferred that the sand washed out.</p> <p>@ 530.4 ft gravel encountered.</p> <p>End of 9/26/15 @ 532.5 ft. Resume drilling on 9/28/15. @ 532.5 ft portions of the gravel are cemented with calcium carbonate.</p> <p>@ 533.7 ft sand was washed away and gravel not recovered.</p> <p>@ 535 ft hard to very hard conglomerate rock; calcite-cemented.</p> <p>@ 536.5 - 536.55 ft silt lense; gray (7.5YR 5/1).</p> <p>@ 537.2 ft gravel obstructed sample collection.</p>
530								
535								
540								



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 23 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					@ 540 ft. Poorly graded GRAVEL with Sand (GP); dark brown (7.5YR 3/2); 55% fine gravel; angular to subrounded; 40% very fine to coarse sand; angular to subrounded; 5% silt.		Screen	End of continuous coring @ 540 ft on 9/28/15. @ 540 - 556 ft sand is quartz and mafics. Gravel is quartz, mafics, and granite.
545					@ 545 ft. Same as above (540 ft); 55% fine gravel to 6 mm; angular.		Bottom of Sump	
550					@ 550 ft. Same as above (540 ft) 80% fine gravel; angular; 20% very fine to coarse sand.	GP		Very hard drilling from 547 - 556 ft.
555								Reamed borehole using 12-1/4" bit from 435 - 550 ft on 9/26/15 through 9/28/15.



# Borehole ID: KAFB-106234

**Client:** US Army Corps of Engineers

**Project Location:** KAFB, Albuquerque, NM

**Project Name:** KAFB RAPID SWMU ST-106 and SS-111

**Project Number:** 500433

**Date Started:** 9/18/2015

**Date TD Reached:** 10/1/2015

**Date Completed:**

**Ground Elevation AMSL (ft):** Not Recorded

**Y Coordinate:**

**X Coordinate:**

**Hole Diameter Upper (in.):** 16

**Hole Diameter Lower (in.):** 14-3/4

**Surface Completion Type:** Flush

**Groundwater Levels BGS (ft):**

▽ At Time of Drilling: 459.00

▼ At End of Drilling: Not Recorded

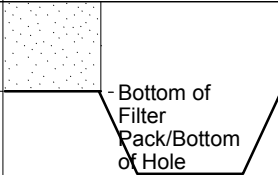
▽ After Drilling: 458.90

**Drilling Contractor:** National Drilling

**Drilling Method:** Mud, 94 mm core barrel

**Logged By:** David Kessler

Page 24 of 24

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
555					@ 555 ft. Poorly graded GRAVEL with Sand (GP); dark brown (7.5YR 3/2); 80% fine gravel; angular; 20% very fine to coarse sand; angular to subrounded.	GP		Total depth = 556 ft bgs. Reached total depth on 10/1/15. Reamed borehole using 14-3/4" bit from 83 - 556 ft on 9/30/15 through 10/1/15.
560								
565								
570								